

Profile SFR- 35

INSOT Creep loop

INDIA

NAME OF THE FACILITY	IN SODIUM TEST FACILITY – CREEP LOOP
ACRONYM	INSOT
COOLANT(S) OF THE FACILITY	Sodium
LOCATION (address)	Fast Reactor Technology Group (FRTG), Indira Gandhi Centre for Atomic Research (IGCAR), Kalpakkam, India
OPERATOR	FRTG, IGCAR
CONTACT PERSON	Dr. P. Selvaraj, Director, Fast Reactor Technology Group, Indira Gandhi Centre for Atomic Research, Kalpakkam – 603102, India, +91 44 27480083, pselva@igcar.gov.in

STATUS OF THE FACILITY	In operation
Start of operation (Date)	2003

MAIN RESEARCH FIELDS	<input type="checkbox"/> Zero power facility for V&V and licensing purpose
	<input type="checkbox"/> Design Basis Accidents (DBA) and Design Extended Conditions (DEC)
	<input type="checkbox"/> Thermal-hydraulics
	<input type="checkbox"/> Coolant chemistry
	<input checked="" type="checkbox"/> Materials
	<input type="checkbox"/> Systems and components
	<input type="checkbox"/> Instrumentation & ISI & R

TECHNICAL DESCRIPTION

Description of the facility

INSOT creep loop is designed to study the creep properties of the PFBR component materials under the influence of flowing sodium. Sodium hold up is 500 kg. Loop has an air cooler, a heater vessel with 60 kW capacity immersion heaters. There are four number s of test sections in the hot leg. Maximum loop operating temperature is 625°C. Electrochemical carbon meters and foil equilibration chambers are also available to monitor carbon activity in the sodium. Maximum sodium flow in the loop is 5 m³/h and so far loop has completed 59,600 hours of cumulative operation. Material of construction of the loop is SS316L[N]/ SS316L. Four test chambers available for conducting long term high temperature creep experiments up to 600°C.

Acceptance of radioactive materials - No

Scheme /Diagram

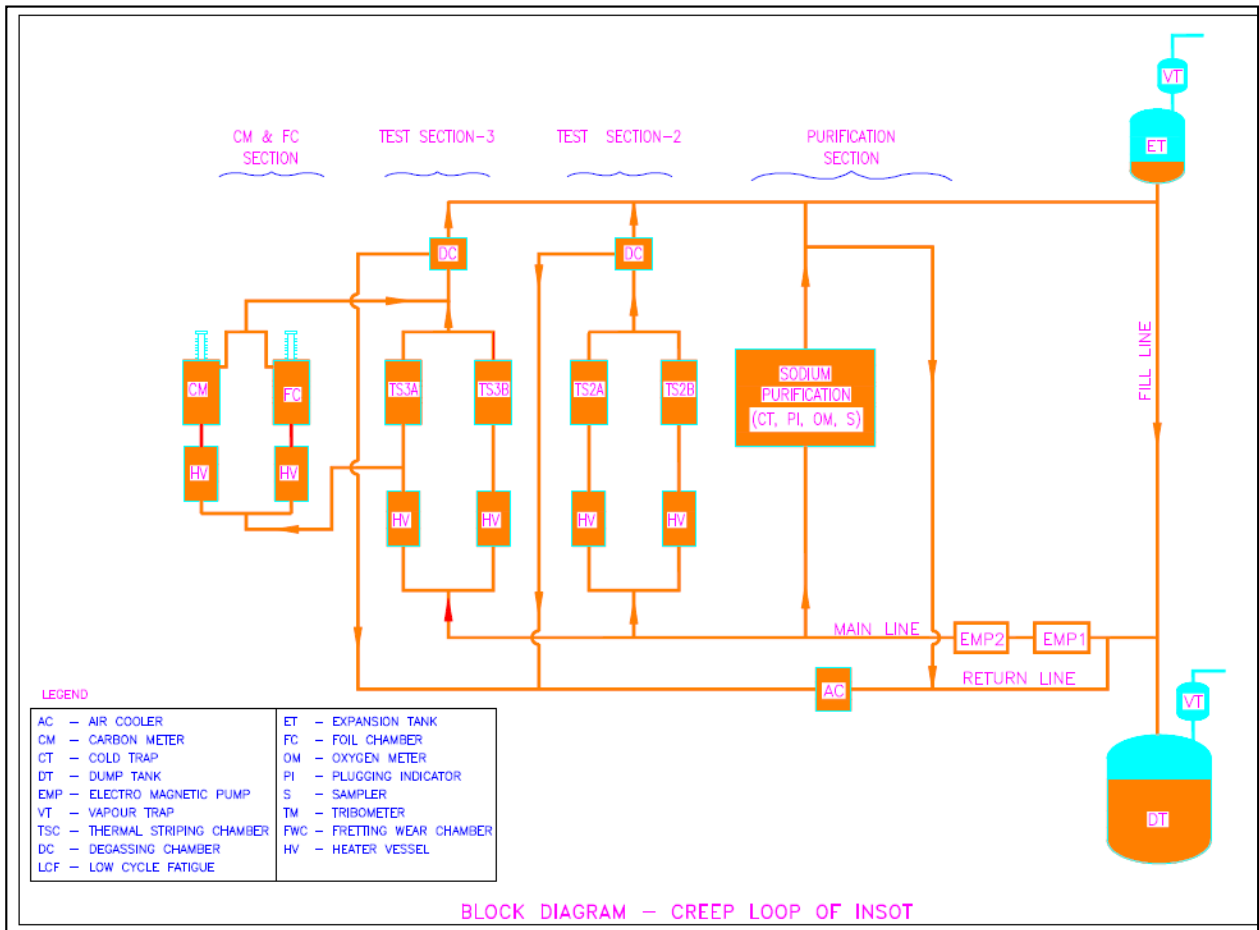


FIG. 1. Scheme of the INSOT creep loop facility

3D Drawing/Photo



FIG. 2: View of creep loop

Parameters table

Coolant inventory	0.5 tonne
Power	Heater power of 60 kW
No of test sections	Two [each test section consists of two test chambers]
Test sections	
	<u>Characteristic dimensions</u> Each test section occupies a space of 2.5 m high × 2 m long × 1 m wide. Test specimen: Gauge diameter: 4 mm Gauge length : 20 mm
	<u>Static/Dynamic experiment</u> Dynamic
	<u>Temperature in the test section</u> 200-600°C; up to 400°C in cold leg and up to 625°C maximum in hot leg.
	<u>Operating pressure and design pressure</u> Operating pressure- 6.0 bar Design pressure – 10 bar
	<u>Flow range (mass velocity etc)</u> Sodium flow velocity of 2.5 m/s in test chambers. Sodium flow of 1 m ³ /h in test sections.
Coolant chemistry measurement and control (active or not, measured parameters)	Coolant is not active Coolant purity is maintained by cold trapping and monitored using online plugging indicator, and periodical sampling and analysis
Instrumentation	Programmable Logic Control based Supervisory control and data acquisition system. Thermocouples for temperature measurement. Permanent magnet type flow meters for sodium flow measurement. Wire type and spark plug type leak detectors, and sodium aerosol detectors for sodium leak detection. Resistance type discontinuous and mutual inductance type continuous level probes for monitoring sodium level.

COMPLETED EXPERIMENTAL CAMPAIGNS: MAIN RESULTS AND ACHIEVEMENTS

43 numbers of creep rupture experiments on SS316LN; Mod 9 Cr-1Mo, P91B materials have been completed at high temperatures of 600 °C.

PLANNED EXPERIMENTS (including time schedule)

Long term, high temperature creep rupture experiments on FBR structural materials up to 600°C and Creep crack growth experiments on FBR material specimens in sodium are planned.

TRAINING ACTIVITIES

Training activities can be considered with IGCAR Kalpakkam for the operation of experimental campaign under the supervision of IGCAR qualified staff.

REFERENCES

1. “Operating experience of In-Sodium Test facility”, S.Vijayaraghavan,

M.Shanmugasundaram, M.Shanmugavel, K.K. Rajan, S. Venugopal, K. Bhanusankara Rao and M. Rajan, Proceedings of the National conference on “Operating Experience of Nuclear Reactors and Power Plants,“OPENUPP-2006” November, 2006, Mumbai.

2. Experimental facility for Creep rupture testing in flowing sodium, S. Ravi, K. Laha, M.D. Mathew, S. Venugopal, K. Bhanu Sankara Rao, K.K. Rajan, M. Rajan, S.L. Mannan, Proceedings of the International conference & Exhibition on Pressure Vessels and Piping, “OPE 2006”, Chennai, February 2006.
3. Experience in Long Term Operation of Sodium Loop for Creep Experiments in Dynamic Sodium at High Temperature, P.Rajasundaram, S.Vijayaraghavan, T.Chandran, M.Shanmugavel, M.Shanmugasundaram, S.Ravi, K.Laha, B.Babu, M.D.Mathew, K.K.Rajan., Elsevier, Procedia Engineering, Volume 55, 2013, Pages 842-849, <https://doi.org/10.1016/j.proeng.2013.03.341>