



COMPARISON OF HEAT TRANSFER FLUIDS, CRANE TEMPER AND MPG, FOR OPTIMIZING ENERGY AND MATERIAL SAVINGS IN A SECONDARY REFRIGERATION SYSTEM*

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BACKGROUND TO THE COMPARISON - SYSTEM LAYOUT



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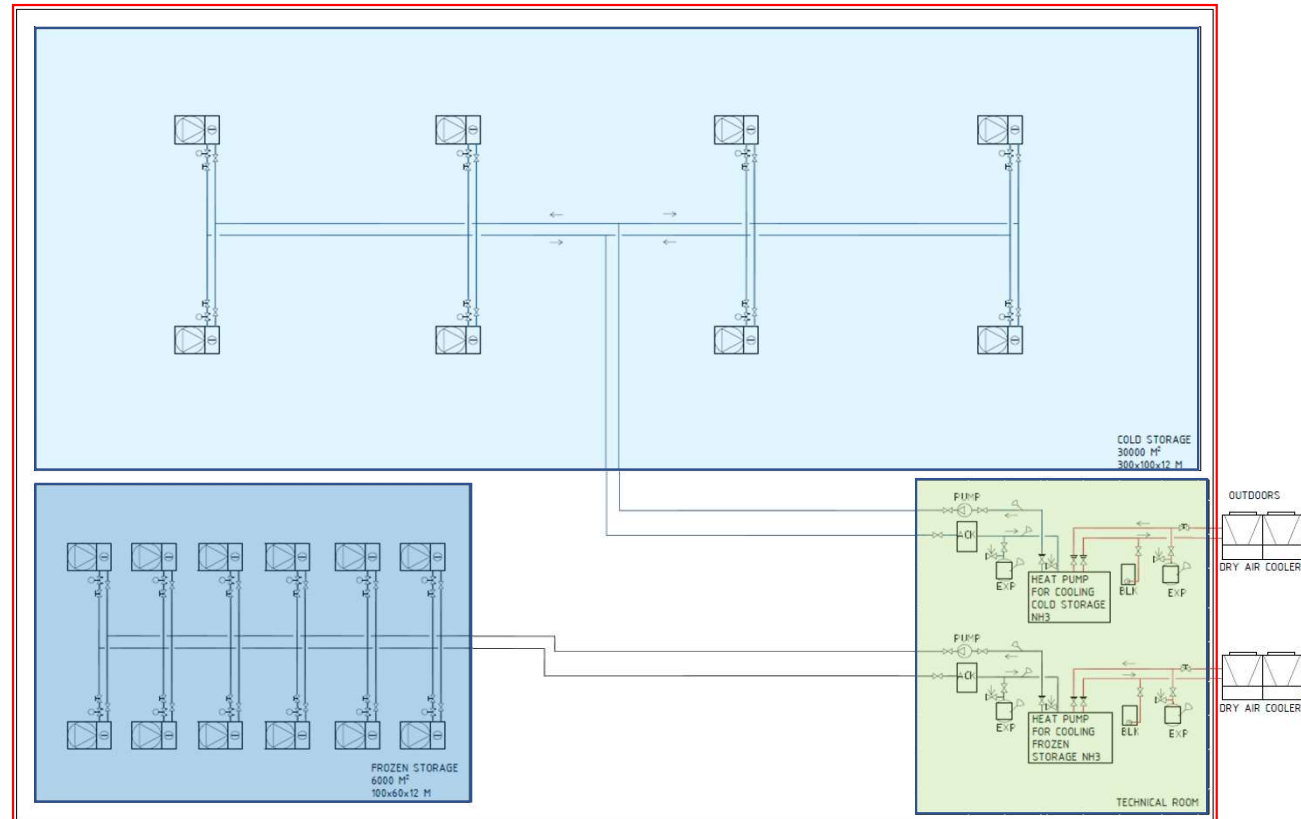
Conditions

	Cold Room	Freezer Room
Room Temperature [°C]	+2	-22
Size [m ²]	30 000	6 000
Height [m]	12	12
Annual Average outdoor temperature [°C]	8	8
Building Temperature [°C]	15	15
Refrigeration Power [kW]	217	168
Cooling energy demand [MWh/year]	1 173	957
System Volume HTF ¹ [m ³]	7,1	11,3

Calculation costs

Electricity: 272 €/MWh²

Costs for CRANE Temper and MPG is based on market conditions for October 2022. Please contact your local distributor for more details.



¹HTF - cold room: MPG 30%/CRANE Temper-15, freezer room: MPG 54%/CRANE Temper-40

²Average EU price Jan-Oct 2022 <https://www.energypriceindex.com/price-data>

INVESTMENT COST FOR SYSTEM OPTIMIZED ON ENERGY



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Investment Cost (€)

	MPG	Part of investment	CRANE Temper	Part of investment	Cost reduction	Reduction
Cold Storage (Pipes + Fans)	300 762	37%	251 762	32%	49 000	16%
Freeze Storage (Pipes + Fans)	486 114	60%	445 514	56%	40 600	8%
HTF Cold Storage	7 225	1%	25 571	3%	-18 346	-254%
HTF Freeze Storage	20 769	3%	68 177	9%	-47 408	-228%
Total Cost	814 870		791 024		23 846	3%

Due to CRANE Temper's thermal properties, the heat transfer area can be reduced when optimizing on energy:

- Cold room – from 365,4m² to 219,2m²
- Freeze room – from 254,1m² to 179,3m²

This reduces the cost for the fan air coolers

When using CRANE Temper (even if the fluid is more expensive), the installation cost is 3% (23 846 €) lower, compared with installing an MPG system.

Energy saving by this option will be 9% (see next slide).

ENERGY SAVINGS - OPTIMIZED ENERGY

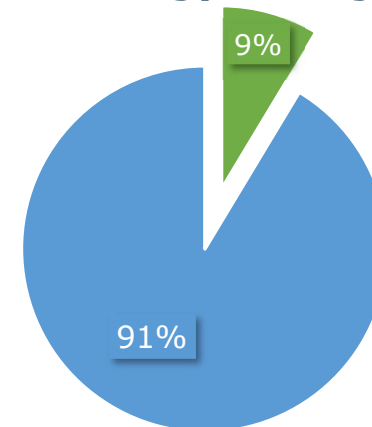


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Energy Consumption (MWh)

	MPG	CRANE Temper	Reduction
Pump Energy Cold Storage	21	12	41%
Compressor Energy Cold Storage	367	348	5%
Total Energy Cold Storage	388	360	7%
Pump Energy Freeze Storage	21	9	58%
Compressor Energy Freeze Storage	399	368	8%
Total Energy Freeze Storage	419	377	10%
Total Energy For Project	807	737	9%
Energy Reduction Total			70
Estimated Yearly Energy Cost Reduction (1MWh= 272 €)*			18 958 €

Energy Savings



*Average EU price Jan-Oct 2022 <https://www.energypriceindex.com/price-data>

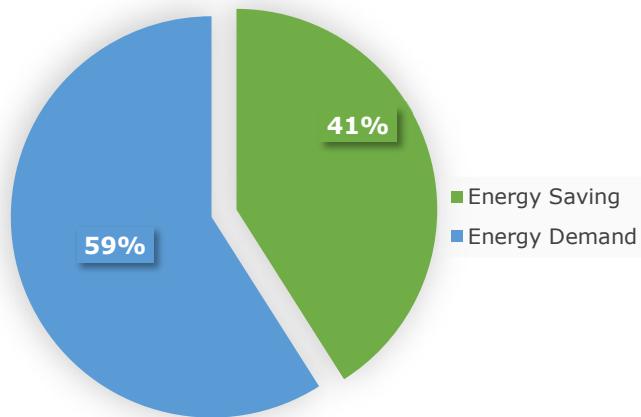
Using CRANE Temper instead of MPG gives a 9% energy saving for the entire system.

PUMP ENERGY SAVINGS - OPTIMIZED ENERGY

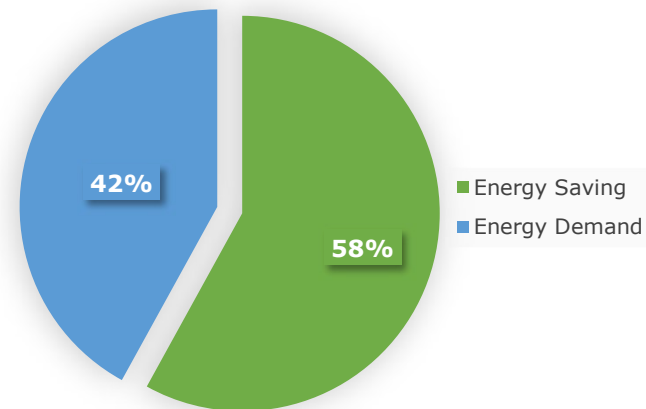


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Pump Energy Cold Storage



Pump Energy Freeze Storage



The pump energy is the part of the systems total energy that is directly influenced by the HTF. Green part is the pump energy saving obtained when using CRANE Temper instead of MPG.

This is where the largest impact of CRANE Tempers performance can be seen.

INVESTMENT COST FOR SYSTEM OPTIMIZED ON PIPE DIMENSIONS



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Investment Cost (€)

	MPG	Part of investment	CRANE Temper	Part of investment	Cost reduction	Saving
Cold Storage (Pipes + Fans)	300 762	37%	241 905	36%	58 857	20%
Freeze Storage (Pipes + Fans)	486 114	60%	349 352	52%	136 762	28%
HTF Cold Storage	7 225	1%	20 644	3%	-13 419	-186%
HTF Freeze Storage	20 769	3%	63 478	9%	-42 709	-206%
Total Cost	814 870		675 379		139 491	17%

System volumes are reduced when optimized on pipes:

- Cold room – from 7,1m³ to 5,5m³
- Freeze room – from 11,3m³ to 10,5m³

When using CRANE Temper (even if the fluid is more expensive), the installation cost is 17% (139 491 €) lower, compared with installing an MPG system

Energy saving by this option will be 8% (see next slide).

ENERGY SAVINGS - OPTIMIZED PIPES



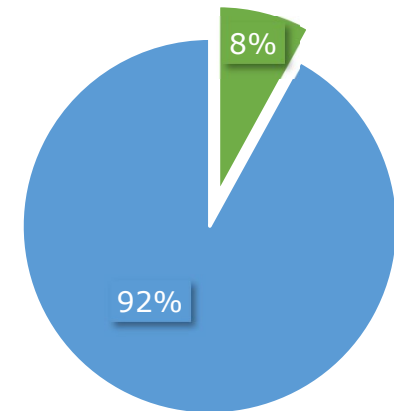
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Energy Consumption (MWh)

	MPG	CRANE Temper	Reduction
Pump Energy Cold Storage	21	15	30%
Compressor Energy Cold Storage	367	348	5%
Total Energy Cold Storage	388	363	6%
Pump Energy Freeze Storage	21	15	26%
Compressor Energy Freeze Storage	399	368	8%
Total Energy Freeze Storage	419	383	9%
Total Energy For Project	807	746	8%
Energy Reduction Total			61
Estimated Yearly Energy Cost Reduction (1MWh= 272 €)*			16 565 €

*Average EU price Jan-Oct 2022 <https://www.energypriceindex.com/price-data>

Energy Savings



Since CRANE Temper has a lower viscosity, smaller pipes can be used, and the system can be built at a lower cost.

On top of saving installation cost, this approach also gives an energy reduction for the entire system of roughly 8%.

CHOOSING THE RIGHT SYSTEM



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Cost Comparison

	MPG	CRANE Temper (optimized Energy)	CRANE Temper (optimized Pipes)
Investment Cost	814 870 €	791 024 €	675 379 €
Yearly Energy Cost	219 504 €	200 546 €	202 939 €
Savings at installation (year 0)	0	23 846 €	139 491 €
Annual energy saving	0	18 958 €	16 565 €

Summary

In this cooling and freezing installation, the unique properties of CRANE Temper makes it more cost-effective to use than MPG as the HTF.

Optimizing on energy – installation cost is higher compared with when optimizing on pipes, still lower than for the MPG installation. Annual energy savings will be larger than when optimizing on pipes.

Optimizing on pipes – annual energy savings will be slightly lower than when optimizing on energy. Installation cost will be lower compared with when optimizing on energy (and MPG installation).

Conclusion – it is favorable to design the system optimized on pipes.