HYDROGEN CONVERSION
DIESEL TRACTOR

Purpose
Convert Diesel Tractor to Operate on Hydrogen/Diesel Fuel Blend
Reduce Emissions
Reduce Dependence on Fossil Fuels

Background
Wind To Hydrogen Project and Major Funding Sponsored by Basin Electric Power Cooperative
Three Trucks Have Been Converted to Hydrogen Fuel
Hydrogen Produced by Electrolysis Powered by Wind Turbine

Collaborative Effort Of Conversion By
Mechanical Engineering
Agricultural And Biosystems Engineering
Electrical And Computer Engineering

Tractor Specs
Challenger MT525B
95 PTO
Caterpillar 3056E Engine
5.98 Liter In-Line 6 Cylinder

Hydrogen Facts
Clean Burning
3rd Most Abundant Element
High Energy Content/Unit Mass
Colorless, Odorless, And Tasteless
Low Density
Found in Nature
Hydrogen Plumbing Options

- Stainless Steel Tubing
- Flexible Plastic Tubing
- Hydrogen Will Not Permeate
- Withstands High Pressure

Hydrogen Control

- Manual Needle Valve for Testing
- Electronic Circuitry to Control Hydrogen Delivery System
  - Circuitry Will Control Valves and Monitor Pressures

Hydrogen Delivery System

- Compressed Natural Gas (CNG) Components
  - No Vehicle Standards For Hydrogen Components

Cylinder Pressure Locations

- Pressure Spikes When Hydrogen Combusts
- Pressure Monitored Using Transducers Mounted in the Engine Head
  - Used to Set Hydrogen Flow Limit
  - Water Jacket Type Transducers
Hydrogen Fuel Tank
- Aluminum, Fiberglass, Carbon Fiber
- Front Tractor Location
- Minimal Operator Sight Obstruction
- Short Hydrogen Delivery Line
- Filling Ease and No Tractor Modification

Tank Brackets
- Displacement and Stress Analysis Performed
- Can Hold Two 140 lb Tanks Securely

Hydrogen Safety Precautions
- Check Valves
- Pressure Switch
- Pressure Sensing
- Leak Tests
- Over-Pressure Shut-Off

Hydrogen Injection Methods
- Multi-Cylinder vs. Single Injection
  - Multi-Cylinder: Expensive, Engine Controller Obstacles
  - Single Injection: Simple, Less Expensive, Controlling Ease
- Injection into Air Intake Elbow

Displacement FEA
Stress FEA

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