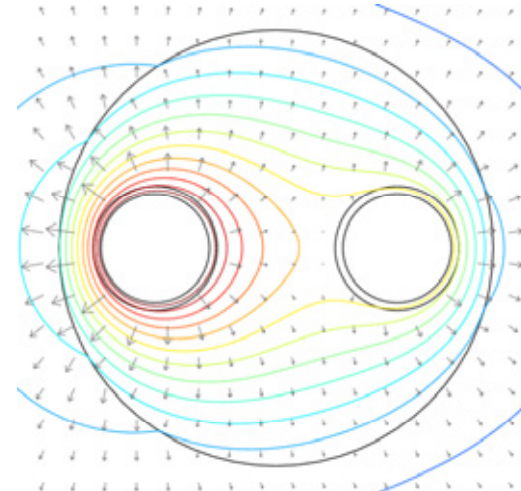


“Local Heat Transfer in Borehole Heat Exchangers”



José Acuña, Björn Palm

KTH, Sweden

Outline

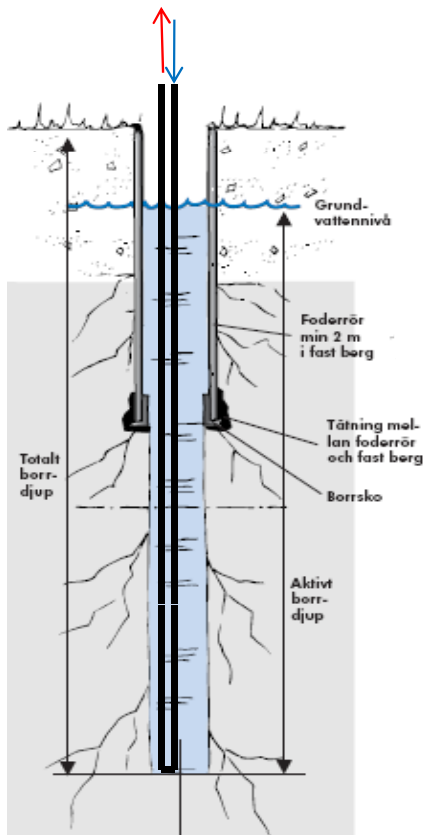
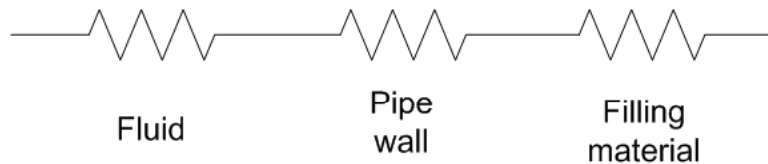
- Introduction to Borehole Heat Exchangers
- Motivation to this work
- Models description
- Results and Discussion



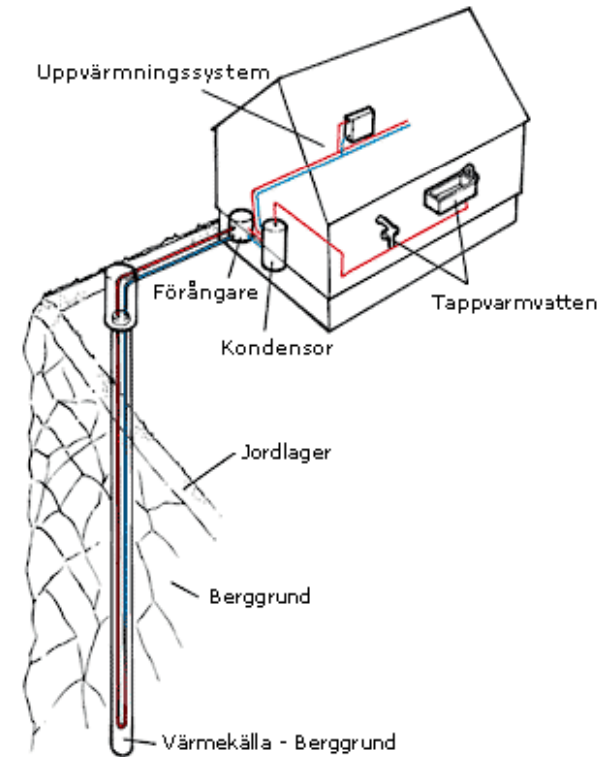
Ground Source Heat Pumps

- Borehole:
Three parts: fluid, pipe, and filling material

(These parts represent a thermal resistance that must be minimized)

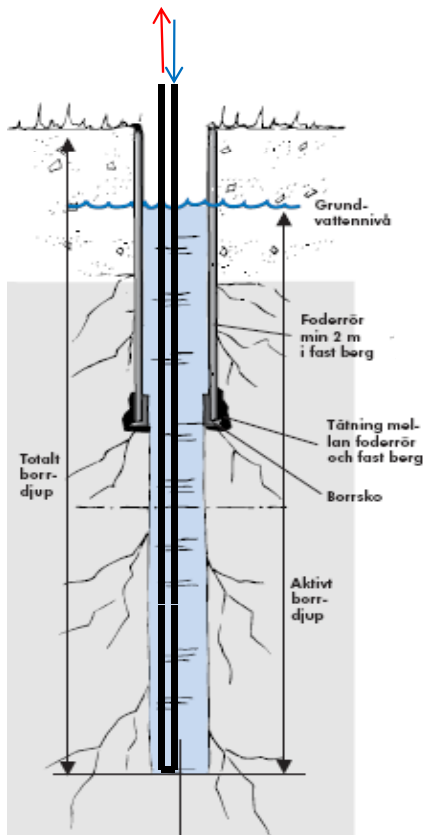


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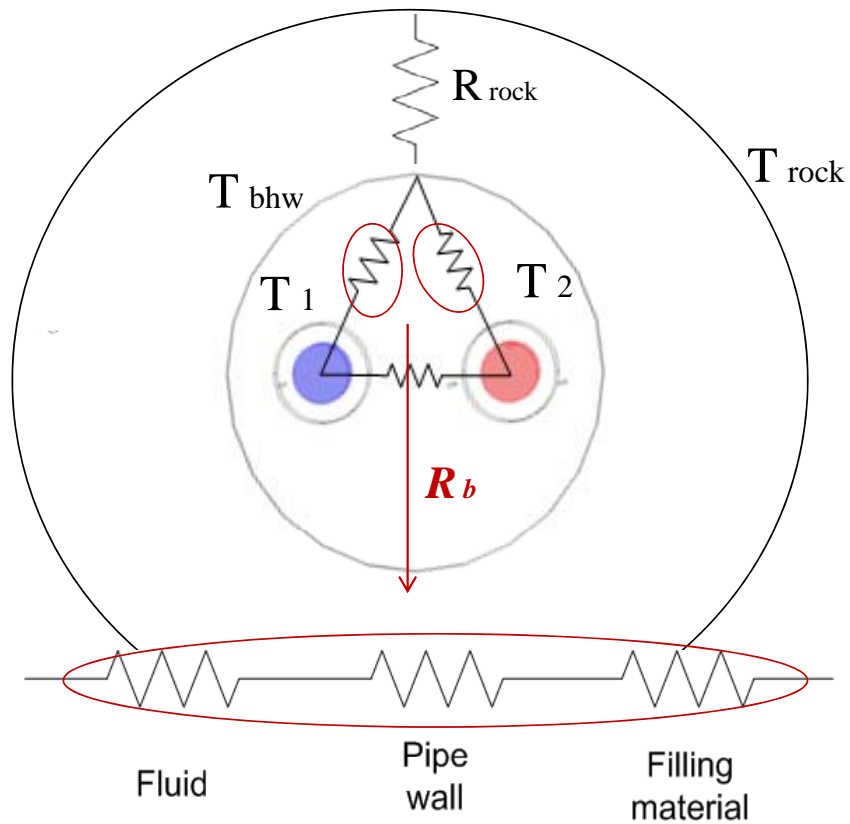


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Thermal Resistances



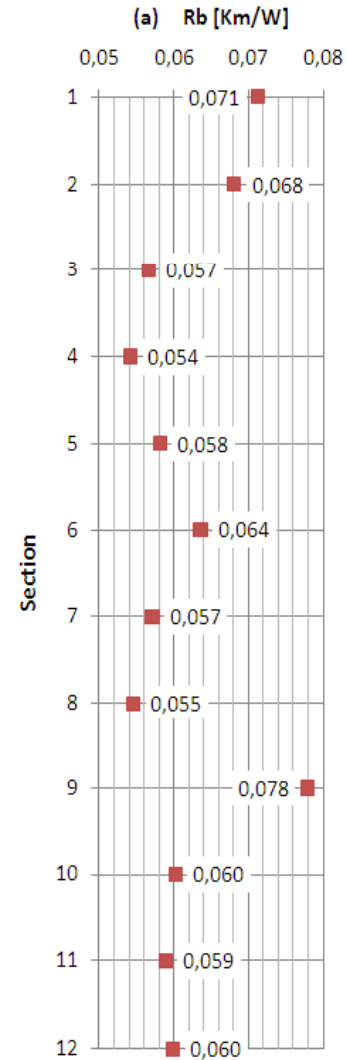
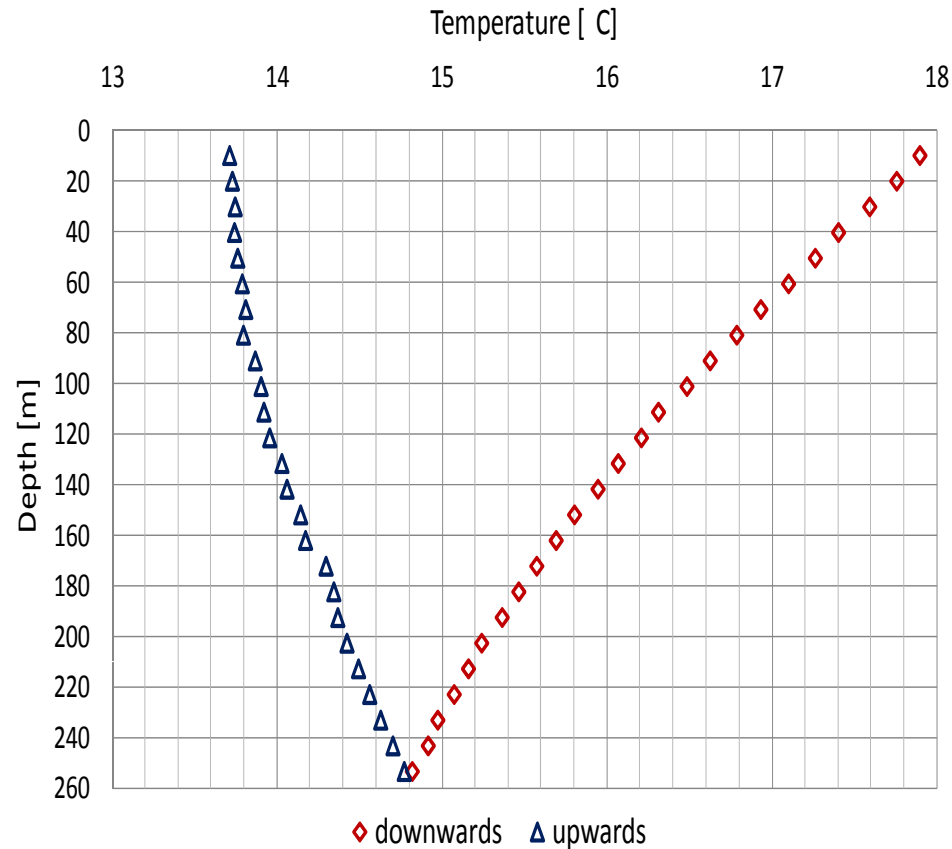
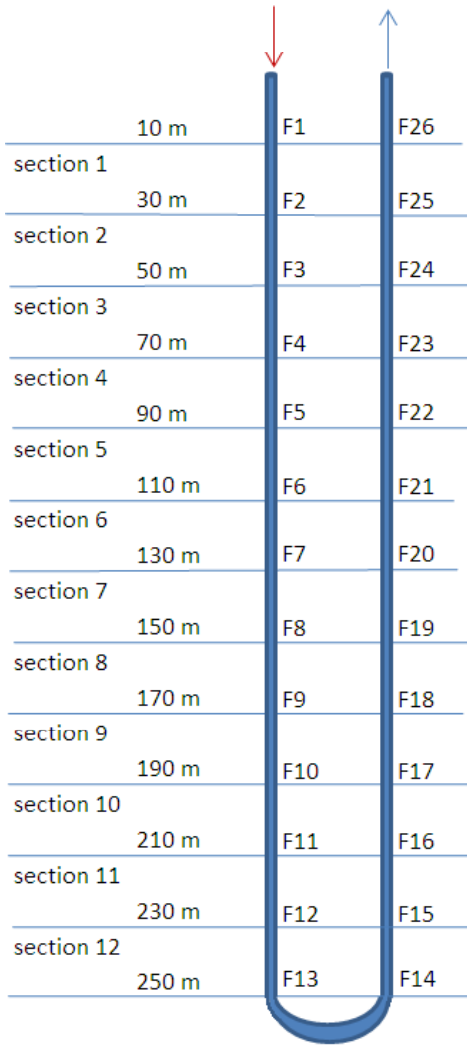
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$$R_b = \frac{T_f - T_{bhw}}{q'}$$

$$T_f = \frac{T_1 + T_2}{2}$$

Motivation - Experiments



The problem

- For the given conditions - Where are the pipes? qualified!
- How does this influence the thermal Performance? R_b ?
- How much do the use of spacers help?



No spacers



13 mm spacers



38 mm spacers

Models



Pipes
apart



Pipes together
aside



Pipes together
aside 2



Pipes together
centered



13 mm spacers
centered



13 mm spacers
aside



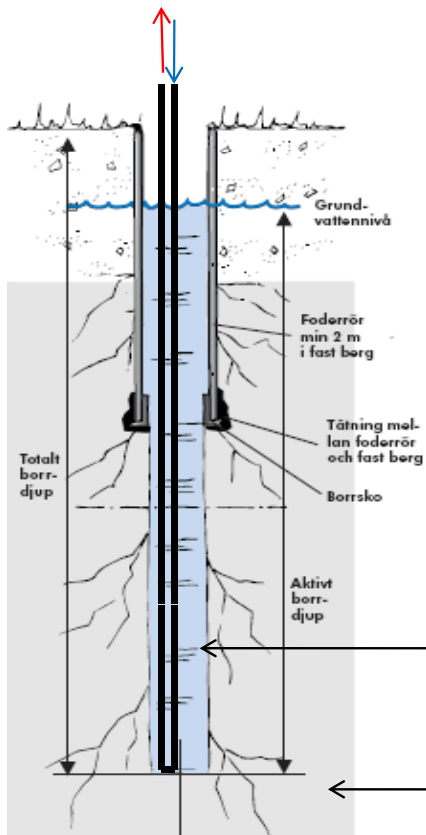
38 mm spacers
centered



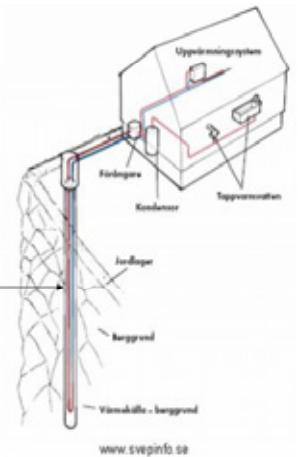
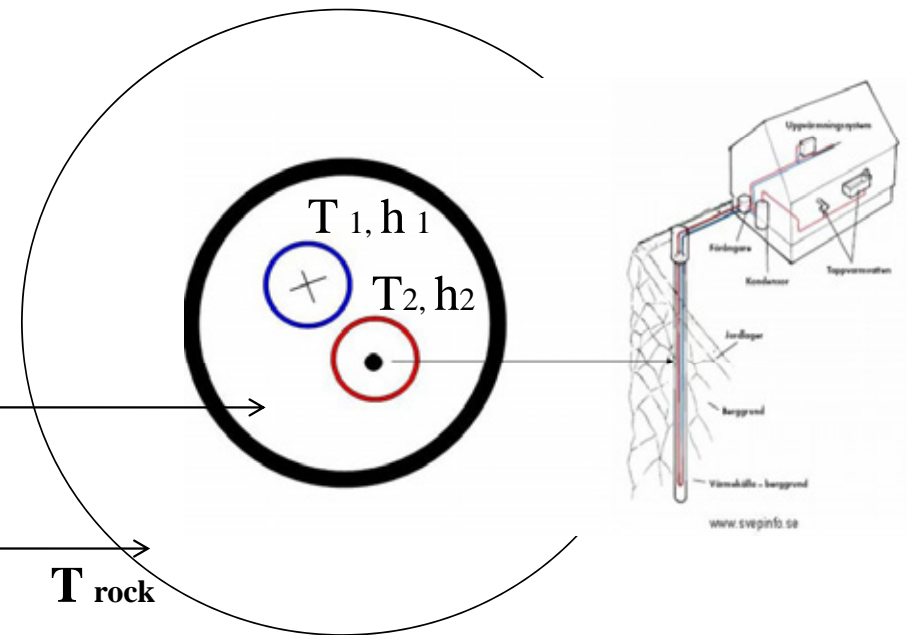
38 mm spacers
aside

Subdomains and Boundary Conditions

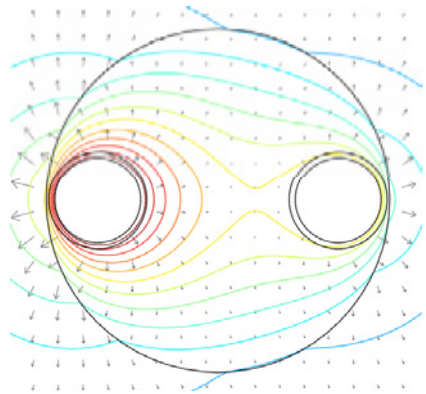
- Boundary conditions based on field measurements



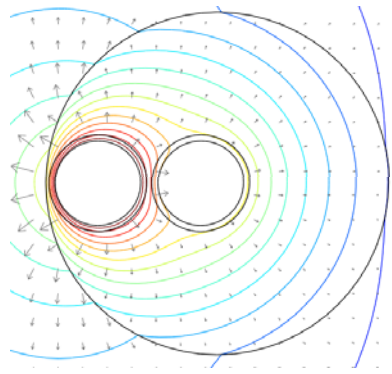
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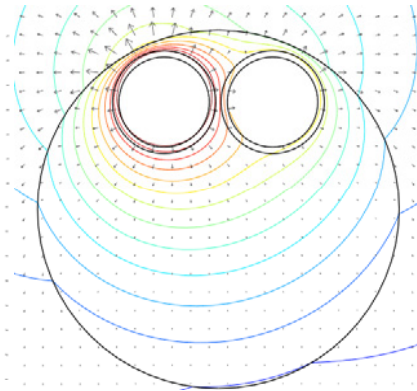
Results



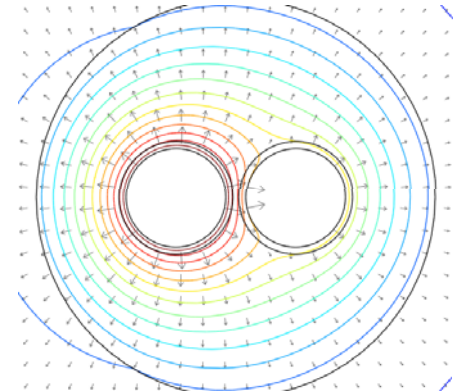
Pipes
apart



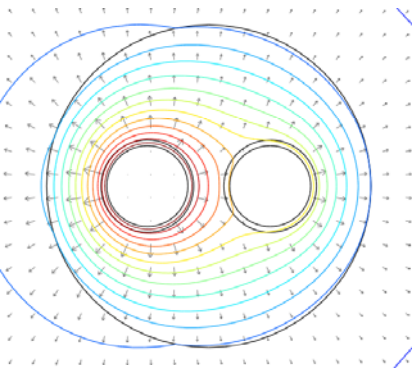
Pipes together
aside



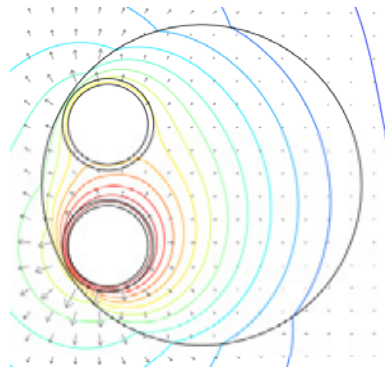
Pipes together
aside 2



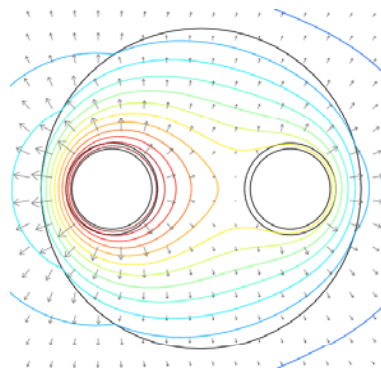
Pipes together
centered



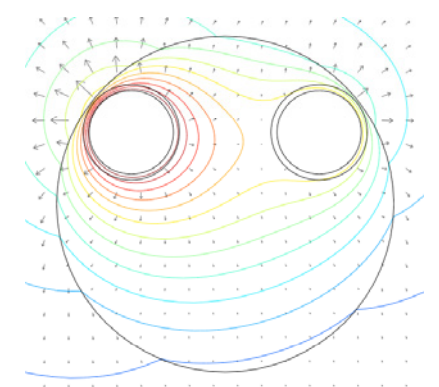
13 mm spacers
centered



13 mm spacers
aside



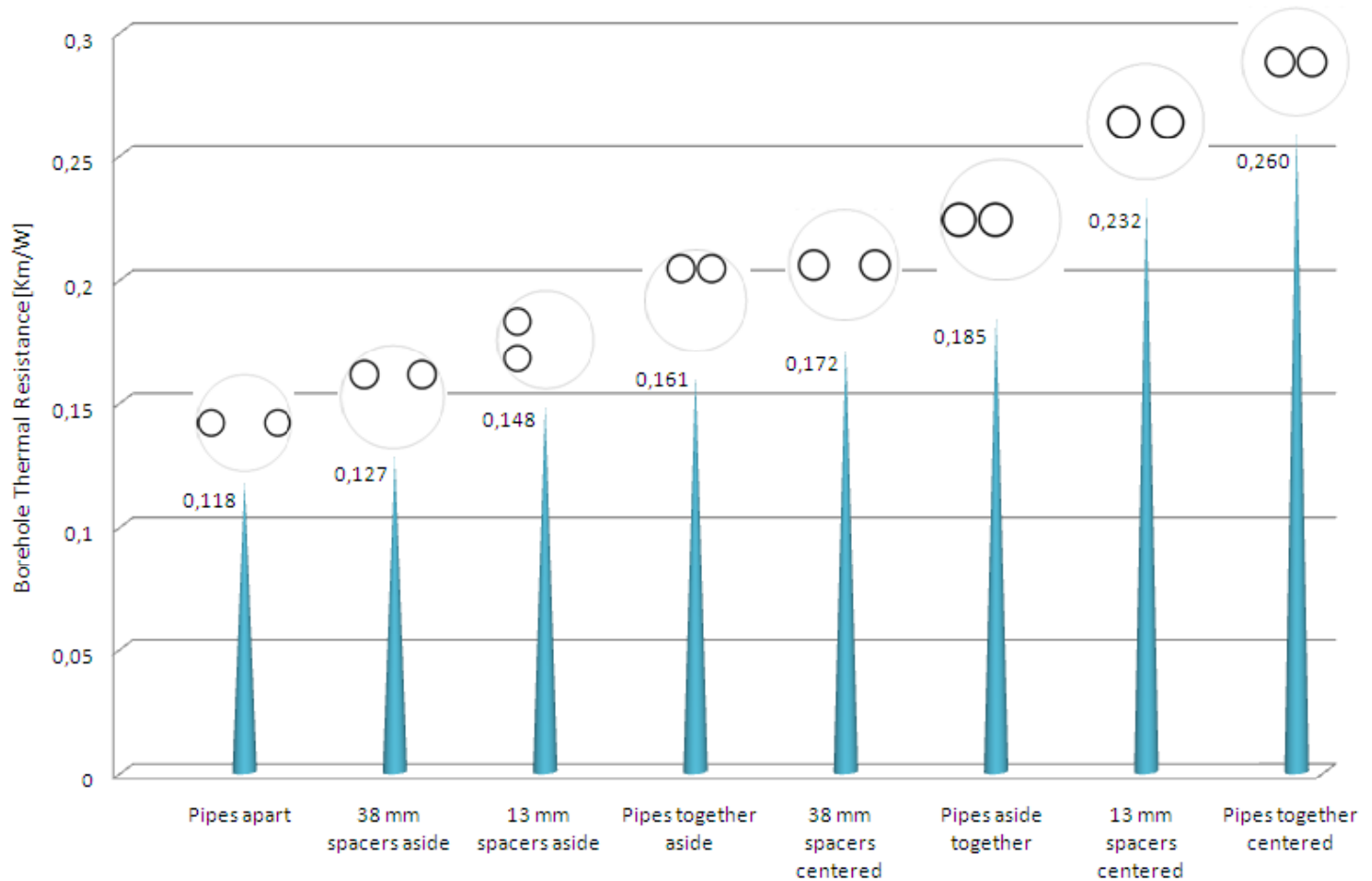
38 mm spacers
centered



38 mm spacers
aside



Results and Discussion



Thank you

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