College of Engineering
Department of Mechanical & Industrial Engineering

College of Engineering
School of Electrical Engineering & Computer Science

To Predict ▶ To Design ▶ To Perform

ME, ECE Capstone Design Programs

Team #48 Mechanical Pig for Pipeline Cleaning

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Background & Objective

A pig is a device used in the oil and gas industry to remove debris from pipelines. Team 48 created and tested* a mechanical cleaning pig to avoid getting stuck due to paraffin wax build-up in pipelines.

*team designed and built test loop

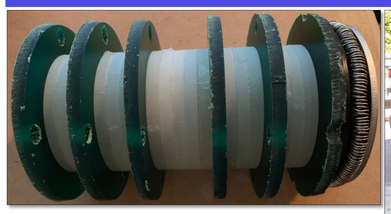
Engineering Specifications

Pipe/Pig Diameter 4"	Pig/Pipe Tolerances ± 1-5%
Pig Length 6-7"	Steps to launch/recover pig 3
Pig Weight 6-10 lbm	Paraffin Wax to Remove 80-100%
Paraffin to Overcome 1-6 lbm	Pig launch/recovery time 10-15 mins

Safety Considerations

- Avoid pipeline damage
- Avoid over pressuring pipeline
- Avoid overheating pipeline
- Wear safety goggles and close toed shoes

Design Overview

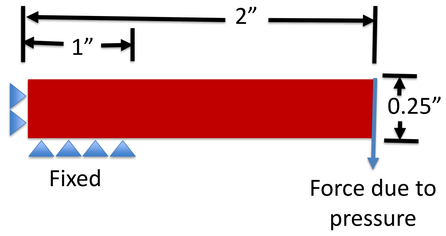


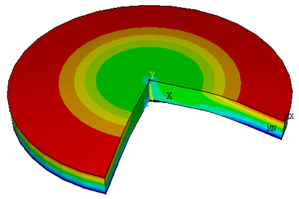
Prototype Pig

Test Loop

Engineering Analysis

A finite element analysis determined 0.404" of paraffin will stop the pig. 2-D axisymmetric elements were used.





Max deflection = 2.78”

Above: (left) free body diagram of pig face; (right) FEA results

Manufacturing

Test Loop	Pig
Purchase tank, pump, pipe, and joints	Waterjet: create polyurethane and polyethylene annular discs
Assemble test loop	Turning: create threads on steel pipe
CPVC cement sections	Weld end cap onto steel battery housing
Teflon tape threads	Assemble electrical circuit

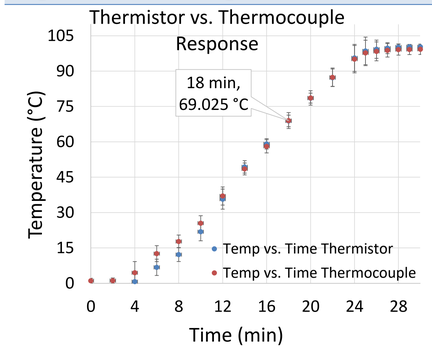
danos PRODUCING CONFIDENCE

Crimson Midstream, LLC

DRINKWATER PRODUCTS

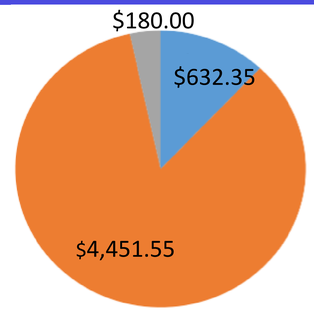
Testing Results

Pressure Test	PASSED
Pig Waterproof Test	PASSED
Paraffin Application Test	PASSED
Heating Element Calibration	PASSED
Accelerometer Response	PASSED
Pig Passes through Paraffin	PASSED



Above: (left) heating element calibration; (right) paraffin wax application

Spending



Total Spending: $5,263.90

September	October	November	December	January	February	March	April	May
Objectives & engineering specifications	Design concept selection & preliminary analysis	Detailed analysis & embodiment planning	Procurement	Prototype manufacturing & assembly	Testing & Verification	Final Report & Prototype Handoff		

Sponsors: Crimson Midstream, Danos, Drinkwater Products

Adviser: Dr. Ram Devireddy