



## The Challenge

Coiled steel springs are used as emergency fail-safe systems to close a valve in power-loss conditions. However, they have several issues:

- Large and heavy: Up to 910 mm and 120 kg, making installation difficult
- Coils are more vulnerable to fatigue and corrosion due to large surface area exposure

## Mission Statement

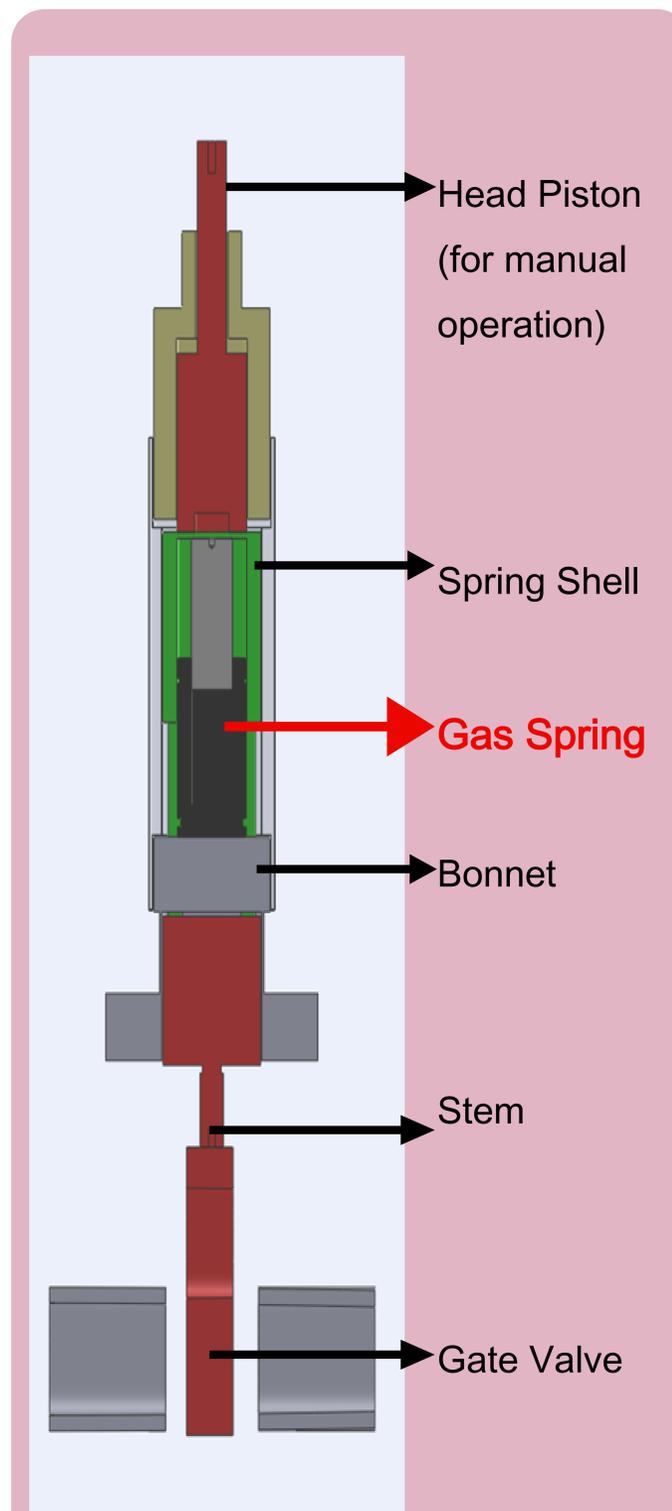
Our task was to create a smaller and lighter valve fail-safe mechanism than the current coiled steel spring system while maintaining simplicity and reliability.

## Design Criteria

Based on the current valve operation standards and applications environment.

<b>Force Generated</b>	Min: 3.9 kN Max: 170 kN
<b>System Weight</b>	Max: 120 kg
<b>Height</b>	Max: 910 mm
<b>Stroke Length</b>	Min: 25 mm Max: 230 mm
<b>Operation Temperature</b>	Min: -10 °C Max: 65 °C
<b>Fail-safe Operation Time</b>	Small valves: 5 sec Large valves: 30 sec

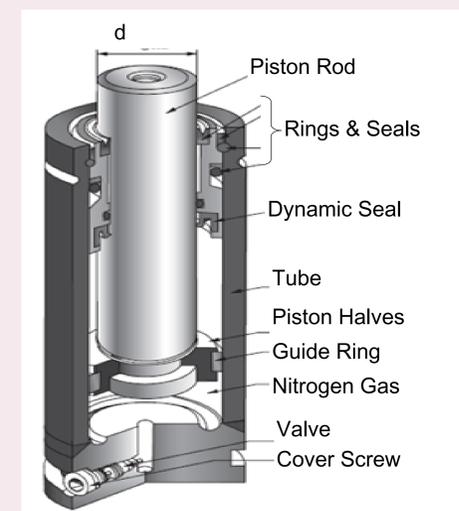
## Valve Actuator Assembly with Gas Spring



Picture 1: New Design

### Kaller Gas spring features:

Weight: 2.66 kg  
Size: 245 x 7.5  
Stroke length: 100 mm



Picture 2: Gas Spring

Our solution is to replace the coil spring (shown in Picture 3) with the equally powerful and reliable nitrogen gas spring (shown in Picture 2).



Picture 3: Current Design

## Results

### Similarities in Operation

The force-displacement curves of steel and gas springs show that gas springs can be a successful replacement.



## Conclusion

All the targeted design criteria are achieved. Main achievements are:

	Steel	Gas	Reduction
Weight (kg)	89	70	25%
Size (cm <sup>3</sup> )	7489	4485	40%

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- Cameron: Daniel Baxter, Fred Davila

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## References

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