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# Setup Time Reduction of Injection Moulding Machines at the Automotive Supplier Plasman

Master's thesis in Production engineering

Zainab Nouri

DEPARTMENT OF TECHNOLOGY MANAGEMENT OF ECONOMICS

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Department of Materials and Manufacturing Technology  
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CHALMERS UNIVERSITY OF TECHNOLOGY  
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Setup Time Reduction of Injection Moulding Machines at the Automotive Supplier  
Plasman

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## **Abstract**

Plasman AB is a global company that produces various plastic components for customers. The production system within the injection molding department needs to be more efficient to increase productivity and minimised stop time in the process.

This project has analysed the setup process time to identify possible improvements to decrease the setup time to achieve higher productivity, lower cost, or increased capacity. The other purpose of this project is to set new work standards for operators to follow and minimised the variation in the setup process.

The setup process has been videotaped and analysed in the Avix software. All performed activities were analysed and reviewed to find improvements and identify activities that could be performed before or after the setup process.

Implementing a combination of the Organizational methods and technical improvement proposals on the injection molding machine 8 in Gothenburg gave a reduction of 45% in the setup Process time. For machine 3202, the theoretical improvement could result in a reduction of 21% in the setup process

Keywords: Setup, Production, Improvement, SMED, Avix, Standardisation, Injection Moulding Machine



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A special thanks go to my supervisor Magnus Älmegran from Plasman AB, for all the help, support, and guidance within the company and throughout the project to carry out the project excellently and smoothly to feel welcome within the company.

I would also like to thank Peter Gudnason, my supervisor at Plasman Gothenburg manufacturing, for all his support during the project. Thanks to his aid, the study at the plant flowed more smoothly than expected.

A big thanks go to all the Plasman, the Gothenburg manufacturing staff, and Simrishamn manufacturing for being ready to answer my questions and participate in the project.

Zainab Nouri, Gothenburg, Januari 2023



# List of Acronyms

Below is the list of acronyms that have been used throughout this thesis listed in alphabetical order:

ABS	Acrylonitrile Butadiene Styrene a terpolymer made by polymerising styrene and acrylonitrile in the presence of polybutadiene
IMM	Injection Moulding Machine
PAGO	Manufacturing factory in Gothenburg
PASI	Manufacturing factory in Simrishamn
PBT	Polybutylene Terephthalate, a thermoplastic engineering polymer
PC	Poly Carbonates, a group of thermoplastic polymers
SAP	System, Application and Product in data processing



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# 1

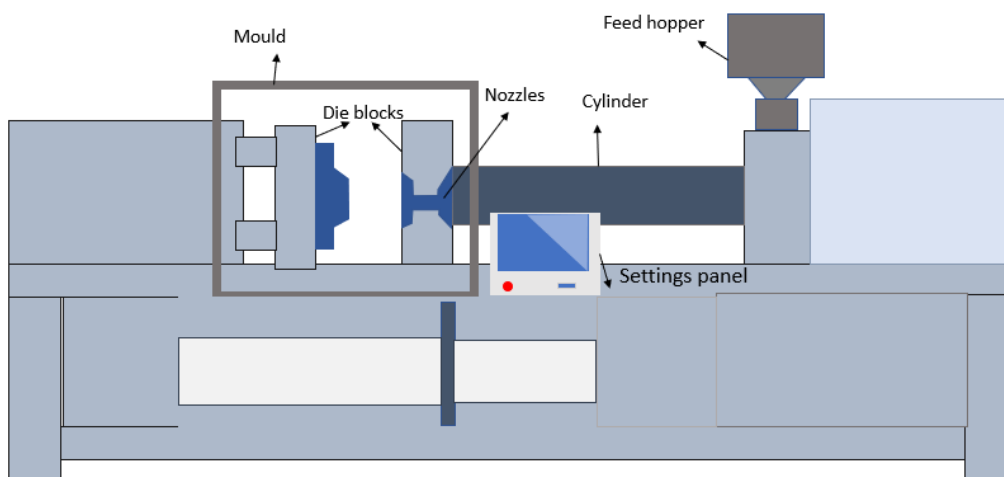
## Introduction

### 1.1 Background

In today's global world, all sectors are fiercely competitive and assertive in satisfying the demands of both the market and the customer because of globalisation and industry digitalisation. Where every industry strives to boost production and improve quality, all automotive industries and their suppliers are among the sectors that should focus on productivity growth and continuous improvement. Plasman AB is also one of the system suppliers in the automotive industry that strives for increased productivity by reducing waste in all processes, especially in machining processes. This paper will help Plasman analyse some of the machine's functions and optimise their setup time in both manufacturing plants in Sweden.

#### 1.1.1 Injection moulding process

Injection moulding is when heated polymer material is formed using moulds. The granules of the polymer material pass from the feed hopper into the cylinder, where the material is heated. The molten material pushes through the nozzles of the injection units into the die cavity. After the material cools in the form, the die blocks open, and the manufactured component can be collected, usually by robots. The illustration below shows the basic structure of an injection moulding machine[1].



**Figure 1.1:** *A simplified model of injection moulding machine*

The injection moulding process is suitable for producing products with high precision and complex shape. The materials used in this process are primarily thermoplastics or thermosets, but composites can also be processed. The production speed of this type of process is high and usually ranges from 1-50 parts per minute. Flexibility is limited due to requiring dedicated dies and the corresponding tool change and setup time to change the dies [1].

### 1.1.2 About Plasman

Plasman is a global organisation with 24 Manufacturing locations in eleven countries worldwide with more than 4400 employees. The European headquarters of Plasman is in Gothenburg, Sweden. Plasman has two manufacturing plants in Sweden, Gothenburg and Simrishamn. Plasman manufactures plastic parts as a system supplier to various automotive industries worldwide, such as Ford, Volvo Cars, and Volvo Trucks.

The manufacturing factory in Gothenburg (PAGO) is a plant with the size of 20000  $m^2$  and has 408 employees. Eight stations at the plant consist of one injection moulding machine (IMM) weighing between 2300- 4000 tons. Two injection moulding machines are a combo with two tools running simultaneously. These machines produce items for Volvo Cars at Torslanda regarding model series 60 and 90. The factory also has other customers, such as Volvo in Ghent, Malaysia, and China, and they produce workshop spare parts.

The Manufacturing plant in Simrishamn (PASI) is a plant with the size of 22000  $m^2$  and has 268 employees and 17 IMM machines weighing between 650 and 4000 tons. With a capacity of 50 000 produced parts per day. The plant uses production processes such as injection moulding, painting, priming and finally assembling the parts into larger components that they ship to their customers.

For further analysis in this master thesis, one machine in PAGO has been chosen for an in-depth analysis.

### 1.1.3 About the station 8 in PAGO

In 2018 a new station was constructed called 'Machine 8'. This injection moulding machine is a combo machine that can simultaneously produce twenty-nine items and has 15 internal tools. The weight of tools is between 15-25 tons. In the station, two operators scan the items and pack them into pallets that are then transported away by AGV trucks.

The goal of constructing the new machine was a higher OEE than 85% when the company planned the investment. However, currently the setup time is higher than the planned scheduled time. Since its construction, there have been several projects looking at specific parts of the setup process in order to decrease the setup time. However, these projects have yet to look upon the complete setup process.

### 1.1.4 About the station in PASI

The injection moulding 'Machine 3202' has been installed since 2015. This machine produces 21 items variant by utilising 10 tools with a weight range between 10 and 15 tons. This machine is also a combo machine and produces between 2 and 4 products simultaneously, depending on the current item variant. The goal for this

machine was a higher OEE than 88%.

In the station, two operators and a robot help to collect the item from the machine, which goes onto a conveyor belt. The operators check the quality of the products and pack them into pallets that truck drivers pick up for transport.

## 1.2 Purpose

This study aims to measure and analyse the current state of setup time through the described methods in chapter 3. This study will assist in identifying areas in the setup that need improvements. All improvement recommendations will be discussed with the station's personnel through the already-established communication channels to ease the execution of the chosen improvement. Additionally, this step helps with the project's other goals of standardising work processes and using SMED as a lean tool. The improvement result will be presented as a percentage increase in OEE and a percentage reduction in setup time.

## 1.3 Delimitation

This project will focus only on two plants that are placed in Sweden. The project is planned between August 2022 and January 2023. The SMED analysis will be performed only on IMM8 in Gothenburg's manufacturing plant and IMM3202 in Simrishamn's manufacturing plant. The project and the video recording step will only be performed for one of the product variants for each machine. Analysis of the setup process is limited to the daily shifts. The production planning and setup time analysis considers only these two machines.

- This project will only analyse the whole station and production line with regard to the setup process.
- This project will not perform changes in the construction of the tools, machines, and equipment.
- This project will not consider the disturbances which may occur during the setup process and their root causes.



# 2

## Theory

There are many approaches to reducing the manufacturing costs for a machine in the manufacturing industry. One of the effective methods is to reduce the idle and stop time of the machine, i.e. the production time should be increased, which leads to an increased capacity for the station. An increased capacity means the machine's available time increases, leading to an increased overall equipment effectiveness value (OEE). Lowering the overhead cost per part produced.

There are many methods to increase the OEE for a machine or station in a factory, however, one possible way is to reduce the setup time. The setup operation is a non-value-adding process. Therefore it should be minimised as much as possible [2]. Within 'lean management' and 'Just In Time', the processes waste should be minimised to increase the capacity through increased productivity. Productivity can be calculated through the Formula:

$$Productivity : MxPxU \quad (2.1)$$

M stands for the method used during production. P is for the performance factor, a value of how well the work is performed during the ideal cycle time. The ideal cycle time for a machine operating is 100%. U stands for machine utilisation, which is also 100% in an ideal factory [3]. However, the gap between a factory's actual process and the ideal is due to the setup time and machine stoppages caused by breakdowns [4]. The SMED model presented by Shingo (1985)[5] has been adopted to improve productivity and minimise setup time. The model has contributed to performing some activities while the machine runs, which could be excluded from the setup time.

### 2.1 OEE

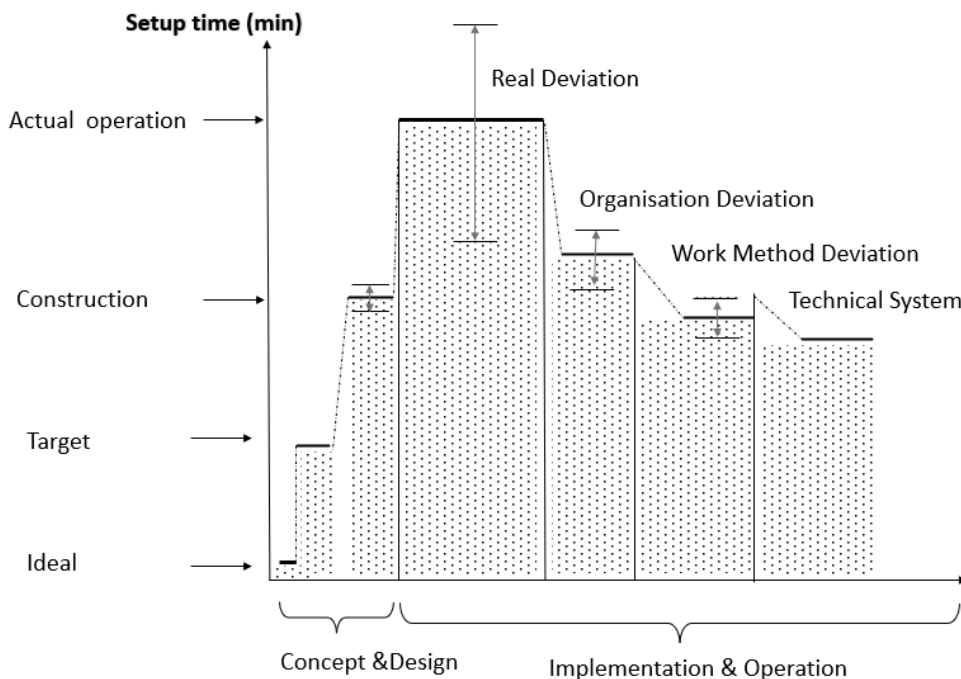
Overall Equipment Effectiveness (OEE) is a quantitative metric for measuring the productivity of a production facility in a manufacturing plant, which has been used since Seiichi Nakajima in the 1980s [6]. OEE can be utilised to measure the avoidable costs that affect the efficiency of a plant. Production losses can be determined by comparing the OEE values between the original and the current value of the plant. Losses such as breakdown, setup and adjustment, idling and minor stoppages, reduced speed or loss of speed, quality defects, and rework should be eliminated to increase the OEE[6, 7].

### 2.2 Setup process performance

*Setup time* is the time taken to change the manufacturing conditions from one product to another. Setup time is measured from the last part produced to the first

after the tool or mould has been changed. The setup time has a unit of seconds, minutes or hours, and the number of people measuring during this operation should not influence this time. During the set-up process, the capacity is reduced to zero because the machine is not running[2].

In an ideal manufacturing system, setup time should not interfere with the machine's manufacturing cycle, and a setup time of 1 to 3 seconds is ideal. In reality, an ideal system for a setup operation is difficult to achieve due to manufacturing system limitations and the system design. Other factors such as operation, maintenance and implementation constraints also affect the performance of the setup process and increase setup time. The final implemented setup operation of a manufacturing process may end with a higher time than the planned and targeted time. The organisational and work method deviation is higher than the technical one as shown in the simplified figure 2.1 of the setup process potential saving based on Kaiser(2002)[8]. Therefore, the potential for improvement in organisational deviations and work methods is higher than in technical ones and are usually easier to implement with fewer resources [8].



**Figure 2.1:** *Setup process potential deviations based on Kaiser(2002)*

### 2.3 Evaluation of setup process

The setup process can be evaluated using the RPE (Resetting Performance Evaluation) framework, which evaluates on four levels: organisation, method, technical and profitability[8]. This framework is a structured approach that identifies the potential for improvement at all levels. In this framework, it is recommended to start with profitability, organisation method and technology. However, if one of these

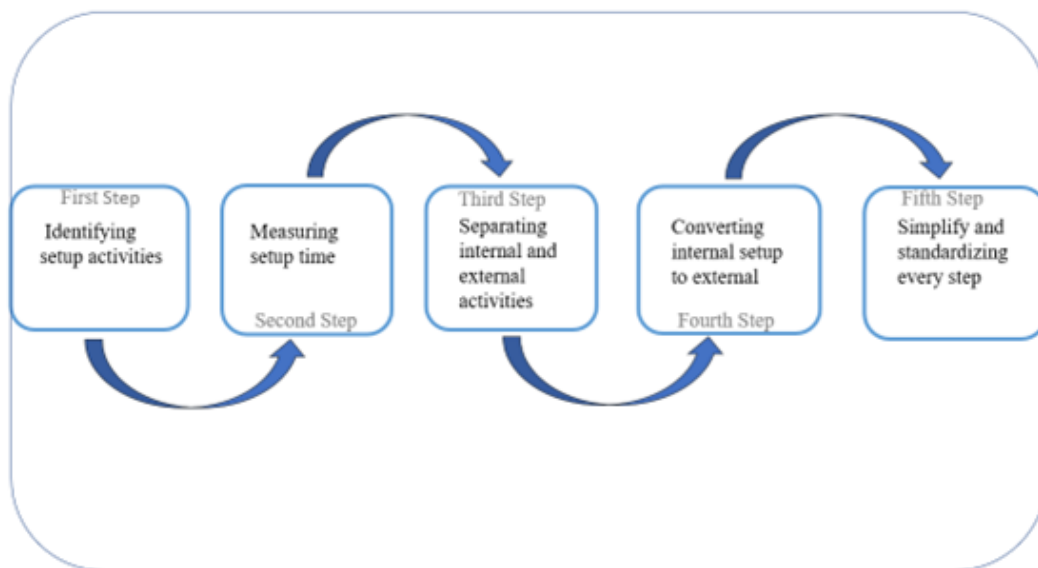
areas shows excellent potential for improvement, the analysis can start there and then move to other levels.

### 2.3.1 Organisation evaluation

One of the most important factors at the organisational level is to measure the setup process time of the workstation or machine. The other essential factors that should be considered when examining the organisational assessment are the workstation layout, manning for the setup process and the walking path analysis. These four factors should be analysed to improve the organisation[8].

#### 2.3.1.1 Methodology of SMED

SMED Single Minute Exchange of Die is a tool for analysing setup operations to reduce coverage over time and improve this process. SMED was developed in Japan at Toyota by Shigeo Shingo when he was working on improving a tool change. The principle of SMED is to identify external and internal activities. Identify setup activities, measure setup time, separate internal and external activities, convert internal setup to external and simplify and standardise each step. The single minute of the dies process will be performed in five steps; see figure 2.2.

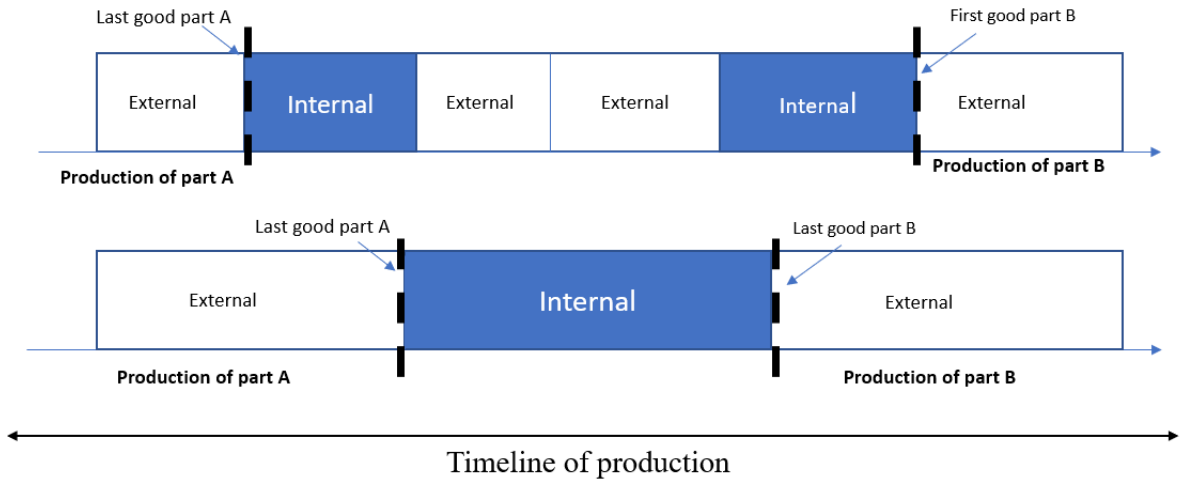


**Figure 2.2:** *Five steps of SMED methodology*

The first two steps aim to conduct and document an organisational study of the entire setup process to understand the activities and work tasks better. These steps can be performed through video recordings, work sample studies or interviews and observing the staff.

Steps three and four of the SMED methodology consist of separating the internal and external activities and converting the internal setup activities into external elements, see figure 2.3. All activities are categorised as external in this step and can be performed during production. The internal setup activities refer to the operations that have to take place when the machine is stopped. The external activities are the setup activities that can be performed when the machine is running. This

step is vital to examine each activity and determine why each internal task should be performed during the setup process. During this step, possibilities to separate the external tasks from the internal setup activities of the current state should be identified.



**Figure 2.3:** *Separating internal and external setup and converting internal to external*

### 2.3.2 Method evaluation

The analysis of the current method of the setup process is a critical level of the evaluation of the setup process. It is recommended to analyse the method of the setup process in each form in order to find as much improvement potential as possible. Detailed analysis also enables the critique of the work method and the task. Breaking down the work method and understanding each task will facilitate the application of steps 4 and 5 of the SMED methodology: separate internal and external activities and convert the identified external activities into internal ones. Be sure to discuss suggestions for improvement at this stage with the workforce and team leader to avoid disagreements and increase the potential to maintain correct and accepted work standards[8].

### 2.3.3 Profitability

For the improved setup process, a profitability analysis should be carried out to see the result in terms of lower inventory costs or longer lead time. For a detailed and correct profitability analysis, valid data on the profitability parameters should be collected in collaboration with the other department, such as the company's accounting department, to calculate the current operating costs. The data is also used to calculate the financial savings from reduced setup process time.

### 2.3.4 Technical system evaluation

An evaluation of the technical system of the setup process should be carried out to determine which technical solutions are used and how well they currently work.

## 2.4 Standardised work

The concept of the standard refers to the best-known and agreed way of performing a work task. The standard created is valid until the application or solution to a cause is conducted or found. The standardised does not have to be good, but it describes what is used. Standardisation is essential at every level in organisations; the different levels are flow, process and workplace. The flow standard refers to the capacity of a process, work hours and the buffer size. The process standard focuses on maintenance intervals, work instructions and the planning time of a process. The workplace standards deal with a workplace layout, and the placement of equipment [9].

There are many reasons to introduce standardised work in the manufacturing system at the process level, such as maintaining the same speed within production, better performance and the same level of quality for products and processes. In addition, through standardised work, variation can be measured, and improvement is based on various reasons [10].

Implementation of standardised work contributes to a standardised way of working and, simultaneously, to a standard time. In order to standardise the work, it should be stable to a certain extent to achieve the standard times. This leads to closer scrutiny of working methods and identifying errors and improvements when the planned time is not met [9].

Three documents can be used to establish: a standardised work schedule, standardised work and a standardised work combination table. A standardised work chart is a document containing a description of the activities an employee must perform during the work, including a picture and time for the task. This document is closely related to standardised work, which requires a certain level of knowledge and skill on the part of the operators. Errors and mistakes can occur when implementing new work instructions, but that is part of the implementation process [10].

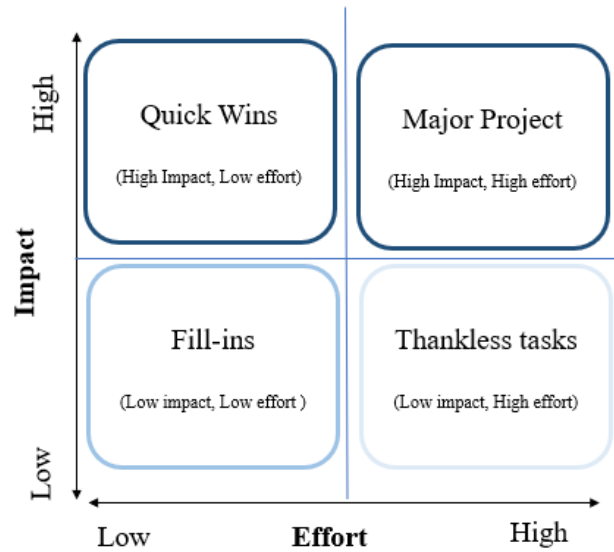
## 2.5 Follow-up of a standardised work

Standardised work methods should be followed up as a manufacturing system to pursue continuous improvement, high resource efficiency and avoid quality issues. The most important factor of the standardised work method that should be considered is the planned time [9]. A follow-up should be carried out in case of deviation from the planned time for the standardised work. Tracking is necessary when the products and tools change and when the tools are improved. In case of available resources for the organisation, it is beneficial to follow up regularly to avoid a drop in system performance [11].

## 2.6 Priority matrix

A priority matrix is a tool to determine which solutions and improvement proposals should be prioritised after identifying areas for improvement by evaluating them in terms of impact, the difficulty of implementation and the effort required. Effort refers to all resources in terms of investment, time, planning and personnel. The matrix helps to categorise the proposals or work tasks into four different categories, as figure 2.4 shows: Quick wins, Major projects, Fill-ins and Thankless tasks. Quick

wins are high-value tasks that are both important and challenging. Implementing the suggestions in this category requires little effort and has a significant impact to reduce setup time. Improvement proposals that fall into the major projects category are solutions that require a high level of effort and whose implementation is associated with significant projects and investments. Improvement proposals that require more effort and have a lower impact belong to the thankless task category. Improvement proposals requiring little effort and low impact belong to the fill-in category[12].

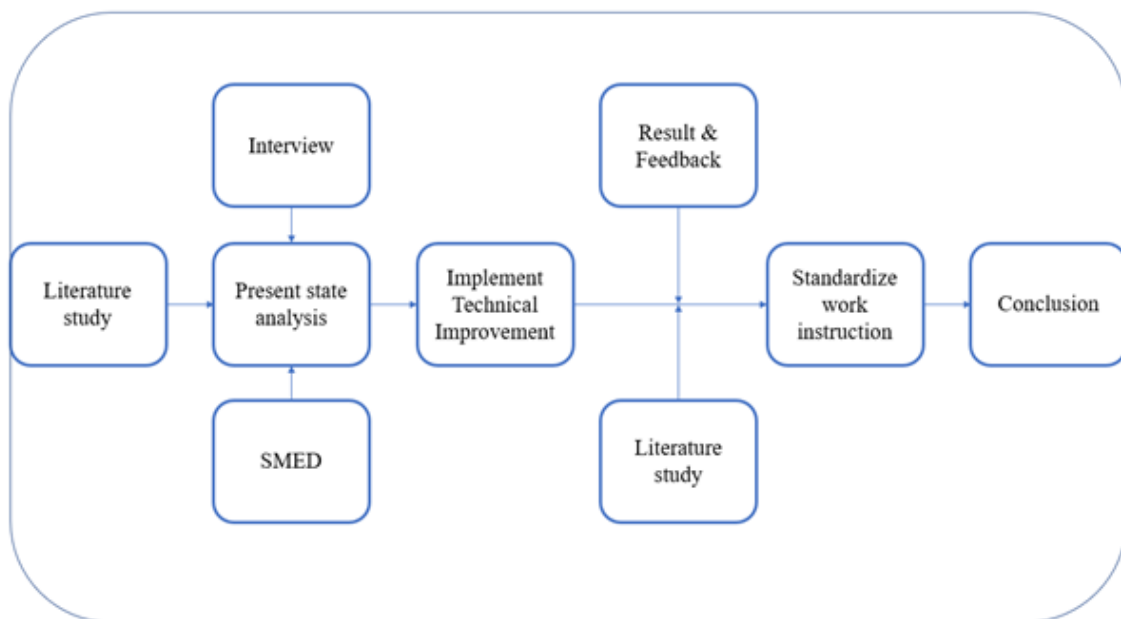


**Figure 2.4:** *Priority Matrix model*

# 3

## Methods

Different methods will be used to achieve the project's goal, but the most important one is SMED, which can be used to analyse the setup process and reduce the current time with the support of Avix. To use Avix, the setup process is measured using video recordings, which helps to verify the flow of activities. A spaghetti diagram is created to visualise the path of operators during the setup. As the figure 3.1 shows, once improvements have been identified, some of the possible improvements are implemented. The results are analysed again and fed back into the process and used to create standardised work instructions.



**Figure 3.1:** : *An Illustration of the Method*

### 3.1 Organisation evaluation

As a first step, before the setup process was videotaped and documented, an analysis was conducted at the station by observing the operators during several setup processes. This step led to a better understanding of how the setup process is planned and what methods are used and mapped together. An interview was conducted with one of the experienced operators performing the setup during the video recording to explain the main activity. A list of activities in Avix was made. The activities performed by the operators were documented during the video recording of the

setup process for better understanding. During the meeting, the setup procedure was analysed step by step, which led to identifying some areas for improvement and unavoidable errors. The possible variations of working methods depending on the tool and operator were also discussed and documented.

#### **3.1.1 Recording**

Video recording was done to document the setup process and to measure the time for all operations. The video recording facilitated the analysis of the operation and the setup procedure and allowed for the repetition of the operations. The filming was planned so that each operator was filmed through a GoPro camera installed on their forehead. The camera was placed at an appropriate angle to ensure that all activities and operations were filmed. Before the video recordings, the operators were informed about the purpose of the study. Participation in the survey was not voluntary, but all four operators participated with consent. During the first attempt to film in PAGO, one of the operators refused to put on the Go-Pro camera, but he had to be replaced by another. After the improvements were made, the video recording of the process was also done with the Go-Pro cameras. This time, other operators were selected for the recordings because of the limited staff at the plant.

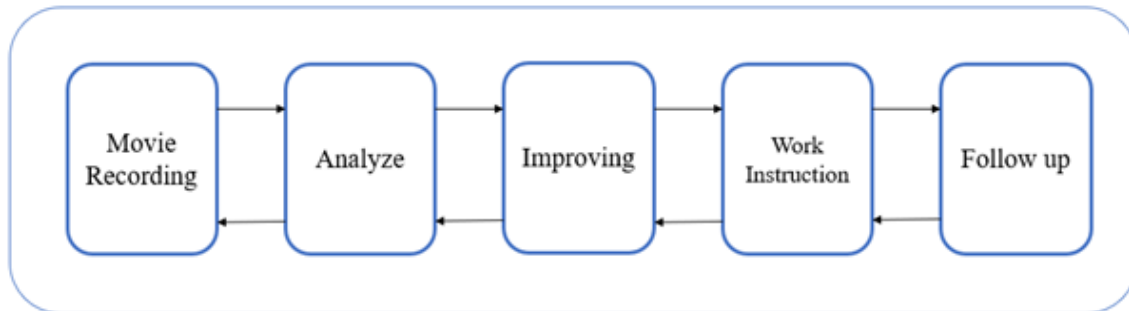
#### **3.1.2 Avix**

Avix is a computer software for managing film processes in order to improve the process. The purpose of using Avix in this study was to obtain a standardised time for the different steps of the setup process. Avix is used in the project to optimise the setup process by dividing the recorded setup process into sequences of work tasks and separate activities using the SMED module. The SMED module is one of the various modules in Avix that allows users to separate the internal tasks from the external tasks and rearrange the sequence to minimise the inner setup work. This module can be used to create a SMED analysis chart, which provides an excellent visualisation of the relationships between the reset activities and the planning of the external activities before and after the internal setup process.

Using the data from Avix, a spaghetti diagram was created. With the help of Avix's time analysis, potential time savings could be generated. This enabled a detailed analysis of current working methods. The study is widely used to eliminate waste and invest in technical improvements. Avix is also used to print work instructions with annotations, descriptions and pictures to guide operators in performing the setup process better.

Avix is also used in order to identify opportunities for improvement in a smart manner through using general analysis diagrams. In the general analysis work diagram, the different work activities for a process are classified into four different colour categories green, yellow, red and orange. Green represents value-adding activities such as grinding, milling, drilling or assembling an object. Yellow is used for the required activities to accomplish a process such as taking, placing, handling, adjusting, inspecting, returning, following and reading instructions. Losses are represented by the colour red, which indicates the disorganisation of an object and a stop in a work-

flow. Walking steps and movements are two types of loss which arise in an existing layout. The orange represents waiting when operators must wait for each other or other processes. This diagram enables to see how the total time of the process is disturbed between different activities and how productive the work methods are.



**Figure 3.2:** *:An Illustration of Avix work*

### 3.1.3 Spaghetti diagram

A spaghetti diagram is an efficient way to visualise the operator's walking path during the setup operation. This type of diagram facilitates comparison before and after implementing improvements and makes it easier to see how the movement between different points in the station has been reduced. The tasks performed and their walking paths during the setup process were recorded. Extracting these walking paths and the movements of the workers from the recorded video and plotting them on a principal map of the workplace resulted in the spaghetti diagram of the present state analysis. The spaghetti diagram of the improved version of the setup procedure is based on Avix's new sequence of tasks and the choice of the shortest walking path. The spaghetti diagram was also used to generate a solution for finding a reasonable walking path, planning tasks that come on the same walking path and avoiding walking back and forth between two positions in the station. It is also an effective way for operators to save walking distances and time, and it is easier to convince operators and the team leader to try the new procedures.

### 3.1.4 Standardised work

A standardised work method for the setup procedure has been provided. Establishing standardized work was one of the project's primary purposes.

## 3.2 Method evaluation

As part of the improvement of the method, the focus was on the activities during the setup process, i.e. all internal activities. The activities that saved the most time for the installation process were prioritised. This step was done by surveying the operators and asking them for ideas on which methods could be improved.

### 3.3 Technical evaluation

The main focus for improving and developing the technical system for the installation process was to reprogram the robots so that when the snippets are snapped, they end up in the right place in PAGO. The second task was to solve related technical problems. The technical improvement suggestions are discussed with a knowledgeable and experienced PLC programmer and technician to evaluate and verify possible solutions.

### 3.4 Profitability evaluation

An evaluation of the proposed improvements was carried out from an economic perspective by calculating the current state and comparing it with the improved state. The data used are the machine costs and personnel costs, the number of setup processes on the machines per week. It should be noted that all types of downtime in the machine IMMS8 are documented in PAGO and sent to SAP. From there, the data can be extracted. In contrast to PASI, the data is posted via the operators and team leaders, and the machine is not connected to SAP, which leads to uncertainties regarding the accuracy of the times. A percentage improvement is presented in the results section later in this report.

A further evaluation of all the proposed improvements was carried out using the advantages based on the return on profitability and the impact they have on the efficiency of the installation time and effort each proposal requires. This evaluation was carried out with the help of team leaders and production managers from both factories. The action list, profitability and savings were presented at a meeting with the production manager and team leader. From there, the placement of the improvement proposals in the priority matrix was determined.

# 4

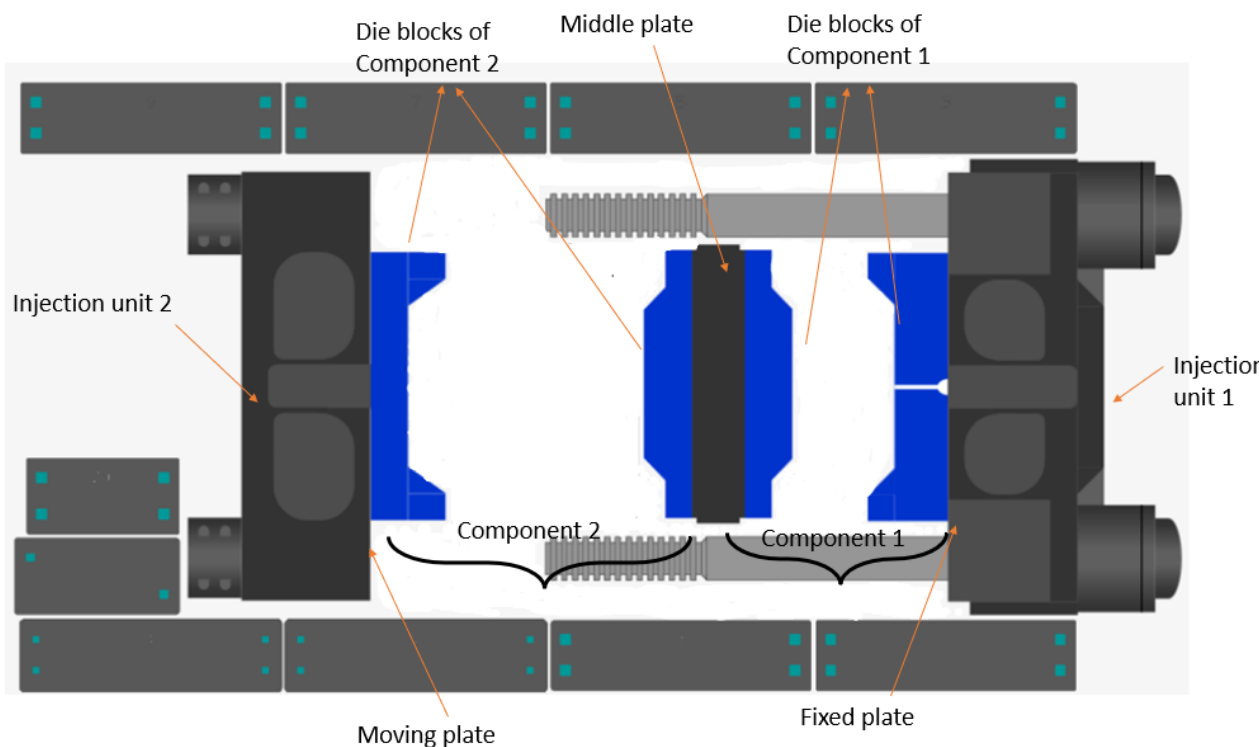
## Present State Analysis

This chapter analyses the current setup process, describing the station's production and setup operation. The gathered data from both plants will be presented with a baseline description for improvements.

### 4.1 PAGO

#### 4.1.1 The production station

The IMM8 machine produces two products at the same time because the mould consists of two parts, each with a pair of die blocks. The material is injected into the die blocks through the injection units, and the die blocks move towards the fixed plates to form the injected material into the products. The cycle time to produce a pair of products depends on the mould and components but is between 60 and 80 seconds.



**Figure 4.1:** *A Mould construction of a combo machine*

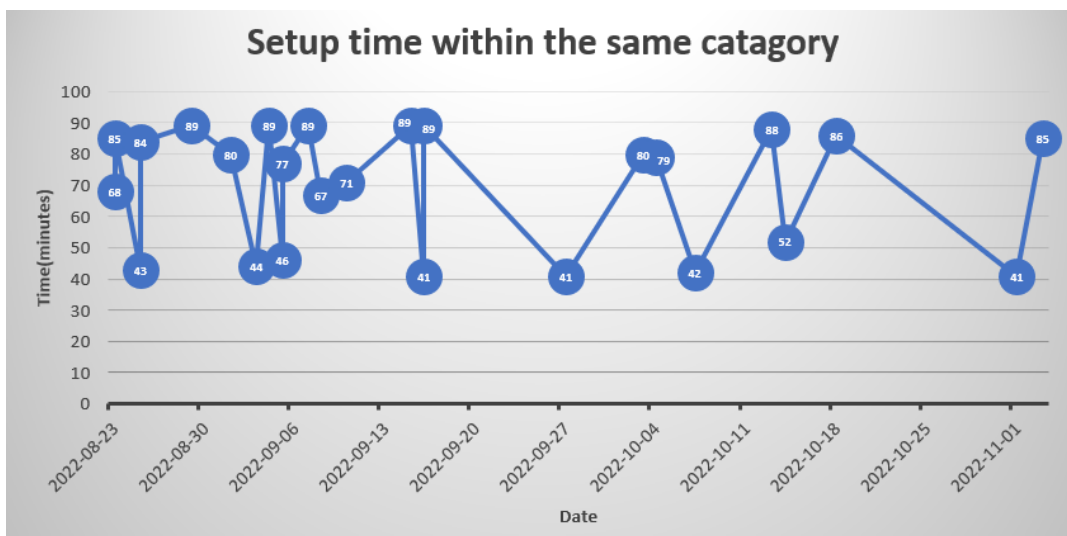
The material used for these products is PC and ABS, except for recipe 15. Since recipe 15 is unpainted, PC and PBT are used instead. Produced products are picked

with the help of the robot, see figure 4.4 and placed in the robot carousel. They are then transferred to the conveyor belt, where the operators check the products for defects and pack them into pallets.

### 4.1.2 Current production planning and setup time

The current production planning is based on customer demand and stock capacity, which are short-term planning, mainly weekly volume planning, and sometimes daily planning. The production planning department prefers to run longer cycles for the same die-cast mould to avoid extra setup time. The planned setup time for IMM8 is between 60 to 120 minutes depending on if only one or both die-cast moulds are switched. The planned setup time stays the same regardless of the experience of the resetting operators, but in some cases, the setup can be postponed to the next shift. Disturbances during setup have a domino effect on subsequent runs, meaning that runs have to be extended to compensate for the lost time and the planning needs to be readjusted. These disturbances lead to stock shortages in production and logistic systems.

According to the graph below, the setup time has been mostly higher than the planned time. The data is taken from week 34 until week 45. The setup time differs depending on each category. *See Appendix B.1 to see the various categories of the tools.* If the setup is between tools within the same category, then the planned time is between 40 and 60 minutes. If the setup is between two different categories, the scheduled setup time is between 90 - 120 minutes.



**Figure 4.2:** Graph of Setup time for setup within the same category

As figure 4.2 shows, the actual setup time for changes within the same category is between 40 to 90 minutes with the average being 69 minutes. Any disturbances that appear when changing between the same category have a more minor complexity than when changing between different categories. It is due to the more complex tasks such as changes in the injection material, so the disturbances when changing between categories have even larger time delays in comparison.

Below, the graph shows the setup time for changes between two different categories, including material changes. The average value for this is approximately 107 minutes. The setup times in the graph are higher than 120 minutes due to the technical problems that have occurred, causing a more extended downtime than planned.

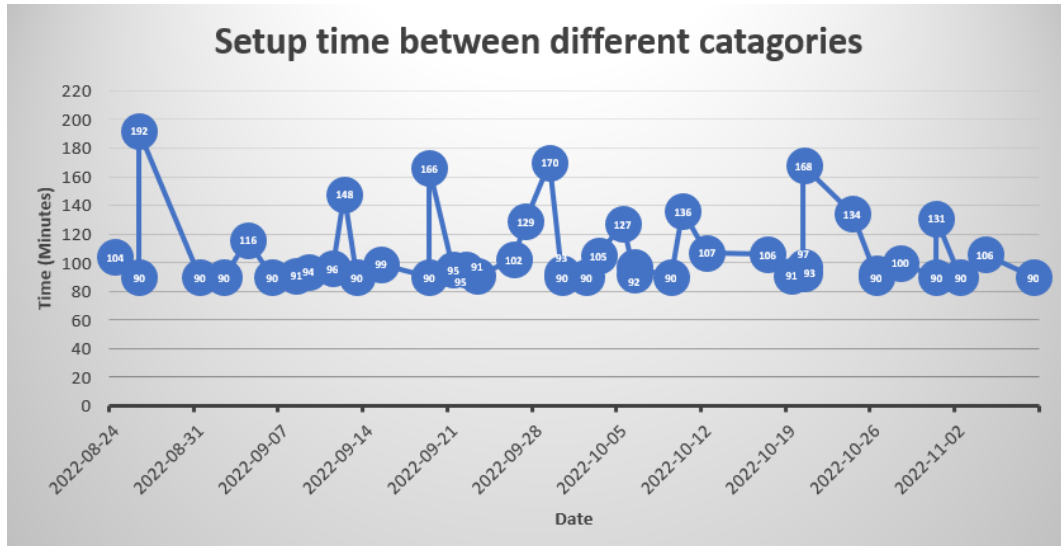


Figure 4.3: Graph of setup time between different categories

The measured OEE between weeks 34 and 44 is 73.57% see the table below. According to the production planning department, this value is much lower than expected at 85% when the machine was constructed.

Table 4.1: Actual percentage of Present state of OEE, availability, Performance for IMM8

OEE	Availability	Performance
73,57%	78,09%	98,67%

### 4.1.3 Current setup process

The setup operation is performed by two operators who have overhead crane licenses. One of the operators has the overhead crane driver role, and the other is the machine owner. The activities are based on what the operators can do and their experience. Detailed predetermined and designed activities for each role do not exist.

The work instructions are not followed because they are not updated The overhead crane driver role (operator 2) includes tasks related to the tool’s transport during the setup process. The machine owner operator (operator 1) takes care of the settings panel and machine settings during the tool change operation and setup process.

Once the setup begins, operator number 2 brings the overhead crane to the station and waits for operator number 1 to material ejection from both sides of the machine to remove the remaining material from the previous product cycle. If the material should be changed for the incoming tool, operator number 2 must wait.

Once this step is over, operator number 1 begins by disconnecting the connectors

and hoses that connect the machine to the outgoing tool at the front. At the same time, operator 2 begins to disconnect the heating connectors that sit above the tool. Once the top of the outgoing tool is disconnected, operator 2 goes to the backside of the machine next to the robot cell and disconnects the connectors and hoses on the backside.

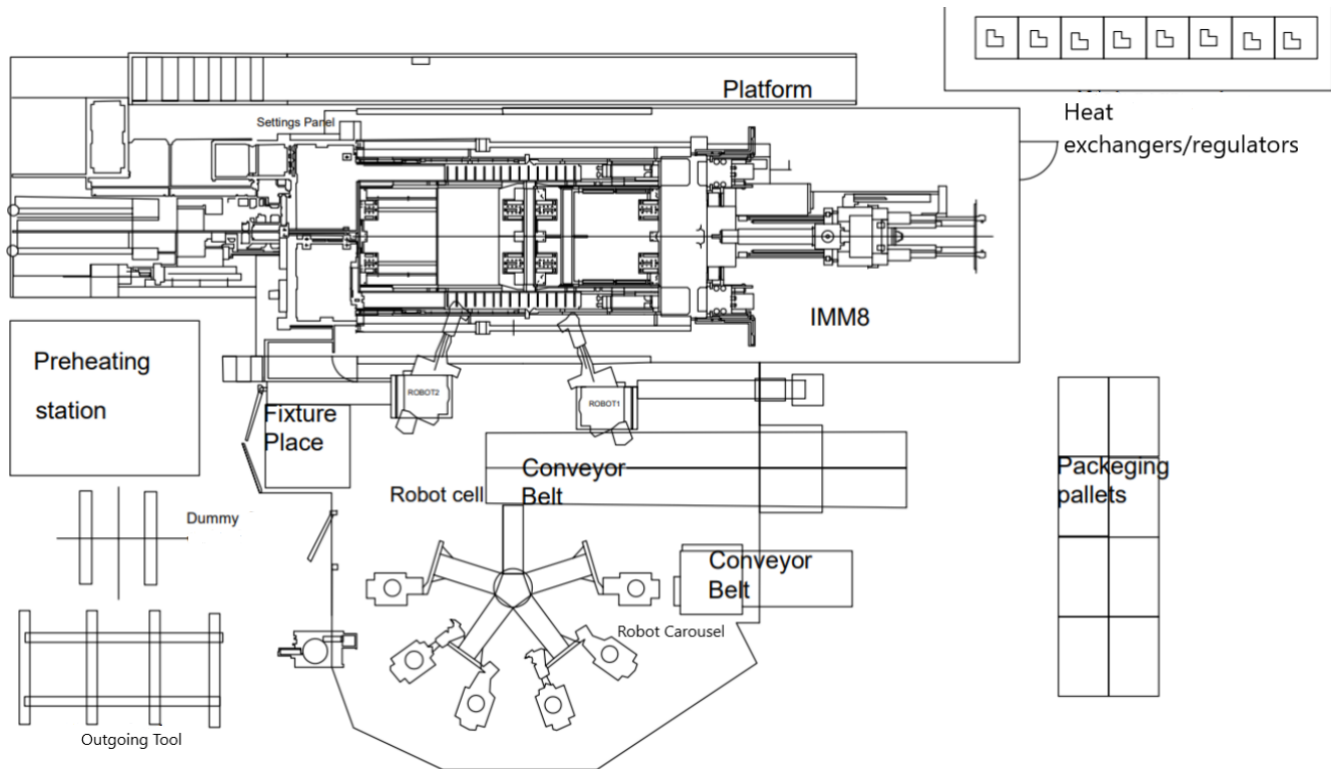
After disconnecting the hoses, put a safety bolt on the tool parts front and back to lock two sides of the mould for safe transport. The operators go to each other and double-check which stage of the process they are in. While operator 2 transports the outgoing tool from the machine to the temporary location of the outgoing tool on the station, see figure 4.4, operator 1 opens the cell and sweeps away residues from produced products. Then a pallet lift is fetched to drive out the outgoing tool's robot fixture. The tool is two parts, and the overhead crane must be moved back and forth several times.

The incoming tool is on the preheating station before the setup. Read Appendix 5 about the preheating station and its function. See figure 4.4 for a better illustration of the station's layout. First, outgoing tool part 2 is transported from the machine to the marked location. The overhead crane is driven open back to the machine, takes tool part 1, and transports next to tool part 2. When the transfer of the outgoing tool is complete, the incoming tool takes place in the machine. First, part 1 of the incoming tool is transported to the machine and connected. Then the overhead cranes move back to the preheating station, and part 2 of the incoming tool is transported to the machine and connected in the right place.

Then Operator 2 connects the heat contacts on top of the instrument. After this step, operator two is done and leaves the station. Operator 1 connects hoses on both the back and front of the machine. Once all the connectors and hoses are connected, operator 1 goes to the heat exchangers, turns on the heat exchangers, starts loading the program, and inputs the new values of the incoming tool. The tool must be heated up to 70 degrees, and thanks to the preheating station, this step takes place quickly.

Operator 1 continues independently with the rest of the tasks, such as loading new programs for the robots and starting the material ejection to reach the fresh material through the machine and eject through the tools. When the operator is alone, everything must be fixed on his own.

As previously mentioned, there are always three operators at the station, one of whom only does not participate in tool change according to work instructions. He waits for tool change to be completed to continue his tasks. The actual tool changeover time has been around 1 hour and 30 minutes during the process. However, the total time between the last produced and the first made part after the setup process is more than expected, 2 h and 30 minutes. See Appendixes D.1, D.2 for an illustration of the operator's walking path during the setup process.

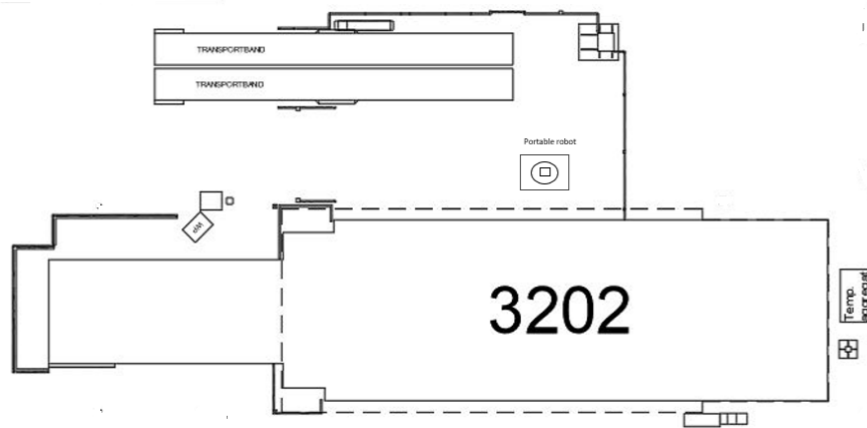


**Figure 4.4:** An illustration figure of the station IMM8: *layout figure shows where the incoming tool, outgoing tool preheating station and Robot cell are placed*

## 4.2 PASI

### 4.2.1 The production station

Machine 3202 also produces two products at the same time. The product cycle for this machine is between 87-95 seconds and depends on the detail and the material. The injection moulding process of the device is based on the same process as IMM8. The figure below, 4.5 show an illustration of workstation 3202.



**Figure 4.5:** *An illustration of workstation station 3202*

### 4.2.2 Current production planning

Customer demand determines the production planning, and the setup schedule can mostly change quickly at short notice. The production planning is for one week period. The planned setup time is 145- 180 minutes for machine 3202, regardless of the combination of tools. This fixed time because the heating process of the tool performs during the setup, which takes between 40 to 60 minutes.

### 4.2.3 Current Setup process

The setup process is divided into two roles: "tool changer" operators and "resetting" operators. The tool changer operators perform the tool change process, and the resetting operation after the tool change performs by the resetting operator. One of the tool changer operators takes care of transporting the outgoing and incoming tools, and the other takes care of disconnecting connectors and hoses. The forklift transports outgoing tool parts from the workstation to a cooling station. After the operator connects the hoses to cool down the tool, drive to the storage location to collect the incoming tool.

The tools should be transported using the overhead crane usually found on other machines to special pallets picked up via the forklift. Machine 1604 is often stopped to move the overhead crane. It is because a safety sensor has yet to be installed at the robot cell on machine 1604. The forklift is constantly charging. It is approximately

200 meters away from the station. The forklift used is broken and has been running at a 60% lower speed since the summer.

According to the production leader, The used forklift was broken at a 60% lower speed than usual. During the setup process, operators move between the three different workstations and tool storage; see Appendix C.3 a layout of those three workstations. Once the tool change is done and the hoses are connected, tool changer operators send a signal to the resetting operator and then leave the station.

It always takes time for the resetting operator to arrive at the workstation; this waiting time is used to heat the tool because there is no preheating operation. The resetting operator checks the material, tool and water temperature. After ejecting the material through the ejection units on the two sides of the machine is time to run the machine and test the product's quality.

The tool change took about 1 hour and 35 minutes, but the whole setup process was performed in 2 hours and 50 minutes, of which 45 minutes was the waiting time for the resetting operator and heating the tool. The measurement system of OEE value for this factory is different from the other plant. According to the production leader, OEE is 50% less. There is no data available for OEE for recent weeks.

The setup occurred between two shifts; the resetting operator was from the evening shift. Once the resetting operator took over the station, he was forced to control everything one extra time before starting his work tasks. See Appendix B.2 to understand better the hierarchy system and the required knowledge of the operator's levels.

### 4.3 Comparison

The setup process of IMM8 performs more effectively than the setup process of machine 3202, and the overall waiting time and waste are lower. The IMM8 station has a larger empty area that can be used to place the tool next to the machine or to preheat it there. Unfortunately, this option is unavailable on machine 3202 because of the limited space outside the station. The station layout for machine 3202 in Appendix C.3 shows the limited space around machine 3202. The transport of the tools is done differently for machine 3202 than for IMM8. Since the tools are not near machine 3202, the tools are transported to and from the station with a forklift. At machine IMM8, only an overhead crane is used to lift the incoming tool from the preheating station, as shown in figure 4.4, to the machine.

The following figure, 4.6, shows a general analysis of the setup process for IMM8. The total waste during the process is 19%, corresponding to 2 559.4 seconds. The total waiting time is 626.2 seconds, 5% of the total time. The rest of the time is accounted for by the activities required to be carried out to complete the changeover process.

Despite the fact that the process for PASI is split between two different roles and 5S has been significantly developed, the waiting time in the setup process is higher than in the setup process for IMM8. A general analysis of the set-up process for machine 3202 shows higher waste and waiting time; see figure 4.7. It depends on the transport of the tool from the tool storage to the machine and from the machine

#### 4. Present State Analysis

to the storage and also lacks planning and communication during the setup process. Operator 2 has to wait for operator 1 to bring the incoming tool to the station; therefore, the total waiting time is higher than the setup process for IMM8.

##### Time per work class

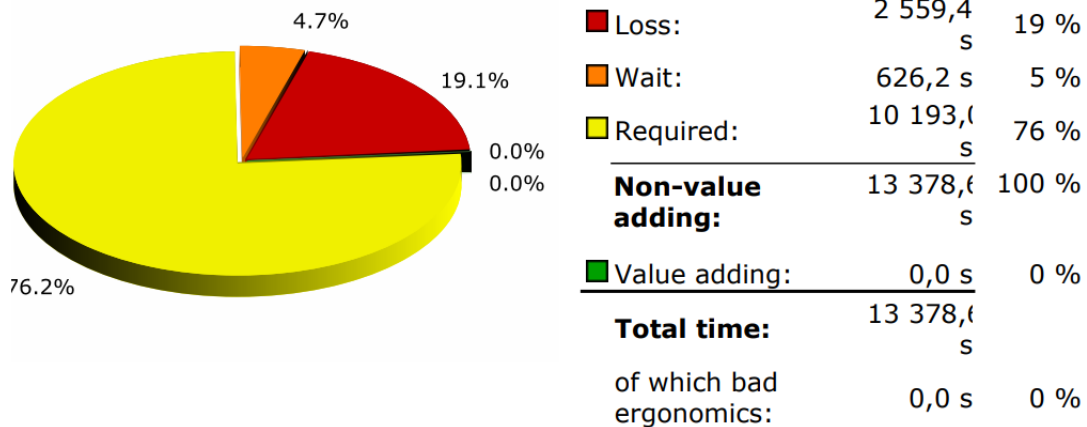


Figure 4.6: General analysis diagram of the setup time IMM8

##### Time per work class

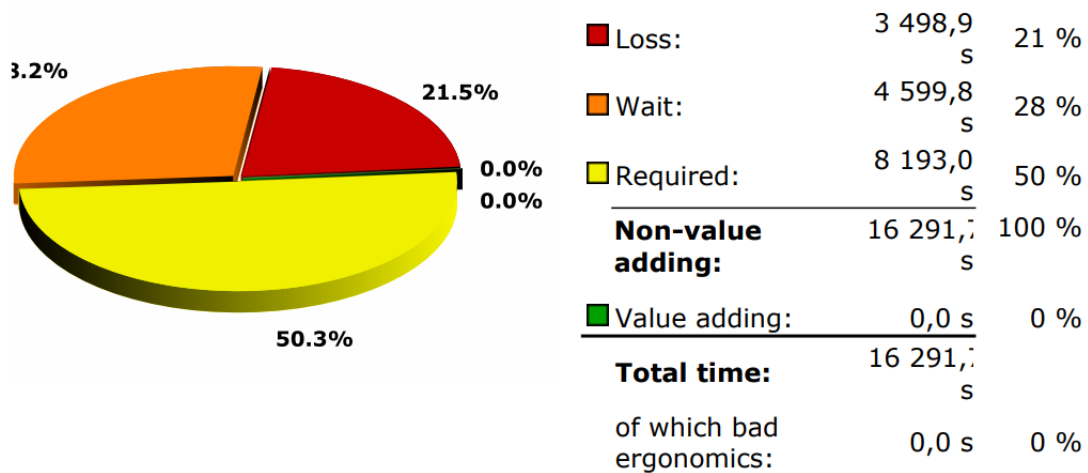


Figure 4.7: General analysis diagram of setup time, Machine 3202

# 5

## Improvement Suggestions

### 5.1 Organisational improvement

The standard working method for the conversion process needs to cover all the different variants. Organisational improvements should be implemented before standardising the process to work with this. The main focus of organisational changes was to reduce the walking distance and the waiting time during the setup.

#### 5.1.1 PAGO

##### *Communication and better planning*

To reduce the time spent by the operators, a solution was introduced to communicate with each other through earphones. This solution could eliminate the time spent walking to each other to communicate while reducing walking distance. The pathway for the original organization has been illustrated in Appendixes D.1 and D.2. Better planning of work tasks should contribute to a reduction of waiting time between the performed operation by operators.

##### *A third operator*

One more operator should be added during the tool change process, plus operator number 2 is allowed to leave the station when operator 1 informs the operator. A third operator contributes less time by performing certain activities such as cleaning inside the robot cell, moving the old robot fixture to the fixture storage, putting back more extensive tools that cannot be carried with them and emptying material.

##### *Train operators*

Appoint two operators to perform the tool change operation, upgrade their skills and train them as resetting operators. It would help remedy simple technical problems during tool changes and reduce the waiting time for a technician. The quality of the tool change will be improved because two people with the same level of knowledge will perform the work. More knowledge leads to skilled operators who know the sequence of operations. The risk of errors and disturbances during the setup procedure will be reduced.

##### *Operator2 doesn't leave the workstation*

When operator 2 leaves the workstation, operator 1 should handle the settings panel, robot cell and material ejection. The availability of operator 2 in the workstation contributes to less walking path for operator 1 in case of disturbances and a lower total loss time.

### 5.1.2 PASI

#### *Communication and better planning*

The waiting time was caused by technical problems such as the broken forklift and planning and communication. The operators are trained for the setup operation and have pre-designed tasks, but the lack of planning leads to one of the operators waiting for the other operator to accomplish a task. The other cause is that operators are not communicating during the process. Regarding communication needs, the operators should go to each other.

## 5.2 Method improvement

To reduce the setup time, the method of the tool change process has been looked into for both plants.

### 5.2.1 PAGO

#### *Internal activities to external*

Some equipment needed when changing tools can be spread out and brought to the station. The savings is the time spent preparing and collecting these pieces of equipment. Some activities can be carried out before starting the tool change. Table 5.1 below presents the activities that can be carried out as external activities.

**Table 5.1:** External activities for PAGO

No	Activity	External/Internal	Time (seconds)	Operator	After/Before setup
1	Bring pallet jack	External	180,6	1	Before
2	Bring overhead crane	External	116	2	Before
3	Prepare overhead crane	External	120	2	Before
4	Bring the Broom to the robot cell	External	49,4	1	Before
6	Bring equipment	External	276	2	Before
7	Fill in yellow clips to Robot cells	External	86	1	After
	Sum		828		

#### *Connection of the hoses*

Using Quick connectors or multi-couplings would decrease the operation time of connecting and disconnecting hoses. This improvement would facilitate this operation for the operators by connecting several hoses simultaneously.

#### *5s*

An essential factor is to keep all tools and equipment used in the tool change process in order. Putting back equipment used during a setup process helps reduce time spent looking for it. All tools should be close at hand. During tool change, a shovel

is needed to remove material, and usually, a shovel is missing in one of the ejection units, which are located on two sides of the machine marked in figure 4.4.

#### *Measure the quality of the ejected material*

A new measurement method should be used to reduce the material quality measurement time for the ejected material from the ejected units. The operator uses visual inspection to see the colour, gloss and viscosity by feeling the liquid material with a shovel and seeing the material's behaviour.

### 5.2.2 PASI

#### *Connection of the hoses*

Machine 3202 has a large number of hoses which is a total of 80 pcs for both sides of the machine, including oil and water hoses. The total time for disconnecting and connecting the machines' hoses is about 13 minutes. A solution to decrease this time is using the quick connector or multiple couplings.

#### *Internal activities to external*

Many activities during the setup process can easily be performed before or after the setup time. The primary activities can be prepared before the setup process starts. The table 5.2 below shows the activity name and the time each activity takes. The table also marked which activities to do after setup or before setup.

**Table 5.2:** External activities for PASI

No	Activity	External/Internal	Time (seconds)	operator	After/Before setup
1	Prepare the overhead crane	External	455,3	2	Before
2	Prepare the forklift	External	345,3	1	Before
3	Transport of the incoming tool	External	361,8	1	Before
4	Transport of the outgoing tool to cooling station	External	242,9	1	Before
5	Transport of the outgoing tool to storage	External	520,9	1	After
6	Drive back the forklift to charge station	External	171	1	After
7	Turn off the robots of machine 1604	External	194,3	2	Before
8	Connect the outgoing to the cooling station	External	164	1	After
9	Move backe overhead crane	External	91,5	2	After
Sum			2 547		

The external activities include all the transport steps of both outgoing and incoming tools. The tools can be placed closer to the workstation and transported to the cooling station or storage after the setup. See Appendix C.4; the green marked area is the incoming temporary place, and the orange marked area is the temporary placing area for the outgoing tool. These proposals and the external activities will be evaluated later in the project.

## 5.3 Technical improvement

Some technical improvement in various areas has been developed. To evaluate how possible it is to implement them. A dialogue has taken place with the technician and the team leader.

### 5.3.1 PAGO

#### *Communication between machine and heat exchanger/regulator unit*

The contact between the settings panel, heat exchanger and regulators did not work when changing tools. Operator 1 had to go to the heat exchangers to turn them off manually, and the same was confirmed after the tool change was complete and they were to be turned on. Solving this technical problem would contribute to a great benefit and additional solution to reduce walking distances for the operators. Additionally, it facilitates inputting the new temperature for each channel of the machine by loading from the program instead of inputting every value to each heat exchangers.

#### *Implementation changes in the heating cables*

The heating cables are attached above the tool have long cords that prevent finding the right contact. Cutting these cables will not affect the machine's construction and would contribute to less time to find the correct cable for the connectors.

#### *Reprogram the robot*

When robots 1 and 2 pick the product from the machine and cut off the remains, they do not end up in garbage bags correctly. The material is hard, and when cut, it flies away and ends up on the cell floor, only to end up on the conveyor belt under the robot and transferred to the garbage bag. Operators should clean the cell when tools are changed because, during production, when the machine is running, it is impossible to open and clean the robot cell for safety reasons. It can be solved by reprogramming the robots so that the scrap remains in garbage bags. Time-saving is that cleaning time will be eliminated. Alternatively, reprogram the entire robot cell so it can be opened while the machine is running and cleaned. The time saving is that the cleaning time of 7 minutes will be eliminated.

#### *Reduction of heating tool time*

As mentioned in chapter 4, "present state analysis," the incoming tools are in the preheating station. As soon as the hoses are disconnected for transporting the tool to the machine, the water channels in the tools lose the temperature, and it takes 15-20 min to warm up the tool to the ideal temperature to run the machine. During this waiting time, the operators clean the surfaces. The heating time of the tools during the setup process differs between the various tools. The heating time should be specified for each tool to decrease the waiting time and loss of the setup process

#### *Avoid driving overhead crane without load*

In order to shorten the transport time of the tool components, the overhead crane should only drive with the load during the tool change. During the setup process, the overhead crane lifts tool component 2 of the outgoing tool to the marked area, dummy see illustration 4.4. The overhead crane returns to the machine without load to lift the outgoing tool component 2. When component 2 is placed in the dummy area, the overhead crane lifts the incoming tool components to the machine. One solution to implement the transport of the outgoing and incoming tools effectively is avoiding driving the overhead crane from the dummy area to the machine without

a load. When the outgoing tool component 1 is lifted from the machine and placed on the dummy, the incoming tool component 1 can be lifted to the machine. This solution involves technical changes to the machine and technical settings.

### **5.3.2 PASI**

*Implement the sensors to avoid stoppages on machine 1604*

During every setup process, machine 1604, placed next to the machine, should stop to move the overhead crane. When the machine stops, it takes 60 to 70 minutes to return to the same production speed. The total loss time can be around 600-700 minutes for one production week. According to the team leader, a safety sensor on the robot cells will solve this problem.

5. Improvement Suggestions

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# 6

## Evaluation of improvement suggestions

A priority matrix has evaluated all technical, organisational and method improvement suggestions for both plants. An action list based on the identified improvement areas and external activities has been created to facilitate evaluating and prioritising these proposals.

### 6.1 PAGO

The performed action list is based on the improvement suggestions and presents each action's saved time. See table below 6.1.

**Table 6.1:** Action list of improvement suggestions

Number	Action list	Description	Time ( <i>min</i> )
1	Better communication	in order to decrease the walk distance, the waiting time and unnecessary movements	7,5
2	A third person	certain work steps, such as emptying materials	12
3	Train operators	educating operators on remedying disturbances	10
4	Better Planning	Better planning of the work task in order to	9
5	Operator 2 does not leave the work station	Operator 2 stays on the work station until the setup process is over	15
6	Prepare the overhead crane	preparing overhead crane before starting the setup process	5
7	Prepare all the equipment	Prepare all the equipment inclusive the pallet jack before the setup	3
8	Connection of the hoses	using quick connector or multi-couplings	25
9	5S	Get tools, gloves, stick, shovel and put back in the right place	5
10	Material quality measurement	this can be converted into measurable	15
11	Remedying disturbances	Connection and communication between machine and heat exchangers	15-20
12	Re-program the robot	to place the material clips in the garbage and avoid cleaning	7
13	Cut heating cords	heating cord that is in bad order and too long, they can be woven and tied together	10
14	Reduction of heating tool time	Speed up the heating process	10
15	Overhead crane	Avoiding to drive the overhead crane empty	3
16	Building walkway on the tool top	it facilitates the movement on the top	3

A priority matrix, figure 6.1, has been performed based on the action list to identify the highest priority proposals.



**Figure 6.1:** *Priority Matrix of action list for workstation IMM8(PAGO)*

The matrix above shows that most actions are classified as quick wins tasks. These quick wins are organisational and methodological improvement proposals that require low effort in terms of time and staff. Action 1: requires a communication tool such as a headset Action 2, adding a third person, an organisational improvement, saves 12 minutes during the setup time. This suggestion can be easily implemented as there is always a staff member available

Action 3 & 4: Better planning and training of operators will save 24 minutes of setup time. Operator training is classified as a major project due to the resources required, such as time and investment in a training centre

Action 5: Requires all the resources already available to operator 2. It is also considered a part of better planning.

Action 6 & 7: Preparation of all equipment, including the overhead crane, can be done before the setup process, requires no effort and can significantly impact the reduction of change over time.

Action 8: Replacing the tool's connection hoses is identified as a thankless action as it requires a massive investment of time and money and saves a total of 5 minutes. In order to replace hoses with quick couplings or multiple couplings, all hoses and the fittings need to be replaced, which leads to a change in the design of the tool.

Action 9: 5s measure of putting equipment and tools in the right order and place is easily implemented through detailed work instructions and operator training.

Action 10: Measuring material quality was identified as a thankless action for this project due to the limited resources available. Measuring the material quality of the material ejected from the machine is not possible for the time being as no historical data is available. The only method is to measure the thickness and behaviour of the

material by visual estimation.

Action 11: Although this is a difficult step and requires effort, eliminating the faults can significantly impact and improve the process. Resources such as maintenance staff and technicians are available; no investment is required, only time and effort.

Action 12: Reprogramming the robot cell is identified as an impossible action due to safety and the resources required, such as external experts and time.

Action 13: This change can easily be done with the help of maintenance and technical staff. There are existing resources for this action, which is beneficial for the process and the operators. It can simplify the process of connecting the heating cables.

Action 14: Reducing the time for heating tools is complicated. It requires historical data, which is not available, and investment in new heating resources.

Action 15: Resources are available for this proposal, but implementation may take time due to the simulation process Action 16: Implementing a catwalk is almost impossible as it may affect the tooling instruction due to the complexity of the installation. It requires much effort and can improve the turnaround time to less than 5 minutes.

According to the priority matrix presented, actions 1, 2, 4, 5, 6, 7, 9 and 11 are selected for implementation.

## 6.2 PASI

Table 6.2 below shows the action list based on the improvement proposals for workstation 3202 and a description for each action.

**Table 6.2:** Action list of improvement suggestions

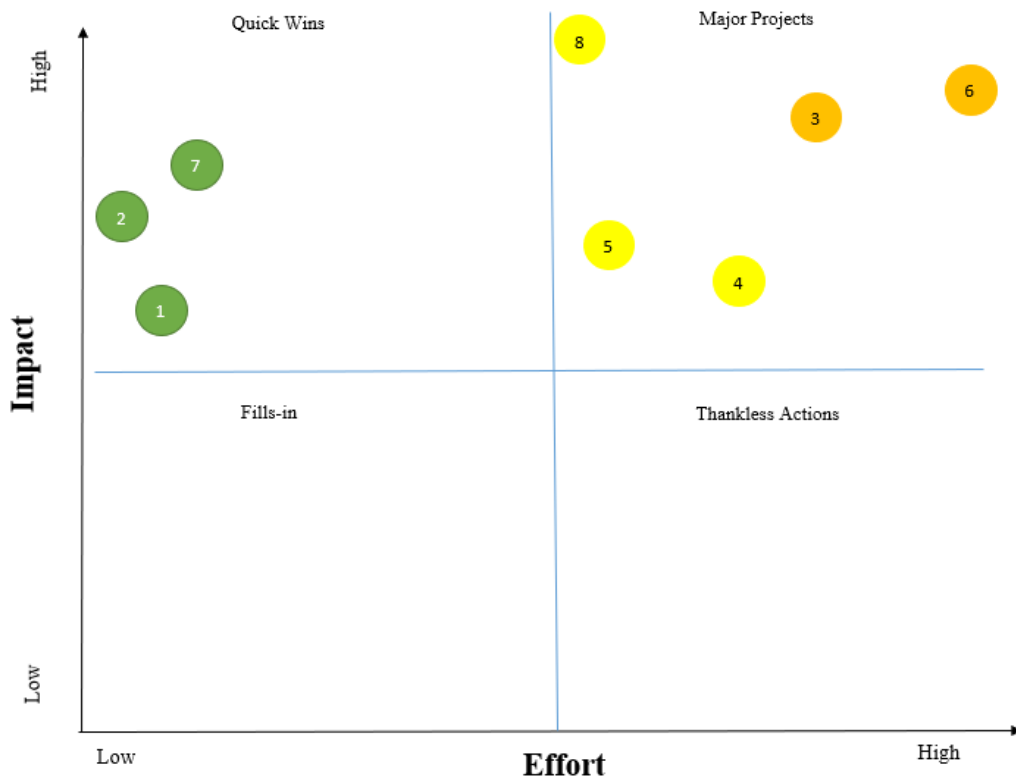
Number	Action list	Description	Time (min)
1	Better communication	Use headphones for communication through a group call instead of going to each other	5,2
2	Prepare the overhead crane before the setup and move it back after	Before starting a resetting process, plan to prepare the equipment and double-check by a checklist; the overhead crane can move back after the setup	9,1
3	Transport the incoming tool closer to the workstation before the setup	use the space opposite the workstation. It requires planning and investing	41,6
4	Place the outgoing tool closer to the machine	Use the space opposite the workstation, and transport the tool after the setup. It requires planning and investing	10,4
5	Changing connection of the hoses	By using a quick connector and multi-couplings, several hoses can be connected at the same time	12,7
6	Preheating station	To heat the tool and the warm channels in of the machine and the tool faster	45
7	Better planning to reduce the waiting time for operators	It requires planning before the setup process and also detailed work instruction	9,5
8	Implement a safety sensor (machine 1604)	Robot cell of machine 1604 does not need to turn off the machine can run during the setup process of machine 3202	68

As the priority matrix figure 6.2 shows, three improvement proposals, numbers 1, 2 and 7, are in the quick wins block. Implementing these suggestions requires better planning of work tasks and pre-designed, detailed and correct work instructions for operators. It is possible through the standardisation of work tasks. The complexity and difficulty of these proposals are low, and the effort required goes through available resources such as time, staff and equipment. Action number 6 was identified as the most critical, as a preheating station requires space either near the machine or somewhere in the plant.

However, according to the team leader, it is an impossible major project; thus it is

## 6. Evaluation of improvement suggestions

marked in red. It has been placed at the far end of the effort line, even though it provides excellent benefits in effectively showing the setup process. Actions 3 and 4, which are suggestions for improving the method and have also been identified as external activities, require a logistical change to the limited space around the workstation marked in Appendix C.4. It is assumed that the reduction of the setup time requires a considerable amount of time and planning. The marked area can be used to shop for outgoing and incoming tools. Currently, the area is used for daily meetings before the start of each shift.



**Figure 6.2:** *Priority Matrix of action list for workstation 3202 (PASI)*

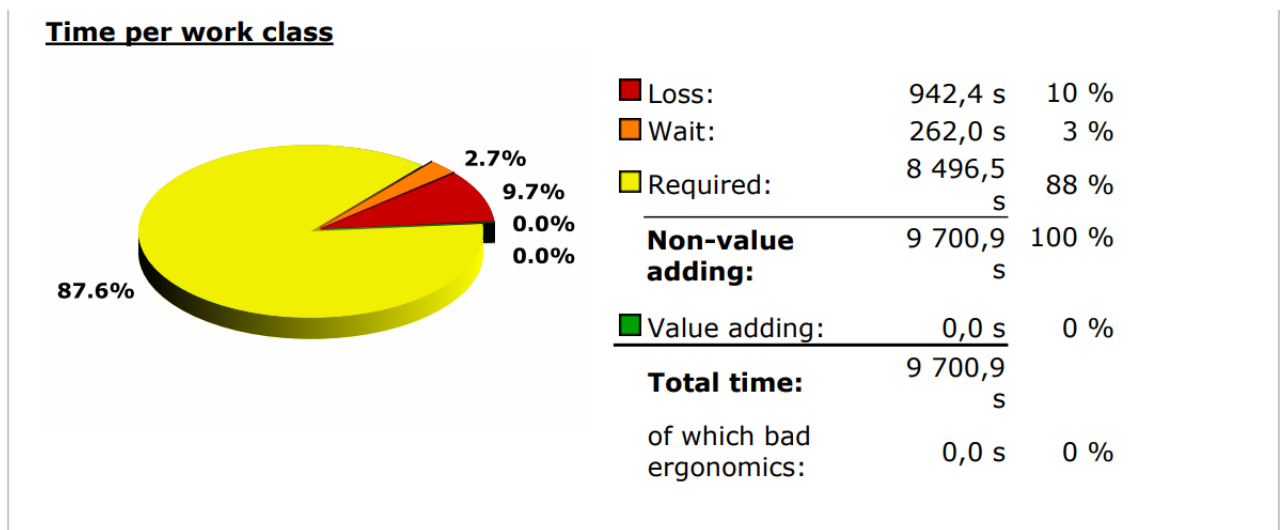
Therefore, based on the evaluation of the above actions, actions 1, 2, 4, 3, 5, 7 and 8 decide to implement and move on. The improved version of the analysis of the setup process is based on eliminating the waiting, communication and transport time and changing the method of connecting the hoses.



**Table 7.1:** Setup process time deviation for external and internal activities, IMM8

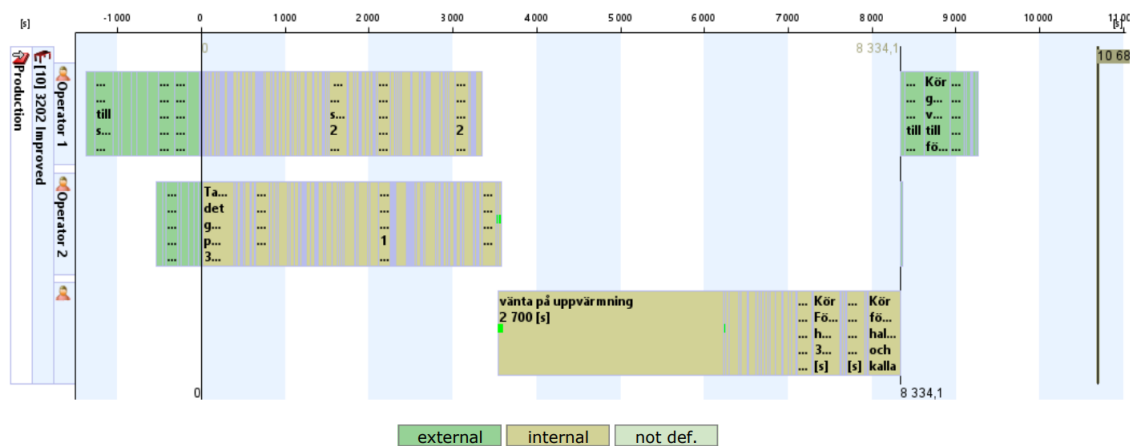
Performer	External Time(s)	Internal Time (s)	Total work time(s)
Operator 1	291	4 473	4 764
Operator 2	296	3 471	3 767
Operator 3	0	649	1 169

The external activities are included in the required work class. The loss of the setup process in the general analysis is the operators' walking time, which was successfully reduced from 19% to 10%. The walking path of the operators has been limited to the necessary areas around the machine and the robot cell. See Appendixes D.3, D.4, D.5 for the operator's walking path illustration of the improved version of the setup process.

**Figure 7.2:** General analysis diagram of the setup time IMM8

### 7.1.2 PASI

The total resetting process time for workstation 3202 decreased from 10 653 seconds 177 minutes to 8 376, a reduction of 21%. According to the general analysed diagram 7.4, the loss of the processing time is 10% for the improved process, and the total waiting time is 5%. The SMED chart figure below 7.3 and table 7.2 present the planned time for the preparations, specifically the time for each operator's external activities. The resetting operator performs only internal activities that are impossible to accomplish when the machine runs. Therefore, the external activity time is 0 for this operator. The operator's walking path during the setup process has been limited because of the new suggestion for placing the outgoing and incoming tools, preparing the truck before setup, and placing it close to the workstation. Appendixes D.9, D.10 and D.11 show the spaghetti diagram for operator's walking path of the improved process.

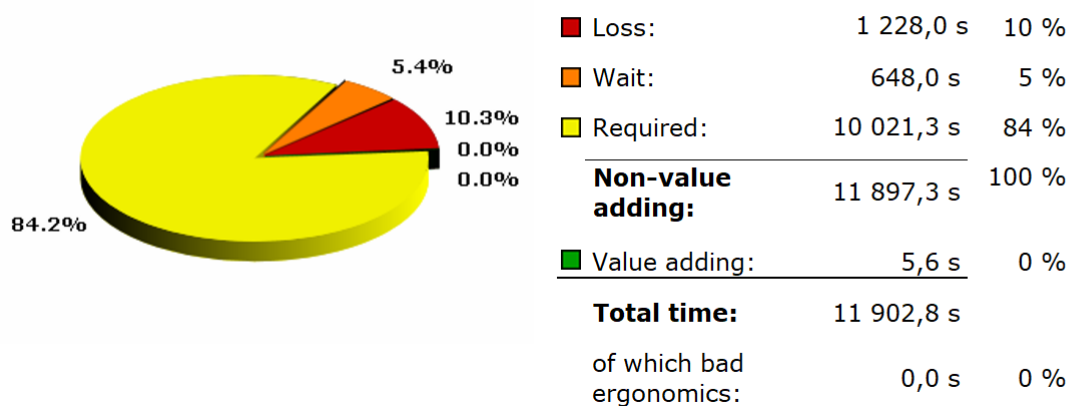


**Figure 7.3:** SMED analysis chart for the theoretically improved setup process for machine 3202

**Table 7.2:** Setup process time deviation for external and internal activities, IMM8

Performer	External Time(s)	Internal Time(s)	Total work time(s)
Operator 1	2 302	3 646	5 649
Operator 2	576	3 576	4 152
Resetting Operator	0	4 801	4 801

#### Time per work class



**Figure 7.4:** General analysis diagram of the improved setup process for machine 3202

## 7.2 Implemented improved setup process

Once the theoretical improvements had been achieved, it was time to implement the suggested improvements into the original setup process to see if the improvement and SMED analysis would lead to an equally good result in the real process.

The improvements were implemented through meetings with the team leader and the production manager of the IMM8 workstation. The suggestions on organisation

## 7. Results

and method were implemented directly with the team leader and the operators. The technical improvements were forwarded to the maintenance department and technicians to examine if they could be implemented.

Video recording of the improved process was planned several times. Still, it could not be recorded at the first attempt due to disruptions and changes in production planning, but it could eventually be carried out. Three operators were selected to record the results of implementation. Two of them had the same level of knowledge and experience, and the third one had less experience than the other two.

Nevertheless, all three operators went through the new standardised work instructions again to ensure that each operation was straightforward. It is essential to mention that the team leader and an experienced operator approved the new standardised work instruction. The operators followed the walking path in the spaghetti diagram of the improved process. The team leader and the production manager took the executive leadership role and convinced the operators to follow the new standardised work instructions and the walk map.

A SMED analysis of the actual improved setup process was conducted to analyse each operation. The extent of specific suggested improvements could be investigated through the SMED analysis. In addition, the SMED analysis in Avix gave an overview of the losses and waiting times of the actual improved setup process.

Performing SMED analysis on the improved setup process of IMM8 also shows an improved result. As figure 7.5 shows, the total downtime for the tool change process is 5 006 seconds, corresponding to 83,5 minutes. The spent external time for external operations is the same as planned.

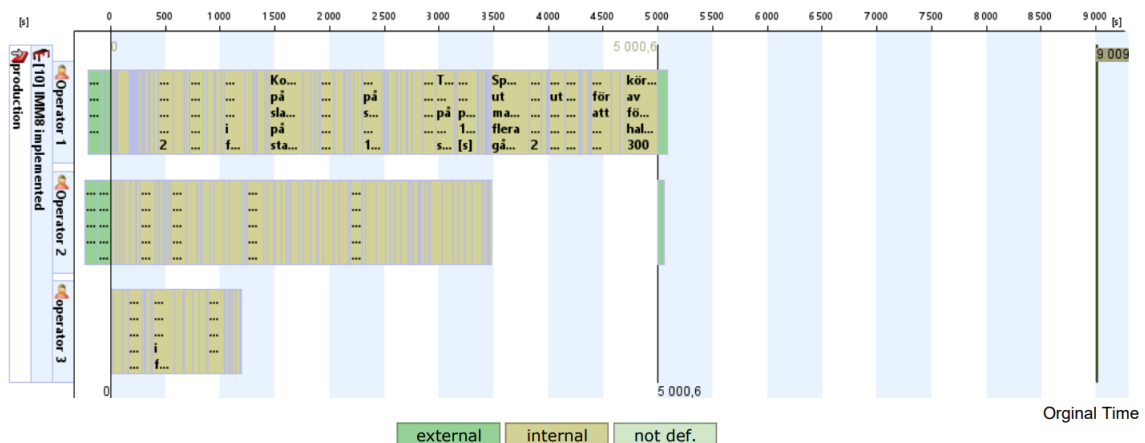


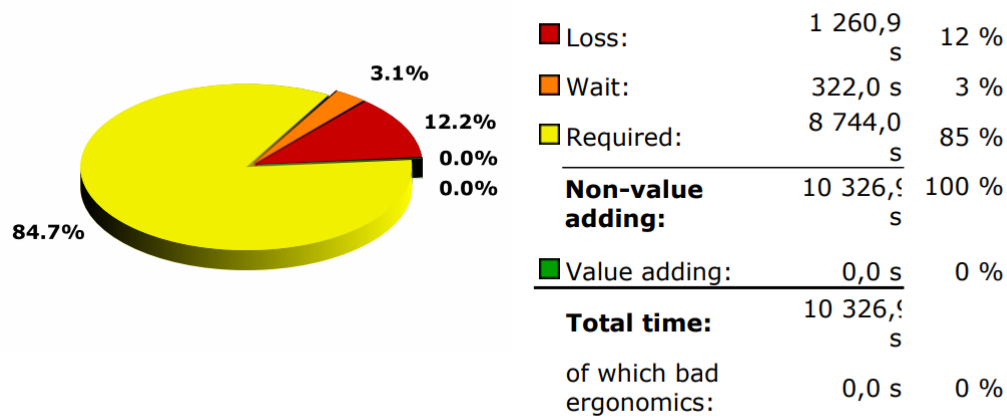
Figure 7.5: SMED analysis chart of the theoretical improved setup process

**Table 7.3:** Setup process time deviation for external and internal activities, IMM8

Performer	External Time(s)	Internal Time(s)	Total work time(s)
Operator 1	291	4 473	5 292
Operator 2	297	3 480	3 778
Operator 3	0	1 197	1 197

According to the general analysis of the actual improved process, figure 7.6 the total process loss is 12% of the total process time corresponding 1 260 seconds. The total waiting time is 3%, corresponding to 322 seconds. The total value adding time is 85%, corresponding to 8 744 seconds.

#### **Time per work class**



**Figure 7.6:** General analysis diagram of the Improved process after implementation of suggestion

The total OEE after the implementation of the improvement proposals also increased. The below table 7.4 shows OEE for that week, 82,19% OEE and an increase of 8,62. The increased performance and availability depend on other factors which are outside the scope of this project.

**Table 7.4:** Actual percentage of Present state of OEE, availability, Performance for IMM8

OEE	Availability	Performance
82,19%	84,43,09%	99,65%

### **7.3 Time savings**

A cost calculation has been performed to state the savings from the organisational, method and technical improvements based on the time savings. The cost saving can not be presented due to the imitated access. The yearly cost is calculated using a simple formula which includes the machine cost (variable cost+fixed cost) and staff cost, and the total spent time on the setup process.

### 7.3.1 PAGO

Combining the organisational, technical and method improvement suggestions gave a reduction of 45% of the total yearly cost of the setup process for IMM8. Improving the organisation, namely eliminating unnecessary waiting time and improving communication and adding a third operator, could cost 25% of the setup process yearly cost. Method improvement, preparing equipment before the setup process and converting some activities to external activities could save 9% of the yearly cost. The rest of the saving is from the technical improvement suggestions, which could reduce the time operators spend walking.

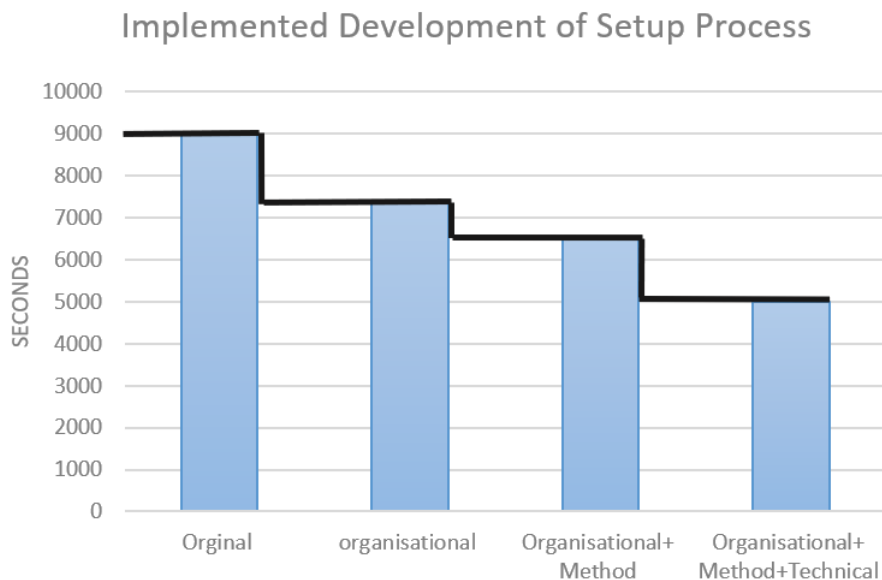
### 7.3.2 PASI

Implementation of all the improvement proposals gives a 36%. The organisational improvement gives a saving of a total of 9.5 minutes for each setup process. By eliminating the waiting time, 7.5% of the yearly cost will be saved. Elimination of transporting outgoing and incoming tools back and forth to the storage station and the cooling station will save 15% of the yearly cost. Technical improvement is the one which can save an enormous amount of the setup process. It is not the setup costs for machine 3202 that decrease. Still, it reduces stop times for machine 1604 and increases the production time for both machines. Installation of the sensor contributes to a percentage gain on process lead time and saves 23% of the costs.

# 8

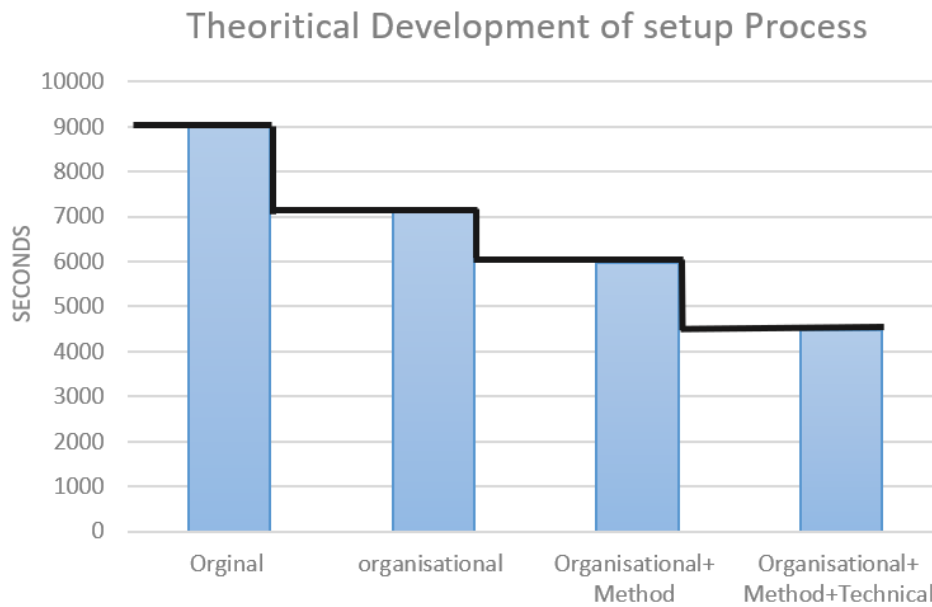
## Discussion

As stated in the results chapter, the setup process could be improved by 45%. The organisation improvements have the most significant impact on the setup process for IMM8, which was expected from the experience of Kaiser(2002). The other technical and method solution also significantly impacts the reduction of the setup time both in the theoretical analysis and the implemented as figure 8.1 and 8.2 show.



**Figure 8.1:** *The impact of improvement suggestion on the real process*

There needs to be more clarity between the actual outcome and the theoretically improved process. This gap depends on many factors. One identified factor is the waiting time for the heating tool process. This process depends on the automatic system of the machine and cannot be influenced by the operators. There is no historical data for the heating of the tool during the setup therefore, it is difficult to determine a specific time for this process. Another factor that influences the actual outcome is the knowledge and experience of the third operator involved. Although operator three had to review new standardised work instructions before starting the changeover and video recording, he was unsure about some operations.



**Figure 8.2:** *The theoretical impact of improvement suggestions on the setup process*

As figure 8.2 shows, the setup process improved by about 2 000 seconds, corresponding to 22% lower time, but in figure 8.1 is approximately 1 700 seconds, corresponding to 18% lower than the original setup time. It is because of the time spent waiting for each other and communicating. It suggests that operators should be educated and more trained and that revising work instructions are insufficient. It is important to note that when filming, the operators received a joint briefing and did not have to train on new standards several times. Undoubtedly, this affects the result, and the more operators perform work, the more comfortable they are with the new standardised work instructions.

The total saved time from converting internal activities to external for IMM8 for this study is 13% of the setup time. However a general saving from converting internal activities to external ones should be between 30%-50%[2]. It is because most activities and operations are impossible to perform without having stoppages. However adding a third person was a good help because three operations can be performed paralleled.

Standardised work is a powerful tool to achieve the calculated and planned time for a process [9]; hence, following this is crucial for the setup process for IMM8. The PAGO plant has work rotations within the workstation and between different injection moulding workstations. Standardised work instructions are a great help and guide for the operator who has performed this only a few times. Not only do inexperienced operators benefit from standardised work, but it is also beneficial for all operators because following the standard method prevents stress and errors in the setup process.

Standardised work is also a key to continuous improvement within organisations considering the occurrence of deviations in the method standard shows the need for

improvement. Deviations that occurred determine whether more training is needed to follow the standards or to update and improve Standardised work instructions[9]. Thus, the standardised work instructions produced for both workstations facilitate the investigation of deviations that have occurred. By investigating and observing that deviation occurs when the standards are not being followed, it is time to plan to train operators to follow more standardised work instructions.

Spaghetti diagrams were a helpful tool for this study, not only for patterning the walking path for the operators but also to visualise the advantages of the new solutions in terms of the short walking path and shorter walking distances. Spaghetti diagram for the improved version of the changeover process facilitate to convince operators, team leaders and production leaders to accept the new solutions.

Furthermore, the reception of the operators and technicians on the floor at workstations was the biggest challenge throughout the project. While filming the setup process to analyse the present state of the two workstations, the operators were sceptical about the project. Another challenge was the implementation of the new standardised work instructions for IMM8. Although implementing the improvement proposals for the IMM8 workplace was no more complicated than discussing, planning and filming to analyse the result, the operators had to be more flexible. Despite all the challenges, the station's production manager was able to convince the operators to comply with the new standards. However, the execution of the setup analysis for both stations went better than expected due to the differences in the machines, the changeover process and the knowledge level of the operators .

It would have benefited the company and the study project to implement the improvement proposal for workstation 3202 in PASI. Documenting a tangible result of improved setup processes, the analysis would contribute to a strong basis for further improvement work, but this could not be carried out due to limited resources.

It would have been beneficial for the project and analysed to document and film tool changes in other shifts to see the difference in the work methodology. In this project, one tool change has been studied for each machine due to the limited project time, but filming several tool changes would contribute to a deeper and broader SMED analysis.



# 9

## Recommendations

### 9.1 Follow-up of standardised work and SMED strategy

For Plasman to succeed in continuously working organised and efficiently with improving the setup process, the organisation should systematically work with following up the Standardised work instruction. The standardised work should be investigated in case of significant deviations. Follow-up of standardised work should occur regularly and in case of planning for new tools.

SMED is considered an effective method for identifying causes of deviations in the method standard[9]. Work with SMED should be performed with the help of experts within the organisation and the process. The expert staff with SMED can have both practical and theoretical experiences to analyse the setup process, especially with the injection moulding process.

It is also recommended that Plasman regularly perform SMED analysis for all injection moulding machines. The setup time should be measured for each moulding tool. The aimed setup time for each tool is unique and should depend on the tool's properties. When the setup time is based on the properties and is unique for each tool, the deviation of the setup process can be measured and analysed. In case of repeated deviations, a SMED analysis can be performed. The time loss can be presented as a capital loss to facilitate decision-making. The organisation will gain a lot from this work, and the capital savings will be higher than the investment cost in the SMED experts' staff.

### 9.2 Further work with improvement proposals

Some improvement suggestions were not possible to implement on the workstation IMM8. According to the priority Matrix, these suggestions can still significantly impact the setup process.

For the Simrishamn plant to get as much as possible from this study and SMED analysis, it is recommended to continue working on implementing the improvement proposals. This project can be used as a solid foundation for submission to the person in charge of the plant for further planning and making the necessary decisions about improvement proposals. The new standardised species instruction is also recommended for an improved and streamlined setup process. Another recommendation for workstation 3202 is to collect and register the data to enable further

analysis of the setup process.

Furthermore, it is recommended for the Goteborg plant to work with training operators as resetting operators to increase the operators' knowledge simultaneously as an actor with a substantial impact on improving the process. It applies to the setup process for the IMM8 but to all injection moulding machines. For trained resetting operators

As previously highlighted in this paper, machines 3202 and IMM8 have different tools. The heating process time of the tool varies between these different tools. Therefore it would be a great asset to measure the time spent on this process for each tool and investigate the factors that may affect this process.

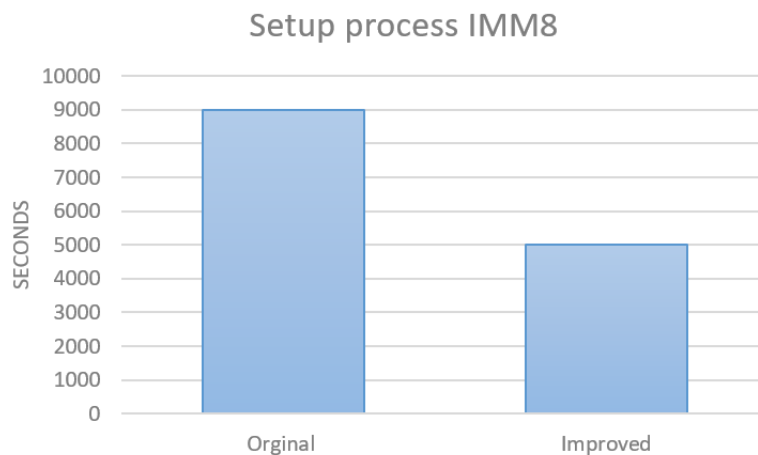
The planned time for the setup process is generally for two categories. Specifying the production planning is recommended for the Simrishamn plant to have a more efficient setup process and profitable production. In addition, it is recommended that the Gothenborg plant analyse the present production planning and improve it through specific time for a specific tool. Analysis and production planning changes were outside this project's scope. However, there is potential for improvement in production planning.

# 10

## Conclusion

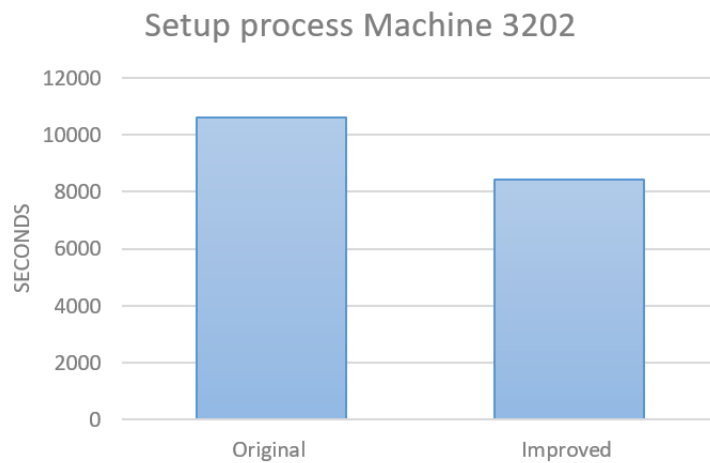
The study aimed to analyse the setup process of two injection moulding machines in two different plants for Plasman AB and improve their setup processes by adopting SMED analysis.

The Setup time for the machine IMM8 could decrease by 45% by implementing the organisational, method and technical improvements. Combining these improvements led to a more efficient setup process with less waiting time and decreased total loss of the process by 7%. The total setup procedure time for the actual process after the implementation is 5 006 seconds compared to the original process time, which was 9 000 seconds; see figure 10.1. The OEE for this machine increased from 73,57% to 82,19%, so an 8,62 percentage improvement in OEE.



**Figure 10.1:** Comparison of setup process time between original and improved version, IMM8 workstation

The setup process analysing of machine 3202 could also decrease by 39% but this reduction, in reality, depends on the combination of the improvement suggestions. The reduction means from 10 626 seconds for the original setup process to 8 447 for the improved version of the setup procedure; see figure 10.2 for a visualised comparison. This saved time means an increased production time and a lower loss time for the whole production station.



**Figure 10.2:** *Comparison of setup process time between original and improved version, workstation 3202*

Despite resistance from the staff at the IMM8 workstation, the operators were aware of the required work tasks during the setup and wanted to improve the process and the team leader.

Since tool variation is high for IMM8 and there is a rotation of personnel performing tool changes, everyone in the organisation should be flexible.

The yearly cost saving for the company is enormous, especially for the IMM8 machine. For workstation 3202, significant savings also apply, but due to limited space and technical systems, some improvements could not be in action. These savings from the projects and increased OEE can remove night shift.

# 11

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# A

## Appendix 1

**Table A.1:** External Activities and preparation activities for operator 1, Work station IMM8

<b>Operator 1</b>	<b>work station : IMM8</b>		
<b>Tasks</b>	<b>Time(s)</b>	<b>External/Internal</b>	<b>Before/After(setup)</b>
Bring pallet jack	124,6	External	Before
Bring the broom	49,4	External	Before
Bring equipment	31,6	External	Before
Refill yellow clips	85,8	External	After

**Table A.2:** External Activities and preparation activities for operator 2, Work station IMM8

<b>Operator 2</b>	<b>work station : IMM8</b>		
<b>Tasks</b>	<b>Time(s)</b>	<b>External/Internal</b>	<b>Before/After(setup)</b>
Bring over head crane	116	External	Before
prepare the overhead crane and immerse to machine	1 20	External	Before
Drive back the overhead crane	31,6	External	After

**Table A.3:** External Activities and preparation activities for operator 1, Work station 3202 , PASI

<b>Operator 1</b>	<b>Work station: 3202</b>		
<b>Task</b>	<b>Time(S)</b>	<b>External/internal</b>	<b>Before/After (Setup)</b>
Go to the forklift station	106,9 s	External	Before
Drive the forklift to the workstation	211,5 s	External	Before
Drive to the incoming tool	74,8 s	External	Before
lift the incoming tool by forklift	27,9 s	External	Before
place the incoming tool in place	123,5 s	External	Before
Go to the robot settings panel	60,3 s	External	Before
Turn off the robot	134,0 s	External	Before
Drive the forklift to the pallet	124,2 s	External	Before
take the pallet to station	189,0 s	External	Before
Drive to the workstation	163,2 s	External	Before
Drive to the incoming tool	135,6 s	External	Before
Turn off the charge	11,8 s	External	Before
Start the forklift	15,1 s	External	Before
Drive toward the machine	58,7 s	External	After
take the outgoing too to the cooling station	222,1 s	External	After
Place the tool on the station	7,0 s	External	After
Drive the outgoing tool to the storage	309,4 s	External	After
Drive back to the charging station	171,0 s	External	After
Go to the cooling station	13,8 s	External	After
Put the gloves on	5,1 s	External	After
Connect the longer hoses	47,2 s	External	After
Go and bring the short hoses	20,4 s	External	After
Connect the short hoses	13,4 s	External	After
Place the outgoing tool	35,1 s	External	After
Open the valves	7,1 s	External	After
Hang the sign on the tool	14,8 s	External	After

**Table A.4:** External Activities and preparation activities for operator 2, Work station 3202, PASI

<b>operator 2</b>	<b>Work station: 3202</b>		
<b>Task</b>	<b>Time (S)</b>	<b>External/internal</b>	<b>Before/After (Setup)</b>
Go to machine 3203	74,2	External	Before
Stop the machine	43,9	External	Before
Wait for the machine	144,6	External	Before
Drive the overhead crane to machine 3202	39,3	External	Before
Drive the overhead crane	84,4	External	Before
Turn on the machine	68,9	External	Before
Go to machine 1604	49,4	External	Before
Make sure if the robot is turned-off	37,9	External	Before
Go to machine 3203	28,4	External	After
leave the remote of the overhead crane	4,4	External	After



# B

## Appendix 2

B. Appendix 2

No	Tool Name	Categori	Setup Time between tools in same catagori( Minutes )	Setup time between tools in different catagories (Minute)
1	FH Halo (111) + Inner (134) LH 23526996	A	40-60	90-120
	FH Halo (111) + Inner (134) RH 23527039			
2	FH Led (113) + Inner (134) LH 23526465	A	40-60	90-120
	FH Led (113) + Inner (134) RH 23526802			
3	Sturdy Halo (114) + Inner (227) LH 84449299	B	40-60	90-120
	Sturdy Halo (114) + inner (227) RH 84449301			
4	Sturdy Led (116) + Inner (224) LH 84449151	B	40-60	90-120
	Sturdy Led (116) + Inner (224) RH 84449155			
5	FMX Halo (117) + Inner (243) LH 24143981	C	40-60	90-120
	FMX Halo (117) + Inner (243) RH 24145948			
6	FMX Led (119) + Inner (240) LH 24144015	C	40-60	90-120
	FMX Led (119) + Inner (240) RH 24144011			
7	FMD Halo (120) + Inner (251) LH 84407515	D	40-60	90-120
	FMD Halo (120) + Inner (251) RH 84407498			
8	FMD Led (122) + Inner (248) LH 84407376	D	40-60	90-120
	FMD Led (122) + Inner (248) RH 84407380			
9	VTC FP CLOSING with Seal LH 78524045	E	40-60	90-120
	Frame grill base (130) H2 23835096			
10	VTC FP CLOSING with Seal RH 78524048	E	40-60	90-120
	Door extention (126) + Inner (127) 84412118			
11	Door extention (126) + Inner (127) 84389462	F	0	90-120
	Fender extention (129) + Inner (128) LH 82674220			
12	Fender extention (129) + Inner (128) RH 82674229	G	0	90-120
	Bumper corner (110) + DUMMY LH 22766194			
13	Bumper corner (110) + DUMMY RH 22766195	H	40-60	90-120
	Front panel lower enh (123) EMB1425 84235714			
14	VTC GRILLE MESH FH13 23835186 (131) H2 23835186	I	40-60	90-120
	Front panel lower enh (123) H5 84235714			
14	Front panel lower (124) H5 78524326	J	40-60	90-120
	VTC GRILLE MESH FH16 ASSY 23832900 (132) H2			

Figure B.1: Production planning

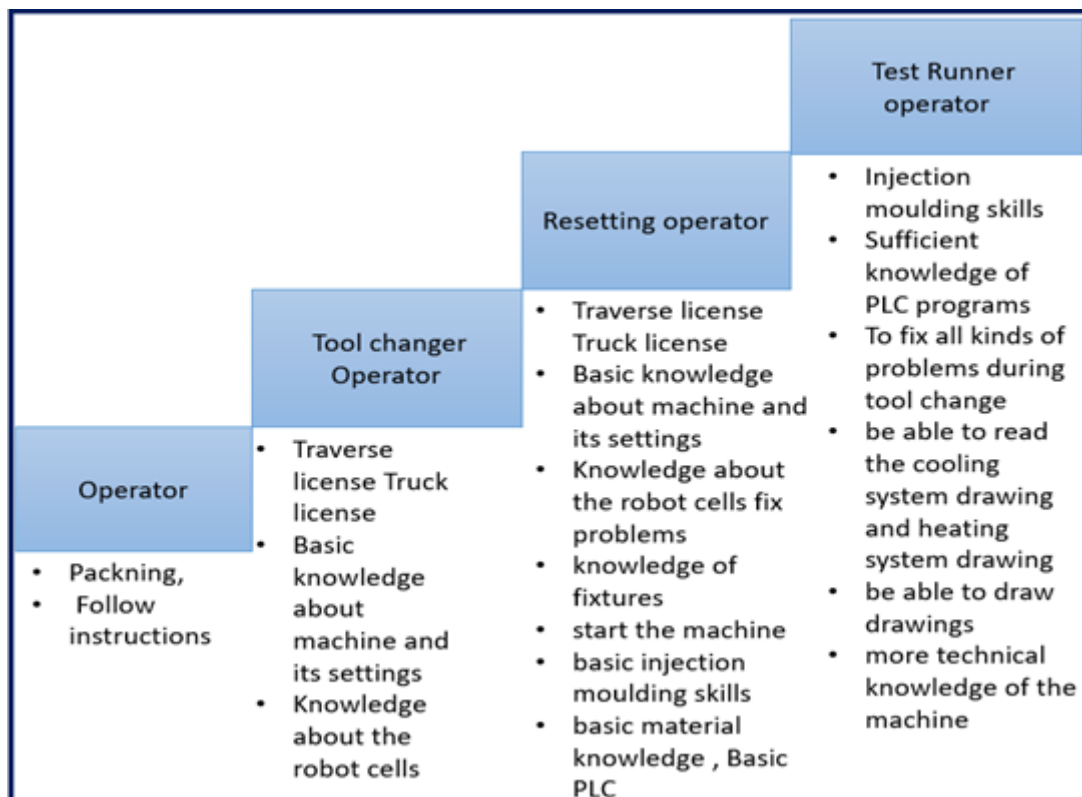
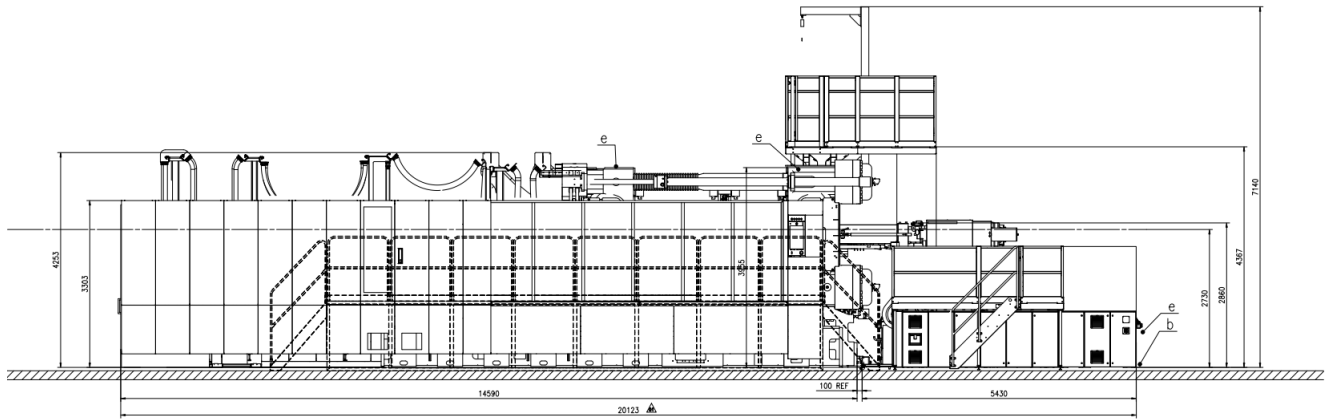


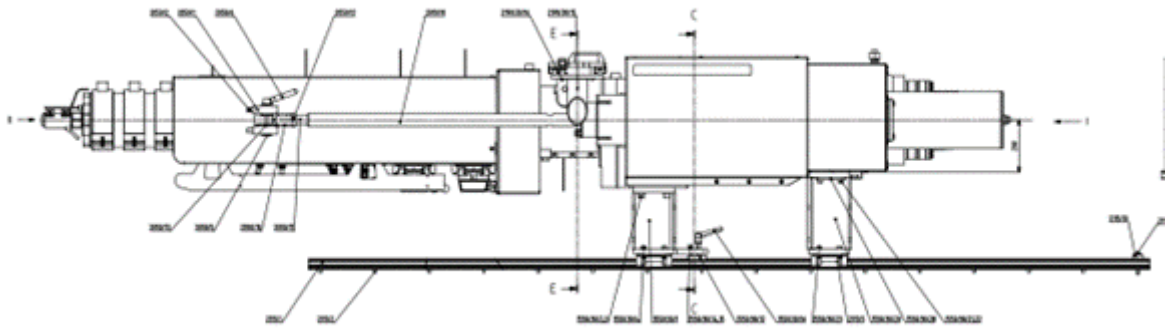
Figure B.2: knowledge specification of the different roles of operators for workstation 3202, PASI

# C

## Appendix 3



**Figure C.1:** 2D view of Machine IMM8



**Figure C.2:** Top view of Machine IMM8

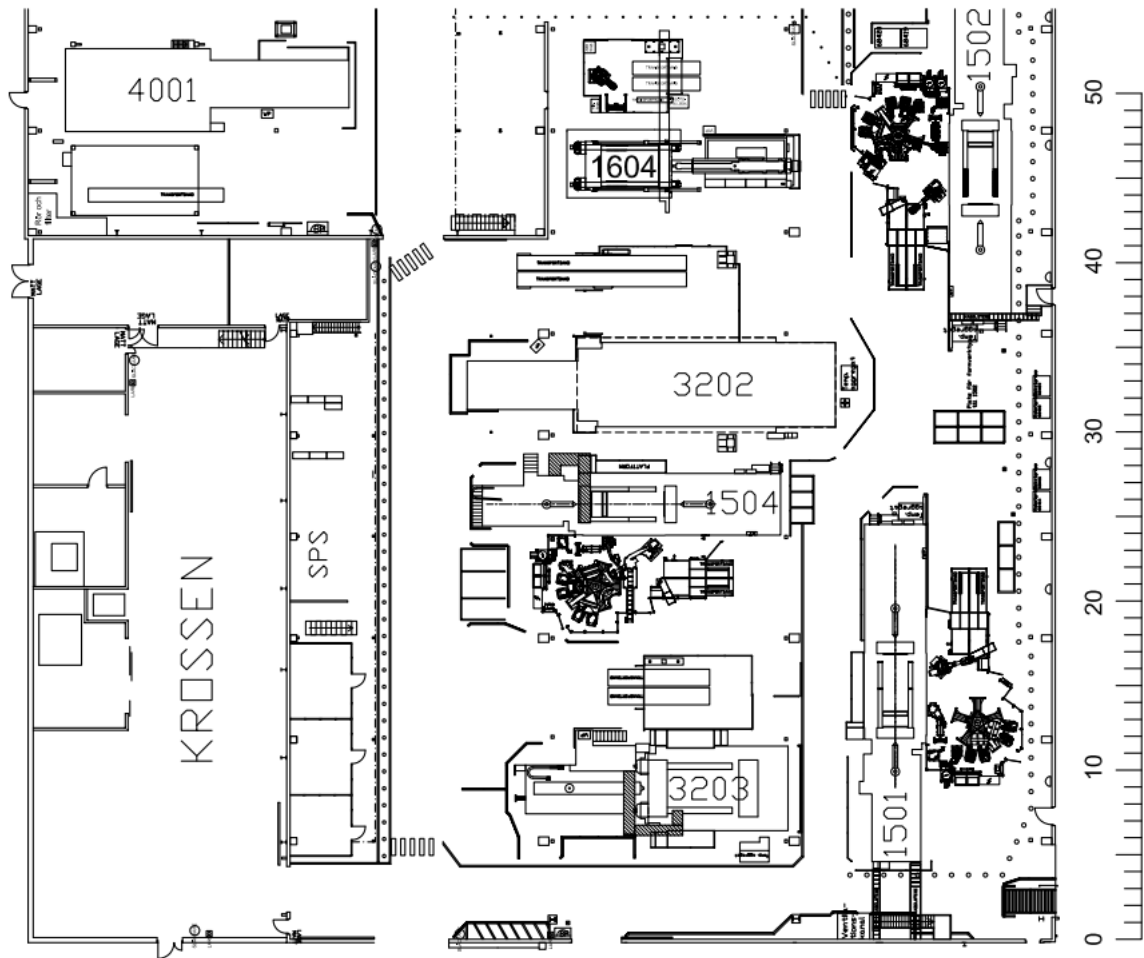


Figure C.3: layout of Machine 3202, 3203, and 1604

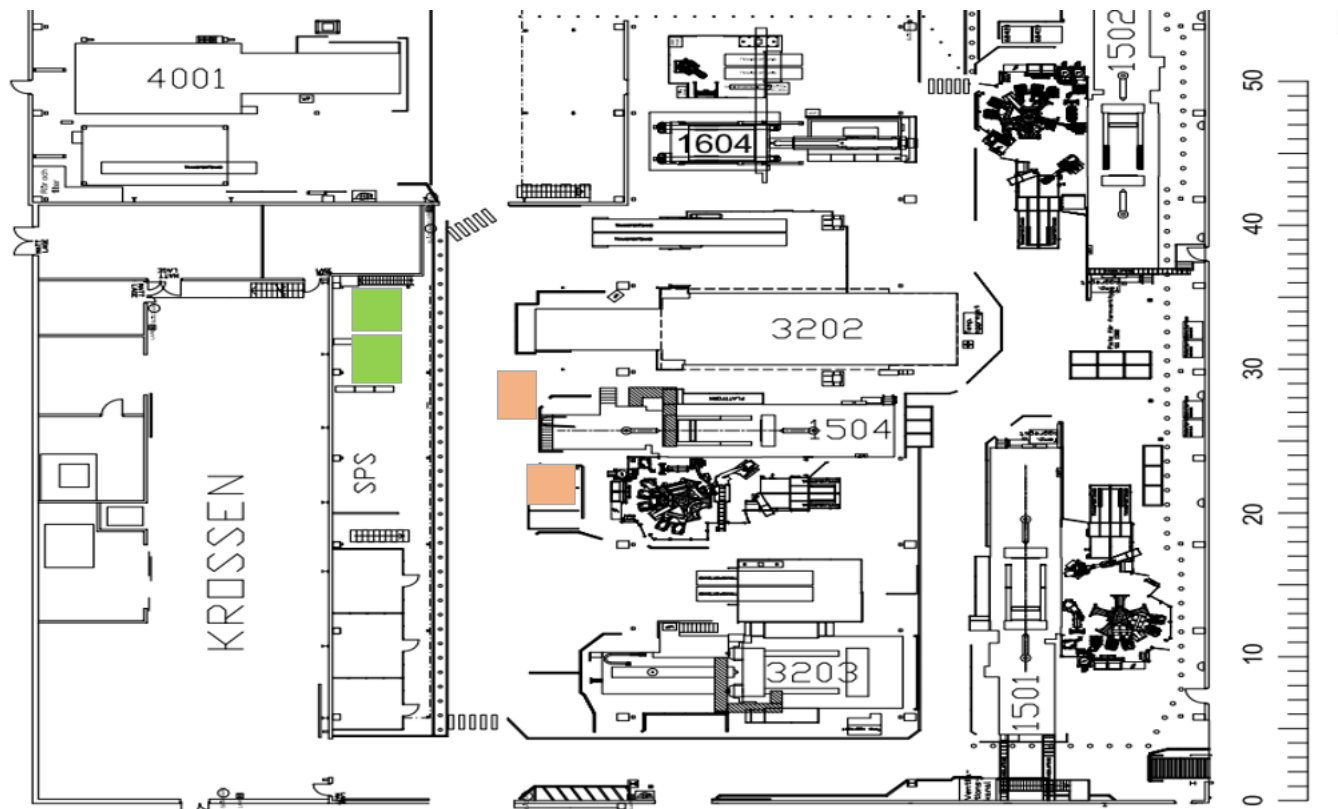


Figure C.4: Outgoing and incoming tool's temporary place

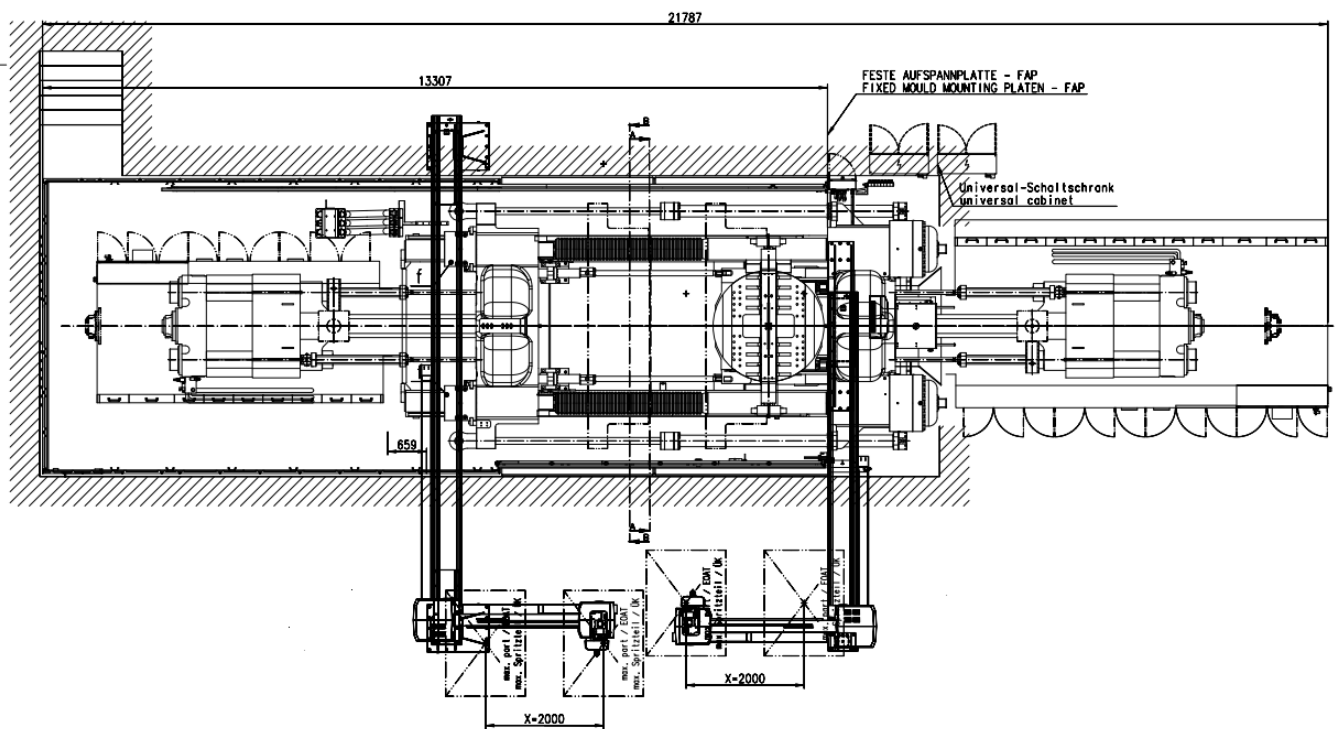


Figure C.5: Top view of machine 3202

# D

## Appendix 4

PAGO

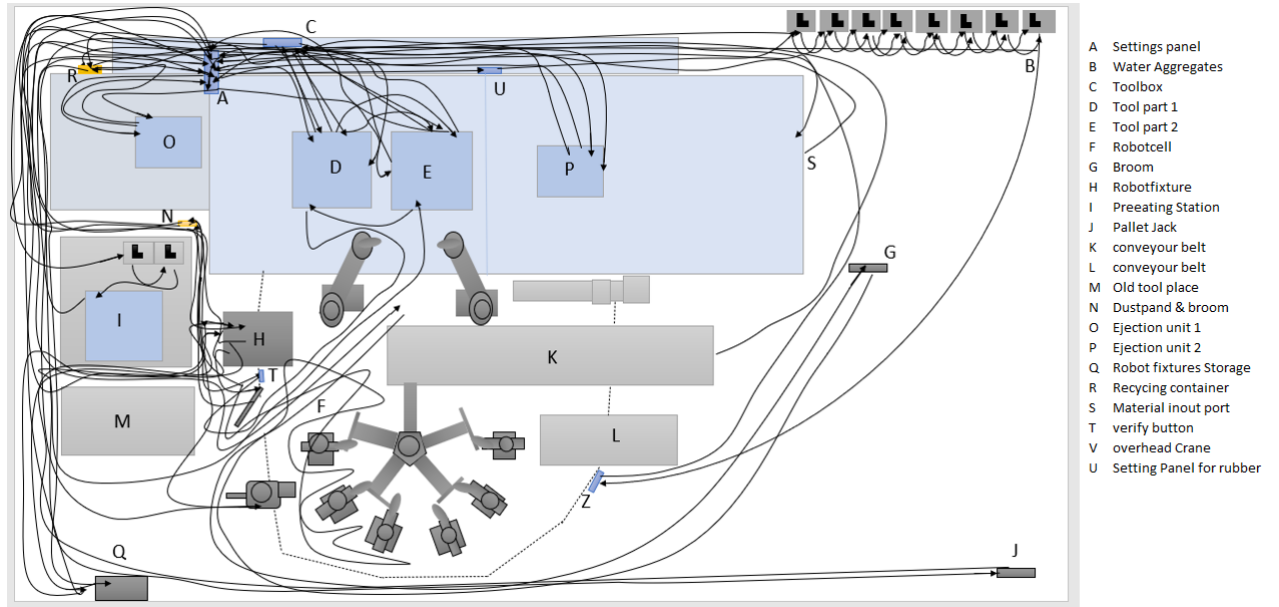


Figure D.1: Spaghetti diagram operator 1 present state

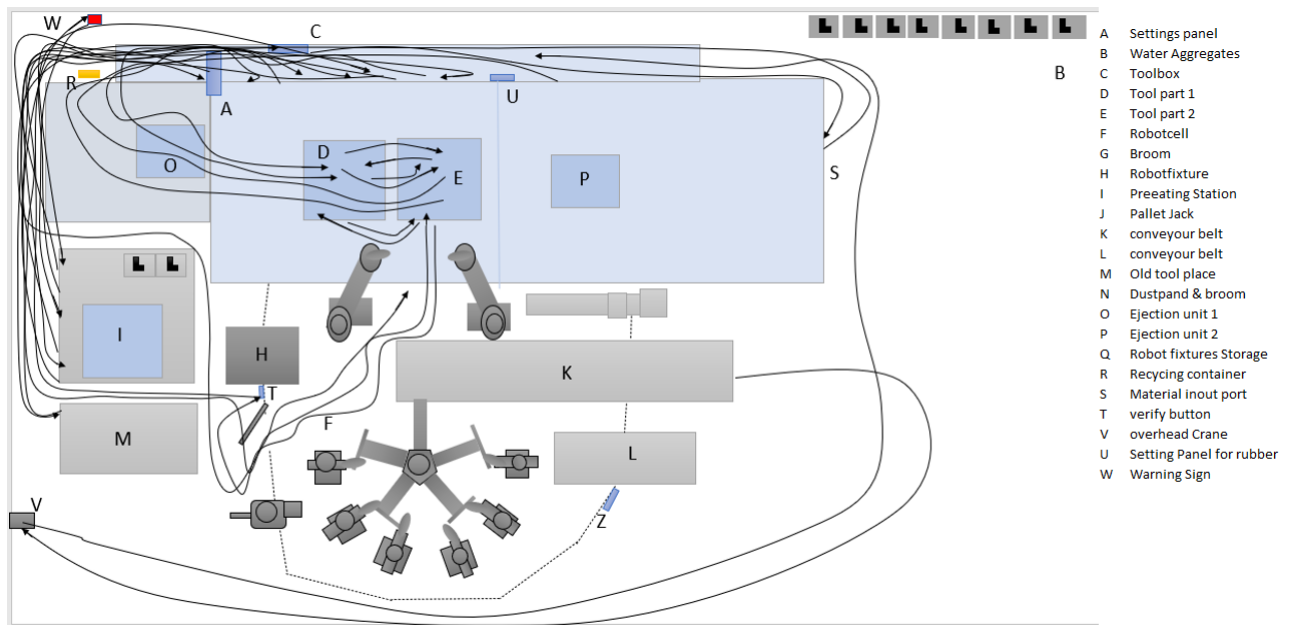


Figure D.2: Spaghetti diagram operator 2 present state

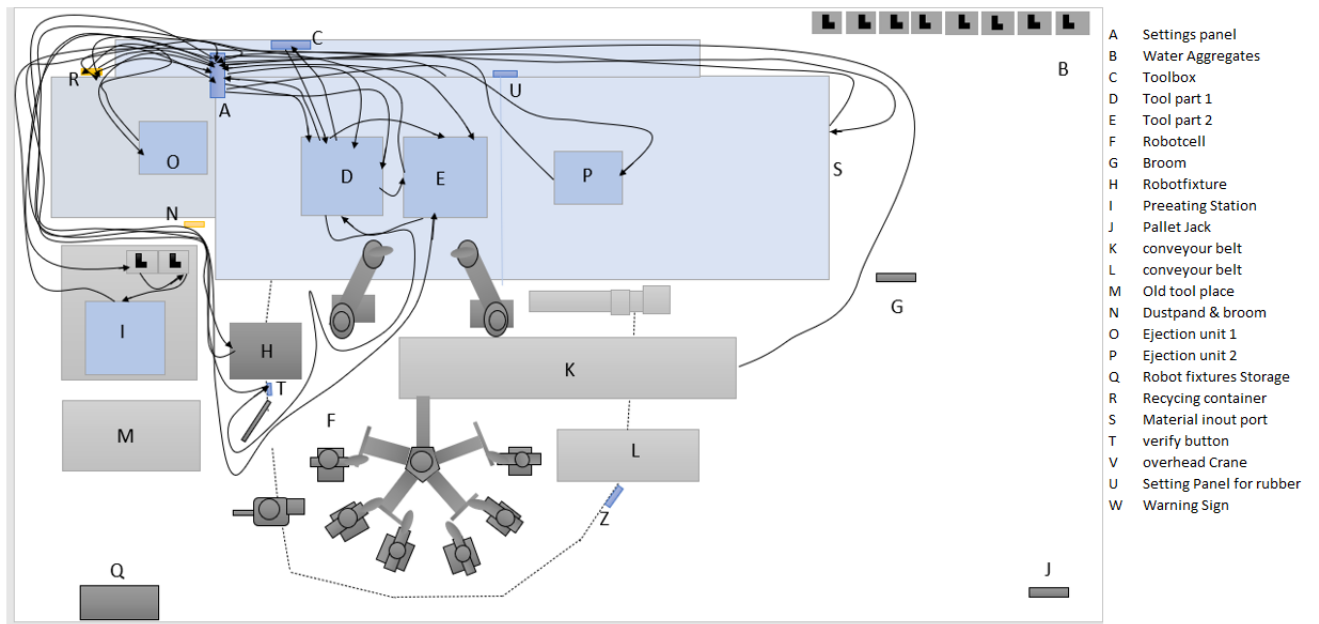


Figure D.3: Spaghetti diagram operator 1 improved process

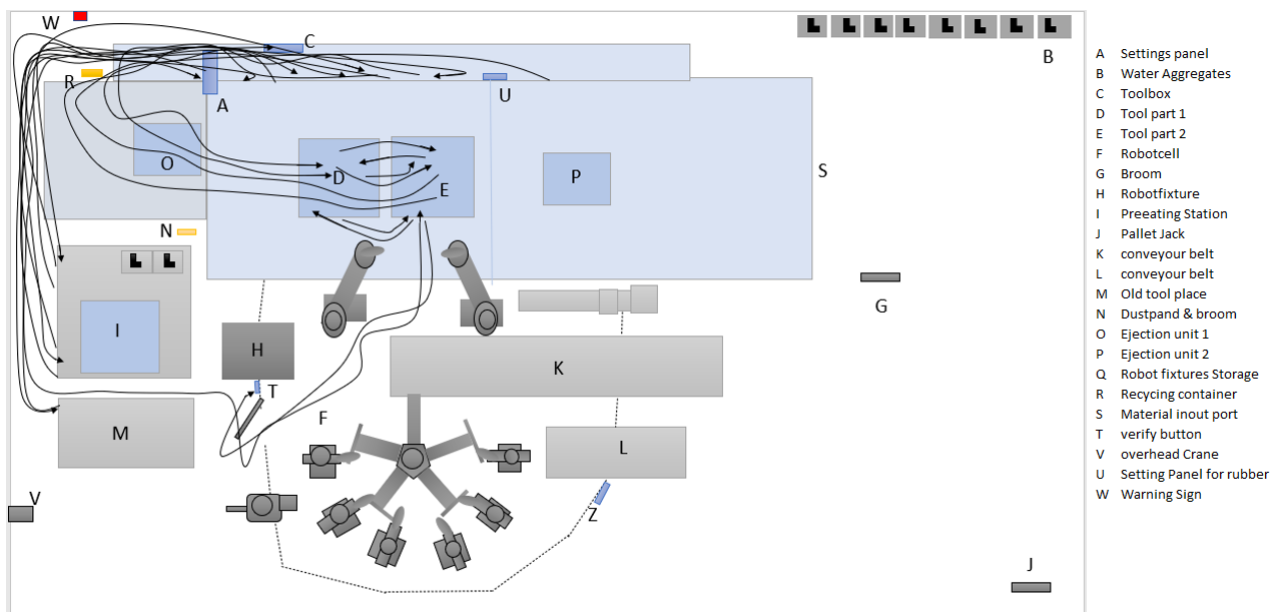


Figure D.4: Spaghetti diagram operator 2 improved process

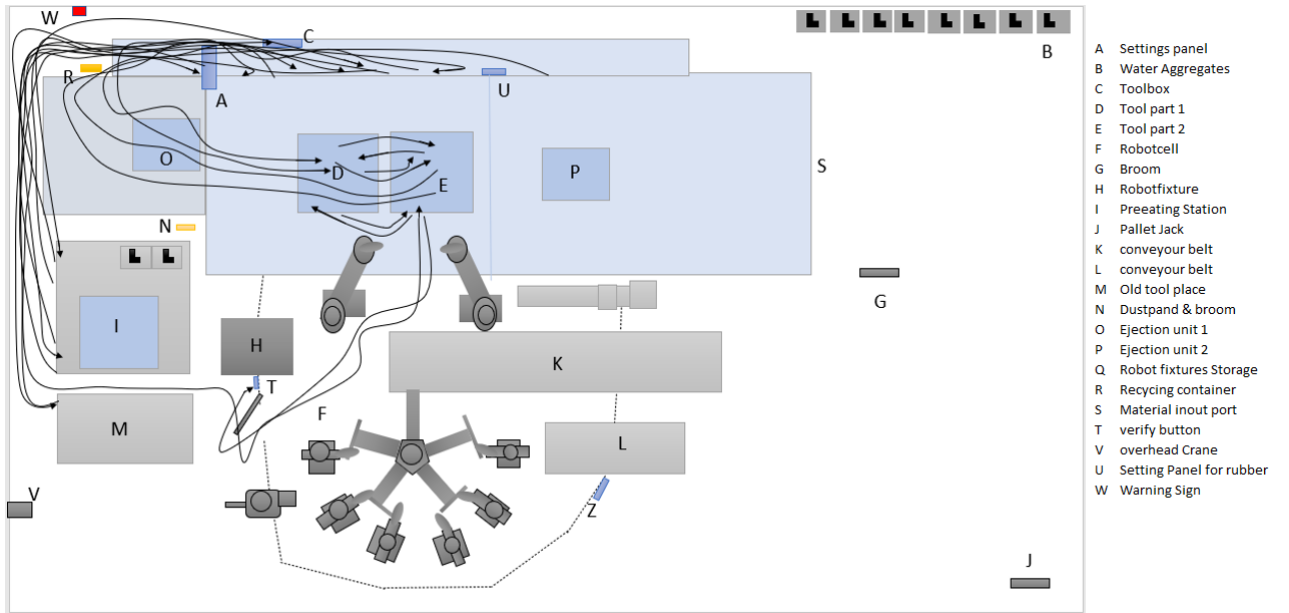


Figure D.5: *Spaghetti diagram operator three improved process*

*PASI*

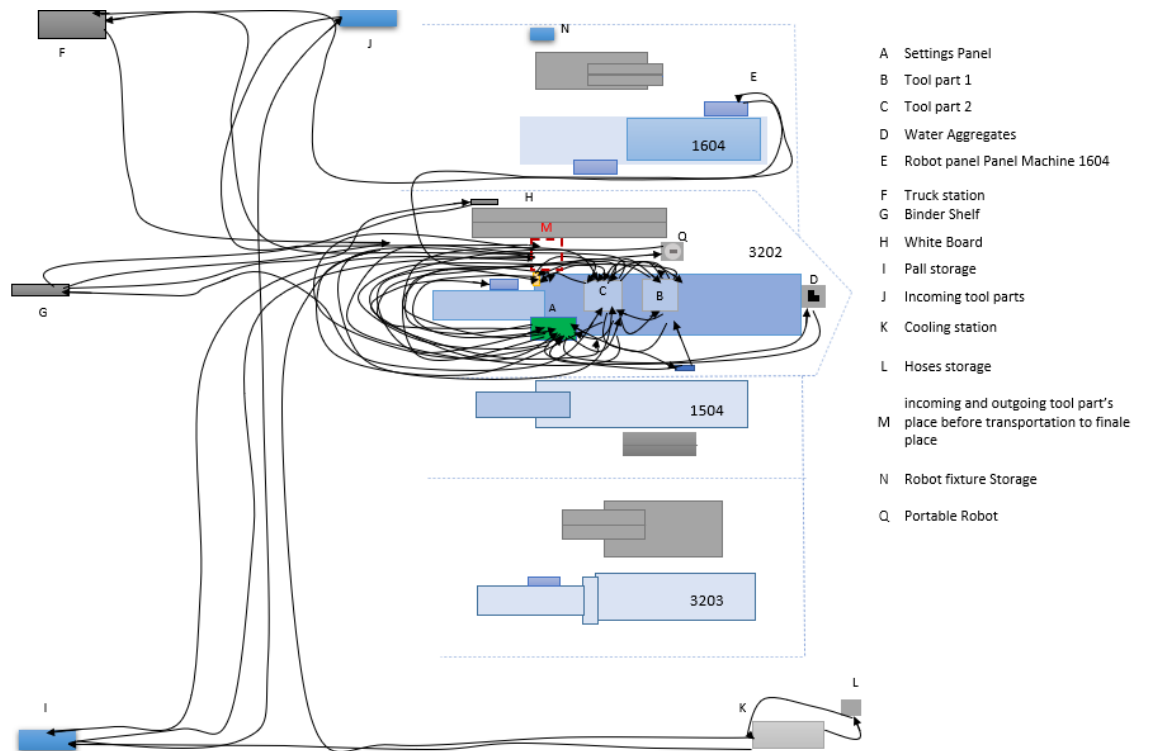


Figure D.6: *Spaghetti diagram operator 1 present state*

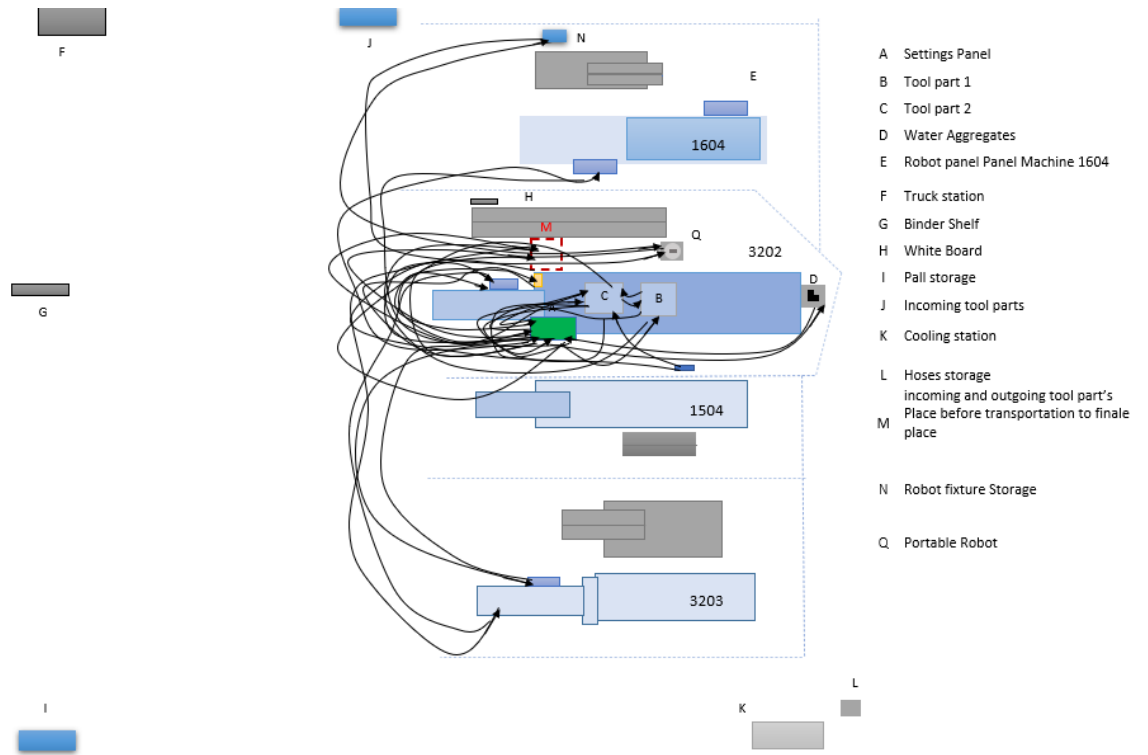


Figure D.7: Spaghetti diagram operator 2 present states, workstation 3202

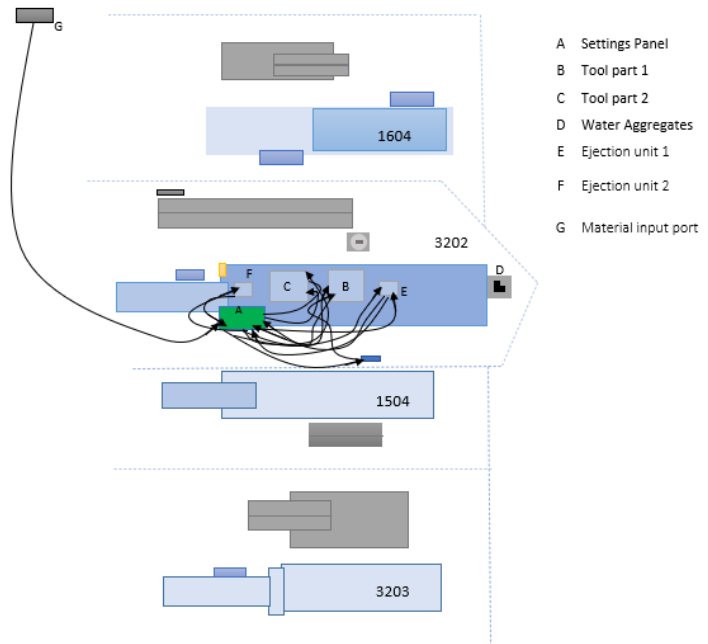


Figure D.8: Spaghetti diagram resetting operator present state, Workstation 3202

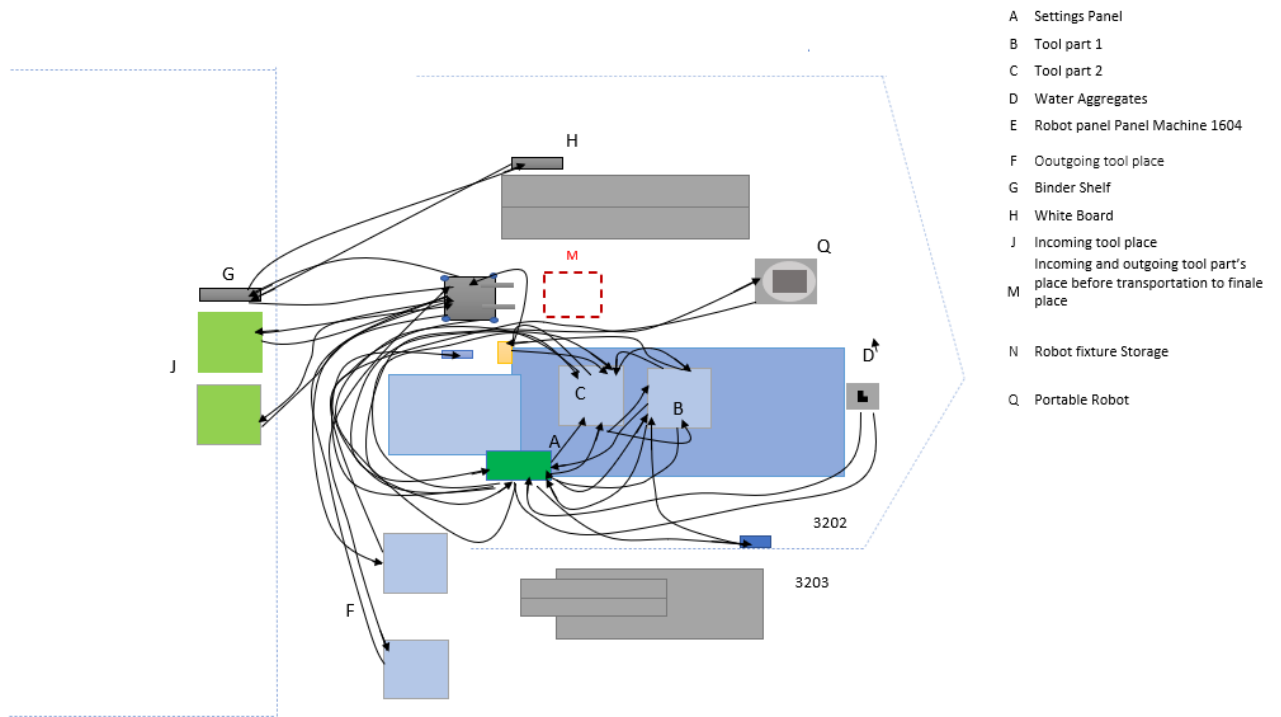


Figure D.9: Spaghetti diagram operator 1 improved version, workstation 3202

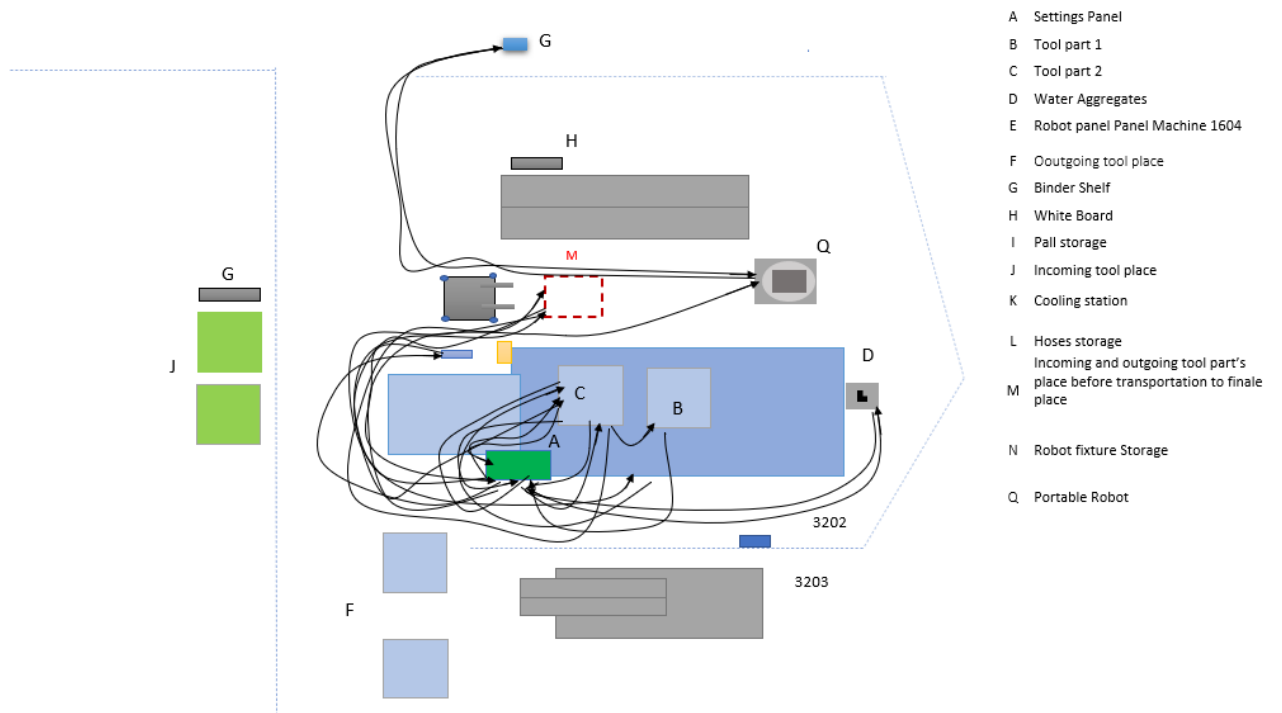


Figure D.10: Spaghetti diagram operator 2 improved version, workstation 3202

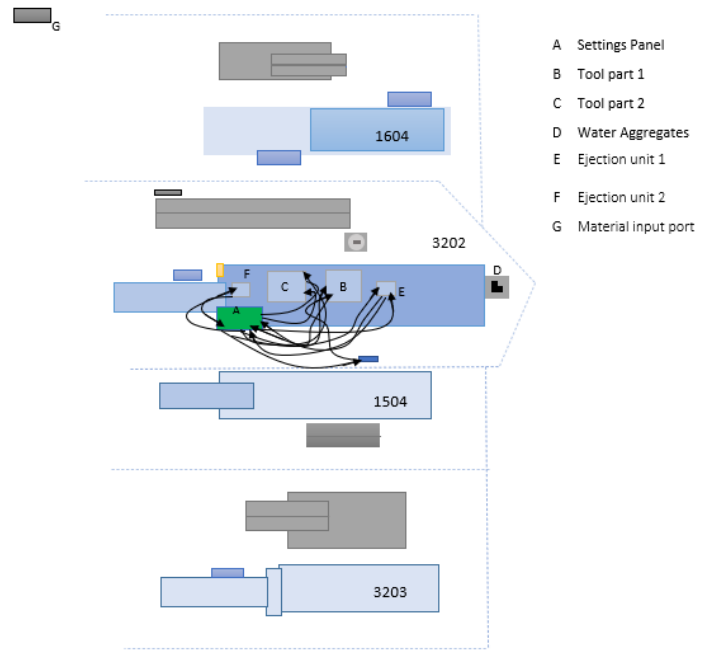


Figure D.11: Spaghetti diagram resetting operator, workstation 3202



# E

## Appendix 5

*Preheating station* In PAGO for machine IMM8,

A preheating station with 2 water aggregates is used to preheat the tool and its water channels to save the waiting time for heating the incoming tool during the setup process.

It takes a long time to heat the tool from the room to the ideal temperature of 70-90 degrees because the tools are built of steel and weigh 10 to 20 tons. Earlier, before implementing the preheating station, the incoming tool was heated during the setup process with 8 water aggregates, 12kW/PC, from a temperature of 20 degrees to a temperature between 65-70. This process took 3-9 hours during the setup process. Therefore a Preheating station with 2 water aggregates, 12kW/PC, could help the heating process. Instead of waiting 9 hours during the setup process, the incoming tool could be heated in the preheating station close to the station at least 8 hours before the tool changeover. This process could decrease the waiting time to achieve the ideal temperature for the tool by eliminating the waiting for the tool. Currently, it takes 10-15 minutes, sometimes 20 minutes, to heat the tool and its heat channel through the electricity. The heating of the heating channels of the tool can not be affected due to the limited available technical system.



# F

## Appendix 6

PAGO

### Time per work class

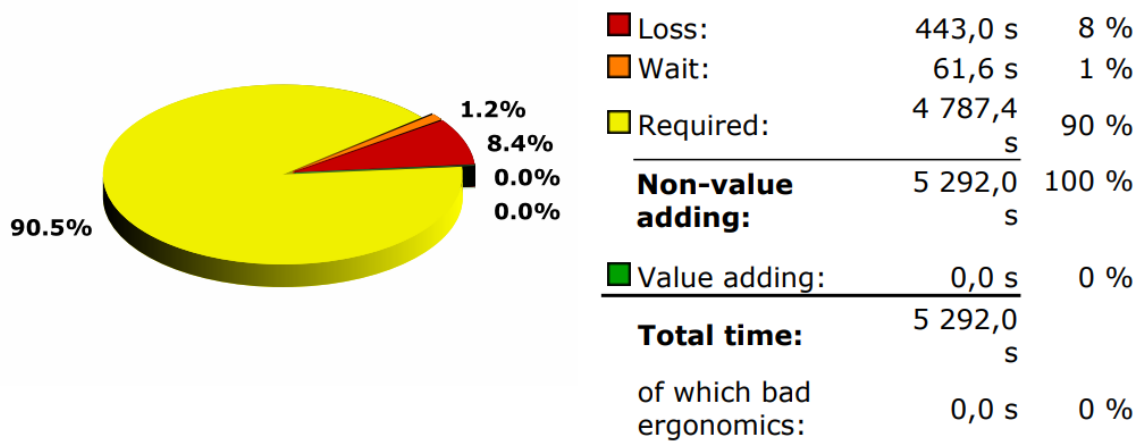
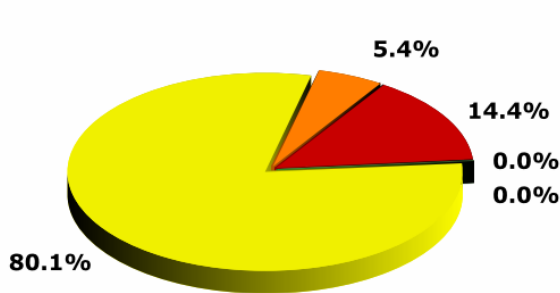


Figure F.1: General analysis diagram of improved setup process of IMM8, operator 1

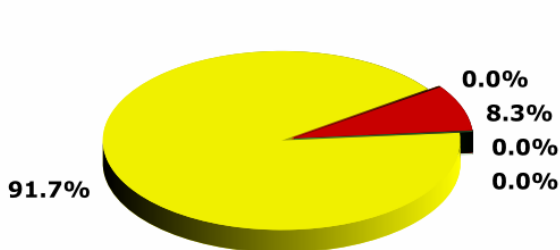
**Time per work class**



Loss:	535,6 s	14 %
Wait:	200,4 s	5 %
Required:	2 971,2 s	80 %
<hr/>		
<b>Non-value adding:</b>	3 707,2 s	100 %
Value adding:	0,0 s	0 %
<hr/>		
<b>Total time:</b>	3 707,2 s	
of which bad ergonomics:	0,0 s	0 %

Figure F.2: General analysis diagram of improved setup process of IMM8, operator 2

**Time per work class**



Loss:	54,2 s	8 %
Wait:	0,0 s	0 %
Required:	595,0 s	92 %
<hr/>		
<b>Non-value adding:</b>	649,1 s	100 %
Value adding:	0,0 s	0 %
<hr/>		
<b>Total time:</b>	649,1 s	
of which bad ergonomics:	0,0 s	0 %

Figure F.3: General analysis diagram of improved setup process of IMM8, operator 3

PASI

**Time per work class**

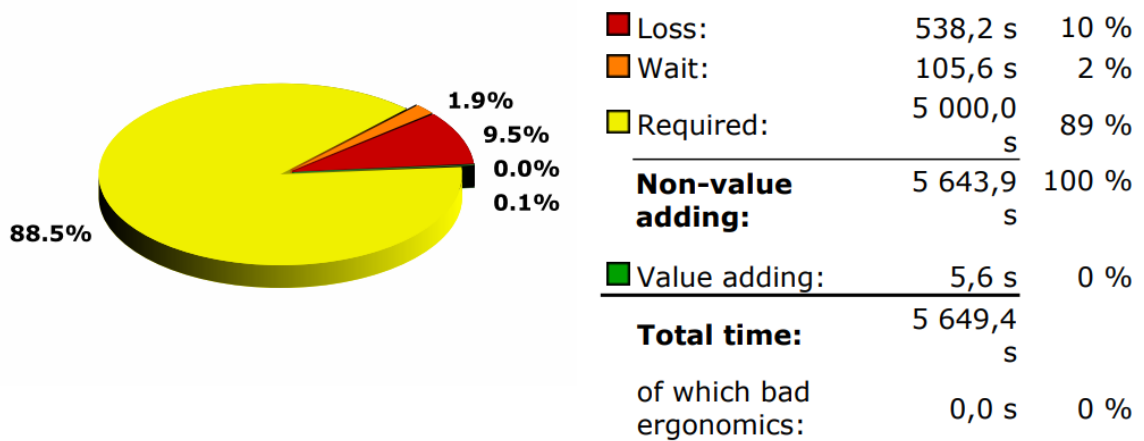


Figure F.4: General analysis diagram of the improved setup process 3202 operator 1 1

**Time per work class**

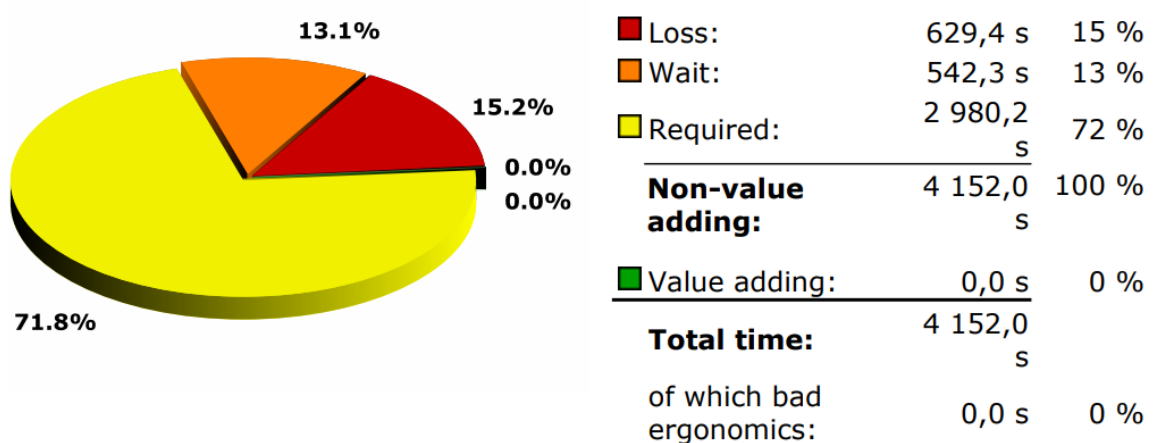
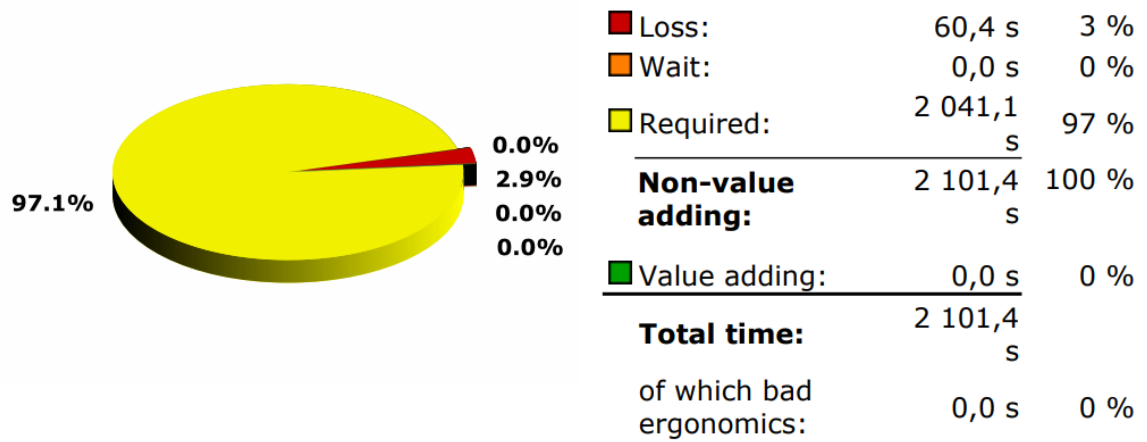


Figure F.5: General analysis diagram of the improved setup process for machine 3202 operator 2

**Time per work class**



**Figure F.6:** *General analysis diagram of the improved setup process for machine 3202, resetting operator*

# G

## Appendix 7

IMM8  
 Change over instructions  
*Operator 1 Standardized work instructions*

### Changeover Instruction



<b>Department</b>	production	<b>Machine</b>	10
<b>from - to</b>	IMM8 implemented	<b>Revision</b>	
<b>Resource</b>	Operator 1	<b>Creator</b>	

<b>Changeover time</b>	<b>Down time</b> 5 006,0 s	<b>Operator 1</b>	<b>Preparation</b>	205,6 s	Internal	5 006,0 s	Reordering	85,8 s	<b>Σ Work</b>	5 297,3 s
------------------------	-------------------------------	-------------------	--------------------	---------	----------	-----------	------------	--------	---------------	-----------

Preparation			
Start:	-205,6 s	<b>Hämta pallyft</b>	
<b>Work:</b>	<b>124,6 s</b>		
Stop:	-81,0 s		
Start:	-81,0 s	<b>Hämta sop borsten</b>	
<b>Work:</b>	<b>49,4 s</b>		
Stop:	-31,6 s		
Start:	-31,6 s	<b>Hämta verktyg</b>	
<b>Work:</b>	<b>31,6 s</b>		
Stop:	0,0 s		

## Changeover Instruction



<b>Department</b>	production	<b>Machine</b>	10
<b>from - to</b>	IMM8 implemented	<b>Revision</b>	
<b>Resource</b>	Operator 1	<b>Creator</b>	

<b>Changeover time</b>	<b>Down time</b> 5 006,0 s	<b>Operator 1</b>	Preparation	205,6 s	<b>Internal</b>	5 006,0 s	Reordering	85,8 s	<b>Σ Work</b>	5 297,3 s
------------------------	-------------------------------	-------------------	-------------	---------	-----------------	-----------	------------	--------	---------------	-----------

Internal tasks			
Start:	0,0 s	<b>Gå till panelen</b>	
<b>Work:</b>	<b>15,7 s</b>		
Stop:	15,7 s		
Start:	15,7 s	<b>Logga in för att komma åt inställningar</b>	
<b>Work:</b>	<b>9,1 s</b>		
Stop:	24,7 s		
Start:	24,7 s	<b>Stäng av vatten Aggraterna</b> kommunikationsfel skall detta sker manuellt	
<b>Work:</b>	<b>20,0 s</b>		
Stop:	44,7 s		
Start:	44,7 s	<b>Tryck Avlasta</b> sekvens slangar	
<b>Work:</b>	<b>16,1 s</b>		
Stop:	60,8 s		
Start:	60,8 s	<b>Koppla loss slangar på stack 1 och häng tillbaka på pitas</b>	
<b>Work:</b>	<b>106,5 s</b>		
Stop:	167,3 s		
Start:	167,3 s	<b>Dubbelkolla att allt är bortkopplat</b> man kan måla loss bultarna och slippa fråga	
<b>Work:</b>	<b>10,1 s</b>		
Stop:	177,4 s		
Start:	177,4 s	<b>Gå och Hämta mutter och bulten</b>	
<b>Work:</b>	<b>6,5 s</b>		
Stop:	183,9 s		

## Changeover Instruction



<b>Department</b>	production	<b>Machine</b>	10
<b>from - to</b>	IMM8 implemented	<b>Revision</b>	
<b>Resource</b>	Operator 1	<b>Creator</b>	

Internal tasks			
Start:	183,9 s	<b>Lossna mutter från ena sidan av bulten</b>	
<b>Work:</b>	<b>10,5 s</b>		
Stop:	194,5 s		
Start:	194,5 s	<b>Skruva bulten till stack 1</b>	
<b>Work:</b>	<b>17,0 s</b>		
Stop:	211,5 s		
Start:	211,5 s	<b>Gå hämta bulten och muttern för stack 2</b>	
<b>Work:</b>	<b>5,2 s</b>		
Stop:	216,8 s		
Start:	216,8 s	<b>Skruva isär bulten och muttern</b>	
<b>Work:</b>	<b>9,7 s</b>		
Stop:	226,4 s		
Start:	226,4 s	<b>Skruva bulten och muttern på stack 2</b>	
<b>Work:</b>	<b>12,5 s</b>		
Stop:	238,9 s		
Start:	238,9 s	<b>Ta bort Grå kontak och häng på plats</b>	
<b>Work:</b>	<b>12,2 s</b>		
Stop:	251,1 s		
Start:	251,1 s	<b>Tabort Gröna kontakten låt det hänga</b>	
<b>Work:</b>	<b>16,6 s</b>		
Stop:	267,7 s		
Start:	267,7 s	<b>Kvittera framsidan</b>	
<b>Work:</b>	<b>14,2 s</b>		
Stop:	281,9 s		

## Changeover Instruction



<b>Department</b>	production	<b>Machine</b>	10
<b>from - to</b>	IMM8 implemented	<b>Revision</b>	
<b>Resource</b>	Operator 1	<b>Creator</b>	

Internal tasks			
Start:	281,9 s	<b>Kontrollera allt</b>	
<b>Work:</b>	<b>4,6 s</b>		
Stop:	286,5 s		
Start:	286,5 s	<b>Lossna på mouldfix</b>	
<b>Work:</b>	<b>11,7 s</b>		
Stop:	298,2 s		
Start:	298,2 s	<b>kontrollera en gång till</b>	
<b>Work:</b>	<b>9,2 s</b>		
Stop:	307,4 s		
Start:	307,4 s	<b>Lossna på mouldfix Stack 2</b>	
<b>Work:</b>	<b>36,5 s</b>		
Stop:	343,9 s		
Start:	343,9 s	<b>Gå till usprutningsenheten 1</b>	
<b>Work:</b>	<b>10,5 s</b>		
Stop:	354,4 s		
Start:	354,4 s	<b>Töm materialet</b>	
<b>Work:</b>	<b>40,4 s</b>		
Stop:	394,8 s		
Start:	394,8 s	<b>Stänger av material luckan</b>	
<b>Work:</b>	<b>36,0 s</b>		
Stop:	430,8 s		
Start:	430,8 s	<b>Gå tillbaka till Panelen och kvittera</b>	
<b>Work:</b>	<b>7,6 s</b>		
Stop:	438,4 s		

## Changeover Instruction



<b>Department</b>	production	<b>Machine</b>	10
<b>from - to</b>	IMM8 implemented	<b>Revision</b>	
<b>Resource</b>	Operator 1	<b>Creator</b>	

Internal tasks			
Start:	438,4 s	<b>Öppna formen till stack 2</b>	
<b>Work:</b>	<b>128,6 s</b>		
Stop:	566,9 s		
Start:	566,9 s	<b>Stäng formen</b>	
<b>Work:</b>	<b>100,0 s</b>		
Stop:	667,0 s		
Start:	667,0 s	<b>Gå till förvärmnings stationen</b>	
<b>Work:</b>	<b>19,2 s</b>		
Stop:	686,2 s		
Start:	686,2 s	<b>Stäng av aggregaten och vänta på ideal tryck</b>	
<b>Work:</b>	<b>38,1 s</b>	Stäng av aggregaten och vänta på tills det är rött	
Stop:	724,3 s		
Start:	724,3 s	<b>Ta Bort slangar och häng tillbaka på plats</b>	
<b>Work:</b>	<b>125,0 s</b>		
Stop:	849,3 s		
Start:	849,3 s	<b>Gå tillbaka till panelen</b>	
<b>Work:</b>	<b>24,3 s</b>		
Stop:	873,6 s		
Start:	873,6 s	<b>lossna mouldfix till stack 1 och öppna formen</b>	
<b>Work:</b>	<b>73,2 s</b>		
Stop:	946,8 s		
Start:	946,8 s	<b>Gå tillbaka till förvärmnings stationen</b>	
<b>Work:</b>	<b>12,8 s</b>		
Stop:	959,7 s		

## Changeover Instruction



<b>Department</b>	production	<b>Machine</b>	10
<b>from - to</b>	IMM8 implemented	<b>Revision</b>	
<b>Resource</b>	Operator 1	<b>Creator</b>	

Internal tasks			
Start:	959,7 s	<b>Kör bort oljetanken</b>	
<b>Work:</b>	<b>48,0 s</b>		
Stop:	1 007,7 s		
Start:	1 007,7 s	<b>Öppna Fixture grinden</b>	
<b>Work:</b>	<b>22,7 s</b>		
Stop:	1 030,4 s		
Start:	1 030,4 s	<b>sopa bort rester i fixture området</b>	
<b>Work:</b>	<b>194,3 s</b>		
Stop:	1 224,8 s		
Start:	1 224,8 s	<b>Kör in nya fixturen och stäng grinden</b>	
<b>Work:</b>	<b>76,7 s</b>		
Stop:	1 301,5 s		
Start:	1 301,5 s	<b>Kvittera vid cell grinden</b>	
<b>Work:</b>	<b>4,8 s</b>		
Stop:	1 306,3 s		
Start:	1 306,3 s	<b>Gå tillbaka till Panelen</b>	
<b>Work:</b>	<b>19,7 s</b>		
Stop:	1 325,9 s		
Start:	1 325,9 s	<b>Stäng formen stack 1 och låsa mouldfix</b>	
<b>Work:</b>	<b>79,5 s</b>		
Stop:	1 405,4 s		
Start:	1 405,4 s	<b>Ta pinnen , Hjälp till operatör 1och häng tillbaka pinnen</b>	
<b>Work:</b>	<b>23,8 s</b>		
Stop:	1 429,2 s		

## Changeover Instruction



<b>Department</b>	production	<b>Machine</b>	10
<b>from - to</b>	IMM8 implemented	<b>Revision</b>	
<b>Resource</b>	Operator 1	<b>Creator</b>	

Internal tasks			
Start:	1 429,2 s	<b>Gå tillbaka till panelen</b>	
<b>Work:</b>	<b>23,7 s</b>		
Stop:	1 453,0 s		

## Changeover Instruction



<b>Department</b>	production	<b>Machine</b>	10
<b>from - to</b>	IMM8 implemented	<b>Revision</b>	
<b>Resource</b>	Operator 1	<b>Creator</b>	

Internal tasks			
Start: 1 453,0 s <b>Work: 300,0 s</b> Stop: 1 753,0 s	<b>Koppla på slangar på stack 1</b>		
Start: 1 753,0 s <b>Work: 69,9 s</b> Stop: 1 822,8 s	<b>Hjälp till att operatör 2 med placering av stack 2</b>		
Start: 1 822,8 s <b>Work: 44,9 s</b> Stop: 1 867,7 s	<b>kvittra grind och stäng formen</b>		
Start: 1 867,7 s <b>Work: 40,0 s</b> Stop: 1 907,7 s	<b>Vänta på operatör 2</b>		
Start: 1 907,7 s <b>Work: 10,1 s</b> Stop: 1 917,8 s	<b>Kvittra grind</b>		
Start: 1 917,8 s <b>Work: 128,7 s</b> Stop: 2 046,5 s	<b>Stäng formen och lås mould fix till stack 2</b>		
Start: 2 046,5 s <b>Work: 88,1 s</b> Stop: 2 134,6 s	<b>Lossna bulten för Stack 2</b>		
Start: 2 134,6 s <b>Work: 12,0 s</b> Stop: 2 146,6 s	<b>Skruva ihop bulten och muttern igen och lägg tillbaka</b>		

## Changeover Instruction



<b>Department</b>	production	<b>Machine</b>	10
<b>from - to</b>	IMM8 implemented	<b>Revision</b>	
<b>Resource</b>	Operator 1	<b>Creator</b>	

Internal tasks			
Start: 2 146,6 s <b>Work: 27,8 s</b> Stop: 2 174,4 s	<b>Gå till Stack 1 och lossna bulten och muttern</b>		
Start: 2 174,4 s <b>Work: 6,3 s</b> Stop: 2 180,7 s	<b>Skruv ihop bulten och muttern och lägg tillbaka</b>		
Start: 2 180,7 s <b>Work: 17,2 s</b> Stop: 2 197,9 s	<b>Kvittra grinden</b>		
Start: 2 197,9 s <b>Work: 27,8 s</b> Stop: 2 225,7 s	<b>Gå till baksidasidan</b>		
Start: 2 225,7 s <b>Work: 82,8 s</b> Stop: 2 308,6 s	<b>Lossna säkerhets bulten (baksidan)</b>		
Start: 2 308,6 s <b>Work: 180,0 s</b> Stop: 2 488,6 s	<b>Koppla på slangar (baksidan)</b>		
Start: 2 488,6 s <b>Work: 14,2 s</b> Stop: 2 502,8 s	<b>kontrollera att allt är kopplad</b>		
Start: 2 502,8 s <b>Work: 10,0 s</b> Stop: 2 512,8 s	<b>kvittra robotcellen</b>		

## Changeover Instruction



<b>Department</b>	production	<b>Machine</b>	10
<b>from - to</b>	IMM8 implemented	<b>Revision</b>	
<b>Resource</b>	Operator 1	<b>Creator</b>	

Internal tasks			
Start: 2 512,8 s Work: 22,5 s Stop: 2 535,3 s	Gå till framsidan		
Start: 2 535,3 s Work: 6,0 s Stop: 2 541,2 s	kvittra grinden		
Start: 2 541,2 s Work: 78,6 s Stop: 2 619,8 s	Öppna formen till stack 1 & 2		
Start: 2 619,8 s Work: 43,6 s Stop: 2 663,4 s	koppla verktygs koden 1&2 (framsidan)		
Start: 2 663,4 s Work: 52,0 s Stop: 2 715,4 s	koppla verktygs koden 1 och 2 (baksidan)		
Start: 2 715,4 s Work: 10,0 s Stop: 2 725,4 s	Kvittra		
Start: 2 725,4 s Work: 34,1 s Stop: 2 759,5 s	Ladda program		
Start: 2 759,5 s Work: 94,7 s Stop: 2 854,2 s	Sätt nollpunkterna		

## Changeover Instruction



<b>Department</b>	production	<b>Machine</b>	10
<b>from - to</b>	IMM8 implemented	<b>Revision</b>	
<b>Resource</b>	Operator 1	<b>Creator</b>	

Internal tasks			
Start: 2 854,2 s Work: 125,1 s Stop: 2 979,3 s	Öppna formen		
Start: 2 979,3 s Work: 179,0 s Stop: 3 158,4 s	Töm materialet på kort sidan		
Start: 3 158,4 s Work: 21,0 s Stop: 3 179,4 s	Gå till maskinen		
Start: 3 179,4 s Work: 182,2 s Stop: 3 361,5 s	Backa mella plattan		
Start: 3 361,5 s Work: 12,8 s Stop: 3 374,4 s	Gå till Panelen till gummisprutan och sätt på den		
Start: 3 374,4 s Work: 45,0 s Stop: 3 419,4 s	vänta in rätt gummi temperatur		
Start: 3 419,4 s Work: 27,7 s Stop: 3 447,1 s	Töm materialet		
Start: 3 447,1 s Work: 4,4 s Stop: 3 451,5 s	Kvittra		

## Changeover Instruction



<b>Department</b>	production	<b>Machine</b>	10
<b>from - to</b>	IMM8 implemented	<b>Revision</b>	
<b>Resource</b>	Operator 1	<b>Creator</b>	

Internal tasks			
Start:	3 451,5 s	<b>Dubbelkolla vattens värme och flödet</b>	
<b>Work:</b>	<b>9,4 s</b>		
Stop:	3 460,9 s		
Start:	3 460,9 s	<b>Gå tillbaka till panelen</b>	
<b>Work:</b>	<b>16,5 s</b>		
Stop:	3 477,4 s		
Start:	3 477,4 s	<b>Dubbelkolla att robotcellen är ifylld med fixturer</b>	
<b>Work:</b>	<b>18,9 s</b>		
Stop:	3 496,3 s		
Start:	3 496,3 s	<b>Spruta ut material flera gånger</b>	
<b>Work:</b>	<b>350,0 s</b>		
Stop:	3 846,3 s		
Start:	3 846,3 s	<b>kvittera</b>	
<b>Work:</b>	<b>5,0 s</b>		
Stop:	3 851,3 s		
Start:	3 851,3 s	<b>Töm materialet för stack 2</b>	
<b>Work:</b>	<b>108,6 s</b>	spruta igenom det nya materialet igenom verktyget för att för ett jämnt flöde	
Stop:	3 959,8 s		
Start:	3 959,8 s	<b>Backa gummi munstycket</b>	
<b>Work:</b>	<b>45,7 s</b>		
Stop:	4 005,6 s		
Start:	4 005,6 s	<b>Sätt på gummi panelen</b>	
<b>Work:</b>	<b>15,0 s</b>		
Stop:	4 020,6 s		

## Changeover Instruction



<b>Department</b>	production	<b>Machine</b>	10
<b>from - to</b>	IMM8 implemented	<b>Revision</b>	
<b>Resource</b>	Operator 1	<b>Creator</b>	

Internal tasks			
Start:	4 020,6 s	<b>Gå till panelen, kvittera</b>	
<b>Work:</b>	<b>7,4 s</b>		
Stop:	4 028,0 s		

## Changeover Instruction



<b>Department</b>	production	<b>Machine</b>	10
<b>from - to</b>	IMM8 implemented	<b>Revision</b>	
<b>Resource</b>	Operator 1	<b>Creator</b>	

Internal tasks			
Start:	4 028,0 s	<b>Spruta ut material genom stack 2</b>	
<b>Work:</b>	<b>146,7 s</b>		
Stop:	4 174,7 s		
Start:	4 174,7 s	<b>Spruta ut gummi genom stack 2</b>	
<b>Work:</b>	<b>124,8 s</b>		
Stop:	4 299,5 s		
Start:	4 299,5 s	<b>öppna glas dörren</b>	
<b>Work:</b>	<b>8,1 s</b>		
Stop:	4 307,6 s		
Start:	4 307,6 s	<b>Ta bort materialet på Stack 2</b>	
<b>Work:</b>	<b>27,4 s</b>		
Stop:	4 335,1 s		
Start:	4 335,1 s	<b>Flytta på plattan med utsprutna material</b>	
<b>Work:</b>	<b>41,2 s</b>		
Stop:	4 376,3 s		
Start:	4 376,3 s	<b>Släng materialet</b>	
<b>Work:</b>	<b>8,9 s</b>		
Stop:	4 385,2 s		
Start:	4 385,2 s	<b>Gå tillbaka till stack 2 och dubbelkolla</b>	
<b>Work:</b>	<b>14,7 s</b>		
Stop:	4 399,9 s		
Start:	4 399,9 s	<b>kvittera</b>	
<b>Work:</b>	<b>10,0 s</b>		
Stop:	4 409,9 s		

## Changeover Instruction



<b>Department</b>	production	<b>Machine</b>	10
<b>from - to</b>	IMM8 implemented	<b>Revision</b>	
<b>Resource</b>	Operator 1	<b>Creator</b>	

Internal tasks			
Start:	4 409,9 s	<b>Förreda för att köra halvskott</b>	
<b>Work:</b>	<b>191,2 s</b>		
Stop:	4 601,1 s		
Start:	4 601,1 s	<b>Kör första halvskottet</b>	
<b>Work:</b>	<b>76,0 s</b>		
Stop:	4 677,1 s		
Start:	4 677,1 s	<b>Öppna glasdörren och kontrollera kvalite</b>	
<b>Work:</b>	<b>46,9 s</b>		
Stop:	4 724,0 s		
Start:	4 724,0 s	<b>körning av första halvskottet</b>	
<b>Work:</b>	<b>282,0 s</b>		
Stop:	5 006,0 s		

## Changeover Instruction



<b>Department</b>	production	<b>Machine</b>	10
<b>from - to</b>	IMM8 implemented	<b>Revision</b>	
<b>Resource</b>	Operator 1	<b>Creator</b>	

<b>Changeover time</b>	<b>Down time</b> 5 006,0 s	<b>Operator 1</b>	Preparation	205,6 s	Internal	5 006,0 s	<b>Reordering</b>	<b>85,8 s</b>	<b>Σ Work</b>	<b>5 297,3 s</b>
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Reordering										
Start:	5 006,0 s	<b>Fyll på gula klips</b>								
<b>Work:</b>	<b>85,8 s</b>									
Stop:	5 091,8 s									

*operator 2 Standardized work instructions***Changeover Instruction**

<b>Department</b>	production	<b>Machine</b>	10
<b>from - to</b>	IMMS implemented	<b>Revision</b>	
<b>Resource</b>	Operator 2	<b>Creator</b>	

<b>Changeover time</b>	<b>Down time</b> 5 006,0 s	<b>Operator 2</b>	<b>Preparation</b>	235,9 s	Internal	3 518,8 s	Reordering	60,0 s	<b>Σ Work</b>	<b>3 814,6 s</b>
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Preparation			
Start:	-235,9 s	<b>Hämta Traverser</b>	
<b>Work:</b>	<b>115,9 s</b>		
Stop:	-120,0 s		
Start:	-120,0 s	<b>Förbreda travesen och sänk ner till maskinen</b>	
<b>Work:</b>	<b>120,0 s</b>		
Stop:	0,0 s		

**Changeover Instruction**

<b>Department</b>	production	<b>Machine</b>	10
<b>from - to</b>	IMMS implemented	<b>Revision</b>	
<b>Resource</b>	Operator 2	<b>Creator</b>	

<b>Changeover time</b>	<b>Down time</b> 5 006,0 s	<b>Operator 2</b>	<b>Preparation</b>	235,9 s	<b>Internal</b>	<b>3 518,8 s</b>	Reordering	60,0 s	<b>Σ Work</b>	<b>3 814,6 s</b>
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Internal tasks			
Start:	0,0 s	<b>Gå till verktyget</b>	
<b>Work:</b>	<b>11,4 s</b>		
Stop:	11,4 s		
Start:	11,4 s	<b>Klättrar upp på verktyget</b>	
<b>Work:</b>	<b>35,8 s</b>		
Stop:	47,1 s		
Start:	47,1 s	<b>koppla loss kontakter på verktygsdel 2</b>	
<b>Work:</b>	<b>33,4 s</b>		
Stop:	80,6 s		
Start:	80,6 s	<b>gå till verktygsdel 2</b>	
<b>Work:</b>	<b>13,1 s</b>		
Stop:	93,7 s		
Start:	93,7 s	<b>koppla loss kontakter på stack 2 sedan 1</b>	
<b>Work:</b>	<b>24,7 s</b>	koppla loss på stack 2 sedan gå över till 1	
Stop:	118,4 s	Tabort kontakten , ta i hartingen (dra ej i sladden)	
Start:	118,4 s	<b>Går ner från verktygets topp till</b>	
<b>Work:</b>	<b>56,9 s</b>		
Stop:	175,3 s		
Start:	175,3 s	<b>Kvittera nyckeln vid stegen , kvittera nyckeln vid panelen</b>	
<b>Work:</b>	<b>4,0 s</b>	kvitera både	
Stop:	179,3 s		

## Changeover Instruction



<b>Department</b>	production	<b>Machine</b>	10
<b>from - to</b>	IMM8 implemented	<b>Revision</b>	
<b>Resource</b>	Operator 2	<b>Creator</b>	

Internal tasks			
Start: 179,3 s Work: 45,1 s Stop: 224,4 s	<b>Gå till maskinens baksida</b>		
Start: 224,4 s Work: 9,1 s Stop: 233,5 s	<b>koppla loss kontakten från baksidan placera på plats</b>		
Start: 233,5 s Work: 29,7 s Stop: 263,2 s	<b>Ta och koppla säkerhets mutter och bult</b> warning: koppla säkerhets mutter och bult efter du koppla loss ett stack		
Start: 263,2 s Work: 7,9 s Stop: 271,1 s	<b>Gå till stack 2</b>		
Start: 271,1 s Work: 134,1 s Stop: 405,1 s	<b>Koppla loss slangar och häng på ställen</b>		
Start: 405,1 s Work: 16,3 s Stop: 421,4 s	<b>Gå hämta bult och mutter</b>		
Start: 421,4 s Work: 25,8 s Stop: 447,3 s	<b>skruva bulten och muttern på stack 2</b>		
Start: 447,3 s Work: 21,6 s Stop: 468,9 s	<b>Rätta till slangar</b> häng de i ordning så att de inte kläms vid bytet		

## Changeover Instruction



<b>Department</b>	production	<b>Machine</b>	10
<b>from - to</b>	IMM8 implemented	<b>Revision</b>	
<b>Resource</b>	Operator 2	<b>Creator</b>	

Internal tasks			
Start: 468,9 s Work: 21,3 s Stop: 490,2 s	<b>Gå ner dubbellkolla allt är bortkopplad och kvittera</b> dubbelkolla att allt är bortkopplat medans du går ner, och säkerhets bulten sitter rätt		
Start: 490,2 s Work: 2,1 s Stop: 492,2 s	<b>kvittera</b>		
Start: 492,2 s Work: 24,1 s Stop: 516,3 s	<b>Gå Till skylten</b>		
Start: 516,3 s Work: 17,8 s Stop: 534,2 s	<b>Hämta varning skylten och ställ vid verktyget</b>		
Start: 534,2 s Work: 17,6 s Stop: 551,8 s	<b>Gå tillbaka till maskinens framsida</b>		
Start: 551,8 s Work: 4,4 s Stop: 556,2 s	<b>Ta fjärrkontrollen</b>		
Start: 556,2 s Work: 131,9 s Stop: 688,1 s	<b>Starta traversen(sänka ner och koppla på verktyget</b>		
Start: 688,1 s Work: 97,0 s Stop: 785,1 s	<b>Koppla loss stack 2</b>		

## Changeover Instruction



<b>Department</b>	production	<b>Machine</b>	10
<b>from - to</b>	IMM8 implemented	<b>Revision</b>	
<b>Resource</b>	Operator 2	<b>Creator</b>	

Internal tasks			
Start:	785,1 s	<b>Lyft upp verktyget/vrid på verktyget 180</b>	
<b>Work:</b>	<b>37,4 s</b>		
Stop:	822,5 s		
Start:	822,5 s	<b>Gå till förvärmnings stationen</b>	
<b>Work:</b>	<b>16,3 s</b>		
Stop:	838,8 s		
Start:	838,8 s	<b>Sänk ner verktyget till markerade platsen</b>	
<b>Work:</b>	<b>65,0 s</b>		
Stop:	903,8 s		
Start:	903,8 s	<b>sänk ner verktyget til markerade platsen</b>	
<b>Work:</b>	<b>40,1 s</b>		
Stop:	944,0 s		
Start:	944,0 s	<b>Kör tillbaka traversen till stationen</b>	
<b>Work:</b>	<b>88,0 s</b>	kör tillbaka traversen tillverktyget medans operatörn går tillbaka till stationen vid verktyget	
Stop:	1 031,9 s		
Start:	1 031,9 s	<b>Sänk ner traversen, justera tillverktyget</b>	
<b>Work:</b>	<b>47,9 s</b>		
Stop:	1 079,9 s		
Start:	1 079,9 s	<b>kontrollera att den sitter i traversen</b>	
<b>Work:</b>	<b>8,9 s</b>		
Stop:	1 088,8 s		
Start:	1 088,8 s	<b>koppla loss stack 1</b>	
<b>Work:</b>	<b>102,0 s</b>	Operatör 1 kommer och kör bort maksindelarna så att operatör 2 kan koppla loss verktyget och vrid på den 180 grader	
Stop:	1 190,8 s		

## Changeover Instruction



<b>Department</b>	production	<b>Machine</b>	10
<b>from - to</b>	IMM8 implemented	<b>Revision</b>	
<b>Resource</b>	Operator 2	<b>Creator</b>	

Internal tasks			
Start:	1 190,8 s	<b>Lyft upp stack 1</b>	
<b>Work:</b>	<b>36,5 s</b>		
Stop:	1 227,3 s		
Start:	1 227,3 s	<b>Gå till andra sidan av maskinen</b>	
<b>Work:</b>	<b>16,4 s</b>		
Stop:	1 243,7 s		
Start:	1 243,7 s	<b>Sänk ner verktyget till markerade platsen</b>	
<b>Work:</b>	<b>153,9 s</b>		
Stop:	1 397,6 s		
Start:	1 397,6 s	<b>Hämta pinne köra loss traversen</b>	
<b>Work:</b>	<b>27,8 s</b>		
Stop:	1 425,4 s		
Start:	1 425,4 s	<b>kör traversen till nya stack</b>	
<b>Work:</b>	<b>59,3 s</b>	Vänd på kruken rätt	
Stop:	1 484,7 s		
Start:	1 484,7 s	<b>Vänd på kruken rätt</b>	
<b>Work:</b>	<b>16,4 s</b>		
Stop:	1 501,1 s		
Start:	1 501,1 s	<b>koppla traversen till nya verktyget</b>	
<b>Work:</b>	<b>53,3 s</b>		
Stop:	1 554,4 s		
Start:	1 554,4 s	<b>Lyfta upp nya verktyget till stationen</b>	
<b>Work:</b>	<b>53,5 s</b>		
Stop:	1 607,9 s		

## Changeover Instruction



<b>Department</b>	production	<b>Machine</b>	10
<b>from - to</b>	IMM8 implemented	<b>Revision</b>	
<b>Resource</b>	Operator 2	<b>Creator</b>	

Internal tasks			
Start:	1 607,9 s	<b>Lyfta upp nya verktyget till stationen</b>	
<b>Work:</b>	<b>23,5 s</b>		
Stop:	1 631,4 s		

## Changeover Instruction



<b>Department</b>	production	<b>Machine</b>	10
<b>from - to</b>	IMM8 implemented	<b>Revision</b>	
<b>Resource</b>	Operator 2	<b>Creator</b>	

Internal tasks			
Start:	1 631,4 s	<b>Gå till framsiden av maskinen</b>	
<b>Work:</b>	<b>14,6 s</b>		
Stop:	1 646,0 s		
Start:	1 646,0 s	<b>Justera verktyget sänk ner det till maskinen</b>	
<b>Work:</b>	<b>74,1 s</b>		
Stop:	1 720,1 s		
Start:	1 720,1 s	<b>Vrid på verktyget 180 grader</b>	
<b>Work:</b>	<b>32,7 s</b>		
Stop:	1 752,8 s		
Start:	1 752,8 s	<b>Koppla verktyget på maskinen</b>	
<b>Work:</b>	<b>67,1 s</b>	*man kunde stänga formen vid detta steg om operatör 2 känner sig ok med de	
Stop:	1 819,9 s		
Start:	1 819,9 s	<b>Vänta på operatör 1 för stänga formen</b>	
<b>Work:</b>	<b>60,0 s</b>	detta kan man ta bort	
Stop:	1 879,9 s		
Start:	1 879,9 s	<b>Låsa verktyget</b>	
<b>Work:</b>	<b>16,0 s</b>		
Stop:	1 895,9 s		
Start:	1 895,9 s	<b>koppla loss traversen</b>	
<b>Work:</b>	<b>42,1 s</b>		
Stop:	1 938,0 s		
Start:	1 938,0 s	<b>Kör tillbaka traversen till nya stack 2</b>	
<b>Work:</b>	<b>98,4 s</b>		
Stop:	2 036,4 s		

## Changeover Instruction



<b>Department</b>	production	<b>Machine</b>	10
<b>from - to</b>	IMM8 implemented	<b>Revision</b>	
<b>Resource</b>	Operator 2	<b>Creator</b>	

Internal tasks			
Start:	2 036,4 s	<b>Koppla traversen på nya stack 2</b>	
<b>Work:</b>	<b>53,7 s</b>		
Stop:	2 090,1 s		
Start:	2 090,1 s	<b>Lyfta upp verktyget till stationen</b>	
<b>Work:</b>	<b>74,2 s</b>		
Stop:	2 164,2 s		
Start:	2 164,2 s	<b>Gå till framsidan av maskinen</b>	
<b>Work:</b>	<b>25,1 s</b>		
Stop:	2 189,3 s		
Start:	2 189,3 s	<b>Justera verktyget och sänk ner till maskinen</b>	
<b>Work:</b>	<b>109,2 s</b>		
Stop:	2 298,5 s		
Start:	2 298,5 s	<b>Vrid på verktyget 180 grader</b>	
<b>Work:</b>	<b>27,9 s</b>		
Stop:	2 326,5 s		
Start:	2 326,5 s	<b>Koppla verktyget på maskinen</b>	
<b>Work:</b>	<b>99,1 s</b>		
Stop:	2 425,6 s		
Start:	2 425,6 s	<b>Kontrollera och justera vid fel placering av</b>	
<b>Work:</b>	<b>83,5 s</b>		
Stop:	2 509,0 s		
Start:	2 509,0 s	<b>Vänta på operatör 1 för stänga formen</b>	
<b>Work:</b>	<b>60,0 s</b>		
Stop:	2 569,0 s		

## Changeover Instruction



<b>Department</b>	production	<b>Machine</b>	10
<b>from - to</b>	IMM8 implemented	<b>Revision</b>	
<b>Resource</b>	Operator 2	<b>Creator</b>	

Internal tasks			
Start:	2 569,0 s	<b>Torka av gummi rester på maskinen</b>	
<b>Work:</b>	<b>38,7 s</b>		
Stop:	2 607,8 s		
Start:	2 607,8 s	<b>Vänta på operatör 1, kör maskinen till verktyget</b>	
<b>Work:</b>	<b>75,0 s</b>		
Stop:	2 682,8 s		
Start:	2 682,8 s	<b>Vänta tills operatör 1 låser verktyget</b>	
<b>Work:</b>	<b>79,0 s</b>		
Stop:	2 761,8 s		
Start:	2 761,8 s	<b>lägg kontrollen på verktygsdel 2</b>	
<b>Work:</b>	<b>17,0 s</b>		
Stop:	2 778,7 s		
Start:	2 778,7 s	<b>Ta på dig handskar och gå till maskinenstopp</b>	
<b>Work:</b>	<b>20,2 s</b>		
Stop:	2 798,9 s		
Start:	2 798,9 s	<b>Öppna grinden och klättra på maskinen gå till stack 2</b>	
<b>Work:</b>	<b>50,4 s</b>		
Stop:	2 849,3 s		
Start:	2 849,3 s	<b>Ta kontrollen</b>	
<b>Work:</b>	<b>8,9 s</b>		
Stop:	2 858,2 s		
Start:	2 858,2 s	<b>Ställa sig tillbaka på rätta plats</b>	
<b>Work:</b>	<b>5,8 s</b>		
Stop:	2 864,0 s		

## Changeover Instruction



<b>Department</b>	production	<b>Machine</b>	10
<b>from - to</b>	IMM8 implemented	<b>Revision</b>	
<b>Resource</b>	Operator 2	<b>Creator</b>	

Internal tasks			
Start:	2 864,0 s	<b>Koppla loss traversen</b>	
<b>Work:</b>	<b>44,2 s</b>		
Stop:	2 908,2 s		
Start:	2 908,2 s	<b>Kör upp traversen en bit</b>	
<b>Work:</b>	<b>27,8 s</b>		
Stop:	2 936,0 s		
Start:	2 936,0 s	<b>Lämna kontrollen till operatör 1</b>	
<b>Work:</b>	<b>22,1 s</b>		
Stop:	2 958,1 s		
Start:	2 958,1 s	<b>koppla kontakter till stack 2</b>	
<b>Work:</b>	<b>100,2 s</b>		
Stop:	3 058,3 s		
Start:	3 058,3 s	<b>Koppla kontakter till stack 2</b>	
<b>Work:</b>	<b>102,3 s</b>		
Stop:	3 160,6 s		
Start:	3 160,6 s	<b>Koppla gummi slang och vakum slang</b> OBS: Gäller bara R15	
<b>Work:</b>	<b>47,5 s</b>		
Stop:	3 208,1 s		
Start:	3 208,1 s	<b>Koppla elkontakten till material behållaren</b>	
<b>Work:</b>	<b>61,5 s</b>		
Stop:	3 269,6 s		
Start:	3 269,6 s	<b>Gå till stack 1</b>	
<b>Work:</b>	<b>68,0 s</b>		
Stop:	3 337,6 s		

## Changeover Instruction



<b>Department</b>	production	<b>Machine</b>	10
<b>from - to</b>	IMM8 implemented	<b>Revision</b>	
<b>Resource</b>	Operator 2	<b>Creator</b>	

Internal tasks			
Start:	3 337,6 s	<b>koppla kontakter på verktyget</b>	
<b>Work:</b>	<b>85,5 s</b>		
Stop:	3 423,1 s		
Start:	3 423,1 s	<b>Ta fjärr kontrollen och lägg på verktyget</b>	
<b>Work:</b>	<b>23,0 s</b>		
Stop:	3 446,1 s		
Start:	3 446,1 s	<b>Gå ner från maskinen till maskin panelen</b>	
<b>Work:</b>	<b>30,9 s</b>		
Stop:	3 477,0 s		
Start:	3 477,0 s	<b>Kvittera</b>	
<b>Work:</b>	<b>5,0 s</b>		
Stop:	3 482,0 s		
Start:	3 482,0 s	<b>Tryck på skärmen och öppna porten</b>	
<b>Work:</b>	<b>8,6 s</b>		
Stop:	3 490,6 s		
Start:	3 490,6 s	<b>Ta fjärrkontrollen och lägg det på sidan</b>	
<b>Work:</b>	<b>9,8 s</b>		
Stop:	3 500,4 s		
Start:	3 500,4 s	<b>Gå till knappen och stäng glas porten till maskinen</b>	
<b>Work:</b>	<b>15,4 s</b>		
Stop:	3 515,8 s		
Start:	3 515,8 s	<b>Kvittera med nyckel</b>	
<b>Work:</b>	<b>2,9 s</b>		
Stop:	3 518,8 s		

## operator 3 Standardized work instructions

## Changeover Instruction



<b>Department</b>	production	<b>Machine</b>	10
<b>from - to</b>	IMM8 implemented	<b>Revision</b>	
<b>Resource</b>	operator 3	<b>Creator</b>	

<b>Changeover time</b>	<b>Down time</b>	<b>operator 3</b>	Preparation	0,0 s	<b>Internal</b>	<b>1 197,0 s</b>	Reordering	0,0 s	<b>Σ Work</b>	<b>1 197,0 s</b>
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Internal tasks			
Start:	0,0 s	<b>hämta sopborsten till cellen</b>	
<b>Work:</b>	<b>16,1 s</b>		
Stop:	16,1 s		
Start:	16,1 s	<b>sopa golvet</b>	
<b>Work:</b>	<b>79,3 s</b>		
Stop:	95,4 s		
Start:	95,4 s	<b>Ställ tillbaka sopborsten</b>	
<b>Work:</b>	<b>5,2 s</b>		
Stop:	100,6 s		
Start:	100,6 s	<b>Gå till förvärmnings stationen</b>	
<b>Work:</b>	<b>19,2 s</b>		
Stop:	119,8 s		
Start:	119,8 s	<b>Stäng av aggregaten och vänta på ideal tryck</b>	
<b>Work:</b>	<b>38,1 s</b>	Stäng av aggregaten och vänta på tils det är rätt	
Stop:	157,9 s		
Start:	157,9 s	<b>Ta Bort slangar och häng tillbaka på plats</b>	
<b>Work:</b>	<b>125,0 s</b>		
Stop:	282,9 s		
Start:	282,9 s	<b>Hämta pinne ...</b>	
<b>Work:</b>	<b>20,0 s</b>	En tredje person krävs för att putta till traversen så att man kan få loss den och köra tillbaka.	
Stop:	302,9 s	lägg tillbaka pinne på plats	

## Changeover Instruction



<b>Department</b>	production	<b>Machine</b>	10
<b>from - to</b>	IMM8 implemented	<b>Revision</b>	
<b>Resource</b>	operator 3	<b>Creator</b>	

Internal tasks			
Start:	302,9 s	<b>Gå tillbaka till förvärmnings stationen</b>	
<b>Work:</b>	<b>12,8 s</b>		
Stop:	315,8 s		
Start:	315,8 s	<b>Kör bort oljetanken</b>	
<b>Work:</b>	<b>48,0 s</b>		
Stop:	363,8 s		
Start:	363,8 s	<b>Öppna Fixture grinden</b>	
<b>Work:</b>	<b>22,7 s</b>		
Stop:	386,5 s		
Start:	386,5 s	<b>sopa bort rester i fixture området</b>	
<b>Work:</b>	<b>194,3 s</b>		
Stop:	580,9 s		
Start:	580,9 s	<b>Kör in nya fixturen och stäng grinden</b>	
<b>Work:</b>	<b>76,7 s</b>		
Stop:	657,6 s		
Start:	657,6 s	<b>Kvittera vid celll grinden</b>	
<b>Work:</b>	<b>4,8 s</b>		
Stop:	662,3 s		
Start:	662,3 s	<b>Kör bort rullhyllan</b>	
<b>Work:</b>	<b>9,1 s</b>		
Stop:	671,4 s		
Start:	671,4 s	<b>Köra bort det gamla fixturen och lämna åt sidan</b>	
<b>Work:</b>	<b>77,8 s</b>		
Stop:	749,2 s		

## Changeover Instruction



<b>Department</b>	production	<b>Machine</b>	10
<b>from - to</b>	IMM8 implemented	<b>Revision</b>	
<b>Resource</b>	operator 3	<b>Creator</b>	

Internal tasks			
Start:	749,2 s	<b>Kör ut den nya fixturen och placera mitt emot grinden</b>	
<b>Work:</b>	<b>60,3 s</b>		
Stop:	809,5 s		
Start:	809,5 s	<b>Gå och kör in det gamla fixturen till rätt plats</b>	
<b>Work:</b>	<b>58,1 s</b>		
Stop:	867,6 s		
Start:	867,6 s	<b>Lägg verktyget tillbaka</b>	
<b>Work:</b>	<b>21,9 s</b>		
Stop:	889,5 s		
Start:	889,5 s	<b>Sopa Golvet</b>	
<b>Work:</b>	<b>142,9 s</b>		
Stop:	1 032,3 s		
Start:	1 032,3 s	<b>Flytt på plattan</b>	
<b>Work:</b>	<b>11,7 s</b>		
Stop:	1 044,0 s		
Start:	1 044,0 s	<b>Lägg plattan under stack 2</b>	
<b>Work:</b>	<b>34,4 s</b>		
Stop:	1 078,4 s		
Start:	1 078,4 s	<b>Ta stege och ställ fram för stack 2</b>	
<b>Work:</b>	<b>10,0 s</b>		
Stop:	1 088,4 s		
Start:	1 088,4 s	<b>Gå uppför stege och tabort gummi klumper</b>	
<b>Work:</b>	<b>16,2 s</b>		
Stop:	1 104,7 s		

## Changeover Instruction



<b>Department</b>	production	<b>Machine</b>	10
<b>from - to</b>	IMM8 implemented	<b>Revision</b>	
<b>Resource</b>	operator 3	<b>Creator</b>	

Internal tasks			
Start:	1 104,7 s	<b>Flytt tillbaka steget</b>	
<b>Work:</b>	<b>8,7 s</b>		
Stop:	1 113,3 s		
Start:	1 113,3 s	<b>Ta bort materialet på Stack 2</b>	
<b>Work:</b>	<b>27,4 s</b>		
Stop:	1 140,7 s		
Start:	1 140,7 s	<b>Flytta på plattan med utsprutna material</b>	
<b>Work:</b>	<b>41,2 s</b>		
Stop:	1 182,0 s		
Start:	1 182,0 s	<b>Släng materialet</b>	
<b>Work:</b>	<b>15,0 s</b>		
Stop:	1 197,0 s		

Machine 3202

Change over instructions

*Operator 1 Standardized work instructions*

### Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 1	<b>Creator</b>	

<b>Changeover time</b>	<b>Down time</b> 3 575,8 s	<b>Operator 1</b>	<b>Preparation</b>	1 377,8 s	Internal	3 346,6 s	Reordering	925,1 s	<b>Σ Work</b>	5 649,4 s
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Preparation			
Start: -1 377,8 s <b>Work: 106,9 s</b> Stop: -1 270,9 s	<b>Gå till Trucken</b>		
Start: -1 270,9 s <b>Work: 211,5 s</b> Stop: -1 059,3 s	<b>Kör Trucken till stationen</b>		
Start: -1 059,3 s <b>Work: 74,8 s</b> Stop: -984,5 s	<b>Kör till nya verktyget</b>		
Start: -984,5 s <b>Work: 27,9 s</b> Stop: -956,6 s	<b>Placera nya verktyget på trucken</b>		
Start: -956,6 s <b>Work: 123,5 s</b> Stop: -833,1 s	<b>Placera nya verktyget på plats</b>		
Start: -833,1 s <b>Work: 60,3 s</b> Stop: -772,9 s	<b>Gå till Robotpanelen</b>		
Start: -772,9 s <b>Work: 134,0 s</b> Stop: -638,9 s	<b>Stäng av det</b>		

### Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 1	<b>Creator</b>	

Preparation			
Start: -638,9 s <b>Work: 124,2 s</b> Stop: -514,7 s	<b>Kör trucken till pallen</b>		
Start: -514,7 s <b>Work: 189,0 s</b> Stop: -325,7 s	<b>Kör pallen till Stationen</b>		
Start: -325,7 s <b>Work: 163,2 s</b> Stop: -162,5 s	<b>Kör till Stationen</b>		
Start: -162,5 s <b>Work: 135,6 s</b> Stop: -26,9 s	<b>Kör till nya verktyget</b>		
Start: -26,9 s <b>Work: 11,8 s</b> Stop: -15,1 s	<b>Stäng av laddningen</b>		
Start: -15,1 s <b>Work: 15,1 s</b> Stop: 0,0 s	<b>Starta Trucken</b>		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 1	<b>Creator</b>	

<b>Changeover time</b>	<b>Down time</b> 3 575,8 s	<b>Operator 1</b>	Preparation	1 377,8 s	<b>Internal</b>	<b>3 346,6 s</b>	Reordering	925,1 s	<b>Σ Work</b>	<b>5 649,4 s</b>
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Internal tasks			
Start:	0,0 s	<b>Gå till maskinen</b>	
<b>Work:</b>	<b>13,5 s</b>		
Stop:	13,5 s		
Start:	13,5 s	<b>Ta rostskydds pappret</b>	
<b>Work:</b>	<b>5,4 s</b>		
Stop:	19,0 s		
Start:	19,0 s	<b>klippa rost skydd</b>	
<b>Work:</b>	<b>4,3 s</b>		
Stop:	23,3 s		
Start:	23,3 s	<b>Häng tillbaka rostskydd</b>	
<b>Work:</b>	<b>4,0 s</b>		
Stop:	27,3 s		
Start:	27,3 s	<b>Gå till formen</b>	
<b>Work:</b>	<b>6,8 s</b>		
Stop:	34,0 s		
Start:	34,0 s	<b>Tejpa rostskyddet</b>	
<b>Work:</b>	<b>27,2 s</b>		
Stop:	61,3 s		
Start:	61,3 s	<b>sätt på rost skydd</b>	
<b>Work:</b>	<b>21,6 s</b>		
Stop:	82,9 s		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 1	<b>Creator</b>	

Internal tasks			
Start:	82,9 s	<b>Gå till panelen</b>	
<b>Work:</b>	<b>14,3 s</b>		
Stop:	97,2 s		
Start:	97,2 s	<b>kvittra</b>	
<b>Work:</b>	<b>23,1 s</b>		
Stop:	120,3 s		
Start:	120,3 s	<b>Gå till andra sidan</b>	
<b>Work:</b>	<b>32,9 s</b>		
Stop:	153,3 s		
Start:	153,3 s	<b>Stäng Glas dörren</b>	
<b>Work:</b>	<b>15,4 s</b>		
Stop:	168,6 s		
Start:	168,6 s	<b>Gå till panelen</b>	
<b>Work:</b>	<b>24,1 s</b>		
Stop:	192,7 s		
Start:	192,7 s	<b>Kvittra</b>	
<b>Work:</b>	<b>5,6 s</b>		
Stop:	198,3 s		
Start:	198,3 s	<b>Stäng formen</b>	
<b>Work:</b>	<b>23,1 s</b>		
Stop:	221,4 s		
Start:	221,4 s	<b>Öppna glassdörren</b>	
<b>Work:</b>	<b>12,0 s</b>		
Stop:	233,4 s		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 1	<b>Creator</b>	

Internal tasks			
Start: 233,4 s <b>Work: 14,4 s</b> Stop: 247,7 s	<b>Gå till vattenaggregaterna</b>		
Start: 247,7 s <b>Work: 9,3 s</b> Stop: 257,1 s	<b>Stäng av aggregaterna</b>		
Start: 257,1 s <b>Work: 15,1 s</b> Stop: 272,2 s	<b>Gå till Maksinen</b>		
Start: 272,2 s <b>Work: 37,6 s</b> Stop: 309,8 s	<b>Lås verktygen</b>		
Start: 309,8 s <b>Work: 7,2 s</b> Stop: 317,0 s	<b>Gå till Panelen</b>		
Start: 317,0 s <b>Work: 6,0 s</b> Stop: 323,0 s	<b>Stäng glasdörren</b>		
Start: 323,0 s <b>Work: 5,1 s</b> Stop: 328,1 s	<b>Kvittera</b>		
Start: 328,1 s <b>Work: 24,8 s</b> Stop: 352,9 s	<b>Gå till Cellen</b>		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 1	<b>Creator</b>	

Internal tasks			
Start: 352,9 s <b>Work: 5,6 s</b> Stop: 358,5 s	<b>Ta fram låset</b>		
Start: 358,5 s <b>Work: 11,3 s</b> Stop: 369,8 s	<b>Häng låset</b> Säkerhets grej		
Start: 369,8 s <b>Work: 9,1 s</b> Stop: 378,9 s	<b>öppna Glasdörren</b>		
Start: 378,9 s <b>Work: 41,2 s</b> Stop: 420,1 s	<b>Stäng av ventiler</b>		
Start: 420,1 s <b>Work: 4,0 s</b> Stop: 424,2 s	<b>Ta fram verktyg</b>		
Start: 424,2 s <b>Work: 44,2 s</b> Stop: 468,4 s	<b>Koppla loss slangar på stack 2</b>		
Start: 468,4 s <b>Work: 5,6 s</b> Stop: 474,0 s	<b>Koppla loss större slangar</b>		
Start: 474,0 s <b>Work: 1,5 s</b> Stop: 475,5 s	<b>Ta fram skyftnycken verktyget</b>		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 1	<b>Creator</b>	

Internal tasks			
Start:	475,5 s	<b>koppla loss slangarna</b>	
<b>Work:</b>	<b>36,4 s</b>	vad är dessa slangar för något	
Stop:	511,9 s		
Start:	511,9 s	<b>Gå och häng korta slangen</b>	
<b>Work:</b>	<b>3,4 s</b>		
Stop:	515,3 s		
Start:	515,3 s	<b>Häng slangarna vid maskinen på sidan</b>	
<b>Work:</b>	<b>53,3 s</b>		
Stop:	568,6 s		
Start:	568,6 s	<b>Stäng av ventilerna för stack 1</b>	
<b>Work:</b>	<b>20,4 s</b>		
Stop:	589,0 s		
Start:	589,0 s	<b>Ta fram skyftnyckeln</b>	
<b>Work:</b>	<b>4,5 s</b>		
Stop:	593,6 s		
Start:	593,6 s	<b>Kopplas loss slangarna</b>	
<b>Work:</b>	<b>53,5 s</b>		
Stop:	647,1 s		
Start:	647,1 s	<b>Häng de korta slangarna till höger sidan</b>	
<b>Work:</b>	<b>3,8 s</b>		
Stop:	650,9 s		
Start:	650,9 s	<b>Rätta till slangarna på sidan</b>	
<b>Work:</b>	<b>7,3 s</b>		
Stop:	658,2 s		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 1	<b>Creator</b>	

Internal tasks			
Start:	658,2 s	<b>Ta fram verktyg</b>	
<b>Work:</b>	<b>2,7 s</b>		
Stop:	660,9 s		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 1	<b>Creator</b>	

Internal tasks			
Start:	660,9 s	<b>Lås formen</b>	
<b>Work:</b>	<b>7,5 s</b>		
Stop:	668,4 s		
Start:	668,4 s	<b>Lås formen</b>	
<b>Work:</b>	<b>10,6 s</b>		
Stop:	679,0 s		
Start:	679,0 s	<b>Gå till andra formen</b>	
<b>Work:</b>	<b>5,1 s</b>		
Stop:	684,1 s		
Start:	684,1 s	<b>Lås formen</b>	
<b>Work:</b>	<b>13,7 s</b>		
Stop:	697,8 s		
Start:	697,8 s	<b>Gå till Glasdörren</b>	
<b>Work:</b>	<b>10,9 s</b>		
Stop:	708,7 s		
Start:	708,7 s	<b>Stäng till Glasdörren</b>	
<b>Work:</b>	<b>6,2 s</b>		
Stop:	714,9 s		
Start:	714,9 s	<b>Kvittera</b>	
<b>Work:</b>	<b>2,3 s</b>		
Stop:	717,2 s		
Start:	717,2 s	<b>Ta låset</b>	
<b>Work:</b>	<b>16,3 s</b>		
Stop:	733,4 s		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 1	<b>Creator</b>	

Internal tasks			
Start:	733,4 s	<b>lägg fjärkontrollen åt sidan</b>	
<b>Work:</b>	<b>3,2 s</b>		
Stop:	736,7 s		
Start:	736,7 s	<b>kolla på instruktioner</b>	
<b>Work:</b>	<b>27,7 s</b>		
Stop:	764,3 s		
Start:	764,3 s	<b>Gå till panelen</b>	
<b>Work:</b>	<b>57,7 s</b>		
Stop:	822,0 s		
Start:	822,0 s	<b>Vänta på operatör 2</b>	
<b>Work:</b>	<b>24,9 s</b>		
Stop:	846,9 s		
Start:	846,9 s	<b>Gå in till formen</b>	
<b>Work:</b>	<b>8,4 s</b>		
Stop:	855,3 s		
Start:	855,3 s	<b>Vrid på verktyget (manuellt)</b>	
<b>Work:</b>	<b>13,0 s</b>		
Stop:	868,3 s		
Start:	868,3 s	<b>Gå till whiteboarden</b>	
<b>Work:</b>	<b>31,8 s</b>		
Stop:	900,1 s		
Start:	900,1 s	<b>Ta Pärmen och blada in instruktioner till föregående from</b>	
<b>Work:</b>	<b>17,7 s</b>		
Stop:	917,8 s		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 1	<b>Creator</b>	

Internal tasks			
Start:	917,8 s	<b>Gå till skåpen</b>	
<b>Work:</b>	<b>28,1 s</b>		
Stop:	945,9 s		
Start:	945,9 s	<b>Ställ in gamla pärmen</b>	
<b>Work:</b>	<b>5,9 s</b>		
Stop:	951,8 s		
Start:	951,8 s	<b>Ta ut nya pärmen</b>	
<b>Work:</b>	<b>5,9 s</b>		
Stop:	957,7 s		
Start:	957,7 s	<b>Gå till stationen</b>	
<b>Work:</b>	<b>43,2 s</b>		
Stop:	1 000,9 s		
Start:	1 000,9 s	<b>Sätt upp nya verktygets instruktioner</b>	
<b>Work:</b>	<b>49,6 s</b>		
Stop:	1 050,5 s		
Start:	1 050,5 s	<b>Öppna Pärmen och ta fram rätt sida</b>	
<b>Work:</b>	<b>11,8 s</b>		
Stop:	1 062,3 s		
Start:	1 062,3 s	<b>Gå till trucken</b>	
<b>Work:</b>	<b>5,3 s</b>		
Stop:	1 067,6 s		
Start:	1 067,6 s	<b>Vänta på operatör 2</b>	
<b>Work:</b>	<b>32,1 s</b>		
Stop:	1 099,7 s		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 1	<b>Creator</b>	

Internal tasks			
Start:	1 099,7 s	<b>Placera Pallen under verktyget</b>	
<b>Work:</b>	<b>40,0 s</b>		
Stop:	1 139,8 s		
Start:	1 139,8 s	<b>Vänta på operatör 2</b>	
<b>Work:</b>	<b>26,0 s</b>		
Stop:	1 165,7 s		
Start:	1 165,7 s	<b>Gå till stationen</b>	
<b>Work:</b>	<b>73,1 s</b>		
Stop:	1 238,8 s		
Start:	1 238,8 s	<b>Byt program</b>	
<b>Work:</b>	<b>13,3 s</b>		
Stop:	1 252,1 s		
Start:	1 252,1 s	<b>Byt program</b>	
<b>Work:</b>	<b>76,7 s</b>		
Stop:	1 328,8 s		
Start:	1 328,8 s	<b>Stäng Glasdörren och kvittera</b>	
<b>Work:</b>	<b>11,3 s</b>		
Stop:	1 340,1 s		
Start:	1 340,1 s	<b>Stäng formen</b>	
<b>Work:</b>	<b>51,6 s</b>		
Stop:	1 391,7 s		
Start:	1 391,7 s	<b>Spänn fast verktyget</b>	
<b>Work:</b>	<b>44,8 s</b>		
Stop:	1 436,5 s		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 1	<b>Creator</b>	

Internal tasks			
Start:	1 436,5 s	<b>Vänta på opertör 2</b>	
<b>Work:</b>	<b>22,6 s</b>		
Stop:	1 459,1 s		
Start:	1 459,1 s	<b>Ta fjärrkontrollen</b>	
<b>Work:</b>	<b>3,0 s</b>		
Stop:	1 462,2 s		
Start:	1 462,2 s	<b>Kör traversen till stack</b>	
<b>Work:</b>	<b>33,0 s</b>		
Stop:	1 495,1 s		
Start:	1 495,1 s	<b>Gå till Stack 2</b>	
<b>Work:</b>	<b>21,2 s</b>		
Stop:	1 516,4 s		
Start:	1 516,4 s	<b>Lyft upp stack 2</b>	
<b>Work:</b>	<b>215,4 s</b>		
Stop:	1 731,8 s		
Start:	1 731,8 s	<b>Gå till Panelsidan</b>	
<b>Work:</b>	<b>24,5 s</b>		
Stop:	1 756,2 s		
Start:	1 756,2 s	<b>Sänk ner stack 2 till maskinen</b>	
<b>Work:</b>	<b>55,1 s</b>		
Stop:	1 811,3 s		
Start:	1 811,3 s	<b>Vrid på Stack 2 180 grader (manuellt)</b>	
<b>Work:</b>	<b>26,4 s</b>		
Stop:	1 837,8 s		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 1	<b>Creator</b>	

Internal tasks			
Start:	1 837,8 s	<b>koppla Stack 2 till maskinen</b>	
<b>Work:</b>	<b>41,6 s</b>		
Stop:	1 879,4 s		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 1	<b>Creator</b>	

Internal tasks			
Start:	1 879,4 s	<b>lägg fjärr kontrollen på sidan</b>	
<b>Work:</b>	<b>8,3 s</b>		
Stop:	1 887,7 s		
Start:	1 887,7 s	<b>Gå till panelen</b>	
<b>Work:</b>	<b>1,7 s</b>		
Stop:	1 889,4 s		
Start:	1 889,4 s	<b>Stäng glas dörren och kvittera</b>	
<b>Work:</b>	<b>12,8 s</b>		
Stop:	1 902,1 s		
Start:	1 902,1 s	<b>Stäng formen till stack 2</b>	
<b>Work:</b>	<b>58,5 s</b>		
Stop:	1 960,7 s		
Start:	1 960,7 s	<b>spänn fast verktyget</b>	
<b>Work:</b>	<b>51,2 s</b>		
Stop:	2 011,9 s		
Start:	2 011,9 s	<b>Gå till cell sidan</b>	
<b>Work:</b>	<b>33,5 s</b>		
Stop:	2 045,4 s		
Start:	2 045,4 s	<b>Ta fram låset</b>	
<b>Work:</b>	<b>7,4 s</b>		
Stop:	2 052,8 s		
Start:	2 052,8 s	<b>Häng låset</b>	
<b>Work:</b>	<b>6,9 s</b>		
Stop:	2 059,7 s		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 1	<b>Creator</b>	

Internal tasks			
Start:	2 059,7 s	<b>Öppna glasdörren</b>	
<b>Work:</b>	<b>9,8 s</b>		
Stop:	2 069,5 s		
Start:	2 069,5 s	<b>Ta upp slangarna</b>	
<b>Work:</b>	<b>29,9 s</b>		
Stop:	2 099,3 s		
Start:	2 099,3 s	<b>Koppla på slangarna</b>	
<b>Work:</b>	<b>152,4 s</b>		
Stop:	2 251,8 s		
Start:	2 251,8 s	<b>koppla loss extra slangar</b>	
<b>Work:</b>	<b>46,9 s</b>		
Stop:	2 298,7 s		
Start:	2 298,7 s	<b>Häng slangarna på stolpen bredvid datorn</b>	
<b>Work:</b>	<b>29,6 s</b>		
Stop:	2 328,3 s		
Start:	2 328,3 s	<b>Gå tillbaka till maskinen</b>	
<b>Work:</b>	<b>4,2 s</b>		
Stop:	2 332,5 s		
Start:	2 332,5 s	<b>Öppna ventilerna</b>	
<b>Work:</b>	<b>26,3 s</b>		
Stop:	2 358,8 s		
Start:	2 358,8 s	<b>Gå till stack 1</b>	
<b>Work:</b>	<b>2,0 s</b>		
Stop:	2 360,8 s		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 1	<b>Creator</b>	

Internal tasks			
Start:	2 360,8 s	<b>Ta ut slangar för stack 1</b>	
<b>Work:</b>	<b>16,0 s</b>		
Stop:	2 376,8 s		
Start:	2 376,8 s	<b>Koppla på slangar på höger sidan</b>	
<b>Work:</b>	<b>113,3 s</b>		
Stop:	2 490,1 s		
Start:	2 490,1 s	<b>Öppna ventiler</b>	
<b>Work:</b>	<b>17,4 s</b>		
Stop:	2 507,5 s		
Start:	2 507,5 s	<b>Koppla slangar på vänster sidan till stack 1</b>	
<b>Work:</b>	<b>91,6 s</b>		
Stop:	2 599,1 s		
Start:	2 599,1 s	<b>Koppla loss extra slangar</b>	
<b>Work:</b>	<b>20,7 s</b>		
Stop:	2 619,8 s		
Start:	2 619,8 s	<b>Byt plats på nödvändiga slangar</b>	
<b>Work:</b>	<b>7,2 s</b>		
Stop:	2 627,0 s		
Start:	2 627,0 s	<b>Öppna ventiler</b>	
<b>Work:</b>	<b>11,8 s</b>		
Stop:	2 638,8 s		
Start:	2 638,8 s	<b>Koppla på olje slangar</b>	
<b>Work:</b>	<b>38,7 s</b>		
Stop:	2 677,5 s		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 1	<b>Creator</b>	

Internal tasks			
Start:	2 677,5 s	<b>Kontrollera</b>	
<b>Work:</b>	<b>11,3 s</b>		
Stop:	2 688,8 s		
Start:	2 688,8 s	<b>Stäng till glasdörren och kvittera</b>	
<b>Work:</b>	<b>11,7 s</b>		
Stop:	2 700,5 s		
Start:	2 700,5 s	<b>Gå till panel sidan</b>	
<b>Work:</b>	<b>17,2 s</b>		
Stop:	2 717,7 s		
Start:	2 717,7 s	<b>läsupp låset och ta med dig</b>	
<b>Work:</b>	<b>3,7 s</b>		
Stop:	2 721,4 s		
Start:	2 721,4 s	<b>Stäng glasdörren och kvittera</b>	
<b>Work:</b>	<b>9,4 s</b>		
Stop:	2 730,9 s		
Start:	2 730,9 s	<b>Kör in</b>	
<b>Work:</b>	<b>117,0 s</b>		
Stop:	2 847,9 s		
Start:	2 847,9 s	<b>Öppna formen</b>	
<b>Work:</b>	<b>38,1 s</b>		
Stop:	2 886,0 s		
Start:	2 886,0 s	<b>Öppna glas dörren</b>	
<b>Work:</b>	<b>9,6 s</b>		
Stop:	2 895,6 s		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 1	<b>Creator</b>	

Internal tasks			
Start:	2 895,6 s	<b>Gå in till formen och ta bort rostskydd på stack 1</b>	
<b>Work:</b>	<b>25,5 s</b>		
Stop:	2 921,1 s		
Start:	2 921,1 s	<b>Gå till panelen</b>	
<b>Work:</b>	<b>1,6 s</b>		
Stop:	2 922,7 s		
Start:	2 922,7 s	<b>Stäng dörren och kvittera</b>	
<b>Work:</b>	<b>22,8 s</b>		
Stop:	2 945,5 s		
Start:	2 945,5 s	<b>Kör ut</b>	
<b>Work:</b>	<b>84,2 s</b>		
Stop:	3 029,7 s		
Start:	3 029,7 s	<b>Hjälpa till operatör 2 (robot)</b>	
<b>Work:</b>	<b>160,4 s</b>		
Stop:	3 190,1 s		
Start:	3 190,1 s	<b>gå till cellen</b>	
<b>Work:</b>	<b>20,8 s</b>		
Stop:	3 210,8 s		
Start:	3 210,8 s	<b>Ta greppet till roboten</b>	
<b>Work:</b>	<b>8,5 s</b>		
Stop:	3 219,3 s		
Start:	3 219,3 s	<b>sätt det på roboten</b>	
<b>Work:</b>	<b>13,1 s</b>		
Stop:	3 232,4 s		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 1	<b>Creator</b>	

Internal tasks			
Start:	3 232,4 s	<b>sätt det på roboten</b>	
<b>Work:</b>	<b>5,9 s</b>		
Stop:	3 238,3 s		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 1	<b>Creator</b>	

Internal tasks			
Start:	3 238,3 s	<b>kvittera och ta låset</b>	
<b>Work:</b>	<b>13,3 s</b>		
Stop:	3 251,6 s		
Start:	3 251,6 s	<b>Gå till datorn</b>	
<b>Work:</b>	<b>17,3 s</b>		
Stop:	3 268,8 s		
Start:	3 268,8 s	<b>Rapportera och skicka larm</b>	
<b>Work:</b>	<b>77,7 s</b>		
Stop:	3 346,6 s		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 1	<b>Creator</b>	

<b>Changeover time</b>	<b>Down time</b>	<b>Operator 1</b>	Preparation	1 377,8 s	Internal	3 346,6 s	<b>Reordering</b>	<b>925,1 s</b>	<b>Σ Work</b>	<b>5 649,4 s</b>
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Reordering			
Start:	3 575,8 s	<b>Kör upp traversen och kör mot andra maskinen</b>	
<b>Work:</b>	<b>58,7 s</b>		
Stop:	3 634,6 s		
Start:	3 634,6 s	<b>Kör gamla formen till nedkylning station</b>	
<b>Work:</b>	<b>222,1 s</b>		
Stop:	3 856,6 s		
Start:	3 856,6 s	<b>Placera verktyget på stationen</b>	
<b>Work:</b>	<b>7,0 s</b>		
Stop:	3 863,6 s		
Start:	3 863,6 s	<b>Kör gamla verktyget till förvring stället</b>	
<b>Work:</b>	<b>309,4 s</b>		
Stop:	4 173,1 s		
Start:	4 173,1 s	<b>Kör tillbaka till laddningstationen</b>	
<b>Work:</b>	<b>171,0 s</b>		
Stop:	4 344,0 s		
Start:	4 344,0 s	<b>Gå till nedkylning stationen</b>	
<b>Work:</b>	<b>13,8 s</b>		
Stop:	4 357,8 s		
Start:	4 357,8 s	<b>Ta handskar på</b>	
<b>Work:</b>	<b>5,1 s</b>		
Stop:	4 362,9 s		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 1	<b>Creator</b>	

Reordering			
Start:	4 362,9 s	<b>Koppla på långa Slangar</b>	
<b>Work:</b>	<b>47,2 s</b>		
Stop:	4 410,2 s		
Start:	4 410,2 s	<b>Gå för hämta kort slang</b>	
<b>Work:</b>	<b>20,4 s</b>		
Stop:	4 430,5 s		
Start:	4 430,5 s	<b>Koppla på korta slangen</b>	
<b>Work:</b>	<b>13,4 s</b>		
Stop:	4 443,9 s		
Start:	4 443,9 s	<b>placera gamla verktyget</b>	
<b>Work:</b>	<b>35,1 s</b>		
Stop:	4 479,0 s		
Start:	4 479,0 s	<b>öppna ventilerna</b>	
<b>Work:</b>	<b>7,1 s</b>		
Stop:	4 486,1 s		
Start:	4 486,1 s	<b>häng skylten på formen</b>	
<b>Work:</b>	<b>14,8 s</b>		
Stop:	4 500,9 s		

Operator 2 Standardized work instructions

**Changeover Instruction**



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 2	<b>Creator</b>	

<b>Changeover time</b>	<b>Down time</b> 3 575,8 s	<b>Operator 2</b>	<b>Preparation</b>	<b>543,1 s</b>	Internal	3 575,8 s	Reordering	33,1 s	<b>Σ Work</b>	<b>4 152,0 s</b>
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Preparation			
Start:	-543,1 s	<b>Gå till andra maskinen</b>	
<b>Work:</b>	<b>74,2 s</b>		
Stop:	-468,8 s		
Start:	-468,8 s	<b>Stanna maskinen</b>	
<b>Work:</b>	<b>43,9 s</b>		
Stop:	-424,9 s		
Start:	-424,9 s	<b>Vänta på maskinen</b>	
<b>Work:</b>	<b>144,6 s</b>		
Stop:	-280,3 s		
Start:	-280,3 s	<b>Kör traversen till 3202</b>	
<b>Work:</b>	<b>39,3 s</b>		
Stop:	-241,0 s		
Start:	-241,0 s	<b>Kör traversen förbi maskinen</b>	
<b>Work:</b>	<b>84,8 s</b>		
Stop:	-156,2 s		
Start:	-156,2 s	<b>Sätt på maskinen igen</b>	
<b>Work:</b>	<b>68,9 s</b>		
Stop:	-87,3 s		
Start:	-87,3 s	<b>Gå till maskinen</b>	
<b>Work:</b>	<b>49,4 s</b>		
Stop:	-37,9 s		

**Changeover Instruction**



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 2	<b>Creator</b>	

<b>Changeover time</b>	<b>Down time</b> 3 575,8 s	<b>Operator 2</b>	<b>Preparation</b>	<b>543,1 s</b>	Internal	3 575,8 s	Reordering	33,1 s	<b>Σ Work</b>	<b>4 152,0 s</b>
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Preparation			
Start:	-543,1 s	<b>Gå till andra maskinen</b>	
<b>Work:</b>	<b>74,2 s</b>		
Stop:	-468,8 s		
Start:	-468,8 s	<b>Stanna maskinen</b>	
<b>Work:</b>	<b>43,9 s</b>		
Stop:	-424,9 s		
Start:	-424,9 s	<b>Vänta på maskinen</b>	
<b>Work:</b>	<b>144,6 s</b>		
Stop:	-280,3 s		
Start:	-280,3 s	<b>Kör traversen till 3202</b>	
<b>Work:</b>	<b>39,3 s</b>		
Stop:	-241,0 s		
Start:	-241,0 s	<b>Kör traversen förbi maskinen</b>	
<b>Work:</b>	<b>84,8 s</b>		
Stop:	-156,2 s		
Start:	-156,2 s	<b>Sätt på maskinen igen</b>	
<b>Work:</b>	<b>68,9 s</b>		
Stop:	-87,3 s		
Start:	-87,3 s	<b>Gå till maskinen</b>	
<b>Work:</b>	<b>49,4 s</b>		
Stop:	-37,9 s		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 2	<b>Creator</b>	

<b>Changeover time</b>	<b>Down time</b> 3 575,8 s	<b>Operator 2</b>	<b>Preparation</b>	<b>543,1 s</b>	Internal	3 575,8 s	Reordering	33,1 s	<b>Σ Work</b>	<b>4 152,0 s</b>
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Preparation			
Start:	-543,1 s	<b>Gå till andra maskinen</b>	
<b>Work:</b>	<b>74,2 s</b>		
Stop:	-468,8 s		
Start:	-468,8 s	<b>Stanna maskinen</b>	
<b>Work:</b>	<b>43,9 s</b>		
Stop:	-424,9 s		
Start:	-424,9 s	<b>Vänta på maskinen</b>	
<b>Work:</b>	<b>144,6 s</b>		
Stop:	-280,3 s		
Start:	-280,3 s	<b>Kör traversen till 3202</b>	
<b>Work:</b>	<b>39,3 s</b>		
Stop:	-241,0 s		
Start:	-241,0 s	<b>Kör traversen förbi maskinen</b>	
<b>Work:</b>	<b>84,8 s</b>		
Stop:	-156,2 s		
Start:	-156,2 s	<b>Sätt på maskinen igen</b>	
<b>Work:</b>	<b>68,9 s</b>		
Stop:	-87,3 s		
Start:	-87,3 s	<b>Gå till maskinen</b>	
<b>Work:</b>	<b>49,4 s</b>		
Stop:	-37,9 s		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 2	<b>Creator</b>	

<b>Changeover time</b>	<b>Down time</b> 3 575,8 s	<b>Operator 2</b>	<b>Preparation</b>	<b>543,1 s</b>	Internal	3 575,8 s	Reordering	33,1 s	<b>Σ Work</b>	<b>4 152,0 s</b>
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Preparation			
Start:	-543,1 s	<b>Gå till andra maskinen</b>	
<b>Work:</b>	<b>74,2 s</b>		
Stop:	-468,8 s		
Start:	-468,8 s	<b>Stanna maskinen</b>	
<b>Work:</b>	<b>43,9 s</b>		
Stop:	-424,9 s		
Start:	-424,9 s	<b>Vänta på maskinen</b>	
<b>Work:</b>	<b>144,6 s</b>		
Stop:	-280,3 s		
Start:	-280,3 s	<b>Kör traversen till 3202</b>	
<b>Work:</b>	<b>39,3 s</b>		
Stop:	-241,0 s		
Start:	-241,0 s	<b>Kör traversen förbi maskinen</b>	
<b>Work:</b>	<b>84,8 s</b>		
Stop:	-156,2 s		
Start:	-156,2 s	<b>Sätt på maskinen igen</b>	
<b>Work:</b>	<b>68,9 s</b>		
Stop:	-87,3 s		
Start:	-87,3 s	<b>Gå till maskinen</b>	
<b>Work:</b>	<b>49,4 s</b>		
Stop:	-37,9 s		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 2	<b>Creator</b>	

<b>Changeover time</b>	<b>Down time</b> 3 575,8 s	<b>Operator 2</b>	<b>Preparation</b>	<b>543,1 s</b>	Internal	3 575,8 s	Reordering	33,1 s	<b>Σ Work</b>	<b>4 152,0 s</b>
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Preparation			
Start:	-543,1 s	<b>Gå till andra maskinen</b>	
<b>Work:</b>	<b>74,2 s</b>		
Stop:	-468,8 s		
Start:	-468,8 s	<b>Stanna maskinen</b>	
<b>Work:</b>	<b>43,9 s</b>		
Stop:	-424,9 s		
Start:	-424,9 s	<b>Vänta på maskinen</b>	
<b>Work:</b>	<b>144,6 s</b>		
Stop:	-280,3 s		
Start:	-280,3 s	<b>Kör traversen till 3202</b>	
<b>Work:</b>	<b>39,3 s</b>		
Stop:	-241,0 s		
Start:	-241,0 s	<b>Kör traversen förbi maskinen</b>	
<b>Work:</b>	<b>84,8 s</b>		
Stop:	-156,2 s		
Start:	-156,2 s	<b>Sätt på maskinen igen</b>	
<b>Work:</b>	<b>68,9 s</b>		
Stop:	-87,3 s		
Start:	-87,3 s	<b>Gå till maskinen</b>	
<b>Work:</b>	<b>49,4 s</b>		
Stop:	-37,9 s		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 2	<b>Creator</b>	

<b>Changeover time</b>	<b>Down time</b> 3 575,8 s	<b>Operator 2</b>	<b>Preparation</b>	<b>543,1 s</b>	Internal	3 575,8 s	Reordering	33,1 s	<b>Σ Work</b>	<b>4 152,0 s</b>
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Preparation			
Start:	-543,1 s	<b>Gå till andra maskinen</b>	
<b>Work:</b>	<b>74,2 s</b>		
Stop:	-468,8 s		
Start:	-468,8 s	<b>Stanna maskinen</b>	
<b>Work:</b>	<b>43,9 s</b>		
Stop:	-424,9 s		
Start:	-424,9 s	<b>Vänta på maskinen</b>	
<b>Work:</b>	<b>144,6 s</b>		
Stop:	-280,3 s		
Start:	-280,3 s	<b>Kör traversen till 3202</b>	
<b>Work:</b>	<b>39,3 s</b>		
Stop:	-241,0 s		
Start:	-241,0 s	<b>Kör traversen förbi maskinen</b>	
<b>Work:</b>	<b>84,8 s</b>		
Stop:	-156,2 s		
Start:	-156,2 s	<b>Sätt på maskinen igen</b>	
<b>Work:</b>	<b>68,9 s</b>		
Stop:	-87,3 s		
Start:	-87,3 s	<b>Gå till maskinen</b>	
<b>Work:</b>	<b>49,4 s</b>		
Stop:	-37,9 s		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 2	<b>Creator</b>	

<b>Changeover time</b>	<b>Down time</b> 3 575,8 s	<b>Operator 2</b>	<b>Preparation</b>	<b>543,1 s</b>	Internal	3 575,8 s	Reordering	33,1 s	<b>Σ Work</b>	<b>4 152,0 s</b>
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Preparation			
Start:	-543,1 s	<b>Gå till andra maskinen</b>	
<b>Work:</b>	<b>74,2 s</b>		
Stop:	-468,8 s		
Start:	-468,8 s	<b>Stanna maskinen</b>	
<b>Work:</b>	<b>43,9 s</b>		
Stop:	-424,9 s		
Start:	-424,9 s	<b>Vänta på maskinen</b>	
<b>Work:</b>	<b>144,6 s</b>		
Stop:	-280,3 s		
Start:	-280,3 s	<b>Kör traversen till 3202</b>	
<b>Work:</b>	<b>39,3 s</b>		
Stop:	-241,0 s		
Start:	-241,0 s	<b>Kör traversen förbi maskinen</b>	
<b>Work:</b>	<b>84,8 s</b>		
Stop:	-156,2 s		
Start:	-156,2 s	<b>Sätt på maskinen igen</b>	
<b>Work:</b>	<b>68,9 s</b>		
Stop:	-87,3 s		
Start:	-87,3 s	<b>Gå till maskinen</b>	
<b>Work:</b>	<b>49,4 s</b>		
Stop:	-37,9 s		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 2	<b>Creator</b>	

<b>Changeover time</b>	<b>Down time</b> 3 575,8 s	<b>Operator 2</b>	<b>Preparation</b>	<b>543,1 s</b>	Internal	3 575,8 s	Reordering	33,1 s	<b>Σ Work</b>	<b>4 152,0 s</b>
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Preparation			
Start:	-543,1 s	<b>Gå till andra maskinen</b>	
<b>Work:</b>	<b>74,2 s</b>		
Stop:	-468,8 s		
Start:	-468,8 s	<b>Stanna maskinen</b>	
<b>Work:</b>	<b>43,9 s</b>		
Stop:	-424,9 s		
Start:	-424,9 s	<b>Vänta på maskinen</b>	
<b>Work:</b>	<b>144,6 s</b>		
Stop:	-280,3 s		
Start:	-280,3 s	<b>Kör traversen till 3202</b>	
<b>Work:</b>	<b>39,3 s</b>		
Stop:	-241,0 s		
Start:	-241,0 s	<b>Kör traversen förbi maskinen</b>	
<b>Work:</b>	<b>84,8 s</b>		
Stop:	-156,2 s		
Start:	-156,2 s	<b>Sätt på maskinen igen</b>	
<b>Work:</b>	<b>68,9 s</b>		
Stop:	-87,3 s		
Start:	-87,3 s	<b>Gå till maskinen</b>	
<b>Work:</b>	<b>49,4 s</b>		
Stop:	-37,9 s		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 2	<b>Creator</b>	

<b>Changeover time</b>	<b>Down time</b> 3 575,8 s	<b>Operator 2</b>	<b>Preparation</b>	<b>543,1 s</b>	Internal	3 575,8 s	Reordering	33,1 s	<b>Σ Work</b>	<b>4 152,0 s</b>
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Preparation			
Start:	-543,1 s	<b>Gå till andra maskinen</b>	
<b>Work:</b>	<b>74,2 s</b>		
Stop:	-468,8 s		
Start:	-468,8 s	<b>Stanna maskinen</b>	
<b>Work:</b>	<b>43,9 s</b>		
Stop:	-424,9 s		
Start:	-424,9 s	<b>Vänta på maskinen</b>	
<b>Work:</b>	<b>144,6 s</b>		
Stop:	-280,3 s		
Start:	-280,3 s	<b>Kör traversen till 3202</b>	
<b>Work:</b>	<b>39,3 s</b>		
Stop:	-241,0 s		
Start:	-241,0 s	<b>Kör traversen förbi maskinen</b>	
<b>Work:</b>	<b>84,8 s</b>		
Stop:	-156,2 s		
Start:	-156,2 s	<b>Sätt på maskinen igen</b>	
<b>Work:</b>	<b>68,9 s</b>		
Stop:	-87,3 s		
Start:	-87,3 s	<b>Gå till maskinen</b>	
<b>Work:</b>	<b>49,4 s</b>		
Stop:	-37,9 s		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 2	<b>Creator</b>	

<b>Changeover time</b>	<b>Down time</b> 3 575,8 s	<b>Operator 2</b>	<b>Preparation</b>	<b>543,1 s</b>	Internal	3 575,8 s	Reordering	33,1 s	<b>Σ Work</b>	<b>4 152,0 s</b>
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Preparation			
Start:	-543,1 s	<b>Gå till andra maskinen</b>	
<b>Work:</b>	<b>74,2 s</b>		
Stop:	-468,8 s		
Start:	-468,8 s	<b>Stanna maskinen</b>	
<b>Work:</b>	<b>43,9 s</b>		
Stop:	-424,9 s		
Start:	-424,9 s	<b>Vänta på maskinen</b>	
<b>Work:</b>	<b>144,6 s</b>		
Stop:	-280,3 s		
Start:	-280,3 s	<b>Kör traversen till 3202</b>	
<b>Work:</b>	<b>39,3 s</b>		
Stop:	-241,0 s		
Start:	-241,0 s	<b>Kör traversen förbi maskinen</b>	
<b>Work:</b>	<b>84,8 s</b>		
Stop:	-156,2 s		
Start:	-156,2 s	<b>Sätt på maskinen igen</b>	
<b>Work:</b>	<b>68,9 s</b>		
Stop:	-87,3 s		
Start:	-87,3 s	<b>Gå till maskinen</b>	
<b>Work:</b>	<b>49,4 s</b>		
Stop:	-37,9 s		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 2	<b>Creator</b>	

Preparation			
Start:	-37,9 s	Dubbelkolla att roboten har stannat	
Work:	<b>37,9 s</b>		
Stop:	0,0 s		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 2	<b>Creator</b>	

<b>Changeover time</b>	<b>Down time</b>	<b>Operator 2</b>	Preparation	543,1 s	<b>Internal</b>	<b>3 575,8 s</b>	Reordering	33,1 s	<b>Σ Work</b>	<b>4 152,0 s</b>
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Internal tasks			
Start:	0,0 s	Gå till datorn	
Work:	<b>11,2 s</b>		
Stop:	11,2 s		
Start:	11,2 s	Tabort det gamla programet	
Work:	<b>372,7 s</b>		
Stop:	383,9 s		
Start:	383,9 s	Gå tillbaka till maskinen	
Work:	<b>24,8 s</b>		
Stop:	408,8 s		
Start:	408,8 s	Gå upp för stege	
Work:	<b>15,7 s</b>		
Stop:	424,5 s		
Start:	424,5 s	Kör traversen till formen	
Work:	<b>33,1 s</b>		
Stop:	457,6 s		
Start:	457,6 s	Gå ovanför verktyget	
Work:	<b>16,0 s</b>		
Stop:	473,6 s		
Start:	473,6 s	Koppla loss kontakter	
Work:	<b>13,3 s</b>		
Stop:	486,8 s		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 2	<b>Creator</b>	

Internal tasks			
Start:	486,8 s	<b>Lägg sladdar åt sidan</b>	
<b>Work:</b>	<b>27,2 s</b>		
Stop:	514,0 s		
Start:	514,0 s	<b>Dra bulten åt sidan</b>	
<b>Work:</b>	<b>5,3 s</b>		
Stop:	519,3 s		
Start:	519,3 s	<b>Kär traversen ner till verktyget</b>	
<b>Work:</b>	<b>61,9 s</b>		
Stop:	581,2 s		
Start:	581,2 s	<b>Putta in bulten i kroken</b>	
<b>Work:</b>	<b>7,6 s</b>		
Stop:	588,8 s		
Start:	588,8 s	<b>Sätt muttern på andra sidan</b>	
<b>Work:</b>	<b>6,8 s</b>		
Stop:	595,6 s		
Start:	595,6 s	<b>Gå ner för trappan</b>	
<b>Work:</b>	<b>33,8 s</b>		
Stop:	629,4 s		
Start:	629,4 s	<b>Stäng dörren</b>	
<b>Work:</b>	<b>2,9 s</b>		
Stop:	632,3 s		
Start:	632,3 s	<b>Kvittera</b>	
<b>Work:</b>	<b>5,4 s</b>		
Stop:	637,8 s		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 2	<b>Creator</b>	

Internal tasks			
Start:	637,8 s	<b>öppna formen</b>	
<b>Work:</b>	<b>171,7 s</b>		
Stop:	809,4 s		
Start:	809,4 s	<b>lyft upp verktyget</b>	
<b>Work:</b>	<b>42,1 s</b>		
Stop:	851,5 s		
Start:	851,5 s	<b>lyft upp verktyget</b>	
<b>Work:</b>	<b>42,6 s</b>		
Stop:	894,1 s		
Start:	894,1 s	<b>Gå till Cell sidan</b>	
<b>Work:</b>	<b>25,3 s</b>		
Stop:	919,3 s		
Start:	919,3 s	<b>Sänk ner verktyget och placera på plattan</b>	
<b>Work:</b>	<b>110,5 s</b>		
Stop:	1 029,8 s		
Start:	1 029,8 s	<b>lossna bulten och kroken</b>	
<b>Work:</b>	<b>20,7 s</b>		
Stop:	1 050,5 s		
Start:	1 050,5 s	<b>Kör upp till traversen till andra formen</b>	
<b>Work:</b>	<b>58,3 s</b>		
Stop:	1 108,7 s		
Start:	1 108,7 s	<b>Gå till andra sidan</b>	
<b>Work:</b>	<b>45,3 s</b>		
Stop:	1 154,0 s		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 2	<b>Creator</b>	

Internal tasks			
Start:	1 154,0 s	<b>Öppna dörren</b>	
<b>Work:</b>	<b>2,4 s</b>		
Stop:	1 156,4 s		
Start:	1 156,4 s	<b>Gå upp för trappan</b>	
<b>Work:</b>	<b>12,7 s</b>		
Stop:	1 169,1 s		
Start:	1 169,1 s	<b>Gå ovanför formen</b>	
<b>Work:</b>	<b>7,1 s</b>		
Stop:	1 176,2 s		
Start:	1 176,2 s	<b>Sänk ner kroken till bulten</b>	
<b>Work:</b>	<b>15,4 s</b>		
Stop:	1 191,6 s		
Start:	1 191,6 s	<b>Putta bulten i kroken</b>	
<b>Work:</b>	<b>8,4 s</b>		
Stop:	1 200,0 s		
Start:	1 200,0 s	<b>Rätta till kroken</b>	
<b>Work:</b>	<b>7,4 s</b>		
Stop:	1 207,4 s		
Start:	1 207,4 s	<b>Gå ner för trappan</b>	
<b>Work:</b>	<b>17,7 s</b>		
Stop:	1 225,1 s		
Start:	1 225,1 s	<b>Stäng dörren</b>	
<b>Work:</b>	<b>2,7 s</b>		
Stop:	1 227,8 s		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 2	<b>Creator</b>	

Internal tasks			
Start:	1 227,8 s	<b>Gå in till panelen</b>	
<b>Work:</b>	<b>1,7 s</b>		
Stop:	1 229,5 s		
Start:	1 229,5 s	<b>Kvittera</b>	
<b>Work:</b>	<b>2,3 s</b>		
Stop:	1 231,8 s		
Start:	1 231,8 s	<b>Stäng glas dörren och kvittera</b>	
<b>Work:</b>	<b>13,7 s</b>		
Stop:	1 245,5 s		
Start:	1 245,5 s	<b>lossnar verktyget</b>	
<b>Work:</b>	<b>51,5 s</b>		
Stop:	1 296,9 s		
Start:	1 296,9 s	<b>Öppna formen</b>	
<b>Work:</b>	<b>49,8 s</b>		
Stop:	1 346,7 s		
Start:	1 346,7 s	<b>Öppna glas dörren</b>	
<b>Work:</b>	<b>5,4 s</b>		
Stop:	1 352,1 s		
Start:	1 352,1 s	<b>koppla loss Stack 1</b>	
<b>Work:</b>	<b>12,4 s</b>		
Stop:	1 364,5 s		
Start:	1 364,5 s	<b>Gå in till formen</b>	
<b>Work:</b>	<b>6,0 s</b>		
Stop:	1 370,5 s		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 2	<b>Creator</b>	

Internal tasks			
Start:	1 370,5 s	<b>Vrid på verktyget 180 grader manuell</b>	
<b>Work:</b>	<b>20,6 s</b>		
Stop:	1 391,1 s		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 2	<b>Creator</b>	

Internal tasks			
Start:	1 391,1 s	<b>Kör upp verktyget</b>	
<b>Work:</b>	<b>59,8 s</b>		
Stop:	1 450,8 s		
Start:	1 450,8 s	<b>Gå till cell sidan</b>	
<b>Work:</b>	<b>35,1 s</b>		
Stop:	1 486,0 s		
Start:	1 486,0 s	<b>Kör ner stack 1</b>	
<b>Work:</b>	<b>74,0 s</b>		
Stop:	1 559,9 s		
Start:	1 559,9 s	<b>Vänta på operatör 1 trucken</b>	
<b>Work:</b>	<b>60,3 s</b>		
Stop:	1 620,2 s		
Start:	1 620,2 s	<b>Hjälp till med placering av formen</b>	
<b>Work:</b>	<b>31,8 s</b>		
Stop:	1 651,9 s		
Start:	1 651,9 s	<b>Koppla loss kroken på traversen</b>	
<b>Work:</b>	<b>21,4 s</b>		
Stop:	1 673,4 s		
Start:	1 673,4 s	<b>Kör upp traversen en bit</b>	
<b>Work:</b>	<b>28,8 s</b>		
Stop:	1 702,2 s		
Start:	1 702,2 s	<b>Hjälp till placering av nya verktyget</b>	
<b>Work:</b>	<b>125,7 s</b>		
Stop:	1 827,9 s		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 2	<b>Creator</b>	

Internal tasks			
Start: 1 827,9 s <b>Work: 11,7 s</b> Stop: 1 839,6 s	<b>Hämta fjärkontrollen</b>		
Start: 1 839,6 s <b>Work: 20,6 s</b> Stop: 1 860,2 s	<b>Sänk ner kroken till verktyget</b>		
Start: 1 860,2 s <b>Work: 9,0 s</b> Stop: 1 869,2 s	<b>Putta in bulten till kroken och sätt muttern på</b>		
Start: 1 869,2 s <b>Work: 112,1 s</b> Stop: 1 981,3 s	<b>Lyft verktyget till maskinen</b>		
Start: 1 981,3 s <b>Work: 23,1 s</b> Stop: 2 004,4 s	<b>Gå till panel sidan</b>		
Start: 2 004,4 s <b>Work: 101,7 s</b> Stop: 2 106,2 s	<b>Sänk ner verktyget</b>		
Start: 2 106,2 s <b>Work: 9,2 s</b> Stop: 2 115,4 s	<b>Placera verktyget rätt och justera</b>		
Start: 2 115,4 s <b>Work: 142,6 s</b> Stop: 2 258,0 s	<b>Vänta på operatör 1 för att stänga formen</b>		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 2	<b>Creator</b>	

Internal tasks			
Start: 2 258,0 s <b>Work: 1,3 s</b> Stop: 2 259,3 s	<b>Gå till tappen</b>		
Start: 2 259,3 s <b>Work: 2,0 s</b> Stop: 2 261,3 s	<b>Öppna dörren</b>		
Start: 2 261,3 s <b>Work: 11,6 s</b> Stop: 2 272,9 s	<b>Gå uppför trappan</b>		
Start: 2 272,9 s <b>Work: 2,6 s</b> Stop: 2 275,5 s	<b>Gå ovanför verktyget</b>		
Start: 2 275,5 s <b>Work: 1,3 s</b> Stop: 2 276,8 s	<b>lägg fjärkontrollen åt sidan</b>		
Start: 2 276,8 s <b>Work: 10,2 s</b> Stop: 2 287,0 s	<b>Ta loss muttern och putta bort bulten</b>		
Start: 2 287,0 s <b>Work: 4,9 s</b> Stop: 2 291,9 s	<b>Kör loss kroken på traversen</b>		
Start: 2 291,9 s <b>Work: 5,7 s</b> Stop: 2 297,6 s	<b>Lämna fjärkontrollen till operatör 1</b>		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 2	<b>Creator</b>	

Internal tasks			
Start:	2 297,6 s	<b>Vänta på operatör 1 för flytta traversen</b>	
<b>Work:</b>	<b>17,8 s</b>		
Stop:	2 315,4 s		
Start:	2 315,4 s	<b>koppla kontaktarna</b>	
<b>Work:</b>	<b>125,3 s</b>		
Stop:	2 440,7 s		
Start:	2 440,7 s	<b>Gå ner för maskinen</b>	
<b>Work:</b>	<b>17,5 s</b>		
Stop:	2 458,3 s		
Start:	2 458,3 s	<b>Stäng dörren</b>	
<b>Work:</b>	<b>3,6 s</b>		
Stop:	2 461,9 s		
Start:	2 461,9 s	<b>Gå till panelen och kvittera</b>	
<b>Work:</b>	<b>4,2 s</b>		
Stop:	2 466,1 s		
Start:	2 466,1 s	<b>Vänta på formbytare 1</b>	
<b>Work:</b>	<b>23,2 s</b>		
Stop:	2 489,3 s		
Start:	2 489,3 s	<b>Gå till trappan</b>	
<b>Work:</b>	<b>5,2 s</b>		
Stop:	2 494,5 s		
Start:	2 494,5 s	<b>Öppna dörren</b>	
<b>Work:</b>	<b>2,6 s</b>		
Stop:	2 497,1 s		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 2	<b>Creator</b>	

Internal tasks			
Start:	2 497,1 s	<b>Gå upp för trappan</b>	
<b>Work:</b>	<b>10,6 s</b>		
Stop:	2 507,8 s		
Start:	2 507,8 s	<b>Gå ovanför verktyget</b>	
<b>Work:</b>	<b>7,7 s</b>		
Stop:	2 515,5 s		
Start:	2 515,5 s	<b>Ta losst muttern och dra ut bulten</b>	
<b>Work:</b>	<b>10,1 s</b>		
Stop:	2 525,6 s		
Start:	2 525,6 s	<b>Ta fjärkontrollen</b>	
<b>Work:</b>	<b>4,0 s</b>		
Stop:	2 529,6 s		
Start:	2 529,6 s	<b>Kör upp traversen</b>	
<b>Work:</b>	<b>30,1 s</b>		
Stop:	2 559,7 s		
Start:	2 559,7 s	<b>Sätt muttern tillbaka på bulten</b>	
<b>Work:</b>	<b>5,8 s</b>		
Stop:	2 565,5 s		
Start:	2 565,5 s	<b>koppla kontakter</b>	
<b>Work:</b>	<b>39,9 s</b>		
Stop:	2 605,5 s		
Start:	2 605,5 s	<b>Gå ner för trappan</b>	
<b>Work:</b>	<b>16,8 s</b>		
Stop:	2 622,2 s		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 2	<b>Creator</b>	

Internal tasks			
Start:	2 622,2 s	<b>Stäng dörren</b>	
<b>Work:</b>	<b>4,4 s</b>		
Stop:	2 626,6 s		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 2	<b>Creator</b>	

Internal tasks			
Start:	2 626,6 s	<b>kvittra</b>	
<b>Work:</b>	<b>5,5 s</b>		
Stop:	2 632,2 s		
Start:	2 632,2 s	<b>Lås upp både verktygen</b>	
<b>Work:</b>	<b>28,9 s</b>		
Stop:	2 661,0 s		
Start:	2 661,0 s	<b>Koppla på slangar</b>	
<b>Work:</b>	<b>132,7 s</b>		
Stop:	2 793,7 s		
Start:	2 793,7 s	<b>Öppna ventiler</b>	
<b>Work:</b>	<b>24,6 s</b>		
Stop:	2 818,3 s		
Start:	2 818,3 s	<b>Koppla olje slangar</b>	
<b>Work:</b>	<b>37,8 s</b>		
Stop:	2 856,1 s		
Start:	2 856,1 s	<b>Gå häng extra slangar</b>	
<b>Work:</b>	<b>10,7 s</b>		
Stop:	2 866,8 s		
Start:	2 866,8 s	<b>Ta loss gamla robot greppet</b>	
<b>Work:</b>	<b>14,2 s</b>		
Stop:	2 880,9 s		
Start:	2 880,9 s	<b>Ta greppet med till förvaringen</b>	
<b>Work:</b>	<b>34,0 s</b>		
Stop:	2 914,9 s		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 2	<b>Creator</b>	

Internal tasks			
Start:	2 914,9 s	<b>Ta nya greppet</b>	
<b>Work:</b>	<b>6,0 s</b>		
Stop:	2 921,0 s		
Start:	2 921,0 s	<b>Ta med till stationen</b>	
<b>Work:</b>	<b>26,2 s</b>		
Stop:	2 947,2 s		
Start:	2 947,2 s	<b>Lägg på pallen</b>	
<b>Work:</b>	<b>10,7 s</b>		
Stop:	2 957,8 s		
Start:	2 957,8 s	<b>Hjälp till formbytare 1</b>	
<b>Work:</b>	<b>52,0 s</b>		
Stop:	3 009,8 s		
Start:	3 009,8 s	<b>Gå till panelen</b>	
<b>Work:</b>	<b>19,7 s</b>		
Stop:	3 029,5 s		
Start:	3 029,5 s	<b>Starta värmen</b>	
<b>Work:</b>	<b>12,4 s</b>		
Stop:	3 041,9 s		
Start:	3 041,9 s	<b>Gå till aggregaterna</b>	
<b>Work:</b>	<b>51,3 s</b>		
Stop:	3 093,3 s		
Start:	3 093,3 s	<b>Sätt på aggregaterna</b>	
<b>Work:</b>	<b>10,1 s</b>		
Stop:	3 103,4 s		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 2	<b>Creator</b>	

Internal tasks			
Start:	3 103,4 s	<b>Gå till maskinen</b>	
<b>Work:</b>	<b>17,2 s</b>		
Stop:	3 120,5 s		
Start:	3 120,5 s	<b>Vänta på formbytare 1</b>	
<b>Work:</b>	<b>122,1 s</b>		
Stop:	3 242,6 s		
Start:	3 242,6 s	<b>Gå in till maskinen och ta bort rostskydd på formen</b>	
<b>Work:</b>	<b>18,4 s</b>		
Stop:	3 261,0 s		
Start:	3 261,0 s	<b>Gå till cellen</b>	
<b>Work:</b>	<b>14,6 s</b>		
Stop:	3 275,6 s		
Start:	3 275,6 s	<b>Kvittera och låsa upp låset</b>	
<b>Work:</b>	<b>17,9 s</b>		
Stop:	3 293,4 s		
Start:	3 293,4 s	<b>Stäng cellen</b>	
<b>Work:</b>	<b>17,4 s</b>		
Stop:	3 310,8 s		
Start:	3 310,8 s	<b>Gå till panelen</b>	
<b>Work:</b>	<b>39,4 s</b>		
Stop:	3 350,3 s		
Start:	3 350,3 s	<b>justera roboten</b>	
<b>Work:</b>	<b>165,9 s</b>		
Stop:	3 516,2 s		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 2	<b>Creator</b>	

Internal tasks			
Start:	3 516,2 s	<b>Gå till cellen</b>	
<b>Work:</b>	<b>16,5 s</b>		
Stop:	3 532,6 s		
Start:	3 532,6 s	<b>Sätt robotgreppet på</b>	
<b>Work:</b>	<b>43,2 s</b>		
Stop:	3 575,8 s		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Operator 2	<b>Creator</b>	

<b>Changeover time</b>	<b>Down time</b>	<b>Operator 2</b>	Preparation	543,1 s	Internal	3 575,8 s	<b>Reordering</b>	<b>33,1 s</b>	<b>Σ Work</b>	<b>4 152,0 s</b>
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Reordering			
Start:	3 575,8 s	<b>Gå till maskin 3203</b>	
<b>Work:</b>	<b>28,6 s</b>		
Stop:	3 604,5 s		
Start:	3 604,5 s	<b>Lämna fjärkontrollen</b>	
<b>Work:</b>	<b>4,4 s</b>		
Stop:	3 608,9 s		

*Resetting Operator Standardized work instructions***Changeover Instruction**

<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Resetting operator	<b>Creator</b>	

<b>Changeover time</b>	<b>Down time</b>	<b>Resetting operator</b>	Preparation	0,0 s	<b>Internal</b>	<b>2 101,4 s</b>	Reordering	0,0 s	<b>Σ Work</b>	<b>2 101,4 s</b>
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Internal tasks			
Start:	0,0 s	<b>Dubbelkolla materialet</b>	
<b>Work:</b>	<b>22,8 s</b>		
Stop:	22,8 s		
Start:	22,8 s	<b>Gå till maskinen</b>	
<b>Work:</b>	<b>30,0 s</b>		
Stop:	52,8 s		
Start:	52,8 s	<b>Kolla på sidan om material inmatning</b>	
<b>Work:</b>	<b>6,7 s</b>		
Stop:	59,5 s		
Start:	59,5 s	<b>Spruta ut material</b>	
<b>Work:</b>	<b>113,9 s</b>		
Stop:	173,4 s		
Start:	173,4 s	<b>Ta bort materialet</b>	
<b>Work:</b>	<b>24,5 s</b>		
Stop:	197,9 s		
Start:	197,9 s	<b>Spruta ut materialet på andra sidan</b>	
<b>Work:</b>	<b>81,4 s</b>		
Stop:	279,2 s		
Start:	279,2 s	<b>Kontrollera vid behov</b>	
<b>Work:</b>	<b>16,4 s</b>		
Stop:	295,6 s		

**Changeover Instruction**

<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Resetting operator	<b>Creator</b>	

Internal tasks			
Start:	295,6 s	<b>Material utsprutning</b>	
<b>Work:</b>	<b>91,1 s</b>		
Stop:	386,7 s		
Start:	386,7 s	<b>Ta bort materialet på sidan</b>	
<b>Work:</b>	<b>35,3 s</b>		
Stop:	422,0 s		
Start:	422,0 s	<b>Dubbelkolla matieral behållaren</b>	
<b>Work:</b>	<b>21,5 s</b>		
Stop:	443,5 s		
Start:	443,5 s	<b>För bort matieralklumpen till sidan</b>	
<b>Work:</b>	<b>45,1 s</b>		
Stop:	488,6 s		
Start:	488,6 s	<b>Stäng glasdörren och kvittera</b>	
<b>Work:</b>	<b>28,6 s</b>		
Stop:	517,2 s		
Start:	517,2 s	<b>Dosera upp nya materialet</b>	
<b>Work:</b>	<b>25,2 s</b>		
Stop:	542,5 s		
Start:	542,5 s	<b>Kör bort material klumpen</b>	
<b>Work:</b>	<b>71,1 s</b>		
Stop:	613,5 s		
Start:	613,5 s	<b>Ta bort material klumpen</b>	
<b>Work:</b>	<b>70,8 s</b>		
Stop:	684,4 s		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Resetting operator	<b>Creator</b>	

Internal tasks			
Start:	684,4 s	<b>Ställ tillbaka verktyget</b>	
<b>Work:</b>	<b>12,7 s</b>		
Stop:	697,1 s		
Start:	697,1 s	<b>Tvätta av formen</b>	
<b>Work:</b>	<b>75,7 s</b>		
Stop:	772,9 s		
Start:	772,9 s	<b>Kontrollera slangar</b>	
<b>Work:</b>	<b>36,5 s</b>		
Stop:	809,4 s		
Start:	809,4 s	<b>Tvätta av andra formen</b>	
<b>Work:</b>	<b>42,5 s</b>		
Stop:	851,9 s		
Start:	851,9 s	<b>Stäng dörren och kvittera</b>	
<b>Work:</b>	<b>23,0 s</b>		
Stop:	874,9 s		
Start:	874,9 s	<b>Kör Första halvskott</b>	
<b>Work:</b>	<b>171,0 s</b>		
Stop:	1 045,9 s		
Start:	1 045,9 s	<b>Ta bort produkterna</b>	
<b>Work:</b>	<b>20,0 s</b>		
Stop:	1 065,8 s		
Start:	1 065,8 s	<b>Kör Första halvskott</b>	
<b>Work:</b>	<b>312,1 s</b>		
Stop:	1 377,9 s		

## Changeover Instruction



<b>Department</b>	Production	<b>Machine</b>	10
<b>from - to</b>	3202 Improved	<b>Revision</b>	
<b>Resource</b>	Resetting operator	<b>Creator</b>	

Internal tasks			
Start:	1 377,9 s	<b>Hämta produkten</b>	
<b>Work:</b>	<b>15,0 s</b>		
Stop:	1 392,9 s		
Start:	1 392,9 s	<b>Hämta produkten</b>	
<b>Work:</b>	<b>28,2 s</b>		
Stop:	1 421,1 s		
Start:	1 421,1 s	<b>Ta bort fastnat material</b>	
<b>Work:</b>	<b>27,6 s</b>		
Stop:	1 448,7 s		
Start:	1 448,7 s	<b>Hämta verktyg</b>	
<b>Work:</b>	<b>17,6 s</b>		
Stop:	1 466,4 s		
Start:	1 466,4 s	<b>Kör första halvskottet</b>	
<b>Work:</b>	<b>219,6 s</b>		
Stop:	1 685,9 s		
Start:	1 685,9 s	<b>Ta bort produkterna</b>	
<b>Work:</b>	<b>20,1 s</b>		
Stop:	1 706,0 s		
Start:	1 706,0 s	<b>Kvittera</b>	
<b>Work:</b>	<b>7,1 s</b>		
Stop:	1 713,1 s		
Start:	1 713,1 s	<b>Kör första halvskottet och kalla inn Roboterna</b>	
<b>Work:</b>	<b>388,3 s</b>		
Stop:	2 101,4 s		

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