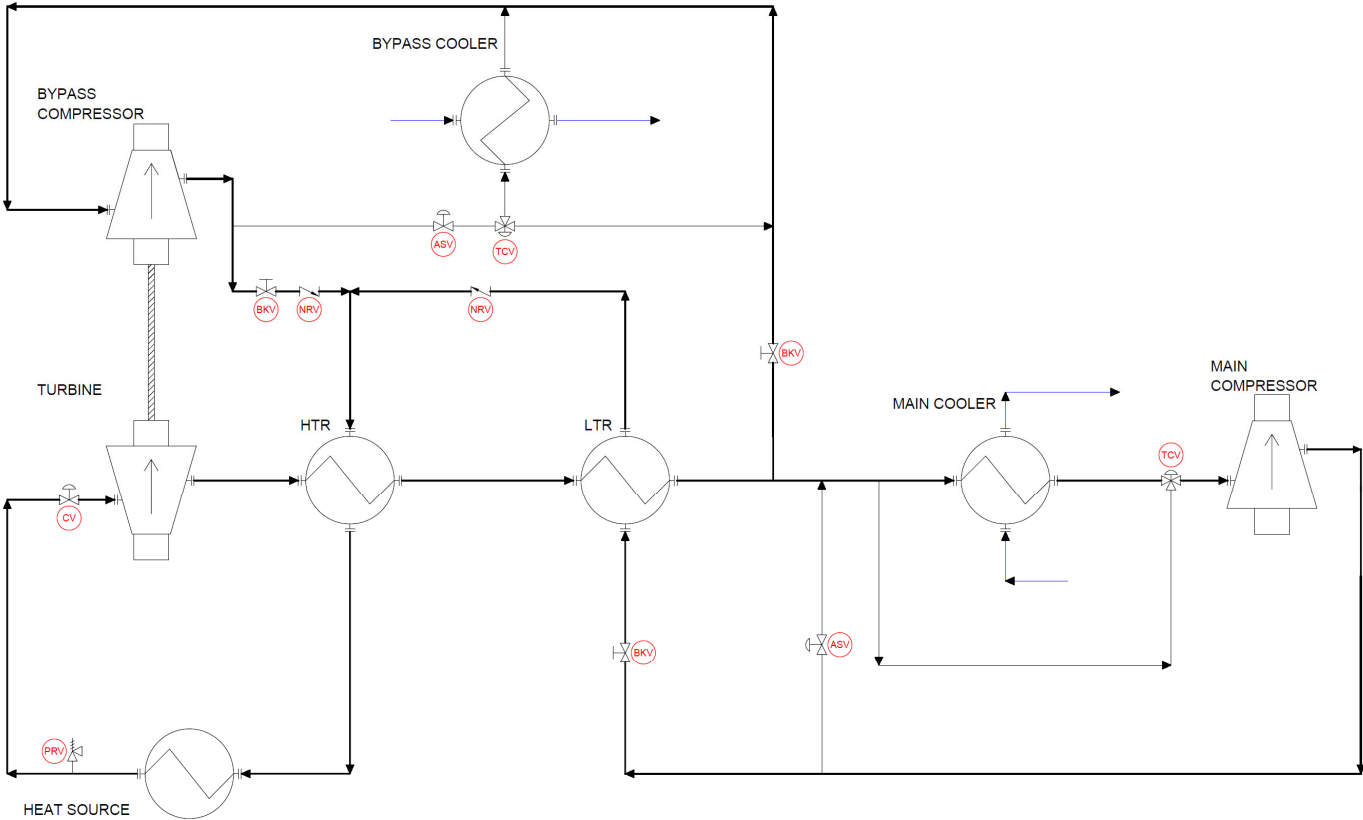




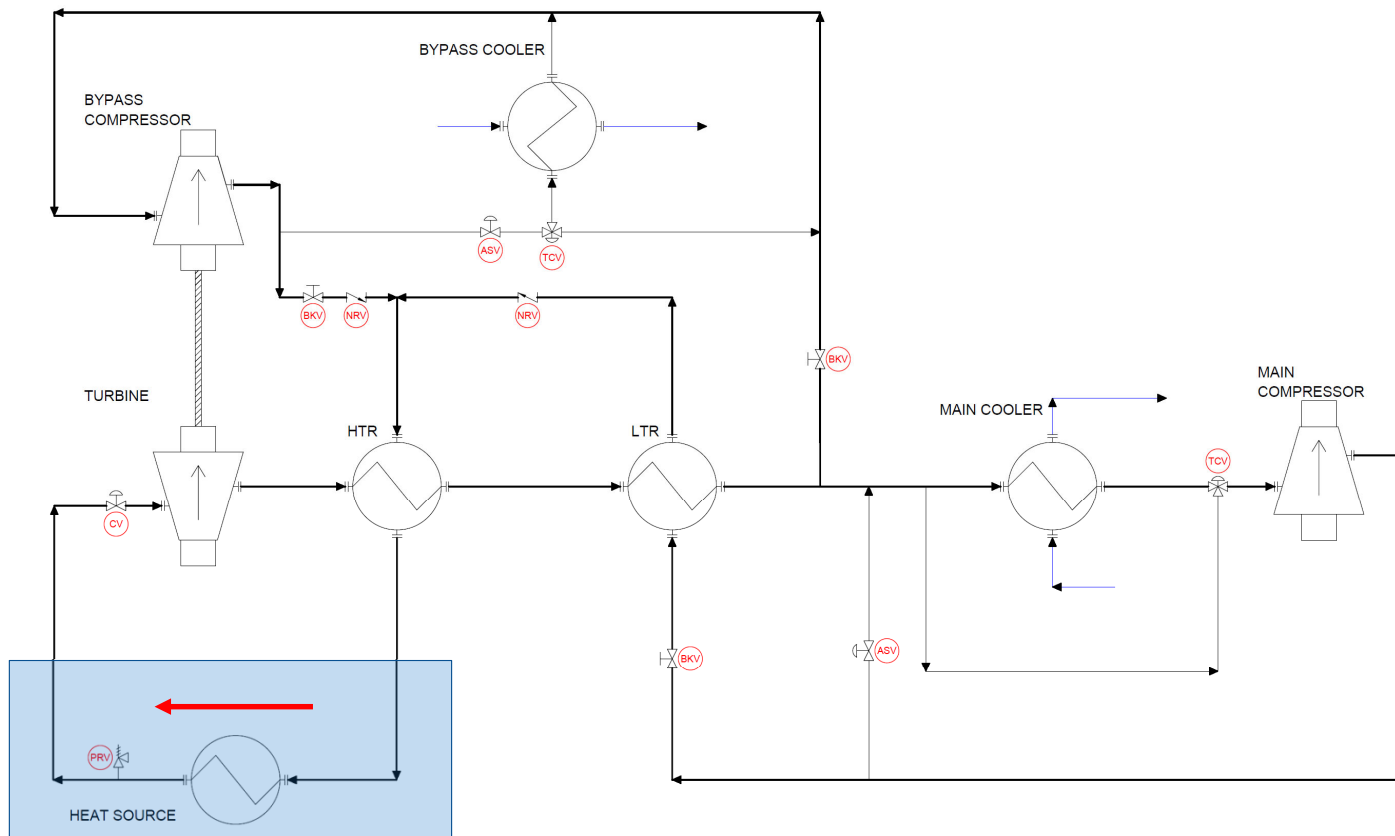
Supercritical CO₂ Controls Strategies for a Fixed-Speed Recompression Closed Brayton Cycle

January Smith (Southwest Research Institute)

Recompression Closed Brayton Cycle

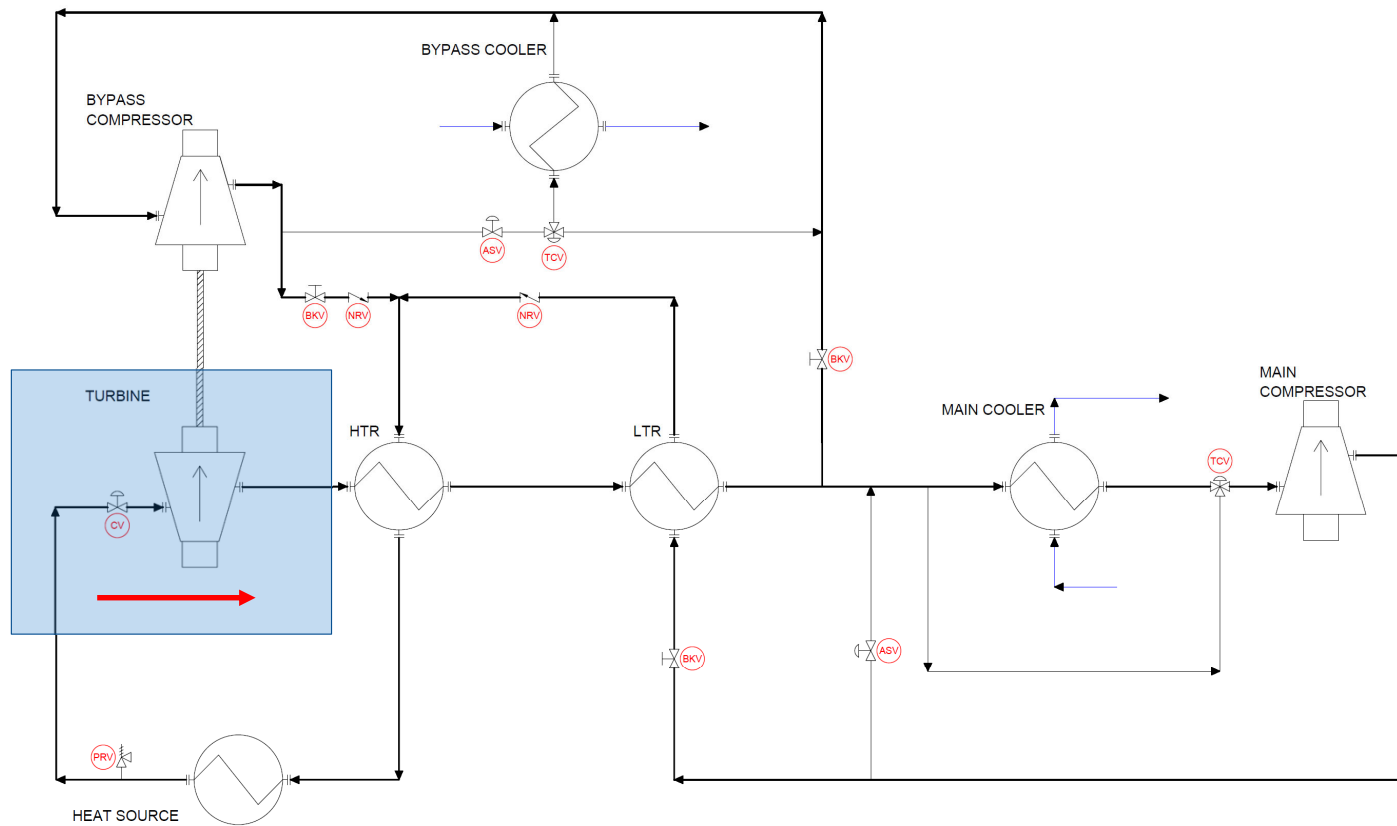


Heat Source

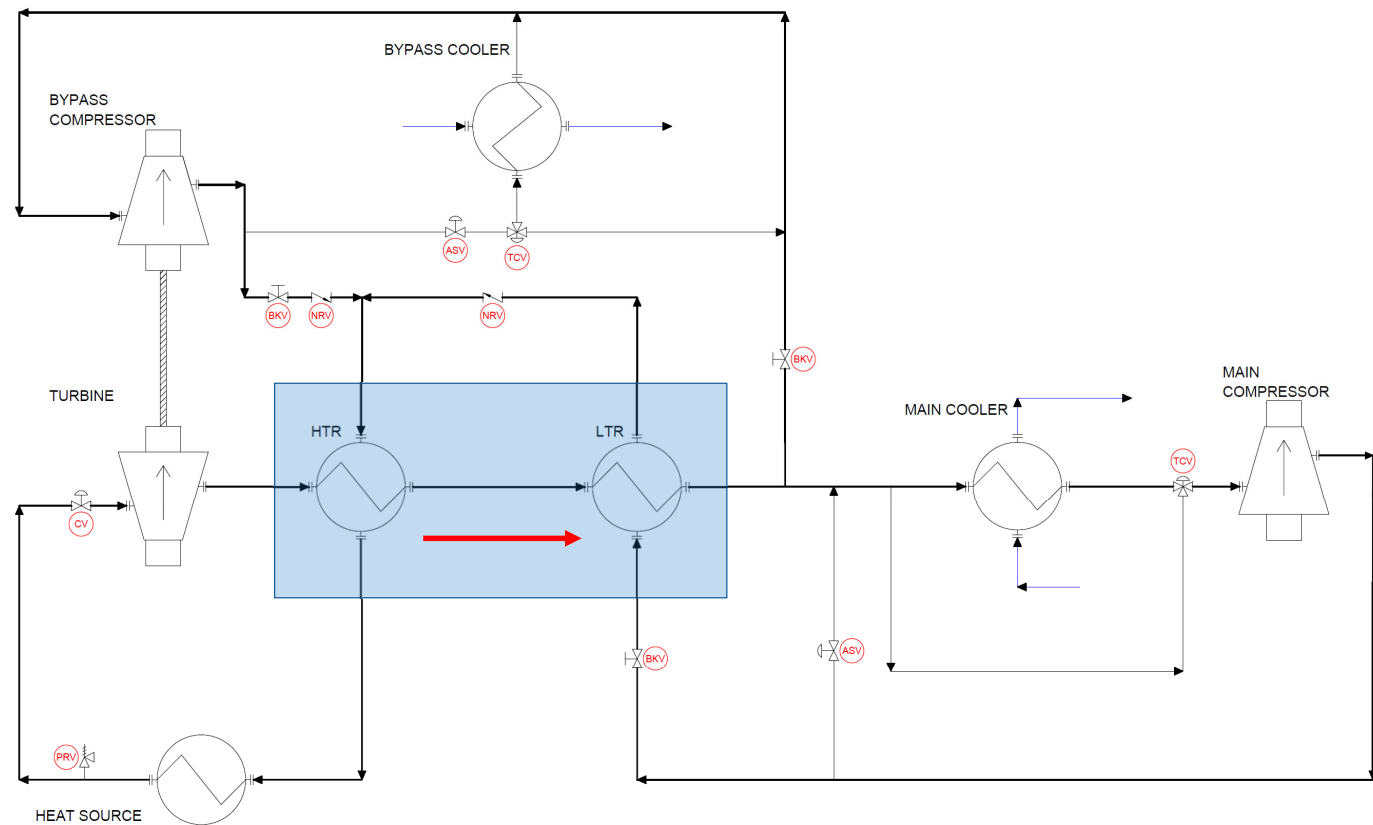


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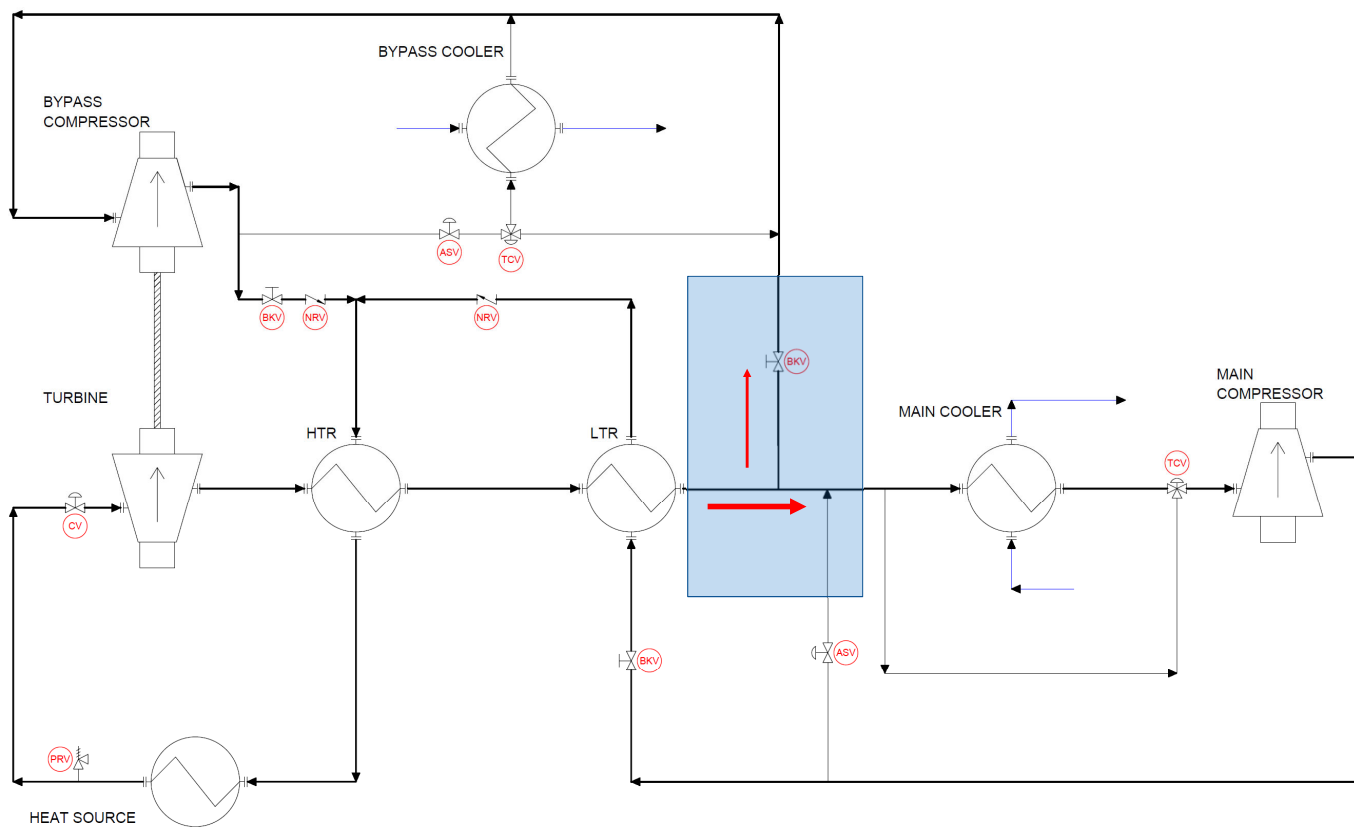
Turbine



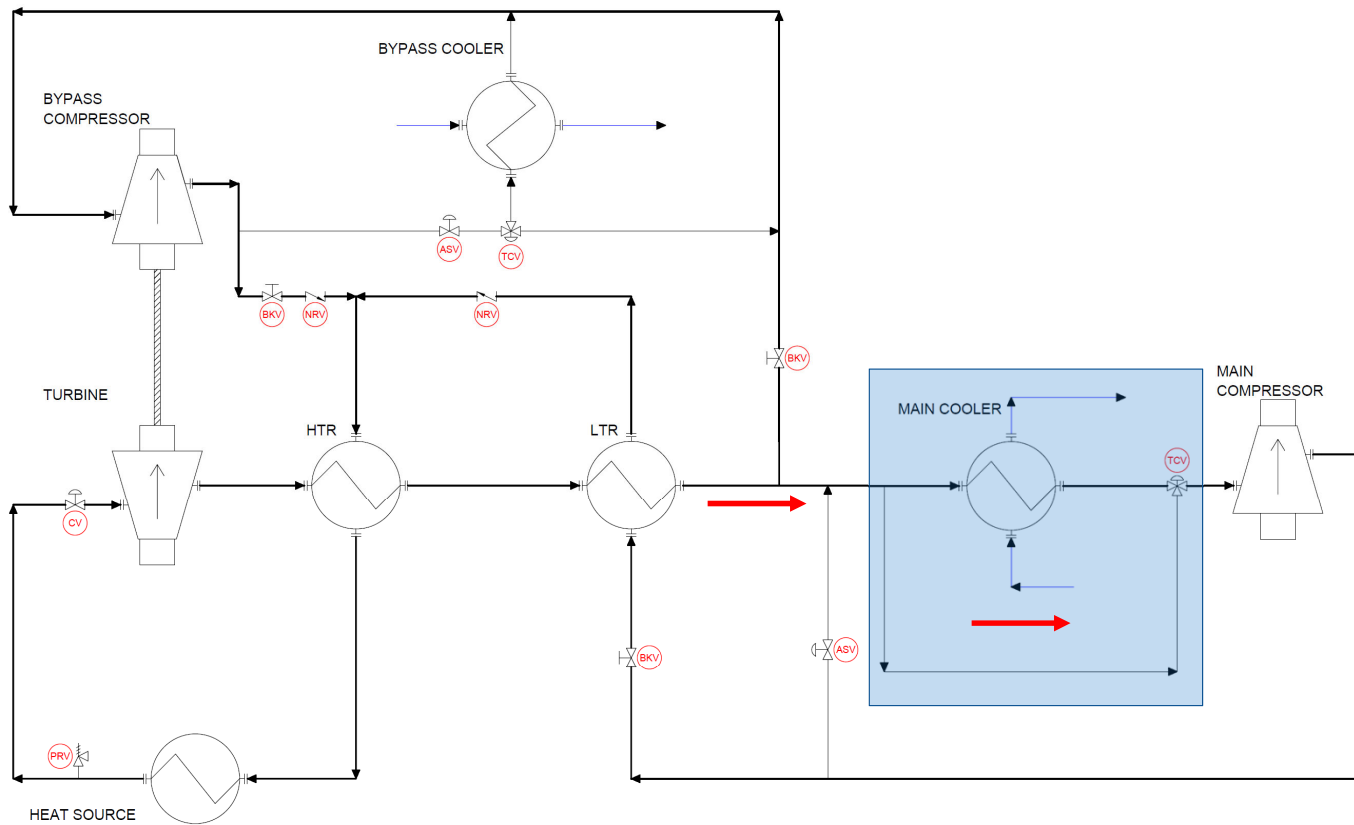
Low Pressure – Hot Side Recuperation



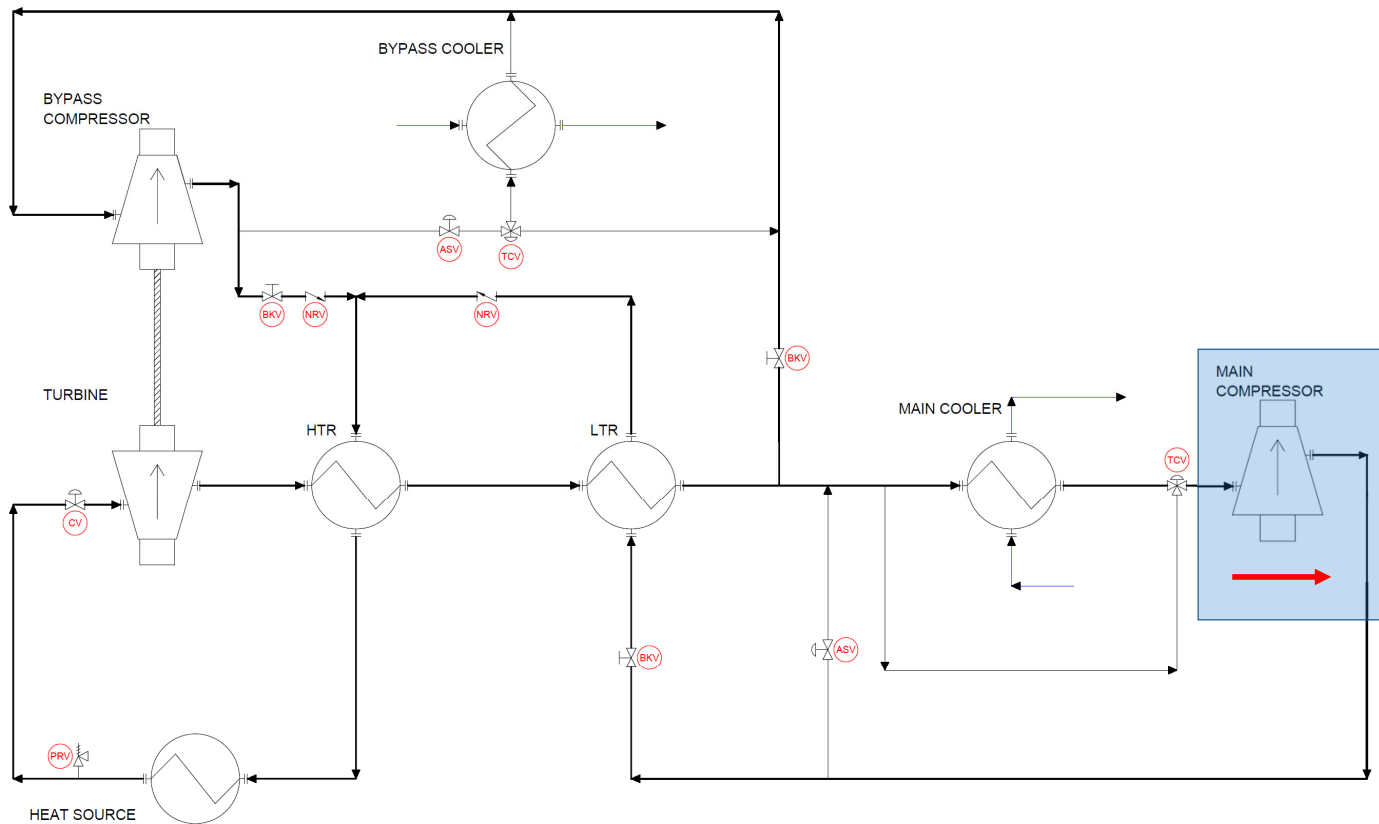
Compressor Split



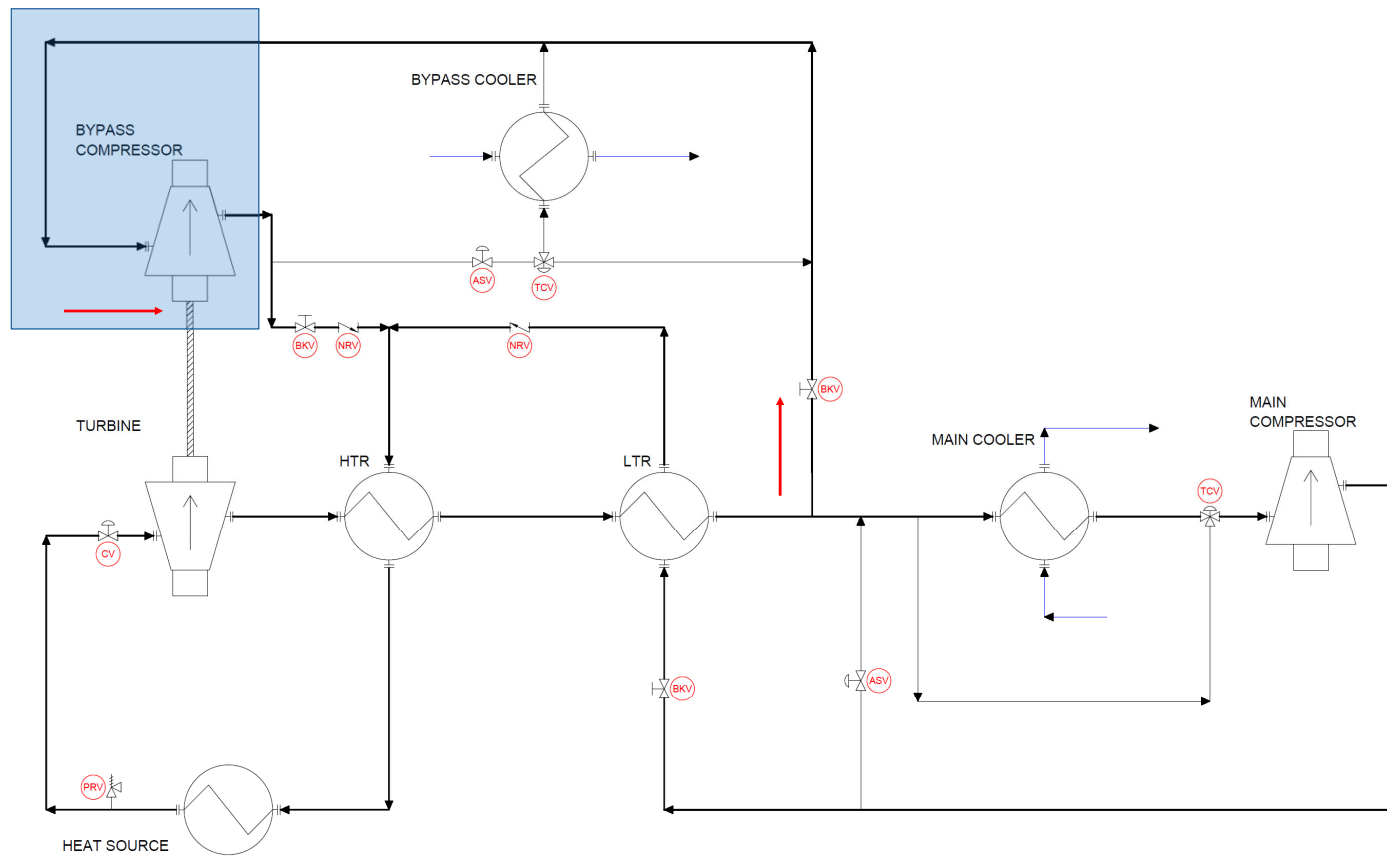
Main Cooler



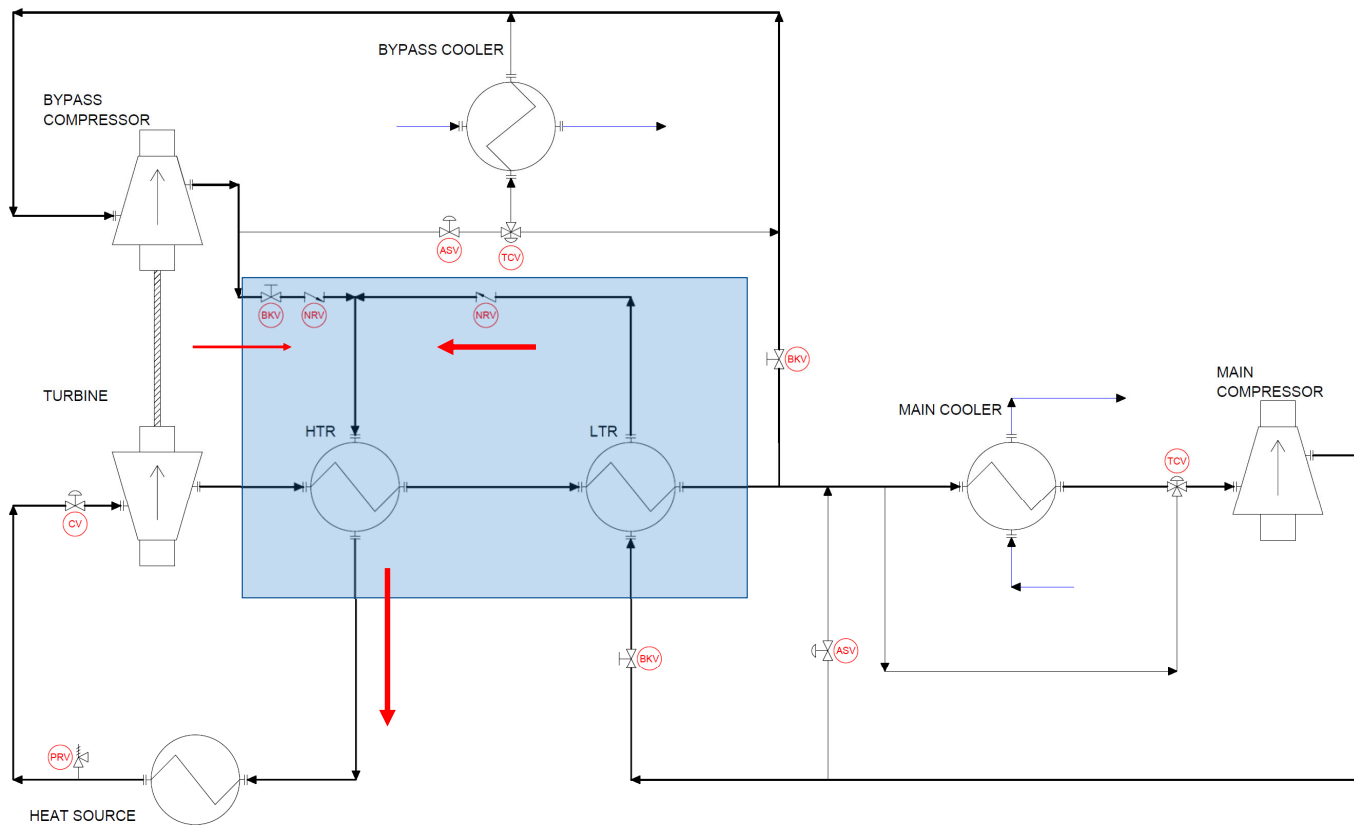
Main Compressor



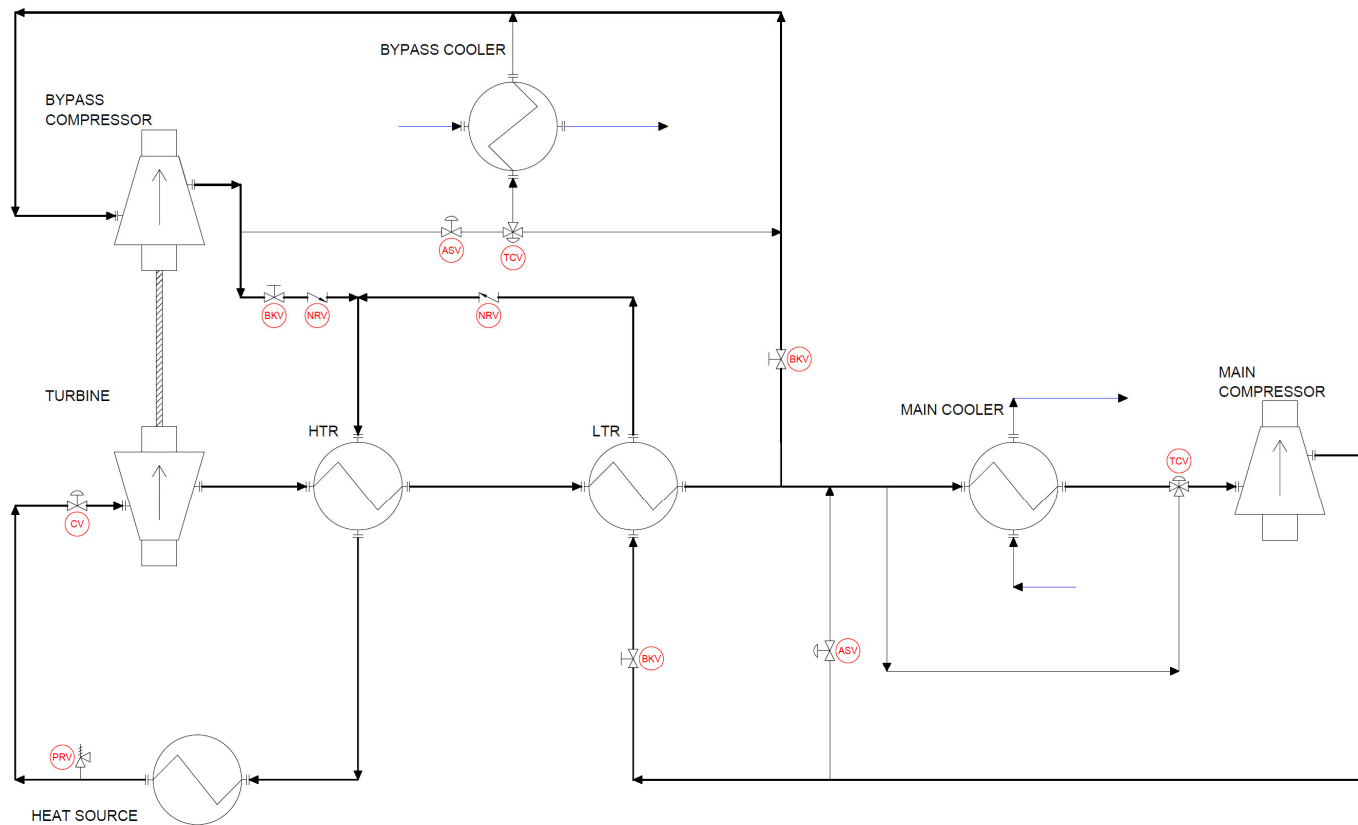
Bypass Compressor



Compressor Mix and Recuperation

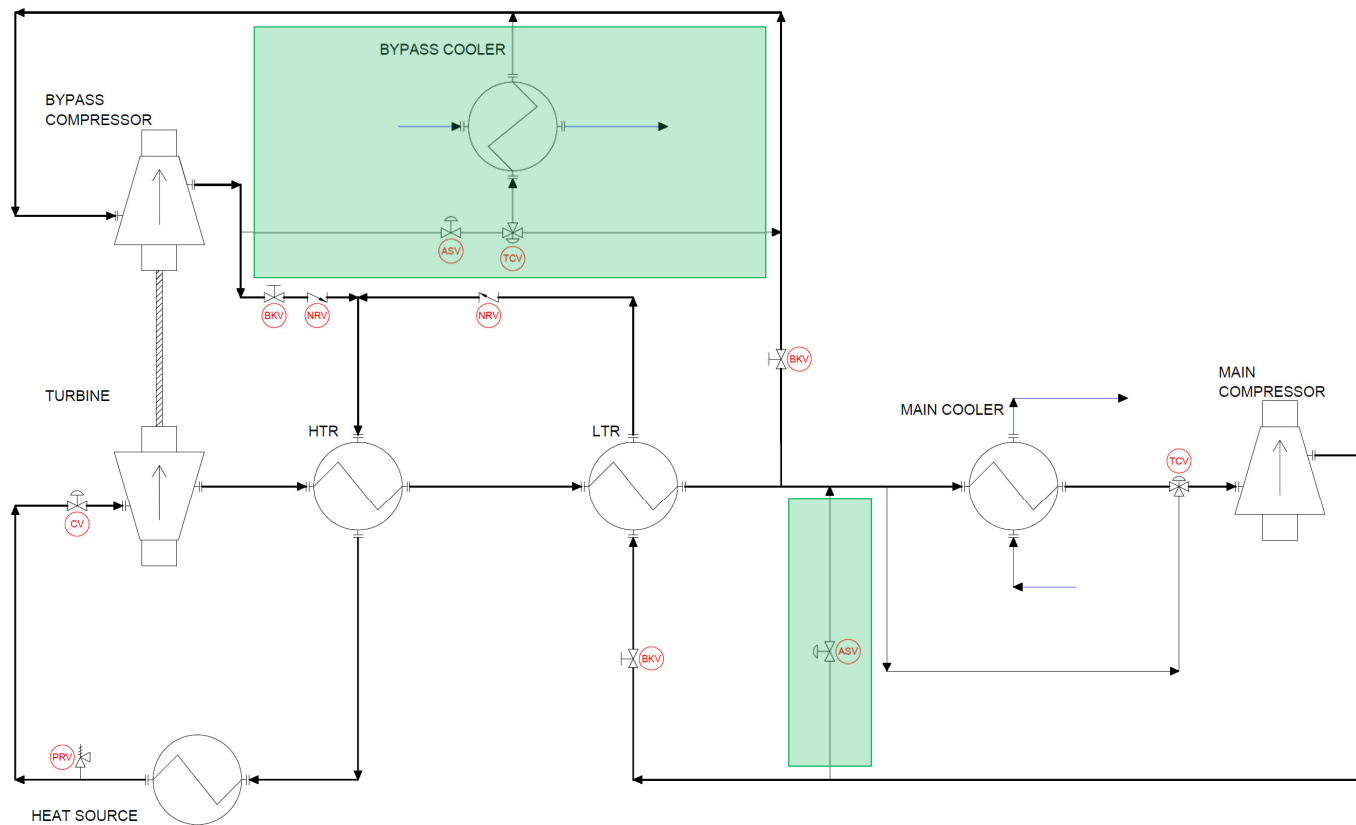


Recompression Closed Brayton Cycle



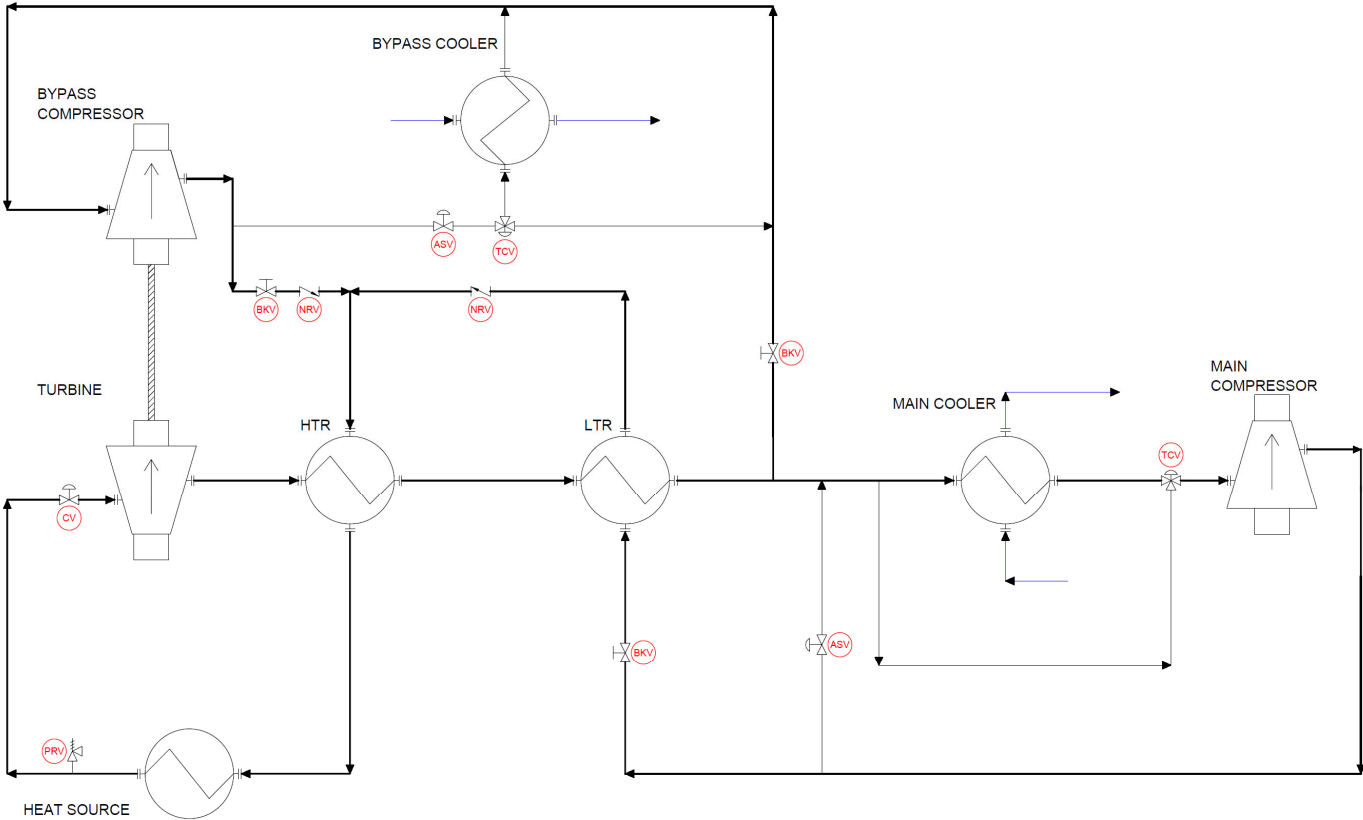
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Compressor Recycle



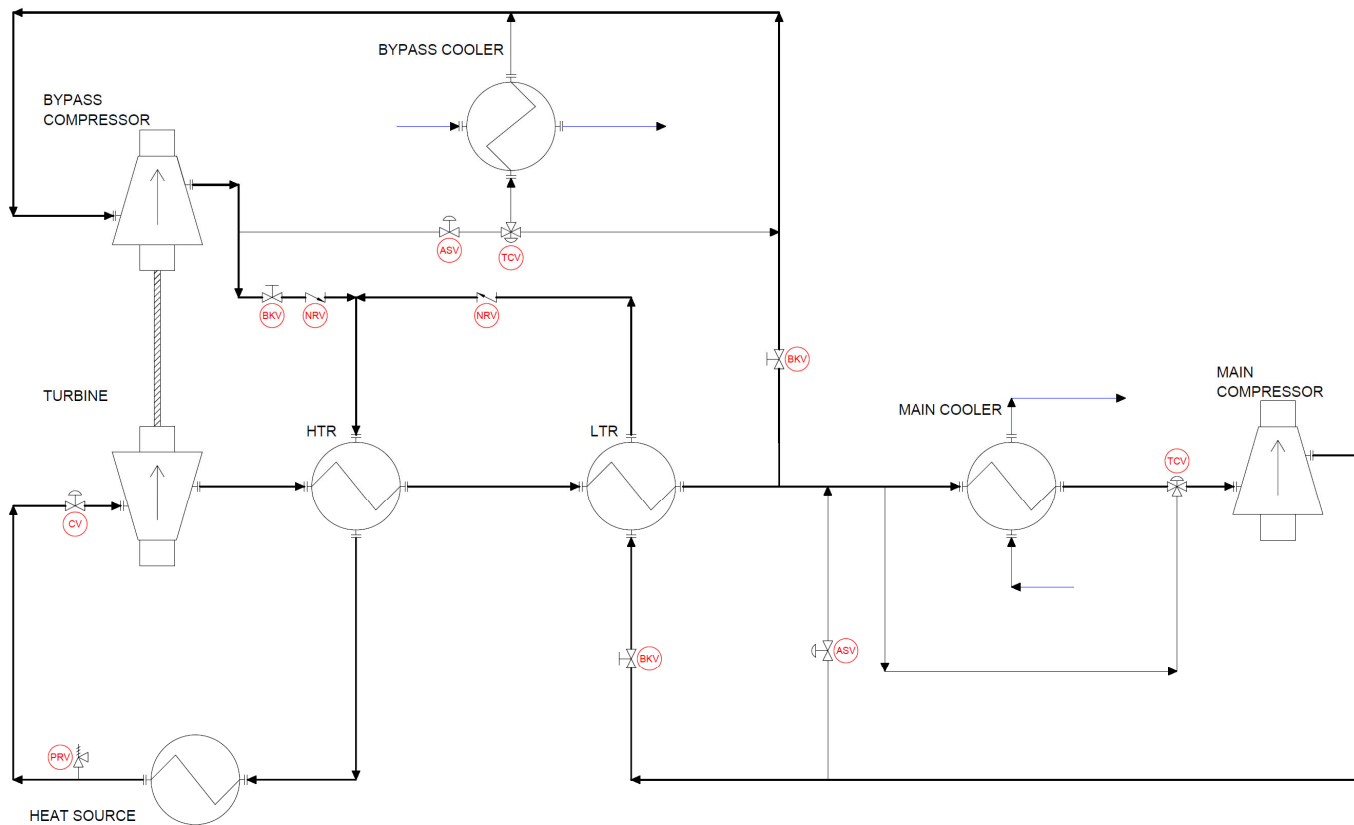
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Recompression Closed Brayton Cycle



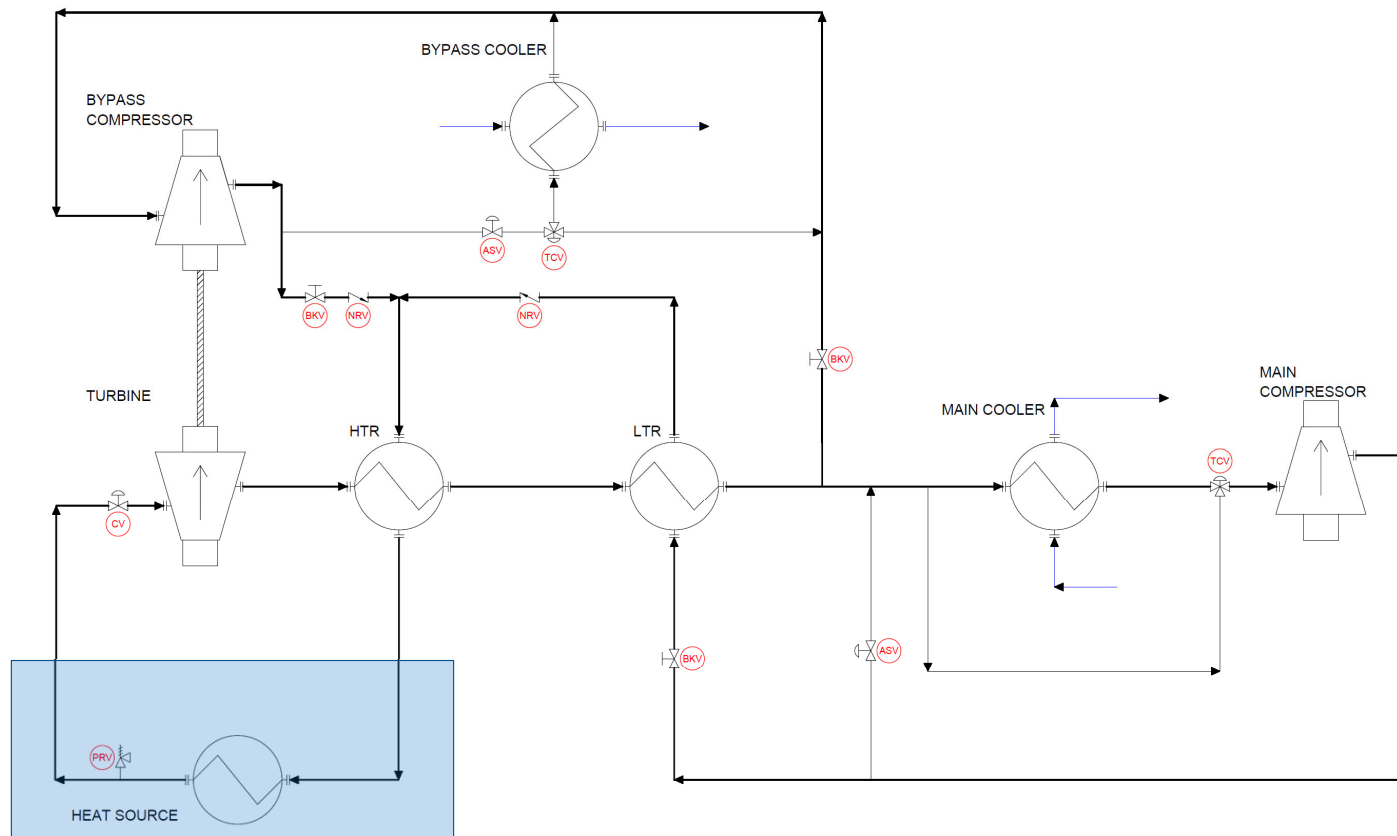
MAIN PROCESS CONTROLS

Turbine Inlet Temperature



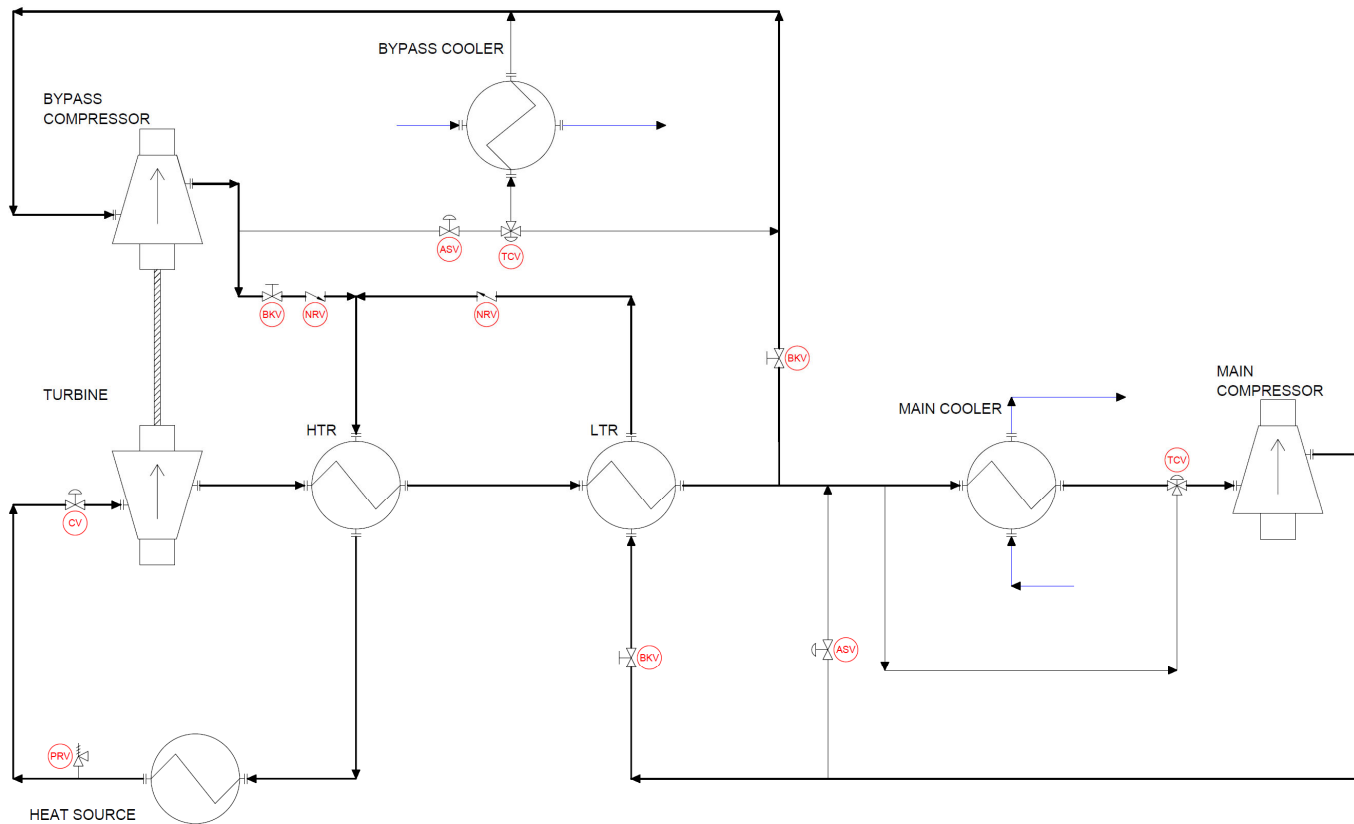
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Turbine Inlet Temperature



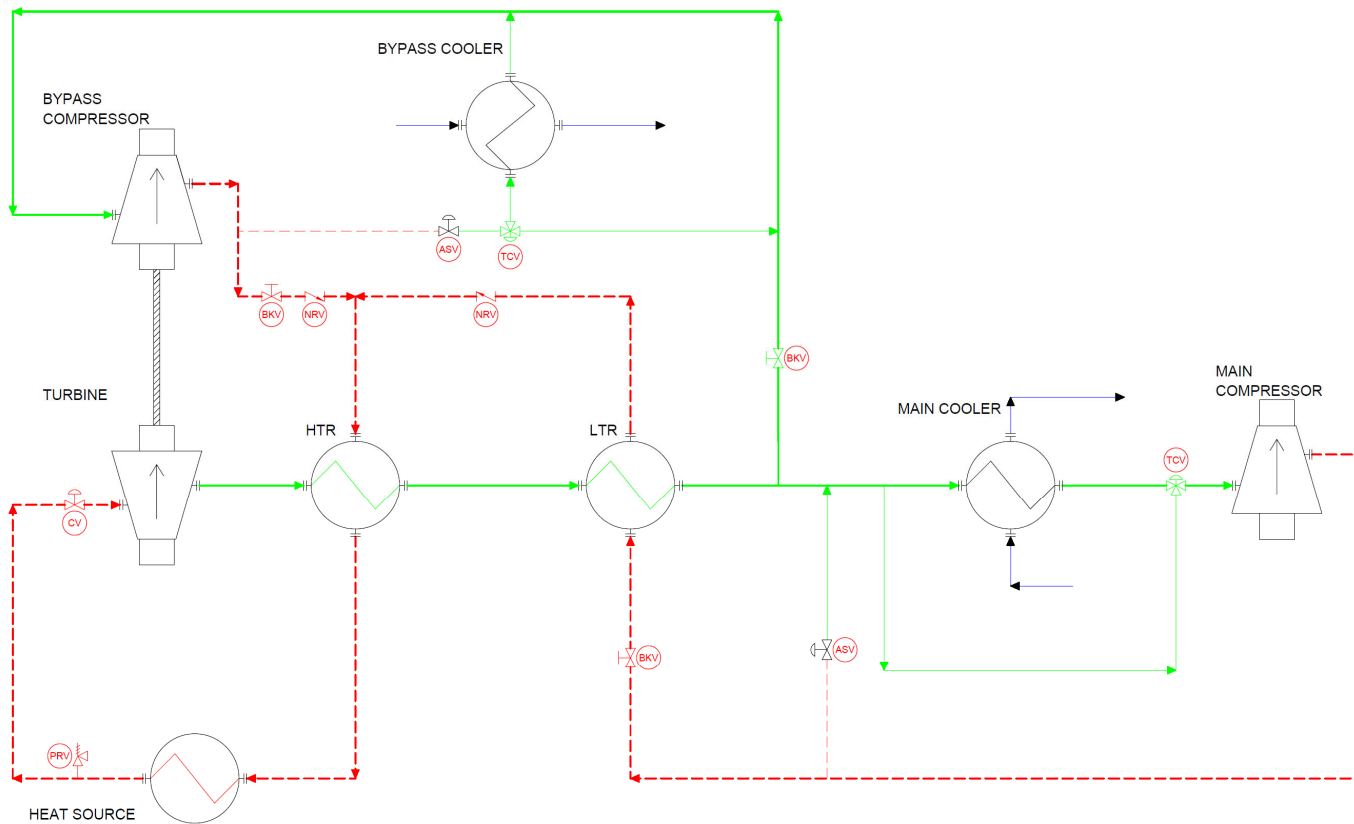
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High Side Pressure

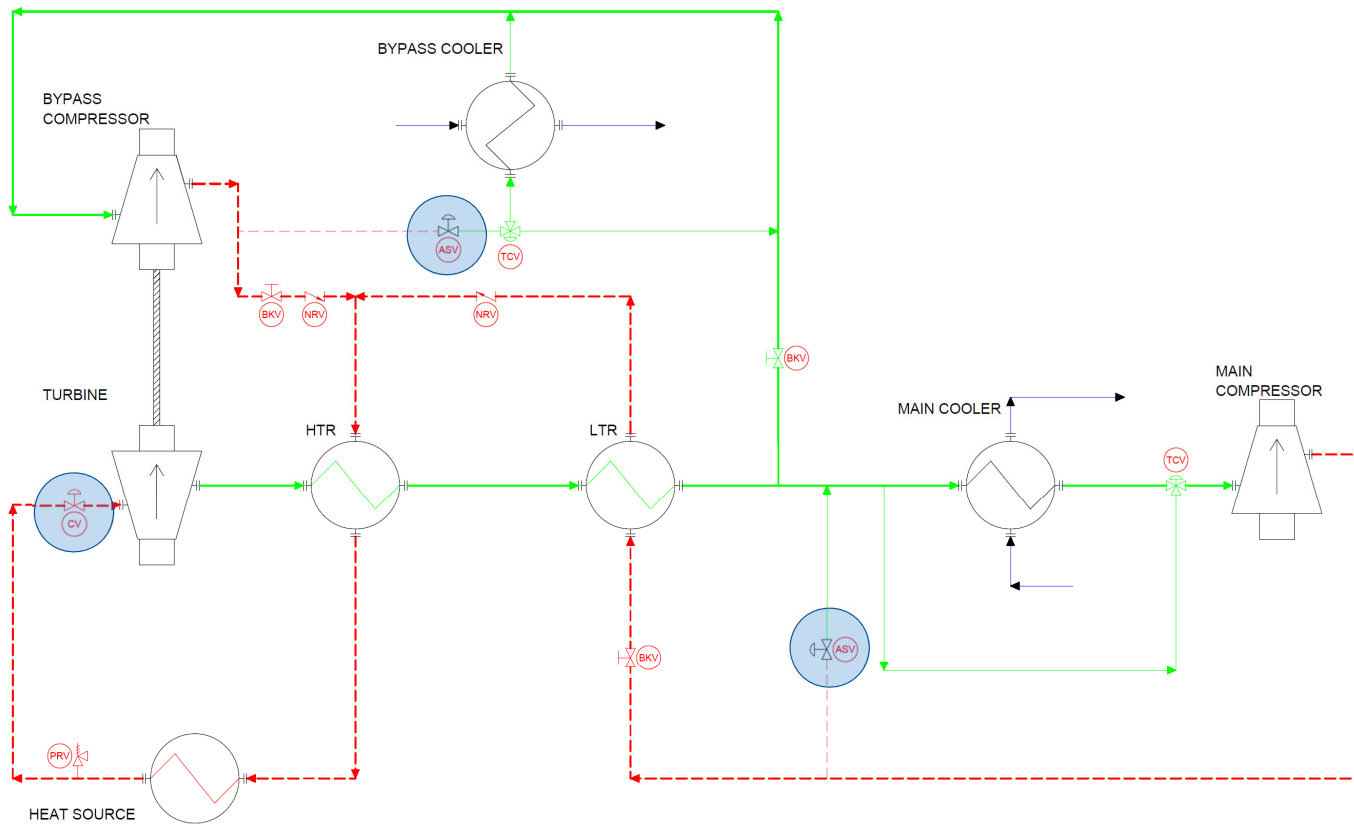


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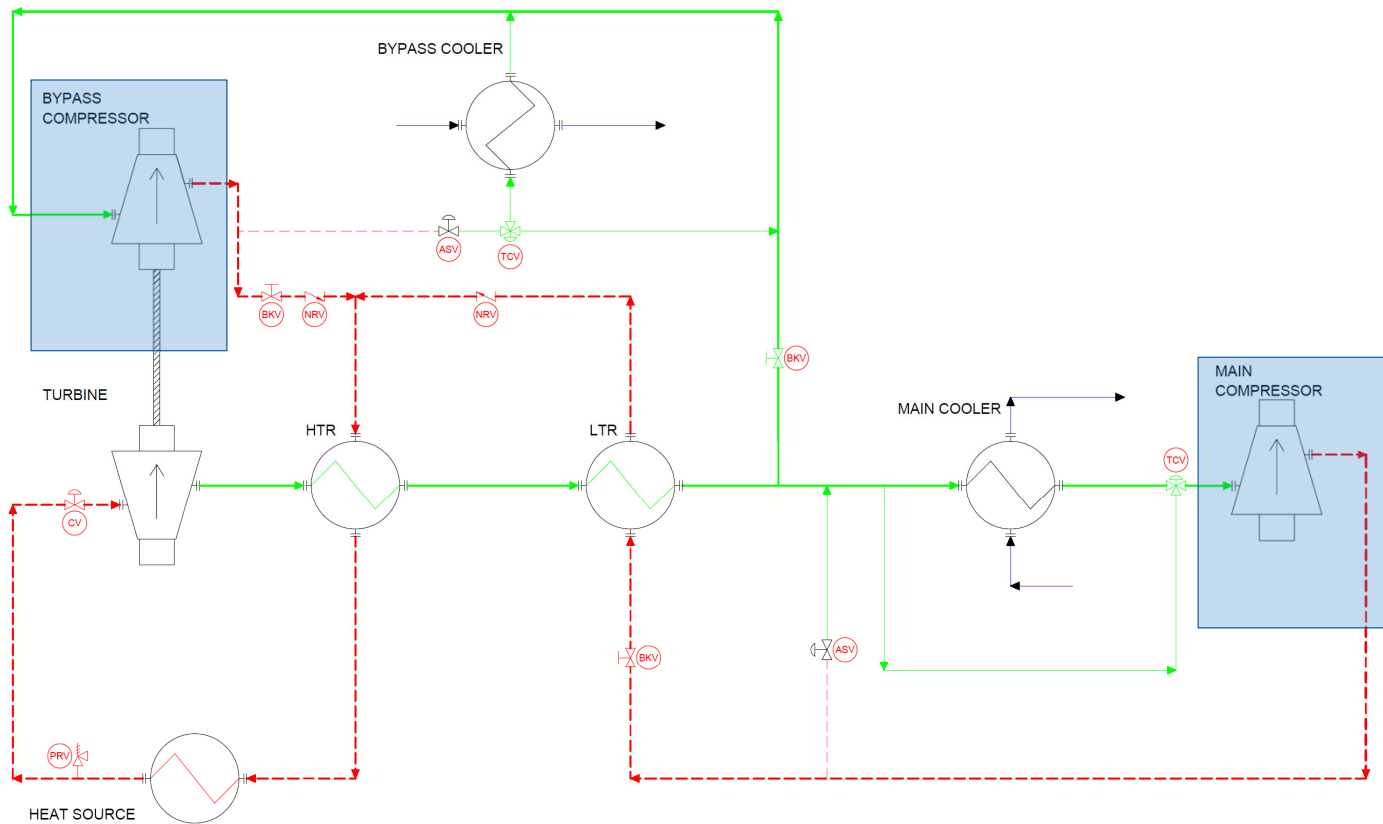
High Side Pressure



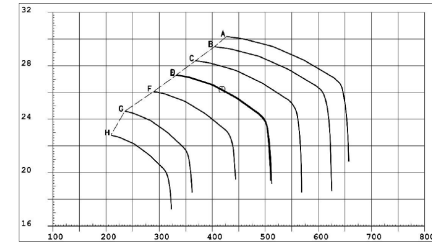
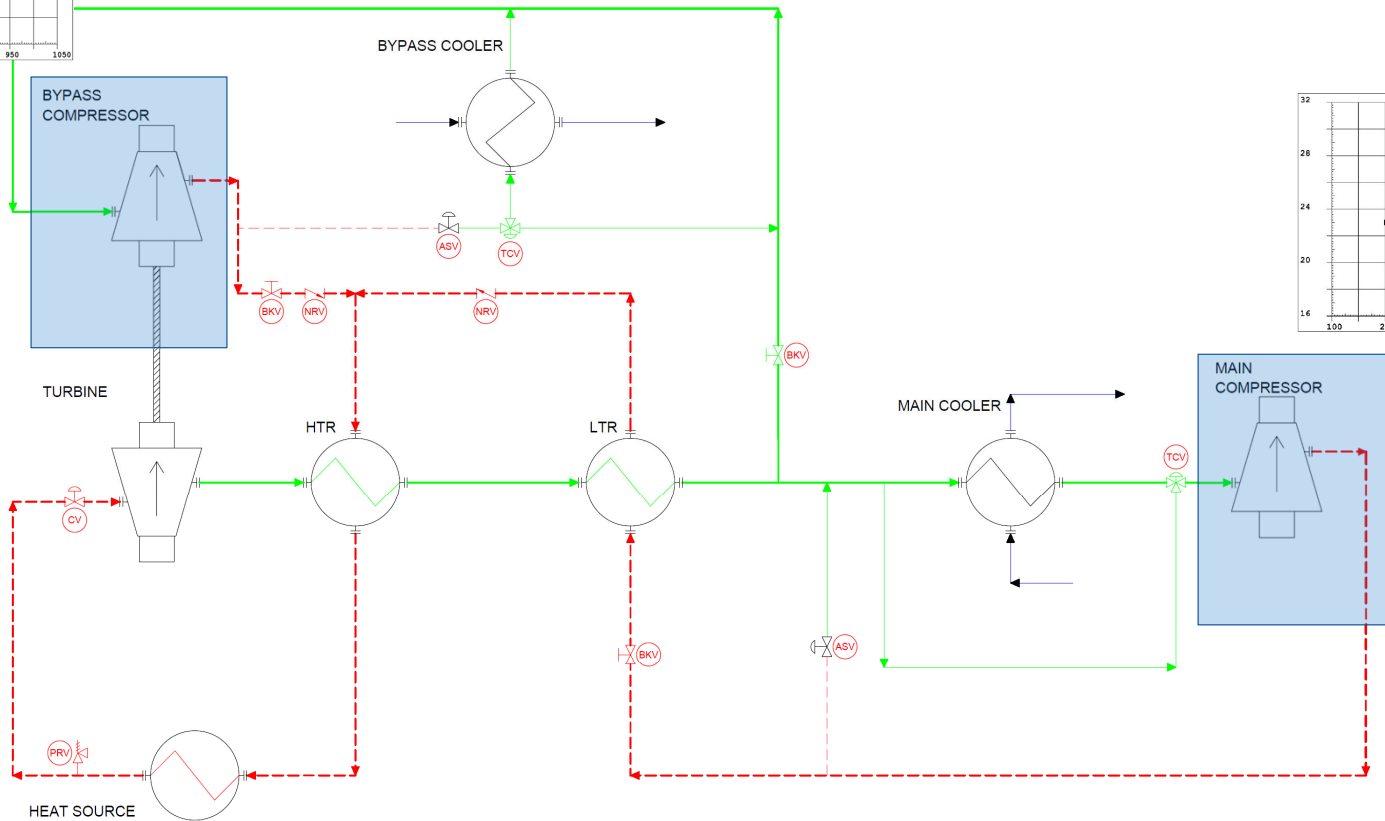
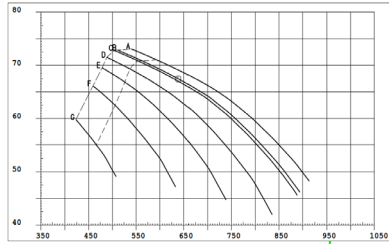
High Side Pressure



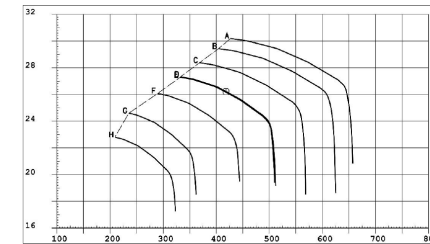
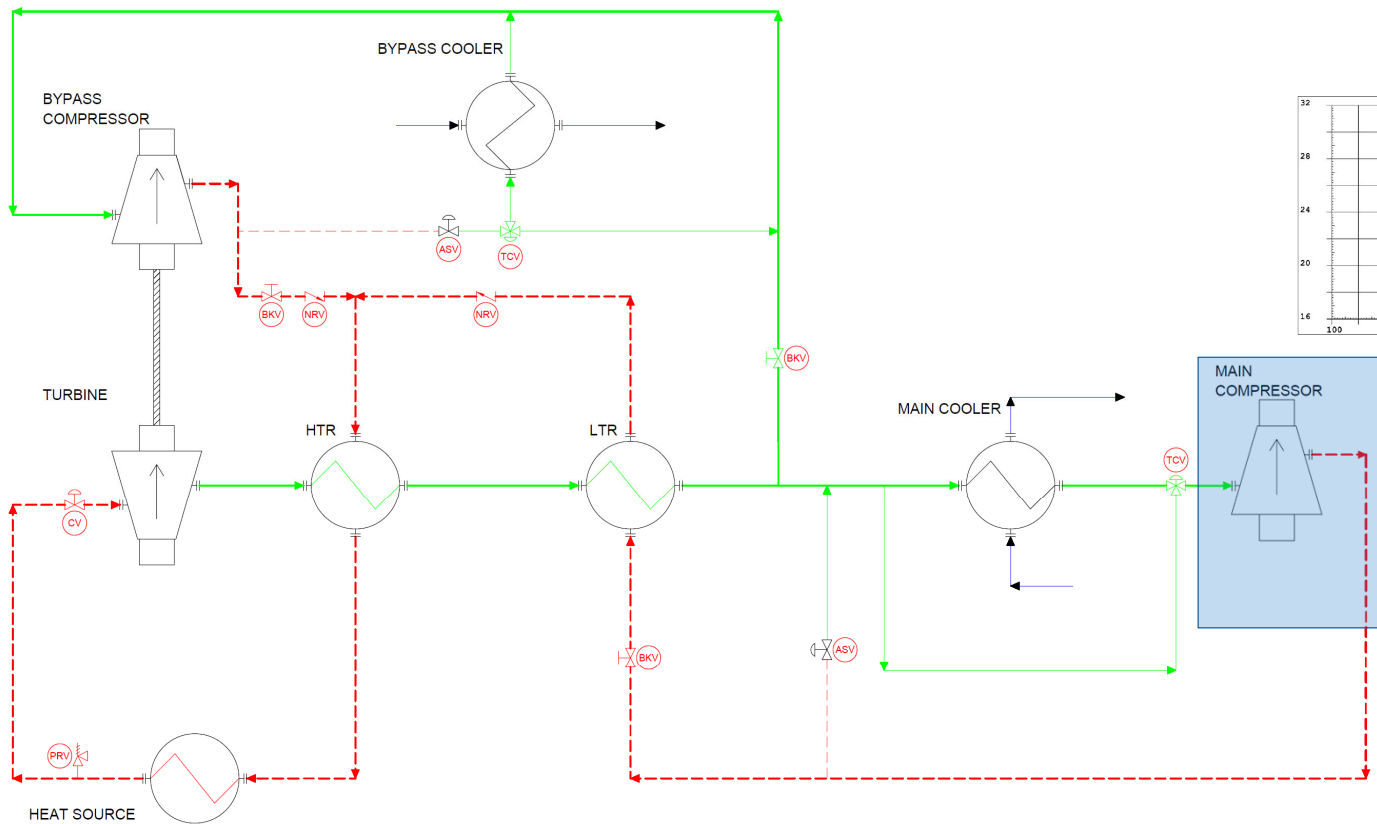
High Side Pressure



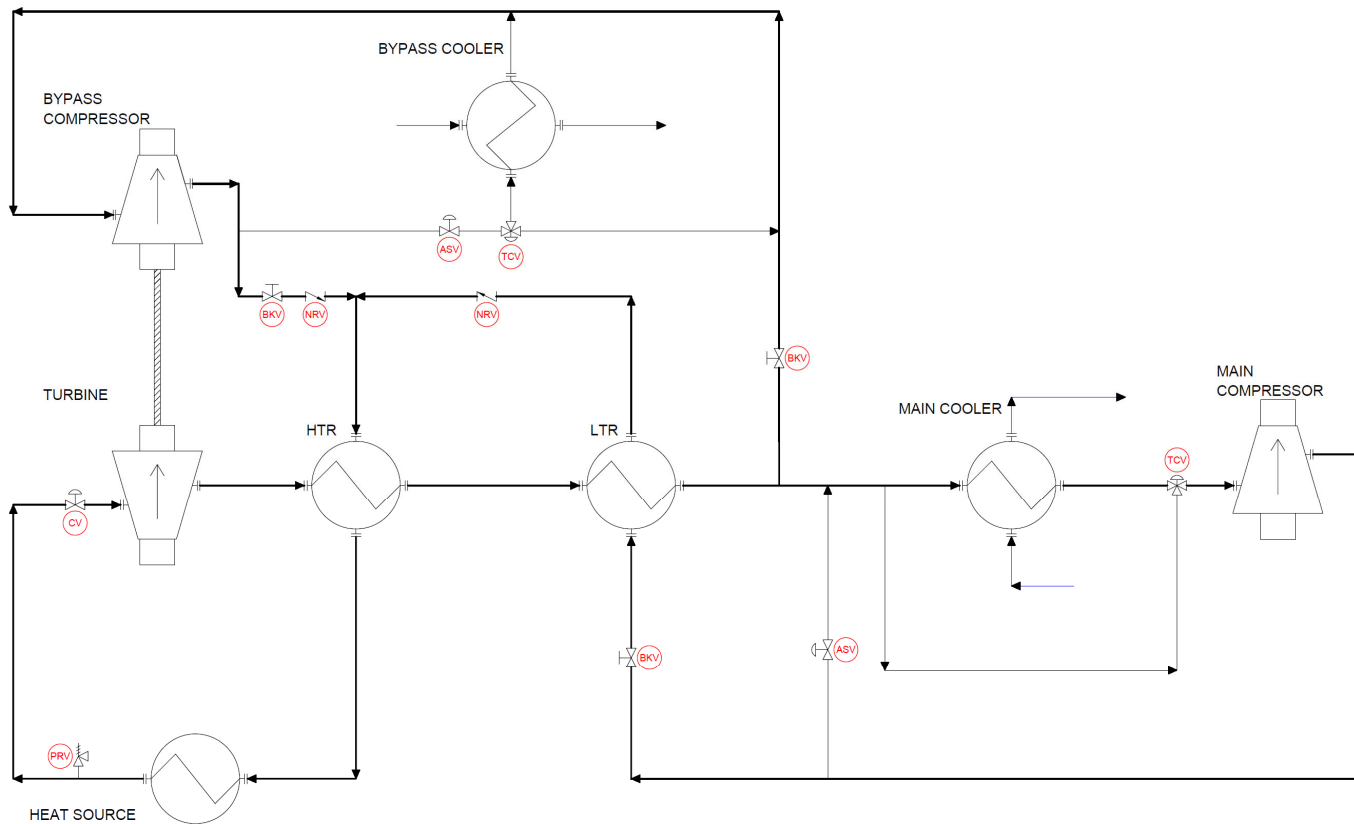
High Side Pressure



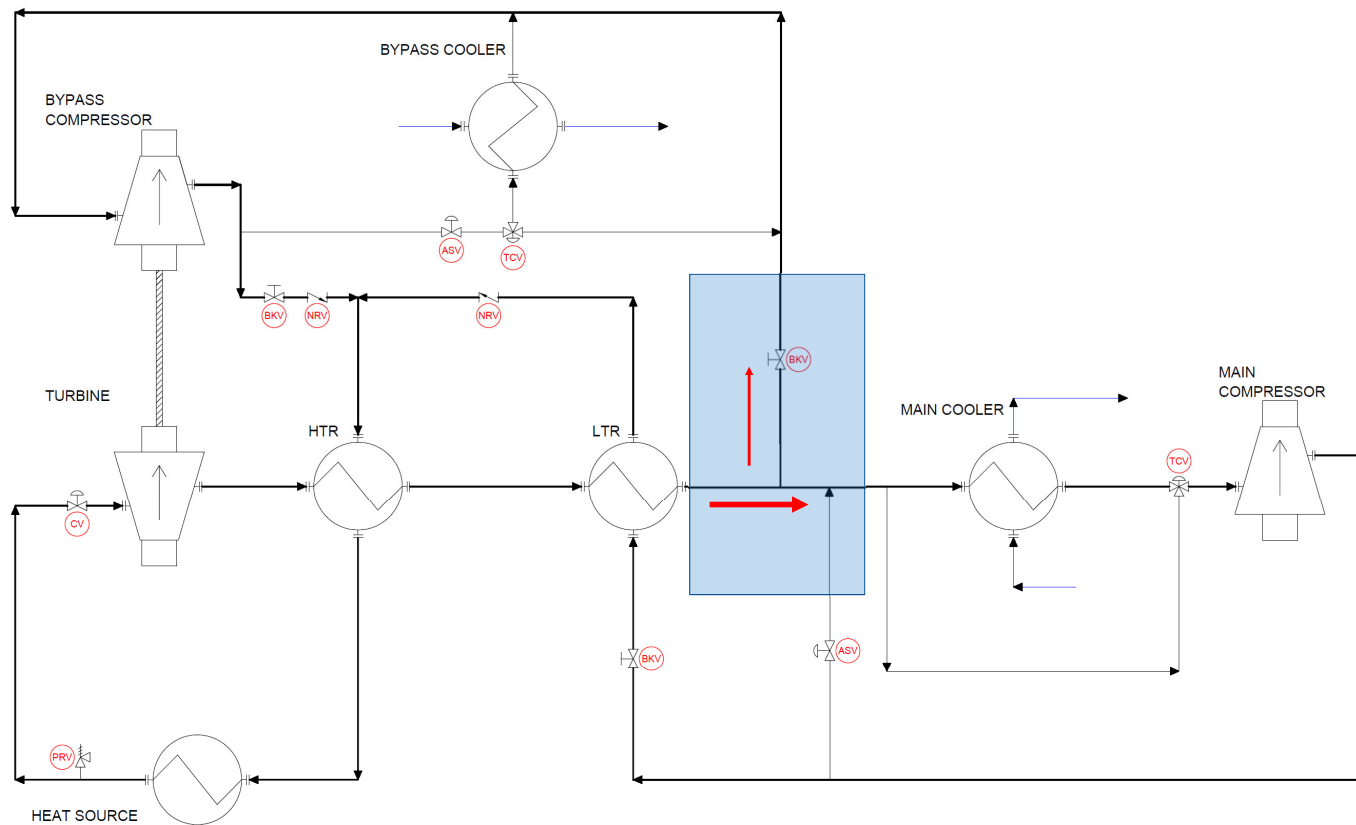
High Side Pressure



Mass Flow Split Fraction

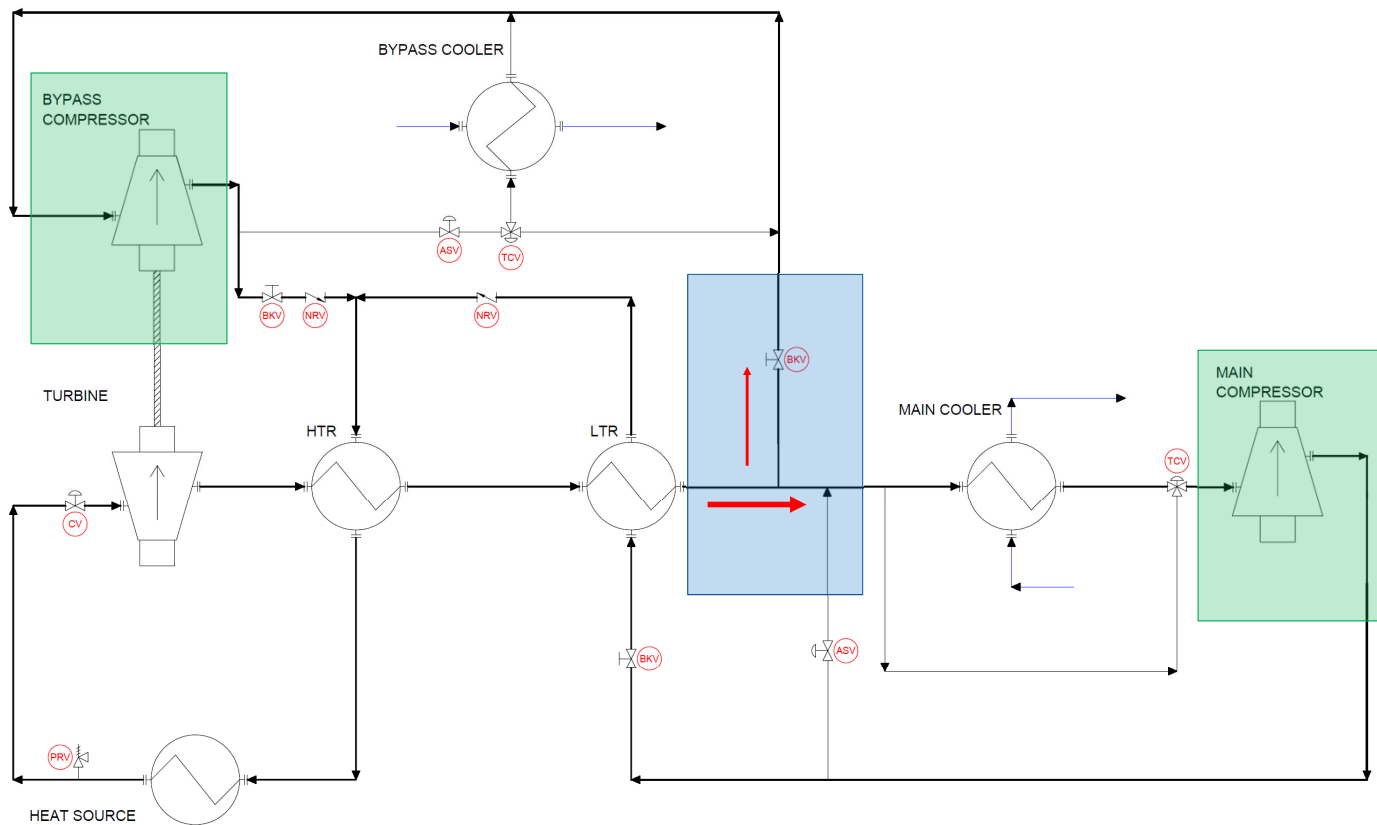


Mass Flow Split Fraction

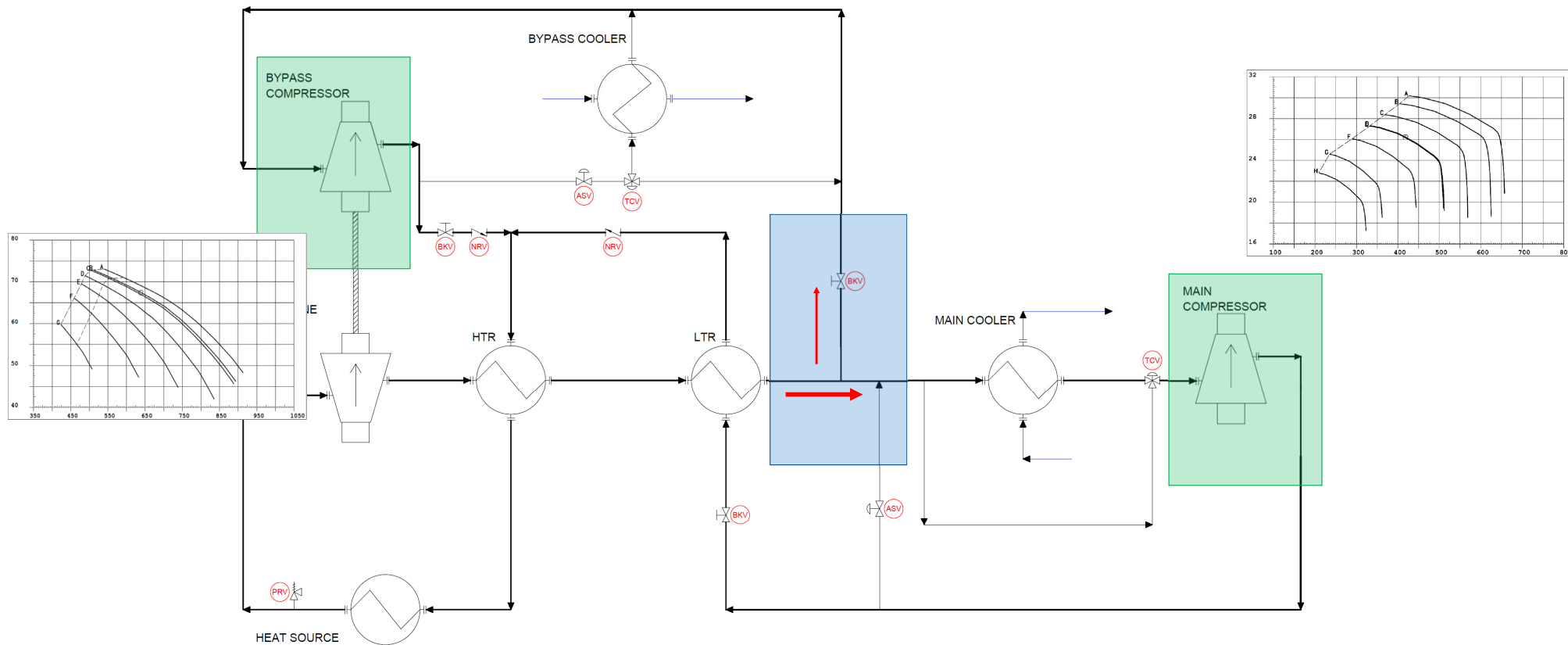


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Mass Flow Split Fraction

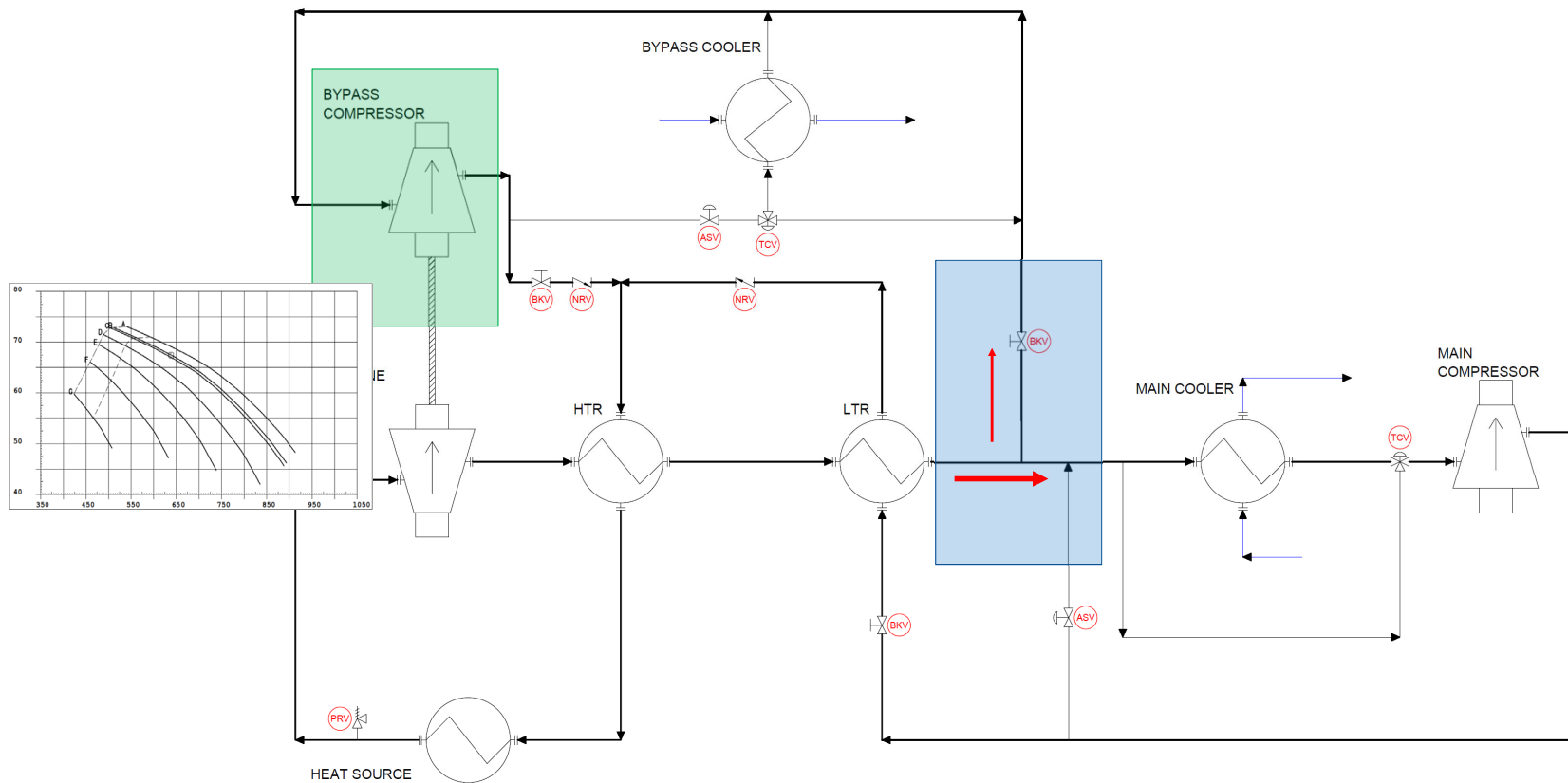


Mass Flow Split Fraction



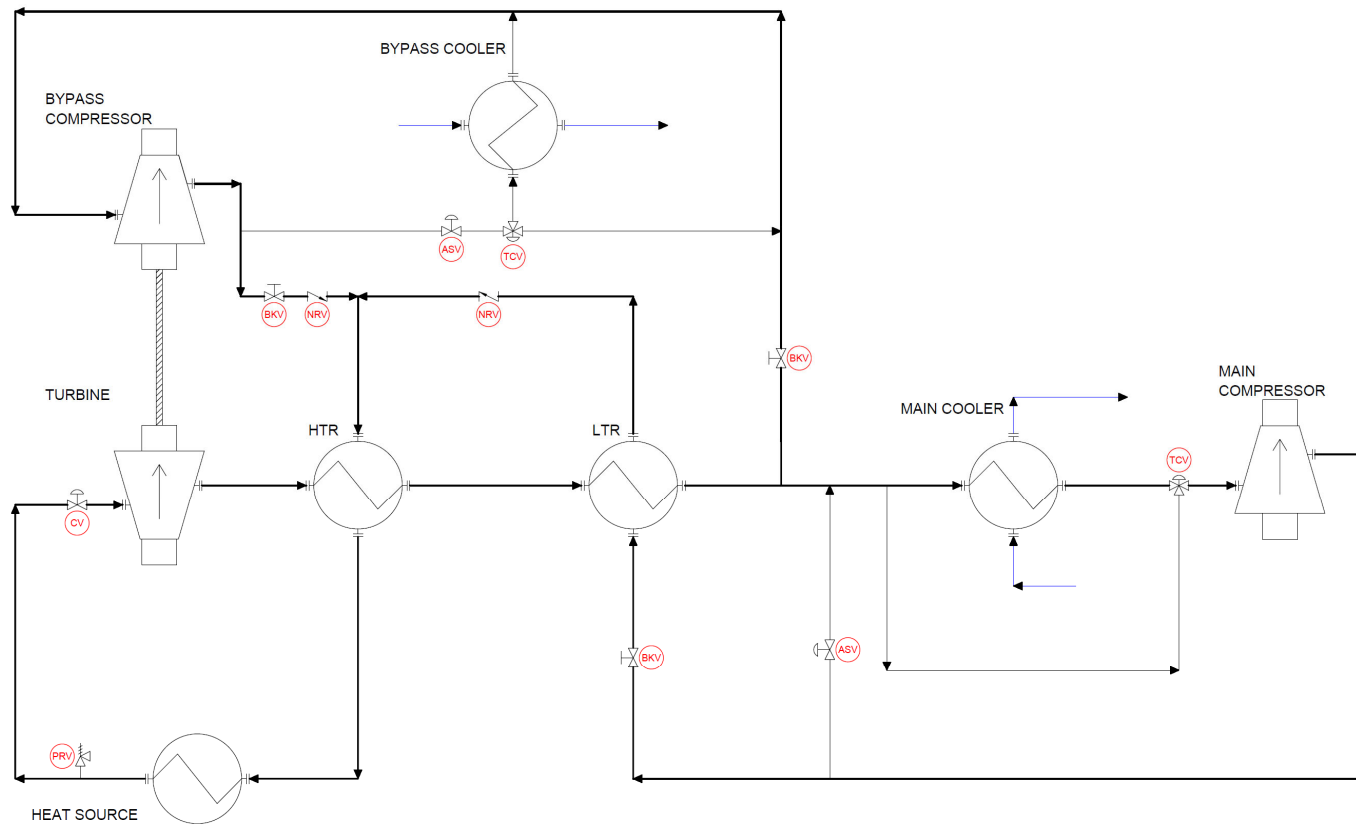
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Mass Flow Split Fraction



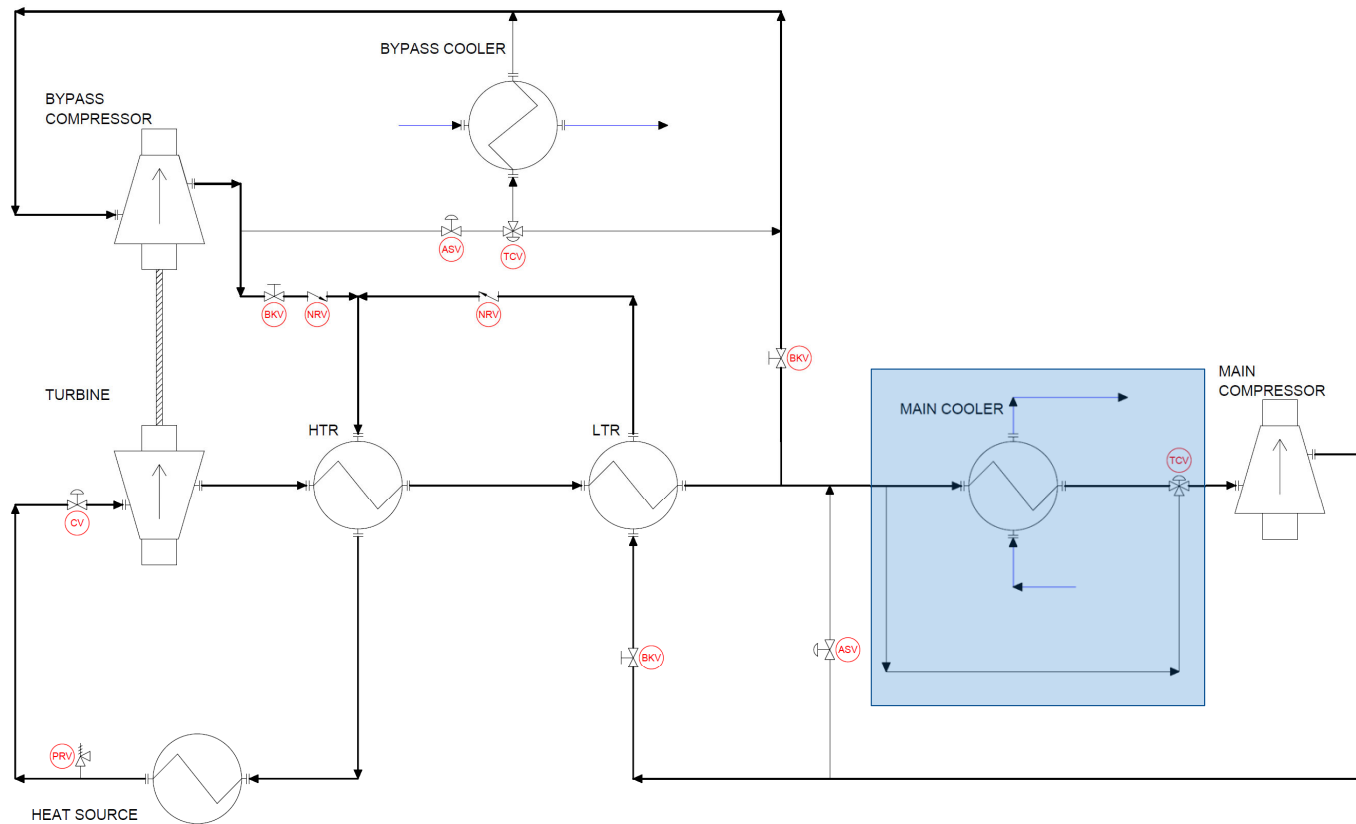
The 7th International Supercritical CO₂ Power Cycles • February 21 – 24, 2022 • San Antonio, TX, USA

Main Compressor Suction Temperature

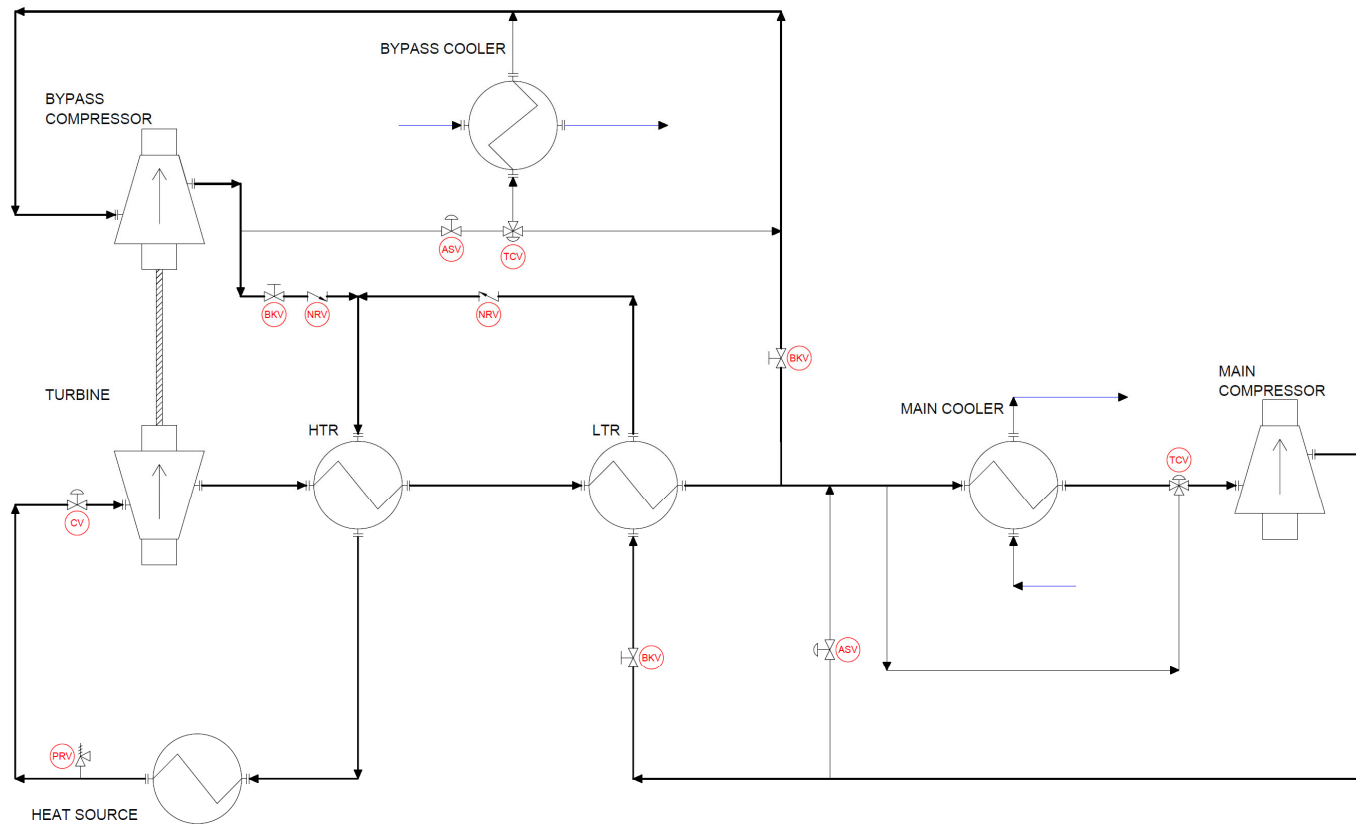


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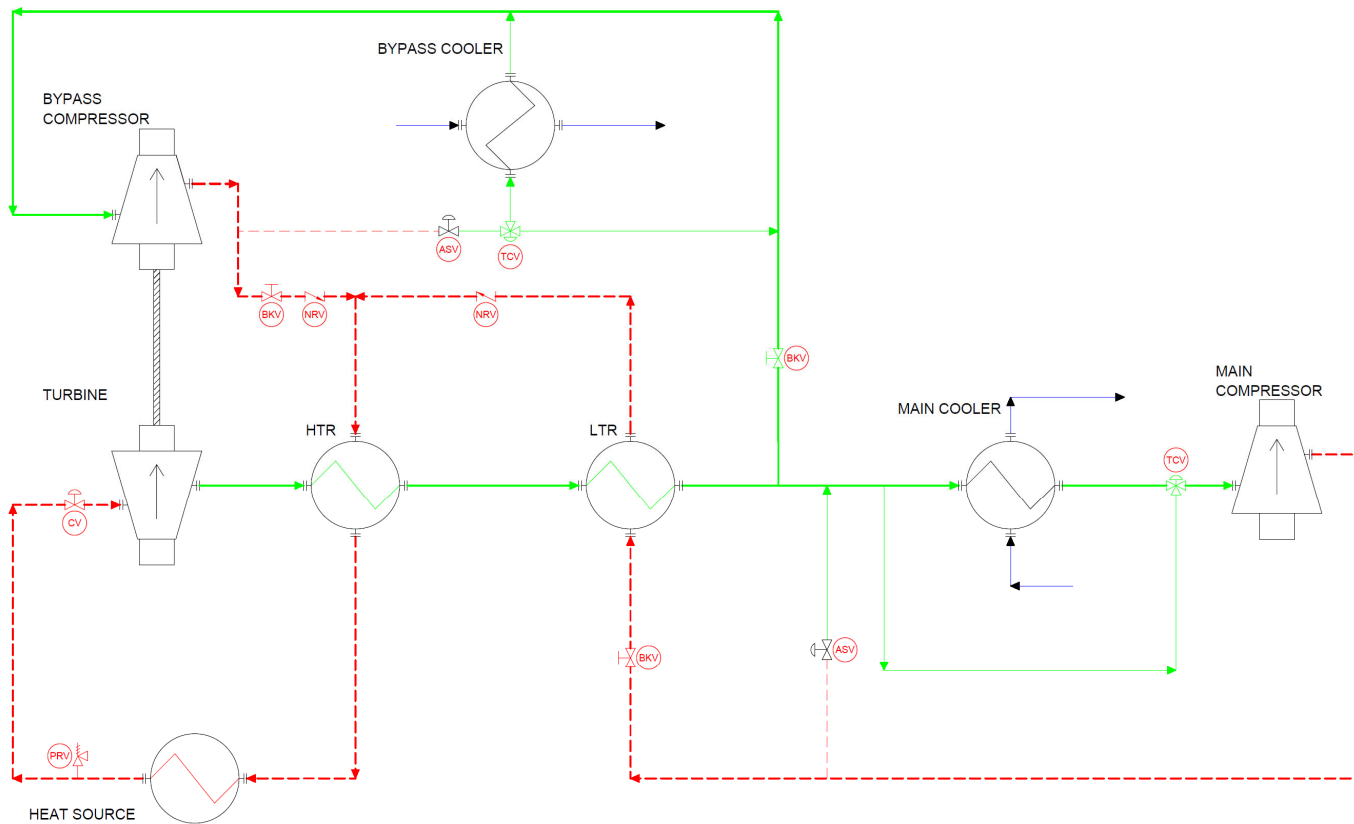
Main Compressor Suction Temperature



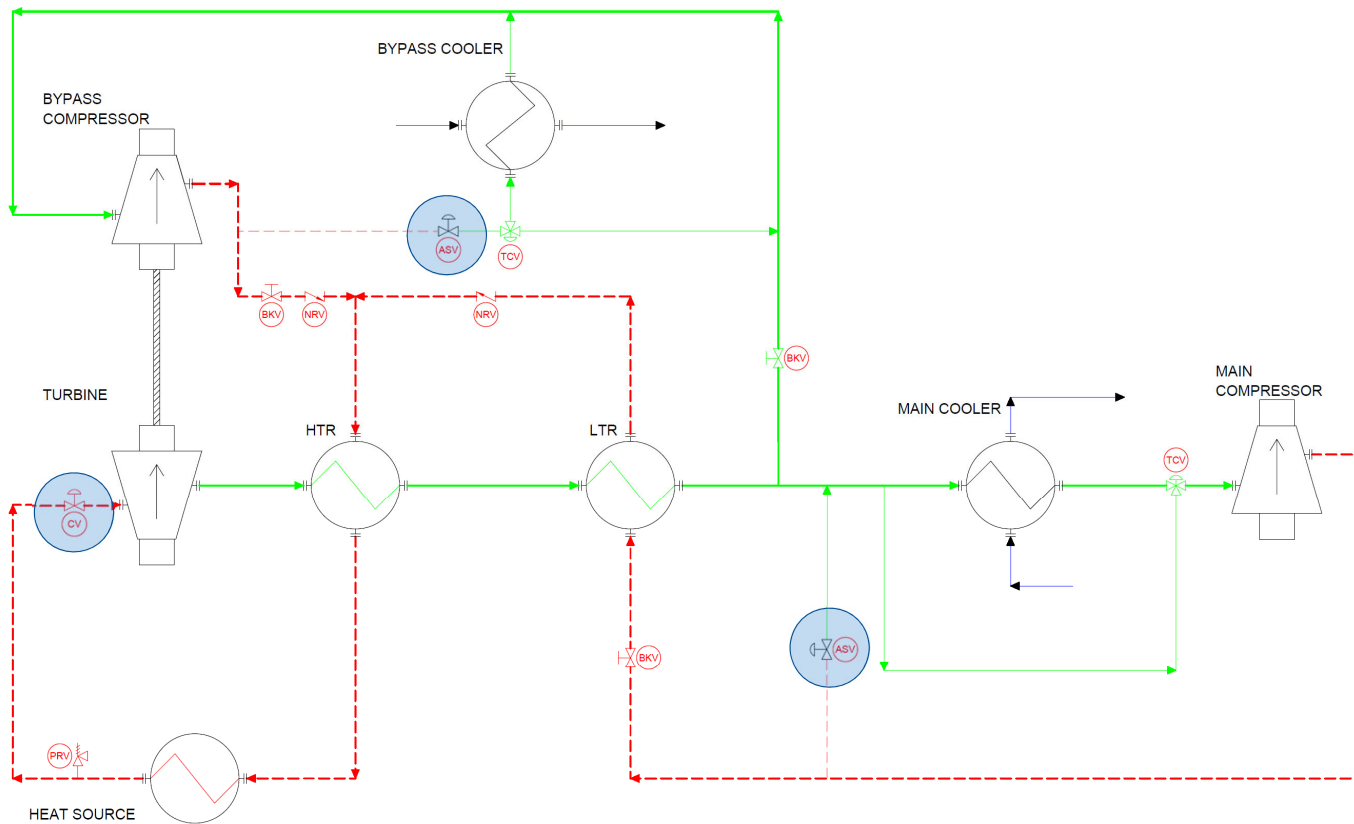
Low Side Pressure



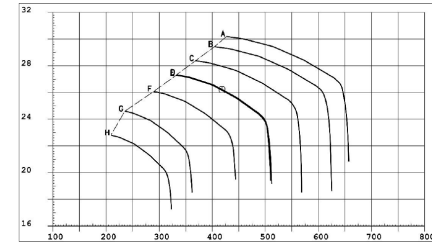
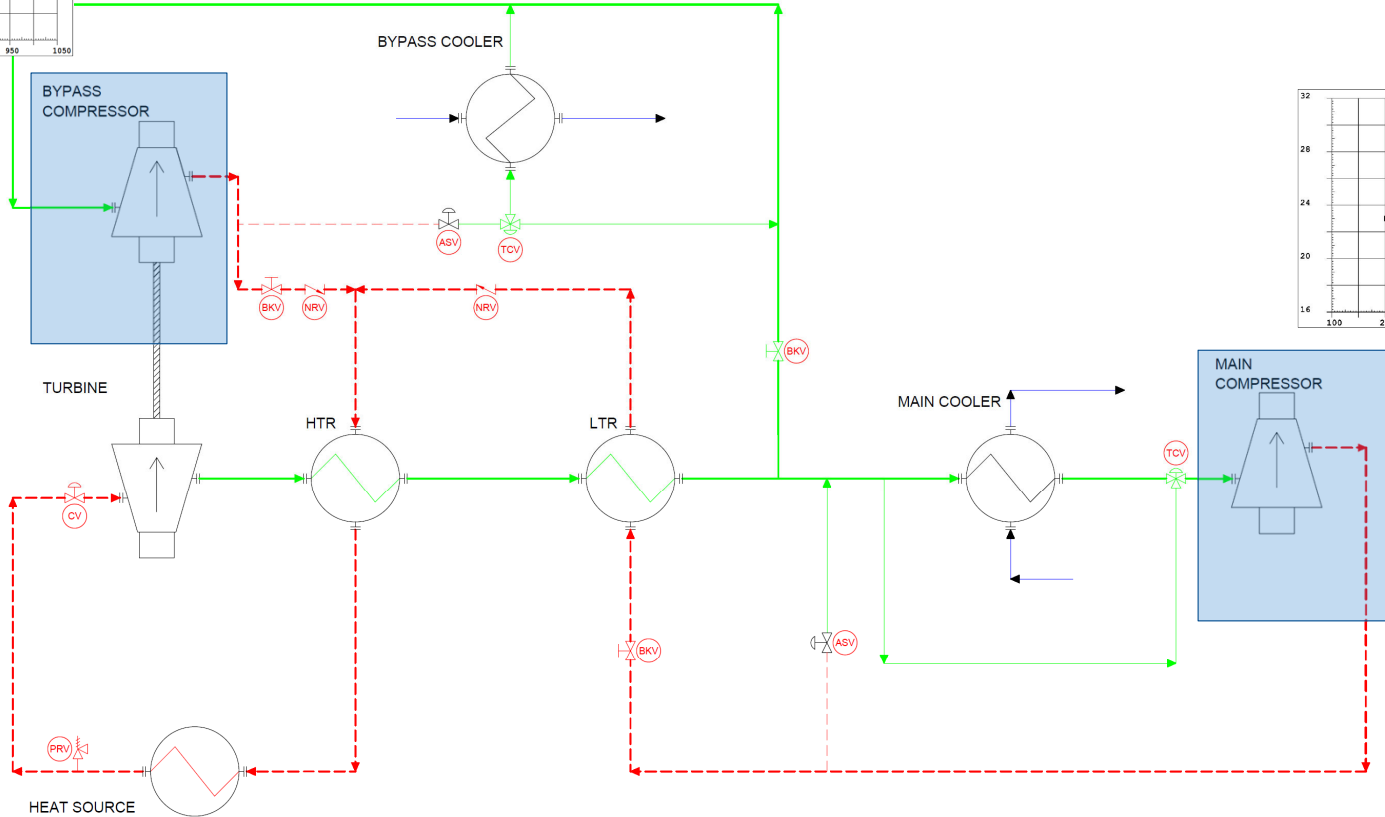
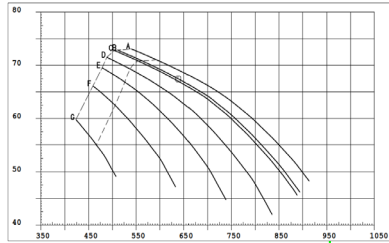
Low Side Pressure



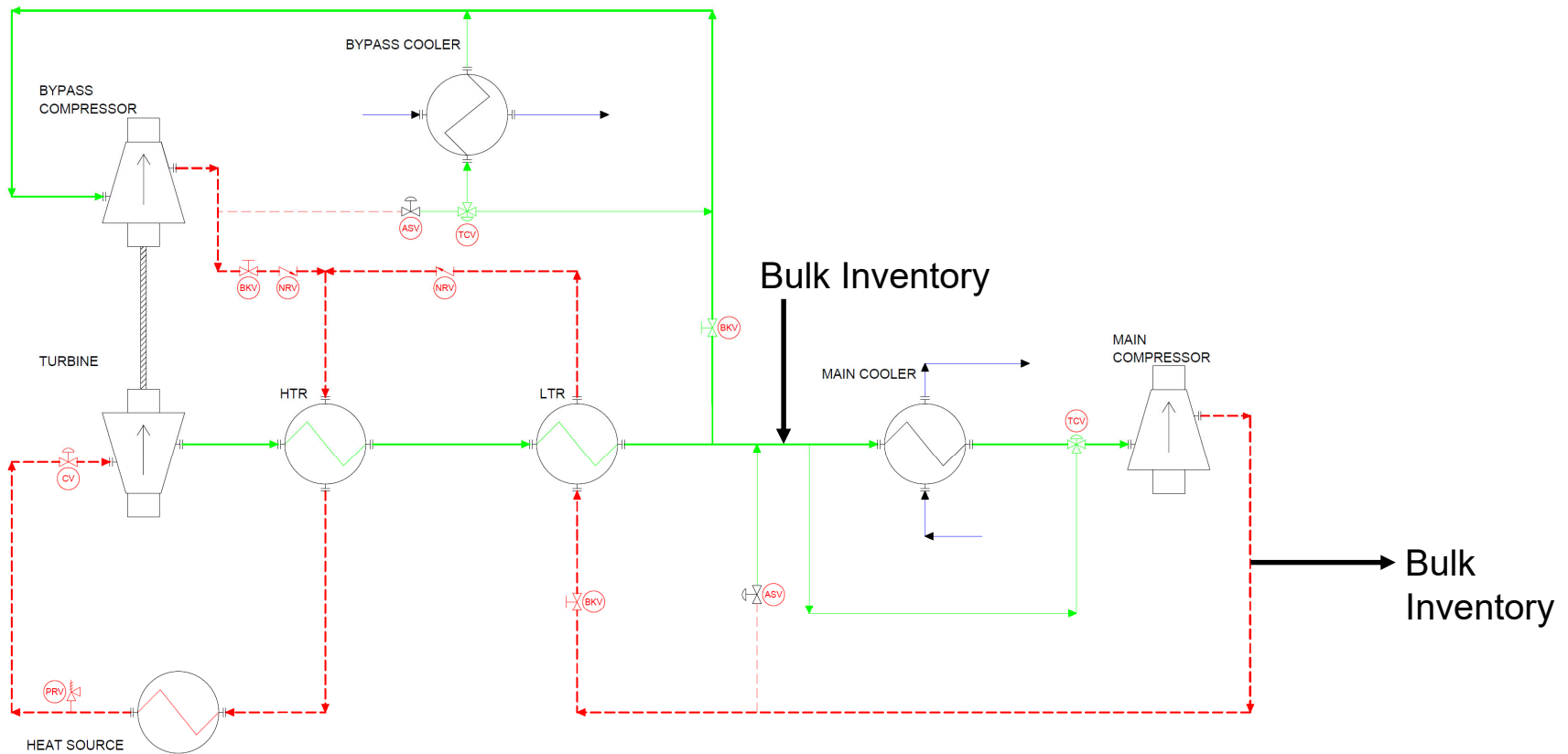
Low Side Pressure



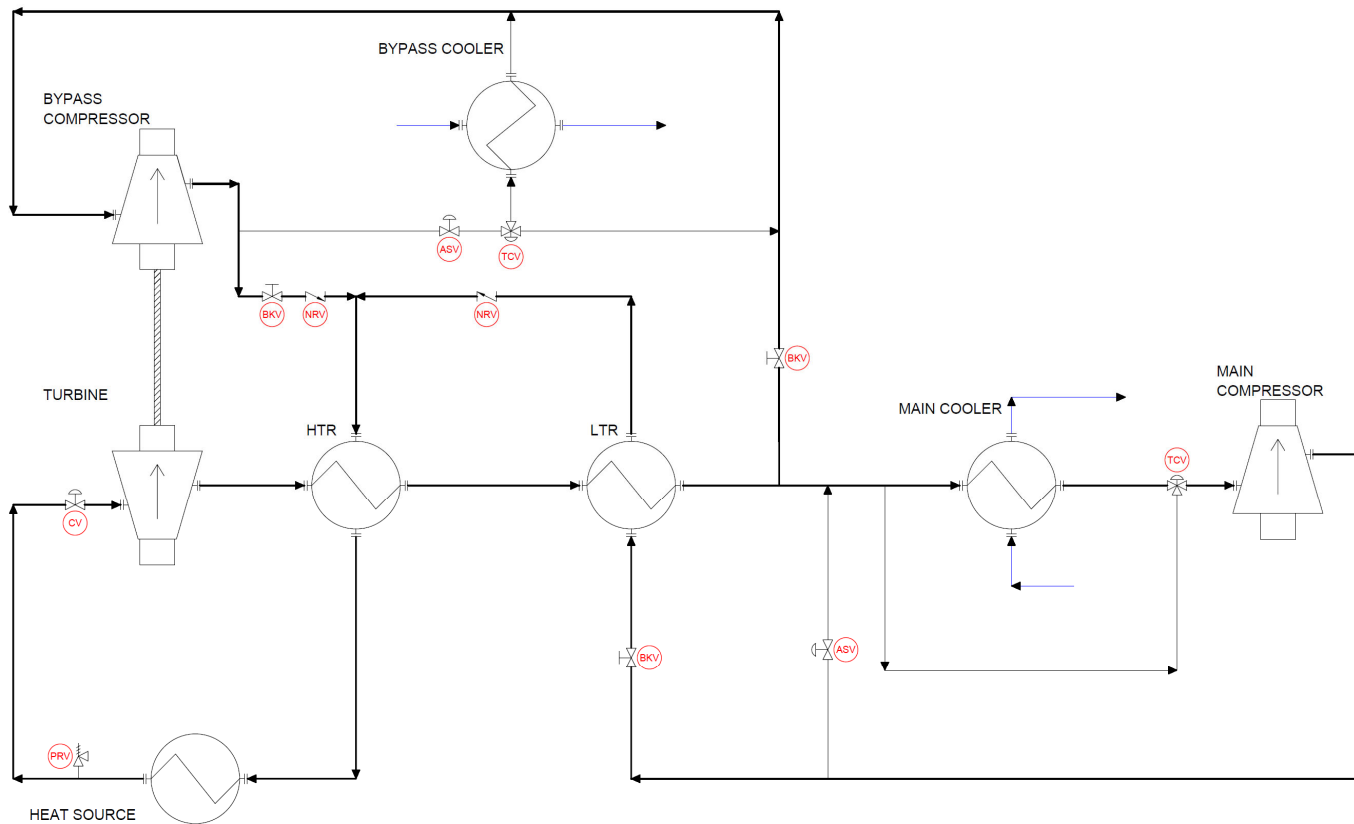
Low Side Pressure



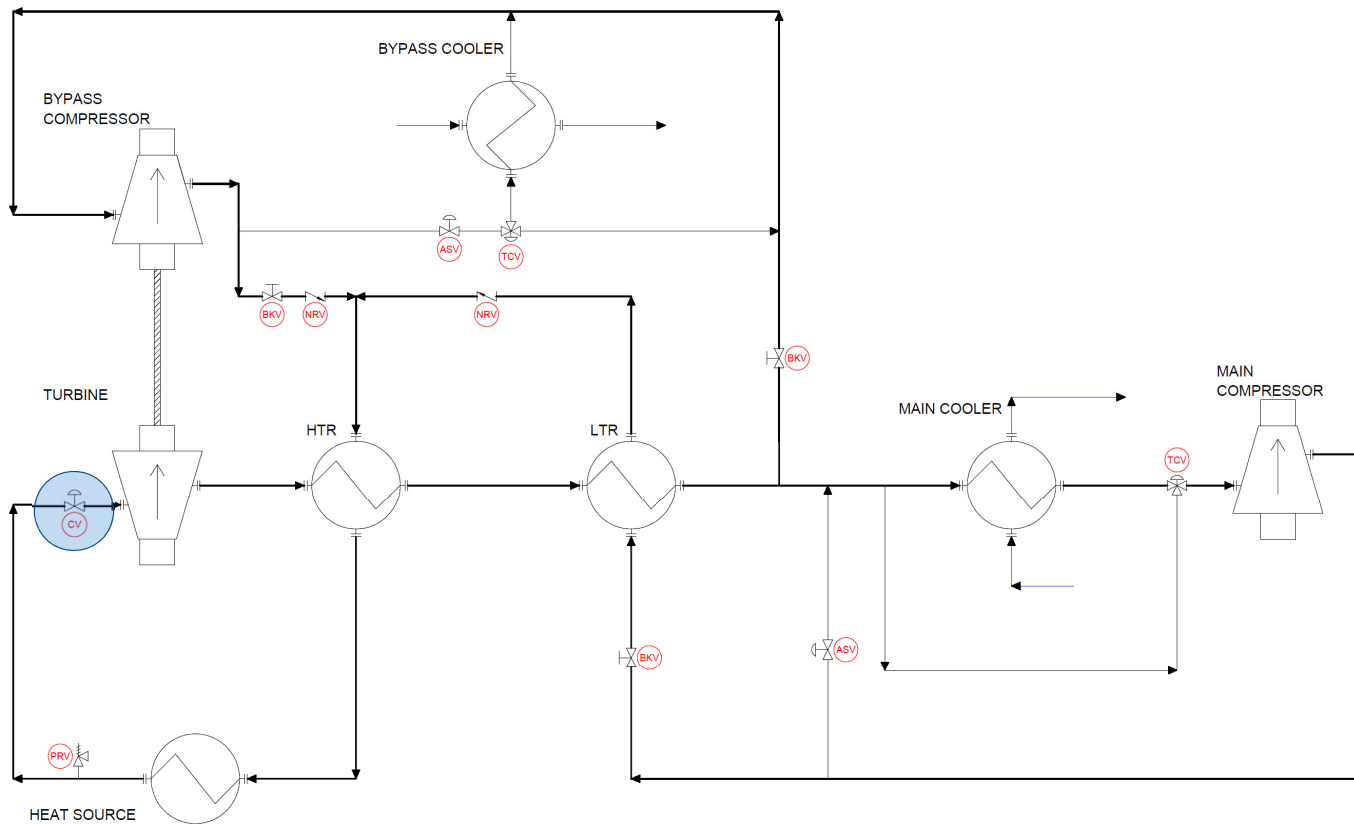
Low Side Pressure



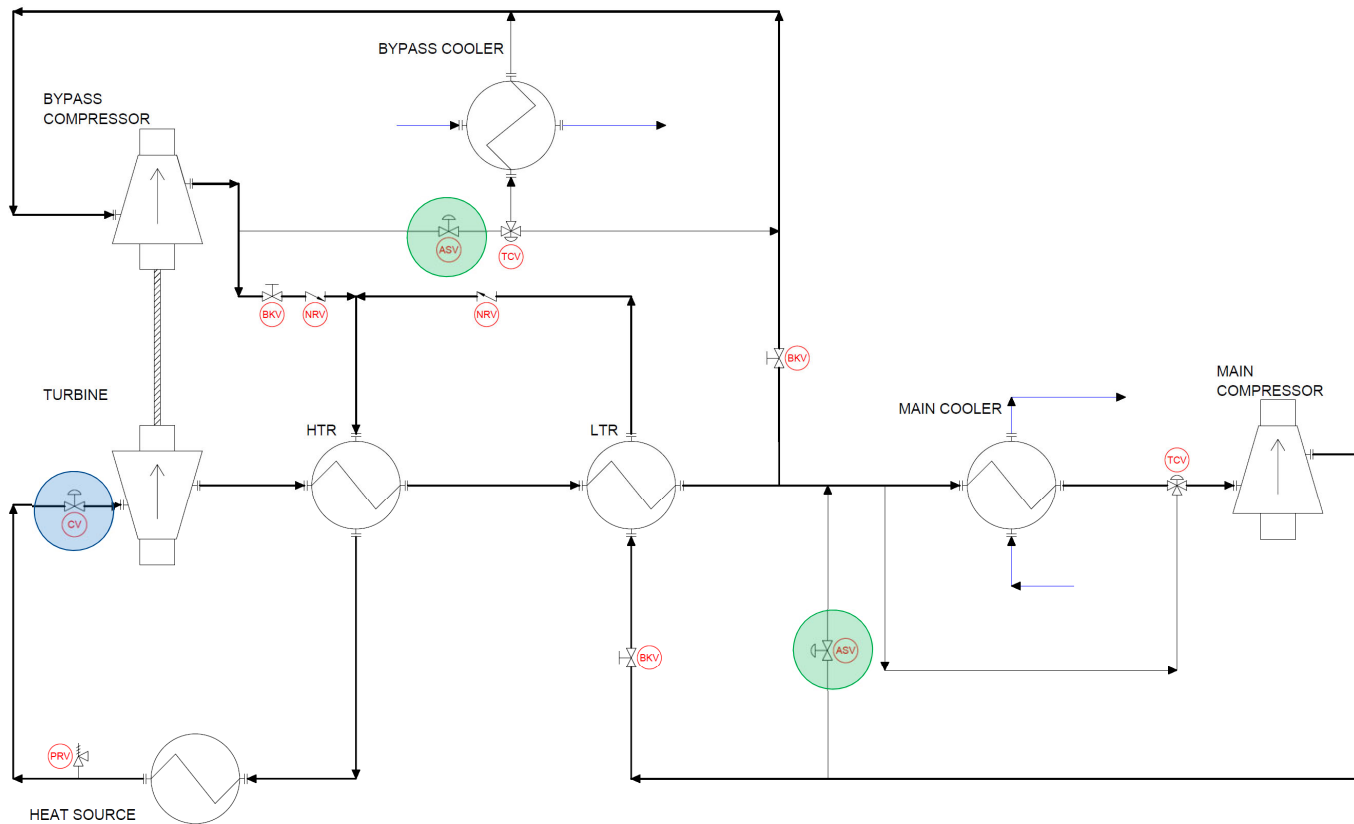
Transient Variables



Transient Variables



Transient Variables

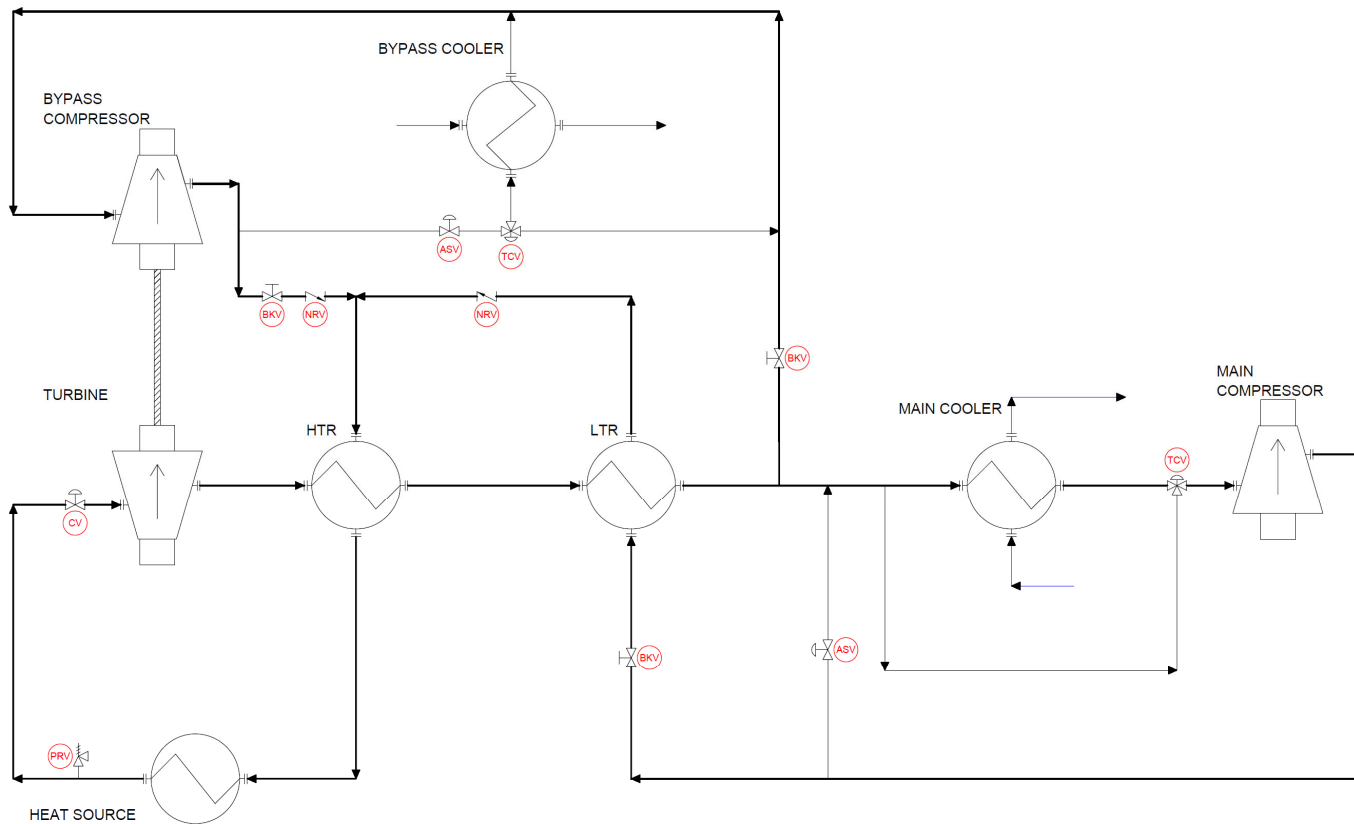


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EQUIPMENT PROTECTION

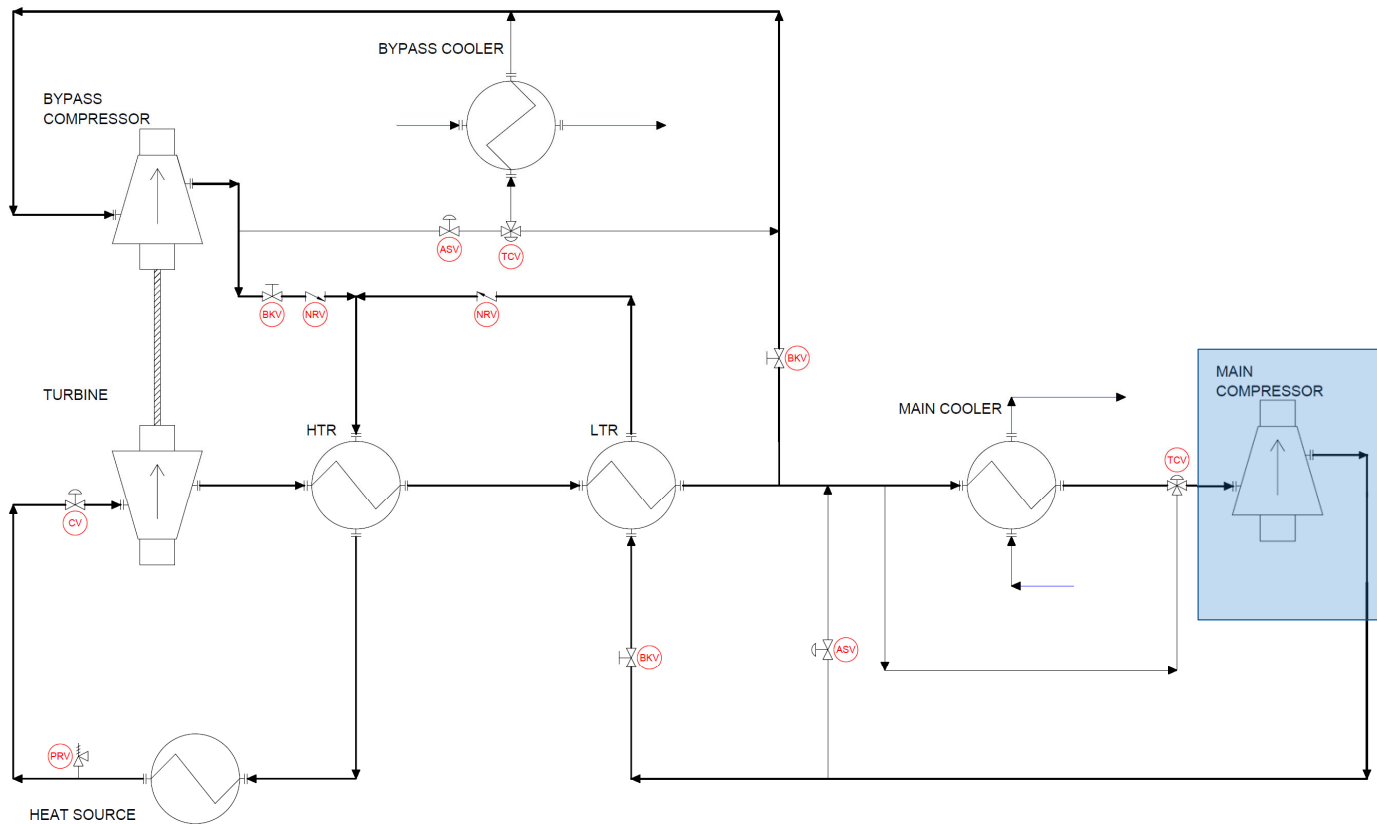
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Main Compressor



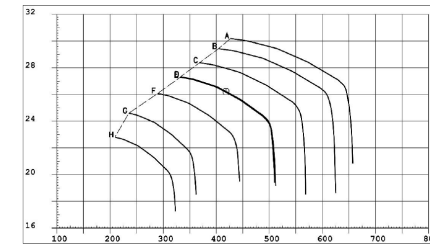
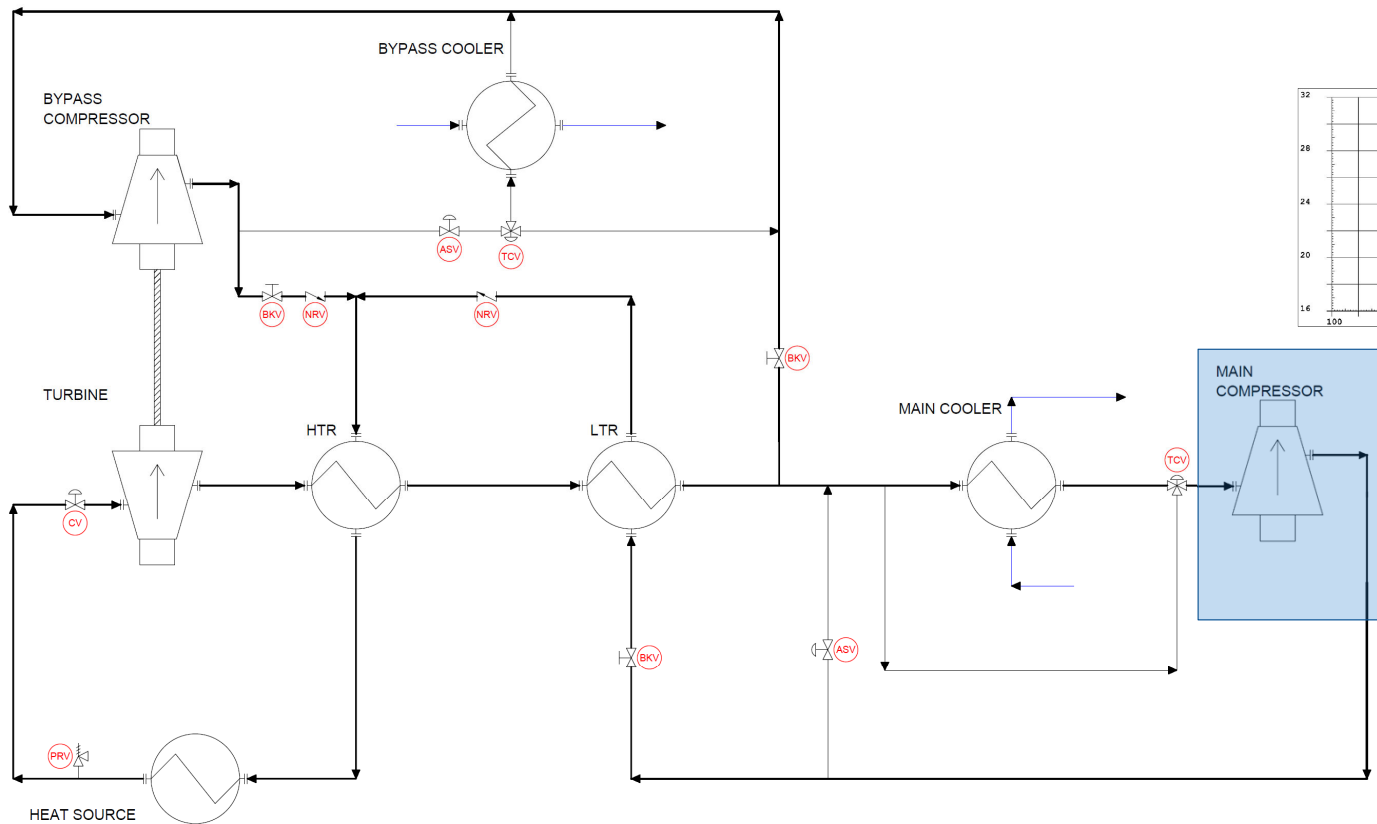
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Main Compressor

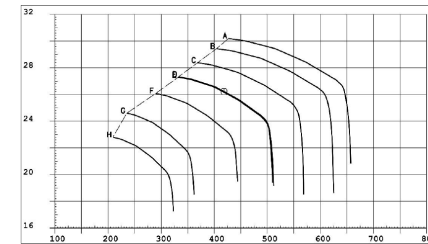
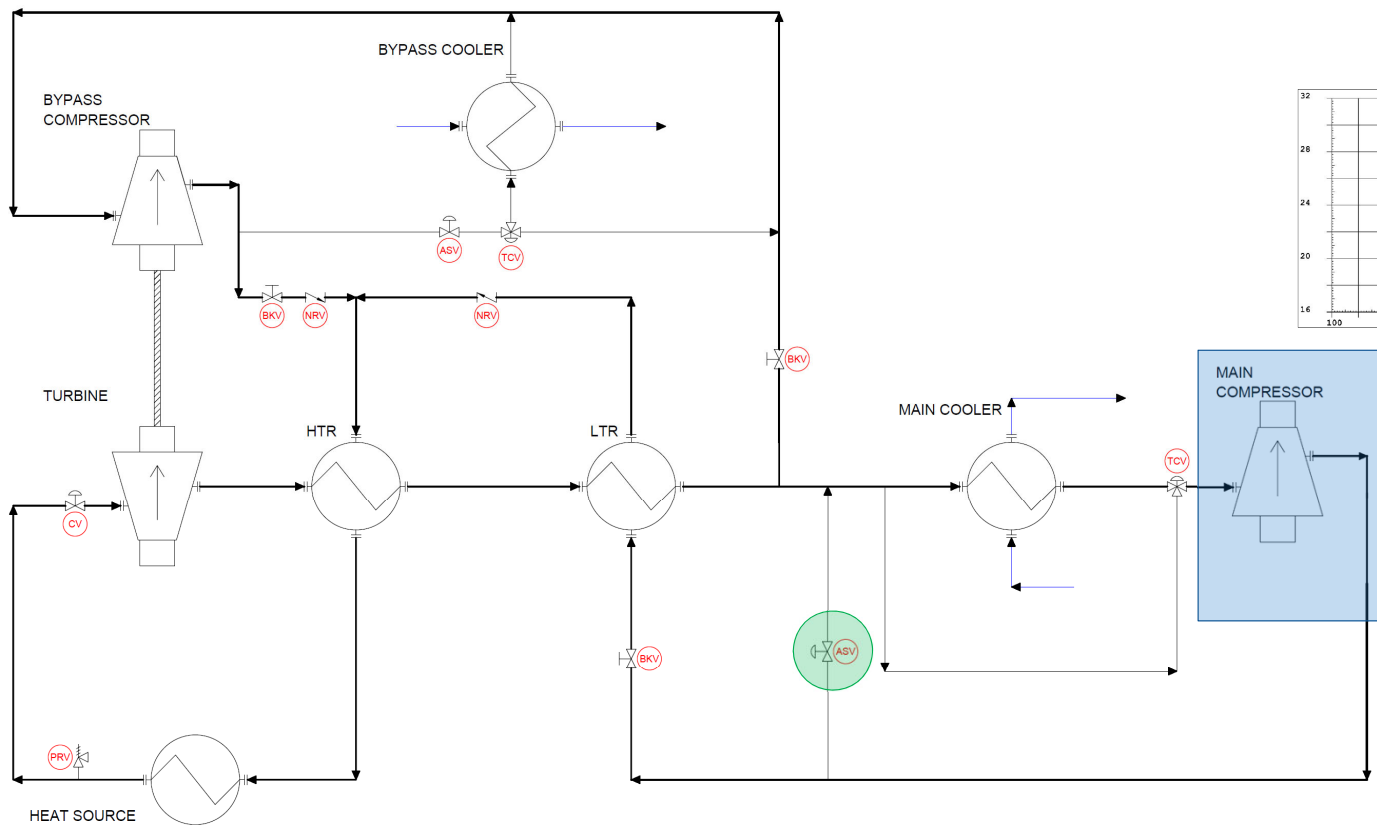


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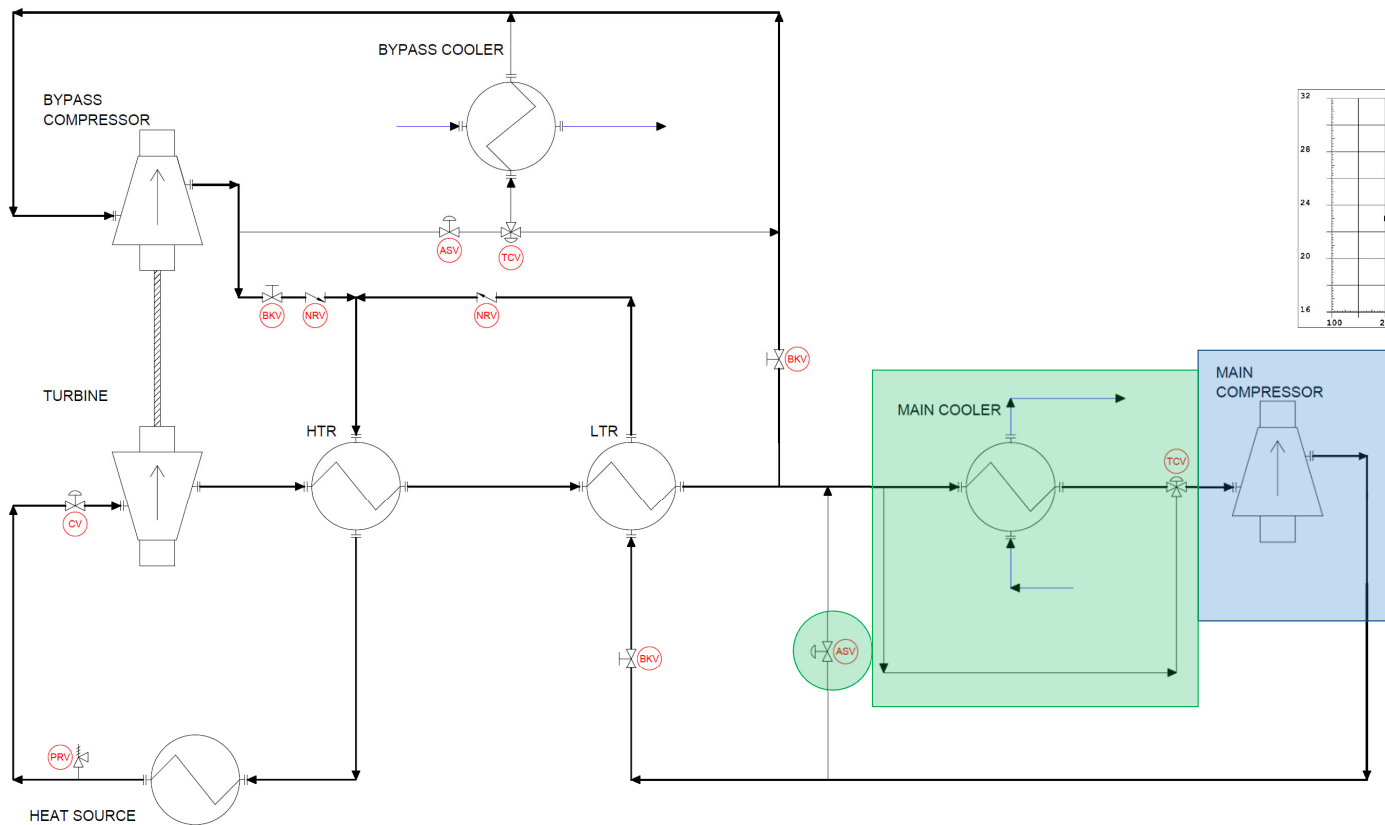
Main Compressor



Main Compressor

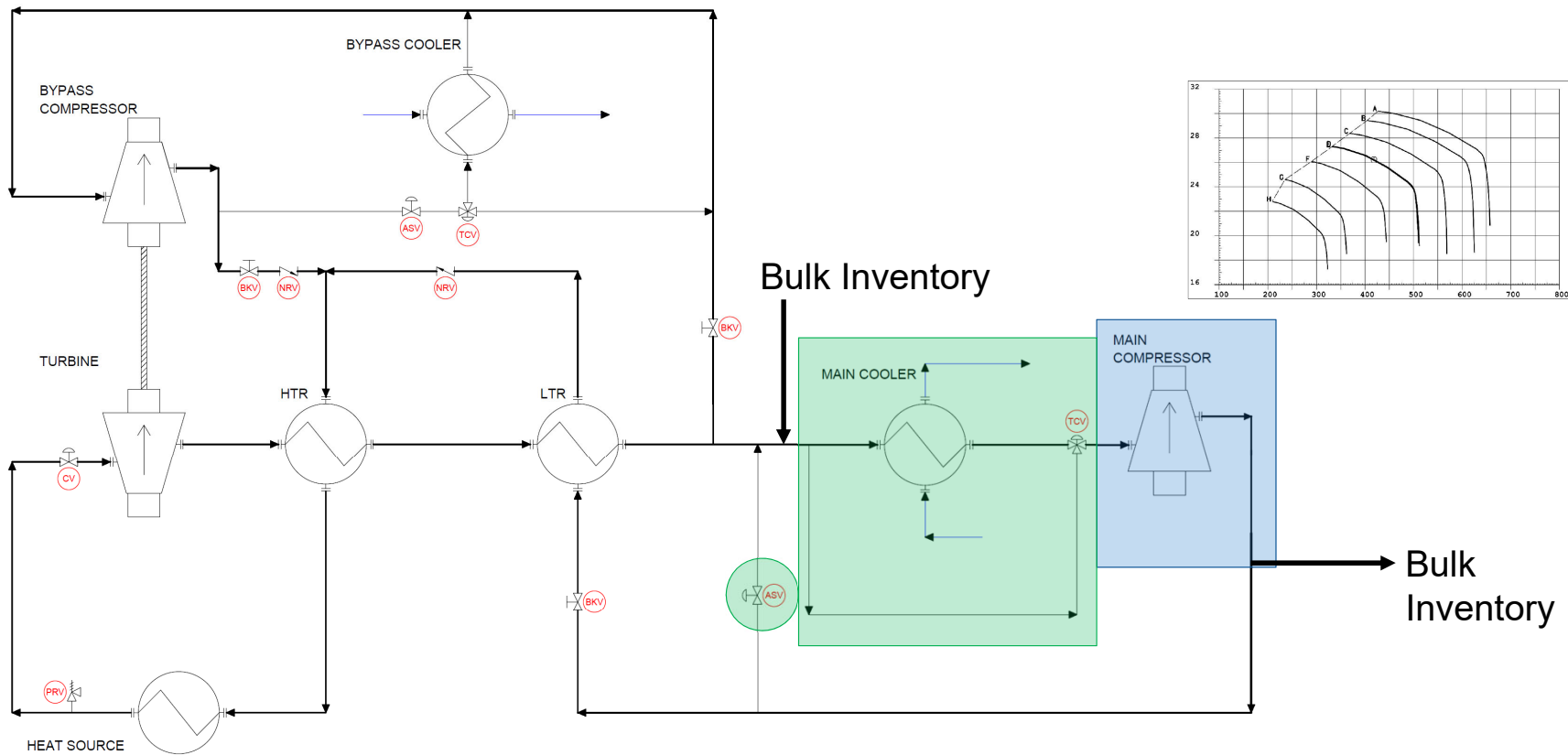


Main Compressor



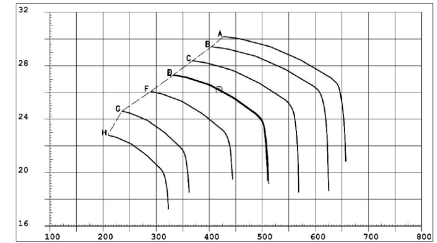
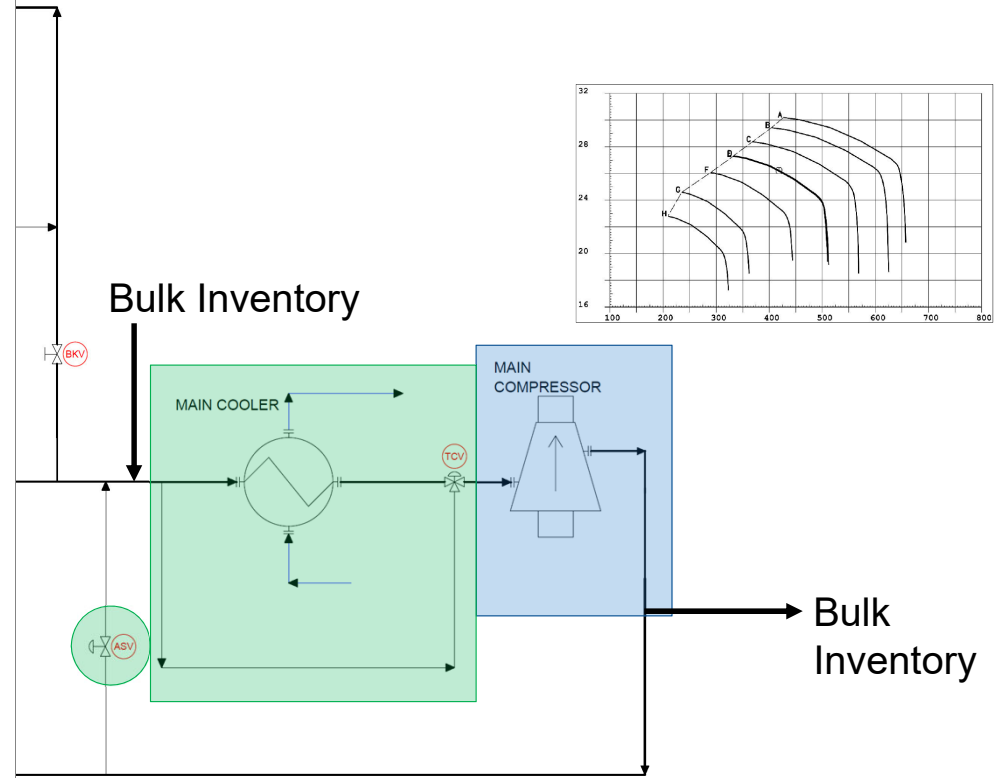
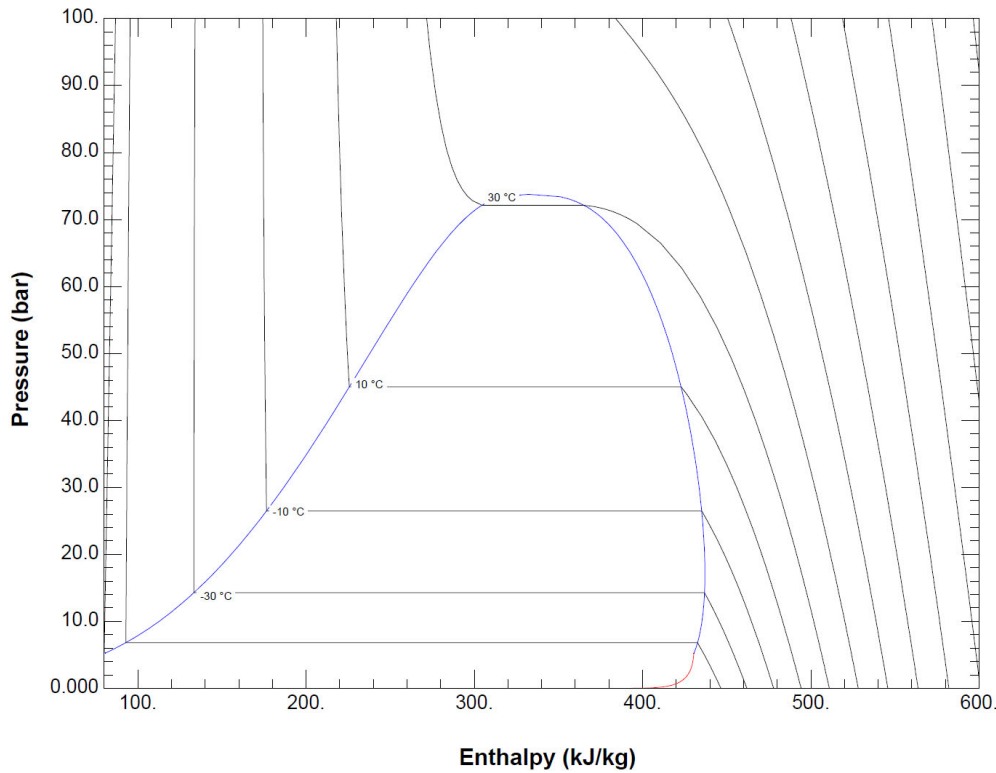
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Main Compressor

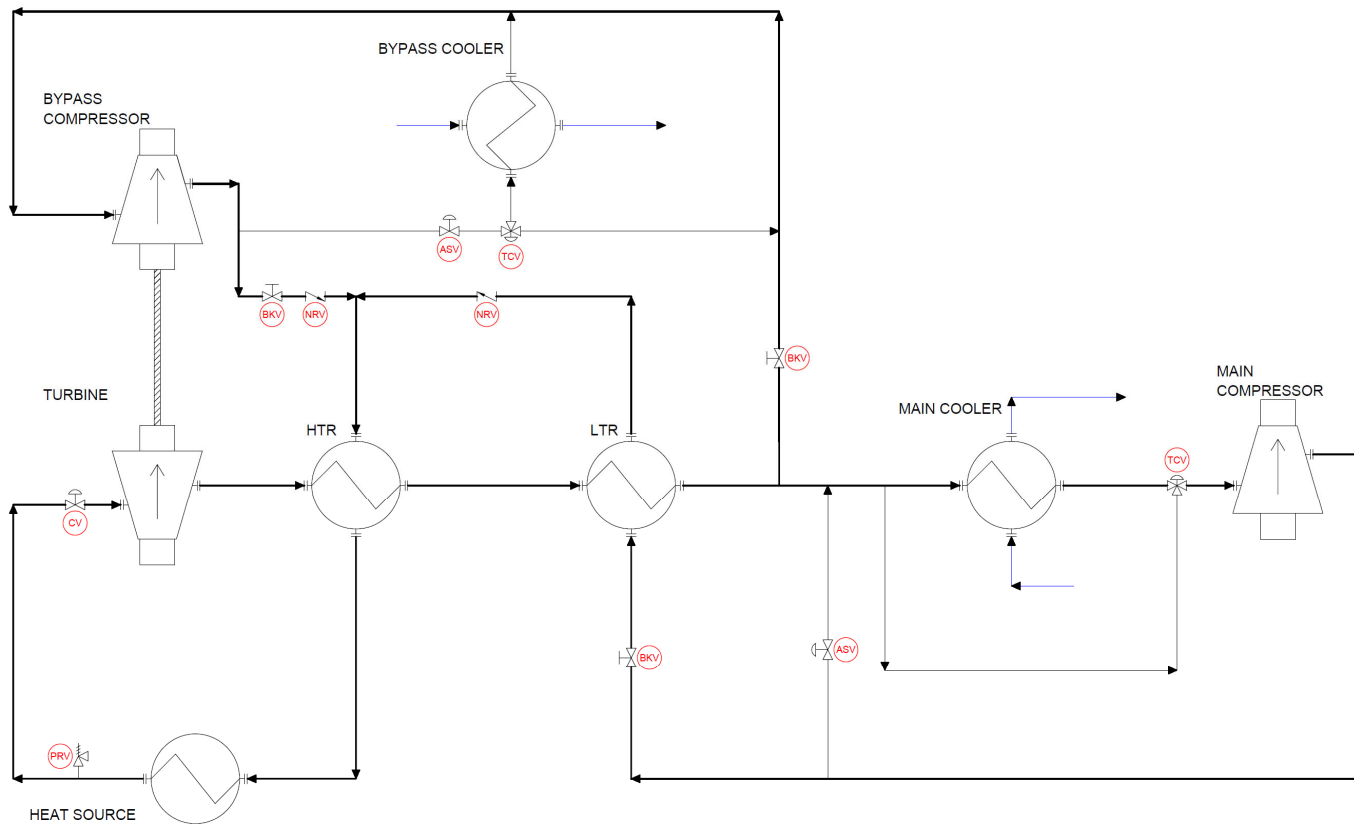


Main Compressor

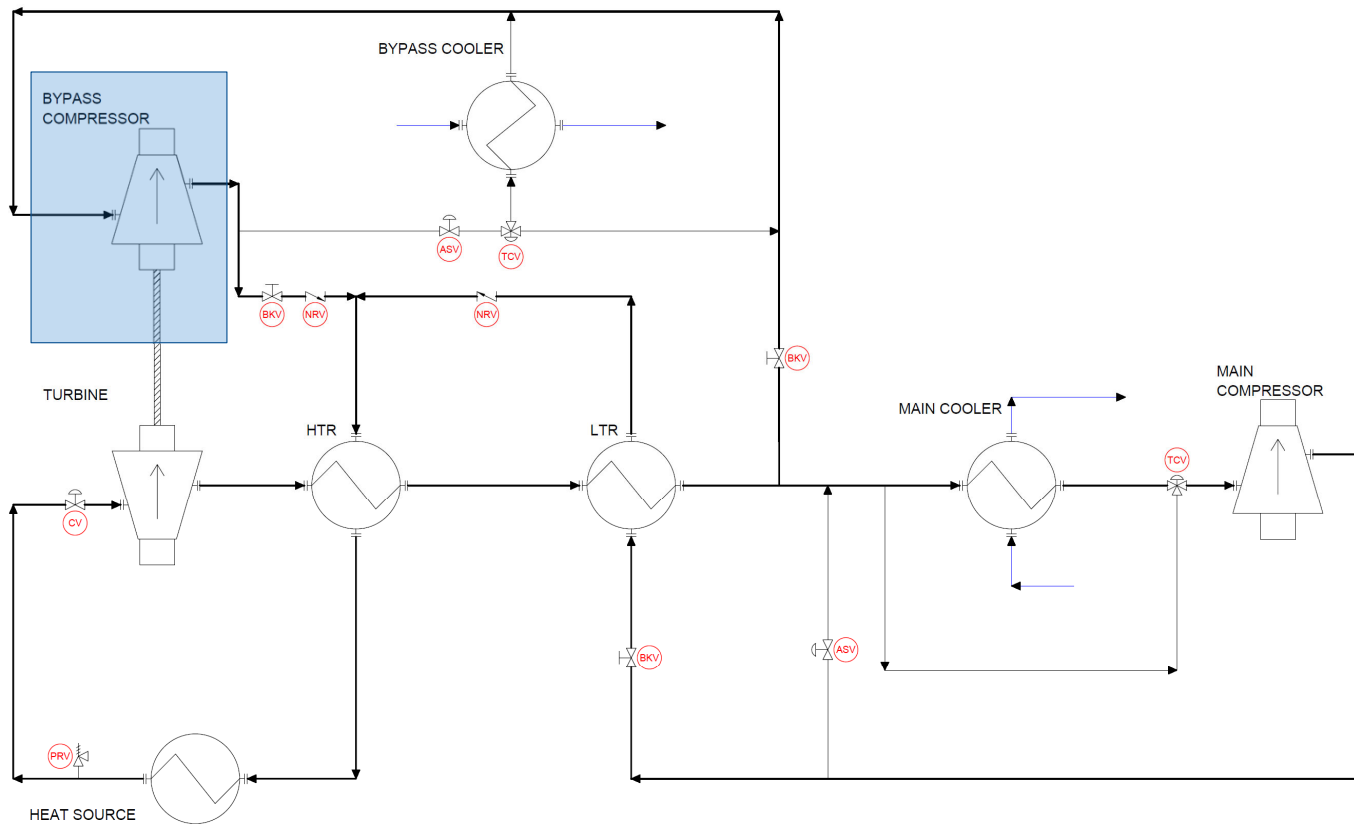
1: Pressure vs. Enthalpy plot: carbon dioxide



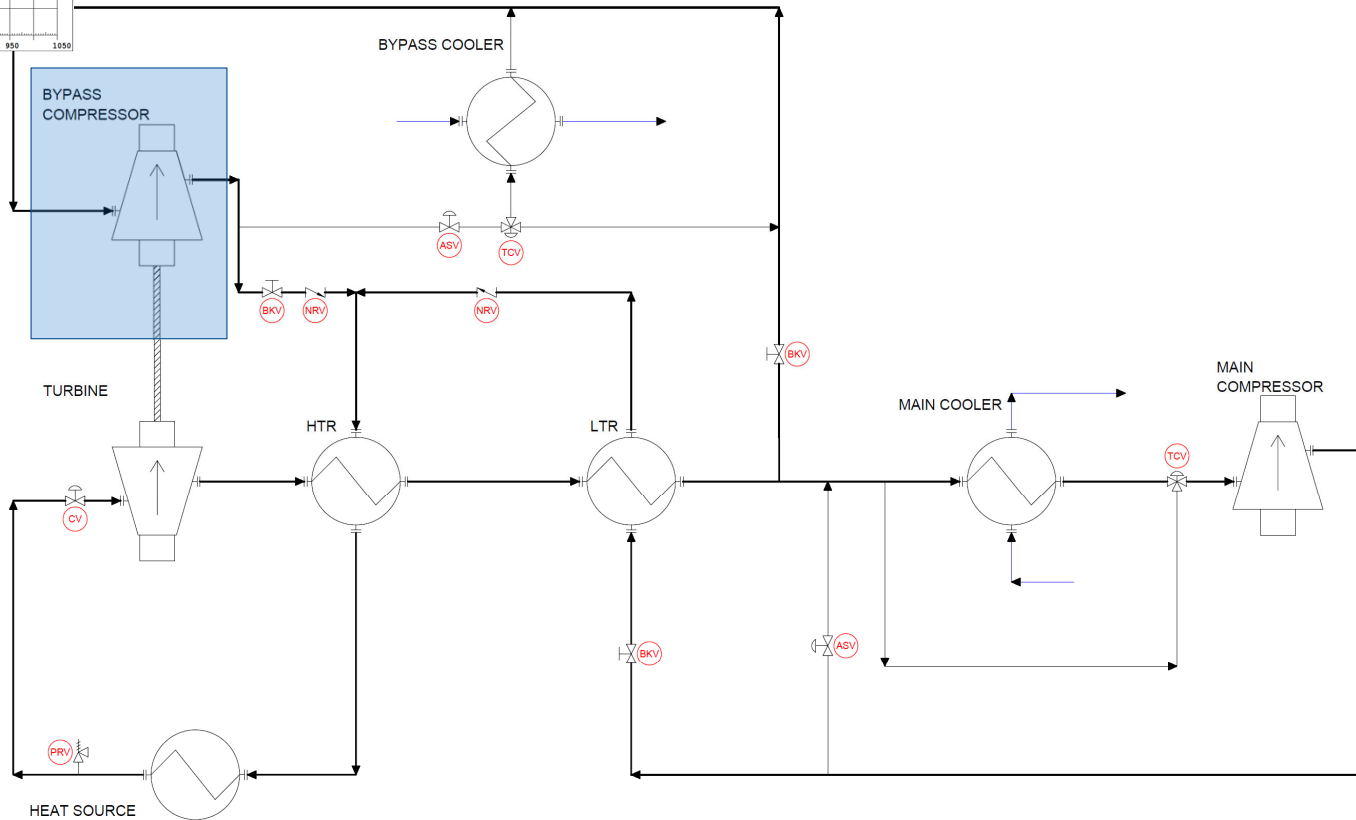
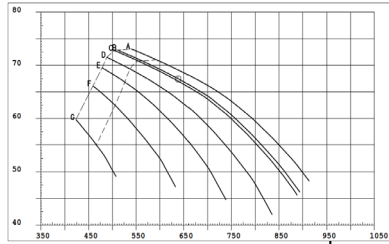
Bypass Compressor



Bypass Compressor

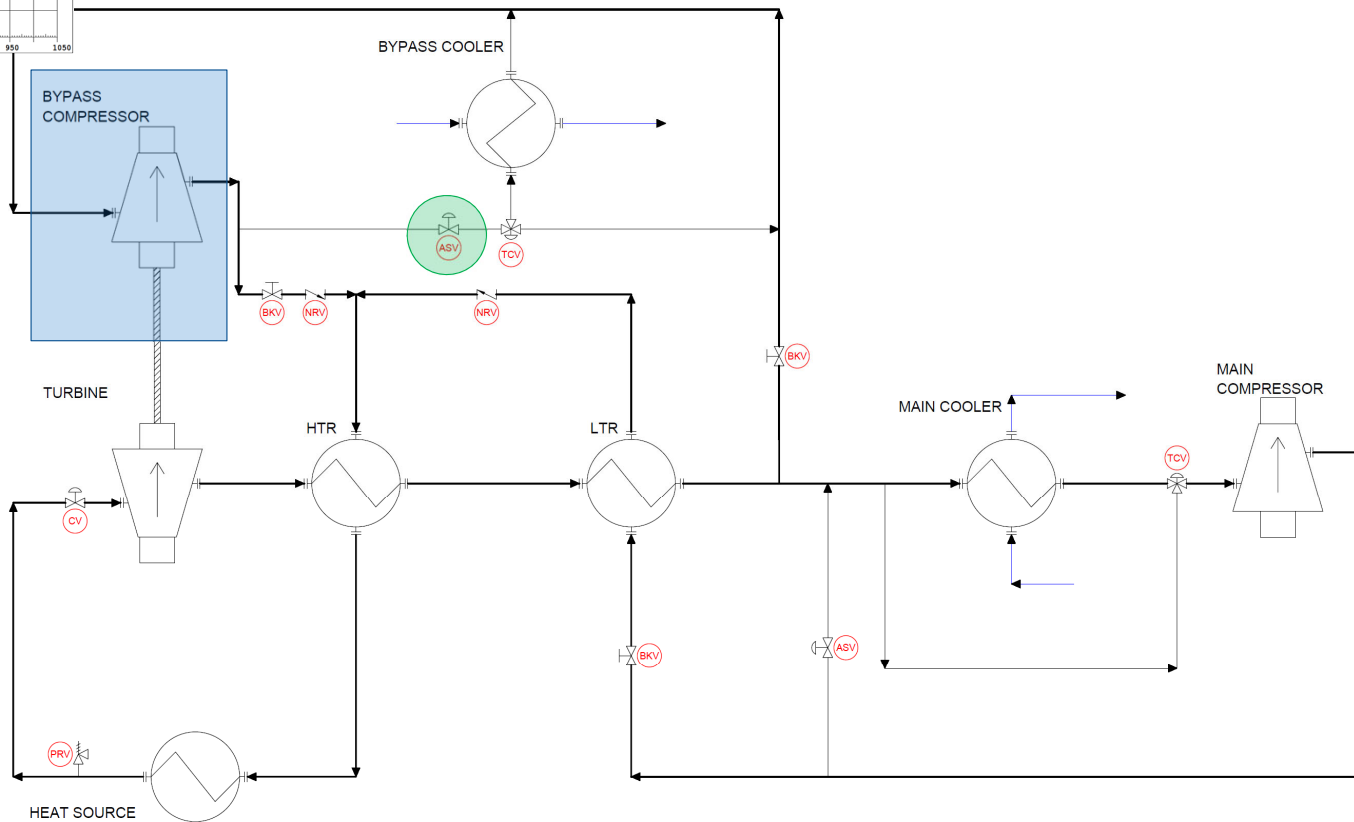
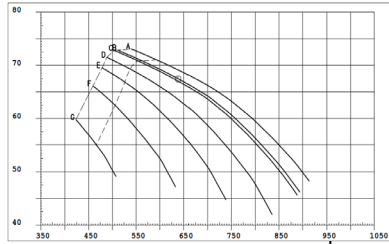


Bypass Compressor



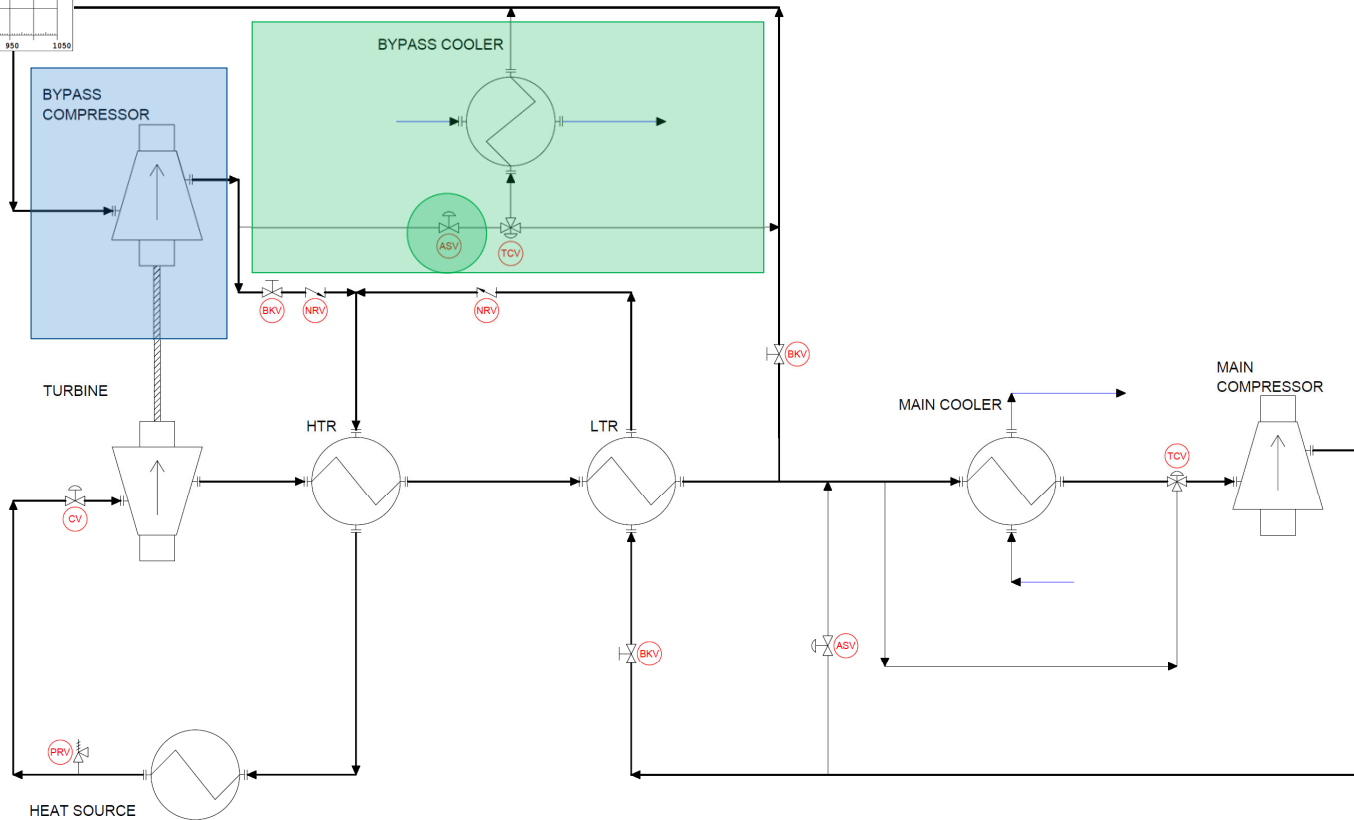
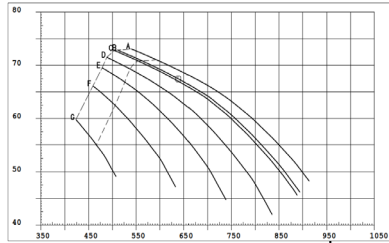
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Bypass Compressor



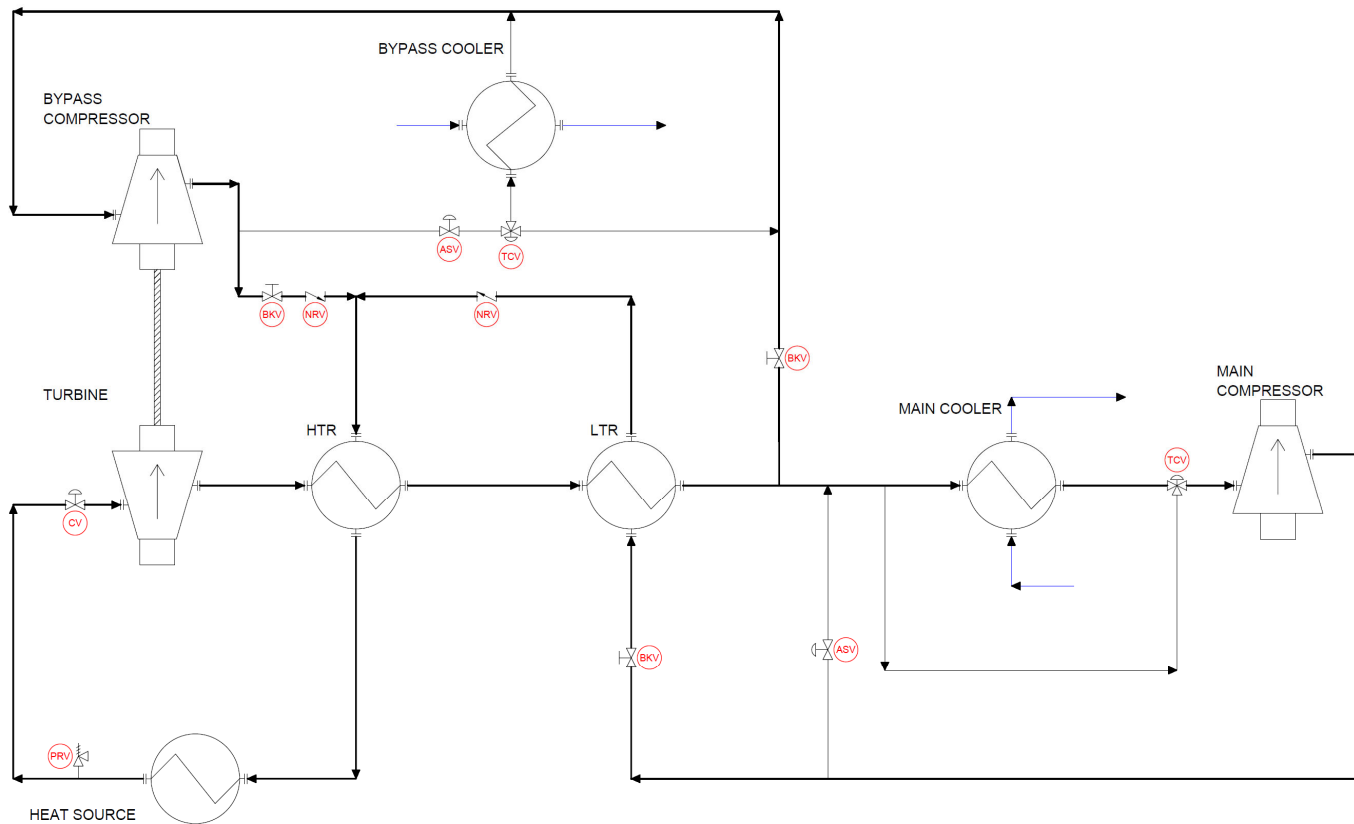
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Bypass Compressor



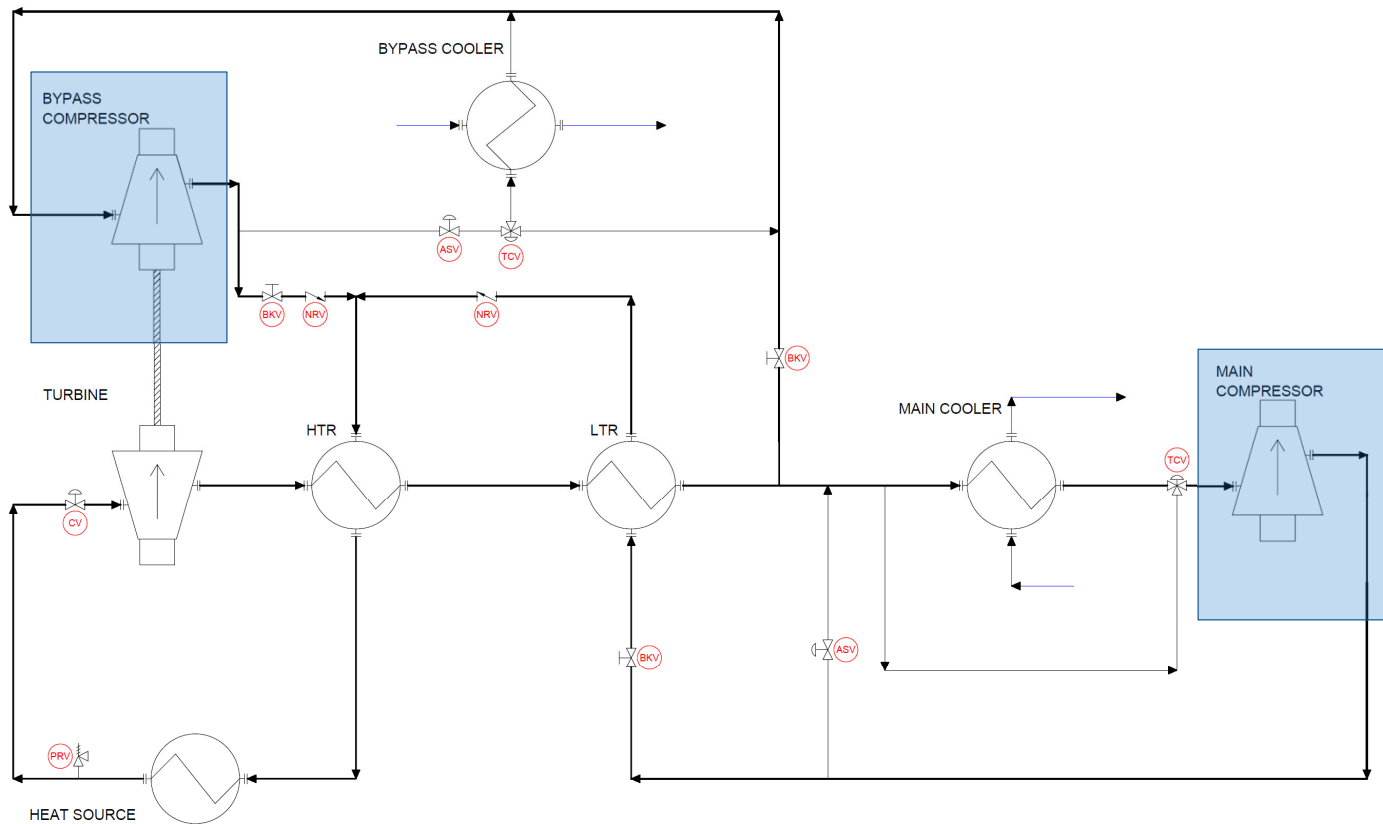
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Parallel Compressors



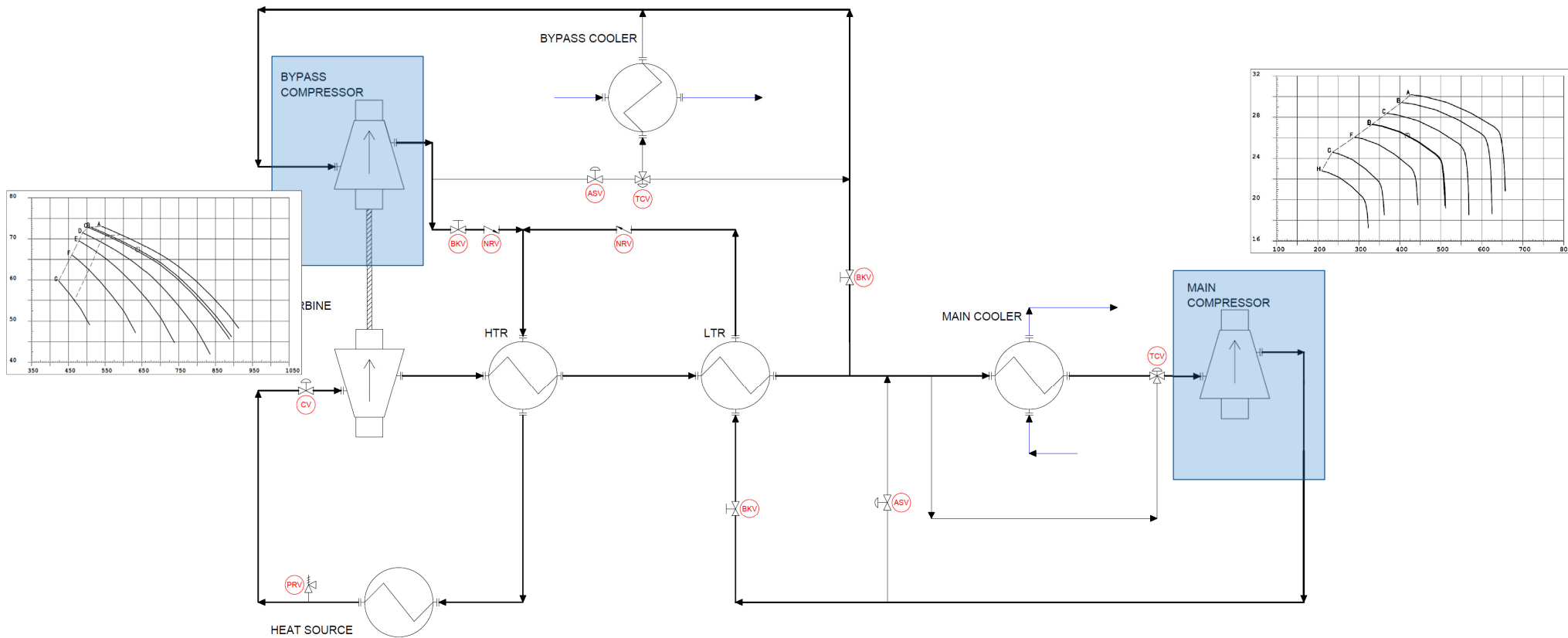
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Parallel Compressors



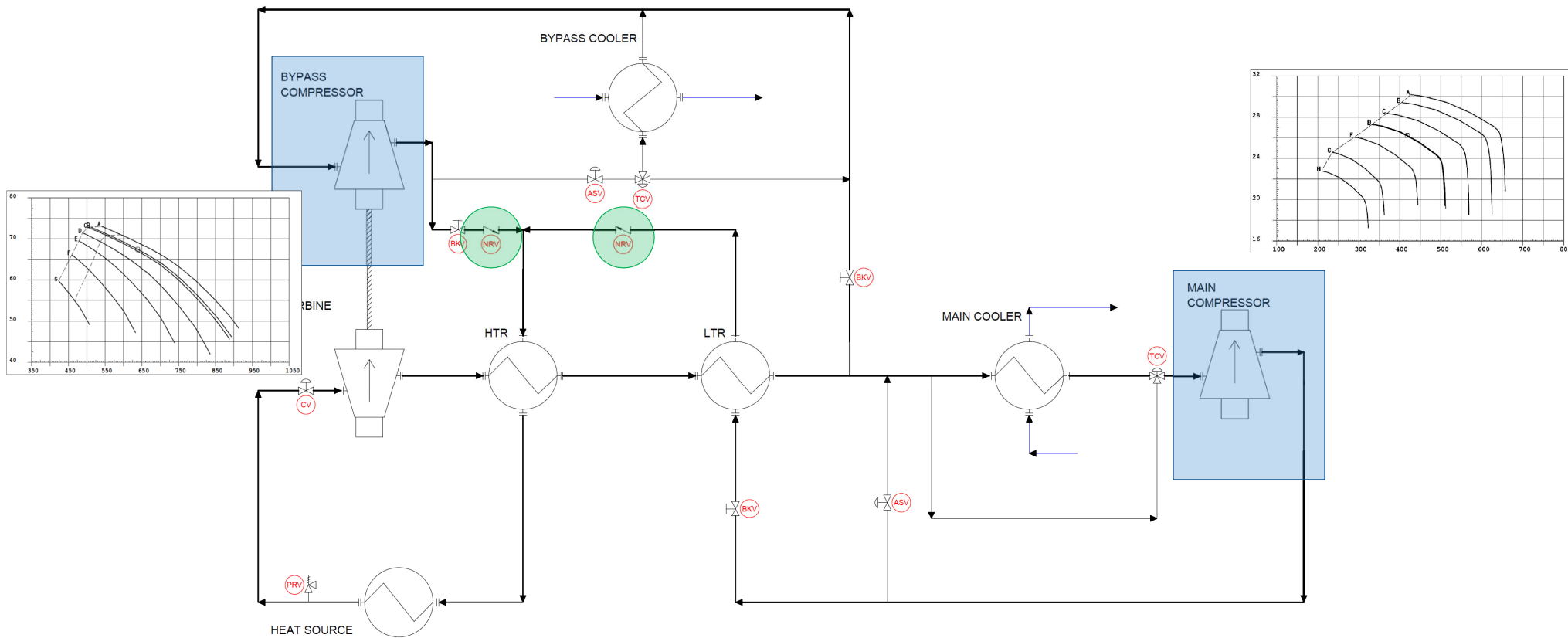
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Parallel Compressors



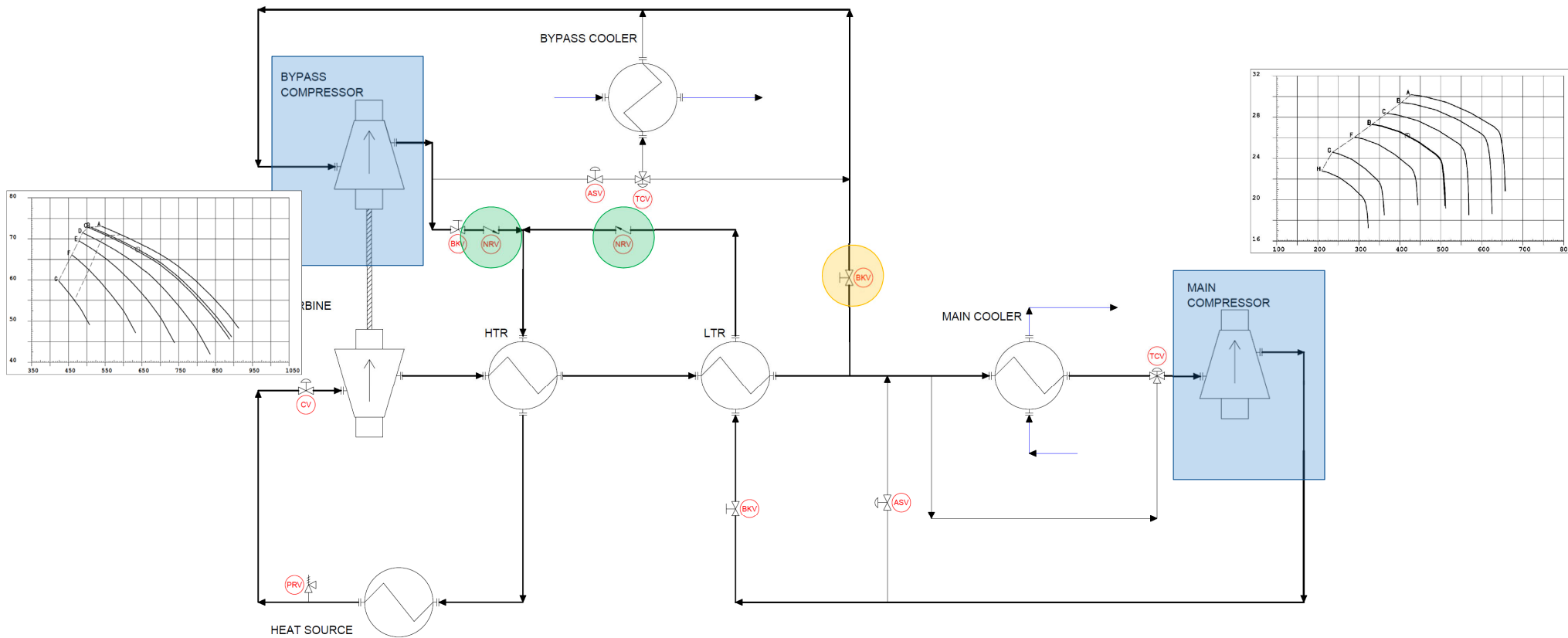
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Parallel Compressors



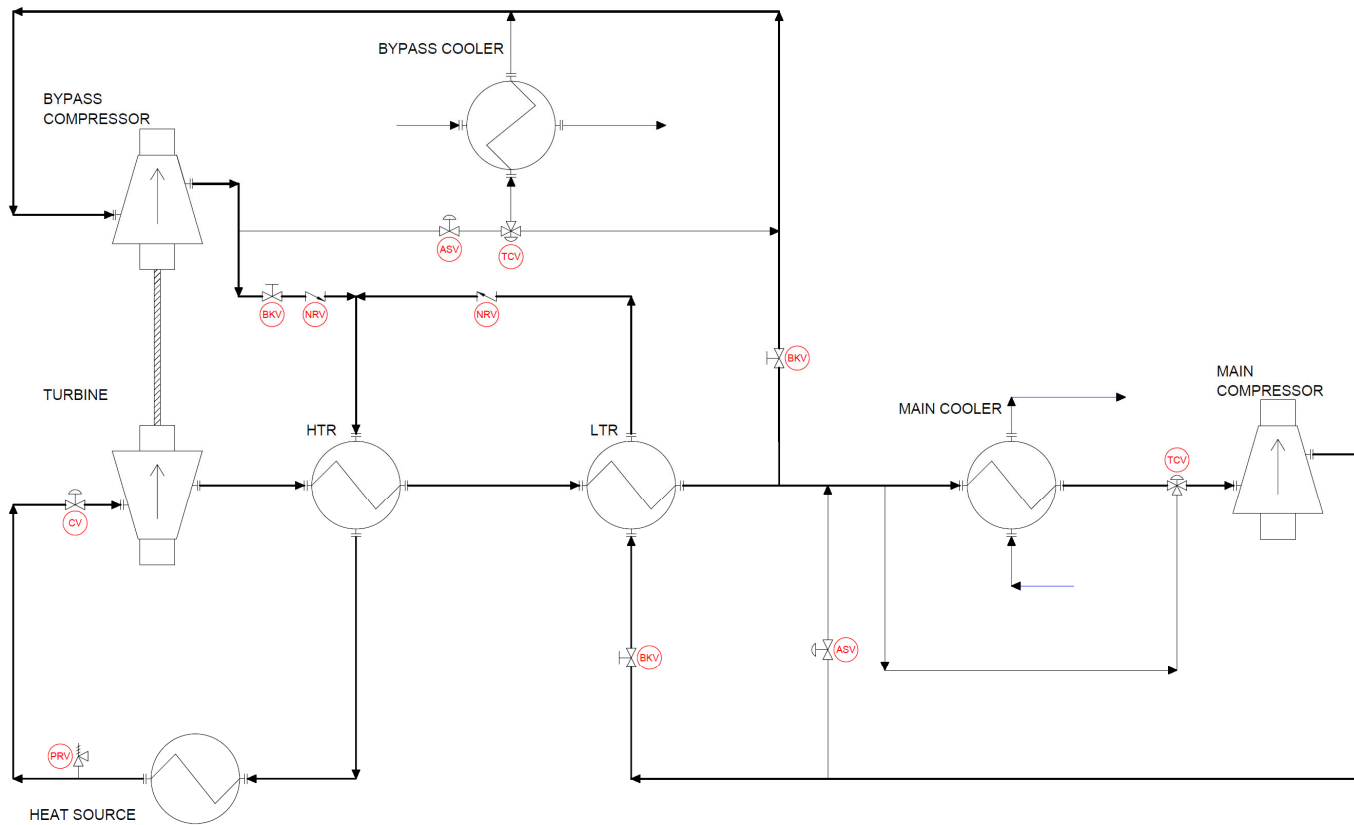
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Parallel Compressors

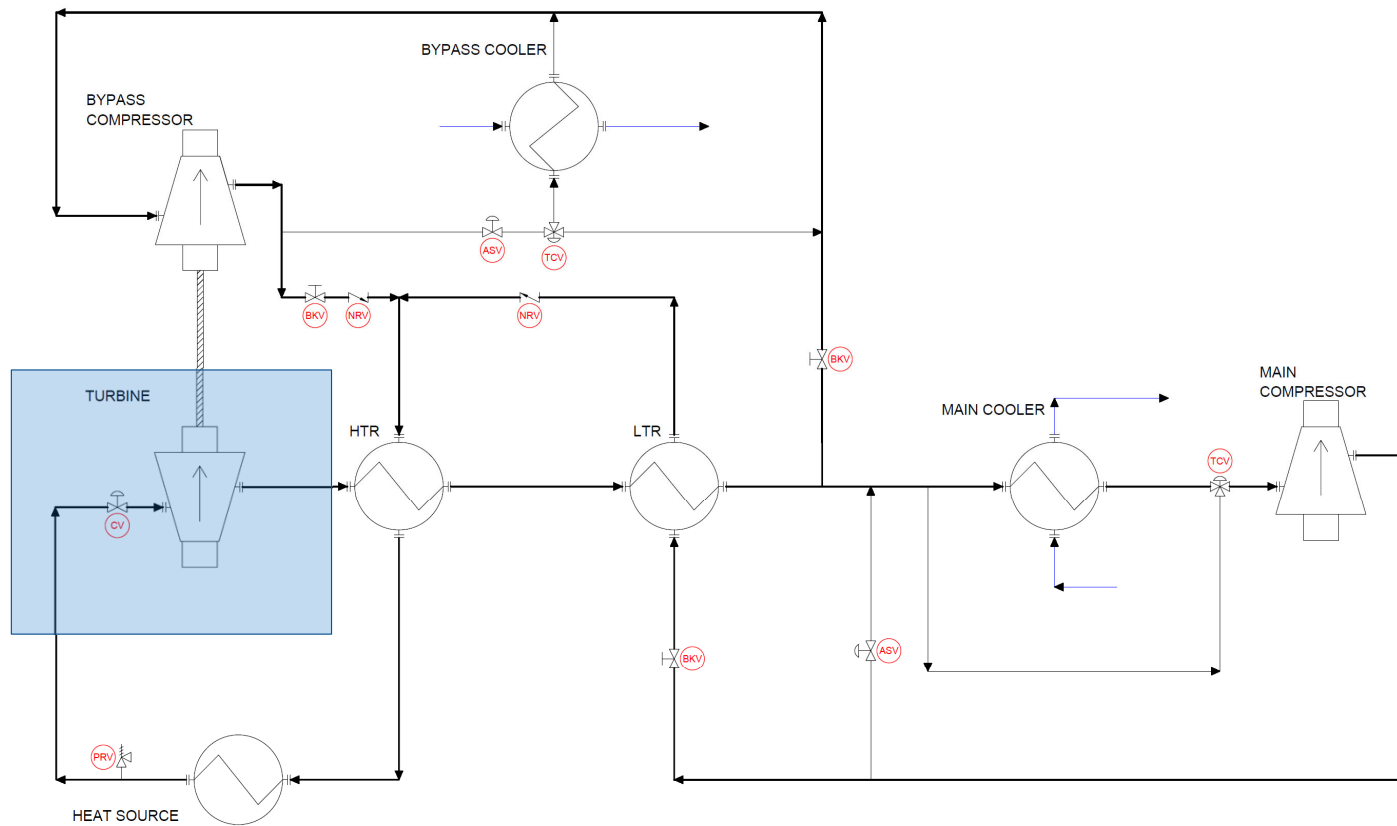


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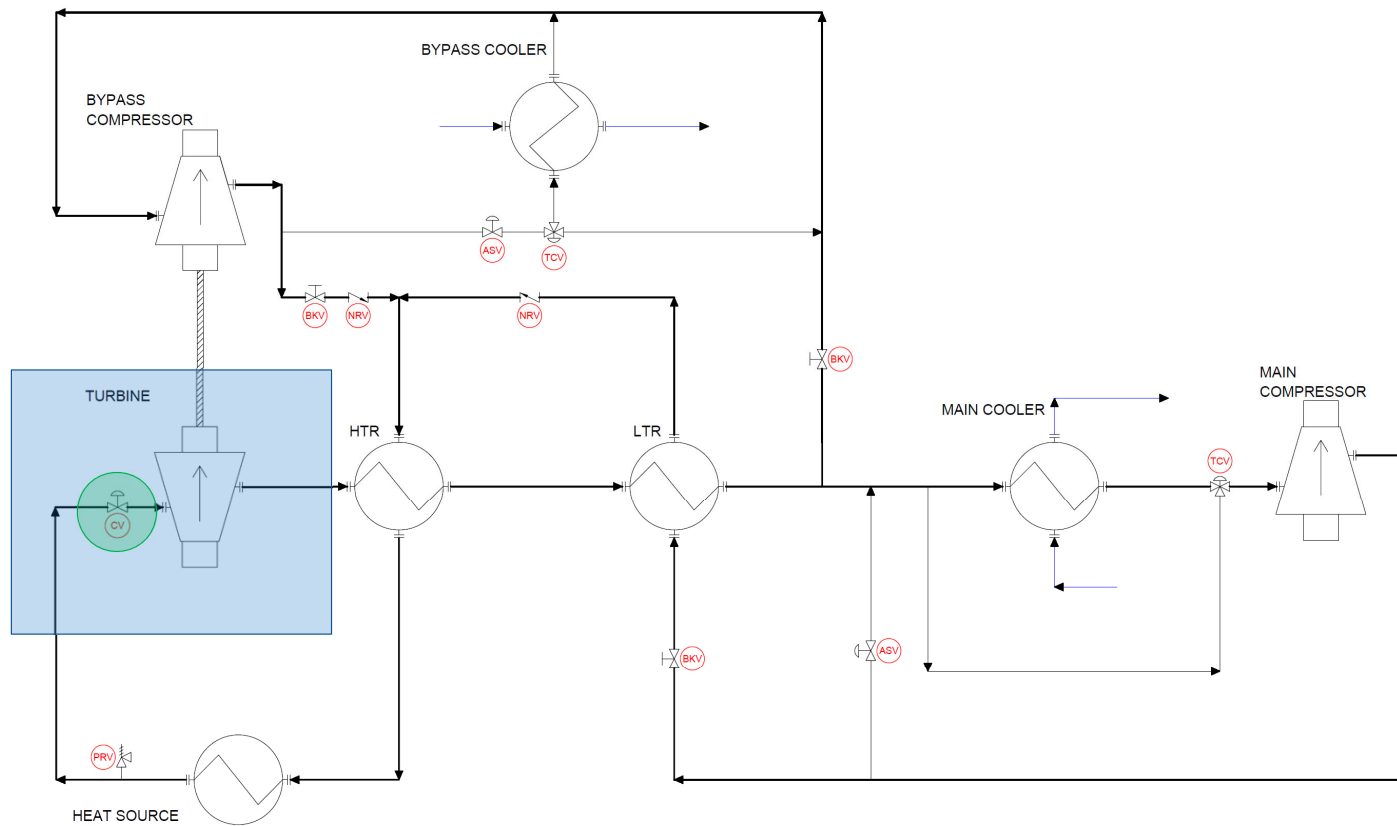
Turbine



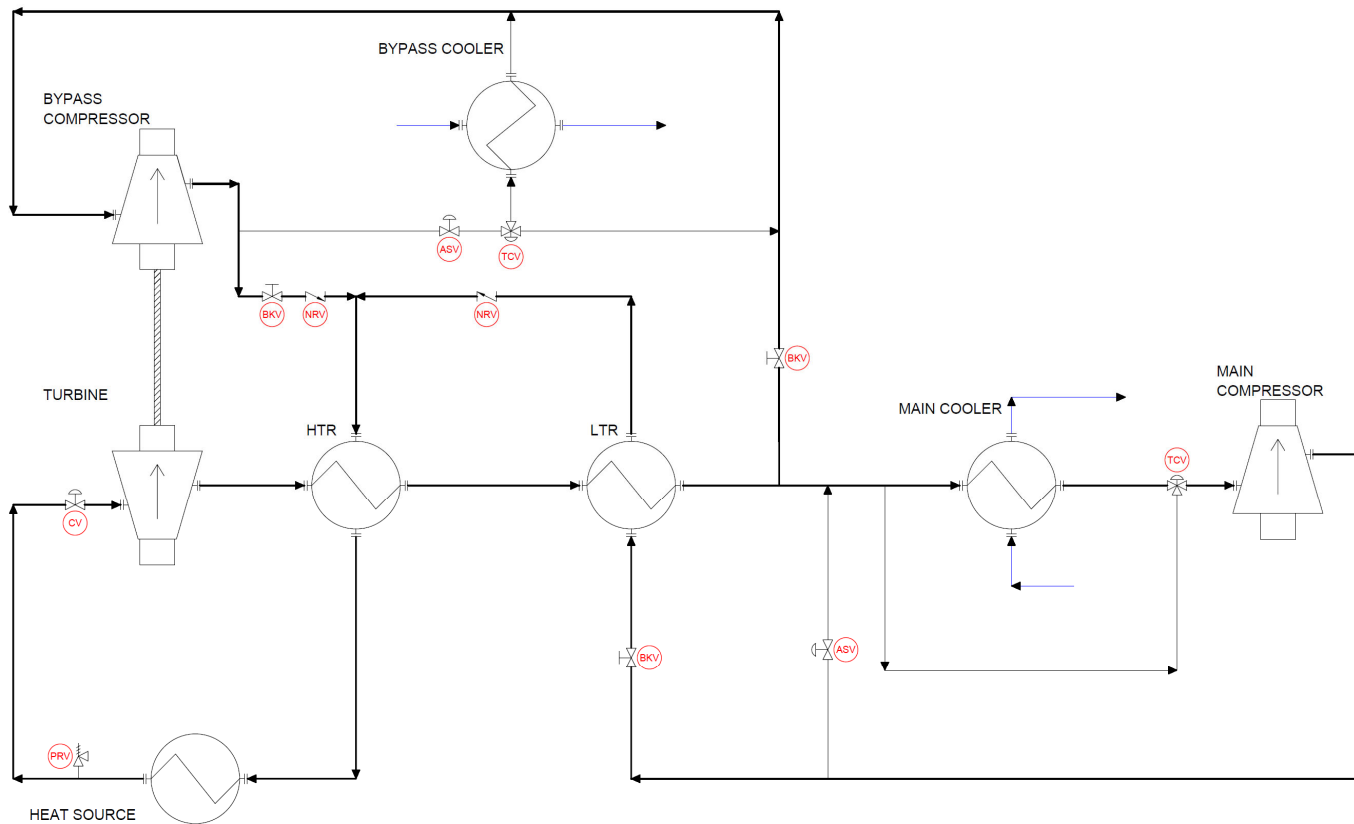
Turbine



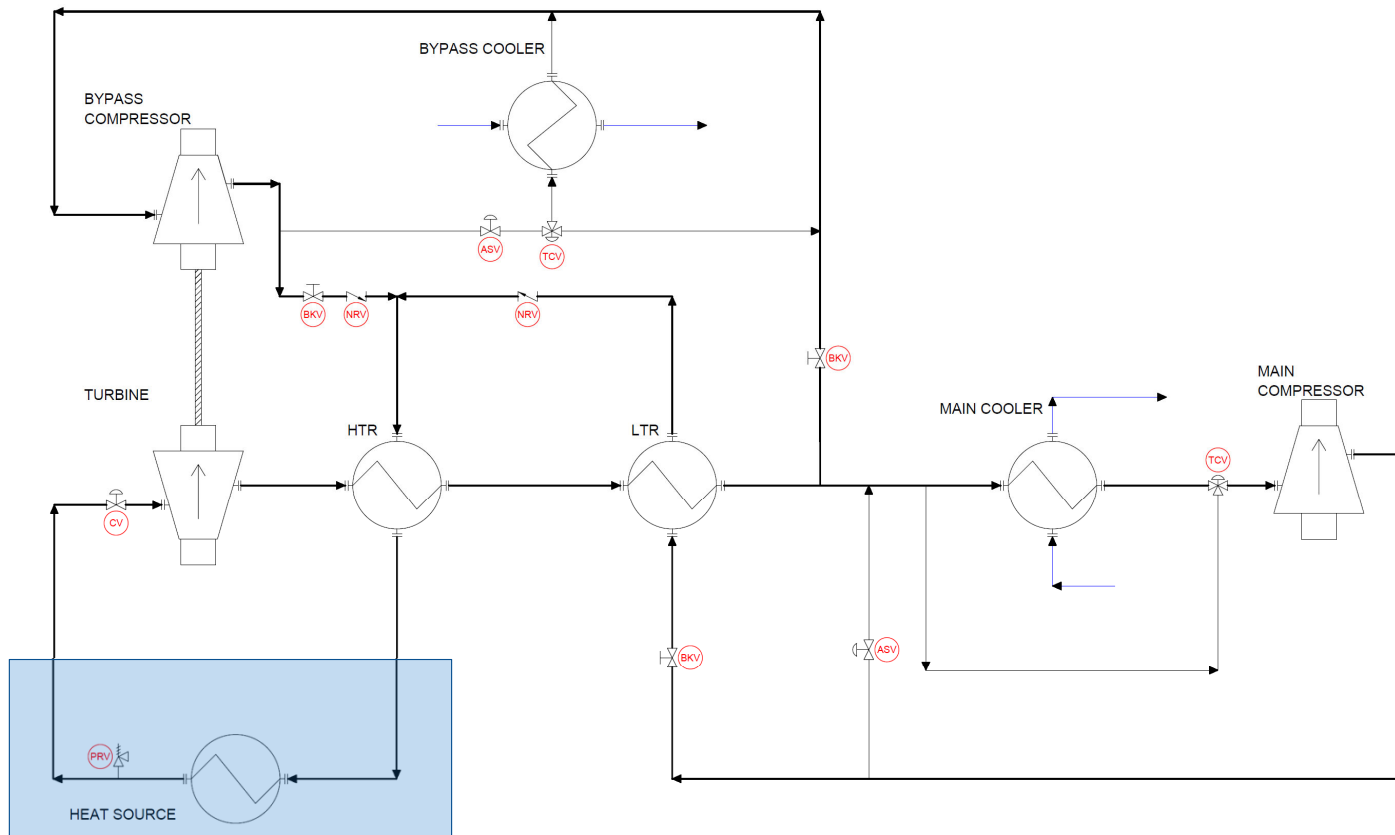
Turbine



Heater

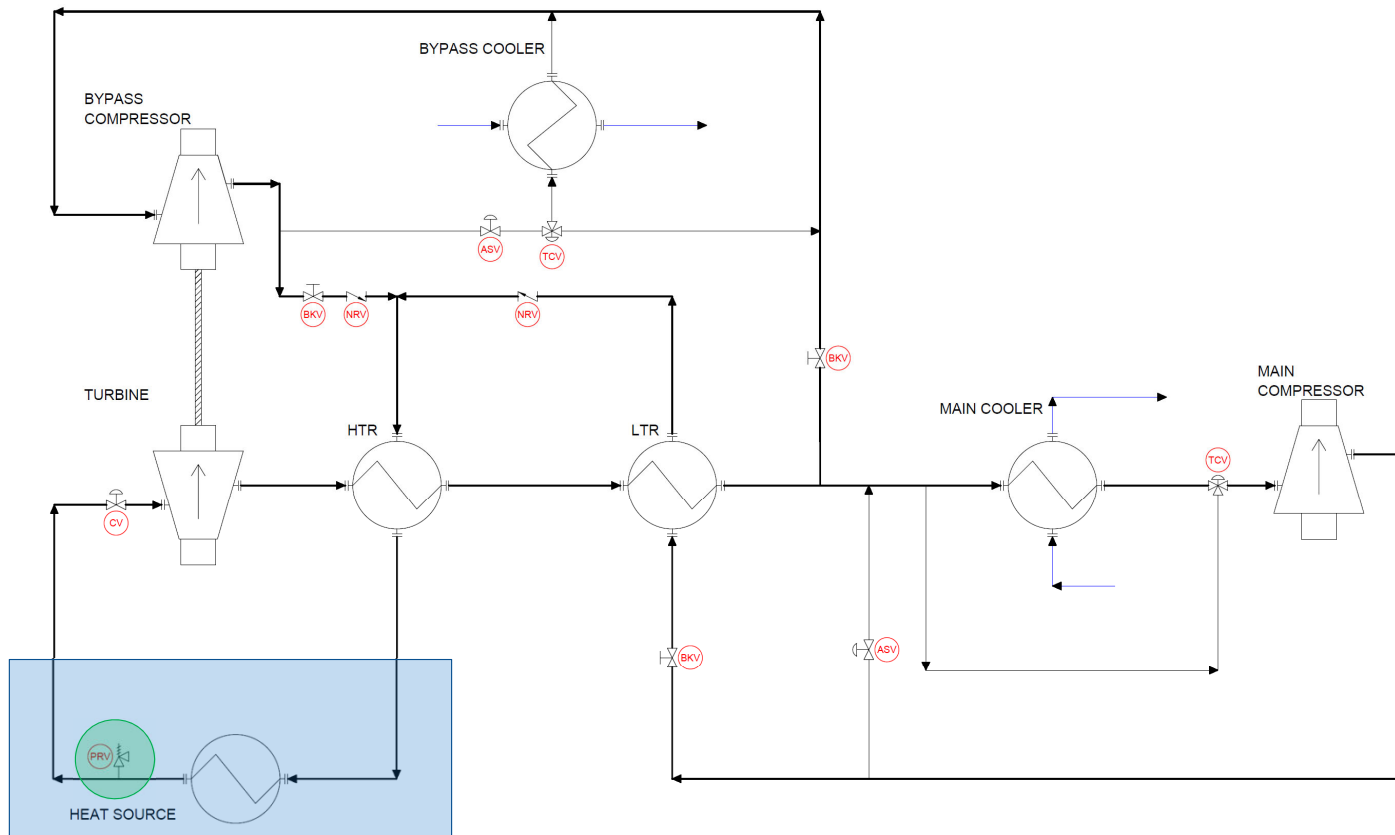


Heater



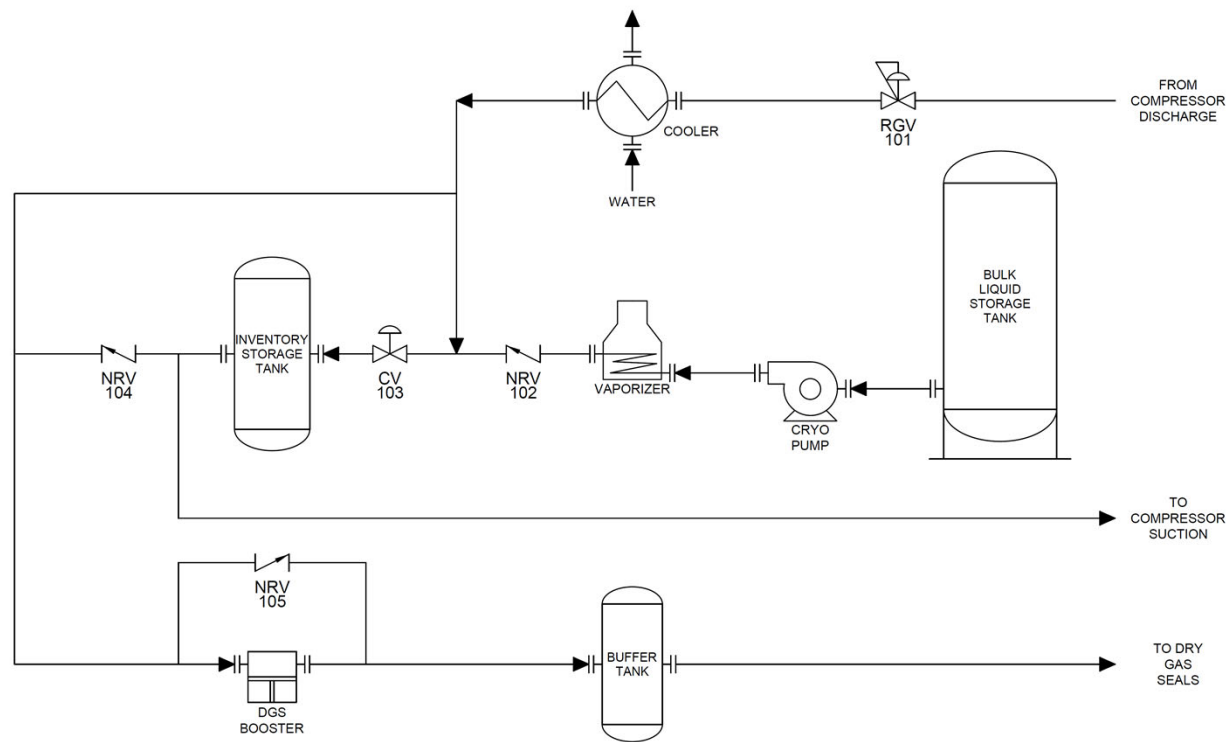
The 7th International Supercritical CO₂ Power Cycles • February 21 – 24, 2022 • San Antonio, TX, USA

Heater

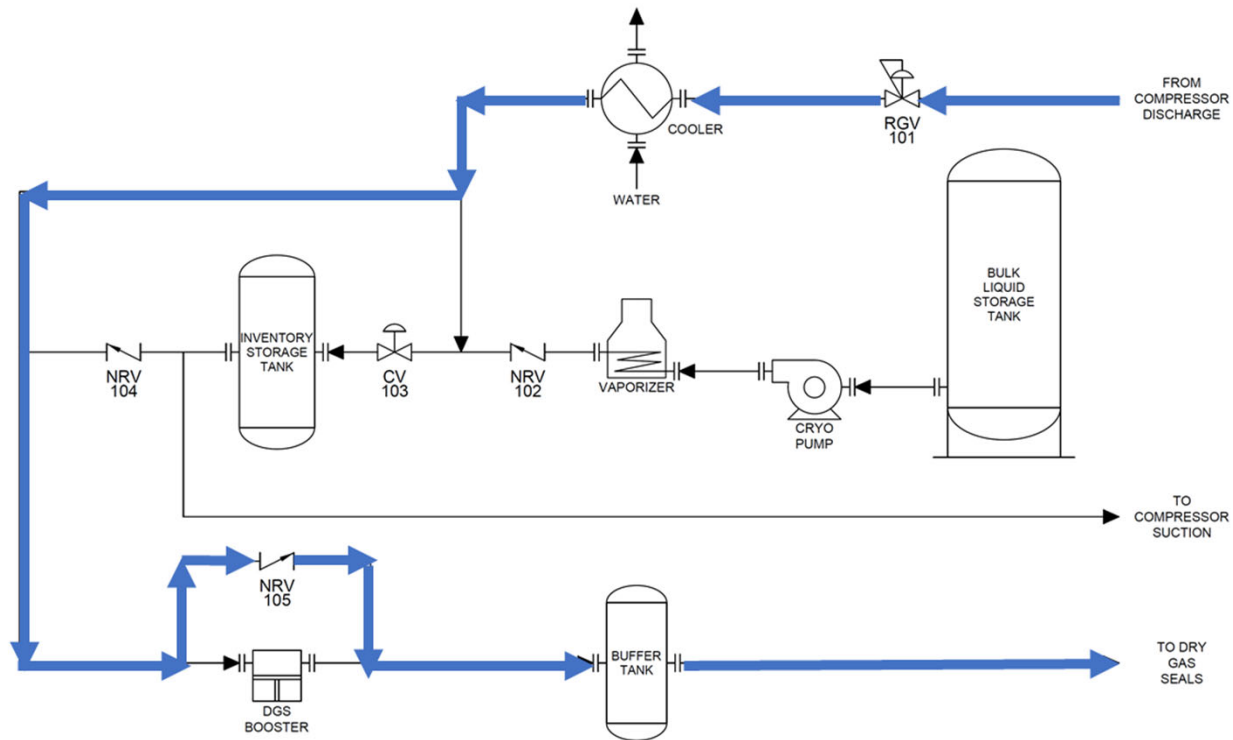


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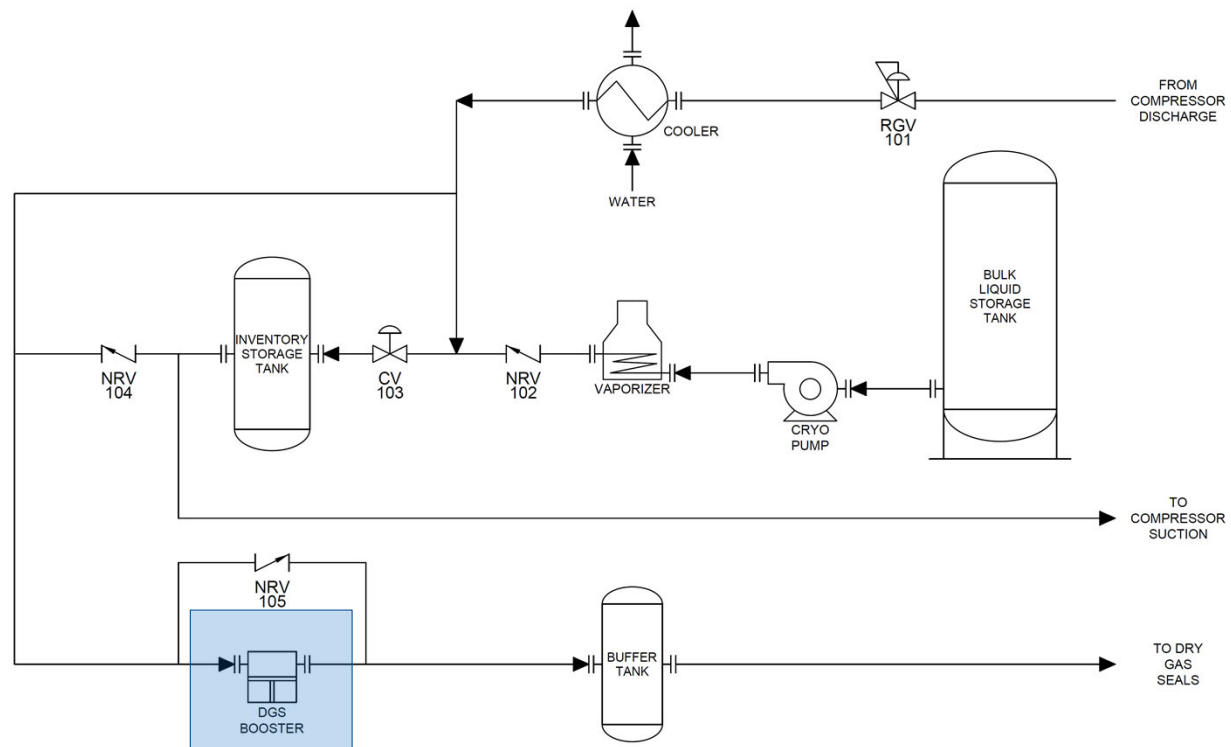
Dry Gas Seals



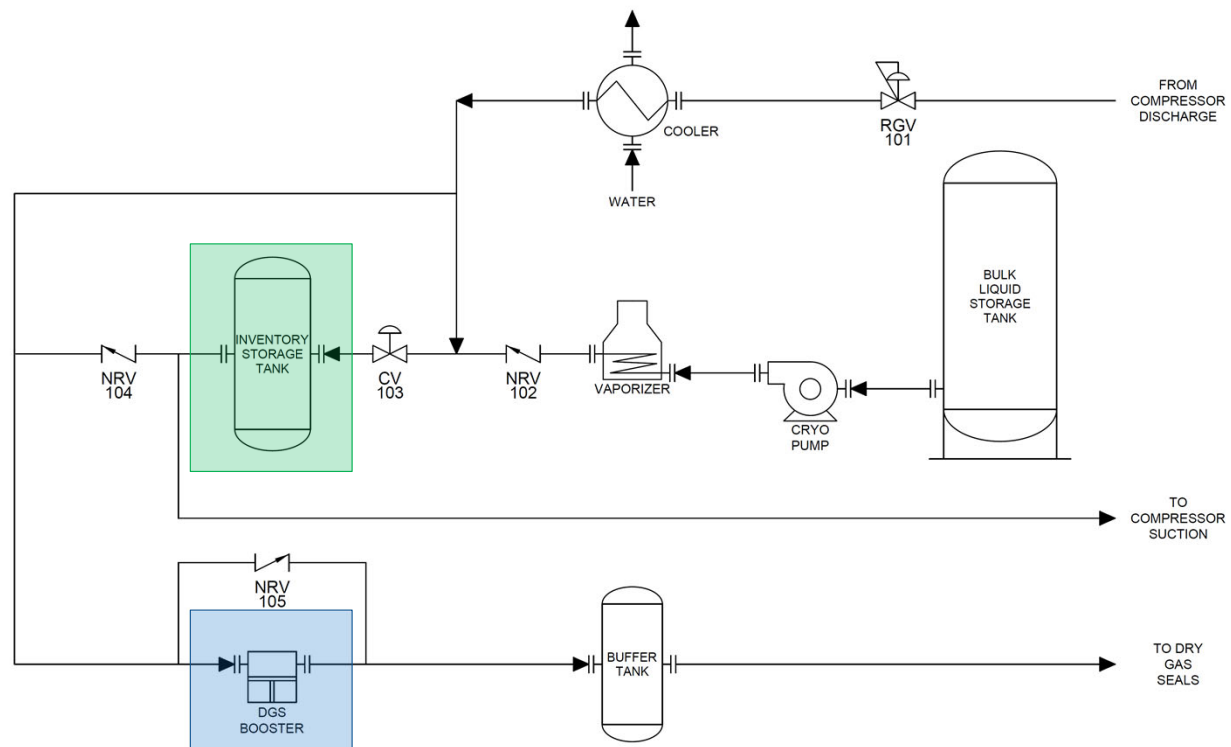
Dry Gas Seals



Dry Gas Seals



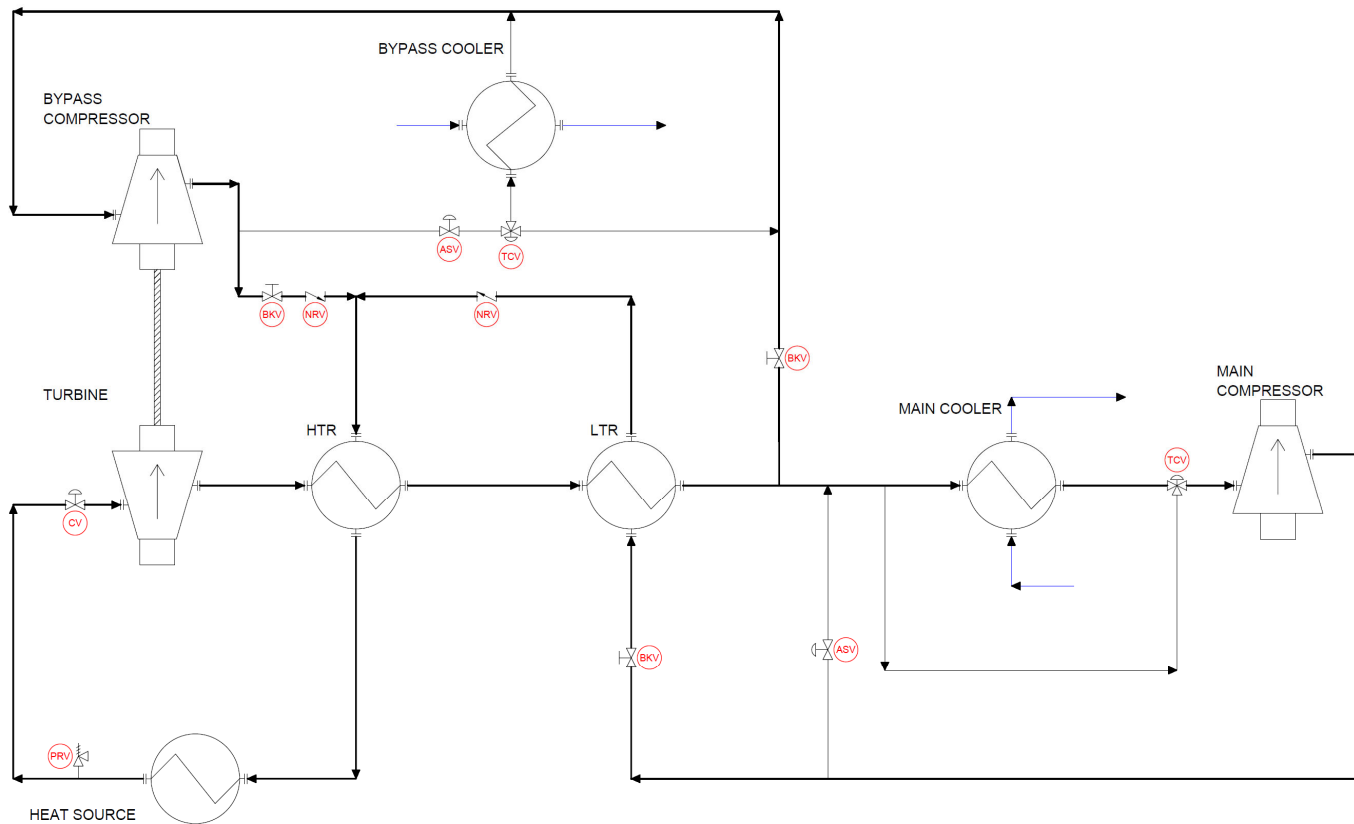
Dry Gas Seals



CHALLENGES FOR SAFE TRIP

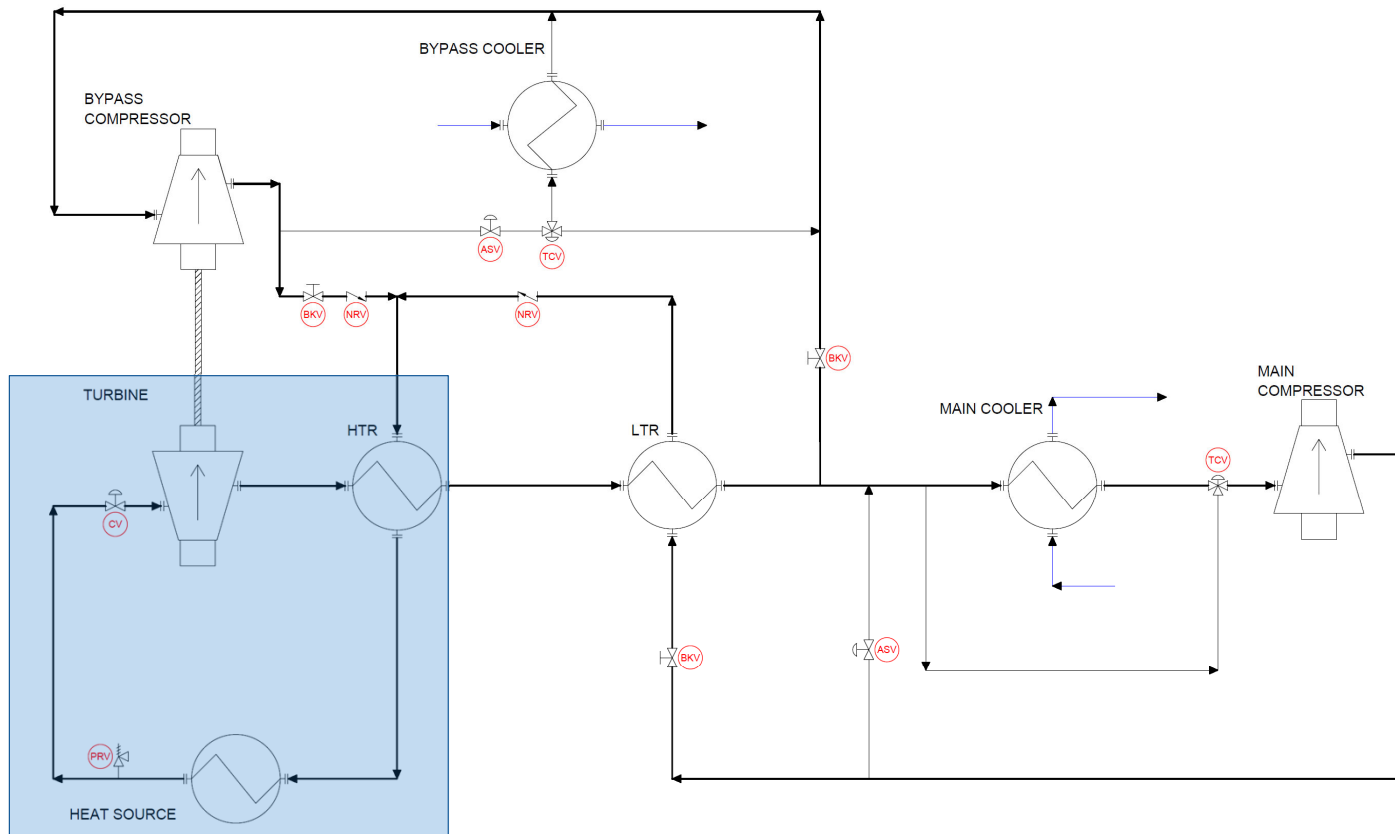
The 7th International Supercritical CO₂ Power Cycles • February 21 – 24, 2022 • San Antonio, TX, USA

Temperature Migration



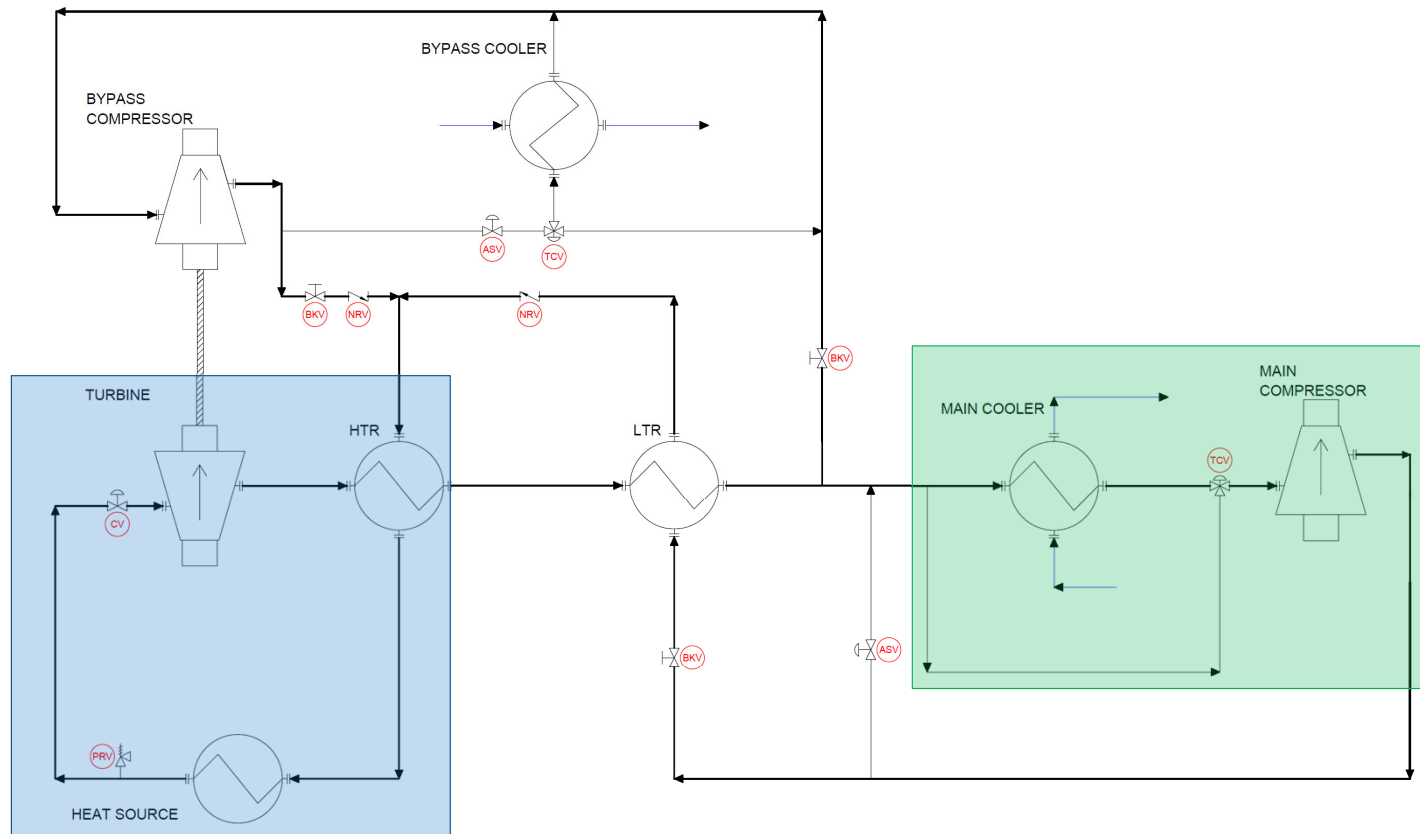
The 7th International Supercritical CO₂ Power Cycles • February 21 – 24, 2022 • San Antonio, TX, USA

Temperature Migration



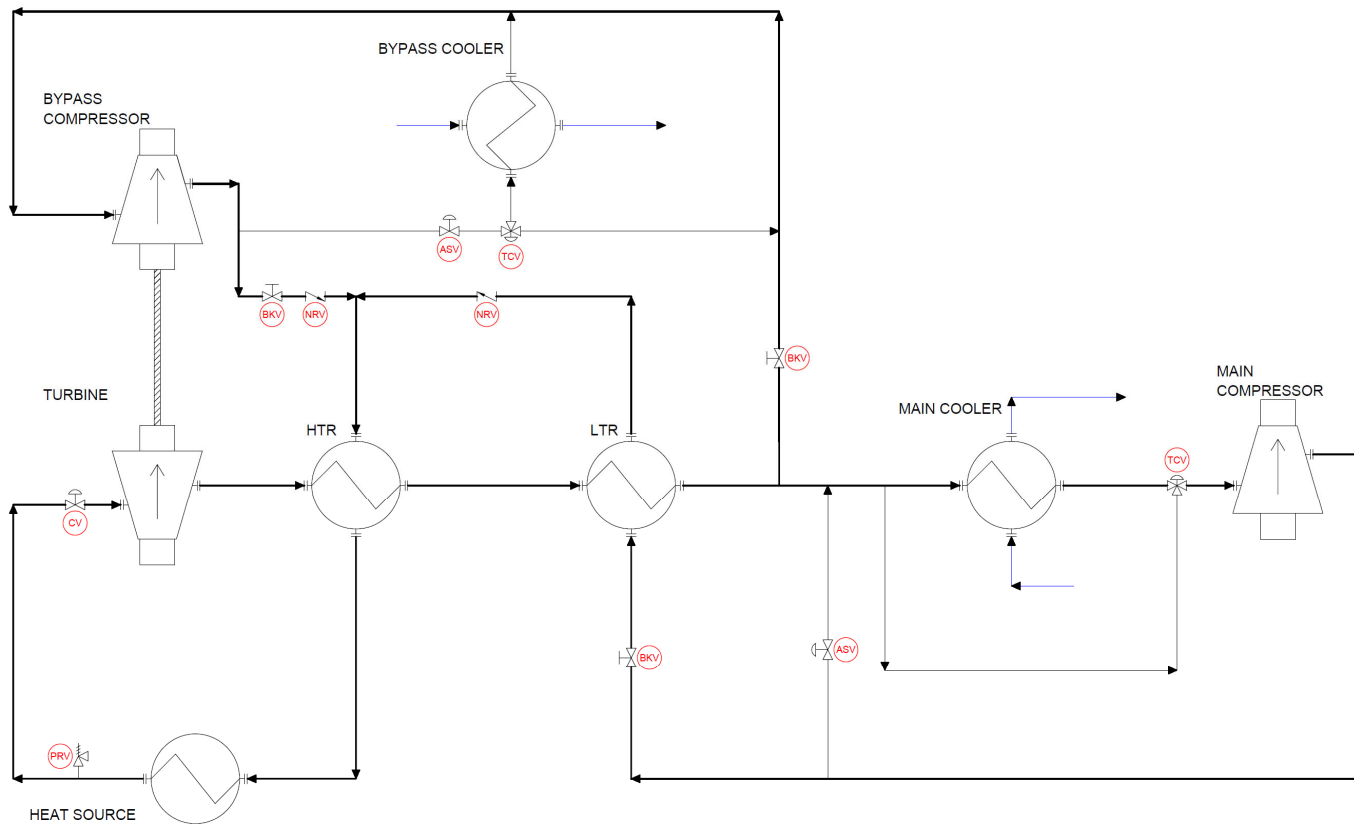
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Temperature Migration

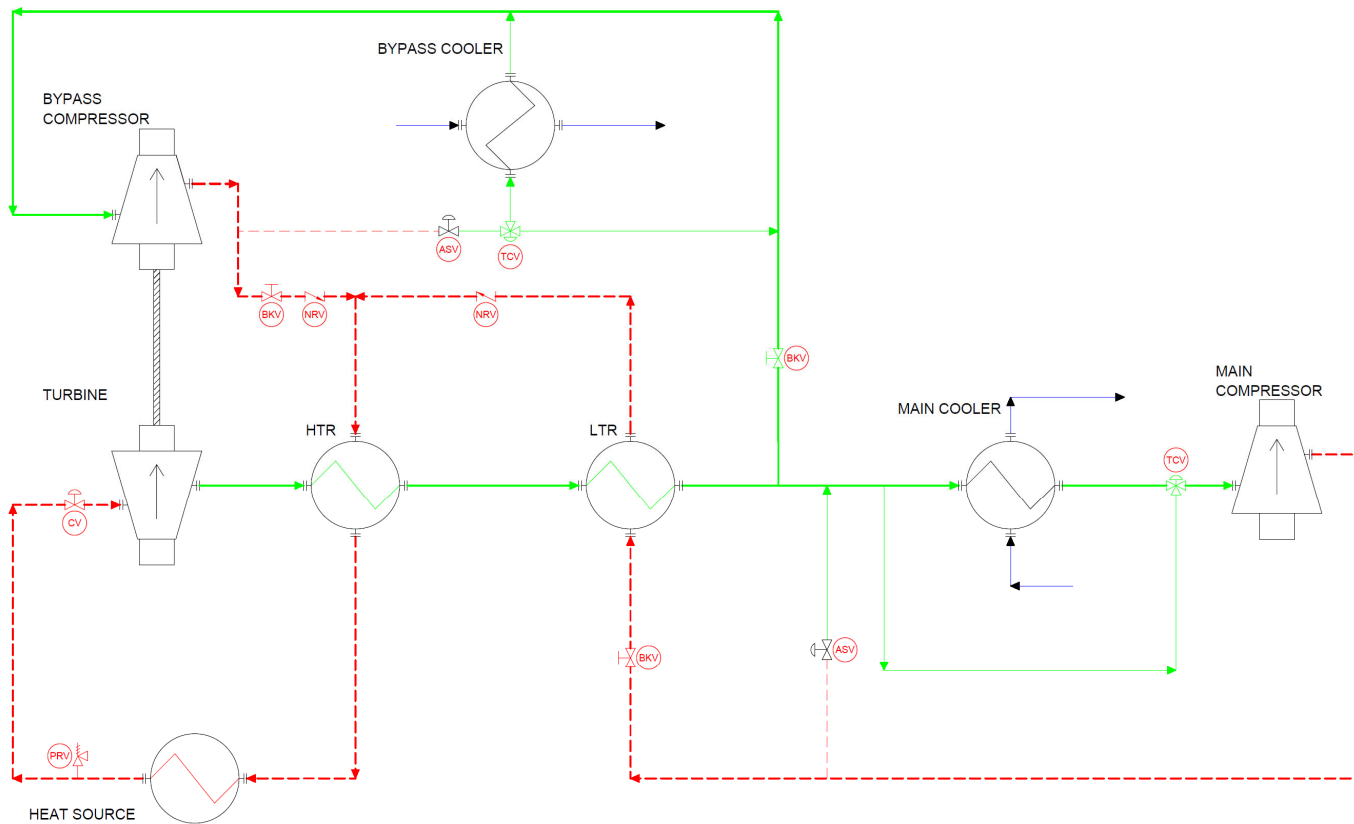


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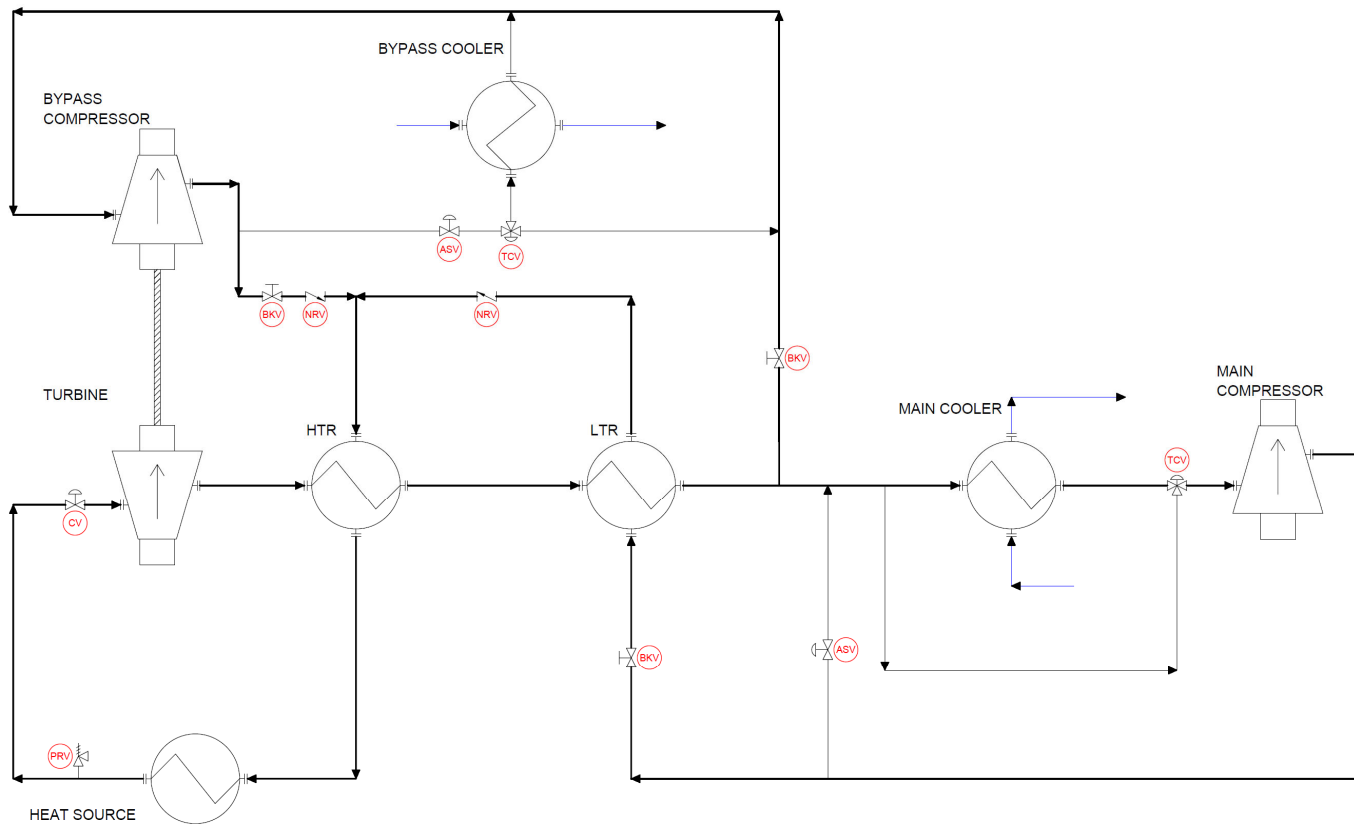
Settle Out Pressure



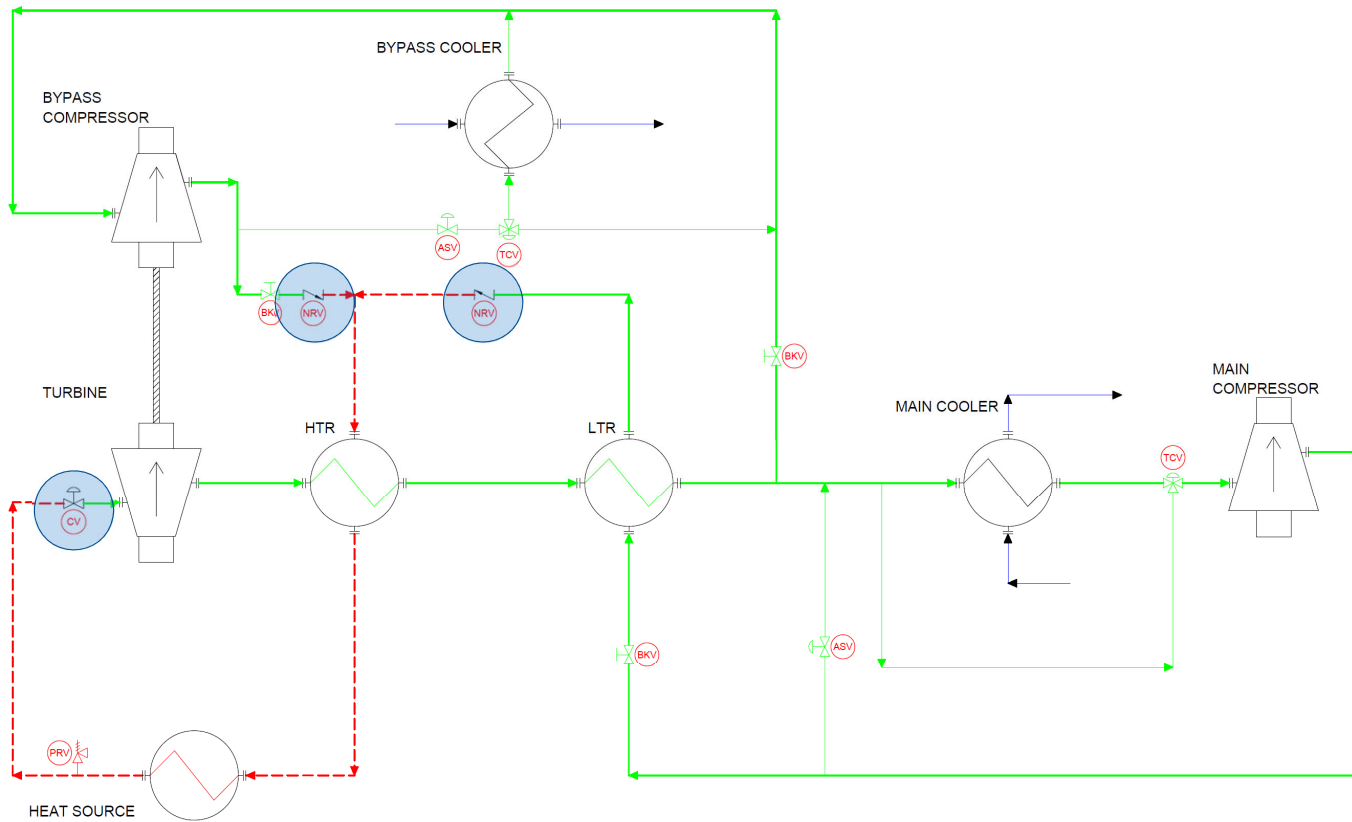
Settle Out Pressure



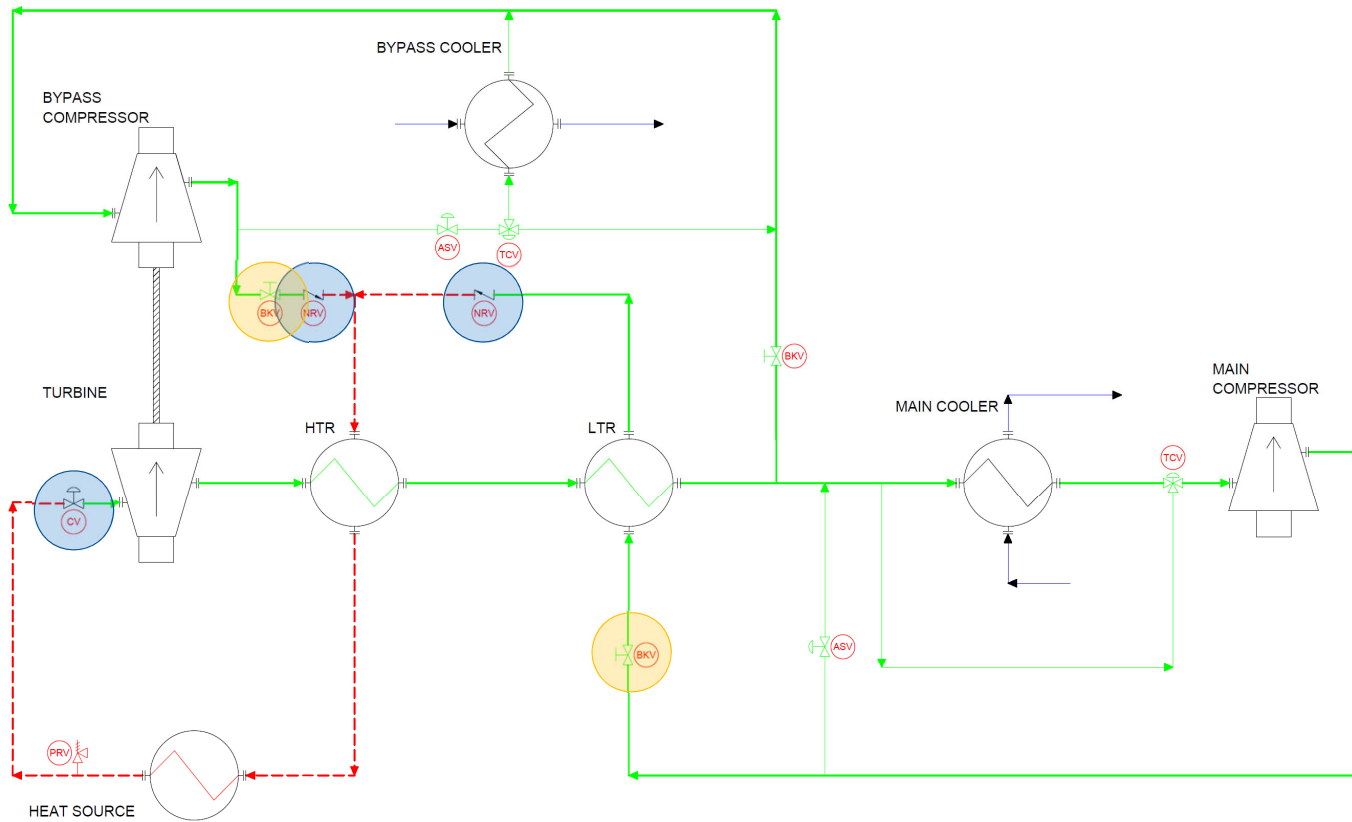
Settle Out Pressure



Settle Out Pressure

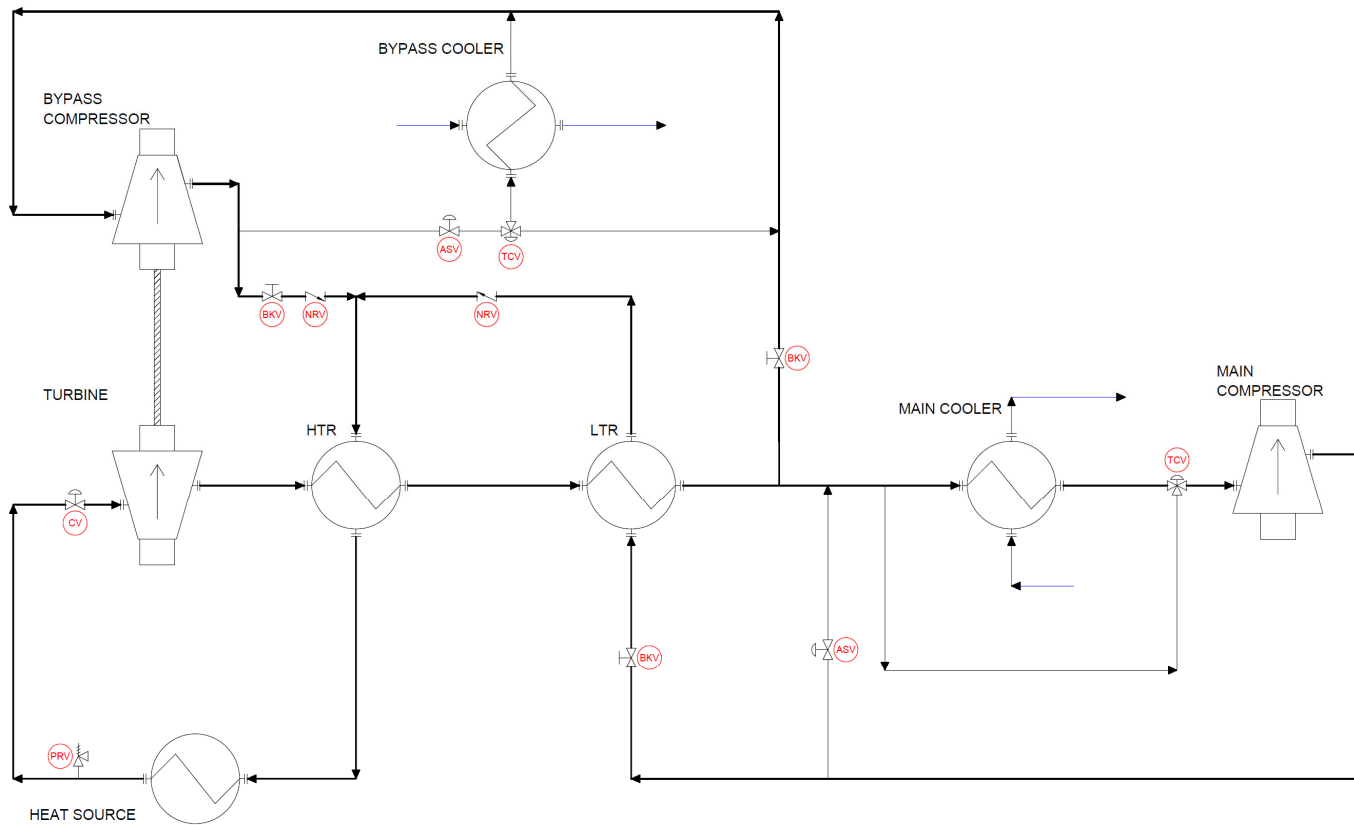


Settle Out Pressure

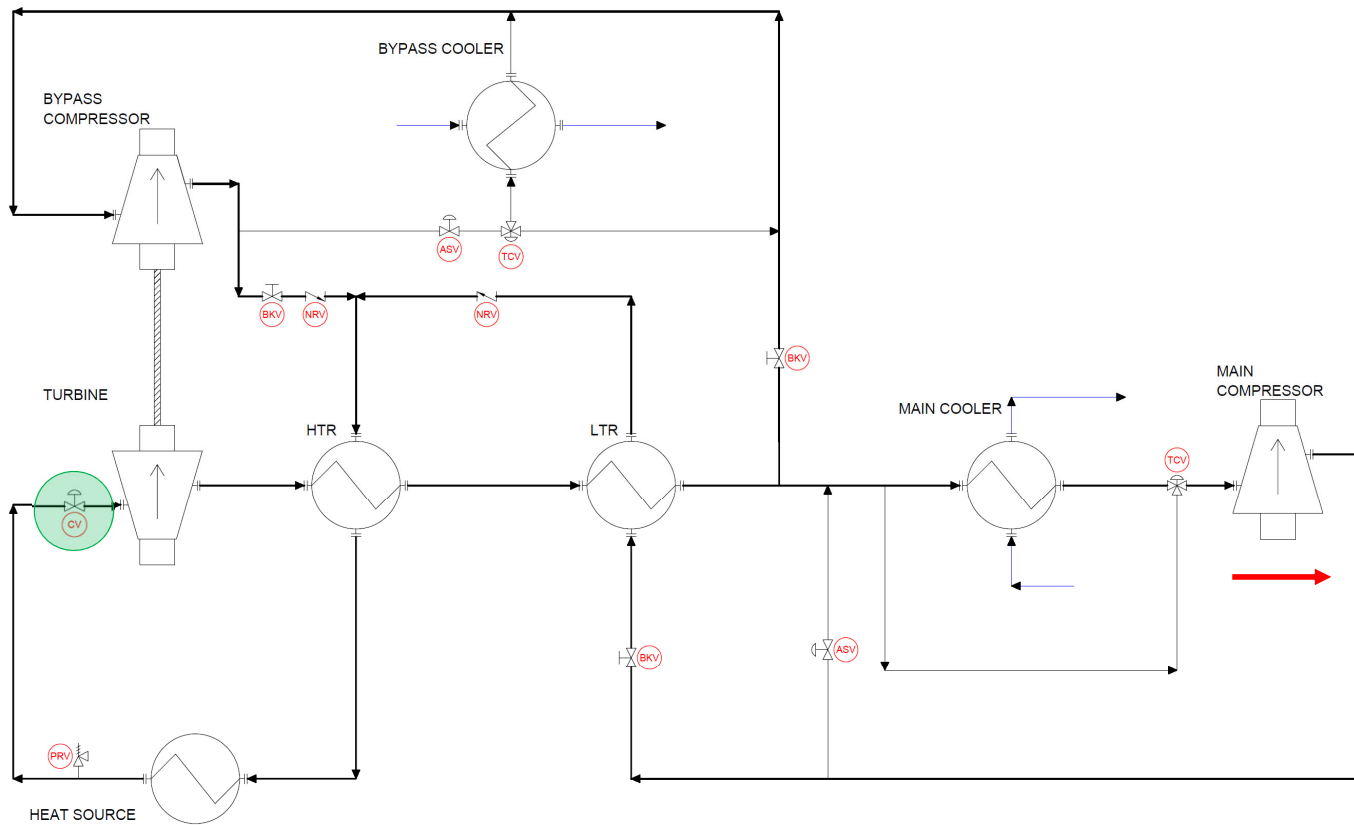


SYSTEM TRIPS

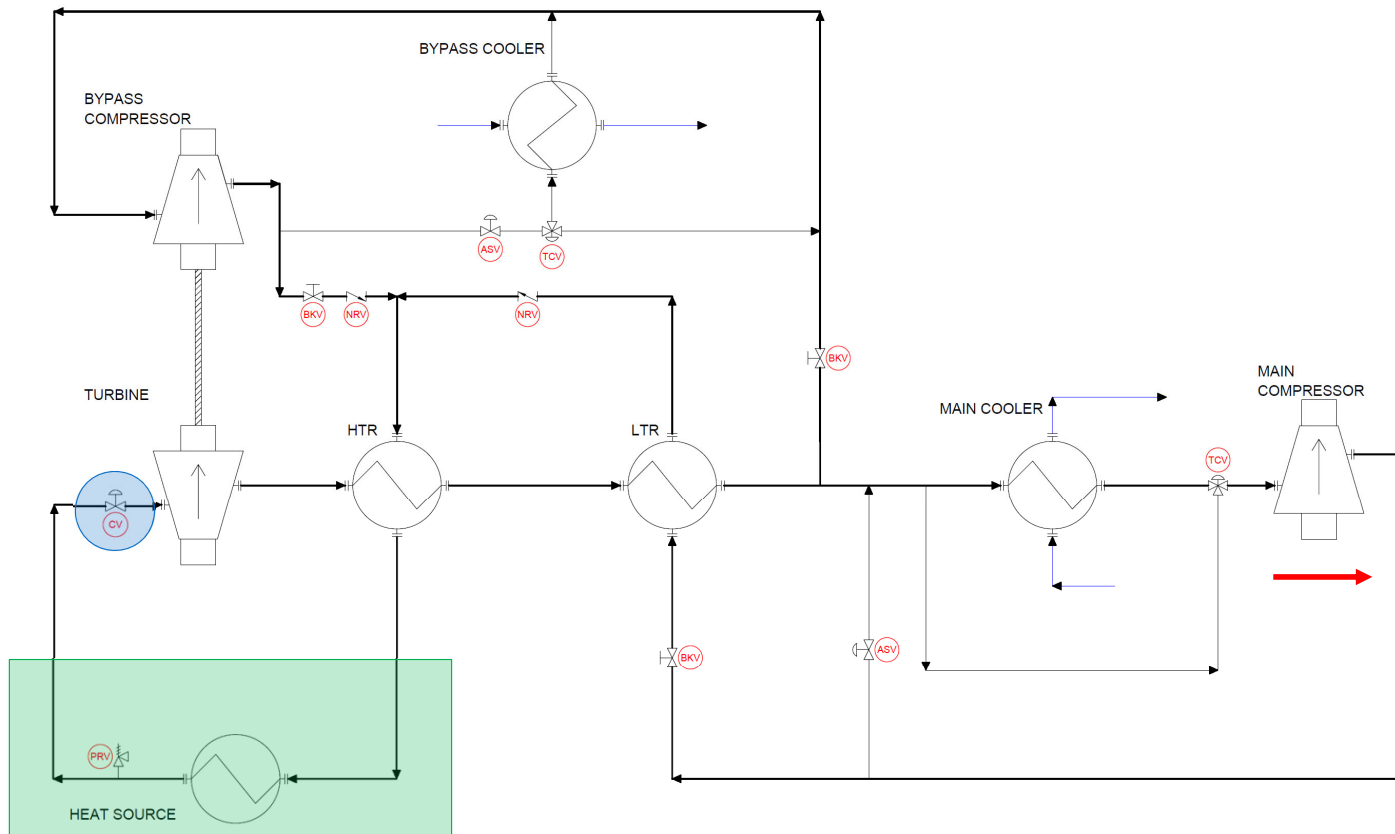
Level 1 Trip



Level 1 Trip

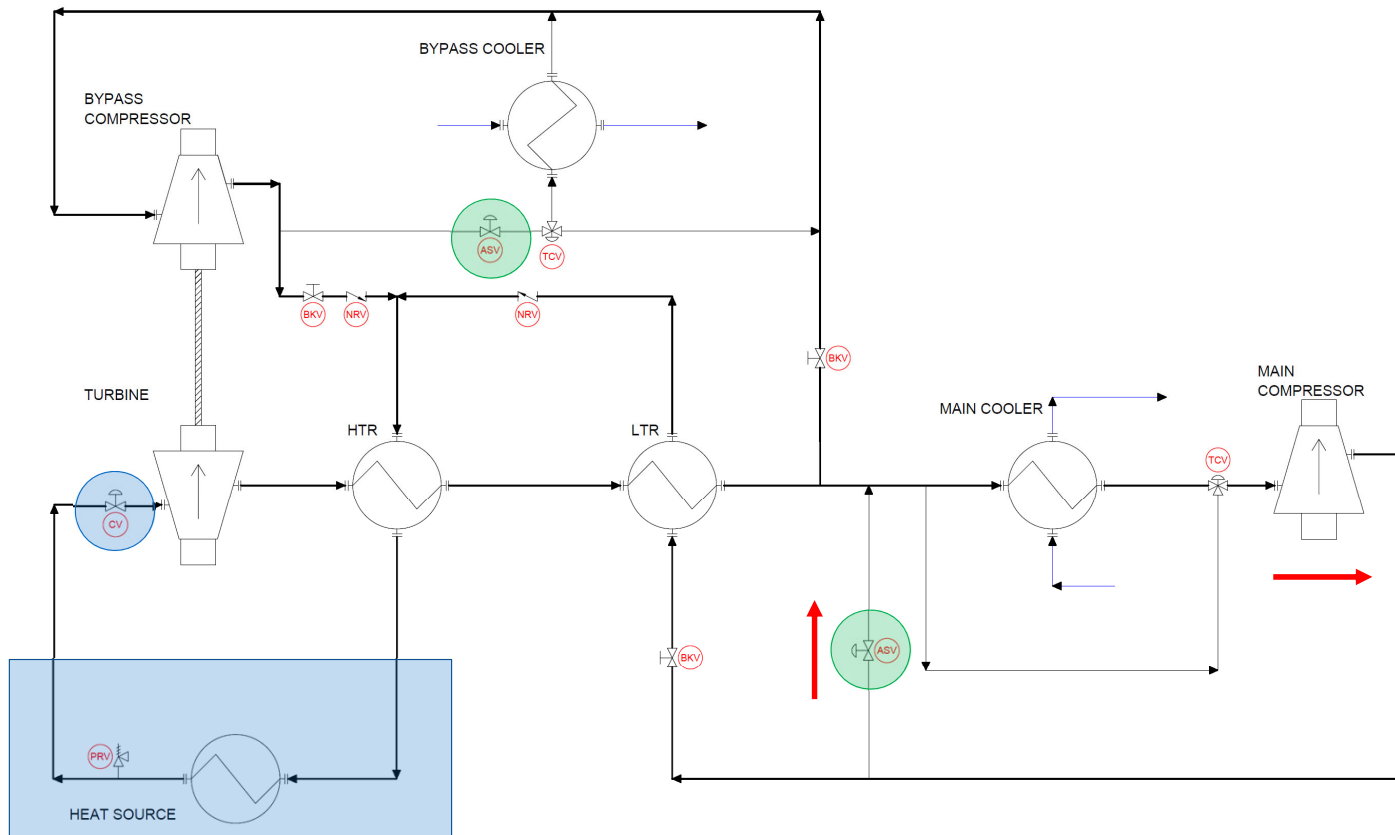


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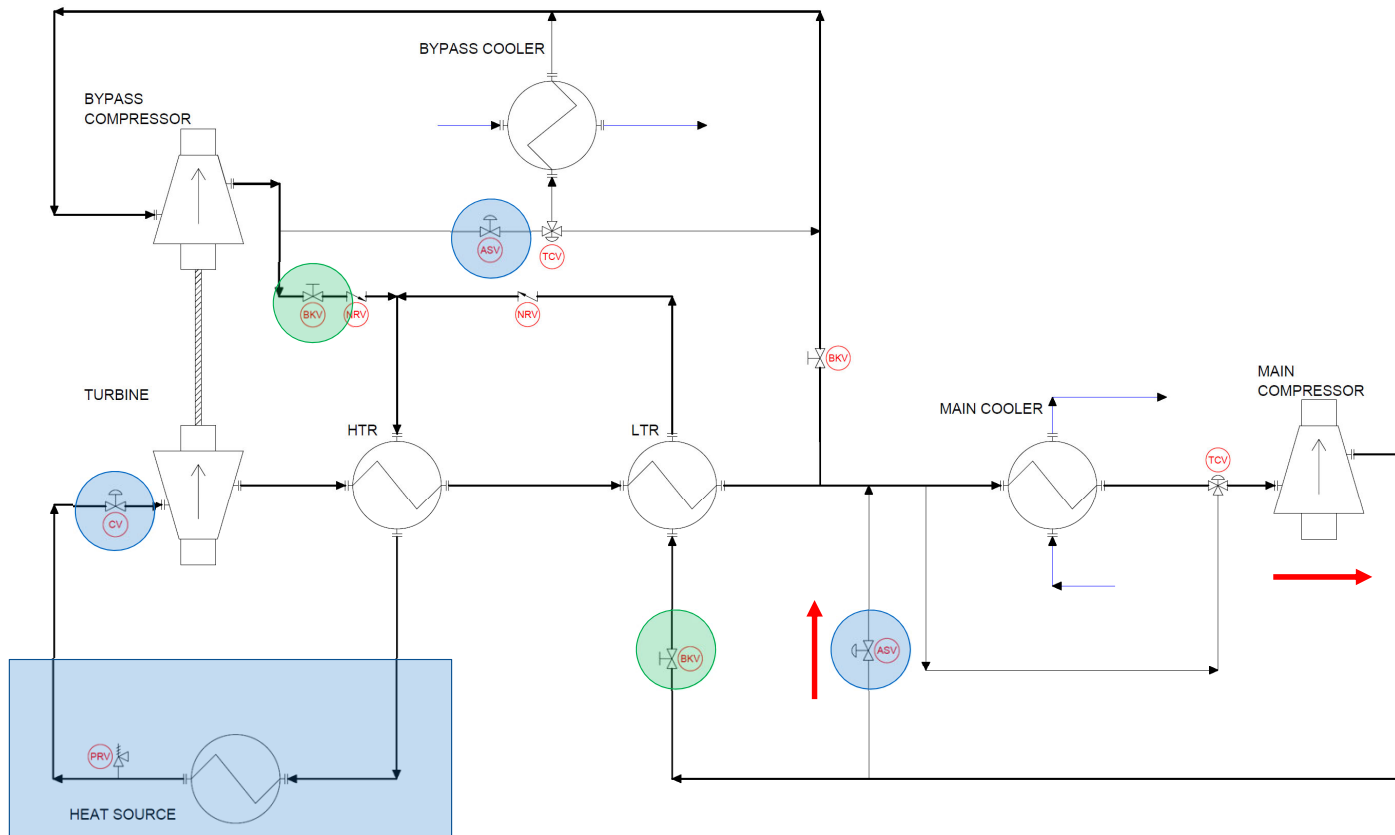
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Level 1 Trip



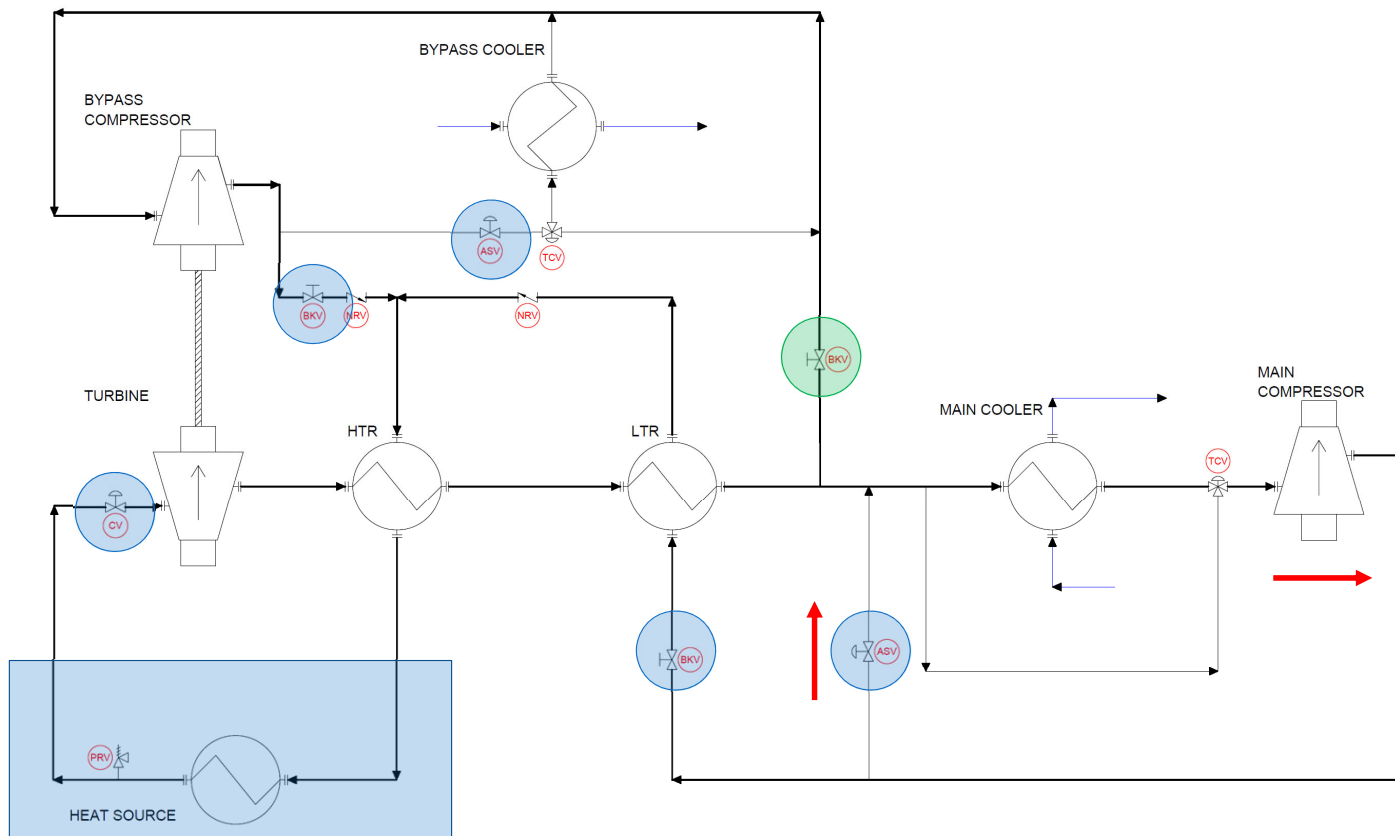
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Level 1 Trip



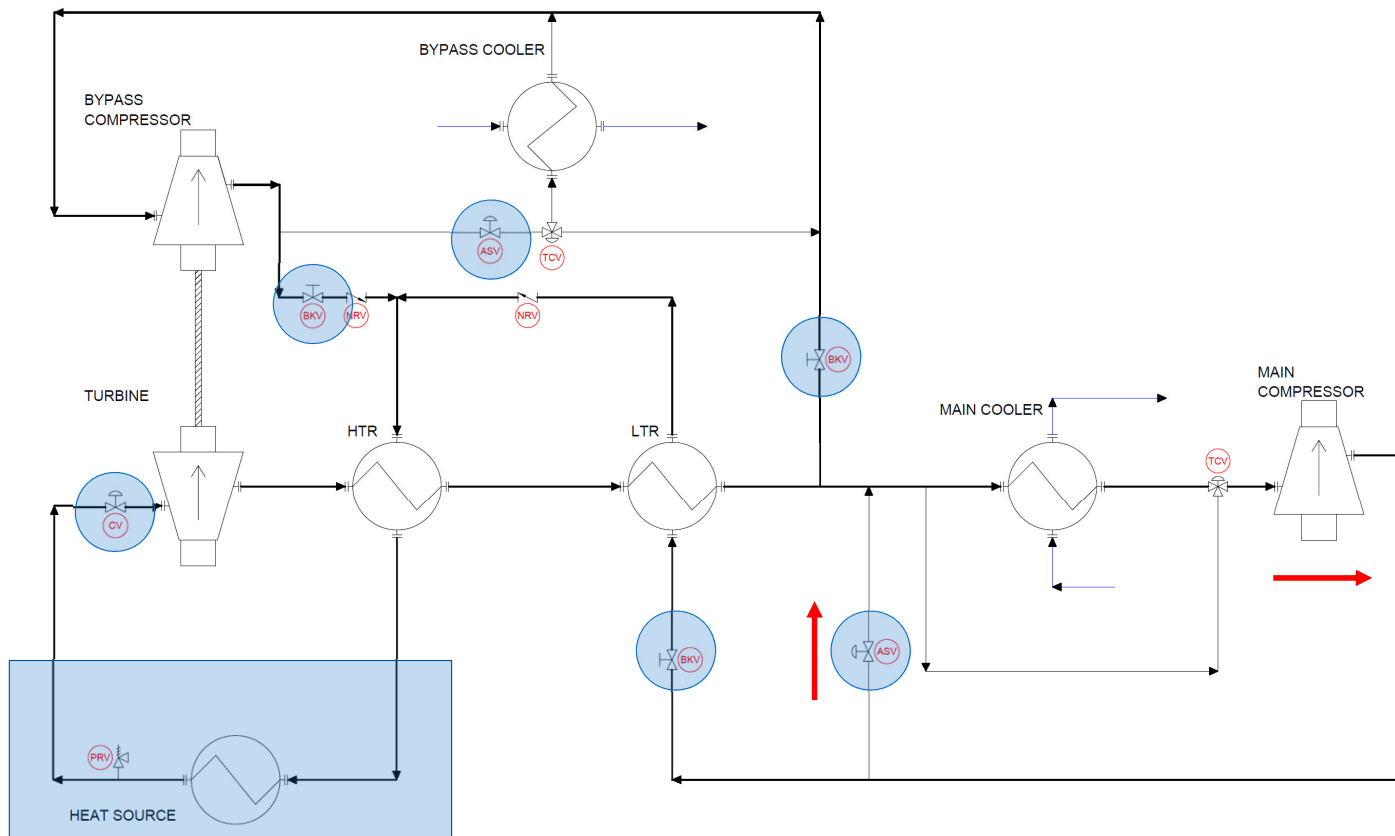
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Level 1 Trip



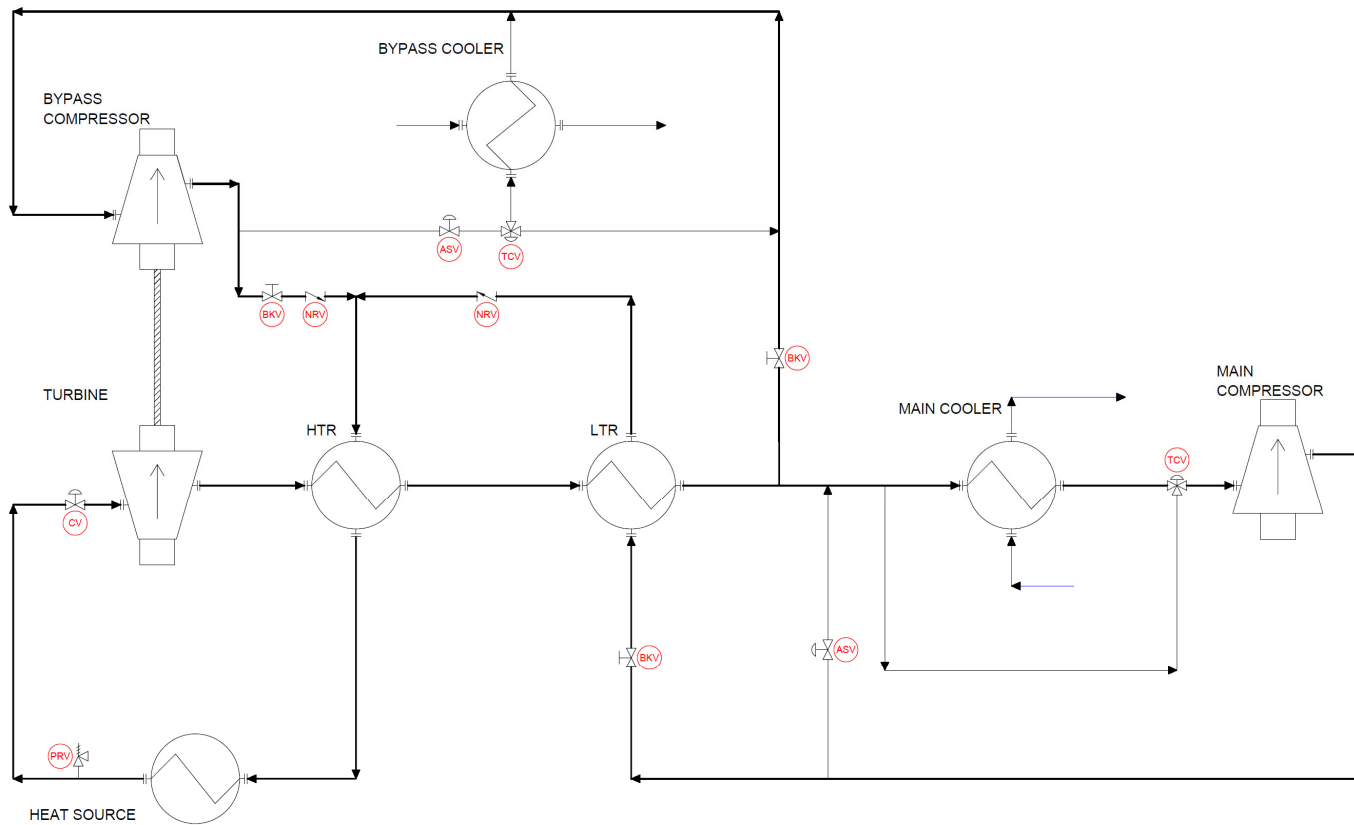
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Level 1 Trip

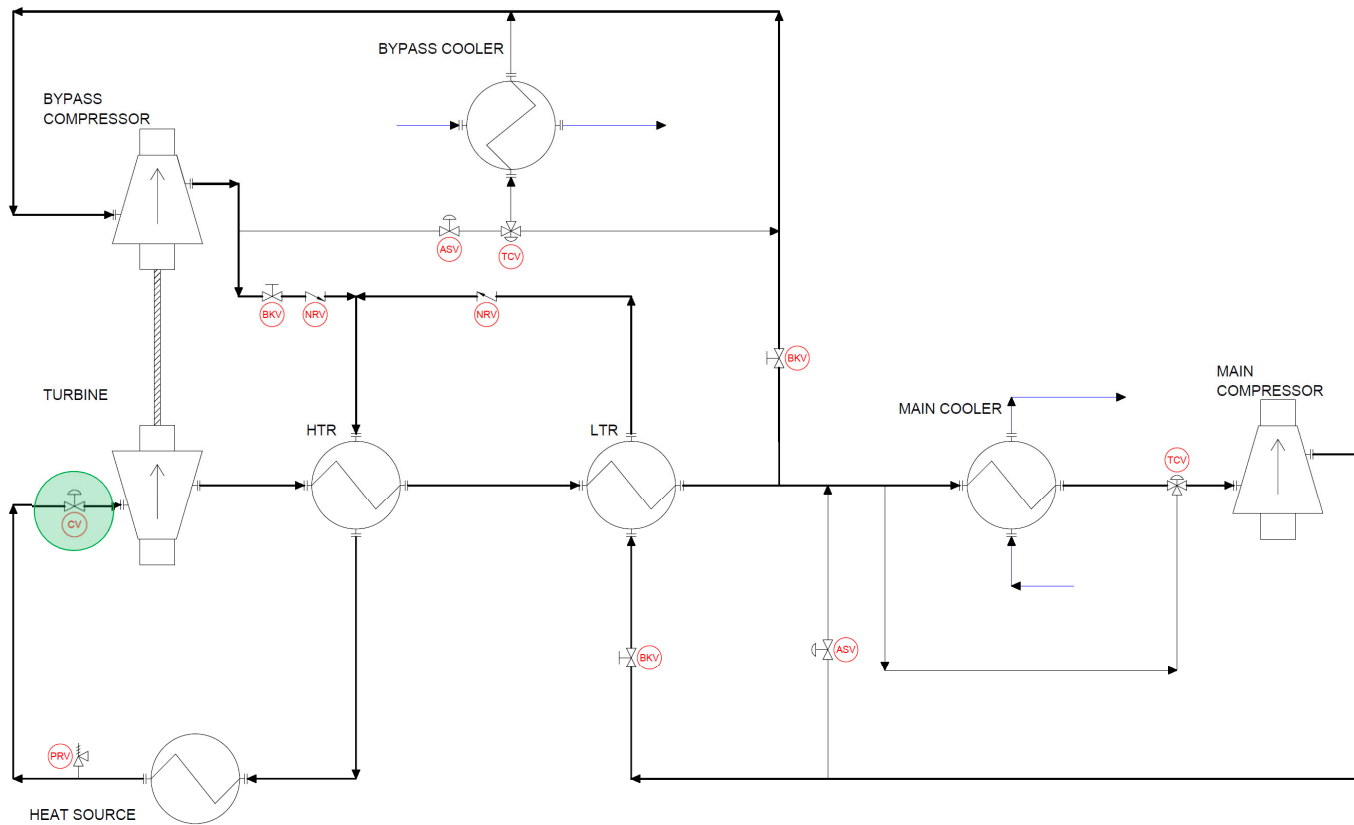


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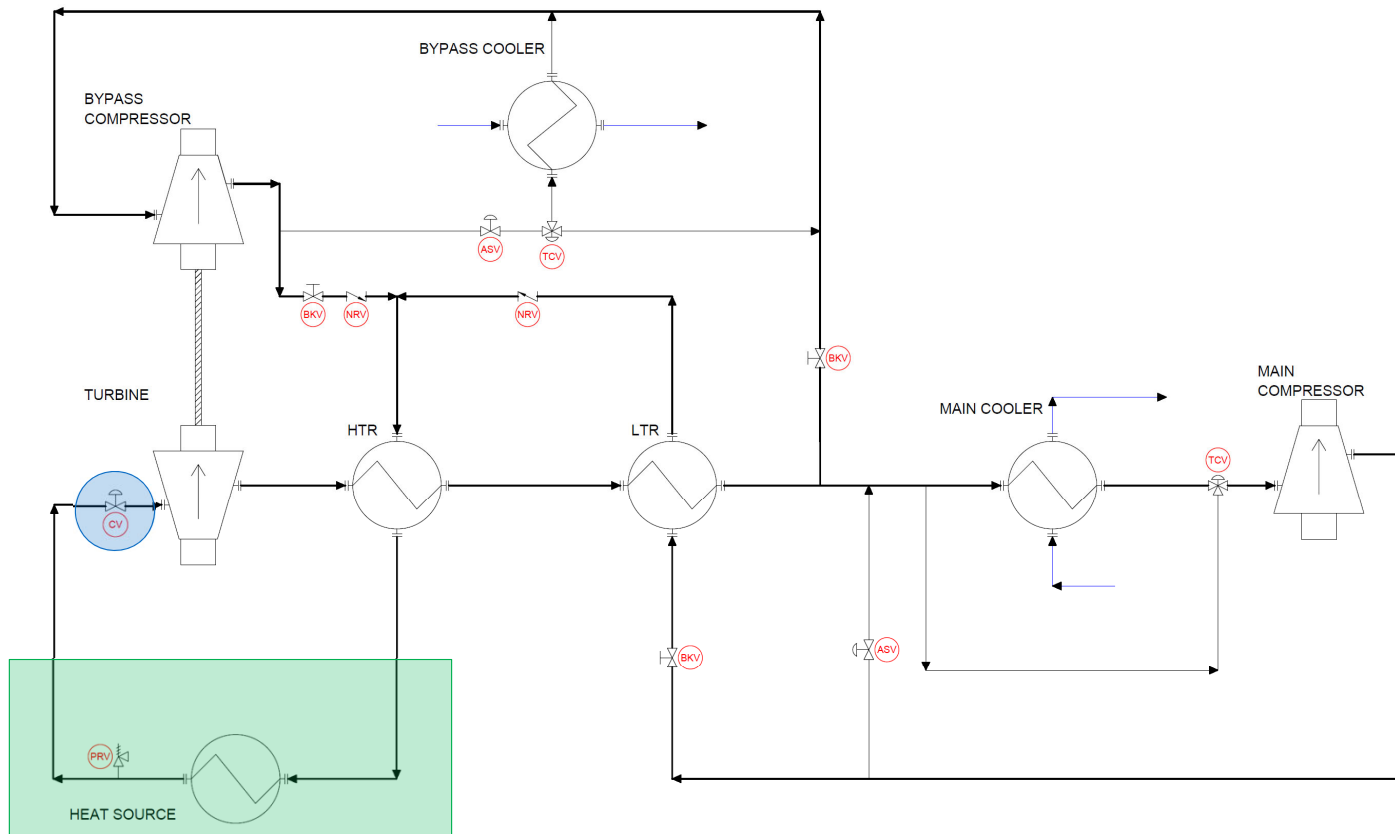
Level 2 Trip



Level 2 Trip

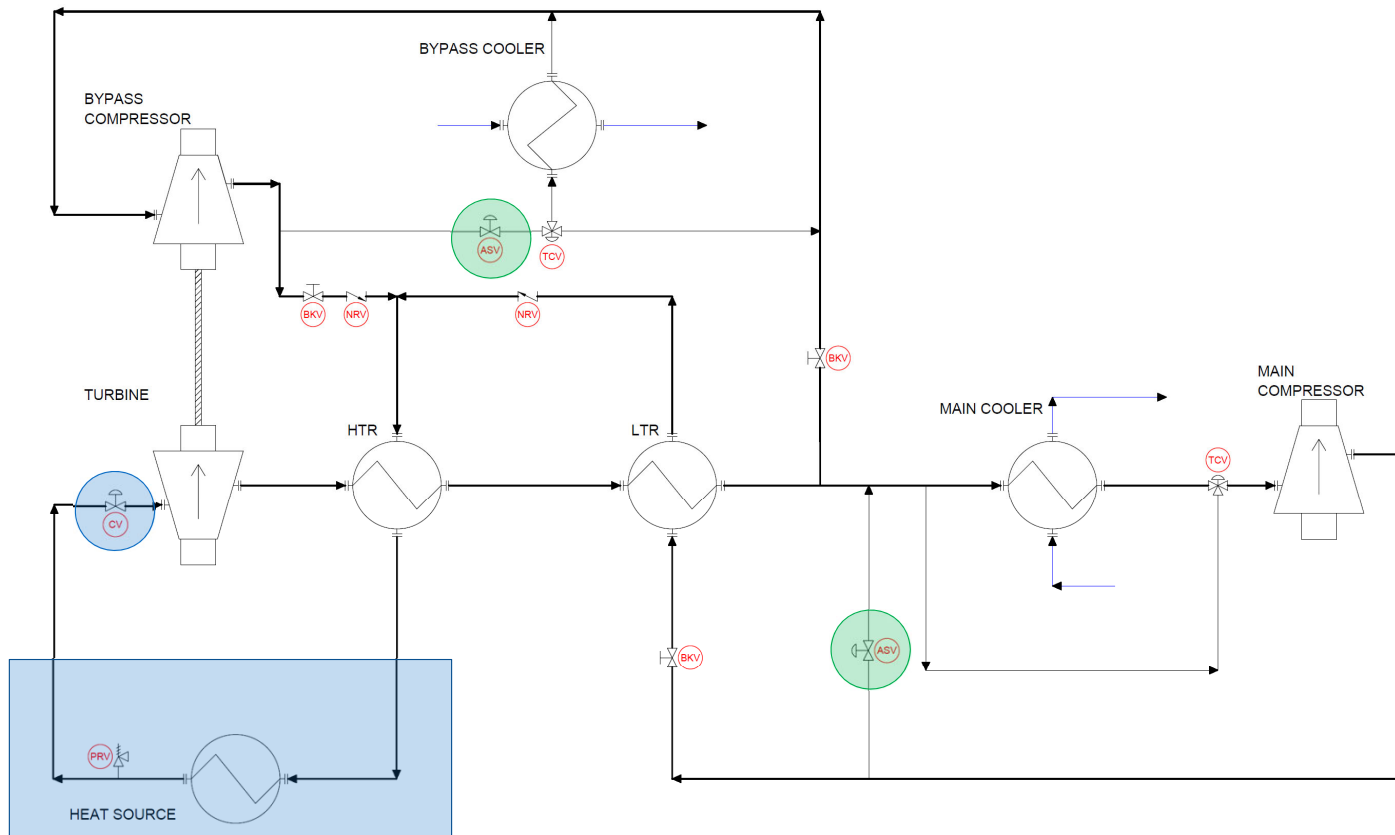


Level 2 Trip



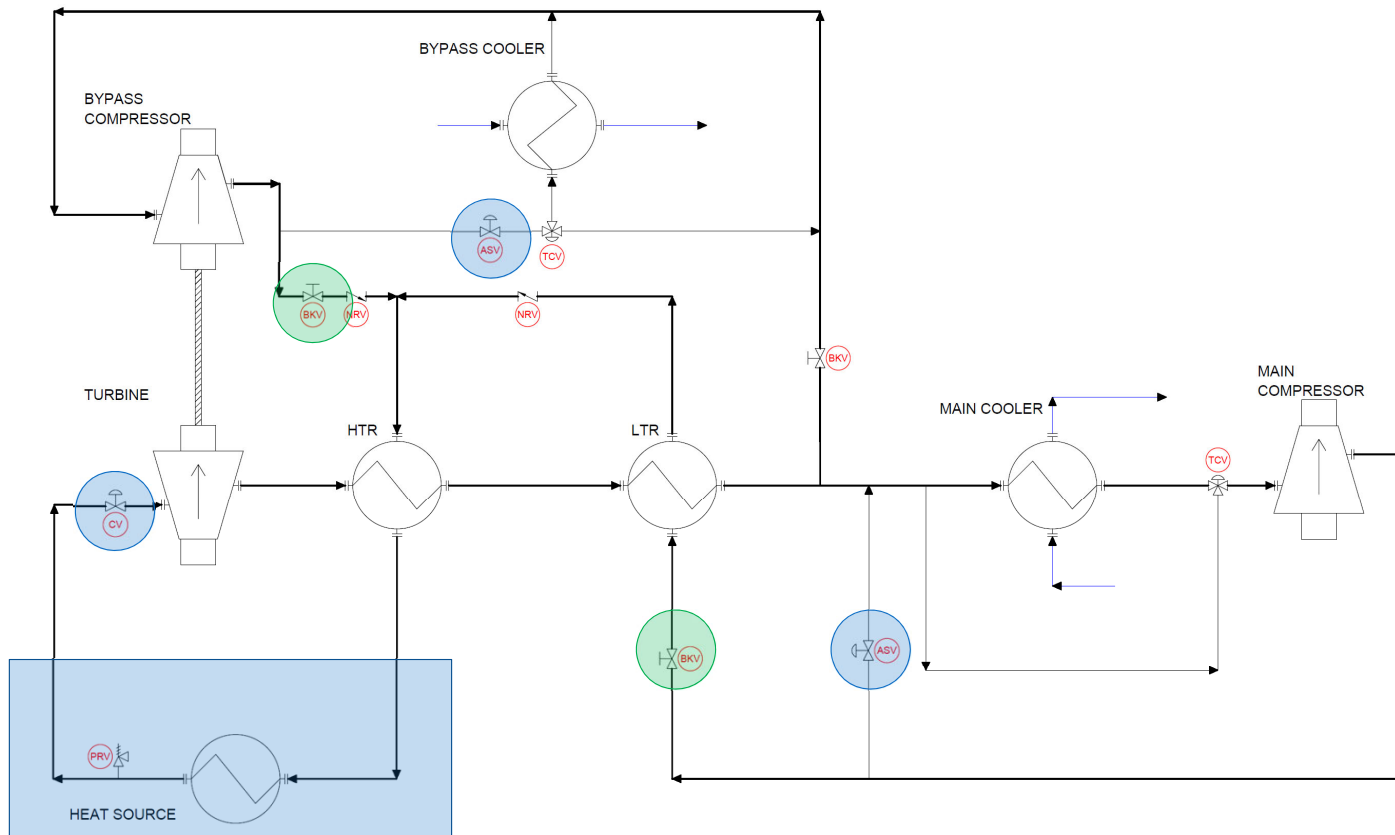
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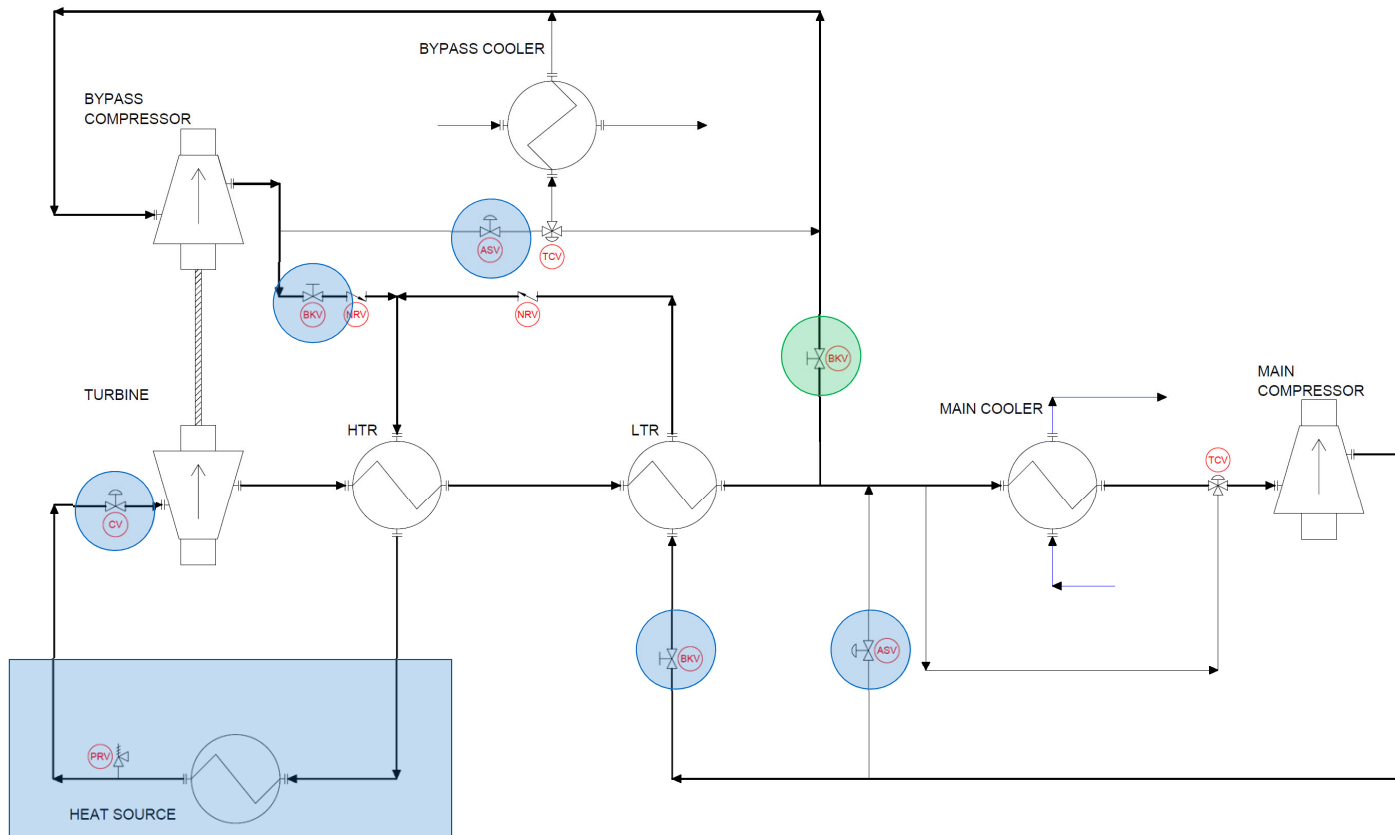
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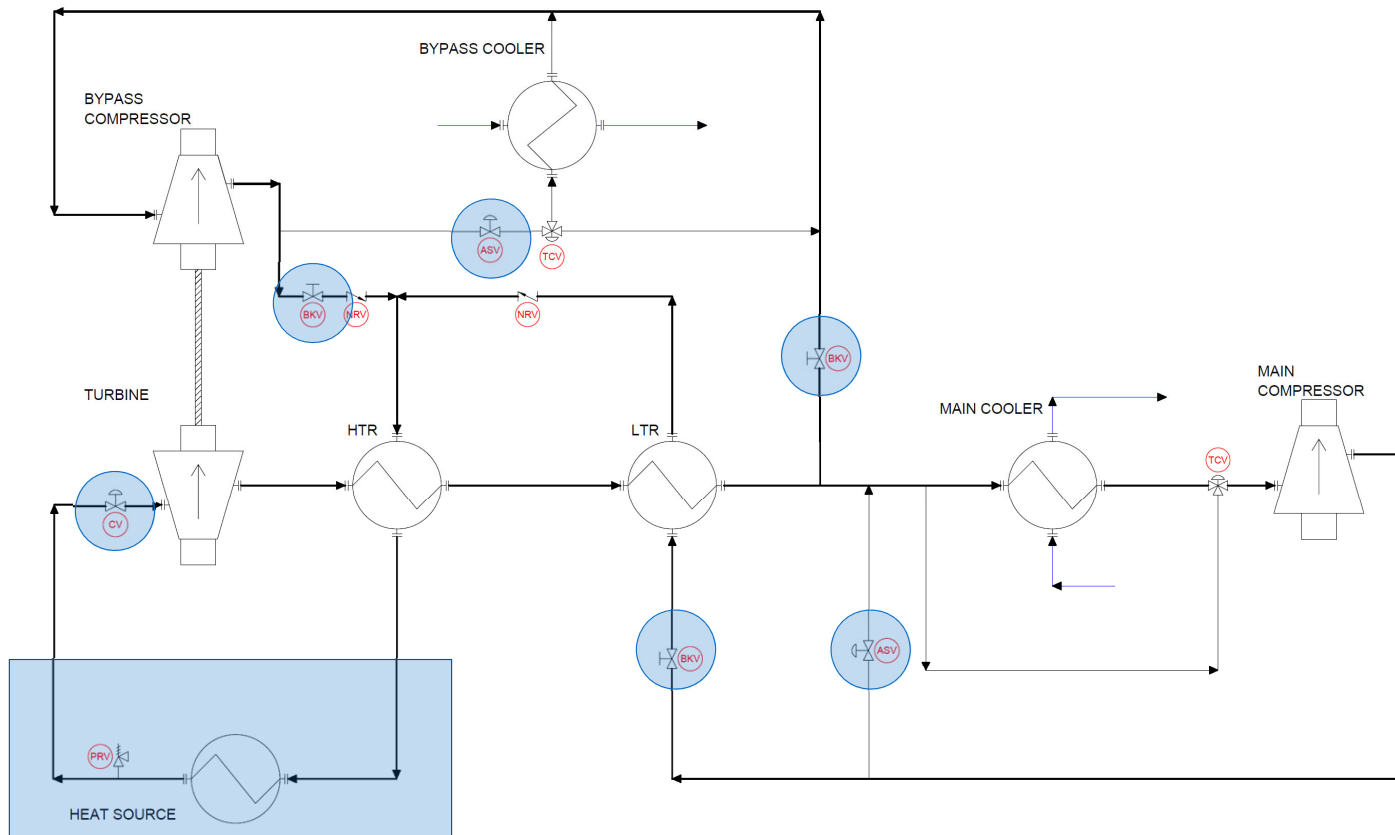
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QUESTIONS?

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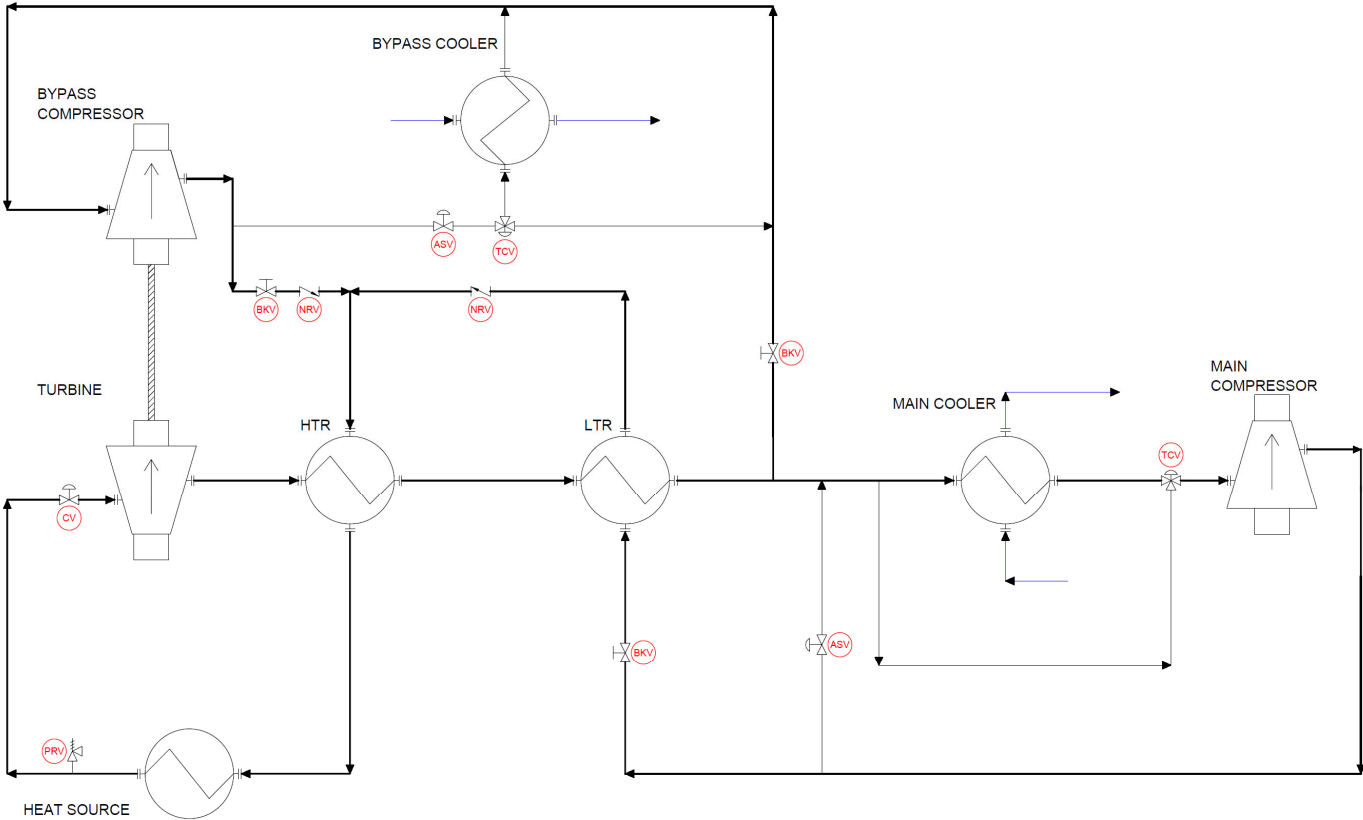
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Recompression Closed Brayton Cycle



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