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Overview of the

ISM-4080 *and* ISM-4081

Integrated Shutdown Module

Submersible *Shutdown*
with a *mechanical* leak detector

- *Simple*
- *Inexpensive*
- *Easily Tested*
- *No False Alarms*
- *Easy, Inexpensive Retrofits*

Part# ISM-4101
For 99 LD-2000

Part# ISM-4102
For 99 LD-3000

- A System That Utilizes the LD-2000 or LD-3000 Mechanical Line Leak Detector to Perform 3 GPH @ 10 PSI (catastrophic) Line Tests

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- Meet EPA Hourly Test Requirement by Performing Line Tests In-Between Dispensing Activity

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- Integrates Line Leak Alarms to Offsite Reporting

- Significantly Reduces Thermal Contraction Slow Flow

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How Mechanical Line Leak Detectors Function

- Mechanical line leak detectors (MLLD) are line pressure monitors
- MLLD checks for pressure drop in line when the pump is off

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- The ISM Switch detects falling line pressure and initiates a line test to look for line leaks or overcome thermal contraction

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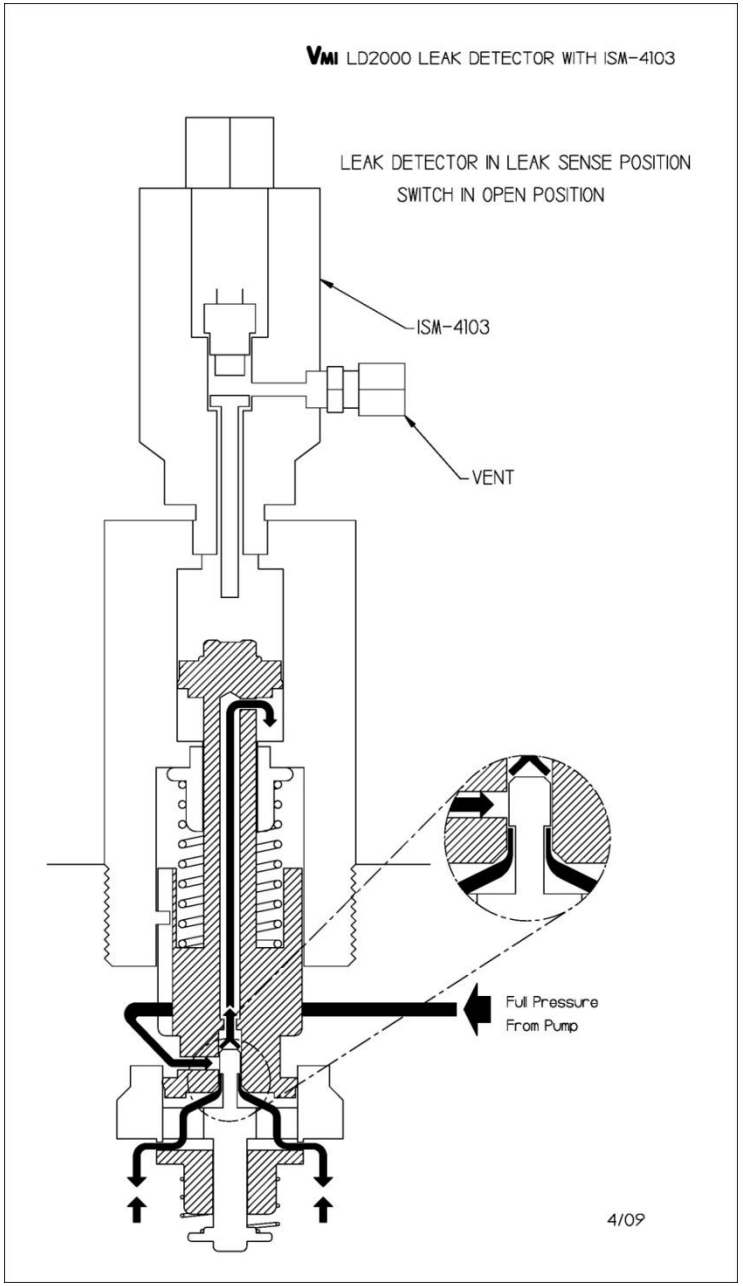
Falling line pressure, due to thermal contraction or line leak

Leak detector responds to line pressure change

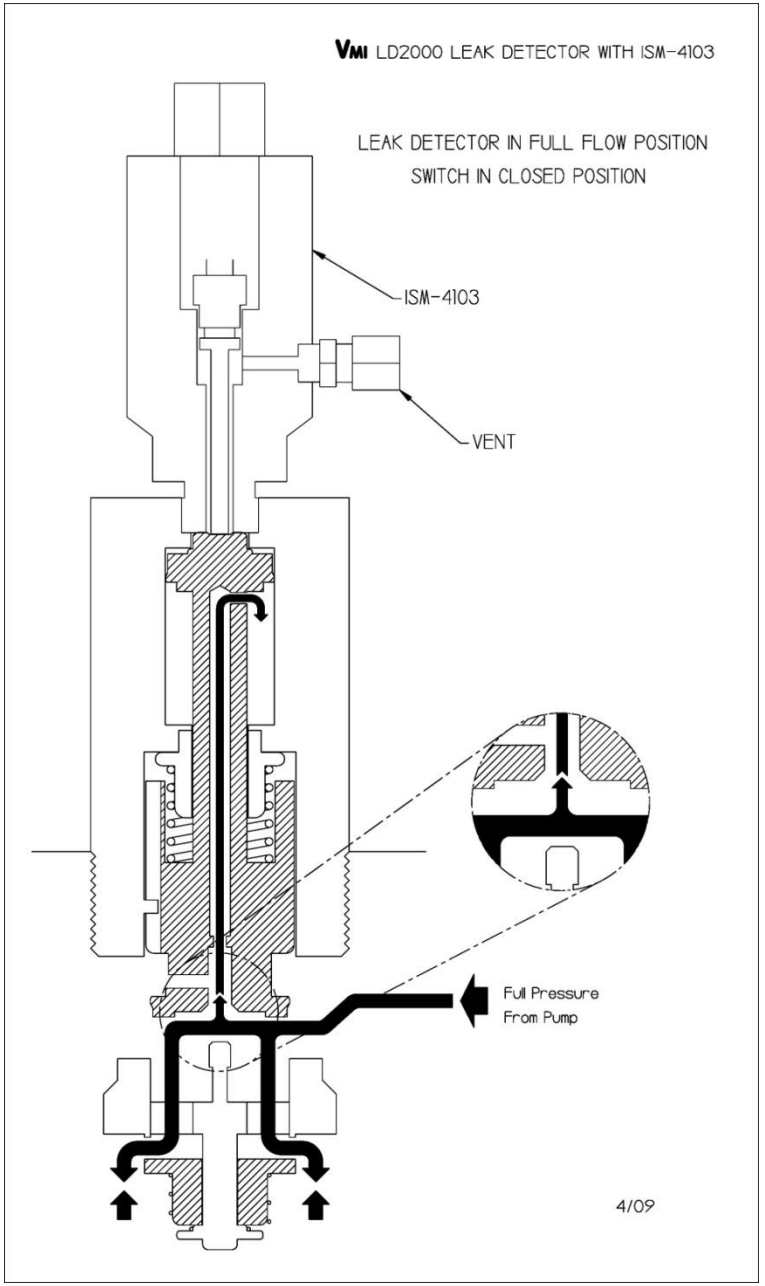
ISM-4103 switch opens to notify ISM-4080 to start line repressurization cycle



Line has been tested and repressurized

Switch has been closed and ISM-4080 notified

ISM-4080 shuts off the submersible and monitors line pressure



Overview of ISM-4080

- During authorization or during inactive (monitoring) periods, provide submersible shut-down in the event of a catastrophic line leak
- Submersible shut-down is the only option for a catastrophic line leak, no alarm only option

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Overview

- Provide Hourly Testing
- Eliminate thermal induced false alarms
- Test and repressurize the line during periods of thermal contraction

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Overview

- Monitor single point sump sensors:
  - ISM-4080: Submersible shut-down if the sump sensor is activated
  - ISM-4081: Alarm only option at sump sensor activation

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Overview

- Provide a means for an uninterrupted tank test without submersible restarts if needed
- Allows authorized dispensing during this time

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Overview

- Provide a means to report line test failures and sump alarms to site monitoring equipment

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Overview

- Utilize existing mechanical line leak detectors - 99 series (since 2/98) - LD-2000 & LD-3000
- The ISM-4080 can utilize existing sump sensor wiring to reduce installation costs

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Overview

- Where multiple submersibles are piped into a single delivery line, ISM-4080 & 4081 Modules may be wired to “stage” the submersibles, ensuring (EPA) 3 GPH line leak detection

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Three Components of ISM-4080 + ISM-4081

1. A certified mechanical line leak detector: VMI LD-2000 or LD-3000

and

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Three Components of ISM-4080 + ISM-4081

2. A Piston Switch to determine: The position (status) of the mechanical line leak detector which identifies falling line pressure

and

Three Components of ISM-4080 & ISM-4081

3. A Microprocessor:
   - **Receives line pressure/leak detector status information from the piston switch**
   - **May receive sump sensor status**
   - **Controls power to the turbine**
   - **Alarm outputs**
   - **Staged Turbine Control**

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Continuous Line Leak Monitoring
Automatic Line Test

- Line pressure is monitored through a switch attached to the mechanical leak detector
- If line pressure falls below 12 PSI, a wait time is established

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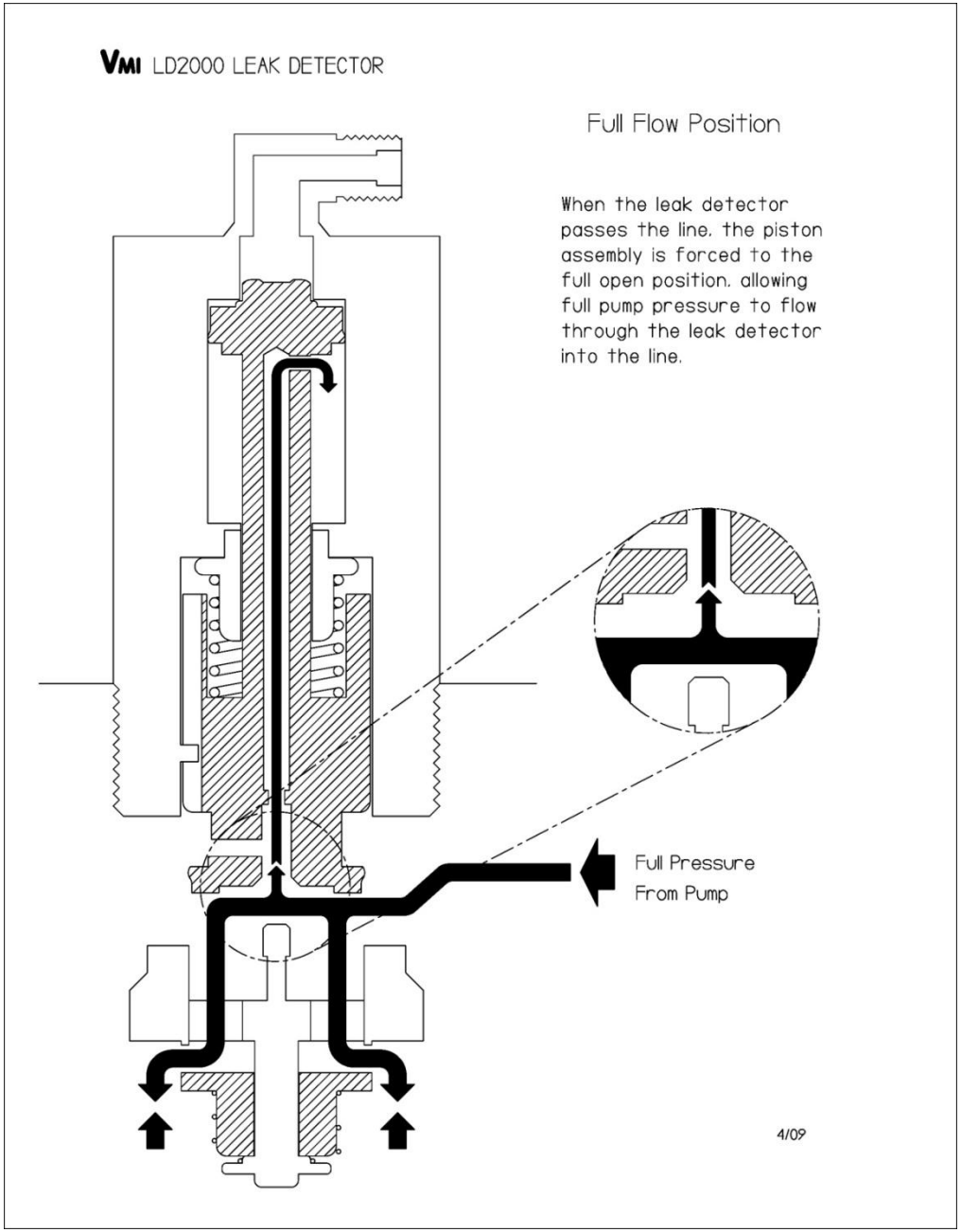

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Continuous Line Leak Monitoring Automatic Line Test

- Wait time is sufficient for the leak detector to reset if there is a 2 GPH @ 10 PSI line leak (or less)

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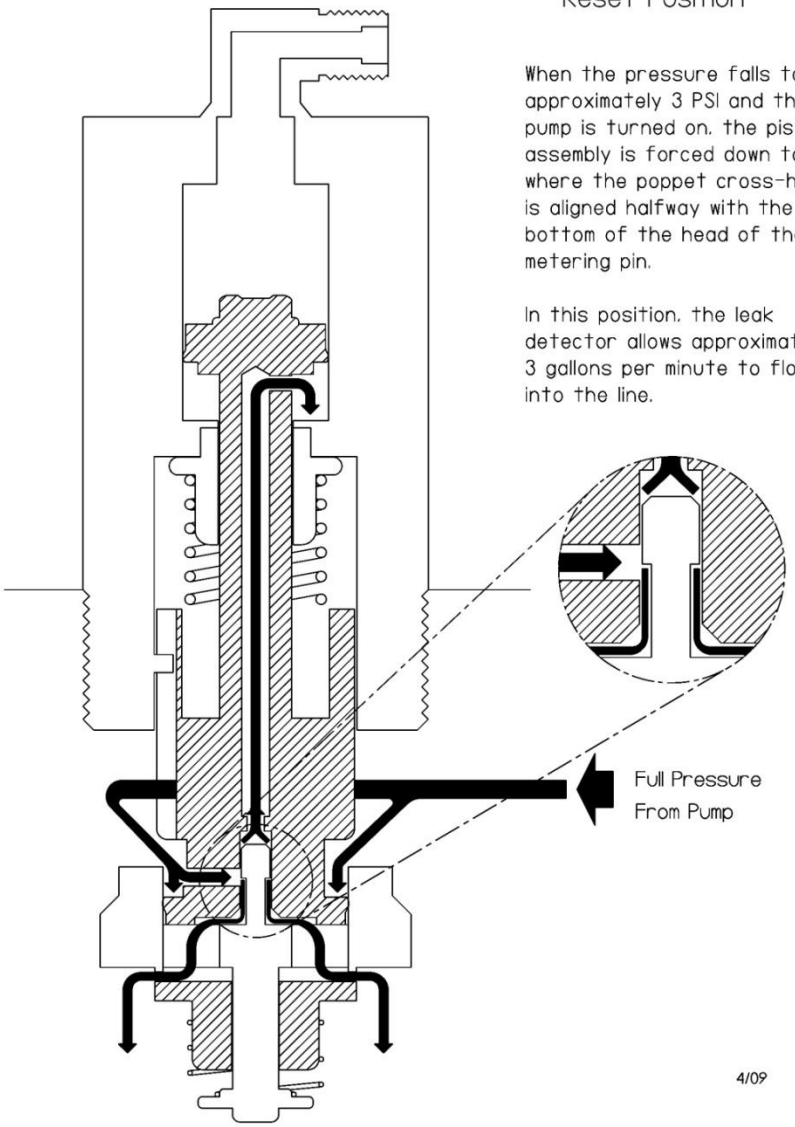
VMI LD2000 LEAK DETECTOR

Reset Position

When the pressure falls to approximately 3 PSI and the pump is turned on, the piston assembly is forced down to where the poppet cross-hole is aligned halfway with the bottom of the head of the metering pin.

In this position, the leak detector allows approximately 3 gallons per minute to flow into the line.



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How Do We Know The Leak Detector Is Reset?

- Each line is unique
- To ensure the leak detector is reset, we have the installer measure the bleed-back (line resiliency)

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Reset, Continued

- Bleed-back gives us the unique volume each (tight) line holds before a leak detector is reset
- Wait times are based upon this volume (set at install)

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Continuous Line Leak Monitoring
Automatic Line Test

- After the reset period has elapsed, a line test is run. If the line passes the catastrophic test, the ISM resets and monitors the line for pressure loss again

- If the line fails a monitor test, the submersible is shut-down and an alarm is activated

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- After an authorization, the ISM-4080 allows the leak detector up to 15 seconds to repressurize the line and open
- Shut-down and alarm if the leak detector does not open

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- A leak test of the mechanical line leak detector to detect a catastrophic line leak, stay in slow-flow and for the ISM to shut-down the submersible during both an authorization and during an Automatic (Monitor) Line Test is required for post-installation and Annual Equipment Testing

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No New Wires To The Submersible Pump Sump

- ISM-4080 monitors a normally closed Piston Switch on an intrinsically safe circuit
- The Piston Switch may be installed in parallel with an existing N/C sump sensor that does not have a resister inline

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No New Wires, Continued

- When installed in this manner, the ISM-4080 is able to discriminate between the sump sensor and the piston switch

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Ready Relay

- When the Leak Detector Moves Open, the Piston Switch Opens, the ISM Closes the Ready Relay

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Ready Relay

- With the Line Passed, this Relay Can Safely Start Additional Submersibles
- May Be Used to Open Solenoid Valves That Have Isolated Above-ground Portions of the Line While the Under-ground Portion was Tested

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Ready Relay

- May Be Used to Open Solenoid Valves Closed During Line Testing
  - Allow Fuel to Loading Rack
  - Allow Filling of Day Tanks
  - Allow Fuel onto Boat Dock
  - Allow Fuel into Polishers

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No Interference With Automatic Tank Testing

Three Options

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Option 1

- The Key Pad allows the installer to enter the disable hours for tank testing
- The ISM stops repressurization every day at the same time
- Battery backup to keep timer settings and run time

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Option 2

- The ISM-4080 will stop repressurization on a signal from the site Tank Test (Monitoring) Equipment
  - **AC Signal**
  - **DC Signal**

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Option 3

- Set the run time for the submersible to 0 seconds

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Alarm Output

- Alarm output is a contact closure
- Report through site monitoring auxiliary sensor input

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Alarm Output, Continued

- Report through stand-alone light, horn, etc.
  - 115vac to 250vac, up to 8 amps
  - Up to 30 vdc, up to 5 amps

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Authorization Signal

- Authorization signal may be between 60 to 240V
- Contactor control through the ISM

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Operation of System

- Certified Mechanical Line Leak Detectors
  - Independent testing at Ken Wilcox Associates confirms VMI leak detectors operate as originally certified with Piston Switch installed

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Operation of System

- Independent testing confirms VMI leak detectors operate as originally certified with Computer Processor initiated leak tests

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Operation of System

- Independent testing confirms the submersible pump is shut-down when the mechanical line leak detector finds a catastrophic line leak of 3 GPH @ 10 PSI

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Operation of System

- Independent testing confirms Computer Processor recognizes sump sensor activation and shuts submersible pump off

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Fuel Compatibility: Ethanol, Methanol, Biodiesel, & Aviation Fuels

- All VMI mechanical line leak detectors are delivered from the factory for use in up to 100% concentrations of the above fuels
- For concentrations over 20% Alcohol, concentrations over 5% Biodiesel, or any Aviation Fuel use Stainless Steel Vent Kit

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Ethanol Issues

- Ethanol wants to “off-gas” or return to a vapor state
- Vapor pockets cause slow flow or missed detection in electronic line leak monitors
- Only by keeping the line pressure above 5 PSI can this be prevented

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Following are two slides taken at an E-85 site

- The ISM-4080 installed at this and many other sites has been effective at reducing false alarms
- Credited with saving the submersible at this site due to low fuel

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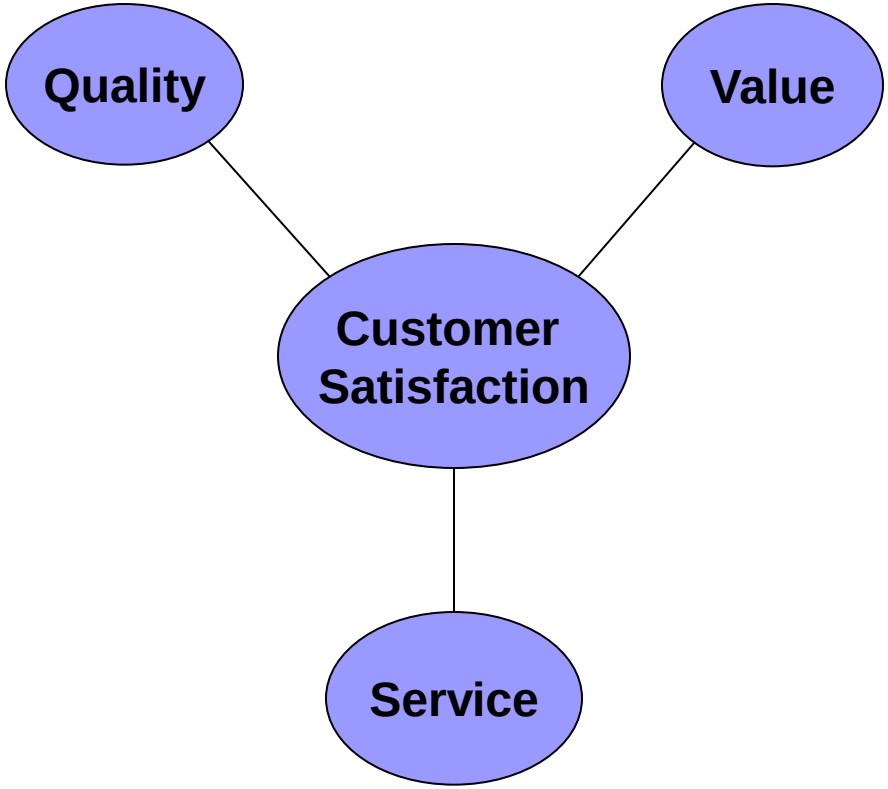
NASA
E85
85% Ethanol
K6-1345
SORENSEN MOVING & STORAGE
Highland Tank
KSC/CCAFS PATROL
CHEVROLET
31


NASA
K6-1345
NO SMOKING
FLAMMABLE
E85

Meets All Regulatory Codes



- Submersible shut down due to a catastrophic leak
- Alarm notification
- Defeat thermal contraction
- Allow tank quiet time for testing

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