

## BOILING POINT ANALYZER

### Low Range Model

*Shell Development Company Design*

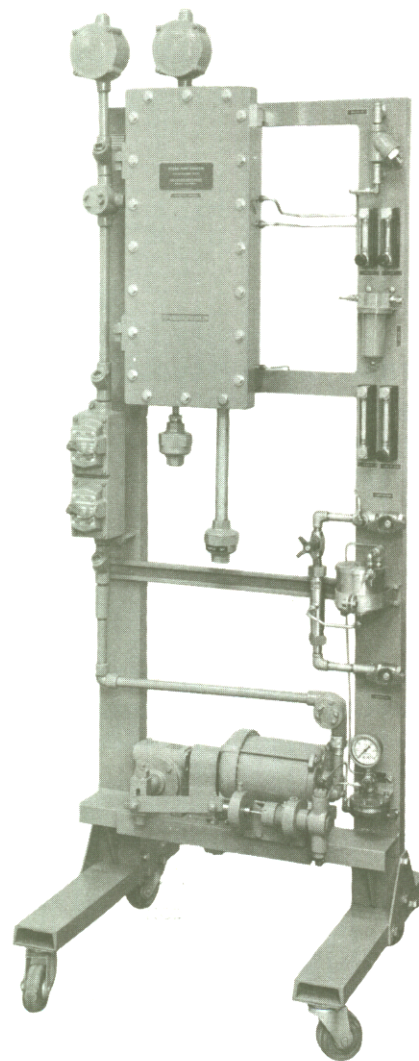
The Low Range Model BOILING POINT ANALYZER, operates in the Initial to 20% recovered range.

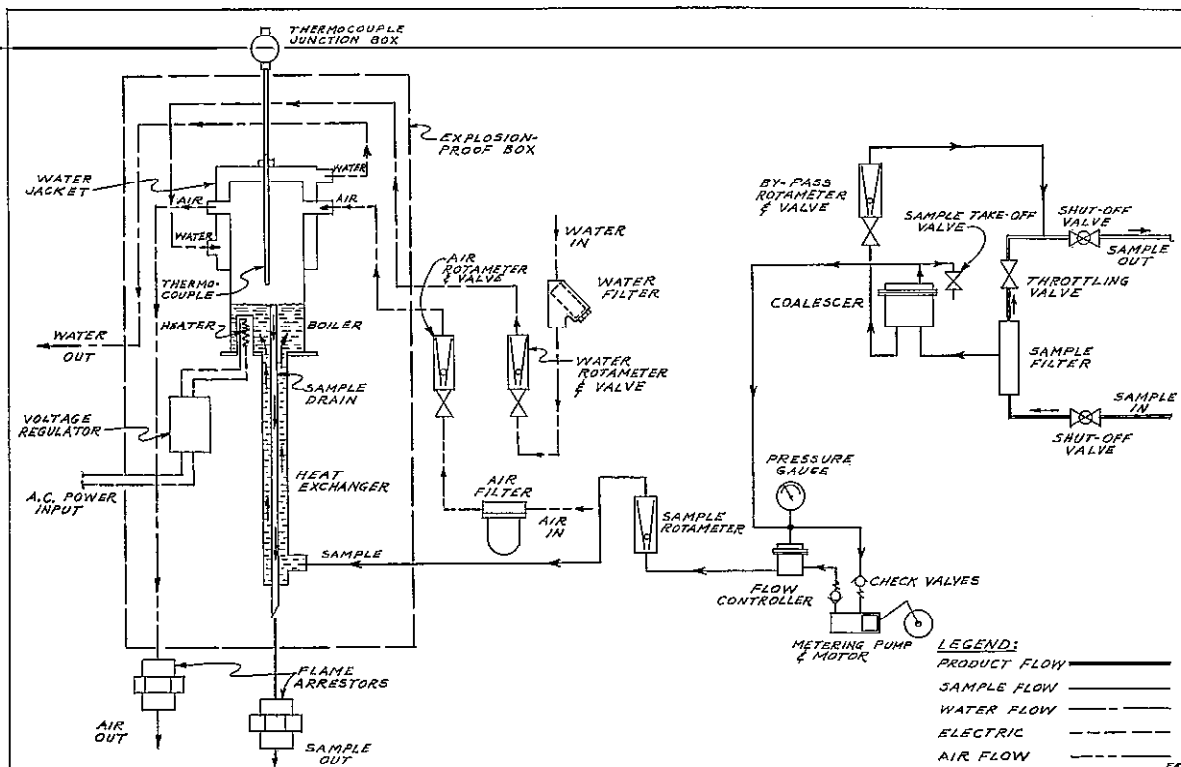
### APPLICATIONS

The analyzer has been successfully applied to many plant streams including several multistream applications. Generally, the instrument may be placed on any stream where the boiling point temperature is between approximately 150 and 500°F. (for any boiling point between the initial and 20% points). Special models operating to as low as 100°F. are also available. 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 be considered.

### OPERATION

A complete sampling system is provided with the analyzer. The incoming sample is filtered by an IN-LINE FILTER containing an alundum element; the sample then passes into the COALESCER which removes all free water from the sample. The coalesced water is continually drained and returned to the process line. A constant sample flow rate is provided by a Hills-McCanna Masterline metering pump. The metered sample flows into a tube in tube heat exchanger where the incoming sample is pre-heated by the outgoing sample and then enters the boiler. An overflow tube and liquid seal in the bottom of the boiler maintains a constant reservoir of liquid in the boiler. The sample is heated with an electric cartridge heater causing vigorous boiling at a uniform rate. The upper portion of the boiler is surrounded by a water-cooled condenser. The operation of the boiler is similar to a single plate distillation column, wherein the lightest vapors condense on the walls of the upper water-cooled section of the boiler. By adjusting the vertical position in the boiler of an assembly containing a thermocouple, a location may be found where the temperature coincides with the desired boiling point of the sample, within the limits of initial to 20% boiling point. If the material's boiling point temperature should change, the temperature of the reflux ring associated with that of the boiling point will change and will be indicated by the sensing thermocouple. The upper portion of the boiler (above the sample reflux line) is continuously purged with a small air flow to remove water vapor and non-condensable gases.





Flow Diagram

### DESCRIPTION OF COMPONENTS

**Housing** — The boiler assembly and constant voltage regulator are housed in an aluminum explosion-proof housing designed for use in Class 1, Group D, Division 1 hazardous areas. The housing, sampling system and other components are mounted on a vertical welded steel frame.

**Sample Flow Control** — Sample flow is obtained through use of a Hills-McCanna Masterline metering pump. Sample required can range between 5 to 15 ml per minute. The volume used should be the maximum that is within the capacity of the heater to boil the sample.

**Sampling System** — The sampling system supplied with the standard analyzer consists of a Hallikainen Model 1090 Self-Cleaning IN-LINE FILTER, a Hallikainen Model 1336 COALESCER, four rotameters, and associated block and metering valves and gauges, all piped and mounted.

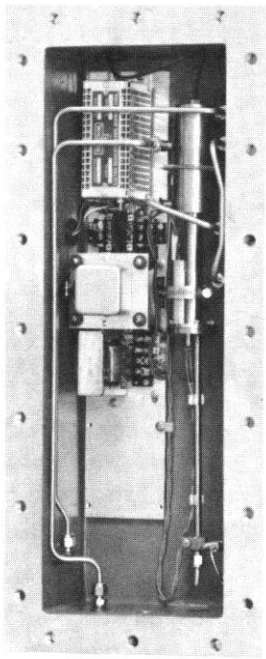
**IN-LINE FILTER** — The IN-LINE FILTER consists of a hollow aluminum tube enclosed in a stainless steel cylinder with "O" ring seals. The sample for the analyzer must pass through the walls of the aluminum filter element. The high velocity slipstream sweeps the inner walls of the filter tube and provides a self-cleaning action by carrying away stream contaminants. The filter element is rated at 7 - 14 micron size particle removal.

**COALESCER** — The COALESCER is designed to remove all free water from the sample at the sample temperature. To reduce residence time in the COALESCER and to provide a means for continuously removing the coalesced water, a continuous by-pass system is provided to return the water to the process stream. A rotameter and needle valve are included in the by-pass flow system, to regulate the by-pass flow rate.

**Sample Flow Rotameter** — To monitor the sample flow rate and to detect the presence of air or vapor in the sample line, a rotameter is provided between the flow controller, and the instrument boiler.

**Boiler** — The boiler is fabricated of stainless steel and is heliarc welded. The lower part of the boiler consists of a tube in tube heat exchanger, the hot outgoing sample preheating the incoming sample.

**Cartridge Heater** — The cartridge heater is a high watt density type operating off a Regohm voltage regulator with voltage taps equal to 60, 80 and 100% of heater wattage rating to permit flexibility in boiling the different samples.



**Boiler Assembly**

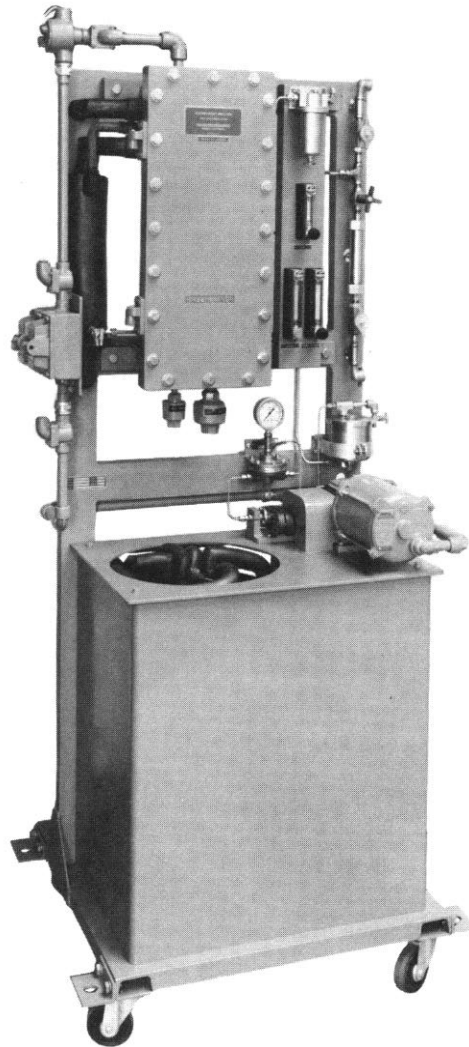
**Cooling Water System** — The cooling water system is supplied with a 100 mesh, stainless steel strainer, a needle valve for flow control, and a rotameter for flow indication. A special model incorporating automatic refrigeration and a closed eutectic liquid cooling system for the boiler is also available. This model permits measurement of initial boiling points to as low as 100°F (See photo below).

**Purge Air System** — The purge air system is provided with a filter, needle valve for flow control and a rotameter for flow indication.

**Thermocouple Assembly** — The thermocouple assembly utilizes an iron constantan type J thermocouple in a non-corrosive sheath. The thermocouple for the various boiling points to be measured is all that will have to be changed in the analyzer to secure the boiling point measurement desired. Special models incorporating multiple thermocouples can be supplied to permit measuring various boiling point temperatures alternately or simultaneously.

#### **CORRELATION OF RESULTS**

Operation of this continuous Boiling Point Analyzer is not a duplication of the ASTM D-86 distillation test method and therefore cannot always 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 of interest. The analyzer readout will correlate directly with ASTM D-86 results with a repeatability of plus or minus 1°F.



**Low Temperature Model With Self-Contained Refrigeration Unit**

## GENERAL SPECIFICATIONS

Normal Operating Temperature Range:	150 to 500°F. (standard models, special model available for operation from 100°F.)
Time Constant:	Decreasing temp - 2 minutes. Increasing temp - 5½ minutes.
Boiling Point Range:	Between Initial and 20% recovered (desired boiling point must be specified on order).
Inlet Sample Pressure Limitations:	30 to 150 psig (consult factory for variations).
Inlet Sample Temperature Limitations:	Sample must be below its initial boiling point temperature and for maximum COALESCER efficiency, should be less than 160°F. (A sample cooler can be supplied as an accessory at extra cost.)
Sample Flow Rate:	5 to 15 ml./min. Sample discharged to atmospheric drain; however, by use of a second pumping assembly (supplied at extra cost) on the metering pump the sample may be returned to a pressurized process line.
IN-LINE FILTER Element Particle Removal Rating:	7 to 14 micron standard with alundum element.
COALESCER Water Removal Rating:	All free water from the sample 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 - 115v ± 10%, 60 cycles 6 amp. maximum. Connection for ½" conduit. (Other voltages and frequencies at extra cost.) Air - Regulated 20 psig., 0.5 cubic feet/hr. (nominal) required. ¼" tube fitting provided at air in. Air out through flame arrestor (connection ¾" NPT) . Water - 100°F. maximum, 4 gal/hr. flow rate (nominal) 5 to 100 psig. ¼" tube fitting provided at "water in," ¼" NPT female at "water out."
Sweepstream Sample In and Out:	⅜" NPT female connections provided. ½" pipe recommended for sweepstream piping by customer.
Sample Drain:	¾" NPT. Sample must drain to atmosphere, but provision can be made to return sample to process line by additional pumping assembly on metering pump.
Analyzer Signal Out:	Type J iron constantan thermocouple, ½" NPT connection.
Dimensions:	29" wide 12" deep x 75" high
Weight:	Approximate gross shipping weight - 440 lbs. Approximate net weight - 300 lbs. These weights do not include horizontal feet and casters.

### Model Numbers

Initial Point — Model 1007

10% Point — Model 1008

5% Point — Model 1347

20% Point — Model 1338

For Low Temperature Model, add suffix /S15 to any of the above