

Design and Evaluation of a Multiphase Valve



Wyatt Andree, Molly Gutcher,
Elena Koukina, Johannes Santen,
Connor Stokes

Faculty Advisor: Jessica Townsend
Angel Advisors: Matthew Neal, Wego Wang
Sponsor Liaison: Jeremy Pitts

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Stickler, Keith McWhorter



Company Background

OsComp has developed a breakthrough multiphase compression technology that significantly reduces the operating and capital costs of wellhead production of natural gas. OsComp is drastically changing the existing technology, so any existing subcomponents are not optimized for OsComp's application.

Problem

Multiphase flow is a condition that exists in the OsComp technology, but is uncommon in other commercially available compressors. Currently available valves are not explicitly designed to meet the specifications required by OsComp for lifetime and optimal compressor efficiency.

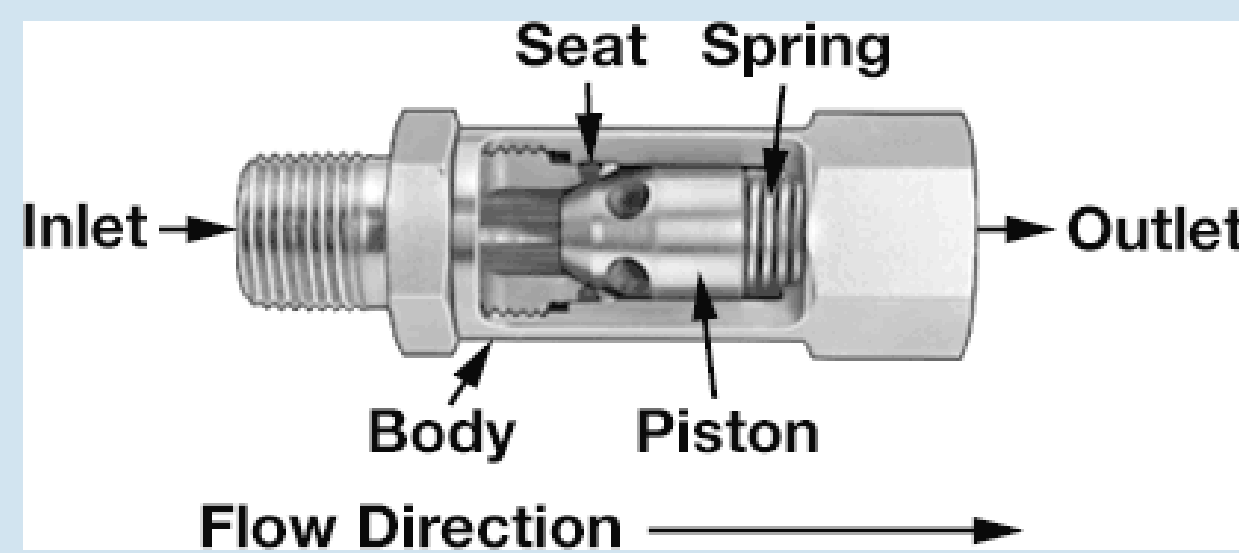
Project Goal

Identify or develop a valve that meets OsComp goals for compressor operating conditions, including the ability to handle multiphase flow.

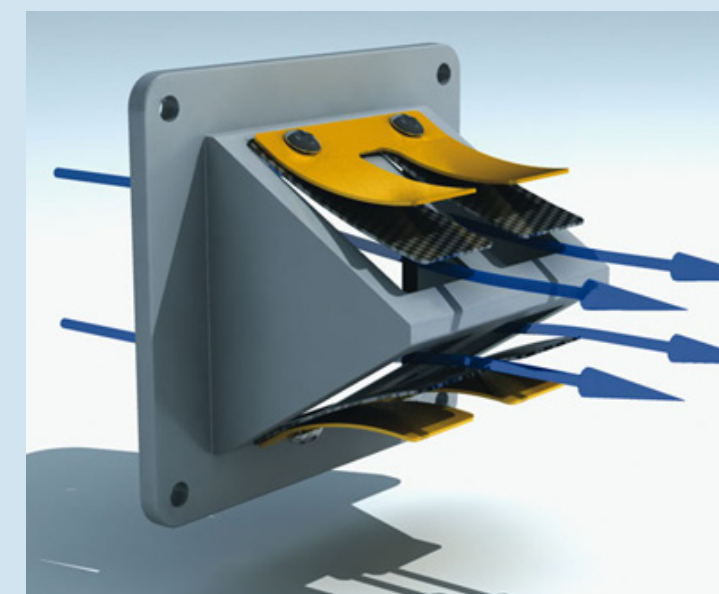
Phase 1: Preliminary Research

Studied available valves and failure modes:

- Spring loaded check valves, reed valves
- Fail due to liquid slug impact with small, fragile moving



A spring loaded check valve; used in a number of common household objects and are therefore designed to be simple and inexpensive.



An example of a reed valve; a type of check valve commonly used in motorcycle engines.

Determined metrics of success:

- Handle multiphase flow - the priority
- High back pressure
- Sufficient exhaust area
- Rapid opening and closing times

Phase 2: Valve and Tester Design

Valve Prototype:

- Prevents failure associated with multiphase flow by deflecting liquid slugs into a heavy, stationary component of the valve, reducing their kinetic energy before they impact the lightweight, moving components (such as the reed on the reed valve to the left)
- Evaluated via efficiency simulations, physics calculations, and other qualitative and quantitative metric evaluations
- One design selected and refined from original pool of approximately five ideas

Testing Apparatus:

- Force multiphase flow through valve prototype at high speeds
- Establish conditions under which prototype will fully open and close

Phase 3: Testing and Analysis

- Up to two valves undergo simultaneous accelerated lifetime testing
- Accelerometer data characterizes operation

