

TMP news

Project Reference Person

Aldo Sammartano

Editor TM.P. S.p.A. Termomeccanica Pompe

Project Developed in-house

Authorisation from the Court of La Spezia N. 5/08 dtd. 02/12/2008

TM.P. S.p.A Termomeccanica Pompe

Tel. +39 0187 5521 • Fax 0187 552506

June 2014, issue 02

Via del Molo, 3 La Spezia Italy • pumps@termomeccanica.com • www.tmp.termomeccanica.com

TMP pump supply for an Indian Nuclear Power Plant with relative qualification by the local Nuclear Energy Body

Termomeccanica Pompe has been selected by Larsen & Toubro Limited (L&T) to supply the booster pumps and the main boiler feed pumps with all their relative accessories and auxiliaries for two 700 MW units of the Rajasthan Nuclear Power Plant in India. L&T, one of the largest companies in India's private sector, is a technology, engineering, construction and manufacturing company. In order to qualify Termomeccanica Pompe for this kind of supply, the Indian Nuclear Authority (NPCIL - Nuclear Power Corporation of India Limited) required to verify in advance the dry running capability of this type of machines using a test pump with similar characteristics.

The dry running requirement is not usually found in the boiler feed pump specifications issued for power plants located in Europe or the United States but is mandatory for NPCIL.

The dry running capability is actually one of the most severe conditions for boiler feed pumps because this means they have to be capable of accepting without damages the following events:

- a severe transient reduction in suction pressure well below that required for cavitation free operation;
- a complete loss of water due to incidents such as the inadvertent closure of the suction valve.

In such cases, vaporization in the pump occurs accompanied by a two-phase flow condition, large hydraulic forces, loss of damping and high rotor amplitudes with possible contact between rotor and stator. The pumps have also to accept without distress or seizure the re-establishment of normal suction conditions following the transient condition without the necessity of being shutdown. For the test pump, Termomeccanica Pompe chose to design and manufacture a very rugged machine with similar features to the Rajasthan Project pumps and to subject it to the same type of dry-running test.

The main similarities between the test pump and the actual Rajasthan Project pumps can be summarised as follows:

■ Enlarged clearances between stationary wear rings and impeller:

given that higher excitation forces and, consequently, larger rotor amplitudes have to be expected during dry-running test and operations, the internal clearances are increased with respect to the nominal design clearance defined by API 610 standards and applicable for projects without dry-running operation. The clearances enlargement has to correspond to the right compromise between the objective to prevent contact between rotor and stator and the necessity to minimise the consequential loss of efficiency caused by the increasing of the internal clearance between the stationary wear rings and impeller.

■ Critical speeds:

particular care has to be dedicated to the critical speeds issue in order to allow the operation under vaporization condition, i.e. under a condition where the dampening and bearing forces of the sealing clearances practically disappear.

Under wet conditions, the liquid flows through the small annular areas created by the clearances separating the regions in the pump under different pressures (such as the wear rings). It creates what is called a hydrodynamic bearing effect and essentially transforms the rotor from one supported by two bearing that are external to the pump to one with other additional internal bearings lubricated by the liquid being pumped. This phenomenon is generally called the Lomakin effect.

The critical speed calculation under dry running condition takes into account the loss of the Lomakin effect, which causes a reduction of the critical speeds.

■ Rotor damped unbalance response:

another important calculation is also performed, the rotor damped unbalance response, which allows to establish the peak-to-peak displacement of the unbalanced rotor.

Under the dry running condition, such calculation proved that the rotor displacement at clearance of the rotating members of the test pump was similar to that requested of the boiler feed pumps.

■ Arrangement and materials:

the test pump arrangement was as per the Rajasthan Project pumps arrangement, i.e. with one stage, between bearings and double suction impeller and the same pump materials were used for all the wet components, i.e. Martensitic s.s. with 13% minimum Chromium content.

To prevent seizure or galling between stationary and rotating parts, the wear rings and the shaft sleeves of the test pump were heat treated to get a hardness 100 HB higher than the casting components (impeller and casing).

■ mechanical seals :

the API plan was selected for boiler feed water service with seal faces materials suitable for dry-running condition. The mechanical seal arrangement, the internal circulating device and the seal chamber were designed to optimize the thermal insulation of the fluid operating in the seal. Under such condition, the circulating seal fluid is maintained at low temperature, guaranteeing

constant water lubricity and therefore preventing high seal faces wear. The hot and dry running test procedures as well as the sequence of the tests were strictly defined in accordance with NPCIL's technical specifications and in full compliance with the requirements of the Rajasthan project. A dedicated hot test loop able to handle water at 159 °C was specifically designed and installed in TMP's in-house Test Centre to run the hot test.

On May 8th 2014, the test pump was tested in the presence of:

- a L&T inspector
- TUV NORD as Third Party Inspector.

The test pump was monitored during the entire duration of the test. It was monitored on both sides with X-Y axis no contact shaft vibration probes, seismic detector vibration sensors in the bearing housings, RTDs in the bearing cages and with a water temperature RTD, suction and discharge pressure transmitters, a torque-meter, a flow-meter, a tachometer and a phono-meter. Only the temperature of the inlet water coming through the loop of the mechanical seals was measured with local temperature gauges. After the hot performance tests (Q-H, Q-Pabs., Q- η eff., Q-NPSHreq.), the dry running capability was established by the closing of the suction valve with the pump running at full speed, rated flow and a water temperature of 159 °C. The test began when discharge pressure collapsed by at least 50% due to occurrence of vapour locking and lasted for more than 5 minutes. During the entire transient, all the pump parameters were recorded and found within the acceptable limits.

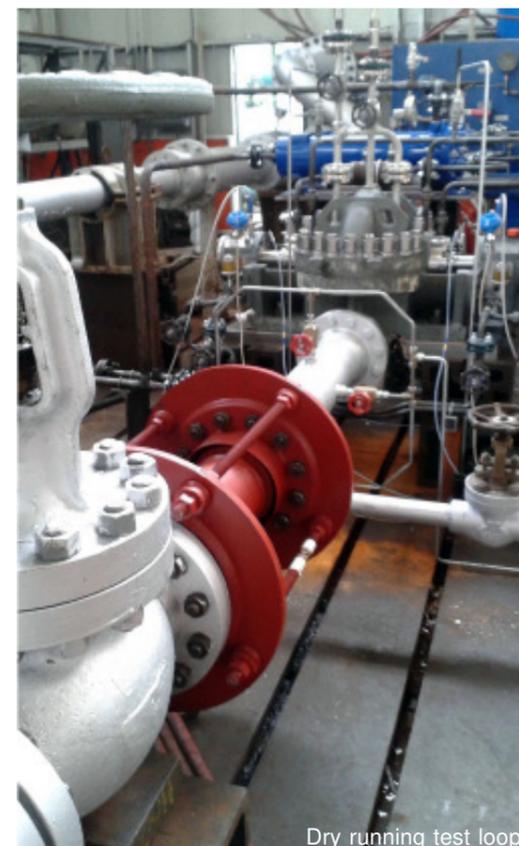
The pump was then switched off, with the recording of the rundown time until complete stop, and left to cool down. The following day, the pump was restarted and retested at full power so as to compare the performance curves with the previous day's tests. Confirmation was obtained that no measurable change had occurred. Finally, the pump was dismantled and inspected for possible damages. No wear of the labyrinths nor any degradation of any pump component was detected.

The tests performed demonstrated that the test pump, with its very rugged design, could sustain a transient "loss of suction", starting with cavitation at the suction impeller and ending with a complete "steaming out" of the impeller region without difficulties.

The dry running test was quite significant to verify that all the design criteria used for the real project pumps will be able to fully guarantee a proper pump behaviour, without any seizure or wear between the stationary and rotating components, failure of the mechanical seals or loss of pump performances.

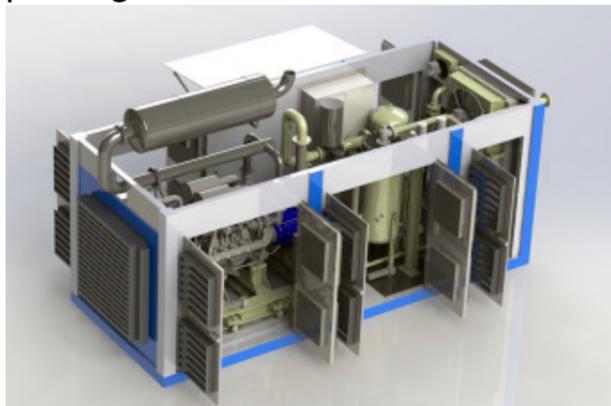


Rajasthan Nuclear Plant



Dry running test loop

Contract in the Romanian Oil&Gas Sector for Adicomp, new entry in Termomeccanica Pompe Group specialized in air and gas compressor packages



IRCAT Package 3D Rendering

Adicomp S.r.l., historical and strategic partner of Termomeccanica Compressori (T.M.C.), became part of the Termomeccanica Group's mechanical business last September. The company specializes in the production and treatment of compressed air and gas, supplying turn-key innovative solutions with advanced technology which respond to its specific customer demands. This article describes a project recently completed by Adicomp, project commissioned by its Romanian distributor, IRCAT, for the end-user Schlumberger.

One of the businesses IRCAT, main player in the Romanian heavy industries equipment, portable power and air & gas compression sectors, is involved with is the management and exploitation of oil and natural gas wells, quite numerous in Romania. There are indeed more than 2.000 of such wells in the country. In this context, there is a strong demand for an increase in the production of "well head gas" on "old wells", demand which has led to the collaboration between IRCAT and Adicomp for the development of a specific package.

Adicomp represents a partner that is particularly prepared on the issue, especially taking in consideration its latest cooperation contract with Compressco (USA), world leader in the sector, contract which was signed at the beginning of 2014.

The scope of works is to supply a complete system composed of a DOOSAN gas motor, which IRCAT officially distributes in Romania, and an Adicomp Gas compressor package with a T.M.C. screw block (SCA30G model).

The motor carries out the dual function of transmitting movement to the compressor and feeding an alternator for the production of electric power, capitalizing on the maximum capacity of the motor itself.



IRCAT package at end user site

The compressor flow (net of motor consumption) is of 2.250 Nm³/h while pressure ranges from 0,7 to 2 bar(g) at suction and from 13 to 17 bar(g) at discharge. The mechanical power of the electrical motor is approx. 230kW. Only 3% of the gas is used to feed the motor while the rest gets compressed and sent to a pipeline to be treated and used in the network. The specificity of this project actually consists in the capacity of the system to feed itself and therefore to be installed in remote locations deprived of power supply. The package is installed on a 20-ft container and can therefore be easily transported by truck from one site to another.

Another project technical specification of particular interest are the environmental conditions in which this package is designed to operate in, i.e. a temperature range of -20 to +40°C. In order to guarantee full and efficient operation of the system under such climatic conditions, maximum attention was given to maintaining the operating temperature stability within the container through the study and use of both customized insulation and heating/cooling systems.

This contract falls within a larger supply project of a total of eight packages with similar technical characteristics and final use destined to Romanian companies such as Romgaz, Petrom/OMV, etc.

The increase of gas production from "old" wells through the Adicomp compression system is also of wide interest for the rest of Europe and the world. Furthermore, such type of packages represents a winning solution for shale gas extraction, another high-growth sector.

Termomeccanica receives Lloyd's Register Quality Assurance Award



On May 29th, the holding company Termomeccanica SpA received from Lloyd's Register Quality Assurance the prestigious **LRQA Italy Integrated Award** as recognition for the competence and professionalism demonstrated during the implementation of the Quality, Environmental and Health & Safety management systems within the various companies of the Termomeccanica group. The award was handed to Aldo Bellotti, Termomeccanica Group Quality Assurance Manager, by Enrico Memmo, Italy, Malta & Croatia Sales and Marketing Manager of LRQA.

Flash News

TMP signs new contracts in the international Oil&Gas sector

New 1.5 M€ contract for the Russian Oil&Gas market

Termomeccanica Pompe acquired last April a new contract of a total value of approximately 1,500,000.00 euro for the supply of n.2 API610 BB3-type process pumps. The first pump will be coupled to an electric motor and the second to a turbine to be installed at the ORSK refinery (OAO "Orsknefteorgsintez") located in the south of Russia. The TMP pumps are destined to the new visbreaking plant under construction within the scope of the refinery's upgrading.

RUSSNEFT, one of the main Russian companies operating in the Oil&Gas sector, is not only the plant's end-user but also TMP's customer. The delivery of the order is planned for the end of 2014.

A 4M\$ order for the U.A.E. upstream market

Termomeccanica Pompe also acquired last April a new contract of approximately 4.000.000,00 US dollars for the supply of n. 48 API 610 VS4-type process pumps, pumps to be installed at the "SARB EPC Package #4 Project" plant in the United Arab Emirates. The plant's end-user is ADMA-OPCO (Abu Dhabi Marine Operating Company), which belongs to the ADNOC, (Abu Dhabi National Oil Co.) Group, while the EPC contractor, direct customer of TMP is Korea's Hyundai Engineering & Construction Co. Ltd. (HDEC). The full development of the Satah Al Razboot (SARB) oil field is a strategic initiative of ADNOC which falls under the company's plans to enhance its oil production capacities and under the wider development strategy of Abu Dhabi.

More specifically, such project, through its 7 packages, should allow ADMA-OPCO to add 100.000 barrels a day (bpd) to ADNOC's current production capacity.

The delivery of the order is planned to take place between December 2014 and February 2015.

TMP's 2014 Training Plan

"An organization's ability to learn, and translate that learning into action rapidly, is the ultimate competitive advantage." – Jack Welch jr

Termomeccanica Pompe's 2014 training initiatives have been designed in continuity with previous years taking in consideration two main areas. The first area regards the transversal competences, more specifically the consolidation of foreign language and managerial skills. The second area is related to the enhancement of the technical and professional background. Twenty technical courses have been programmed, covering all of the company departments and involving a total of seventy employees. Amongst the subjects to be addressed are materials, components with external technology and non-destructive testing, leading to the obtainment of the relative certificates. On top of the company's allocated budget, TMP is also using other sources of funding to carry out its Training Plan such as Fondimpresa and provincial government funds dedicated to company training.

The editors of this issue are:

G. Bongiorno - S. Carret - F. Ciardelli -
E. Crocco - M. Fiori - L. Poli - A. Riccobaldi

Our mission

To contribute to the success of our customers through our experience and know-how. We pursue this goal giving the utmost consideration to the hard work and commitment of both employees and suppliers, respecting the Environment and complying with the expectations of our Shareholders.