



**Italian National Agency for New Technologies,
Energy and the Environment**

Solar Thermodynamic Project

ENEA Research Activities

Solar Collector Assembly Test Loop and Laboratory Studies

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Solar Thermodynamic Project

PCS test loop

Main objectives

- Test the optical and thermal efficiency of the new solar collector assembly under development in ENEA
- Analyze the behavior of the process components (pump, valves, piping...) with molten salt as heat transfer fluid
- Verify the instrumentation, control system and operating procedures (molten salt management)

All the tests will be performed with the same operating parameters (flow, temperature) of the future power plant.

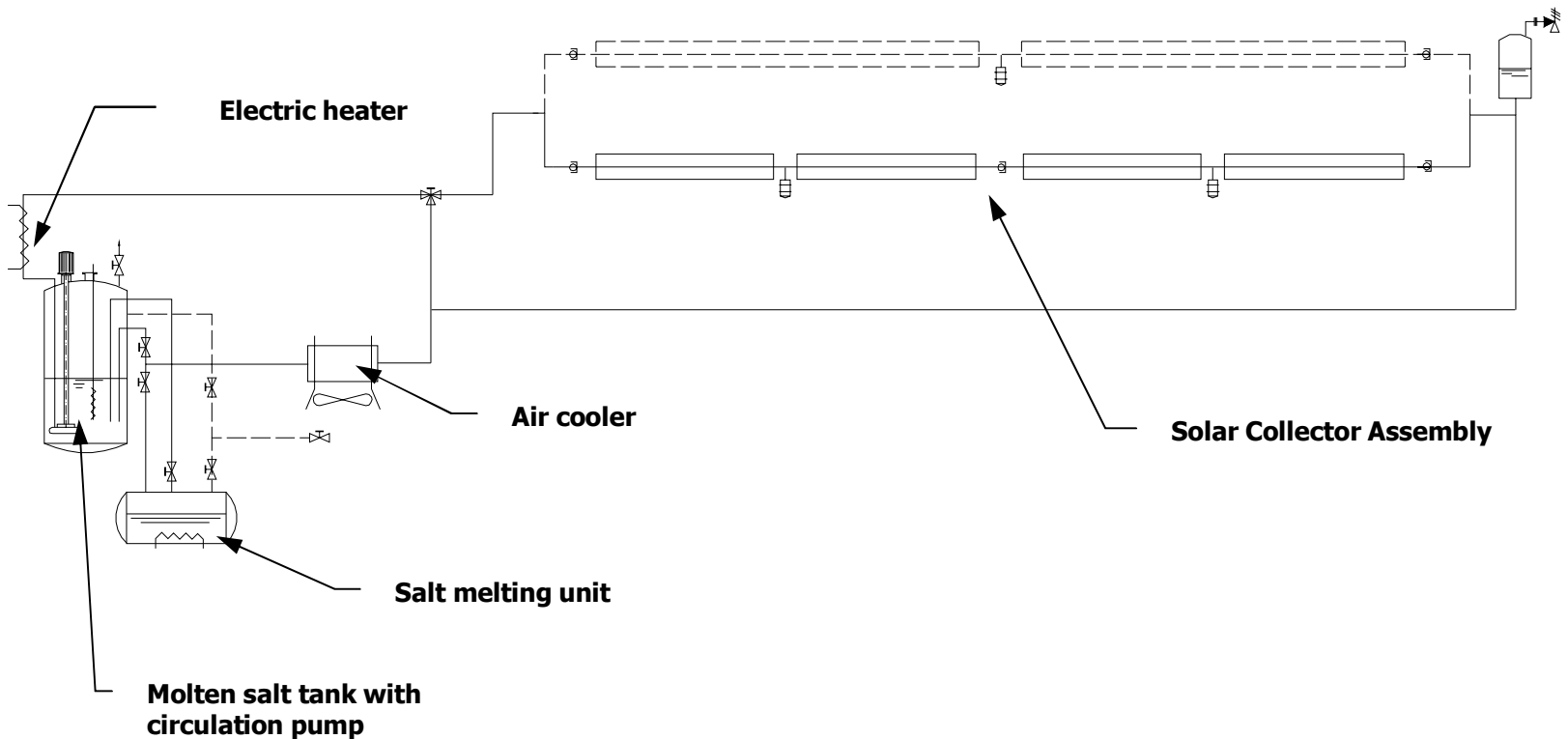
Solar Thermodynamic Project

PCS test loop

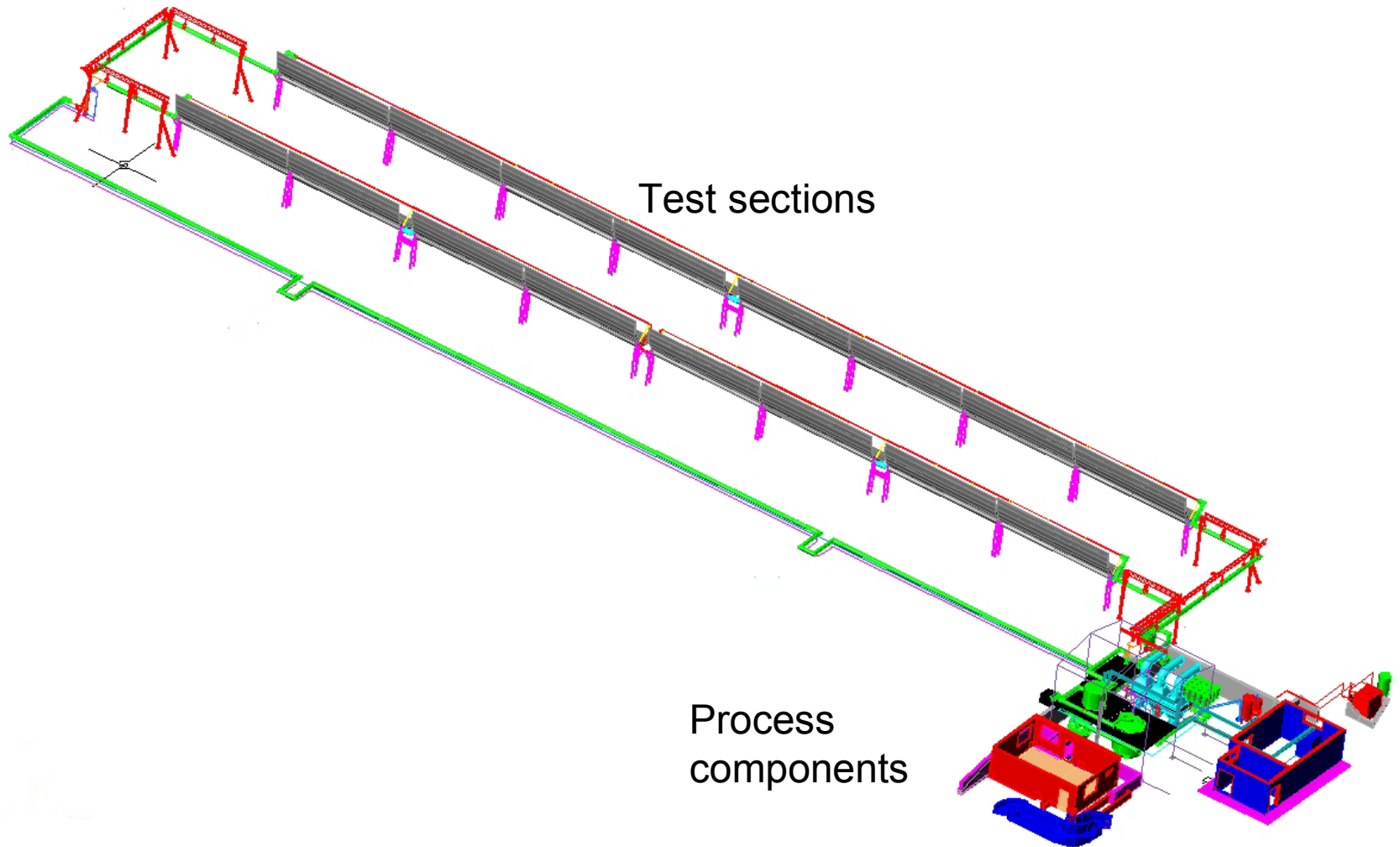
Main parameters

- Heat transfer fluid: mixture of molten salt (40% KNO_3 60% NaNO_3)
- Normal operating temperature: 290 – 550°C
- Fully operation during night time or cloudy days
- Heat transfer fluid flow: 2 – 6.6 kg/s
- Design pressure: 8.5 bar
- Molten salt volume: 3 m³
- Maximum thermal power: 500 kW

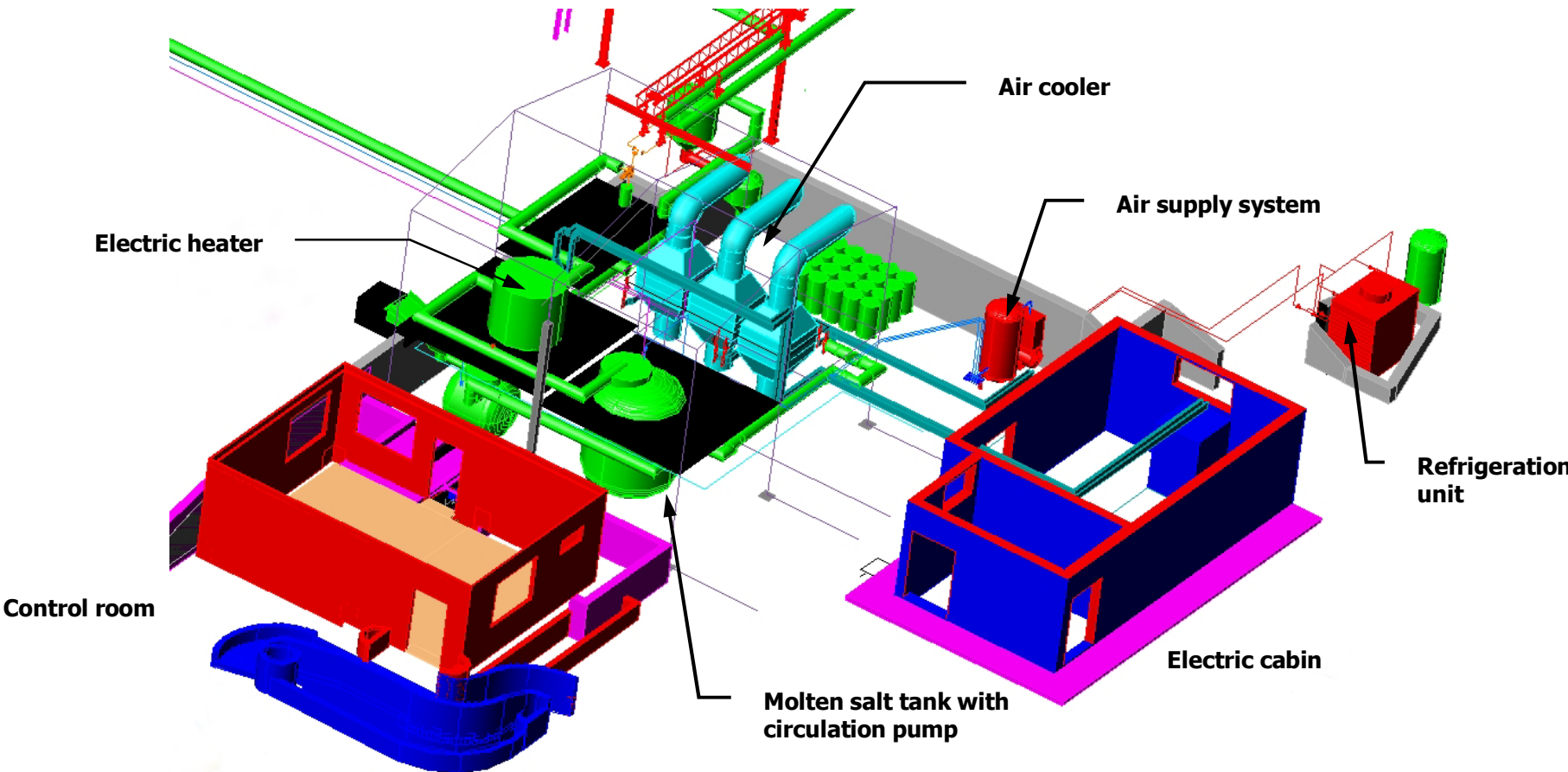
PCS test loop: layout



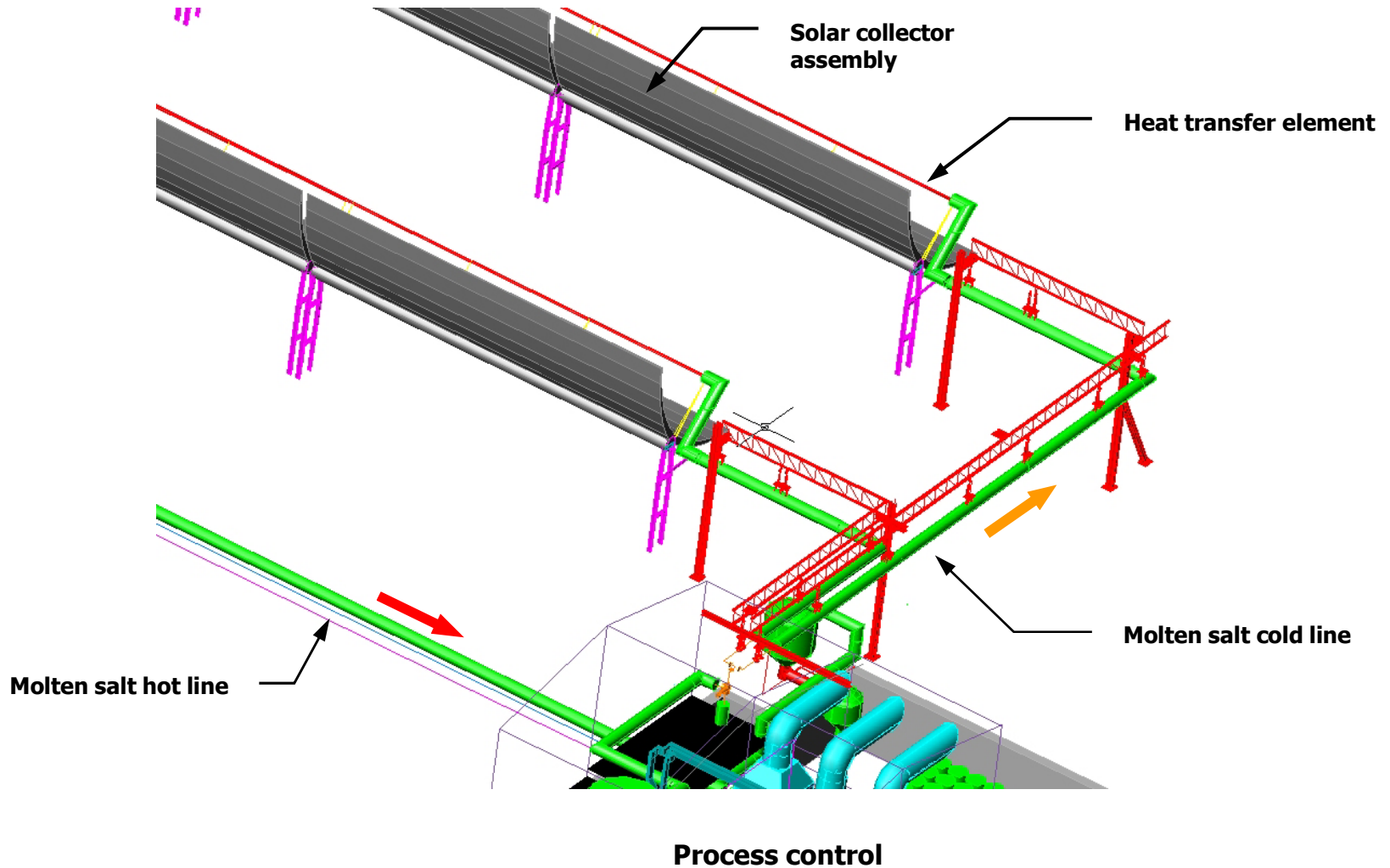
PCS test loop: aerial view



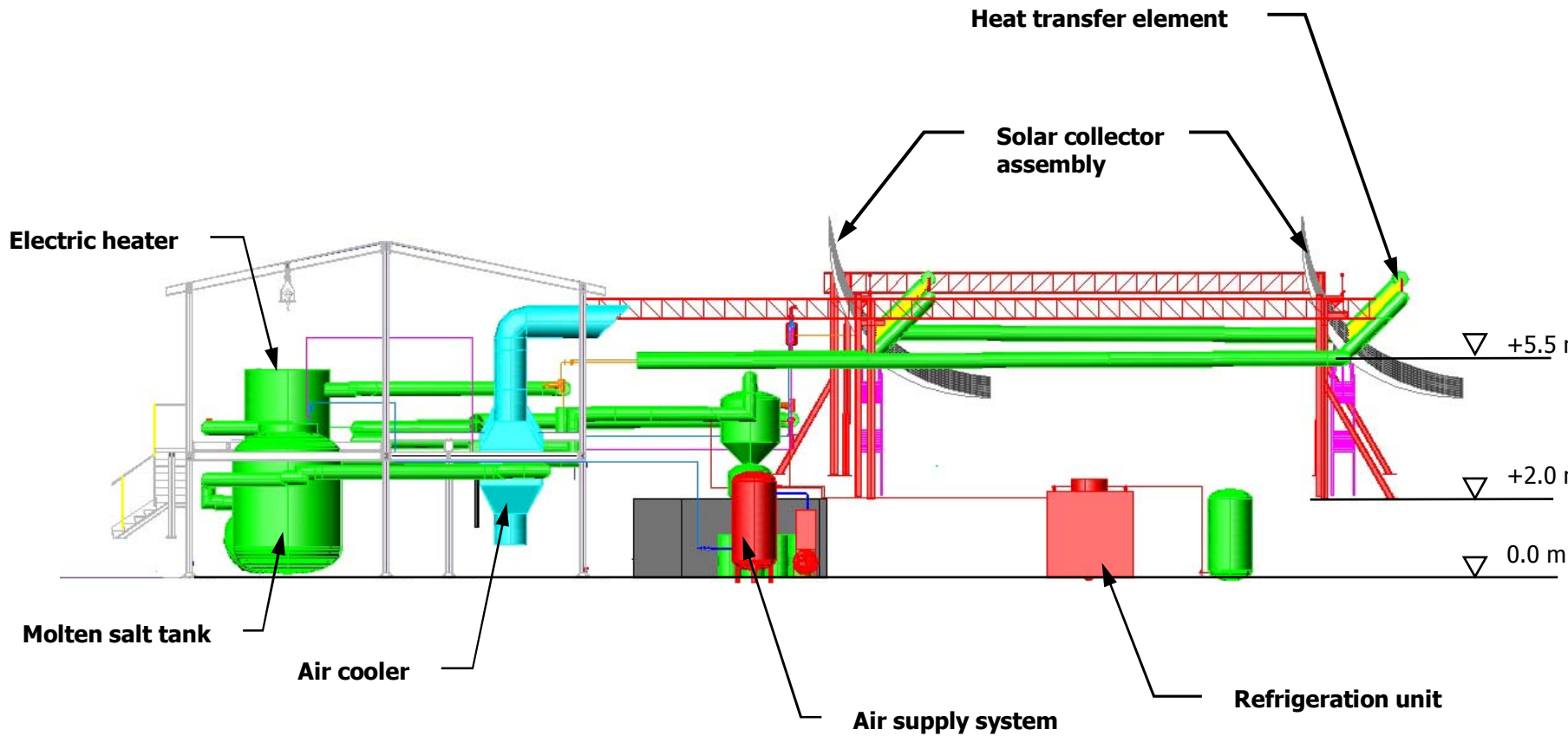
PCS test loop: process components view



PCS test loop: test section inlet view



PCS test loop: front view

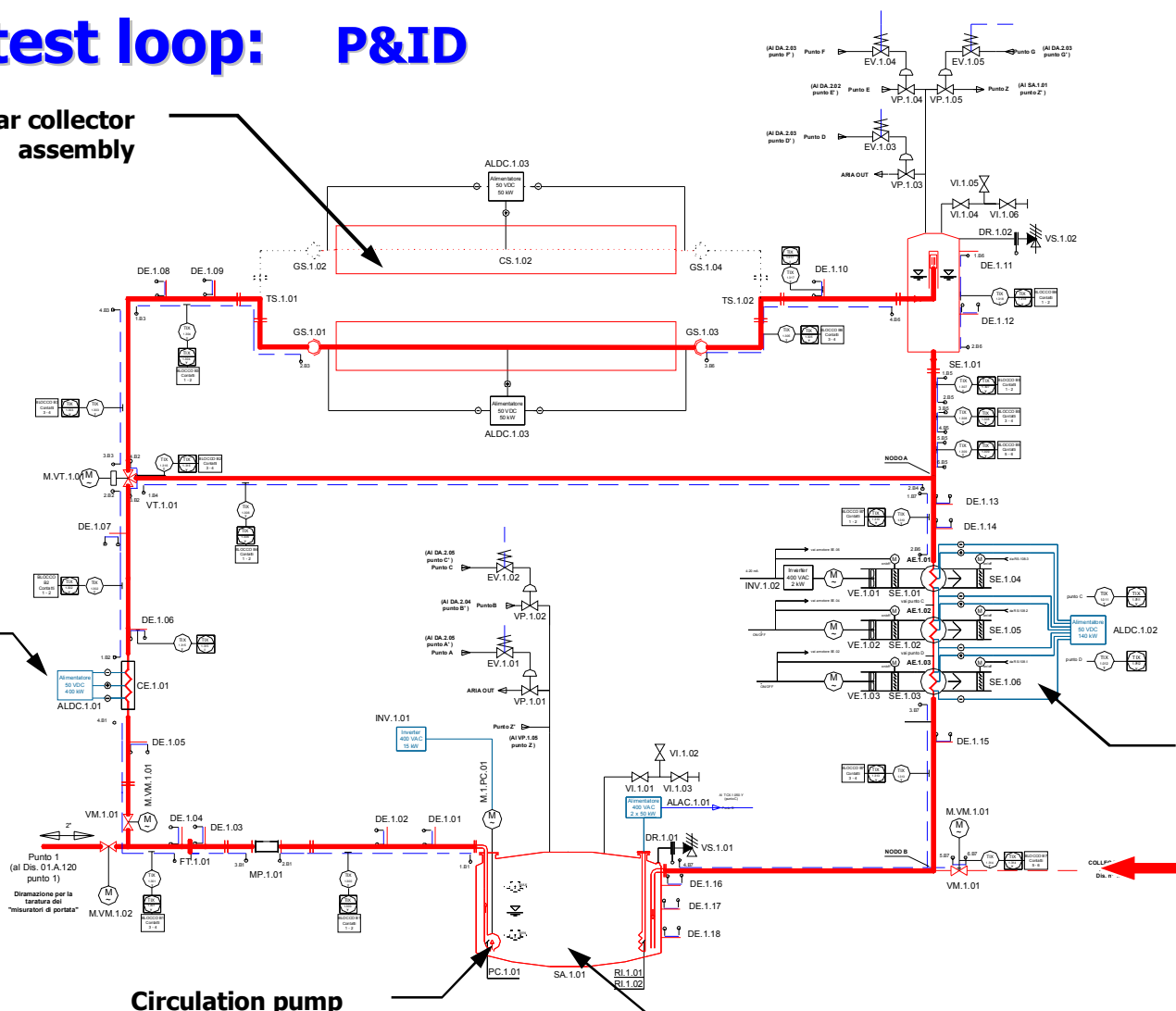




PCS test loop: P&ID

Solar collector assembly

Electric heater



Air cooler

From salt melting system

Circulation pump

Molten salt tank

Primary Loop : *Ball Joint Flanges*



Metallic Gasket

Hydraulic Joints
between Pipelines
and Collectors



REXOR Test Rig

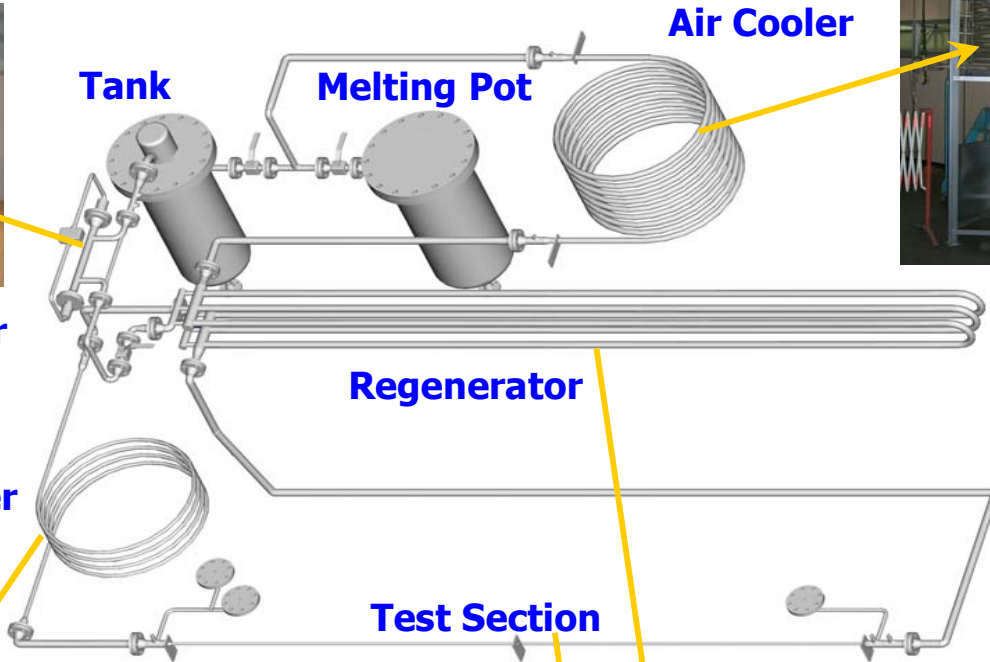


Experimental
Assessment
for Coating
Performances
and Calibration
on AISI 316L
Pipes

MOSE (Molten Salt Experiences) Test Loop



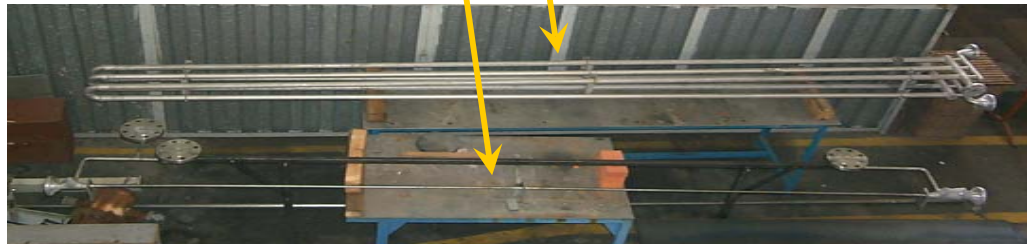
Mass Flow Meter



Air Cooler



Electric Heater



Test Section

Static and Fatigue Corrosion Testing for Stainless Steel Bathed by Molten Salt



Temperature
and Pressure
Control

AISI 304 Melting Pot

Welded Samples of AISI 316L after 750 hrs in Contact to Molten Salt at different Temperatures



Original Sample



290 °C



550 °C



590 °C

Laboratory Study of Molten Salt Mixtures



Autoclaves for Pressure and
Temperature Measurements of
Molten Salt at Constant Volume

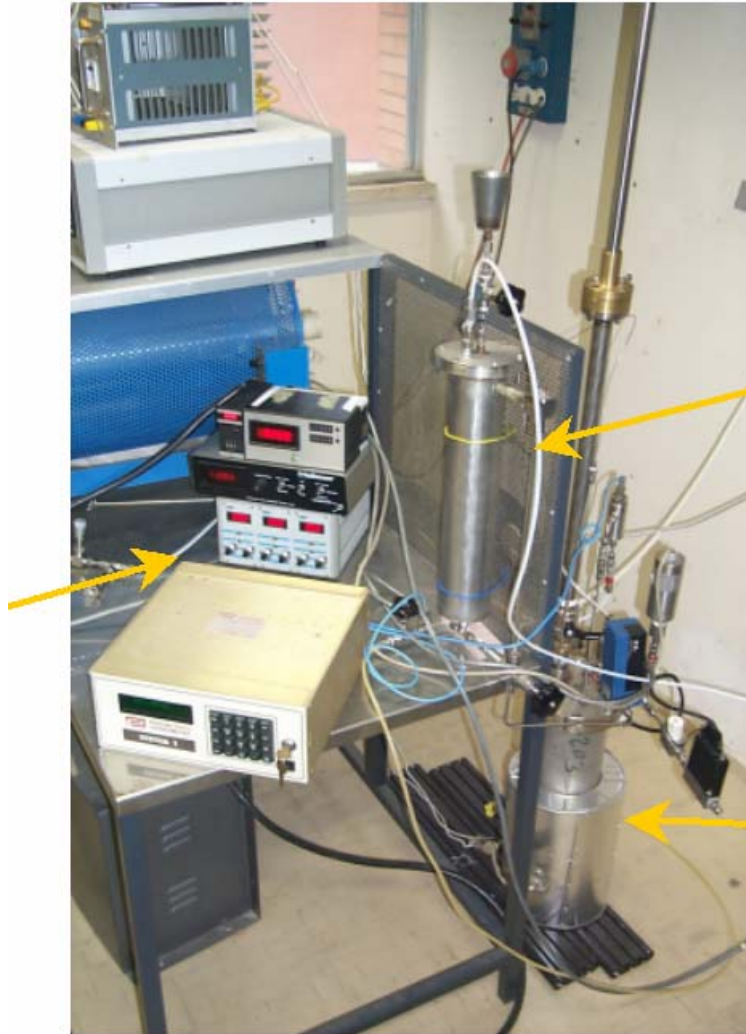


Mixture of Molten and Solid Salt
after 10 Months Exposure on Air

Laboratory Study of Molten Salt Mixtures

Test Section on
Molten Salt, Water
and Air Interaction:
Measurements of
Hydroxides and
Carbonates

Gas-chromatograph
Control Section



Water/Air
Feeding
Loop

Autoclaves

Primary Loop: Heating Line Test

