User manual
Henco **Ecoline calculation tool**

HENCO **Ecoline** is an energy saving solution for recirculation loops and limits heat loss between supply and return pipe. HENCO **Ecoline** allows to mount the return line in the supply line and offers several advantages:

ONLY HALF OF THE MATERIAL QUANTITIES NEEDED

- Fittings
- Brackets
- Fire stop barriers
- Insulation
- Core drill holes
- Assembly

ENERGY SAVING

- Limited heat loss
- Always the required temperature at the draw-off point
- Legionella contamination can be prevented with temperature control

LESS SPACE CONSUMPTION

- A separate pipe for the circulation water is no longer required.

HENCO **Ecoline** is designed on the Henco Super Size concept, a concept for all dimensions from 32 up to 75 mm! All assembly instructions for processing products of Henco are applicable.

Underlying tool is intended to calculate all relevant parameters in 1 riser when the installation of the HENCO **Ecoline** solution is foreseen. Note: The influence of a horizontal collector between different vertical riser is not included in this tool.

This tool will give you the following information based on the supplied input:

- Pressure losses of the risers
- Pressure losses of the branches
- The recirculation flow (l/s) that is needed to compensate for the heat losses of the riser piping
- The power of the required circulation pump
- The tap water temperature at each floor
- The return water temperature inside the inner pipe at each level

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GENERAL INSTRUCTIONS:

On the opening page all the parameters which are used as input for the calculations are depicted in red, or with a red border.
As long as the "CALCULATE" button on the upper left is not clicked, no results appear. Whenever a parameter is altered, the results disappear, this is to prevent the results not matching the parameters. Only after clicking on "CALCULATE", do the correct results appear.

STEP 1:

CALCULATE	Floor height (m)	Ecoline diameter (mm)	Insulation (W/m.K) /thickness (mm)	T in outer pipe (°C)	T in inner pipe (°C)	Recirculation pressure loss (Pa) outer pipe	Recirculation pressure loss (Pa) inner pipe	Tap water flow (l/min)	Tap water pipe diameter (mm)	Tap riser friction pressure loss (kPa)	Tap branch friction pressure loss (kPa)
Number of floors	4		0.03								
Target temp (°C)	55										
Ambient temp (°C)	25										
Floor 4	3.5	40	20					10	16		
Floor 3	3.5	40	20					10	16		
Floor 2	3.5	40	20					10	16		
Floor 1	3.5	40	20					10	16		
Temp in/out (°C)				75							
Recirculation flow (l/s)											

Choose number of floors, if different from the default value (3 floors). The table will automatically update when the number of floors is adapted.

STEP 2:

CALCULATE	Floor height (m)	Ecoline diameter (mm)	Insulation (W/m.K) /thickness (mm)	T in outer pipe (°C)	T in inner pipe (°C)	Recirculation pressure loss (Pa) outer pipe	Recirculation pressure loss (Pa) inner pipe	Tap water flow (l/min)	Tap water pipe diameter (mm)	Tap riser friction pressure loss (kPa)	Tap branch friction pressure loss (kPa)
Number of floors	4		0.03								
Target temp (°C)	60										
Ambient temp (°C)	25										
Floor 4	3.5	40	20					10	16		
Floor 3	3.5	40	20					10	16		
Floor 2	3.5	40	20					10	16		
Floor 1	3.5	40	20					10	16		
Temp in/out (°C)				75							
Recirculation flow (l/s)											

Choose "Target temperature". This is the temperature that is required at the end (top) of the riser.
This is the lowest temperature in the riser.

STEP 3:

CALCULATE	Floor height (m)	Ecoline diameter (mm)	Insulation (W/m.K) /thickness (mm)	T in outer pipe (°C)	T in inner pipe (°C)	Recirculation pressure loss (Pa) outer pipe	Recirculation pressure loss (Pa) inner pipe	Tap water flow (l/min)	Tap water pipe diameter (mm)	Tap riser friction pressure loss (kPa)	Tap branch friction pressure loss (kPa)
Number of floors	4		0.03								
Target temp (°C)	60										
Ambient temp (°C)	20										
Floor 4	3.5	40	20					10	16		
Floor 3	3.5	40	20					10	16		
Floor 2	3.5	40	20					10	16		
Floor 1	3.5	40	20					10	16		
Temp in/out (°C)				75							
Recirculation flow (l/s)											

Adjust the ambient temperature as needed. This is the temperature around the pipes in the riser. Choose the lowest temperature that can occur during the year.

STEP 4:

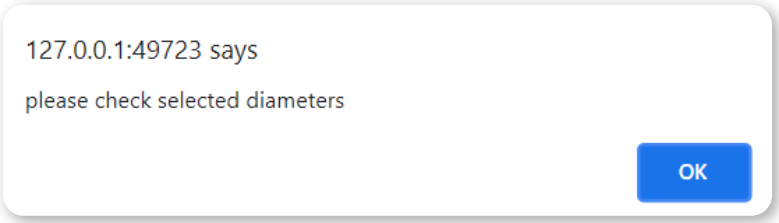
CALCULATE	Floor height (m)	Ecoline diameter (mm)	Insulation (W/m.K) /thickness (mm)	T in outer pipe (°C)	T in inner pipe (°C)	Recirculation pressure loss (Pa) outer pipe	Recirculation pressure loss (Pa) inner pipe	Tap water flow (l/min)	Tap water pipe diameter (mm)	Tap riser friction pressure loss (kPa)	Tap branch friction pressure loss (kPa)
Number of floors	4		0.03								
Target temp (°C)	60										
Ambient temp (°C)	20										
Floor 4	4	40	20					10	16		
Floor 3	4	40	20					10	16		
Floor 2	4	40	20					10	16		
Floor 1	3.5	40	20					10	16		
Temp in/out (°C)				75							
Recirculation flow (l/s)											

Choose the floor heights if different from the default value.

STEP 5:

CALCULATE	Floor height (m)	Ecoline diameter (mm)	Insulation (W/m.K) /thickness (mm)	T in outer pipe (°C)	T in inner pipe (°C)	Recirculation pressure loss (Pa) outer pipe	Recirculation pressure loss (Pa) inner pipe	Tap water flow (l/min)	Tap water pipe diameter (mm)	Tap riser friction pressure loss (kPa)	Tap branch friction pressure loss (kPa)
Number of floors	4		0.03								
Target temp (°C)	60										
Ambient temp (°C)	20										
Floor 4	4	40	20					10	16		
Floor 3	4	40	20					10	16		
Floor 2	4	63	20					10	16		
Floor 1	3.5	75	20					10	16		
Temp in/out (°C)				75							
Recirculation flow (l/s)											

Choose Ecoline diameter from the drop-down boxes. A floor should always have an equal or bigger diameter than the floor above. If not, an error message will appear during calculation.



Guideline for choosing the diameter for the Ecoline solution: always one diameter bigger than what you would use in an installation with a standard external return line. So if you would choose diameter 50 for a standard circulation system, choose diameter 63 if you want to install the Ecoline solution.

STEP 6:

CALCULATE	Floor height (m)	Ecoline diameter (mm)	Insulation (W/m.K) /thickness (mm)	T in outer pipe (°C)	T in inner pipe (°C)	Recirculation pressure loss (Pa) outer pipe	Recirculation pressure loss (Pa) inner pipe	Tap water flow (l/min)	Tap water pipe diameter (mm)	Tap riser friction pressure loss (kPa)	Tap branch friction pressure loss (kPa)
Number of floors	4		0.035								
Target temp (°C)	60										
Ambient temp (°C)	20										
Floor 4	4	40	20					10	16		
Floor 3	4	40	20					10	16		
Floor 2	4	63	20					10	16		
Floor 1	3.5	75	20					10	16		
Temp in/out (°C)				75							
Recirculation flow (l/s)											

Choose the heat conduction coefficient of the used pipe insulation. The heat conduction coefficient can be consulted in Henco's technical manual.

STEP 7:

CALCULATE	Floor height (m)	Ecoline diameter (mm)	Insulation (W/m.K) /thickness (mm)	T in outer pipe (°C)	T in inner pipe (°C)	Recirculation pressure loss (Pa) outer pipe	Recirculation pressure loss (Pa) inner pipe	Tap water flow (l/min)	Tap water pipe diameter (mm)	Tap riser friction pressure loss (kPa)	Tap branch friction pressure loss (kPa)
Number of floors	4		0.035								
Target temp (°C)	60										
Ambient temp (°C)	20										
Floor 4	4	40	20					10	16		
Floor 3	4	40	20					10	16		
Floor 2	4	63	25					10	16		
Floor 1	3.5	75	25					10	16		
Temp in/out (°C)				75							
Recirculation flow (l/s)											

Choose insulation thickness for each floor.

STEP 8:

CALCULATE	Floor height (m)	Ecoline diameter (mm)	Insulation (W/m.K) /thickness (mm)	T in outer pipe (°C)	T in inner pipe (°C)	Recirculation pressure loss (Pa) outer pipe	Recirculation pressure loss (Pa) inner pipe	Tap water flow (l/min)	Tap water pipe diameter (mm)	Tap riser friction pressure loss (kPa)	Tap branch friction pressure loss (kPa)
Number of floors	4		0.035								
Target temp (°C)	60										
Ambient temp (°C)	20										
Floor 4	4	40	20					10	16		
Floor 3	4	40	20					10	16		
Floor 2	4	63	25					10	16		
Floor 1	3.5	75	25					10	16		
Temp in/out (°C)				65							
Recirculation flow (l/s)											

Choose the water temperature entering the riser. This value can be different from the boiler setpoint due to heat losses in the distribution piping (collector).

STEP 9:

CALCULATE	Floor height (m)	Ecoline diameter (mm)	Insulation (W/m.K) /thickness (mm)	T in outer pipe (°C)	T in inner pipe (°C)	Recirculation pressure loss (Pa) outer pipe	Recirculation pressure loss (Pa) inner pipe	Tap water flow (l/min)	Tap water pipe diameter (mm)	Tap riser friction pressure loss (kPa)	Tap branch friction pressure loss (kPa)
Number of floors	4		0.035								
Target temp (°C)	60										
Ambient temp (°C)	20										
Floor 4	4	40	20					8	16		
Floor 3	4	40	20					10	16		
Floor 2	4	63	25					15	16		
Floor 1	3.5	75	25					12	16		
Temp in/out (°C)				65							
Recirculation flow (l/s)											

Enter the tap water flows at each floor. The user needs to take into account a diversity factor for water usage on each floor and between floors. The program itself does not use a diversity factor on the tap water flows.

STEP 10:

CALCULATE	Floor height (m)	Ecoline diameter (mm)	Insulation (W/m.K) /thickness (mm)	T in outer pipe (°C)	T in inner pipe (°C)	Recirculation pressure loss (Pa) outer pipe	Recirculation pressure loss (Pa) inner pipe	Tap water flow (l/min)	Tap water pipe diameter (mm)	Tap riser friction pressure loss (kPa)	Tap branch friction pressure loss (kPa)
Number of floors	4		0.035								
Target temp (°C)	60										
Ambient temp (°C)	20										
Floor 4	4	40	20					8	16		
Floor 3	4	40	20					10	16		
Floor 2	4	63	25					15	26		
Floor 1	3.5	75	25					12	20		
Temp in/out (°C)				65							
Recirculation flow (l/s)											

From the drop-down lists, the appropriate tap water (branch) diameter can be chosen.

STEP 11:

CALCULATE	Floor height (m)	Ecoline diameter (mm)	Insulation (W/m.K) /thickness (mm)	T in outer pipe (°C)	T in inner pipe (°C)	Recirculation pressure loss (Pa) outer pipe	Recirculation pressure loss (Pa) inner pipe	Tap water flow (l/min)	Tap water pipe diameter (mm)	Tap riser friction pressure loss (kPa)	Tap branch friction pressure loss (kPa)
Number of floors	4		0.035								
Target temp (°C)	60										
Ambient temp (°C)	20										
Floor 4	4	40	20	60.10	60.10	7.38	164.93	8	16	1.56	310.91
Floor 3	4	40	20	60.93	60.12	7.32	165.06	10	16	34.56	485.80
Floor 2	4	63	25	62.07	60.43	4.07	166.60	15	26	16.32	20.25
Floor 1	3.5	75	25	63.48	60.84	0.24	147.60	12	20	11.43	1.42
Temp in/out (°C)				65	61.32						
Recirculation flow (l/s)	0.0143					19.00	644.18			63.87	

When all parameters (inputs) are set correctly, click on the "CALCULATE" button. The results will appear. If results are not satisfactory, adapt parameters and recalculate.

STEP 12:

CALCULATE	Floor height (m)	Ecoline diameter (mm)	Insulation (W/m.K) /thickness (mm)	T in outer pipe (°C)	T in inner pipe (°C)	Recirculation pressure loss (Pa) outer pipe	Recirculation pressure loss (Pa) inner pipe	Tap water flow (l/min)	Tap water pipe diameter (mm)	Tap riser friction pressure loss (kPa)	Tap branch friction pressure loss (kPa)
Number of floors	4		0.035								
Target temp (°C)	60										
Ambient temp (°C)	20										
Floor 4	4	40	20	60.10	60.10	7.69	183.79	8	20	1.56	71.55
Floor 3	4	50	20	60.91	60.12	3.97	183.93	10	26	7.25	0.93
Floor 2	4	63	25	62.12	60.39	0.78	185.43	15	32	11.44	4.72
Floor 1	3.5	75	25	63.52	60.80	0.25	164.31	12	26	11.43	0.70
Temp in/out (°C)				65	61.28						
Recirculation flow (l/s)	0.0147					12.69	717.46			31.68	

In the above screenshot is shown that the diameters of main pipe and branches are changed to lower the pressure drops related to tap water use (last 2 columns).

STEP 13:

CALCULATE	Floor height (m)	Ecoline diameter (mm)	Insulation (W/m.K) /thickness (mm)	T in outer pipe (°C)	T in inner pipe (°C)	Recirculation pressure loss (Pa) outer pipe	Recirculation pressure loss (Pa) inner pipe	Tap water flow (l/min)	Tap water pipe diameter (mm)	Tap riser friction pressure loss (kPa)	Tap branch friction pressure loss (kPa)
Number of floors	4		0.035								
Target temp (°C)	60										
Ambient temp (°C)	20										
Floor 4	4	40	20	60.10	60.10	7.69	183.79	8	20	1.56	71.55
Floor 3	4	50	20	60.91	60.12	3.97	183.93	10	26	7.25	0.93
Floor 2	4	63	25	62.12	60.39	0.78	185.43	15	32	11.44	4.72
Floor 1	3.5	75	25	63.52	60.80	0.25	164.31	12	26	11.43	0.70
Temp in/out (°C)				65	61.28						
Recirculation flow (l/s)	0.0147					12.69	717.46			31.68	

The highlighted value is the recirculation flow (l/s) that is needed to compensate for the heat losses of the riser piping. This flow gets bigger with more floors, bigger floor to floor distances, thinner insulation, higher target temperature, lower input temperature and with insulation with higher heat conduction coefficient.

STEP 14:

CALCULATE	Floor height (m)	Ecoline diameter (mm)	Insulation (W/m.K) /thickness (mm)	T in outer pipe (°C)	T in inner pipe (°C)	Recirculation pressure loss (Pa) outer pipe	Recirculation pressure loss (Pa) inner pipe	Tap water flow (l/min)	Tap water pipe diameter (mm)	Tap riser friction pressure loss (kPa)	Tap branch friction pressure loss (kPa)
Number of floors	4		0.035								
Target temp (°C)	60										
Ambient temp (°C)	20										
Floor 4	4	40	20	60.10	60.10	7.69	183.79	8	20	1.56	71.55
Floor 3	4	50	20	60.91	60.12	3.97	183.93	10	26	7.25	0.93
Floor 2	4	63	25	62.12	60.39	0.78	185.43	15	32	11.44	4.72
Floor 1	3.5	75	25	63.52	60.80	0.25	164.31	12	26	11.43	0.70
Temp in/out (°C)				65	61.28						
Recirculation flow (l/s)	0.0147					12.69	717.46			31.68	

The pressure loss for recirculation is given separately for outer and inner pipe. The recirculation pump, when choosing 1 pump per riser, is dimensioned based on the sum of both pressure drops. If a common recirculation pump is chosen, the pressure drops of the distribution lines have to be added.

So, in case of 1 re-circulation pump at the feet of the riser working point of the pump has to be:

flow = 0.0147 l/s = 53 l/h
head = 12.69 + 717.46 = 730.15 Pa (100 kPa = 1 bar = 10 mWK).

STEP 15:

CALCULATE	Floor height (m)	Ecoline diameter (mm)	Insulation (W/m.K) /thickness (mm)	T in outer pipe (°C)	T in inner pipe (°C)	Recirculation pressure loss (Pa) outer pipe	Recirculation pressure loss (Pa) inner pipe	Tap water flow (l/min)	Tap water pipe diameter (mm)	Tap riser friction pressure loss (kPa)	Tap branch friction pressure loss (kPa)
Number of floors	4		0.035								
Target temp (°C)	60										
Ambient temp (°C)	20										
Floor 4	4	40	20	60.10	60.10	7.69	183.79	8	20	1.56	71.55
Floor 3	4	50	20	60.91	60.12	3.97	183.93	10	26	7.25	0.93
Floor 2	4	63	25	62.12	60.39	0.78	185.43	15	32	11.44	4.72
Floor 1	3.5	75	25	63.52	60.80	0.25	164.31	12	26	11.43	0.70
Temp in/out (°C)				65	61.28						
Recirculation flow (l/s)	0.0147					12.69	717.46			31.68	

The highlighted values show the tap water temperature at each floor.

STEP 16:

CALCULATE	Floor height (m)	Ecoline diameter (mm)	Insulation (W/m.K) /thickness (mm)	T in outer pipe (°C)	T in inner pipe (°C)	Recirculation pressure loss (Pa) outer pipe	Recirculation pressure loss (Pa) inner pipe	Tap water flow (l/min)	Tap water pipe diameter (mm)	Tap riser friction pressure loss (kPa)	Tap branch friction pressure loss (kPa)
Number of floors	4		0.035								
Target temp (°C)	60										
Ambient temp (°C)	20										
Floor 4	4	40	20	60.10	60.10	7.69	183.79	8	20	1.56	71.55
Floor 3	4	50	20	60.91	60.12	3.97	183.93	10	26	7.25	0.93
Floor 2	4	63	25	62.12	60.39	0.78	185.43	15	32	11.44	4.72
Floor 1	3.5	75	25	63.52	60.80	0.25	164.31	12	26	11.43	0.70
Temp in/out (°C)				65	61.28						
Recirculation flow (l/s)	0.0147					12.69	717.46			31.68	

The highlighted values show the return water temperature inside the inner pipe at each level. These values are merely informative and have no practical value, except for the temperature at the bottom of the riser as this temperature can be used for calculation of heat losses in the return line of the distribution piping.

STEP 17:

CALCULATE	Floor height (m)	Ecoline diameter (mm)	Insulation (W/m.K) /thickness (mm)	T in outer pipe (°C)	T in inner pipe (°C)	Recirculation pressure loss (Pa) outer pipe	Recirculation pressure loss (Pa) inner pipe	Tap water flow (l/min)	Tap water pipe diameter (mm)	Tap riser friction pressure loss (kPa)	Tap branch friction pressure loss (kPa)
Number of floors	4		0.035								
Target temp (°C)	60										
Ambient temp (°C)	20										
Floor 4	4	40	20	60.10	60.10	7.69	183.79	8	20	1.56	71.55
Floor 3	4	50	20	60.91	60.12	3.97	183.93	10	26	7.25	0.93
Floor 2	4	63	25	62.12	60.39	0.78	185.43	15	32	11.44	4.72
Floor 1	3.5	75	25	63.52	60.80	0.25	164.31	12	26	11.43	0.70
Temp in/out (°C)				65	61.28						
Recirculation flow (l/s)	0.0147					12.69	717.46			31.68	

The highlighted values indicate the pressure losses caused by friction when tap water is used. These values include the pressure losses in piping and T-pieces.
If values are too high (>> 1 kPa/m of piping) choose bigger diameters for main pipe.

REMARK:
the calculated pressure losses are only taking into account the friction losses and not the static pressure due to the height of tap water point (10 m higher = -1 bar).

STEP 18:

CALCULATE	Floor height (m)	Ecoline diameter (mm)	Insulation (W/m.K) /thickness (mm)	T in outer pipe (°C)	T in inner pipe (°C)	Recirculation pressure loss (Pa) outer pipe	Recirculation pressure loss (Pa) inner pipe	Tap water flow (l/min)	Tap water pipe diameter (mm)	Tap riser friction pressure loss (kPa)	Tap branch friction pressure loss (kPa)
Number of floors	4		0.035								
Target temp (°C)	60										
Ambient temp (°C)	20										
Floor 4	4	40	20	60.10	60.10	7.69	183.79	8	20	1.56	71.55
Floor 3	4	50	20	60.91	60.12	3.97	183.93	10	26	7.25	0.93
Floor 2	4	63	25	62.12	60.39	0.78	185.43	15	32	11.44	4.72
Floor 1	3.5	75	25	63.52	60.80	0.25	164.31	12	26	11.43	0.70
Temp in/out (°C)				65	61.28						
Recirculation flow (l/s)	0.0147					12.69	717.46			31.68	

The highlighted values indicate the pressure losses caused by friction when tap water is used. These values indicate the pressure drop in the T-pieces at each floor.
If values are too high, choose bigger diameters for branch pipe.