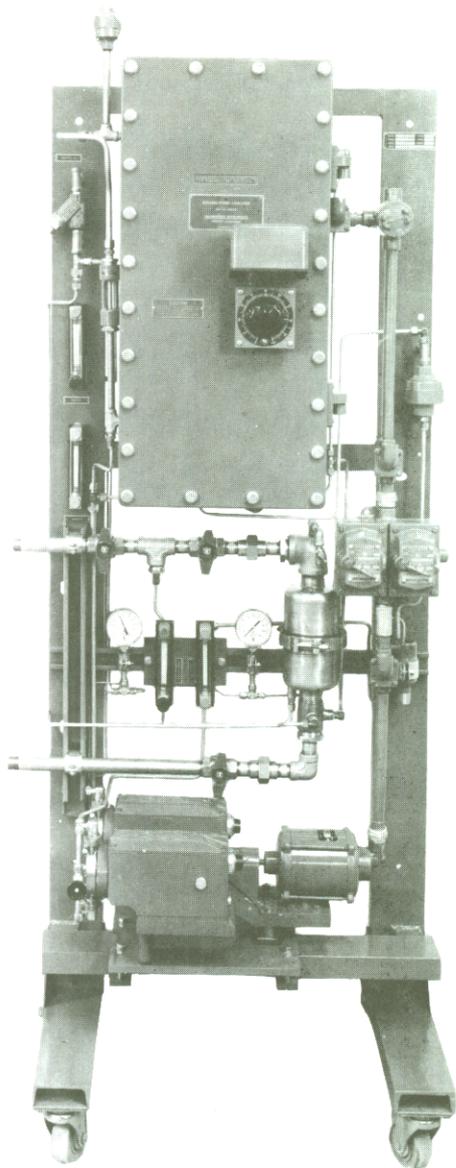


BOILING POINT ANALYZER

Mid-Range Model

Sun Oil Company Design

Model 1340



The Mid-Range Model BOILING POINT ANALYZER operates in the 30% to 70% recovered range. This analyzer is, in effect, a single stage still to which sample is fed at a constant rate by means of a metering pump and boiled at a constant heat input. Cooled distillate is removed from the boiler at a constant rate equal to a percentage of the feed rate by a second metering pump. The amount removed can be any quantity between 30% and 70% of the input rate. The temperature measured by the thermocouple in the boiler can be correlated with the ASTM boiling point temperature equal to the percentage of distillate removed, within the limits of the 30% to 70% recovered rate. Excess condensate is returned to the boiler as reflux. The remaining portion of the feed is removed as bottoms from an overflow line in the boiler.

With this analyzer's requirement for cooling water, protection from freezing is required. The instrument should be installed with overhead protection at least; but where freezing will be encountered, a shed incorporating heating should also be considered.

DESCRIPTION

The still (boiler), voltage regulator, etc. are all contained within one large explosion-proof housing, mounted on a vertical steel frame. This frame can be provided with horizontal feet and casters for portability, if desired, at an extra charge. Sample flow is controlled by a duplex Hills-McCanna Masterline metering pump mounted on a horizontal channel on the lower portion of the frame. In addition, the sampling system consisting of the combined FILTER-COALESCECER with block valves is mounted on the frame. To complete the accessories, a total of four rotameters are supplied: one for sample in, one for FILTER-

COALESCECER by-pass, one for water, and one for distillate. A strainer for the cooling water is also provided.

Across the metering pump on the sample inlet is a Moore differential pressure regulator used to maintain a constant differential pressure across the pump.

OPERATION

Product feed is pumped by one unit of the duplex metering pump at the rate of 25 cc per minute. The sample flows upward through a heat exchanger into the boiler which fills to the level of an overflow through which the bottoms product from the boiler is discharged. The sample charge is boiled by heat supplied by a cart-

ridge heater energized through a constant voltage regulator which is fitted with a number of taps to permit selection of the most suitable power supply to the cartridge heater for the sample being analyzed. Vapors are condensed on the inner wall of the reflux condenser with the condensate filling an annulus that gathers the liquid to the distillate pump. Excess reflux overflows the annulus and returns to the boiler.

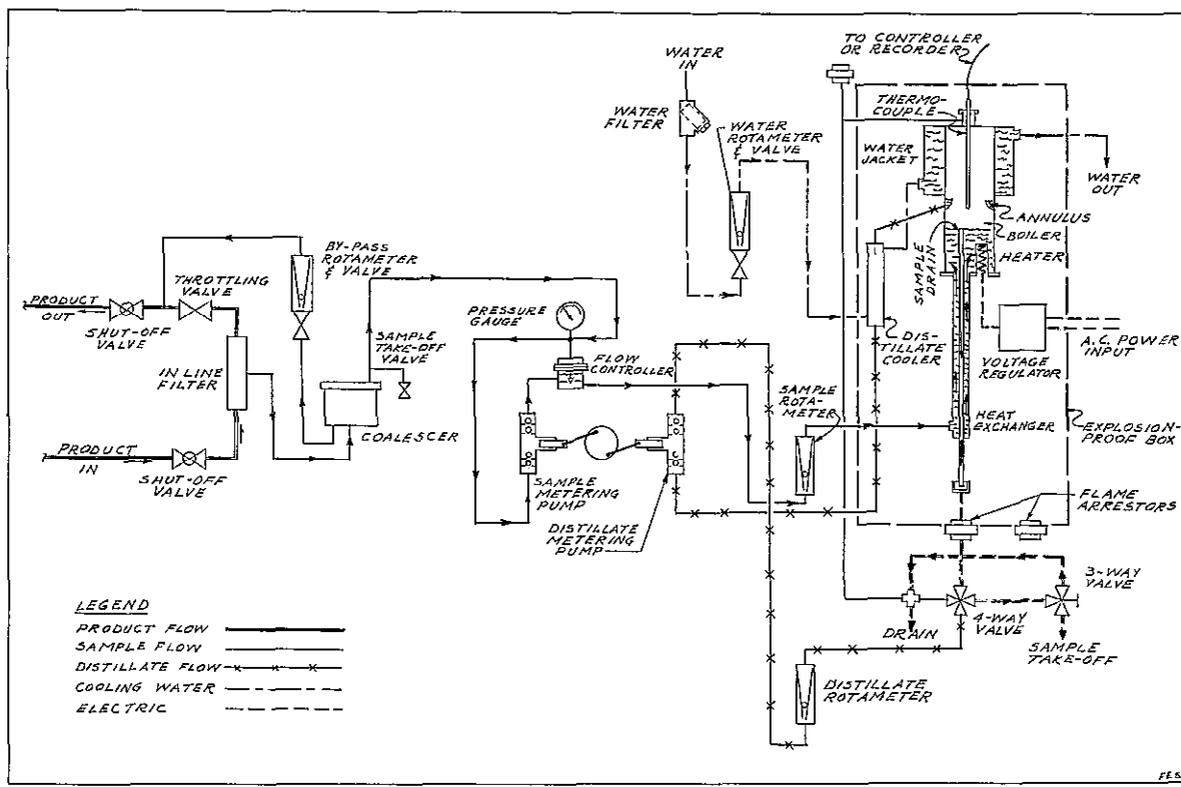
In monitoring the boiling point desired, the distillate pump (other half of the duplex metering pump) must be adjusted to pump distillate somewhere between 30 and 70% of the rate at which the feed pump supplies sample to the boiler; the actual rate is dependent on boiling point (recovered rate) desired. Two valves are provided that permit diverting the flow of distillate and bottoms to two graduated receivers (not supplied) where their rates may be compared.

The sample must boil rapidly enough to evaporate at least 30 - 70% of the charge otherwise the distillate pump may run dry.

Any excess condensate refluxes back to the boiler. The correct heat input can be determined by gradually reducing the heat input to the point where the distillate level just begins to drop below the annulus and will show bubbles in the distillate rotameter. The heat should then be increased about 20% to provide an adequate margin of safety.

A thermocouple just below the bottom of the annulus may record a temperature higher or lower than that measured by the D-86 ASTM boiling point method. This difference will remain quite constant as the boiling range of the feed varies. However, for those who want to read the exact boiling point temperature on the recorder to correspond with the D-86 ASTM, the recorder may be offset.

When the analyzer is used on gasoline or similar products with a percentage of light ends, a slightly different version of boiler is used. In addition to a cooler, an absorber filled with HELI-PAK (Podbielniak) is provided to collect and condense these light ends and add them to the distillate.



Flow Diagram

FES

DESCRIPTION OF COMPONENTS

Housing — The boiler assembly, condenser, (absorber when required) and constant voltage regulator are housed in an aluminum explosion-proof housing designed for use in Class 1, Group D, Division 1 hazardous areas. This housing and all other components of the analyzer are mounted on a welded steel vertical frame (normally supplied without horizontal feet or casters; however, these are available at extra charge.)

Sample Flow Control — Sample flow is provided by a precision metering pump, a Hills-McCanna Masterline duplex, one pump unit delivers approximately 25cc per minute (approx ½ gallon per hour); and a second pumping unit removes the distillate from the boiler annulus at a constant rate based on boiling point measurement desired between 30 and 70%.

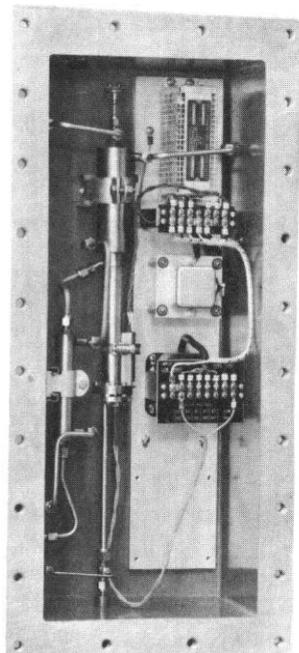
Motor — A ¼ h.p. single phase, 60 cycle, explosion-proof motor, suitable for use in Class 1, Group D, Division 1 hazardous areas drives both of the pumps from a common gear reducer. The motor is protected from overload by a thermal cut-out built into the motor,

FILTER - COALESCER — The FILTER - COALESCER is enclosed in a stainless steel cylinder with O-ring seal. The sample for the analyzer must pass through the first three layers of Fiberglas for removal of particles. Tests indicate particle removal down to 2 micron. The coalescing is performed by the remaining layers of Fiberglas and finally by the outer wrapping of polyurethane. Sample temperatures should not exceed 160°F and preferably should be as low as possible in order to remove the water.

Flow Rotameters — To monitor the sample flow rate and detect the presence of air or vapor in the sample line, a rotameter is provided between the sample metering pump and instrument boiler. Another rotameter is located in the line between the distillate pump and sample discharge to indicate flow of distillate. A rotameter with needle valve is included in the FILTER - COALESCER by-pass stream to adjust for correct flow.

Boilers — Both of the boilers used are fabricated of stainless steel and of heliarc welded construction. The lower portion of either boiler assembly is a tube in tube heat exchanger arranged so that the hot outgoing sample preheats the incoming sample.

Cartridge Heater — The cartridge heater is rated 250 watts at 120 volts AC. It is inserted into a well located on the flange of the heat exchanger onto which the boiler is mounted.

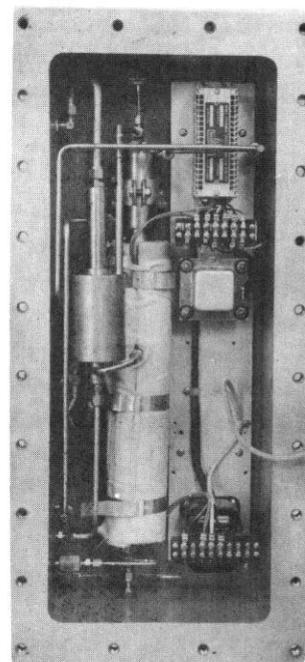


**Boiler Assembly
for
heavier products**

Constant Voltage Source — This is a Regohm voltage regulator which automatically inserts and removes series resistances, so as to maintain a constant voltage output. This type of regulator is relatively independent of line frequency and can maintain the output voltage within ½ % for 60 cycle operation and for combined effects of line, load and frequency. The voltage output from the Regohm regulator is applied to a variable transformer providing an output voltage (adjustable) to heater of from 30 to 120 volts.

Cooling Water System — The cooling water system is provided with a 100-mesh stainless steel screen in a stainless steel body, a needle valve for flow control and a rotameter for flow indication.

Thermocouple Assembly — The thermocouple assembly utilizes a Type J iron constantan thermocouple encased in a stainless steel sheath and held in the proper location within the boiler by a tubing connector at the top of the boiler.



**Boiler Assembly
for
lighter products**

CORRELATION OF RESULTS

Operation of this continuous BOILING POINT ANALYZER is not a duplication of the ASTM D-86 distillation test method and cannot therefore be expected to yield temperatures obtained by that method. Justification of the instrument lies in the fact that it does have the ability to quickly recognize changes in the boiling point temperature. The analyzer results can be correlated directly with the ASTM D-86 results, with a repeatability of $\pm 1^\circ\text{F}$.

GENERAL SPECIFICATIONS

Normal Operating Temperature Range:	150 to 500°F.
Response Time:	Approximately 2½ minutes (dead time and time constant)
Inlet Sample Pressure Limitations:	30 to 150 psig (consult factory for variations.)
Inlet Sample Filter Particle Removal	Sample should be below its initial boiling point temperature; and for maximum COALESCER efficiency, it should be as cool as possible. Maximum sample temperature into the COALESCER should not exceed 160°F. (A sample cooler can be supplied as an accessory at extra cost.)
Sample Flow Rate:	25cc per minute. Sample normally is discharged to atmospheric drain; however, on special order and at extra cost, a system to return the sample to a pressurized line can be supplied.
Inlet Sample Filter Particle Removal Rating:	7 to 14 micron is standard; other elements are available at extra cost.
COALESCER Water Removal Rating:	All free water from the sample is removed at the stream temperature.
Materials of Construction:	All metal parts in contact with the sample are stainless steel.
Recommended Installation:	Overhead weather protection is desirable. Where freezing temperatures are expected, full protection with heating is recommended.
Utilities:	Electrical - 115 volts $\pm 10\%$, 60 cycle, 7 amperes maximum. Connection for ½" conduit. Separate switches provided for heater and total power. (Other voltages and frequencies at extra cost.) Water - 100°F. maximum; 5 to 100 psig; 5 gal/hr nominal. ¼" NPT female connection provided at "water in" and "water out."
Sweepstream Sample In and Out:	3/8" NPT female connections provided. ½" pipe recommended for customer's sweepstream piping.
Analyzer Output Signal:	Type J iron constantan thermocouple.
Dimensions:	28" wide x 67" high x 18" deep (without horizontal feet and casters.)
Weight:	Approximately 425 lbs. gross (shipping weight); approximately 340 lbs. net. Both without horizontal feet and casters.