
# The NICODEME contract:

## Trans-national access to large research infrastructure (TALI)

**Do you need to carry out tests on your valves and fittings for use in the nuclear energy industry during the coming period of time? If so the following article could be of interest to you, as under the auspices of the NICODEME contract started in January 2007, and as part of the EURATOM specific programme for research and training on nuclear energy, EDF Group is about to open up trans-national access to its research infrastructure and facilities for experimental testing. In fact access to the EDF Group's thermal-hydraulic test laboratory will be openly offered to all researchers and end-users throughout the European Community Member States or associated states with the exception of France. With testing promised to be carried out before the end of 2007, we suggest that interested parties read on...**

*By Eric Sanchez and Jean-Francois Le-Rouzic, EDF Group, France*

The Materials and Mechanics of Components Department of the EDF Group Research and Development Section has decided to sponsor new opportunities for research teams and end-users to gain access to its research infrastructure so that they can carry out experimental tests. This plan has been brought about as a result of financial assistance from the European Commission and will lead to access to the department's thermal-hydraulic test laboratory. The laboratory itself consists of two different testing facilities, called CYPRES and CYTHERE, which operate in pressurized water or steam. It is planned to carry out all selected experiments before the end of 2007. Access to the test facilities can be gained by filling in your test proposal on the application forms which can be obtained from eric.sanchez@edf.fr, or downloaded from http://rd.edf.com/tali. These will then be evaluated by a selection committee in September 2007 with notification of acceptance/rejection flowing soon afterwards.

## Description of the CYPRES test facility

The CYTHERE test facility is able to test the endurance of valve components during opening/closing cycles under high differential pressures (up to 160 bar) and high flow-rates (up to 100 $m^3$/h). Moreover, a pressurizer enables one-shot discharge tests to be carried out with steam (through a drum of three inches in diameter) or water (through a line of six inches diameter). Figure 1 shows a drawing of the CYPRES test facility scheme. The CYPRES test facility performance is shown in Table 1.

| Fluid | Maximum service pressure | Temperature | Flowrate | Volume | Electrical power | Remarks |
|---|---|---|---|---|---|---|
| Pressurized water | 15 ≤ P ≤ 175 bar | 40 ≤ T ≤ 300°C | 0,40 ≤ Q ≤ 14 kg/s | | B01CP : 170 kW<br>E04CP : 850 kW | ∅3″ line, DN 80<br>$\Delta P_{max}$ ≤ 160 bar |
| Saturated steam | 0 ≤ P ≤ 175 bar | 100 ≤T≤ 355°C | Q ≤ $39.10^{-3}$ kg/s (continuous)<br>Q ≤ 2,5 kg/s (discharge) | 2,5 $m^3$ rated volume | | |
| Pressurized water | 1 ≤ P ≤ 175 bar | 100 ≤ T ≤ 355°C | Q : 0 à 278 kg/s (cold water)<br>Q : 0 à 231 kg/s (hot water) | 2,5 $m^3$ rated volume | | Steam or hot gas discharge<br>∅6″ line, DN 150 |

*Table 1: CYPRES test facility performance*

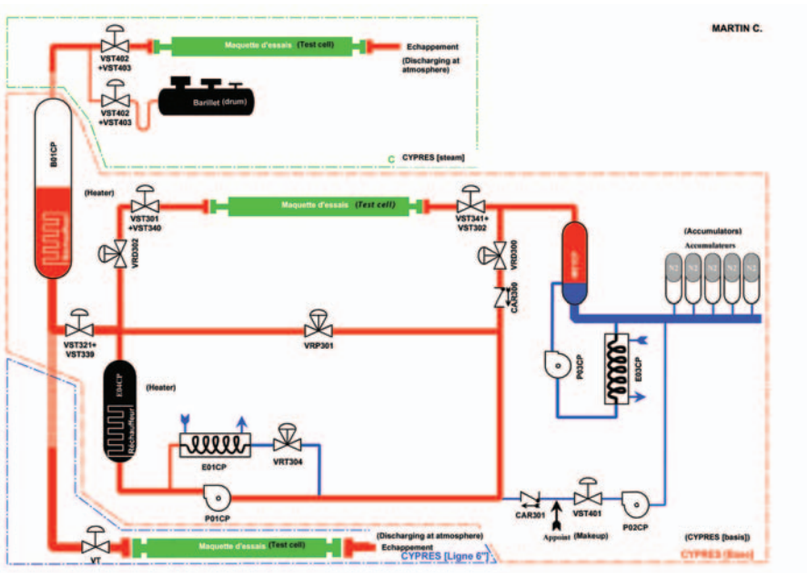
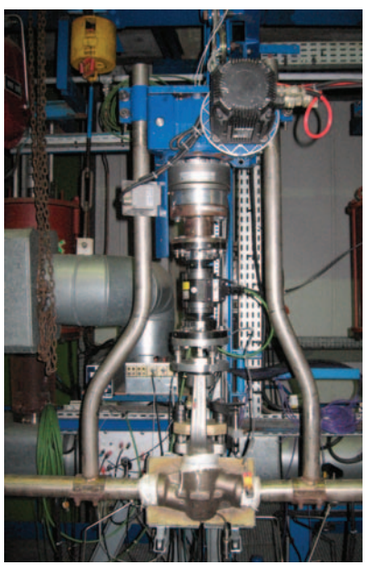



*Figure 1: The CYPRES test facility scheme*

The main advantages which the CYPRES test facility offers are:

- its possibility to perform a high number of opening/closing cycles in a limited period of time (as an example, it's possible to perform up to 1000 cycles in only four days)
- its high differential pressure (up to 160 bar)
- the excellent repeatability of the thermal and pressure parameters between each cycle

The research team has gained a vast amount of experience in the handling of a large number of tests during the twenty years during in which the CYPRES test facility has been in operation. This knowledge includes:



- cyclic high-pressure testing: opening under differential, closing under nominal flow-rate, endurance and the determination of the major technical characteristics of the components
- coefficient of discharge
- safety valve set pressure measurements with or without water plug
- rupture disk testing
- steam extraction to reproduce accidental conditions (loss of coolant accident)
- hydraulic flow tests
- electric motor operator valve design

Furthermore, the flexibility of the CYPRES test facility also allows other kind of tests to be performed, such as:

- cold water, hot water or steam extraction testing;
- hot gas extraction (nitrogen, or other inert gases)
- the independent use of the pressurizer to perform steam testing
- others tests which still need to be defined

## Description of the CYTHERE test facility

The CYTHERE test facility is able to perform thermal shock cycling experiments on valves, fittings and others components by alternate circulation of cold and hot fluids through the test section. The maximum difference in temperature is 260°C under a maximum pressure of 176 bar. The flow-rate can extend up to 100 $m^3$/h. The CYTHERE test facility performance is shown in table 2.

| Fluid | Maximum service pressure | Temperature | Flowrate | Volume | Electrical power | Remarks |
|---|---|---|---|---|---|---|
| Pressurized water | 15 ≤ P ≤ 175 bar | 50 ≤ T ≤ 295°C | 0,40 ≤ Q ≤ 15,5 kg/s | | B01CT and B02CT : 650 kW for each tanks | |
| Pressurized water | 15 ≤ P ≤ 175 bar | 50 ≤ T ≤ 295°C | 0,40 ≤ Q ≤ 31 kg/s | | | |
| Pressurized water | 15 ≤ P ≤ 175 bar | 50 ≤ T ≤ 295°C | Hot water ≤ 3 kg/s<br>cold water ≤ 21 kg/s | | | Check valve test $\Delta T_{max}$ = 245°C |

*Table 2: CYTHERE test facility performance*

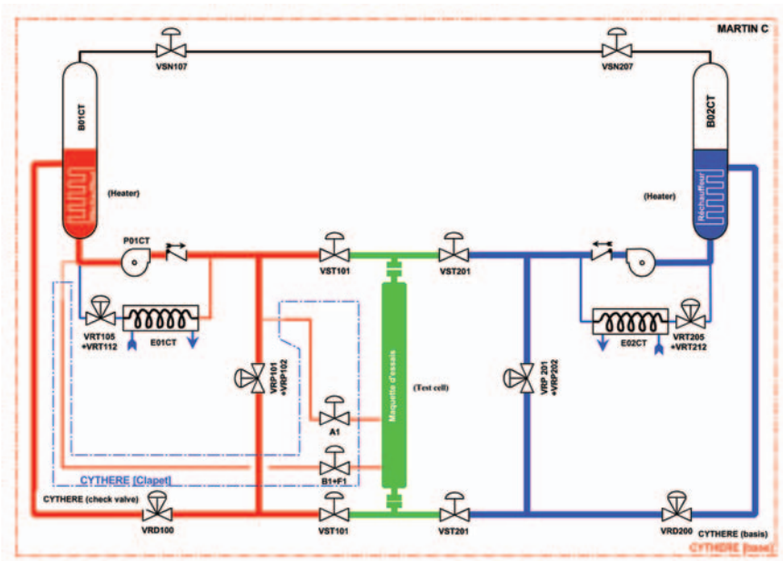



*Figure 2: The CYTHERE test facility scheme*

The main advantages of the CYTHERE test facility are:

- its capability to perform a high number of thermal cycles in a limited period of time
- the high amplitude of the thermal shock (up to 260°C)
- the excellent repeatability of the thermal and pressure parameters between each cycle
- the very short duration of the thermal transient (0.4s)

In the CYTHERE test facility, the research team has experience of a large number of test methodologies, including:

- thermal shocks tests
- pressurized water circulation tests
- endurance measurements (for example: swan neck)
- check valve tests
- flow-meter apparatus comparison

Apart from these kind of experiments, it is also possible to combine both the CYPRES and CYTHERE test facilities to optimize the parameters of the discharge tests in order to avoid the depletion of pressure during the experiment. In this way, very high flow-rates can be reached (up to 950 $m^3/h$).


**For further information, contact Eric Sanchez, phone: +33 (0)1 60 73 63 26, fax: +33 (0)1 60 73 65 59, e-mail: eric.sanchez@edf.fr, web: http://rd.edf.com/tali.**