

## VAPOR PRESSURE ANALYZER Model 1354

The petroleum industry has used the ASTM Reid vapor pressure test as an indication of product specification and for quality control. The measurement of vapor pressure has become of increasing economic importance during the last several years since petroleum refining management has found it necessary to operate processes at optimum efficiency in order to meet increasing labor and equipment costs.

A VAPOR PRESSURE ANALYZER placed in the field to record and/or control the vapor pressure of a stream:

1. Provides a rapid, continuous, accurate indication of product vapor pressure which may be used for monitoring or control purposes.
2. Reduces the frequency of laboratory analyses and thus the cost of operation.

Reid vapor pressure is normally a specification within ASTM D-323 procedure. The VAPOR PRESSURE ANALYZER can provide a signal directly in terms of RVP. The analyzer is adjusted and calibrated by comparing the analyzer output with the laboratory Reid vapor pressure test. Confidence in the analyzer's performance is so high that the VAPOR PRESSURE ANALYZER is commonly being used for in-line blending where Reid vapor pressure is a product specification.

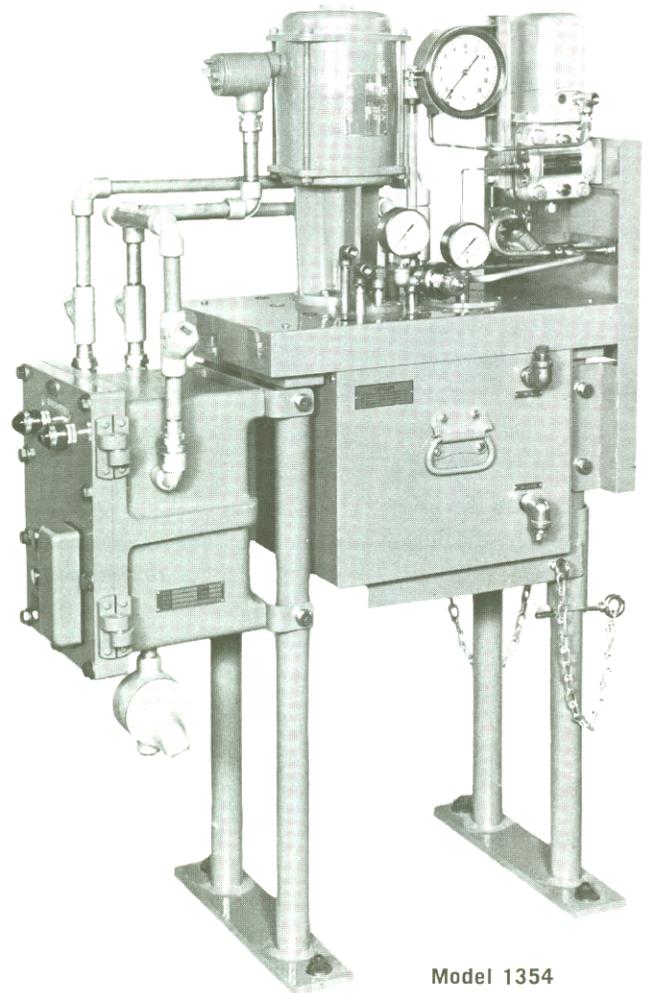
### ADVANTAGES

- Fast speed of response
- Simplicity in design
- Sturdy construction
- Precise sample temperature control
- Readout directly in RVP

### APPLICATION

A typical refinery application for the analyzer is in the control of gasoline or jet fuel blending. Control of Reid vapor pressure in the blend allows maximum injection of the low cost pressurizing agent (usually butane in the gasoline blend). The VAPOR PRESSURE ANALYZER'S fast response lends itself to closed loop control thus permitting a tight Reid vapor pressure specification. The analyzer has an extremely attractive pay-out potential when combined with an automatic blending system to control the injection of butane into the blending of gasoline.

Other successful applications include such products as jet fuel, light hydrocrackate, kerosene and virgin naphtha. The analyzer has the capability of measuring any hydrocarbon's vapor pressure up to 250 psia.



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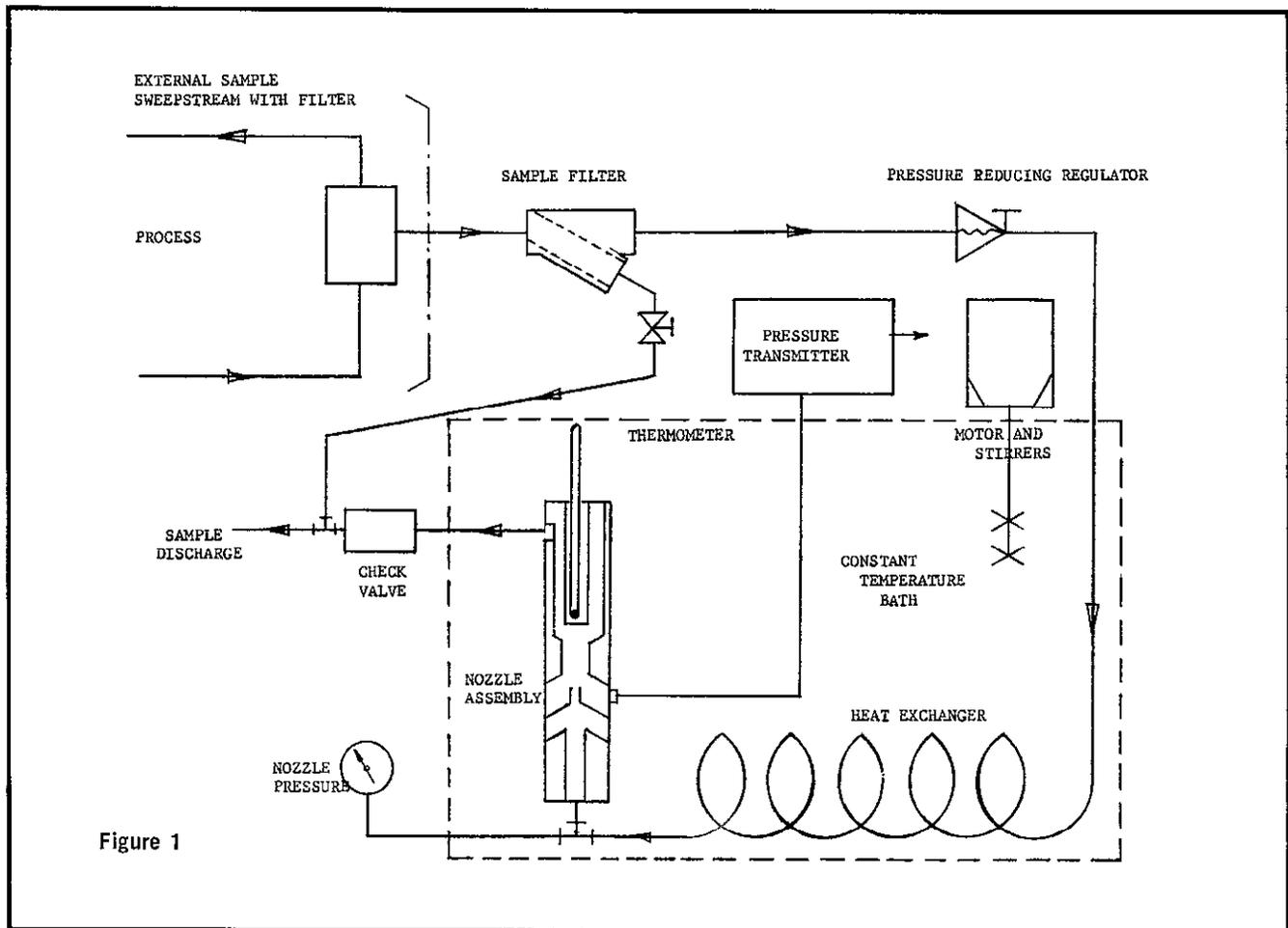


Figure 1

## PRINCIPLE OF OPERATION

Figure 1 illustrates a schematic flow diagram of the instrument. The analyzer incorporates a constant temperature controlled bath in which the heat exchanger and nozzle assembly are immersed. The temperature of the sample is regulated at  $100^{\circ}\text{F.} \pm 0.1^{\circ}\text{F.}$  by means of the Hallikainen THERMOTROL Temperature Controller which incorporates proportional and reset control modes and utilizes a resistance thermometer as primary sensing element located in the bath.

The sample first passes through a Y strainer with 100 mesh screen to filter out particles, and thence to a conventional pressure regulator which maintains a constant pressure ahead of the vapor pressure sensing nozzle. The nozzle increases the velocity head in the mixing section so that the pressure head on the downstream side of the nozzle approaches zero, (application of Bernoulli's equation). The minimum pressure in this chamber is limited to the vapor pressure of the sample material. This vapor pressure is sensed by an absolute pressure transmitter. Precise sample temperature indication is provided by an etched stem thermometer located in a well downstream of the nozzle assembly. The sample upon leaving the nozzle passes through a check valve which provides three to four pounds back pressure on the system to prevent flow reversal in the event of instrument malfunction. The schematic flow diagram and description above cover an analyzer which discharges sample to atmosphere. For those applications where sample is to be discharged to a line under pressure the check valve is replaced by a back pressure regulating valve and a pressure gauge. The absolute transmitters considered standard are Foxboro type 11AM (pneumatic output signal), Foxboro E13DM or Taylor 801-TA-14111 (electrical output signals). Other transmitters can also be supplied according to customer preference at additional cost.

## DETAILED DESCRIPTION

**Housing** — The oil bath and electronic controls are each contained in lightweight aluminum explosion proof housing suitable for Class 1, Group D, Division 1 hazardous areas. The oil bath cover and box are insulated with Maranite and Fiberglas and enclosed in a 16 gauge steel housing.

**Motor** — A universal motor for use on 115/220 volts 50/60 hz is utilized. This motor is an induction type and develops  $\frac{1}{8}$  HP at 1440 RPM — for 50 hz;  $\frac{1}{6}$  HP at 1725 RPM — for 60 hz. The motor shaft extends through the top cover to drive two stirrers for agitation of the bath liquid.

**Heat Exchanger** — The stainless steel heat exchanger has sufficient capacity to condition an input sample, ranging between 70-120°F., to 100°F. If the sample temperature exceeds this range, a sample preheater and/or cooler may be supplied as an accessory to bring the temperature within this range (see Figure 2).

**Cooling Coil** — A cooling coil is provided in the oil bath for constant circulation of cooling water when, and if, required.

**Temperature Control** — The temperature of the sample fluid is maintained by a Hallikainen THERMOTROL Temperature Controller. Because of the controller's unique design, changes in ambient temperature or line voltage have a negligible effect on the controlled sample temperature. The immersion heater used for the constant temperature bath is rated at 1500 watts.

**Stirrer** — Two stainless steel stirrers of special design (Hallikainen Jet-Stir Impeller) are used to agitate the bath medium, minimizing the overall time constant and temperature gradients. The hollow blade stirrer causes the bath medium to flow radially out through the blades with a high velocity as well as in directions normal and tangential to the blade surface.

**Pressure Regulator** — A stainless steel pressure regulator maintains a constant pressure on the upstream side of the nozzle.

**Sample Temperature Measurement** — A special etched stem thermometer (range 94-108°F.) is provided to read the sample temperature at the discharge of the nozzle.

**Check Valve** — A stainless steel valve is provided on those analyzers discharging to atmosphere. This is installed at the sample discharge outside the bath.

**Back Pressure Regulator** — For those analyzers discharging to a process line under pressure, the check valve is replaced by a conventional stainless steel back pressure regulating valve to control back pressure within the analyzer.

**Pressure Gauges** —  $2\frac{1}{2}$ " pressure gauge is supplied to measure pressure at inlet to nozzle (also back pressure when applicable).

**Local Indication** — Where a transmitter with pneumatic output signal is used, a  $4\frac{1}{2}$ " receiver gauge (3-15 psig input) with scale graduated 0-20 psia is provided as standard equipment (other scales on special order). If the transmitter provides an electrical output signal, a  $4\frac{1}{2}$ " absolute pressure gauge graduated 0-30 psia for gasoline or as required for other products, is provided as standard equipment.

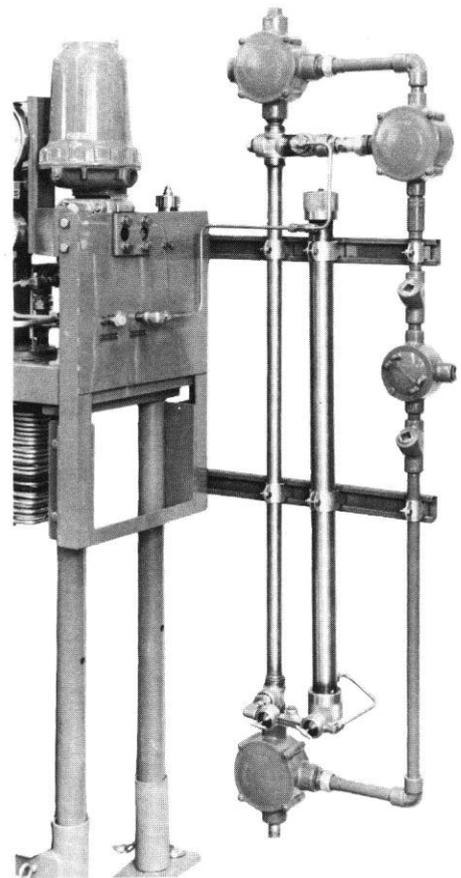
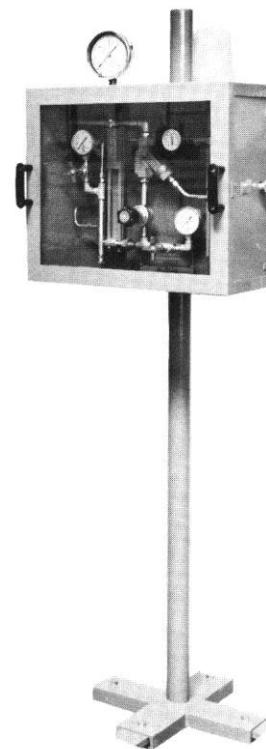


Figure 2



Model 1462

Inlet Pressure Requirements — When discharging to a line under pressure, the minimum inlet pressure should be equal to the following:

$$\text{Inlet Pressure} \quad = \quad 2.5 \text{ (Discharge Pressure)} + 40$$

gauge  gauge

For the sample conditions where the inlet pressure does not meet this requirement, additional system pressure may be provided at the inlet through the addition of a pump to the sample system (at extra cost). Another alternative is to utilize the Model 1464 SAMPLE RETURN SYSTEM (see separate brochure) which is designed to return samples to a pressurized line.

## MODEL 1462

Certain applications require vapor pressure measurements at the product's flowing temperature. For these conditions the Model 1462 can be supplied. Essentially this design involves the same principles found in the Model 1354 analyzer less the bath assembly.

The sample system is similar to the 1354 except that it is completely contained in an insulated housing. Purpose for this is to minimize the heat loss and to make the vapor pressure measurement at the flowing temperature.

Range and performance is identical with the Model 1354. Pneumatic or electrical outputs are available as desired.

## GENERAL SPECIFICATIONS

Vapor Pressure Range: 0 to 20 psia (standard model for gasoline, etc.). Other ranges, lower or higher are also available.

Repeatability:  $\pm 0.1$  psia on 0-20 psia range.

Response Time: 43 seconds (includes 25 second dead time).

Linearity: 0.5% of span.

Inlet Pressure Limitations: 500 psig maximum. A minimum 50 psig at the nozzle is required for analyzers discharging to atmosphere. (See above for pressure requirements).

Discharge Pressure Limitations: The sample may be discharged to atmosphere or returned to the process line.

Inlet Temperature Limitations: Approximately 70-120°F. (but fluctuations must be minimal).

Materials of Construction: All metal parts in contact with the sample are stainless steel.

Sample Inlet Connection: 1/4" NPT Male.

Sample Outlet Connection: 1/4" NPT Male.

Cooling Coil Connections: 1/4" Female In and Out.

Electric Transmitter Connections: 1/2" NPT Female.

Pneumatic Transmitter Connections: 1/4" NPT Female.

Flow Rate: Approximately 15-50 GPH depending on back pressure. 15 GPH when discharging to atmosphere. As discharge pressure rises flow increases.

Transmitter Output Signal: Pneumatic or electric as specified.

Dimensions: 34" long x 16" deep x 52" high (approximately).

Weight: Net Weight (approx.) 400 lbs. Shipping Weight (approx.) 625 lbs.

Utilities:

Electrical: 115 volt or 230 volt (select one), 50 or 60 hz (select one) 1950 watt (max.). Connections are 1/2" NPT. (These figures exclude power requirements of electrical transmitters which will require their own power supply. Power supplies for transmitters are not included as standard).

Air: As required for pneumatic transmitter. Connections are 1/4" NPT Female. A 20 psig supply is required for transmitter. Air regulating valve not supplied as standard.

Cooling Water: Requirements depend on operating conditions.