



MAGMAhpdc

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Modeling in Preprocessor

Handling STL Files

1. Check the integrity of the STL files before loading into MAGMA-preprocessor (Using DeskArtes as a tool to verify and repair the STL files)
2. Using CMD file to load the STL files
3. Overlapping geometries are only necessary if the user is not sure about the proper connection.

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Modeling in Preprocessor

Handling STL Files

```

=====
#
# MAGMApre command file
#
# created: Wed May 24 14:33:00 2000
# by user: MAGMA_NT_01@magma
# on host: MAGMA_NT_01
#
=====
# Downloading Stl files using command lines
#
set mat 19 1
load sla STL/runner.stl
csel 0 1 1 SLA.runner
name sel runner
csel 0 1 1 SLA
name sel runner_mac
save sheet 0 runner

set mat 12 1
load sla STL/feeder.stl
csel 1 1 1 SLA.feeder
name sel feeder
csel 1 1 1 SLA
name sel feeder_mac
save sheet 1 feeder

set mat 1 1
load sla STL/Casting.stl
csel 2 1 1 SLA.Casting
name sel cast
csel 2 1 1 SLA
name sel Casting_mac
save sheet 2 Casting
=====
File: CHD/stl_load.cmd Line: 52
OK CANCEL SAVE FILE SAVE AS IMPORT... HELP
  
```

Example of the CMD for loading the STL files into preprocessor, it is also important to pay attention of the overlapping principle while creating the CMD file



Modeling in Preprocessor

Handling STL Files



Flat surface contact,
geometry overlapping
is not necessary



Flat surface contact, geometry
overlapping is not necessary



Round surface contact, geometry
overlapping might be or might not be
necessary. Depend on the triangulation of
the STL files.

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Modeling in Preprocessor

How to Use Venting

1. **Without venting** MAGMASOFT® will calculate the filling as if there is **no back pressure** inside the cavities, which is not realistic.
2. In case vent is not available at the casting, it is advisable to put a **small vent at the estimated last area of filling**, to get more comprehensive filling.
3. MAGMASOFT® accept **only cylindrical geometry for venting**. It's cross section area is determined by the **cross section area of the overflow neck or vent area which one is smaller**.
4. Venting system works independently on enmeshment

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Modeling in Preprocessor

How to Use Venting



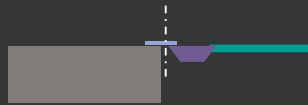
Detail X

A

$$A_{\square} = A_{\circ}$$

$$r = \sqrt{\frac{A}{\pi}}$$

In case of the overflow necks are smaller than the vent areas, the cross section areas of the overflow necks should be taken for venting calculation



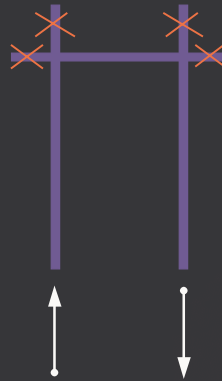
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Modeling in Preprocessor

How to Model Cooling Channel

Only active cooling channel should be modeled in MAGMASOFT®. Active means there must be always flowing water inside them.



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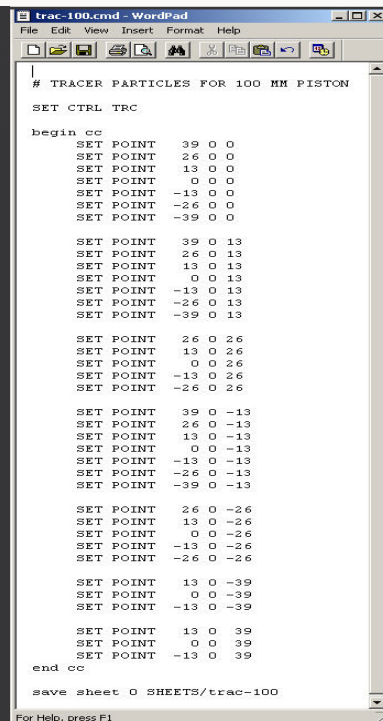


Modeling in Preprocessor

Using CMD and Sheet for Tracer Particles

How comprehensive is the tracer particle result is depend on how the particles are defined in preprocessor.

It is advisable to create tracer template in a sheet, so that the user can load that sheet and scale it as per requirement.



```
# TRACER PARTICLES FOR 100 MM PISTON

SET CTRL TRC

begin cc
  SET POINT 39 0 0
  SET POINT 26 0 0
  SET POINT 13 0 0
  SET POINT 0 0 0
  SET POINT -13 0 0
  SET POINT -26 0 0
  SET POINT -39 0 0

  SET POINT 39 0 13
  SET POINT 26 0 13
  SET POINT 13 0 13
  SET POINT 0 0 13
  SET POINT -13 0 13
  SET POINT -26 0 13
  SET POINT -39 0 13

  SET POINT 26 0 26
  SET POINT 13 0 26
  SET POINT 0 0 26
  SET POINT -13 0 26
  SET POINT -26 0 26

  SET POINT 39 0 -13
  SET POINT 26 0 -13
  SET POINT 13 0 -13
  SET POINT 0 0 -13
  SET POINT -13 0 -13
  SET POINT -26 0 -13
  SET POINT -39 0 -13

  SET POINT 26 0 -26
  SET POINT 13 0 -26
  SET POINT 0 0 -26
  SET POINT -13 0 -26
  SET POINT -26 0 -26

  SET POINT 13 0 -39
  SET POINT 0 0 -39
  SET POINT -13 0 -39

  SET POINT 13 0 39
  SET POINT 0 0 39
  SET POINT -13 0 39
end cc

save sheet 0 SHEETS/trac-100
```

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For Help, press F1

Meshing

1. At the areas with high melt velocity and thin walled, turbulence and backwash are not expected. Therefore it is allowed to have only 2 layer in enmeshment.
2. Example:
 - a. Ingate → 2 layers are allowed
 - b. Overflow necks → 1 layer is allowed
 - c. Flashes → 1 layer is allowed

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Simulation Setup

Cooling Channel Definition COOLMED VS WATER

- COOLMED** → This material will always take heat away (heat up in the material is not possible), this behavior is similar to water cooling that is flowing continuously.
- Water** → The heat up in this material is possible. This is enable the user to simulate switch on and off the cooling channel during the casting process. Calculation time using this water cooling channel is longer than using coolmed, due to the time needed to calculated the heating up of the water.

For continuous water cooling channel during the casting process, it could be considered to use coolmed to save the calculation time.

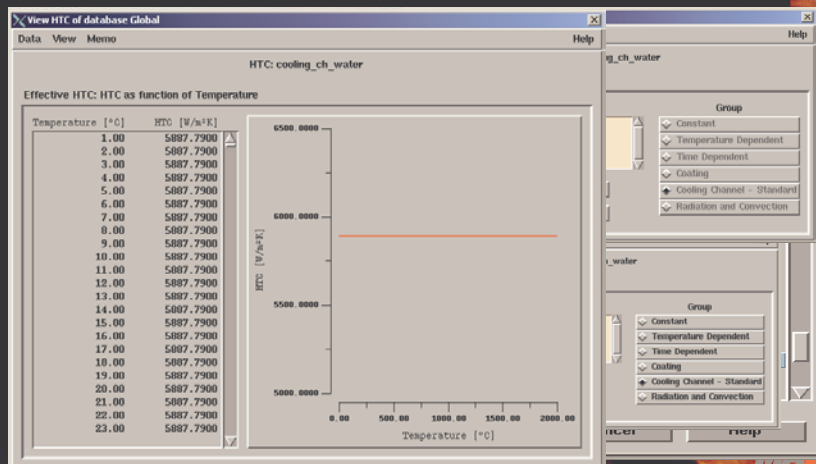
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Simulation Setup

Heat Transfer Definition for Cooling Channel Standard

HTC for cooling channel standard can be calculated and defined within MAGMASOFT as follow:

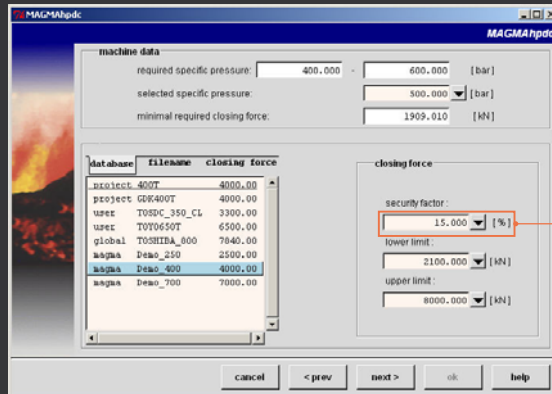


Simulation Setup

Projected Area with Slide Core in HPDC Calculator

Purpose: To calculate the closing force required and select the suitable machine to do the job.

If slide cores are available, it is advisable to increase the security factor in the input machine data.



The screenshot shows the 'MAGMA hpdc' window. Under 'machine data', the 'required specific pressure' is 400.000 [bar], 'selected specific pressure' is 300.000 [bar], and 'minimal required closing force' is 1909.010 [kN]. A table lists various machine models and their closing forces. The 'closing force' section shows a 'security factor' of 15.000 [%], with 'lower limit' at 2100.000 [kN] and 'upper limit' at 8000.000 [kN]. A red box highlights the security factor field, with an arrow pointing to the text '20%-30%'.

database	Filename	closing force
project	400T	4000.00
project	60K400T	4000.00
user	TOSDC_350_CL	3300.00
user	TOT0650T	6500.00
global	TOSHIBA_000	7040.00
magma	Deao_250	2500.00
magma	Deao_400	4000.00
magma	Deao_700	7000.00

20%-30%

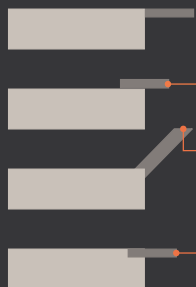
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Simulation Setup

Ingate Cross Section Area

The value of the ingate cross section area displayed by MAGMASOFT® inside the HPDC calculator is calculated on the contact surface between casting and ingate. This value might need correction for several cases:



The value displayed is correct

The values displayed are incorrect, they are too big, the real values are the cross section area of the **thinnest wall at the ingate**

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Simulation Setup

HPDC Machine

Pay attention of the max. piston acceleration value. Almost all of machine maker give this data value at 10% too high. MAGMA has corrected the value, did experiments and come out with the Demo_Machines in the MAGMASOFT® database. These machines should be used in the calculation.

If specific machine is required, it is necessary to calculate the max. piston acceleration correctly. Max. piston acceleration [a] is determined by the velocity at the 1st phase [v₁], 2nd phase [V₂] and the time required to reach the velocity at 2nd phase [t] during the casting process.

$$a = \frac{V_2 - V_1}{t}$$

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Simulation Setup

Pressurize Setup

The pressurize option in MAGMASOFT is used to calculate feeding and avoid the melt sinking at the top of the casting during solidification.



The pressurize option in MAGMASOFT is used to avoid the melt sinking at the top of the casting during solidification.

The required pressure is calculated as follow:

$$P_r = \rho \cdot g \cdot h$$

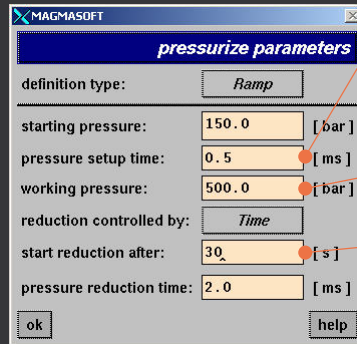
As long as the the intensifier pressure (working pressure) equal or bigger than P_r, MAGMASOFT® will calculate feeding correctly.

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Simulation Setup

Pressurize Setup



MAGMASOFT

pressurize parameters

definition type: *Ramp*

starting pressure: 150.0 [bar]

pressure setup time: 0.5 [ms]

working pressure: 500.0 [bar]

reduction controlled by: *Time*

start reduction after: 30 [s]

pressure reduction time: 2.0 [ms]

ok help

The pressure setup time can be set to 0 ms, means that pressurization works immediately after filling, not realistic, but also not wrong in term of calculation.

The working pressure must be equal or bigger than $\rho \cdot g \cdot h$

For safety reason, it is better to put start reduction after time equal or bigger than solidification time of the casting (ideally, should be the time when the ingate is no more active).