Profile SFR-59

ST-300

LATVIA

GENERAL INFORMATION

NAME OF THE FACILITY	Thermo-vacuum chamber for high temperature LM tests
ACRONYM	ST-300
COOLANT(S) OF THE FACILITY	Na, Li
LOCATION (address):	Institute of Physics University of Latvia (IPUL), Salaspils, Latvia ,LV-2169
OPERATOR	IPUL
CONTACT PERSON (name, address, institute, function, telephone, email):	Ernests Platacis, IPUL, Miera 32, Salaspils, Latvia LV-2169 Head of Hydro-mechanic Laboratory, Tel. +371 2651 3424, erik@sal.lv

STATUS OF THE FACILITY	In operation
Start of operation (date):	**1987**

MAIN RESEARCH FIELD(S)

- ☐ Zero power facility for V&V and licensing purposes
- ☐ Design Basis Accidents (DBA) and Design Extended Conditions (DEC)
- x Thermal-hydraulics
- . Coolant chemistry
- x Materials
- x Systems and components
- x Instrumentation & ISI&R

TECHNICAL DESCRIPTION

Description of the facility

The thermo-physical facility ST-300 was design for testing of liquid metal equipment and for investigation of their thermo-hydraulic characteristics under specific conditions, first at all, at extremely high working temperatures. Long –term including resource testing of modules and sections possible.

The facility includes the following basic units and systems:

1) Double – wall vacuum chamber cooled by water. The capacity of thermal power removal - 300 kW The volume of the chamber i- 12m^3 (D=2m; L=4m).The chamber consists of two main parts joint by jigs: a stationary lid and movable cylindrical container (working volume) mounted on a rail-trolley. The lid is connected to the vacuum system, alarm circuits and other communications, equipped also with various supply leads.

2) Experimental and engineering systems for operation of the facility: hydraulic; current supply; gas and vacuum; heating; cooling system of the lid and of the body; a control and monitoring system. Heating of the heat carrier occurs when an electric current passes through the pipes of a heater containing liquid metal. Range of current passes through heater pipes is adjustable (0 – 10 000A).

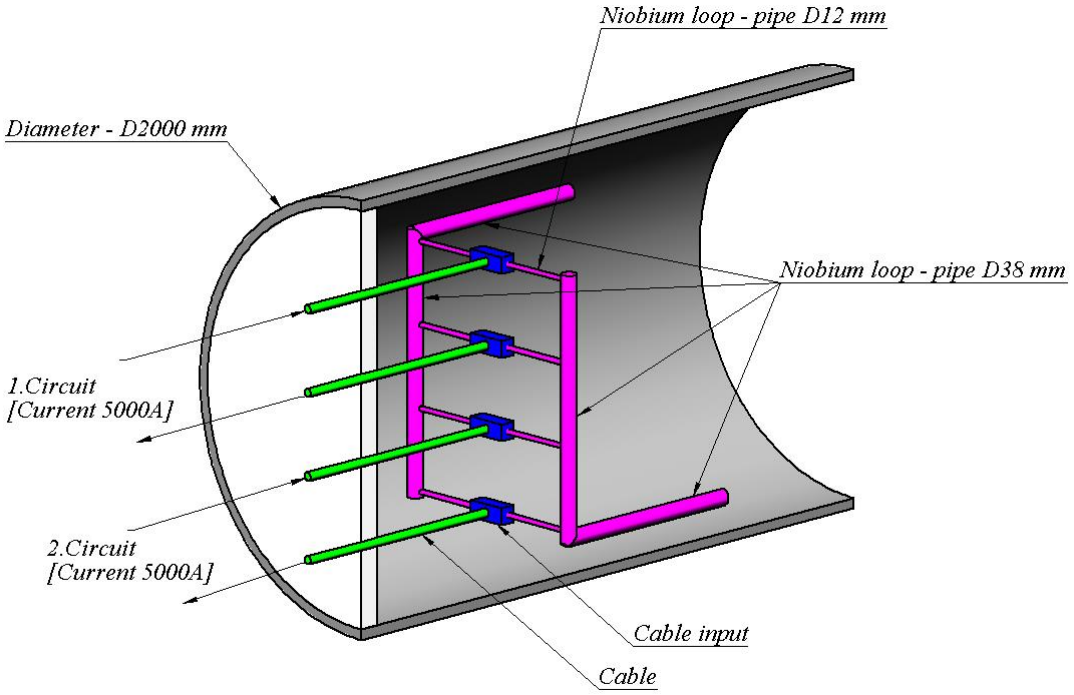


FIG. 1. Scheme of the LM loop heater

The facility allows performing experiments under specific conditions:

- Fine vacuum (of the order of 6.65x10^{-4} Pa);
- the temperature of objects to be investigated ranging from 200 to 1200K;
- avoidance of oxidation of construction materials (caused by the high temperature).

Acceptance of radioactive material
No

Scheme/diagram

No presented

3D drawing/photo

FIG. 2. View of the ST – 300 facility

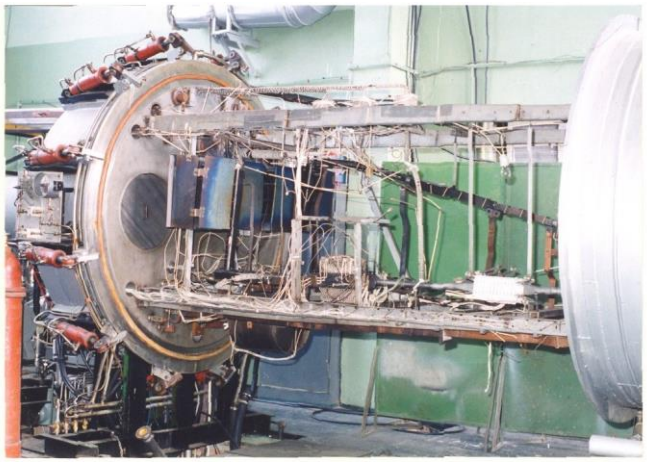
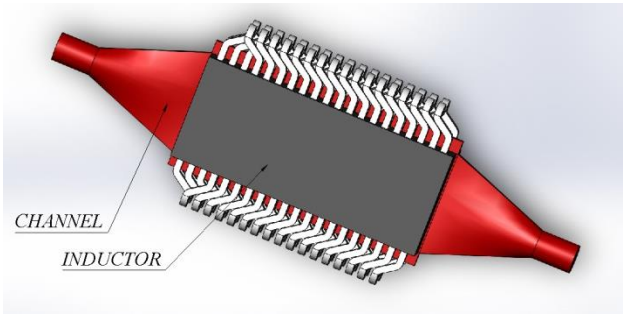


FIG. 3. Li loop for testing of components at temperature up to 1200K



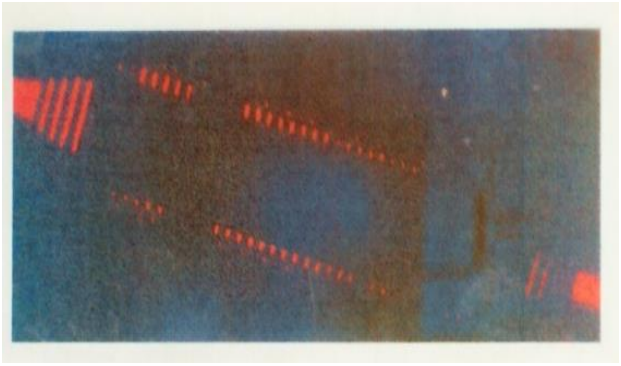


FIG. 3. Scheme (left) and photo (right) of flat EMP with Nb made channel at 1249K

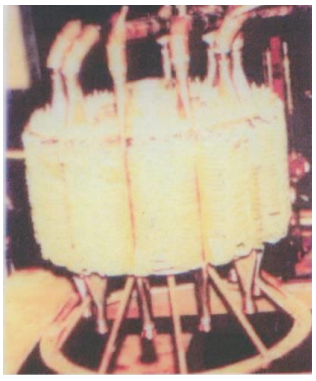


FIG. 3. Multi (10) – channel induction EMP

FIG. 4. Annual EMP with Nb made channel, tested temperature up to 1150K

Parameters table

Coolant inventory in the test loops	Up to 24 L/s (depend on test queries)
Power	300kW
Test sections	
The subject of inquiry –the prototype liquid metal system-must be placed on a carrier stably fastened to the lid of the chamber. The dimensions of the system are limited by the size of the chamber (D2m;L=4m)	Stainless steel sodium loop has been installed
TS - 2	High temperature niobium (Nb) loop has been installed
TS - 3	Multi – channel SS loop has been developed and installed; ;
Coolant chemistry measurement and control (active or not, measured parameters)	Not measured
Instrumentation	Thermocouples, pressure transducers, electromagnetic flow meters,

COMPLETED EXPERIMENTAL CAMPAIGNS: MAIN RESULTS AND ACHIEVEMENTS

1) Stainless steel sodium loop has been installed into vacuum chamber. Two electromagnetic pumps tested at temperature up to 1050K. Flow rate of the heat carrier (Na) in the loop – up to 15L/s, pressure drop – up to 2 bar.

2) High temperature niobium (Nb) loop has been installed into vacuum chamber.Two high temperature electromagnetic pumps with Nb made channels, as well as pressure transducers and flow meters tested at temperatures up to 1200K. Heat carrier – lithium (Li), flow rate – up 5L/s,

pressure – up to 2 bar. Workability of all the components confirmed. Production technology of niobium made components mastered.

3) Multi – channel SS loop has been developed and installed into vacuum chamber. A fail-safe induction pump with 10 independent channels tested at 450^0 C. Heat carrier – sodium; Q- up to 25L/s; pressure drop – up to 2 bars. Emergency regimes of EMPs and recording of the relevant local and integral characteristics considered.

PLANNED EXPERIMENTS (including time schedule)

Hydraulic and corrosion tests of liquid metal (Li) spallation target for the fusion material investigation facility IFMIF. Required velocities over the substrate ($\geq$ 13m/s) foreseen. Loop and induction pump with Nb made channel installed. Preparation stopped by financial reasons.

TRAINING ACTIVITIES

Training activities should be agreed with IPUL for the operation of the experimental campaign under the supervision of IPUL qualified staff

REFERENCES (*specification of availability and language*)

1. BYSTROV P., KIRISIK E., USHAKOV J., SMIRNOV V., PLATACIS E., PUKIS M., TINTE A., ZVANE G. " Design of the induction MHD – pumps for nuclear space-power plants"; Proceedings on the Conference on Energy Transfer in Magneto hydro dynamic flows; Cadarache – France, pp. 113 – 120,1991.
2. PLATACIS E., PUKIS M., ZANDARTS J., ZVANE G., BYSTROV P. " Experimental processing of electromagnetic pumps for nuclear plants and investigation of MHD-flows in the fission reactor elements"; Proceedings on the Conference on Energy Transfer in Magneto hydro dynamic flows; Cadarache – France, pp. 137 -142, 1991.
3. IVANOV S., FOLIFOROV V., PLATACIS E., KIRISIK YE., LEVIN M., BYSTROV P. " Special features of electromagnetic pumps investigations for space nuclear reactors"; Proceedings of the Second International Conference on Energy transfer in magneto hydrodynamic flows; Aussois, France, pp. 643 – 650; 1994.