CCM

USER MANUAL

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CCM

The software product CCM is fully oriented to the manufacturers of castings by the method of centrifugal casting with vertical and horizontal axis of alloy steels and cast irons. The first – technological part - offers complete generation of technologies of consultative nature for the production of pipe details, transitions, cylinder liners, bimetallic mill shafts and more.

The software supports databases entered by the user:

- charge materials

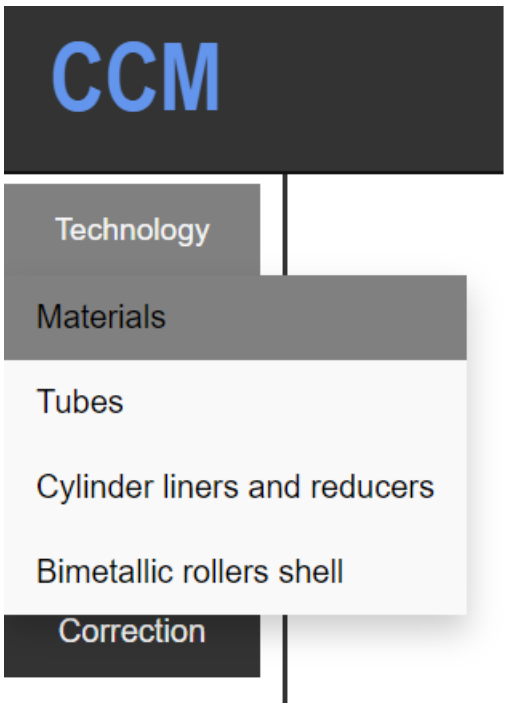
- steel and cast iron foundry brands

- molds

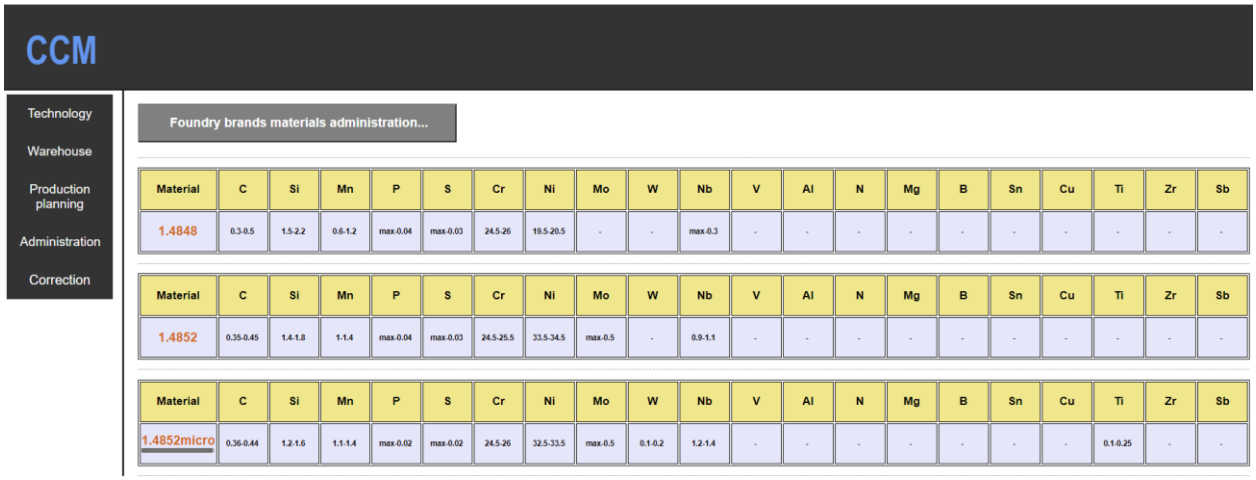
In addition to the production technology, CCM generates a material balance for the selected material that the user has chosen for the specific part and offers deoxidizers, modifiers and microalloying elements depending on the specific case.

1.Add/Edit/Delete foundry materials

Select from the menu -> **Technology / Materials**.



This opens the following page:

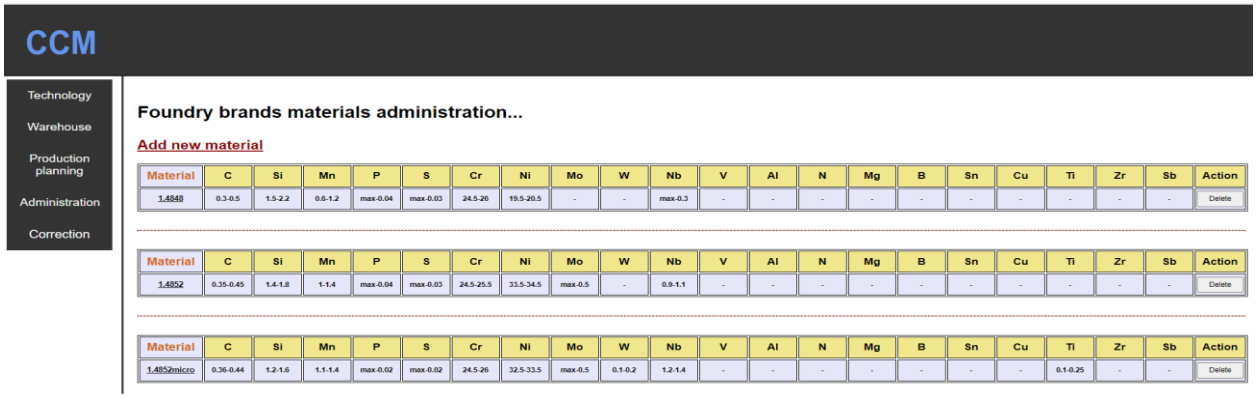


Each line represents a material entered by the user with the appropriate chemical composition. This page is entirely informative. The software offers access levels – a specific user other than the administrator of the organization using the product may have limited access given by the administrator to the option to add new materials and edit existing ones, but will still be able to view those that has been already entered.

1.1. Add new and edit existing materials

Select the button:

This opens the following page:

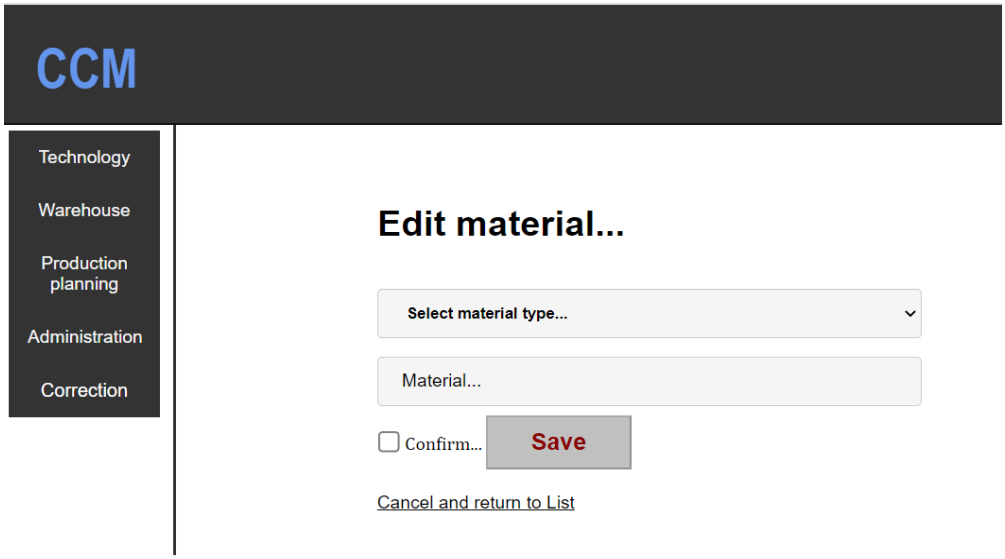


There are three options – add a new material, edit an existing material, and delete a material.

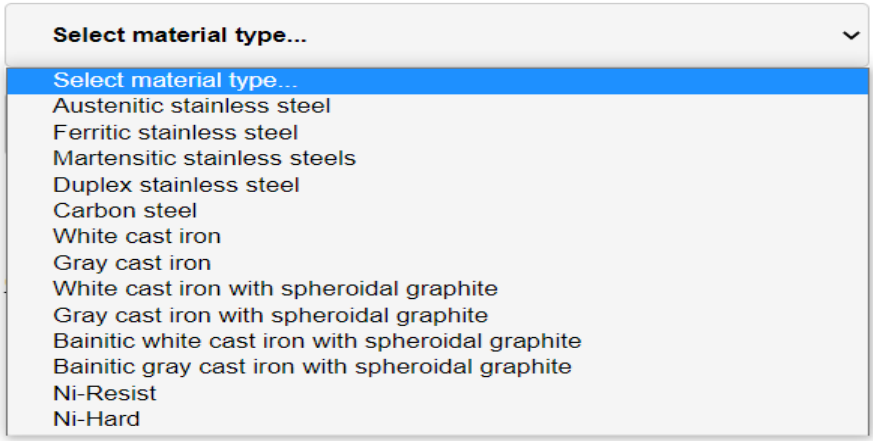
1.1.1. Add new materials

Click on:

This opens:



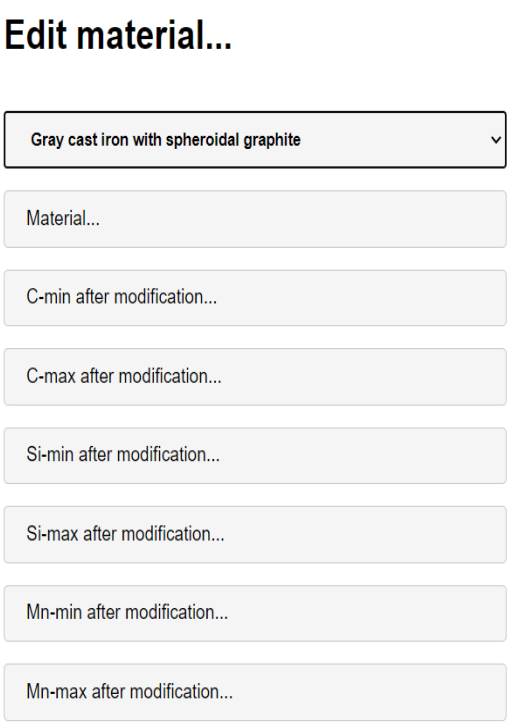
Select -> **Select material type…** and select the type of input material:



If you select a type other than **White cast iron with spheroidal graphite**, **Gray cast iron with spheroidal graphite**, **Bainitic white cast iron with spheroidal graphite** or **Bainitic gray cast iron with spheroidal graphite**, this opens:

Enter the chemical composition that must be achieved in the furnace before casting.

Otherwise, the following opens:

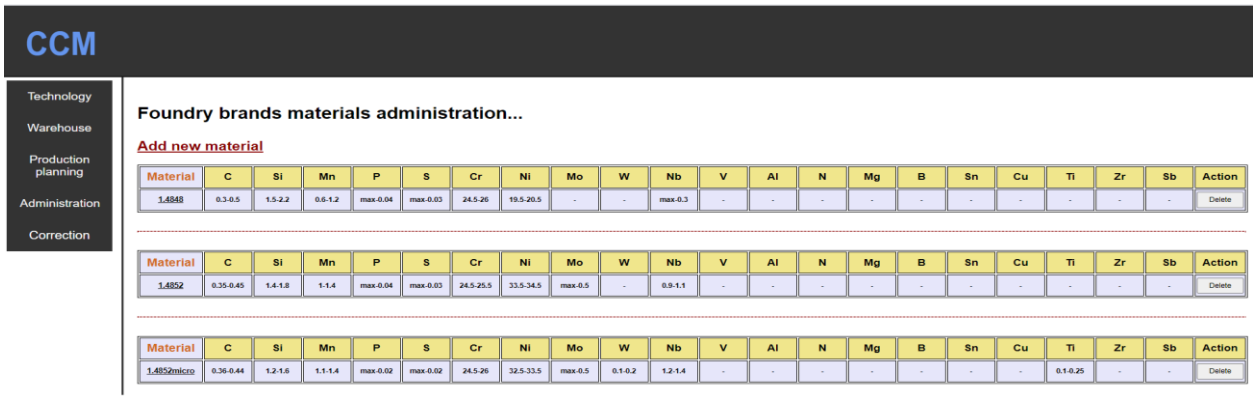


In this case, you must enter the chemical composition that you expect to achieve after the modification in the foundry bucket. When preparing the material balance, the software will independently determine the chemical composition that you need to achieve in the furnace based on the composition of the modifiers that you have entered in the charge materials section.

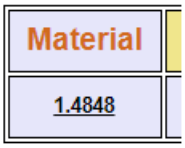
After entering the required data, confirm and save:

1.1.2. Edit existing materials

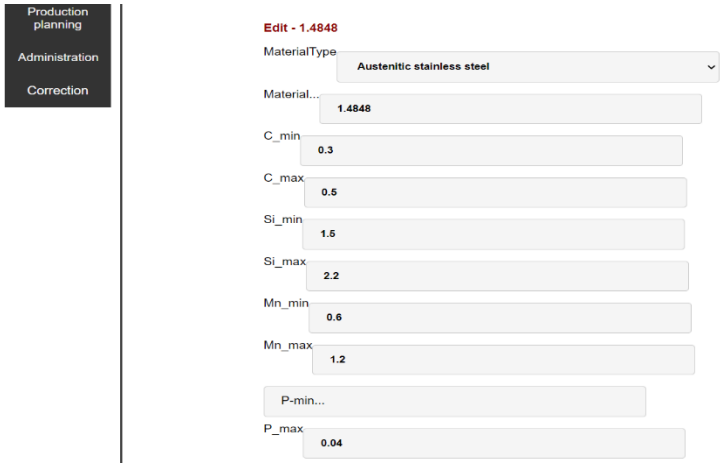
On the page:



Go to the name of the material you want to change:



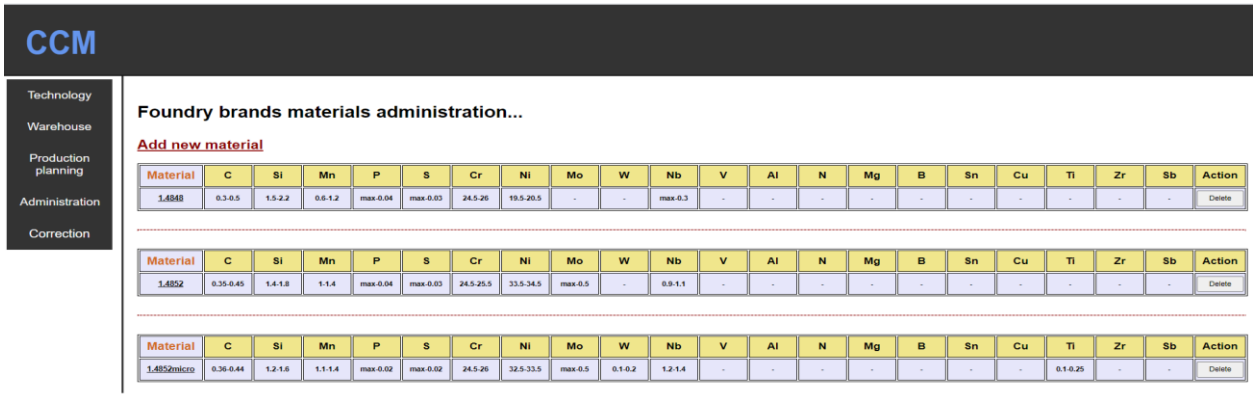
This opens the following page:



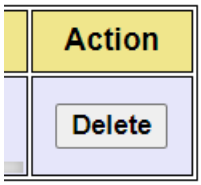
Make the necessary changes and save.

1.2 Delete materials

Open the page:



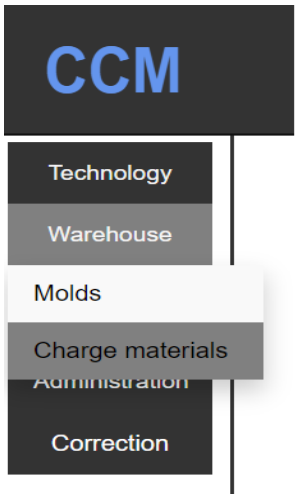
Select the button -> **Delete** from the line of material you want to remove:



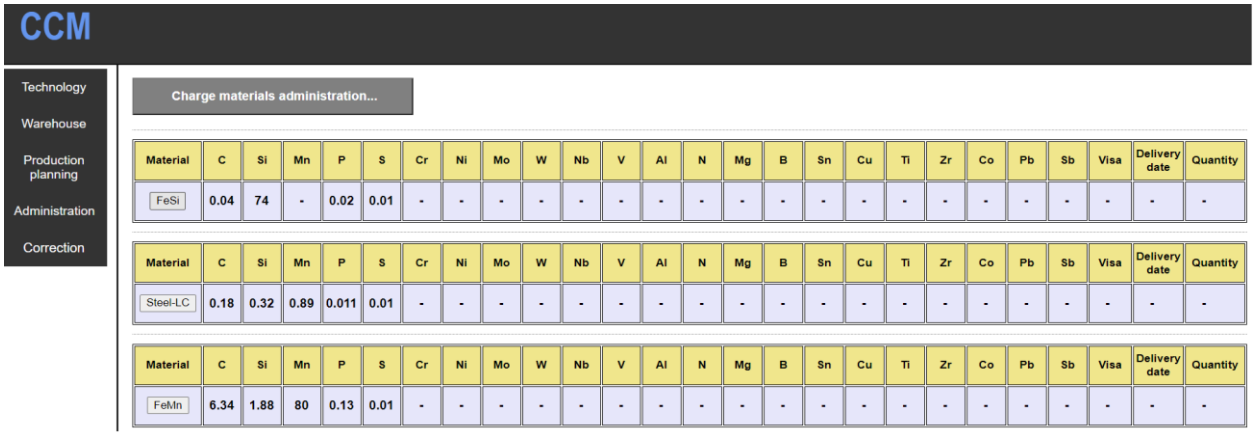
Clicking it will permanently remove the selected material from the database.

2. Add/Edit/Delete charge materials

Select from the menu -> **Warehouse/Charge materials**:



This opens the following page:

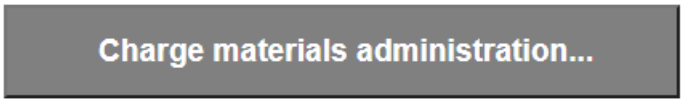


This is an informative page, visualizing all the materials available in the warehouse. Changes related to the charge materials cannot be made from it. If you go over the name of the charge material:

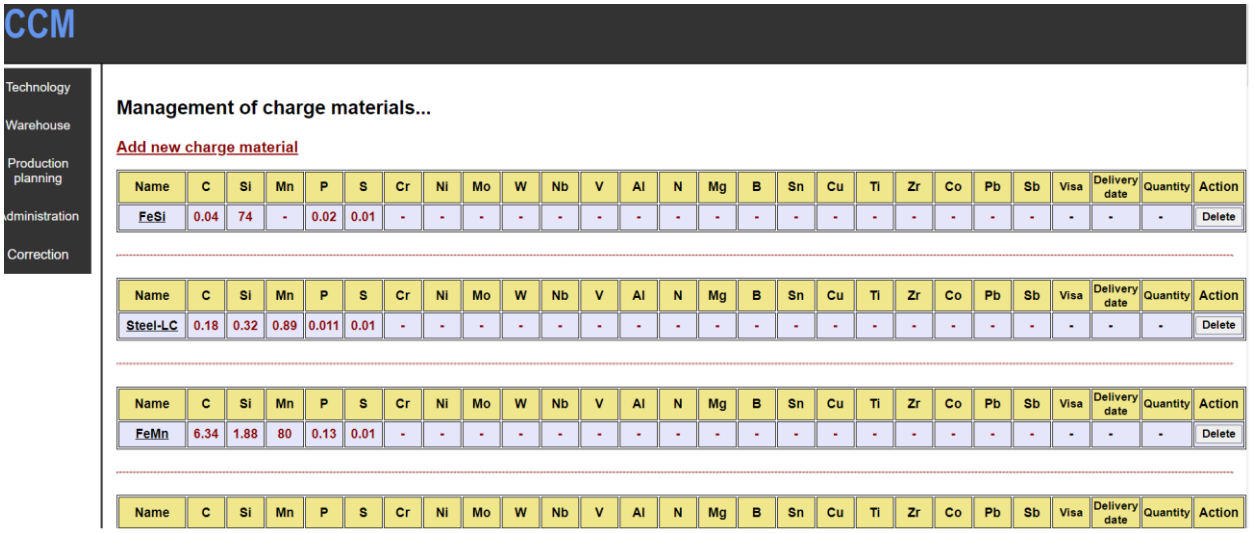
You will see the certificate from the manufacturer of the respective material, if it is attached by the employee responsible for the addition of the charge materials.

2.1. Add new charge material and edit existing charge materials

Go to:



This opens the following:



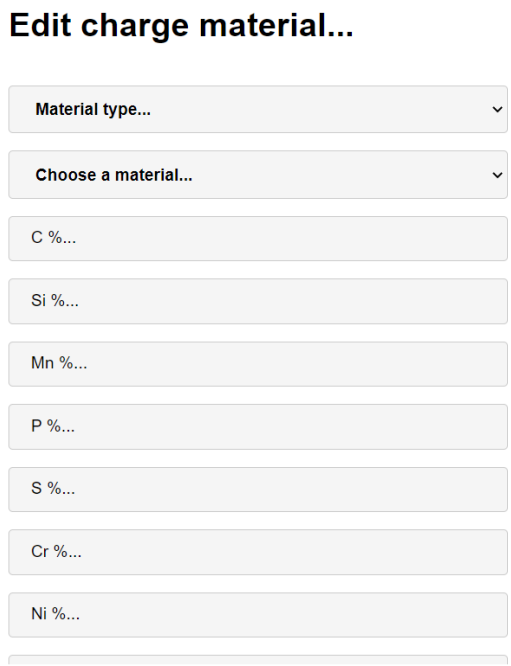
The content fields that would cause questions are:

- Visa – a number that is assigned to the material in question in the process of incoming control.
- Delivery data – the date on which the material arrived at the warehouse.
- Quantity – the amount of material obtained in the warehouse.

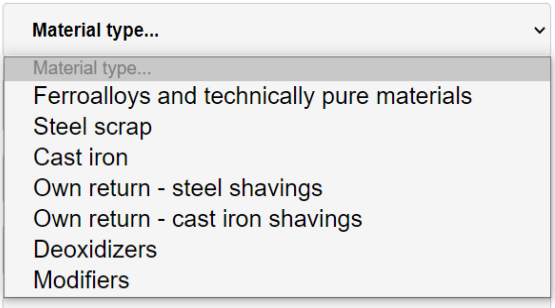
2.1.1. Add new charge materials

Choose:

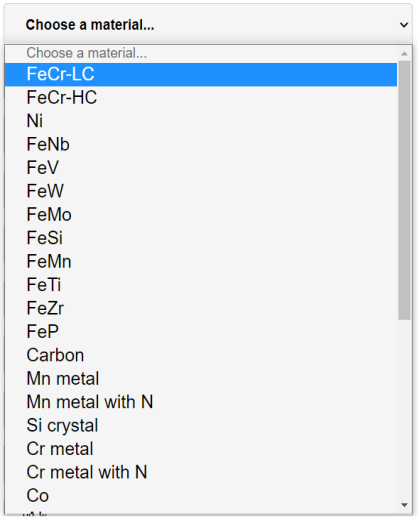
A page in the following format appears:



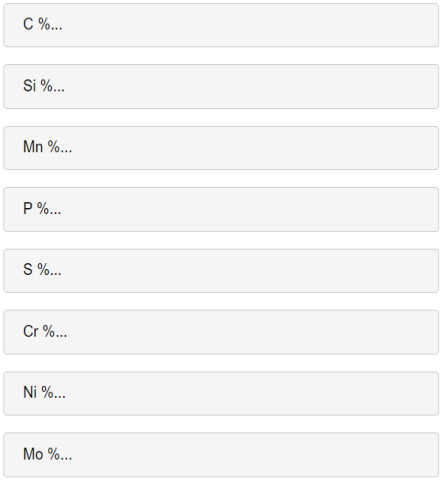
You must select a material type from the field -> **Material type…**:



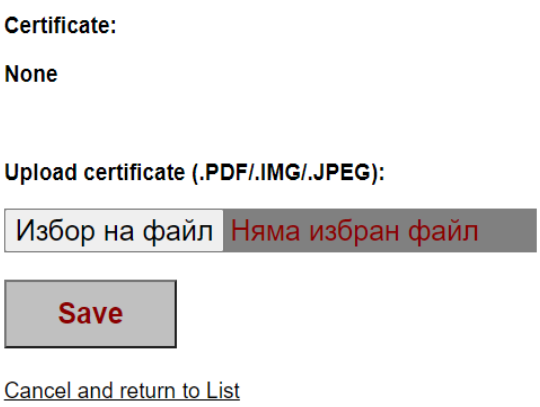
Then you need to select a material from the field -> **Choose a material…**:



Then enter the chemical composition of the material in the corresponding fields:



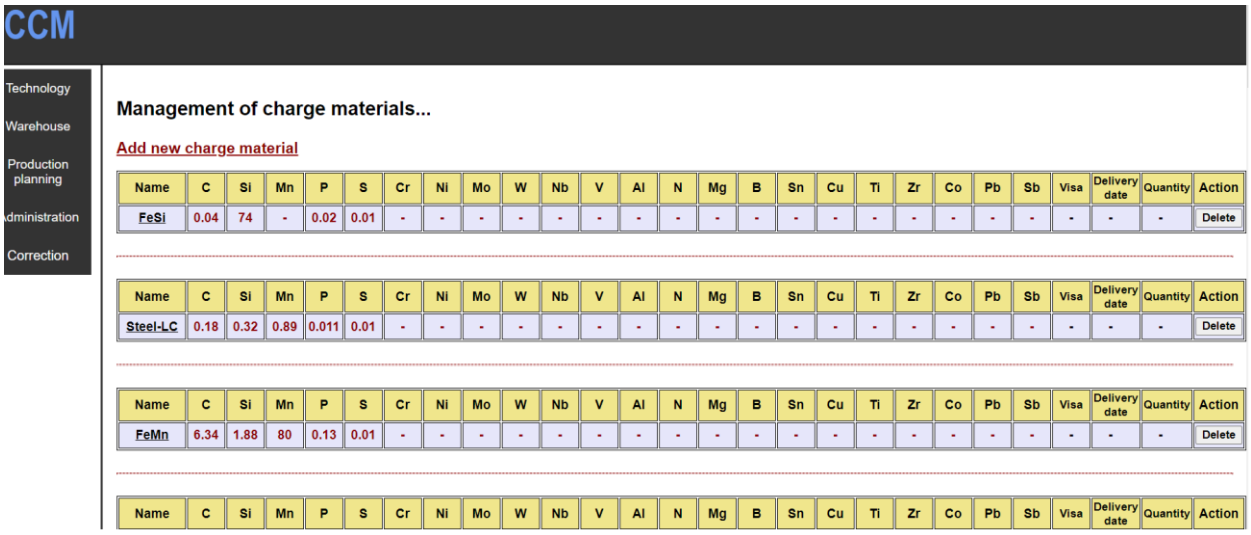
Attach a certificate, if any and save:



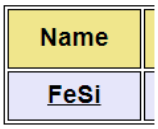
In this way, you can enter an unlimited number of materials of the same type with the same name. You can distinguish them by visa number, chemical composition, delivery date and quantities.

2.1.2. Edit existing charge materials

From the page:



Go to the name of the material you want to change:

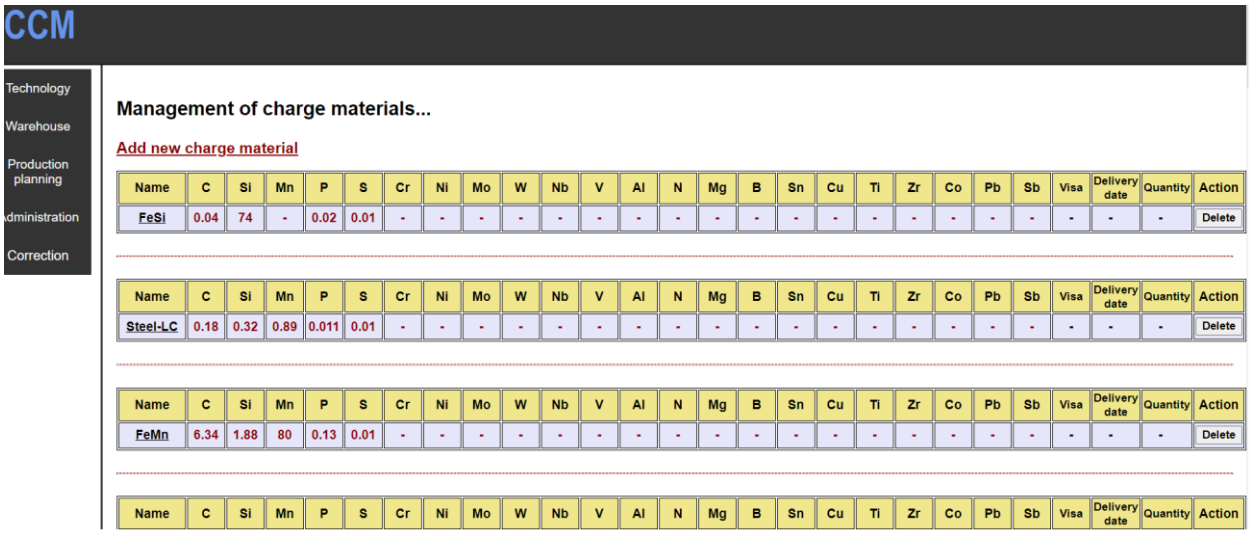


This opens the following page:

Make the desired changes and save them.

2.2. Delete charge materials

From the page:

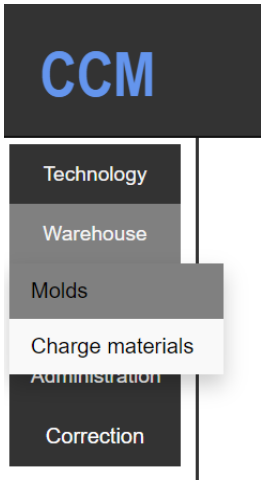


Select the button -> **Delete** from the line of the material you want to remove:

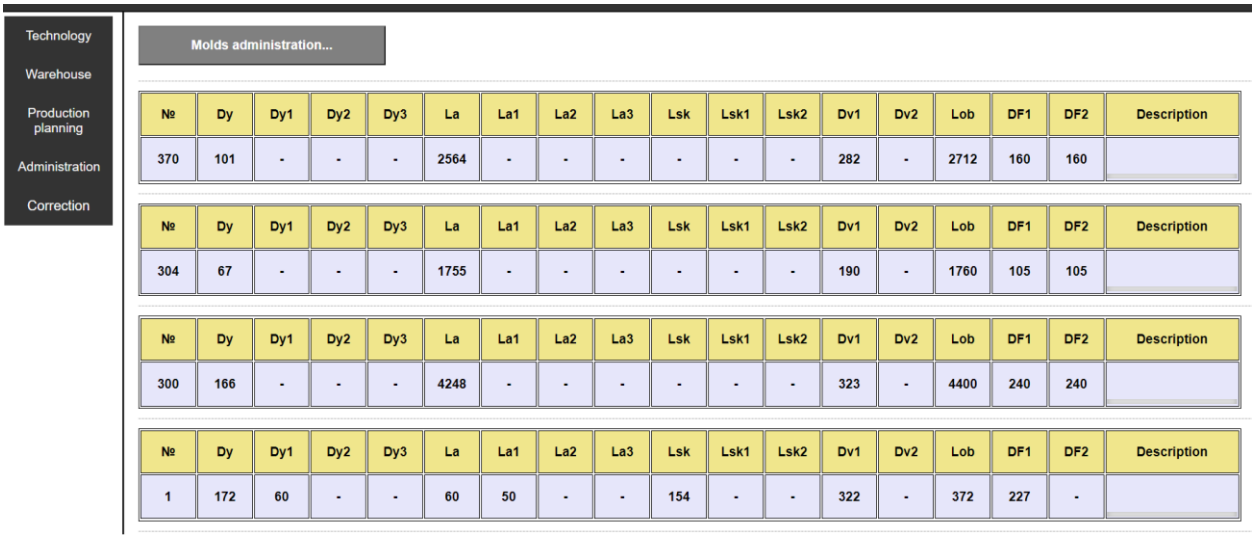
This will permanently remove the selected material from the database.

3. Add/Edit/Delete on molds

Choose -> **Warehouse/Molds**:



This opens the following page:



№	Dy	Dy1	Dy2	Dy3	La	La1	La2	La3	Lsk	Lsk1	Lsk2	Dv1	Dv2	Lob	DF1	DF2	Description
370	101	-	-	-	2564	-	-	-	-	-	-	282	-	2712	160	160	

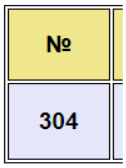
№	Dy	Dy1	Dy2	Dy3	La	La1	La2	La3	Lsk	Lsk1	Lsk2	Dv1	Dv2	Lob	DF1	DF2	Description
304	67	-	-	-	1755	-	-	-	-	-	-	190	-	1760	105	105	

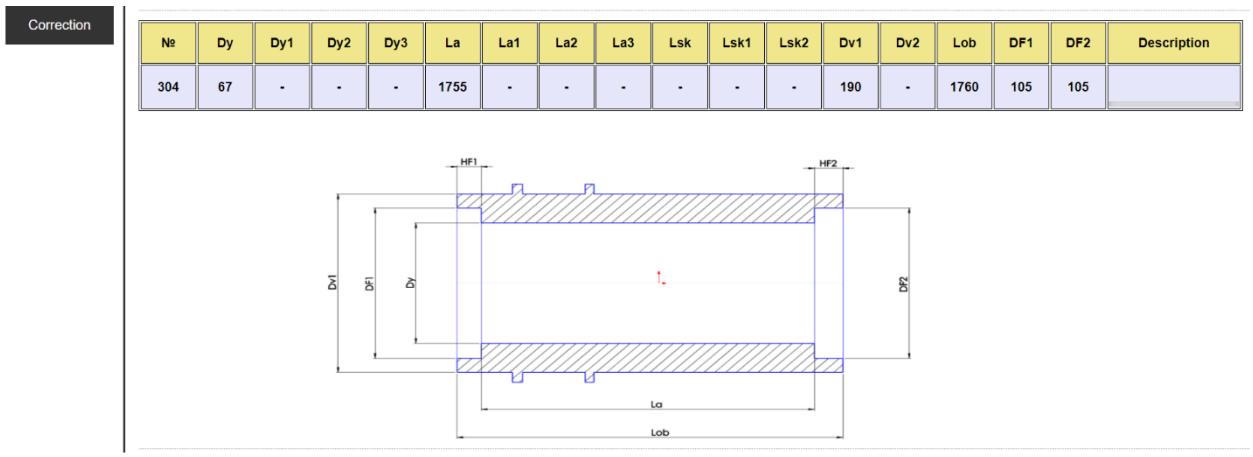
№	Dy	Dy1	Dy2	Dy3	La	La1	La2	La3	Lsk	Lsk1	Lsk2	Dv1	Dv2	Lob	DF1	DF2	Description
300	166	-	-	-	4248	-	-	-	-	-	-	323	-	4400	240	240	

№	Dy	Dy1	Dy2	Dy3	La	La1	La2	La3	Lsk	Lsk1	Lsk2	Dv1	Dv2	Lob	DF1	DF2	Description
1	172	60	-	-	60	50	-	-	154	-	-	322	-	372	227	-	

This is an informational page. It is not possible to make changes related to the mold equipment of the company.

If you go to the mold number, a sketch will open showing the internal configuration of the selected mold:



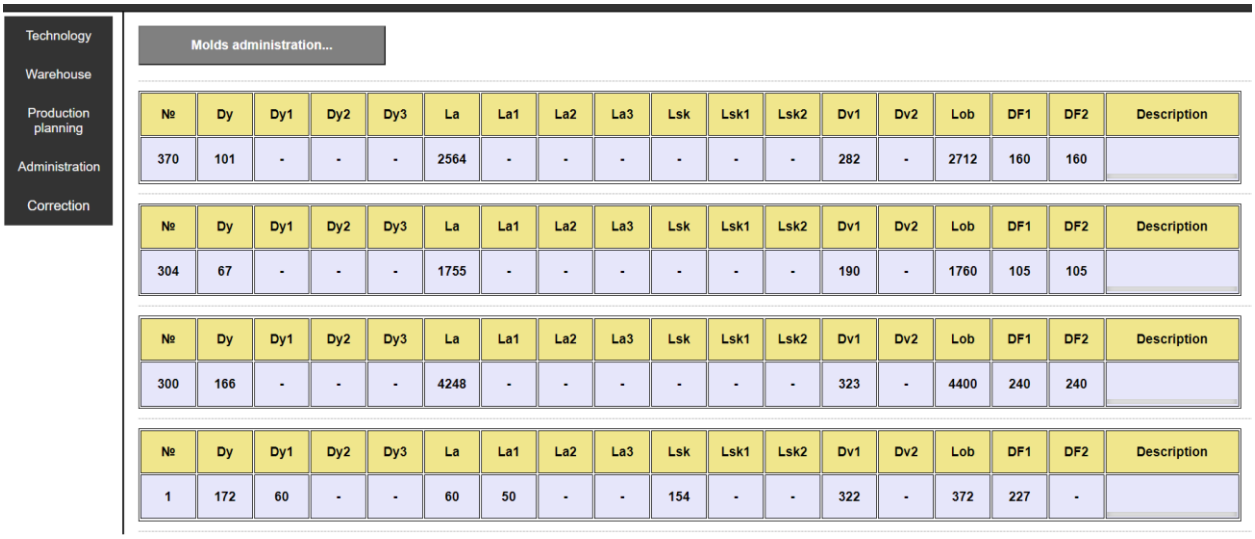


№	Dy	Dy1	Dy2	Dy3	La	La1	La2	La3	Lsk	Lsk1	Lsk2	Dv1	Dv2	Lob	DF1	DF2	Description
304	67	-	-	-	1755	-	-	-	-	-	-	190	-	1760	105	105	

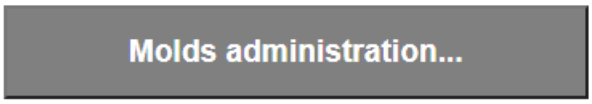
3.1. Add new or edit existing molds

3.1.1. Add new molds

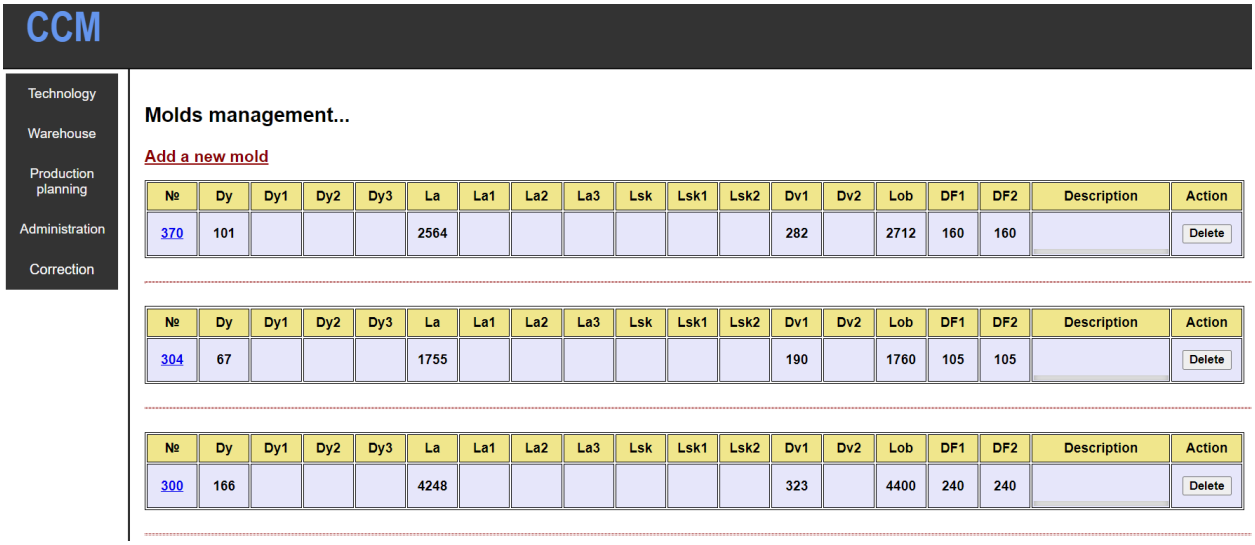
From the page:



Choose:

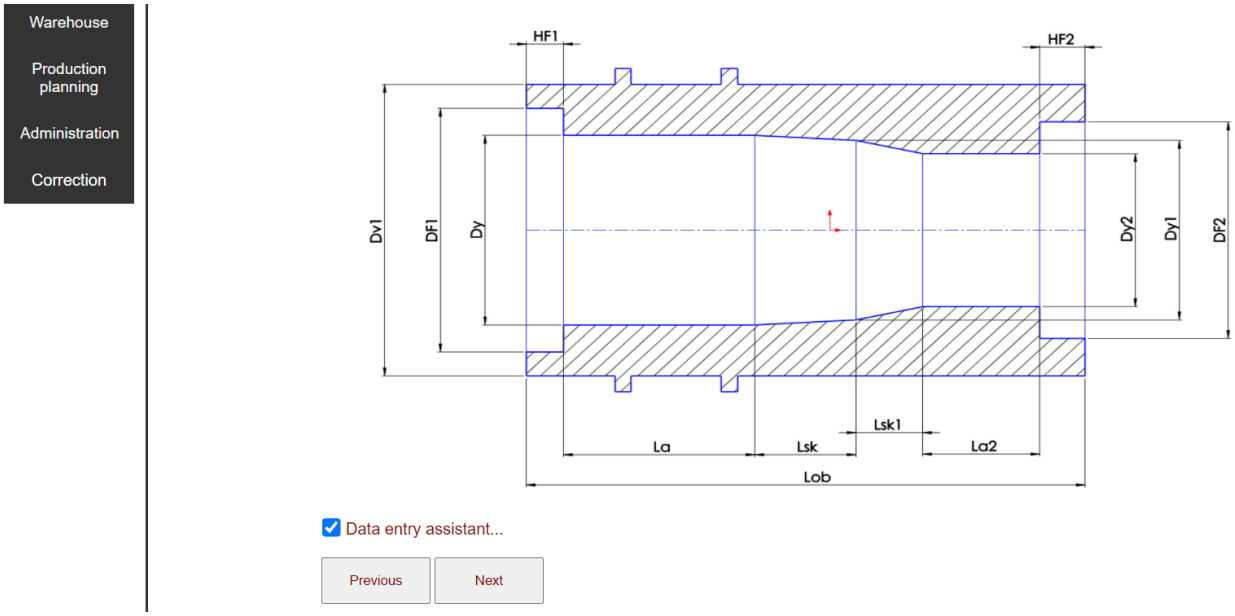


This opens the following page:



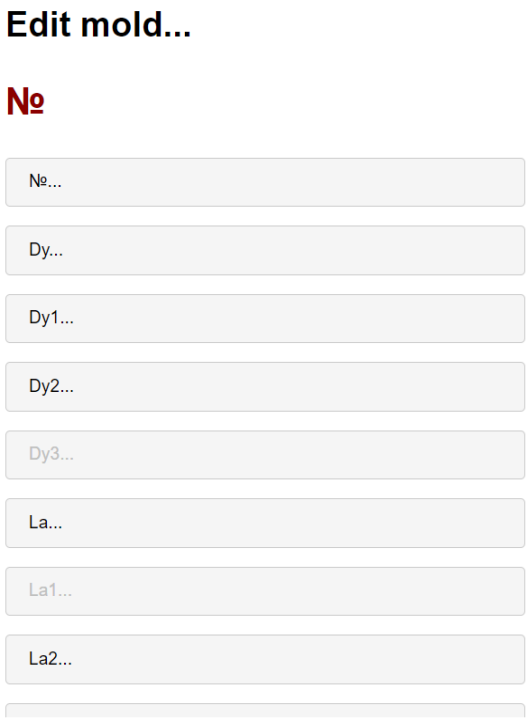
Choose:

This will open a page with the fields for entering information for creating a new mold at the top of which you can select the configuration of the mold to be created:



It is recommended to use the **Data entry assistant…** checkbox, as it will disable the fields that you do not need to create the new mold. You have a choice between configurations containing up to four internal diameter sizes and three bevels between them, covering all possible combinations between them.

After the required configuration is selected and the **Data entry assistant…** is checked, the size input fields take the following form:



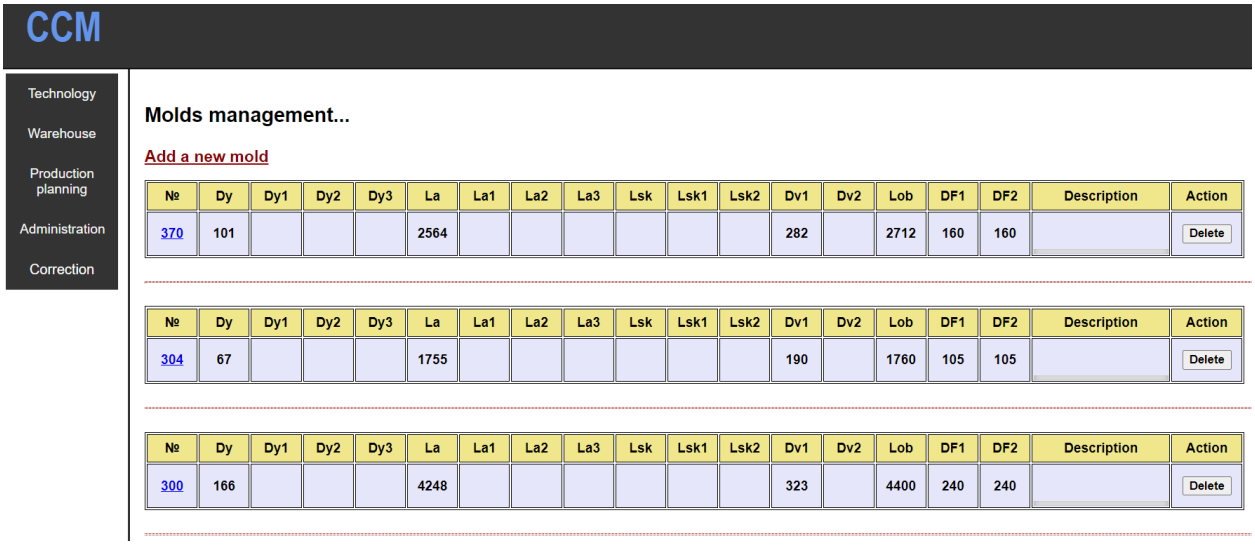
Unnecessary fields are disabled, which greatly simplifies the process of data entry. The fields check the entered values and notify when the rule for successively decreasing values of diameters is violated – in this case it is not possible for Dy2 to be greater than Dy1, the value of which in turn cannot

be greater than the value of Dy. If this rule is violated, the software will not allow saving the new mold and will indicate the field in which the error occurred.

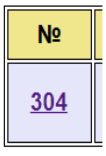
After entering the values and description of the mold, which is optional, save with the **Save** button:

3.1.2. Edit existing molds

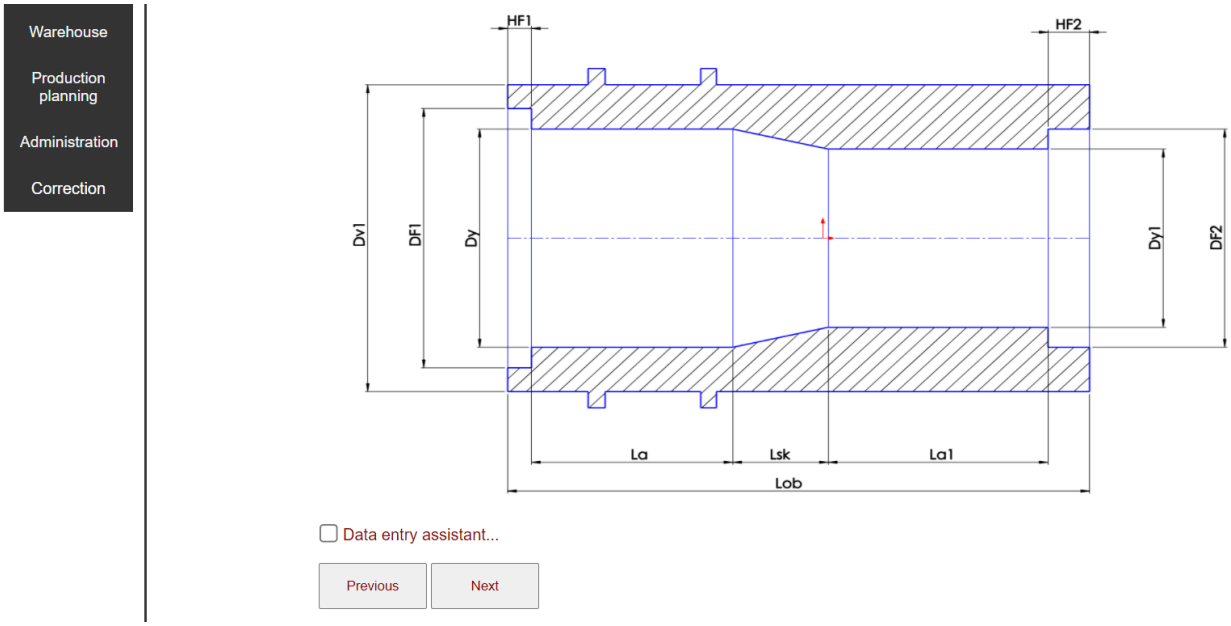
From the page:



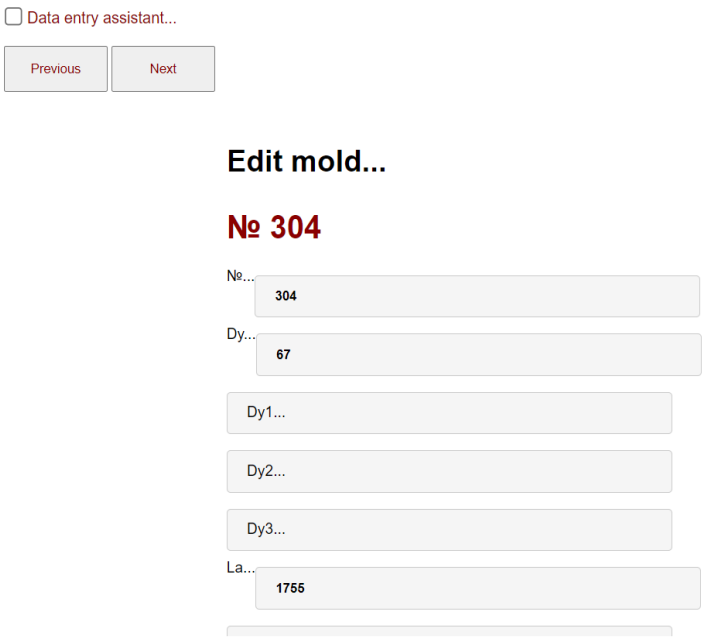
Select the number of the mold you want to change:



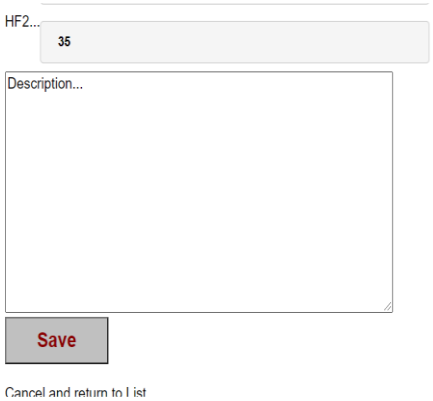
This opens the data page of the selected mold at the top of which the configuration of the mold is visualized:



Below it are the fields with the information about the mold:

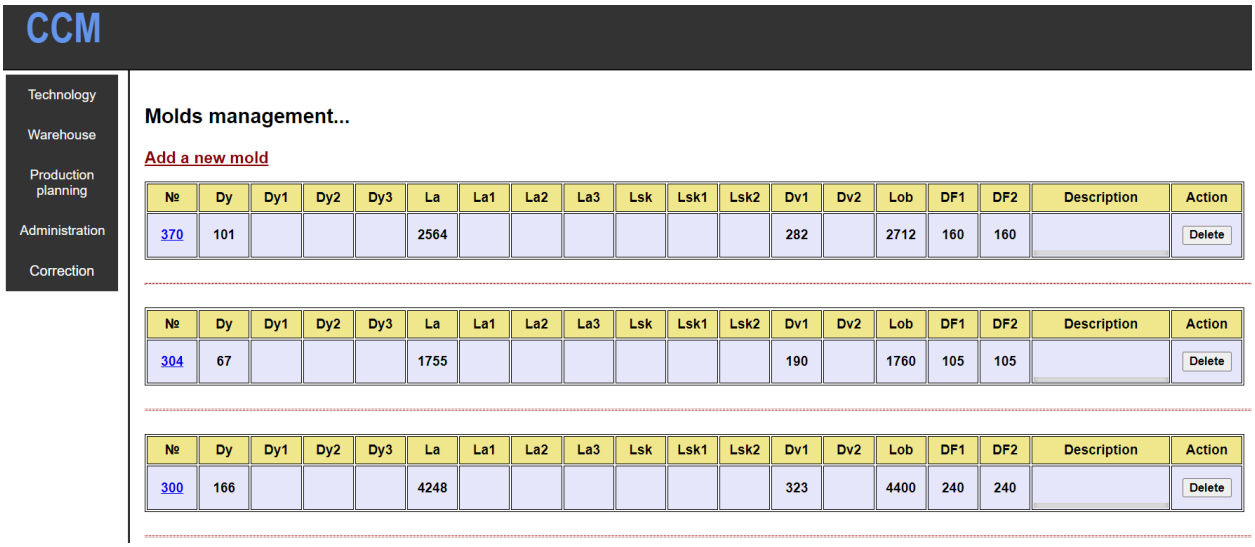


Make the desired changes and save them:



3.2. Delete molds

From the page:



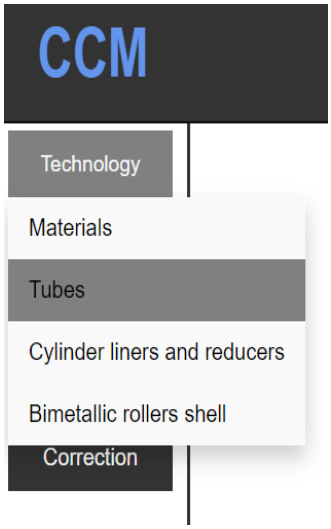
Select the **Delete** button from the row of the mold you want to remove:

This removes the selected mold from the database of available molds.

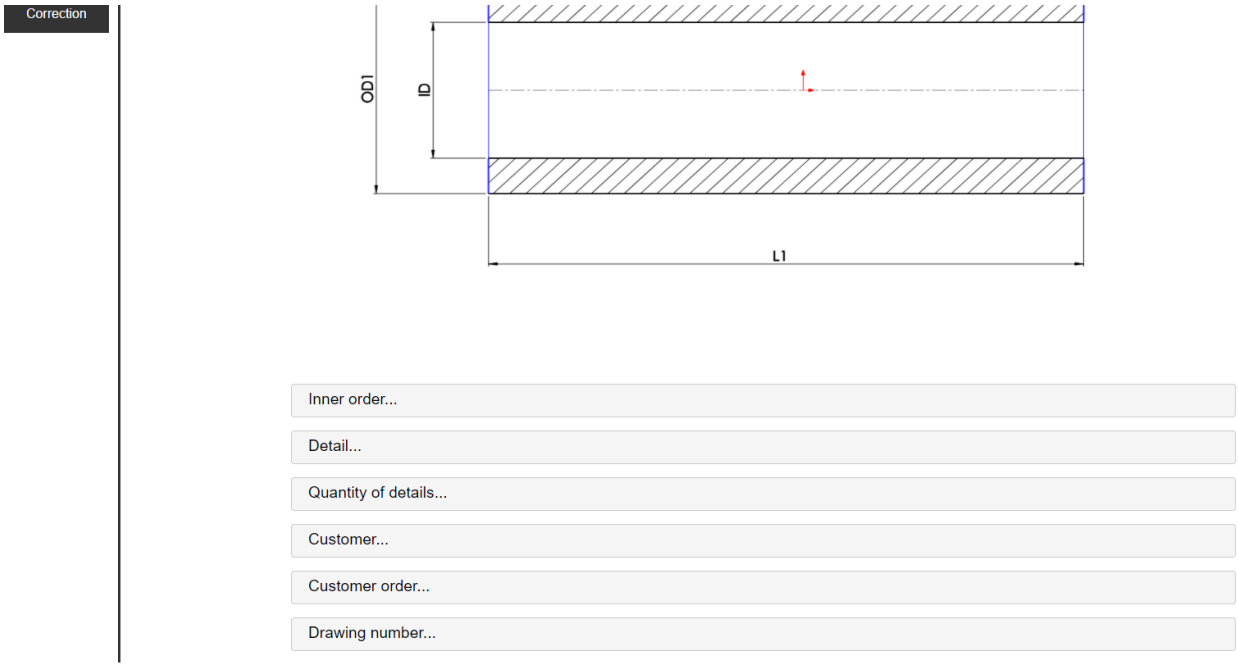
4. Generate casting technologies

4.1. Pipe technologies

Select from the menu -> **Technology/Tubes**:

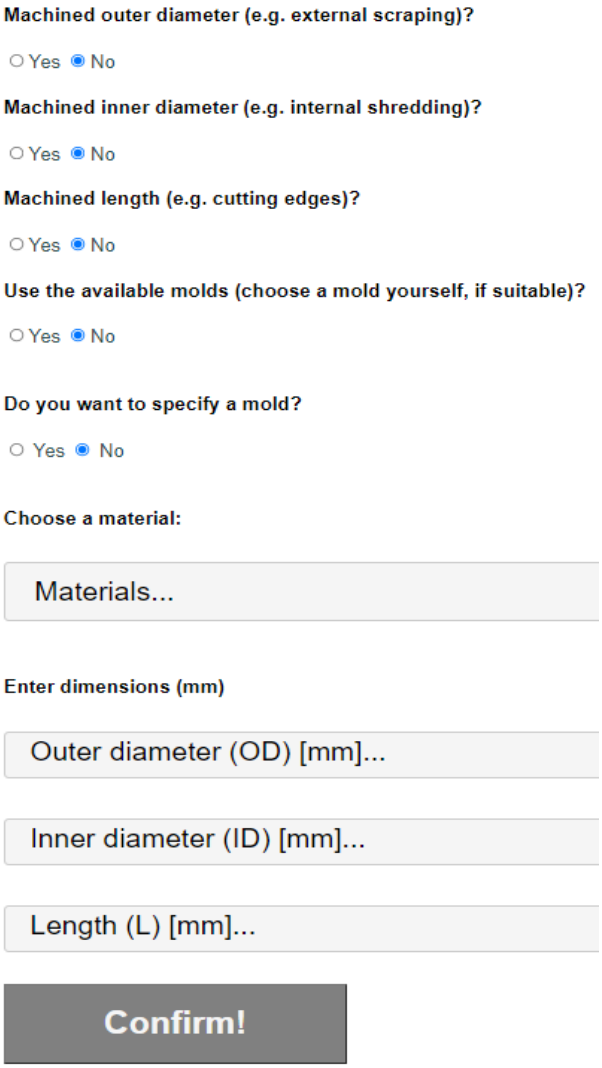


This opens the page for entering the necessary data for creating a technology for the production of pipe detail:



The fields **Inner order…**, **Detail…**, **Quantity of details…**, **Customer…**, **Customer order…** and **Drawing number** are currently filled in manually by the user. Once the second module of the software is completed, they will be filled in automatically after selecting the sales order registered in the program.

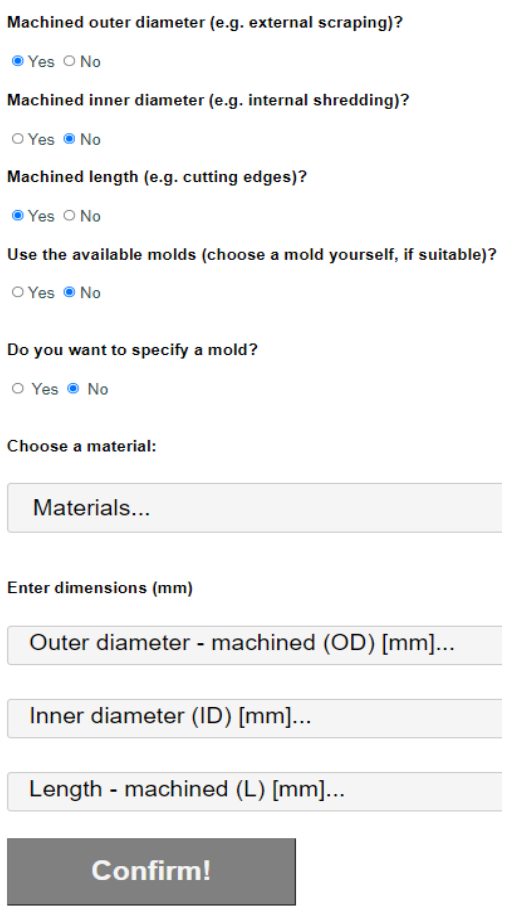
Below these fields is the following form:



You have the following options related to the detail:

- Is the outer surface of the detail being machined?
- Is the inner surface of the detail being machined?
- Are the ends of the detail cut?

By default, all options are set to “No”. In this situation, the fields **Outer diameter (OD)[mm]…**, **Inner diameter (ID)[mm]…** and **Length (L)[mm]…** must be filled in with the final dimensions of the detail with the necessary machining allowances provided by you, if necessary. Otherwise, by changing one of the checkboxes of the fields **Machined outer diameter (e.g. external scraping)**, **Machined inner diameter (e.g. internal shredding)** or **Machined length (e.g. cutting edges)** from “No” to “Yes”, the **Outer diameter (OD)[mm]…**, **Inner diameter (ID)[mm]…** and **Length (L)[mm]…** also change depending on the applied conditions:



In the example, the field **Outer diameter (OD)[mm]…** has changed to **Outer diameter - machined (OD)[mm]…** and the field **Length (L)[mm]…** has changed to **Length - machined (L)[mm]…** because we have indicated that the outer diameter is machined and the length is machined, while the field **Inner diameter (ID)[mm]…** has remained unchanged because we have indicated that the inner diameter of the detail is not machined. In this case in the fields **Outer diameter - machined (OD)[mm]…** and **Length - machined (L)[mm]…** we must enter the dimensions corresponding to the treated surfaces of the pipe – outer diameter and length. In this case, the software will automatically apply the necessary additive for machining the outer diameter and the overlength of the detail, ensuring the receipt of defect–free surfaces. The value we entered in the field **Inner diameter (ID)[mm]…** will remain unchanged because we have indicated that the inner diameter is not machined, which means that this value is final.

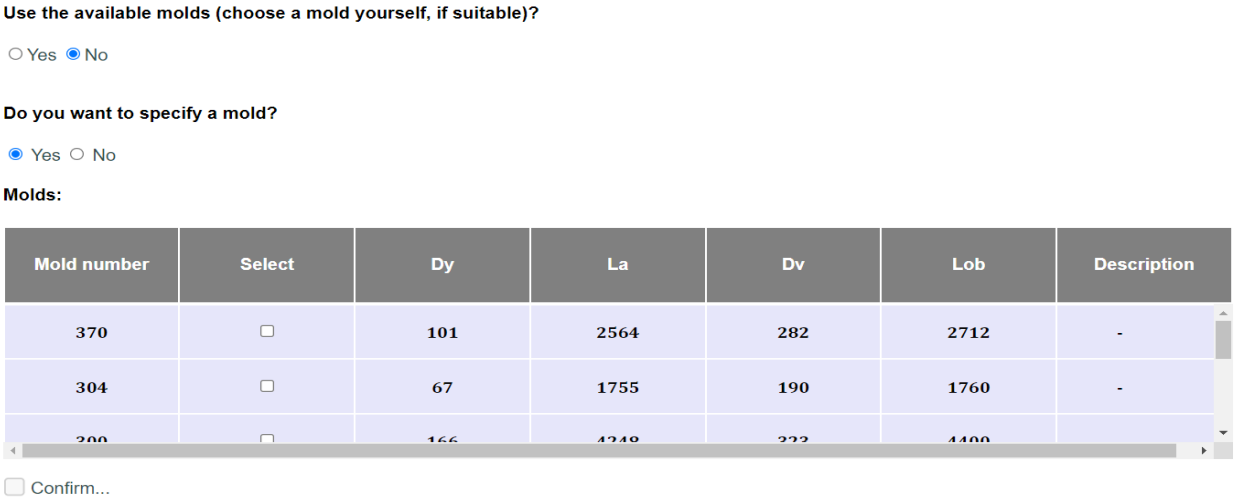
If we want to put the necessary additions for machining ourselves, we do not have to change the values of the fields **Machined outer diameter (e.g. external scraping)**, **Machined inner diameter (e.g. internal shredding)** or **Machined length (e.g. cutting edges)** from “No” to ”Yes”. In this case, we must enter the desired final dimensions of the detail, including the intended additions in the fields **Outer diameter (OD)[mm]…, Inner diameter (ID)[mm]…** and **Length (L)[mm]….** Entered in this way, these dimensions will not be changed by the software.

Regarding the mold in which you will pour the pipe, there are three options:

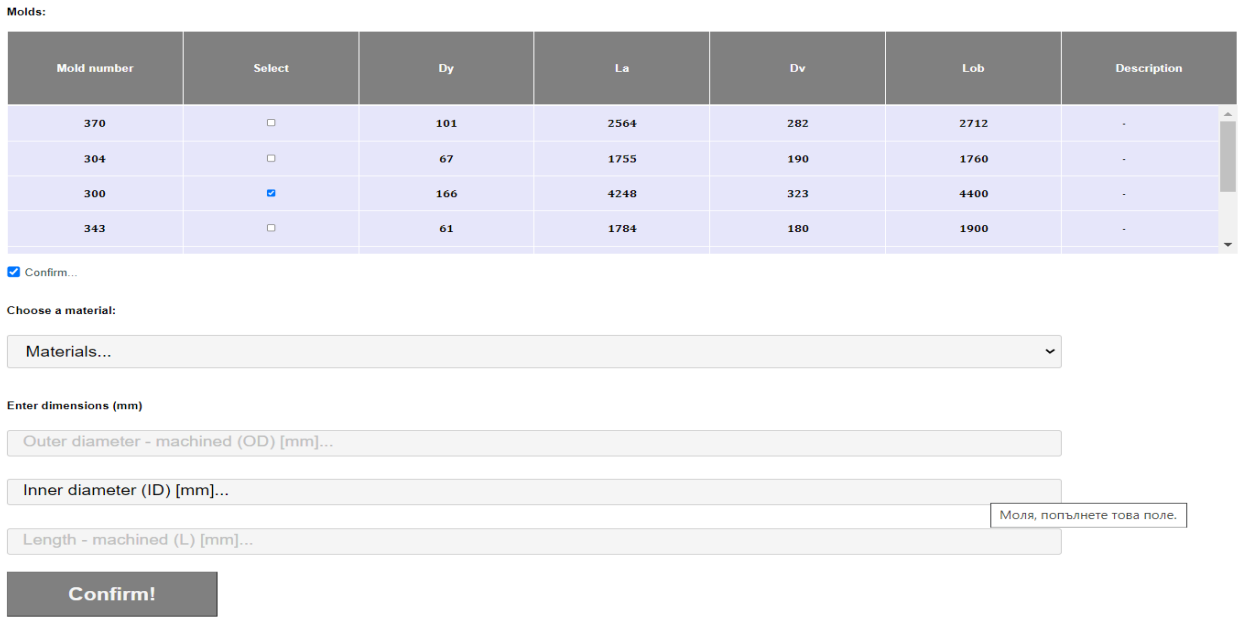
- The software itself selects a suitable mold if you have one in the mold database. To use this option you need to change the value of **Use the available molds (choose a mold yourself, if**

suitable)? - from “No” to ”Yes”. In this case, the software will process the dimensions of the detail entered by you, if you have specified that the surfaces are machined, it will resize with the necessary machining additives, will take into account the shrinkage of the detail depending on your chosen material, will take into account the refractory coating thickness and will look for a suitable mold that will be included in the finished technology. If you do not have a suitable mold, technology will anyway be generated, but you will be informed that you do not have a suitable mold.

- You must indicate the mold you will use. In this case you need to change the value of **Do you want to specify a mold?** from “No” to ”Yes”. This opens the following form:



Check the box on the mold you will use and then confirm your choice. In this case, the dimension entry form changes as follows:



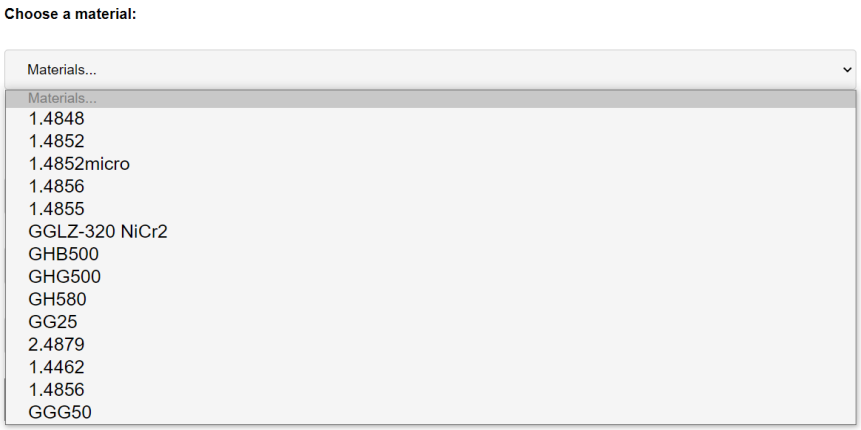
The fields **Outer diameter (OD)[mm]…** and **Length (L)[mm]…** are prohibited for data entry, as these values will be calculated by the software based on the size of the selected mold. You only need to enter the inner diameter for which you have the machined / untreated options we discussed above.

If you choose to use this option and at the same time the value of **Use the available molds (choose a mold yourself, if suitable)?** is “Yes”, the software will automatically change it to “No”. It is not

possible to use an automatic mold selection when you have specified one – more important is your choice.

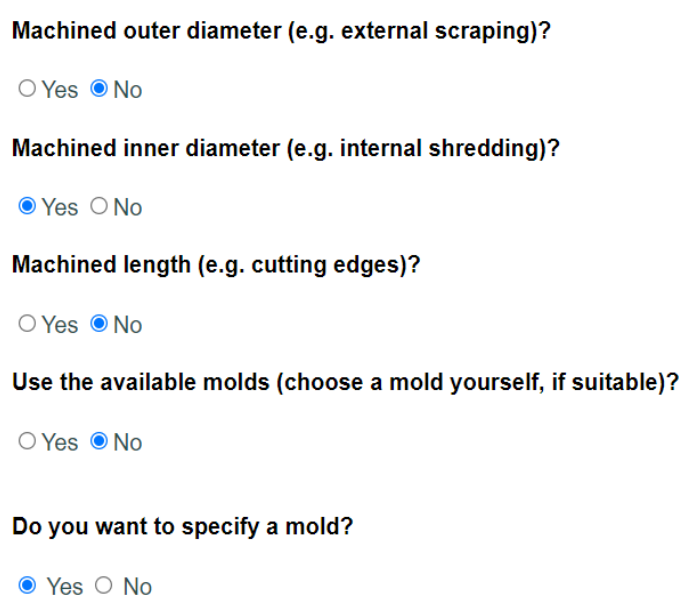
The third option you have is the values of **Use the available molds (choose a mold yourself, if suitable)?** and **Do you want to specify a mold?** to be “No”. In this case, the software will not look for a mold – it will prepare a technology for a detail for a pipe, in which we are not interested in the available molds in our mold park.

To continue developing pipe detail technology, you must specify a material in the **Materials…** field:



Once all the necessary data has been entered, we need to confirm which starts the creation of the technology.

Example:



304	☐	67	1755	190	1760	-
300	☑	166	4248	323	4400	-

Confirm...

Choose a material:

Materials...

Enter dimensions (mm)

Outer diameter (OD) [mm]...

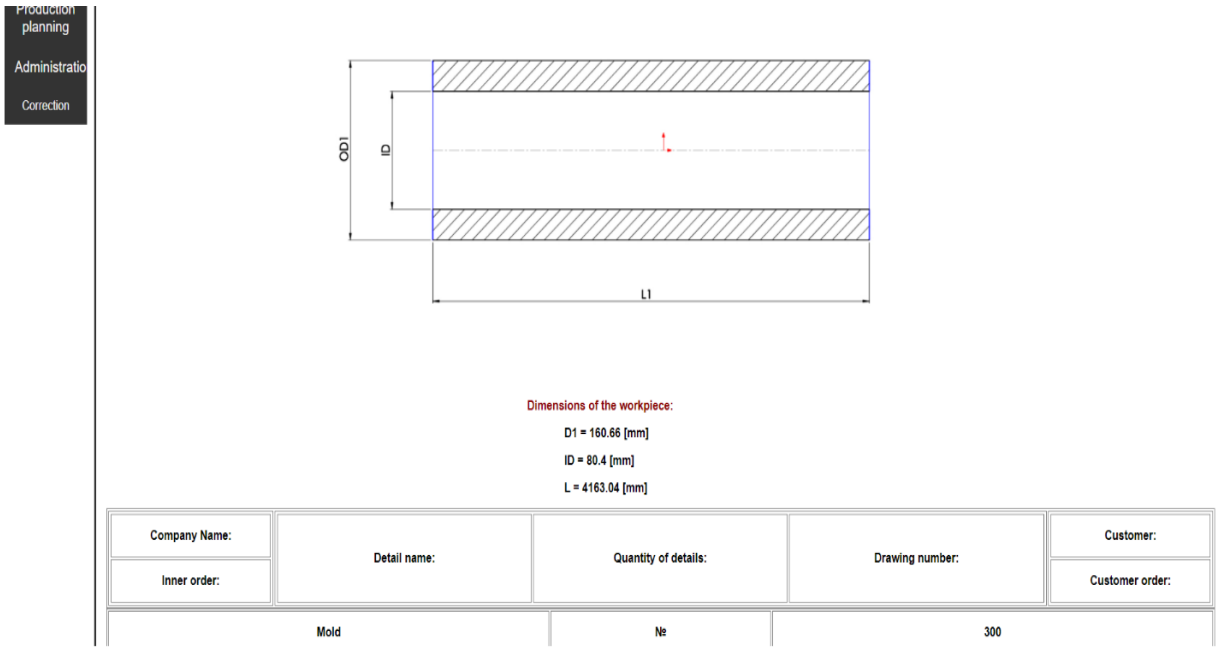
98.4

Length (L) [mm]...

Confirm!

We choose a mold № 300, machined inner diameter (machined size is ϕ 98.4 mm.). Then confirm with **Confirm** button:

A page with the finished technology opens:



Below the sketch of the part, which is the subject of the present technology, there is a table indicating the dimensions of the detail which we will produce with mold №300. We accepted the software to set the necessary allowance for machining on the inner diameter of the detail – we entered for the size of the processed inner diameter ϕ 98.4 mm., the final size of the inner diameter generated by the software is ϕ 80.4 mm, i.e. the system has set an allowance for machining of 9mm. for each side. With a total thickness of the detail of 40.13 mm. this is an acceptable addition to ensure that a defect–free part is obtained after machining.

The following are the data for the mold, the technological parameters for casting and the parameters for the preparation and application of the refractory coating of the mold:

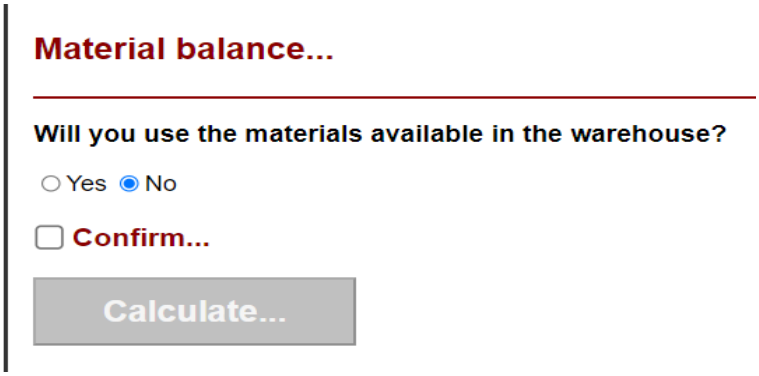
Mold	№	300
Active diameter of the mold (Dy)	mm	166
Active length of the mold (La)	mm	4248
Outer diameter of the mold (Dv)	mm	323
Total length of the mold (Lob)	mm	4400
Flange socket - front (hot) end of the mold - Df1	mm	240
Flange socket - rear (cold) end of the mold - Df2	mm	240
Dimensions of flange - front (hot) end of the mold	mm	ф235 хф65 x40
Dimensions of the flange - rear (cold) end of the mold	mm	ф235 хф20 x40
Refractory gasket - front (hot) end of the mold	mm	ф235 хф65 x5
Refractory gasket - rear (cold) end of the mold	mm	ф235 хф20 x5
Spout - bore diameter	mm	ф40

Technological parameters of casting and crystallization		
Casting weight	kg	493.37
Rotation speed	min^{-1}	1296
Duration of rotation of the mold at maximum speed	min	10
Second rotation speed	min^{-1}	864
Duration of rotation of the mold at second speed	min	20
Temperature of the material in the furnace before pouring	°C	1630 - 1650
Temperature of the material in the bucket before pouring	°C	1510 - 1530
Pouring spout temperature	°C	650 - 700
Bucket temperature	°C	600 - 650
Mold temperature before pouring the material	°C	80 - 130 - 180
Cool the mold after pouring the material	min	0
Heating the mold after pouring the material	min	0

The parameters with zero value should not be applied – in this case the software has determined that it is not necessary to heat or cool the mold in the process of casting and crystallization.

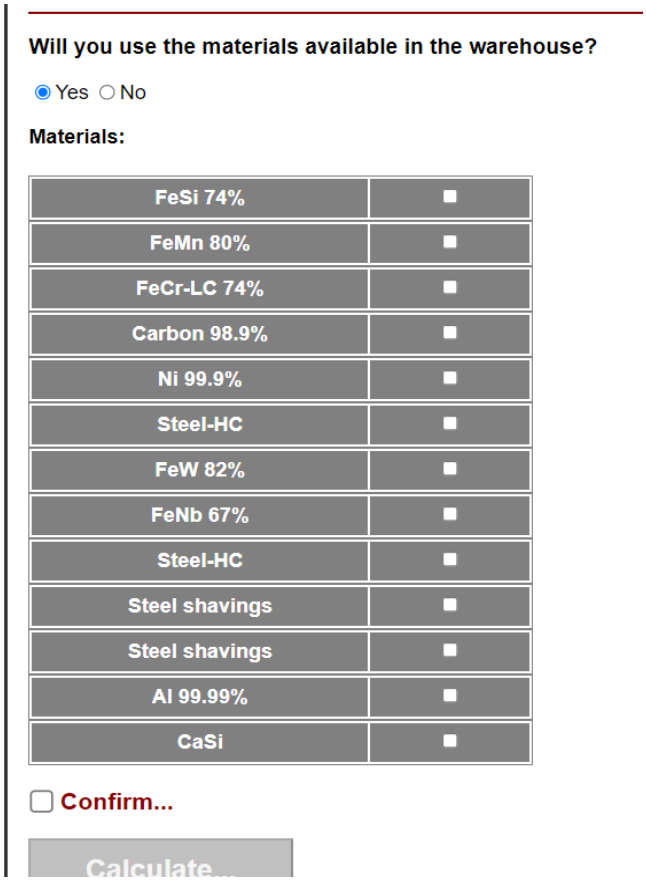
Refractory coating of the mold		
Type of refractory coating		Al silicate
Refractory coating components	%	Al silicate/SiO2 = 70/30
Density of the refractory coating	T/m^3	1.340
Coating nozzle size	mm	3.0
Coating device speed	sec/m	39.69
Flow rate of the refractory coating	sec/l	30 - 31
Spray pressure of the refractory coating	MPa	0.18
Mold temperature when applying the refractory coating	°C	220 - 240
Speed of rotation of the mold when applying the refractory coating	min^{-1}	949
Thickness of the refractory coating	mm	1.1 - 1.3

Below this table is the form for preparing a material balance for the material we have chosen – 1.4852micro:



There are two options here:

- To use charge materials from the warehouse we have created (i.e. we have available in the actual warehouse of the company). In this case, the check mark must be “Yes”:



A form opens in which the software shows us a sample of all the necessary charge materials to produce a melt with the brand 1.4852 micro. If we have two duplicate materials by name and do not specify which will be used, by default the software will apply the last one added to the system. In addition, it is possible that the charge uses its own return from machining – it is included in the balance only after its box is checked. If we do not check the checkbox, the charge will be made entirely of fresh materials.

If we want to prepare a material balance with materials from our warehouse, but do not put any check marks, then the balance will be generated with the last materials added in the warehouse and without including its own return.

After making your choice, you need to confirm and press the **Calculate** button**:**

Material Balance (kg/100kg)

1.4852micro min max Charge materials kg/100kg	C 0.36 0.44	Si 1.2 1.6	Mn 1.1 1.4	P max 0.02	S max 0.02	Cr 24.5 26	Ni 32.5 33.5	Mo max 0.5	W 0.1 0.2	Nb 1.2 1.4	V	N	Mg	B	Sn	Cu	Ti 0.1 0.25	Zr	Sb min
Ni: 26.03кг	-	-	-	-	-	-	99.9	-	-	-	-	-	-	-	-	-	-	-	-
FeCrLC: 27.38кг	0.18	0.68	-	0.027	0.016	74	-	-	-	-	-	-	-	-	-	-	-	-	-
FeMn: 1.35кг	6.34	1.88	80	0.13	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FeSi: 1.41кг	0.04	74	-	0.02	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FeNb: 1.63кг	-	-	-	-	-	-	-	-	-	67	-	-	-	-	-	-	-	-	-
FeW: 0.18кг	-	-	-	-	-	-	-	-	82	-	-	-	-	-	-	-	-	-	-
Carbon: 0.19кг	98.9	0.012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Steel HC: 21.81кг	0.25	0.08	0.24	0.01	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Steel shavings: 20кг	0.15	0.5	0.8	0.002	0.03	25	35	-	-	1.1	-	-	-	-	-	-	-	-	-
Composition:	**0.411**	**1.419**	**1.266**	**0.012**	**0.007**	**25.27**	**33.017**	**-**	**0.15**	**1.319**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

In the bucket:

FeTi: 3.85 kg

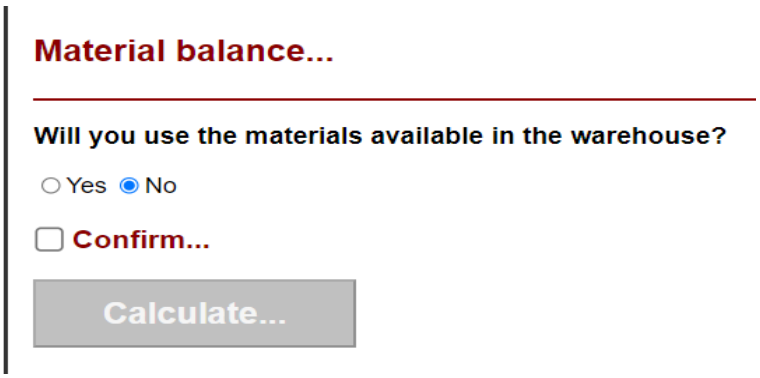
Al: 0.25 kg

CaSi: 1.27 kg

A material balance is generated for 100 kg. of melt according to the limits of the chemical elements we have set when creating the material brand 1.4852 micro and the chemical compositions of the charge materials which we have entered when registering them in the system.

Below the table are the quantities of deoxidizers and carriers of microalloying elements (in this case only Ti is required), which must be added to the melt in the casting bucket before casting (for one detail – in this case they are calculated on the basis of 493.37 kg. which is the weight of our detail).

The second option we have when preparing the material balance is to use the software built–in database for charge materials – this is useful if we want to create a technology with a new material for our production and do not keep in stock the charge materials for its production. In this case we leave the check mark “No” – this is the default, we confirm and calculate:



Material Balance (kg/100kg)

1.4852micro min max Charge materials kg/100kg	C 0.36 0.44	Si 1.2 1.6	Mn 1.1 1.4	P max 0.02	S max 0.02	Cr 24.5 26	Ni 32.5 33.5	Mo max 0.5	W 0.1 0.2	Nb 1.2 1.4	V	N	Mg	B	Sn	Cu	Ti 0.1 0.25	Zr	Sb min
Ni: 33.03кг	0.05	0.01	0.01	-	0.01	-	99.9	-	-	-	-	-	-	-	-	0.02	-	-	-
FeCrLC: 36.07кг	0.06	1	-	0.03	0.02	70	-	-	-	-	-	-	-	-	-	-	-	-	-
FeMn: 1.53кг	6.5	1.1	75	0.2	0.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FeSi: 1.2кг	0.01	75	0.35	0.035	0.02	0.25	-	-	-	-	-	-	-	-	-	-	-	-	-
FeNb: 1.94кг	0.5	2.5	1.5	0.1	0.1	-	-	-	-	67	-	-	-	-	-	-	-	-	-
FeW: 0.19кг	1	1	0.6	0.06	0.05	-	-	1	80	-	-	-	-	-	0.1	0.25	-	-	0.05
Carbon: 0.14кг	98.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Steel HC: 25.9кг	0.43	0.31	0.3	0.03	0.025	0.05	0.05	-	-	-	-	-	-	-	-	0.1	-	-	-
Composition:	**0.418**	**1.415**	**1.267**	**0.024**	**0.02**	**25.267**	**33.012**	**0.002**	**0.15**	**1.3**	**-**	**-**	**-**	**-**	**-**	**0.033**	**-**	**-**	**-**

In the bucket:

FeTi: 3.85 kg

Al: 0.25 kg

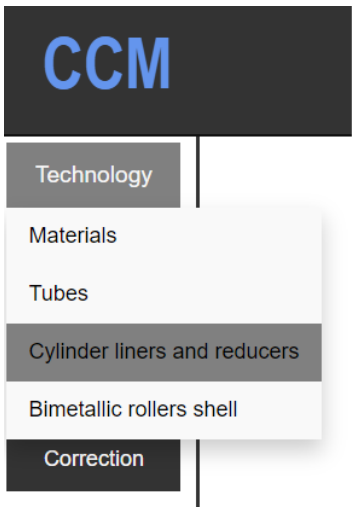
CaSi: 1.27 kg

Print

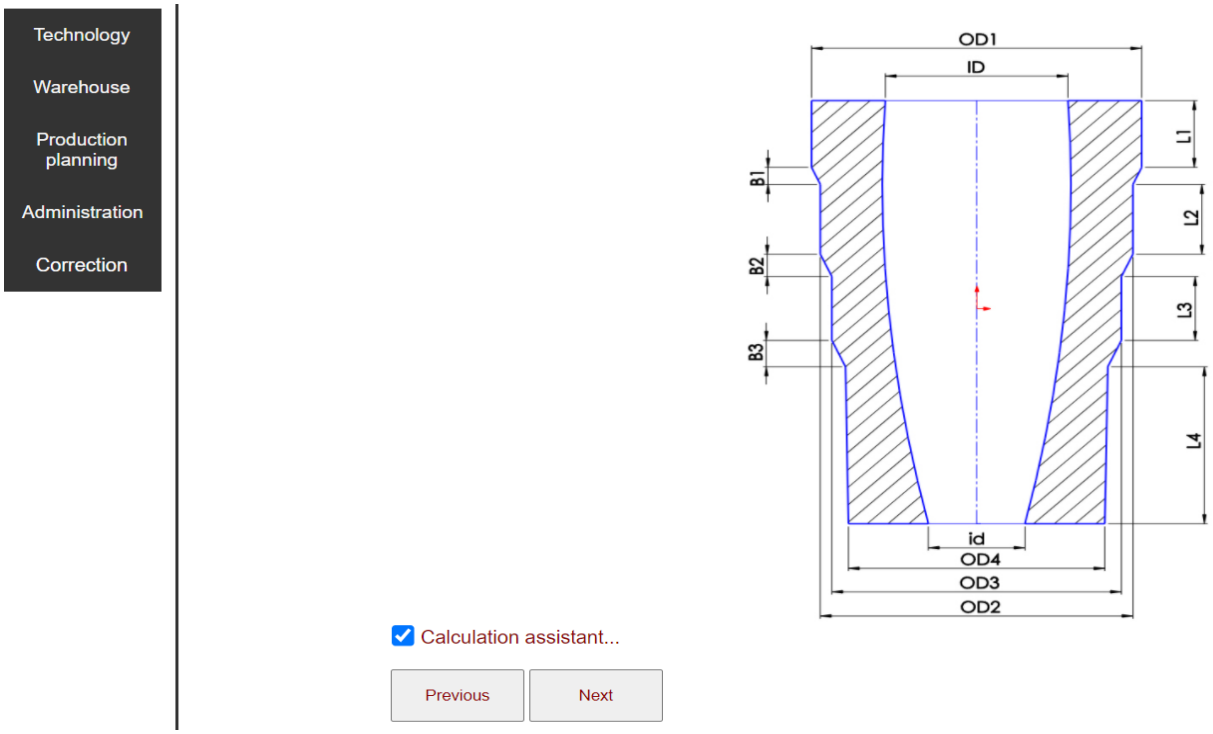
The result is analogous to the first option, but there is no possibility to use its own return. From the **Print** button, we have the option to print the technology or save it as a PDF file on our computer. After the introduction of the second module of the software, it will be possible to keep the technology in the software, as it will be linked to the production planning, warehouse management and so on.

4.2. Cylinder liner technology.

From the menu select -> **Technology/Cylinder liners and reducers**:



This opens the following page:



Select the configuration of the detail for which you want to create technology and check the **Calculation assistant…** box. This will significantly reduce the possibility of making a mistake when entering the data needed to create the technology.

Below are the fields **Inner order…**, **Detail…**, **Quantity of details…**, **Customer…**, **Customer order…** and **Drawing number**, similar to those described in the pipe example (point 4.1.). Below them the following fields follow:

Machine with vertical/horizontal axis?

○ Horizontal axis ◉ Vertical axis

Machined outer diameter (e.g. external scraping)?

○ Yes ◉ No

Machined inner diameter (e.g. internal shredding)?

○ Yes ◉ No

Machined length (e.g. cutting edges)?

○ Yes ◉ No

Use the available molds (choose a mold yourself, if suitable)?

○ Yes ◉ No

Do you want to specify a mold?

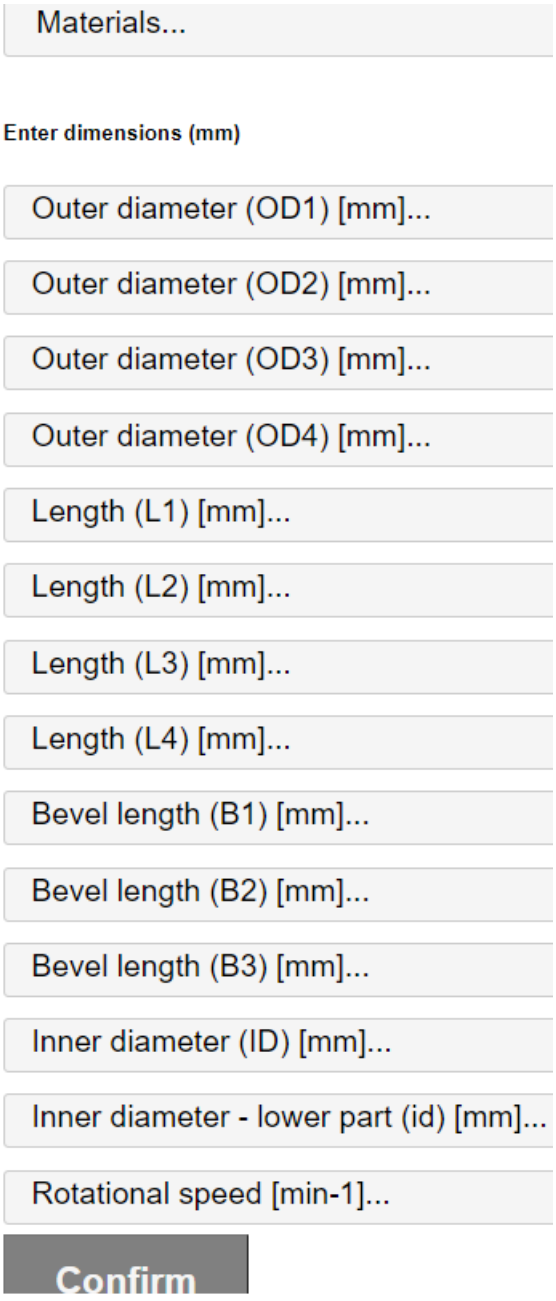
○ Yes ◉ No

Choose a material:

The only difference from the pipe example is the **Machine with vertical/horizontal axis?** field. It determines our choice about the machine on which we will produce the part – with a horizontal or vertical axis. When we use the calculation assistant, the field changes dynamically depending on the

choice we have made – the sketches of the parts we choose between reflect the actual orientation of the part, which in turn determines the type of machine – with a horizontal or vertical axis.

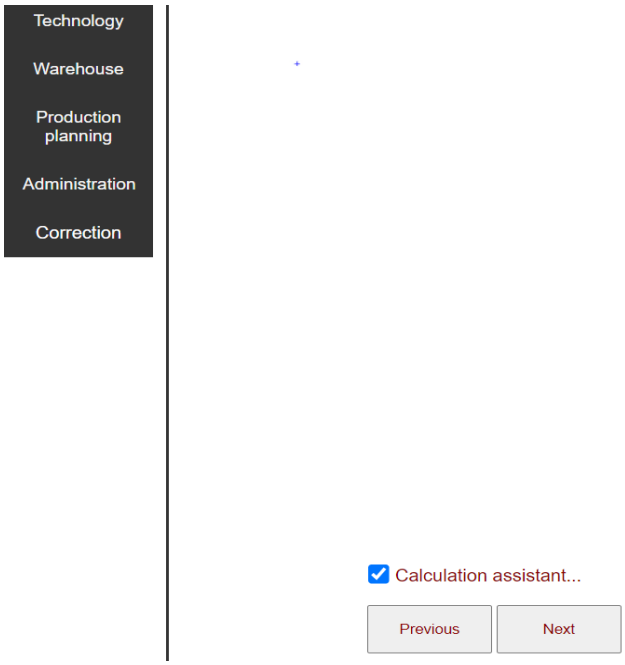
This is what follows:

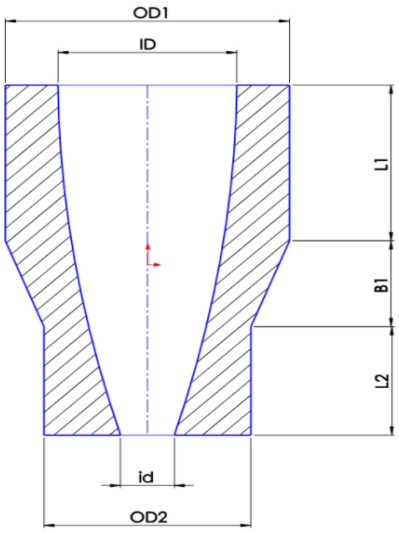


The names of the fields for entering the dimensions correspond to the size indices of the sketches. When the calculation assistant is used, the fields that are not needed change their color and are disabled for data entry.

Example:

Select the following configuration and check -> **Calculation assistant…**:





Then choose:

Machine with vertical/horizontal axis?

○ Horizontal axis ◉ Vertical axis

Machined outer diameter (e.g. external scraping)?

◉ Yes ○ No

Machined inner diameter (e.g. internal shredding)?

◉ Yes ○ No

Machined length (e.g. cutting edges)?

◉ Yes ○ No

Use the available molds (choose a mold yourself, if suitable)?

◉ Yes ○ No

Do you want to specify a mold?

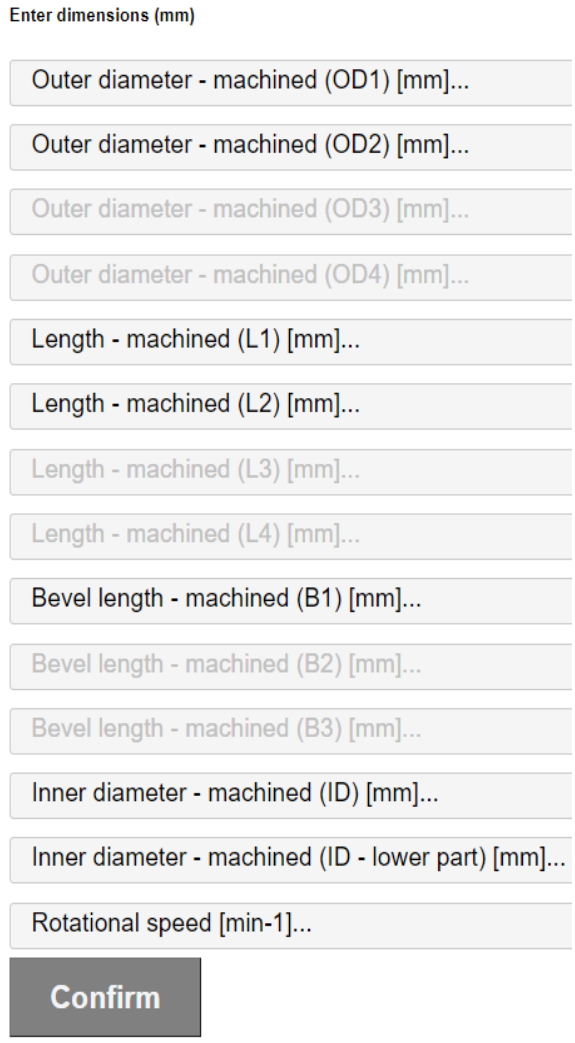
○ Yes ◉ No

Choose a material:

GG25

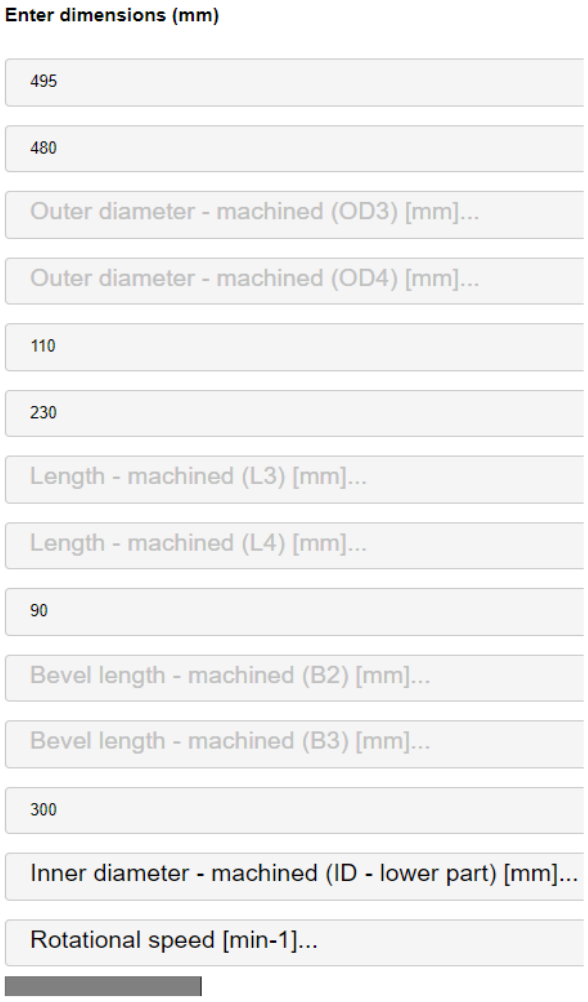
Here we have set the detail to be with machined outer, inner diameter and length. In addition, we have indicated that we want automatic selection of the mold, if there is a suitable one. The material we have chosen is GG25.

After selecting a configuration and checking the calculation assistant checkbox, the dimension entry fields have become as follows:



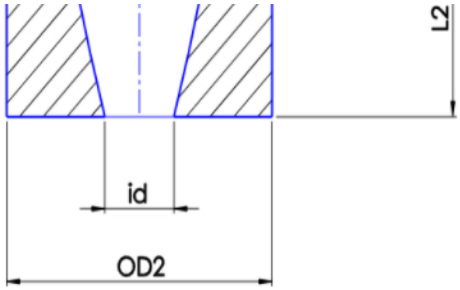
Fields that are not required for the calculation we selected are disabled.

We enter the dimensions of the detail we want to produce, but we must pay attention to the fact that we must enter the dimensions of the part after machining (the fields show us what data we need to enter), because we chose the options for the machined outer, inner diameter and length. In this case, the software itself will add the machining additives to the dimensions we enter.



We must pay attention to the fields for internal diameters and rotation speed. We can specify the values of the inner diameters at the top and bottom of the detail – in this case we cannot enter a value in the rotation speed field – the software will calculate the speed according to the two values of the inner diameters we have entered. We can enter the value of the inner diameter at the top of the detail and the value of the speed – the software will determine the value of the inner diameter at the bottom of the detail. Keep in mind that the software will check the speed value you enter and if it is too high or too low it will warn you and therefore technology will not be generated. The third option is the one we will choose in this example – we enter only the value of the inner diameter at the top of the detail – the software will determine the values of the inner diameter at the bottom of the detail and the rotation speed.

Once we have entered the data, we confirm our choice and generate the technology:



Dimensions of the workpiece:

OD1 = 509.85 [mm]

OD2 = 496.98 [mm]

L1 = 148.5 [mm]

L2 = 247.5 [mm]

B1 = 103.95 [mm]

ID = 250 [mm]

id = 227 [mm]

L = 499.95 [mm]

At the top of the page, the dimensions of the detail that the software offers are visualized. They are followed by the information about the mold:

Mold	№	240
Active diameter of the mold (Dy1)	mm	518
Active diameter of the mold (Dy2)	mm	505
Active length of the mold (La1)	mm	150
Active length of the mold (La2)	mm	250
Bevel length (Sk1)	mm	105
Outer diameter of the mold (Dv1)	mm	751
Outer diameter of the mold (Dv2)	mm	659
Total length of the mold (Lob)	mm	1360
Flange socket - Df1	mm	580
Bottom socket - Df2	mm	570
Dimensions of flange	mm	ф572 хф210 х65
Dimensions of bottom	mm	ф562х65
Refractory gasket - for the flange	mm	ф572 хф200 х5
Refractory gasket - for the bottom	mm	ф562 хф475 х5
Spout - bore diameter	mm	ф80

As we can see from the table above, the software has found a suitable mold with № 240. The dimensions of the detail that are indicated are calculated based on the dimensions of the mold, which takes into account the thickness of the refractory coating, shrinkage and added machining to the dimensions, which we entered in the form on the previous page. In fact, what defines the choice of the necessary mold are the dimensions that we enter when creating the technology. If even one of the dimensions does not meet the requirements after the additions, shrinkage and thickness of the refractory coating are taken into account, the software will tell us that we do not have a suitable mold

and the above table will remain empty, but still the remaining fragments of technology will be generated.

In our case, the following information about the mold follows:

Technological parameters of casting and crystallization		
Casting weight	kg	551.99
Rotation speed	min^{-1}	598.03
Duration of rotation of the mold at maximum speed	min	20
Second rotation speed	min^{-1}	398.69
Duration of rotation of the mold at second speed	min	20
Temperature of the material in the furnace before pouring	°C	1400 - 1420
Temperature of the material in the bucket before pouring	°C	1340 - 1350
Amount of flux added to the jet from the bucket - after pouring 2/3 of the metal into the mold	kg	1.0
Pouring spout temperature	°C	650 - 700
Bucket temperature	°C	600 - 650
Mold temperature before pouring the material	°C	60 - 80
Cool the mold after pouring the material	min	15

Refractory coating of the mold		
Type of refractory coating		SiO2
Component A (water)	l	15
Component B (bentonit)	kg	0.550
Component C (Celite)	kg	6
Density of the refractory coating	T/m^3	1.145
Coating nozzle size	mm	4.0
Coating device speed	sec/m	124.92
Flow rate of the refractory coating	sec/l	34
Spray pressure of the refractory coating	MPa	0.18
Mold temperature when applying the refractory coating	°C	200 - 220
Speed of rotation of the mold when applying the refractory coating	min^{-1}	537
Thickness of the refractory coating	mm	1.3 - 1.5

Heat treatment		
Heating speed	°C/h	70°C/h
Heating temperature	°C	600°C
Retention time	h	6.2
Cooling speed	°C/h	50°C/h to 200°C

Material balance...

Will you use the materials available in the warehouse?

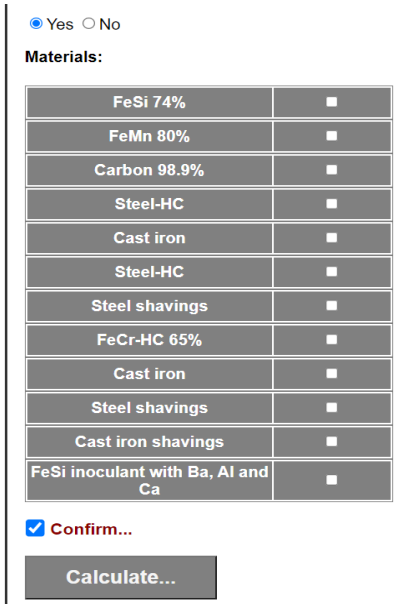
○ Yes ◉ No

☐ **Confirm...**

Calculate...

You can see that a heat treatment mode is proposed in order to reduce the tensions in the detail, which is in line with the selected material and thickness of the detail.

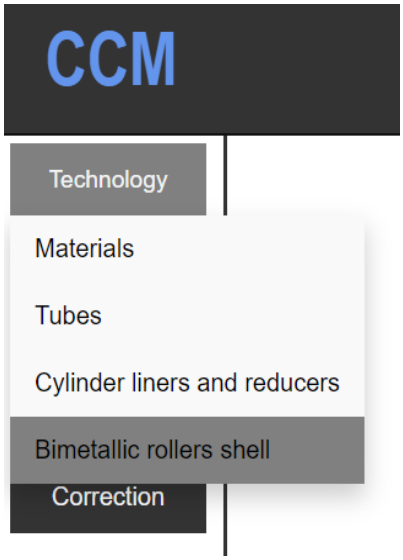
The material balance is then calculated in a similar way to that shown in the pipe example above:



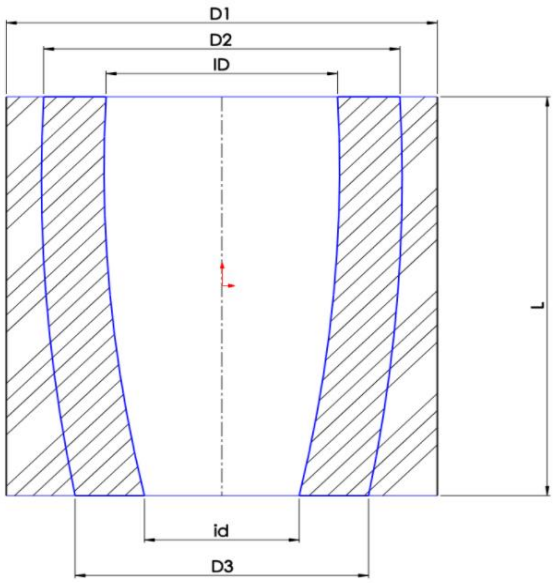
GG25 min max / Charge materials kg/100kg	C	Si	Mn	P	S	Cr	Ni	Mo	W	Nb	V	N	Mg	B	Sn	Cu	Ti	Zr	Sb
	2.8 3.3	1.7 2	0.5 1	max 0.2	max 0.12	0.3 0.6	max 0.5												min
FeCrHC: 0.69кг	4.39	-	-	-	-	65	-	-	-	-	-	-	-	-	-	-	-	-	-
FeMn: 0.79кг	6.34	1.88	80	0.13	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FeSi: 2кг	0.04	74	-	0.02	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbon: 0.82кг	98.9	0.012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Steel HC: 47.85кг	0.25	0.08	0.24	0.01	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CastIron: 47.85кг	4.39	0.7	0.044	0.053	0.024	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Composition:	3.068	1.867	0.77	0.032	0.017	0.45	-	-	-	-	-	-	-	-	-	-	-	-	-

4.3. Bimetal mill shaft technologies

From the menu choose -> **Technology/Bimetallic rollers shell**:



This opens the following page:



Previous Next

Machine with vertical/horizontal axis?

○ Horizontal axis ◉ Vertical axis

Machined outer diameter (e.g. external scraping)?

◉ Yes ○ No

Machined inner diameter (e.g. internal shredding)?

◉ Yes ○ No

Machined length (e.g. cutting edges)?

◉ Yes ○ No

Use the available molds (choose a mold yourself, if suitable)?

○ Yes ◉ No

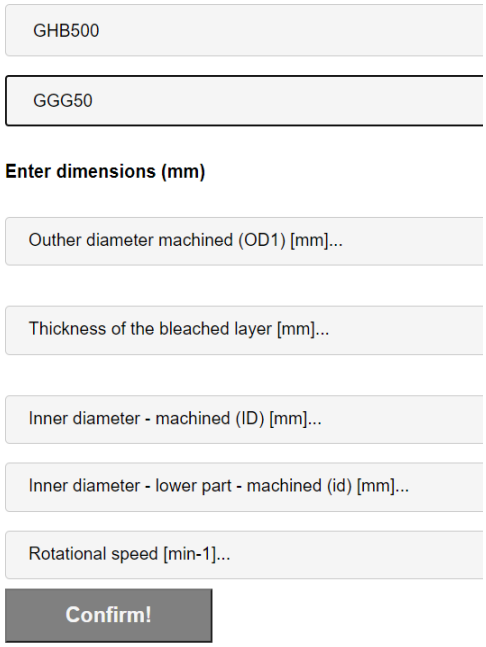
Do you want to specify a mold?

◉ Yes ○ No

Molds:

Mold number	Select	Dy
400	☑	835
403	☐	1030
402	☐	1033

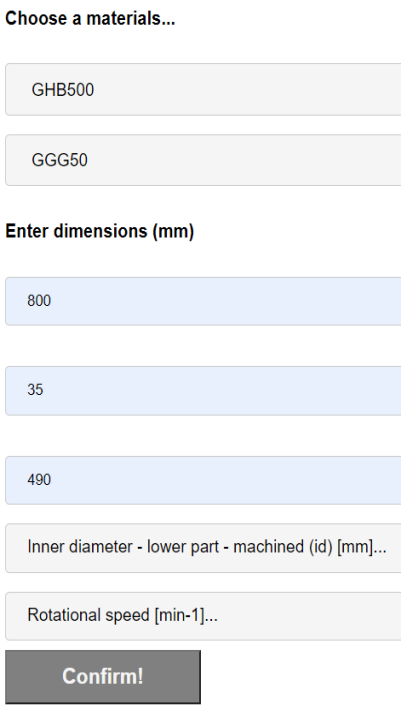
For the purposes of this example, as a value of the outer, inner diameter and length we will enter the dimensions of the machined detail. We will indicate which mold we will use – in this case we have chosen a mold № 400. You should bear in mind that if the mold we have specified is not suitable, the software will report an error and will not generate a technology.



Unlike the previous two examples, here we must specify two types of materials – for the outer and inner layer of the casting. In this case we have chosen ductile iron (ledeburite and pearlite).

The fields for entering dimensions have changed – they inform us that they are waiting for the values for the dimensions of the processed detail. In the field **Thickness of bleached layer [mm]…** in all cases you must enter the value of the thickness of the bleached layer, which we expect to get in the casting. The software itself decides how much to increase the weight of the bleached layer to ensure that the set thickness is obtained in the final product.

We enter the data:

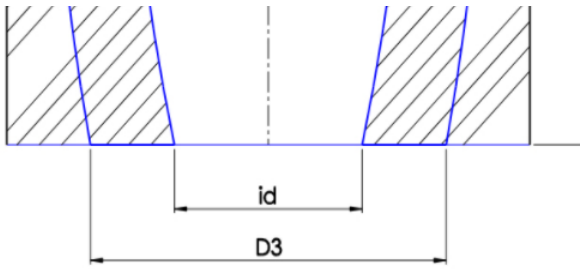


The casting length field is missing, as the length is determined by the mold we have specified.

Here, as in the example with the cylinder liner, we have the various options for entering the inner diameters and rotation speeds.

Confirm by clicking on the **Confirm!** button.

The generated technology appears on the screen, in the upper part of which the dimensions of the detail are visualized:



Dimensions of the workpiece:

D1 = 823.68 [mm]

D2 = 730 [mm]

D3 = 689 [mm]

ID = 430 [mm]

id = 359 [mm]

L = 1250.37 [mm]

The details of the technology follow below:

Mold	№	400
Active diameter of the mold (Dy1)	mm	835
Active length of the mold (La1)	mm	1263
Outer diameter of the mold (Dv)	mm	1035
Total length of the mold (Lob)	mm	1480
Flange socket - Df1	mm	940
Bottom socket - Df2	mm	940
Dimensions of flange	mm	ф932 хф629 х100
Dimensions of bottom	mm	ф932х150
Refractory gasket - for the flange	mm	ф932 хф619 х5
Refractory gasket - for the bottom	mm	ф932 хф805 х5
Spout - bore diameter	mm	ф80
Technological parameters of casting and crystallization		

Technological parameters of casting and crystallization		
Casting weight - first layer	kg	1596.32
Casting weight - second layer	kg	2206.16
Weight of II layer - I bucket	kg	1470.77
Weight of II layer - II bucket	kg	735.39
Rotation speed	min^{-1}	419
Duration of rotation of the mold at maximum speed	min	60
Second rotation speed	min^{-1}	279
Duration of rotation of the mold at second speed	min	60
Temperature of the material (I layer) in the furnace before pouring	°C	1400 - 1420
Temperature of the material (II layer) in the furnace before pouring	°C	1430 - 1450
Temperature of the material (I layer) in the bucket before pouring	°C	1330 - 1340
Temperature of the material (II layer) in the bucket before pouring	°C	1370 - 1380
Amount of flux added to the jet from the bucket - after pouring 2/3 of the metal for the first layer in the mold	kg	2.5
Intermediate time between casting of I and II layer	min	4'00"
Pouring spout temperature	°C	650 - 700
Bucket temperature	°C	600 - 650
Mold temperature before pouring the material	°C	40 - 60
Cool the mold after pouring the material	min	0

Refractory coating of the mold		
Type of refractory coating		SiO2
Component A (water)	l	15
Component B (bentonit)	kg	0.550
Component C (Celite)	kg	6
Density of the refractory coating	T/m^3	1.145
Coating nozzle size	mm	4.0
Coating device speed	sec/m	201.36
Flow rate of the refractory coating	sec/l	34
Spray pressure of the refractory coating	MPa	0.18
Mold temperature when applying the refractory coating	°C	200 - 220
Speed of rotation of the mold when applying the refractory coating	min^{-1}	423
Thickness of the refractory coating	mm	1.9 - 2.1
Heat treatment		
Heating speed	°C/h	70°C/h
Heating temperature	°C	480°C
Retention time	h	3.7
Cooling speed	°C/h	50°C/h to 200°C

The calculation of the material balances for the first and the second layer follows:

Will you use the materials available in the warehouse?

◉ Yes ○ No

Materials - I layer:

FeSi 74%	■
FeMn 80%	■
Carbon 98.9%	■
Ni 99.9%	■
Steel-HC	■
Cast iron	■
Steel-HC	■
FeV 80%	■
FeMo 69%	■
Cast iron	■
FeSi inoculant with Ba, Al and Ca	■
NiMg nodularisers	■
MgFeSi nodularisers	■

Materials - II layer:

FeSi 74	■
FeMn 80	■
Carbon 98.9	■
Ni 99.9	■
Steel-HC 0.25	■
Cast iron 4.39	■
Steel-HC 0.65	■
Cu 99.9	■
Cast iron 4.47	■
FeSi inoculant with Ba, Al and Ca	■
NiMg nodularisers 5.9	■
MgFeSi nodularisers 6.5	■

☐ **Confirm...**

GHB500 min max / Charge materials kg/100kg	C	Si	Mn	P	S	Cr	Ni	Mo	W	Nb	V	N	Mg	B	Sn	Cu	Ti	Zr	Sb
	3.3 3.6	0.63 0.83	0.45 0.65	max 0.1	max 0.012	max 0.2	2.46 2.66	0.7 0.9			0.1 0.2								min
Ni: 2.56кг	-	-	-	-	-	-	99.9	-	-	-	-	-	-	-	-	-	-	-	-
FeMn: 0.6кг	6.34	1.88	80	0.13	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FeSi: 0.27кг	0.04	74	-	0.02	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FeV: 0.19кг	-	-	-	-	-	-	-	-	-	-	80	-	-	-	-	-	-	-	-
FeMo: 1.16кг	0.018	1.95	-	0.041	0.078	-	-	69	-	-	-	-	-	-	-	-	-	-	-
Carbon: 0.4кг	98.9	0.012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Steel HC: 23.71кг	0.25	0.08	0.24	0.01	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CastIron: 71.12кг	4.39	0.7	0.044	0.053	0.024	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Composition:	**3.467**	**0.73**	**0.57**	**0.041**	**0.02**	**-**	**2.559**	**0.8**	**-**	**-**	**0.15**		**-**	**-**	**-**	**-**	**-**	**-**	**-**
GHB500 after modified min max	**C** 3.3 3.6	**Si** 0.9 1.1	**Mn** 0.45 0.65	**P** max 0.1	**S** max 0.012	**Cr** max 0.2	**Ni** 3 3.3	**Mo** 0.7 0.9	**W**	**Nb**	**V** 0.1 0.2	**N**	**Mg** 0.07 0.09	**B**	**Sn**	**Cu**	**Ti**	**Zr**	**Sb** min
Composition in the bucket	**3.467**	**1.018**	**0.57**	**0.041**	**0.02**	**-**	**3.161**	**0.8**	**-**	**-**	**0.15**	**-**	**0.081**	**-**	**-**	**-**	**-**	**-**	**-**

In the bucket:

NiMg nodularisers: 15.96 kg

MgFeSi nodularisers: 9.58 kg

GGG50	C	Si	Mn	P	S	Cr	Ni	Mo	W	Nb	V	N	Mg	B	Sn	Cu	Ti	Zr	Sb
min	3.4	1.21	0.3	max	max	max	min									1			min
max	3.6	1.41	0.5	0.05	0.015	0.05	0.15									1.3			
Charge materials kg/100kg																			
Ni: 0.25кг	-	-	-	-	-	-	99.9	-	-	-	-	-	-	-	-	-	-	-	-
FeMn: 0.4кг	6.34	1.88	80	0.13	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FeSi: 1.08кг	0.04	74	-	0.02	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbon: 0.41кг	98.9	0.012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cu: 1.15кг	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	99.9	-	-	-
Steel HC: 24.18кг	0.25	0.08	0.24	0.01	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CastIron: 72.53кг	4.39	0.7	0.044	0.053	0.024	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Composition:	**3.511**	**1.312**	**0.413**	**0.042**	**0.02**	**-**	**0.25**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1.15**	**-**	**-**	**-**

	C	Si	Mn	P	S	Cr	Ni	Mo	W	Nb	V	N	Mg	B	Sn	Cu	Ti	Zr	Sb
GGG50 after modified	3.4	2.3	0.3	max	max	max	min						0.07			1			min
min	3.6	2.5	0.5	0.05	0.015	0.05	0.15						0.09			1.3			
max																			
Composition in the bucket	**3.511**	**2.417**	**0.413**	**0.042**	**0.02**	**-**	**0.25**	**-**	**-**	**-**	**-**	**-**	**0.097**	**-**	**-**	**1.15**	**-**	**-**	**-**

In the bucket:

FeSi inoculant with Ba, Al and Ca - II layer-I bucket: 5.88 kg

FeSi inoculant with Ba, Al and Ca - II layer-II bucket: 2.94 kg

MgFeSi nodularisers - II layer-I bucket: 27.21 kg

MgFeSi nodularisers - II layer-II bucket: 13.6 kg

What is special in this case is the content of the tables with the finished material balances. We chose cast iron with spheroidal graphite. To achieve this we use magnesium modifiers in quantities indicated below the tables. These modifiers have a chemical composition that significantly changes the chemical composition of the melt after their addition to the foundry bucket. Therefore, when introducing the chemical composition of materials with a spheroidal shape of graphite into the system, it requires the introduction of the boundaries of the elements corresponding to the final chemical composition that we want to achieve. The software independently determines the quantities of the required modifiers depending on the brand of material, takes into account their chemical composition, takes into account the composition to be achieved in the foundry bucket, then determines the limits of chemical elements in the furnace to ensure the final melt composition after modification. In this case, the upper part of the tables reflects the chemical composition in the furnace, and the lower part – the chemical composition achieved after the modification.

Important: in certain cases, the software will not generate technology. Instead, it will show you a message advising you to contact us to discuss the technology you want to generate. This happens when the parameters of the technology have reached and exceeded certain boundary conditions set in the software. In these cases, there is a serious risk of rejects from poor quality products, accidents related to employees performing the technology in your actual production or damage to the equipment.

Important: the technologies generated by the CCM software are of a consultative nature – before their actual implementation in your foundry production, they must be checked and approved by a person representative of your organization and with the necessary experience and qualification in the field of centrifugal casting of steel or cast iron parts with horizontal and vertical axis.