Analytical Technology & Control Limited

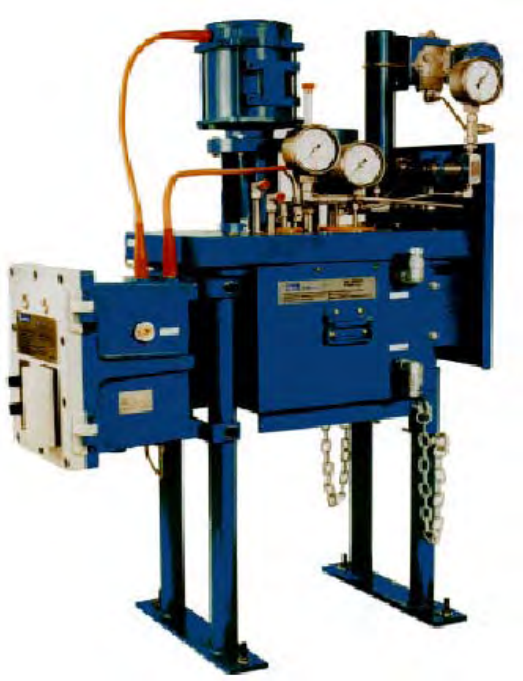
ATAC Hallikainen Model 1354 Vapour Pressure Analyser

MEASURES THE VAPOUR PRESSURE OF A HYDROCARBON LIQUID STREAM

The Model 1354 Vapour Pressure Analyser is a completely automatic process stream instrument for measuring vapour pressure. Accurate measurements that correlate with ASTM D323 / D1267 can be made on samples having viscosities up to 10 cP.

TYPICAL APPLICATIONS

- Liquefied Petroleum Gas
- Gasoline
- Naphthas / Kerosenes
- Crude Oil
- Fuel Oil



PRINCIPLE OF OPERATION

The sample flows under constant temperature and pressure through a nozzle which is mounted inside a venturi shaped aspirator. As the sample is forced through the nozzle, the fluid velocity increases creating a pressure drop sufficient to induce incipient vapourisation of the liquid.

The relationship between the fluid velocity and pressure is given by the flow energy equation:

$$(V_1)^2 + P_1 = (V_2)^2 + P_2 + F_2$$

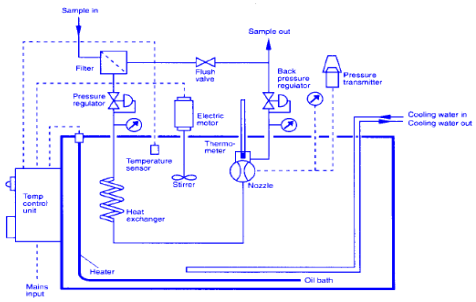
where V_1 is the fluid velocity at inlet
V_2 is the fluid velocity at outlet
P_1 is inlet pressure
P_2 is outlet pressure
F_2 is fluid friction loss

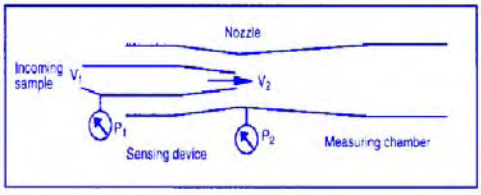
If V_2 can be made sufficiently large while V_1 and P_1 are held constant then, ignoring friction, the pressure of the fluid out of the nozzle can be reduced to the effective vapour pressure of the sample.

Since the fluid temperature is held constant and the pressure at the nozzle inlet is maintained at a level that causes vapourisation of the sample, the pressure at the nozzle output is effectively the Kinetic Vapour Pressure, (KVP), and is calibrated to equal the Reid Vapour Pressure (RVP). This pressure is measured by an absolute pressure transmitter that gives a continuous output. A back pressure regulator prevents back flow of the sample and vapourisation in the output line.

Nozzle inlet pressure is maintained constant by passing the sample through a pressure regulating valve. The critical components are maintained at a fixed temperature by immersion in an oil bath, the temperature, of which, is controlled by a precision temperature controller, heater and, when necessary, water cooling. The temperature is monitored by the relevant ASTM (IP) thermometer.

The analyser can be fitted with a “smart” electrical output signal from a microprocessor based transmitter to interface with a DCS.





ONE OF THE ATAC RANGE OF PROCESS ANALYSERS

SPECIFICATION

Analyser performance

Accurate measurements can be made from samples having viscosities up to 10 cP.

Available Ranges	0 - 1 bar a minimum 0 - 10 bar a maximum other spans available other units available
Repeatability	± 0.007 bar (0.1 psi).
Precision	Within ASTM D 323 test limits (ASTM D 1267 for LPG).
Response time	Better than 45 seconds

Output signal

Range	4 - 20 mA fully isolated loop powered or digital output (depending on transmitter selected)

Out-of-service alarm contact signalling mains failure (or off) or bath temperature fuse blown.

Sample conditions required at inlet

Pressure (g)
Dependent upon the back pressure at the analyser outlet, but it must normally exceed ***[outlet pressure (bar) x 2.5] + 7 bar***.
Standard max pressure: 40 bar (600psi)

Temperature
Should remain within the range 27°C - 50°C (80°F - 120°F).
Fluctuations must be minimal and not exceed 5°C (9°F).

Flow
55 - 230 litres / hour (12 - 50 gallons /hour) depending upon the back pressure.

Sample conditioning

Complete sample systems can be supplied to pre-condition process sample to the conditions required at the analyser inlet.

Sample disposal

Return to process or a recovery system.
Sample recovery systems can be supplied.

Utility requirements

Power supply

Voltage	115V or 230V ± 10% single phase.
Frequency	50 or 60 Hz
Consumption	2.0 kVA.

Cooling water
A supply of potable water at up to 135 l/h (30gal/h) and at a temperature not exceeding 30°C should be provided to carry away the excess heat. The necessary coil is fitted as standard. If potable water is not available, alternative cooling coil materials can be provided.

Oil for temperature bath
11 litres (2.5 gal) of Shell Thermia B or equivalent. Reid vapour pressure tests are carried out at 37.8°C (100°F), but with this instrument, temperatures up to 110°C (240°F) may be selected and controlled to ± 0.1°C.

Local display

Gauge indicates absolute vapour pressure. 0 - 100% linear scale on the transmitter.

Standard connections

Sample inlet	$^1/_4$" NPT(male)
Sample outlet	$^3/_8$" NPT (male)
Cooling water	$^1/_4$" NPT (female) IN
Cooling water	$^1/_4$" NPT (female) OUT
Electrical	EM20 CENELEC ($^1/_2$" NPT NEC)
Signal out	As transmitter specification either EExd or EExia with 4-20mA isolated output or digital output.

Explosion protection

The analyser is ATEX certified
Ex II 2G EEx d e IIB T1-T6*
*model dependent
for use in zone 1 hazardous areas.
Certificate no. EPSILON 04SYS1283V1

Environmental protection

Will operate satisfactorily under normal ambient temperature conditions in the range 0 - 55°C (32 - 130°F) but should be sheltered from direct sun and rain.

Dimensions and weight (typical)

The general appearance of the instrument is as shown in the illustration.

Width	450 mm
Depth	1045 mm
Height	1400 mm
Weight	180 kg

Floor fixing bolt holes (4 off $^5/_8$" dia) at 448 mm ($17^5/_8$") x 351 mm ($13^{13}/_{16}$") centres.

Options

- Configuration for CSA local approval
- Cooling coil in Hastelloy C or Monel
- Vapour pressure of LPG to ASTM D 1267
- "Smart" transmitter with integral microprocessor permitting remote diagnostics, configuration and interrogation of transmitter plus loop integrity test using the manufacturer's hand-held communicator.

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