This article discusses the various aspects of the chromatograph/component-gas

separation mechanism, including how the process works and what to expect over

time as the chromatograph ("chromat") runs.

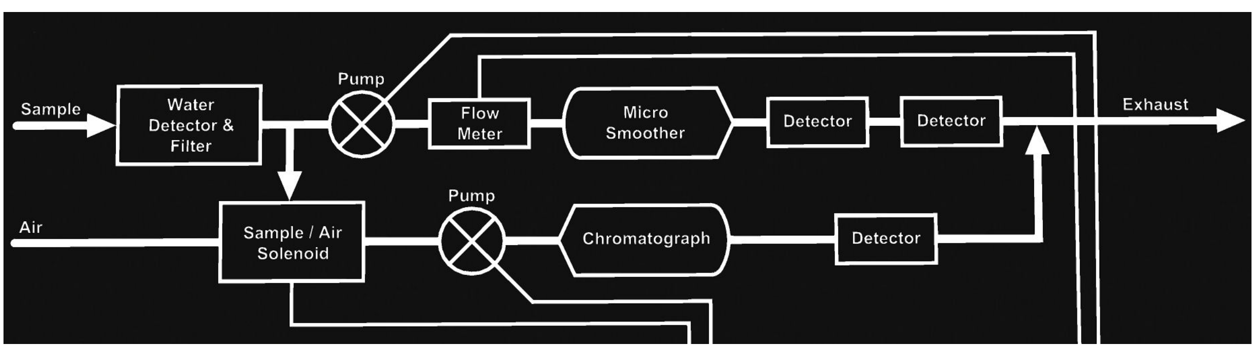
PREREQUISITES:

There are no prerequisites for this article.

SOME BASIC FACTS ABOUT THE BLOODHOUND'S CHROMATOGRAPH:

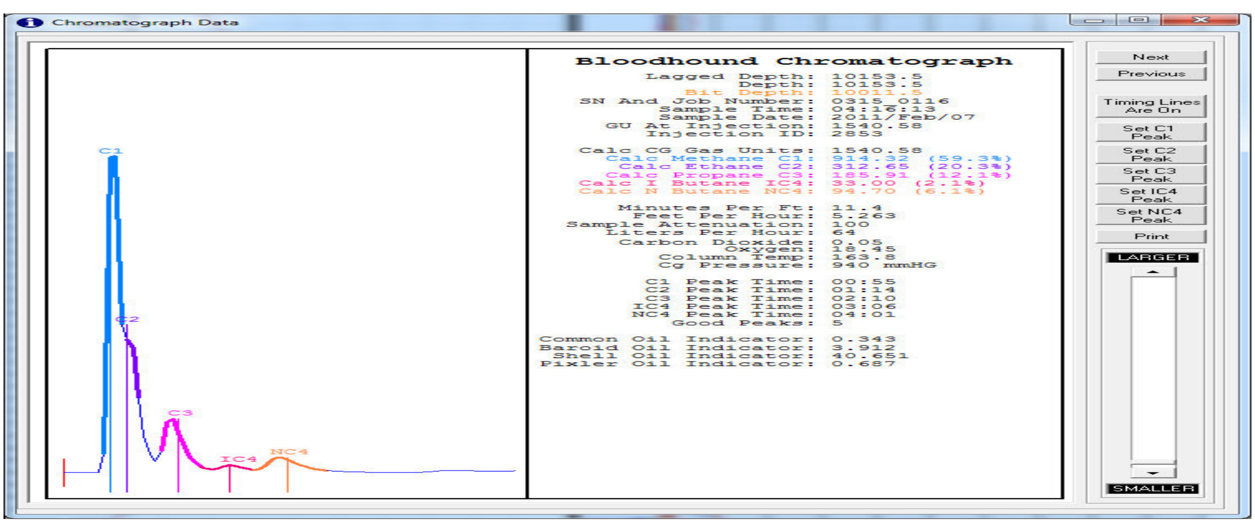
1) SNAPSHOT-BASED: In all versions of the Bloodhound, the chromatography system is actually a second sub-system within the Bloodhound's core infra-red (IR) plumbing circuit. While the IR circuit continually runs and in real-time identifies the total hydrocarbon-based gas volume on a near real-time basis, the Chromatograph is a "snapshot in time" that is created with a short sample that is taken on the fly. Embracing the concept that the Bloodhound is, "two devices in one: a real-time infra-red detector for total gas, CO2, O2, and H2S as well as a chromatograph/hotwire system", this begins to make sense.

Below is a basic flowchart showing the two systems and how they connect.

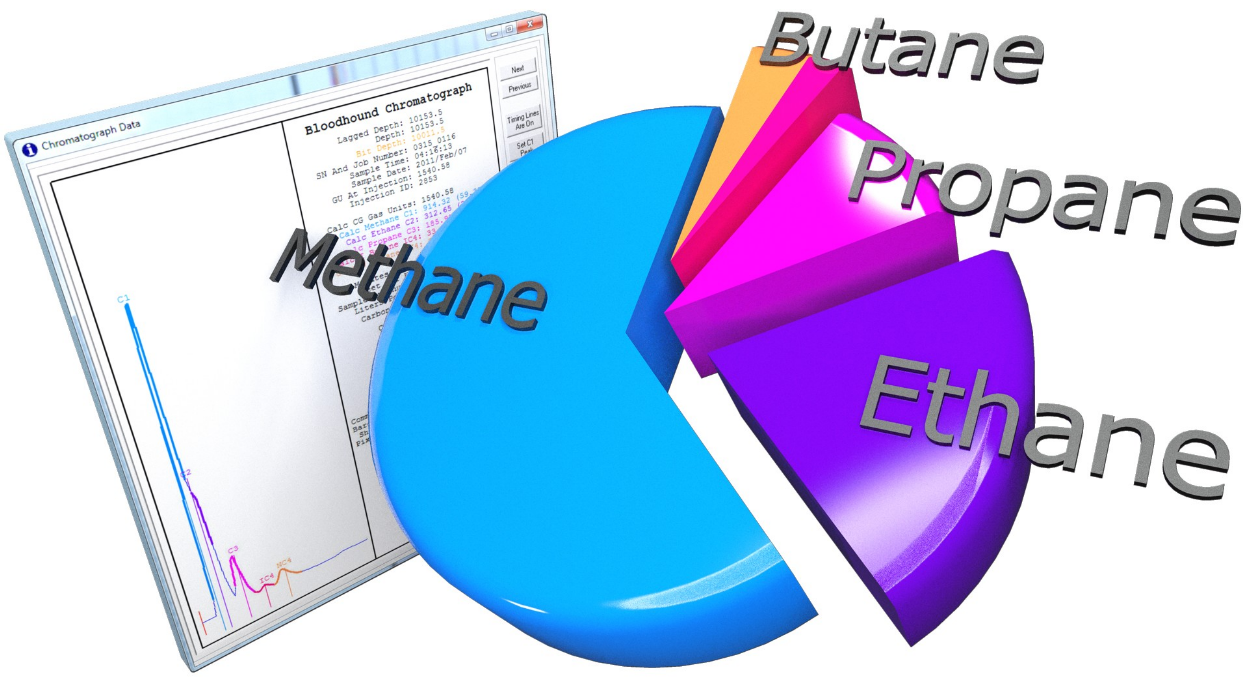


2) SAMPLING MECHANISM: Taking into consideration the "snapshot" concept described above, this is accomplished by having a solenoid in the Bloodhound

open for a few seconds to the main real-time gas line while a second pump which is dedicated to the chromatograph part of the system pulls in a sample. The solenoid then closes and the IR/real-time portion of the system continues as normal. When the solenoid switches away from the sample line, it uses fresh air from the inside of the case as a medium to "push" the sample through the heated chromatograph column, which is a long tube that consists of a proprietary mixture of filtering particulates. As the sample is pushed through the column, the hydrocarbons separate into their component gases in order of molecular weight from lightest to heaviest (EX: methane, ethane, propane, butane, etc.). The gases then escape the end of the column and are run through an entirely separate chamber in the Bloodhound's sensor block where a VQ sensor picks up the hydrocarbons (this is a pollister - think of it as a very modern version of a "hotwire" sensor). When the sensor is activated it sends an electrical signal to the Bloodhound's brain board, where it is interpreted as gas. This occurs over a period of a few minutes, and when a "chromat run" is completed, the whole process starts over again with the solenoid re-opening. This process results in a "chromat run" that takes several minutes to complete and produces a chart of the component gases as parabolas in sequential order from lowest to highest molecular weight (see image below).



3) <u>"MODEL-BASED" COMPONENT GASES:</u> Based on the sampling mechanism described above, one would expect to see a chromatograph breakout of the component gases about once every five to eight minutes. While technically this is true, what the Bloodhound builds is less of a direct reading of the gases by volume at the time of the injection and more of a percentage-based model of the components. This model can be thought of simply as a pie chart that is used against whatever the current "real-time" total gas number is to break out the C-values (see image below).



4) <u>EXTRAPOLATIVE REAL-TIME COMPONENT GASES:</u> What does it mean that a "real-time breakout" of the C-values can be had with this model? Well, once the chromat run is completed and the model is complete as well, the Bloodhound applies to the real-time total gas numbers to approximate component gas volumes

until the completion of the next chromat run. For example, if the current model

says there is 75% methane, and 25% ethane (with no other component gases),

and your current real-time reading on the Bloodhound shows 3000 units, then

in the real-time data viewer screen you should see for methane a total of 2250

units and for ethane a total of 750 units, and for each of the rest 0 units (see

image below for an example of a component gas breakout as shown about 2/3

of the way down on the real-time data screen).

5) SPECIFICATIONS OF THE BLOODHOUND'S CHROMAT: Below is a list of features

outlining the specification of the chromatograph on the current generations of

Bloodhound Units. The Bloodhound's chromatograph has a default setting in

all models that readily captures C1 (methane) through NC4 (normal butane).

This aligns nicely with the included software package, iBall Instruments' Gas

Chart. Using Gas Chart and the Bloodhound, the Bloodhound Standard can

capture, measure, and break apart C1 through NC4. With the Bloodhound

Enhanced unit, you can capture and measure through NC5 (normal pentane).

NOTE: *The Bloodhound *can* identify other gases farther down the chain; however, these will not be identified and factored into the overall model. By raising the column temperature and extending the run-time, you can see these "non-bold" peaks form in these situations. If this is a need, the recommended procedure is to get them to appear on the Gas Chart Chromat Run screens, estimate the volume/percentage under all of the curves, and build a spreadsheet to derive partial gases from the whole using your own model. This is considered a highly advanced process and is not covered in detail in this knowledge base. If you need more information on how this is accomplished, please contact sales or support.*

A) CHROMAT RUN-TIME DEFAULT:

i) BLOODHOUND STANDARD: 8 Minutes, 120 to 130 degrees, captures C1-NC4.

ii) BLOODHOUND ENHANCED: 13 Minutes, 140 to 180 degrees, captures C1-NC4.

B) MAXIMUM "MEASURED" CHROMAT CAPTURE ABILITIES:

i) BLOODHOUND STANDARD: C1 through NC4* with an 8-minute run at approx 120 degrees Fahrenheit.

ii) BLOODHOUND ENHANCED: C1 through NC5* with a 13-minute run at approx 160-degrees Fahrenheit.

NOTE: *Setting longer chromatograph runs will capture gases further down the line, but they will not be automatically calculated into the component values, and must be visually estimated from the chart on the chromat run (see image in section #2 above).*

C) DEFAULT CHROMATOGRAPH COLUMN TEMPERATURE:

i) BLOODHOUND STANDARD: 120-130 degrees Fahrenheit

ii) BLOODHOUND ENHANCED: 140-180 degrees Fahrenheit

D) MAX CHROMAT TEMPERATURE:

i) BLOODHOUND STANDARD: 220-degrees Fahrenheit*

ii) BLOODHOUND ENHANCED: 220-degrees Fahrenheit*

NOTE: *At 220-degrees Fahrenheit, a thermal fuse will trip inside of the chromatograph column which will render the chromatograph inoperative.*