

Profile SFR-3

FRIYG

CHINA

GENERAL INFORMATION

NAME OF THE FACILITY Fast Reactor Fuel rod simulator hydraulic test Rig
ACRONYM FRIYG
COOLANT(S) OF THE FACILITY WATER
LOCATION (address): China Institute of Atomic Energy(CIAE),Fangshan District,
Beijing, China
OPERATOR CIAE
CONTACT PERSON (name, address, institute, function, telephone, email): XU Yijun, China Institute of Atomic Energy, Department of
Fast Reactor Research and Design, Tel:+86-10-
69358195,Mail:juntaxu2008@163.com

STATUS OF THE FACILITY In operation
Start of operation (date): 2014

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

FRIYG is a comprehensive water test rig for reactor fuel rod simulator hydraulic research, including flow rate and pressure drop relationship test of the rod, the flow-induced vibration test and the flow characteristics of the reactor core (fuel rods and low pressure head).

The FRIYG test rig consists of a main loop and some auxiliary loops, including the water purification loop, pressurizer, water cooling loop and heating equipment and so on.

The main loop consists of a mechanical pump, a heater exchanger, three test sections, valves and connecting pipes. The function of the main loop is to provide the stable water flow flux to the test sections. The maximal flow flux is 160 m³/h with 95°C water. The test sections are the main part of the test rig. The main goals of the sections are to satisfy the hydraulic test requirement of new MOX fuel and CFR600 fuel assemblies, for example the rod flow rate distribution test and confirmation the detail dimensions of the flow holes in the rods and the flow-induced vibration test of the new-designed subassemblies in the water. In the test, various kinds of the flow can be got through the different pumps set.

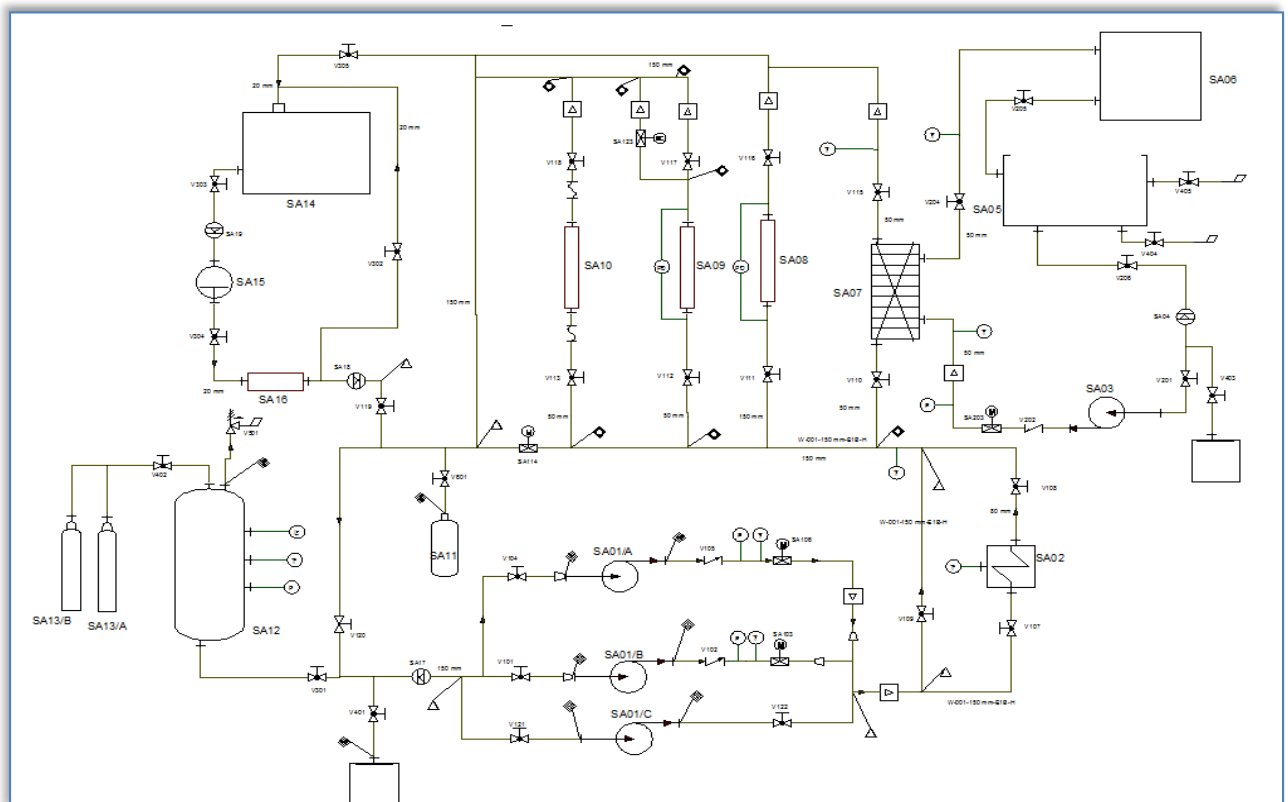
At the same time, considering the complex relationship of the high pressure head and low pressure head in the reactor core in CEFR and CFR600, a special test section is designed to focus on the 7 subassembly flow characteristics in the low pressure head.

For the loop operation safety, the interlocking device of temperature and pressure are used. When the temperature of the water in the loop runs over 110°C, or the pressure in the loop runs over 1.6 MPa, the heater in the loop or the pumps will stop automatically.

Acceptance of radioactive material

No

Scheme/diagram



SA01/A: main pump ;SA02 heater of the loop ;SA03: cooling loop water pump;
 SA07: heat exchanger; SA08-10: test sections; SA14:water purification device
 SA12:pressurizer; SA13: Nitrogen device

FIG. 1. The flow chart of the FRIYG loop

3D drawing/photo

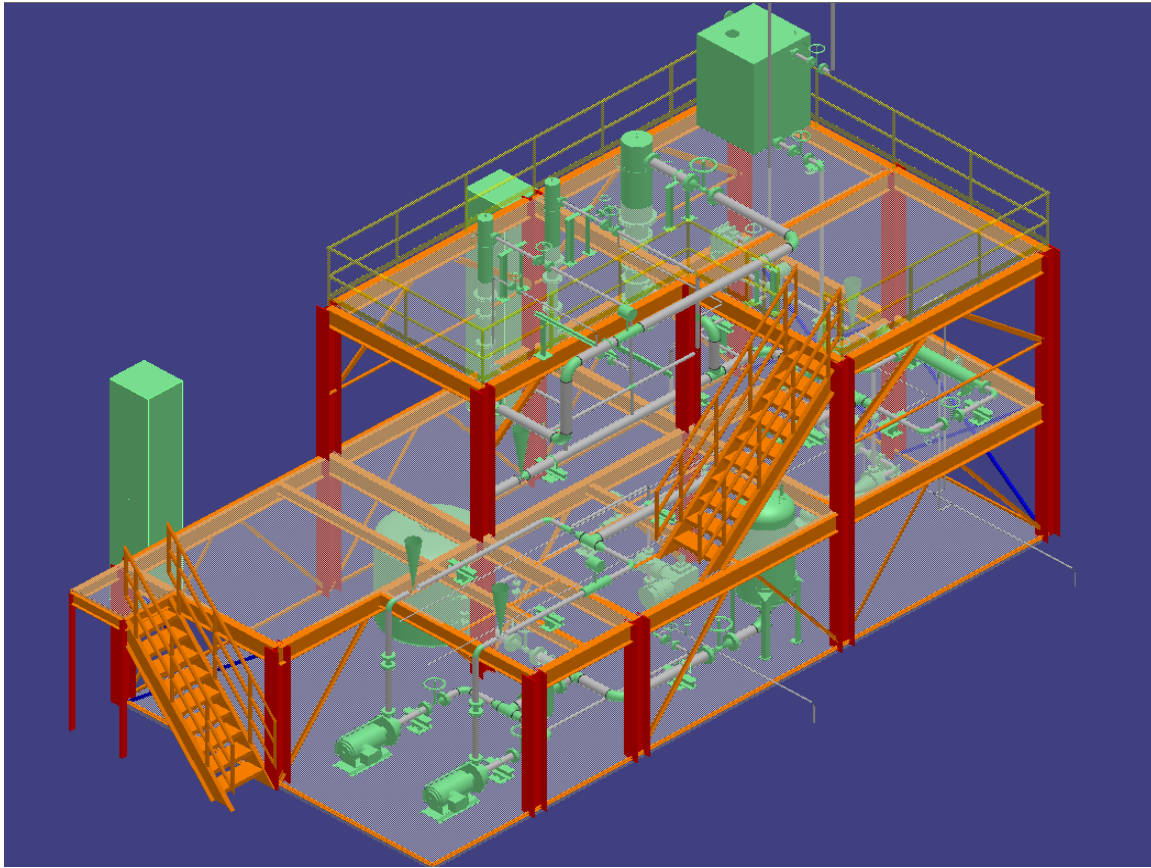


FIG. 2. The 3-D picture of the loop

Parameters table

Coolant inventory	Water ,about 1 tons
Power	Max 50 kW
Test sections	
TS #1	<u>Characteristic dimensions</u> Outside diameter 219 mm Overall height →3500 mm
	<u>Static/dynamic experiment</u> Dynamic
	<u>Temperature range in the test section (Delta T)</u> The maximum operation temperature is 95°C
	<u>Operating pressure and design pressure</u> Operating Pressure →0.6MPa (gauge) Design pressure →0.8MPa (gauge)
	<u>Flow range (mass, velocity, etc.)</u> The water flow rate can be got from 3 ~ 120m ³ /h The maximum sodium flow rate is 160m ³ /h
Coolant chemistry measurement and control (active or not, measured parameters)	The coolant in the loop is desalination water. The off-line measurement of the various hydronium concentration in the water can be used. Among them, the Cl ⁻ is lower than 2.5μg/L and Na ⁺ is lower than 5μg/L and the conductance of the water is lower 2.

Instrumentation	Thermocouples, pressure transducer, flow meters,
-----------------	--------------------------------------------------

COMPLETED EXPERIMENTAL CAMPAIGNS: MAIN RESULTS AND ACHIEVEMENTS

As the Mox fuel rod simulator test platform, FRIYG test loop has been put into operation in July ,2014. A serial hydraulic test for the new-designed rods will be carried out in this test rig, including the flow distribution test ,the flow-induced vibration test of the rod simulators and the water scouring test for the long term .

After that, for the new designed MOX subassembly ,the flow distribution researches between the fuel rod and the supporter will be planned in the next year.

PLANNED EXPERIMENTS (including time schedule)

Neither the new fuel rods subassemblies nor the other steel shielding rods, they should have the hydraulic tests before they will be put into the reactor. So in the future, homemade rods will be tested in this facility and a series of tests will be done.

TRAINING ACTIVITIES

Training activities can be agreed with CIAE for operation and experimental researches under the supervision of CIAE qualified staff.

REFERENCES (*specification of availability and language*)

[1] CEFR CT-1545 A ,CEFR fuel rod simulator hydraulic test reports , 2002,CIAE technical reports for CEFR, Chinese language .

[2] ZYY·KY·KGB·MK·MOXFZ-1·SZ·97,Design and layout of the FRIYG test rig, CIAE technical reports for CEFR, Chinese language .