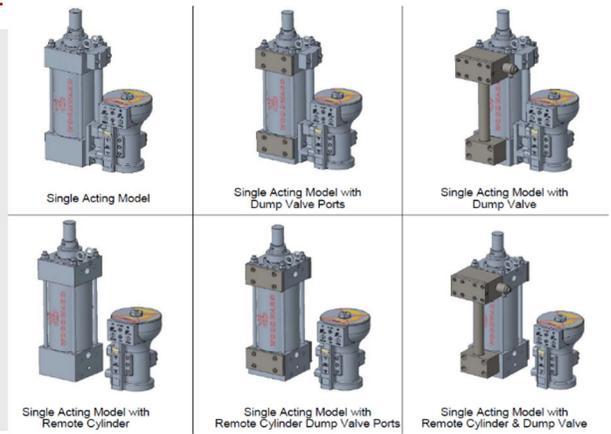


## Single-Acting Electro-hydraulic Actuator with Trip Function

Woodward VariStroke-GI - a range of electrohydraulic actuators ensuring fast, accurate and reliable operation of steam turbine governor valves, valve racks and trip valves. The VariStroke high speed rotating spool valve technology eliminates control issues normally associated with contaminated turbine oil systems.

This single-acting actuator family is ideal for mechanical and generator-drive applications utilizing a low-pressure, up to 35bar, oil source (typically turbine lube oil) to provide its output power.

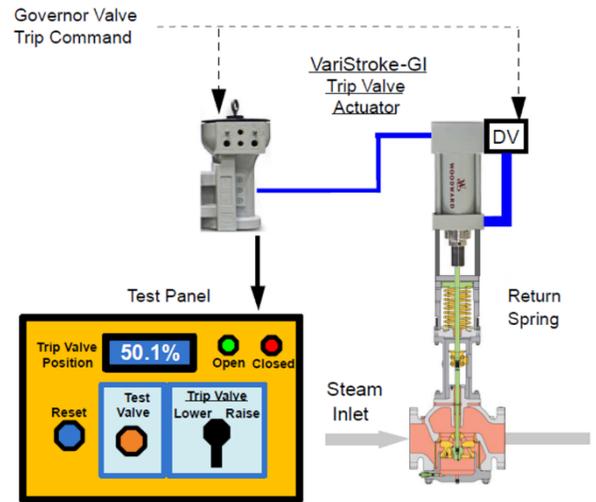


A recent geothermal plant upgrade by PT PM Control Systems, a Woodward Channel Partner (Authorized System Integrator & Authorized Independent Service Facility) in Indonesia, has seen the successful retrofit of two trip valve actuation systems replacing the OEM equipment by the Woodward VariStroke-GI.

The 55MW Mitsubishi Steam Turbine was equipped with the original OEM actuation system comprising an electrical motor rotating a series of gears to position a pilot valve. The pilot valve controlled the flow of oil to a rotary actuator to open and close the turbine trip valve. Mechanical wear and tear meant the end user was unable to accurately control the opening and closing of the trip valve resulting in unacceptable delay whenever the turbine was started or stopped.

The VariStroke-GI directly replaces both the existing antiquated servo system and power cylinder. This saves costly repairs to the aging servos, eliminates the difficulty of obtaining spare parts for obsolete equipment, and reduces calibration time. The VariStroke-GI can be configured to accept manual reset, raise/lower, and partial stroke test commands. Both an analog 4-20mA signal as well as discrete min & max indication output signals make it easy to for operators or the plant DCS to verify T&TV position and health.

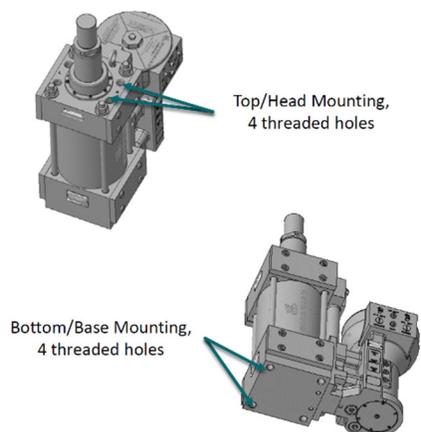
To meet with the requirement of this project, PTPM Control Systems have specifically engineered and fabricated a customized power piston with return spring that can provide the required force to control the T&TV accurately and safely.



Typical Application of VariStroke-GI

### Integrated Models

- Cylinder Base
- Cylinder Head



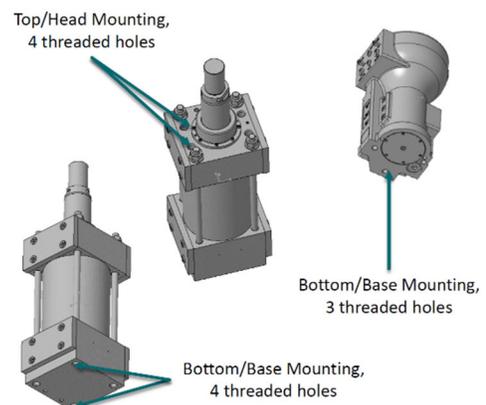
### Servo Only Models

- Base Mounting



### Remote Servo Models

- Servo
  - Base Mounting
- Cylinder
  - Base or Head Mounting



## The Retrofit Requirement

In a geothermal steam turbine, the Trip & Throttle Valves (TTVs) plays a critical safety and control role. The valve must be able to close rapidly (typically within 1 second) to trip the turbine in case of an emergency. Fast closing is essential to prevent damage to the turbine or associated equipment. It is also important that the valve can be controlled accurately throughout its range to facilitate smooth turbine startup and shutdown.

The key requirements of the project were to ensure that the new actuation system will be able to trip the turbine within the expected duration regardless of the load on the turbine and to be equipped with both electrical and mechanical trip.

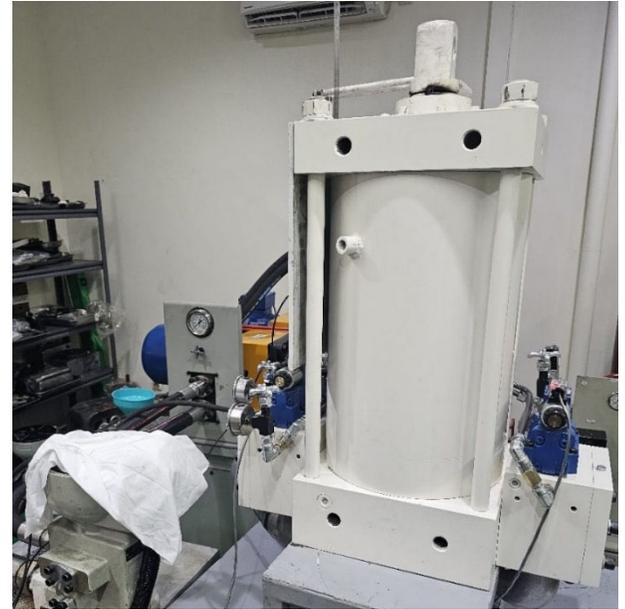
As the size of the cylinder is large, dual fast acting dump valves were included to ensure the fast draining of hydraulic oil to trip the turbine promptly during emergency condition.

The VariStroke Servo not only trips the system upon receiving a trip command from the safety controller, but also comes with failsafe features that dumps the hydraulic pressure during failure condition (e.g. losing electric signal/power). The new actuation system is also equipped with mechanical tripping mechanism such as autostop oil holding pilot oil pressure.

PT PM Control Systems conducted multiple tests both at factory and site to prove the performance of the actuation system provided exceeded the requirement.



**Autostop Oil Trip System**



**Stroking test in workshop**



**Stroking and performance test at site**

## Before Retrofit – Old Actuation System



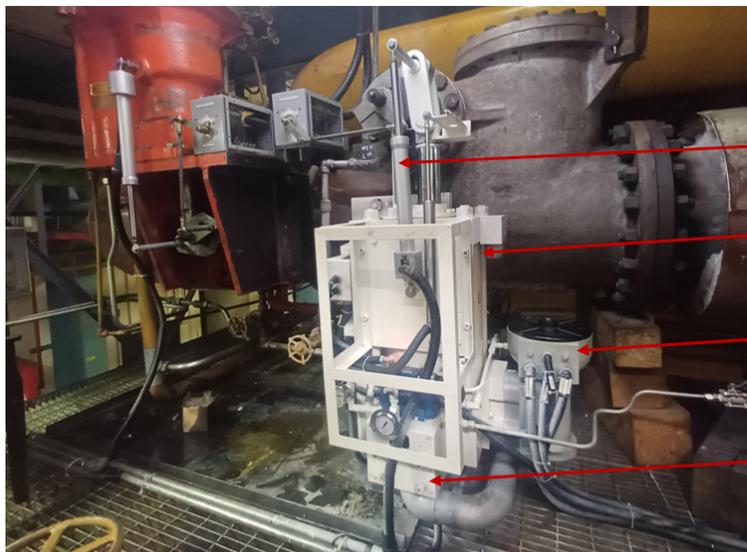
Rotary T&TV actuated  
by Power Cylinder

Pilot Valve controlling  
position of Power Cylinder

Electric Motor controlled  
by PLC

LVDT Feedback to DCS

## After Retrofit – New Actuation System



LVDT Position Feedback

Customized Power Cylinder

VariStroke-GI Servo

Dual fast acting dump valve

After the completion of the retrofit, the customer was able to start and stop the turbine fully automatically within hours as compared to pre-retrofit condition of days when they must manually adjust multiple components.

Turbine startup speed can be controlled smoothly and steadily, thus reducing the risk of rotor vibration during the startup process lengthening the lifespan of the turbine.

They have also eliminated multiple stages of obsoleted components that are no longer supported in the market. The retrofit ensures that the turbine T&TV actuation system remains reliable for the next decade or longer.

### Contact Us:

**Woodward Singapore**  
(PM Control Systems Pte Ltd)

8 Joo Koon Crescent  
Singapore 629011  
Tel: +65 6779 2822

Sales Inquiry: [sales.sg@woodward.com](mailto:sales.sg@woodward.com)