Safer, Smarter Pipeline with Automated Isolation

Through Built-In Actuator Redundancy

A field-ready dual-drive electrohydrostatic actuator delivering SIL 2 integrity with inherent rather than bolted-on redundancy, reducing site interventions on remote Emergency Shutdown Valves

CATEGORY · Health, Safety & Environment

About this proposal. Paper proposal prepared for the ADIPEC 2026 Technical Conference (Abu Dhabi, 2–5 November 2026) under the **Health, Safety & Environment** category. It follows the SPE paper-proposal format (Objectives/Scope; Methods, Procedures, Process; Results, Observations, Conclusions; Novel/Additive Information) within the 225–450-word limit, presents original, previously unpublished electrohydraulic-actuator engineering, and observes SPE policy on non-commercial content. Safety-integrity results reflect internal evaluation against the cited standards, with independent functional-safety certification on a defined path.

Prepared by
Thomas Afshari | Inventor & Co-Founder, Drive-Drive Power
tom@drivedrivepower.com · 480-334-6088

Paper Proposal

1. Objectives / Scope (25-75 words)

Pipeline Emergency Shutdown Valves are a cornerstone safety-instrumented function. A conventional SIL 2 hydraulic power unit reaches that level on a single motor, with no redundancy in the drive itself. This paper presents a field-ready dual-drive electrohydrostatic actuator (EHA) whose two independent drive lanes build in a level of redundancy beyond the SIL 2 baseline, holding SIL 2 integrity while reducing the manned interventions that expose personnel at remote, unmanned sites.

2. Methods, Procedures, Process (75-100 words)

The actuator design was qualified through a component-level Failure Modes, Effects and Diagnostic Analysis under IEC 61508 and IEC 61511 in low-demand mode, with average probability of failure on demand computed per IEC 61508-6 Annex B. Failure-rate data were drawn from recognised reliability databases with independent cross-checks. The valve, accumulator-driven fail-close arrangement and redundant solenoids were held identical against a single-motor baseline, isolating the actuator channel and its redundancy concept. The one-out-of-two diagnostics inherent to the two independent drive lanes were credited to migrate failure modes from dangerous-undetected to dangerous-detected.

3. Results, Observations, Conclusions (100-200 words)

The actuator meets the SIL 2 requirement in internal evaluation, and does so by a fundamentally different route than the single-motor baseline. That baseline depends on bolted-on hardware — a dual-wound motor, a redundant drive canister and a second resolver — to attain the required redundancy and diagnostic coverage. In the dual-drive actuator the same redundancy is inherent: the two independent drive lanes deliver one-out-of-two operation and the diagnostic visibility — inter-motor current cross-checking, drive-gear and idler-gear phase-lock signatures, correction-table drift trending, hold-mode leak quantification and partial-stroke torque-differential analysis — as a property of the architecture rather than as added components. These inherent diagnostics substantially reduce the undetected-dangerous failure rate relative to the baseline, migrating the dominant failure modes from dangerous-undetected to dangerous-detected. The resulting margin is sufficient to support a materially extended proof-test interval while remaining within the SIL 2 band. Because the dominant maintenance-dispatch triggers are observable from the control room, fewer proof tests and site visits are required — each avoided intervention removing a depressurization event and an exposure window at an unmanned location. Safety integrity, component count and personnel exposure improve together rather than through trade-off, in an actuator engineered for field deployment.

4. Novel / Additive Information (25-75 words)

The design reframes SIL 2 compliance from bolting on external redundancy until the failure rate is small enough to embedding redundancy and diagnostic coverage in the actuator architecture itself, and establishes the dual-drive gear-pair signature as a credited safety diagnostic. It delivers reduced manned intervention as a direct HSE benefit for remote, unmanned pipeline shutdown valves, in a deployable solution with a defined path to independent certification.

Total ≈ 425 words · within SPE/ADIPEC 225–450-word proposal guideline. Structured per the SPE four-section proposal format. Title and author details are provided in the submission portal fields, not in the proposal body.