Drill String Safety Valve Project Report

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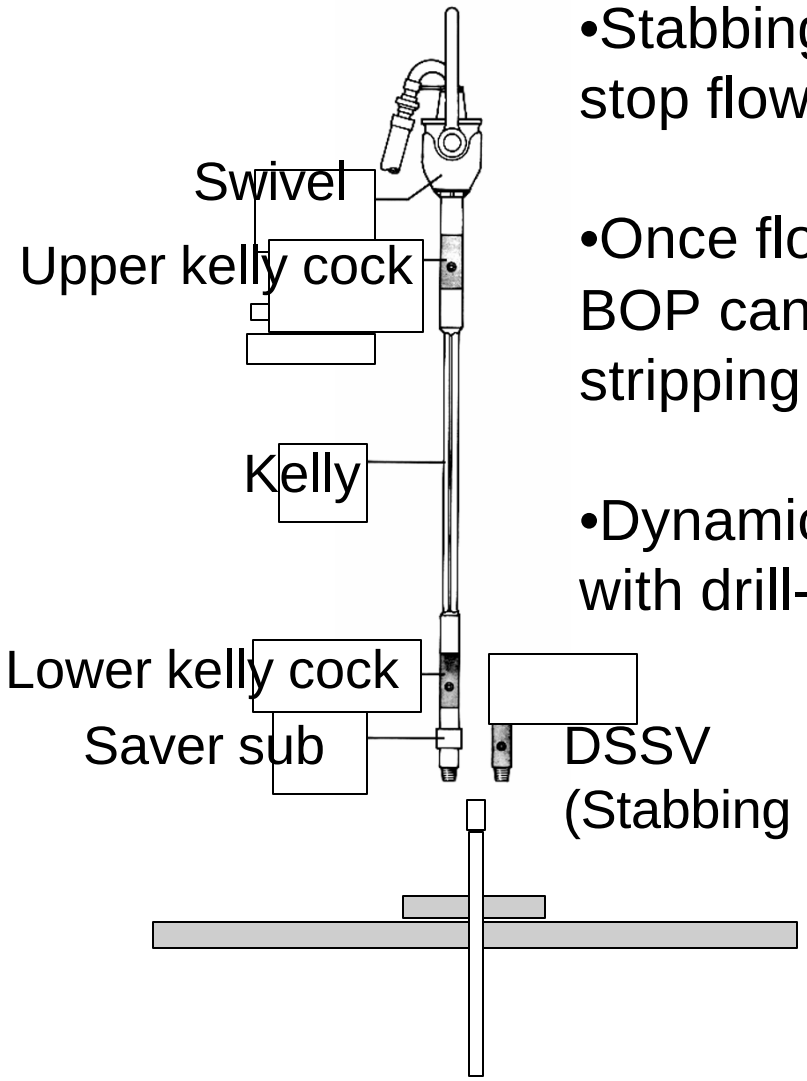
Presentation Outline

- Background
  - Terminology
  - Problem Areas
- Objectives
- Approach
- Summary
- Recommendations

Terminology



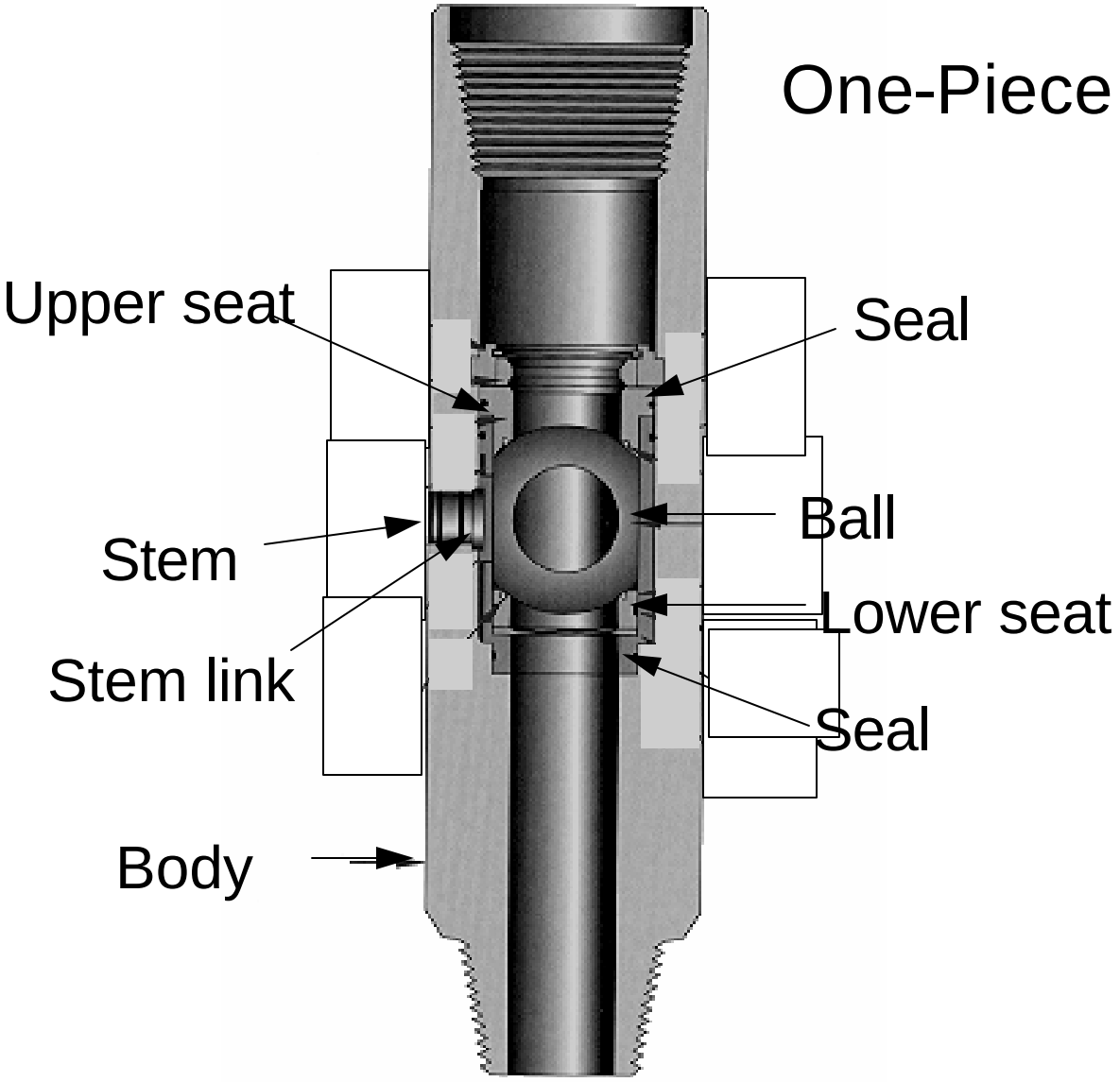
- Stabbing Valves often used to stop flow on drill-string during trips.
- Once flow is stopped, an inside BOP can be put in place prior to stripping pipe back to bottom.
- Dynamic kill of UGB works best with drill-string on bottom.

Terminology

Drillstring safety valves are ball valves used to stop flow through the drillstring.

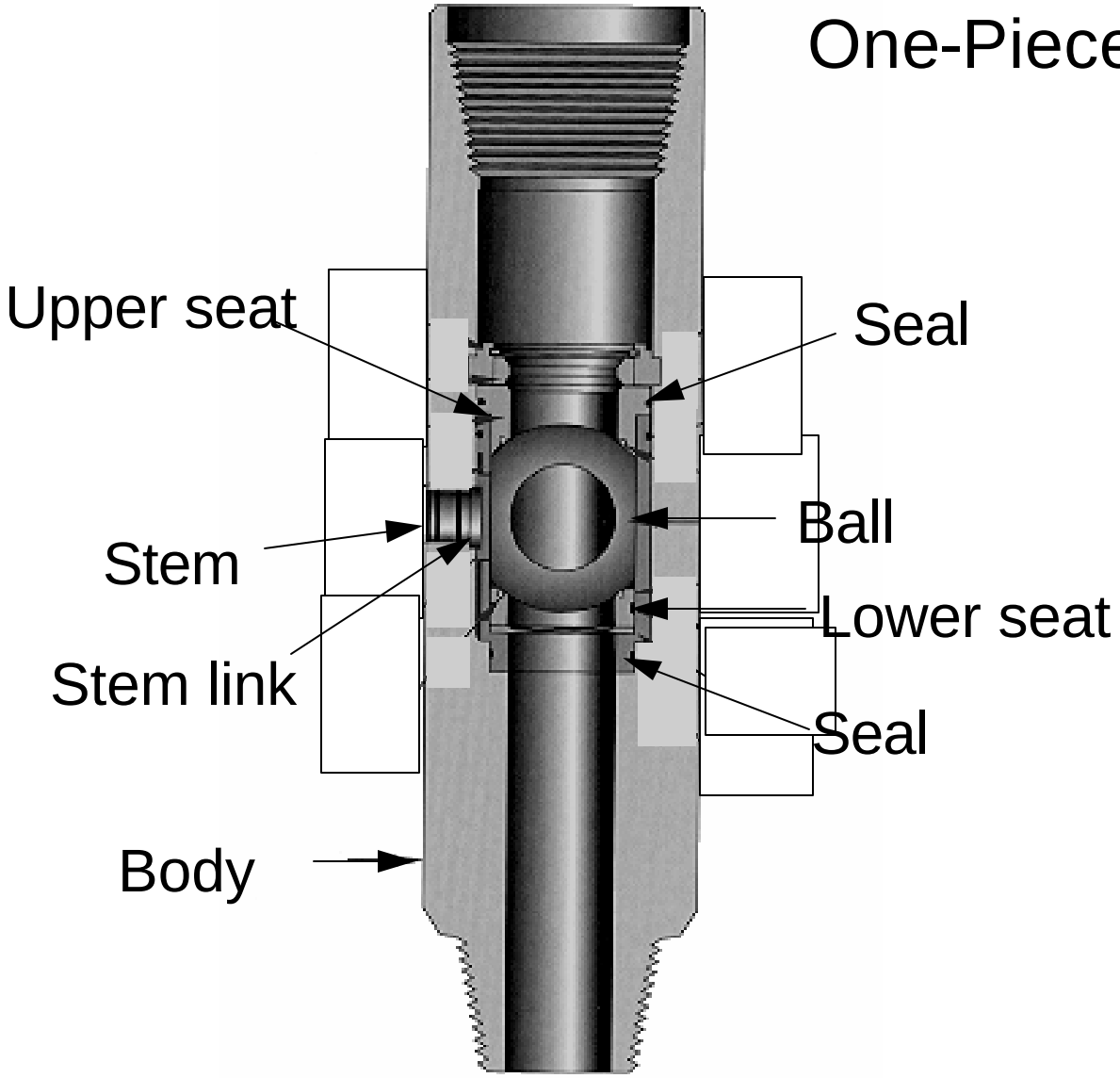
Traditional 2-Piece "TIW" Valve

Terminology



Terminology

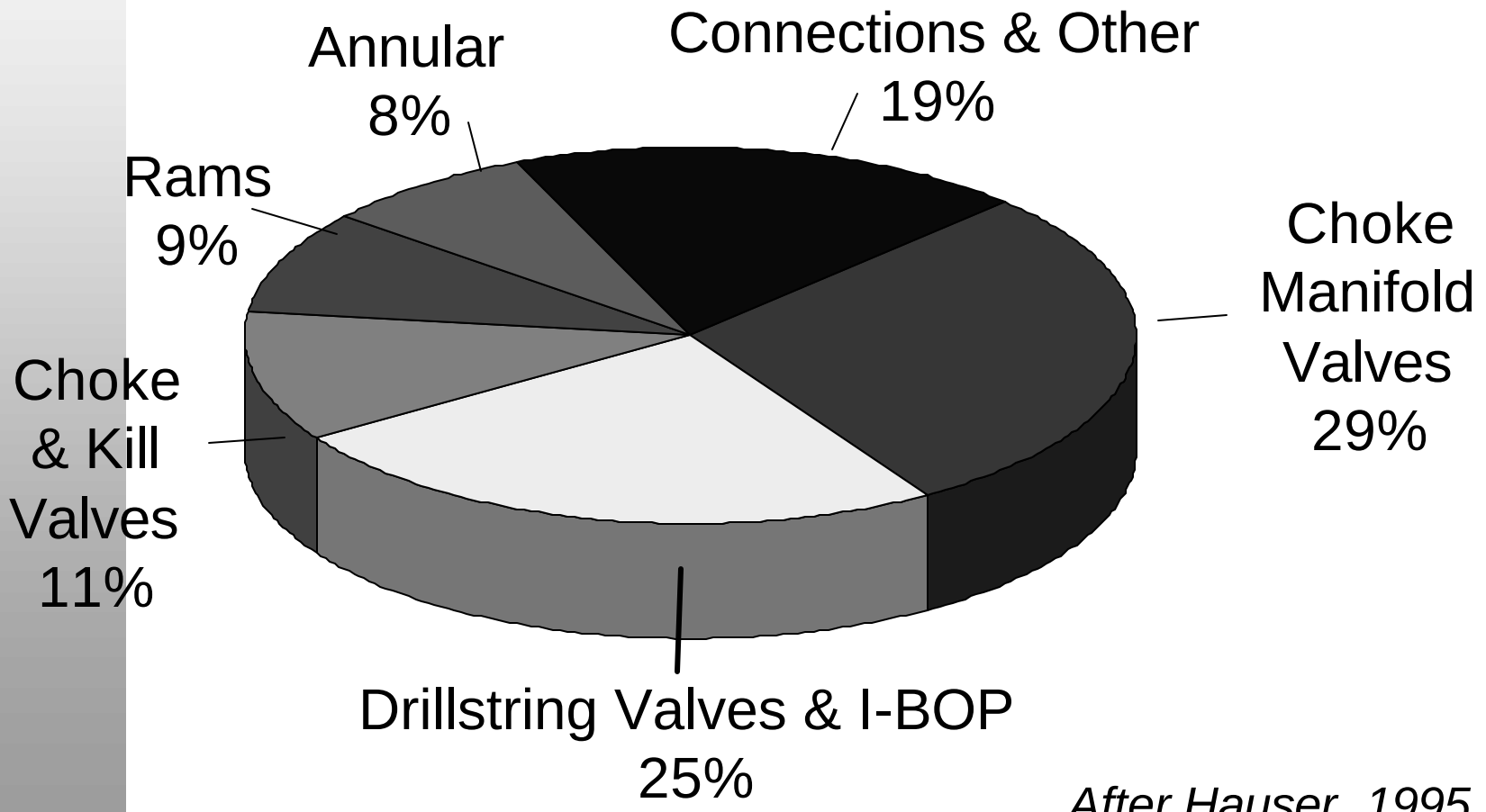
One-Piece Canister Design



Canister Design Cut-Away

Problem Areas

High Failure Rate for Pressure Tests



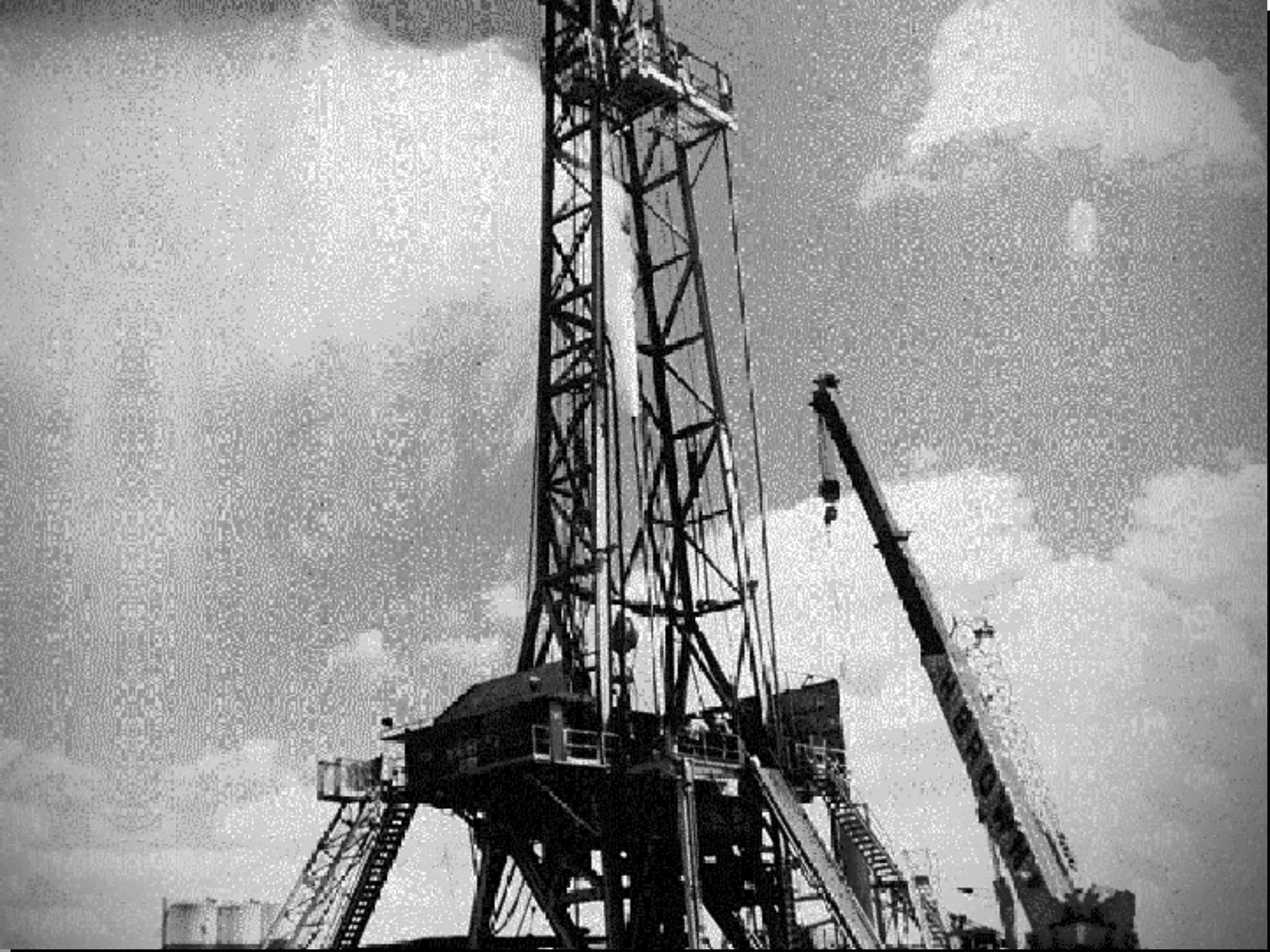
After Hauser, 1995

Problems Seen in Practice

- Failure to Close
- Failure to Open
- Failure to Seal
  - Bottom to top.
  - Top to bottom.
  - Inside to Outside.

•*Mobil Oil Survey of operators identified 29 failures during well control.*

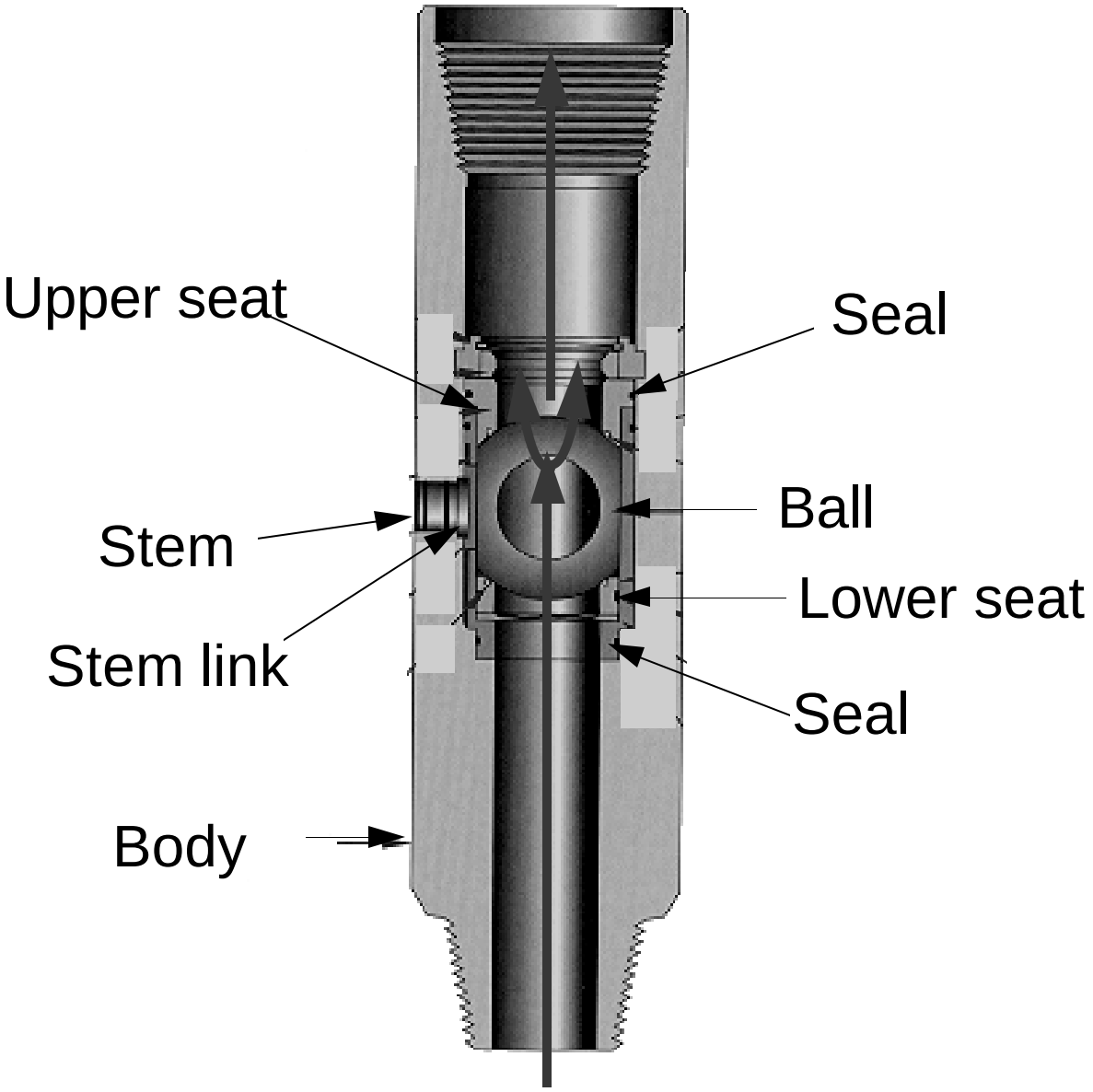
•*Problems have led to blowouts and loss of life.*



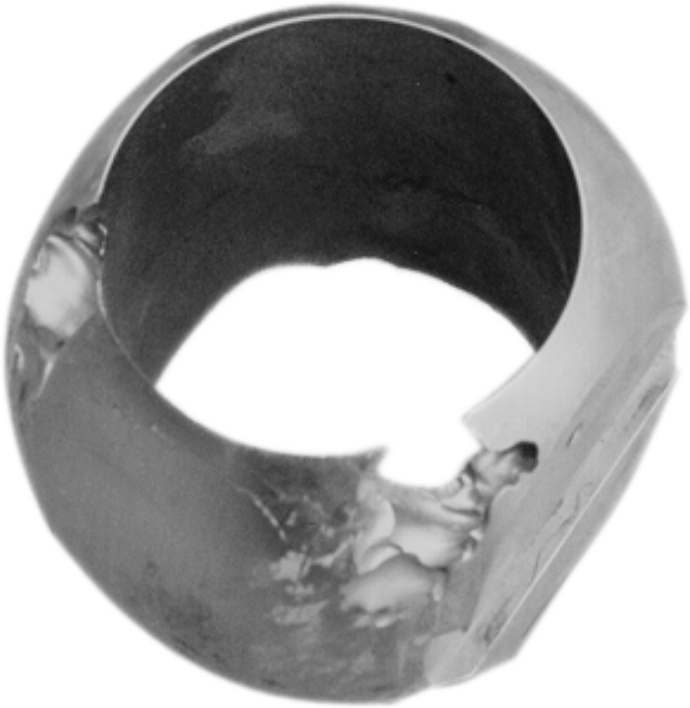
Project Objectives

- Identify Common Modes of Failure.
- Identify Alternative/Auxillary Devices.
- Investigate Improved Design.
- Construct Test Apparatus.
- Evaluate Improved Design.
- Develop Recommendations for Improved Safety.

Valve Failures



Flow-Cut Ball & Seat

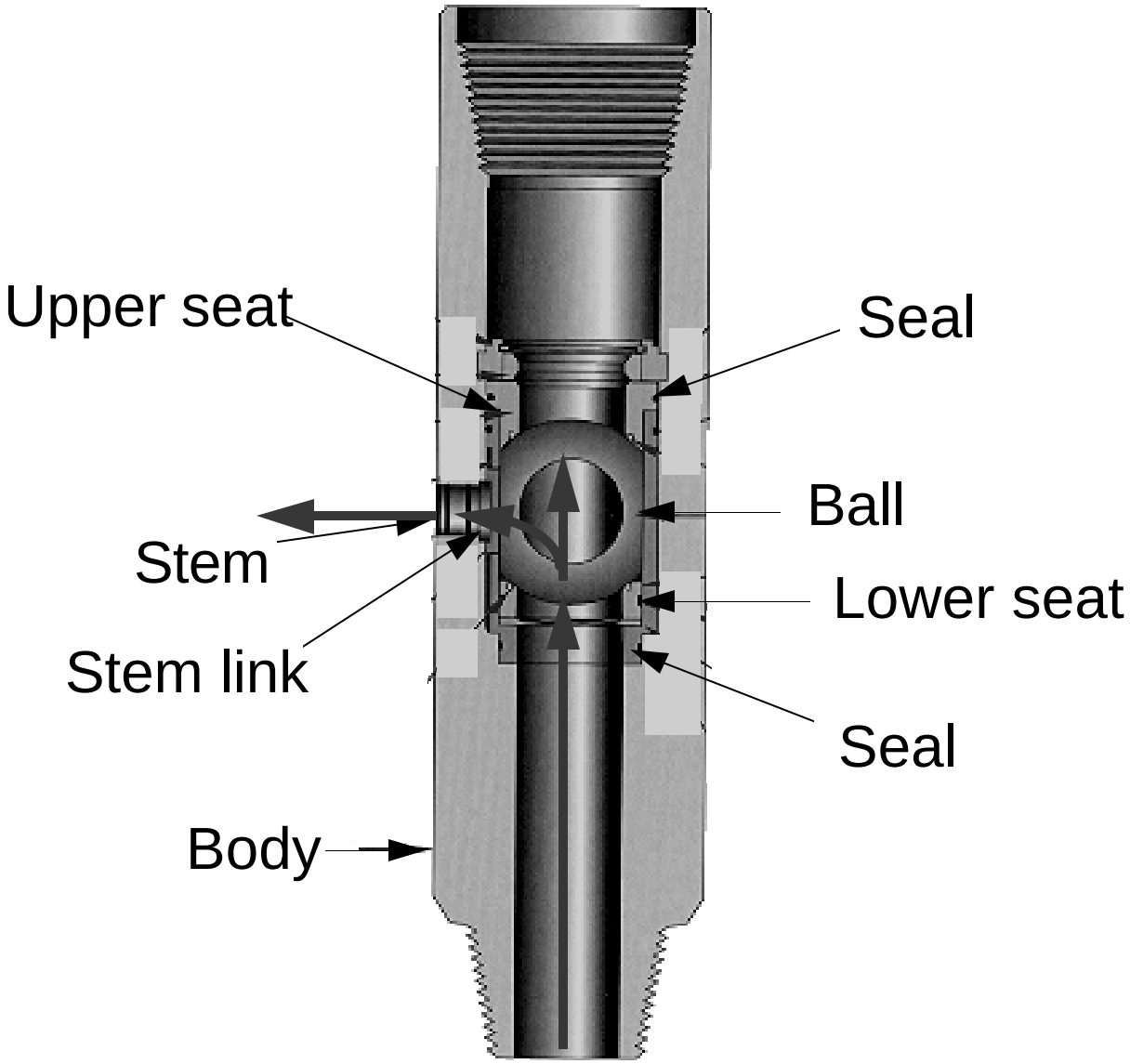


Caused by Human Error (Partially Closed Valve)

Wireline-Cut Ball

Over-Rotation of Ball

Valve Failures

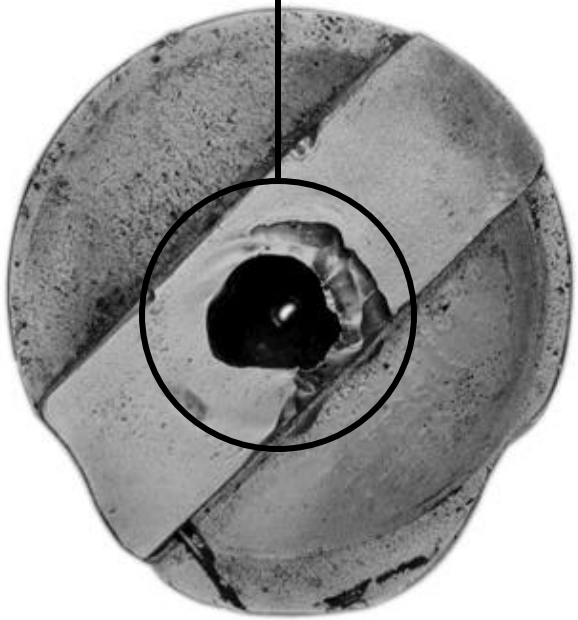


Valve Stem Failure

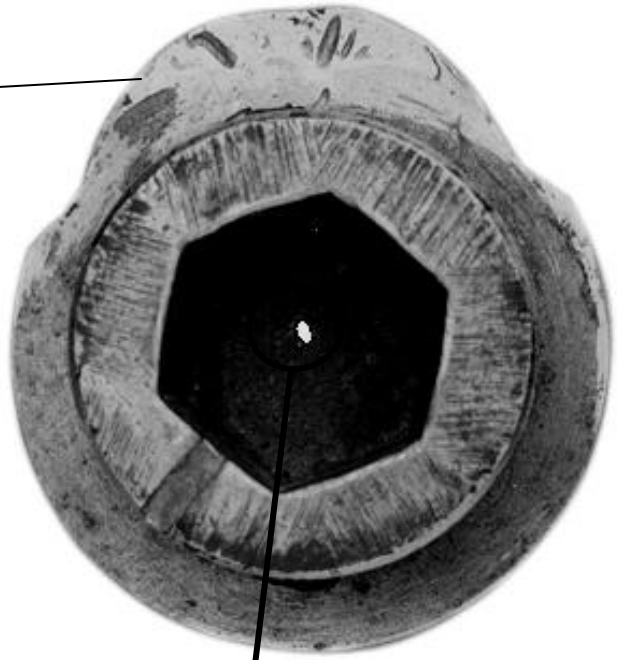
Side View

Valve Stem Stop

Eroded Hole



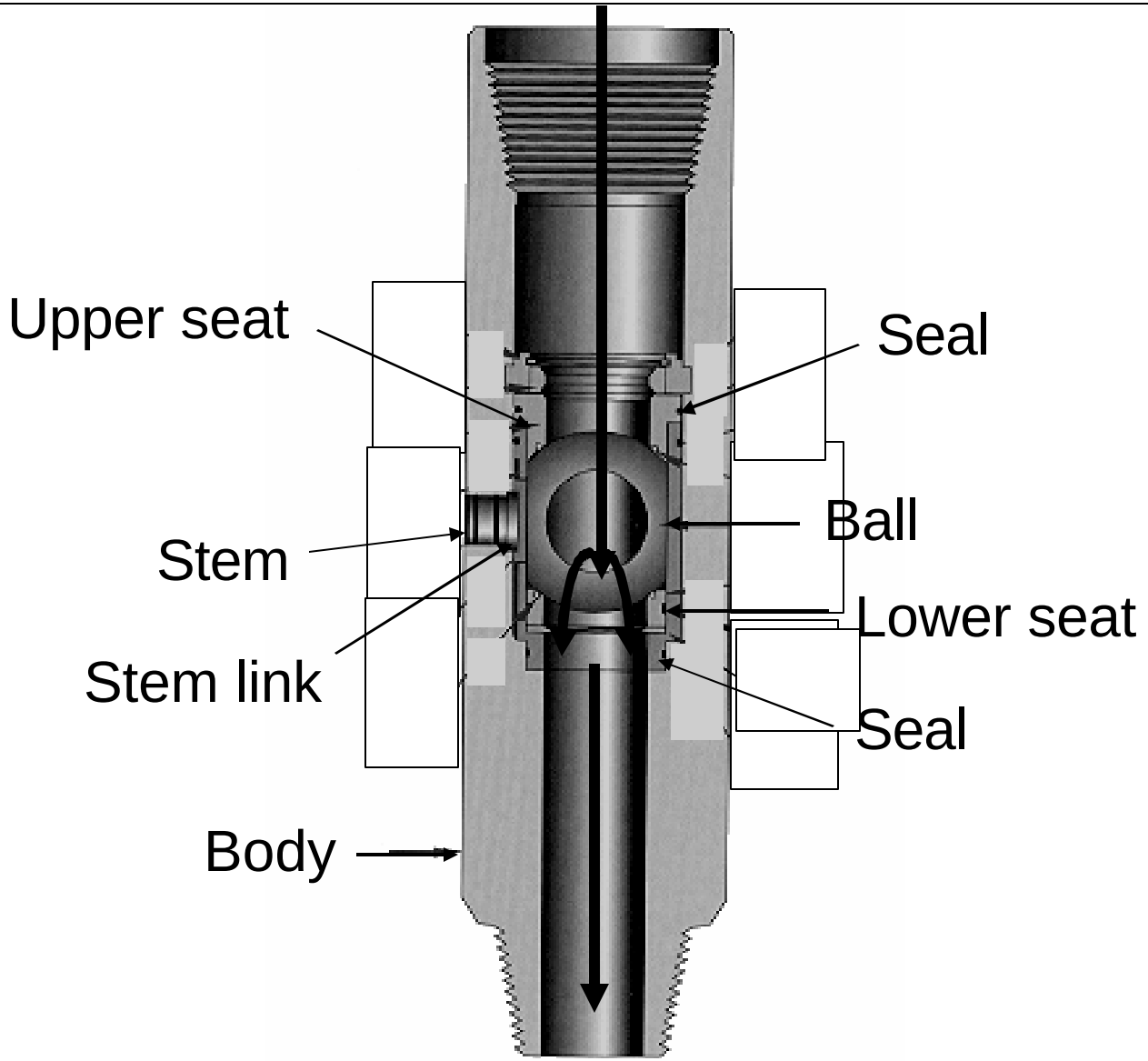
Interior View



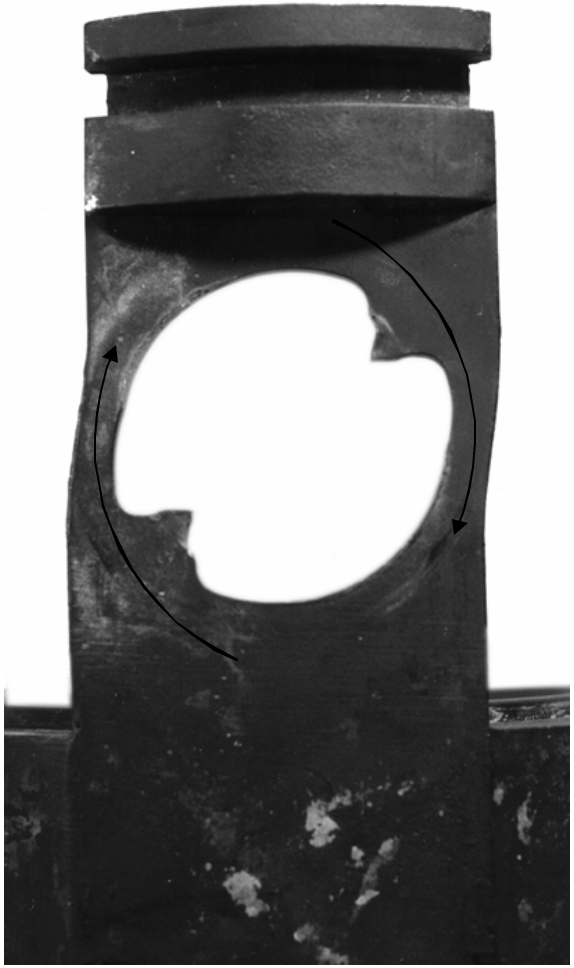
Eroded Hole

Exterior View

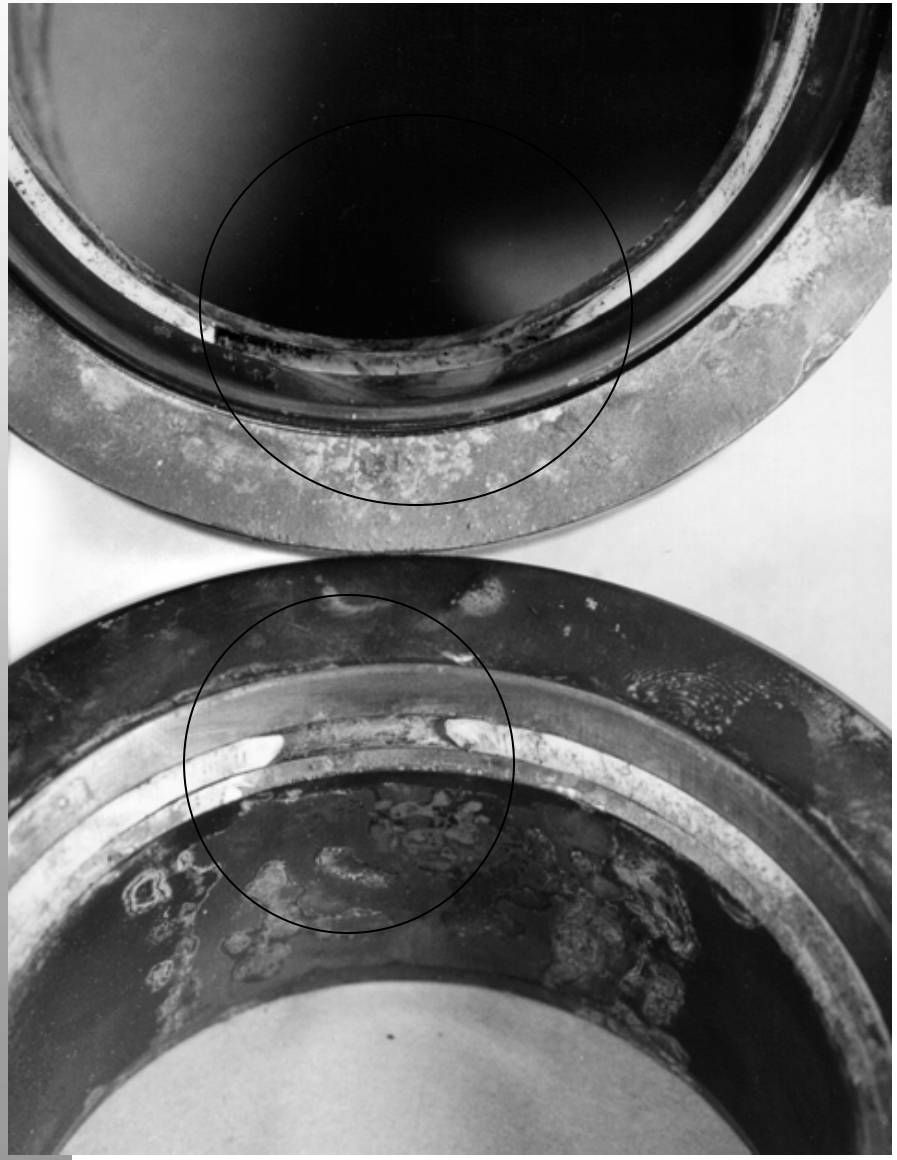
Valve Failures



canister cage



Valve Seat Failure



Auxillary Equipment

- Pit Volume Totalizer System
- Drill Collar Float
- Drop-In Check Valve
- Velocity Valve
- Double Valve Assembly
- Low Torque Valves
- Choke Manifolds
- Shear Rams

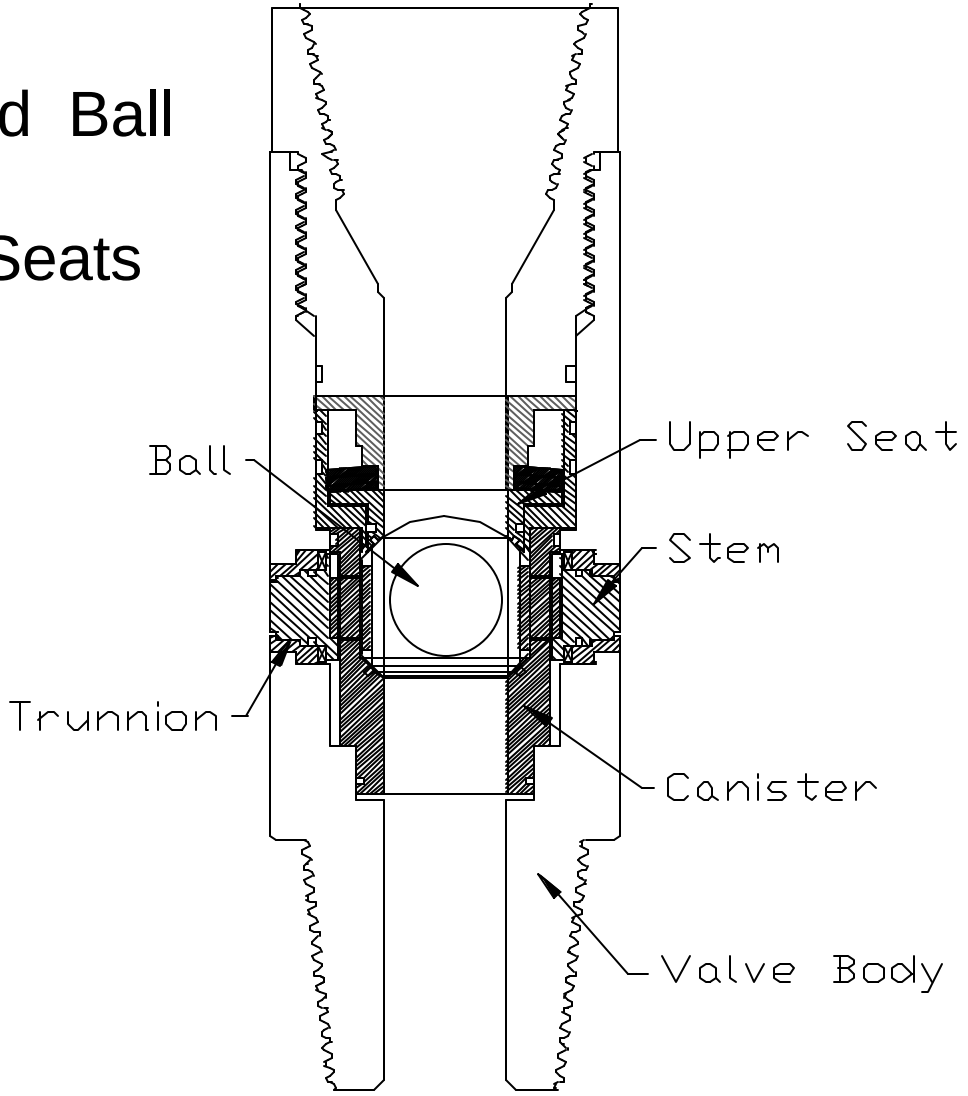
Student Design Projects

- New DSSV Design with Improved Torque Characteristics at high pressures.
- New DSSV Storage Stand.

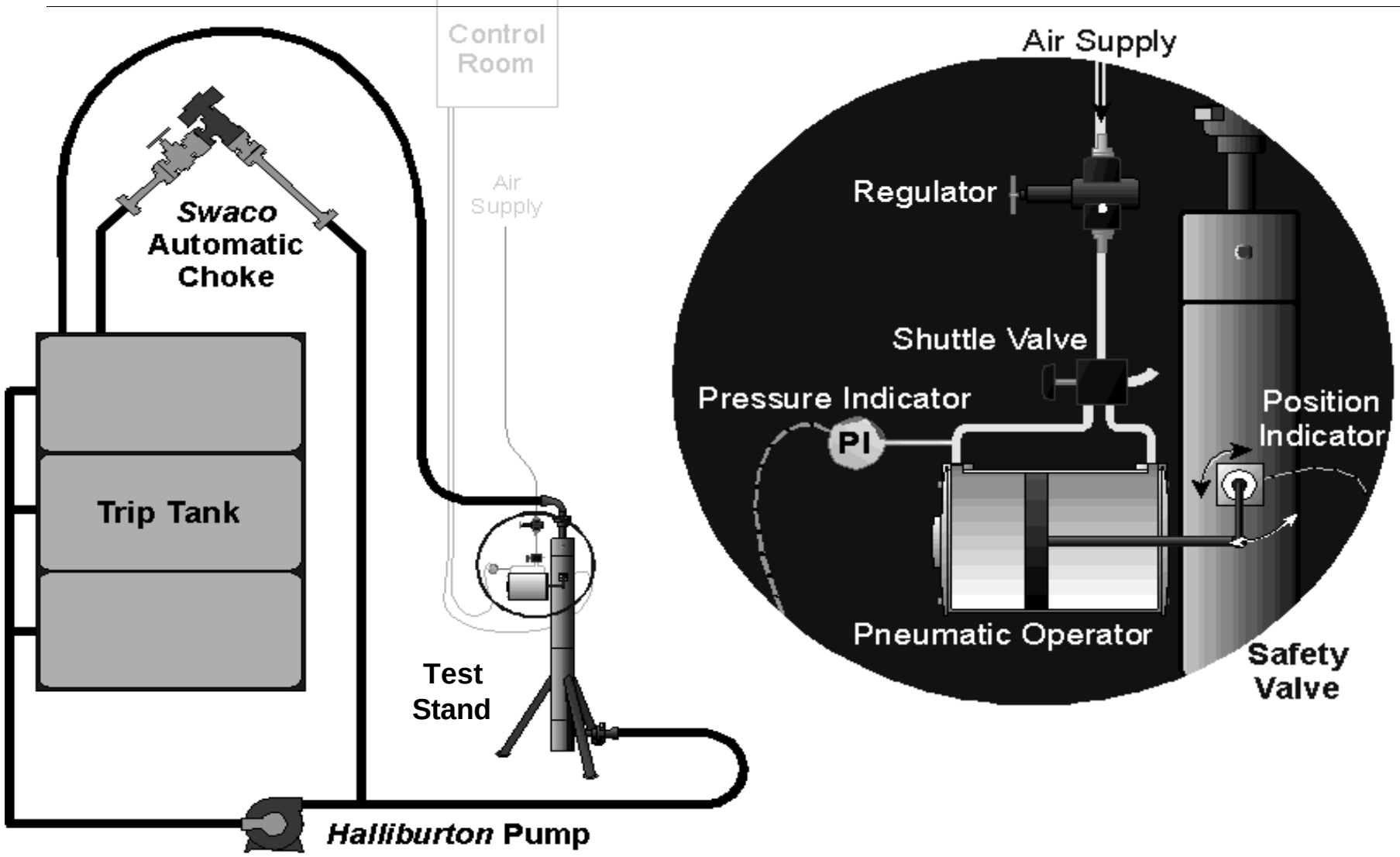
LSU DSSV Design

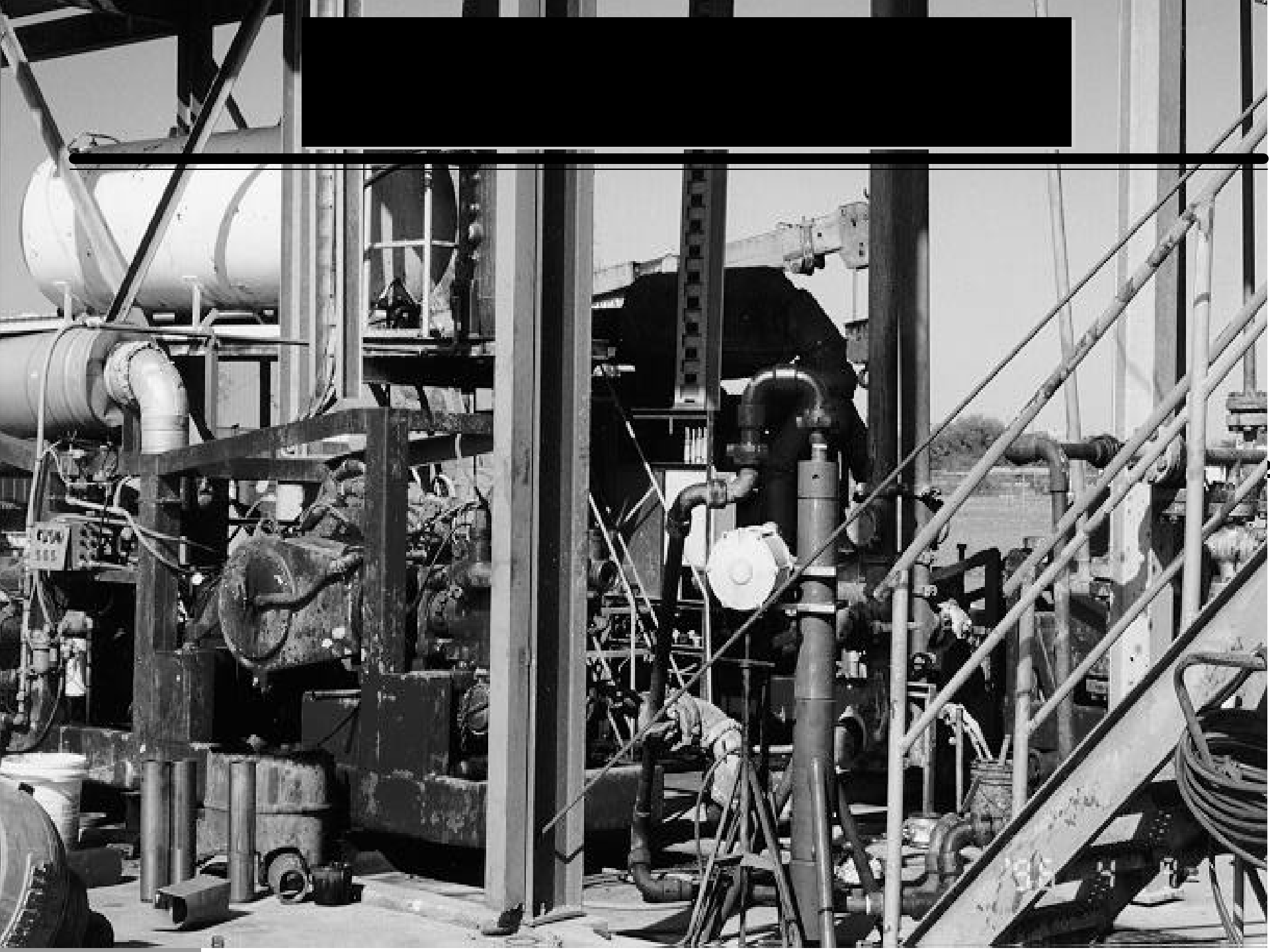
Trunnion Mounted Ball

Spring Loaded Seats



Test Apparatus Design



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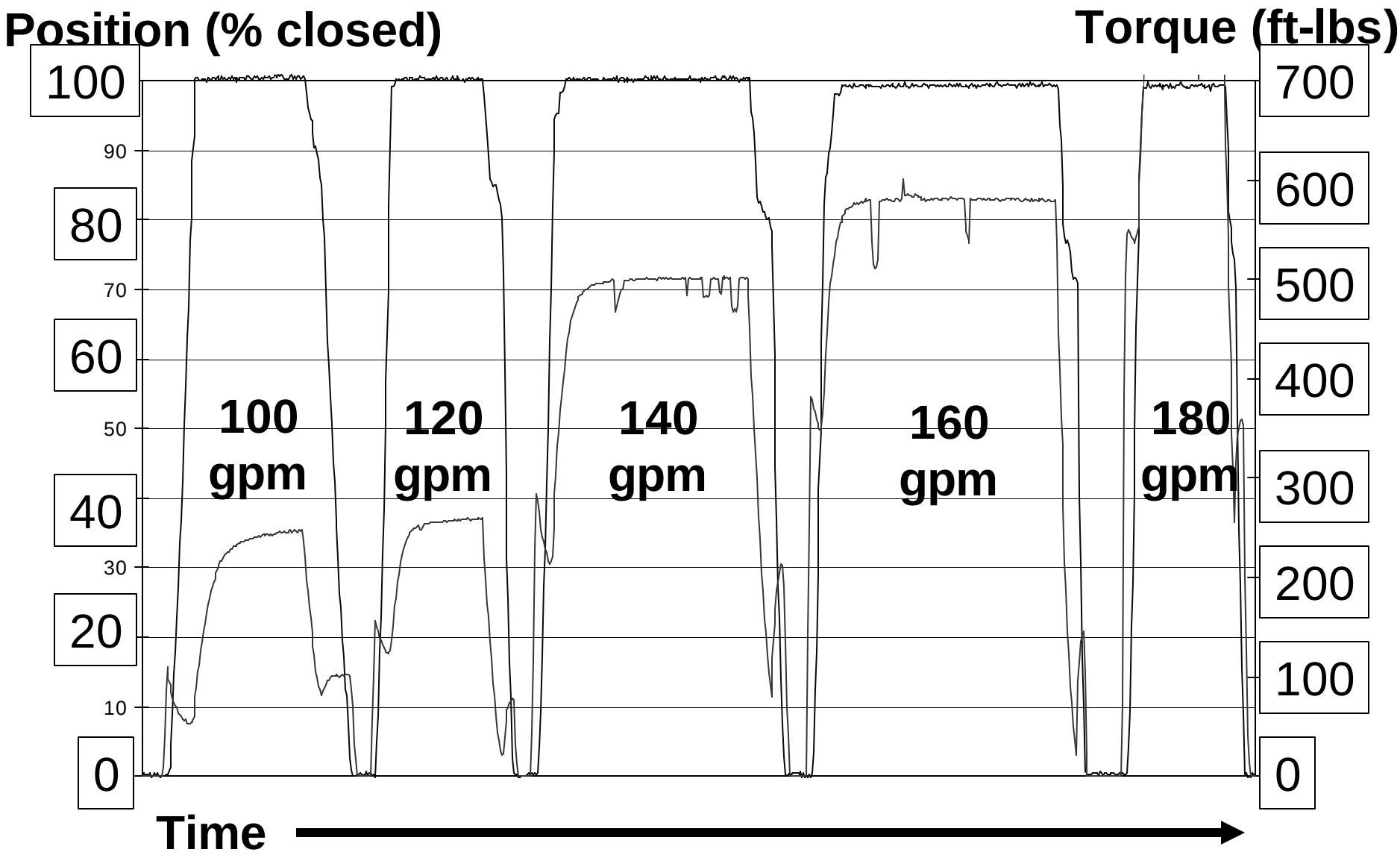
Torque & Position vs Time

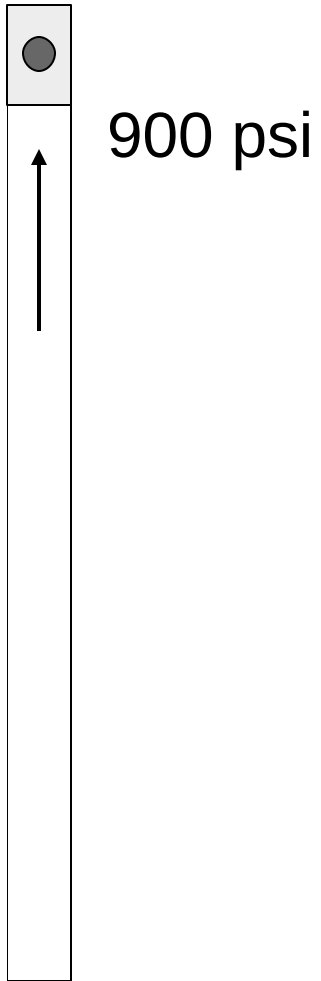


Closing Torque

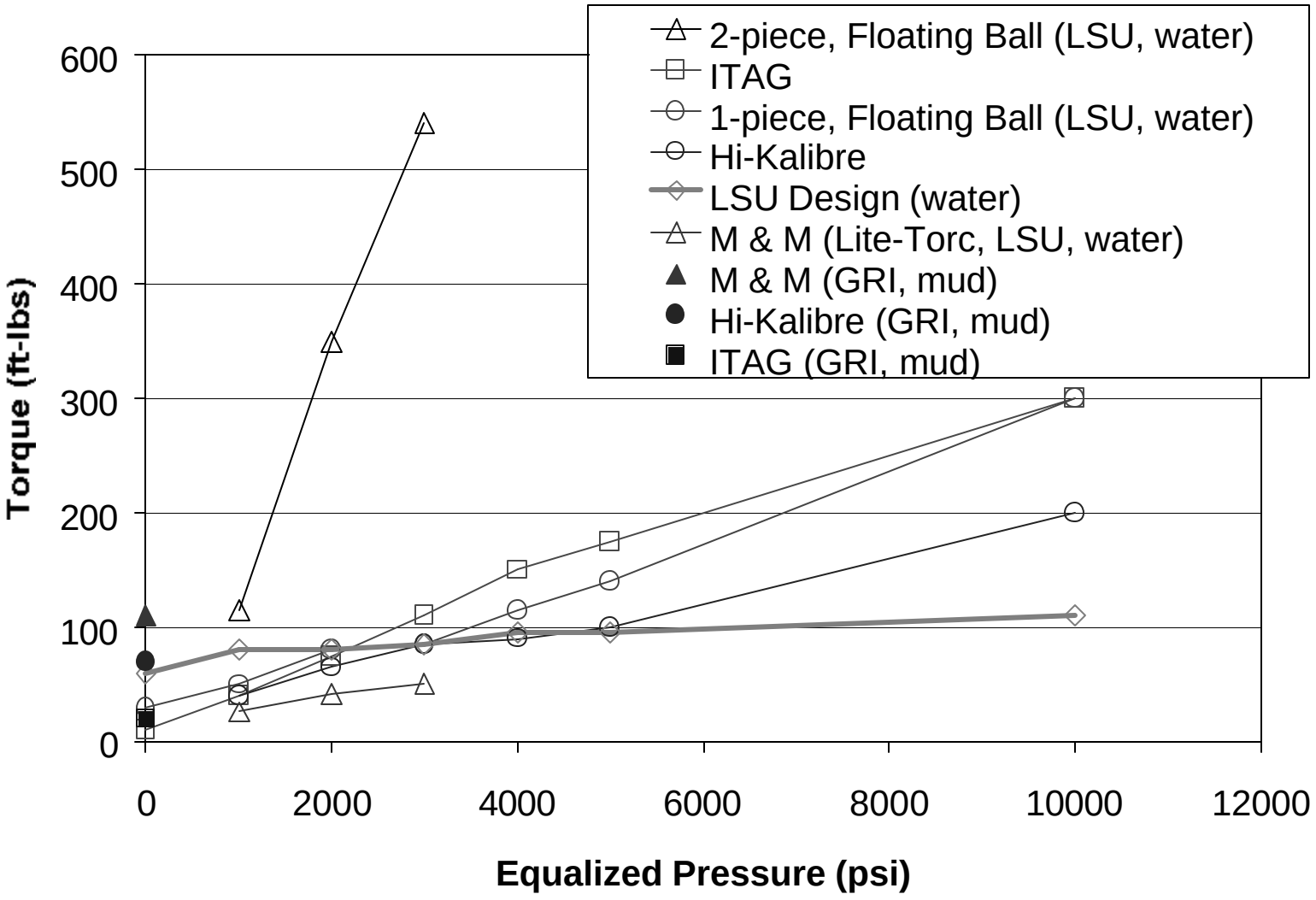
With 2,000 psi Shut-In Pressure

Flow Rate (gpm)	2-Piece DSSV	1-Piece DSSV	
	1s close	1s close	4s close
100	100	110	350
120	240	150	370
140	280	250	385
160	370	390	----
180	550	545	----

Water Hammer ?

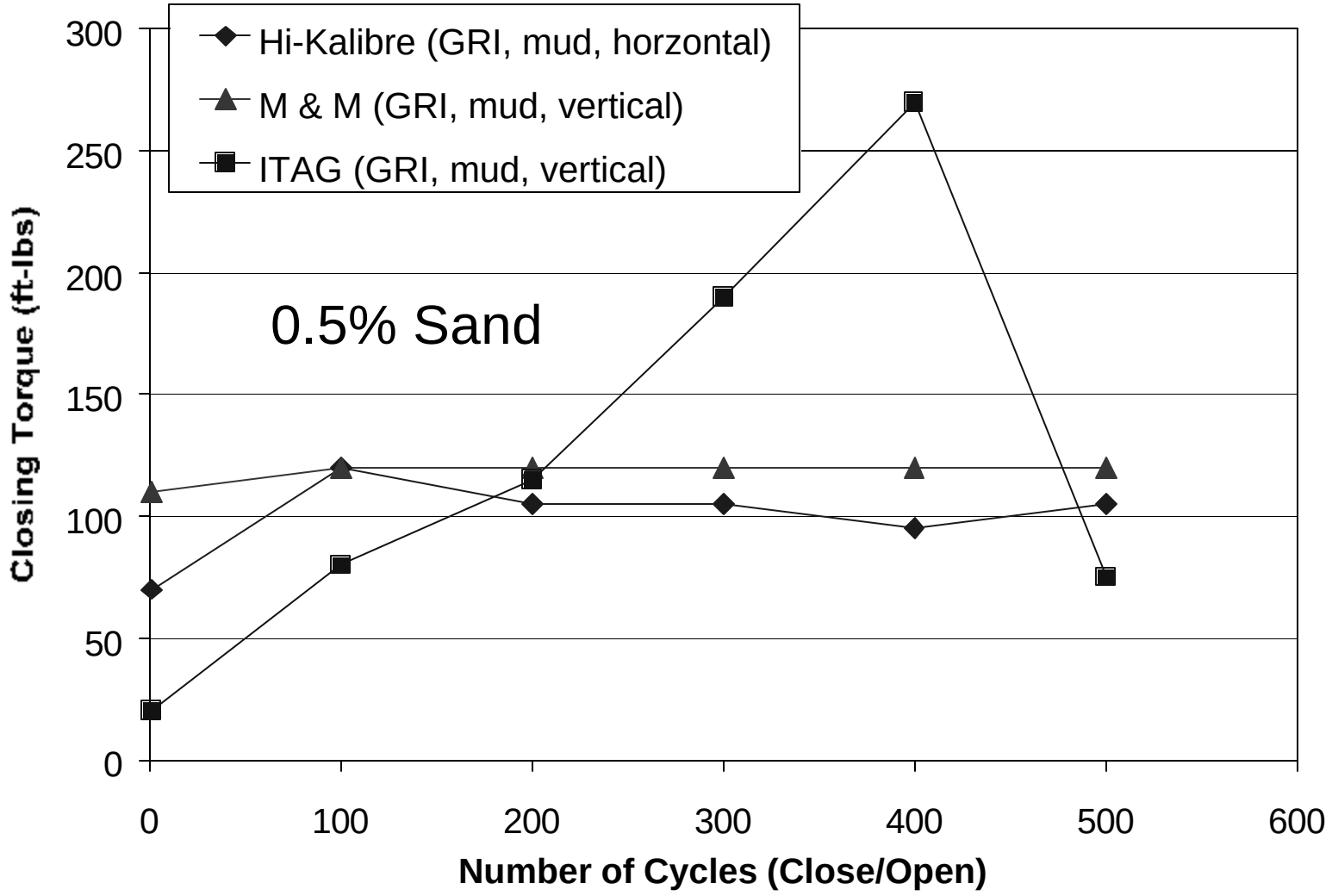


Closing Torque, 2.75-in. ID

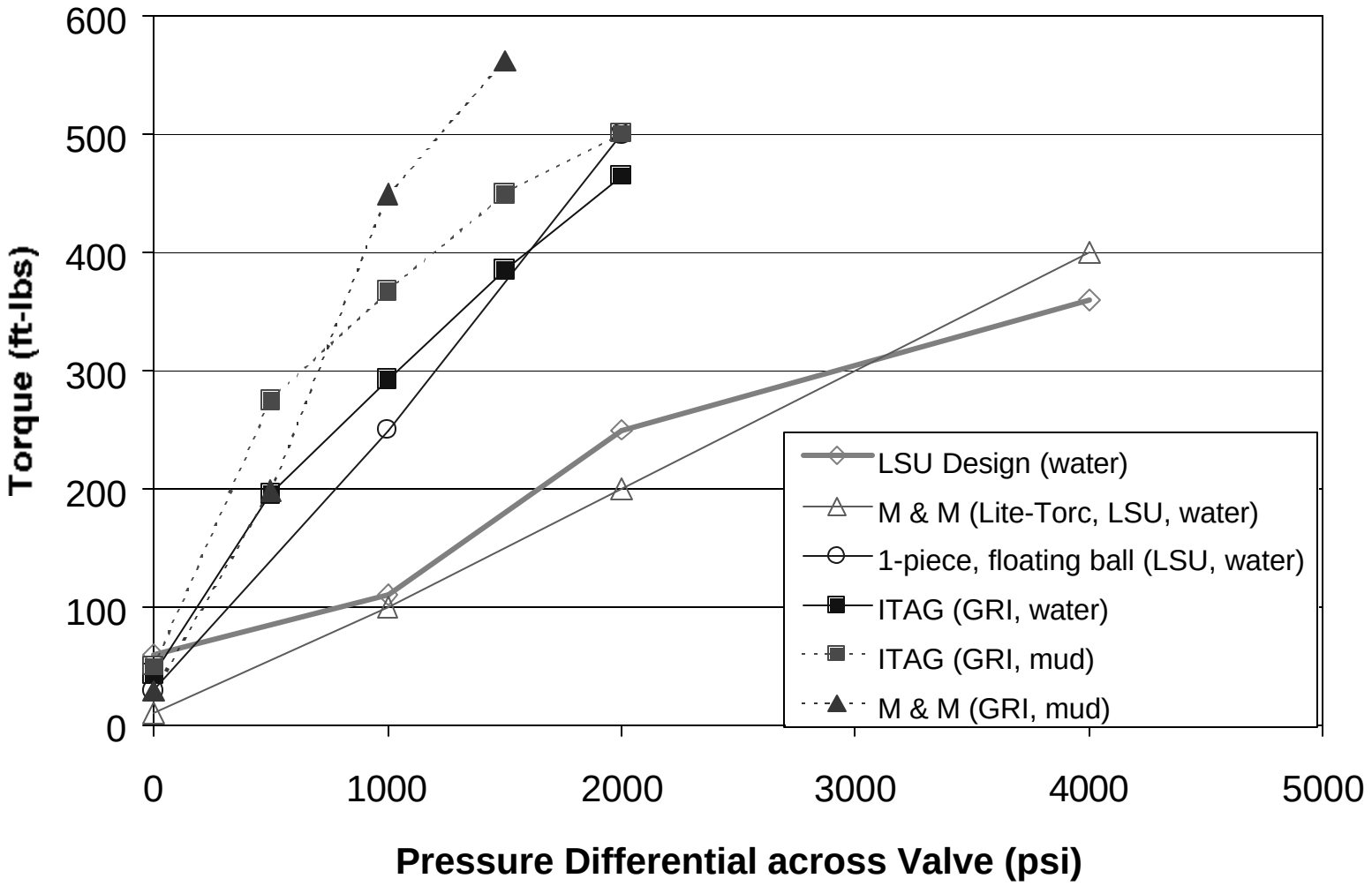


Effect of Valve cycling in 16 ppg mud

After Tarr -SPE39320



Opening Torque (0% Equalized)



General Observations

- Operating torque requirements for valve can vary greatly with valve use and weathering.
- Valve storage and maintenance is an important aspect of maintaining low torque valve operation.


DSSV
PHASE IV


DSSV
PHASE IV
Double Click Here
to start Movie

Conclusions

- DSSV Failures are Significant.
- Common Modes of Failure Identified.
- Problems poorly understood in field.
- Improved design is possible.
- Valve maintenance is important.

Recommendations

- 1. The DSSV intended for use as a stabbing valve to stop flow through the drillstring during tripping operations should not be used in the drillstring for other operations. The stabbing valve should be maintained in a "like-new" condition and used only during periodic pressure testing with fresh water.
- 2. Operators and/or drilling contractors should check threads, valve wrench, and lift sub on the stabbing valve and actuate the stabbing valve close and open each tour.
- 3. Operators and/or drilling contractors should use a drillstring float whenever practical to provide redundant protection against a high-rate flow through the drill-string during tripping operations.
- 4. When floats are not used, shear rams are recommended for redundant protection against blowouts through the drillstring during tripping operations.
- 5. Drill String Safety Valves should not be the only means for stopping flow from the drillstring at the surface when reverse circulating the well during completion operations. Flow should be routed through hydraulically operated valves and a choke manifold.
- 6. Drill string safety valves should not be the only means for stopping flow through the drill string when significant piping and flow restrictions are present above the valve.