Profile SFR-46

TSTF

INDIA

NAME OF THE FACILITY	THERMAL SHOCK TEST FACILITY
ACRONYM	TSTF
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):	2011

MAIN RESEARCH FIELD(S)

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

TECHNICAL DESCRIPTION

Description of the facility

Loop is constructed to carry out thermal shock testing of electromagnets of Diverse Safety Rod Drive Mechanism (DSRDM) assembly and to test the Temperature Sensitive Magnetic Switch (TSMS) for thermal shocks. Thermal shock of magnitude in the order of 5-8°C/s was simulated. TSMS is a safety device located in the central canal plug and is directly above the centre fuel sub assembly of the reactor. When the temperature of sodium issuing out of central fuel sub assembly exceeds a limit, the TSMS cut off the power supply to main electro magnet holding the Diverse Safety Rod, causing the reactor shut down. The loop has two test vessels. The system has a heater of capacity 35kW to achieve the maximum sodium temperature of 635°C. Material of construction of the loop is SS316L. So far, it has completed 8000 h of cumulative operation.

ACCEPTANCE OF RADIOACTIVE MATERIALS - No

Scheme/Diagram

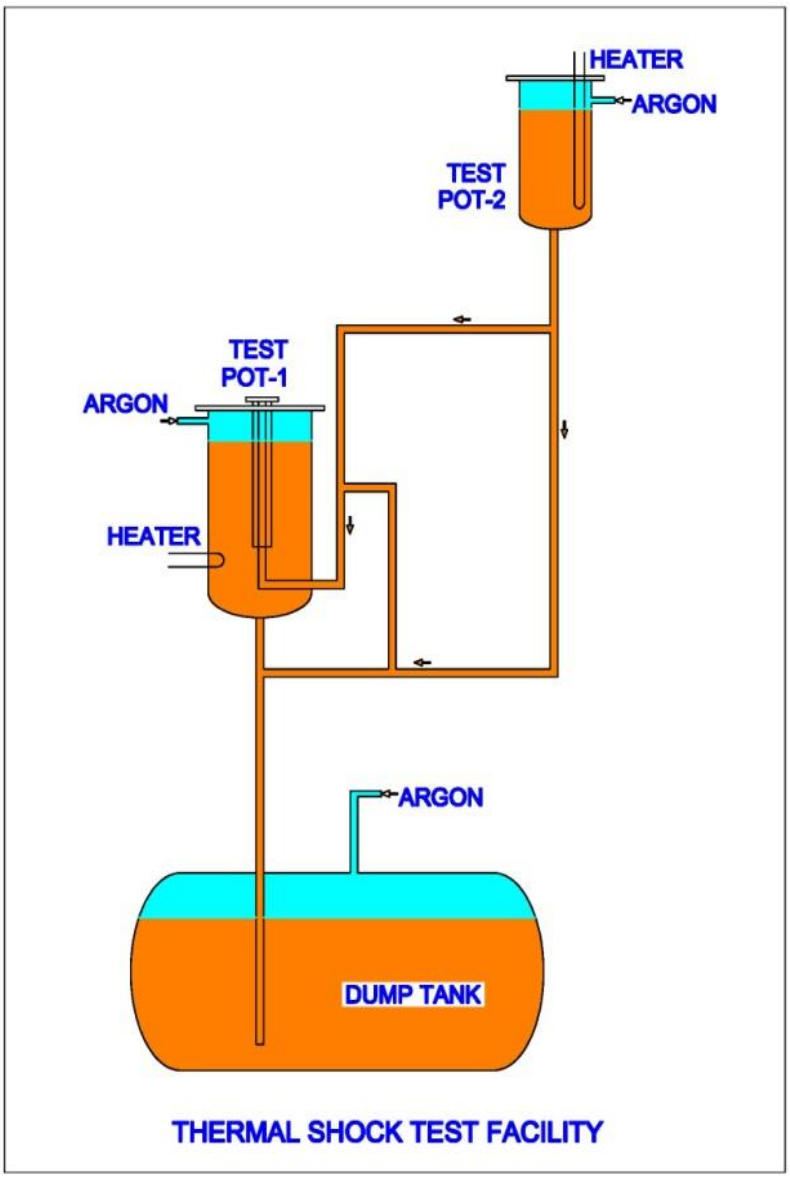

FIG.1. Scheme of Thermal Shock Test Facility

3D Drawing/Photo

FIG.2. TSTF Structure with Test Pot-1

FIG.3. TSTF Loop Pipe lines

Parameters table

Coolant inventory	1.5 tonnes of sodium
Power	Heater power of 35 kW
No of test sections	Two
Test sections	
	Characteristic dimensions Test Pot-1: 3.9 m tall, 1 m top vessel and 0.6 m bottom vessel. Test Pot-2: 1.6 m tall, 0.9 m diameter.
	Static/Dynamic experiment Dynamic
	Temperature in the test section 400-500°C
	Operating pressure and design pressure Operating pressure- 1.5 bar Design pressure – 2.5 bar
	Flow range (mass velocity etc) Sodium flow -15m^3/h
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	Thermocouples for temperature measurement Permanent magnet flow meter 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

1000 thermal shock cycles were conducted on the DSRDM electromagnet and the magnet has been qualified for 10 years of reactor operations.

500 thermal shock cycles were carried out on hard face coated specimens.

Testing of material specimens for bearings and core catcher applications [2000 h of exposure completed]

PLANNED EXPERIMENTS (including time schedule)

Development, testing of materials for high temperature bearings and core catcher applications is planned. [April-2018 to Mar 2020]

Response time of TSMS will be measured by carrying out temperature transient studies. [Scheduled next year]

TRAINING ACTIVITIES

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

REFERENCES (*specification of availability*):

1. Experimental evaluation of structural integrity of scram release electromagnet", Nuclear Engineering and Design 274 (2014) pp.90–99.
2. Experimental qualification of mechanical and electrical sub systems of a complex mechanism against fatigue failure, Transactions of Indian Institute of Metals, Vol.60 (2); 549-554, 2016.