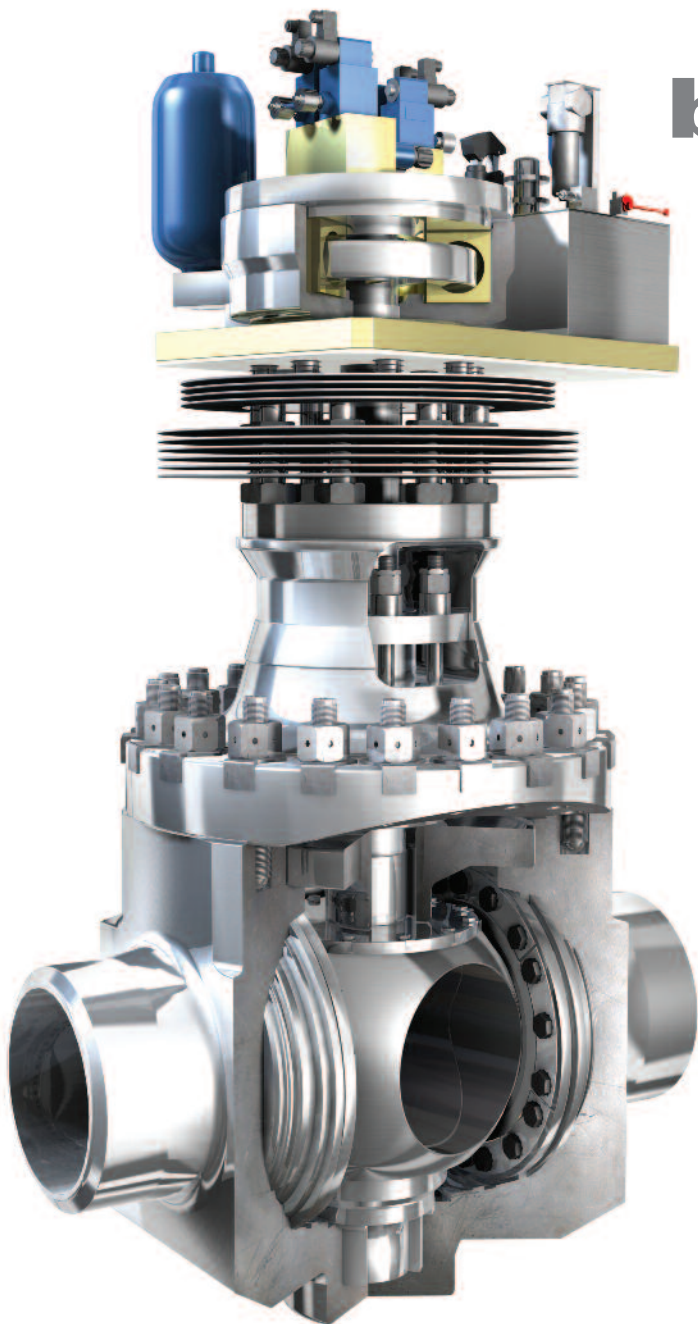


# Presentation by Vanatome: Radioactive dose level reduction

**Created in 1978, French valve maker Vanatome quickly specialized in the design and manufacturing of nuclear valves with intrinsic high performances based on a specific know how, a strong technical culture and a solid experience feedback / return on experience. This article details the history of the company and focuses on Vanatome product lines that cut down the overall radioactivity dose level.**

*By Patrick Artru and Luc Todo,  
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In the course of the eighties, while industrial structures set up for the French nuclear program realization were stabilized, Vanatome developed a collaboration with the leaders of civil nuclear technology and nuclear propulsion naval programs by filling the needs that were not fulfilled to finally become one of their regular partners by matching their required expectations. Several patents have been the key to the different stages of the company's development. Numerous qualifications and satisfactory operational experience came to validate the standard ranges

offered in on-off valves, instrumentation, valves and control valves

Since the beginning, Vanatome acquired an organization quality based on the ISO 9001 requirements in parallel of, and to go with, its "product development" program. Today the company offers its customers a global service while matching their specific demands with always the objective to cut down the product life cycle cost and to improve the safety thanks to:

- A comprehensive range of products covering all technologies required for all nuclear systems

- Innovative, patented, qualified and proved technical solutions
- A deep experience in maintenance services and technical assistance
- A highly qualified and experienced engineering and R&D team
- Advanced IT systems: 3D CAD; seismic, bombing shock, finite elements calculations; CAM system leading to total traceability
- Mastering of international standards and calculation codes (RCCM - France, OTT 87-Russia, ASME III - USA)
- A project management policy

Vanatome has undertaken to supplement its offer for nearly 10 years now in two ways: By diversifying itself by the development of a complete range of regulation valves dedicated to all market



segments/ branches of industry and by completing its nuclear range with product lines focusing on cutting down the cost of maintenance and cutting down the overall radioactivity dose level. In this article we are focusing on this last subject.

**Radioactive dose level reduction**

The overall radioactive dose level reduction is a priority. The overall radioactive dose level is the sum of each dose level, and can be reduced by cutting down exposure time. Moreover the overall dose level is mainly coming from the cobalt isotopes Co58 & Co60, so we have to reduce the potential sources represented by their respective “parent” isotope: Nickel Ni58 & Cobalt Co59. The content of Co59 is traces (only few hundreds ppm) in stainless steel but with high content (around 60%) in the hard facing materials: stellite. The stellite material, used for the high tribological and with features such as thermal shock withstanding, corrosion resistance and high hardness, represents the best choice; but the wrong choice in terms of the radioactive factor. Actually, the radioactive dose level will be effectively reduced by limiting the operator exposure time and the radioactive sources content. We have identified several axes of improvement such as

- cobalt free technologies
- cobalt free materials
- solutions to limit the exposure time during maintenance operations
- low retention or no retention technologies
- cancellation of the lapping in-situ

**1. Cobalt free technologies**

Vanatome offers several valve technologies without hard facing, designed today under the three international nuclear construction codes (RCC-M, ASME, OTT 87), or technology with no friction or controlled friction technology.

**Soft Seat Ball Valves**

This is the ¼ turn ball valve technology where the tightness is ensured by a contact metal (ball) and polymer (valve seat). The polymer materials and features will be selected according to the fluid maximum temperature: the HDPE for low temperature and the PEEK for temperature up to 238°C.

**Soft Seat Cylindrical Plug Valves**

This is the ¼ turn technology without retention. The sealing, inserted in the plug, comes in several materials according to the fluid pressure & temperature. This “Top Entry” design is a quick maintenance design without special tools: less than 10 minutes are necessary to dismantle and assembly the valve of ND 50mm for instance. This valve is suitable for the installation in glove boxes, behind biological protection with remote control system.

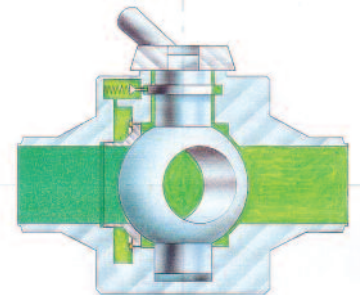
**“EQUIBALL” High Temperature Metal/Metal Sealing Ball Valve with cascading movement system**

With the classic trunnion ball valve technologies there is a continuous friction between the ball and the seat during the operation. Due to the difference of pressure the friction force is high and can damage the sealing surfaces. In further development of metal/metal ball valves the target was to design a fitting that made it possible to switch it in the closed position with a low torque and without friction between

ball and seats in spite of a high sealing force. In that case the ball hard facing is not necessary.

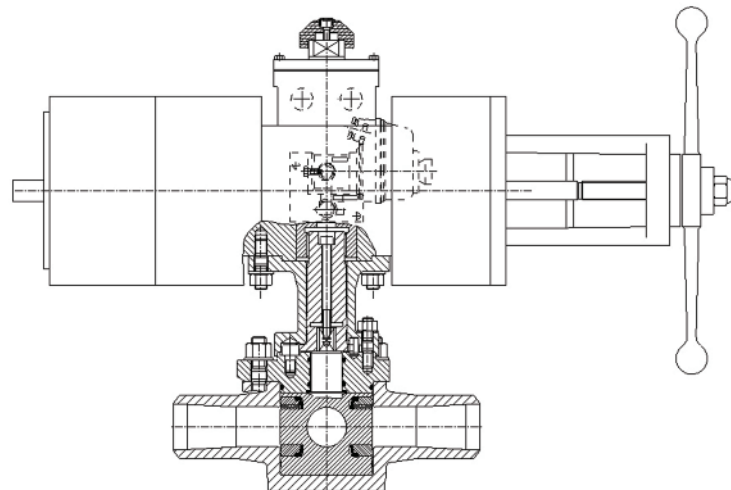
The valve described here above presents a metal/metal sealing trunnion ball valve with “cascading movement system” with among others the following advantages:

- low friction during operation
- low operating torque: no seat differential pressure during operation
- long life cycle
- insensitivity to actuator over torque
- safe closure and smooth closure: closed on position limit switch with torque limit switch as second safety switch
- no seating damage by differential pressure: dynamic strength supported by bearings
- quarter turn valve: very fast operation



**Cobalt free hard facing**

Vanatome has tested several materials to substitute for the stellite (DELORO, COLMONOY, NOREM) and has selected and qualified today a process of deposit of the NOREM 2 (iron based materials).



## Parallel slide gate valve "EQUIDISC"

The parallel slide gate valve technology is a pressure seal tightness technology: higher is the pressure and better is the tightness. In order to use cobalt free hard facing we have to control the strength on the sealing surfaces during operations: in that respect the plug shape has been re-designed to reduce the disk bearing stress in order to reach areas where the high hardness of the stellite is not necessary anymore.

## 2. Solutions to limit the exposure time during maintenance operations

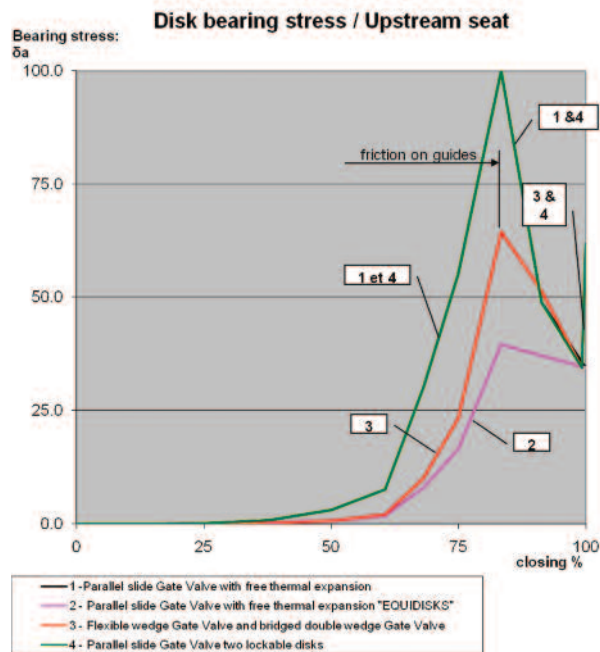
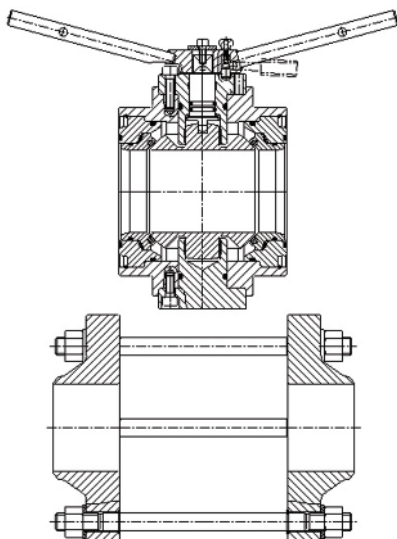
To reduce the exposure time we have to reduce the maintenance time; the main idea has been to design independent mechanical sub-assemblies (or associated by modules) in order to give to the end users:

- interchangeability
- quick and easy installation
- easy expertise and inspection
- low cost of maintenance
- sub-assemblies already tested in the plant

## Modular designs

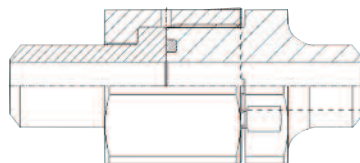
### Valve cell type

The design is a cell – flange design specially developed for the ball valve technology: the ball valve is included in a cell which can be quickly removed from the pipe by dismantling the flanges.



### Connectors HT/HP 3 pieces

The design is a cell/quick connectors: the union fitting is a 3 pieces connector qualified for high temperature and/or for high pressure. In that case the valve can be quickly removed from the pipe connections and repaired or maintained in the warehouse and not in the contaminated area.



### Valves with removable seats

The sealing parts of the valve are the weak points in terms of wearing and maintenance. This is why Vanatome has designed a removable seat for the Globe Valve technology (as well as for the Piston Check Valve technology) in order to reduce the maintenance time in situ. The valve sealing parts are the plug and the seat inside the cage: the plug is easily removable by removing two pins and the cage can be removed from the body.

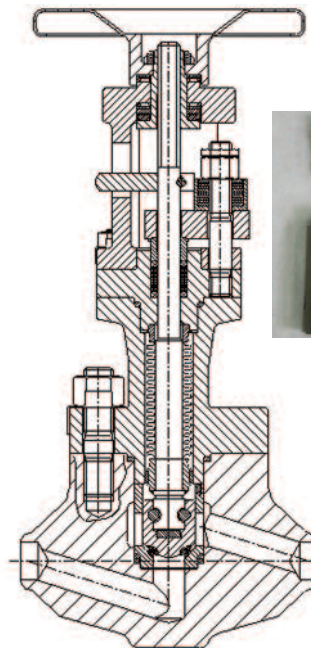
### Top entry technologies

There are two top entry valve technologies:

- cylindrical plug valves
- ball valves

The top entry valve technology is a without maintenance-body valve: no operation of lapping is necessary on site. The valve refurbishing consists of changing the plug and the seats with new parts or restored ones: the restoration can be limited to a simple polish of the sealing surfaces and can be

performed in a workshop. Moreover the compactness of those technologies and the low weight of the parts make the maintenance easy and allows for reduced space to perform it.



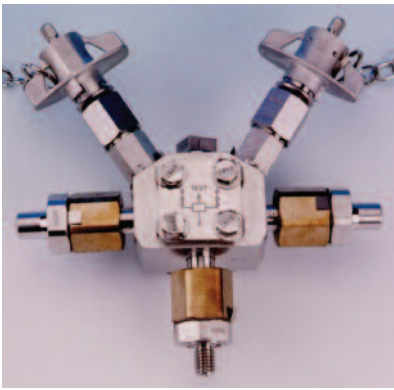
### Cancellation of lapping in situ

In order to limit the exposure time we have to cancel the time consuming maintenance actions such as the lapping. In that respect the selection of the valve technology has to be in favor of the technologies that do not require any body maintenance.

Those technologies are:

- The top entry technologies such as the top entry ball valve or the cylindrical plug valve





- The technologies with removable seats such as globe valve, bellows globe valve or piston check valve.

### 3. Predictive maintenance

The exposure time during maintenance operations can also be reduced by selecting the right maintenance actions: this new way of maintenance is so-called predictive maintenance: the maintenance is not performed any longer by "systematic maintenance campaign". Vanatome has developed several devices to allow the end user to set-up the predictive maintenance policy by planning in advance the maintenance actions:

#### Leak detector

This device is used to detect the leak through a bellows for the bellows globe valve technology (the external tightness is ensured in that case by the second barrier: the packing gland) as well as the leak along the stem for the cylindrical plug valve technology.

#### Periodical test devices

When a nuclear class Parallel Slide Gate Valve is welded on the pipe the test of valve tightness is only possible by cutting the line and installing the valve in a test bench. Vanatome has developed the Body Anti-Overpressure Automatic Device: this device is designed to balance the pressure between the body and the line in order to avoid the pressure locking effect. But this device allows also the End-User to test the tightness of the valves seats by putting under pressure the valve body



and to check the pressure decrease over the time. If this pressure drop is out of the relevant criteria the valve has to be opened and re-lapped.

#### Torque measurement

The torque measurement system can be installed to control the valve operating torque. This device allows the end user to check the measured operating torque against the theoretical operating torque.

#### Packing gland tightening control system

The packing gland tightening control system is installed in all the multi-turn valves technologies. This device controls a constant strength on the packing gland to get the no-leakage tightness along the valve stem. But this device allows the end user also to check the packing wear without opening the valve by a local visual control and to predict the period of maintenance by calculation of the packing wear speed.

### 4. The no retention and low retention technologies

#### No retention technology

The cylindrical plug valve is a technology without retention. Actually there is no dead area in the valve where a liquid can be caught: in that case during the dismantling of the valve and the removal of the internal parts the operator does not face any potential radioactive liquid.

#### Low retention technology

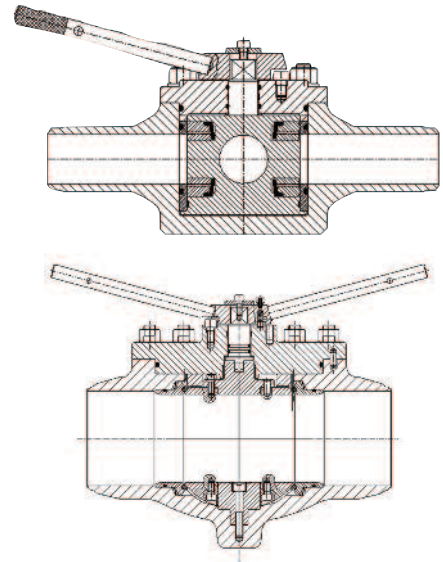
The ball valve is a low retention valve: a very small dead area inside the valve. This feature concerns the soft seat ball valves as well as the metal/metal seating ball valves. However, in case of soft seat ball valve it is possible to go to a non-retention valve by filling the dead volume between the ball and the body with anti-retention sleeves.

#### Reduction of specific areas

In order to reduce the retention areas the butt welding (BW) connecting ends are preferable to the socket welding connecting ends.

### Conclusion

In the fields of dose level, site safety, maintenance costs, operators' safety, Vanatome tries hard to offer innovative solutions able to improve operations in nuclear power plants. Vanatome endeavors to be faithful to this way of development for the last thirty years.



### About the Authors

Patrick Artru joined Vanatome in 1979 as an Engineer in charge of the valve design.



Following Vanatome's growth he has been in charge of R&D and Manager of the Engineering department. In 1996

he became a Member of the Management Board. Currently he is Vice-President Operations in charge of Technology and Production including Engineering, R&D, Product Marketing and Plant Management.

Luc Todo joined TECHNIP (one of the top five corporations in the field of oil, gas, petrochemical engineering, construction & services) in 1990 as a Process Engineer. He spent a few years as Plant Start up Supervisor and Manager in China, Malaysia, and

Netherlands. Upon obtaining his MBA he was appointed as a Risk Management Auditor reporting to the Chairman of the



Group. Late 2002 he joined VANATOME as a Member of the Management Board in charge of International Sales including business development and communication. His current position is Deputy Managing Director of VANATOME.

