

JUSTIFICATION FOR THE KALSI MOV ACTUATOR TEST STAND

INTRODUCTION

Based on feedback from more than 23 units, the Kalsi Engineering MOV Actuator Test stand has proven to be useful and cost effective in supporting both plant engineering and maintenance activities. Chiefly, the Kalsi MOV Test Stand helps:

- Improve margins by accurate quantification of actuator output by eliminating assumptions, unconservatism, or excessive conservatism. - *Tests have demonstrated 10% - 40% additional capability over calculated or published values (Limitorque and Rotork actuators)*
- Improve MOV reliability by guaranteeing fitness for service by identifying refurbishment problems before installation. - *Significant savings in maintenance realized by all users*
- Increase plant availability by preventing inadvertent MOV damage, unscheduled shutdown & critical path/restart delays
- Enhance Safety by minimizing time at valve by performing torque switch settings offline - *Reduced personnel exposure to radiation*

The Kalsi MOV Test Stand was designed in close collaboration with Duke Power engineering and maintenance personnel who had many years of experience with other torque test stands. This stand was specifically developed to address two key limitations in other test stands: (1) the effect of thrust on torque and (2) the lack of measurement accuracy for different size actuators – smallest to largest.

NEED FOR ACTUATOR TEST STAND

For safety related MOVs, NRC IE Bulletin 85-03, GL 89-10, & GL 96-05 identified the need to (1) Accurately determine MOV actuator output and torque switch setting (2) Determine valve thrust/torque requirements (3) Establish margins under design basis conditions and (4) Ensure the margins are maintained. *MOV margins are also a key determinant in setting JOG MOV periodic verification static test frequencies.* Limitorque provides equations to calculate actuator output torque capabilities. However this guidance is subject to the following limitations:

- Output can be significantly higher due to conservatism in equations
- Output can also be significantly lower due to manufacturing tolerances and assembly/maintenance practices.
- The effect of stem thrust on output torque is significant for some actuators but is not taken into account

Additionally, some actuator manufacturers only provide simplified actuator output tables with no supporting methodologies. For instance, degraded voltage output provided only at few discreet voltages, with no method for interpolating and actuator stall capabilities are not provided.

Refurbishment of Actuators can introduce problems that cause:

- Overloading/damage to MOV due to improper switch settings
- Reduced output capabilities/margins. (Can only be detected by in situ diagnostic testing)
- The MOV to be removed/reworked resulting in increased cost and radiation exposure
- Unplanned shutdowns/extended outages

DC motor actuator output, margin, and MOV stroke time are significantly affected by the combined effect & uncertainties in:

- Motor efficiency
- Actuator gear efficiency
- Voltage, and
- Load history
- Ambient temperature

BENEFITS & APPLICATIONS OF KALSI TEST STAND

Regain/improve margin to expand set-up window; extend periodic verification static test frequencies; avoid unwarranted equipment modification

The Kalsi MOV Test Stand can improve MOV Margins by precisely quantifying actuator output. It eliminates bounding, excessively conservative assumptions by quantifying/verifying:

- Output torque both with and without stem thrust
- True under voltage capability
- Torque switch balance and repeatability
- Gear box efficiency
- Electric Motor Temperature effects

Tests have demonstrated 10% - 40% additional capability over calculated or published values (Limitorque and Rotork).

Improve MOV reliability by preventing faulty actuator from being installed

The Kalsi MOV Test Stand helps guarantee fitness for service by detecting actuator degradation, misassembly and troubleshooting sources of actuator malfunction

- Damaged thrust bearings
- Identify excessive bearing preload due to improper shim thickness or high preload on bolts
- Worm to worm shaft misalignment
- Worm/worm gear excessive wear or damage

Enhance the readiness of replacement actuators for outages. Spare actuators are maintained and certified in between outages

Cost savings through improved reliability and safety

The Kalsi MOV Test Stand helps enhance plant productivity and safety by minimizing time at valve

- Set torque switches for butterfly valves that close on torque. (HBC/SMB is tested on the test stand)
- Set torque switches to protect MOVs that operate on limits.
- Develop spring pack displacement versus stem torque/thrust curves. Particularly important when it is not feasible to install stem torque/thrust sensors on valve.
- Select optimum spring pack for required torque control
- Minimize personnel radiation exposure and reduce ALARA related costs.