

## Profile SFR- 38

**LCTR**

**INDIA**

NAME OF THE FACILITY	LARGE COMPONENT TEST RIG
ACRONYM	LCTR
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, <a href="mailto:pselva@igcar.gov.in">pselva@igcar.gov.in</a>
<b>STATUS OF THE FACILITY</b>	In operation
Start of operation (Date)	1994
<b>MAIN RESEARCH FIELDS</b>	<input type="checkbox"/> Zero power facility for V&V and licensing purposes <input type="checkbox"/> Design Basis Accidents (DBA) and Design Extended Conditions (DEC) <input checked="" type="checkbox"/> Thermal-hydraulics <input checked="" type="checkbox"/> Coolant chemistry <input checked="" type="checkbox"/> Materials <input checked="" type="checkbox"/> Systems and components <input checked="" type="checkbox"/> Instrumentation & ISI & R

## TECHNICAL DESCRIPTION

### Description of the facility

LCTR test rig is used to carry out full scale testing of reactor components of Prototype Fast Breeder Reactor (PFBR) under simulated reactor conditions in sodium. In this loop, there are four test vessels of different capacities, in each of which independent test conditions can be maintained. There is an electromagnetic pump of 20 m<sup>3</sup>/h capacity for sodium circulation and online purification. There is a heater vessel with immersion heaters of 200 kW capacity and 150kW capacity air heat exchanger for heat rejection. Sodium hold up in storage tanks is 100 tons. Maximum temperature of loop operation is 600°C and the material of construction of loop is SS 316. So far, this loop has been operated for more than 80,000 h.

**ACCEPTANCE OF RADIOACTIVE MATERIALS – No**

Scheme/Diagram

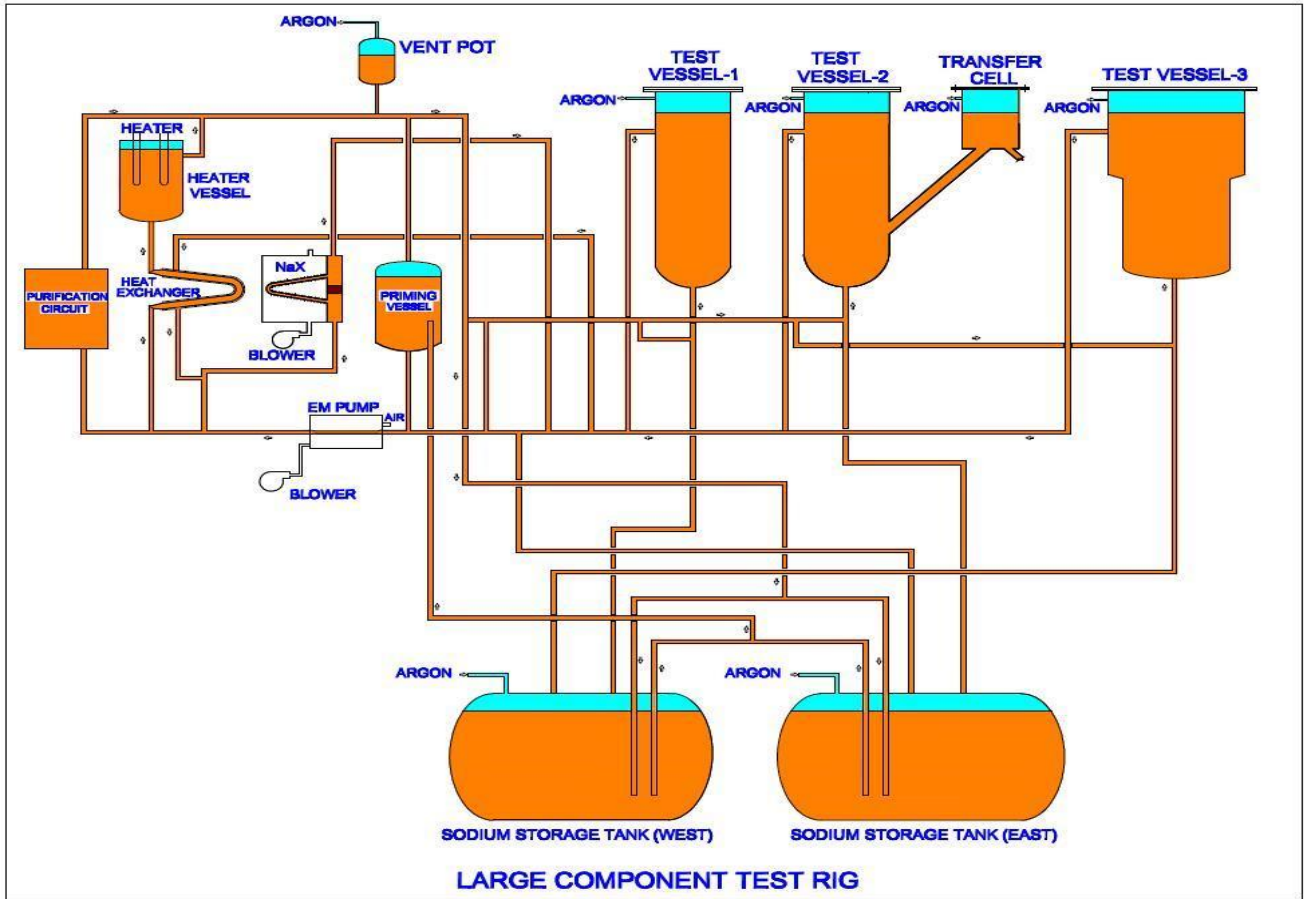


FIG. 1. Scheme of LCTR

3D Drawing/photo



*FIG. 2. LCTR Structure with Pipe lines and Test Vessels*



*FIG.3. Purification Circuit and Sampler Unit.*



*FIG.4. LCTR Cover Gas Header.*

**Parameters table**

Coolant inventory	100 tonne
Power	Heater vessels with a total power of 220 kW immersion heaters
No of test sections	Four
Test sections	
	<p><b><u>Characteristic dimensions</u></b>  <i>Test Vessel-1:</i> Length = 12500 mm, Outer Diameter = 1000 mm  <i>Test Vessel-2:</i> Length = 13150 mm, Outer Diameter = 2080mm  <i>Test Veessel-3:</i>            Bottom Portion – Length = 3900 mm, Outer Diameter = 1000 mm            Top Portion – Length = 4400 mm, Outer Diameter = 3000 mm  <i>Test Vessel-5:</i> Length = 13150 mm , Outer Diameter = 1710 mm</p>
	<p><u>Static/Dynamic experiment</u>            Dynamic</p>
	<p><u>Temperature in the test section</u>            200-550°C</p>
	<p><u>Operating pressure and design pressure</u>            Operating pressure- 0.3 bar (g)            Design pressure – 5 bar (g)</p>
	<p><u>Flow range (mass velocity etc)</u>            Sodium flow -16 m<sup>3</sup>/h</p>
Coolant chemistry measurement and control (active or not, measured parameters)	<p>Coolant is not active            Coolant purity is maintained by cold trapping and monitored using online plugging indicator, and periodical sampling and analysis</p>
Instrumentation	<p>Thermocouples for temperature 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</p>

**COMPLETED EXPERIMENTAL CAMPAIGNS: MAIN RESULTS AND ACHIEVEMENTS**

PFBR shutdown mechanisms such as Control Safety Rod Drive Mechanism (CSRDM) and Diverse Safety Rod Drive Mechanism (DSRDM) were tested and qualified for reactor operating conditions. CSRDM and DSRDM were qualified for 18 and 10 years of reactor operation respectively. Ultra Sonic Under Sodium Scanner (USUSS) for viewing reactor internals was tested successfully in sodium. Mutual inductance type continuous and discrete level probes with active lengths more than 6000 mm were calibrated in sodium. Performance testing of Primary Ramp and Primary Tilting Mechanism (PRPTM) and in vessel fuel transfer machine was completed. Testing of Failed Fuel Location Module (FFLM) was carried out. Heat transfer and temperature distribution studies in roof slab model and control plug model of PFBR were successfully completed. Performance testing of DC conduction pump and Miniature size Annular Linear Induction Pump, Testing of integrated cold trap for future SFR's, Testing and qualification of indigenously developed translation bellows and gripper bellows of Control Rod Drive Mechanism for FBTR.

## **PLANNED EXPERIMENTS (including time schedule)**

Under sodium imaging experiments with ultrasonic transducers – Mar 2019- Sep-2019

Testing of Transfer Arm Gripper mechanism in sodium – Oct-2019 – Dec 2019

Testing of integrated plugging indicator for future SFR's Jan 2020 – July 2020.

## **TRAINING ACTIVITIES**

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

## **REFERENCES**

1. Large Component Test Rig (LCTR) –Operation Experience, National Conference of Nuclear Reactors and Power Plants, OPENUPP-2006, Mumbai, Nov.2006.
2. Testing and qualification of Control & Safety Rod and its drive mechanism of Fast Breeder Reactor, Nuclear Engineering and Design 240 (2010) 1728–1738.