

# TVAT

Turbine Valve Actuator Tester

Actuator prediction diagnostic solution



Made in Korea



## Introduction of Company

**Future Automation Co., Ltd.** was founded in May 1998 as a company with the mission of "Challenging mind and customer satisfaction". Through the engineering, design, manufacture and installation of industrial sectors' pneumatic, hydraulic, and vacuum system, we are in charge of the efficiency, environmental management, productivity, and product quality of each industry.

Especially, it is important to check the performance of turbine valve hydraulic actuators, which is a core device installed to control the amount of steam supplied to the turbines of nuclear power plants and thermal power plants. **"Performance Prediction Diagnostic Tester (TVAT) for Turbine Valve Hydraulic Actuators"** evaluates performance through diagnosis of malfunctions in advance and increased reliability of the power plant's maintenance and diagnosis technology. It was distributed to power plants and favorably received to power generation companies for its successful performance on the power plant site demonstration test.

The **"Performance Prediction Diagnostic Tester (TVAT) for Turbine Valve Hydraulic Actuators"**, the world's first developed tester in the area of futuristic automation, is a new product that has been verified of its performance and successfully applied on the field of power plants. We have gained the new product (NEP) certification, and we are concentrating on expanding distribution to domestic power generation companies. We are also mainly working on strengthening our marketing competence to secure overseas production and sales based in China, Europe, Russia and Southeast Asia, and promoting new market openings.

Thank you

President Engineer K.C YOUN

## Company History

- 1998. 05 Establishment of Future Automation  
(Company Motto: Challenging Mind and Customer Satisfaction)
- 1998 ~ Pohang Research Institute of Industrial Science and Technology, Samsung Heavy Industries, Samsung SDI, Samsung Electro-Mechanics, Registered Renault, Samsung Motors and Daewoo Shipbuilding as supplier
- 2010. 08 **Certified as Venture company**
- 2011. 05 Submitted for "Busan International Machine Tool Exhibition"
- 2011. 12 Submitted for "2011 Korea invention patent exhibition"  
Awarded by Minister of Knowledge Economy (Gold Prize)
- 2008 ~ Patent registration: 10 cases (PCT international application: 2 cases)
- 2012. 03 Submitted for "Busan International Nuclear Industry Exhibition"
- 2012. 05 **"Turbine valve actuator tester(TVAT)" first supplied First time supplying the power generation, Korea Southern Power (KOSPO)**
- 2012. 08 Factory Registration
- 2012. 10 **Certified Quality Management System (ISO9001)**
- 2013. 04 Selected as a preferred product for public agency purchase
- 2013~ Submitted for "International electric power, power generation industry exhibition" & "Busan International Environment & Energy Industry Exhibition"
- 2013. 10 Certified as INNOBIZ company
- 2015. 05 **Acquired New Product (NEP) Certification** (Ministry of Commerce, Industry and Energy)  
"Turbine Steam Valve Hydraulic Actuator System Non-isolated Moving Tester"
- 2015. 10 Submitted for "BIXPO2015" and awarded silver prize for power company group
- 2015 ~ **"Turbine valve actuator tester(TVAT)" scheduled to be supplied**  
(KOEN, KOSPO, EWP, KOMIPO, WP, KHNP)
- 2016. 04 Submitted for "Busan International Nuclear Industry Exhibition"
- 2016. 11 Submitted for "EP China 2016" - Beijing, China
- 2017. 09 **Designated as a venture business start-up innovative procured product**  
(Public Procurement Service)
- 2018. 04 Wolsung nuclear in Korea with successful the field test.
- 2018 ~ **Wolsung nuclear power plant(KHNP) supplying of TVAT**

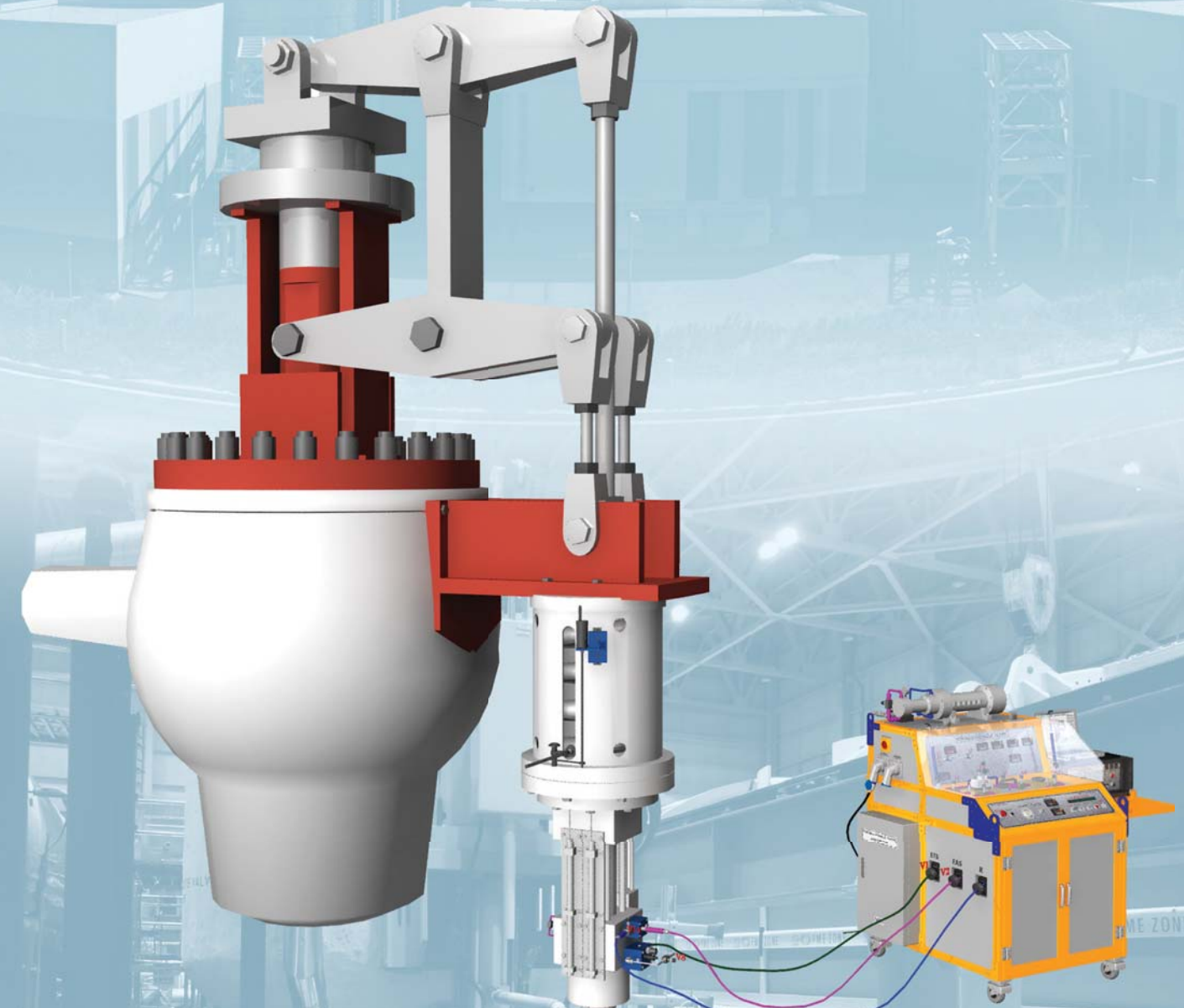




## Certifications, Patents, Awards



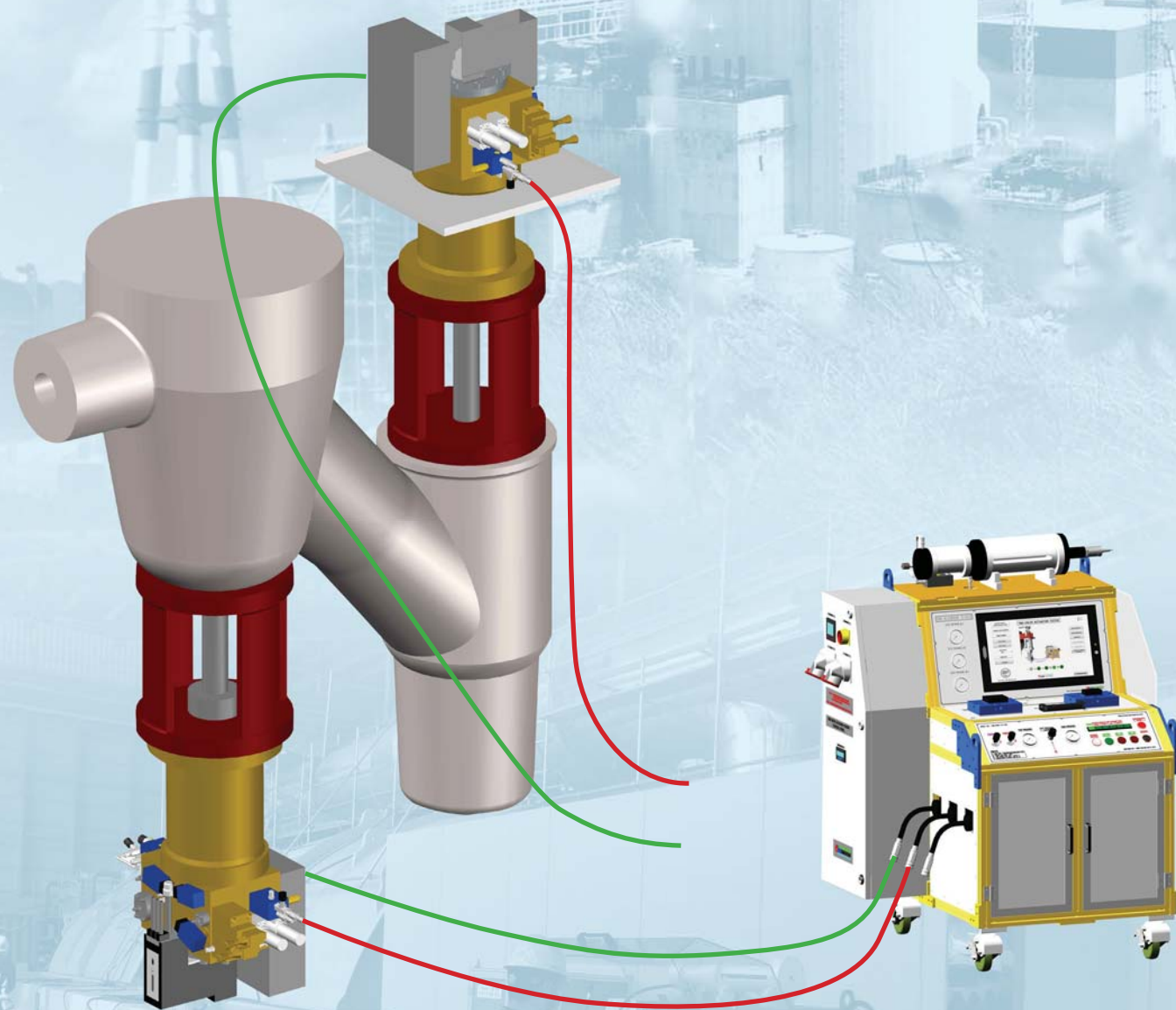
## Actuator diagnostic 3D Image – Pak. Type Real time failure prediction monitoring system(Optional)





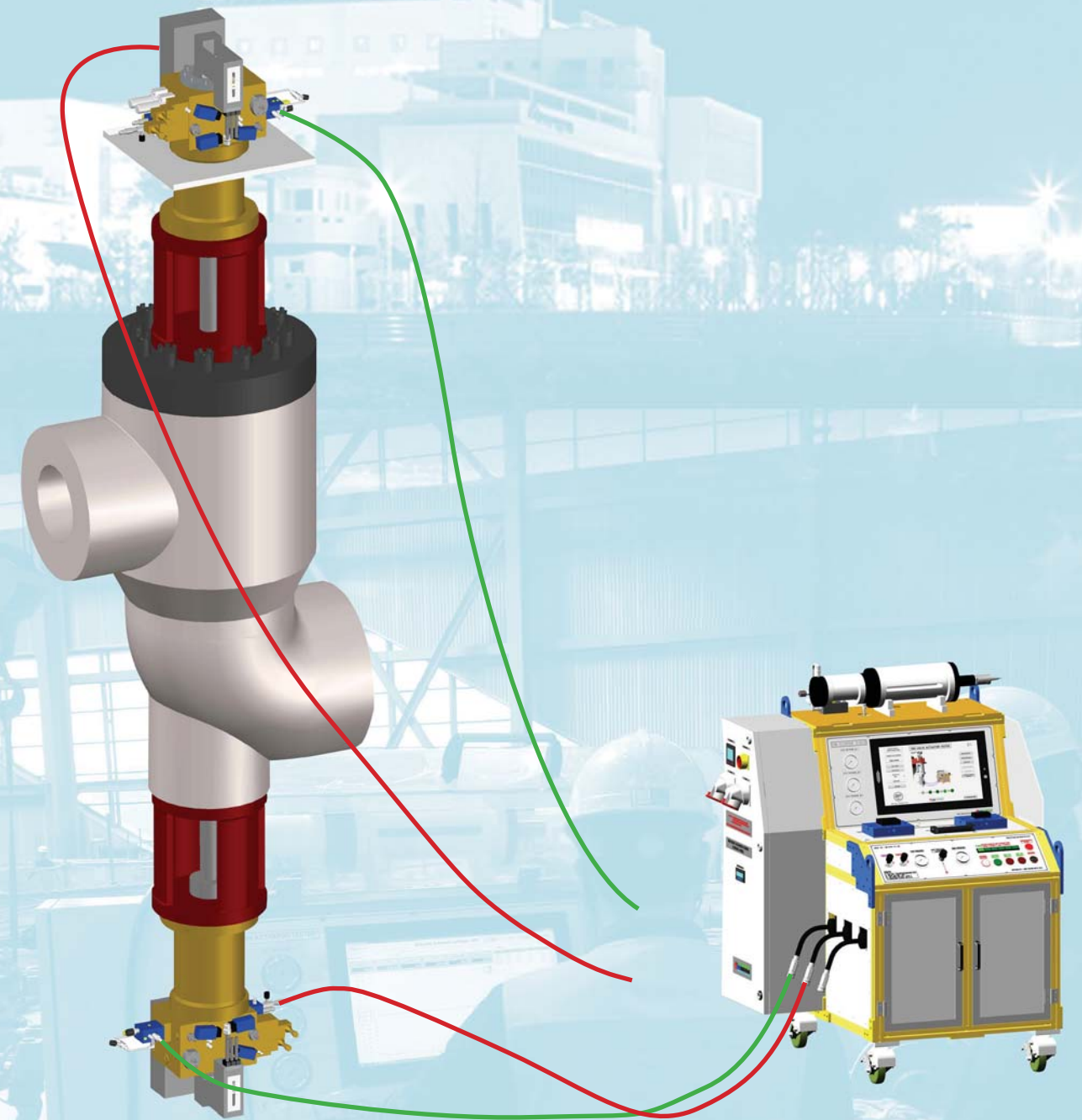
## Actuator diagnostic 3D Image – Rexroth Type

Real time failure prediction monitoring system(Optional)



## Actuator diagnostic 3D Image – Rexroth Type

Real time failure prediction monitoring system(Optional)





## Performance Prediction Diagnostic Tester (TVAT) for Turbine Valve Actuators



- Power supply: 380 ~ 480VAC
- Tested pressure: 5 ~ 250 bar (max.)
- Dimensions (mm): 1200 x 1100 x 1750 (H)
- ※ Specifications are subject to change without notice.

▶ The "Performance Prediction Diagnostic Tester (TVAT) for Turbine Valve Hydraulic Actuators" has been certified by the Ministry of Industry and Commerce of the Ministry of Commerce, Industry and Energy (NEP).

It is a new innovative product of the world's first developed power plant maintenance and diagnostic technology which has successfully received the power plant field test.

▶ "Turbine Valve Hydraulic Actuators" of thermal power plants and nuclear power plants are important core devices that are installed to control the amount of steam supplied to the turbine, which requires high durability and reliability. It has significantly improved the serious problem of current generation maintenance technology, which couldn't diagnose its performance without separating the hydraulic actuator from the system.

▶ **This product has been favorably received by Wolsung nuclear and thermal power plant in Korea with successful the field test.**

- "Performance Prediction Diagnostic Tester (TVAT) for Turbine Valve Hydraulic Actuators ", which is moveable for easy access to the plant site. Without disconnecting the turbine valve hydraulic actuator from the system, it is possible to diagnose performance and this prevents the power plant from being turned off, save enormous maintenance cost, shorten the maintenance period, and determine the replacement period. Stable supply and demand can be expected due to increased reliability of maintenance and improved power plant operation efficiency.

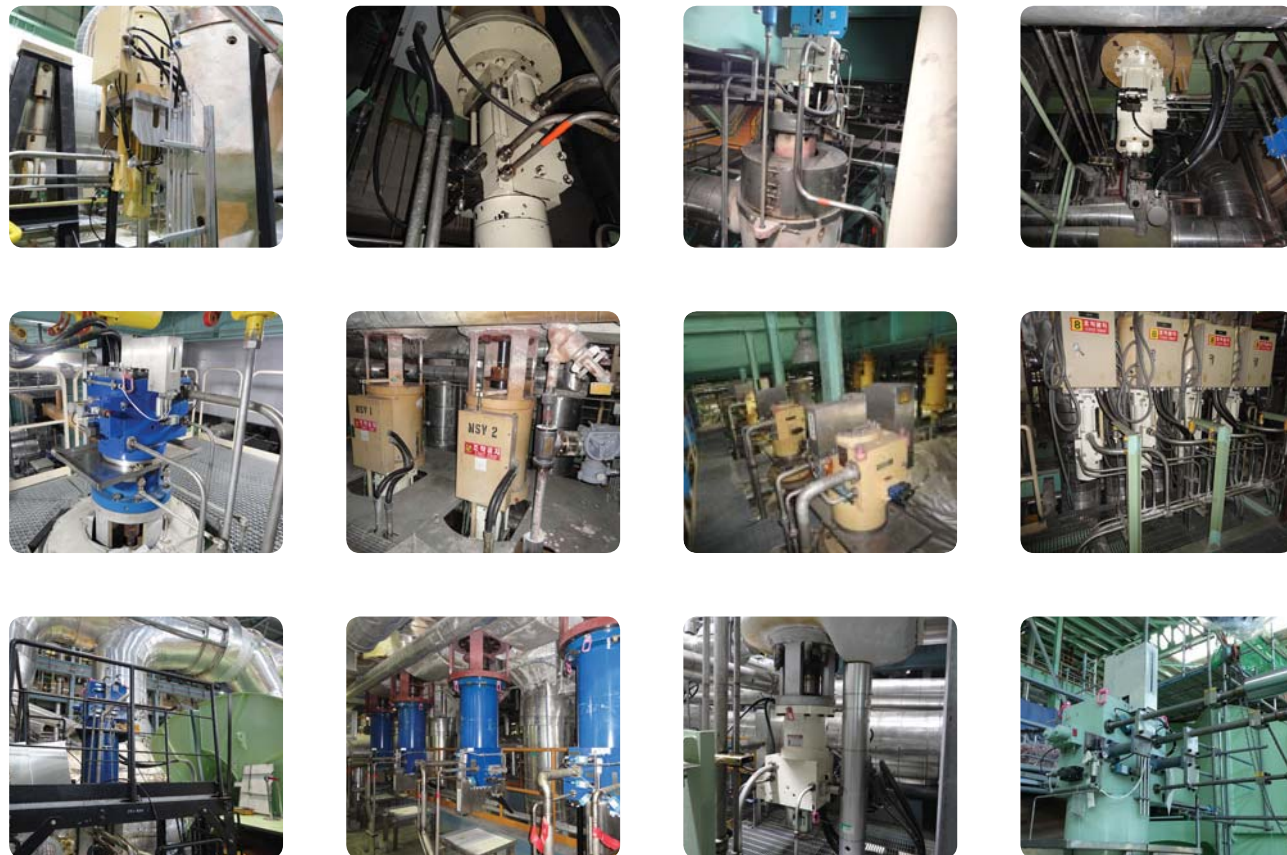
## Present Problems and Countermeasures for Performanc Prediction Diagnostic Tester for Turbine Valve Actuators

- No checkup and predictive diagnosis on performance without separating the body are possible.
- It is difficult to secure the reliability of the maintenance due to the inability to get a full inspection within the
- maintenance period.
- After the maintenance, it is not possible to test the performance of the power plant itself.
- Delays in maintenance and enormous maintenance and diagnostics costs.
- Actual preventive maintenance is not possible through pre-defect check.



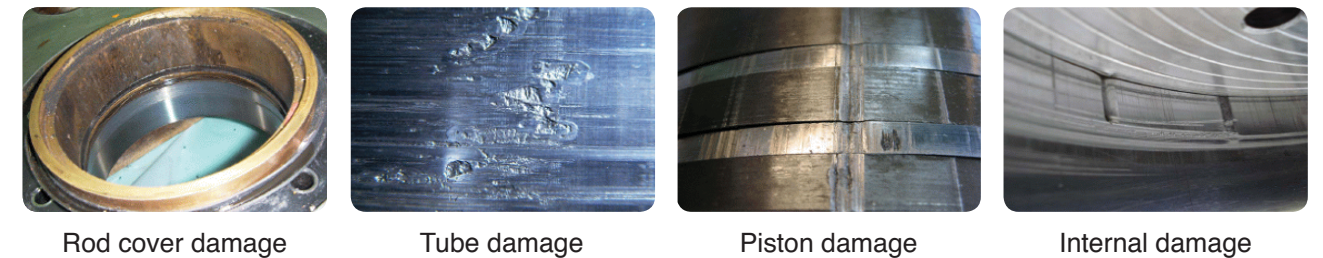


## Power plant turbine valve actuator installation site



- ▶ Turbine Valve Hydraulic Actuators are constantly used for one cycle (1.6 ~ 8 years) due to the characteristics of power generation facilities. Despite being the core equipment requiring high durability and reliability, the current maintenance and diagnosis technology cannot check defects in advance without removing the system. It has greatly improved this significant problem.
- ▶ It is not necessary to separate the Turbine Valve Hydraulic Actuators from the system by using TVAT, and it is possible to perform default checks through preliminary full checkup without removing the system, so that actual preventive maintenance and reliability of the diagnosis technology can be increased.

## Contamination of hydraulic oil due to internal damage of actuator



- ▶ Turbine Valve Hydraulic Actuators are caused by foreign substance (iron powder) due to Internal damage circulating in the hydraulic system, causing the contamination of the hydraulic operating oil to accelerate the abrasion within the hydraulic actuators.  
In particular, it has a negative impact on servo control valve (FAS, shut-off valve) and emergency stop valve (ETS, solenoid valve) which are vulnerable to the pollution of hydraulic operating oil. It is a major cause of the frequent breakdown and cutback (power generation reduction).
- ▶ As shown in the picture above, to check the internal damage condition of the main turbine valve, which is the core equipment of the power plant, the turbine valve hydraulic actuator must be separated from the system and requested to be taken out for maintenance to an outsourcing company.
- ▶ Disassembling the hydraulic actuator at the repair shop of the outsourcing company is necessary to verify the condition of internal damage visually so that the performance can be checked. The serious problem of the existing power maintenance technology which could not be check defaults beforehand was significantly improved.
- ▶ Performance Prediction Diagnostic Tester (TVAT) for Turbine Valve Hydraulic Actuators can be used to check the performance of turbine valve hydraulic actuators without separating them from the steam valve system. It can contribute greatly to the actual preventive maintenance, improvement of the reliability of development maintenance (diagnosis) technology, and the improvement of the operation efficiency.

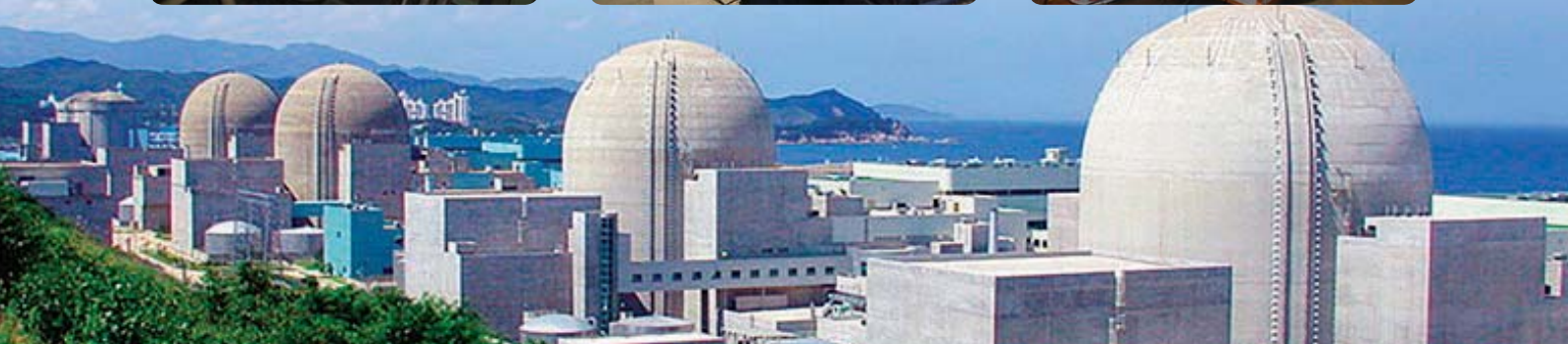


- ▶ Improving power quality and increasing power generation efficiency can contribute to stable power generation



## Necessity of Performance Prediction Diagnostic Tester(TVAT) before malfunctioning

- ▶ Turbine Valve Hydraulic Actuators are core devices of nuclear power plants and thermal power plants., Although high durability and reliability is required due to the characteristic of power generation facilities, the present inspection method can only carry out maintenance limited to specific hydraulic actuators that are checked to have trouble and it can not be diagnosed without separating the hydraulic actuator from the system.
- ▶ It is a portable on-site performance prediction diagnostic tester that doesn't have to go through the inconvenience of separating the hydraulic actuator for unnecessary maintenance and reinstalling. It does not incur huge maintenance cost and allows the full inspection within a fixed maintenance period.



- ▶ Actual preventive maintenance is possible through preliminary full inspection and performance evaluation without separating the Turbine Valve Hydraulic Actuators from the steam valve system.
- ▶ Maintenance cost dramatically saved thorough saving in whole inspection and repair.
- ▶ Ensures reliability of power generation maintenance through power plant self-certification test before installing system.

## Differences from existing similar product technologies

- ▶ A picture showing that it is currently possible for inspection only if it is separated from the system

<There are various types of turbine steam valve hydraulic actuators in power plants as shown below>





- ▶ In order to diagnose the performance of the hydraulic actuator, it is necessary to separate it from the system, and it is troublesome to move the system to an external inspection service company for disassembly and confirmation, and a huge maintenance cost is required.
- ▶ Since it isn't possible for whole inspection, some or all of the planned maintenance cycle is being replaced, which delays the maintenance period and costs immensely.

## A non-separating Performance Diagnosis using TVAT



- ▶ TVAT doesn't separate the hydraulic actuator from the system. It determines whether to continue use and measures and analyzes the diagnosed results for whole inspection, so it can secure the reliability of the power generation maintenance. TVAT is the newest developed product that allows one to prevent malfunctioning factors of power plants by establishing a periodical maintenance diagnosis system of power plants.

## Differences from existing similar product technologies-2



- ▶ The current method is to test the hydraulic actuator by attaching the valves to the hydraulic actuator and supplying power to each of them, so that the ambiguity of the test results can be known with the data including the servo valve, the dump seat part and the cylinder leakage.

- ▶ It is not possible to test the performance of the power plant itself before installing the system's warehousing goods and spare parts.
- ▶ In order to diagnose the performance of the Actuator main body, it must be separated from the system and moved to the outsourcing company. Therefore, it is not possible to inspect the overall inspection within maintenance period.
- ▶ This portable tester has the key technology that enables performance diagnosis (application of predictive diagnosis algorithm) without separation from the system.
- ▶ In other words, it is possible to evaluate the integrity of the core device through the pre-inspection of the actuator body.

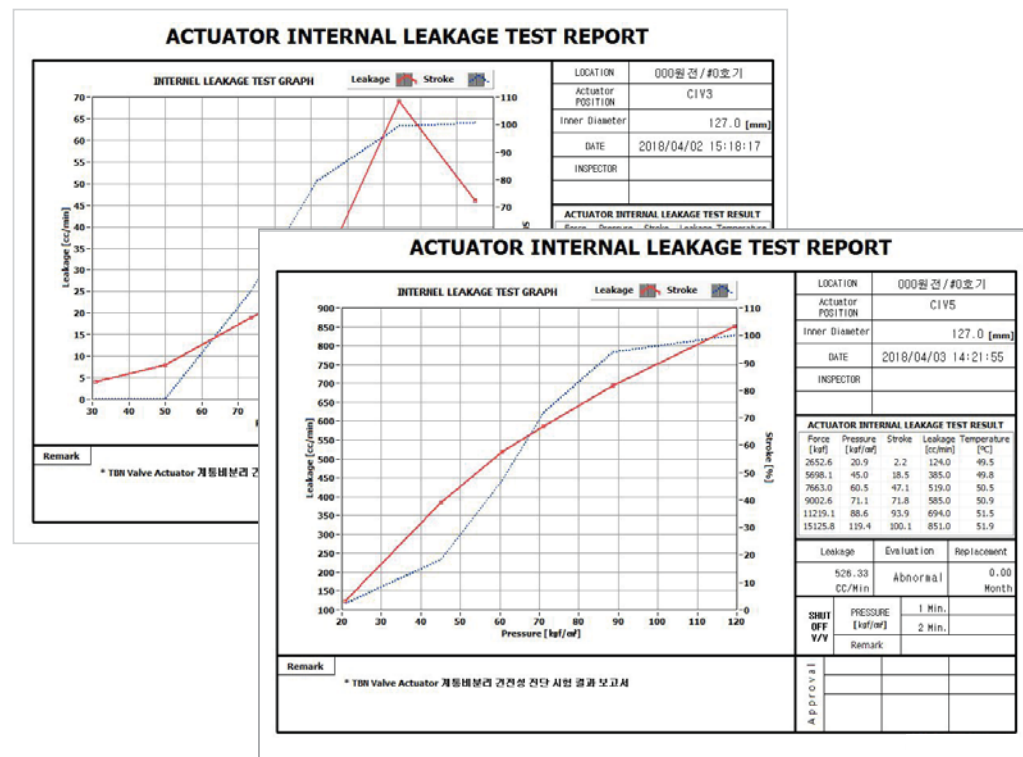
Category		TVAT	Similar Products
1	Performance diagnosis(Category)	Diagnosis of Actuator	Diagnosis of valves
2	On-site mobility	YES	NO
3	System non-separation test	YES	NO
4	Self-performance verification test	YES	NO
5	Occasional inspection	YES	NO
6	Hydraulic actuator leakage test	YES	NO
7	Dump seat part test	YES	—
8	Shutoff valve test	YES(Optional)	—
9	Servo valve test	YES(Optional)	—
10	Diagnosis time	3M/H	120 M/H

- ▶ Currently, the valve test device is a similar product, but it is a fixed type that is owned by an external company. It is necessary to separate the hydraulic actuator from the system and disassemble it from the external company for visual confirmation.
- ▶ The diagnostic method used by the existing similar product doesn't allow performance diagnosis before the hydraulic actuator is separated from the system.

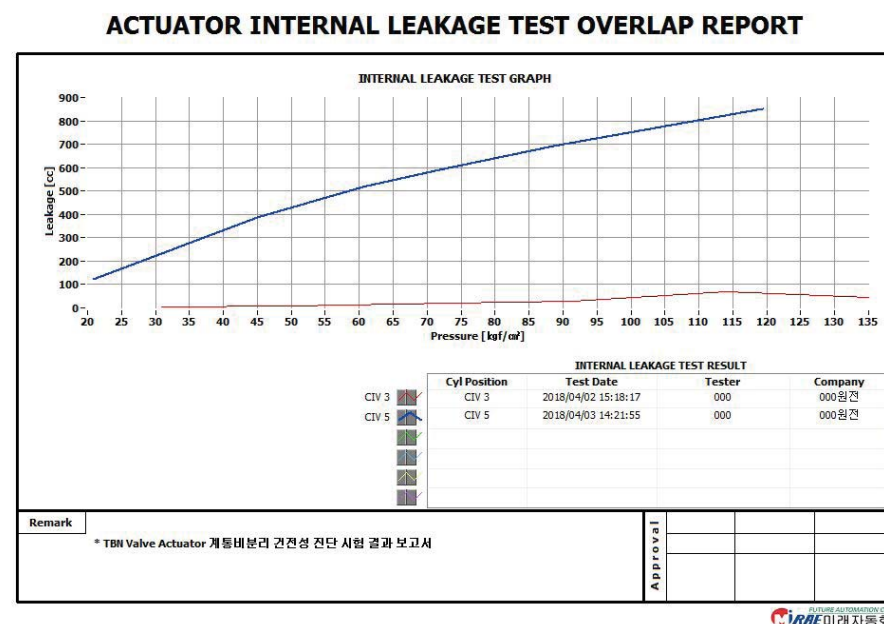


## Cases of preventing malfunctioning factors in advance and diagnosis result report document

- ▶ Reference list and Actuator integrity result report example (from domestic power plants)



- ▶ By Type, Before & after Maintenance and Next Maintenance Cycle analysis(OVERLAP REPORT)



- ▶ Before installation in the system after maintenance of the hydraulic actuator, there was a successful case of actual preventive preservation by filtering out nonconformity (rejection) systems using the “test system” after the performance verification test of the power plant.



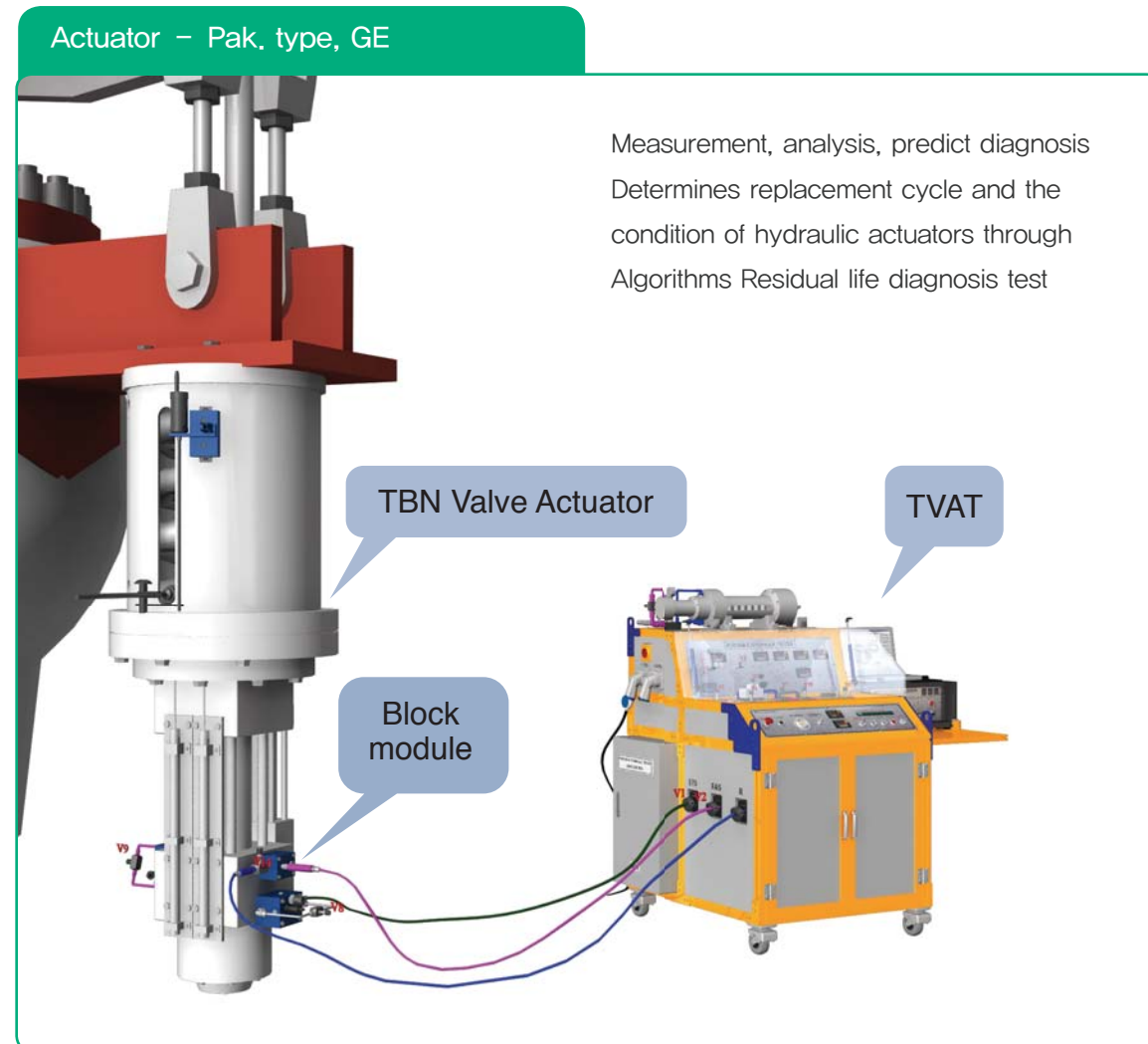
- ▶ Use of the data of Actuator's overall inspection and diagnosis judges whether or not to use until the next maintenance cycle. Therefore, it is possible to secure the reliability of power generation maintenance by virtue of preventive maintenance and integrity, and to prevent the cause of power plant failure beforehand by constructing a system for maintenance diagnosis of power plants.



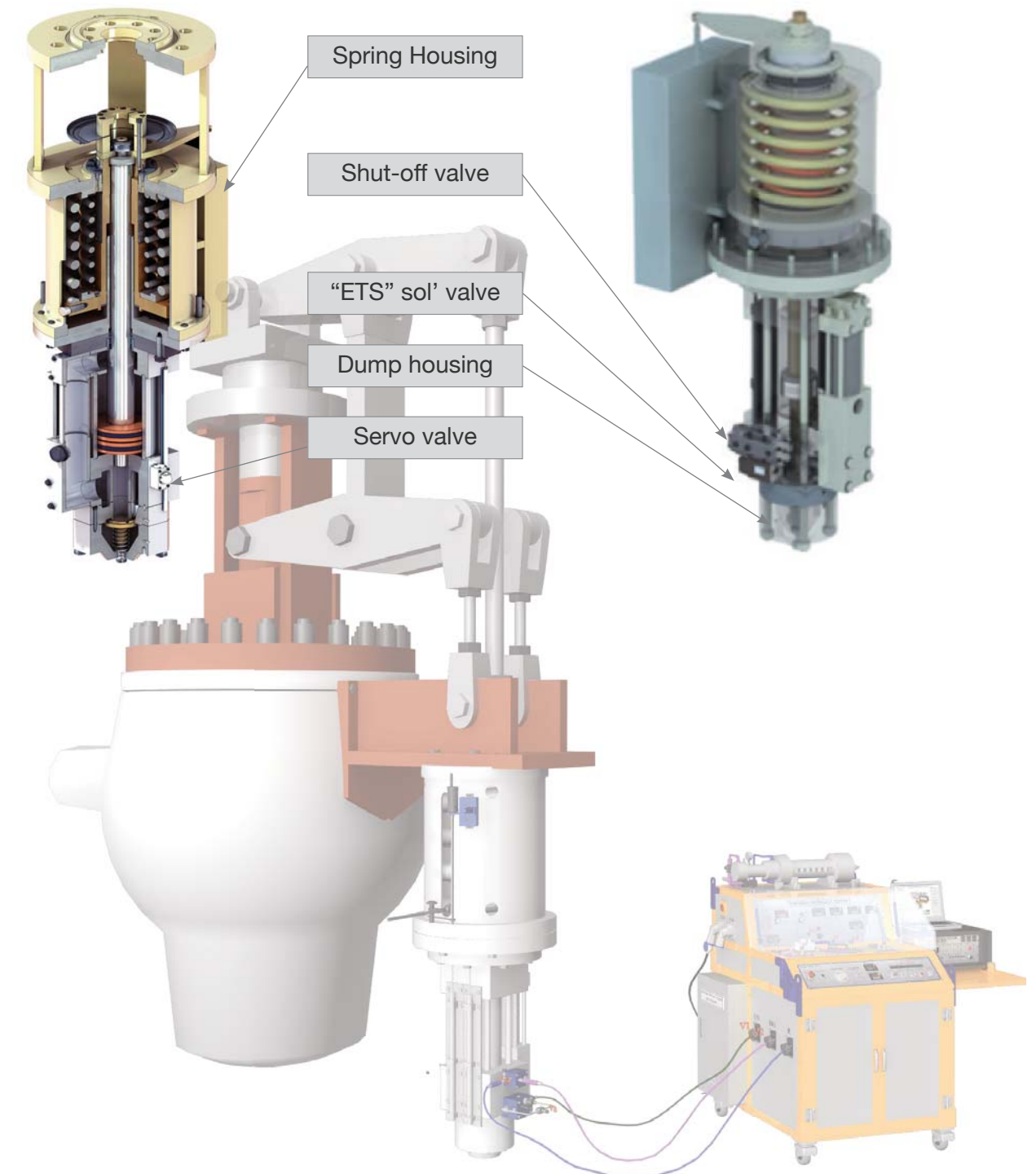


## Picture of an example of System Non-separation Performance Prediction Diagnostic Test-1

## Actuator integrity diagnostic details and functions



Power plant site demonstration test video, catalog data of product introduction can be check out on the company's website at <http://www.servokorea.co.kr>

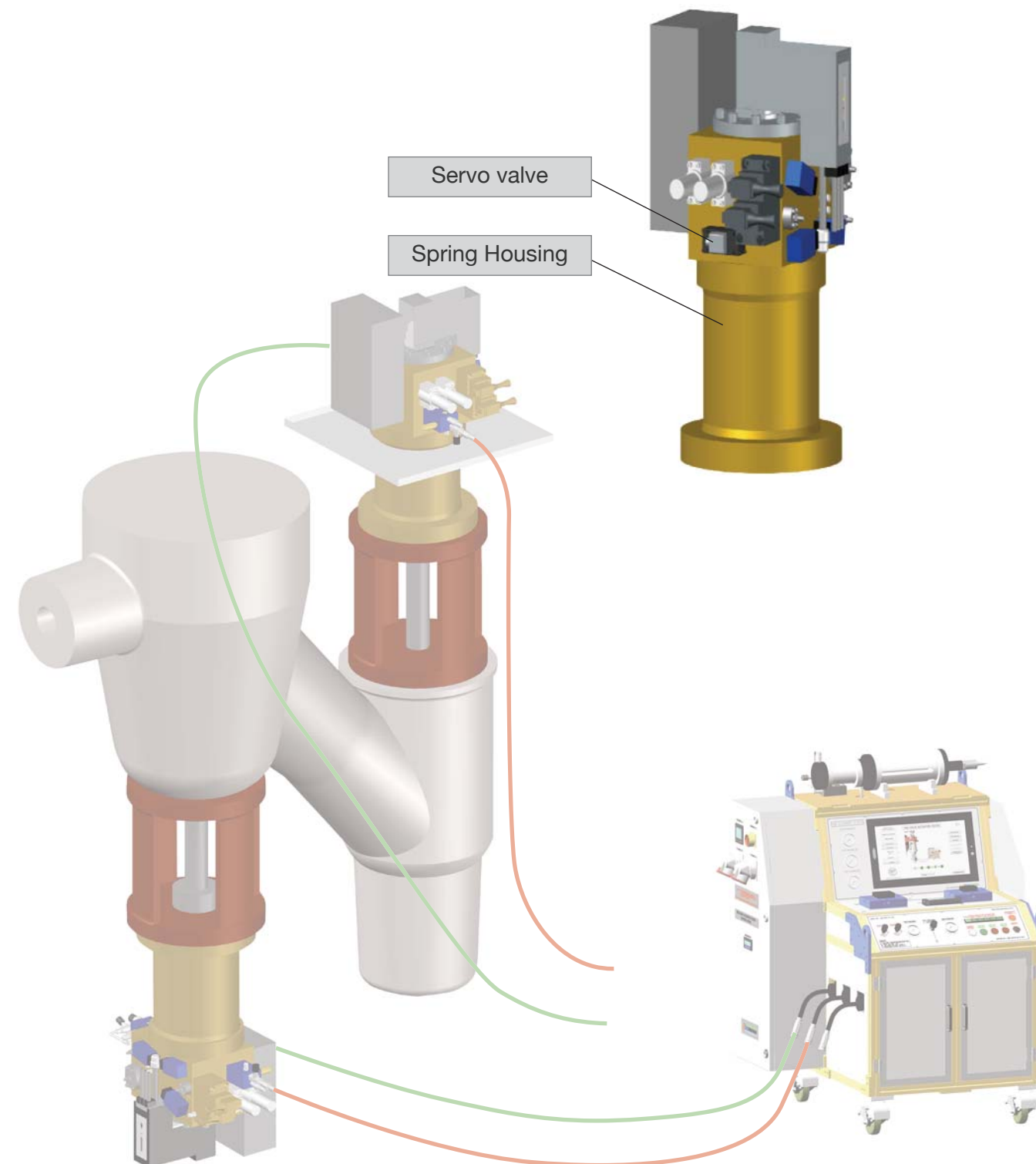
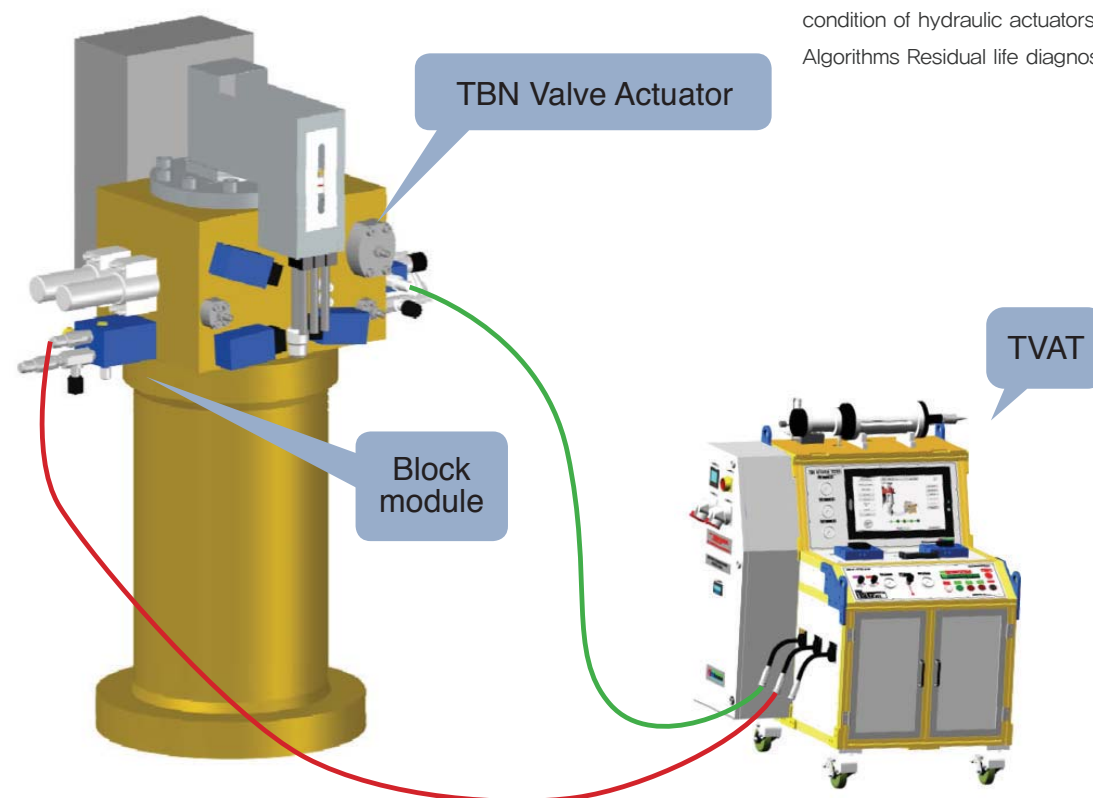




## Actuator integrity diagnostic details and functions

### Actuator – Rex. type

Measurement, analysis, predict diagnosis  
Determines replacement cycle and the  
condition of hydraulic actuators through  
Algorithms Residual life diagnosis test

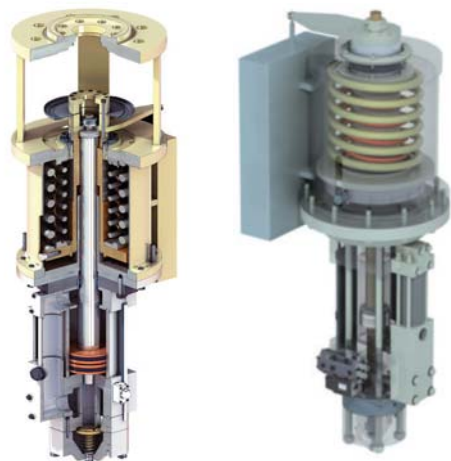




## Performance Diagnosis Items

- ▶ Turbine Valve Hydraulic Actuators are periodically maintained every 2 to 8 years, but they must be separated from the system to perform performance diagnosis and repair service.  
This has dramatically improved the problem of current diagnosis and maintenance technology that doesn't allow one to judge (inspect) performance because it is impossible to carry out whole performance diagnosis within the maintenance system. It is a performance predicting diagnosis test system for It is a field portable performance prediction diagnostic tester for ensuring reliability of power generation maintenance and establishment of a new maintenance (diagnosis) environment

### Actuator Pak. - Type



### Actuator Rex. - Type

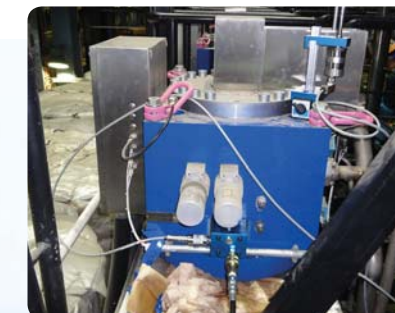


- ① Performance diagnostic test for turbine valve hydraulic actuator
- ② Dump housing seat & dumping speed test
- ③ Automatic determination of maintenance and replacement cycle of predicting diagnosis test for malfunction
- ④ Verification test of performance of power plant after maintenance
- ⑤ Self actuating trial run before configuration synchronization
- ⑥ Real time failure prediction monitoring system(Option)



- ▶ Automatically measures, stores, and reports the test results of thrust, test pressure, stroke (opening ratio), leakage, and oil temperature of turbine valve hydraulic actuators and prints out the report of results on the performance test. Compares and analyzes the next cycle of maintenance and allowed to use it as a big data. It is possible to prevent cutbacks in advance and efficiently manage the system by predicting the maintenance cycle through predicting malfunctions of the core equipment of the power plant.

## Diagnosis of soundness by special diagnosis block module

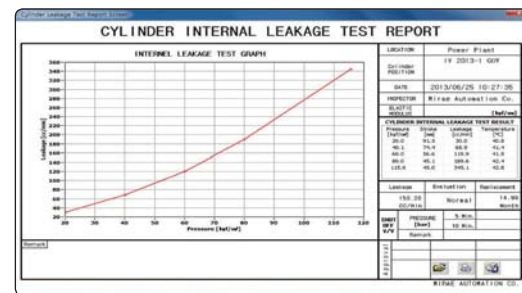
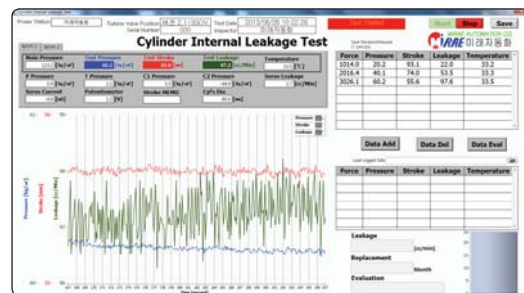
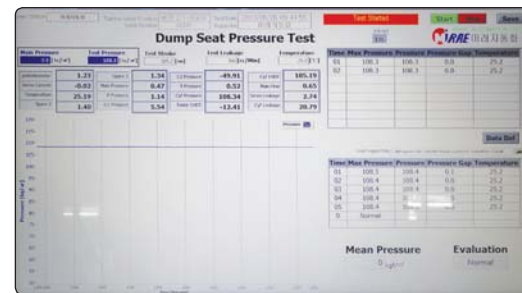
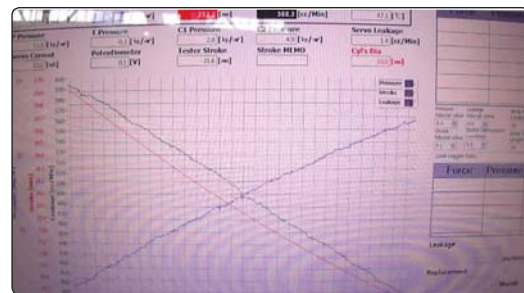


- ▶ The pre-integrity diagnostic test technique for the Actuator main body automatically cuts off the existing hydraulic system hydraulic line (FAS, ETS line) piped to the Actuator, and the special test block module design technology with the test oil supply flow path for the integrity diagnosis is applied.
- ▶ We can pre-inspect of integrity without separation of the actuator from the system.



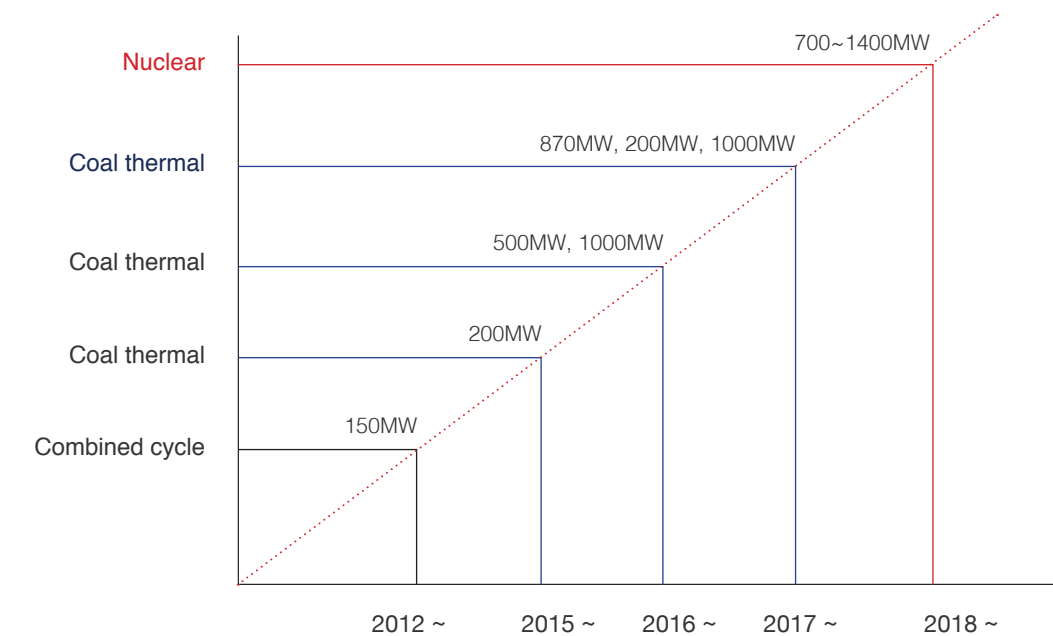
Repair, Replacement Cycle Determination Life Span Prediction  
Diagnosis Algorithm Configuration

Status of supply and reference list of integrity diagnosis test



Performance prediction diagnostic test screen

Report of diagnostic test result





## Status of supply and reference list of integrity diagnosis test

This product has been favorably received by Wolsung nuclear and thermal power plant in Korea with successful the field test.



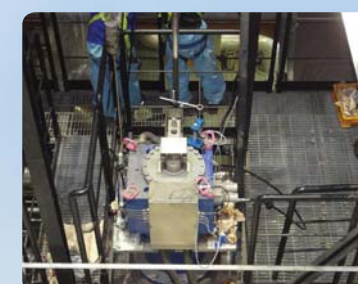
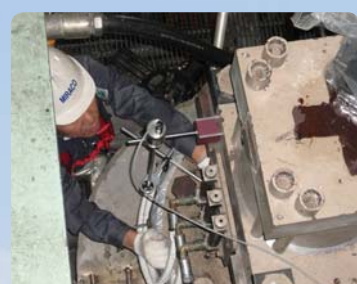
## Status of supply and reference list of integrity diagnosis test





# Turbine Valve Actuator Tester(TVAT)

# Turbine Valve Actuator Tester(TVAT)





## Technical briefing and TVAT operation training





## Expected Effect

- ▶ Realization of reliable maintenance of power generation through actual preventive maintenance and dramatic reduction in diagnosis and maintenance costs due to shortened maintenance period.
- ▶ Diagnosis and maintenance of current plant actuators can drastically improve disadvantages that depend entirely on subcontractors.  
By reducing reliance on subcontractors, reducing maintenance and diagnostics costs, and enabling power plant self-sufficiency verification tests, it is expected to contribute greatly to securing (improving) reliability of power generation maintenance technology.
  - Increase efficiency of power plant operation by systematic management of malfunctioning cycle in replacement of hydraulic actuator and repairs
  - Reduced maintenance cost by shortening maintenance period(maintenance costs by 1/40)
  - Actual preventive maintenance and prevention of cutbacks in advance through prediction diagnosis of malfunctions
  - Eliminate the factors of malfunction by carrying out the performance verifying test of the power plant before installing the system and after installation and maintenance
  - Periodical maintenance and establishment of a diagnosis system
- ▶ This new product dramatically improves this, has substantial preventive maintenance and an ongoing maintenance (diagnosis) system for actuator.  
Predictive Diagnosis and Maintenance Before installation of the spare parts after installation, it is possible to contribute to improvement of power quality and productivity by improving the reliability of power generation maintenance and operation efficiency by testing the integrity of the power plant itself.

## Power plant company's tour purchase consultation





Domestic and other participating into the exhibition and domestic and foreign buyers baljeonsa business conference



TVAT is the on-site portable integrity diagnostic system to check the overall inspection with non-separated "TBN Valve Actuator" at nuclear and thermal power plants to check the integrity of system itself and to increase reliability of power generation maintenance technology.





## Overseas buyers invited to demonstrate tour



## ► Visit to China Nuclear Power Plant (CNNP), product introduction



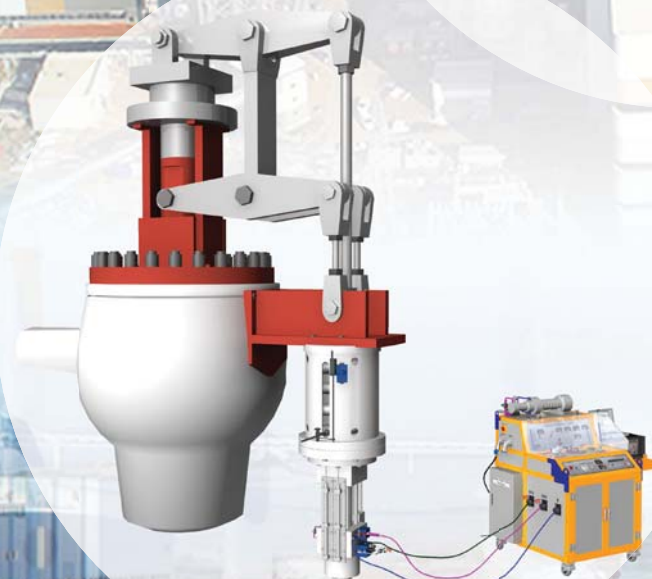
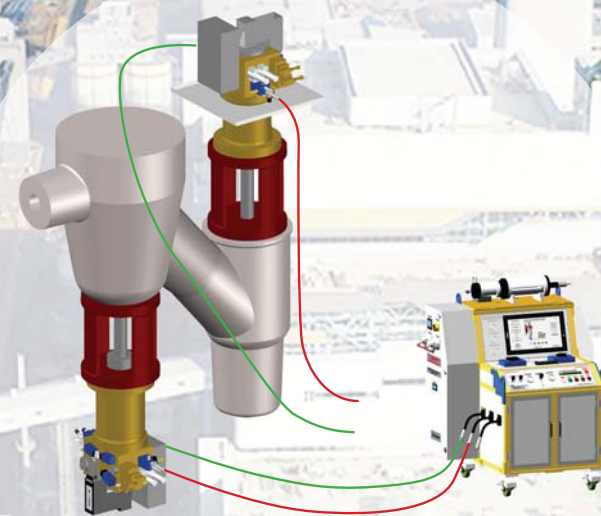
## ► Visit to Southeast Asia





# Turbine Valve Actuator Tester(TVAT)

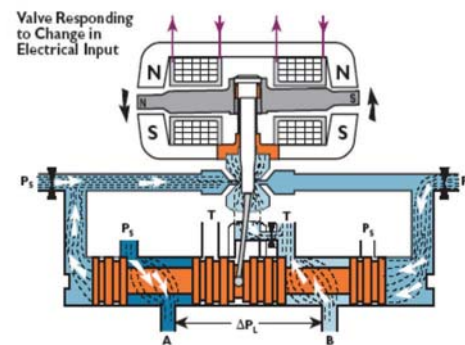
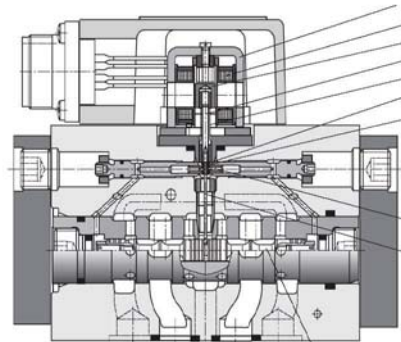
Buyers invited business meetings



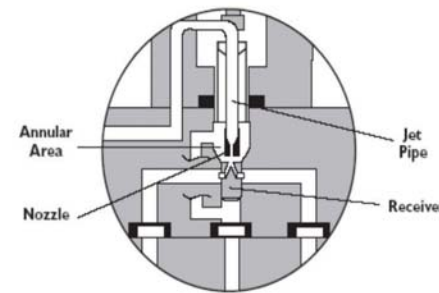
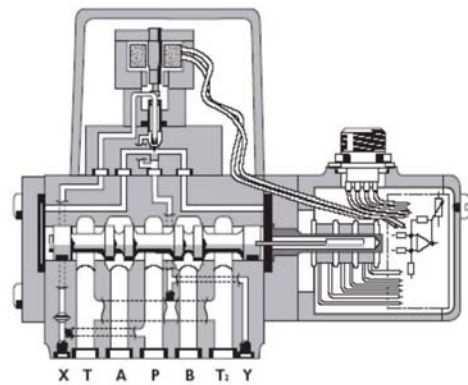


## Hydraulic servo control Valve

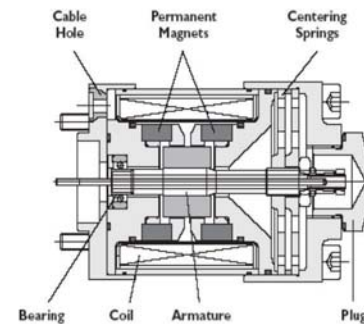
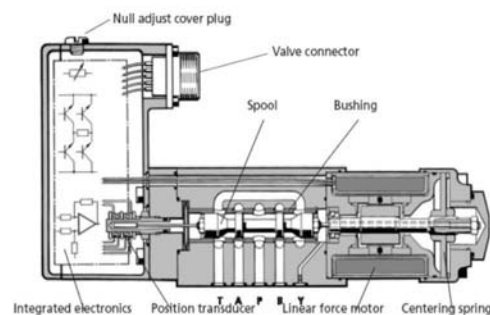
### ▶ Nozzle Flapper Type



### ▶ Jet Pipe Type

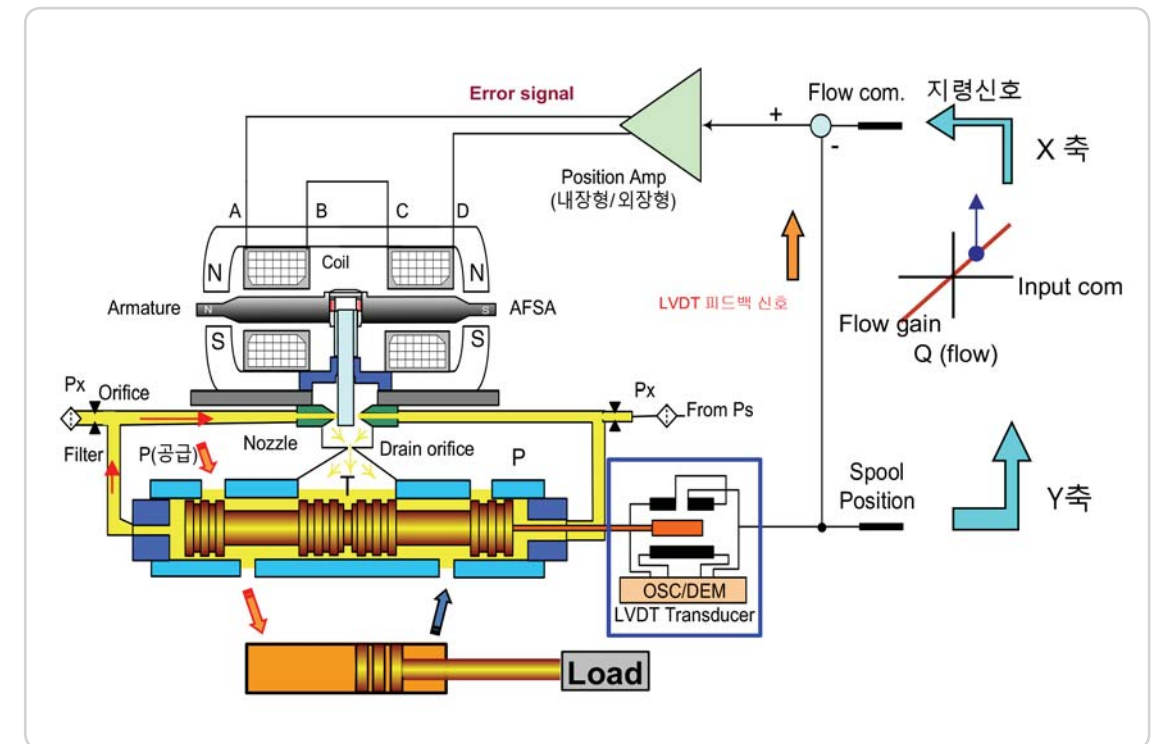


### ▶ Linear Motor Type (Voice Coil)



## Hydraulic servo control Valve

### ▶ EFB Servo valve (1 stage)



#### 〈 Servo Valve Test Item Ex. (Option) 〉

- Null Point Test
- Pressure Gain Test
- Threshold Test
- Hysteresis Test





## Hydraulic System



## Hydraulic System

### Block Lifting Transporter System of Ship & Block Lifter



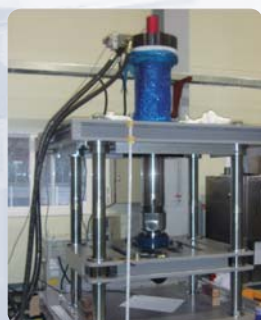
### Hydraulic Power Unit & Hydraulic System



### Steel Plate Side Hyd' Pusher Position Control System of Ship



### Hydraulic Servo Press & Portable Block Lifter







## Hydraulic System



## Vacuum System

### Hydraulic Power Unit & Hydraulic System



### Vacuum Lifting Crane & Vacuum System







## Shaft Coupling Centering Apparatus



Flange hole alignment jig

## Angle Cutting Robot Conveyor System



## Pneumatic Servo Control System



## Vacuum Recovery System



### Water-Ring Vacuum Pump



Model : OMP-W00-50D

- Max. Vacuum : 720mmHg.G
- Noise Level (Max.) : 76dB(A)
- Material : SUS304
- Working Temperature : below 90°C
- Net Weight : 60~100kg
- Port Size : 11/2"(40A)

## Other equipment







## Items for Sale

- Turbine Valve Actuator Tester(TVAT) for **Power Plants**
- Hydraulic system and pneumatic system
- Vacuum Product & Vacuum Lifting Crane system



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