

Black Hawk Seals

Seal Test Bench

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Customer Background

Black Hawk Seals (BHS) is an innovative supplier of high-quality, economically This bench is competitor seal companies, facilitating knowledge of seal design designed to gather data on head seals and backup seals to compare BHS products to other /performance. Depending on the material composition and seal type, seal performance changes. For this project, BHS provided seven seal types with various material compositions, and established Black Hawk Seal test parameters to evaluate them.

Problem Statement / Scope of Work

Black Hawk Seals is in need of data on static seal performance and a system that will evaluate seals at various parameters to test and collect that data. This will allow BHS to alter seals' design and material composition to develop superior products.

Implement a system to evaluate baseline performance of various static seals under captured data from tests the following parameters: Temperature, Pressure, Number of Cycles. Analyze ; Compare measured seal extrusion and deformation, and provide feedback of findings to BHS

Requirements Matrix

Req. #	DESIGN REQUIREMENTS	DESIGN TARGETS	VALIDATION
1	RATIONALE Collect data from the test at 3000 psi	Evaluate the performance during and after then test	Static Inrupte-Testing
2	Testing Procedure provided by Company Client Collect data at 3000 psi	Evaluate the performance during and after then test	Static Inrupte-Testing
3	Testing Procedure provided by Company Client Ambient temperature of 210F ± 5F	Evaluate the performance during and after then test at this range of temperature and at 3000 psi	Static Inrupte-Testing
4	Testing Procedure provided by Company Client Ambient temperature of 230F ± 5F	Evaluate the performance during and after then test at this range of temperature and at 3000 psi	Static Inrupte-Testing
5	Testing Procedure provided by Company Client At cycle time (2s on and 2s off)	Duration of the impulse of the hydraulic fluid	Using PLC through LabVIEW
6	Testing Procedure provided by Company Client 10,000 cycle minimum per head seal and backup seal	Duration of entire tests to be done on the head seal/backup seal	Program into PLC through LabVIEW
7	Testing Procedure provided by Company Client Oil type	Document the hydraulic fluid that was used	N/A
8	Measurements before testing	Get measurements on seals, including identification, supplier, cross section, height, and weight	Use of various measurement equipment
9	Measurements after testing	Get measurements, including the identification, cross section, height, and weight	Use of various measurement equipment
10	Testing Procedure provided by Company Client Documentation	Photograph the tested seals, then slice a small cross section. Measure the non-contact extrusion. Complete a test report for all the machinery for all 8 suppliers.	Capture measurements taken and record the data to treat a conclusion.

Experimentation / Concepts Exploration



O-ring Test Fixture
Houses the O-rings in a steel consisting of two O seals are installed end caps and one main body. and cap.

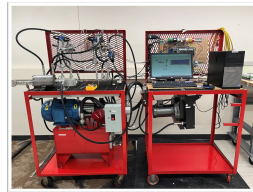


LabVIEW
Graphical environment used to visually program. LabVIEW takes in the necessary sensor data while simultaneously controlling the pump, as well as the DCV cycling.



Heating Band
Heating bands are placed on either side of each fixture and powered by a 240V outlet. The whole fixture will reach 250°F in about 30 minutes.

Final Design



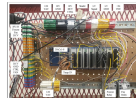
Test Bench Layout



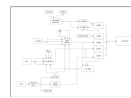
LabVIEW Front Panel



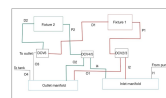
Block Diagram



PLC wiring



Electrical Wiring



Hose Layout

Failure Mode and Effect Analysis

Item	Requirements	Potential Failure Mode	Potential Effects of Failure	Severity	Cause/Action	Potential Cause(s) of Failure	Occurrence
Seal Bench Provides pressurized fluid requires for our static seal testing	Pressure Fluid Control pressurized fluid from pump to testing housing	Pump and motor coupling fails from pressure	No ability to pressurize fluid No ability to transfer/pressurize fluid	8	Coupling metal not able to withstand shear stress	No weak of coupling material Press not made to stated specifications	3
		Pressure gauges stop working	No ability to measure pressure	9	Gauges loose from housing	Press not made to stated specifications	1
Seal threads of fittings with threads of housing	Fluid Leaks	Pressure drops	filling leaks	4	to much thread lip or to little or broken part O-ring		5
monitor system	broken control valve	inability to use one or both test fixtures	loss of DCV	3	friction, improper installation, over pressure		2
monitor system	broken pressure transducer	inability to collect data from that point	loss of pressure transducer	3	over pressure, old warranty		2
make sure intercooler is set up and venting	burnt oil	hazardous fumes	bad fluid	9	too much friction causing heat to build up intercooler not hooked up		2

Testing



Backup Seal after 10,000-cycle test under microscope

