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Automation of the unloading of a die casting machine

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Abstract

This work was carried out as part of a Master's Degree in Mechanical Engineering at ISEP, in order to fulfil the requirements to get approval in an ERASMUS Project with 30 ECTS. The practical work was developed in a small company located at Gueifães, Maia, named Fundwell, being its core business the production of parts in aluminium alloy using die casting process.

The work consisted of cleaning, replacing, readapting and making the necessary programming tasks to make put a robotic arm perform unloading operations in a die casting machine. The robot is an IRB 1600 model manufactured by ABB, which was out of use for three years. The project started with the robot cleaning task. Then, the robot was placed in front of the die casting machine considering the adequate distances needed for it to correctly attending the machine, but allowing the access to the machine by workers performing the necessary setup and maintenance operations. Thus, the pedestal for the robot needed to be designed and manufactured. Afterwards, the robot was connected and placed in front of the machine. The final stage was testing the programme regarding a real part.

Keywords

Automation, Die casting machine, Fundwell, Robotic arm, Robot pedestal, Manufacturing, Robot Programming

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List of symbols and abbreviations

ABB	*Asea Brown Boveri*
CAD	*Computer Aided Design*
dB (A)	*Decibel with A weighting*
ECTS	*European Credits Transfer System*
EU	*European Union*
IP	*International Protection Marking*

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1. INTRODUCTION

Company characterization

The problem

Methods

1. Introduction

This work was carried on based on an ERASMUS PROJECT in order to get 30 ECTS in the second semester of the 2016/2017 academic year. It was developed in the company Fundwell. The purpose of the project was to automate the unloading operations of a die casting machine using an ABB IRB 1600 robotic arm.

1.1. Company characterization

Fundwell is a small company located near Porto, in the Gueifães village. Its logo can be seen in Figure 1. Its main activity is die casting of metal parts in aluminium and zinc alloys. Fundwell's customers are mostly located in Portugal but the company also exports to other European countries, namely Spain and Belgium.

Figure 1: Logo Fundwell [1]

The Company was founded in 2003 by Mr. Magalhães, starting with only two die casting machines, and over time enlarged the number of equipment related with its activity. Fundwell started with one facility with 100 square meters covered area, and acquired recently a second facility with 500 square meters covered area. The second area is not yet fully equipped so there is still space for expansion. The dream of the company's owner is that one day he can bring the two facilities' together in one big area of 5000 square meters. [1]

The organization chart of the company is quite simple as can be observed in Figure 2 being that structure based in the CEO Mr. António Magalhães, followed in a second level by all the collaborators. There are two engineers and a secretary who does the administrative tasks and helps when and where is needed. All the other people are production workers usually working in the shop floor performing all the tasks related to the parts manufacturing and internal logistics.

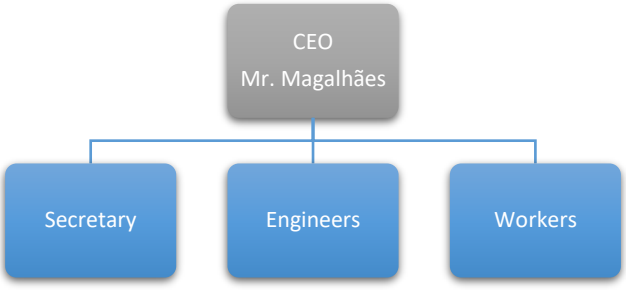


Figure 2: Organization chart of Fundwell's structure

1.2. The problem

The company's main activity is the manufacture of metallic parts obtained by high-pressure die casting in a mass production way, complemented or not by machining operations, providing to the customers rough or finished parts.

In order to make the next part it is necessary to take out the previous one. The complete die casting process is automated excluding the last phase of the process - unloading the parts from the machine.

Due to the large amounts of parts produced per day, this operation can take between three and six labour hours, depending on the type of parts being produced. This is a time-consuming task which is affecting severely the productivity and cost of each part.

Therefore, the process of unloading parts, should be automated. If the process is automated, the company does not need a worker for that simple but time-consuming task, who loses a lot of time waiting for a new part extraction at the end of each production cycle but having anything to do during the usual process cycle time. Thus, the company can save a worker for other operations by automating the extraction task in the high-pressure die casting machine.

There is already an ABB robotic arm at the company, which was used in the past for the same job. The company needed to take out the robot due to problems related to its positioning, too close to the machine, mainly due to two reasons:

1. When they wanted to change the die or a problem occurred there was not enough space to reach the moulding injection area into the die casting machine in an easy way.
2. The lubrication used in each injection cycle was severely affecting the robot arm.

Now, the company wants to reuse it and let it execute the job again wherefore it was intended. This project can be divided into distinct tasks:

1. First, the robot must be cleaned because it is out of use for a long time. It was very dirty and all the components must be lubricated again.
2. After the robot is cleaned, the pedestal for the robot should be made. To make this pedestal, the corresponding drawing should be made.
3. When all components are ready, the robot could be placed but, for this task could be performed, a placement plan is needed.
4. In the fourth step, it should come to “life” again, needing to be connected and installed at the right spot and in the right way.
5. When the robot is installed properly, it should be programmed to do the job. This is the last task of the job. Testing is also included in this step.

Unforeseen problems will be resolved as good as possible as well.

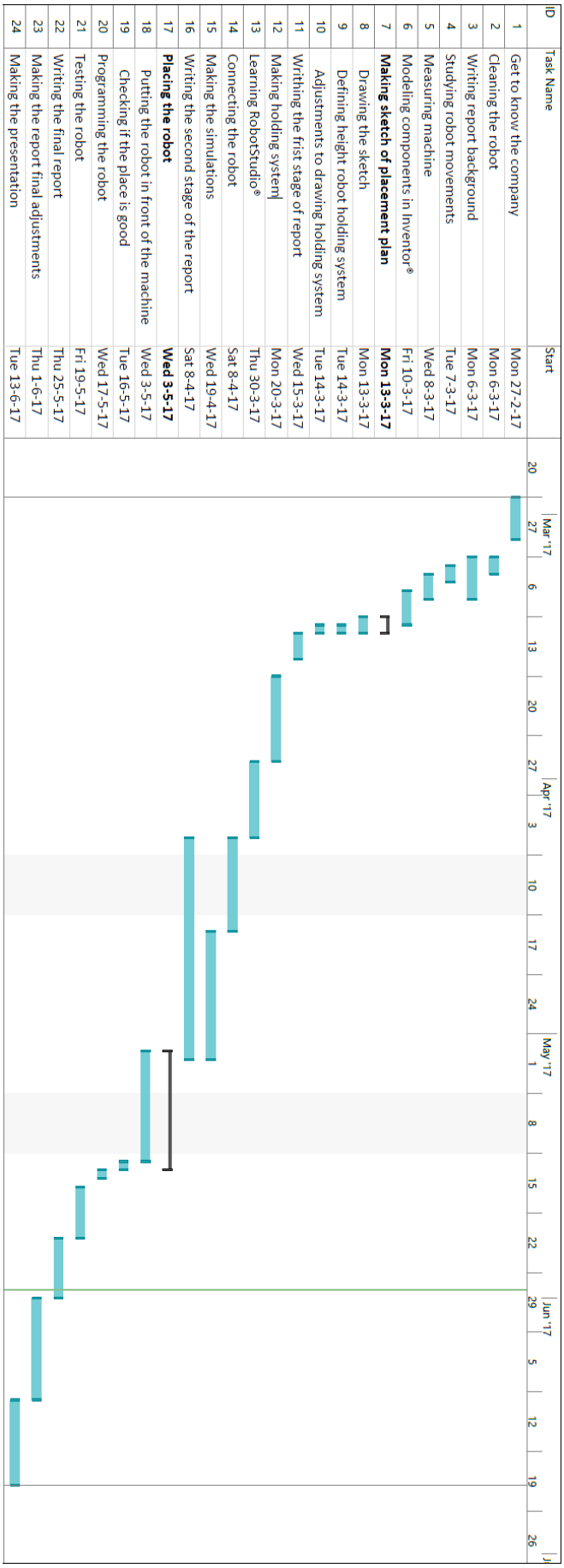
1.3. Strategy

The strategy to overcome the problem includes, like the problem, different steps.

1. Start writing the background of the project supported by internet and websites, looking for useful documents. Besides that, there are also several manuals and datasheet which can give a lot of useful information.
2. Continue the work and start the robot cleaning task. The information given by Mr Magalhães was very useful at this stage because he knows the right products to use in each part of the robot, in order to put it in the right condition without damaging the devices that make part of the robot.
3. After that, it was needed to make a floor plan where the robot should be placed. The robot implantation drawing was performed using the Autodesk Inventor® software, as well as the robot pedestal, and the RobotStudio ® software was used to carry out the robot work simulation. After the drawings were perfectly established and verified, it was needed to search for manufacturers able to produce the robot pedestal following the project that was conceived.
4. The next step was to place the robot in the right place and connect it to the controller and high-pressure injection machine, being very useful the help given by two technicians from SONAFI company. The pedestal fixation to the floor was also performed with the help of the two technicians from Sonafi company.
5. The final stage was the programming task, being very useful the help provided by Professor Manuel Silva, Co-Supervisor of this work, due to initial lack of skills and experience of the author regarding robot programming tasks. Manuals and tutorials were also very helpful. The programming was performed based on RobotStudio® software, which allows programming and simulating the robot movements offline. The online programming was performed with the help of a programmer from Sonafi company.

1.4. Methods

From the beginning, it was necessary to make a proper plan. Several things had to be done in cooperation with other companies or equipment had to be available at the right time. The only way to manage these things and succeed was to make a good plan so that external people could be informed in advance and could come to help us when it was necessary. The GANTT diagram depicted in Figure 3 represents the plan initially drawn to schedule the different activities and coordinate all entities. To make that plan, there was a brainstorm session with the company's CEO, allowing estimating the time needed for each task.



ID	Task Name	Start
1	Get to know the company	Mon 27-2-17
2	Cleaning the robot	Mon 6-3-17
3	Writing report background	Mon 6-3-17
4	Studying robot movements	Tue 7-3-17
5	Measuring machine	Wed 8-3-17
6	Modeling components in Inventor®	Fri 10-3-17
7	**Making sketch of placement plan**	**Mon 13-3-17**
8	Drawing the sketch	Mon 13-3-17
9	Defining height robot holding system	Tue 14-3-17
10	Adjustments to drawing holding system	Tue 14-3-17
11	Writhing the frist stage of report	Wed 15-3-17
12	Making holding system	Mon 20-3-17
13	Learning RobotStudio®	Thu 30-3-17
14	Connecting the robot	Sat 8-4-17
15	Making the simulations	Wed 19-4-17
16	Writing the second stage of the report	Sat 8-4-17
17	**Placing the robot**	**Wed 3-5-17**
18	Putting the robot in front of the machine	Wed 3-5-17
19	Checking if the place is good	Tue 16-5-17
20	Programming the robot	Wed 17-5-17
21	Testing the robot	Fri 19-5-17
22	Writing the final report	Thu 25-5-17
23	Making the report final adjustments	Thu 1-6-17
24	Making the presentation	Tue 13-6-17

Figure 3: GANTT Diagram

The project can be differentiated into the following tasks showed in Table 1.

ID	Task Name	Start
1	Get to know the company	Mon 27-2-17
2	Cleaning the robot	Mon 6-3-17
3	Writing report background	Mon 6-3-17
4	Studying robot movements	Tue 7-3-17
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22	Writing the final report	Thu 25-5-17
23	Making the report final adjustments	Thu 1-6-17
24	Making the presentation	Tue 13-6-17

Table 1: Different project tasks

The time was estimated task by task. This gave us a good view on how long the project would take. During the project development, the diagram needed to suffer some adjustments due to some unexpected happenings. Tasks can overlap because some of them can occur simultaneously in time, not depending on the others.

2. BACKGROUND

Die casting

Robotic arm

Current Situation

2. Background

To get a good understanding about how this work was performed, this section will introduce some background information. It starts by explaining the high-pressure die casting process and work possible to perform with the robotic arm owned by Fundwell. Afterwards, some information about the initial situation is presented, as well as the reason why the robotic arm was shut down and how the initial situation was found.

2.1. Die casting

2.1.1. Introduction

Die casting is a manufacturing technique used to produce geometrically complex metal parts. For this process are used reusable moulds, called dies. For the process of die casting, there are a couple of things that are elementary. It is needed a furnace which melts the metal. This metal will be transferred by the die casting machine to the die. The die has the negative shape of the final product.

In our daily lives, everybody encounters products made by high-pressure die casting process, such as door knobs, power tools, sport accessories, and so on. Even in sports, if the reader thinks about golf where metal golf clubs are used. All these parts undergo the die casting process, as well as several other industries. They use the process to produce parts for aerospace, automotive, computers and much more [3, 4].

Figure 4 shows some parts obtained by high-pressure die casting process.

Figure 4: Parts obtained by high-pressure die casting process [4]

The metals which are the most commonly used in this process are non-ferrous ones, such as aluminium and zinc alloys. There are two main types of die casting:

1. there are hot chamber machines which make use of metals with a low melting point, such as zinc alloys;
2. on the other hand, there are cold chamber machines for metals with a higher melting temperature, such as aluminium alloys.

These two types will be explained further on in this report [2].

2.1.2. The process

High-pressure die casting process consists of five main stages. After these steps, the product is finished and ready for usage. Depending on the part complexity, the cycle time will take between two seconds to one minute. The five stages are the following ones [2]:

- *Step 1: Clamping*

  This is the first step and contains the preperation and clamping. Before the die closing process can start, the two half parts of the die must be cleaned from the previous injection. After they are cleaned, they need to be lubricated, facilitating the injection of the new part. After the lubrication, the die casting machine will close and secure the halves of the die as can be seen in Figure 5. After closing the die, a strong enough holding force must be applied to keep the die closed during the injection process, which exerts a considerable pressure in the opposite direction (trying to open the die). The time required for this step depends on the machine, used for the process. Typically, Lager machines with greater clamping force will require more time.

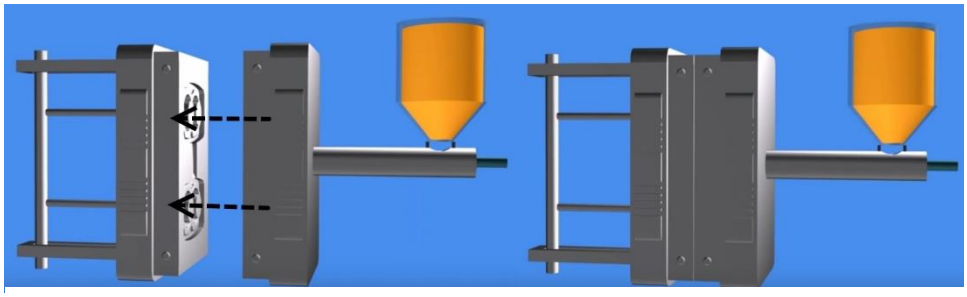

Figure 5: Clamping [5]

- *Step 2: Injection*

  The metal is melted in the furnace. After the metal has becoming fluid it must be injected into the die as illustrated in Figure 6. How the molten metal is transported to the die depends on the type of die casting machine. The metal is injected under very high pressure into the die. The pressure used for the injection goes from 70 to 1.400 bar. This pressure is used to keep the metal in the die during the solidification. Each amount of molten metal injected into the die constitutes an action called shot. The time that is

used to fill the die and its channels is called injection or cycle time. This time is typically very short to prevent the metal from solidification during the injection.

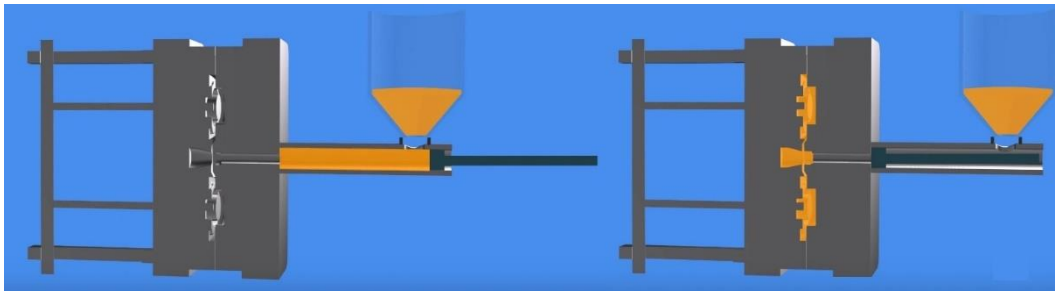

Figure 6: Injection [5]

- *Step 3: Cooling*

  The cooling phase starts after the metal is properly injected. When the injection is finished, the metal will cool down and solidify. Only if the cooling time has elapsed the die can open again. The bigger the wall thickness of the injected part, the longer it takes to solidify the part. If the heat transfer process is more difficult due to a part complex part geometry, the time to cool it down will also be longer. The cooled part is shown in Figure 7 by the lighter colour.

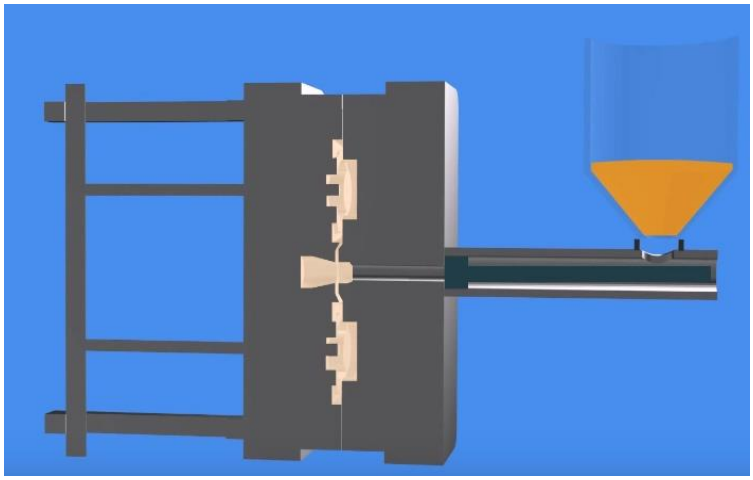

Figure 7: Cooling [5]

- *Step 4: Ejection*

  When the part is completely solidified, it can be ejected. The two die halves will open and the ejection mechanism will eject the part out of the die as depicted in Figure 8. During the cooling process, the part will shrink a little and can adheres to the die. Therefore, the ejection mechanism will need some force to push the part out of the die. After the ejection phase, the die can close and the cycle can be started again.

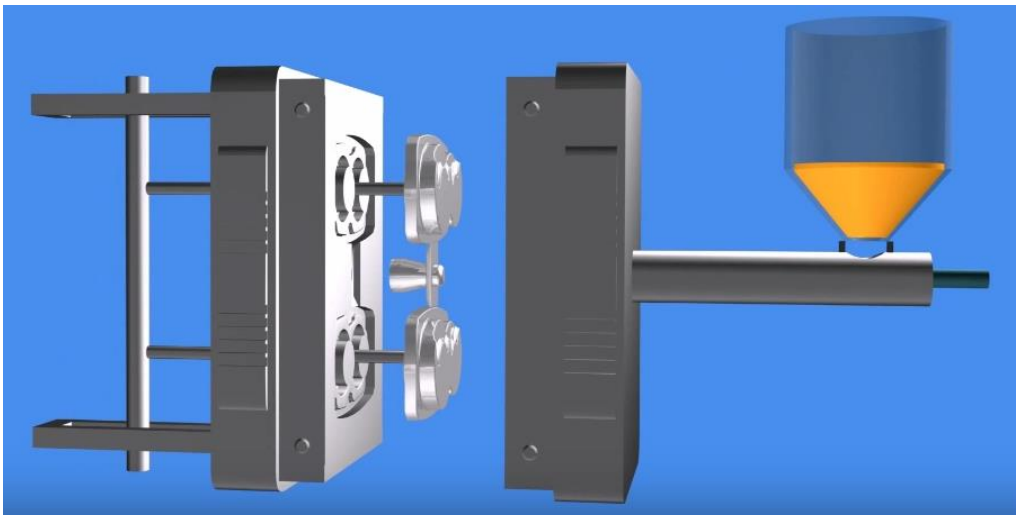

Figure 8: Ejection [5]

- *Step 5: Trimming*

  When the part is pushed out, there are still rough edges and the channels used for the injection are still attached to the part. To get the final part, it must be trimmed, manually or mechanically (in a press machine). Figure 9 shows a trimmed part. The materials which are trimmed away can be recycled for making new parts.

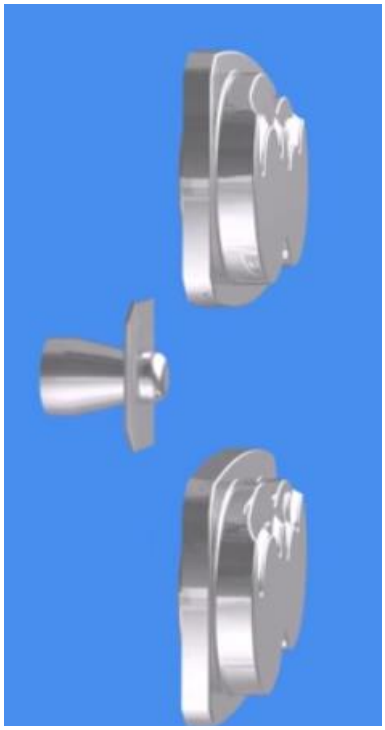

Figure 9: Trimming [5]

2.1.3. Hot versus cold chamber die casting machine

Hot chamber die casting machine

When the melting point of the metal to be injected is below approximately 500°C, it can be processed in a hot chamber die casting machine. If the melting point is above this temperature it would damage the injection system. In this case, the furnace is not separated from the injection system, which is immersed into a molten metal pool. Therefore, there is no need to transfer the molten metal to the die casting machine. There is a metal feeding system called gooseneck. When the cycle is starting, a plunger, powered by a hydraulic pressure, retracts. The retraction allows the gooseneck to get filled with molten metal. When the cylinder starts pushing the molten metal into the die, the inlet door for the molten metal gets sealed. The plunger will build up a pressure into the die until the metal is solidified. After that, the plunger will retract and the die will open. When it is open, the part must be ejected. Figure 10 and Figure 11 show where the different parts of the machine are in the opened and closed state. Alloys suitable to be injected in hot chamber die casting machines are, for example, zinc and lead alloys [2].

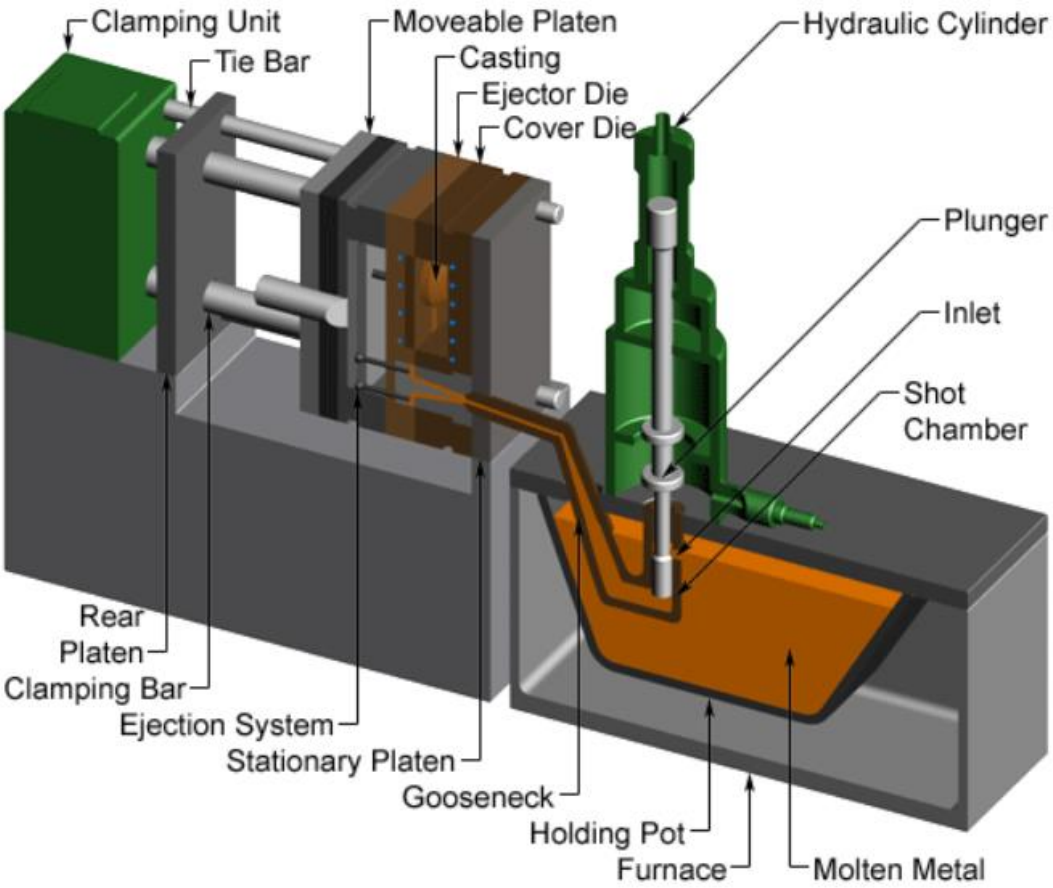

Figure 10: Hot chamber die casting machine – opened state [2]

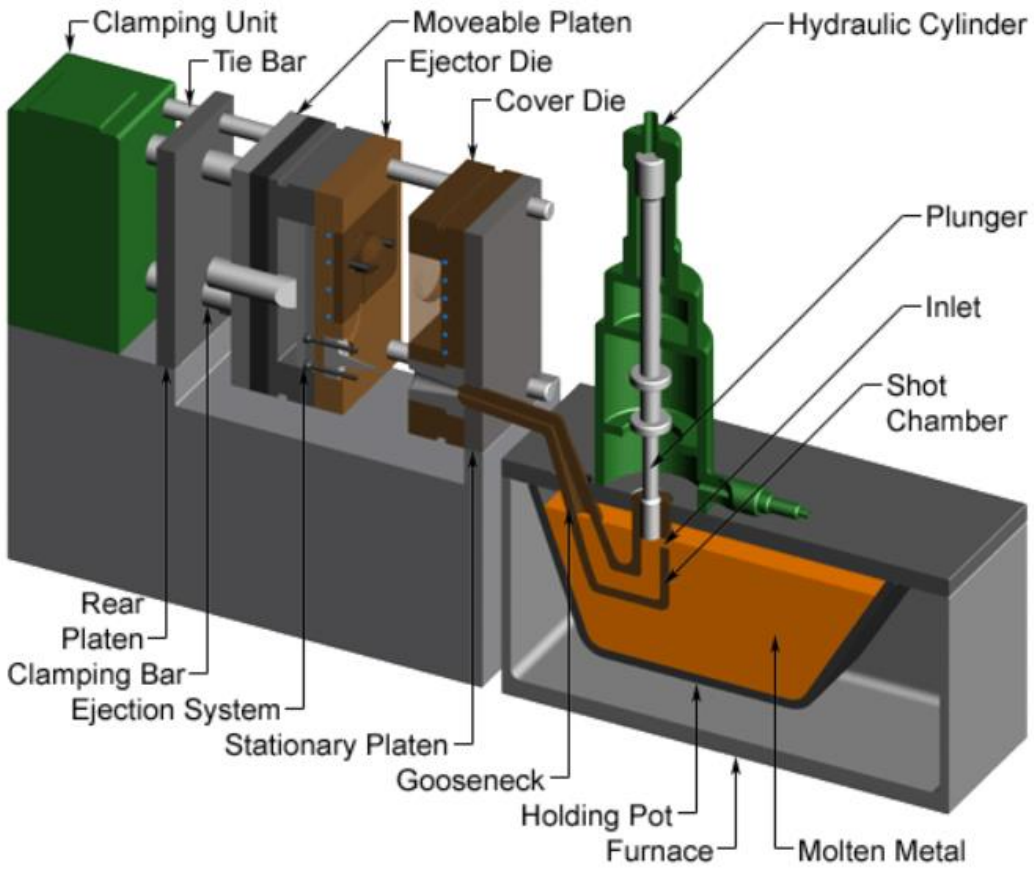

Figure 11: Hot chamber die casting machine – closed state [2]

Cold chamber die casting machine

When the melting point of the metal to be melted is above approximately 500°C, a hot chamber die casting machine is not recommended anymore. If a hot chamber die casting machine is used for this kind of metals with a high melting point, the lifetime of the machine would be very short. The high temperature would damage the plunger, which would not last very long either. The biggest difference compared to the hot chamber die casting machine is that, in this case, the furnace is separated from the machine. Therefore, there is a need for a ladle to move the molten metal from the furnace to the machine itself. The molten metal is deposited by the ladle into the unheated injection cylinder or shot chamber. The hydraulic piston delivers a shot into the die. The pressure will be held until the melted metal is solidified just like in the hot chamber die casting machine. After solidification, the die will open and the part can be ejected. Figure 12 and Figure 13 show where the different parts of the machine are in the opened and closed state. Aluminium alloys are one of the most used alloys, for which a cold chamber die casting machine is needed [2].

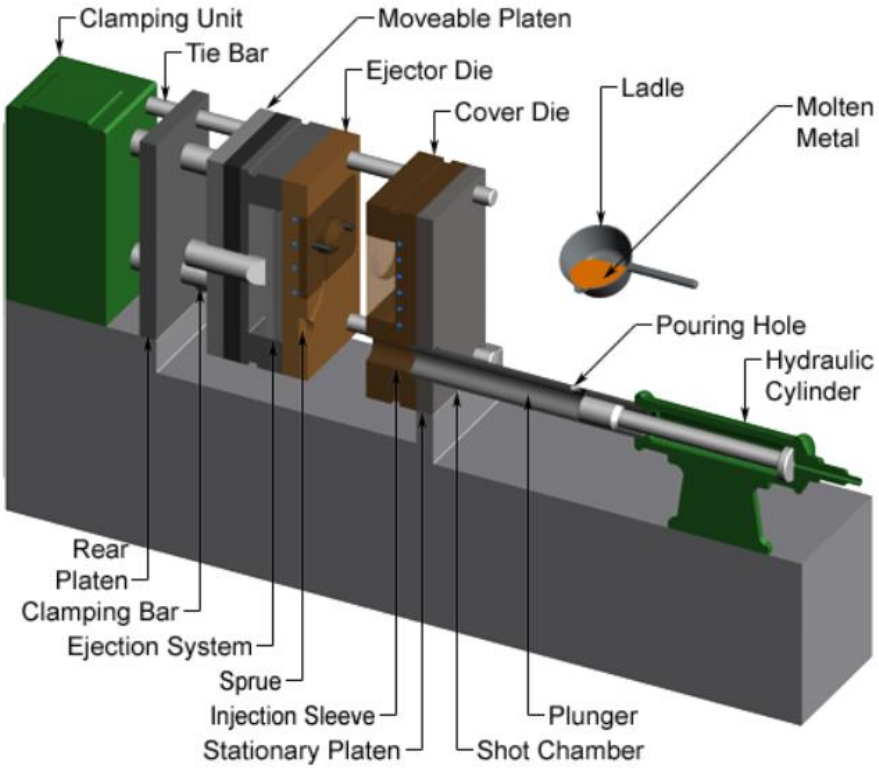

Figure 12: Cold chamber die casting machine – opened state [2]

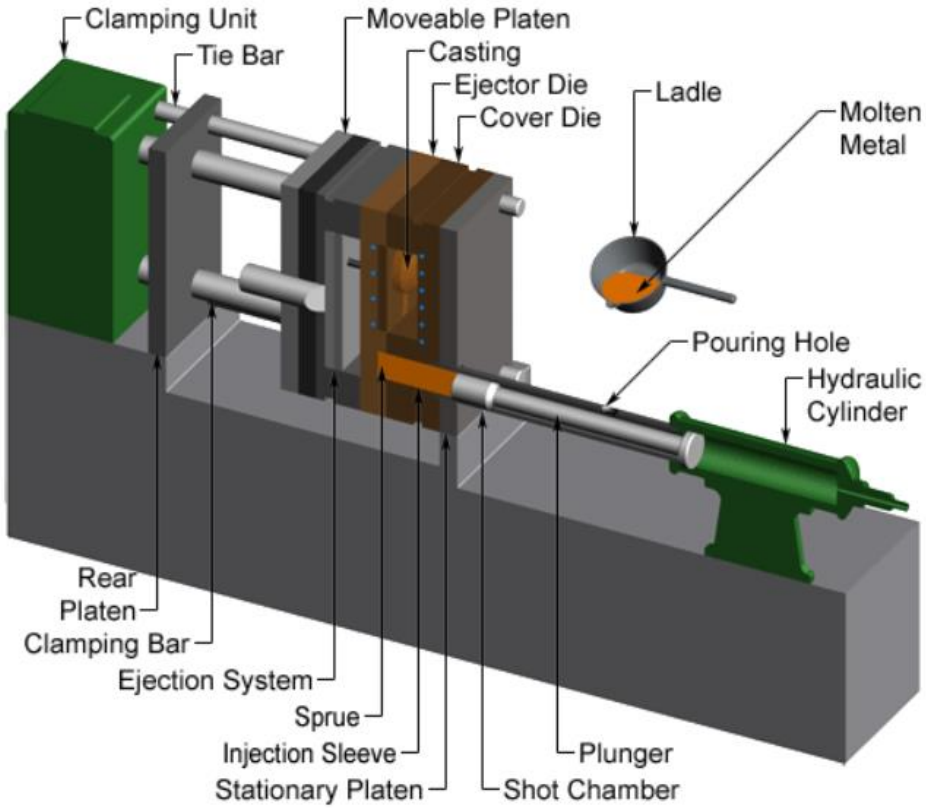

Figure 13: Cold chamber die casting machine – closed state [2]

The company where this project was developed only has cold chamber die casting machines. Since here aluminium alloys are the most used material to make the parts, the cold chamber machine is the most suitable equipment to produce injected parts in these kinds of alloys. However, this company does not only produce aluminium parts. If their costumers ask Fundwell, it is possible to order parts in zinc alloys. In theory, they should use a hot chamber die casting machine for this case. If the part is big enough, it is possible to make it with a cold chamber die casting machine and not with a hot chamber one. Therefore, to save money, the company uses this trick to produce the zinc parts. In this way, they do not have to invest in a hot chamber die casting machine that they would not use a lot.

2.2. Industrial robot

2.2.1. Introduction

There is a difference between robots whose are designed to act and look like humans, also known as androids, and other robots built for industrial processes. The definition of a manipulating industrial robot is defined as follows in ISO 8373: *An automatically controlled, reprogrammable, multipurpose, manipulator programmable in three or more axes, which may be either fixed in place or mobile for use in industrial automation applications [6].*

A robot is able to execute different tasks. It can be used for multiple purposes. The different tasks can be done with the same robot by only changing the manipulator and reprogramming.

Nowadays, the different types of robots are enormous. The appearance of an industrial robot is purely functional. The capacities and abilities of the robot matters. The range of the robot, the maximum speed of executing its tasks, how accurately it can execute the tasks, the maximum load of the robot and so on are crucial. Industrial robots are a set composed of the manipulator, the arm, the controller and the teach pendant. The arm itself can be moved into three or more axes. These together with the size of the robot define the work volume of the robot [7]. Figure 14 shows a few different types of robotic arms.

Figure 14: Different types of robotic arms with different end effectors [8]

2.2.2. End effectors

As previously stated, an industrial robot consists of a set of arms. At the end of the arm, the robot has an end effector. The type of end effector depends on the type of job that the robot must execute. For example, to manipulate cookies, a robot will need a completely different end effector compared to the one used to manipulate a motor block [9, 10].

For industrial robotics, it is possible to split the end effector into four different categories [9]:

1. Impactive: referring to claws or grippers that directly have an impact on the object to be manipulated;
2. Ingressive: these end effectors have pins, needles or hackles which physically penetrate the body of the object. This can be used for clothes or other objects where it is not harmful to penetrate it;
3. Astrictive: when an object exists out of the right material or the right surface, a suction force can be applied to objects surface. Depending on the object, vacuum, magneto- or electro-adhesion can be used;
4. Contigutive: in this case, direct contact between the end effector and the object to be manipulated, is required. Examples of these methods are glue, surface tension or freezing.

Figure 15 shows a gripper (left) and an end effector which make use of vacuum (right) to pick up something.

Figure 15: Two different types of end effectors [11, 12]

Depending on the task that must be performed, it is adopted a proper combination of the right arm and end effector.

2.2.3. Robotics and die casting

The environment in a die casting company is always very dirty and there is always a lot of dust, being very tough on machinery. When a company wants to use a robot inside this kind of environment, it needs a specially protected robot. These sorts of robots are called foundry robots by ABB. These robots have an extra protection to protect them in the foundry environment. They are IP67 protected which means that they are dust-tight and they can resist to immersion in water to 1 m depth. They are painted with a two-component epoxy-paint for even better protection. These robots can also be washed with high-pressure steam if needed. Therefore, they will live longer in this kind of environments [13].

Figure 16 shows a robot which is adequate to work in a foundry environment.

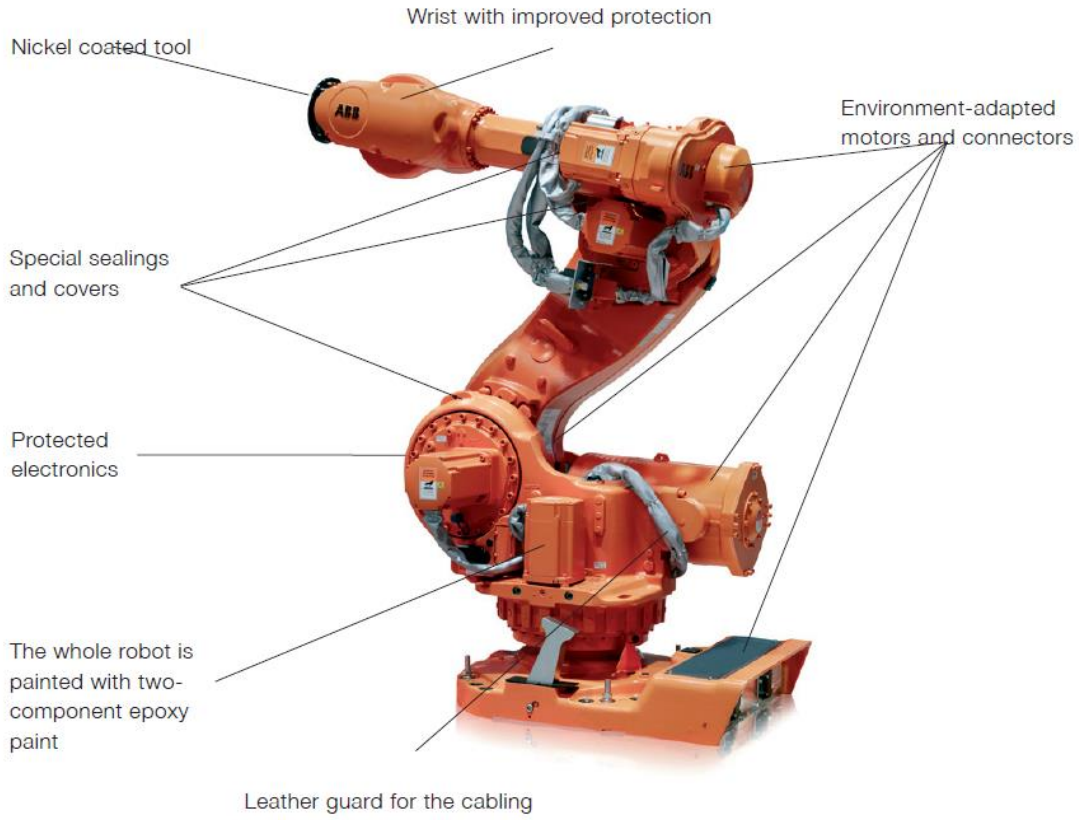

Figure 16: Foundry protected robotic arm [13]

2.2.4. Robot programming

The programming of a robot from ABB can be done in RobotStudio®. This is a sofware platform to simulate and offline program your ABB robots. The program has a built in virtual controller which is an exact copy of the software that runs in the real robot. This means that when a virtual simulation is done on a PC, the programmer can upload the offline program previously made to the robot controller. The code behind the simulation is called RAPID-code. A machine understands only the lowest level of programming code. It communicates with “0” and “1”. RAPID-code is a higher level of programming code. It makes use of readable words like IF and OR so it is possible for the programmer to understand. The RAPID-code is converted afterwards into the language that the robot can understand. An example of RAPID-code can be seen in Figure 17 [14].

```
MODULE MainModule
  VAR num length;
  VAR num width;
  VAR num area;

  PROC main()
    length := 10;
    width := 5;
    area := length * width;
    TPWrite "The area of the rectangle is " \Num:=area;
  END PROC
ENDMODULE
```

Figure 17: Example of RAPID-code [14]

3. DEVELOPMENT

Problem analysis

Current situation

Brainstorming and preliminary drafts

Selecting the best idea

Developing the main idea

Budgeting

Critical analysis and prospects of development

Equipment instruction manual

Maintenance guidelines

3. Development

In this chapter of the report is presented a detailed description of the work that has been done. Here are described the steps that have been performed and how they were made. It is also presented an analysis of the problem and the corresponding solution.

3.1. Problem analysis

As stated, Fundwell produces die casted parts in aluminium and zinc alloys. Every part that is made by one of their machines needs to be taken out of the machine and needs to be put away. After that, a new part can be made and the cycle starts again.

To fulfil this task, it is needed a worker who takes every part out of the machine and waits for the next one. Due to this waste of time in waiting, it is quite expensive to have a worker just doing this job. In the past, the solution of the company was to put a robot arm performing this task. This robot arm could take over the job of the worker and, meanwhile the worker could perform another task. This was a good solution but the placement of the robot, in relation to the machine was not adequate.

That time, the robot had two tasks to do: not only taking the part out of the machine but also spraying the mould after taking it out. This is a necessary task that must be done in order to lubricate the mould cavities making easier the next extraction. The problem was that the chemicals in the spray were aggressive for the robot and especially for its paint. The robot suffered a lot regarding these chemicals and therefore it had to be taken out of his job. There was also another problem. As stated before, the robot placement was not good either. When there was a problem with the machine, the maintenance technician could not reach it properly, since the robot was in front of it. This was another lead to the decision to take the robot out of service.

Recently the company decided to put the robot back in place doing what it was meant for, taking the parts out of the machine. The spraying system is now integrated into the machine and this task no longer has to be done by the robot. For this reason, is expected that the robot will no longer be severely affected by the spray chemicals.

The problem that the company faced is that the robot was very dirty and stood still for a long time. Furthermore, it needed to be positioned in a place different than before to avoid the same problem found previously. Finally, the robot had to be cleaned and reconnected - thus a plan had to be devised for defining the proper location and a program had to be written so it could start working again.

3.2 Current situation

3.2.1 IRB 1600

The robot which is used on this project is the IRB 1600 from ABB. This robotic arm has six axes. The information about each axis can be seen in Table 2.

Working range	1.45
Axis 1	+180° to -180°
Axis 2	+150° to -90°
Axis 3	+65° to -245°
Axis 4	+200° to -200° def.
	+/-190° revolution
Axis 5	+115° to -115°
Axis 6	+400° to -400° def.
	+/-288 revolution

Table 2: Working range in degrees of the IRB 1600 [15]

The robot is easy to put the robot working in place, being possible to fixed on the floor, on a shelf, on the wall, tilted or inverted. There are two main versions of this robot. A compact short arm version and a larger version with a longer arm. The larger version is the one which is available in the company. It has a maximum working range of 1450 mm as can be seen in Figure 18. This robot can also be used as a foundry robot. As stated before, this series of robots are designed to perform their tasks inside an environment such as the one found in a die casting company. [16]

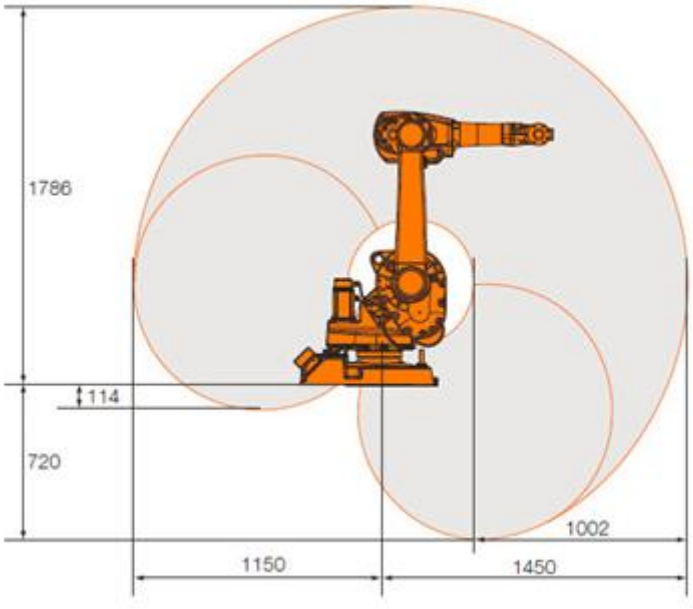

Figure 18: IRB 1600-x/1.45 working range [15]

The robot has a payload capacity of 8 kg when its arm is completely stretched out. This is the strongest type of the four robots in this range. The robot needs a power supply of 200-600 V and 50-60 Hz.

To control the robot, an IRC 5 controller is used, corresponding to the fifth generation of the ABB robot controllers. In Figure 19 is depicted the robot and his controller. [15]

Figure 19: IRB 1600 and his IRC 5 controller [16]

3.2.2 Gripper

The gripper available in the company is a Schunk PGN-plus-80-2-AS-SD parallel gripper, shown in Figure 21. It has a closing force of 1180 N and the maximum recommended workpiece weight is 4.3 kg. The maximum weight of workpieces at Fundwell never reaches this value, but it can be useful to use the gripper when it is needed to do some other operations with the robot, besides unloading the die casting machine. The opening time of the gripper is 0.03 seconds and the closing time is 0.05 seconds, according to the information of the Schunk company which can be found in the bibliographic reference [17]. Every jaw can move 4 mm aside. It is the strongest and dust tight version of PGN-plus-80. The fact that it is dust tight is very important because it will operate in a foundry environment. Figure 20 shows the gripper with the claws assembled on it [17].

Figure 21: Gripper PNG-plus-80-2-AS-SD [17]

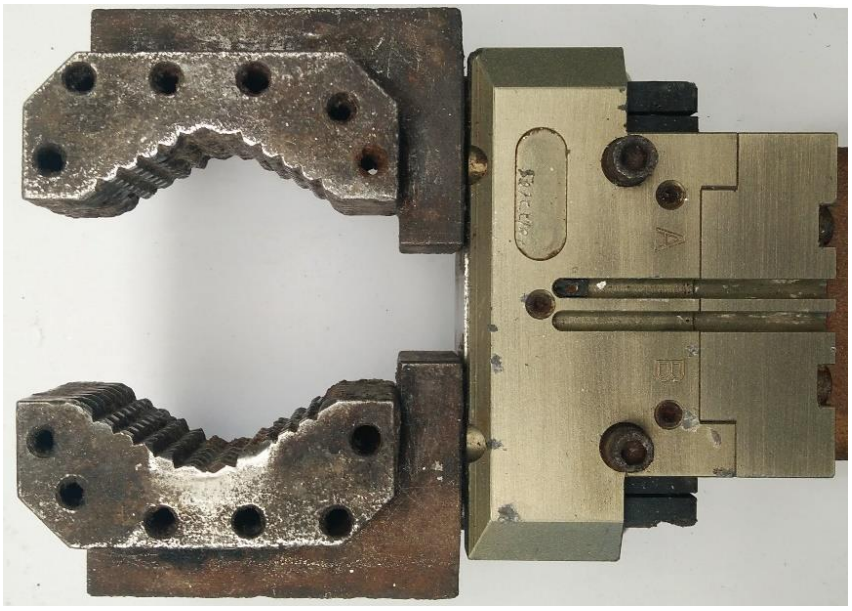

Figure 20: Gripper with assembled claws

3.2.3 Colosio 214

The machine whose loading and unloading needs to be automated is a cold die casting machine from Colosio, the model PFO 200. The machine is already 20 years old so there is not much information available. The only information available, was found in some documents from the company itself, but they are written in Italian. The rest was found on the internet. The information on the internet was however from the latest version of the machine. The machine is similar to all other machines at Fundwell. It has a locking force of 200 ton. The machine has a 1240 mm height, a 5450 mm width and a 1865 mm depth. The height and width of the parts that can be made by the machine are between 200 mm and 500 mm. Figure 22 shows a die casting machine from Colosio, the model PFO 200. [18]

Figure 22: Colosio die casting machine [18]

3.2.4 Requirements of the project

To succeed in the project some requirements were stated. They were set at the beginning of the project and were set by the CEO of the company itself. These requirements are summarized below.

1. First of all, an automated system must be designed in order to perform the unloading task of the parts produced in a cold chamber high-pressure die casting machine, using an existing robot;
2. Secondly, the robotic arm has to be positioned as well as possible, allowing for maintenance procedures and easier die changing operations;
3. Lastly, the robot should not only unload the die casting machine but it should also check, by the use of sensors, if the part is “ok” or not. Afterwards, it needs to put the part away.

3.3 Brainstorming & preliminary drafts

In this section are described all the ideas that were considered for solving the problem presented. Furthermore, the first conceived drawings that were made are also explained.

3.3.1 Brainstorm concerning the pedestal

There was already an old pedestal for fixing the robot to the ground and so, a decision had to be made: was their a need to make a new pedestal or is adjusting the old one to the right needs enough? The old pedestal was too high and the holes for screwing the robot to it, were not placed in the best thinkable position. A tilted pedestal was also thought as a possible solution. To check all these options, some drawings were made in Autodesk Inventor® as can be seen in Figure 23, and compared.

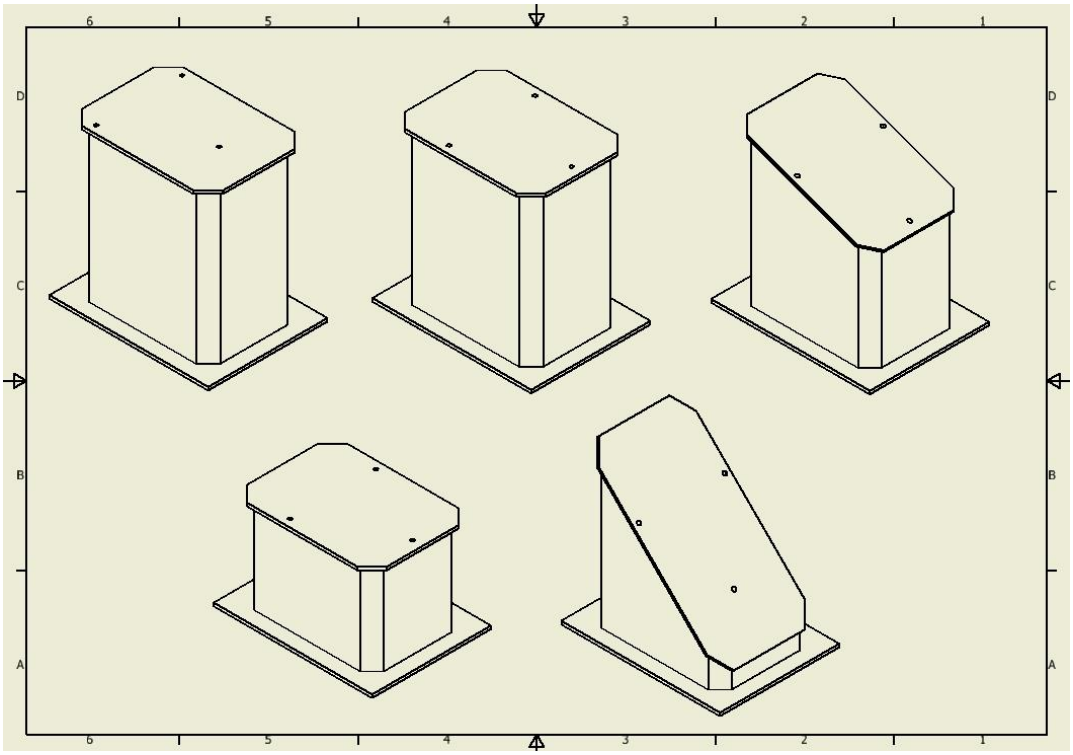

Figure 23: Preliminary drafts about the new design of the pedestal

3.3.2 Brainstorm concerning the placement plan

Before the robot placement plan could be made, it had to be figured out in which program the drawing would be made. The advantage of AutoCAD® is that it is adequate for this kind of needs. The biggest challenge, was to overcome the lack of skills initially presented by the author of this report regarding the use of this software. Another program which could be used is also from Autodesk, named Inventor®. It is a 3D drawing software but it is possible to make 2D drawings

of the 3D drawings that have been made. The author had already three and a half years of experience in this program. Also, the 3D model was needed in a later stage of the project.
To make a proper plan there was also the need to figure out where the robot should be placed in front of the machine. This was the next problem which had to be considered. The placement of the robot was important since its position needs to be far enough to allow maintenance operations and mould exchange but, simultaneously, it needs to be close enough to allow the parts unloading, checking operation and storage in a proper container without distance constrains.

3.4 Selecting the best idea

In this section, an explanation can be found about the decisions which were made to select the best idea. Here it will be explained the reasons behind each decision. The elaboration of the project is described in the next chapter.

3.4.1 The most suitable pedestal

After good consideration, the reasons behind the needed to manufacture a tilted pedestal did not present a real advantage and the manufacturing process would be much more expensive. Therefore, it was chosen to adjust the old pedestal and cut it. A model of this pedestal can be seen in Figure 24. The height needed to cut out was 300 mm, so that the robot would be low enough that it could move free enough without touching the machine. The holes, to screw the robot on the pedestal, were adjusted closer to the front of the pedestal. In that way, the position of the robot on the pedestal would be better.

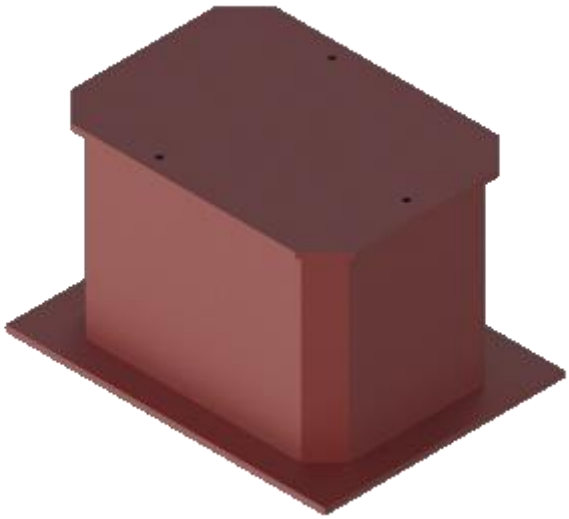

Figure 24: Drawing of new pedestal

3.4.2 Program for the placement plan

Since the experience of the author in Autodesk Inventor® is higher than in Autodesk AutoCAD® the choice for Inventor® was easy. The 3D view in Inventor® could be used in further stages and it gave an extra view on the case. Converting it to a 2D-plan was also easy.

3.4.3 Programming

The software used for the robot programming was ABB RobotStudio®. This software is an application from ABB and gives the opportunity to program robots offline and later upload the program developed to the robot controller. This software also allows simulating the developed programs. Because of all these advantages the choice was easy.

Learning how the program works was the first stage because the experience of the author in using this software was very low. The use of manuals and tutorials helped to succeed in this part of the job.

3.5 Developing the main idea

In this section, there is an explanation of each step that was performed. Step by step the project has been accomplished. Every subsection can be seen as a new step that was made.

3.5.1 Cleaning the robot

The robot was out of service for quite a long time, having been put aside for almost three years. It was very dirty and needed to be cleaned. With the condition the robot had at the beginning of the project, it wouldn't be useful to bring it back to life. Moreover, the paint was very bad and was peeling off.

In Figure 25 it is possible to see it before and after the cleaning operation. It was first cleaned with a high-pressure washing machine to make the complete robot moisturised in the petrol - petrol is used to get out all the grease of the robot. The good thing about the sprayer is that it allows spraying the robot very fast and well. The bad thing about it is that it should be done in an open surrounding. Therefore, cleaning was done outside but because of the bad weather, it was needed to wait a few days before it was possible to start this operation properly. The parts, which easily could be detach from the robot such as the gripper and the pressure control device, were taken off because it was easier to clean them aside and it was also better to clean the robot itself properly. After completely moisturising the greatest filth could be scraped off the robot. This was done with a putty knife because otherwise there would be too much spill off petrol. Afterwards, it was started the cleaning with a brush. This took a while but it gave a nice result as can be seen in the before and after states in Figure 25. The parts that were detached also got

their own cleaning with the brush. When the robot was cleaned with the brush it was taken outside again to finish it with the high-pressure device.

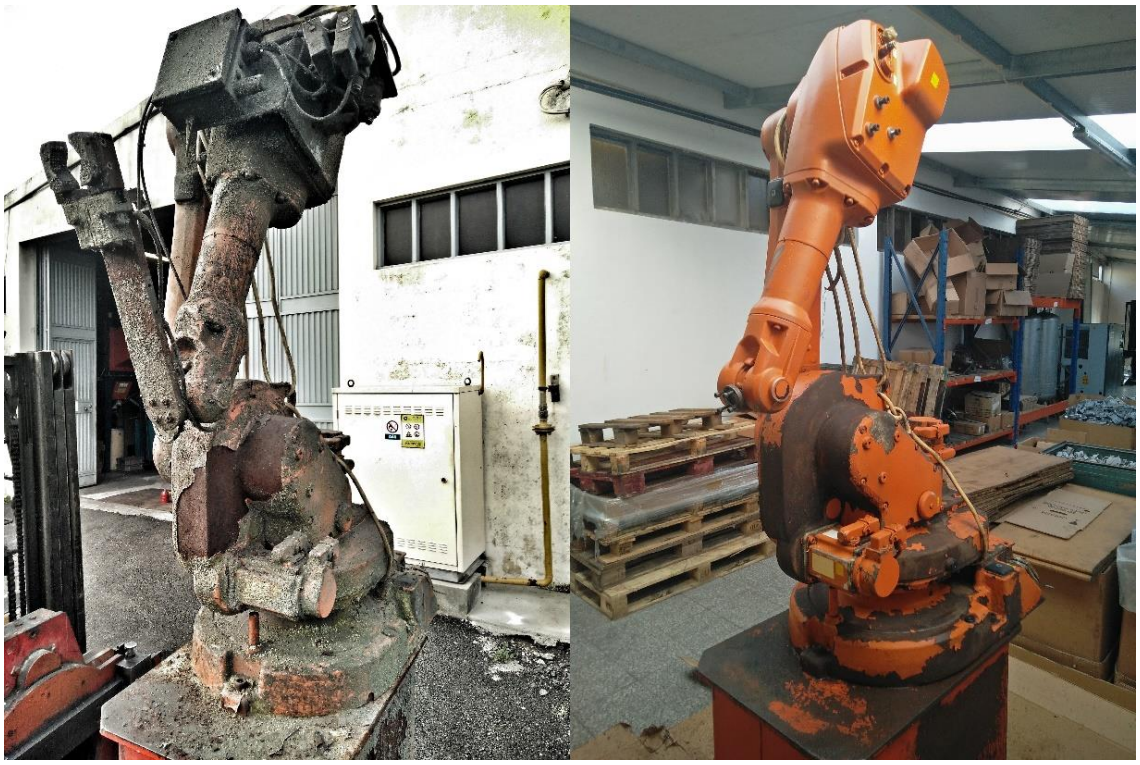

Figure 25: Robot before (left) and after (right) the cleaning process

3.5.2 Making a placement plan

To make a proper plan, the first thing which had to be done, was taking measurements. First of all, the dimensions of the robot were measured. A little sketch on a paper was made and a drawing of the basic dimensions of the robot and its different parts was made. The search for a CAD model of the robot on the internet was a good idea good idea due to its complex shape. This would save a lot of time if it would not be drawn by the author itself. The CAD model that was found can be seen in Figure 26. After that, all dimensions of the CAD model which was found were verified, being possible to confirm that they are coincident with the model owned by the company. There was one thing missing. The gripper was not a standard part of the robot so this was made by the author itself to complete the robot design. In Figure 26 can be seen the complete CAD model already provided with its gripper.

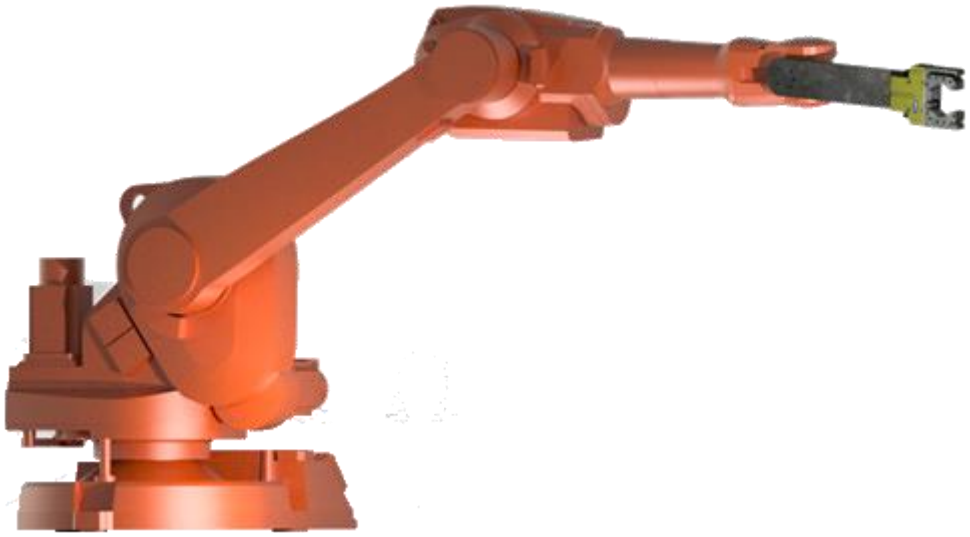

Figure 26: 3D Drawing Robot and gripper [19]

To have the right dimensions of the robotic arm, a sketch of the robot with annotation of its important dimensions was also made as can be seen in Figure 27. With this sketch, the total dimension of the robot could easily be calculated. With these dimensions in mind, it would be easier to make a first check of the placement of the robot later on. The total length of the arm can be divided into four parts. Part 1 is from the centre of the first robot rotation point to the second rotation point of the robot. This distance is 150 mm. Part 2 has a length of 700 mm and part 3 has a length of 600 mm. The gripper, part4, has a length of 330 mm. Thus, the total length of the robotic arm is 1780 mm.

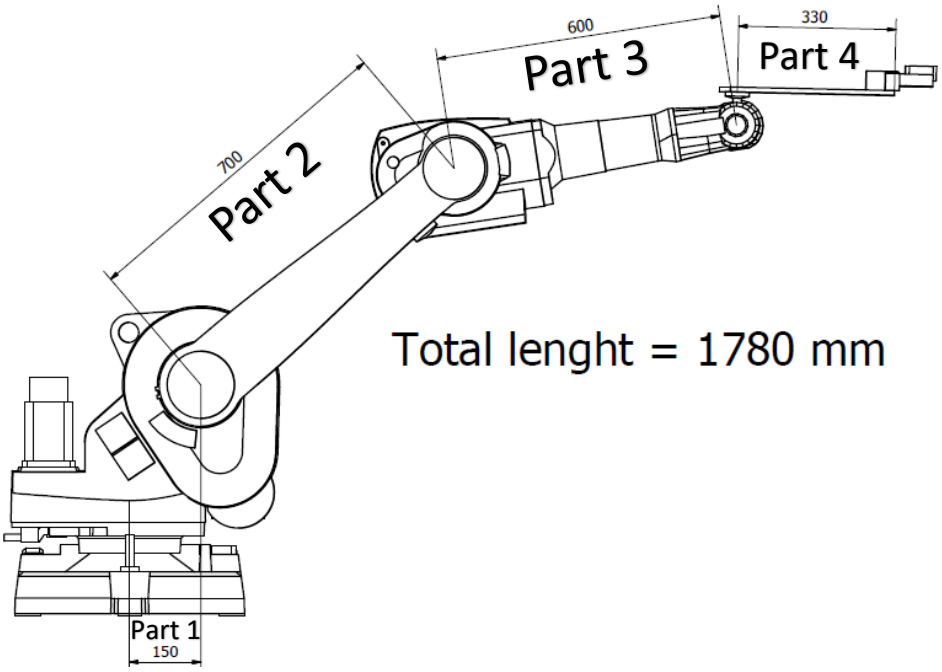

Figure 27: Dimensions Robotic arm

Next, the measurements of the old pedestal were made. Its drawing was made using Inventor® software so the robot could be placed on it in an assembly. There were two things not so good about the old pedestal. First of all, it was too high, and second, the holes to fasten the robot on the pedestal were located too close to the backside of the pedestal. The old pedestal was adjusted so a plan was made to make the adjustments. In Figure 28 intends to compare the old and new pedestal.

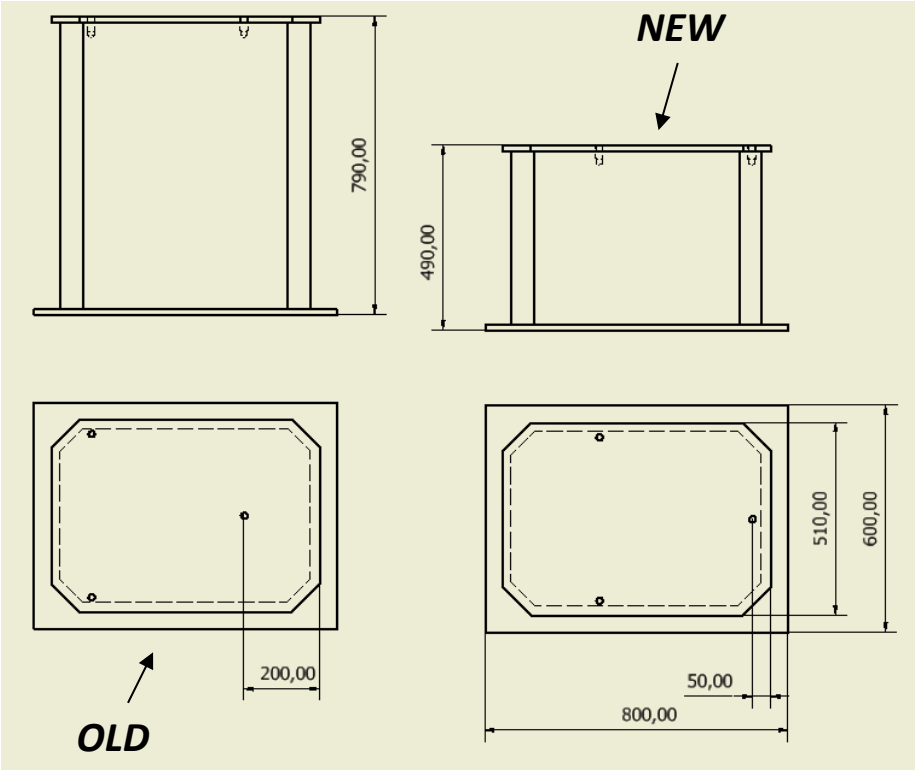

Figure 28: Old vs new pedestal

The old pedestal was 790 mm in height and the front hole for the fastening was at a distance of 200 mm from its front face. The new pedestal is 490 mm in height and the first hole is at a distance of 50 mm.

The next step in the plan was putting the robot in front of the die casting machine as shown in Figure 29. The drawing of the new pedestal was made after this step. The robot was positioned on a place which, at that moment, seemed to be a good one. The total length of the arm was considered and it was positioned as good as possible. The conclusion was that the pedestal needed to be much lower so the robotic arm would not touch the tie bars while it was moving. Also, the robot was positioned, as far away from the machine as it could be. The measurements which were taken after the placement were just some indicators for making the plan on the computer easier.

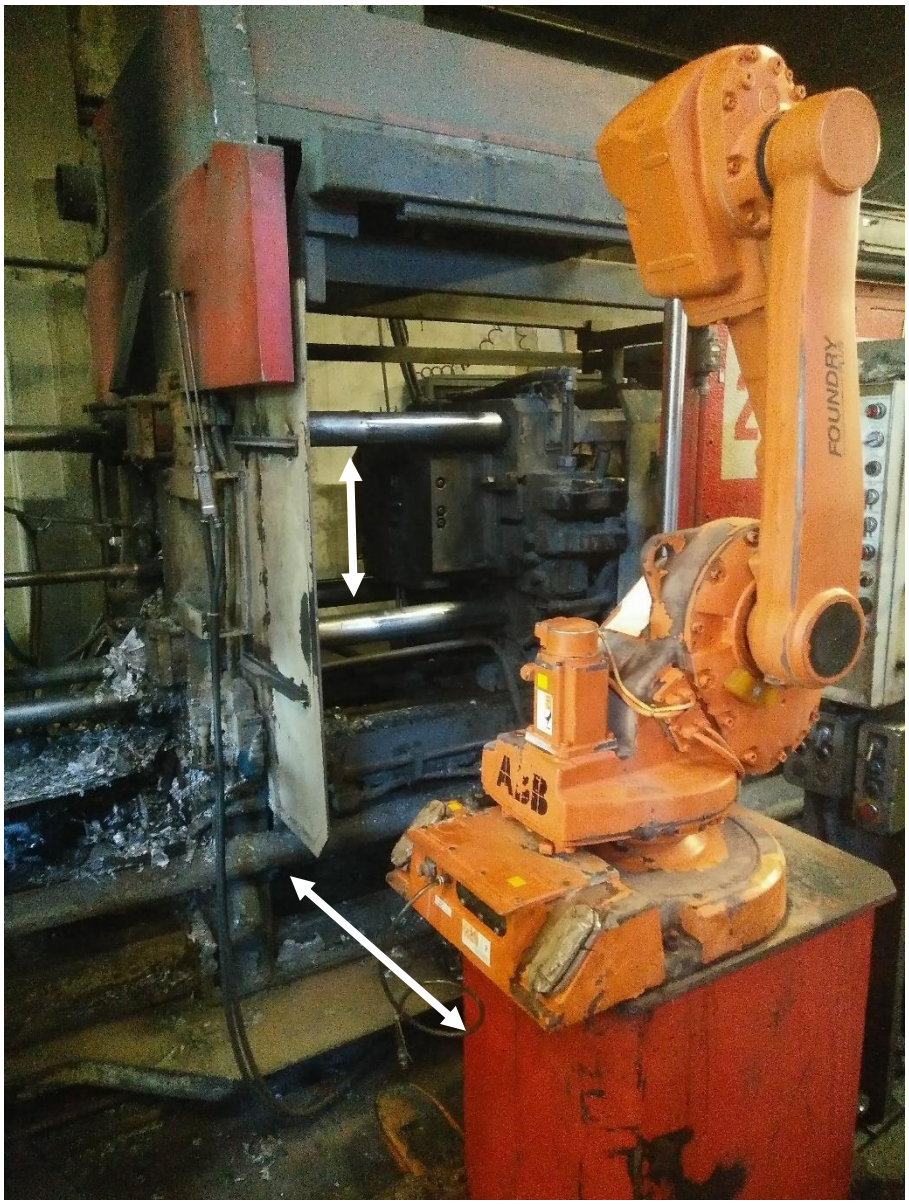

Figure 29: Main distances to take into account on the robot positioning

Besides the pedestal and the robot, there was a third object which had to be drawn to make a proper plan. The die casting machine itself. To make a good plan it was not necessary to draw the complete machine in detail. There were plans of the machines on paper in the company. These plans were used to make simple contours of the tie bars and the die. To be precise, these drawings gave more the boundary conditions for the movement of the robot than a true view of the machine.

After these steps, it was possible to virtually place the robot on the pedestal and put it in front of the machine, as can be seen in Figure 30. To execute its job as required, the robot must be placed in a certain position which allows performing the needed tasks without colliding with the die casting machine but, as far as possible from it so workers still can reach the machine if

something wrong occurs during the die casting process. Also, the height of the pedestal could be checked in the 3D view.

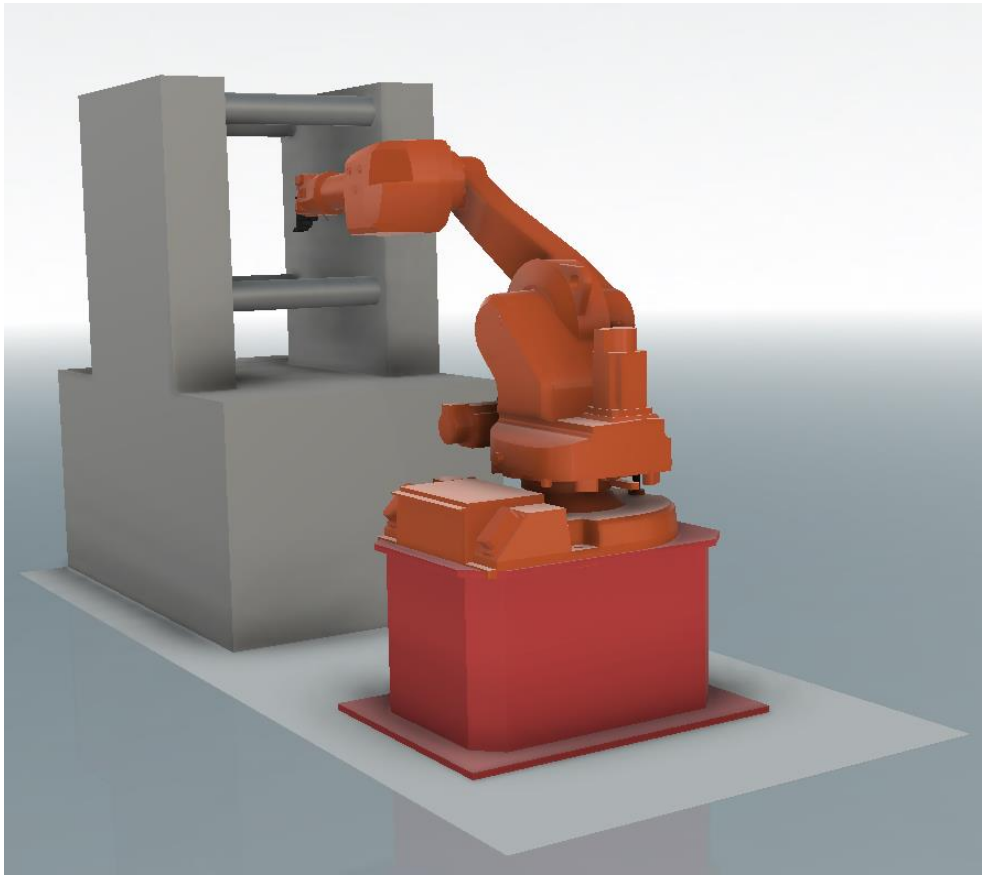

Figure 30: 3D model of robot in front of machine

To make a good placement plan a top view of the situation was needed, as presented in Figure 31. The best dimensions could be point out on this top view and used afterwards for the robot placement. The robot was placed on 1,015 meters away from the first tie bar. In this way, it has enough space to move and its arm does not need to be completely stretched. The reason not to have the arm stretched completely is the following: if in the future for some reason the robot needs to go further with its arm it will still be possible. Otherwise, the work, which has been done in this project, should be repeated all over again. The first drawing of the placement plan was not yet the right one. After consultation with Mr Magalhães, the provisional plan was obtained.

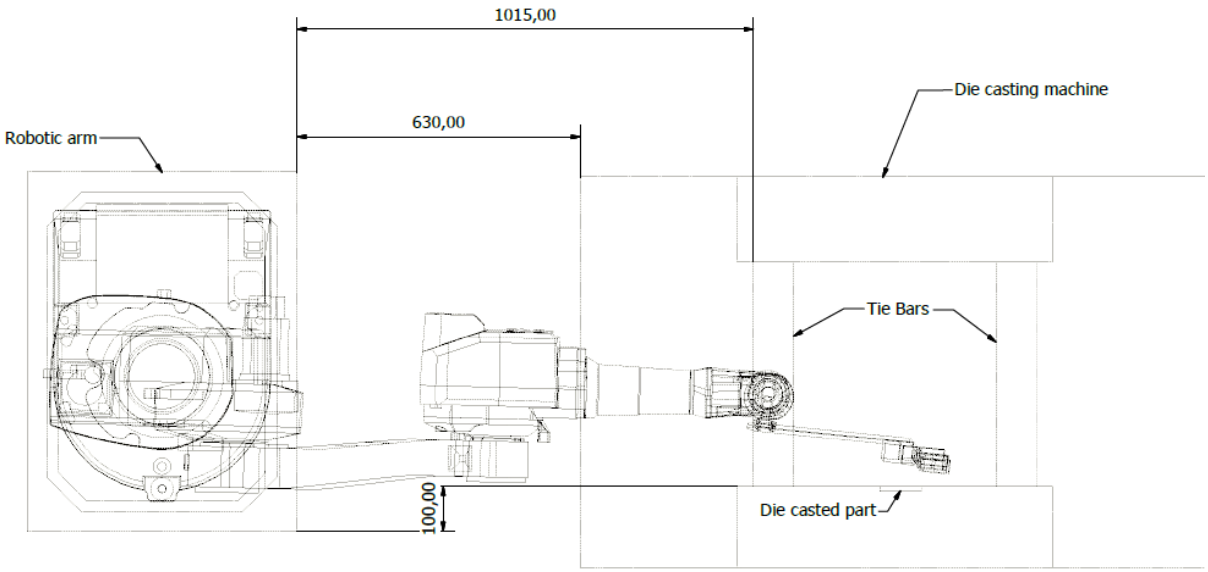

Figure 31: Top view of placement plan for the robot in front of the machine

3.5.3 Pedestal building

Before it was possible to start building a new pedestal the robot had to be taken out of the old one as can be seen in Figure 32. This had to be done with a forklift and a chain attached to the robot. Regarding the means at disposal in the company, the task presented some risks, so, caution was advised.

Figure 32: Taking the robot out of the pedestal

After the robot was taken off, some marks were made on the pedestal to cut it afterwards. Two cuts had to be made for the top plate to be lowered so that it could be reused. A weld was located directly under the top plate so it would not be easy to cut the pedestal right there. Therefore, the first cutting line was marked 100 mm beneath the top plate. From this line, another line parallel with it was drawn 300 mm down (see Figure 33), and the space between the lines had to be removed. Both lines were carved in the pedestal with a metal nail. It was very important that both lines were parallel because after cutting the pedestal and removing the middle part, both parts had to be welded again and the top plate had to be perfectly horizontal as before.

Figure 33: Pedestal cutting lines

After carefully carving the lines, the cutting of the pedestal could be started. An angle grinder was used for this job. This is a handheld power tool which is able to cut through the metal pedestal. As can be seen in Figure 34 it was done by hand, being a tricky job: it was not simple to keep on going straight but it was the only option available to do this job, since there were no other tools to perform the task.

Figure 34: Cutting the pedestal along the first line

The top plate was cut off first because there were some other adjustments needed to be made on this plate. The holes of the plate had to be moved forward. The problem was that there was no machine in the company suitable to do this job. So, the top plate needed to be sent to another company able to do it for Fundwell. The holes on the top plate were marked on the spot where they must be made, as it is possible to see in Figure 35.

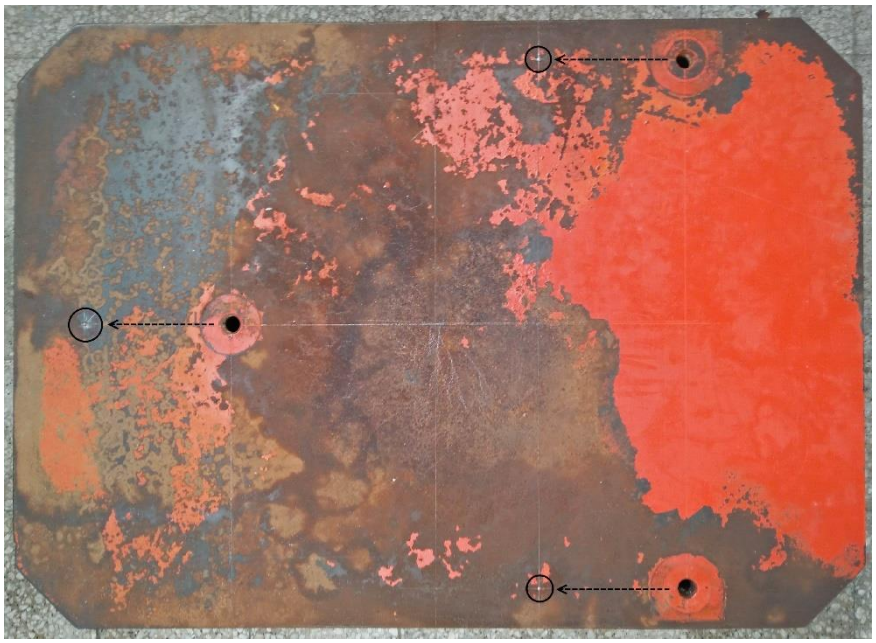

Figure 35: Positioning of the new holes

After cutting the top plate (see Figure 36), and sending the top plate to the company for making the holes, the cutting of the second part could be started, as shown in Figure 37.

Figure 36: Pedestal top plate cut off

Figure 37: Cutting the pedestal along the second line

After removing the middle part of the pedestal and drilling the new holes it was time to rebuild it. The top plate and bottom part had to be placed on top of each other and welded together, as can be seen in Figure 38. The pedestal was not welded completely all around but just on some points. In this way, there was still a chance to correct some faults without too much cutting. Afterwards, it was planned to weld the pedestal all around. For now, this is the end stage of building the pedestal. The next step was placing the robot on top of the pedestal and place the set in front of the machine to check if everything was fine and done well.

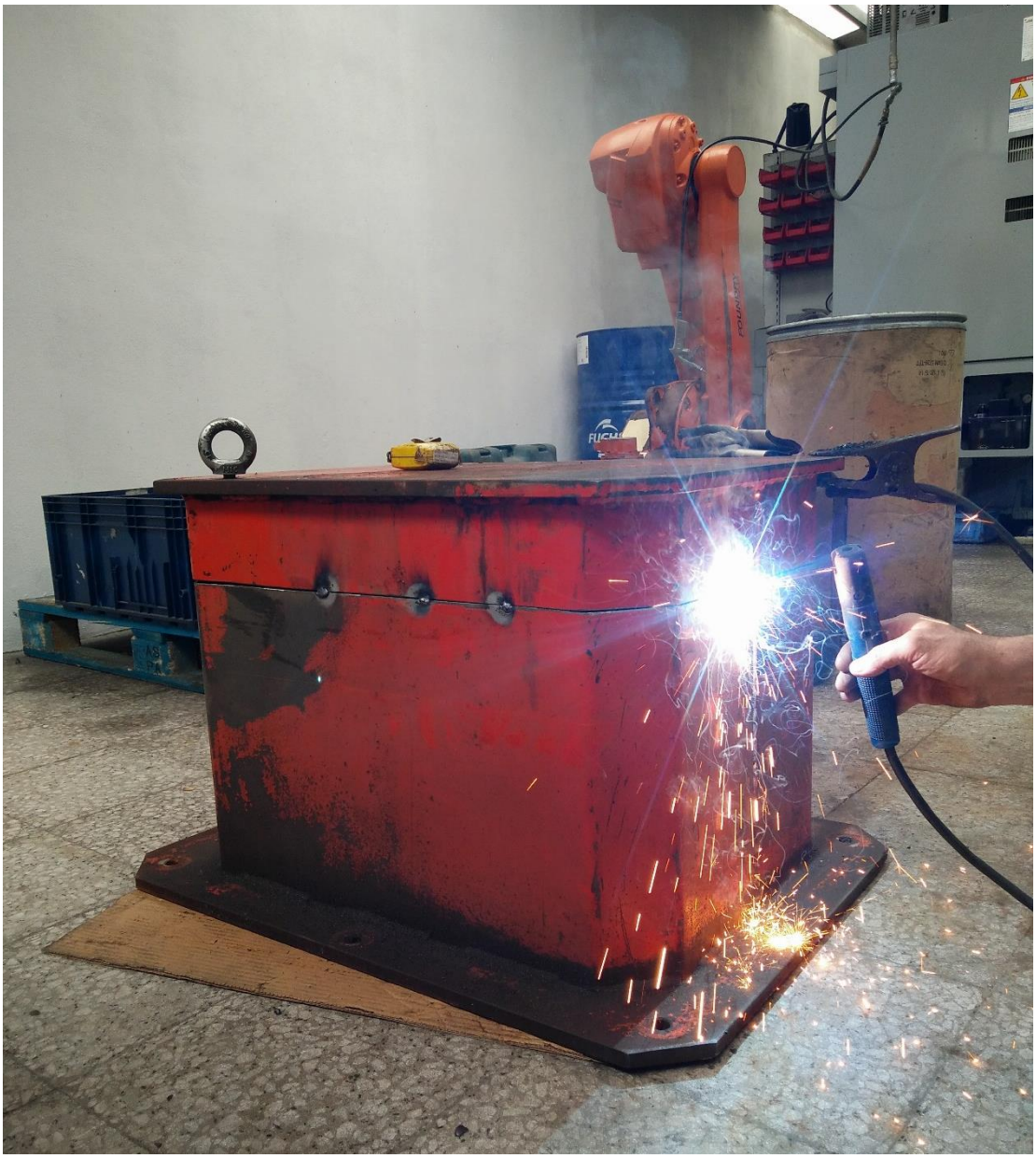

Figure 38: Welding the pedestal

Next, the robot and the pedestal could be assembled. The robot was put on top of the pedestal and positioned the holes in the robot, to tight it, with the holes in the pedestal. When this was done, the old screws were used to fix the robot on its holding system. This was the last task

before the placing and connection of the robot could start. In Figure 39 it is possible to see the robot tight on the new, lower, pedestal.

Figure 39: Robot tight on new pedestal

3.5.4 Robot connection and placing

As said before, some placement plans were made to position the robot in front of the die casting machine in order for it to be hindered as little as possible, if maintenance must be done, or when It is needed to change the die for a new part.

For the connection, two technicians of the Sonafi company were contacted to help, since they had the know-how and they also connected the robot the first time three years ago.

To perform the connection, the electric circuits of the robot and the die casting machine were carefully studied. The robot and the controller needed a power supply and the signals of the die casting machine had to be connected to the IRC 5 controller. First, the power supply was

connected. Secondly, as can be seen in Figure 40, all signals were connected with the right wire so the controller could read these signals. Therefore, the robot controller could read, for example, when the door of the die casting machine is open or closed. The corresponding electric scheme can be found in Appendix I.

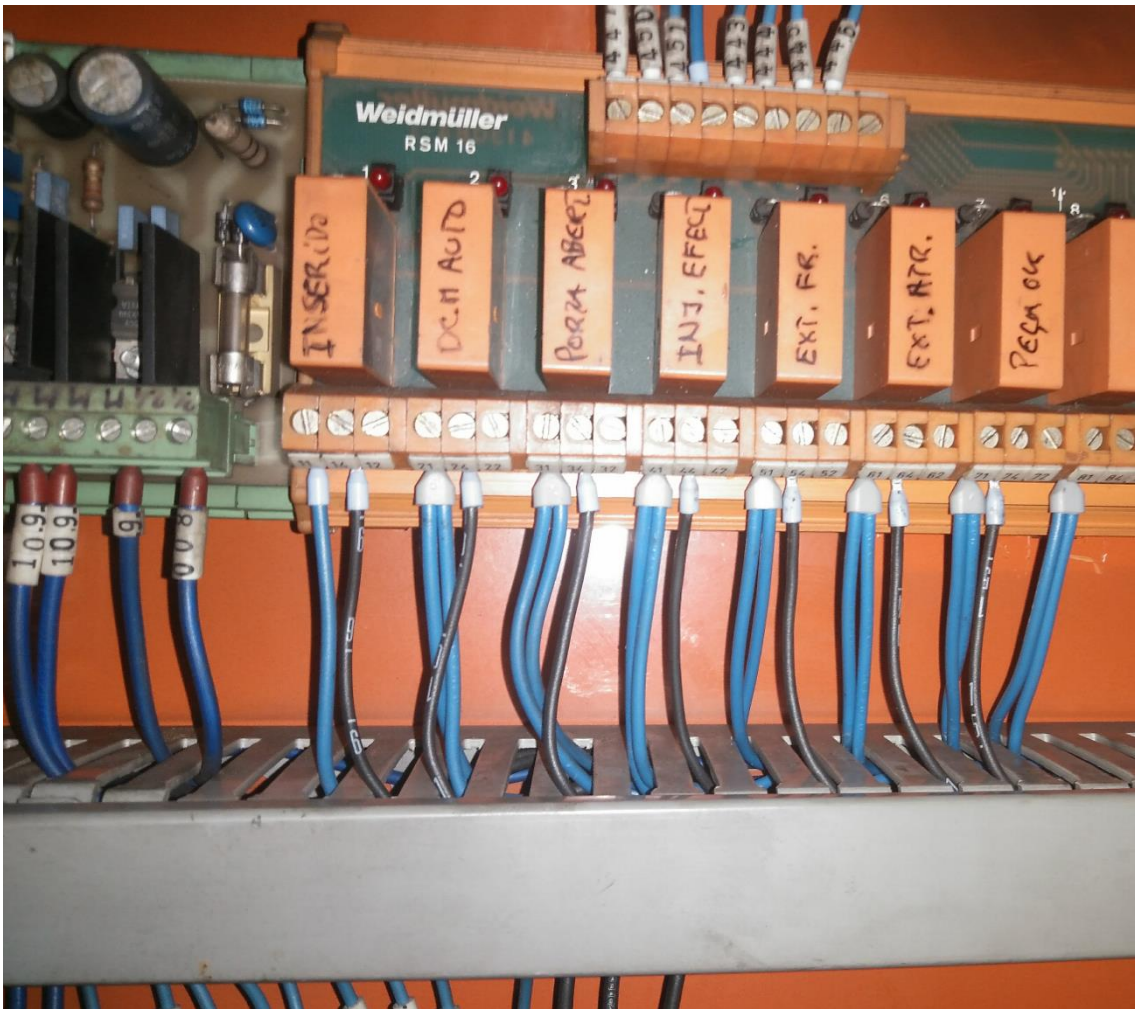

Figure 40: Connection signals from the die casting machine to the robot controller

There was still another sensor which had to be connected. When the parts come out of the machine the program must have the possibility to check if the die casted part is correct or not. Whit this purpose, there is an external system with 12 inductive sensors on it (right side of Figure 41). When, for example, there come out 12 parts at the same time, this sensor can check if they are all there. If one is missing it gives a signal that something is wrong. As seen in Figure 41, when a different die produces less than 12 parts, the possibility exists to disable some of the inductive sensors. On the left side of Figure 41 the device can be seen to enable and disable the different sensors.

Figure 41: Inductive sensor to check the parts

After all the connections were done, the robot was started up and its axis calibrated. To calibrate the robot, it had to be manually jogged into its home position (markings on the robot indicated the home position).

When the calibration was done the signals had to be checked. Every sensor should give the right signal so that when the robot was programmed, it would know in which state the die casting machine found itself. The air pressure to open and close the gripper was also connected.

After all these steps, the placement of the robot could start. First some marks were made on the ground based on the placement plan made before. This was done to mark the right distance between the pedestal and the robot. The robot was placed in front of the machine on the right spot. Due to the new positioning of the robot, it needed to be recalibrated. After this was done the gripper was tested and it was verified that the gripper claws were too wide for the part with which the system was going to be tested. Therefore, the gripper claws were made smaller as can be seen in Figure 42. To check if there were no mistakes in the calculations of the placement

plan the distance from the robot to the machine was tested afterwards trough manual jogging the robot into the machine. Everything worked correctly and the robot arm could reach the part as calculated.

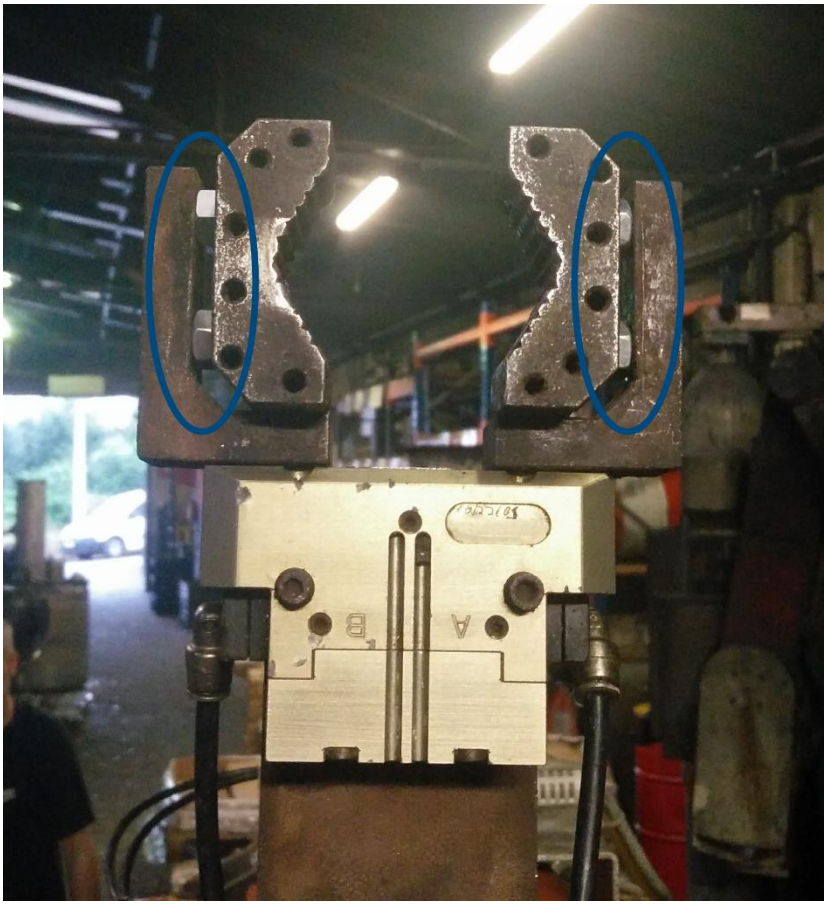

Figure 42: Smaller gripper claws

When everything was installed correctly the pedestal was fixed to the ground with four screws, one on each corner. First, four holes needed to be made at every corner with a drilling machine provided with an adequate drill. In each hole, an anchor bolt was knocked. Afterwards they were tightened so they were anchored in the ground. The working principle can be seen in Figure 43.

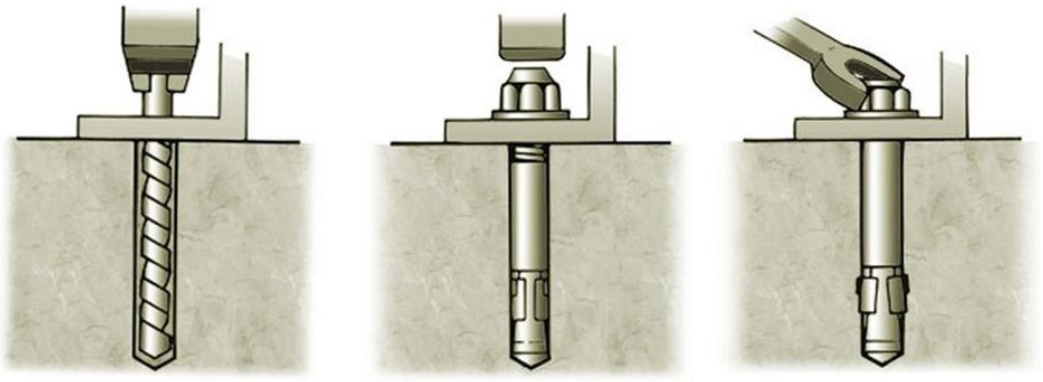

Figure 43: Working principle anchor bolts [20]

3.5.5 Robot programming

For the robot programming, the ABB RobotStudio® software was used. With this software, a simulation of the program was made. Therefor there was the opportunity to illustrate every step of the unloading job even before the robot was in operation.

The flowchart shown in Figure 44 is a description of the program needed to execute the unloading job and the check operation. In this paragraph, the flowchart gives a global view of the program for a good understanding of the program and the different tasks the robot needs to execute.

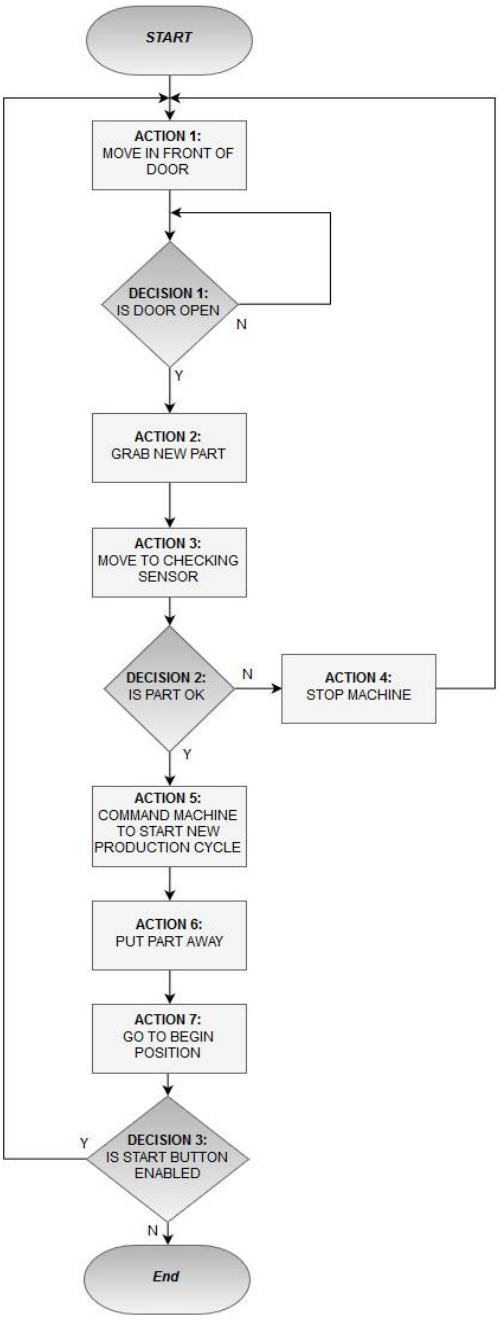

Figure 44: Flowchart of robot program

START:

To start the machine, the emergency stop must be deactivated and the input signal "start button" must be activated. Figure 45 shows the start button in the simulation in the activated state.

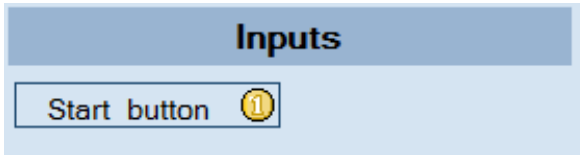

Figure 45: Start button activated

ACTION 1: MOVE IN FRONT OF THE DOOR

When the die casting machine starts its cycle, the robot does not have to wait to go in front of the machine. It waits in front of the die casting machine during the die casting process. It also rotates its gripper so there will be no errors due to unreachability. The white line in Figure 44 shows the path which was taken by the robot.

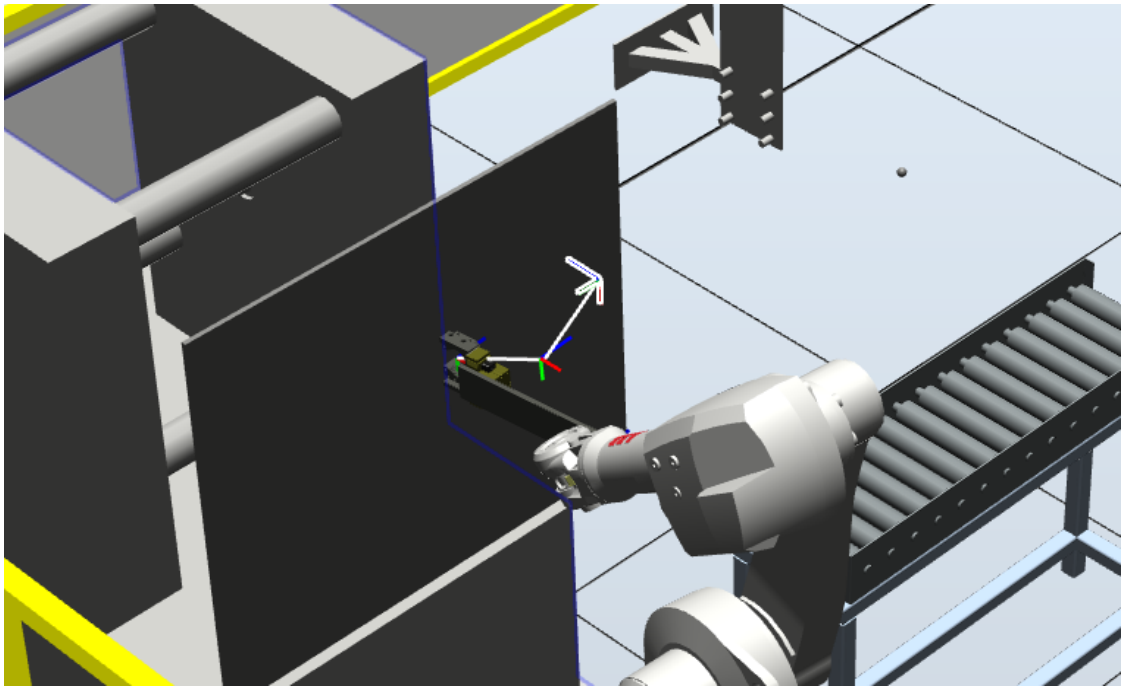

Figure 46: Robot stopped in front of the die casting machine door

DECISION 1: IS DOOR OPEN?

The first decision the robot has to make, is to check if the production cycle is done. This can be done by checking if the door is open or not. When the die casting process is finished, the door of the die casting machine will open automatically. In the simulation, this is simulated by a mechanism. In this way, the door opens smoothly and gives the user a realistic view of the door opening. When the door is open, it will trigger a sensor which will activate a signal. When the

signal is activated, the robot knows that it can continue to ACTION 2. The open door can be seen in Figure 47.

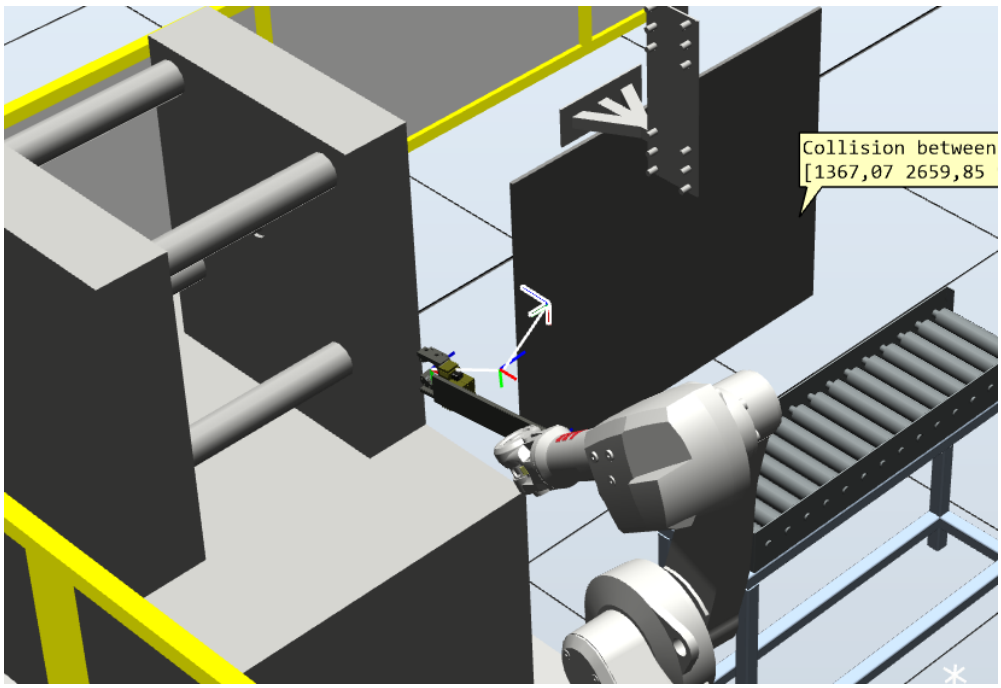

Figure 47: Die casting machine with door open

If the door is not open, the robot will wait in front of the die casting machine. It will repeat DECISION 1 every time it gets a negative answer. If it gets, on a certain moment, a positive answer, it means that the door is open and it can go onto the next action. Between the positive signal and the actual entering of the machine there is a time delay to avoid any collision between the robot and the door.

ACTION 2: GRAB NEW PART

In this step, the robot will move in front of the part and grab it with its gripper. It will close its gripper and take the part out of one half of the die. Figure 48 shows the grabbing operation of the part.

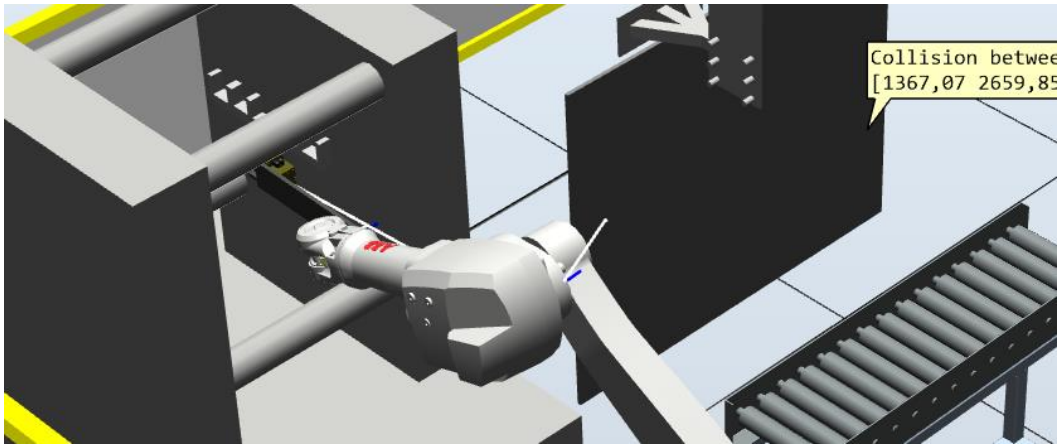

Figure 48: Grabbing the part

ACTION 3: MOVE TO CHECKING PART

After the robot grabs the part, it gets out of the machine and goes to the sensor which can check if the part is ok. It follows a path in a way that the part does not collide with the machine. The sensor is located on a higher point at the right side of the robot.

DECISION 2: IS PART OK?

As previously stated, an inductive sensor is used to check if the part who comes out of the machine is correct. When the sensor gives a positive signal, the robot can proceed to ACTION 6. If there is a negative signal, it means that something is wrong with the machine or with the die casting process. In this case, the robot will go to ACTION 5. In Figure 49 is shown the simulation of the part checking.

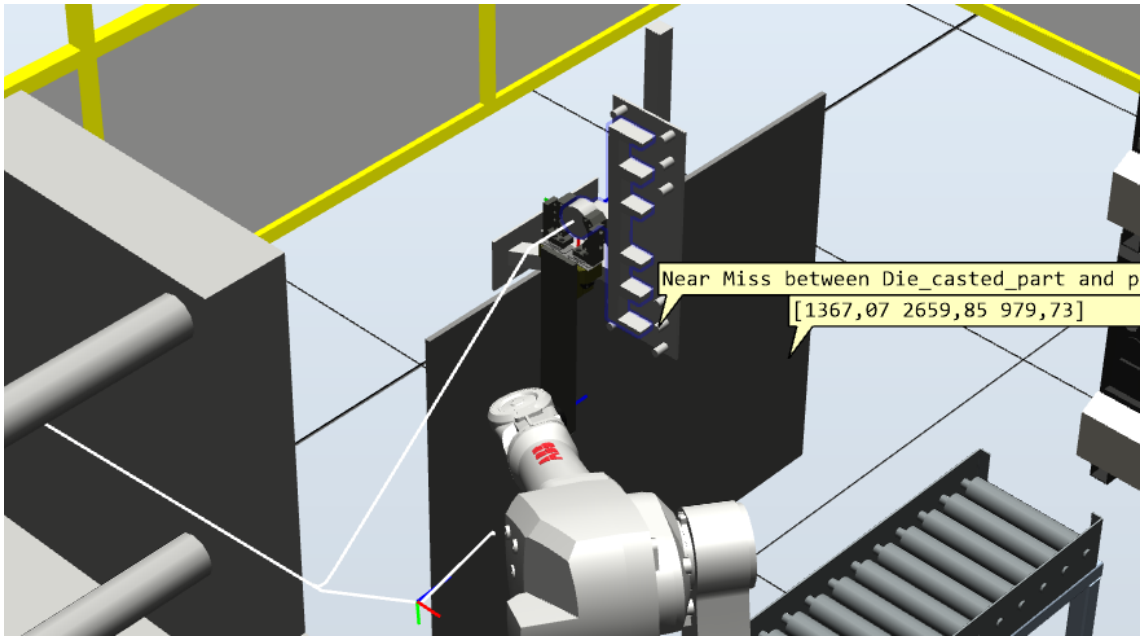

Figure 49: Checking if the part is correct

ACTION 4: STOP MACHINE

When something is wrong with the parts and the sensor detects it, the machine needs to be stopped and the robot goes to its starting position. When this happens, a technician should come to identify the problem and fix it. The machine and the robot program must be restarted. These steps are done manually by the technician and therefore they are not included in the flowchart. The defective part will be put away on a different container.

ACTION 5: COMMAND THE MACHINE TO START A NEW CYCLE

When the sensor indicates that the part is correct, the machine can restart a new production cycle. The robot will output a signal which will give the machine the needed command to start again. The door of the machine will close and the machines starts making a new part. This action comes before the robot putting away the part to save time.

ACTION 6: PUT PART AWAY

While the door is closing, the robot continues its path. It will put the part away on a conveyor system dropping of the part by opening the gripper. In Figure 50 it can be seen that the die casting machine door is closing at the same time that the robot is the putting away the part. The white line represents again the path followed by the robot.

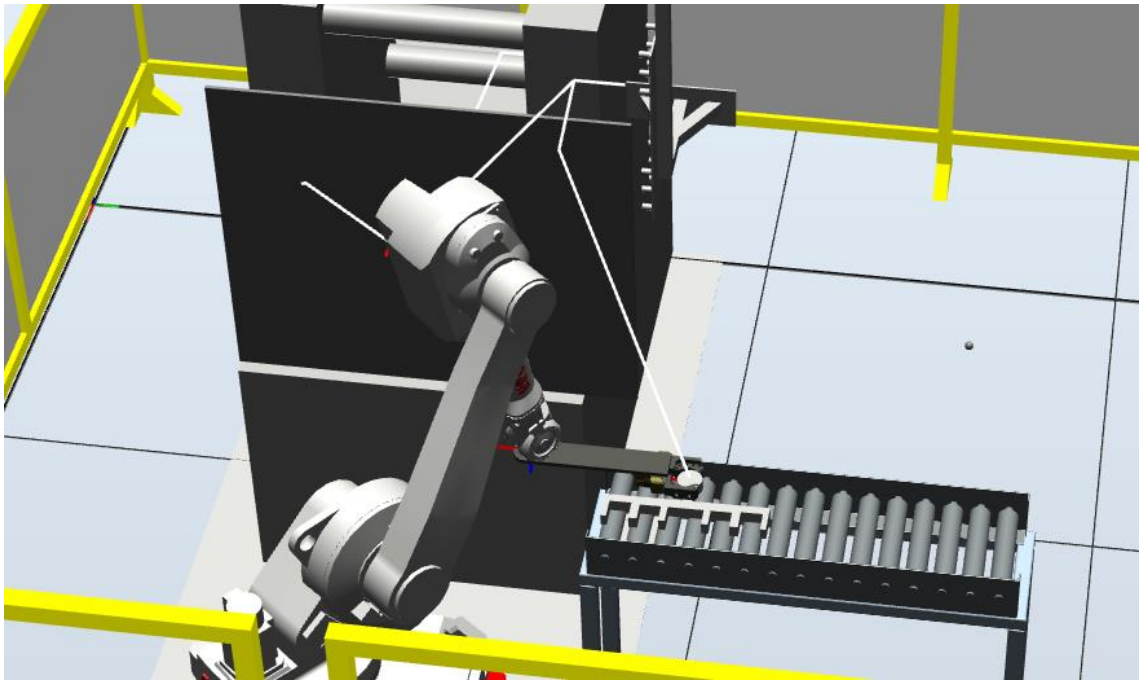

Figure 50: Closing door and putting part away

ACTION 7: GO TO START POSITION

When the robot has placed the part away, it can go back to its starting position. In this position, it is ready to start a new cycle or, if needed, stop and stand in a safe way. This is the last action of one cycle. In Figure 51 the robot can be seen again at his starting position with the part placed away and in white the complete path taken by the robot.

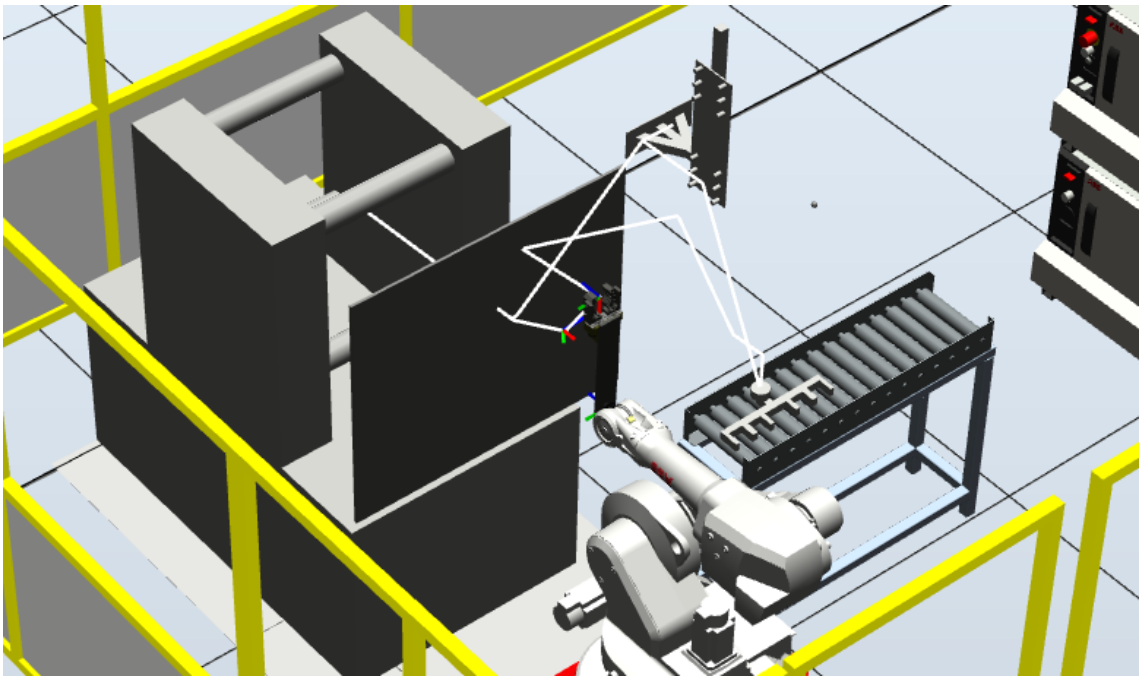

Figure 51: Robot in the starting position at the end of the cycle

DECISION 3: IS START BUTTON ENABLED?

The last step is to see if the robot program should end or be repeated. If the start button is no longer enabled, the robot will end and stay in its beginning position. If it is in this position, there is space for maintenance and if needed, the company workers can put a new die in the machine. If the start button is still enabled, it can continue the work and the robot will repeat its tasks.

END

This is the end of the program. If the program comes to this state, it needs to be restarted to continue working.

The programming of the real robot was accomplished with the help of an external programmer specialised in programming industrial robots for the loading and unloading of die casting machines. The code was written online during the testing phase. The code of this program can be found in Appendix II.

3.5.6 Robot testing

This was the final stage of the project. At this point, everything was built and installed. The robot was programmed to perform its task for the first time, but there were still some errors occurring. During the online programming, these problems and errors were identified and corrected. In this subsection, are explained all problems which occurred during the testing phase and all of them were resolved.

PROBLEM 1:

The first problem which occurred was related to a signal. When the robot was tested, the arm went into the machine to grab the part. While the arm was inside the die casting machine, the door had to be open during the whole time, which was not occurring: The door closed and hit the arm. To solve this problem, a signal was added which could inform the die casting machine that the arm is out of the machine and on a safe place. This signal only allows the machine to be able to close the door after the robot arm had checked if the part was correct or not.

PROBLEM 2:

The second problem was related to the extraction of the part from the die casting machine. When a part is made, it stays in the mould. As referred in the background information. The die casting machine will extract the part, after the opening of the two halves of the mould, by pushing it out. When the part is pushed out, the robot needs to grab it before it falls but, on the other hand, if the claws of the robot gripper touches the part before it is pushed out of the mould, an error will occur when the die casting machine pushes the part out. To avoid this error, the die casting machine and the robot needs to be synchronised. The extraction time was adjusted to the time needed for the robot to enter the die casting machine and go to the right spot in front of the part. Due to this adjustment, the gripper could close exactly on the right time and take the part out of the machine.

PROBLEM 3:

The last problem was related with the sensor used to check the part quality. For the part which was used for the initial test only two sensors were used and the sensor was not calibrated properly. When the gripper was put in front of the sensors, it sent a signal corresponding to a bad part, and the robot rejected the part, even if the part was a good one. When the part was in front of the sensors, one of it did not react while the other one was reacting fine. Letting the part come closer to the sensor was no option because in that way it would be to close for the other sensor which reacted fine. The only option was adjusting the sensor which did not react, bringing it closer to the part. After this adjustment, both sensors both reacted perfectly and the good parts were no longer rejected.

When all the problems were solved, the program was finished. The robot could perform its job according to planned and no errors occurred any more. The die casting process was now fully automated. Some screenshots of a video made of the real unloading can be seen in Figure 52.

The grabbing, checking and putting away of the part can be seen, as well as the waiting in front of the machine.

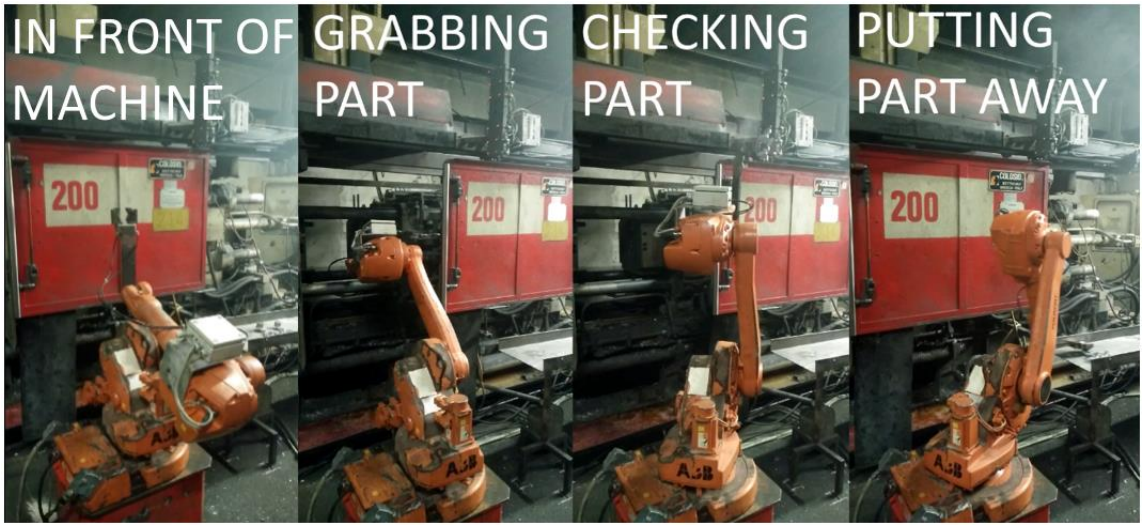

Figure 52: Screenshots of video made during real unloading of the die casting machine

3.6 Budgeting

The cost of the project implementation was also computed, regarding parts, technician service and so on. In this section is presented the total cost of the project. Table 3 presents the cost calculation in a chart.

CALCULATION COST PROJECT				
Task	***Equipment/service***	***cost per piece***	***amount***	***total price***
Cleaning	Petrol	€ 9,99	3	€ 29,97
Cutting	Cutting wheel	€ 2,96	5	€ 14,80
Making new holes in the pedestal	External company	€ 113,00	1	€ 113,00
Welding	Welding electrodes	€ 0,07	3	€ 0,22
Robot connection	Technichians	€ 300,00	2	€ 600,00
Robot placing	Technichians	€ 250,00	2	€ 500,00
Robot programming	Technichians	€ 250,00	1	€ 250,00
TOTAL				***€ 1.507,99***

Table 3: Calculation of the project cost

For the cleaning of the robot, some petrol was used. In total, three jerrycans were used which leads to a total cost for the cleaning of €29,97. For the cutting, only the cutting wheels presents a cost. Five cutting wheels were used. The total cost for the cutting was €14,80. The last material cost was for the welding. The total cost for the welding electrodes was €0,22. The material costs were significantly smaller than the service costs. For the new holes which were made in the top

plate of the pedestal, an external company was contacted. The cost for this was €113,00. The connection and placing was done with the help of two technicians. The total price of these two technicians was €1.100,00, being this the biggest cost. Also for the programming someone came to help. This costed €250,00.

As can be seen in Chart 1, the costs for the materials is only 3 percent of the total cost. The biggest cost was the connection and placing of the robot, with respectively 40 percent and 33 percent. The help for the programming also had a big cost, that represented 17 percent of the total cost.

The total cost of the project was €1.507,99. This cost was controlled because the pedestal was adjusted and the robot was already owned by the company so there was no need to buy a new one. The working hours of the author and the people who helped from Fundwell itself, were not considered because they were too difficult to calculate.

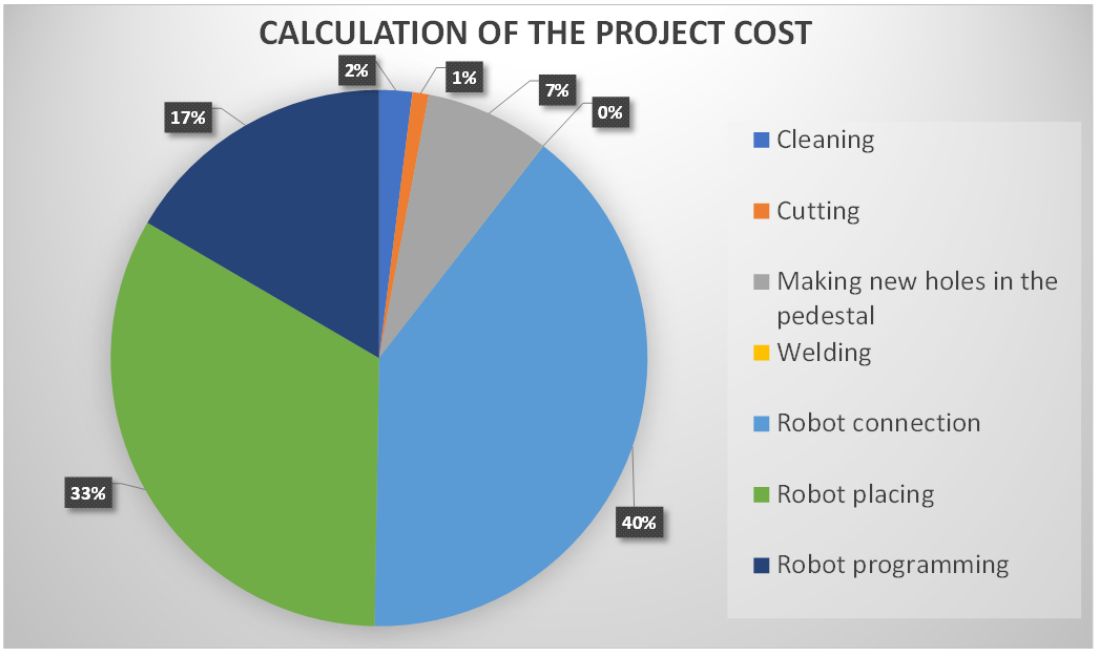

Chart 1: Costs corresponding to each task performed on the robot

3.7 Critical analysis and prospects for improvement

3.7.1 SWOT analysis

After the project was finished it was conclude that there were stills some possibilities for improvement. The complete process has it strengths and weaknesses. It was possible to describe them through a SWOT analysis of the project and it was also possible to define the opportunities and treats identified when the project was finished. In the following paragraphs can be found a description of this SWOT analysis. An overview of the SWOT analysis can be seen in Figure 53.

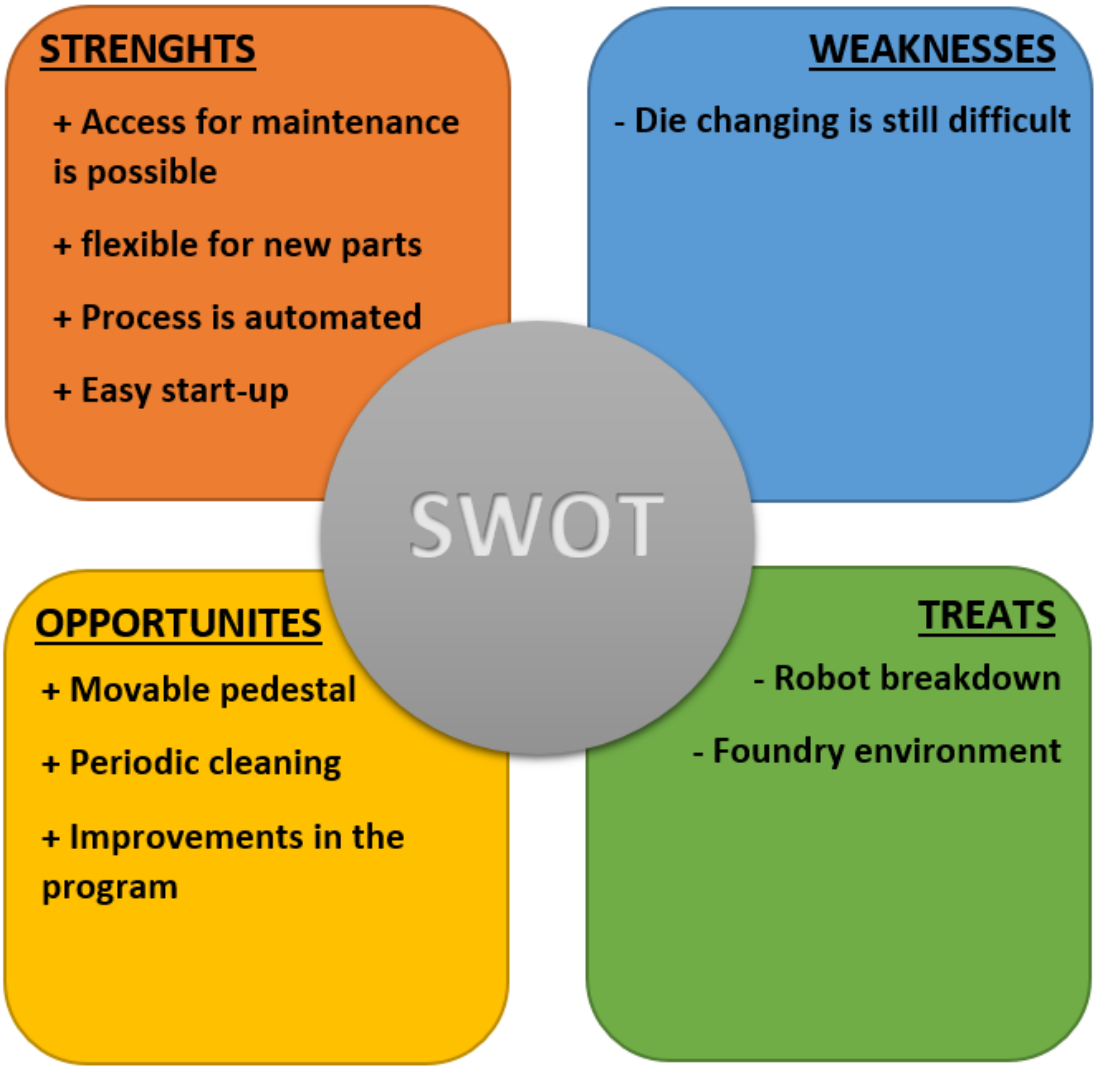

Figure 53: SWOT analysis about the final results

Strengths:

1. One of the most important aspects that justified the robot been taken out in the first place was its bad positioning in front of the machine. It was too close, so maintenance on the machine became difficult after they placed the robot the first time. This has changed and now the space between the robot and the machine is big enough to do the needed maintenance.
2. Every part which is made in the die casting machines has a similar cylindrical part as can be seen in Figure 54. This cylindrical area is where the part will be grabbed to take it out of the die casting machine when it is finished. Since the cylindrical part is always present it does not matter for the robot if it needs to unload a new type of parts. The cylindrical part can only differ in size but the size of the gripper is also adjustable.

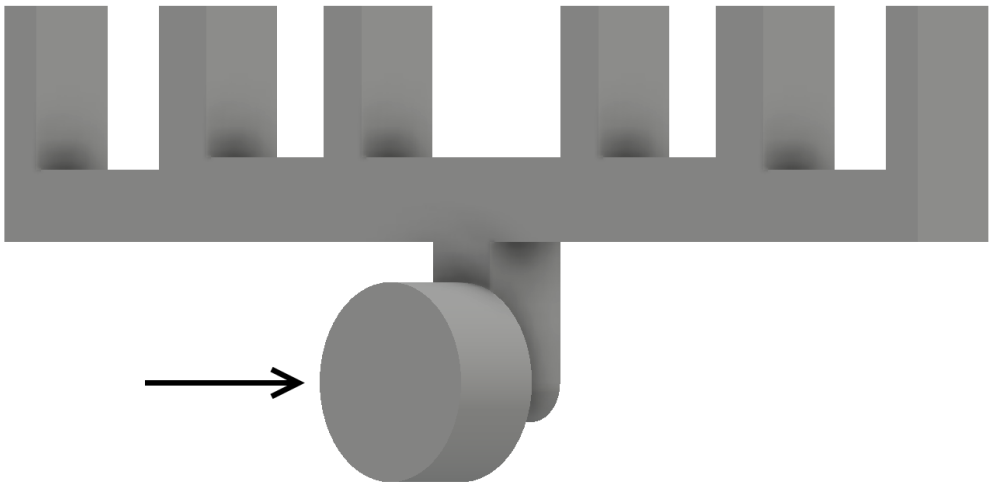

Figure 54: CAD drawing of die casted part with cylindrical part

Every die has a different amount of parts (between one and twelve). Therefore, if the die casted part is changed, the amount of parts in one die can also change. Since the sensor system is able to check twelve parts every sensor can be switched off so that fewer parts can also be checked.

3. Presently the robot is installed, and the whole process of die casting and unloading is automated. This saves money because the company no longer needs a worker to perform this job. This was also one of the main objects of the task given at the beginning of the project. The time to make one part is 49 seconds. From 6 a.m. until 1 a.m. there is always someone in the company so the robot can work for 19 hours a day. This means that every minute 1.22 parts ($\frac{60}{49}$) can be made. In one hour 73.4 parts ($\frac{60*60}{49}$) can be made, corresponding to 1395 parts ($\frac{60*60*19}{49}$) in one working day.
4. It is easy to start up the robot. By use of the instruction manual, which can be found further on in this report, the robot can be started in a few minutes.

Weaknesses:

1. The biggest weakness which is still in this process is the fact that changing a die continues to be difficult. When the workers want to change a die, they have to lift it over the robot. The robot cannot be moved out of the way so there is no option to change the die in an easy way. This was also a problem in the past and was not solved with the repositioning.

Treats:

1. If the robot breaks down, the machine can no longer work fully automated. Not only a worker is needed while the robot is being fixed, but the robot also needs to be moved away with a forklift and, afterwards, it has to be placed back in position. New tests have

to be conducted and everything has to be checked again, which takes considerable time and can cost a lot of money. Breakdown of the robot is something which almost never happens so when seen over the years the company expected earn more money than lose by putting the robot attending the machine.

2. Since the robot works in a foundry environment, the chance of a breakdown is bigger. The robot is protected, so therefore breakdown should be reduced to the minimum.

Opportunities:

1. One of the opportunities which could solve the problem of the die changing and at least a part of the treat regarding the robot breakdown is making a movable pedestal. When the pedestal becomes movable, it will be possible to move the robot away when the die needs to be changed. This process would be the same as in the past when the robot was not yet installed. Furthermore, when the robot has a breakdown, it can be moved away from the machine door and a worker can take over the job again until the robot is fixed.
2. To make sure that the robot stays working and in good condition, periodic cleaning can help. The robot would no longer become too dirty and its chances for good working are bigger.
3. The program which was developed was not tested for a long period. After a longer time of working, improvements can be made and time can be saved due to changes in the it.

3.7.2. Future improvements for pedestal

As stated, the main improvement for this project would be a movable pedestal. Since this idea came up in a later stage, there was no longer enough time to carry out the complete work. The drawings of the first idea have been made and can be seen as a future project. The complete assembly can be seen in Figure 55. This subsection describes the idea by hand of the drawings.

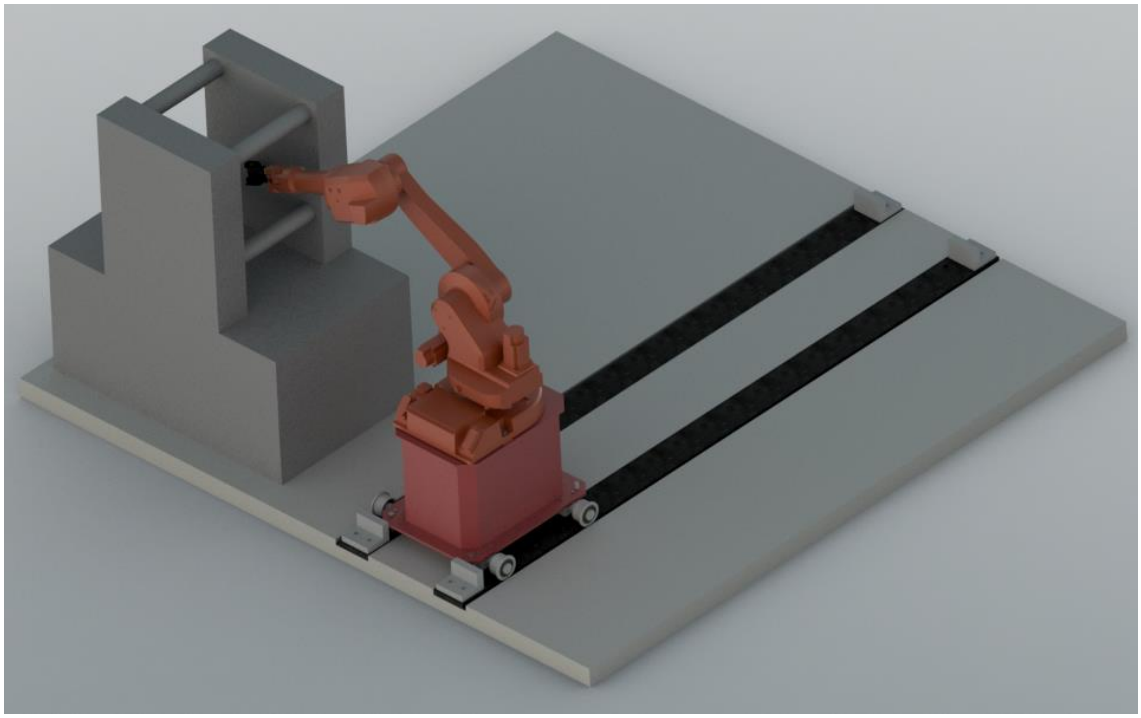

Figure 55: Complete assembly of movable pedestal

To move the robot to a different place, a rail system is needed. There are a few requirements which are mandatory. To make a good plan, the following aspects were considered:

1. To save time and money, it should be easier to keep the same pedestal which was made for this project. There is the need for some sort of wheels to make the pedestal movable. This would make the support higher again so it was important to keep the wheel shaft as close as possible to the ground, so a new and lower pedestal is not needed.
2. The rails where the support should ride on, should be in the ground. So that there is no danger of hitting them or the danger that people could fall over it.
3. There should be some kind of stop at each end of the rail. This way, when the robot is moved, it would always stop on the same spot. These stops should also be detachable to avoid hitting them when the robot is in the normal working position or moved away for maintenance.
4. The pedestal has to be bolted properly in place so that when the robot moves its arm, the pedestal does not shake.

As can be seen in Figure 56, the wheel shaft is fixed under the support. There are two wheel shafts and they are both fixed with two metal brackets, being each bracket fixed with two screws.

The wheel shaft is a cylindrical bar with the wheels attached. These wheels can spin due to the roller bearings inside them.

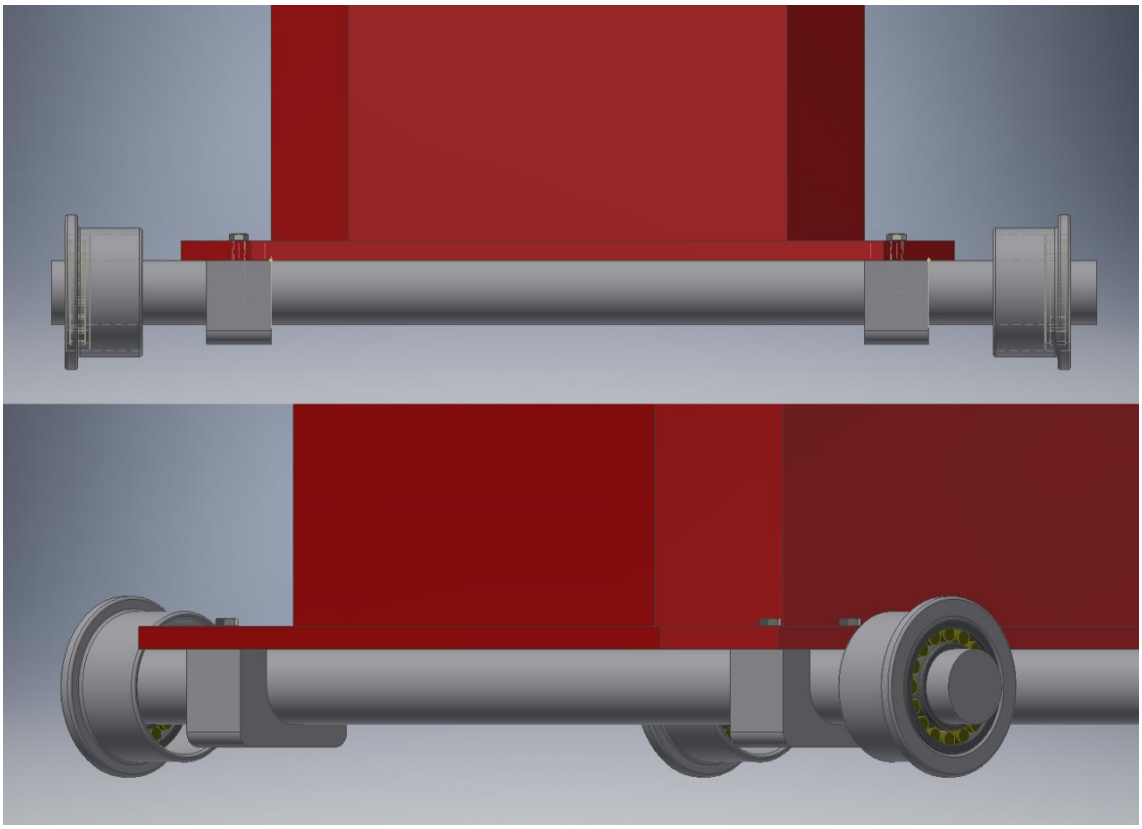

Figure 56: Wheel shaft tight to the support

The wheels are designed so they can roll with minimum friction over the rails. They have a wider flat surface to roll over the rail and make enough contact to hold the combined weight of the pedestal and robot. On the place where the rail is lower and a bit in the ground, the wheels have a wider diameter. Due to this wider diameter, the wheels fit into the rail and when the robot and its pedestal are moved, the rail makes it possible to keep the pedestal on its track. In Figure 57 is depicted a view of the wheels and the track. The rails itself lay in the ground so when the pedestal is moved to the other end of the rail, they are not in the way.

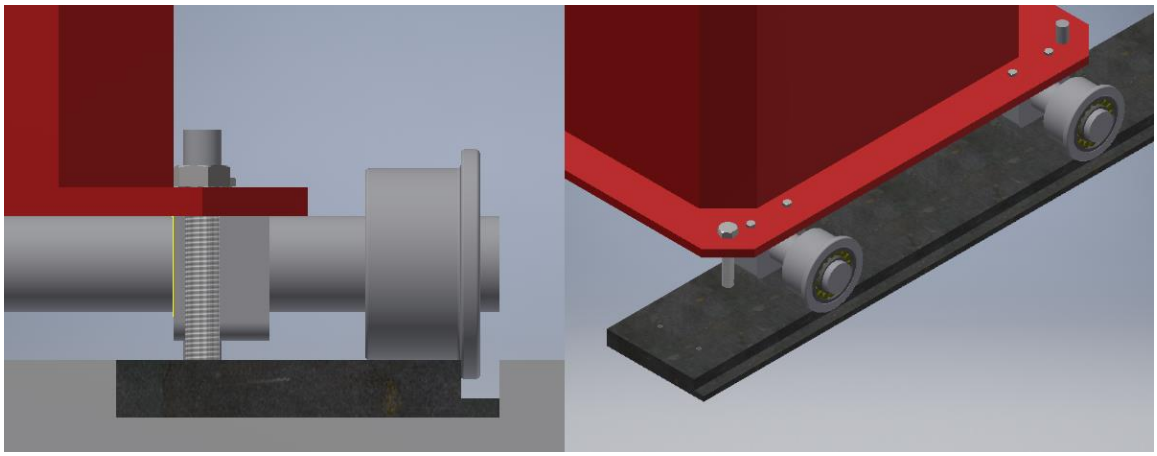

Figure 57: Design of wheels and rail

To make sure the pedestal is stopped at the right place when it is moved, each end of the rails has a stop. These stops are metallic L formed parts, as can be seen in Figure 58. They are fixed to the rails with two screws. When the robot is moved they can be removed so they do not disturb the movement of workers.

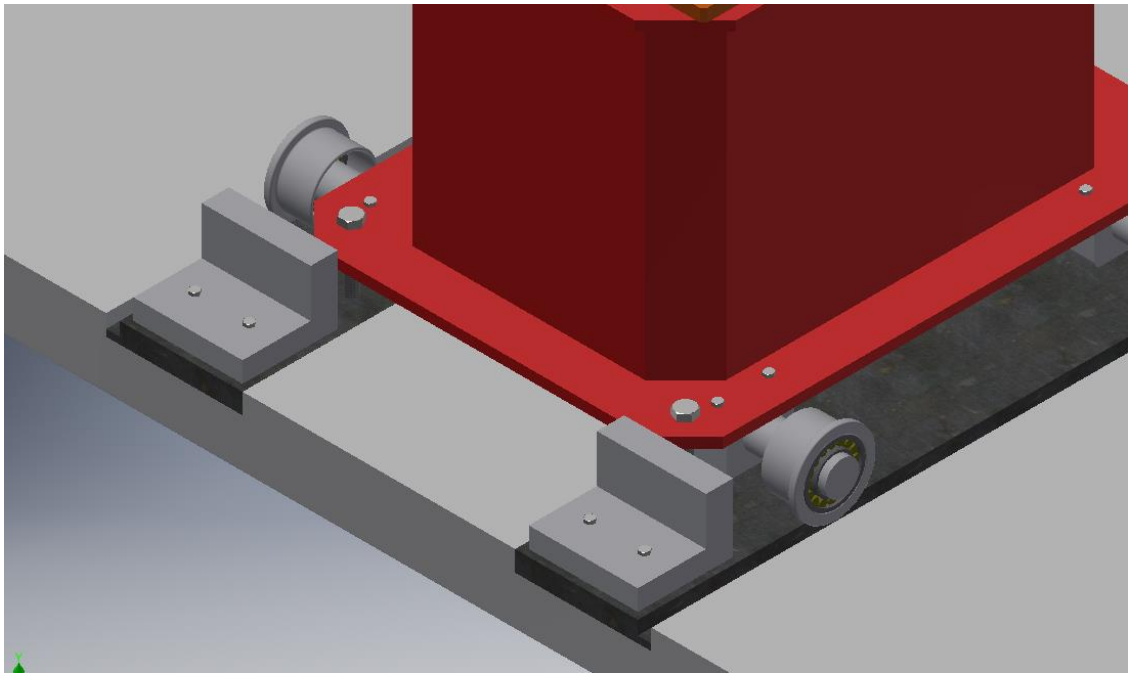

Figure 58: Stopping system

When the robot is in its working position it should be tight securely. When the pedestal is not tight securely, it can vibrate when the robot is working. If the pedestal shakes the targets of the robot are not on the same place anymore and lack of accuracy could occur. To make this possible a hole should be made in the pedestal and in the rail. These holes are centred above each other so that a pin can go through. This pin assures, together with the stopping system, that the robot is positioned exactly on the right spot. Besides the pin, also three screws secure the pedestal, as can be seen in Figure 60.

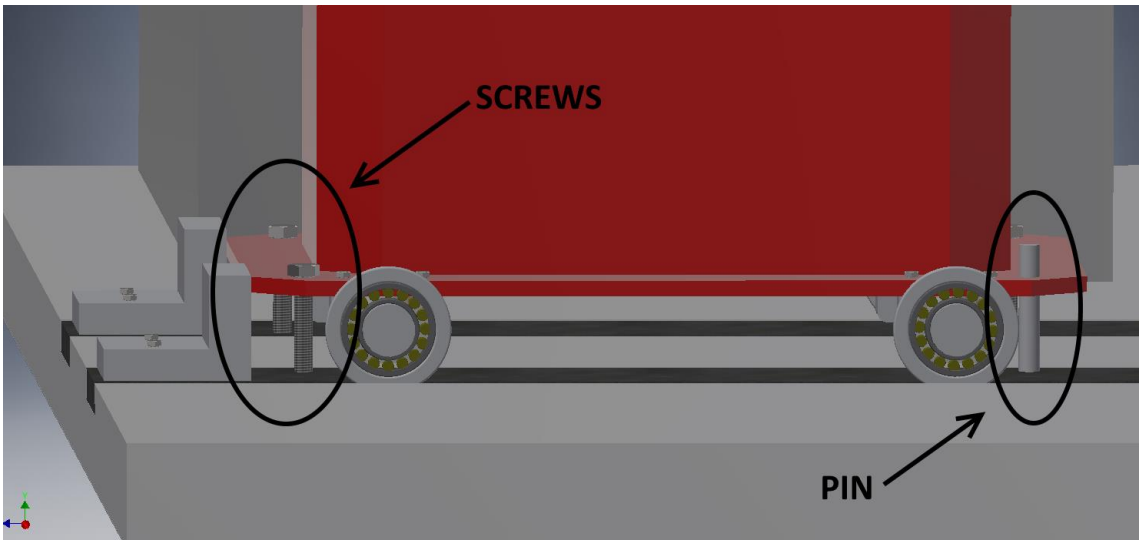

Figure 60: Pin and screws to lock the pedestal

This design can probably be improved. The drawings presented in the previous figures were made after a first brainstorm. This was done since changing a die is still not very easy with the current design. A closer look of the complete design can be seen in Figure 59.

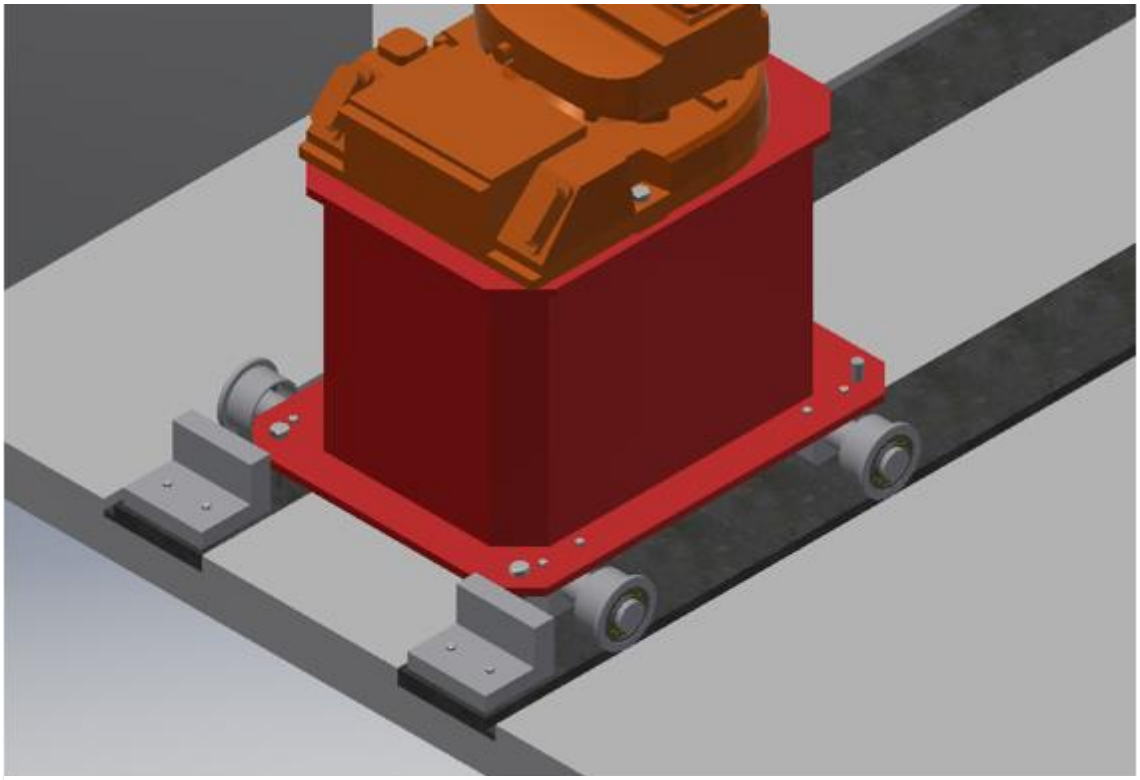

Figure 59: Complete design of the movable support

3.8 Equipment instructions manual

The robot and machine are synchronised and programmed so the process of die casting is automated. When the robot needs to be started or when the machine and robot are stopped and the process should be restarted, several steps needs to be taken. This section describes how to use the equipment developed in this report. It describes how the robot and the die casting machine can be put in automatic mode. However, when the robot needs to be reprogrammed a programmer should be contacted because it is impossible to perform this task without previous training and experience.

STEP 1:

In the first step the emergency stop needs to be turned off. If the emergency stop is not turned off, the control panel will give an error. As can be seen in Figure 61, the emergency stop is a red button located on the left side of the IRC 5 which needs to be rotated to be turned off. A message will show up on the screen of the controller if this button is turned off and “OK” needs to be selected.

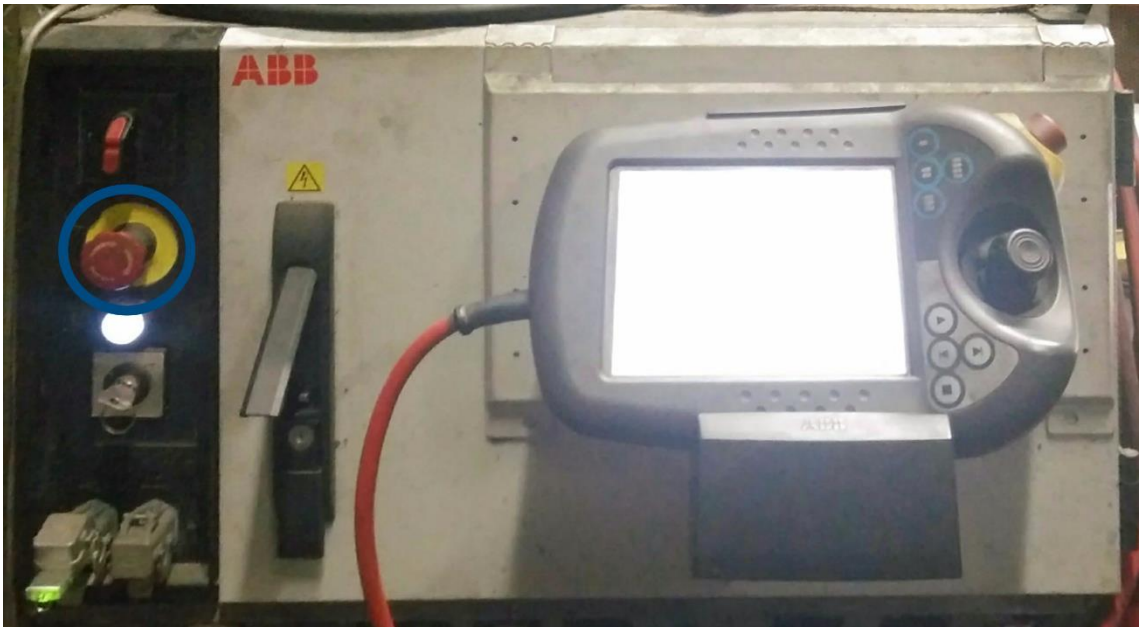

Figure 61: Location of the emergency stop

STEP 2:

Next “PP para principal” should be selected on the control panel to go back to the main menu. As can be seen in Figure 62, “PP para principal” is located on the bottom left side. After “PP para principal” is selected, the control panel will ask the user if you are sure to go through and “Sim” (Yes) should be selected.

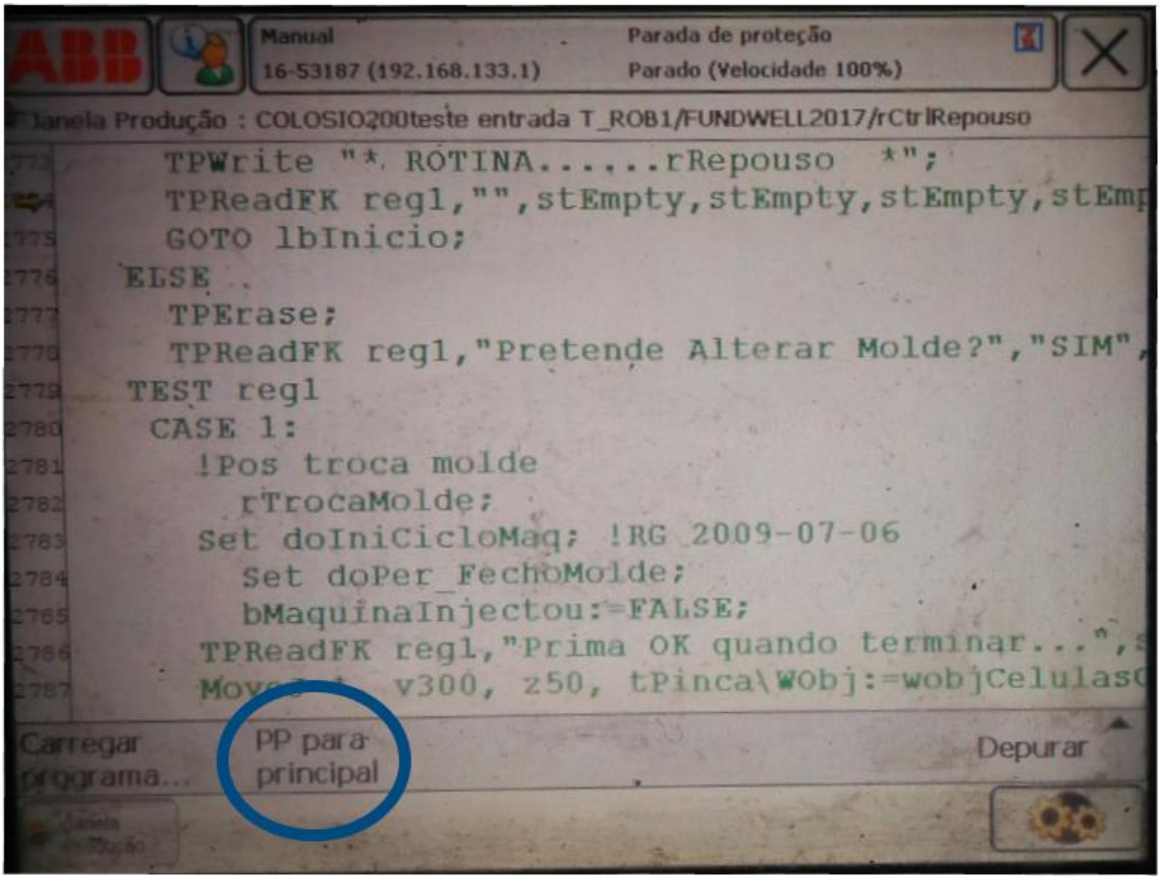

Figure 62: Control panel "PP para principal" screen

STEP 3:

To power the robot arm (its motors), the white push button with a light on it (beneath the emergency stop) should be pressed as can be seen in Figure 63.

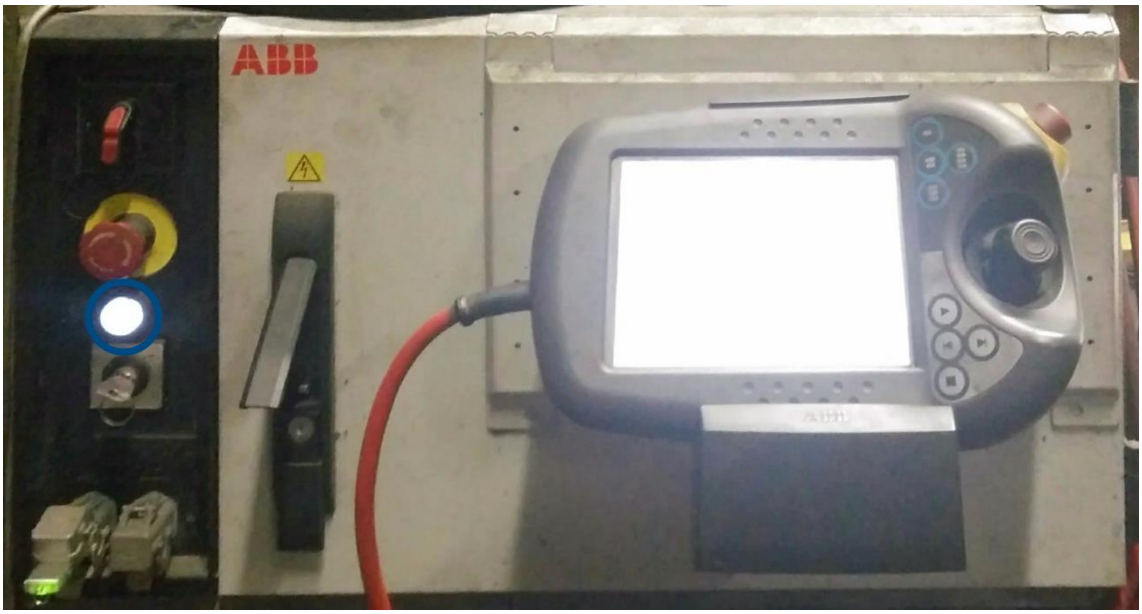

Figure 63: Location of the power up push button

STEP 4:

The previous step makes the robot ready to start. After, the start button itself can be pushed. As can be seen in Figure 64, the start button (that looks like a play button) is located on the right side of the teach pendant.

Figure 64: Location of the start button on the teach pendant

STEP 5:

The next question which will be presented to the user is: “Pretende Alterar Molde?” (Do you want to change die?) as can be seen in Figure 65. Since this is not the case, “NÃO” (No) should be selected.

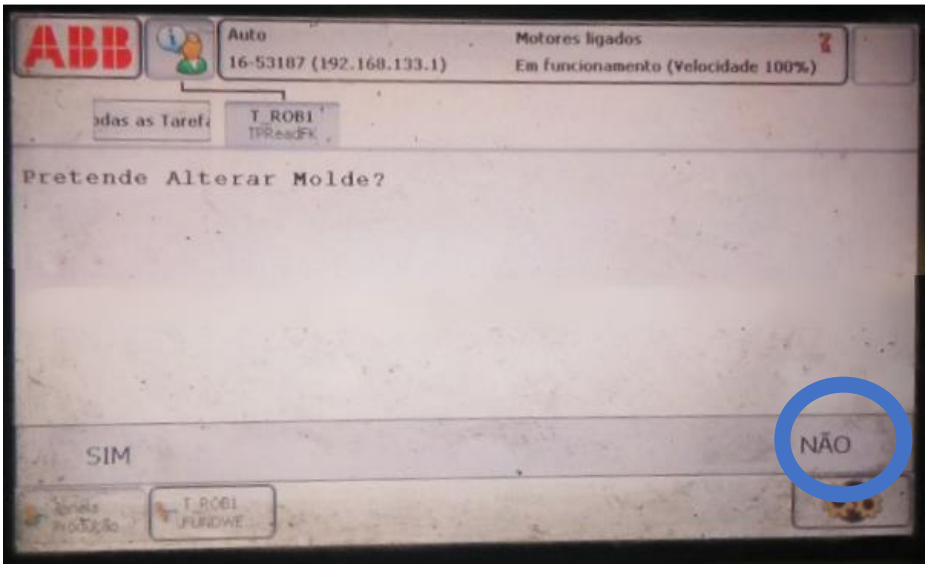

Figure 65: Question "Pretende Alterar Molde" on the device

STEP 6:

When reaching this point, a program needs to be selected. This is the last step. Program 1 should be selected, using the numeric keyboard on the right side of the display as can be seen in Figure 66. Program 1 is Bost281. After the program is selected, “OK” should be pressed to start the program.

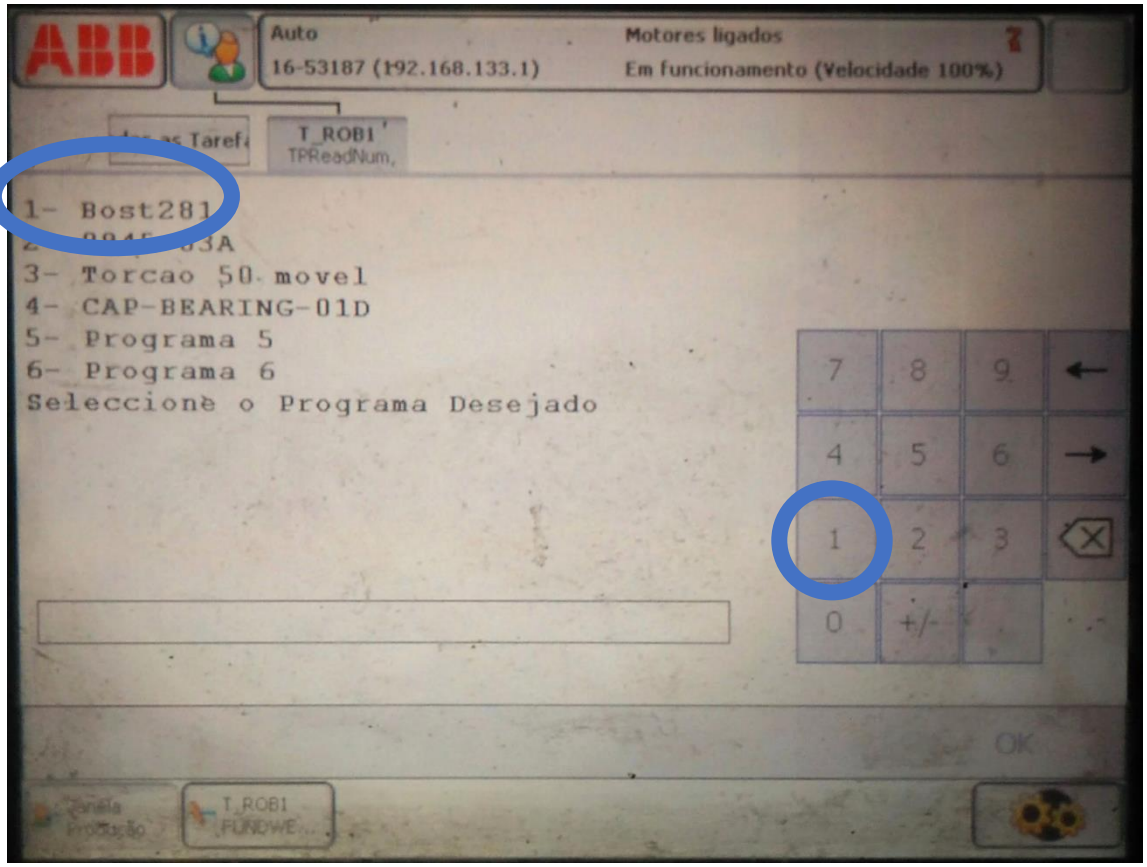

Figure 66: Program selection

3.9 Maintenance guidelines

There can always go something wrong. When something is malfunctioning in the machine in or the robot, corrective maintenance should be performed. This section gives a brief explanation of the things which need to be done. When the robot or the machine is broken, a specialist should be contacted. Surely there are a few measures which can be taken to easy the specialists work.

DIE CASTING MACHINE MAINTENACE

If there is something malfunctioning or broken with the die casting machine, the die casting process should be stopped. When that happens, the robot will stop also and due to the new location of the robot, maintenance should be possible without taking the robot out of is normal

working position. The new robot positioning gives the maintenance personnel the possibility to do their work on the machine without being troubled by the robot.

ROBOT MAINTENACE:

When the robot gets broken, the machine also has to be stopped. The robot can be checked on its spot if the problem is easy to solve, or can be taken from its position. When the robot is taken out, the die casting process can be continued manually by a worker to save time and money. As described earlier, the robot and its pedestal can be removed from its spot without any problem. The robot can also be taken off from its pedestal since everything is fixed with screws.

After maintenance is done, the robot and its pedestal will need to be placed on the exact same spot. Because of the holes in the ground and the pedestal, it is easy to make sure that everything is again on the same position. The only thing which needs to be done is the recalibration of the robot. Since maintenance was performed on the robot, the calibration of the robot could be wrong. After the calibration, the program has to be tested again, if everything goes well, and the die casting process can be restarted.

4. CONCLUDING REMARKS

4. Concluding remarks

The goal of this project, carried out at Fundwell company, was to automate the unloading and checking operations of a die casting machine. At the end of the internship, I can proudly state that the project was accomplished successfully. The robot worked and everything was automated. I never had an internship before and it was a true enrichment for me. I was a totally different way of studying and I learned a lot on a technical and social level. In Belgium, I probably would not had the chance to do a project in the field. For me this was a fantastic opportunity.

During my internship, I was challenged a lot. I had to use the knowledge and skills which I already had but I also developed new skills. I had to make CAD drawings and simulations for the robot. I had to make a placement plan and had to think about the pedestal. For the CAD drawings, I used Inventor® software. This program was already familiar to me and this internship helped me to maintain these skills. The robot simulation and programming were new for me. I heard from the program RobotStudio® before but I had no experience in that. I learned through some tutorials and instruction manuals how to make a simulation and a program. This was the biggest new skill I earned during this Erasmus project.

On a social level, I also learned a lot. I learned to cooperate with people with a totally different way of thinking. I think that from all Portuguese people I met and with the ones I had to work with, that they all were very helpful, nice and friendly. Even if their English was not the best they still tried to communicate and they explained everything I asked them. They made me feel very comfortable and I never had the feeling I was not welcome. Working with my boss was not always the easiest but we made it and I learned a lot of it.

I did this internship at ISEP in the master degree in Mechanical Engineering. From the beginning, they were very kind and helpful. Everything was new for me but I felt no worries about the project at all. Because of the good care of Professor Francisco Silva, a lot of stress was taken away. I really had the feeling that they cared about their Erasmus students. They gave me the opportunity to learn how it is to work in a Portuguese company and how people work here in this country. Because of them I had the chance to learn things I would never have learned in my home country. This was for me a life experience to never forget.

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6. APPENDIXES

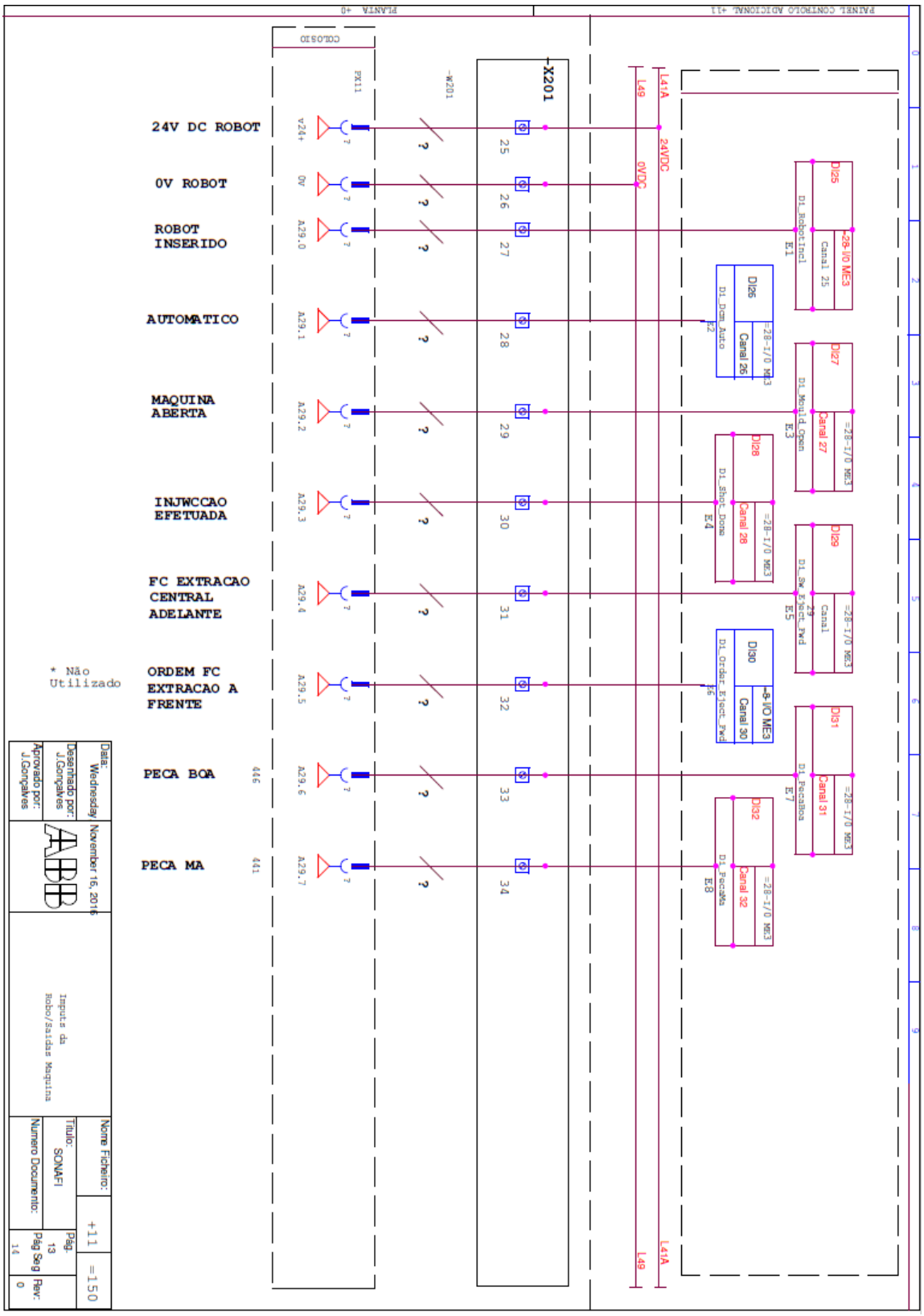
6. Appendixes

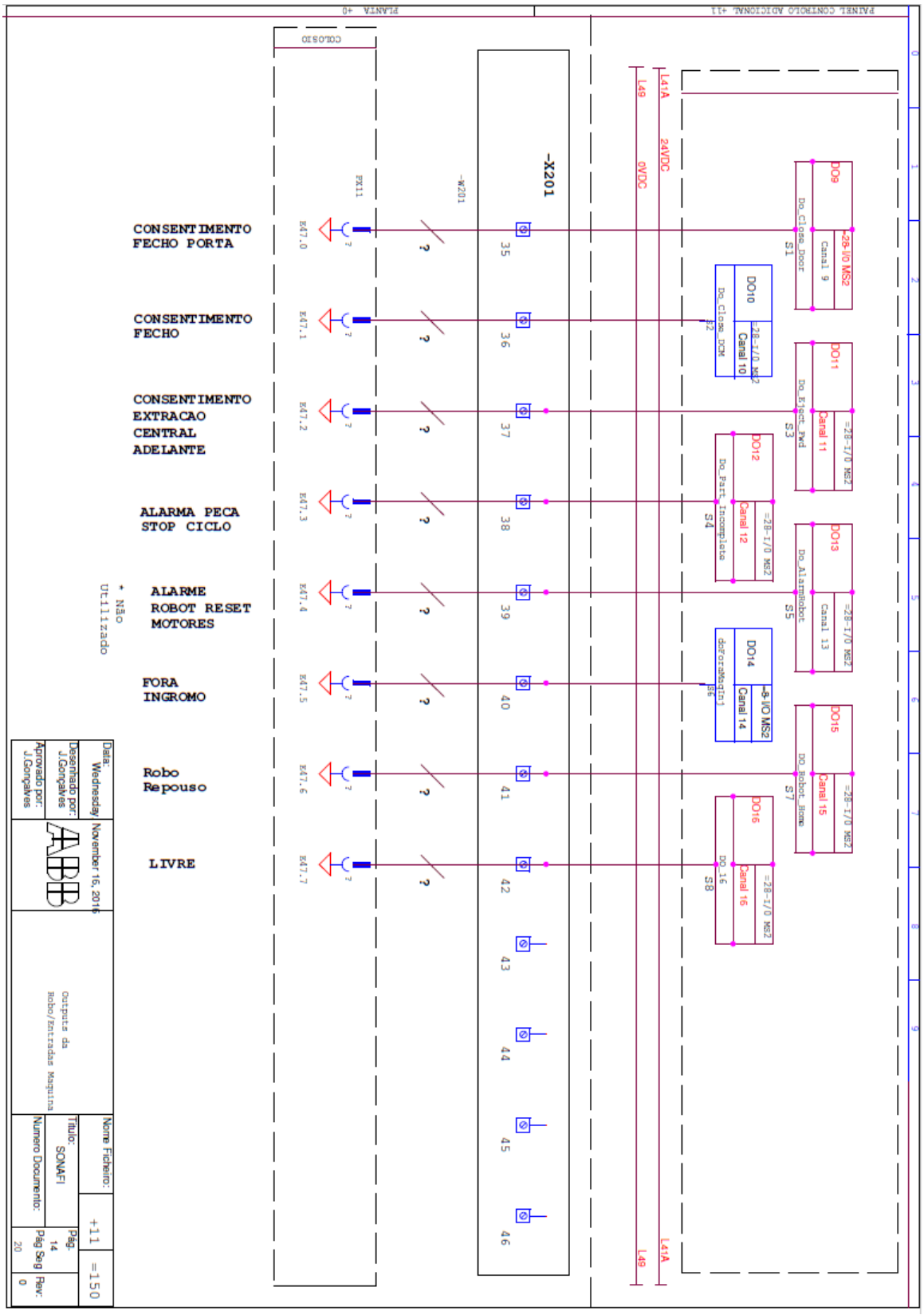
Appendix I includes the electric schemes needed to connect the wires to the right sensor of the die casting machine in order to have good communication between robot and die casting machine

Appendix II includes the program code written for the robot to unload the die casting machine.

APPENDIX I

ELEKTRIC SCHEME


24V DC ROBOT
0V ROBOT
ROBOT INSERIDO
AUTOMATICO
MAQUINA ABERTA
INJWCCAO EFETUADA
FC EXTRACAO CENTRAL ADELANTE
ORDEM FC EXTRACAO A FRENTE
PECA BOA
PECA MA
* Não Utilizado
+X201
24VDC
0VDC
Inputs da Robo/Saidas Maquina
Nome Ficheiro: +11 =150
Titulo: SONAFI
Numero Documento:
Pág: 13
Pág Seg 14
Rev: 0
Data: Wednesday, November 16, 2016
Desenhado por: J.Gonçalves
Aprovado por: J.Gonçalves


PAINEL CONTROLO ADICIONAL +11
PLANTA +0
-X201
CONSENTIMENTO FECHO PORTA
CONSENTIMENTO FECHO
CONSENTIMENTO EXTRACAO CENTRAL ADELANTE
ALARMA PECA STOP CICLO
ALARME ROBOT RESET MOTORES
FORA INGROMO
Robo Repouso
LIVRE
* Não Utilizado
24VDC
0VDC
Outputs da Robo/Entradas Maquina
Nome Ficheiro: +11
Titulo: SONAFI
Numero Documento: =150
Pag: 14
Pag Seg: 20
Rev: 0
Data: Wednesday November 16, 2016
Desenhado por: J.Gonçalves
Aprovado por: J.Gonçalves

APPENDIX II

PROGRAM CODE

```
MODULE FUNDWELL2017
  ! ***********************************************************
  !
  ! Programa Principal p/ Robô IRB1600
  ! Contem toda estrutura do programa
  ! Programa apoiado por duas Task
  ! T_ROB1 - Programa Principal
  ! SPRAY_AUX - Controlo Pinça Spray em Manual(Multitask)
  !
  ! Versão: 1
  ! Data:   7/05/2007
  ! Autor:  ABB J.Gonçalves
  !
  ! Versão: 2
  ! Data:   11/05/2009
  ! Autor:  ABB L.Vieira
  !
  ! Alterações
  ! Data: 2009-07-06
  ! Autor: Rui Guimarães
  ! 1-Comentadas as instruções do sinal doIniCicloMaq
  ! 2-Alterado nome de DO doFechaPortaMaq para doPer_FechoMolde
  ! 3-CONST pos posCanto1ZColos:=[-3000,160,-3000]; alterada posição em y de 155 para 180
  ! 4-alterado pulso de recua pistão para 2s
  ! 5-alterados pontos pRampaMaq80 , pRampaMaq90
  ! Data: 2009-07-06
  ! Autor: Luis Vieira
  ! Modificação extrutura do programa para suportar 10 moldes diferentes
  ! Rotinas relativas a cada molde do tipo "rPROG_"
  !***********************************************************
    !TCP
    !PERS tooldata tPinca:=[TRUE,[[-380,0,55],[1,0,0,0]],[4,[-200,0,35],[1,0,0,0],0,0,0]];
    PERS tooldata tPinca:=[TRUE,[[-380,0,55],[1,0,0,0]],[6,[-200,0,35],[1,0,0,0],0,0,0]];
    !Trajectórias
    LOCAL CONST robtarget pRepouso := [[352.41,0.00,743.40],
[0.521634,-2.29654E-05,0.853169,-1.65473E-06],[0,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pCRITICO := [[-3.58,149.98,1218.74],[0.496414,-0.507513,0.502911,0.493036],
[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    PERS robtarget  pActual:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E+09,9E
+09,9E+09,9E+09,9E+09]];
    !Pontos para Máquina
    CONST robtarget pMaq10:=[[90.39,470.74,895.43],[0.489195,-0.510584,0.489192,-0.510572],
[1,-2,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq20:=[[95.57,789.71,648.89],[0.489164,-0.510595,0.489184,-0.510597],
[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq30:=[[82.37,1293.29,584.23],[0.489139,-0.510644,0.489135,-0.51062],
[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq40:=[[99.95,1293.27,586.24],[0.489102,-0.510688,0.489092,-0.510653],
[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq50:=[[120.58,1293.27,586.24],[0.489101,-0.510689,0.489091,-0.510654],
[0,-2,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq60:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E+09,9E
+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq70:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E+09,9E
+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq80:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E+09,9E
+09,9E+09,9E+09,9E+09]];
```

```
    !Pontos para Máquina PROG 1
    CONST robtarget pMaq10_1:=[[90.39,470.74,895.43],[0.489195,-0.510584,0.489192,-0.510572],
[1,-2,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq20_1:=[[-5.96,967.71,905.98],[0.509222,-0.493793,0.510222,-0.486348],
[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq30_1:=[[-11.34,1575.20,890.11],[0.509222,-0.493793,0.510222,-0.486349],
[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq40_1:=[[13.66,1575.20,890.11],[0.509221,-0.493792,0.510224,-0.486348],
[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq50_1:=[[118.46,1577.27,891.57],[0.513919,-0.498267,0.508041,-0.479074],
[0,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq60_1:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E+09,9E
+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq70_1:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E+09,9E
+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq80_1:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E+09,9E
+09,9E+09,9E+09,9E+09]];
    !Pontos para Máquina PROG 2
    CONST robtarget pMaq10_2:=[[90.39,470.74,895.43],[0.489195,-0.510584,0.489192,-0.510572],
[1,-2,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq20_2:=[[95.57,789.71,648.89],[0.489164,-0.510595,0.489184,-0.510597],
[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq30_2:=[[82.37,1293.29,584.23],[0.489139,-0.510644,0.489135,-0.51062],
[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq40_2:=[[54.40,1293.27,586.21],[0.489081,-0.510694,0.489086,-0.510672],
[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq50_2:=[[144.61,1293.26,586.19],[0.489076,-0.510712,0.489065,-0.510679],
[0,-2,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq60_2:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E+09,9E
+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq70_2:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E+09,9E
+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq80_2:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E+09,9E
+09,9E+09,9E+09,9E+09]];
    !Pontos para Máquina PROG 3
    CONST robtarget pMaq10_3:=[[90.39,470.74,895.43],[0.489195,-0.510584,0.489192,-0.510572],
[1,-2,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq20_3:=[[95.57,789.71,648.89],[0.489164,-0.510595,0.489184,-0.510597],
[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq30_3:=[[82.37,1293.29,584.23],[0.489139,-0.510644,0.489135,-0.51062],
[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq40_3:=[[148.75,1293.29,584.17],[0.489113,-0.510674,0.489105,-0.510644],
[0,-2,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq50_3:=[[120.58,1293.27,586.24],[0.489101,-0.510689,0.489091,-0.510654],
[0,-2,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq60_3:=[[61.02,1292.89,584.12],[0.489088,-0.510671,0.489103,-0.510672],
[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq70_3:=[[54.05,789.71,648.86],[0.489138,-0.510608,0.489169,-0.510625],
[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq80_3:=[[14.25,593.12,810.50],[0.0619991,-0.701353,0.705574,0.0801528],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    !Pontos para Máquina PROG 4
    CONST robtarget pMaq10_4:=[[90.39,470.74,895.43],[0.489195,-0.510584,0.489192,-0.510572],
[1,-2,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq20_4:=[[95.57,789.71,648.89],[0.489164,-0.510595,0.489184,-0.510597],
[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq30_4:=[[82.37,1293.29,584.23],[0.489139,-0.510644,0.489135,-0.51062],
[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
```

```
    CONST robtarget pMaq40_4:=[[99.95,1293.27,586.24],[0.489102,-0.510688,0.489092,-0.510653],
[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq50_4:=[[134.24,1293.27,586.24],[0.489099,-0.510689,0.489093,-0.510654],
[0,-2,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq60_4:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E+09,9E
+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq70_4:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E+09,9E
+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq80_4:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E+09,9E
+09,9E+09,9E+09,9E+09]];
    !Pontos para Máquina PROG 5
    CONST robtarget pMaq10_5:=[[90.39,470.74,895.43],[0.489195,-0.510584,0.489192,-0.510572],
[1,-2,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq20_5:=[[95.57,789.71,648.89],[0.489164,-0.510595,0.489184,-0.510597],
[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq30_5:=[[82.37,1293.29,584.23],[0.489139,-0.510644,0.489135,-0.51062],
[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq40_5:=[[99.95,1293.27,586.24],[0.489102,-0.510688,0.489092,-0.510653],
[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq50_5:=[[120.58,1293.27,586.24],[0.489101,-0.510689,0.489091,-0.510654],
[0,-2,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq60_5:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E+09,9E
+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq70_5:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E+09,9E
+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq80_5:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E+09,9E
+09,9E+09,9E+09,9E+09]];
    !Pontos para Máquina PROG 6
    CONST robtarget pMaq10_6:=[[90.39,470.74,895.43],[0.489195,-0.510584,0.489192,-0.510572],
[1,-2,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq20_6:=[[95.57,789.71,648.89],[0.489164,-0.510595,0.489184,-0.510597],
[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq30_6:=[[82.37,1293.29,584.23],[0.489139,-0.510644,0.489135,-0.51062],
[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq40_6:=[[99.95,1293.27,586.24],[0.489102,-0.510688,0.489092,-0.510653],
[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq50_6:=[[120.58,1293.27,586.24],[0.489101,-0.510689,0.489091,-0.510654],
[0,-2,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq60_6:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E+09,9E
+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq70_6:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E+09,9E
+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq80_6:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E+09,9E
+09,9E+09,9E+09,9E+09]];

    !Pontos para Teste fora da Maquina
    CONST robtarget pMaq10T:=[[290.08,30.19,1173.89],[0.705053,-0.0329527,0.708317,0.0100702],
[0,0,-1,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq20T:=[[224.03,26.06,1302.66],[0.768591,-0.0296222,0.638958,0.0111012],
[0,0,-1,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq30T:=[[383.26,41.72,1332.45],[0.614198,-0.0480853,0.787468,0.0184967],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq40T:=[[379.55,75.57,1411.93],[0.614391,-0.0834145,0.784527,-0.00911064],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq50T:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E+09,9E
+09,9E+09,9E+09,9E+09]];
    !Pontos para Teste nas FotoCélulas
    CONST robtarget pCelulas10:=[[528.84,113.04,1545.16],[0.71048,-0.0107142,0.70353,-0.0122083],
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[0,1,-2,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pCelulas20:=[[547.81,128.55,1535.59],[0.703879,-0.0127606,0.708636,-0.0471835],
[0,1,-2,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pCelulas30:=[[396.96,101.45,1545.17],[0.710481,-0.010716,0.703529,-0.0122085],
[0,1,-2,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pCelulas40:=[[226.91,-6.47,1383.64],[0.696409,-0.103297,0.669946,0.235619],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pCelulas50:=[[610.63,-192.65,890.42],[0.325781,0.283532,0.814444,0.387502],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    !Pontos para Teste nas FotoCélulas PROG 1
    CONST robtarget pCelulas10_1:=[[382.95,453.73,1629.09],[0.707164,0.00884277,0.706707,0.020145],
[0,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pCelulas20_1:=[[505.68,453.80,1654.26],[0.707213,0.00875933,0.70666,0.0200857],
[0,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pCelulas30_1:=[[382.95,453.73,1629.09],[0.707166,0.00884104,0.706705,0.0201439],
[0,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pCelulas40_1:=[[376.95,210.06,1678.94],[0.731083,0.149193,0.664474,-0.0416331],
[0,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pCelulas50_1:=[[585.37,-194.92,1296.04],[0.497955,0.193758,0.709929,0.458803],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    !Pontos para Teste nas FotoCélulas PROG 2
    CONST robtarget pCelulas10_2:=[[421.49,119.28,1539.20],
[0.707304,-0.0058643,0.706339,-0.0277783],[0,1,-2,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pCelulas20_2:=[[517.64,125.18,1538.48],
[0.706997,-0.0162289,0.706342,-0.0311841],[0,1,-2,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pCelulas30_2:=[[396.96,101.45,1545.17],[0.710481,-0.010716,0.703529,-0.0122085],
[0,1,-2,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pCelulas40_2:=[[226.91,-6.47,1383.64],[0.696409,-0.103297,0.669946,0.235619],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pCelulas50_2:=[[610.63,-192.65,890.42],[0.325781,0.283532,0.814444,0.387502],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    !Pontos para Teste nas FotoCélulas PROG 3
    CONST robtarget pCelulas10_3:=[[408.01,154.14,1320.39],
[0.710191,-0.0106929,0.703826,-0.0119775],[0,0,-1,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pCelulas20_3:=[[518.96,155.35,1320.40],[0.71019,-0.0106929,0.703827,-0.0119773],
[0,0,-1,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pCelulas30_3:=[[352.50,155.33,1320.40],
[0.710191,-0.0106916,0.703826,-0.0119728],[0,0,-1,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pCelulas40_3:=[[226.91,-6.47,1383.64],[0.696409,-0.103297,0.669946,0.235619],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pCelulas50_3:=[[610.63,-192.65,890.42],[0.325781,0.283532,0.814444,0.387502],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    !Pontos para Teste nas FotoCélulas PROG 4
    CONST robtarget pCelulas10_4:=[[517.19,69.93,1538.80],[0.706976,-0.0132251,0.70624,-0.0351449],
[0,1,-2,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pCelulas20_4:=[[566.90,69.92,1538.80],[0.706976,-0.0132196,0.70624,-0.035144],
[0,1,-2,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pCelulas30_4:=[[396.96,101.45,1545.17],[0.710481,-0.010716,0.703529,-0.0122085],
[0,1,-2,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pCelulas40_4:=[[226.91,-6.47,1383.64],[0.696409,-0.103297,0.669946,0.235619],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pCelulas50_4:=[[564.48,-238.05,930.21],[0.399071,0.3224,0.783506,0.350596],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    !Pontos para Teste nas FotoCélulas PROG 5
    CONST robtarget pCelulas10_5:=[[528.84,113.04,1545.16],[0.71048,-0.0107142,0.70353,-0.0122083],
[0,1,-2,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pCelulas20_5:=[[547.81,128.55,1535.59],
[0.703879,-0.0127606,0.708636,-0.0471835],[0,1,-2,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
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    CONST robtarget pCelulas30_5:=[[396.96,101.45,1545.17],[0.710481,-0.010716,0.703529,-0.0122085],
[0,1,-2,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pCelulas40_5:=[[226.91,-6.47,1383.64],[0.696409,-0.103297,0.669946,0.235619],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pCelulas50_5:=[[610.63,-192.65,890.42],[0.325781,0.283532,0.814444,0.387502],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    !Pontos para Teste nas FotoCélulas PROG 6
    CONST robtarget pCelulas10_6:=[[528.84,113.04,1545.16],[0.71048,-0.0107142,0.70353,-0.0122083],
[0,1,-2,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pCelulas20_6:=[[547.81,128.55,1535.59],
[0.703879,-0.0127606,0.708636,-0.0471835],[0,1,-2,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pCelulas30_6:=[[396.96,101.45,1545.17],[0.710481,-0.010716,0.703529,-0.0122085],
[0,1,-2,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pCelulas40_6:=[[226.91,-6.47,1383.64],[0.696409,-0.103297,0.669946,0.235619],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pCelulas50_6:=[[610.63,-192.65,890.42],[0.325781,0.283532,0.814444,0.387502],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];

    !Pontos para inserir a peça para voltear na mesa de apoio
    CONST robtarget pSuporteColoca10:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E
+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSuporteColoca20:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E
+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSuporteColoca30:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E
+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSuporteColoca40:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E
+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSuporteColoca50:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E
+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSuporteColoca60:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E
+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    !Pontos para retirar a peça depois de voltear na mesa de apoio
    CONST robtarget pSuporteRetira10:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E
+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSuporteRetira20:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E
+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSuporteRetira30:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E
+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSuporteRetira40:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E
+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSuporteRetira50:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E
+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSuporteRetira60:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E
+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    !Pontoos para Retirar gito da prensa (NÃO ESTA A SER UTILIZADO NESTA VERSÃO)
    CONST robtarget pGito10:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E+09,9E
+09,9E+09,9E+09,9E+09]];
    CONST robtarget pGito20:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E+09,9E
+09,9E+09,9E+09,9E+09]];
    CONST robtarget pGito30:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E+09,9E
+09,9E+09,9E+09,9E+09]];
    CONST robtarget pGito40:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E+09,9E
+09,9E+09,9E+09,9E+09]];
    CONST robtarget pGito50:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E+09,9E
+09,9E+09,9E+09,9E+09]];
    CONST robtarget pGito60:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E+09,9E
+09,9E+09,9E+09,9E+09]];
    CONST robtarget pGito70:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E+09,9E
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+09,9E+09,9E+09,9E+09]];
    CONST robtarget pGito80:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E+09,9E ↵
+09,9E+09,9E+09,9E+09]];
    CONST robtarget pGito90:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E+09,9E ↵
+09,9E+09,9E+09,9E+09]];
    !Pontos para para soprar a prensa (NÃO ESTA A SER UTILIZADO NESTA VERSÃO)
    CONST robtarget pSoproP10:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E ↵
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSoproP20:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E ↵
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSoproP30:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E ↵
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSoproP40:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E ↵
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSoproP50:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E ↵
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSoproP60:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E ↵
+09,9E+09,9E+09,9E+09,9E+09]];

    !Pontos para colocar a peça na rampa
    CONST robtarget pRampaMaq10:=[[752.60,43.41,671.24],[0.0157226,-0.0235841,0.999511,0.0132255], ↵
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq20:=[[991.11,31.27,369.85],[0.0157248,-0.0235819,0.999511,0.0132259], ↵
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq30:=[[1020.35,104.58,324.03],[0.039029,0.282106,-0.958566,-0.00661801], ↵
[-1,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq40:=[[1020.35,104.58,324.03],[0.0390278,0.2821,-0.958568,-0.00661824], ↵
[-1,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq50:=[[1020.33,91.77,178.64],[0.0390447,0.282132,-0.958558,-0.00662356], ↵
[-1,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq60:=[[1370.88,115.27,151.31], ↵
[0.0251301,0.282135,-0.959045,-0.00103563],[-1,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq70:=[[1247,44,350.65],[0.0390362,0.282101,-0.958567,-0.00662073], ↵
[-1,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq80:=[[1049.59,15.37,345.51],[0.0390506,0.282097,-0.958568,-0.00662572], ↵
[-1,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq90:=[[263.91,20.99,1220.40],[0.714182,-0.0307182,0.697696,0.0471247], ↵
[0,0,-1,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq100:=[[247.03,95.14,1222.03],[0.699917,-0.131023,0.68597,0.149647], ↵
[0,-1,0,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    !Pontos para colocar a peça na rampa PROG 1
    CONST robtarget pRampaMaq10_1:=[[752.60,43.41,847.29],[0.0157224,-0.0235858,0.999511,0.0132247], ↵
[0,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq20_1:=[[784.45,318.45,761.72],[0.015762,-0.0235852,0.99951,0.0132216], ↵
[0,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq30_1:=[[784.45,318.45,587.66],[0.0157619,-0.0235899,0.99951,0.0132199], ↵
[0,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq40_1:=[[1020.35,104.58,324.03], ↵
[0.0390278,0.2821,-0.958568,-0.00661824],[-1,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq50_1:=[[871.49,322.71,422.86], ↵
[0.0284255,0.0241452,-0.99923,-0.0121653],[0,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq60_1:=[[1124.45,328.08,419.10], ↵
[0.0243532,0.0240992,-0.999338,-0.012262],[0,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq70_1:=[[1124.45,328.08,639.97], ↵
[0.0243495,0.0240981,-0.999338,-0.0122639],[0,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq80_1:=[[798.25,197.38,796.44], ↵
[0.0243444,0.024101,-0.999338,-0.0122672],[0,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq90_1:=[[263.91,20.99,1220.40],[0.714182,-0.0307182,0.697696,0.0471247], ↵
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[0,0,-1,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq100_1:=[[247.03,95.14,1222.03],[0.699917,-0.131023,0.68597,0.149647],
[0,-1,0,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    !Pontos para colocar a peça na rampa PROG 2
    CONST robtarget pRampaMaq10_2:=[[752.60,43.41,671.24],[0.0157226,-0.0235841,0.999511,0.0132255],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq20_2:=[[991.11,31.27,369.85],[0.0157248,-0.0235819,0.999511,0.0132259],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq30_2:=[[1020.35,104.58,324.03],
[0.039029,0.282106,-0.958566,-0.00661801],[-1,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq40_2:=[[1020.35,104.58,324.03],
[0.0390278,0.2821,-0.958568,-0.00661824],[-1,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq50_2:=[[1020.33,91.77,178.64],
[0.0390447,0.282132,-0.958558,-0.00662356],[-1,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq60_2:=[[1370.88,115.27,151.31],
[0.0251301,0.282135,-0.959045,-0.00103563],[-1,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq70_2:=[[1247,44,350.65],[0.0390362,0.282101,-0.958567,-0.00662073],
[-1,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq80_2:=[[1049.59,15.37,345.51],
[0.0390506,0.282097,-0.958568,-0.00662572],[-1,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq90_2:=[[263.91,20.99,1220.40],[0.714182,-0.0307182,0.697696,0.0471247],
[0,0,-1,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq100_2:=[[247.03,95.14,1222.03],[0.699917,-0.131023,0.68597,0.149647],
[0,-1,0,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    !Pontos para colocar a peça na rampa PROG 3
    CONST robtarget pRampaMaq10_3:=[[752.60,43.41,671.24],[0.0157226,-0.0235841,0.999511,0.0132255],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq20_3:=[[991.11,31.27,369.85],[0.0157248,-0.0235819,0.999511,0.0132259],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq30_3:=[[1020.35,104.58,324.03],
[0.039029,0.282106,-0.958566,-0.00661801],[-1,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq40_3:=[[1020.35,104.58,324.03],
[0.0390278,0.2821,-0.958568,-0.00661824],[-1,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq50_3:=[[1020.33,91.77,178.64],
[0.0390447,0.282132,-0.958558,-0.00662356],[-1,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq60_3:=[[1370.88,115.27,151.31],
[0.0251301,0.282135,-0.959045,-0.00103563],[-1,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq70_3:=[[1247,44,350.65],[0.0390362,0.282101,-0.958567,-0.00662073],
[-1,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq80_3:=[[1049.59,15.37,345.51],
[0.0390506,0.282097,-0.958568,-0.00662572],[-1,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq90_3:=[[263.91,20.99,1220.40],[0.714182,-0.0307182,0.697696,0.0471247],
[0,0,-1,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq100_3:=[[247.03,95.14,1222.03],[0.699917,-0.131023,0.68597,0.149647],
[0,-1,0,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    !Pontos para colocar a peça na rampa PROG 4
    CONST robtarget pRampaMaq10_4:=[[752.60,43.41,671.24],[0.0157226,-0.0235841,0.999511,0.0132255],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq20_4:=[[991.11,31.27,369.85],[0.0157248,-0.0235819,0.999511,0.0132259],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq30_4:=[[1020.35,104.58,324.03],
[0.039029,0.282106,-0.958566,-0.00661801],[-1,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq40_4:=[[1020.35,104.58,324.03],
[0.0390278,0.2821,-0.958568,-0.00661824],[-1,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq50_4:=[[1020.33,91.77,178.64],
[0.0390447,0.282132,-0.958558,-0.00662356],[-1,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq60_4:=[[1369.29,145.97,148.03],
[0.0302104,0.282358,-0.95883,-0.00265082],[-1,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
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    CONST robtarget pRampaMaq70_4:=[[1369.29,145.97,195.86],
[0.0302107,0.282358,-0.958829,-0.00265185],[-1,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq80_4:=[[1049.59,15.37,345.51],
[0.0390506,0.282097,-0.958568,-0.00662572],[-1,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq90_4:=[[263.91,20.99,1220.40],[0.714182,-0.0307182,0.697696,0.0471247],
[0,0,-1,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq100_4:=[[247.03,95.14,1222.03],[0.699917,-0.131023,0.68597,0.149647],
[0,-1,0,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    !Pontos para colocar a peça na rampa PROG 5
    CONST robtarget pRampaMaq10_5:=[[752.60,43.41,671.24],[0.0157226,-0.0235841,0.999511,0.0132255],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq20_5:=[[991.11,31.27,369.85],[0.0157248,-0.0235819,0.999511,0.0132259],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq30_5:=[[1020.35,104.58,324.03],
[0.039029,0.282106,-0.958566,-0.00661801],[-1,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq40_5:=[[1020.35,104.58,324.03],
[0.0390278,0.2821,-0.958568,-0.00661824],[-1,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq50_5:=[[1020.33,91.77,178.64],
[0.0390447,0.282132,-0.958558,-0.00662356],[-1,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq60_5:=[[1370.88,115.27,151.31],
[0.0251301,0.282135,-0.959045,-0.00103563],[-1,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq70_5:=[[1247,44,350.65],[0.0390362,0.282101,-0.958567,-0.00662073],
[-1,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq80_5:=[[1049.59,15.37,345.51],
[0.0390506,0.282097,-0.958568,-0.00662572],[-1,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq90_5:=[[263.91,20.99,1220.40],[0.714182,-0.0307182,0.697696,0.0471247],
[0,0,-1,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq100_5:=[[247.03,95.14,1222.03],[0.699917,-0.131023,0.68597,0.149647],
[0,-1,0,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    !Pontos para colocar a peça na rampa PROG 6
    CONST robtarget pRampaMaq10_6:=[[752.60,43.41,671.24],[0.0157226,-0.0235841,0.999511,0.0132255],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq20_6:=[[991.11,31.27,369.85],[0.0157248,-0.0235819,0.999511,0.0132259],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq30_6:=[[1020.35,104.58,324.03],
[0.039029,0.282106,-0.958566,-0.00661801],[-1,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq40_6:=[[1020.35,104.58,324.03],
[0.0390278,0.2821,-0.958568,-0.00661824],[-1,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq50_6:=[[1020.33,91.77,178.64],
[0.0390447,0.282132,-0.958558,-0.00662356],[-1,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq60_6:=[[1370.88,115.27,151.31],
[0.0251301,0.282135,-0.959045,-0.00103563],[-1,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq70_6:=[[1247,44,350.65],[0.0390362,0.282101,-0.958567,-0.00662073],
[-1,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq80_6:=[[1049.59,15.37,345.51],
[0.0390506,0.282097,-0.958568,-0.00662572],[-1,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq90_6:=[[263.91,20.99,1220.40],[0.714182,-0.0307182,0.697696,0.0471247],
[0,0,-1,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pRampaMaq100_6:=[[247.03,95.14,1222.03],[0.699917,-0.131023,0.68597,0.149647],
[0,-1,0,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];

    !Pontos para mergulhar a peça na tina da água
    CONST robtarget pTina10:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E+09,9E
+09,9E+09,9E+09,9E+09]];
    CONST robtarget pTina20:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E+09,9E
+09,9E+09,9E+09,9E+09]];
    CONST robtarget pTina30:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E+09,9E
+09,9E+09,9E+09,9E+09]];
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    CONST robtarget pTina40:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E+09,9E
+09,9E+09,9E+09,9E+09]];
    CONST robtarget pTina50:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E+09,9E
+09,9E+09,9E+09,9E+09]];
    CONST robtarget pTina60:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E+09,9E
+09,9E+09,9E+09,9E+09]];
    CONST robtarget pTina70:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E+09,9E
+09,9E+09,9E+09,9E+09]];
    CONST robtarget pTina80:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E+09,9E
+09,9E+09,9E+09,9E+09]];
    !Pontos para a Prensa
    CONST robtarget pPrensaColos10:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pPrensaColos20:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pPrensaColos30:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pPrensaColos40:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pPrensaColos50:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pPrensaColos60:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pPrensaColos70:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pPrensaColos80:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pPrensaColos90:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pPrensaColos100:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E
+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pPrensaColos110:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E
+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pPrensaColos120:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E
+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pPrensaColos130:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E
+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pPrensaColos140:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E
+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    !Pontos para a prensa de masselotes
    CONST robtarget pPrensaMass10:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pPrensaMass20:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pPrensaMass30:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pPrensaMass40:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pPrensaMass50:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pPrensaMass60:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pPrensaMass70:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pPrensaMass80:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pPrensaMass90:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
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    CONST robtarget pPrensaMass100:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pPrensaMass110:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pPrensaMass120:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pPrensaMass130:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pPrensaMass140:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];

    !Pontos para colocar peça c/ defeito no lixo
    CONST robtarget pLixoMaq10 := [[556.14,-340.38,642.91],[0.257319,0.598637,0.747574,0.128662],
[0,0,0,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLixoMaq20:=[[-269.54,-708.39,1000.62],[0.308147,0.682782,0.474365,-0.46242],
[-2,0,-1,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLixoMaq30:=[[-775.51,-1195.83,271.58],
[0.00949633,0.934252,0.356283,-0.0120237],[-2,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLixoMaq40:=[[-914.12,-1317.26,-176.34],[0.0268486,-0.8693,-0.490625,-0.053705],
[-2,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLixoMaq50:=[[-274.63,-765.15,849.83],[0.235485,0.745353,0.523834,-0.338516],
[-2,0,-1,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLixoMaq60:=[[603.73,-326.41,999.40],[0.56725,0.190876,0.786657,-0.151541],
[-1,-1,-1,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLixoMaq70:=[[-6.45,17.70,1229.88],[0.725404,-0.287218,0.405304,0.476469],
[0,-1,-1,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    !Pontos para colocar peça c/ defeito no lixo PROG 1
    CONST robtarget pLixoMaq10_1:=[[556.14,-340.38,642.91],[0.257319,0.598637,0.747574,0.128662],
[0,0,0,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLixoMaq20_1:=[[-269.54,-708.39,1000.62],[0.308147,0.682782,0.474365,-0.46242],
[-2,0,-1,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLixoMaq30_1:=[[-775.50,-814.90,561.01],
[0.00949597,0.934251,0.356286,-0.0120227],[-2,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLixoMaq40_1:=[[-775.51,-814.90,255.16],
[0.00949715,0.934252,0.356285,-0.0120237],[-2,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLixoMaq50_1:=[[-274.63,-765.15,849.83],[0.235485,0.745353,0.523834,-0.338516],
[-2,0,-1,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLixoMaq60_1:=[[603.73,-326.41,999.40],[0.56725,0.190876,0.786657,-0.151541],
[-1,-1,-1,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLixoMaq70_1:=[[-6.45,17.70,1229.88],[0.725404,-0.287218,0.405304,0.476469],
[0,-1,-1,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    !Pontos para colocar peça c/ defeito no lixo PROG 2
    CONST robtarget pLixoMaq10_2:=[[556.14,-340.38,642.91],[0.257319,0.598637,0.747574,0.128662],
[0,0,0,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLixoMaq20_2:=[[-269.54,-708.39,1000.62],[0.308147,0.682782,0.474365,-0.46242],
[-2,0,-1,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLixoMaq30_2:=[[-775.51,-1195.83,271.58],
[0.00949633,0.934252,0.356283,-0.0120237],[-2,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLixoMaq40_2:=[[-914.12,-1317.26,-176.34],
[0.0268486,-0.8693,-0.490625,-0.053705],[-2,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLixoMaq50_2:=[[-274.63,-765.15,849.83],[0.235485,0.745353,0.523834,-0.338516],
[-2,0,-1,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLixoMaq60_2:=[[603.73,-326.41,999.40],[0.56725,0.190876,0.786657,-0.151541],
[-1,-1,-1,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLixoMaq70_2:=[[-6.45,17.70,1229.88],[0.725404,-0.287218,0.405304,0.476469],
[0,-1,-1,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    !Pontos para colocar peça c/ defeito no lixo PROG 3
    CONST robtarget pLixoMaq10_3:=[[556.14,-340.38,642.91],[0.257319,0.598637,0.747574,0.128662],
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[0,0,0,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLixoMaq20_3:=[[-269.54,-708.39,1000.62],[0.308147,0.682782,0.474365,-0.46242],
[-2,0,-1,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLixoMaq30_3:=[[-775.51,-1195.83,271.58],
[0.00949633,0.934252,0.356283,-0.0120237],[-2,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLixoMaq40_3:=[[-914.12,-1317.26,-176.34],
[0.0268486,-0.8693,-0.490625,-0.053705],[-2,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLixoMaq50_3:=[[-274.63,-765.15,849.83],[0.235485,0.745353,0.523834,-0.338516],
[-2,0,-1,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLixoMaq60_3:=[[603.73,-326.41,999.40],[0.56725,0.190876,0.786657,-0.151541],
[-1,-1,-1,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLixoMaq70_3:=[[-6.45,17.70,1229.88],[0.725404,-0.287218,0.405304,0.476469],
[0,-1,-1,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    !Pontos para colocar peça c/ defeito no lixo PROG 4
    CONST robtarget pLixoMaq10_4:=[[556.14,-340.38,642.91],[0.257319,0.598637,0.747574,0.128662],
[0,0,0,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLixoMaq20_4:=[[-269.54,-708.39,1000.62],[0.308147,0.682782,0.474365,-0.46242],
[-2,0,-1,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLixoMaq30_4:=[[-775.51,-1195.83,271.58],
[0.00949633,0.934252,0.356283,-0.0120237],[-2,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLixoMaq40_4:=[[-914.12,-1317.26,-176.34],
[0.0268486,-0.8693,-0.490625,-0.053705],[-2,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLixoMaq50_4:=[[-274.63,-765.15,849.83],[0.235485,0.745353,0.523834,-0.338516],
[-2,0,-1,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLixoMaq60_4:=[[603.73,-326.41,999.40],[0.56725,0.190876,0.786657,-0.151541],
[-1,-1,-1,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLixoMaq70_4:=[[-6.45,17.70,1229.88],[0.725404,-0.287218,0.405304,0.476469],
[0,-1,-1,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    !Pontos para colocar peça c/ defeito no lixo PROG 5
    CONST robtarget pLixoMaq10_5:=[[556.14,-340.38,642.91],[0.257319,0.598637,0.747574,0.128662],
[0,0,0,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLixoMaq20_5:=[[-269.54,-708.39,1000.62],[0.308147,0.682782,0.474365,-0.46242],
[-2,0,-1,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLixoMaq30_5:=[[-775.51,-1195.83,271.58],
[0.00949633,0.934252,0.356283,-0.0120237],[-2,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLixoMaq40_5:=[[-914.12,-1317.26,-176.34],
[0.0268486,-0.8693,-0.490625,-0.053705],[-2,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLixoMaq50_5:=[[-274.63,-765.15,849.83],[0.235485,0.745353,0.523834,-0.338516],
[-2,0,-1,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLixoMaq60_5:=[[603.73,-326.41,999.40],[0.56725,0.190876,0.786657,-0.151541],
[-1,-1,-1,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLixoMaq70_5:=[[-6.45,17.70,1229.88],[0.725404,-0.287218,0.405304,0.476469],
[0,-1,-1,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    !Pontos para colocar peça c/ defeito no lixo PROG 6
    CONST robtarget pLixoMaq10_6:=[[556.14,-340.38,642.91],[0.257319,0.598637,0.747574,0.128662],
[0,0,0,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLixoMaq20_6:=[[-269.54,-708.39,1000.62],[0.308147,0.682782,0.474365,-0.46242],
[-2,0,-1,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLixoMaq30_6:=[[-775.51,-1195.83,271.58],
[0.00949633,0.934252,0.356283,-0.0120237],[-2,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLixoMaq40_6:=[[-914.12,-1317.26,-176.34],
[0.0268486,-0.8693,-0.490625,-0.053705],[-2,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLixoMaq50_6:=[[-274.63,-765.15,849.83],[0.235485,0.745353,0.523834,-0.338516],
[-2,0,-1,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLixoMaq60_6:=[[603.73,-326.41,999.40],[0.56725,0.190876,0.786657,-0.151541],
[-1,-1,-1,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLixoMaq70_6:=[[-6.45,17.70,1229.88],[0.725404,-0.287218,0.405304,0.476469],
[0,-1,-1,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
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    !Pontos para Lubrificação
    CONST robtarget pEntraLub10:=[[60.54,1293.01,584.20],[0.489127,-0.510662,0.489123,-0.510625],
[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pEntraLub20:=[[17.45,1290.01,584.20],[0.227898,-0.672352,0.658246,-0.250435],
[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pEntraLub30:=[[10.86,1289.87,584.17],
[4.89957E-05,0.717308,-0.696756,2.85334E-05],[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pEntraLub40:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pEntraLub50:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    !
    CONST robtarget pSaidaLub10:=[[-45.10,743.84,586.35],[9.47461E-05,0.717314,-0.69675,7.2914E-05],
[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaLub20:=[[18.85,281.14,1075.29],[0.378193,-0.573227,0.599329,0.411322],
[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaLub30:=[[266.79,90.64,1075.29],[0.54286,-0.144363,0.816666,0.132362],
[0,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaLub40:=[[290.19,56.82,1307.64],[0.707008,-0.0114708,0.707019,-0.0114658],
[0,1,-2,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaLub50:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    !
    CONST robtarget pLubFixo10:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubFixo20:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubFixo30:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubFixo40:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    !
    CONST robtarget pLubMovel10:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubMovel20:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubMovel30:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubMovel40:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    !
    CONST robtarget pLubSopro10:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubSopro20:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubSopro40:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubSopro30:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubSopro50:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubSopro60:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    !
    CONST robtarget pLub110:=[[47.48,1244.39,586.37],[7.99104E-05,0.717308,-0.696757,5.65189E-05],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
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    CONST robtarget pLub120:=[[47.41,1493.17,586.30],[0.000115777,0.717332,-0.696731,9.21752E-05],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub130:=[[47.49,1395.89,586.32],[0.000107538,0.717307,-0.696757,8.2945E-05],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub140:=[[47.50,1460.71,586.32],[0.000109624,0.717306,-0.696758,8.23128E-05],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub150:=[[47.50,1584.36,586.32],[0.000110614,0.717303,-0.696761,8.11327E-05],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub160:=[[47.49,1715.34,586.22],[0.000151434,0.717316,-0.696748,0.000119149],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub210:=[[-57.05,1715.33,586.16],[0.000175794,0.717336,-0.696727,0.000148146],
[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub220:=[[-57.05,1614.96,586.16],[0.000177206,0.717337,-0.696727,0.000146039],
[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub230:=[[-57.04,1530.54,586.17],[0.000175879,0.717334,-0.69673,0.000145533],
[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub240:=[[-57.05,1405.05,586.16],[0.000178323,0.717336,-0.696727,0.000148315],
[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub250:=[[-55.48,1304.54,586.16],[0.00017689,0.717335,-0.696728,0.000148947],
[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub260:=[[-54.45,1244.39,586.37],[7.82245E-05,0.717308,-0.696756,5.63503E-05],
[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    !Pontos para Lubrificação PROG 1
    CONST robtarget pEntraLub10_1:=[[60.54,1293.01,584.20],[0.489127,-0.510662,0.489123,-0.510625],
[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pEntraLub20_1:=[[17.45,1290.01,584.20],[0.227898,-0.672352,0.658246,-0.250435],
[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pEntraLub30_1:=[[10.86,1289.87,584.17],
[4.89957E-05,0.717308,-0.696756,2.85334E-05],[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pEntraLub40_1:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pEntraLub50_1:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    !
    CONST robtarget pSaidaLub10_1:=[[-45.10,743.84,586.35],
[9.47461E-05,0.717314,-0.69675,7.2914E-05],[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaLub20_1:=[[18.85,281.14,1075.29],[0.378193,-0.573227,0.599329,0.411322],
[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaLub30_1:=[[266.79,90.64,1075.29],[0.54286,-0.144363,0.816666,0.132362],
[0,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaLub40_1:=[[290.19,56.82,1307.64],
[0.707008,-0.0114708,0.707019,-0.0114658],[0,1,-2,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaLub50_1:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    !
    CONST robtarget pLubFixo10_1:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubFixo20_1:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubFixo30_1:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubFixo40_1:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    !
    CONST robtarget pLubMovel10_1:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubMovel20_1:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
```

```
    CONST robtarget pLubMovel30_1:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E ↵
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubMovel40_1:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E ↵
+09,9E+09,9E+09,9E+09,9E+09]];
    !
    CONST robtarget pLubSopro10_1:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E ↵
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubSopro20_1:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E ↵
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubSopro40_1:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E ↵
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubSopro30_1:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E ↵
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubSopro50_1:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E ↵
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubSopro60_1:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E ↵
+09,9E+09,9E+09,9E+09,9E+09]];
    !
    CONST robtarget pLub110_1:=[[20.47,1244.39,586.37],[7.91518E-05,0.71731,-0.696754,5.84155E-05], ↵
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub120_1:=[[20.43,1493.17,586.30],[0.000113417,0.717333,-0.696731,9.02364E-05], ↵
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub130_1:=[[47.49,1395.89,586.32],[0.000107538,0.717307,-0.696757,8.2945E-05], ↵
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub140_1:=[[47.50,1460.71,586.32],[0.000109624,0.717306,-0.696758,8.23128E-05], ↵
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub150_1:=[[47.50,1584.36,586.32],[0.000110614,0.717303,-0.696761,8.11327E-05], ↵
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub160_1:=[[20.36,1715.34,586.22],[0.000152298,0.717316,-0.696748,0.000118896], ↵
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub210_1:=[[-57.05,1715.33,586.16],                                          ↵
[0.000175794,0.717336,-0.696727,0.000148146],[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub220_1:=[[-57.05,1614.96,586.16],                                          ↵
[0.000177206,0.717337,-0.696727,0.000146039],[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub230_1:=[[-57.04,1530.54,586.17],[0.000175879,0.717334,-0.69673,0.000145533], ↵
[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub240_1:=[[-57.05,1405.05,586.16],                                          ↵
[0.000178323,0.717336,-0.696727,0.000148315],[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub250_1:=[[-55.48,1304.54,586.16],[0.00017689,0.717335,-0.696728,0.000148947], ↵
[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub260_1:=[[-54.45,1244.39,586.37],                                          ↵
[7.82245E-05,0.717308,-0.696756,5.63503E-05],[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    !Pontos para Lubrificação PROG 2
    CONST robtarget pEntraLub10_2:=[[54.43,1293.26,651.75],[0.498966,-0.500135,0.479681,-0.520388], ↵
[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pEntraLub20_2:=[[38.15,1293.26,632.71],[0.323464,-0.62809,0.615047,-0.350129],  ↵
[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pEntraLub30_2:=[[38.18,1293.25,632.67],[0.120505,-0.710362,0.684044,-0.113787], ↵
[0,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pEntraLub40_2:=[[24.96,1295.70,632.66],                                       ↵
[0.00418101,-0.720573,0.693366,0.000249256],[0,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pEntraLub50_2:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E ↵
+09,9E+09,9E+09,9E+09,9E+09]];
    !
    CONST robtarget pSaidaLub10_2:=[[-5.22,743.45,586.33],                                        ↵
[0.00010876,0.717337,-0.696726,8.60217E-05],[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaLub20_2:=[[18.85,281.14,1075.29],[0.378193,-0.573227,0.599329,0.411322],  ↵
[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
```

```
    CONST robtarget pSaidaLub30_2:=[[266.79,90.64,1075.29],[0.54286,-0.144363,0.816666,0.132362],
[0,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaLub40_2:=[[290.19,56.82,1307.64],
[0.707008,-0.0114708,0.707019,-0.0114658],[0,1,-2,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaLub50_2:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    !
    CONST robtarget pLubFixo10_2:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubFixo20_2:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubFixo30_2:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubFixo40_2:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    !
    CONST robtarget pLubMovel10_2:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubMovel20_2:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubMovel30_2:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubMovel40_2:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    !
    CONST robtarget pLubSopro10_2:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubSopro20_2:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubSopro40_2:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubSopro30_2:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubSopro50_2:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubSopro60_2:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    !
    CONST robtarget pLub110_2:=[[47.48,1244.39,586.37],[7.99104E-05,0.717308,-0.696757,5.65189E-05],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub120_2:=[[47.41,1493.17,586.30],[0.000115777,0.717332,-0.696731,9.21752E-05],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub130_2:=[[47.49,1395.89,586.32],[0.000107538,0.717307,-0.696757,8.2945E-05],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub140_2:=[[47.50,1460.71,586.32],[0.000109624,0.717306,-0.696758,8.23128E-05],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub150_2:=[[47.50,1584.36,586.32],[0.000110614,0.717303,-0.696761,8.11327E-05],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub160_2:=[[47.49,1715.34,586.22],[0.000151434,0.717316,-0.696748,0.000119149],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub210_2:=[[-8.24,1715.51,586.10],[0.000209428,0.715623,-0.698487,0.000185699],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub220_2:=[[-57.05,1614.96,586.16],
[0.000177206,0.717337,-0.696727,0.000146039],[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub230_2:=[[-57.04,1530.54,586.17],[0.000175879,0.717334,-0.69673,0.000145533],
[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub240_2:=[[-57.05,1405.05,586.16],
[0.000178323,0.717336,-0.696727,0.000148315],[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
```

```
    CONST robtarget pLub250_2:=[[-55.48,1304.54,586.16],[0.00017689,0.717335,-0.696728,0.000148947],
[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub260_2:=[[-8.30,1244.38,586.34],[9.49779E-05,0.717312,-0.696752,7.6623E-05],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    !Pontos para Lubrificação PROG 3
    CONST robtarget pEntraLub10_3:=[[60.54,1422.44,584.20],[0.489127,-0.510663,0.48912,-0.510627],
[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pEntraLub20_3:=[[17.45,1378.02,598.59],[0.227898,-0.672352,0.658246,-0.250436],
[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pEntraLub30_3:=[[-5.75,1289.86,584.15],
[5.92374E-05,0.717306,-0.696758,3.97866E-05],[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pEntraLub40_3:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pEntraLub50_3:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    !
    CONST robtarget pSaidaLub10_3:=[[-31.42,743.84,586.35],
[9.79703E-05,0.717318,-0.696746,7.67494E-05],[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaLub20_3:=[[18.85,281.14,1075.29],[0.378193,-0.573227,0.599329,0.411322],
[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaLub30_3:=[[266.79,90.64,1075.29],[0.54286,-0.144363,0.816666,0.132362],
[0,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaLub40_3:=[[290.19,56.82,1307.64],
[0.707008,-0.0114708,0.707019,-0.0114658],[0,1,-2,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaLub50_3:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    !
    CONST robtarget pLubFixo10_3:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubFixo20_3:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubFixo30_3:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubFixo40_3:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    !
    CONST robtarget pLubMovel10_3:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubMovel20_3:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubMovel30_3:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubMovel40_3:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    !
    CONST robtarget pLubSopro10_3:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubSopro20_3:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubSopro40_3:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubSopro30_3:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubSopro50_3:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubSopro60_3:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    !
```

```
    CONST robtarget pLub110_3:=[[7.01,1428.68,602.19],[0.114896,-0.708271,0.687652,-0.110843],
[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub120_3:=[[6.98,1486.31,674.53],[0.114882,-0.70828,0.687643,-0.110857],
[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub130_3:=[[47.49,1395.89,586.32],[0.000107538,0.717307,-0.696757,8.2945E-05],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub140_3:=[[47.50,1460.71,586.32],[0.000109624,0.717306,-0.696758,8.23128E-05],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub150_3:=[[47.50,1584.36,586.32],[0.000110614,0.717303,-0.696761,8.11327E-05],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub160_3:=[[7.00,1547.22,602.17],[0.114891,-0.708274,0.687649,-0.110845],
[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub210_3:=[[-36.69,1551.20,619.95],[0.120317,0.706932,-0.686503,-0.120347],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub220_3:=[[-57.05,1614.96,586.16],
[0.000177206,0.717337,-0.696727,0.000146039],[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub230_3:=[[-57.04,1530.54,586.17],[0.000175879,0.717334,-0.69673,0.000145533],
[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub240_3:=[[-57.05,1405.05,586.16],
[0.000178323,0.717336,-0.696727,0.000148315],[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub250_3:=[[-55.48,1304.54,586.16],[0.00017689,0.717335,-0.696728,0.000148947],
[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub260_3:=[[-36.67,1504.26,619.92],[0.120328,0.70692,-0.686516,-0.120338],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    !Pontos para Lubrificação PROG 4
    CONST robtarget pEntraLub10_4:=[[54.43,1293.26,651.75],[0.498966,-0.500135,0.479681,-0.520388],
[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pEntraLub20_4:=[[38.15,1293.26,632.71],[0.323464,-0.62809,0.615047,-0.350129],
[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pEntraLub30_4:=[[-0.75,1293.43,632.71],[0.306926,-0.639175,0.62291,-0.330508],
[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pEntraLub40_4:=[[-21.63,1293.43,632.71],[0.0139924,0.70891,-0.705032,0.0134301],
[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pEntraLub50_4:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    !
    CONST robtarget pSaidaLub10_4:=[[-5.22,743.45,586.33],
[0.00010876,0.717337,-0.696726,8.60217E-05],[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaLub20_4:=[[18.85,281.14,1075.29],[0.378193,-0.573227,0.599329,0.411322],
[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaLub30_4:=[[266.79,90.64,1075.29],[0.54286,-0.144363,0.816666,0.132362],
[0,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaLub40_4:=[[290.19,56.82,1307.64],
[0.707008,-0.0114708,0.707019,-0.0114658],[0,1,-2,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaLub50_4:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    !
    CONST robtarget pLubFixo10_4:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubFixo20_4:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubFixo30_4:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubFixo40_4:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    !
    CONST robtarget pLubMovel10_4:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
```

```
    CONST robtarget pLubMovel20_4:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubMovel30_4:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubMovel40_4:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    !
    CONST robtarget pLubSopro10_4:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubSopro20_4:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubSopro40_4:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubSopro30_4:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubSopro50_4:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubSopro60_4:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    !
    CONST robtarget pLub110_4:=[[-22.33,1306.41,643.89],[0.0140908,0.708952,-0.704986,0.0135328],
[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub120_4:=[[-21.33,1700.64,643.89],[0.0140922,0.708952,-0.704986,0.0135343],
[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub130_4:=[[-21.33,1507.72,643.89],[0.0140914,0.708953,-0.704985,0.0135344],
[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub140_4:=[[-21.32,1507.72,643.89],[0.221276,0.673681,-0.677399,-0.195757],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub150_4:=[[47.50,1584.36,586.32],[0.000110614,0.717303,-0.696761,8.11327E-05],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub160_4:=[[-21.32,1700.65,643.89],[0.0140886,0.708952,-0.704986,0.0135329],
[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub210_4:=[[-21.42,1700.63,643.80],[0.0141341,0.708986,-0.70495,0.0135816],
[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub220_4:=[[-57.05,1614.96,586.16],
[0.000177206,0.717337,-0.696727,0.000146039],[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub230_4:=[[-57.04,1530.54,586.17],[0.000175879,0.717334,-0.69673,0.000145533],
[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub240_4:=[[-57.05,1405.05,586.16],
[0.000178323,0.717336,-0.696727,0.000148315],[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub250_4:=[[-55.48,1304.54,586.16],[0.00017689,0.717335,-0.696728,0.000148947],
[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub260_4:=[[-21.42,1315.95,643.80],[0.0141339,0.708981,-0.704956,0.0135798],
[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    !Pontos para Lubrificação PROG 5
    CONST robtarget pEntraLub10_5:=[[60.54,1293.01,584.20],[0.489127,-0.510662,0.489123,-0.510625],
[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pEntraLub20_5:=[[17.45,1290.01,584.20],[0.227898,-0.672352,0.658246,-0.250435],
[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pEntraLub30_5:=[[10.86,1289.87,584.17],
[4.89957E-05,0.717308,-0.696756,2.85334E-05],[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pEntraLub40_5:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pEntraLub50_5:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    !
    CONST robtarget pSaidaLub10_5:=[[-45.10,743.84,586.35],
[9.47461E-05,0.717314,-0.69675,7.2914E-05],[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
```

```
    CONST robtarget pSaidaLub20_5:=[[18.85,281.14,1075.29],[0.378193,-0.573227,0.599329,0.411322],
[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaLub30_5:=[[266.79,90.64,1075.29],[0.54286,-0.144363,0.816666,0.132362],
[0,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaLub40_5:=[[290.19,56.82,1307.64],
[0.707008,-0.0114708,0.707019,-0.0114658],[0,1,-2,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaLub50_5:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    !
    CONST robtarget pLubFixo10_5:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubFixo20_5:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubFixo30_5:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubFixo40_5:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    !
    CONST robtarget pLubMovel10_5:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubMovel20_5:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubMovel30_5:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubMovel40_5:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    !
    CONST robtarget pLubSopro10_5:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubSopro20_5:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubSopro40_5:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubSopro30_5:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubSopro50_5:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubSopro60_5:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    !
    CONST robtarget pLub110_5:=[[47.48,1244.39,586.37],[7.99104E-05,0.717308,-0.696757,5.65189E-05],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub120_5:=[[47.41,1493.17,586.30],[0.000115777,0.717332,-0.696731,9.21752E-05],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub130_5:=[[47.49,1395.89,586.32],[0.000107538,0.717307,-0.696757,8.2945E-05],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub140_5:=[[47.50,1460.71,586.32],[0.000109624,0.717306,-0.696758,8.23128E-05],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub150_5:=[[47.50,1584.36,586.32],[0.000110614,0.717303,-0.696761,8.11327E-05],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub160_5:=[[47.49,1715.34,586.22],[0.000151434,0.717316,-0.696748,0.000119149],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub210_5:=[[-57.05,1715.33,586.16],
[0.000175794,0.717336,-0.696727,0.000148146],[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub220_5:=[[-57.05,1614.96,586.16],
[0.000177206,0.717337,-0.696727,0.000146039],[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub230_5:=[[-57.04,1530.54,586.17],[0.000175879,0.717334,-0.69673,0.000145533],
[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
```

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    CONST robtarget pLub240_5:=[[-57.05,1405.05,586.16],
[0.000178323,0.717336,-0.696727,0.000148315],[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub250_5:=[[-55.48,1304.54,586.16],[0.00017689,0.717335,-0.696728,0.000148947],
[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub260_5:=[[-54.45,1244.39,586.37],
[7.82245E-05,0.717308,-0.696756,5.63503E-05],[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    !Pontos para Lubrificação PROG 6
    CONST robtarget pEntraLub10_6:=[[60.54,1293.01,584.20],[0.489127,-0.510662,0.489123,-0.510625],
[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pEntraLub20_6:=[[17.45,1290.01,584.20],[0.227898,-0.672352,0.658246,-0.250435],
[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pEntraLub30_6:=[[10.86,1289.87,584.17],
[4.89957E-05,0.717308,-0.696756,2.85334E-05],[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pEntraLub40_6:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pEntraLub50_6:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    !
    CONST robtarget pSaidaLub10_6:=[[-45.10,743.84,586.35],
[9.47461E-05,0.717314,-0.69675,7.2914E-05],[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaLub20_6:=[[18.85,281.14,1075.29],[0.378193,-0.573227,0.599329,0.411322],
[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaLub30_6:=[[266.79,90.64,1075.29],[0.54286,-0.144363,0.816666,0.132362],
[0,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaLub40_6:=[[290.19,56.82,1307.64],
[0.707008,-0.0114708,0.707019,-0.0114658],[0,1,-2,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaLub50_6:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    !
    CONST robtarget pLubFixo10_6:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubFixo20_6:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubFixo30_6:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubFixo40_6:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    !
    CONST robtarget pLubMovel10_6:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubMovel20_6:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubMovel30_6:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubMovel40_6:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    !
    CONST robtarget pLubSopro10_6:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubSopro20_6:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubSopro40_6:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubSopro30_6:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubSopro50_6:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLubSopro60_6:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E+09,9E
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+09,9E+09,9E+09,9E+09,9E+09]];
    !
    CONST robtarget pLub110_6:=[[47.48,1244.39,586.37],[7.99104E-05,0.717308,-0.696757,5.65189E-05],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub120_6:=[[47.41,1493.17,586.30],[0.000115777,0.717332,-0.696731,9.21752E-05],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub130_6:=[[47.49,1395.89,586.32],[0.000107538,0.717307,-0.696757,8.2945E-05],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub140_6:=[[47.50,1460.71,586.32],[0.000109624,0.717306,-0.696758,8.23128E-05],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub150_6:=[[47.50,1584.36,586.32],[0.000110614,0.717303,-0.696761,8.11327E-05],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub160_6:=[[47.49,1715.34,586.22],[0.000151434,0.717316,-0.696748,0.000119149],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub210_6:=[[-57.05,1715.33,586.16],
[0.000175794,0.717336,-0.696727,0.000148146],[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub220_6:=[[-57.05,1614.96,586.16],
[0.000177206,0.717337,-0.696727,0.000146039],[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub230_6:=[[-57.04,1530.54,586.17],[0.000175879,0.717334,-0.69673,0.000145533],
[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub240_6:=[[-57.05,1405.05,586.16],
[0.000178323,0.717336,-0.696727,0.000148315],[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub250_6:=[[-55.48,1304.54,586.16],[0.00017689,0.717335,-0.696728,0.000148947],
[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pLub260_6:=[[-54.45,1244.39,586.37],
[7.82245E-05,0.717308,-0.696756,5.63503E-05],[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
!Novo 11-11-2013
    CONST robtarget pSaidaSemLub10_1:=[[59.32,1293.29,584.18],
[0.489118,-0.510664,0.489113,-0.510641],[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub20_1:=[[-40.76,1274.56,600.01],
[0.0165437,0.714972,-0.698874,0.0107557],[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub30_1:=[[-41.05,915.89,589.51],
[0.0165607,0.714978,-0.698868,0.0107774],[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub40_1:=[[18.17,314.91,1043.84],
[0.344988,-0.594678,0.621738,0.375212],[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub50_1:=[[266.79,90.64,1075.28],[0.542855,-0.144358,0.81667,0.13236],
[0,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub60_1:=[[290.18,56.82,1307.64],
[0.707012,-0.0114758,0.707016,-0.0114505],[0,1,-2,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub70_1:=[[290.19,56.82,1307.64],
[0.707008,-0.0114708,0.707019,-0.0114658],[0,1,-2,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub80_1:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E
+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub10_2:=[[59.32,1293.29,584.18],
[0.489118,-0.510664,0.489113,-0.510641],[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub20_2:=[[-40.76,1274.56,600.01],
[0.0165437,0.714972,-0.698874,0.0107557],[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub30_2:=[[-41.05,915.89,589.51],
[0.0165607,0.714978,-0.698868,0.0107774],[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub40_2:=[[18.17,314.91,1043.84],
[0.344988,-0.594678,0.621738,0.375212],[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub50_2:=[[266.79,90.64,1075.28],[0.542855,-0.144358,0.81667,0.13236],
[0,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub60_2:=[[290.18,56.82,1307.64],
[0.707012,-0.0114758,0.707016,-0.0114505],[0,1,-2,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub70_2:=[[290.19,56.82,1307.64],
[0.707008,-0.0114708,0.707019,-0.0114658],[0,1,-2,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub80_2:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E
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+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub10_3:=[[59.32,1293.29,584.18],
[0.489118,-0.510664,0.489113,-0.510641],[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub20_3:=[[-40.76,1274.56,600.01],
[0.0165437,0.714972,-0.698874,0.0107557],[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub30_3:=[[-41.05,915.89,589.51],
[0.0165607,0.714978,-0.698868,0.0107774],[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub40_3:=[[18.17,314.91,1043.84],
[0.344988,-0.594678,0.621738,0.375212],[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub50_3:=[[266.79,90.64,1075.28],[0.542855,-0.144358,0.81667,0.13236],
[0,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub60_3:=[[290.18,56.82,1307.64],
[0.707012,-0.0114758,0.707016,-0.0114505],[0,1,-2,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub70_3:=[[290.19,56.82,1307.64],
[0.707008,-0.0114708,0.707019,-0.0114658],[0,1,-2,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub80_3:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E
+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub10_4:=[[59.32,1293.29,584.18],
[0.489118,-0.510664,0.489113,-0.510641],[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub20_4:=[[-40.76,1274.56,600.01],
[0.0165437,0.714972,-0.698874,0.0107557],[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub30_4:=[[-41.05,915.89,589.51],
[0.0165607,0.714978,-0.698868,0.0107774],[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub40_4:=[[18.17,314.91,1043.84],
[0.344988,-0.594678,0.621738,0.375212],[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub50_4:=[[266.79,90.64,1075.28],[0.542855,-0.144358,0.81667,0.13236],
[0,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub60_4:=[[290.18,56.82,1307.64],
[0.707012,-0.0114758,0.707016,-0.0114505],[0,1,-2,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub70_4:=[[290.19,56.82,1307.64],
[0.707008,-0.0114708,0.707019,-0.0114658],[0,1,-2,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub80_4:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E
+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub10_5:=[[59.32,1293.29,584.18],
[0.489118,-0.510664,0.489113,-0.510641],[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub20_5:=[[-40.76,1274.56,600.01],
[0.0165437,0.714972,-0.698874,0.0107557],[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub30_5:=[[-41.05,915.89,589.51],
[0.0165607,0.714978,-0.698868,0.0107774],[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub40_5:=[[18.17,314.91,1043.84],
[0.344988,-0.594678,0.621738,0.375212],[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub50_5:=[[266.79,90.64,1075.28],[0.542855,-0.144358,0.81667,0.13236],
[0,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub60_5:=[[290.18,56.82,1307.64],
[0.707012,-0.0114758,0.707016,-0.0114505],[0,1,-2,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub70_5:=[[290.19,56.82,1307.64],
[0.707008,-0.0114708,0.707019,-0.0114658],[0,1,-2,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub80_5:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E
+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub10_6:=[[59.32,1293.29,584.18],
[0.489118,-0.510664,0.489113,-0.510641],[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub20_6:=[[-40.76,1274.56,600.01],
[0.0165437,0.714972,-0.698874,0.0107557],[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub30_6:=[[-41.05,915.89,589.51],
[0.0165607,0.714978,-0.698868,0.0107774],[1,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub40_6:=[[18.17,314.91,1043.84],
[0.344988,-0.594678,0.621738,0.375212],[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub50_6:=[[266.79,90.64,1075.28],[0.542855,-0.144358,0.81667,0.13236],
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[0,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub60_6:=[[290.18,56.82,1307.64],
[0.707012,-0.0114758,0.707016,-0.0114505],[0,1,-2,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub70_6:=[[290.19,56.82,1307.64],
[0.707008,-0.0114708,0.707019,-0.0114658],[0,1,-2,1],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pSaidaSemLub80_6:=[[54.13,0.00,452.15],[0.470059,0,0.882635,0],[0,0,0,0],[9E
+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    ! Objectos de Trabalho
    PERS wobjdata wobjMaq := [FALSE,TRUE,"",[[0,0,0],[1,0,0,0]],[[0,0,0],[1,0,0,0]]];
    PERS wobjdata wobjPrensaColosi := [FALSE,TRUE,"",[[866.807447030235,-1741.27722570023,200],
[0.924693751082191,0,0,-0.380711789559435]],[[0,0,0],[1,0,0,0]]];
    PERS wobjdata wobjTinaMaq := [FALSE,TRUE,"",[[0,0,0],[1,0,0,0]],[[0,0,0],[1,0,0,0]]];
    PERS wobjdata wobjCelulasColos := [FALSE,TRUE,"",[[0,0,0],[1,0,0,0]],[[0,0,0],[1,0,0,0]]];
    PERS wobjdata wobjRampaMaq := [FALSE,TRUE,"",[[0,0,0],[1,0,0,0]],[[0,0,0],[1,0,0,0]]];
    PERS wobjdata wobjMesaApoio := [FALSE,TRUE,"",[[0,0,0],[1,0,0,0]],[[0,0,0],[1,0,0,0]]];
    PERS wobjdata wobjLixo := [FALSE,TRUE,"",[[0,0,0],[1,0,0,0]],[[0,0,0],[1,0,0,0]]];
    ! Velocidades
    CONST speeddata vTrabalhoMaq := [3000,200,5000,1000];
    CONST speeddata vDentroMaq := [1000,250,5000,1000];
    CONST speeddata vAproximaMaq := [500,250,5000,1000];
    CONST speeddata vTrabalhoInv := [1500,500,5000,1000];
    CONST speeddata vTrabalhoTina := [1500,500,5000,1000];
    CONST speeddata vTrabalhoRampa := [2500,400,5000,1000];
    CONST speeddata vAproximaInv := [500,500,5000,1000];
    CONST speeddata vTinaMaq := [200,500,5000,1000];
    PERS speeddata vLubrifica;
    CONST speeddata vSopro := [500,500,5000,1000];
    CONST speeddata vTiraInv := [150,500,5000,1000];
    ! Variaveis Numericas
    LOCAL PERS num nTempoPinça :=2;
    PERS num nTCicloMaq :=16.216;
    PERS num nNumPecasMaq :=25;
    PERS num nNumTotPecaMaq :=787140;
    PERS num nTempoEjectMaq:=10;
    PERS num nTEsperaPrensaMaq :=20;
    PERS num nDataTeste:=1;
    PERS num nNumPecasMaq_1{4}:=[2366,4517,6524,8644];
    PERS num nTempoEspLub;
    PERS num nPrograma:=1;
    ! Variaveis boleanas
    LOCAL VAR bool bFalha :=FALSE;
    VAR bool bFalhaEjectFrent :=FALSE;
    VAR bool bFalhaEjectAtras :=FALSE;
    VAR bool bPeçaOK :=FALSE;
    PERS bool bMaquinaInjectou:=FALSE;
    PERS bool bDataMudou :=FALSE;
    PERS bool Flag_RadialErr := FALSE;
    PERS bool bLubrificaMANUAL := FALSE;

    !***************************************************************************
    !************ Activar p/ trabalhar só com a Rampa Sem Prensa ***************
    CONST bool bRampaMaq :=FALSE;
    !***************************************************************************
    !************ Activar p/ trabalhar com Lubrificação ************************
    PERS bool bComLubrificacao :=TRUE;
    !***************************************************************************
    !************ Activar p/ partir masselotes *********************************
    CONST bool bComMasselotes :=TRUE;
```

```
    !"""""""""""""""""""""""""""""""""""""""""""""""""""""""""""""""""""""""""""""""""
    !Variaveis String
    LOCAL PERS string stAux:="02:43:39";
    LOCAL PERS string stAux1:="2000-01-01";
    LOCAL PERS string stDia := "01";
    LOCAL PERS string stDataNova:="2000-01-01";
    LOCAL PERS string stDataVelha:="2000-01-01";
    CONST string stLinha :="==================================================";
    PERS string strNivelDesmold;
    !
    PERS string strPrograma:="9945-02A";
    PERS string strPrograma_1:="Bost281";
    PERS string strPrograma_2:="9945-03A";
    PERS string strPrograma_3:="Torcao 50 movel";
    PERS string strPrograma_4:="CAP-BEARING-01D";
    PERS string strPrograma_5:="Programa 5";
    PERS string strPrograma_6:="Programa 6";
    PERS string strPrograma_7:="Programa 7";
    PERS string strPrograma_8:="Programa 8";
    !
    !Variáveis Clock
    VAR clock clkTciclo;
    !==================== Zona Seguranca Repouso ==============
    CONST pos posCentroEsfera:=[-3,150,1219];
    VAR wzstationary wzZonaRep;
    VAR shapedata shpVZonaSegRep;
    PERS num nRaioEsfera:=30;
    !========================= Zona seguranca Maq ==============
    CONST pos posCanto1ZColos:=[-3000,180,-3000];
    CONST pos posCanto2ZColos:=[3000,3000,3000];
    VAR wzstationary wzZonaColos;
    VAR shapedata shpVZonaSegColos;
    !===========================================================
    VAR intnum intMaqInjectou;
    CONST robtarget pEntraLub60:=[[10.87,1289.88,584.20],
[3.43918E-05,0.717302,-0.696762,1.50043E-05],[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pCRITICO10:=[[38.92,882.20,535.84],[0.022635,-0.708411,0.705364,0.0101415],
[0,-1,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq90:=[[14.24,593.12,810.48],[0.0619852,-0.701363,0.705567,0.0801365],
[0,0,-1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq100:=[[-4.93,945.52,890.03],[0.509204,-0.493821,0.510191,-0.486372],
[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq110:=[[145.48,449.39,1326.06],[0.686465,0.0948728,0.717791,-0.0673888],
[0,-1,1,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq120:=[[358.04,394.95,1606.94],[0.677185,0.12534,0.724126,-0.0367717],
[0,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    CONST robtarget pMaq130:=[[13.66,1575.20,890.11],[0.509221,-0.493792,0.510223,-0.486349],
[1,-1,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]];
    !===========================================================
    !===========================================================

PROC main()
!Ciclo principal do programa
!Estrutura do programa
  AccSet 50, 100;
  VelSet 100, 5000;
  rInicia;
```

```
  rMenuPrincipal;

  WHILE TRUE DO
    rCiclo (nPrograma);
  ENDWHILE

ENDPROC

PROC rCiclo (num nPrograma_aux)

    rAbrePinca;
    lbInicio:
    IF (diLubManual=1 AND diMaqAuto=0 AND diPortaAberta=1 AND diRoboInserido=1) THEN
        TEST nPrograma_aux
            CASE 1:
                rPROG_LubrificaManual_1;
            CASE 2:
                rPROG_LubrificaManual_2;
            CASE 3:
                rPROG_LubrificaManual_3;
            CASE 4:
                rPROG_LubrificaManual_4;
            CASE 5:
                rPROG_LubrificaManual_5;
            CASE 6:
                rPROG_LubrificaManual_6;
            DEFAULT:
                TPWrite "Programa Invalido!";
                TPWrite "Faça PP para Principal e Introduza";
                TPWrite "um Programa Válido";
                STOP;
        ENDTEST
    ENDIF
    ! Garantir Inicio Ciclo da Máquina
    !PulseDO\PLength:=1,doIniCicloMaq;
    TPErase;
    stAux:=CTime();
    stAux1:=CDate();
    TPWrite "========================================";
    TPWrite "     ABB                      " + stAux1;
    TPWrite "   ROBÓTICA                     " + stAux;
    TPWrite "========================================";
    TPWrite "  PROGRAMA: " + strPrograma;
    TPWrite "  TEMPO CICLO         = "\Num:=nTCicloMaq;
    TPWrite "  NUMERO PEÇAS DO DIA = "\Num:=nNumPecasMaq;
    TPWrite "  NUMERO PEÇAS TOTAL  = "\Num:=nNumTotPecaMaq;
    TPWrite "  " + strNivelDesmold;
    TPWrite "  Aguarda Ordem Maquina... ";
    TPWrite "========================================";
    rLigaIntMaquInjecao;
    WaitUntil diMaqAuto = 1  AND diPortaAberta = 1 AND diRoboInserido = 1 AND bMaquinaInjectou=TRUE ↵
\MaxTime:=2\TimeFlag:=bFalha;
    IF bFalha=TRUE THEN
       GOTO lbInicio;
    ENDIF
    IDelete intMaqInjectou;
    bMaquinaInjectou:=FALSE;
    ClkReset clkTCiclo;
```

```
    ClkStart clkTciclo;

    TEST nPrograma_aux
        CASE 1:
            rPROG_Programa_1;
        CASE 2:
            rPROG_Programa_2;
        CASE 3:
            rPROG_Programa_3;
        CASE 4:
            rPROG_Programa_4;
        CASE 5:
            rPROG_Programa_5;
        CASE 6:
            rPROG_Programa_6;
        DEFAULT:
            TPWrite "Programa Invalido!";
            TPWrite "Faça PP para Principal e Introduza";
            TPWrite "um Programa Válido";
            STOP;
    ENDTEST
ENDPROC

!*************************************************************
! PROGRAMA 1
!*************************************************************
PROC rPROG_Programa_1()
    ! Vai Para a máquina tirar a Peça
    rPROG_Colosio_1;
    ! Verifica Pecas nas Fotocélulas
    rPROG_FotocelulaColos_1;

    IF  bPeçaOK = FALSE THEN
        ! Peça não está completa nas fotocelulas
        Set doFalhaPeca;
        rPROG_PecaDefeitoColo_1;
        ! Após peca NOK descarrega a peca mas nao se pode reiniciar o ciclo
        ! sem passar a maquina a manual
        TPWrite " Falha na Deteccao de Pecas";
        TPWrite " Aguarda Máquina em Modo Manual";
        WaitUntil  diMaqAuto = 0;
        TPWrite " Aguarda Máquina em Modo Automático";
        WaitUntil  diMaqAuto = 1;
        Reset doFalhaPeca;
        Set doIniCicloMaq; !RG 2009-07-06
        Set doPer_FechoMolde;
        rLigaIntMaquInjecao;
        GOTO lbFim;
    ENDIF

    ! MÁQUINA NÃO ESTÁ PREPARADA PARA ISTO
    !ELSEIF diPecaBOA = 0  THEN
    !! Maquina Diz que a peça não foi boa para ela
    !  Set doIniCicloMaq;
    !  Set doPer_FechoMolde;
    !  rLigaIntMaquInjecao;
    !  rPecaDefeitoColo;
    !GOTO lbFim;
```

```
    !ENDIF

    Set doIniCicloMaq;!RG 2009-07-06
    Set doPer_FechoMolde;
    rLigaIntMaquInjecao;

    !Só noutra fase
    !rPrensaMass;

    !Só noutra fase
    !rTinaMaq;

    !Noutra fase
    !IF bRampaMaq THEN
    !   rRampaMaq;
    !ELSE
    !   rPrensaMaq;
    !ENDIF

    ! Alterar na outra fase
    rPROG_RampaMaq_1;

lbFim:
    rRepouso;
    nNumPecasMaq:=nNumPecasMaq+1;
    nNumTotPecaMaq:=nNumTotPecaMaq+1;
    ClkStop clkTciclo;
    nTCicloMaq:=ClkRead(clkTCiclo);
    rData;
ENDPROC

!###############################################################
! PROGRAMA 2
!###############################################################
PROC rPROG_Programa_2()
    ! Vai Para a máquina tirar a Peça
    rPROG_Colosio_2;
    ! Verifica Pecas nas Fotocélulas
    rPROG_FotocelulaColos_2;

    IF  bPeçaOK = FALSE THEN
        ! Peça não está completa nas fotocelulas
        Set doFalhaPeca;
        rPROG_PecaDefeitoColo_2;
        ! Após peca NOK descarrega a peca mas nao se pode reiniciar o ciclo
        ! sem passar a maquina a manual
        TPWrite " Falha na Deteccao de Pecas";
        TPWrite " Aguarda Máquina em Modo Manual";
        WaitUntil  diMaqAuto = 0;
        TPWrite " Aguarda Máquina em Modo Automático";
        WaitUntil  diMaqAuto = 1;
        Reset doFalhaPeca;
        Set doIniCicloMaq; !RG 2009-07-06
        Set doPer_FechoMolde;
        rLigaIntMaquInjecao;
        GOTO lbFim;
    ENDIF
```

```
    ! MÁQUINA NÃO ESTÁ PREPARADA PARA ISTO
    !ELSEIF diPecaBOA = 0  THEN
    !! Maquina Diz que a peça não foi boa para ela
    !  Set doIniCicloMaq;
    !  Set doPer_FechoMolde;
    !  rLigaIntMaquInjecao;
    !  rPecaDefeitoColo;
    !GOTO lbFim;
    !ENDIF

    Set doIniCicloMaq;!RG 2009-07-06
    Set doPer_FechoMolde;
    rLigaIntMaquInjecao;

    !Só noutra fase
    !rPrensaMass;

    !Só noutra fase
    !rTinaMaq;

    !Noutra fase
    !IF bRampaMaq THEN
    !   rRampaMaq;
    !ELSE
    !   rPrensaMaq;
    !ENDIF

    ! Alterar na outra fase
    rPROG_RampaMaq_2;

lbFim:
    rRepouso;
    nNumPecasMaq:=nNumPecasMaq+1;
    nNumTotPecaMaq:=nNumTotPecaMaq+1;
    ClkStop clkTciclo;
    nTCicloMaq:=ClkRead(clkTCiclo);
    rData;
ENDPROC

!###########################################################
! PROGRAMA 3
!###########################################################
PROC rPROG_Programa_3()
    ! Vai Para a máquina tirar a Peça
    rPROG_Colosio_3;
    ! Verifica Pecas nas Fotocélulas
    rPROG_FotocelulaColos_3;

    IF  bPeçaOK = FALSE THEN
        ! Peça não está completa nas fotocelulas
        Set doFalhaPeca;
        rPROG_PecaDefeitoColo_3;
        ! Após peca NOK descarrega a peca mas nao se pode reiniciar o ciclo
        ! sem passar a maquina a manual
        TPWrite " Falha na Deteccao de Pecas";
        TPWrite " Aguarda Máquina em Modo Manual";
        WaitUntil  diMaqAuto = 0;
        TPWrite " Aguarda Máquina em Modo Automático";
```

```
        WaitUntil  diMaqAuto = 1;
        Reset doFalhaPeca;
        Set doIniCicloMaq; !RG 2009-07-06
        Set doPer_FechoMolde;
        rLigaIntMaquInjecao;
        GOTO lbFim;
    ENDIF

    ! MÁQUINA NÃO ESTÁ PREPARADA PARA ISTO
    !ELSEIF diPecaBOA = 0  THEN
    !! Maquina Diz que a peça não foi boa para ela
    !  Set doIniCicloMaq;
    !  Set doPer_FechoMolde;
    !  rLigaIntMaquInjecao;
    !  rPecaDefeitoColo;
    !GOTO lbFim;
    !ENDIF

    Set doIniCicloMaq;!RG 2009-07-06
    Set doPer_FechoMolde;
    rLigaIntMaquInjecao;

    !Só noutra fase
    !rPrensaMass;

    !Só noutra fase
    !rTinaMaq;

    !Noutra fase
    !IF bRampaMaq THEN
    !   rRampaMaq;
    !ELSE
    !   rPrensaMaq;
    !ENDIF

    ! Alterar na outra fase
    rPROG_RampaMaq_3;

lbFim:
    rRepouso;
    nNumPecasMaq:=nNumPecasMaq+1;
    nNumTotPecaMaq:=nNumTotPecaMaq+1;
    ClkStop clkTciclo;
    nTCicloMaq:=ClkRead(clkTCiclo);
    rData;
ENDPROC

!###########################################################
! PROGRAMA 4
!###########################################################
PROC rPROG_Programa_4()
    ! Vai Para a máquina tirar a Peça
    rPROG_Colosio_4;
    ! Verifica Pecas nas Fotocélulas
    rPROG_FotocelulaColos_4;

    IF  bPeçaOK = FALSE THEN
        ! Peça não está completa nas fotocelulas
```

```
        Set doFalhaPeca;
        rPROG_PecaDefeitoColo_4;
        ! Após peca NOK descarrega a peca mas nao se pode reiniciar o ciclo
        ! sem passar a maquina a manual
        TPWrite " Falha na Deteccao de Pecas";
        TPWrite " Aguarda Máquina em Modo Manual";
        WaitUntil  diMaqAuto = 0;
        TPWrite " Aguarda Máquina em Modo Automático";
        WaitUntil  diMaqAuto = 1;
        Reset doFalhaPeca;
        Set doIniCicloMaq; !RG 2009-07-06
        Set doPer_FechoMolde;
        rLigaIntMaquInjecao;
        GOTO lbFim;
    ENDIF

    ! MÁQUINA NÃO ESTÁ PREPARADA PARA ISTO
    !ELSEIF diPecaBOA = 0  THEN
    !! Maquina Diz que a peça não foi boa para ela
    !  Set doIniCicloMaq;
    !  Set doPer_FechoMolde;
    !  rLigaIntMaquInjecao;
    !  rPecaDefeitoColo;
    !GOTO lbFim;
    !ENDIF

    Set doIniCicloMaq;!RG 2009-07-06
    Set doPer_FechoMolde;
    rLigaIntMaquInjecao;

    !Só noutra fase
    !rPrensaMass;

    !Só noutra fase
    !rTinaMaq;

    !Noutra fase
    !IF bRampaMaq THEN
    !   rRampaMaq;
    !ELSE
    !   rPrensaMaq;
    !ENDIF

    ! Alterar na outra fase
    rPROG_RampaMaq_4;

lbFim:
    rRepouso;
    nNumPecasMaq:=nNumPecasMaq+1;
    nNumTotPecaMaq:=nNumTotPecaMaq+1;
    ClkStop clkTciclo;
    nTCicloMaq:=ClkRead(clkTCiclo);
    rData;
ENDPROC

!###########################################################
! PROGRAMA 5
!###########################################################
```

```
PROC rPROG_Programa_5()
    ! Vai Para a máquina tirar a Peça
    rPROG_Colosio_5;
    ! Verifica Pecas nas Fotocélulas
    rPROG_FotocelulaColos_5;

    IF  bPeçaOK = FALSE THEN
        ! Peça não está completa nas fotocelulas
        Set doFalhaPeca;
        rPROG_PecaDefeitoColo_5;
        ! Após peca NOK descarrega a peca mas nao se pode reiniciar o ciclo
        ! sem passar a maquina a manual
        TPWrite " Falha na Deteccao de Pecas";
        TPWrite " Aguarda Máquina em Modo Manual";
        WaitUntil  diMaqAuto = 0;
        TPWrite " Aguarda Máquina em Modo Automático";
        WaitUntil  diMaqAuto = 1;
        Reset doFalhaPeca;
        Set doIniCicloMaq; !RG 2009-07-06
        Set doPer_FechoMolde;
        rLigaIntMaquInjecao;
        GOTO lbFim;
    ENDIF

    ! MÁQUINA NÃO ESTÁ PREPARADA PARA ISTO
    !ELSEIF diPecaBOA = 0  THEN
    !! Maquina Diz que a peça não foi boa para ela
    !  Set doIniCicloMaq;
    !  Set doPer_FechoMolde;
    !  rLigaIntMaquInjecao;
    !  rPecaDefeitoColo;
    !GOTO lbFim;
    !ENDIF

    Set doIniCicloMaq;!RG 2009-07-06
    Set doPer_FechoMolde;
    rLigaIntMaquInjecao;

    !Só noutra fase
    !rPrensaMass;

    !Só noutra fase
    !rTinaMaq;

    !Noutra fase
    !IF bRampaMaq THEN
    !   rRampaMaq;
    !ELSE
    !   rPrensaMaq;
    !ENDIF

    ! Alterar na outra fase
    rPROG_RampaMaq_5;

lbFim:
    rRepouso;
    nNumPecasMaq:=nNumPecasMaq+1;
    nNumTotPecaMaq:=nNumTotPecaMaq+1;
```

```
    ClkStop clkTciclo;
    nTCicloMaq:=ClkRead(clkTCiclo);
    rData;
ENDPROC

!###########################################################
! PROGRAMA 2
!###########################################################
PROC rPROG_Programa_6()
    ! Vai Para a máquina tirar a Peça
    rPROG_Colosio_6;
    ! Verifica Pecas nas Fotocélulas
    rPROG_FotocelulaColos_6;

    IF  bPeçaOK = FALSE THEN
        ! Peça não está completa nas fotocelulas
        Set doFalhaPeca;
        rPROG_PecaDefeitoColo_6;
        ! Após peca NOK descarrega a peca mas nao se pode reiniciar o ciclo
        ! sem passar a maquina a manual
        TPWrite " Falha na Deteccao de Pecas";
        TPWrite " Aguarda Máquina em Modo Manual";
        WaitUntil  diMaqAuto = 0;
        TPWrite " Aguarda Máquina em Modo Automático";
        WaitUntil  diMaqAuto = 1;
        Reset doFalhaPeca;
        Set doIniCicloMaq; !RG 2009-07-06
        Set doPer_FechoMolde;
        rLigaIntMaquInjecao;
        GOTO lbFim;
    ENDIF

    ! MÁQUINA NÃO ESTÁ PREPARADA PARA ISTO
    !ELSEIF diPecaBOA = 0  THEN
    !! Maquina Diz que a peça não foi boa para ela
    !  Set doIniCicloMaq;
    !  Set doPer_FechoMolde;
    !  rLigaIntMaquInjecao;
    !  rPecaDefeitoColo;
    !GOTO lbFim;
    !ENDIF

    Set doIniCicloMaq;!RG 2009-07-06
    Set doPer_FechoMolde;
    rLigaIntMaquInjecao;

    !Só noutra fase
    !rPrensaMass;

    !Só noutra fase
    !rTinaMaq;

    !Noutra fase
    !IF bRampaMaq THEN
    !   rRampaMaq;
    !ELSE
    !   rPrensaMaq;
    !ENDIF
```

```
    ! Alterar na outra fase
    rPROG_RampaMaq_6;

lbFim:
    rRepouso;
    nNumPecasMaq:=nNumPecasMaq+1;
    nNumTotPecaMaq:=nNumTotPecaMaq+1;
    ClkStop clkTciclo;
    nTCicloMaq:=ClkRead(clkTCiclo);
    rData;
ENDPROC

PROC rRepouso()
    ! Coloca Robô na Posição de Repouso
    !GOTO abb;
    MoveJ pCRITICO, vTrabalhoMaq, z20, tPinca\WObj:=wobjCelulasColos;
    !abb:
    !MoveJ pRepouso, vTrabalhoMaq, fine, tPinca\WObj:=wobj0;
    !
ENDPROC

PROC rLubrificaManual()
  bLubrificaMANUAL := TRUE;
  MoveJ pCRITICO, vTrabalhoMaq, z20, tPinca\WObj:=wobjCelulasColos;
  MoveJ pCRITICO10, vTrabalhoMaq, z20, tPinca\WObj:=wobjCelulasColos;
  ! INICIO LUBRIFICACAO MOVEL
  MoveL pLub110, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  rPulverizaDesmMovel;
  WaitTime 0.5;
  MoveL pLub120, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  WaitTime nTempoEspLub;
  !
  !MoveL pLub130, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub140, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub150, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  MoveL pLub160, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  ! FIM LUBRIFICACAO MOVEL
  rDesligaTudoMovelFixo;
  ! INICIO LUBRIFICAÇÃO FIXO
  MoveL pLub210, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  rPulverizaDesmFixo;
  WaitTime 0.5;
  !
  !MoveL pLub220, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub230, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub240, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub250, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  MoveL pLub260, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  ! FIM LUBRIFICACAO MOVEL
  rDesligaTudoMovelFixo;

  ! Movimentos de saída
  MoveL pSaidaLub10, vTrabalhoMaq, z10, tPinca\WObj:=wobjMaq;
  MoveJ pSaidaLub20, vTrabalhoMaq, z100, tPinca\WObj:=wobjMaq;
  WaitTime 0.1;
  rRepouso;
  WaitTime 0.1;
```

```
  bLubrificaMANUAL :=FALSE;
ENDPROC

PROC rPROG_LubrificaManual_1()
  bLubrificaMANUAL := TRUE;
  MoveJ pCRITICO, vTrabalhoMaq, z20, tPinca\WObj:=wobjCelulasColos;
  MoveJ pCRITICO10, vTrabalhoMaq, z20, tPinca\WObj:=wobjCelulasColos;
  ! INICIO LUBRIFICACAO MOVEL
  MoveL pLub110_1, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  rPulverizaDesmMovel;
  WaitTime 0.5;
  MoveL pLub120_1, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  WaitTime nTempoEspLub;
  !
  !MoveL pLub130_1, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub140_1, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub150_1, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  MoveL pLub160_1, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  ! FIM LUBRIFICACAO MOVEL
  rDesligaTudoMovelFixo;
  ! INICIO LUBRIFICAÇÃO FIXO
  MoveL pLub210_1, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  rPulverizaDesmFixo;
  WaitTime 0.5;
  !
  !MoveL pLub220_1, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub230_1, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub240_1, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub250_1, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  MoveL pLub260_1, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  ! FIM LUBRIFICACAO MOVEL
  rDesligaTudoMovelFixo;

  ! Movimentos de saída
  MoveL pSaidaLub10_1, vTrabalhoMaq, z10, tPinca\WObj:=wobjMaq;
  MoveJ pSaidaLub20_1, vTrabalhoMaq, z100, tPinca\WObj:=wobjMaq;
  WaitTime 0.1;
  rRepouso;
  WaitTime 0.1;
  bLubrificaMANUAL :=FALSE;
ENDPROC

PROC rPROG_LubrificaManual_2()
  bLubrificaMANUAL := TRUE;
  MoveJ pCRITICO, vTrabalhoMaq, z20, tPinca\WObj:=wobjCelulasColos;
  MoveJ pCRITICO10, vTrabalhoMaq, z20, tPinca\WObj:=wobjCelulasColos;
  ! INICIO LUBRIFICACAO MOVEL
  MoveL pLub110_2, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  rPulverizaDesmMovel;
  WaitTime 0.5;
  MoveL pLub120_2, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  WaitTime nTempoEspLub;
  !
  !MoveL pLub130_2, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub140_2, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub150_2, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  MoveL pLub160_2, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  ! FIM LUBRIFICACAO MOVEL
```

```
  rDesligaTudoMovelFixo;
  ! INICIO LUBRIFICAÇÃO FIXO
  MoveL pLub210_2, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  rPulverizaDesmFixo;
  WaitTime 0.5;
  !
  !MoveL pLub220_2, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub230_2, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub240_2, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub250_2, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  MoveL pLub260_2, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  ! FIM LUBRIFICACAO MOVEL
  rDesligaTudoMovelFixo;

  ! Movimentos de saída
  MoveL pSaidaLub10_2, vTrabalhoMaq, z10, tPinca\WObj:=wobjMaq;
  MoveJ pSaidaLub20_2, vTrabalhoMaq, z100, tPinca\WObj:=wobjMaq;
  WaitTime 0.1;
  rRepouso;
  WaitTime 0.1;
  bLubrificaMANUAL :=FALSE;
ENDPROC

PROC rPROG_LubrificaManual_3()
  bLubrificaMANUAL := TRUE;
  MoveJ pCRITICO, vTrabalhoMaq, z20, tPinca\WObj:=wobjCelulasColos;
  MoveJ pCRITICO10, vTrabalhoMaq, z20, tPinca\WObj:=wobjCelulasColos;
  ! INICIO LUBRIFICACAO MOVEL
  MoveL pLub110_3, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  rPulverizaDesmMovel;
  WaitTime 0.5;
  MoveL pLub120_3, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  WaitTime nTempoEspLub;
  !
  !MoveL pLub130_3, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub140_3, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub150_3, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  MoveL pLub160_3, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  ! FIM LUBRIFICACAO MOVEL
  rDesligaTudoMovelFixo;
  ! INICIO LUBRIFICAÇÃO FIXO
  MoveL pLub210_3, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  rPulverizaDesmFixo;
  WaitTime 0.5;
  !
  !MoveL pLub220_3, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub230_3, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub240_3, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub250_3, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  MoveL pLub260_3, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  ! FIM LUBRIFICACAO MOVEL
  rDesligaTudoMovelFixo;

  ! Movimentos de saída
  MoveL pSaidaLub10_3, vTrabalhoMaq, z10, tPinca\WObj:=wobjMaq;
  MoveJ pSaidaLub20_3, vTrabalhoMaq, z100, tPinca\WObj:=wobjMaq;
  WaitTime 0.1;
  rRepouso;
```

```
  WaitTime 0.1;
  bLubrificaMANUAL :=FALSE;
ENDPROC

PROC rPROG_LubrificaManual_4()
  bLubrificaMANUAL := TRUE;
  MoveJ pCRITICO, vTrabalhoMaq, z20, tPinca\WObj:=wobjCelulasColos;
  MoveJ pCRITICO10, vTrabalhoMaq, z20, tPinca\WObj:=wobjCelulasColos;
  ! INICIO LUBRIFICACAO MOVEL
  MoveL pLub110_4, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  rPulverizaDesmMovel;
  WaitTime 0.5;
  !MoveL pLub120_4, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !WaitTime nTempoEspLub;
  MoveL pLub130_4, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !BOLACHA
  MoveL pLub140_4, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  MoveL pLub130_4, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub150_4, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  MoveL pLub160_4, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  ! FIM LUBRIFICACAO MOVEL
  rDesligaTudoMovelFixo;
  ! INICIO LUBRIFICAÇÃO FIXO
  MoveL pLub210_4, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  rPulverizaDesmFixo;
  WaitTime 0.5;
  !
  !MoveL pLub220_4, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub230_4, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub240_4, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub250_4, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  MoveL pLub260_4, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  ! FIM LUBRIFICACAO MOVEL
  rDesligaTudoMovelFixo;

  ! Movimentos de saída
  MoveL pSaidaLub10_4, vTrabalhoMaq, z10, tPinca\WObj:=wobjMaq;
  MoveJ pSaidaLub20_4, vTrabalhoMaq, z100, tPinca\WObj:=wobjMaq;
  WaitTime 0.1;
  rRepouso;
  WaitTime 0.1;
  bLubrificaMANUAL :=FALSE;
ENDPROC

PROC rPROG_LubrificaManual_5()
  bLubrificaMANUAL := TRUE;
  MoveJ pCRITICO, vTrabalhoMaq, z20, tPinca\WObj:=wobjCelulasColos;
  MoveJ pCRITICO10, vTrabalhoMaq, z20, tPinca\WObj:=wobjCelulasColos;
  ! INICIO LUBRIFICACAO MOVEL
  MoveL pLub110_5, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  rPulverizaDesmMovel;
  WaitTime 0.5;
  MoveL pLub120_5, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  WaitTime nTempoEspLub;
  !
  !MoveL pLub130_5, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub140_5, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub150_5, vLubrifica, fine, tPinca\WObj:=wobjMaq;
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  MoveL pLub160_5, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  ! FIM LUBRIFICACAO MOVEL
  rDesligaTudoMovelFixo;
  ! INICIO LUBRIFICAÇÃO FIXO
  MoveL pLub210_5, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  rPulverizaDesmFixo;
  WaitTime 0.5;
  !
  !MoveL pLub220_5, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub230_5, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub240_5, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub250_5, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  MoveL pLub260_5, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  ! FIM LUBRIFICACAO MOVEL
  rDesligaTudoMovelFixo;

  ! Movimentos de saída
  MoveL pSaidaLub10_5, vTrabalhoMaq, z10, tPinca\WObj:=wobjMaq;
  MoveJ pSaidaLub20_5, vTrabalhoMaq, z100, tPinca\WObj:=wobjMaq;
  WaitTime 0.1;
  rRepouso;
  WaitTime 0.1;
  bLubrificaMANUAL :=FALSE;
ENDPROC

PROC rPROG_LubrificaManual_6()
  bLubrificaMANUAL := TRUE;
  MoveJ pCRITICO, vTrabalhoMaq, z20, tPinca\WObj:=wobjCelulasColos;
  MoveJ pCRITICO10, vTrabalhoMaq, z20, tPinca\WObj:=wobjCelulasColos;
  ! INICIO LUBRIFICACAO MOVEL
  MoveL pLub110_6, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  rPulverizaDesmMovel;
  WaitTime 0.5;
  MoveL pLub120_6, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  WaitTime nTempoEspLub;
  !
  !MoveL pLub130_6, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub140_6, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub150_6, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  MoveL pLub160_6, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  ! FIM LUBRIFICACAO MOVEL
  rDesligaTudoMovelFixo;
  ! INICIO LUBRIFICAÇÃO FIXO
  MoveL pLub210_6, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  rPulverizaDesmFixo;
  WaitTime 0.5;
  !
  !MoveL pLub220_6, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub230_6, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub240_6, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub250_6, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  MoveL pLub260_6, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  ! FIM LUBRIFICACAO MOVEL
  rDesligaTudoMovelFixo;

  ! Movimentos de saída
  MoveL pSaidaLub10_6, vTrabalhoMaq, z10, tPinca\WObj:=wobjMaq;
  MoveJ pSaidaLub20_6, vTrabalhoMaq, z100, tPinca\WObj:=wobjMaq;
```

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  WaitTime 0.1;
  rRepouso;
  WaitTime 0.1;
  bLubrificaMANUAL :=FALSE;
ENDPROC

PROC rPROG_Colosio_1()
  VAR robtarget pActual;
  ! Retira peça da Máquina Colosio
  MoveJ pCRITICO, vTrabalhoMaq, z20, tPinca\WObj:=wobjCelulasColos;
  MoveJ pMaq10_1, vTrabalhoMaq, z100, tPinca\WObj:=wobjMaq;
  MoveJ pMaq20_1, vTrabalhoMaq, z100, tPinca\WObj:=wobjMaq;
  MoveJ pMaq30_1, vTrabalhoMaq, z200, tPinca\WObj:=wobjMaq;
  MoveL pMaq130, vTrabalhoMaq, fine, tPinca\WObj:=wobjMaq;
  !MoveL pMaq50_1, vAproximaMaq, fine, tPinca\WObj:=wobjMaq;
  WaitTime 0.2;
  SetDO doExtratorFrente,1;
  WaitUntil diExtratorFrente=1\MaxTime:=nTempoEjectMaq\TimeFlag:=bFalhaEjectFrent;
  WaitTime 1.0;
  IF NOT bFalhaEjectFrent THEN
    MoveL pMaq50_1, vAproximaMaq, fine, tPinca\WObj:=wobjMaq;
    !WaitTime 0.1;
    rFechaPinça;
    WaitTime 1.0;
    Reset doExtratorFrente;
    WaitUntil diExtratorAtras=1\MaxTime:=nTempoEjectMaq\TimeFlag:=bFalhaEjectAtras;
  ELSE
    ! Falha Ejectores não foram a frente
    WaitTime 0.2;
    pActual:=CRobT(\Tool:=tPinca);
    MoveL pActual,vAproximaMaq,fine,tPinca;
    rAbrePinca;
    WaitTime 0.2;
    MoveL pMaq40_1, vAproximaMaq, fine, tPinca\WObj:=wobjMaq;
    Reset doExtratorFrente;
    WaitUntil diExtratorAtras=1\MaxTime:=nTempoEjectMaq\TimeFlag:=bFalhaEjectAtras;
  ENDIF
  MoveL pMaq40_1, v500, z0, tPinca\WObj:=wobjMaq;
  MoveL pMaq100, vTrabalhoMaq, z100, tPinca\WObj:=wobjMaq;
  MoveJ pMaq110, vTrabalhoMaq, z100, tPinca\WObj:=wobjMaq;
  MoveJ pMaq120, vTrabalhoMaq, z100, tPinca\WObj:=wobjMaq;
  !IF bComlubrificacao THEN
    !!$$$$$$$$$$$$$$$$$$$$$$$
    !bLubrificaMANUAL :=FALSE;
    !!$$$$$$$$$$$$$$$$$$$$$$$
    !rPROG_Lubrifica_AUTO_1;
  !ELSE
    !PulseDO\PLength:=3,doRecuarPist;
      !MoveL pSaidaSemLub10_1, vTrabalhoMaq, z10, tPinca\WObj:=wobjMaq;
      !MoveL pSaidaSemLub20_1, vTrabalhoMaq, z50, tPinca\WObj:=wobjMaq;
      !MoveJ pSaidaSemLub30_1, vTrabalhoMaq, z50, tPinca\WObj:=wobjMaq;
      !MoveJ pSaidaSemLub40_1, vTrabalhoMaq, z50, tPinca\WObj:=wobjMaq;
      !MoveJ pSaidaSemLub50_1, vTrabalhoMaq, z50, tPinca\WObj:=wobjMaq;
      !MoveJ pSaidaSemLub60_1, vTrabalhoMaq, z50, tPinca\WObj:=wobjMaq;
  !ENDIF
  WaitTime 0.1;
  !rRepouso;
  WaitTime 0.1;
```

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ENDPROC

PROC rPROG_Colosio_2()
  VAR robtarget pActual;
  ! Retira peça da Máquina Colosio
  MoveJ pCRITICO, vTrabalhoMaq, z20, tPinca\WObj:=wobjCelulasColos;
  MoveJ pMaq10_2, vTrabalhoMaq, z100, tPinca\WObj:=wobjMaq;
  MoveJ pMaq20_2, vTrabalhoMaq, z100, tPinca\WObj:=wobjMaq;
  MoveJ pMaq30_2, vTrabalhoMaq, z200, tPinca\WObj:=wobjMaq;
  MoveL pMaq40_2, vTrabalhoMaq, fine, tPinca\WObj:=wobjMaq;
  WaitTime 0.2;
  SetDO doExtratorFrente,1;
  WaitUntil diExtratorFrente=1\MaxTime:=nTempoEjectMaq\TimeFlag:=bFalhaEjectFrent;
  IF NOT bFalhaEjectFrent THEN
    MoveL pMaq50_2, vAproximaMaq, fine, tPinca\WObj:=wobjMaq;
    !WaitTime 0.1;
    rFechaPinça;
    WaitTime 1.0;
    Reset doExtratorFrente;
    WaitUntil diExtratorAtras=1\MaxTime:=nTempoEjectMaq\TimeFlag:=bFalhaEjectAtras;
  ELSE
    ! Falha Ejectores não foram a frente
    WaitTime 0.2;
    pActual:=CRobT(\Tool:=tPinca);
    MoveL pActual,vAproximaMaq,fine,tPinca;
    rAbrePinca;
    WaitTime 0.2;
    MoveL pMaq40_2, vAproximaMaq, fine, tPinca\WObj:=wobjMaq;
    Reset doExtratorFrente;
    WaitUntil diExtratorAtras=1\MaxTime:=nTempoEjectMaq\TimeFlag:=bFalhaEjectAtras;
  ENDIF
  MoveL pMaq40_2, v500, z0, tPinca\WObj:=wobjMaq;
  IF bComlubrificacao THEN
    !$$$$$$$$$$$$$$$$$$$$$$$$
    bLubrificaMANUAL :=FALSE;
    !$$$$$$$$$$$$$$$$$$$$$$$$
    rPROG_Lubrifica_AUTO_2;
  ELSE
    PulseDO\PLength:=3,doRecuarPist;
      MoveL pSaidaSemLub10_2, vTrabalhoMaq, z10, tPinca\WObj:=wobjMaq;
      MoveL pSaidaSemLub20_2, vTrabalhoMaq, z50, tPinca\WObj:=wobjMaq;
      MoveJ pSaidaSemLub30_2, vTrabalhoMaq, z50, tPinca\WObj:=wobjMaq;
      MoveJ pSaidaSemLub40_2, vTrabalhoMaq, z50, tPinca\WObj:=wobjMaq;
      MoveJ pSaidaSemLub50_2, vTrabalhoMaq, z50, tPinca\WObj:=wobjMaq;
      MoveJ pSaidaSemLub60_2, vTrabalhoMaq, z50, tPinca\WObj:=wobjMaq;
  ENDIF
  WaitTime 0.1;
  !rRepouso;
  WaitTime 0.1;
ENDPROC

PROC rPROG_Colosio_3()
  VAR robtarget pActual;
  ! Retira peça da Máquina Colosio
  MoveJ pCRITICO, vTrabalhoMaq, z20, tPinca\WObj:=wobjCelulasColos;
  MoveJ pMaq10_3, vTrabalhoMaq, z100, tPinca\WObj:=wobjMaq;
  MoveJ pMaq20_3, vTrabalhoMaq, z100, tPinca\WObj:=wobjMaq;
  MoveJ pMaq30_3, vTrabalhoMaq, z200, tPinca\WObj:=wobjMaq;
```

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  MoveL pMaq40_3, vTrabalhoMaq, fine, tPinca\WObj:=wobjMaq;
  WaitTime 0.2;
  SetDO doExtratorFrente,1;
  WaitUntil diExtratorFrente=1\MaxTime:=nTempoEjectMaq\TimeFlag:=bFalhaEjectFrent;
  IF NOT bFalhaEjectFrent THEN
    !MoveL pMaq50_3, vAproximaMaq, fine, tPinca\WObj:=wobjMaq;
    !WaitTime 0.1;
    rFechaPinça;
    WaitTime 1.0;
    Reset doExtratorFrente;
    WaitUntil diExtratorAtras=1\MaxTime:=nTempoEjectMaq\TimeFlag:=bFalhaEjectAtras;
  ELSE
    ! Falha Ejectores não foram a frente
    WaitTime 0.2;
    pActual:=CRobT(\Tool:=tPinca);
    MoveL pActual,vAproximaMaq,fine,tPinca;
    rAbrePinca;
    WaitTime 0.2;
    MoveL pMaq40_3, vAproximaMaq, fine, tPinca\WObj:=wobjMaq;
    Reset doExtratorFrente;
    WaitUntil diExtratorAtras=1\MaxTime:=nTempoEjectMaq\TimeFlag:=bFalhaEjectAtras;
  ENDIF
  MoveL pMaq40, v500, z0, tPinca\WObj:=wobjMaq;
  IF bComlubrificacao THEN
    !$$$$$$$$$$$$$$$$$$$$$$$
    bLubrificaMANUAL :=FALSE;
    !$$$$$$$$$$$$$$$$$$$$$$$
    rPROG_Lubrifica_AUTO_3;
  ELSE
    PulseDO\PLength:=3,doRecuarPist;
      MoveL pSaidaSemLub10_3, vTrabalhoMaq, z10, tPinca\WObj:=wobjMaq;
      MoveL pSaidaSemLub20_3, vTrabalhoMaq, z50, tPinca\WObj:=wobjMaq;
      MoveJ pSaidaSemLub30_3, vTrabalhoMaq, z50, tPinca\WObj:=wobjMaq;
      MoveJ pSaidaSemLub40_3, vTrabalhoMaq, z50, tPinca\WObj:=wobjMaq;
      MoveJ pSaidaSemLub50_3, vTrabalhoMaq, z50, tPinca\WObj:=wobjMaq;
      MoveJ pSaidaSemLub60_3, vTrabalhoMaq, z50, tPinca\WObj:=wobjMaq;
      !MoveJ pSaidaSemLub70_1, vTrabalhoMaq, z50, tPinca\WObj:=wobjMaq;
      !MoveJ pSaidaSemLub80_1, vTrabalhoMaq, z50, tPinca\WObj:=wobjMaq;
      !Stop;
  ENDIF
  WaitTime 0.1;
  !rRepouso;
  WaitTime 0.1;
ENDPROC

PROC rPROG_Colosio_4()
  VAR robtarget pActual;
  ! Retira peça da Máquina Colosio
  MoveJ pCRITICO, vTrabalhoMaq, z20, tPinca\WObj:=wobjCelulasColos;
  MoveJ pMaq10_4, vTrabalhoMaq, z100, tPinca\WObj:=wobjMaq;
  MoveJ pMaq20_4, vTrabalhoMaq, z100, tPinca\WObj:=wobjMaq;
  MoveJ pMaq30_4, vTrabalhoMaq, z200, tPinca\WObj:=wobjMaq;
  MoveL pMaq40_4, vTrabalhoMaq, fine, tPinca\WObj:=wobjMaq;
  WaitTime 0.2;
  SetDO doExtratorFrente,1;
  WaitUntil diExtratorFrente=1\MaxTime:=nTempoEjectMaq\TimeFlag:=bFalhaEjectFrent;
  IF NOT bFalhaEjectFrent THEN
    MoveL pMaq50_4, vAproximaMaq, fine, tPinca\WObj:=wobjMaq;
```

```
    !WaitTime 0.1;
    rFechaPinça;
    WaitTime 1.0;
    Reset doExtratorFrente;
    WaitUntil diExtratorAtras=1\MaxTime:=nTempoEjectMaq\TimeFlag:=bFalhaEjectAtras;
  ELSE
    ! Falha Ejectores não foram a frente
    WaitTime 0.2;
    pActual:=CRobT(\Tool:=tPinca);
    MoveL pActual,vAproximaMaq,fine,tPinca;
    rAbrePinca;
    WaitTime 0.2;
    MoveL pMaq40_4, vAproximaMaq, fine, tPinca\WObj:=wobjMaq;
    Reset doExtratorFrente;
    WaitUntil diExtratorAtras=1\MaxTime:=nTempoEjectMaq\TimeFlag:=bFalhaEjectAtras;
  ENDIF
  MoveL pMaq40, v500, z0, tPinca\WObj:=wobjMaq;
  IF bComlubrificacao THEN
    !$$$$$$$$$$$$$$$$$$$$$$$
    bLubrificaMANUAL :=FALSE;
    !$$$$$$$$$$$$$$$$$$$$$$$
    rPROG_Lubrifica_AUTO_4;
  ELSE
    PulseDO\PLength:=3,doRecuarPist;
      MoveL pSaidaSemLub10_4, vTrabalhoMaq, z10, tPinca\WObj:=wobjMaq;
      MoveL pSaidaSemLub20_4, vTrabalhoMaq, z50, tPinca\WObj:=wobjMaq;
      MoveJ pSaidaSemLub30_4, vTrabalhoMaq, z50, tPinca\WObj:=wobjMaq;
      MoveJ pSaidaSemLub40_4, vTrabalhoMaq, z50, tPinca\WObj:=wobjMaq;
      MoveJ pSaidaSemLub50_4, vTrabalhoMaq, z50, tPinca\WObj:=wobjMaq;
      MoveJ pSaidaSemLub60_4, vTrabalhoMaq, z50, tPinca\WObj:=wobjMaq;
  ENDIF
  WaitTime 0.1;
  !rRepouso;
  WaitTime 0.1;
ENDPROC

PROC rPROG_Colosio_5()
  VAR robtarget pActual;
  ! Retira peça da Máquina Colosio
  MoveJ pCRITICO, vTrabalhoMaq, z20, tPinca\WObj:=wobjCelulasColos;
  MoveJ pMaq10_5, vTrabalhoMaq, z100, tPinca\WObj:=wobjMaq;
  MoveJ pMaq20_5, vTrabalhoMaq, z100, tPinca\WObj:=wobjMaq;
  MoveJ pMaq30_5, vTrabalhoMaq, z200, tPinca\WObj:=wobjMaq;
  MoveL pMaq40_5, vTrabalhoMaq, fine, tPinca\WObj:=wobjMaq;
  WaitTime 0.2;
  SetDO doExtratorFrente,1;
  WaitUntil diExtratorFrente=1\MaxTime:=nTempoEjectMaq\TimeFlag:=bFalhaEjectFrent;
  IF NOT bFalhaEjectFrent THEN
    MoveL pMaq50_5, vAproximaMaq, fine, tPinca\WObj:=wobjMaq;
    !WaitTime 0.1;
    rFechaPinça;
    WaitTime 1.0;
    Reset doExtratorFrente;
    WaitUntil diExtratorAtras=1\MaxTime:=nTempoEjectMaq\TimeFlag:=bFalhaEjectAtras;
  ELSE
    ! Falha Ejectores não foram a frente
    WaitTime 0.2;
    pActual:=CRobT(\Tool:=tPinca);
```

```
    MoveL pActual,vAproximaMaq,fine,tPinca;
    rAbrePinca;
    WaitTime 0.2;
    MoveL pMaq40_5, vAproximaMaq, fine, tPinca\WObj:=wobjMaq;
    Reset doExtratorFrente;
    WaitUntil diExtratorAtras=1\MaxTime:=nTempoEjectMaq\TimeFlag:=bFalhaEjectAtras;
  ENDIF
  MoveL pMaq40_5, v500, z0, tPinca\WObj:=wobjMaq;
  IF bComlubrificacao THEN
    !$$$$$$$$$$$$$$$$$$$$$$$$
    bLubrificaMANUAL :=FALSE;
    !$$$$$$$$$$$$$$$$$$$$$$$$
    rPROG_Lubrifica_AUTO_5;
  ELSE
    PulseDO\PLength:=3,doRecuarPist;
      MoveL pSaidaSemLub10_5, vTrabalhoMaq, z10, tPinca\WObj:=wobjMaq;
      MoveL pSaidaSemLub20_5, vTrabalhoMaq, z50, tPinca\WObj:=wobjMaq;
      MoveJ pSaidaSemLub30_5, vTrabalhoMaq, z50, tPinca\WObj:=wobjMaq;
      MoveJ pSaidaSemLub40_5, vTrabalhoMaq, z50, tPinca\WObj:=wobjMaq;
      MoveJ pSaidaSemLub50_5, vTrabalhoMaq, z50, tPinca\WObj:=wobjMaq;
      MoveJ pSaidaSemLub60_5, vTrabalhoMaq, z50, tPinca\WObj:=wobjMaq;
  ENDIF
  WaitTime 0.1;
  !rRepouso;
  WaitTime 0.1;
ENDPROC

PROC rPROG_Colosio_6()
  VAR robtarget pActual;
  ! Retira peça da Máquina Colosio
  MoveJ pCRITICO, vTrabalhoMaq, z20, tPinca\WObj:=wobjCelulasColos;
  MoveJ pMaq10_6, vTrabalhoMaq, z100, tPinca\WObj:=wobjMaq;
  MoveJ pMaq20_6, vTrabalhoMaq, z100, tPinca\WObj:=wobjMaq;
  MoveJ pMaq30_6, vTrabalhoMaq, z200, tPinca\WObj:=wobjMaq;
  MoveL pMaq40_6, vTrabalhoMaq, fine, tPinca\WObj:=wobjMaq;
  WaitTime 0.2;
  SetDO doExtratorFrente,1;
  WaitUntil diExtratorFrente=1\MaxTime:=nTempoEjectMaq\TimeFlag:=bFalhaEjectFrent;
  IF NOT bFalhaEjectFrent THEN
    MoveL pMaq50_6, vAproximaMaq, fine, tPinca\WObj:=wobjMaq;
    !WaitTime 0.1;
    rFechaPinça;
    WaitTime 1.0;
    Reset doExtratorFrente;
    WaitUntil diExtratorAtras=1\MaxTime:=nTempoEjectMaq\TimeFlag:=bFalhaEjectAtras;
  ELSE
    ! Falha Ejectores não foram a frente
    WaitTime 0.2;
    pActual:=CRobT(\Tool:=tPinca);
    MoveL pActual,vAproximaMaq,fine,tPinca;
    rAbrePinca;
    WaitTime 0.2;
    MoveL pMaq40_6, vAproximaMaq, fine, tPinca\WObj:=wobjMaq;
    Reset doExtratorFrente;
    WaitUntil diExtratorAtras=1\MaxTime:=nTempoEjectMaq\TimeFlag:=bFalhaEjectAtras;
  ENDIF
  MoveL pMaq40, v500, z0, tPinca\WObj:=wobjMaq;
  IF bComlubrificacao THEN
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```
    !$$$$$$$$$$$$$$$$$$$$$$
    bLubrificaMANUAL :=FALSE;
    !$$$$$$$$$$$$$$$$$$$$$$
    rPROG_Lubrifica_AUTO_6;
  ELSE
    PulseDO\PLength:=3,doRecuarPist;
      MoveL pSaidaSemLub10_6, vTrabalhoMaq, z10, tPinca\WObj:=wobjMaq;
      MoveL pSaidaSemLub20_6, vTrabalhoMaq, z50, tPinca\WObj:=wobjMaq;
      MoveJ pSaidaSemLub30_6, vTrabalhoMaq, z50, tPinca\WObj:=wobjMaq;
      MoveJ pSaidaSemLub40_6, vTrabalhoMaq, z50, tPinca\WObj:=wobjMaq;
      MoveJ pSaidaSemLub50_6, vTrabalhoMaq, z50, tPinca\WObj:=wobjMaq;
      MoveJ pSaidaSemLub60_6, vTrabalhoMaq, z50, tPinca\WObj:=wobjMaq;
  ENDIF
  WaitTime 0.1;
  !rRepouso;
  WaitTime 0.1;
ENDPROC

PROC rPROG_Lubrifica_AUTO_1()
  ! Coloca blocos de sopro em posição
  MoveJ pEntraLub10_1, vDentroMaq, z10, tPinca\WObj:=wobjMaq;
  MoveJ pEntraLub20_1, vDentroMaq, z10, tPinca\WObj:=wobjMaq;
  MoveJ pEntraLub30_1, vLubrifica, z10, tPinca\WObj:=wobjMaq;
  ! INICIO LUBRIFICACAO MOVEL
  MoveL pLub110_1, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !
  rPulverizaDesmMovel;
  WaitTime nTempoEspLub;
  !
  MoveL pLub120_1, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  WaitTime 0.5;
  !MoveL pLub130_1, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub140_1, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub150_1, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  MoveL pLub160_1, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  ! FIM LUBRIFICACAO MOVEL
  rDesligaTudoMovelFixo;

  ! INICIO LUBRIFICAÇÃO FIXO
  MoveL pLub210_1, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !
  rPulverizaDesmFixo;
  WaitTime 0.5;
  !
  !MoveL pLub220_1, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub230_1, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub240_1, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub250_1, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  MoveL pLub260_1, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  ! FIM LUBRIFICACAO MOVEL
  rDesligaTudoMovelFixo;

  ! Recuo do pistao
  PulseDO\PLength:=1,doRecuarPist;

  ! Movimentos de saída
  MoveL pSaidaLub10_1, vTrabalhoMaq, z10, tPinca\WObj:=wobjMaq;
  MoveJ pSaidaLub20_1, vTrabalhoMaq, z100, tPinca\WObj:=wobjMaq;
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  MoveJ pSaidaLub30_1, vTrabalhoMaq, z100, tPinca\WObj:=wobjMaq;
  MoveJ pSaidaLub40_1, vTrabalhoMaq, z100, tPinca\WObj:=wobjMaq;
  !Reset doAcumuladorDesmoldante;
  lbLubFim:
  !
ENDPROC

PROC rPROG_Lubrifica_AUTO_2()
  ! Coloca blocos de sopro em posição
  MoveJ pEntraLub10_2, vDentroMaq, z10, tPinca\WObj:=wobjMaq;
  MoveJ pEntraLub20_2, vDentroMaq, z10, tPinca\WObj:=wobjMaq;
  MoveJ pEntraLub30_2, vLubrifica, z10, tPinca\WObj:=wobjMaq;
  MoveJ pEntraLub40_2, vLubrifica, z10, tPinca\WObj:=wobjMaq;
  ! INICIO LUBRIFICACAO MOVEL
  MoveL pLub110_2, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !
  rPulverizaDesmMovel;
  WaitTime nTempoEspLub;
  !
  MoveL pLub120_2, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  WaitTime 0.5;
  !MoveL pLub130_2, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub140_2, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub150_2, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  MoveL pLub160_2, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  ! FIM LUBRIFICACAO MOVEL
  rDesligaTudoMovelFixo;

  ! INICIO LUBRIFICAÇÃO FIXO
  MoveL pLub210_2, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !
  rPulverizaDesmFixo;
  WaitTime 0.5;
  !
  !MoveL pLub220_2, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub230_2, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub240_2, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub250_2, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  MoveL pLub260_2, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  ! FIM LUBRIFICACAO MOVEL
  rDesligaTudoMovelFixo;

  ! Recuo do pistao
  PulseDO\PLength:=1,doRecuarPist;

  ! Movimentos de saída
  MoveL pSaidaLub10_2, vTrabalhoMaq, z10, tPinca\WObj:=wobjMaq;
  MoveJ pSaidaLub20_2, vTrabalhoMaq, z100, tPinca\WObj:=wobjMaq;
  MoveJ pSaidaLub30_2, vTrabalhoMaq, z100, tPinca\WObj:=wobjMaq;
  MoveJ pSaidaLub40_2, vTrabalhoMaq, z100, tPinca\WObj:=wobjMaq;
  !Reset doAcumuladorDesmoldante;
  lbLubFim:
  !
ENDPROC

PROC rPROG_Lubrifica_AUTO_3()
  ! Coloca blocos de sopro em posição
  MoveJ pEntraLub10_3, vDentroMaq, z10, tPinca\WObj:=wobjMaq;
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  MoveJ pEntraLub20_3, vDentroMaq, z10, tPinca\WObj:=wobjMaq;
  MoveJ pEntraLub30_3, vLubrifica, z10, tPinca\WObj:=wobjMaq;
  ! INICIO LUBRIFICACAO MOVEL
  MoveL pLub110_3, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !
  rPulverizaDesmMovel;
  WaitTime nTempoEspLub;
  !
  MoveL pLub120_3, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  WaitTime 0.5;
  !MoveL pLub130_3, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub140_3, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub150_3, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  MoveL pLub160_3, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  ! FIM LUBRIFICACAO MOVEL
  rDesligaTudoMovelFixo;

  ! INICIO LUBRIFICAÇÃO FIXO
  MoveL pLub210_3, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !
  rPulverizaDesmFixo;
  WaitTime 0.5;
  !
  !MoveL pLub220_3, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub230_3, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub240_3, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub250_3, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  MoveL pLub260_3, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  ! FIM LUBRIFICACAO MOVEL
  rDesligaTudoMovelFixo;

  ! Recuo do pistao
  PulseDO\PLength:=1,doRecuarPist;

  ! Movimentos de saída
  MoveL pSaidaLub10_3, vTrabalhoMaq, z10, tPinca\WObj:=wobjMaq;
  MoveJ pSaidaLub20_3, vTrabalhoMaq, z100, tPinca\WObj:=wobjMaq;
  MoveJ pSaidaLub30_3, vTrabalhoMaq, z100, tPinca\WObj:=wobjMaq;
  MoveJ pSaidaLub40_3, vTrabalhoMaq, z100, tPinca\WObj:=wobjMaq;
  !Reset doAcumuladorDesmoldante;
  lbLubFim:
  !
ENDPROC

PROC rPROG_Lubrifica_AUTO_4()
  ! Coloca blocos de sopro em posição
  MoveJ pEntraLub10_4, vDentroMaq, z10, tPinca\WObj:=wobjMaq;
  MoveJ pEntraLub20_4, vDentroMaq, z10, tPinca\WObj:=wobjMaq;
  MoveJ pEntraLub30_4, vLubrifica, z10, tPinca\WObj:=wobjMaq;
  MoveJ pEntraLub40_4, vLubrifica, z10, tPinca\WObj:=wobjMaq;
  ! INICIO LUBRIFICACAO MOVEL
  MoveL pLub110_4, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !
  rPulverizaDesmMovel;
  WaitTime nTempoEspLub;
  !BOLACHA
  MoveL pLub130_4, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  MoveL pLub140_4, vLubrifica, fine, tPinca\WObj:=wobjMaq;
```

```
  MoveL pLub130_4, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !FIM BOLACHA
  !MoveL pLub120_4, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !WaitTime 0.5;
  !MoveL pLub130_4, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub140_4, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub150_4, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  MoveL pLub160_4, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  ! FIM LUBRIFICACAO MOVEL
  rDesligaTudoMovelFixo;

  ! INICIO LUBRIFICAÇÃO FIXO
  MoveL pLub210_4, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !
  rPulverizaDesmFixo;
  WaitTime 0.5;
  !
  !MoveL pLub220_4, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub230_4, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub240_4, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub250_4, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  MoveL pLub260_4, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  ! FIM LUBRIFICACAO MOVEL
  rDesligaTudoMovelFixo;

  ! Recuo do pistao
  PulseDO\PLength:=1,doRecuarPist;

  ! Movimentos de saída
  MoveL pSaidaLub10_4, vTrabalhoMaq, z10, tPinca\WObj:=wobjMaq;
  MoveJ pSaidaLub20_4, vTrabalhoMaq, z100, tPinca\WObj:=wobjMaq;
  MoveJ pSaidaLub30_4, vTrabalhoMaq, z100, tPinca\WObj:=wobjMaq;
  MoveJ pSaidaLub40_4, vTrabalhoMaq, z100, tPinca\WObj:=wobjMaq;
  !Reset doAcumuladorDesmoldante;
  lbLubFim:
  !
ENDPROC

PROC rPROG_Lubrifica_AUTO_5()
  ! Coloca blocos de sopro em posição
  MoveJ pEntraLub10_5, vDentroMaq, z10, tPinca\WObj:=wobjMaq;
  MoveJ pEntraLub20_5, vDentroMaq, z10, tPinca\WObj:=wobjMaq;
  MoveJ pEntraLub30_5, vLubrifica, z10, tPinca\WObj:=wobjMaq;
  ! INICIO LUBRIFICACAO MOVEL
  MoveL pLub110_5, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !
  rPulverizaDesmMovel;
  WaitTime nTempoEspLub;
  !
  MoveL pLub120_5, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  WaitTime 0.5;
  !MoveL pLub130_5, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub140_5, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub150_5, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  MoveL pLub160_5, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  ! FIM LUBRIFICACAO MOVEL
  rDesligaTudoMovelFixo;
```

```
  ! INICIO LUBRIFICAÇÃO FIXO
  MoveL pLub210_5, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !
  rPulverizaDesmFixo;
  WaitTime 0.5;
  !
  !MoveL pLub220_5, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub230_5, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub240_5, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub250_5, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  MoveL pLub260_5, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  ! FIM LUBRIFICACAO MOVEL
  rDesligaTudoMovelFixo;

  ! Recuo do pistao
  PulseDO\PLength:=1,doRecuarPist;

  ! Movimentos de saída
  MoveL pSaidaLub10_5, vTrabalhoMaq, z10, tPinca\WObj:=wobjMaq;
  MoveJ pSaidaLub20_5, vTrabalhoMaq, z100, tPinca\WObj:=wobjMaq;
  MoveJ pSaidaLub30_5, vTrabalhoMaq, z100, tPinca\WObj:=wobjMaq;
  MoveJ pSaidaLub40_5, vTrabalhoMaq, z100, tPinca\WObj:=wobjMaq;
  !Reset doAcumuladorDesmoldante;
  lbLubFim:
  !
ENDPROC

PROC rPROG_Lubrifica_AUTO_6()
  ! Coloca blocos de sopro em posição
  MoveJ pEntraLub10_6, vDentroMaq, z10, tPinca\WObj:=wobjMaq;
  MoveJ pEntraLub20_6, vDentroMaq, z10, tPinca\WObj:=wobjMaq;
  MoveJ pEntraLub30_6, vLubrifica, z10, tPinca\WObj:=wobjMaq;
  ! INICIO LUBRIFICACAO MOVEL
  MoveL pLub110_6, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !
  rPulverizaDesmMovel;
  WaitTime nTempoEspLub;
  !
  MoveL pLub120_6, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  WaitTime 0.5;
  !MoveL pLub130_5, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub140_5, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub150_5, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  MoveL pLub160_6, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  ! FIM LUBRIFICACAO MOVEL
  rDesligaTudoMovelFixo;

  ! INICIO LUBRIFICAÇÃO FIXO
  MoveL pLub210_6, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !
  rPulverizaDesmFixo;
  WaitTime 0.5;
  !
  !MoveL pLub220_6, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub230_6, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub240_6, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !MoveL pLub250_6, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  MoveL pLub260_6, vLubrifica, fine, tPinca\WObj:=wobjMaq;
```

```
  ! FIM LUBRIFICACAO MOVEL
  rDesligaTudoMovelFixo;

  ! Recuo do pistao
  PulseDO\PLength:=1,doRecuarPist;

  ! Movimentos de saída
  MoveL pSaidaLub10_6, vTrabalhoMaq, z10, tPinca\WObj:=wobjMaq;
  MoveJ pSaidaLub20_6, vTrabalhoMaq, z100, tPinca\WObj:=wobjMaq;
  MoveJ pSaidaLub30_6, vTrabalhoMaq, z100, tPinca\WObj:=wobjMaq;
  MoveJ pSaidaLub40_6, vTrabalhoMaq, z100, tPinca\WObj:=wobjMaq;
  !Reset doAcumuladorDesmoldante;
  lbLubFim:
  !
ENDPROC

PROC rLubrifica()
  ! Coloca blocos de sopro em posição
  MoveL pEntraLub10, vDentroMaq, z10, tPinca\WObj:=wobjMaq;
  MoveL pEntraLub20, vDentroMaq, z10, tPinca\WObj:=wobjMaq;
  ! Pulverização de desmoldante
  MoveL pLub110, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  !
  rPulverizaDesmMovelFixo;
  WaitTime 1.4;
  !
  MoveL pLub110, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  MoveL pLub120, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  MoveL pLub130, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  MoveL pLub140, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  MoveL pLub150, vLubrifica, fine, tPinca\WObj:=wobjMaq;
  ! Fim de lubrificação
  rDesligaTudoMovelFixo;
  !Set doAcumuladorDesmoldante;
  ! Recuo do pistao
  PulseDO\PLength:=2,doRecuarPist; !RG 2009-07-06 alterado de 1 para 2s
  ! Sopro dos moldes
  MoveL pLubSopro10, vSopro, z1, tPinca\WObj:=wobjMaq;
  rSoproMovelFixo;
  MoveJ pLubSopro20, vSopro, z1, tPinca\WObj:=wobjMaq;
  MoveL pLubSopro30, vSopro, z1, tPinca\WObj:=wobjMaq;
  MoveJ pLubSopro40, vSopro, z1, tPinca\WObj:=wobjMaq;
  MoveL pLubSopro50, vSopro, z1, tPinca\WObj:=wobjMaq;
  ! Fim do Sopro dos moldes
  rDesligaTudoMovelFixo;
  ! Movimentos de saída
  MoveL pSaidaLub10, vTrabalhoMaq, z10, tPinca\WObj:=wobjMaq;
  MoveJ pSaidaLub20, vTrabalhoMaq, z100, tPinca\WObj:=wobjMaq;
  MoveJ pSaidaLub30, vTrabalhoMaq, z100, tPinca\WObj:=wobjMaq;
  MoveJ pSaidaLub40, vTrabalhoMaq, z100, tPinca\WObj:=wobjMaq;
  !Reset doAcumuladorDesmoldante;
  lbLubFim:
  !
ENDPROC

PROC rPROG_FotocelulaColos_1()
  !Testa fotocelulas, ligar N1 e H3
  MoveJ pCelulas10_1, vTrabalhoRampa, z100, tPinca\WObj:=wobjCelulasColos;
```

```
  MoveL pCelulas20_1, vAproximaMaq, fine, tPinca\WObj:=wobjCelulasColos;
  WaitTime 1;
  IF diCheckOK=1 THEN
    bPeçaOK:=TRUE;
  ELSE
    bPeçaOK:=FALSE;
  ENDIF
  MoveL pCelulas30_1, vAproximaMaq, z20, tPinca\WObj:=wobjCelulasColos;
  MoveJ pCelulas40_1, vTrabalhoMaq, z20, tPinca\WObj:=wobjCelulasColos;
  MoveJ pCelulas50_1, vTrabalhoMaq, z20, tPinca\WObj:=wobjCelulasColos;
ENDPROC

PROC rPROG_FotocelulaColos_2()
  !Testa fotocelulas, ligar N1 e H3
  MoveJ pCelulas10_2, vTrabalhoRampa, z200, tPinca\WObj:=wobjCelulasColos;
  MoveL pCelulas20_2, vAproximaMaq, fine, tPinca\WObj:=wobjCelulasColos;
  WaitTime 1;
  IF diCheckOK=1 THEN
    bPeçaOK:=TRUE;
  ELSE
    bPeçaOK:=FALSE;
  ENDIF
  MoveL pCelulas30_2, vAproximaMaq, z100, tPinca\WObj:=wobjCelulasColos;
  MoveJ pCelulas40_2, vTrabalhoMaq, z200, tPinca\WObj:=wobjCelulasColos;
  MoveJ pCelulas50_2, vTrabalhoMaq, z200, tPinca\WObj:=wobjCelulasColos;
ENDPROC

PROC rPROG_FotocelulaColos_3()
  !Testa fotocelulas, ligar N1 e H3
  MoveJ pCelulas10_3, vTrabalhoRampa, z100, tPinca\WObj:=wobjCelulasColos;
  MoveL pCelulas20_3, vAproximaMaq, fine, tPinca\WObj:=wobjCelulasColos;
  WaitTime 1;
  IF diCheckOK=1 THEN
    bPeçaOK:=TRUE;
  ELSE
    bPeçaOK:=FALSE;
  ENDIF
  MoveL pCelulas30_3, vAproximaMaq, z20, tPinca\WObj:=wobjCelulasColos;
  MoveJ pCelulas40_3, vTrabalhoMaq, z20, tPinca\WObj:=wobjCelulasColos;
  MoveJ pCelulas50_3, vTrabalhoMaq, z20, tPinca\WObj:=wobjCelulasColos;
ENDPROC

PROC rPROG_FotocelulaColos_4()
  !Testa fotocelulas, ligar N1 e H3
  MoveJ pCelulas10_4, vTrabalhoRampa, z100, tPinca\WObj:=wobjCelulasColos;
  MoveL pCelulas20_4, vAproximaMaq, fine, tPinca\WObj:=wobjCelulasColos;
  WaitTime 1;
  IF diCheckOK=1 THEN
    bPeçaOK:=TRUE;
  ELSE
    bPeçaOK:=FALSE;
  ENDIF
  MoveL pCelulas30_4, vAproximaMaq, z20, tPinca\WObj:=wobjCelulasColos;
  MoveJ pCelulas40_4, vTrabalhoMaq, z20, tPinca\WObj:=wobjCelulasColos;
  MoveJ pCelulas50_4, vTrabalhoMaq, z20, tPinca\WObj:=wobjCelulasColos;
ENDPROC

PROC rPROG_FotocelulaColos_5()
```

```
  !Testa fotocelulas, ligar N1 e H3
  MoveJ pCelulas10_5, vTrabalhoRampa, z100, tPinca\WObj:=wobjCelulasColos;
  MoveL pCelulas20_5, vAproximaMaq, fine, tPinca\WObj:=wobjCelulasColos;
  WaitTime 1;
  IF diCheckOK=1 THEN
    bPeçaOK:=TRUE;
  ELSE
    bPeçaOK:=FALSE;
  ENDIF
  MoveL pCelulas30_5, vAproximaMaq, z20, tPinca\WObj:=wobjCelulasColos;
  MoveJ pCelulas40_5, vTrabalhoMaq, z20, tPinca\WObj:=wobjCelulasColos;
  MoveJ pCelulas50_5, vTrabalhoMaq, z20, tPinca\WObj:=wobjCelulasColos;
ENDPROC

PROC rPROG_FotocelulaColos_6()
  !Testa fotocelulas, ligar N1 e H3
  MoveJ pCelulas10_6, vTrabalhoRampa, z100, tPinca\WObj:=wobjCelulasColos;
  MoveL pCelulas20_6, vAproximaMaq, fine, tPinca\WObj:=wobjCelulasColos;
  WaitTime 1;
  IF diCheckOK=1 THEN
    bPeçaOK:=TRUE;
  ELSE
    bPeçaOK:=FALSE;
  ENDIF
  MoveL pCelulas30_6, vAproximaMaq, z20, tPinca\WObj:=wobjCelulasColos;
  MoveJ pCelulas40_6, vTrabalhoMaq, z20, tPinca\WObj:=wobjCelulasColos;
  MoveJ pCelulas50_6, vTrabalhoMaq, z20, tPinca\WObj:=wobjCelulasColos;
ENDPROC

PROC rSuporteColoca()
    ! Coloca a peça no suporte para inversão
    MoveJ pSuporteColoca10, v1000, z10, tPinca\WObj:=wobjMesaApoio;
    MoveL pSuporteColoca20, v400, z10, tPinca\WObj:=wobjMesaApoio;
    MoveL pSuporteColoca30, v50, fine, tPinca\WObj:=wobjMesaApoio;
    rAbrePinca;
    MoveL pSuporteColoca40, vAproximaInv, z10, tPinca\WObj:=wobjMesaApoio;
    MoveJ pSuporteColoca50, vAproximaInv, z10, tPinca\WObj:=wobjMesaApoio;
    MoveJ pSuporteColoca60, vTrabalhoInv, z10, tPinca\WObj:=wobjMesaApoio;
    !
ENDPROC

PROC rSuporteRetirar()
    ! Retirar peça do suporte com nova direcção
    MoveJ pSuporteRetira10, vTrabalhoInv, z10, tPinca\WObj:=wobjMesaApoio;
    MoveL pSuporteRetira20, vTrabalhoInv, z10, tPinca\WObj:=wobjMesaApoio;
    MoveL pSuporteRetira30, vAproximaInv, fine, tPinca\WObj:=wobjMesaApoio;
    rFechaPinça;
    MoveL pSuporteRetira40, v100, z1, tPinca\WObj:=wobjMesaApoio;
    MoveJ pSuporteRetira50, vTrabalhoInv, z10, tPinca\WObj:=wobjMesaApoio;
    MoveL pSuporteRetira60, vAproximaInv, z1, tPinca\WObj:=wobjMesaApoio;
    !
ENDPROC

PROC rGitoRetirarPrensa()
  ! Retirar gito da prensa
  ! PARA JÁ, NÃO ESTÁ A SER CHAMADA DE LADO NENHUM
  IF diFTPWithIRB = 1 THEN
    MoveJ pGito10, vTrabalhoMaq, z10, tPinca\WObj:=wobjTinaMaq;
```

```
    MoveL pGito20, v2500, z10, tPinca\WObj:=wobjTinaMaq;
    MoveL pGito30, v400, fine, tPinca\WObj:=wobjTinaMaq;
    rFechaPinça;
    MoveL pGito40, v500, z1, tPinca\WObj:=wobjTinaMaq;
    MoveL pGito50, vTrabalhoMaq, z10, tPinca\WObj:=wobjTinaMaq;
    MoveJ pGito60, vTrabalhoMaq, z10, tPinca\WObj:=wobjTinaMaq;
    MoveL pGito70, v1500, fine, tPinca\WObj:=wobjTinaMaq;
    rAbrePinca;
    WaitTime 0.2;
    MoveL pGito80, vTrabalhoMaq, z10, tPinca\WObj:=wobjTinaMaq;
    MoveL pGito90, vTrabalhoMaq, z10, tPinca\WObj:=wobjTinaMaq;
  ENDIF
ENDPROC

PROC rSoproPrensa()
  ! Sopra a prensa
  ! PARA JÁ, NÃO ESTÁ A SER CHAMADA DE LADO NENHUM
  IF diFTPWithIRB = 1 THEN
    MoveJ pSoproP10, vTrabalhoMaq, z10, tPinca\WObj:=wobjTinaMaq;
    MoveL pSoproP20, v2500, z10, tPinca\WObj:=wobjTinaMaq;
    MoveL pSoproP30, v400, fine, tPinca\WObj:=wobjTinaMaq;
    WaitTime 1.0;
    !rSoproMovel;
    rPulverizaDesmMovel;
    MoveL pSoproP40, v200, fine, tPinca\WObj:=wobjTinaMaq;
    WaitTime 0.2;
    !rDesligaSoproMovel;
    rDesligaPulverizaMovel;
    MoveL pSoproP50, vTrabalhoMaq, z10, tPinca\WObj:=wobjTinaMaq;
    MoveJ pSoproP60, vTrabalhoMaq, z10, tPinca\WObj:=wobjTinaMaq;
  ENDIF
ENDPROC

PROC rTinaMaq()
  ! Arrefecimento da Peça
  !
  MoveJ pTina10, vTrabalhoTina, z100, tPinca\WObj:=wobjTinaMaq;
  MoveJ pTina20, vTrabalhoTina, z100, tPinca\WObj:=wobjTinaMaq;
  FOR i FROM 1 TO 2 DO
    MoveJ pTina30, v400, z100, tPinca\WObj:=wobjTinaMaq;
    MoveJ pTina40, v400, z10, tPinca\WObj:=wobjTinaMaq;
    WaitTime 2;
  ENDFOR
  MoveJ pTina50, v400, fine, tPinca\WObj:=wobjTinaMaq;
  WaitTime 1;
  MoveJ pTina60, v400, z100, tPinca\WObj:=wobjTinaMaq;
  WaitTime 1;
  MoveJ pTina70, vTrabalhoTina, z100, tPinca\WObj:=wobjTinaMaq;
  MoveJ pTina80, vTrabalhoTina, z100, tPinca\WObj:=wobjTinaMaq;
ENDPROC

! Para pegar a peça de outra maneira
PROC rInversor ()
  rSuporteColoca;
  rSuporteRetirar;
ENDPROC

PROC rPROG_RampaMaq_1()
```

```
  ! Coloca Peça Boa na Rampa no caso de não se trabalhar
  ! com a prensa ou esta estar avariada
  MotionSup \Off;

  MoveJ pRampaMaq10_1, vTrabalhoRampa, z100, tPinca\WObj:=wobjRampaMaq;
  MoveJ pRampaMaq20_1, vTrabalhoRampa, z100, tPinca\WObj:=wobjRampaMaq;
  MoveJ pRampaMaq30_1, vTrabalhoRampa, z10, tPinca\WObj:=wobjRampaMaq;
  !MoveJ pRampaMaq40_1, vTrabalhoRampa, z10, tPinca\WObj:=wobjRampaMaq;
  MoveL pRampaMaq50_1, vAproximaMaq, z10, tPinca\WObj:=wobjRampaMaq;
  MoveL pRampaMaq60_1, v200, fine, tPinca\WObj:=wobjRampaMaq;
  rAbrePinca;
  WaitTime 0.2;
  MoveL pRampaMaq70_1, vAproximaMaq, z10, tPinca\WObj:=wobjRampaMaq;
  MoveJ pRampaMaq80_1, vTrabalhoRampa, z10, tPinca\WObj:=wobjRampaMaq;
  MoveJ pRampaMaq90_1, vTrabalhoRampa, z1, tPinca\WObj:=wobjRampaMaq;
  !MoveJ pRampaMaq100_1, vTrabalhoRampa, z50, tPinca\WObj:=wobjRampaMaq;
  !
  MotionSup \On;
  !
  MoveJ pCRITICO, vTrabalhoRampa, z10, tPinca\WObj:=wobjCelulasColos;
  !
ENDPROC

PROC rPROG_RampaMaq_2()
  ! Coloca Peça Boa na Rampa no caso de não se trabalhar
  ! com a prensa ou esta estar avariada
  MotionSup \Off;

  MoveJ pRampaMaq10_2, vTrabalhoRampa, z200, tPinca\WObj:=wobjRampaMaq;
  !MoveJ pRampaMaq20_2, vTrabalhoRampa, z200, tPinca\WObj:=wobjRampaMaq;
  MoveJ pRampaMaq30_2, vTrabalhoRampa, z200, tPinca\WObj:=wobjRampaMaq;
  !MoveJ pRampaMaq40_2, vTrabalhoRampa, z10, tPinca\WObj:=wobjRampaMaq;
  MoveL pRampaMaq50_2, vAproximaMaq, z10, tPinca\WObj:=wobjRampaMaq;
  MoveL pRampaMaq60_2, v200, fine, tPinca\WObj:=wobjRampaMaq;
  rAbrePinca;
  WaitTime 0.2;
  MoveL pRampaMaq70_2, vAproximaMaq, z10, tPinca\WObj:=wobjRampaMaq;
  MoveJ pRampaMaq80_2, vTrabalhoRampa, z10, tPinca\WObj:=wobjRampaMaq;
  MoveJ pRampaMaq90_2, vTrabalhoRampa, z1, tPinca\WObj:=wobjRampaMaq;
  !MoveJ pRampaMaq100_2, vTrabalhoRampa, z50, tPinca\WObj:=wobjRampaMaq;
  !
  MotionSup \On;
  !
  MoveJ pCRITICO, vTrabalhoRampa, z10, tPinca\WObj:=wobjCelulasColos;
  !
ENDPROC

PROC rPROG_RampaMaq_3()
  ! Coloca Peça Boa na Rampa no caso de não se trabalhar
  ! com a prensa ou esta estar avariada
  MotionSup \Off;

  MoveJ pRampaMaq10_3, vTrabalhoRampa, z100, tPinca\WObj:=wobjRampaMaq;
  MoveJ pRampaMaq20_3, vTrabalhoRampa, z100, tPinca\WObj:=wobjRampaMaq;
  MoveJ pRampaMaq30_3, vTrabalhoRampa, z10, tPinca\WObj:=wobjRampaMaq;
  !MoveJ pRampaMaq40_3, vTrabalhoRampa, z10, tPinca\WObj:=wobjRampaMaq;
  MoveL pRampaMaq50_3, vAproximaMaq, z10, tPinca\WObj:=wobjRampaMaq;
  MoveL pRampaMaq60_3, v200, fine, tPinca\WObj:=wobjRampaMaq;
```

```
  rAbrePinca;
  WaitTime 0.2;
  MoveL pRampaMaq70_3, vAproximaMaq, z10, tPinca\WObj:=wobjRampaMaq;
  MoveJ pRampaMaq80_3, vTrabalhoRampa, z10, tPinca\WObj:=wobjRampaMaq;
  MoveJ pRampaMaq90_3, vTrabalhoRampa, z1, tPinca\WObj:=wobjRampaMaq;
  !MoveJ pRampaMaq100_3, vTrabalhoRampa, z50, tPinca\WObj:=wobjRampaMaq;
  !
  MotionSup \On;
  !
  MoveJ pCRITICO, vTrabalhoRampa, z10, tPinca\WObj:=wobjCelulasColos;
  !
ENDPROC

PROC rPROG_RampaMaq_4()
  ! Coloca Peça Boa na Rampa no caso de não se trabalhar
  ! com a prensa ou esta estar avariada
  MotionSup \Off;

  MoveJ pRampaMaq10_4, vTrabalhoRampa, z100, tPinca\WObj:=wobjRampaMaq;
  MoveJ pRampaMaq20_4, vTrabalhoRampa, z100, tPinca\WObj:=wobjRampaMaq;
  MoveJ pRampaMaq30_4, vTrabalhoRampa, z10, tPinca\WObj:=wobjRampaMaq;
  !MoveJ pRampaMaq40_4, vTrabalhoRampa, z10, tPinca\WObj:=wobjRampaMaq;
  MoveL pRampaMaq50_4, vAproximaMaq, z10, tPinca\WObj:=wobjRampaMaq;
  MoveL pRampaMaq60_4, v200, fine, tPinca\WObj:=wobjRampaMaq;
  rAbrePinca;
  WaitTime 0.2;
  MoveL pRampaMaq70_4, vAproximaMaq, z10, tPinca\WObj:=wobjRampaMaq;
  MoveJ pRampaMaq80_4, vTrabalhoRampa, z10, tPinca\WObj:=wobjRampaMaq;
  MoveJ pRampaMaq90_4, vTrabalhoRampa, z1, tPinca\WObj:=wobjRampaMaq;
  !MoveJ pRampaMaq100_4, vTrabalhoRampa, z50, tPinca\WObj:=wobjRampaMaq;
  !
  MotionSup \On;
  !
  MoveJ pCRITICO, vTrabalhoRampa, z10, tPinca\WObj:=wobjCelulasColos;
  !
ENDPROC

PROC rPROG_RampaMaq_5()
  ! Coloca Peça Boa na Rampa no caso de não se trabalhar
  ! com a prensa ou esta estar avariada
  MotionSup \Off;

  MoveJ pRampaMaq10_5, vTrabalhoRampa, z100, tPinca\WObj:=wobjRampaMaq;
  MoveJ pRampaMaq20_5, vTrabalhoRampa, z100, tPinca\WObj:=wobjRampaMaq;
  MoveJ pRampaMaq30_5, vTrabalhoRampa, z10, tPinca\WObj:=wobjRampaMaq;
  !MoveJ pRampaMaq40_5, vTrabalhoRampa, z10, tPinca\WObj:=wobjRampaMaq;
  MoveL pRampaMaq50_5, vAproximaMaq, z10, tPinca\WObj:=wobjRampaMaq;
  MoveL pRampaMaq60_5, v200, fine, tPinca\WObj:=wobjRampaMaq;
  rAbrePinca;
  WaitTime 0.2;
  MoveL pRampaMaq70_5, vAproximaMaq, z10, tPinca\WObj:=wobjRampaMaq;
  MoveJ pRampaMaq80_5, vTrabalhoRampa, z10, tPinca\WObj:=wobjRampaMaq;
  MoveJ pRampaMaq90_5, vTrabalhoRampa, z1, tPinca\WObj:=wobjRampaMaq;
  !MoveJ pRampaMaq100_5, vTrabalhoRampa, z50, tPinca\WObj:=wobjRampaMaq;
  !
  MotionSup \On;
  !
  MoveJ pCRITICO, vTrabalhoRampa, z10, tPinca\WObj:=wobjCelulasColos;
```

```
  !
ENDPROC

PROC rPROG_RampaMaq_6()
  ! Coloca Peça Boa na Rampa no caso de não se trabalhar
  ! com a prensa ou esta estar avariada
  MotionSup \Off;

  MoveJ pRampaMaq10_6, vTrabalhoRampa, z100, tPinca\WObj:=wobjRampaMaq;
  MoveJ pRampaMaq20_6, vTrabalhoRampa, z100, tPinca\WObj:=wobjRampaMaq;
  MoveJ pRampaMaq30_6, vTrabalhoRampa, z10, tPinca\WObj:=wobjRampaMaq;
  !MoveJ pRampaMaq40_6, vTrabalhoRampa, z10, tPinca\WObj:=wobjRampaMaq;
  MoveL pRampaMaq50_6, vAproximaMaq, z10, tPinca\WObj:=wobjRampaMaq;
  MoveL pRampaMaq60_6, v200, fine, tPinca\WObj:=wobjRampaMaq;
  rAbrePinca;
  WaitTime 0.2;
  MoveL pRampaMaq70_6, vAproximaMaq, z10, tPinca\WObj:=wobjRampaMaq;
  MoveJ pRampaMaq80_6, vTrabalhoRampa, z10, tPinca\WObj:=wobjRampaMaq;
  MoveJ pRampaMaq90_6, vTrabalhoRampa, z1, tPinca\WObj:=wobjRampaMaq;
  !MoveJ pRampaMaq100_6, vTrabalhoRampa, z50, tPinca\WObj:=wobjRampaMaq;
  !
  MotionSup \On;
  !
  MoveJ pCRITICO, vTrabalhoRampa, z10, tPinca\WObj:=wobjCelulasColos;
  !
ENDPROC

PROC rPrensaMaq()
  ! Coloca Peça na Prensa para extrair partes excedentes
  IF diFTPWithIRB = 1 THEN
    WaitUntil diFTPInserted=1\MaxTime:=1\TimeFlag:=bFalha;
    IF NOT bFalha THEN
      SetDO doFTPIRBSave,0;
      SetDO doFTPInserted,0;
      !PulseDO\PLength:=3, doSoproPrensa;
      MoveL pPrensaColos10, v1500, z50, tPinca\WObj:=WobjPrensaColosi;
      MoveL pPrensaColos20, v800, z10, tPinca\WObj:=WobjPrensaColosi;
      MoveL pPrensaColos30, v800, z10, tPinca\WObj:=wobjPrensaColosi;
      MoveL pPrensaColos40, v800, z10, tPinca\WObj:=wobjPrensaColosi;
      MoveL pPrensaColos50, v800, z10, tPinca\WObj:=wobjPrensaColosi;
      MoveL pPrensaColos60, v800, z10, tPinca\WObj:=wobjPrensaColosi;
      MoveL pPrensaColos70, v800, z10, tPinca\WObj:=wobjPrensaColosi;
      MoveL pPrensaColos80, v200, fine, tPinca\WObj:=WobjPrensaColosi;
      rAbrePinca;
      WaitTime 0.2;
      MoveL pPrensaColos90, v500, fine, tPinca\WObj:=WobjPrensaColosi;
      MoveL pPrensaColos100, v500, fine, tPinca\WObj:=WobjPrensaColosi;
      MoveL pPrensaColos110, v1500, fine, tPinca\WObj:=WobjPrensaColosi;
      !
      MoveL pPrensaColos120, vTrabalhoMaq, z50, tPinca\WObj:=WobjPrensaColosi;
      MoveL pPrensaColos130, vTrabalhoMaq, z50, tPinca\WObj:=WobjPrensaColosi;
      MoveJ pPrensaColos140, vTrabalhoMaq, fine, tPinca\WObj:=WobjPrensaColosi;
      SetDO doFTPIRBSave,1;
      PulseDO\PLength:=2,doFTPInserted;
      WaitTime 1.0;
      MoveJ pCRITICO, vTrabalhoMaq, z20, tPinca\WObj:=wobjCelulasColos;
      rRepouso;
      !PulseDO\PLength:=15, doSoproPrensa;
```

```
      SetDO doFTPIRBSave,1;
      SetDO doFTPInserted,0;
    ELSE
      !rRampaMaq;
    ENDIF
  ELSE
    !rRampaMaq;
  ENDIF
ENDPROC

PROC rPrensaMass()
  ! Coloca Peça na Prensa para extrair partes excedentes
  IF diFTPWithIRB = 1 THEN
    WaitUntil diFTPMassInserted=1\MaxTime:=1\TimeFlag:=bFalha;
    IF NOT bFalha THEN
      SetDO doFTPIRBMassSave,0;
      SetDO doFTPMassInserted,0;
      !PulseDO\PLength:=3, doSoproPrensa;
      MoveL pPrensaMass10, v1500, z50, tPinca\WObj:=WobjPrensaColosi;
      MoveL pPrensaMass20, v800, z10, tPinca\WObj:=WobjPrensaColosi;
      MoveL pPrensaMass30, v800, z10, tPinca\WObj:=wobjPrensaColosi;
      MoveL pPrensaMass40, v800, z10, tPinca\WObj:=wobjPrensaColosi;
      MoveL pPrensaMass50, v800, z10, tPinca\WObj:=wobjPrensaColosi;
      MoveL pPrensaMass60, v800, z10, tPinca\WObj:=wobjPrensaColosi;
      MoveL pPrensaMass70, v800, z10, tPinca\WObj:=wobjPrensaColosi;
      MoveL pPrensaMass80, v200, fine, tPinca\WObj:=WobjPrensaColosi;
      rAbrePinca;
      WaitTime 0.2;
      MoveL pPrensaMass90, v500, fine, tPinca\WObj:=WobjPrensaColosi;
      MoveL pPrensaMass100, v500, fine, tPinca\WObj:=WobjPrensaColosi;
      MoveL pPrensaMass110, v1500, fine, tPinca\WObj:=WobjPrensaColosi;
      !
      MoveL pPrensaMass120, vTrabalhoMaq, z50, tPinca\WObj:=WobjPrensaColosi;
      MoveL pPrensaMass130, vTrabalhoMaq, z50, tPinca\WObj:=WobjPrensaColosi;
      MoveJ pPrensaMass140, vTrabalhoMaq, fine, tPinca\WObj:=WobjPrensaColosi;
      SetDO doFTPIRBMassSave,1;
      PulseDO\PLength:=2,doFTPMassInserted;
      WaitTime 1.0;
      MoveJ pCRITICO, vTrabalhoMaq, z20, tPinca\WObj:=wobjCelulasColos;
      rRepouso;
      !PulseDO\PLength:=15, doSoproPrensa;
      SetDO doFTPIRBMassSave,1;
      SetDO doFTPMassInserted,0;
    ELSE
      !rRampaMaq;
    ENDIF
  ELSE
    !rRampaMaq;
  ENDIF
ENDPROC

PROC rPROG_PecaDefeitoColo_1()
    ! Coloca Peça Com Defeito no Contentor do Lixo
    MoveJ pLixoMaq10_1, vTrabalhoMaq, z50, tPinca\WObj:=wobjLixo;
    MoveJ pLixoMaq20_1, vTrabalhoMaq, z100, tPinca\WObj:=wobjLixo;
    MoveJ pLixoMaq30_1, vTrabalhoMaq, z100, tPinca\WObj:=wobjLixo;
    MoveJ pLixoMaq40_1, vTrabalhoMaq, fine, tPinca\WObj:=wobjLixo;
    rAbrePinca;
```

```
    WaitTime 0.5;
    MoveJ pLixoMaq50_1, vTrabalhoMaq, z50, tPinca\WObj:=wobjLixo;
    MoveJ pLixoMaq60_1, vTrabalhoMaq, z50, tPinca\WObj:=wobjLixo;
    MoveJ pLixoMaq70_1, vTrabalhoMaq, z50, tPinca\WObj:=wobjLixo;
    MoveJ pCRITICO, vTrabalhoMaq, z20, tPinca\WObj:=wobjCelulasColos;
    !
ENDPROC

PROC rPROG_PecaDefeitoColo_2()
    ! Coloca Peça Com Defeito no Contentor do Lixo
    MoveJ pLixoMaq10_2, vTrabalhoMaq, z50, tPinca\WObj:=wobjLixo;
    MoveJ pLixoMaq20_2, vTrabalhoMaq, z100, tPinca\WObj:=wobjLixo;
    MoveJ pLixoMaq30_2, vTrabalhoMaq, z100, tPinca\WObj:=wobjLixo;
    MoveJ pLixoMaq40_2, vTrabalhoMaq, fine, tPinca\WObj:=wobjLixo;
    rAbrePinca;
    WaitTime 0.5;
    MoveJ pLixoMaq50_2, vTrabalhoMaq, z50, tPinca\WObj:=wobjLixo;
    MoveJ pLixoMaq60_2, vTrabalhoMaq, z50, tPinca\WObj:=wobjLixo;
    MoveJ pLixoMaq70_2, vTrabalhoMaq, z50, tPinca\WObj:=wobjLixo;
    MoveJ pCRITICO, vTrabalhoMaq, z20, tPinca\WObj:=wobjCelulasColos;
    !
ENDPROC

PROC rPROG_PecaDefeitoColo_3()
    ! Coloca Peça Com Defeito no Contentor do Lixo
    MoveJ pLixoMaq10_3, vTrabalhoMaq, z50, tPinca\WObj:=wobjLixo;
    MoveJ pLixoMaq20_3, vTrabalhoMaq, z100, tPinca\WObj:=wobjLixo;
    MoveJ pLixoMaq30_3, vTrabalhoMaq, z100, tPinca\WObj:=wobjLixo;
    MoveJ pLixoMaq40_3, vTrabalhoMaq, fine, tPinca\WObj:=wobjLixo;
    rAbrePinca;
    WaitTime 0.5;
    MoveJ pLixoMaq50_3, vTrabalhoMaq, z50, tPinca\WObj:=wobjLixo;
    MoveJ pLixoMaq60_3, vTrabalhoMaq, z50, tPinca\WObj:=wobjLixo;
    MoveJ pLixoMaq70_3, vTrabalhoMaq, z50, tPinca\WObj:=wobjLixo;
    MoveJ pCRITICO, vTrabalhoMaq, z20, tPinca\WObj:=wobjCelulasColos;
    !
ENDPROC

PROC rPROG_PecaDefeitoColo_4()
    ! Coloca Peça Com Defeito no Contentor do Lixo
    MoveJ pLixoMaq10_4, vTrabalhoMaq, z50, tPinca\WObj:=wobjLixo;
    MoveJ pLixoMaq20_4, vTrabalhoMaq, z100, tPinca\WObj:=wobjLixo;
    MoveJ pLixoMaq30_4, vTrabalhoMaq, z100, tPinca\WObj:=wobjLixo;
    MoveJ pLixoMaq40_4, vTrabalhoMaq, fine, tPinca\WObj:=wobjLixo;
    rAbrePinca;
    WaitTime 0.5;
    MoveJ pLixoMaq50_4, vTrabalhoMaq, z50, tPinca\WObj:=wobjLixo;
    MoveJ pLixoMaq60_4, vTrabalhoMaq, z50, tPinca\WObj:=wobjLixo;
    MoveJ pLixoMaq70_4, vTrabalhoMaq, z50, tPinca\WObj:=wobjLixo;
    MoveJ pCRITICO, vTrabalhoMaq, z20, tPinca\WObj:=wobjCelulasColos;
    !
ENDPROC

PROC rPROG_PecaDefeitoColo_5()
    ! Coloca Peça Com Defeito no Contentor do Lixo
    MoveJ pLixoMaq10_5, vTrabalhoMaq, z50, tPinca\WObj:=wobjLixo;
    MoveJ pLixoMaq20_5, vTrabalhoMaq, z100, tPinca\WObj:=wobjLixo;
    MoveJ pLixoMaq30_5, vTrabalhoMaq, z100, tPinca\WObj:=wobjLixo;
```

```
    MoveJ pLixoMaq40_5, vTrabalhoMaq, fine, tPinca\WObj:=wobjLixo;
    rAbrePinca;
    WaitTime 0.5;
    MoveJ pLixoMaq50_5, vTrabalhoMaq, z50, tPinca\WObj:=wobjLixo;
    MoveJ pLixoMaq60_5, vTrabalhoMaq, z50, tPinca\WObj:=wobjLixo;
    MoveJ pLixoMaq70_5, vTrabalhoMaq, z50, tPinca\WObj:=wobjLixo;
    MoveJ pCRITICO, vTrabalhoMaq, z20, tPinca\WObj:=wobjCelulasColos;
    !
ENDPROC

PROC rPROG_PecaDefeitoColo_6()
    ! Coloca Peça Com Defeito no Contentor do Lixo
    MoveJ pLixoMaq10_6, vTrabalhoMaq, z50, tPinca\WObj:=wobjLixo;
    MoveJ pLixoMaq20_6, vTrabalhoMaq, z100, tPinca\WObj:=wobjLixo;
    MoveJ pLixoMaq30_6, vTrabalhoMaq, z100, tPinca\WObj:=wobjLixo;
    MoveJ pLixoMaq40_6, vTrabalhoMaq, fine, tPinca\WObj:=wobjLixo;
    rAbrePinca;
    WaitTime 0.5;
    MoveJ pLixoMaq50_6, vTrabalhoMaq, z50, tPinca\WObj:=wobjLixo;
    MoveJ pLixoMaq60_6, vTrabalhoMaq, z50, tPinca\WObj:=wobjLixo;
    MoveJ pLixoMaq70_6, vTrabalhoMaq, z50, tPinca\WObj:=wobjLixo;
    MoveJ pCRITICO, vTrabalhoMaq, z20, tPinca\WObj:=wobjCelulasColos;
    !
ENDPROC

PROC rSoproMovelFixo ()
    reset doDesmoldante;
    reset doArSpray;
    reset doPilotagemFixa;
    reset doPilotagemMovel;
    set doSopro;
ENDPROC

PROC rDesligaSoproMovelFixo()
    reset doSopro;
ENDPROC

PROC rPulverizaDesmMovel()
    reset doSopro;
    reset doPilotagemFixa;
    set doDesmoldante;
    set doArSpray;
    set doPilotagemMovel;
 ENDPROC

 PROC rPulverizaDesmFixo()
    reset doSopro;
    reset doPilotagemMovel;
    set doDesmoldante;
    set doArSpray;
    set doPilotagemFixa;
ENDPROC

PROC rPulverizaDesmMovelFixo()
    reset doSopro;
    set doDesmoldante;
    set doArSpray;
    set doPilotagemMovel;
```

```
    set doPilotagemFixa;
 ENDPROC

PROC rDesligaPulverizaMovel()
    reset doPilotagemMovel;
ENDPROC

PROC rDesligaPulverizaFixo()
    reset doPilotagemFixa;
ENDPROC

PROC rDesligaTudoMovelFixo()
    reset doDesmoldante;
    reset doArSpray;
    reset doSopro;
    reset doPilotagemFixa;
    reset doPilotagemMovel;
ENDPROC

PROC rInicia ()
  !Serve para estabelecer condições inicias do programa
  !em caso de inicio do principio
  !Reset doFechaPortaColo;
  Reset doIniCicloMaq; !RG 2009-07-06
  Reset doExtratorFrente;
  Reset doFalhaPeca;
  Reset doFTPInserted;
  Reset doRecuarPist;
  SoftDeact;
  rDesligaTudoMovelFixo;

  !LV RETIRAR
  rCtrlRepouso;

  !"""""""""""""""""""""""""""""""""""""""""""""""""""
  !Condição Para Garantir o primeiro ciclo da Maq
  Set doIniCicloMaq; !RG 2009-07-06
  Set doPer_FechoMolde;
  bMaquinaInjectou:=FALSE;
    rLigaIntMaquInjecao;
ENDPROC

PROC rLigaIntMaquInjecao ()
  IDelete intMaqInjectou;
  CONNECT intMaqInjectou WITH trapmaquinaInjectou;
  ISignalDI diInjEfectuada,1,intMaqInjectou;
ENDPROC

PROC rCtrlRepouso()
lbInicio:
  IF DOutput(DoRepouso)=0 THEN
     TPErase;
     TPWrite "* Robo Nao Esta em Posicao Repouso *";
     TPWrite "* Passe Robo p/ Modo Manual e        *";
     TPWrite "* Coloque-o em Posicao de Repouso .  *";
     TPWrite "* ROTINA......rRepouso  *";
     TPReadFK reg1,"",stEmpty,stEmpty,stEmpty,stEmpty,"STOP";
     GOTO lbInicio;
```

```
   ELSE
     TPErase;
     TPReadFK reg1,"Pretende Alterar Molde?","SIM",stEmpty,stEmpty,stEmpty,"NÃO";
     TEST reg1
        CASE 1:
            !Pos troca molde
            rTrocaMolde;
            Set doIniCicloMaq; !RG 2009-07-06
            Set doPer_FechoMolde;
            bMaquinaInjectou:=FALSE;
            TPReadFK reg1,"Prima OK quando terminar...",stEmpty,stEmpty,stEmpty,stEmpty,"OK";
            MoveJ [[402.81,-366.61,960.43],[0.388058,0.582673,0.593878,0.396499],[0,-1,1,0],[9E
+09,9E+09,9E+09,9E+09,9E+09,9E+09]], v300, z50, tPinca\WObj:=wobjCelulasColos;
            rRepouso;
        CASE 5:
            !
     ENDTEST

   ENDIF
ENDPROC

PROC rTrocaMolde()

    MoveJ [[402.81,-366.61,960.43],[0.388058,0.582673,0.593878,0.396499],[0,-1,1,0],[9E+09,9E+09,9E
+09,9E+09,9E+09,9E+09]], v300, z50, tPinca\WObj:=wobjCelulasColos;
    MoveJ [[737.63,-352.32,1123.21],[0.386943,0.582652,0.594969,0.395986],[0,-1,1,0],[9E+09,9E+09,9E
+09,9E+09,9E+09,9E+09]], v300, z50, tPinca\WObj:=wobjCelulasColos;

ENDPROC

PROC rSegurancaREPOUS()
  ! Actuada Pelo sistema  sinal de Power On/Restart
  ! Para Mudar variaveis alteras (posCentroEsfera/nRaioEsfera)
  ! e Reiniciar Sistema
  ! NAO MEXER !!!!!!!
  WZSphDef\Inside,shpVZonaSegRep,posCentroEsfera,nRaioEsfera;
  WZDOSet\Stat,wzZonaRep\Inside,shpVZonaSegRep,DoRepouso,1;
ENDPROC

PROC rSegurancaCOLOSI()
  ! Actuada Pelo sistema  sinal de Power On/Restart
  ! Para Mudar variaveis alteras (posCanto1ZColos/posCanto2ZColos)
  ! e Reiniciar Sistema
  ! NAO MEXER !!!!!!!
  WZBoxDef\Inside,shpVZonaSegColos,posCanto1ZColos,posCanto2ZColos;
  WZDOSet\Stat, wzZonaColos\Inside, shpVZonaSegColos, doForaMaqInj,0;
ENDPROC

PROC rData()
  ! Detecta mudanca de dia
  bDataMudou:=false;
  stDataNova:=CDate();
  stDia:=StrPart(stDataNova,9,2);
  nDataTeste:=StrMatch(stDataNova,1,stDataVelha);
  IF nDataTeste<>1 THEN
    stDataVelha:=stDataNova;
    nNumPecasMaq:=0;
    bDataMudou:=true;
```

```
  ENDIF
ENDPROC

PROC rMarcas()
    ! Coloca robô na Posição de Marcas
    ! Usada para efeitos de teste em caso de manutenção
    MoveAbsJ [[-45,0,0,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]]\NoEOffs, v100, fine, tool0;
    stop;
    MoveAbsJ [[-90,0,0,0,0,0],[9E+09,9E+09,9E+09,9E+09,9E+09,9E+09]]\NoEOffs, v100, fine, tool0;
    Stop;
ENDPROC

PROC rColosio_T()
  VAR robtarget pActual;
  ! SO PARA TESTAR INTERFACE COM COLOSIO
  ! Retira peça da Máquina COLOSIO
  MoveJ pMaq10T, vTrabalhoMaq, z50, tPinca\WObj:=wobjMaq;
  MoveJ pMaq20T, vTrabalhoMaq, z50, tPinca\WObj:=wobjMaq;
  MoveJ pMaq30T, vTrabalhoMaq, z50, tPinca\WObj:=wobjMaq;
  SetDO doExtratorFrente,1;
  WaitUntil diExtratorFrente=1\MaxTime:=nTempoEjectMaq\TimeFlag:=bFalhaEjectFrent;
  IF NOT bFalhaEjectFrent THEN
      WaitTime 0.2;
      pActual:=CRobT(\Tool:=tPinca);
      MoveJ pActual,vAproximaMaq,fine,tPinca;
      WaitTime 0.1;
      WaitTime 0.1;
      Reset doExtratorFrente;
      WaitUntil diExtratorAtras=1\MaxTime:=nTempoEjectMaq\TimeFlag:=bFalhaEjectAtras;
  ELSE
      ! Falha Ejectores não foram a frente
      WaitTime 0.2;
      pActual:=CRobT(\Tool:=tPinca);
      MoveL pActual,vAproximaMaq,fine,tPinca;
      WaitTime 0.2;
      WaitTime 0.2;
      rAbrePinca;
      WaitTime 0.1;
      MoveJ pMaq40T, vAproximaMaq, fine, tPinca\WObj:=wobjMaq;
      Reset doExtratorFrente;
      WaitUntil diExtratorAtras=1\MaxTime:=nTempoEjectMaq\TimeFlag:=bFalhaEjectAtras;
  ENDIF
  ! Recuar Pistao
  PulseDO\PLength:=3,doRecuarPist;
  !MoveL pMaq40T, vTrabalhoMaq, z50, tPinca\WObj:=wobjMaq;
  MoveJ pMaq30T, vTrabalhoMaq, z50, tPinca\WObj:=wobjMaq;
  MoveJ pMaq20T, vTrabalhoMaq, z50, tPinca\WObj:=wobjMaq;
  !MoveL pMaq10T, vTrabalhoMaq, z50, tPinca\WObj:=wobjMaq;
  !rLubrifica2;
  TPwrite "Fim Injecção";
ENDPROC

PROC rMenuPrincipal()
VAR num nDummy;
  lbIni_rMenuPrincipal:
        TPErase;
        TPWrite "1- " + strPrograma_1;
        TPWrite "2- " + strPrograma_2;
```

```
        TPWrite "3- " + strPrograma_3;
        TPWrite "4- " + strPrograma_4;
        TPWrite "5- " + strPrograma_5;
        TPWrite "6- " + strPrograma_6;
        TPReadNum nDummy,"Seleccione o Programa Desejado";
        nPrograma:=nDummy;
        TEST nDummy
            CASE 1:
                strPrograma:=strPrograma_1;
            CASE 2:
                strPrograma:=strPrograma_2;
            CASE 3:
                strPrograma:=strPrograma_3;
            CASE 4:
                strPrograma:=strPrograma_4;
            CASE 5:
                strPrograma:=strPrograma_5;
            CASE 6:
                strPrograma:=strPrograma_6;
            DEFAULT:
                TPErase;
                TPReadFK reg1,"Valor Invalido! Prima OK para                                    ↵
continuar.",stEmpty,stEmpty,stEmpty,stEmpty,"OK";
                GOTO lbIni_rMenuPrincipal;
        ENDTEST
ENDPROC


TRAP trapMaquinaInjectou
  ! Para Detectar que máquina fez INJEÇÃO
  Reset doIniCicloMaq;
  Reset doPer_FechoMolde;
  bMaquinaInjectou:=TRUE;
ENDTRAP

ENDMODULE
```