

## Measurement of Color

### Accurate, Real-time Reliable Color Measurements

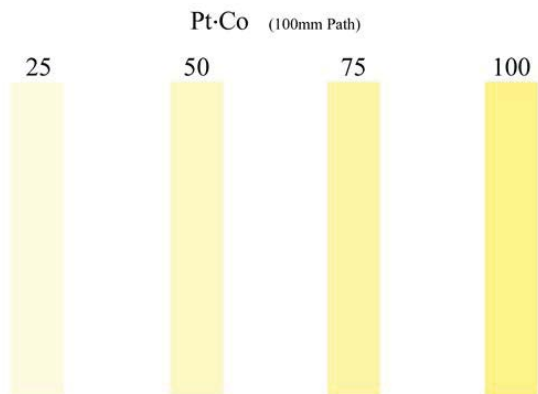
Many liquid product specifications are based on color measurements. Changes in color can be an indicator of final product quality as well as a means to control process variables when implemented in real-time. Several different color “scales” are utilized in measuring color in different products or industries. Some common examples are ASTM color, Saybolt, and APHA (aka Platinum-Cobalt, or Hazen).

Using a Guided Wave color analyzer system to automate the measurements within a process, eliminates the visual judgment of a technician and delivers online real-time color values to the process operators that can be used for quality control or product quality certification. Each color measurement is described here, along with a method summary and suitable Guided Wave analyzer system configuration (listed in Table 1).

### APHA\Pt-Co (Hazen) Color

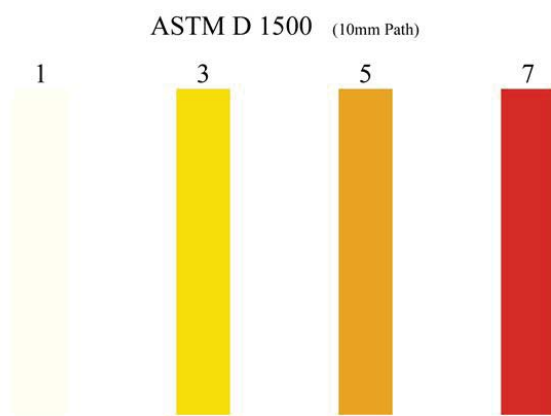
This test method describes a procedure for the visual measurement of the color of light colored liquids. It can be referred to by several names: APHA (American Public Health Association), Platinum-Cobalt (reference ASTM D1209), or Hazen. The measurement was originally developed to detect contamination of water supplies as detected by a slight yellow color. Today it finds use in many industries to measure slight yellowness to determine product quality (either degradation or impurities).

The APHA/Platinum-Cobalt color scale is described in ASTM D1209 “Standard Test Method for Color of Clear Liquids (Platinum-Cobalt Scale)”. The ASTM method is an off-line manual laboratory method. This original test design required an observer to compare the color of a product to a known standard, and then judge the “color”. This color scale ranges from 0 to 500. The lowest value of 0 is referred to as water white. A value of 500 is distinctly yellow.



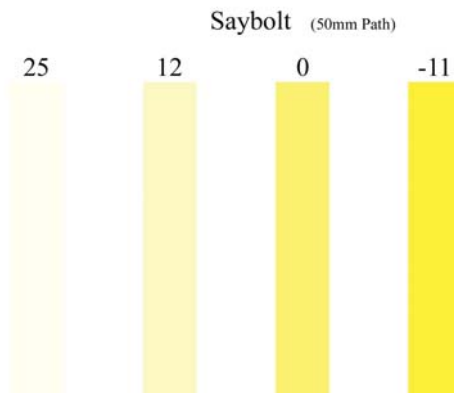
### ASTM Color

ASTM color (reference ASTM D1500, ASTM D1524) describes the color measurement method for fuels including lubricating oils, heating oils, diesel fuels, and petroleum waxes. The color scale ranges from 0.5 to 8. The lowest value of 0.5 being a light yellow, 2 being yellow, 5 being orange, and 8 being a deep red. Both of these ASTM methods are off-line manual laboratory evaluations.



### Saybolt Color

Saybolt color (reference ASTM D156, ASTM D6045) is primarily used in characterizing fuels including automobile and aviation gasolines, jet fuel, diesel fuel, naphthas, kerosene, lubricating oils, heating oils, fuel oils and petroleum waxes. Saybolt is a lighter color range than ASTM. The Saybolt color scale goes from 30, which is considered to be barely perceivable yellow, to -16 which is a definite yellow. Both of these ASTM methods are off-line manual laboratory evaluations. The original test design required an observer to compare the color of a product to a known standard, and then judge the “color”.



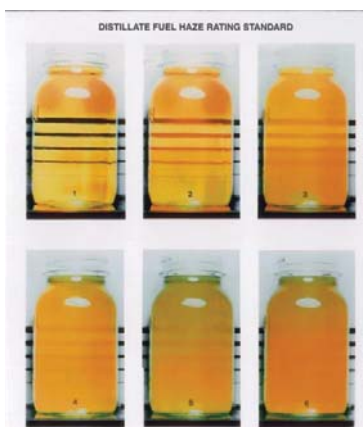
# Measurement of Color

## Turbidity (Haze) Color

Turbidity can be used to indicate solid breakthrough in a process. This can be used as an alarm and to invalidate other optical measurements until the problem can be corrected. Turbidity values can be found in several different units depending on the application. Two common measurement standards are ASTM Method D4176 (Haze), and EPA method 180.1 (NTU).

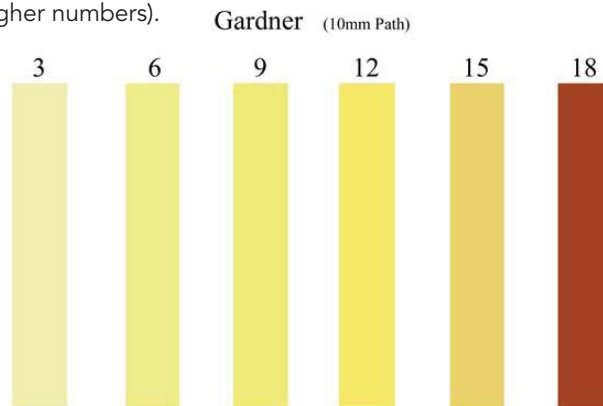
The ASTM method describes the visual standard for measuring turbidity (caused by immiscible water in fuels) by viewing cards with black lines of various thicknesses through a 100mm diameter glass jar of solution. The result is a value (called Haze) between 1 and 6, with 1 being the clearest.

Haze is typically measured in the refining sector and arises from water beyond the solubility limit. EPA 180.1 measures light scatter at 90 degrees in nephelometric turbidity units (NTU). In this method standards of formazin are available at different NTU levels to be used for calibration.



## Gardner Color

Gardner color (reference ASTM D1544, ASTM D6166) is typically used in measuring drying oils, varnishes, fatty acids, polymers, and resins. The Gardner scale is from 1 through 18 with 1 being a light yellow and 18 being a deep reddish brown. Standards for Gardner color can be made from metal salts used in the Platinum-Cobalt scale (for the lower numbers) and from ferric and cobalt chlorides dissolved in hydrochloric acid (for the higher numbers).



## The Smart Choice for Reliable Color Measurement

Guided Wave color analyzers are built on the proven multiwavelength ClearView® db technology. This filter photometer is a dual beam design that provides increased stability over other single beam photometers (document #1033). These complete "ready-to-go" analytical systems include: 1) the photometer or analyzer, 2) the fiber optic cables, 3) the sample interface and 4) the control software and pre-calibration to the specific color application.

Another advantage of the ClearView db analyzer platform is that it is configurable to many different color scale measurements in addition to those described here. The two channel ClearView db analyzer can be configured for two different color measurements, such as ASTM and Saybolt, accomplishing both measurements with one analyzer, simultaneously. Please contact Guided Wave to discuss your specific color measurement needs.

**Table 1: Color Methods Summary & Analyzer Solutions**

	APHA\Pt-Co	ASTM	Saybolt	Turbidity	Gardner
Range	0-500	0.5 to 7	-16 to 30	1 to 6 Haze, NTU 0-1000	1-18
Lightest	0	1	30	1	1
Darkest	500	8	-16	6	18
ASTM Methods	D1209	D1500, D1524	D156, D6045	D4176	D1544, D6166
Typical Configuration	APHA\Pt-Co Analyzer	ASTM Analyzer	Saybolt Analyzer	Turbidity Analyzer	Gardner Analyzer
	30mm Axial Flowcell (50mm Axial Flowcell or SST Probe for low values); Fiber Cables	5mm Flowcell or SST Probe; Fiber Cables	20 or 50mm Axial Flowcell or SST Probe; Fiber Cables	Turbidity Probe or Turbidity Flowcell; Fiber Cables	5mm Flowcell or SST Probe; Fiber Cables
Analyzer Brochure	Doc # 1063	Doc # 1064	Doc #1062	Doc # 1065	Please Call



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