



**ACTIVE
TEST GROUP**



**FPI ALL-IN-VAC TECHNOLOGY.
SYSTEMS FOR PENETRANT TESTING**

 **KAMA**

www.activetest.ru



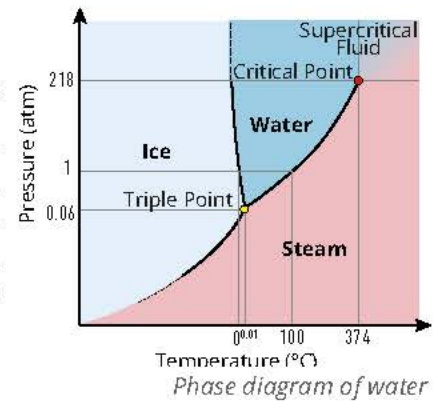
Modern requirements to the quality of products as well as growing competition raise the relevance of NDT quality and reliability issues including the liquid penetrant inspection method (PT/FPI). It requires implementation of technological state of the art and technical know-how. The technical implementation of PT method has not undergone conceptual changes for a long time; it still requires the organization of a separate large area, the consumption of significant quantity of consumables — inspection materials and energy resources.

At the same time the ordinary processes of cleaning, drying, cooling, penetrating, applying the developer do not provide the maximum effectiveness of inspection procedures.

Drying by heating to 100–130 °C is energy-consuming and requires a fairly long time, as well as subsequent cooling of the parts, which can lead to the filling of the cavities of defects with water (capillary condensation) and, as a consequence, to a decrease in concentration of penetrant and its small penetration.

An alternative to thermal drying is drying under vacuum.

The phase diagram shows in what state the water is at various temperatures and pressures. As it can be seen from the diagram, at pressure $P \leq 610$ Pa and temperature $t > 0,01$ °C, water can only be in the gaseous state. Thus, at vacuum drying, moisture removal from the defect occurs hugely faster and there is no need to waste time cooling tested object down.



ActiveTestGroup offers an innovative FPI All-in-VAC technology and system series named KAMA, which allows performing all PT operations in sequence in one sealed chamber.

Automated process provides highly efficient performance, sensitivity, reliability and repeatability of inspection process and its results.

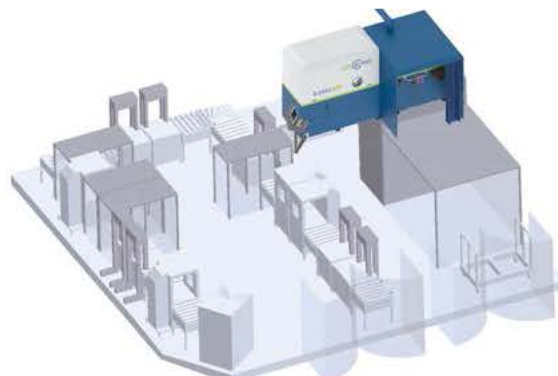
FPI All-in-VAC technology is the main step towards upgrading the non-destructive

liquid penetrant inspection system, which is achieved by providing:

1. replacement of obsolete and worn-out equipment;
2. liquid penetrant inspection parts made from steel and non-ferrous alloys at levels of sensitivity 4 (ultra-high) and 3 (high) in accordance with ASTM E 1417;
3. maximum automatization of the technological process and automatic recording with the possibility of archiving its parameters;
4. possibility to locate whole system in a limited space without additional investments;
5. inspection performance with a cycle time from 40 minutes;
6. safety of production and implementation of LEAN-technology.



KAMA system: rotating table. Loading/Unloading of inspected objects



Graphical conventions of occupied area. Comparison of FPI-line and KAMA system

РОССИЙСКАЯ ФЕДЕРАЦИЯ

ПАТЕНТ
НА ИЗОБРЕТЕНИЕ
№ 2 411 111

Способ неразрушающего контроля капиллярной дефектоскопии объектов

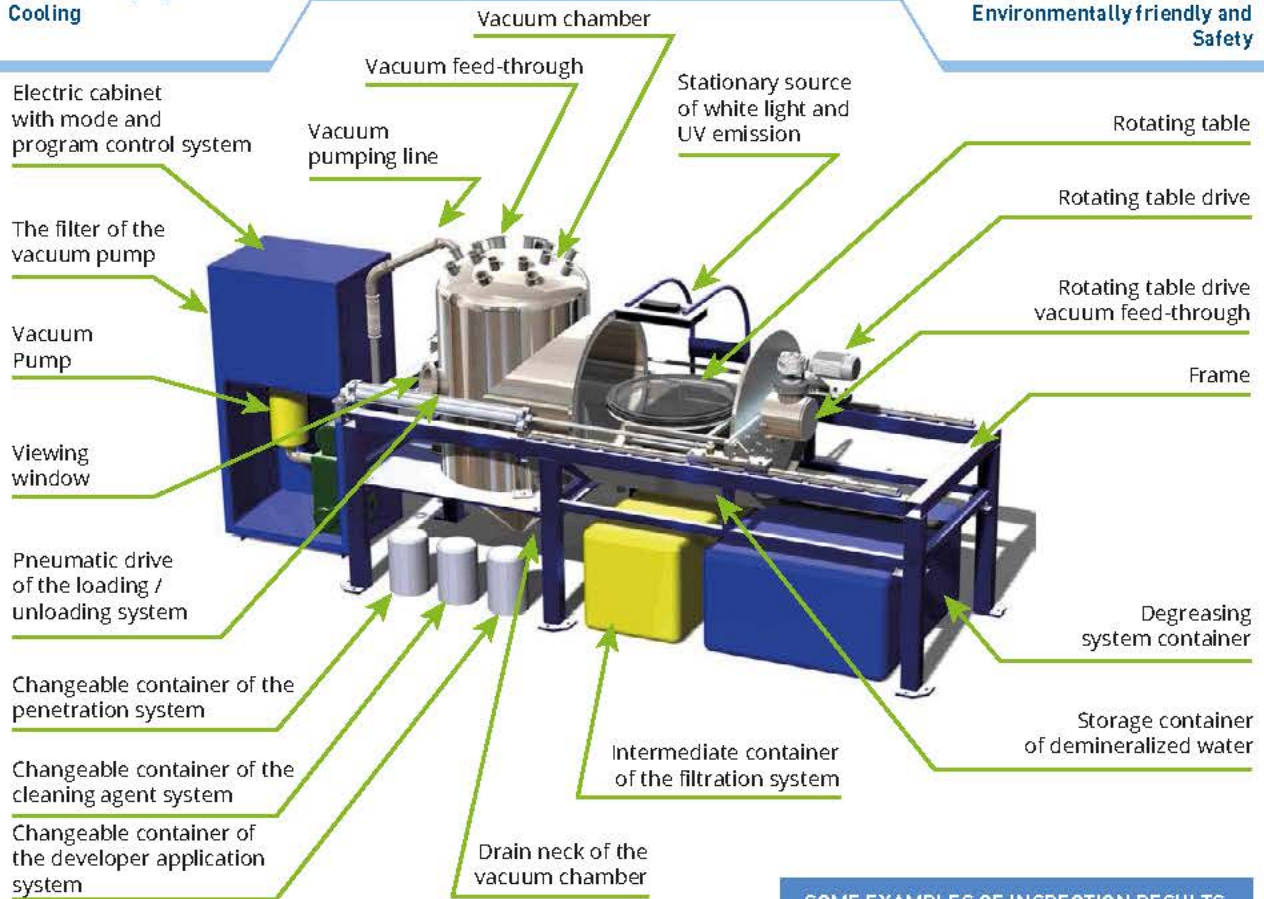
Патентообладатель: Обществу с ограниченной ответственностью "АктивТестГрупп"

Автор:

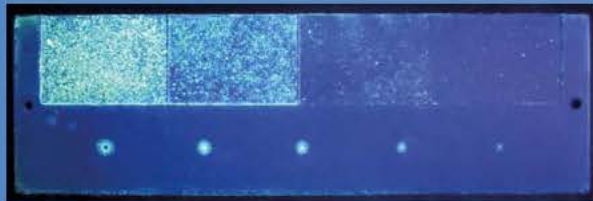
Intensive cleaning
 Degreasing
 Cavitation effect
 Optimized drying
 Cooling



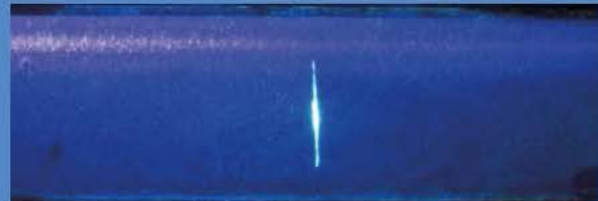
Barbotage
 Adjustable pressure
 Quasi-closed inspection cycle
 Speed and Efficiency
 Environmentally friendly and
 Safety



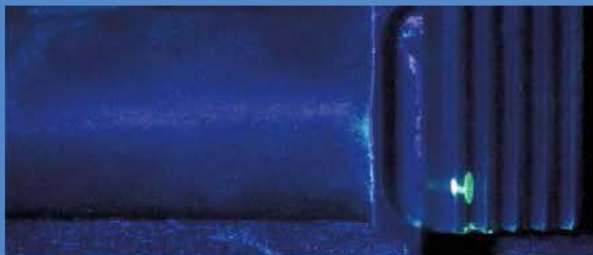
SOME EXAMPLES OF INSPECTION RESULTS



Test panel PSM-5. Star-shape cracks



Test-sample №A1 with a deadlock crack opening width of 1 µm or less



Blade made from heat-resistant alloy with a crack on the lock



Disc. Through radial cracks



Blade of titanium alloy with multiple linear indications of defects such as cracks

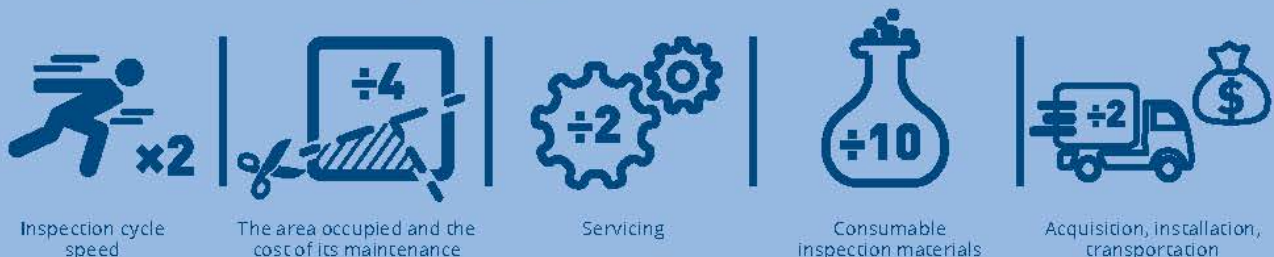


Nozzle. Titanium alloy. A long crack on the inner surface

Common technical parameters of **KAMA** series:

Parameter	Value/Value Range
Dimensions of the basket/fixture for positioning inspected part/parts	Upon Customer requirement
Inspection performance cycle time	From 40 min
Inspection coverage	100% of surface
Applicable penetrant inspection materials	Water-washable and post-emulsified consumables by 4, 3 and 2 level of sensitivity
Inspection materials application	Spraying/ Immersion
Surface preparation of the inspected object	Degreasing, ultrasonic cleaning or barbotage
Range of temperature adjustment of degreasing solution	From 18 °C to 65 °C
Adjustment range of wash water temperature at the penetrant removal stage	From 18 °C to 65 °C
Range of adjustment of the pressure of wash water (by spraying) at the stage of penetrant removal	From 0.5 to 4 atm
The minimum pressure achieved in the sealed chamber at the drying stage	No more than 300 Pa
Range of air pressure adjustment at the developer application stage	From 2 to 4 atm
Inspected parts into the sealed chamber	Mechanical/manual
Inspection under UV area	Isolated cabin/Cabin integrated into system
UV emission range	Upon Customer requirement in accordance with sensitivity level
Method of water treatment	Osmotic filter, capacity upon Customer request
Method of sewage treatment	Carbon filter/filter with nanosorbents, capacity upon Customer request
Monitoring of technological parameters: <ul style="list-style-type: none"> • temperature of degreasing solution; • wash water temperature; • temperature of the inspected object; • ambient temperature; • pressure in the sealed chamber; • rinse water pressure; • pressure of compressed air. 	Set of digital/analog measurement tools for monitoring. Measurement tools tolerances as per Customer requirements.

Indicators of economic efficiency of **KAMA** series:



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