

Profile SFR-39

LEENA

INDIA

NAME OF THE FACILITY Leak Experiments in Natrium loop
ACRONYM LEENA
COOLANT(S) OF THE FACILITY Sodium
LOCATION (address) Fast Reactor Technology Group (FRTG), Indira Gandhi
Centre for Atomic Research (IGCAR), Kalpakkam,
India
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STATUS OF THE FACILITY

Start of operation (Date)

In operation
2007

MAIN RESEARCH FIELDS

- 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

This facility is a static sodium facility and is mainly to qualify the wire type leak detector layout for detecting sodium leaks in secondary circuits of FBRs. This facility has a sodium storage tank, test vessel, test sections with leak simulators and leak detectors. A leak simulator consists of a hole of size 1 mm drilled in the test section, closed with a tapered pin. Maximum sodium temperature in the facility is 550°C. Material of construction of the facility is SS316/304.

ACCEPTANCE OF RADIOACTIVE MATERIALS - No

Scheme/Diagram

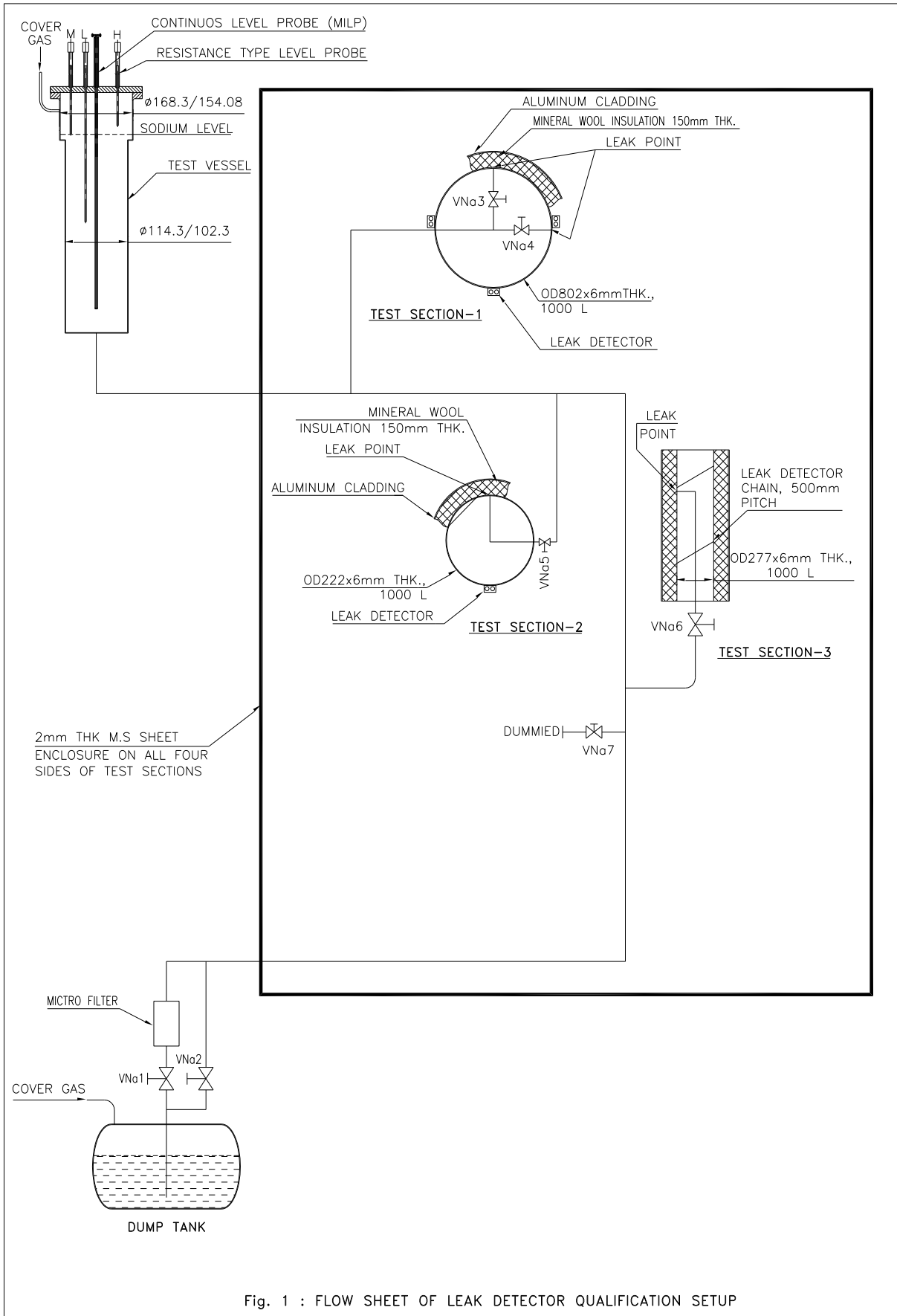


Fig. 1 : FLOW SHEET OF LEAK DETECTOR QUALIFICATION SETUP

KOL-2006\VIJAYAKUMAR\LEAK DETECTOR SETUP-3.DWG



FIG. 2. Leak simulator



FIG. 3. Test setup

Parameters table

Coolant inventory	0.3 tonnes of sodium
Power	Heater power of 50 kW
No of test sections	Three
Test sections	
	<u>Characteristic dimensions</u> Vessel of size 100 NB/ height: 1.9 m and 150NB/height 0.7 m, three test sections of 1 m length and different sizes.
	<u>Static/Dynamic experiment</u> Static
	<u>Temperature in the test section</u> 550°C
	<u>Operating pressure and design pressure</u> Operating pressure- 1 bar Design pressure – 4.0 bar
	<u>Flow range (mass velocity etc)</u> Static facility <u>Leak rate</u> 200 g/h to 5000g/h
Coolant chemistry measurement and control (active or not, measured parameters)	Coolant is not active Coolant purity is maintained by micro filtering.
Instrumentation	Thermocouples for temperature measurement Wire type and spark plug type leak 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

It was found from the LEENA experimental results with present PFBR leak detector layout that a leak rate of 200 g/h and above can be detected within 6.7 hours. To reduce the detection time, modified leak detector layout was arrived based on sodium leak experiments conducted by providing more number of parallel WLD in the horizontal pipelines and reducing the pitch of the WLD in the vertical pipelines. Based on experiments conducted in LEENA facility with modified leak detector layout it was found that a sodium leak rate of 200 g/h can be detected in one hour.



FIG. 4. Test sections after sodium leak experiments

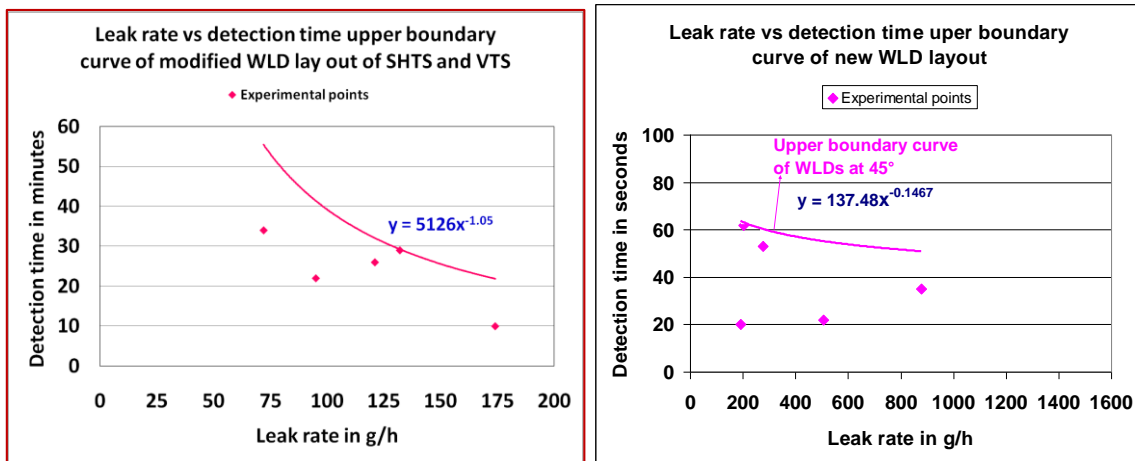


FIG.5. Upper boundary curve of modified WLDs

PLANNED EXPERIMENTS (including time schedule)

Optimizing the wire type leak detector layout for dished ends of sodium components by conducting sodium leak experiments

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. Performance evaluation of PFBR wire type sodium leak detectors, *Nuclear Engineering And Design*, 2011, Vol.241 ,Iss.6 , pp.2271-2279.
2. Experiments in LEENA facility with modified wire type leak detector layout in large sodium pipelines, *Annals of Nuclear Energy*, 103 (2017) 326-333