NEW TECHNOLOGY FOR PRODUCTION TANK GAUGING

RONALD B. BARRIER

AUTOMATION PRODUCTS, CORP.

A B S T R A C T

This paper discusses the utilization of microprocessors for level measurements in multiple sealed oil and water tank batteries that incorporate Vapor Recovery Units which cause pressure variations inside each tank.

The application consists of the integration of two highly accurate pressure (level) transmitters, one low range vapor pressure transmitter, a microprocessor that utilizes specific gravity information and subtraction techniques, resulting in a highly accurate level measurement system for production stock tanks.

O V E R V I E W

The Railroad Commission Rule 36 requiring two people to gauge the level in existing oil and water production stock tanks has forced oil companies to scramble for an economical solution to eliminate personnel climbing tanks to verify production. To compound the situation venting or flaring gas vapors is becoming unacceptable resulting in the installation of some types of Vapor Recovery Systems. The cycling of these vapor recovery systems causes pressure fluctuation inside each tank. When using the hydrostatic head method of level measurement the compensation for this added pressure will greatly increase the accuracy of the resulting measurement.

In our case a microprocessor was used to measure the level of the fluid, the vapor pressure and subtract out the induced error caused by the Vapor Recovery Unit.

T H E O R Y

D x G x H = Pressure

P = Pressure

D = Density

G = Gravity

H = Height Of Fluid

I N O U R A P P L I C A T I O N

$$H = \frac{P}{DXG}$$

D x G becomes a constant therefore H = P

When P1 = Ph + Pvp

P2 = Pvp

Height = P1 - P2

WHERE:

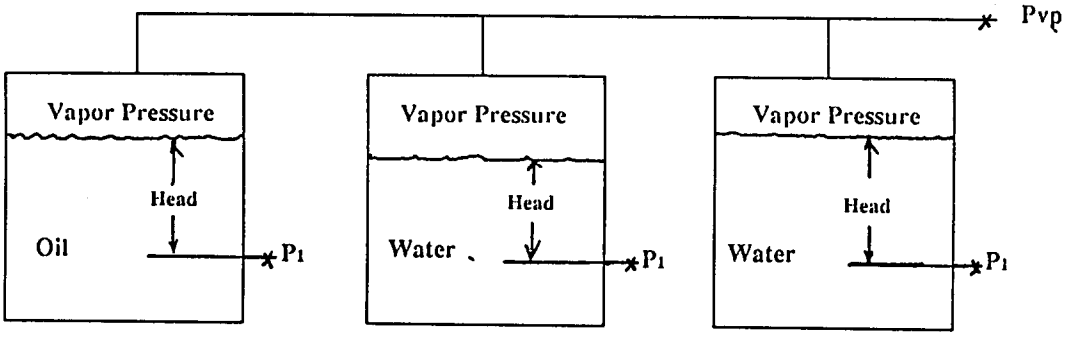
Ph = Hydrostatic Head Pressure

Pvp = Vapor Pressure

P1 = Hydrostatic Head Plus Vapor Pressure

P2 = Pvp

Pvp = Pressure Measured By The Vapor Pressure Transmitter



TYPICAL TANK BATTERY

Hydrostatic head may be defined as the weight of liquid existing above a reference line and is expressed in various units, such as feet or inches. Head is a real force, due to liquid weight, and is exerted equally in all directions. It is independent of the volume of liquid involved or the vessel shape.

If in a closed tank, a pressure greater than atmospheric is applied to the surface of the liquid, this pressure adds to the pressure produced by the hydrostatic head.

A P P L I C A T I O N

A Test Measurement System was installed in the Exxon Sharron Ridge Field. The microprocessor monitored the vapor pressure, two oil tanks and one water tank. The vapor pressure is equal in each tank because each tank was tied to a single trunk line. The Vapor Recovery Unit constantly varies the pressure due to compressors cycling. This cycling causes increased pressure in the tank. The vapor pressure transmitter is mounted at the top of the tank to eliminate freezing and clogging in the condensation line. The level transmitter at the bottom

of the tank measured the pressure caused by the fluid plus the pressure created by the vapor pressure. The level transmitter at the bottom of the tank is a flush diaphragm all 316 SS which eliminates freezing and clogging.

The computer monitors the vapor pressure (VP) and the level transmitter (P1). The vapor pressure transmitter is scaled in the computer in a range equal to feet of the fluid being measured. Example: If the tank being measured is oil then the vapor pressure is calculated in feet of oil. Therefore, when the vapor pressure changes the computer subtracts the error in feet from the level transmitter (P1). The result on the readout is the actual fluid level in the tank. The computer scans each tank, subtracting the appropriate height correction factor for each tank and displays the correct tank levels. The system installed worked as specified.