



VOETS & DONKERS

KOELTECHNIEK EN LUCHTBEHANDELING

Q LOAD CALCULATION GUIDE

34% Glycol/H₂O vs Hydromx[®]

CoP Comparison

THE AIM OF THE PROJECT

To compare the performance of the Compressor for 2 different brines
34% Glycol/H₂O vs Hydromx

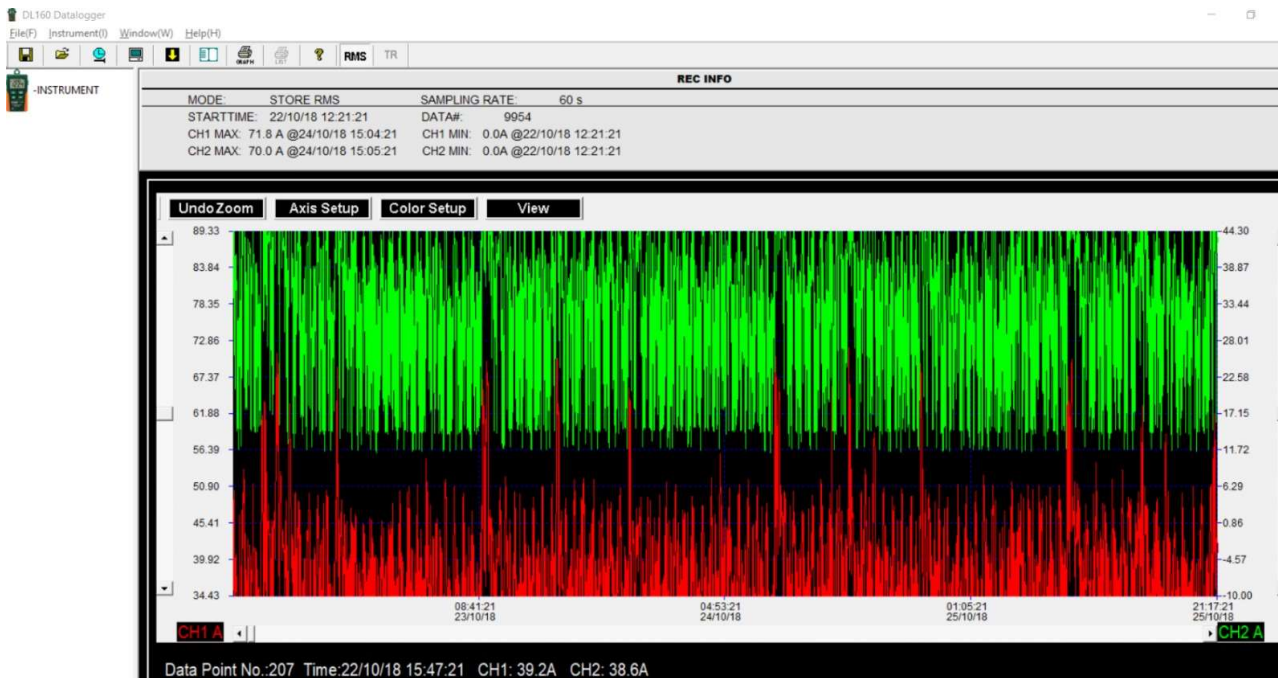
The comparison is going to be done by the ratio of the Coefficient of Performance (CoP) for the periods.

$$\text{CoP} = (\text{Heat Load} / \text{Total Energy Consumed})_{\text{July, August, September}}$$

$$\text{The efficiency} = (\text{CoP}_{\text{after}} / \text{CoP}_{\text{before}})_{\text{July, August, September}}$$

In this project Hydromx PG is granted to provide the efficiency min. 1,2

TOTAL ENERGY CONSUMED



In order to be able to calculate power factors, it is required to have the consumptions values.

For this purposes, data loggers to log the current draw of the chillers (amp) were installed at the site. It is assumed that the voltage, power factor of the compressors are same all the time, during the test.

Since the calculations are proportional calculations and , total consumption will be the power of “current draw” of the compressors, then the “amp measurements” will be enough to be considered as total consumption. Hourly mean of the amp will be the source of the formula for KWH calculation.

$$\text{Power} = \text{Amp} * \text{V} * \sqrt{3} * \cos(\text{fi})$$

TOTAL HEAT LOAD at SIMON FRUIT COLD STORE

There are mainly 3 types of different cooling demand in the system. The amount of energy consumed is the cumulative of all of these.

Heat Load due to Material Cooling;

Q_{material}

This is a batch process and, starts for a certain amount of material at a certain degree and ends as the material reaches the target temperature. Usually, material are entered to chilling process at daily outdoor temp and it continues until they reach 0,3°C.

As soon as the temp is attained ,they moved in to storage cell, which are more stable.

Heat Load due to Cell Cooling

Q_{cell}

Cells are subject to 3 different type of heat load during the storing period.

1. Temp increase due to Heat loss through the walls. Q_{store}
2. Temp increase due to Defrost of fan coils, Q_{defrost}
3. Temp increase due to Material Loading/ unloading, Q_{loading}

1. Storage Cells temp are usually modulates in between 1,2°C – 0,3°C. This is accepted as due to heat loss through the walls.

2. Fan coils in the cells get frozen and the ice has to be melted away. Arbitrarily, the room temperature is increased due to defrosting process.

3. During material loading step, cell temp. increases.

Temp rises needs to be chilled down.

Heat Load due to Removal of Humidity

Q_{H}

The humidity of the material is also important for the ripening of the berries.

Upon request, the speed of ripening is adjusted by means of humidity. Humidity extracted and condensed and removed from the cell.

The amount is recorded by operations

The Energy required for condensation of Humidity should be considered by latent heat for condensation.

TOTAL HEAT LOAD

HEAT LOAD FOR COOLING

There are 3 different types of HEAT LOAD on the system that we need to consider

There are 2 sensible heat and 1 latent heat loads on the compressors. We are going to calculate all these HEAT LOADs and sum them up, to interpret the total heat load on the compressors.

1.) ENERGY TO “MATERIAL COOLING”,

$$Q_{\text{material}} = M_{\text{material}} * C_{p_{\text{material}}} * \Delta T$$

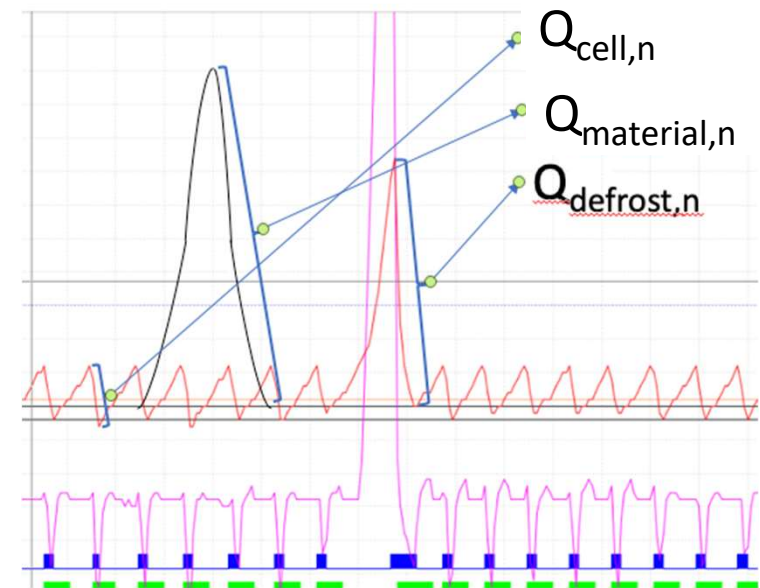
2.) ENERGY FOR “CELL COOLING”

$$Q_{\text{cell}} = M_{\text{air}} * C_{p_{\text{air}}} * \Delta T$$

3.) ENERGY FOR “HUMIDITY REMOVAL”,

$$Q_{\text{H}} = M_{\text{cond}} * \Delta H_{\text{vap}}$$

“Trends with negative slope”



List of Parameters that are needed to be mined from data.- HEAT LOAD

“Trends with negative slope” for the months, of each Cell

1.) ENERGY TO “MATERIAL COOLING”, Q_{material}

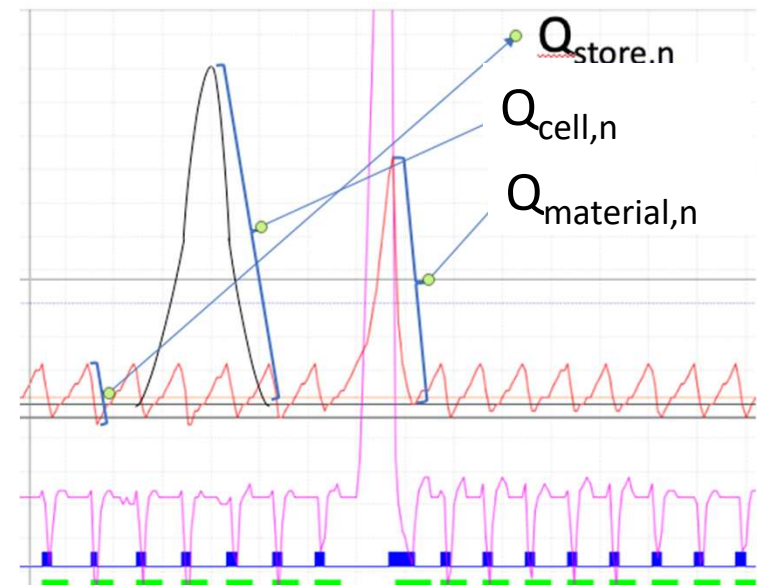
Material temp Trends with “negative slope” within the cells, for each month
Material traffic (kg) in/out within the cells, for each month
Cp values of berries & flowers (literature value)

2.) ENERGY FOR “CELL COOLING” Q_{store} , Q_{defrost} , $Q_{\text{loading}}=Q_{\text{cell}}$

Cell temp Trends with negative slope” within the cells, for each month
Amount of air (kg) remaining in the cell

3.) ENERGY FOR “HUMIDITY REMOVAL”, Q_{H}

Amount condensate water



Total Heat Load Calculation File

| Cells & Time Frames | Capacity (%) | Material Mass (kg) | Material Mass change (kg) | Air Volume (m3) | Σ ΔT Arrange Temp (0°C) | Σ ΔT Product 1 (0°C) | Σ ΔT Product 2 (0°C) | Total (m3) | Used capacity (m3) | Free Space (m3) | Material In (°C) | Qmaterial Change (KJ) | Qair (KJ) |
|---------------------|--------------|--------------------|---------------------------|-----------------|-------------------------|----------------------|----------------------|------------|--------------------|-----------------|------------------|-----------------------|------------|
| CELL 1 28.08-31.08 | 100% | 18.222,00 | 0,00 | 43,00 | 131,30 | 10,90 | 70,80 | 118,00 | 75,00 | 43,00 | 7,00 | 2.709.502,07 | 7.300,15 |
| CELL1 Aug 2018 | 100% | 18.222,00 | 0,00 | 43,00 | 131,30 | 10,90 | 70,80 | 118,00 | 75,00 | 43,00 | 7,00 | 2.709.502,07 | 7.300,15 |
| CELL1 Sep 2018 | 100% | 18.222,00 | 0,00 | 43,00 | 895,70 | 257,00 | 467,00 | 118,00 | 75,00 | 43,00 | 7,00 | 24.010.764,96 | 49.800,82 |
| CELL1 Oct 2018 | | | 0,00 | 118,00 | 1.007,60 | 352,30 | 410,60 | 118,00 | 75,00 | 43,00 | 7,00 | 19.257.135,72 | 80.643,02 |
| CELL1 Nov 2018 | | | 0,00 | 43,00 | 931,80 | 258,20 | 235,00 | 118,00 | 75,00 | 43,00 | 7,00 | 8.178.293,92 | 73.201,48 |
| CELL1 Dec 2018 | 100% | 9.200,00 | 0,00 | 43,00 | 1.670,00 | 263,80 | 172,00 | 118,00 | 75,00 | 43,00 | 0,30 | 2.309.382,00 | 92.850,33 |
| CELL1 Jan 2019 | 100% | 9.200,00 | 0,00 | 43,00 | 2.350,20 | 333,70 | 274,40 | 118,00 | 75,00 | 43,00 | 0,30 | 3.216.849,00 | 130.668,77 |
| CELL1 Feb 2019 | 100% | 9.200,00 | 0,00 | 43,00 | 808,30 | 62,30 | 257,30 | 118,00 | 75,00 | 43,00 | 0,30 | 1.690.684,00 | 44.940,67 |
| CELL1 Mar 2019 | 100% | 9.200,00 | 0,00 | 43,00 | | | | 118,00 | 75,00 | 43,00 | | 0,00 | 0,00 |
| CELL1 Apr 2019 | 100% | 9.200,00 | 0,00 | 43,00 | 2.072,00 | 240,10 | 362,40 | 118,00 | 75,00 | 43,00 | -0,40 | 3.187.225,00 | 115.201,13 |
| CELL1 May 2019 | | | 0,00 | 118,00 | 1.951,00 | 110,10 | 389,50 | 118,00 | 75,00 | 43,00 | | 2.690.494,00 | 107.395,03 |
| CELL1 Jun 2019 | 0% | 0,00 | 0,00 | 118,00 | | | | 118,00 | 75,00 | 43,00 | | 0,00 | 0,00 |
| CELL1 Jul 2019 | | | | 118,00 | 1.554,60 | 815,60 | 1.107,50 | 118,00 | 75,00 | 43,00 | | 3.510.780,00 | 224.602,63 |
| CELL1 Aug 2019 | 54% | 10.000,00 | 10.000,00 | 77,50 | 961,30 | 601,20 | 453,80 | 118,00 | 75,00 | 43,00 | 1,40 | 19.201.000,00 | 96.329,47 |
| CELL1 Sep 2019 | | | 0,00 | 118,00 | 579,50 | 340,20 | 288,60 | 118,00 | 75,00 | 43,00 | | 11.444.160,00 | 58.070,25 |
| CELL 6 Aug 2018 | | | 0,00 | 0,00 | 120,20 | 30,20 | 62,20 | | | 0,00 | | 1.121.680,56 | 3.807,76 |
| CELL 6 Sep 2018 | | | | 47,50 | 1.022,10 | 347,40 | 343,80 | 47,50 | 23,00 | 24,50 | | 7.131.273,79 | 38.338,91 |
| CELL 6 Oct 2018 | | | 0,00 | 47,50 | 509,20 | 215,00 | 264,80 | 47,50 | 23,00 | 24,50 | | 5.261.246,90 | 17.645,00 |
| CELL 6 Nov 2018 | 0% | 0,00 | 0,00 | 47,50 | 233,80 | 194,40 | 99,30 | 47,50 | 23,00 | 24,50 | 7,50 | 0,00 | 14.359,41 |
| CELL 6 Dec 2018 | | | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | | | 0,00 | | 0,00 | 0,00 |
| CELL 6 Jan 2019 | | | 0,00 | 0,00 | 757,30 | 338,90 | 195,40 | | | 0,00 | | 5.753.267,52 | 26.634,22 |
| CELL 6 Feb 2019 | | | 0,00 | 0,00 | 308,40 | 118,70 | 39,80 | | | 0,00 | | 1.592.354,40 | 11.328,81 |
| CELL 6 Mar 2019 | 0% | 0,00 | 0,00 | 47,50 | 108,30 | 101,20 | 75,90 | 47,50 | 23,00 | 24,50 | 9,80 | 0,00 | 6.251,52 |
| CELL 6 Apr 2019 | 0% | 0,00 | 0,00 | 47,50 | | | | 47,50 | 23,00 | 24,50 | | 0,00 | 0,00 |
| CELL 6 May 2019 | 0% | 0,00 | 0,00 | 47,50 | | | | 47,50 | 23,00 | 24,50 | | 0,00 | 0,00 |
| CELL 6 Jun 2019 | 0% | 0,00 | 0,00 | 47,50 | | | | 47,50 | 23,00 | 24,50 | | 0,00 | 0,00 |
| CELL 6 Jul 2019 | 0% | 0,00 | 0,00 | 47,50 | 692,10 | 596,70 | 668,80 | 47,50 | 23,00 | 24,50 | 17,00 | 0,00 | 42.507,05 |
| CELL 6 Aug 2019 | 0% | 0,00 | 0,00 | 47,50 | | | | 47,50 | 23,00 | 24,50 | | 0,00 | 0,00 |
| CELL 6 Sep 2019 | | | | 0,00 | 379,50 | 132,70 | 168,50 | | | 0,00 | | 3.050.966,10 | 14.577,43 |
| CELL 6 Oct 2019 | 83% | 5.650,00 | 0,00 | 28,41 | 999,20 | 221,70 | 269,30 | 47,50 | 23,00 | 24,50 | 1,40 | 5.046.953,80 | 36.704,74 |

Amount of Product

Cummulated values of the Product Temp1 & 2

Highest temp of the Product in that cell by that time frame

Total volume & Used capacity of the cells

Air volume of the cells

Material Mass Change Calculated by the in & out traffic of the product

Free Space m3

Q Material Calculation Mass change, density of the product and product temps

Q Air Arrange Temp, Air Volume and air's density

A – "Trends with negative slope" within the cells, for Cell temp & Product temp for each month

4. In order to determine the temp. with (-) slope, subtract the previous cell from the following one.

The degrees with (-) numbers are the heat load.

5. Repeat step 4 down to the end of the column

6. Repeat the same steps for the Product temp.
Insert a column right to «Product Temp1» (between columns D&E)

Excel screenshot showing the initial data entry and formula application for 'Arrange Temp'.

Formula bar: =#B3-B2

| | A | B | C | D | E | F | G | H |
|----|------------------|--------------|---------|----------------|--------------|----------------|----------|------|
| 1 | Date Time | Arrange Temp | | Product Temp 1 | Defrost Temp | Product Temp 2 | Setpoint | Cool |
| 2 | 10/12/2019 09:37 | 2,6 | | 1 | 0,7 | 0,4 | 0,7 | |
| 3 | 10/12/2019 09:38 | 2,5 | =#B3-B2 | 1 | 0,7 | 0,4 | 0,7 | |
| 4 | 10/12/2019 09:39 | 1,7 | | 0,9 | 0 | 0,4 | 0,7 | |
| 5 | 10/12/2019 09:40 | 1,2 | | 0,8 | -0,6 | 0,4 | 0,7 | |
| 6 | 10/12/2019 09:41 | 0,9 | | 0,7 | -0,4 | 0,3 | 0,7 | |
| 7 | 10/12/2019 09:42 | 0,7 | | 0,5 | -1 | 0,4 | 0,7 | |
| 8 | 10/12/2019 09:43 | 0,6 | | 0,5 | -0,6 | 0,4 | 0,7 | |
| 9 | 10/12/2019 09:44 | 0,6 | | 0,5 | 0 | 0,4 | 0,7 | |
| 10 | 10/12/2019 09:45 | 0,7 | | 0,6 | 0 | 0,4 | 0,7 | |
| 11 | 10/12/2019 09:46 | 0,7 | | 0,6 | 0,1 | 0,4 | 0,7 | |
| 12 | 10/12/2019 09:47 | 0,8 | | 0,7 | 0,1 | 0,3 | 0,7 | |
| 13 | 10/12/2019 09:48 | 0,8 | | 0,7 | 0,2 | 0,4 | 0,7 | |
| 14 | 10/12/2019 09:49 | 0,9 | | 0,7 | 0,1 | 0,3 | 0,7 | |
| 15 | 10/12/2019 09:50 | 1 | | 0,8 | 0,1 | 0,3 | 0,7 | |
| 16 | 10/12/2019 09:51 | 1,1 | | 0,8 | 0,1 | 0,3 | 0,7 | |
| 17 | 10/12/2019 09:52 | 1,2 | | 0,8 | 0,1 | 0,3 | 0,7 | |
| 18 | 10/12/2019 09:53 | 1,3 | | 0,9 | 0,1 | 0,3 | 0,7 | |
| 19 | 10/12/2019 09:54 | 1,4 | | 0,9 | 0,1 | 0,3 | 0,7 | |
| 20 | 10/12/2019 09:55 | 1,3 | | 0,8 | 0,2 | 0,3 | 0,7 | |
| 21 | 10/12/2019 09:56 | 1 | | 0,7 | -0,2 | 0,3 | 0,7 | |
| 22 | 10/12/2019 09:57 | 0,7 | | 0,5 | -1,3 | 0,3 | 0,7 | |
| 23 | 10/12/2019 09:58 | 0,5 | | 0,4 | -1,2 | 0,3 | 0,7 | |
| 24 | 10/12/2019 09:59 | 0,5 | | 0,4 | -0,3 | 0,3 | 0,7 | |
| 25 | 10/12/2019 10:00 | 0,5 | | 0,5 | 0 | 0,3 | 0,7 | |
| 26 | 10/12/2019 10:01 | 0,6 | | 0,6 | 0 | 0,3 | 0,7 | |
| 27 | 10/12/2019 10:02 | 0,6 | | 0,6 | 0 | 0,3 | 0,7 | |
| 28 | 10/12/2019 10:03 | 0,7 | | 0,7 | 0 | 0,3 | 0,7 | |
| 29 | 10/12/2019 10:04 | 0,8 | | 0,8 | 0,1 | 0,3 | 0,7 | |
| 30 | 10/12/2019 10:05 | 0,8 | | 0,7 | 0,3 | 0,3 | 0,7 | |
| 31 | 10/12/2019 10:06 | 0,8 | | 0,7 | 0,6 | 0,3 | 0,7 | |
| 32 | 10/12/2019 10:07 | 0,8 | | 0,8 | 0,5 | 0,3 | 0,7 | |
| 33 | 10/12/2019 10:08 | 0,9 | | 0,8 | 0,5 | 0,3 | 0,7 | |
| 34 | 10/12/2019 10:09 | 1 | | 0,8 | 0,5 | 0,3 | 0,7 | |
| 35 | 10/12/2019 10:10 | 1,1 | | 0,8 | 0,5 | 0,3 | 0,7 | |
| 36 | 10/12/2019 10:11 | 1,2 | | 0,8 | 0,5 | 0,3 | 0,7 | |

Excel screenshot showing the continuation of the calculation for 'Product Temp 1'.

Formula bar: =#B3-B2

| | A | B | C | D | E | F |
|----|------------------|--------------|---|----------------|--------------|----------------|
| 1 | Date Time | Arrange Temp | | Product Temp 1 | Defrost Temp | Product Temp 2 |
| 2 | 10/12/2019 09:37 | 2,6 | | 1 | 0,7 | 0,4 |
| 3 | 10/12/2019 09:38 | 2,5 | | 1 | 0,7 | 0,4 |
| 4 | 10/12/2019 09:39 | 1,7 | | 0,9 | 0 | 0,4 |
| 5 | 10/12/2019 09:40 | 1,2 | | 0,8 | -0,6 | 0,4 |
| 6 | 10/12/2019 09:41 | 0,9 | | 0,7 | -0,4 | 0,3 |
| 7 | 10/12/2019 09:42 | 0,7 | | 0,5 | -1 | 0,4 |
| 8 | 10/12/2019 09:43 | 0,6 | | 0,5 | -0,6 | 0,4 |
| 9 | 10/12/2019 09:44 | 0,6 | | 0,5 | 0 | 0,4 |
| 10 | 10/12/2019 09:45 | 0,7 | | 0,6 | 0 | 0,4 |
| 11 | 10/12/2019 09:46 | 0,7 | | 0,6 | 0,1 | 0,4 |
| 12 | 10/12/2019 09:47 | 0,8 | | 0,7 | 0,1 | 0,3 |
| 13 | 10/12/2019 09:48 | 0,8 | | 0,7 | 0,2 | 0,4 |
| 14 | 10/12/2019 09:49 | 0,9 | | 0,7 | 0,1 | 0,3 |
| 15 | 10/12/2019 09:50 | 1 | | 0,8 | 0,1 | 0,3 |
| 16 | 10/12/2019 09:51 | 1,1 | | 0,8 | 0,1 | 0,3 |
| 17 | 10/12/2019 09:52 | 1,2 | | 0,8 | 0,1 | 0,3 |
| 18 | 10/12/2019 09:53 | 1,3 | | 0,9 | 0,1 | 0,3 |
| 19 | 10/12/2019 09:54 | 1,4 | | 0,9 | 0,1 | 0,3 |
| 20 | 10/12/2019 09:55 | 1,3 | | 0,8 | 0,2 | 0,3 |
| 21 | 10/12/2019 09:56 | 1 | | 0,7 | -0,2 | 0,3 |
| 22 | 10/12/2019 09:57 | 0,7 | | 0,5 | -1,3 | 0,3 |
| 23 | 10/12/2019 09:58 | 0,5 | | 0,4 | -1,2 | 0,3 |
| 24 | 10/12/2019 09:59 | 0,5 | | 0,4 | -0,3 | 0,3 |
| 25 | 10/12/2019 10:00 | 0,5 | | 0,5 | 0 | 0,3 |
| 26 | 10/12/2019 10:01 | 0,6 | | 0,6 | 0 | 0,3 |
| 27 | 10/12/2019 10:02 | 0,6 | | 0,6 | 0 | 0,3 |
| 28 | 10/12/2019 10:03 | 0,7 | | 0,7 | 0 | 0,3 |
| 29 | 10/12/2019 10:04 | 0,8 | | 0,7 | 0 | 0,3 |
| 30 | 10/12/2019 10:05 | 0,8 | | 0,7 | 0,1 | 0,3 |
| 31 | 10/12/2019 10:06 | 0,8 | | 0,7 | 0,3 | 0,3 |
| 32 | 10/12/2019 10:07 | 0,8 | | 0,7 | 0,6 | 0,3 |
| 33 | 10/12/2019 10:08 | 0,9 | | 0,8 | 0,5 | 0,3 |
| 34 | 10/12/2019 10:09 | 1 | | 0,8 | 0,5 | 0,3 |
| 35 | 10/12/2019 10:10 | 1,1 | | 0,8 | 0,5 | 0,3 |
| 36 | 10/12/2019 10:11 | 1,2 | | 0,8 | 0,5 | 0,3 |

Excel screenshot showing the final data entry and formula application for 'Defrost Temp'.

Formula bar: Defrost Temp

| | A | B | C | D | E | F | G |
|----|------------------|--------------|---|----------------|--------------|----------------|------|
| 1 | Date Time | Arrange Temp | | Product Temp 1 | Defrost Temp | Product Temp 2 | Cool |
| 2 | 10/12/2019 09:37 | 2,6 | | 1 | 0,7 | 0,4 | 0,7 |
| 3 | 10/12/2019 09:38 | 2,5 | | 1 | 0,7 | 0,4 | 0,7 |
| 4 | 10/12/2019 09:39 | 1,7 | | 0,9 | 0 | 0,4 | 0,7 |
| 5 | 10/12/2019 09:40 | 1,2 | | 0,8 | -0,6 | 0,4 | 0,7 |
| 6 | 10/12/2019 09:41 | 0,9 | | 0,7 | -0,4 | 0,3 | 0,7 |
| 7 | 10/12/2019 09:42 | 0,7 | | 0,5 | -1 | 0,4 | 0,7 |
| 8 | 10/12/2019 09:43 | 0,6 | | 0,5 | -0,6 | 0,4 | 0,7 |
| 9 | 10/12/2019 09:44 | 0,6 | | 0,5 | 0 | 0,4 | 0,7 |
| 10 | 10/12/2019 09:45 | 0,7 | | 0,6 | 0 | 0,4 | 0,7 |
| 11 | 10/12/2019 09:46 | 0,7 | | 0,6 | 0,1 | 0,4 | 0,7 |
| 12 | 10/12/2019 09:47 | 0,8 | | 0,7 | 0,1 | 0,3 | 0,7 |
| 13 | 10/12/2019 09:48 | 0,8 | | 0,7 | 0,2 | 0,4 | 0,7 |
| 14 | 10/12/2019 09:49 | 0,9 | | 0,7 | 0,1 | 0,3 | 0,7 |
| 15 | 10/12/2019 09:50 | 1 | | 0,8 | 0,1 | 0,3 | 0,7 |
| 16 | 10/12/2019 09:51 | 1,1 | | 0,8 | 0,1 | 0,3 | 0,7 |
| 17 | 10/12/2019 09:52 | 1,2 | | 0,8 | 0,1 | 0,3 | 0,7 |
| 18 | 10/12/2019 09:53 | 1,3 | | 0,9 | 0,1 | 0,3 | 0,7 |
| 19 | 10/12/2019 09:54 | 1,4 | | 0,9 | 0,1 | 0,3 | 0,7 |
| 20 | 10/12/2019 09:55 | 1,3 | | 0,8 | 0,2 | 0,3 | 0,7 |
| 21 | 10/12/2019 09:56 | 1 | | 0,7 | -0,2 | 0,3 | 0,7 |
| 22 | 10/12/2019 09:57 | 0,7 | | 0,5 | -1,3 | 0,3 | 0,7 |
| 23 | 10/12/2019 09:58 | 0,5 | | 0,4 | -1,2 | 0,3 | 0,7 |
| 24 | 10/12/2019 09:59 | 0,5 | | 0,4 | -0,3 | 0,3 | 0,7 |
| 25 | 10/12/2019 10:00 | 0,5 | | 0,5 | 0 | 0,3 | 0,7 |
| 26 | 10/12/2019 10:01 | 0,6 | | 0,6 | 0 | 0,3 | 0,7 |
| 27 | 10/12/2019 10:02 | 0,6 | | 0,6 | 0 | 0,3 | 0,7 |
| 28 | 10/12/2019 10:03 | 0,7 | | 0,7 | 0 | 0,3 | 0,7 |
| 29 | 10/12/2019 10:04 | 0,8 | | 0,7 | 0,1 | 0,3 | 0,7 |
| 30 | 10/12/2019 10:05 | 0,8 | | 0,7 | 0,3 | 0,3 | 0,7 |
| 31 | 10/12/2019 10:06 | 0,8 | | 0,7 | 0,6 | 0,3 | 0,7 |
| 32 | 10/12/2019 10:07 | 0,8 | | 0,7 | 0,5 | 0,3 | 0,7 |
| 33 | 10/12/2019 10:08 | 0,9 | | 0,8 | 0,5 | 0,3 | 0,7 |
| 34 | 10/12/2019 10:09 | 1 | | 0,8 | 0,5 | 0,3 | 0,7 |
| 35 | 10/12/2019 10:10 | 1,1 | | 0,8 | 0,5 | 0,3 | 0,7 |
| 36 | 10/12/2019 10:11 | 1,2 | | 0,8 | 0,5 | 0,3 | 0,7 |

A – "Trends with negative slope" within the cells, for Cell temp & Product temp for each month

7. For the temperatures with (-) slope of the «Product temp1», repeat the step 4.

8. Repeat step 7 down to the end of the column

9. Repeat step 7 and step 8 for «Product Temp2» (between columns G&I)

Excel screenshot showing step 7. The formula bar displays $+D3-D2$. A red arrow points from the instruction box to cell E3. The spreadsheet shows columns A through G with data points for 'Arrange Temp', 'Product Temp 1', and 'Defrost Temp'. Row 3 is highlighted with a dashed red box around the value 1 in column D.

Excel screenshot showing step 8. The formula bar displays $+D3-D2$. A red arrow points from the instruction box down the column E, indicating the formula is being repeated. The spreadsheet shows columns A through G. Row 36 is highlighted at the bottom of the column.

Excel screenshot showing step 9. The formula bar displays $+G3-G2$. A red arrow points from the instruction box to cell H3. The spreadsheet shows columns B through J with data points for 'Product Temp 1', 'Defrost Temp', 'Product Temp 2', and 'Setpoint'. Row 3 is highlighted with a dashed red box around the value 1 in column G.

A – " Trends with negative slope" within the cells, for Cell temp & Product temp for each month

10. To have the cumulated negative temperatures, formulas will be written in the top cell of the subtraction of the "Arrange(cell) temp", "Product temp 1" and "Product temp 2"

11. ΔT that are subject to cooling process is ready for "the Cell temp" & "the Product temp", for the specific month.

| Date Time | Arrange Temp | Product Temp 1 | Product Temp 2 | Defrost Temp | Product Temp 2 |
|------------------|--------------|----------------|----------------|--------------|----------------|
| 10/12/2019 09:37 | 2,6 | | | 0,7 | 0,4 |
| 10/12/2019 09:38 | 2,5 | -0,1 | 1 | 0 | 0,7 |
| 10/12/2019 09:39 | 1,7 | -0,8 | 0,9 | -0,1 | 0 |
| 10/12/2019 09:40 | 1,2 | -0,5 | 0,8 | -0,1 | -0,6 |
| 10/12/2019 09:41 | 0,9 | -0,3 | 0,7 | -0,1 | -0,4 |
| 10/12/2019 09:42 | 0,7 | -0,2 | 0,5 | -0,2 | -1 |
| 10/12/2019 09:43 | 0,6 | -0,1 | 0,5 | 0 | -0,6 |
| 10/12/2019 09:44 | 0,6 | 0 | 0,5 | 0 | 0 |
| 10/12/2019 09:45 | 0,7 | 0,1 | 0,6 | 0,1 | 0 |
| 10/12/2019 09:46 | 0,7 | 0 | 0,6 | 0 | 0,1 |
| 10/12/2019 09:47 | 0,8 | 0,1 | 0,7 | 0,1 | 0,1 |
| 10/12/2019 09:48 | 0,8 | 0 | 0,7 | 0 | 0,2 |
| 10/12/2019 09:49 | 0,9 | 0,1 | 0,7 | 0 | 0,1 |
| 10/12/2019 09:50 | 1 | 0,1 | 0,8 | 0,1 | 0,1 |
| 10/12/2019 09:51 | 1,1 | 0,1 | 0,8 | 0 | 0,1 |
| 10/12/2019 09:52 | 1,2 | 0,1 | 0,8 | 0 | 0,1 |
| 10/12/2019 09:53 | 1,3 | 0,1 | 0,9 | 0,1 | 0,1 |
| 10/12/2019 09:54 | 1,4 | 0,1 | 0,9 | 0 | 0,1 |
| 10/12/2019 09:55 | 1,3 | -0,1 | 0,8 | -0,1 | 0,2 |
| 10/12/2019 09:56 | 1 | -0,3 | 0,7 | -0,1 | -0,2 |
| 10/12/2019 09:57 | 0,7 | -0,3 | 0,5 | -0,2 | -1,3 |
| 10/12/2019 09:58 | 0,5 | -0,2 | 0,4 | -0,1 | -1,2 |
| 10/12/2019 09:59 | 0,5 | 0 | 0,4 | 0 | -0,3 |
| 10/12/2019 10:00 | 0,5 | 0 | 0,5 | 0,1 | 0 |
| 10/12/2019 10:01 | 0,6 | 0,1 | 0,5 | 0 | 0 |
| 10/12/2019 10:02 | 0,6 | 0 | 0,6 | 0,1 | 0 |
| 10/12/2019 10:03 | 0,7 | 0,1 | 0,6 | 0 | 0 |
| 10/12/2019 10:04 | 0,8 | 0,1 | 0,7 | 0,1 | 0 |
| 10/12/2019 10:05 | 0,8 | 0 | 0,7 | 0 | 0,1 |
| 10/12/2019 10:06 | 0,8 | 0 | 0,7 | 0 | 0,3 |
| 10/12/2019 10:07 | 0,8 | 0 | 0,7 | 0 | 0,6 |
| 10/12/2019 10:08 | 0,9 | 0,1 | 0,8 | 0 | 0,5 |
| 10/12/2019 10:09 | 1 | 0,1 | 0,8 | 0 | 0,5 |
| 10/12/2019 10:10 | 1,1 | 0,1 | 0,8 | 0,5 | 0,3 |

| Date Time | Arrange Temp | Product Temp 1 | Product Temp 2 | Defrost Temp | Product Temp 2 |
|------------------|--------------|----------------|----------------|--------------|----------------|
| 10/12/2019 09:37 | 2,6 | | | 0,7 | 0,4 |
| 10/12/2019 09:38 | 2,5 | -0,1 | 1 | 0 | 0,7 |
| 10/12/2019 09:39 | 1,7 | -0,8 | 0,9 | -0,1 | 0 |
| 10/12/2019 09:40 | 1,2 | -0,5 | 0,8 | -0,1 | -0,6 |
| 10/12/2019 09:41 | 0,9 | -0,3 | 0,7 | -0,1 | -0,4 |
| 10/12/2019 09:42 | 0,7 | -0,2 | 0,5 | -0,2 | -1 |
| 10/12/2019 09:43 | 0,6 | -0,1 | 0,5 | 0 | -0,6 |
| 10/12/2019 09:44 | 0,6 | 0 | 0,5 | 0 | 0 |
| 10/12/2019 09:45 | 0,7 | 0,1 | 0,6 | 0,1 | 0 |
| 10/12/2019 09:46 | 0,7 | 0 | 0,6 | 0 | 0,1 |
| 10/12/2019 09:47 | 0,8 | 0,1 | 0,7 | 0,1 | 0,1 |
| 10/12/2019 09:48 | 0,8 | 0 | 0,7 | 0 | 0,2 |
| 10/12/2019 09:49 | 0,9 | 0,1 | 0,7 | 0 | 0,1 |
| 10/12/2019 09:50 | 1 | 0,1 | 0,8 | 0,1 | 0,1 |
| 10/12/2019 09:51 | 1,1 | 0,1 | 0,8 | 0 | 0,1 |
| 10/12/2019 09:52 | 1,2 | 0,1 | 0,8 | 0 | 0,1 |
| 10/12/2019 09:53 | 1,3 | 0,1 | 0,9 | 0,1 | 0,1 |
| 10/12/2019 09:54 | 1,4 | 0,1 | 0,9 | 0 | 0,1 |
| 10/12/2019 09:55 | 1,3 | -0,1 | 0,8 | -0,1 | 0,2 |
| 10/12/2019 09:56 | 1 | -0,3 | 0,7 | -0,1 | -0,2 |
| 10/12/2019 09:57 | 0,7 | -0,3 | 0,5 | -0,2 | -1,3 |
| 10/12/2019 09:58 | 0,5 | -0,2 | 0,4 | -0,1 | -1,2 |
| 10/12/2019 09:59 | 0,5 | 0 | 0,4 | 0 | -0,3 |
| 10/12/2019 10:00 | 0,5 | 0 | 0,5 | 0,1 | 0 |
| 10/12/2019 10:01 | 0,6 | 0,1 | 0,5 | 0 | 0 |
| 10/12/2019 10:02 | 0,6 | 0 | 0,6 | 0,1 | 0 |
| 10/12/2019 10:03 | 0,7 | 0,1 | 0,6 | 0 | 0 |
| 10/12/2019 10:04 | 0,8 | 0,1 | 0,7 | 0,1 | 0 |
| 10/12/2019 10:05 | 0,8 | 0 | 0,7 | 0 | 0,1 |
| 10/12/2019 10:06 | 0,8 | 0 | 0,7 | 0 | 0,3 |
| 10/12/2019 10:07 | 0,8 | 0 | 0,7 | 0 | 0,6 |
| 10/12/2019 10:08 | 0,9 | 0,1 | 0,8 | 0 | 0,5 |
| 10/12/2019 10:09 | 1 | 0,1 | 0,8 | 0 | 0,5 |
| 10/12/2019 10:10 | 1,1 | 0,1 | 0,8 | 0,5 | 0,3 |

Product Traffic determination *(The amount of the products moving in & out to the cells with time frames)*

CoolCells_Registratio_v11

File Home Insert Page Layout Formulas Data Review View Help

Calibri 11

General

Normal Bad Good Neutral

Calculation Check Cell Explanatory... Input

P748 20/35

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V | W | X | Y |
|----|------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|---------|-------|----|-------|-----|----|---|----|---|----|---|----|---|
| 1 | Cell nr | Cell 1 | Cell 2 | Cell 3 | Cell 4 | Cell 5 | Cell 6 | Cell 7 | Cell 8 | Cell 9 | Cell 10 | Cell 11 | Cell 12 | | | | | | | | | | | | |
| 2 | Date | Kg | % | Kg | % | Kg | % | Kg | % | Kg | % | Kg | % | Kg | % | Kg | % | Kg | % | Kg | % | Kg | % | Kg | % |
| 3 | 28/08/2018 | 18222 | 100 | 18620 | 100 | 19115 | 99,8 | 19610 | 100 | | | 6670 | 100 | | | 19610 | 100 | | | 0 | | 0 | | 0 | |
| 4 | 29/08/2018 | 18222 | 100 | 18620 | 100 | 19115 | 99,8 | 19610 | 100 | | | 6670 | 100 | | | 19610 | 100 | | | 0 | | 0 | | 0 | |
| 5 | 30/08/2018 | 18222 | 100 | 18620 | 100 | 19115 | 99,8 | 19610 | 100 | | | 6670 | 100 | | | 19610 | 100 | | | 0 | | 0 | | 0 | |
| 6 | 31/08/2018 | 18222 | 100 | 18620 | 100 | 19115 | 99,8 | 19610 | 100 | | | 6670 | 100 | | | 19610 | 100 | | | 0 | | 0 | | 0 | |
| 7 | 01/09/2018 | 18222 | 100 | 18620 | 100 | 19188 | 100 | 19610 | 100 | 3193 | 53 | 6670 | 100 | | | 19610 | 100 | | | 0 | | 0 | | 0 | |
| 8 | 02/09/2018 | 18222 | 100 | 18620 | 100 | 19188 | 100 | 19610 | 100 | 3193 | 53 | 6670 | 100 | | | 19610 | 100 | | | 0 | | 0 | | 0 | |
| 9 | 03/09/2018 | 18222 | 100 | 18620 | 100 | 19188 | 100 | 19610 | 100 | 3193 | 53 | 6670 | 100 | | | 19610 | 100 | | | 0 | | 0 | | 0 | |
| 10 | 04/09/2018 | 18222 | 100 | 18620 | 100 | 19188 | 100 | 19610 | 100 | 3193 | 53 | 6670 | 100 | | | 19610 | 100 | | | 0 | | 0 | | 0 | |
| 11 | 05/09/2018 | 18222 | 100 | 18620 | 100 | 19188 | 100 | 19610 | 100 | 3193 | 53 | 6670 | 100 | | | 19610 | 100 | | | 0 | | 0 | | 0 | |
| 12 | 06/09/2018 | 18222 | 100 | 18620 | 100 | 19100 | 100 | 19610 | 100 | 3193 | 53 | 6670 | 100 | 19/35 | 54 | 19610 | 100 | | | 0 | | 0 | | 0 | |
| 13 | 07/09/2018 | 18222 | 100 | 18620 | 100 | 19188 | 100 | 19610 | 100 | 3193 | 53 | 6670 | 100 | 19/35 | 54 | 19610 | 100 | | | 0 | | 0 | | 0 | |
| 14 | 08/09/2018 | 18222 | 100 | 18620 | 100 | 19188 | 100 | 19610 | 100 | 3193 | 53 | 6670 | 100 | 19/35 | 54 | 19610 | 100 | | | 0 | | 0 | | 0 | |
| 15 | 09/09/2018 | 18222 | 100 | 18620 | 100 | 19188 | 100 | 19610 | 100 | 3193 | 53 | 6670 | 100 | | | 19610 | 100 | | | 0 | | 0 | | 0 | |
| 16 | 10/09/2018 | 18222 | 100 | 18620 | 100 | 19188 | 100 | 19610 | 100 | 3193 | 53 | 6670 | 100 | | | 19610 | 100 | | | 0 | | 0 | | 0 | |
| 17 | 11/09/2018 | 18222 | 100 | 18620 | 100 | 19188 | 100 | 19610 | 100 | 3193 | 53 | 6670 | 100 | | | 19610 | 100 | | | 0 | | 0 | | 0 | |
| 18 | 12/09/2018 | 18222 | 100 | 18620 | 100 | 19188 | 100 | 19610 | 100 | 3193 | 53 | 6670 | 100 | | | 19610 | 100 | | | 0 | | 0 | | 0 | |
| 19 | 13/09/2018 | 18222 | 100 | 18620 | 100 | 19188 | 100 | 19610 | 100 | 3193 | 53 | 6670 | 100 | | | 19610 | 100 | | | 0 | | 0 | | 0 | |
| 20 | 14/09/2018 | 18222 | 100 | 18620 | 100 | 19100 | 100 | 19610 | 100 | 3193 | 53 | 3532 | 53 | | | 19610 | 100 | | | 0 | | 0 | | 0 | |
| 21 | 15/09/2018 | 18222 | 100 | 18620 | 100 | 19188 | 100 | 19610 | 100 | 0 | 0 | 3532 | 53 | | | 19610 | 100 | | | 0 | | 0 | | 0 | |
| 22 | 16/09/2018 | 18222 | 100 | 18620 | 100 | 19188 | 100 | 19610 | 100 | 0 | 0 | 3532 | 53 | | | 19610 | 100 | | | 0 | | 0 | | 0 | |
| 23 | 17/09/2018 | 18222 | 100 | 18620 | 100 | 19188 | 100 | 19610 | 100 | 0 | 0 | 3532 | 53 | | | 19610 | 100 | | | 0 | | 0 | | 0 | |
| 24 | 18/09/2018 | 18222 | 100 | 18620 | 100 | 19188 | 100 | 19610 | 100 | 0 | 0 | 3532 | 53 | | | 19610 | 100 | | | 0 | | 0 | | 0 | |
| 25 | 19/09/2018 | 18222 | 100 | 18620 | 100 | 19100 | 100 | 19610 | 100 | 0 | 0 | 3532 | 53 | | | 19610 | 100 | | | 0 | | 0 | | 0 | |
| 26 | 20/09/2018 | 18222 | 100 | 18620 | 100 | 19188 | 100 | 19610 | 100 | 0 | 0 | 3532 | 53 | | | 19610 | 100 | | | 0 | | 0 | | 0 | |
| 27 | 21/09/2018 | 18222 | 100 | 18620 | 100 | 19188 | 100 | 19610 | 100 | 0 | 0 | 3532 | 53 | | | 19610 | 100 | | | 0 | | 0 | | 0 | |
| 28 | 22/09/2018 | 18222 | 100 | 18620 | 100 | 19188 | 100 | 19610 | 100 | 0 | 0 | 6025 | 90 | | | 19610 | 100 | | | 0 | | 0 | | 0 | |
| 29 | 23/09/2018 | 18222 | 100 | 18620 | 100 | 19188 | 100 | 19610 | 100 | 0 | 0 | 6025 | 90 | | | 19610 | 100 | | | 0 | | 0 | | 0 | |
| 30 | 24/09/2018 | 18222 | 100 | 18620 | 100 | 0 | 0 | 19610 | 100 | 5945 | 100 | 6025 | 90 | | | 19610 | 100 | | | 0 | | 0 | | 0 | |
| 31 | 25/09/2018 | 18222 | 100 | 18620 | 100 | 0 | 0 | 19610 | 100 | 5945 | 100 | 6025 | 90 | | | 19610 | 100 | | | 0 | | 0 | | 0 | |
| 32 | 26/09/2018 | 18222 | 100 | 18620 | 100 | 0 | 0 | 19610 | 100 | 5945 | 100 | 6025 | 90 | | | 19610 | 100 | | | 0 | | 0 | | 0 | |
| 33 | 27/09/2018 | 18222 | 100 | 18620 | 100 | 0 | 0 | 19610 | 100 | 5945 | 100 | 6025 | 90 | | | 19610 | 100 | | | 0 | | 0 | | 0 | |
| 34 | 28/09/2018 | 18222 | 100 | 18620 | 100 | 0 | 0 | 19610 | 100 | 5945 | 100 | 6025 | 90 | | | 19610 | 100 | | | 0 | | 0 | | 0 | |
| 35 | 29/09/2018 | 18222 | 100 | 18620 | 100 | 0 | 0 | 19610 | 100 | 5945 | 100 | 6025 | 90 | | | 19610 | 100 | | | 0 | | 0 | | 0 | |
| 36 | 30/09/2018 | 18222 | 100 | 18620 | 100 | 0 | 0 | 19610 | 100 | 5945 | 100 | 6025 | 90 | | | 19610 | 100 | | | 0 | | 0 | | 0 | |

1. For Cell 1, it's seen that, on Sep2018, the amount of the product is 18.222 kg and no product is moved out. Cell is 100% full.

On the other hand, there is a traffic during Sep2018 for Cell 11. This traffic is effecting the consumption on the Cooling Energy by opening the cell doors and placing warmer degree products in the cells.

Product Traffic determination *(The amount of the products moving in & out to the cells with time frames)*

AutoSave COP Calculation_Interim_Jul_Aug_v05

File Home Insert Page Layout Formulas Data Review View Help Table Design

Calibri 12

Q290

| | | weight of flowers | 400 kg/palett | | | | | | | | | | | |
|-----|---------------------|-------------------|--------------------|---------------------------|-----------------|-------------------------|----------------------|----------------------|------------|--------------------|-----------------|------------|-------|------|
| | Cells & Time Frames | Capacity (%) | Material Mass (kg) | Material Mass change (Kg) | Air Volume (m3) | Σ ΔT Arrange Temp (0°C) | Σ ΔT Product 1 (0°C) | Σ ΔT Product 2 (0°C) | Total (m3) | Used capacity (m3) | Free Space (m3) | Material I | | |
| 259 | CELL 10 Jul 2019 | | | | 0,00 | 1.739,70 | 1.274,90 | 1.286,10 | | | | | | 0,00 |
| 264 | CELL 10 Aug 2019 | | | | 0,00 | 3.012,70 | 1.501,30 | 520,30 | | | | | | 0,00 |
| 271 | CELL 10 Sep 2019 | | | | 0,00 | 1.636,20 | 345,70 | 133,00 | | | | | | 0,00 |
| 276 | CELL 10 Oct 2019 | | | | 0,00 | 2.080,80 | 476,10 | 192,20 | | | | | | 0,00 |
| 284 | CELL 10 Nov 2019 | | | | 0,00 | 2.121,70 | 252,50 | 373,60 | | | | | | 0,00 |
| 287 | CELL 10 Dec 2019 | | | | 0,00 | 2.056,10 | 560,40 | 118,70 | | | | | | 0,00 |
| 289 | CELL 11 Aug 2018 | | | | 0,00 | 473,30 | 201,60 | 18,30 | | | | | | 0,00 |
| 290 | CELL 11 01.09-13.09 | 48% | 1.668,00 | 1.668,00 | 20,52 | 1.394,20 | 260,00 | 26,90 | 27,00 | 13,50 | 13,50 | | 8,60 | |
| 291 | CELL 11 14.09-18.09 | 100% | 3.510,00 | 1.842,00 | 13,50 | 607,30 | 58,40 | 417,30 | 27,00 | 13,50 | 13,50 | | 10,30 | |
| 292 | CELL 11 19.09-23.09 | 76% | 2.642,00 | -868,00 | 16,81 | 567,70 | 51,50 | 57,10 | 27,00 | 13,50 | 13,50 | | 11,70 | |
| 293 | CELL 11 24.09-30.09 | 98% | 3.417,00 | 775,00 | 13,84 | 685,70 | 39,40 | 64,40 | 27,00 | 13,50 | 13,50 | | 8,40 | |
| 294 | CELL 11 Sep 2018 | | | | 0,00 | 3.254,90 | 409,30 | 565,70 | | | | | | 0,00 |
| 301 | CELL 11 Oct 2018 | | | | 0,00 | 3.123,00 | 271,20 | 63,80 | | | | | | 0,00 |
| 309 | CELL 11 Nov 2018 | | | | 0,00 | 2.877,90 | 426,90 | 89,30 | | | | | | 0,00 |
| 315 | CELL 11 Dec 2018 | | | | 0,00 | 2.417,60 | 561,40 | 90,40 | | | | | | 0,00 |

3. If there is an in&out product traffic in the cell more than once as seen on the left, time frames should thoroughly be written

ΔT for the “Cell Temp” & “Product Temp” for specific amount within the month

| | A | B | C | D | E |
|----|------------------|--------------|--------------|----------------|------|
| 1 | | | | 14,3 | |
| 2 | Date Time | Arrange Temp | C110083;"<0" | Product Temp 1 | -1 |
| 3 | 10/12/2019 09:37 | 2,6 | | 1 | |
| 4 | 10/12/2019 09:38 | 2,5 | -0,1 | 1 | |
| 5 | 10/12/2019 09:39 | 1,7 | -0,8 | 0,9 | -0,1 |
| 6 | 10/12/2019 09:40 | 1,2 | -0,5 | 0,8 | -0,1 |
| 7 | 10/12/2019 09:41 | 0,9 | -0,3 | 0,7 | -0,1 |
| 8 | 10/12/2019 09:42 | 0,7 | -0,2 | 0,5 | -0,2 |
| 9 | 10/12/2019 09:43 | 0,6 | -0,1 | 0,5 | 0 |
| 10 | 10/12/2019 09:44 | 0,6 | 0 | 0,5 | 0 |
| 11 | 10/12/2019 09:45 | 0,7 | 0,1 | 0,6 | 0,1 |
| 12 | 10/12/2019 09:46 | 0,7 | 0 | 0,6 | 0 |
| 13 | 10/12/2019 09:47 | 0,8 | 0,1 | 0,7 | 0,1 |
| 14 | 10/12/2019 09:48 | 0,8 | 0 | 0,7 | 0 |
| 15 | 10/12/2019 09:49 | 0,9 | 0,1 | 0,7 | 0 |
| 16 | 10/12/2019 09:50 | 1 | 0,1 | 0,8 | 0,1 |
| 17 | 10/12/2019 09:51 | 1,1 | 0,1 | 0,8 | 0 |
| 18 | 10/12/2019 09:52 | 1,2 | 0,1 | 0,8 | 0 |
| 19 | 10/12/2019 09:53 | 1,3 | 0,1 | 0,9 | 0,1 |
| 20 | 10/12/2019 09:54 | 1,4 | 0,1 | 0,9 | 0 |
| 21 | 10/12/2019 09:55 | 1,3 | -0,1 | 0,8 | -0,1 |
| 22 | 10/12/2019 09:56 | 1 | -0,3 | 0,7 | -0,1 |
| 23 | 10/12/2019 09:57 | 0,7 | -0,3 | 0,5 | -0,2 |
| 24 | 10/12/2019 09:58 | 0,5 | -0,2 | 0,4 | -0,1 |
| 25 | 10/12/2019 09:59 | 0,5 | 0 | 0,4 | 0 |
| 26 | 10/12/2019 10:00 | 0,5 | 0 | 0,5 | 0,1 |
| 27 | 10/12/2019 10:01 | 0,6 | 0,1 | 0,5 | 0 |
| 28 | 10/12/2019 10:02 | 0,6 | 0 | 0,6 | 0,1 |
| 29 | 10/12/2019 10:03 | 0,7 | 0,1 | 0,6 | 0 |
| 30 | 10/12/2019 10:04 | 0,8 | 0,1 | 0,7 | 0,1 |
| 31 | 10/12/2019 10:05 | 0,8 | 0 | 0,7 | 0 |
| 32 | 10/12/2019 10:06 | 0,8 | 0 | 0,7 | 0 |
| 33 | 10/12/2019 10:07 | 0,8 | 0 | 0,7 | 0 |
| 34 | 10/12/2019 10:08 | 0,9 | 0,1 | 0,8 | 0 |
| 35 | 10/12/2019 10:09 | 1 | 0,1 | 0,8 | 0 |
| 36 | 10/12/2019 10:10 | 1,1 | 0,1 | 0,8 | 0 |

1. When there is a traffic in the cell, we should find the row numbers which refers the in & out dates
2. After finding the product in and out dates, the corresponding row numbers are entered in the formula
3. The calculated figure is entered to the related cell in the Main File

| | Date | Capacity (%) | Material (kg) | Mass (kg) | ΔAT (°C) | Product 1 (kg) | Product 2 (kg) | Total (kg) | Used capacity (kg) | Free capacity (kg) | Material in (C) |
|----|----------|--------------|---------------|-----------|----------|----------------|----------------|------------|--------------------|--------------------|-----------------|
| 7 | Aug 2018 | 100% | 18.222,00 | 0,00 | 43,00 | 131,30 | 10,90 | 70,00 | 115,00 | 75,00 | 43,00 |
| 8 | Sep 2018 | 100% | 18.222,00 | 0,00 | 43,00 | 895,70 | 257,00 | 467,00 | 115,00 | 75,00 | 43,00 |
| 9 | Oct 2018 | 100% | 18.222,00 | 0,00 | 43,00 | 1.607,60 | 352,30 | 416,00 | 115,00 | 75,00 | 43,00 |
| 10 | Nov 2018 | 100% | 9.200,00 | 0,00 | 43,00 | 931,60 | 258,20 | 235,00 | 115,00 | 75,00 | 43,00 |
| 11 | Dec 2018 | 100% | 9.200,00 | 0,00 | 43,00 | 1.670,00 | 263,00 | 172,00 | 115,00 | 75,00 | 43,00 |
| 12 | Jan 2019 | 100% | 9.200,00 | 0,00 | 43,00 | 2.350,20 | 333,70 | 234,00 | 115,00 | 75,00 | 43,00 |
| 13 | Feb 2019 | 100% | 9.200,00 | 0,00 | 43,00 | 800,30 | 63,30 | 253,20 | 115,00 | 75,00 | 43,00 |
| 14 | Mar 2019 | 100% | 9.200,00 | 0,00 | 43,00 | 0,00 | 0,00 | 0,00 | 115,00 | 75,00 | 43,00 |
| 15 | Apr 2019 | 100% | 9.200,00 | 0,00 | 43,00 | 2.072,00 | 240,10 | 36,40 | 115,00 | 75,00 | 43,00 |
| 16 | May 2019 | 0% | 0,00 | 0,00 | 0,00 | 1.933,60 | 115,10 | 305,20 | 115,00 | 75,00 | 43,00 |
| 17 | Jun 2019 | 0% | 0,00 | 0,00 | 0,00 | 118,00 | 0,00 | 0,00 | 115,00 | 75,00 | 43,00 |
| 18 | Jul 2019 | 0% | 0,00 | 0,00 | 0,00 | 118,00 | 1.554,60 | 815,60 | 1.107,50 | 115,00 | 75,00 |
| 19 | Aug 2019 | 54% | 10.000,00 | 10.000,00 | 77,50 | 961,20 | 601,20 | 493,00 | 115,00 | 75,00 | 43,00 |
| 20 | Sep 2019 | 0% | 0,00 | 0,00 | 0,00 | 118,00 | 0,00 | 0,00 | 115,00 | 75,00 | 43,00 |
| 21 | Oct 2019 | 0% | 0,00 | 0,00 | 0,00 | 118,00 | 0,00 | 0,00 | 115,00 | 75,00 | 43,00 |
| 22 | Nov 2019 | 0% | 0,00 | 0,00 | 0,00 | 47,50 | 1.022,10 | 317,40 | 343,00 | 47,50 | 24,50 |
| 23 | Dec 2019 | 0% | 0,00 | 0,00 | 0,00 | 47,50 | 509,20 | 215,00 | 264,00 | 47,50 | 24,50 |
| 24 | Jan 2020 | 0% | 0,00 | 0,00 | 0,00 | 47,50 | 233,00 | 194,40 | 99,30 | 47,50 | 24,50 |
| 25 | Feb 2020 | 0% | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 26 | Mar 2020 | 0% | 0,00 | 0,00 | 0,00 | 47,50 | 109,30 | 101,20 | 75,00 | 47,50 | 24,50 |
| 27 | Apr 2020 | 0% | 0,00 | 0,00 | 0,00 | 47,50 | 0,00 | 0,00 | 47,50 | 24,50 | 24,50 |
| 28 | May 2020 | 0% | 0,00 | 0,00 | 0,00 | 47,50 | 0,00 | 0,00 | 47,50 | 24,50 | 24,50 |
| 29 | Jun 2020 | 0% | 0,00 | 0,00 | 0,00 | 47,50 | 0,00 | 0,00 | 47,50 | 24,50 | 24,50 |
| 30 | Jul 2020 | 0% | 0,00 | 0,00 | 0,00 | 47,50 | 692,10 | 596,70 | 648,00 | 47,50 | 24,50 |
| 31 | Aug 2020 | 0% | 0,00 | 0,00 | 0,00 | 47,50 | 0,00 | 0,00 | 47,50 | 24,50 | 24,50 |
| 32 | Sep 2020 | 0% | 0,00 | 0,00 | 0,00 | 47,50 | 379,50 | 132,70 | 168,50 | 47,50 | 24,50 |
| 33 | Oct 2020 | 83% | 5.650,00 | 0,00 | 28,41 | 999,20 | 221,70 | 296,30 | 47,50 | 23,00 | 24,50 |

Product Traffic determination *(The amount of the products moving in & out to the cells with time frames)*

2. Enter the product amounts obtained from the «CoolCell Registration» file into the related cells in Main File

Amount of Product

| Cells & Time Frames | Capacity (%) | Material Mass (kg) | Material Mass change (kg) | Air Volume (m3) | Arrange Temp (0°C) | Product 1 (0°C) | Product 2 (0°C) | Total (m3) | Used capacity (m3) | Free Space (m3) | Material In (°C) |
|---------------------|--------------|--------------------|---------------------------|-----------------|--------------------|-----------------|-----------------|------------|--------------------|-----------------|------------------|
| CELL 1 28.08-31.08 | 100% | 18.222,00 | 0,00 | 43,00 | 131,30 | 10,90 | 70,80 | 118,00 | 75,00 | 43,00 | 7,00 |
| CELL 1 Aug 2018 | 100% | 18.222,00 | 0,00 | 43,00 | 131,30 | 10,90 | 70,80 | 118,00 | 75,00 | 43,00 | 7,00 |
| CELL 1 Sep 2018 | 100% | 18.222,00 | 0,00 | 43,00 | 895,71 | 257,00 | 467,00 | 118,00 | 75,00 | 43,00 | 7,00 |
| CELL 1 Oct 2018 | | | 0,00 | 118,00 | 1.007,60 | 352,30 | 410,60 | 118,00 | 75,00 | 43,00 | 7,00 |
| CELL 1 Nov 2018 | | | 0,00 | 118,00 | 931,80 | 258,20 | 235,00 | 118,00 | 75,00 | 43,00 | 7,00 |
| CELL 1 Dec 2018 | 100% | 9.200,00 | 0,00 | 43,00 | 1.670,00 | 263,80 | 172,00 | 118,00 | 75,00 | 43,00 | 0,30 |
| CELL 1 Jan 2019 | 100% | 9.200,00 | 0,00 | 43,00 | 2.350,20 | 333,70 | 274,40 | 118,00 | 75,00 | 43,00 | 0,30 |
| CELL 1 Feb 2019 | 100% | 9.200,00 | 0,00 | 43,00 | 808,30 | 62,30 | 257,30 | 118,00 | 75,00 | 43,00 | 0,30 |
| CELL 1 Mar 2019 | 100% | 9.200,00 | 0,00 | 43,00 | | | | 118,00 | 75,00 | 43,00 | |
| CELL 1 Apr 2019 | 100% | 9.200,00 | 0,00 | 43,00 | 2.072,00 | 240,10 | 362,40 | 118,00 | 75,00 | 43,00 | -0,40 |
| CELL 1 May 2019 | | | 0,00 | 118,00 | 1.931,60 | 119,10 | 389,50 | 118,00 | 75,00 | 43,00 | |
| CELL 1 Jun 2019 | 0% | 0,00 | 0,00 | 118,00 | | | | 118,00 | 75,00 | 43,00 | |
| CELL 1 Jul 2019 | | | | 118,00 | 1.554,60 | 815,60 | 1.107,50 | 118,00 | 75,00 | 43,00 | |
| CELL 1 Aug 2019 | 54% | 10.000,00 | 10.000,00 | 77,50 | 961,30 | 601,20 | 453,80 | 118,00 | 75,00 | 43,00 | 1,40 |
| CELL 1 Sep 2019 | | | 0,00 | 118,00 | 579,50 | 340,20 | 288,60 | 118,00 | 75,00 | 43,00 | |
| CELL 6 Aug 2018 | | | | 0,00 | 120,20 | 30,20 | 62,20 | | | 0,00 | |
| CELL 6 Sep 2018 | | | | 47,50 | 1.022,10 | 347,40 | 343,80 | 47,50 | 23,00 | 24,50 | |
| CELL 6 Oct 2018 | | | 0,00 | 47,50 | 509,20 | 215,00 | 264,80 | 47,50 | 23,00 | 24,50 | |
| Eksik Nov 2018 | 0% | 0,00 | 0,00 | 47,50 | 233,80 | 194,40 | 99,30 | 47,50 | 23,00 | 24,50 | 7,50 |
| CELL 6 Dec 2018 | | | | 0,00 | 0,00 | 0,00 | 0,00 | | | 0,00 | |
| CELL 6 Jan 2019 | | | 0,00 | 0,00 | 757,30 | 338,90 | 195,40 | | | 0,00 | |
| CELL 6 Feb 2019 | | | | 0,00 | 308,40 | 118,70 | 39,80 | | | 0,00 | |
| Eksik Mar 2019 | 0% | 0,00 | 0,00 | 47,50 | 108,30 | 101,20 | 75,90 | 47,50 | 23,00 | 24,50 | 9,80 |
| Eksik Apr 2019 | 0% | 0,00 | 0,00 | 47,50 | | | | 47,50 | 23,00 | 24,50 | |
| Eksik May 2019 | 0% | 0,00 | 0,00 | 47,50 | | | | 47,50 | 23,00 | 24,50 | |
| Eksik Jun 2019 | 0% | 0,00 | 0,00 | 47,50 | | | | 47,50 | 23,00 | 24,50 | |
| Eksik Jul 2019 | 0% | 0,00 | 0,00 | 47,50 | 692,10 | 596,70 | 668,80 | 47,50 | 23,00 | 24,50 | 17,00 |
| Eksik Aug 2019 | 0% | 0,00 | 0,00 | 47,50 | | | | 47,50 | 23,00 | 24,50 | |
| CELL 6 Sep 2019 | | | | 0,00 | 379,50 | 132,70 | 168,50 | | | 0,00 | |
| CELL 6 Oct 2019 | 83% | 5.650,00 | 0,00 | 28,41 | 999,20 | 221,70 | 269,30 | 47,50 | 23,00 | 24,50 | 1,40 |

Q_{Material} Calculation

$$Q_{\text{material}} = M_{\text{material}} \times C_p \times \Delta T_{\text{Product 1 \& 2}}$$

$$Q = M_{\text{material}} \times C_p \times \Delta T_{\text{Product 1 \& 2}}$$

There are two types of product: Berries and Flowers. The C_p values of these are 3,64 (kj/kg) for the berries and 1,15 (kj/kg) for the flowers.

AutoSave Off COP Calculation_Interim_Jul_Aug_v05

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Clipboard Font Alignment Number Styles

RSQ: =D291*3,64*(H291+I291)/2

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | P |
|-----|---------|---------------------|-------------------|--------------------|----------------------|-----------------|-------------------------|----------------------|----------------------|------------|--------------------|-----------------|------------------|-----------------------|-----------|
| 4 | | | weigth of flowers | 400 kg/palett | | | | | | | | | | | |
| 5 | | Cells & Time Frames | Capacity (%) | Material Mass (kg) | Material change (kg) | Air Volume (m3) | Σ ΔT Arrange Temp (0°C) | Σ ΔT Product 1 (0°C) | Σ ΔT Product 2 (0°C) | Total (m3) | Used capacity (m3) | Free Space (m3) | Material In (°C) | Qmaterial Change (KJ) | Qair (KJ) |
| 259 | CELL 10 | Jul 2019 | | | | 0,00 | 1.739,70 | 1.274,90 | 1.286,10 | | | 0,00 | | 7.096.471,20 | 47.350,94 |
| 264 | CELL 10 | Aug 2019 | | | | 0,00 | 3.012,70 | 1.501,30 | 520,30 | | | 0,00 | | 7.438.922,40 | 72.853,26 |
| 271 | CELL 10 | Sep 2019 | | | | 0,00 | 1.636,20 | 345,70 | 133,00 | | | 0,00 | | 1.405.308,45 | 36.23,58 |
| 276 | CELL 10 | Oct 2019 | | | | 0,00 | 2.080,80 | 476,10 | 192,20 | | | 0,00 | | 1.757.519,40 | 57.480,02 |
| 284 | CELL 10 | Nov 2019 | | | | 0,00 | 2.121,70 | 252,50 | 373,60 | | | 0,00 | | 2.394.681,20 | 48.881,54 |
| 287 | CELL 10 | Dec 2019 | | | | 0,00 | 2.056,10 | 560,40 | 118,70 | | | 0,00 | | 2.797.340,00 | 47.230,38 |
| 289 | CELL 11 | Aug 2018 | | | | 0,00 | 473,30 | 201,60 | 18,30 | | | 0,00 | | 0,00 | 16.523,38 |
| 290 | CELL 11 | CELL 11 01.09-13.09 | 48% | 1.668,00 | 1.668,00 | 20,52 | 1.394,20 | 260,00 | 26,00 | 27,00 | 13,50 | 13,50 | 8,60 | 870.959,94 | 36.991,42 |
| 291 | CELL 11 | CELL 11 14.09-18.09 | 100% | 3.510,00 | 1.842,00 | 13,50 | 607,30 | 58,40 | 417,30 | 27,00 | 13,50 | 13,50 | 10,30 | +1291/2 | 10.600,73 |
| 292 | CELL 11 | CELL 11 19.09-23.09 | 76% | 2.642,00 | -868,00 | 16,81 | 567,70 | 51,50 | 57,10 | 27,00 | 13,50 | 13,50 | 11,70 | 822.106,59 | 12.337,31 |
| 293 | CELL 11 | CELL 11 24.09-30.09 | 98% | 3.417,00 | 775,00 | 13,84 | 685,70 | 39,40 | 64,40 | 27,00 | 13,50 | 13,50 | 8,40 | 645.525,97 | 12.268,47 |
| 294 | CELL 11 | Sep 2018 | | | | 0,00 | 3.254,90 | 409,30 | 565,70 | | | 0,00 | | 5.077.548,84 | 72.197,92 |
| 301 | CELL 11 | Oct 2018 | | | | 0,00 | 3.123,00 | 271,20 | 63,80 | | | 0,00 | | 1.625.590,88 | 62.932,19 |
| 309 | CELL 11 | Nov 2018 | | | | 0,00 | 2.877,90 | 426,90 | 89,30 | | | 0,00 | | 2.045.221,36 | 65.287,01 |
| 315 | CELL 11 | Dec 2018 | | | | 0,00 | 2.417,60 | 561,40 | 90,40 | | | 0,00 | | 2.561.296,92 | 50.991,86 |
| 321 | CELL 11 | Jan 2019 | | | | 0,00 | 2.223,00 | 209,50 | 122,30 | | | 0,00 | | 1.104.887,42 | 47.814,18 |
| 328 | CELL 11 | Feb 2019 | | | | 0,00 | 1.115,10 | 346,60 | 247,70 | | | 0,00 | | 893.328,80 | 28.961,83 |

Q

Cp

Average of the Product Temp 1&2

Material Mass

Q_{cell} Calculation

$$Q_{\text{Cell}} = M_{\text{Air}} \times C_p \times \Delta T_{\text{Cell}}$$

The key calculation factor in this is how much of the cell capacity is used in percentage (please see next slide)

| Cells & Time Frames | Capacity (%) | Material Mass (kg) | Material Mass change (kg) | Air Volume (m ³) | Σ ΔT Arrange Temp (0°C) | Σ ΔT Product 1 (0°C) | Σ ΔT Product 2 (0°C) | Total (m ³) | Used capacity (m ³) | Free Space (m ³) | Material In (°C) | Q _{material} Change (KJ) | Q _{air} (KJ) |
|-----------------------------|--------------|--------------------|---------------------------|------------------------------|-------------------------|----------------------|----------------------|-------------------------|---------------------------------|------------------------------|------------------|-----------------------------------|-----------------------|
| CELL 10 Jul 2019 | | | | 0,00 | 1.739,70 | 1.274,90 | 1.286,10 | | | 0,00 | | 7.096.471,20 | 47.350,94 |
| CELL 10 Aug 2019 | | | | 0,00 | 3.012,70 | 1.501,30 | 520,30 | | | 0,00 | | 7.438.922,40 | 72.858,20 |
| CELL 10 Sep 2019 | | | | 0,00 | 1.636,20 | 345,70 | 133,00 | | | 0,00 | | 1.405.308,45 | 36.170,58 |
| CELL 10 Oct 2019 | | | | 0,00 | 2.080,80 | 476,10 | 192,20 | | | 0,00 | | 1.757.519,40 | 57.480,02 |
| CELL 10 Nov 2019 | | | | 0,00 | 2.121,70 | 252,50 | 373,60 | | | 0,00 | | 2.394.681,38 | 48.881,54 |
| CELL 10 Dec 2019 | | | | 0,00 | 2.056,10 | 560,40 | 118,70 | | | 0,00 | | 2.797.340,00 | 47.230,38 |
| CELL 11 Aug 2018 | | | | 0,00 | 473,30 | 201,60 | 18,30 | | | 0,00 | | 0,00 | 16.523,38 |
| CELL 11 CELL 11 01.09-13.09 | 48% | 1.668,00 | 1.668,00 | 20,52 | 1.394,20 | 260,00 | 26,90 | 27,00 | 13,50 | 13,50 | 8,60 | 870.809,54 | 36.881,42 |
| CELL 11 CELL 11 14.09-18.09 | 100% | 3.510,00 | 1.842,00 | 13,50 | 607,30 | 58,40 | 417,30 | 27,00 | 13,50 | 13,50 | 10,30 | 3.038.866,74 | *G291 |
| CELL 11 CELL 11 19.09-23.09 | 76% | 2.642,00 | -868,00 | 16,81 | 567,70 | 32,50 | 57,10 | 27,00 | 13,50 | 13,50 | 11,70 | 522.196,58 | 12.337,31 |
| CELL 11 CELL 11 24.09-30.09 | 98% | 3.417,00 | 775,00 | 13,84 | 685,70 | 39,40 | 64,40 | 27,00 | 13,50 | 13,50 | 8,40 | 645.525,97 | 12.268,47 |
| CELL 11 Sep 2018 | | | | 0,00 | 3.254,90 | 409,30 | 565,70 | | | 0,00 | | 5.077.548,84 | 72.197,92 |
| CELL 11 Oct 2018 | | | | 0,00 | 3.123,00 | 271,20 | 63,80 | | | 0,00 | | 1.025.500,88 | 62.932,19 |
| CELL 11 Nov 2018 | | | | 0,00 | 2.877,90 | 426,90 | 89,30 | | | 0,00 | | 2.045.221,36 | 65.287,01 |
| CELL 11 Dec 2018 | | | | 0,00 | 2.417,60 | 561,40 | 90,40 | | | 0,00 | | 2.561.296,92 | 50.991,86 |
| CELL 11 Jan 2019 | | | | 0,00 | 2.223,00 | 209,50 | 122,30 | | | 0,00 | | 1.104.887,42 | 47.814,18 |
| CELL 11 Feb 2019 | | | | 0,00 | 1.115,10 | 346,60 | 247,70 | | | 0,00 | | 893.328,80 | 28.961,83 |
| CELL 11 Mar 2019 | 0% | 0,00 | 0,00 | 27,00 | 606,60 | 302,50 | 86,60 | 27,00 | 13,50 | 13,50 | 13,40 | 0,00 | 21.177,01 |
| CELL 11 Apr 2019 | 0% | 0,00 | 0,00 | 27,00 | 78,40 | 85,60 | 63,10 | 27,00 | 13,50 | 13,50 | 15,30 | 0,00 | 2.737,02 |
| CELL 11 May 2019 | 0% | 0,00 | 0,00 | 27,00 | 96,20 | 122,70 | 68,90 | 27,00 | 13,50 | 13,50 | 18,90 | 0,00 | 3.358,44 |
| CELL 11 Jun 2019 | 0% | 0,00 | 0,00 | 27,00 | 180,20 | 145,40 | 120,90 | 27,00 | 13,50 | 13,50 | 23,50 | 0,00 | 6.290,96 |
| CELL 11 Jul 2019 | | | | 0,00 | 255,50 | 211,80 | 107,70 | | | 0,00 | | 383.883,50 | 7.551,27 |
| CELL 11 Aug 2019 | | | | 0,00 | 2.693,60 | 1.655,50 | 62,70 | | | 0,00 | | 7.127.365,70 | 63.757,65 |

Q

C_p

The air volume left in the cell

Cell Temp

Q_{cell} Calculation

$$Q_{\text{Cell}} = M_{\text{Air}} \times C_p \times \Delta T_{\text{Cell}}$$

The Volumetric calibration of the Cells are provided by Simon Beheer for the capacity occupied and remaining volume ie, if the berries are fully occupying the cell 11, it takes 13,5 m3 of the total of 27m3. 13,5 m3 is remaining with air.

COP Calculation_Interim_Jul_Aug_v05

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Clipboard Font Alignment Number Styles

Formula Bar: =L291+(1-C291)*K291

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | P |
|-----|---------|---------------------|-------------------|--------------------|---------------------------|-----------------|-------------------------|-----------------|-----------------|------------|--------------------|-----------------|------------------|-----------------------|-----------|
| 4 | | | weigth of flowers | | 400 kg/palett | | | | | | | | | | |
| 5 | | Cells & Time Frames | Capacity (%) | Material Mass (kg) | Material Mass change (kg) | Air Volume (m3) | Σ ΔT Arrange Temp (0°C) | Product 1 (0°C) | Product 2 (0°C) | Total (m3) | Used capacity (m3) | Free Space (m3) | Material In (°C) | Qmaterial Change (kJ) | Qair (kJ) |
| 259 | CELL 10 | Jul 2019 | | | | 0,00 | 1.739,70 | 1.274,90 | 1.286,10 | | | 0,00 | | 7.096.471,20 | 47.350,94 |
| 264 | CELL 10 | Aug 2019 | | | | 0,00 | 3.012,70 | 1.501,30 | 520,30 | | | 0,00 | | 7.438.922,40 | 72.858,26 |
| 271 | CELL 10 | Sep 2019 | | | | 0,00 | 1.636,20 | 345,70 | 133,00 | | | 0,00 | | 1.405.308,45 | 36.123,58 |
| 276 | CELL 10 | Oct 2019 | | | | 0,00 | 2.080,80 | 476,10 | 192,20 | | | 0,00 | | 1.757.519,40 | 57.480,02 |
| 284 | CELL 10 | Nov 2019 | | | | 0,00 | 2.121,70 | 252,50 | 373,60 | | | 0,00 | | 2.394.681,38 | 48.881,54 |
| 287 | CELL 10 | Dec 2019 | | | | 0,00 | 2.056,10 | 560,40 | 118,70 | | | 0,00 | | 2.797.340,00 | 47.230,30 |
| 289 | CELL 11 | Aug 2018 | | | | 0,00 | 473,30 | 201,60 | 18,30 | | | 0,00 | | 0,00 | 10.323,50 |
| 290 | CELL 11 | CELL 11 01.09-13.09 | 48% | 1.668,00 | 1.668,00 | 00,00 | 1.334,20 | 260,00 | 26,90 | 27,00 | 13,50 | 13,50 | 8,60 | 870.959,54 | 36.917,42 |
| 291 | CELL 11 | CELL 11 14.09-18.09 | 100% | 3.510,00 | 1.842,00 | K291 | 607,30 | 58,40 | 417,30 | 27,00 | 13,50 | 13,50 | 10,30 | 3.038.866,74 | 10.600,73 |
| 292 | CELL 11 | CELL 11 19.09-23.09 | 76% | 2.642,00 | -868,00 | 16,81 | 567,70 | 51,50 | 57,10 | 27,00 | 13,50 | 13,50 | 11,70 | 522.196,58 | 12.337,31 |
| 293 | CELL 11 | CELL 11 24.09-30.09 | 98% | 3.417,00 | 775,00 | 13,84 | 685,70 | 39,40 | 64,40 | 27,00 | 13,50 | 13,50 | 8,40 | 645.523,37 | 12.268,47 |
| 294 | CELL 11 | Sep 2018 | | | | 0,00 | 3.254,90 | 409,30 | 565,70 | | | 0,00 | | 5.077.548,84 | 72.197,92 |
| 301 | CELL 11 | Oct 2018 | | | | 0,00 | 3.123,00 | 271,20 | 63,80 | | | 0,00 | | 1.625.590,88 | 62.932,19 |
| 309 | CELL 11 | Nov 2018 | | | | 0,00 | 2.877,90 | 426,90 | 89,30 | | | 0,00 | | 2.045.221,36 | 65.287,01 |
| 315 | CELL 11 | Dec 2018 | | | | 0,00 | 2.417,60 | 561,40 | 90,40 | | | 0,00 | | 2.561.296,92 | 50.991,86 |
| 321 | CELL 11 | Jan 2019 | | | | 0,00 | 2.223,00 | 209,50 | 122,30 | | | 0,00 | | 1.104.887,42 | 47.814,18 |
| 328 | CELL 11 | Feb 2019 | | | | 0,00 | 1.115,10 | 346,60 | 247,70 | | | 0,00 | | 893.328,80 | 28.961,83 |
| 329 | CELL 11 | Mar 2019 | 0% | 0,00 | 0,00 | 27,00 | 606,60 | 302,50 | 86,60 | 27,00 | 13,50 | 13,50 | 13,40 | 0,00 | 21.177,01 |
| 330 | CELL 11 | Apr 2019 | 0% | 0,00 | 0,00 | 27,00 | 78,40 | 85,60 | 63,10 | 27,00 | 13,50 | 13,50 | 15,30 | 0,00 | 2.737,02 |
| 331 | CELL 11 | May 2019 | 0% | 0,00 | 0,00 | 27,00 | 96,20 | 122,70 | 68,90 | 27,00 | 13,50 | 13,50 | 18,90 | 0,00 | 3.358,44 |
| 332 | CELL 11 | Jun 2019 | 0% | 0,00 | 0,00 | 27,00 | 180,20 | 145,40 | 120,90 | 27,00 | 13,50 | 13,50 | 23,50 | 0,00 | 6.290,96 |
| 335 | CELL 11 | Jul 2019 | | | | 0,00 | 255,50 | 211,80 | 107,70 | | | 0,00 | | 383.883,50 | 7.551,27 |

Q_{cell}

Product amount as % in the cell

Air Volume left in the cell

Total Heat Load Calculation File

The main file which the cumulated numbers, highest product temp, amount of product is entered in is used for calculating the Q load. Along with the manual entries as explained above, this file also have given and calculated values

| Cells & Time Frames | Capacity (%) | Material Mass (kg) | Material Mass change (kg) | Air Volume (m ³) | Σ ΔT Arrange Temp (0°C) | Σ ΔT Product 1 (0°C) | Σ ΔT Product 2 (0°C) | Total (m ³) | Used capacity (m ³) | Free Space (m ³) | Material In (°C) | Qmaterial Change (KJ) | Qair (KJ) |
|---------------------|--------------|--------------------|---------------------------|------------------------------|-------------------------|----------------------|----------------------|-------------------------|---------------------------------|------------------------------|------------------|-----------------------|------------|
| CELL 1 28.08-31.08 | 100% | 18.222,00 | | 43,00 | 131,30 | 10,90 | 70,80 | 118,00 | 75,00 | 43,00 | 7,00 | 2.709.502,07 | 7.300,15 |
| Aug 2018 | 100% | 18.222,00 | 0,00 | 43,00 | 131,30 | 10,90 | 70,80 | 118,00 | 75,00 | 43,00 | 7,00 | 2.709.502,07 | 7.300,15 |
| Sep 2018 | 100% | 18.222,00 | 0,00 | 43,00 | 895,70 | 257,00 | 467,00 | 118,00 | 75,00 | 43,00 | 7,00 | 24.010.764,96 | 19.800,02 |
| Oct 2018 | | | 0,00 | 118,00 | 1.007,60 | 352,30 | 410,60 | 118,00 | 75,00 | 43,00 | 7,00 | 19.257.135,22 | 80.643,02 |
| Nov 2018 | | | 0,00 | 118,00 | 931,80 | 258,20 | 235,00 | 118,00 | 75,00 | 43,00 | 7,00 | 8.178.293,92 | 73.201,48 |
| Dec 2018 | 100% | 9.200,00 | 0,00 | 43,00 | 1.670,00 | 263,80 | 172,00 | 118,00 | 75,00 | 43,00 | 0,30 | 2.305.382,00 | 92.850,33 |
| Jan 2019 | 100% | 9.200,00 | 0,00 | 43,00 | 2.350,20 | 333,70 | 274,40 | 118,00 | 75,00 | 43,00 | 0,30 | 3.216.849,00 | 130.668,77 |
| Feb 2019 | 100% | 9.200,00 | 0,00 | 43,00 | 808,30 | 62,30 | 257,30 | 118,00 | 75,00 | 43,00 | 0,30 | 1.690.684,00 | 44.940,67 |
| Mar 2019 | 100% | 9.200,00 | 0,00 | 43,00 | | | | 118,00 | 75,00 | 43,00 | | 0,00 | 0,00 |
| Apr 2019 | 100% | 9.200,00 | 0,00 | 43,00 | 2.072,00 | 240,10 | 362,40 | 118,00 | 75,00 | 43,00 | -0,40 | 3.187.225,00 | 115.201,13 |
| May 2019 | | | 0,00 | 118,00 | 1.931,60 | 119,10 | 389,50 | 118,00 | 75,00 | 43,00 | | 2.690.494,00 | 107.395,03 |
| Jun 2019 | 0% | 0,00 | 0,00 | 118,00 | | | | 118,00 | 75,00 | 43,00 | | 0,00 | 0,00 |
| Jul 2019 | | | | 118,00 | 1.554,60 | 815,60 | 1.107,50 | 118,00 | 75,00 | 43,00 | | 3.510.780,00 | 224.602,63 |
| Aug 2019 | 54% | 10.000,00 | 10.000,00 | 77,50 | 501,50 | 601,20 | 455,60 | 118,00 | 75,00 | 43,00 | 1,40 | 19.201.000,00 | 96.329,47 |
| Sep 2019 | | | 0,00 | 118,00 | 579,50 | 340,20 | 288,60 | 118,00 | 75,00 | 43,00 | | 11.444.160,00 | 58.070,25 |
| CELL 6 Aug 2018 | | | 0,00 | 0,00 | 120,20 | 30,20 | 62,20 | | | 0,00 | | 1.121.680,56 | 3.807,76 |
| CELL 6 Sep 2018 | | | | 47,50 | 1.022,10 | 347,40 | 343,80 | 47,50 | 23,00 | 24,50 | | 7.131.273,79 | 38.338,91 |
| CELL 6 Oct 2018 | | | 0,00 | 47,50 | 509,20 | 215,00 | 264,80 | 47,50 | 23,00 | 24,50 | | 5.261.246,90 | 17.645,00 |
| Eksik Nov 2018 | 0% | 0,00 | 0,00 | 47,50 | 233,80 | 194,40 | 99,30 | 47,50 | 23,00 | 24,50 | 7,50 | 0,00 | 14.359,41 |
| CELL 6 Dec 2018 | | | | 0,00 | 0,00 | 0,00 | 0,00 | | | 0,00 | | 0,00 | 0,00 |
| CELL 6 Jan 2019 | | | 0,00 | 0,00 | 757,30 | 338,90 | 195,40 | | | 0,00 | | 5.753.267,52 | 26.634,22 |
| CELL 6 Feb 2019 | | | | 0,00 | 308,40 | 118,70 | 39,80 | | | 0,00 | | 1.592.354,40 | 11.328,81 |
| Eksik Mar 2019 | 0% | 0,00 | 0,00 | 47,50 | 108,30 | 101,20 | 75,90 | 47,50 | 23,00 | 24,50 | 9,80 | 0,00 | 6.651,52 |
| Eksik Apr 2019 | 0% | 0,00 | 0,00 | 47,50 | | | | 47,50 | 23,00 | 24,50 | | 0,00 | 0,00 |
| Eksik May 2019 | 0% | 0,00 | 0,00 | 47,50 | | | | 47,50 | 23,00 | 24,50 | | 0,00 | 0,00 |
| Eksik Jun 2019 | 0% | 0,00 | 0,00 | 47,50 | | | | 47,50 | 23,00 | 24,50 | | 0,00 | 0,00 |
| Eksik Jul 2019 | 0% | 0,00 | 0,00 | 47,50 | 692,10 | 596,70 | 668,80 | 47,50 | 23,00 | 24,50 | 17,00 | 0,00 | 42.507,05 |
| Eksik Aug 2019 | 0% | 0,00 | 0,00 | 47,50 | | | | 47,50 | 23,00 | 24,50 | | 0,00 | 0,00 |
| CELL 6 Sep 2019 | | | | 0,00 | 379,50 | 132,70 | 168,50 | | | 0,00 | | 3.050.966,10 | 14.577,43 |
| CELL 6 Oct 2019 | 83% | 5.650,00 | 0,00 | 28,41 | 999,20 | 221,70 | 269,30 | 47,50 | 23,00 | 24,50 | 1,40 | 5.048.953,00 | 36.704,74 |

Amount of Product

Cummulated values of the Product Temp1 & 2

Total Q_{cell}

Air volume of the cells

Preparing the Heat Load summary file

All of the steps explained in previous slides are applied for each Cell for each month.
 Once the Q_{Material} and Q_{Cell} figures are calculated, these figures are used to prepare a summary, «Heat Load» file.
 Heat Load file is used to create a pivot table for comparisons.

| CELL NUMBER | Cells & Time Frames | Qmaterial Change (Kj) | Qair (Kj) | TOTAL (Kj) |
|-------------|---------------------|-----------------------|-----------|--------------|
| CELL 1 | Aug-18 | 2.709.502,07 | 7.300,15 | 2.716.802,22 |
| CELL 10 | Jul-19 | 7.096.471,20 | 47.350,94 | 7.143.822,14 |
| CELL 10 | Aug-19 | 7.438.922,40 | 72.858,26 | 7.511.780,66 |
| CELL 10 | Sep-19 | 1.405.308,45 | 36.123,58 | 1.441.432,03 |
| CELL 10 | Oct-19 | 1.757.519,40 | 57.480,02 | 1.814.999,42 |
| CELL 10 | Nov-19 | 2.394.681,38 | 48.881,54 | 2.443.562,92 |
| CELL 10 | Dec-19 | 2.797.340,00 | 47.230,38 | 2.844.570,38 |
| CELL 11 | Aug-18 | 0,00 | 16.523,38 | 16.523,38 |
| CELL 11 | Sep-18 | 5.077.548,84 | 72.197,92 | 5.149.746,76 |
| CELL 11 | Oct-18 | 1.625.590,88 | 62.992,19 | 1.688.583,07 |
| CELL 11 | Nov-18 | 2.045.221,36 | 65.287,01 | 2.110.508,37 |
| CELL 11 | Dec-18 | 2.561.296,92 | 50.991,86 | 2.612.288,78 |
| CELL 11 | Jan-19 | 1.104.887,42 | 47.814,18 | 1.152.701,60 |
| CELL 11 | Feb-19 | 893.328,80 | 28.961,83 | 922.290,63 |
| CELL 11 | Mar-19 | 0,00 | 21.177,01 | 21.177,01 |
| CELL 11 | Apr-19 | 0,00 | 2.737,02 | 2.737,02 |
| CELL 11 | May-19 | 0,00 | 3.358,44 | 3.358,44 |
| CELL 11 | Jun-19 | 0,00 | 6.291,96 | 6.291,96 |
| CELL 11 | Jul-19 | 383.889,50 | 7.551,27 | 391.440,77 |
| CELL 11 | Aug-19 | 7.127.365,70 | 63.757,65 | 7.191.123,35 |
| CELL 11 | Sep-19 | 3.477.947,20 | 65.755,64 | 3.543.702,84 |
| CELL 11 | Oct-19 | 1.645.394,60 | 50.107,18 | 1.695.501,78 |
| CELL 11 | Nov-19 | 1.109.617,60 | 37.496,09 | 1.147.113,69 |
| CELL 11 | Dec-19 | 158.394,60 | 16.342,08 | 174.736,68 |
| CELL 12 | Aug-18 | 0,00 | 404,97 | 405,00 |
| CELL 12 | Sep-18 | 2.513.498,81 | 52.447,32 | 2.565.946,13 |
| CELL 12 | Oct-18 | 2.631.521,07 | 38.747,88 | 2.670.268,95 |
| CELL 12 | Nov-18 | 1.175.313,23 | 38.813,42 | 1.214.126,65 |
| CELL 12 | Dec-18 | 5.214.113,45 | 38.517,57 | 5.252.631,02 |
| CELL 12 | Jan-19 | 1.152.615,10 | 54.210,88 | 1.206.825,98 |
| CELL 12 | Feb-19 | 2.416.614,20 | 69.736,56 | 2.486.350,76 |

Total Q Load of each cell/month

Pivot Table

| Row Labels | Sum of Qmaterial Change (Kj) | Sum of Qair (Kj) | Sum of TOTAL (Kj) |
|-------------|------------------------------|------------------|-------------------|
| CELL 10 | 31.124.745 | 704.830 | 31.829.575 |
| CELL 11 | 27.210.417 | 619.282 | 27.829.699 |
| 2018 | 11.909.698 | 267.932 | 11.577.590 |
| 2019 | 15.900.759 | 951.349 | 16.252.109 |
| Jan | 1.104.887 | 47.814 | 1.152.702 |
| Feb | 893.329 | 28.962 | 922.291 |
| Mar | 0 | 21.177 | 21.177 |
| Apr | 0 | 2.737 | 2.737 |
| May | 0 | 3.358 | 3.358 |
| Jun | 0 | 6.291 | 6.291 |
| Jul | 383.884 | 7.551 | 391.435 |
| Aug | 7.127.366 | 63.758 | 7.191.123 |
| Sep | 3.477.947 | 65.756 | 3.543.703 |
| Oct | 1.645.335 | 50.107 | 1.695.442 |
| Nov | 1.109.618 | 37.496 | 1.147.114 |
| Dec | 158.395 | 16.342 | 174.737 |
| CELL 12 | 24.042.128 | 748.918 | 24.791.046 |
| CELL 2 | 98.415.353 | 1.117.207 | 99.532.560 |
| CELL 4 | 139.024.069 | 476.687 | 139.500.756 |
| CELL 5 | 4.995.587 | 741.905 | 5.737.492 |
| CELL 6 | 34.182.933 | 249.429 | 34.432.362 |
| CELL 7 | 29.645.505 | 2.171.692 | 31.817.197 |
| CELL 8 | 36.448.779 | 2.374.217 | 38.822.996 |
| CELL 9 | 32.037.819 | 2.436.478 | 34.474.298 |
| CELL1 | 101.402.271 | 1.081.003 | 102.483.274 |
| CELL3 | 31.755.047 | 123.597 | 31.878.643 |
| Grand Total | 590.284.654 | 12.845.246 | 603.129.900 |

CoP Calculation

$$\text{CoP} = (\text{Heat Load} / \text{Total Energy Consumed})_{\text{July, August, September}}$$

| Date | Heat Load (Kj) | Power (kW) | CoP _{Hydromx} | COP Change |
|---------|----------------|------------|-----------------------------|---------------|
| 09.2020 | 95.619.230 | 21.919 | 4.362 | 65,3% |
| 08.2020 | 118.941.397 | 24.077 | 4.940 | 65,3% |
| 07.2020 | 62.993.854 | 17.135 | 3.676 | 64,2% |
| Date | Heat Load (Kj) | Power (kW) | COP _{water/glycol} | Amb Temp Δ °C |
| 09.2019 | 50.377.251 | 19.092 | 2.639 | 0,83 |
| 08.2019 | 85.549.861 | 28.626 | 2.989 | 1,60 |
| 07.2019 | 44.352.635 | 19.812 | 2.239 | -1,80 |

| | Raw Saving | Q Load | Amb Temp Δ |
|------|------------|--------|------------|
| Sept | -15% | 89,8% | 0,83 |
| Aug | 16% | 39,0% | 1,60 |
| Jul | 14% | 42,0% | -1,80 |