Lovibond® Colour Measurement

Tintometer® Group

Colour Management for Industry

Fuels & Waxes

Fuel Oils & Lubricants, White Oil & Waxes, Petrochemicals, Transparent Liquids

ASTM Color, Saybolt Color, Pt-Co/Hazen/APHA Color, Gardner Color, Lovibond® RYBN, IP Units, Dyed Aviation Gasoline, CIE Values, Spectral Data, Colorimetric Chemical Analysis

Includes tests to determine: acid wash colour, insolubles content in diesel oils, % anti-icing additive fuels, trace concentration of lead in fuels, % marker in diesel fuels, impurities in acetone

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Fuels & Waxes

Ever since it was discovered that distillate fuels can degrade over time, there has been a need for repeatable and accurate tests to check quality.

Fuels and waxes are not colour stable, and one of the first indicators of degradation in performance of the fuel or wax is a change in colour. Lovibond® instruments are widely used in industry to ensure that these colour changes can be monitored reliably and easily, and that industry can ensure their products meet international specifications.

Modern distillate fuels can deteriorate in storage faster than traditional types, and all distillate fuels are vulnerable to the effects of elevated temperatures, so regular testing is needed to analyse trends and ensure the fuel will perform to the required efficiency levels.

Refurbishment of oils, as used in transformers for example, is another industrial application, and colour is again a key determinant of the quality of the refurbishment process. Colour is added to some fuels to ensure correct identification, and also to differentiate them for taxation purposes.

Control of manufacturing also needs accurate analysis of colour, so reliable and repeatable test results are obtained using Lovibond® instruments during refining processes and also to assess possible contamination.

Ever since the late 1800's, Lovibond® instruments have played a major role in accurately assessing the quality of these essential industrial products. Reliable and well suited to the robust demands of petroleum oil production facilities, every instrument is designed to make testing easy, accurate and repeatable, saving the user time and increasing efficiency.

Many thousands of Lovibond® instruments are currently installed in refineries and service providers worldwide. They help to ensure this essential industry continues to maintain high quality standards.

Lovibond® instruments are used for the following tests according to local and international standards – ASTM D1500, ASTM D156 & ASTM D6045 (Saybolt), Pt/Co/APHA Hazen, IP196, Dyed Aviation Gasoline, Marked Oils, Lovibond® RYBN, Gardner color etc.

Why Measure Colour?

The colour of mineral oils and fuels acts as an important indicator of product quality and processing performance throughout the industry. Specifically, colour is used in:

Quality Control

- A quick check on contamination or degradation
- An indication of suitability for a particular purpose
- A guide to the condition of used product

Refining

- As a measure of progress in refining and processing
- Feedback for process control and optimisation
- Identification of product grade

Materials Sourcing

- An immediate guide to supply continuity

Inspection of Incoming Materials

- Assurance that materials meet colour specifications

Production Control

- A check for consistency within and across batches

Inspection of Final Products

- Conformance to predetermined colour tolerances
- Compliance with customer specifications

The Colour Scales

Grading techniques are widely used to assess product colour by comparison with a representative series of fixed colour standards. For many product types, a characteristic set of standards was agreed and adopted long ago to aid colour control and the communication of colour specifications; the result is a series of traditional colour grading scales that have been adopted as industry standards and are still in common use today.

Colour Scale	References	Scope	Range
APHA Color, see Platinum-Cobalt			
ASTM Color	ASTM D 1500, ISO 2049 ASTM D 6045, JIS K 2580	A wide range of petroleum products including lubricating oils, heating oils and diesel fuel oils	0.5 – 8 units
Dyed Aviation Gasoline	ASTM D 2392	Colour acceptability of aviation gasoline that has been dyed for easy identification of grade	Minimum and maximum limits of red, blue, green, brown and purple dyes
Hazen Colour, see Platinum-Cobalt			
Gardner Color	ASTM D 1544	Oils and chemicals ranging from pale yellow to red.	1 – 18 units
Iodine Colour	DIN 6162	Oils and chemicals ranging from yellow to brown. For colours registering 1 or less on the Iodine scale, the Pt-Co Color scale is applicable	1 – 500 units
IP Units	IP 17 Method B	Light coloured products such as refined undyed motor fuel, white spirit or kerosene	Water White (0.25) to Standard White (4.0)
Lovibond® RYBN Colour	IP 17 Method A	Petroleum products in terms of Lovibond® Red, Yellow and Blue units	0.1 – 70 Red, Yellow 0.1 – 40 Blue 0.1 – 3.0 Neutral
Platinum-Cobalt/Hazen/ APHA Color	ASTM D 1209, ASTM D 5386	Clear liquids such as petroleum spirits, solvents and alcohols	0 – 500 mg Pt/l
Saybolt Color	ASTM D 156, ASTM D 6045, JIS K 2580	Light coloured petroleum products including aviation fuels, kerosene, white mineral oils, hydrocarbon solvents and petroleum waxes	–16 (darkest) to +30 (lightest)

Lovibond® Instrument Selection Guide

Spectrophotometric Colorimeters

	PFX*i*-995/P	PFX*i*-950/P	PFX*i*-880/P	PFX*i*-880/IP17	PFX*i*-195/1	PFX*i*-195/2
						
ASTM Color[1)]	●	●	●	o	o	●
Saybolt Color	●	●	●	o	o	●
Pt-Co/Hazen/APHA	●	●	o	o	●	●
Lovibond® RYBN	●	o	o	●		
Gardner Color[2)]	●	o	o	o	●	o
IP Units[3)]	●	o	o	●		
Iodine Colour	o	o	o	o	●	o
Acid Wash Colour	o	o	o	o	o	o
Dyed Aviation Gasoline						
X Y Z tristimulus values	●	●	●	●	●	●
x y Y chromaticity co-ordinates	●	●	●	●	●	●
CIE L*a*b* colour space	●	●	●	●	●	●
L*C*h colour space	●	o	o	o	o	o
Hunter L a b colour space	●	o	o	o	o	o
ΔE colour difference	●	●	●	●	●	●
Transmittance	●	●	●	●	●	●
Optical density	●	o	o	o	●	●
RCMSi Technology	●	●	●	●	●	●
Path length (max.)	6"(153 mm)	6"(153 mm)	6"(153 mm)	6"(153 mm)[3)]	50 mm	50 mm
Windows® Software[4)]	●	o	o	●	●	●
Integrated heater unit	o	o	o	o		

● *Included as standard*

o *optional upgrade*

1) 0.5 – 5 ASTM Color units for diesel fuel

2) The current Gardner scale was specified in 1963; Lovibond® glass filters are also available for earlier 1953 and 1933 versions

3) Results reported as for 18" cell

4) Windows® is a registered trademark of Microsoft Corporation in the United States and other countries

Visual Colorimeters

Visual Comparators

Tintometer Model F	Petroleum Oils Comparator	Gardner Comparator 3000	Comparator 2000+	Nessleriser 2150/2250/1209	
					
	●		●[1]		ASTM Color
					Saybolt Color
			●	●	Pt-Co/Hazen/APHA
●					Lovibond® RYBN
		●	●[2]		Gardner Color
					IP Units
			●		Iodine Colour
			●		Acid Wash Colour
				●	Dyed Aviation Gasoline
					X Y Z tristimulus values
					x y Y chromaticity co-ordinates
					CIE L*a*b* colour space
					L*C*h colour space
					Hunter L a b color space
					ΔE colour difference
					Transmittance
					Optical density
					RCMSi Technology
6”(153 mm)	33 mm tube	10 mm	40 mm	288 mm	Path length
					Windows® Software[4]
					Integrated heater unit

Colour Analysis Made Simple

The four Lovibond® colorimeters described below are easy to use, automatic instruments. There is no need to build up calibration curves as they are already established in the instruments.
The large, clear LCD screen allows the display of graphs and data in a wide variety of languages and the easy-to-use menu system guides operators through the selection of operating parameters.
Measurements are initiated by just a single key press. The accuracy, repeatability and reproducibility of data provided by the instruments allow for tighter colour specifications and greater colour consistency, giving companies the confidence needed to make important decisions regarding high value consignments and refining operations. When measuring Saybolt or Pt-Co Color of clear, water-white products, the long sample path length ensures precise colour measurements, without multiplying errors.

PFX*i*-995/P: Comprehensive Colour Data Requirements

The PFX*i*-995/P provides objective, unbiased colour data according to a comprehensive range of established industry scales, as well as CIE values and spectral data. It is ideal for companies that process a broad selection of product types with varied colour specifications, particularly in central test facilities or in independent testing laboratories.
The instrument is easily customised to display only those scales of interest to the user.

PFX*i*-950/P: Core Colour Scales for Mineral Oils and Petrochemicals

The PFX*i*-950/P is a Colorimeter version of the PFX*i*-995/P and incorporates the popular scales that meet the colour analysis requirements of many oil refineries. It includes both Saybolt Color and ASTM Color – scales that are accepted internationally for oil analysis – as well as Platinum Cobalt Color for oil derivatives and petrochemicals.

PFX*i*-880/P: Automated Saybolt Color and ASTM Color

The PFX*i*-880/P is an automatic colorimeter focusing on Saybolt & ASTM Color. It is designed to conform to the instrument specification in ASTM D 6045. Results can also be displayed in terms of CIE values and spectral data.

PFX*i*-880/IP17: Automated Lovibond® Colour and IP Units

The PFX*i*-880/IP17 is an automatic colorimeter for Lovibond® Colour and IP Units, the colour scales specified in the Institute of Petroleum's Method 17. Results can also be displayed in terms of CIE values and spectral data.

RCMSi Technology – Internet Calibration Capability

All PFX*i* instruments include new RCMSi technology (Remote Calibration & Maintenance Service via internet).
This unique feature allows a calibrated measurement to be taken using an ISO 17025 certified liquid standard. The spectral response is transmitted to The Tintometer Ltd's secure calibration server in Amesbury, UK. On completion of this procedure, a traceable calibration certificate is made electronically available to the user. The RCMSi system not only gives the user added confidence that the instrument is working within tight ISO standards but also reduces the need for expensive on-site servicing and preventative maintenance of the unit.

Confidence in Instrument Performance

The PFX*i*-995/P, PFX*i*-950/P, PFX*i*-880/P and PFX*i*-880/IP17 are rugged colorimeters with a fabricated steel housing; they are designed to function equally as a QC instrument within the laboratory or on 24 hour operation in a production environment. A diagnostic test routine and status report allow users to conduct periodic checks on the instrument.

PFX*i*-880/950/995 Technical Specification

Measuring principle	16 interference filters
Spectral response	420 – 710 nm
Bandwidth	10 nm
Repeatability	
• chromaticity	+/– 0.0002
• ΔE	0.2
Measurement time	Less than 30 seconds
Baseline calibration	Single key press; fully automated
Light source	5 Volt, 10 Watt Tungsten Halogen
Illuminant	CIE Illuminant A, B, C, D65
Observer	2°, 10°
Path length	0.1 –153 mm (0.004" – 6")
Interface	USB. LAN, RS232
Data storage	100,000+ Measurements
Input voltage	Universal, (90 – 214 Vac), via external power supply
Compliance	CE, RoHS, WEEE
Display	240 x 128 back-lit graphic display, (white on blue)
Keypad	23 key tactile membrane keypad, washable polyester with audible feedback
Instructions	English, French, German, Italian, Portuguese, Russian, Spanish, Chinese and Japanese
Heater unit	Optional, Ambient to 95 °C max
Instrument housing	Fabricated steel with tough, textured paint finish
Dimensions	Width 515 mm, depth 195 mm, height 170 mm
Weight	7.7 kg

Each instrument is supplied complete with genuine Lovibond® optical glass cells of the relevant path lengths for each of the colour scales included, a service pack, a spare lamp and instructions.

Colour Scale	Range	Path length	Resolution	PFX*i*-995/P	PFX*i*-950/P	PFX*i*-880/P	PFX*i*-880/IP17
Saybolt Color	–16 (darkest) to +30 (lightest)	100 mm	1	●	●	●	o
ASTM Color	0.5 – 8 units	33 mm	0.1	●	●	●	o
Pt-Co/Hazen/APHA Color	0 – 500 mg Pt/l	100 mm	0.1	●	●	o	o
Gardner Color	1 – 18 units	10 mm	0.1	●	o	o	o
Lovibond® RYBN Colour	0 – 70 Red, Yellow; 0 – 40 Blue; 0 – 3.9 Neutral	1 – 153 mm	0.1	●	o	o	●
IP Units	Water White (0.25) to Standard White (4.0)	6"	–	●	o	o	●
CIE Values	Defined by spectrum locus	Depends on	–				
– X Y Z Tristimulus values		saturation of		●	●	●	●
– x y Y Chromaticity coordinates		sample colour		●	●	●	●
– CIE L*a*b* Colour space				●	●	●	●
– L*C*h Colour space				●	o	o	o
– Hunter L a b Colour space				●	o	o	o
– ΔE colour difference				●	●	●	●
Spectral Data							
– transmittance	0 – 100% (full spectrum and specified wavelength)		0.01%	●	●	●	●
– optical density	0 – 2.5 (full spectrum and specified wavelength)		0.0001	●	●	●	●

Optional Items for Individual Applications

Integrated heater unit	A factory fitted option for maintaining samples such as waxes in a liquid state	o	o	o	o
Windows® software for data capture on PC	Allows data sets to be automatically downloaded to a PC. It also permits remote control of the instrument	●	●	●	●
Certified colour reference standards	Ideal for routine calibration and verification of test data (see page 11)	o	o	o	o

● included as standard **o available as an optional upgrade**

Lovibond® PFX*i*-195 Automatic Colorimeter

Automatic Grading of One Dimensional Colour Scales

The PFX*i*-195 is a highly efficent spectrophotometric colorimeter, which automatically measures the colour of transparent samples according to the one-dimensional colour scales that have been adopted as industry standards in oils and chemicals processing. Results can also be displayed in terms of spectral data and CIE values. Each version of the PFX*i*-195 includes a selection of standard colour scales that are used in a specific industry sector: the PFX*i*-195/1 for chemicals, industrial oils and fatty acids and the PFX*i*-195/2 for petroleum oils and fuels. Colour scale upgrade kits enable additional colour scales to be added to standard instrument versions. The PFX*i*-195 also allows users to obtain a closest match to stored references or to build up a customised scale from a series of reference samples. It includes a calculation and description of off-hue factor for many scales.

Confidence in Colour Measurement

The PFX*i*-195 responds to the demand for consistent and reliable colour data, from R&D through to processing and production. It removes all subjectivity involved in colour measurement, supplying unbiased readings that are unaffected by operator or environment. The proven optical system ensures excellent repeatability of measurements giving confidence in communication and control of colour.

Colour Testing and Analysis Made Simple

The PFX*i*-195 is an easy to use, automatic instrument requiring no special skills to operate. The built-in menu guides users through the selection of operating parameters such as colour scale. Thereafter, readings are made with single key press, taking less than 30 seconds to complete.
Data sets can be saved in the instrument, printed out or automatically down loaded to a PC where they can be processed and stored for future analysis, traceability and monitoring trends. ΔE colour difference measurements can be used to ensure samples fall within acceptable colour limits. Windows® compatible software enables the generation of spectral and CIE diagrams as well as analysis of spectral data. It also permits direct control of the PFX*i*-195 from the computer.

Ideally Suited to Laboratory or Production Environments

Comprehensive facilities for colour measurement and data analysis make the PFX*i*-195 an ideal choice for the laboratory. However, with excellent calibration stability, password protection for tamper proof control and simple operation, the PFX*i*-195 also supports the migration of quality control to the manufacturing area, making it a cost-effective option for dedicated production testing. For easy maintenance, the PFX*i*-195 includes a robust steel sample chamber, which is easily removed, then cleaned or replaced if a spillage occurs, and the precision filament lamp is easily accessed and changed from outside the instrument.

PFX*i*–195 Technical Specification

Measuring principle	9 interference filters
Spectral response	420 – 710 nm
Bandwidth	10 nm
Repeatability	
• Chromaticity (x y)	+/– 0.0004
• ΔE	0.4
Measurement time	Less than 30 seconds
Baseline calibration	Single key press; fully automated
Light source	5 Volt, 10 Watt Tungsten Halogen
Illuminant	CIE Illuminant A, B, C, D65
Observer	2°, 10°
Path length	0.1 – 50 mm
Interface	USB, LAN, RS232
Data storage	100,000+ Measurements

PFX*i*–195 Technical Specification

Input voltage	Universal (90 – 240 Vac), via external power supply
Compliance	CE, RoHS, WEEE
Display	240 x 128, back-lit graphic display, (white on blue)
Keypad	23 key tactile membrane keypad; washable polyester with audible feedback
Languages	English, French, German, Italian, Portuguese, Russian, Spanish, Chinese and Japanese
Instrument housing	Fabricated steel with tough, textured paint finish
Dimensions	Width 435 mm, depth 195 mm, height 170 mm
Weight	6.8 kg

Each PFX*i*-195 is supplied complete with Windows® compatible software, genuine Lovibond® optical glass cells for the colour scales included, a spare lamp and instructions.

Colour Scale	Range	Path length	PFX*i*–195/1	PFX*i*–195/2
Saybolt Color	–16 (darkest) to +30 (lightest)	50 mm	o	●
ASTM Color	0.5 – 8 units	33 mm	o	●
Pt-Co/Hazen/APHA Color	0 – 500 mg Pt/l	50 mm	●	●
Gardner Color	1 – 18 units	10 mm	●	o
Iodine Colour	1 – 500 units	10 mm	●	o
Acid Wash Colour (ASTM D848)	1– 14	Tube AF223	o	o
CIE Values	Defined by spectrum locus	Depends on		
– X Y Z Tristimulus values		saturation of	●	●
– x y Y Chromaticity coordinates		sample colour	●	●
– CIE L*a*b* Colour space			●	●
– ΔE colour difference			o	o
Spectral Data				
• transmittance	0 – 100% (full spectrum and specified wavelength)		●	●
• optical density	0 – 2.5 (full spectrum and specified wavelength)		●	●

Optional Items for Individual Applications

Certified colour reference standards	Ideal for routine calibration of and verification of test data (see page 11).	o	o
Adaptor for 10.65 mm (Gardner) tubes	For Gardner color of hot samples in tubes, e.g. testing the colour stability of fatty acids and drying oils after heating.	o	o
Adaptor for 33 mm (ASTM Color) tubes	For ASTM Color of samples in tubes.	o	o
Spectrophotometer cell holder	Allows use of standard width (12.5 mm) spectrophotometer cells.	o	o

● **included as standard** o **available as an optional upgrade**

Lovibond® Tintometer® Model F

The Tintometer® Model F Colorimeter is a visual instrument for measurement of practically all petroleum products in terms of Lovibond® units according to IP 17 Method A. Colour is determined by comparing the light transmitted through the sample with that transmitted through Lovibond® Colour standards – a series of accurately calibrated coloured glasses in each of the colours red, yellow and blue, going from very pale to dark. Waxes are measured for colour either by transmitted light when in a molten condition or by reflected light when solid.The Model F is supplied with a complete set of 11 racks containing the Lovibond® Colour standards (Red 0.1 – 0.9, 1.0 – 9.0, 10.0 – 70; Yellow 0.1 – 0.9, 1.0 – 9.0, 10.0 – 70; Blue 0.1 – 0.9, 1.0 – 9.0, 10.0 – 40; Neutral 0.1 – 0.9, 1.0 – 3.0), a sample chamber liner with a white PTFE reference, a spare white reference, standard rectangular fused glass cells, and instructions.

Lovibond® Comparator System 2000+

A Flexible, Modular System for Visual Colour Grading

Using a suitable Comparator instrument, the sample is visually matched against calibrated, colour stable glass standards in test discs. The Comparator 2000+ is a short path length instrument (up to 40 mm) for visually matching samples with relatively dark colours. Nessleriser systems are longer path length instruments for matching a column of sample in a glass cylinder of appropriate path length; they are designed for measuring unsaturated samples that are below the sensitivity of the Comparator 2000+. A selection of Lovibond® colour grading discs for use with the Comparator System 2000+ is shown in the table right.

Lovibond® Gardner Comparator 3000

A single scale, 3-field instrument for visual colour grading by direct comparison between the sample and Lovibond® glass colour standards housed in a pair of discs. The advantage of a 3-section field of view is that the sample and two consecutive glasses on the colour scale are viewed simultaneously, making it easier to achieve the optimum colour match. For rapid colour grading within predetermined colour limits, the glass standards can be set to the two limiting colours so that it is easy to check that the sample is within tolerance. The tungsten halogen light source is colour corrected to CIE standard illuminant C, which guarantees constant lighting conditions for colour grading. All industry – standard tubes can be used in the instrument.

Lovibond® Petroleum Oils Comparator

The Lovibond® Petroleum Oils Comparator (POC) conforms to the instrument requirements specified in ASTM D 1500 for visual determination of ASTM Color by direct comparison with coloured glass standards. It is widely used for colour grading of petroleum products such as lubricating oils, heating oils and diesel fuel. The POC is a 3-field instrument which incorporates the 16 glass standards that make up the scale in a pair of discs. With a 3-section field of view, the sample and two adjacent standards on the ASTM Color scale are viewed simultaneously, making it easier to achieve the optimum colour match. For rapid grading within predetermined colour limits, the glass standards can be set to the two limiting colours. The tungsten halogen light source is colour corrected to CIE illuminant C, guaranteeing constant lighting conditions for colour grading, irrespective of ambient lighting.

Colour Scale	Disc	Range Covered	Instrument	Accessories Required
ASTM Color	24 12 70	1, 2, 3, 3.5, 4, 4.5, 5 units [1]	Comparator 2000+	33 mm cell, 60 68 80
	29 28 30	0.5, 1, 2, 3, 3.5, 4, 4.5 units [1]	Comparator 2000+	33 mm cell, 60 68 80
Dyed Aviation	24 78 00	Blue, Green, Brown, Purple (min and max of each)	Nessleriser 2250	200 mm cylinders, 35 42 10
Gasoline	24 79 00	Red (min and max)	Nessleriser 2250	200 mm cylinders, 35 42 10
Gardner Color	24 30 30	1, 2, 3, 4, 5, 6, 7, 8, 9 units	Comparator 2000+	10 mm cell, 60 68 10
	24 30 40	10, 11, 12, 13, 14, 15, 16, 17, 18 units	Comparator 2000+	10 mm cell, 60 68 10
Pt-Co/Hazen/APHA	24 28 01	50, 75, 100, 150, 200, 250, 300, 400, 500 mg Pt/l	Comparator 2000+	40 mm cell, 60 68 10
	24 28 50	200, 225, 250, 300, 350, 400, 450, 500 mg Pt/l	Comparator 2000+	40 mm cell, 60 68 90
	28 41 70	10, 20, 30, 40, 50, 60, 70, 80, 90 mg Pt/l	Nessleriser 2150	113 mm cylinders, 35 30 80
	28 41 20	70, 85, 100, 125, 150, 175, 200, 225, 250 mg Pt/l	Nessleriser 2150	113 mm cylinders, 35 30 80
	28 41 30	50, 60, 70, 80, 100, 150, 200, 250, 300 mg Pt/l	Nessleriser 2150	113 mm cylinders, 35 30 80
	28 41 50	0, 2.5, 5.0, 7.5, 10, 15, 20, 25, 30 mg Pt/l	Nessleriser 2250	250 mm cylinders, 35 42 00
	28 41 60	30, 35, 40, 45, 50, 55, 60, 65, 70 mg Pt/l	Nessleriser 2250	250 mm cylinders, 35 42 00
	28 39 70	0, 2.5, 5.0, 7.5, 10, 15, 20, 25, 30 mg Pt/l	Nessleriser 1209 [2]	100 ml cylinders, 35 42 30
	28 39 80	30, 35, 40, 45, 50, 55, 60, 65, 70 mg Pt/l	Nessleriser 1209 [2]	100 ml cylinders, 35 42 30

Recommended item for 2000+ Comparator System

Daylight 2000 Lighting units: Standardised bench top light sources for the comparator 2000+ and Nessleriser. These guarantee constant lighting conditions for accurate colour grading, particularly when the sample is very pale in colour.

[1] Restricted range used by UK MoD for F76 type diesel fuel [2] Conforms to the path length requirements specified in ASTM D 1209

Test Kits based on the Comparator System 2000

Available for the most commonly used colour scales and colorimetric tests, these kits are a convenient means of ordering the complete range of equipment required.

Colorimetric Chemical Analysis

Colorimetric chemical analysis is a quantitative test method which relies on measuring the intensity of colour produced by chemical reactions to determine the concentration of a particular chemical present in a sample. Procedures for colorimetric analysis rely on three basic stages:

- isolation of the chemical from interfering materials which may be present;
- production of a colour by the action of an appropriate chemical reagent on the isolated chemical;
- measurement of the depth of colour so produced which is proportional to the concentration of the chemical.

The Tintometer Group has simplified the procedure for many popular colorimetric tests by supplying standard methods and a corresponding series of ready-made coloured glass filters, which are calibrated to allow direct measurement of concentration levels. The treated sample and the glass filters are viewed together in a 'Comparator' instrument under standardised lighting conditions to obtain the optimum colour match. The following colorimetric test discs are available:

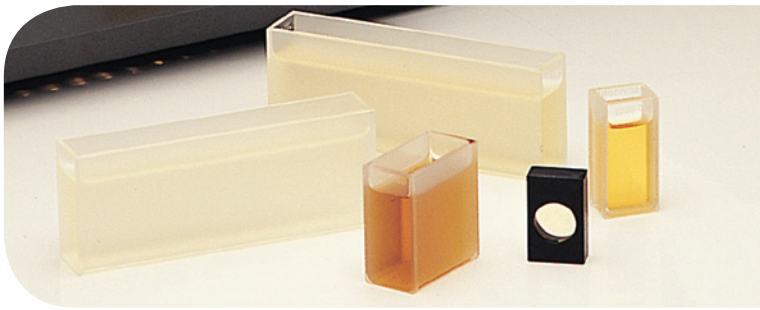
Type	Colour Scale	Range	Apparatus Included
AF 334 43 33 40	Gardner Color	1 – 18 units	Lovibond® Comparator 2000+ with Daylight 2000 Lighting Unit, Gardner discs 4/30 AS & 4/30 BS, W680/OG/10 mm path length fused glass cell
AF 329 43 32 90	Pt-Co/Hazen/APHA Color	0 – 250 mg Pt/l	Nessleriser 2150 with Daylight 2000 Lighting Unit and Nessler cylinders, Nessleriser 2250 upgrade with Nessler cylinders, Pt-Co/Hazen discs CAA, CAB & NSB, stand for using Nessleriser with natural lighting
AF 325 43 32 50	Pt-Co/Hazen/APHA Color	10 – 250 mg Pt/l	Nessleriser 2150 with Daylight 2000 Lighting Unit and Nessler cylinders, Pt-Co/Hazen discs NSH & NSB, stand for using Nessleriser with natural lighting
AF 328 43 32 80	Pt-Co/Hazen/APHA Color, Low Range	0 – 70 mg Pt/l	Nessleriser 2250 with Daylight 2000 Lighting Unit and Nessler cylinders, Pt-Co/Hazen discs CAA & CAB, stand for using Nessleriser with natural lighting
AF 327 43 32 70	Pt-Co/Hazen/APHA Color, Low Range, according to ASTM D 1209	0 – 70 mg Pt/l	Nessleriser 1209 with the Daylight 2000 Lighting Unit and 100 ml (288 mm) Nessler cylinders, Pt-Co/Hazen discs 1209/1 & 1209/2, deionised water

Test	Disc	Range Covered	Instrument	Accessories Required	Scope
Acid Wash Colour	29 64 30 29 64 31	1, 2, 3, 4, 5, 6, 7, 8	Comparator 2000+	Tube, 35 22 20	Quality testing of industrial aromatic hydrocarbons according to ASTM D 848
Anti-Icing Additives	24 33 00	0.04, 0.06, 0.08, 0.10, 0.12, 0.14, 0.15, 0.16, 0.18 % by vol.	Comparator 2000+	10 ml, 13.5 mm cells 35 42 43	Determination of % by volume of diethylene glycol monomethyl ether in aviation fuels
	24 44 10	0, 0.05, 0.07, 0.08, 0.1, 0.12, 0.15, 0.2% by vol	Comparator 2000+	10 ml, 13.5 mm cells 35 42 43	As above; conforms to NATO requirements
Carbonisable Substances	24 46 00	0.2, 0.6, 0.8, 1.0, 1.2, 1.4, 1.6, 1.8, 2.0 % insolubles	Comparator 2000+	13.5 mm cells 60 68 30	Measurement of % insolubles in lubricating oil
	29 16 10	Pass/fail, single filter	Comparator 2000+	Tube, 35 26 00	Quality testing of white mineral oils (ASTM D 565)
	29 64 90	Pass/fail, single filter	Comparator 2000+	10 mm cell, 60 68 10	British Pharmacopoeia sulphuric acid test for carbonisable substances in liquid paraffin
Euromarker in Kerosene	24 70 10	0, 20, 50, 100, 120, 150%	Comparator 2000+	Extraction tube 35 26 20	Determination of % of recommended dosage (6 mg/l).
Euromarker in Clean Diesel	24 70 20	0, 50, 75, 100, 125%	Comparator 2000+	Extraction tube 35 26 20	Warehouse test for determination of % recommended dosage (6mg/l).
	24 70 30	0, 5, 10, 20, 30, 40, 50, 75, 100%	Comparator 2000+	Extraction tube 35 26 20	Roadside test for determination of % of marked oil in unmarked oil
Impurities in Acetone	29 28 00	Pass/fail, single filter	Nessleriser 2150	Nessler cylinders 35 30 80	Quality testing of acetone and methanol according to ASTM D 1363
Lead Content	25 17 00	0.002, 0.004, 0.006, 0.008, 0.010, 0.012, 0.014, 0.016, 0.018, 0.02 mg Pb	Comparator 2000+	5 mm cell, 60 67 90 20 mm cell, 60 68 50	Aviation turbine fuels and light petroleum distillates, as specified in IP 224
	29 65 90	2, 4, 6, 8, 10, 12, 14, 16, 20 ppb	Comparator 2000+	13.5 mm cells 35 42 43	Determination of trace concentrations of lead gasoline or naphthas, UOP Method 350
Methanol in Water	29 99 70	0, 100, 300, 500, 700, 900, 1200, 1500, 2000 ppm V/V	Comparator 2000+	13.5 mm cells 35 42 43	Methanol in water
Quinizarin in Marked Oils	24 43 10	10, 20, 30, 40, 50, 60, 70, 80, 100% marked oil	Comparator 2000+	Extraction tube 35 26 20	Roadside test to determine presence of quinizarin marked oils as prescribed by by HM Revenue & Customs
	24 43 20	40, 50, 60, 80, 100, 120, 140, 200% recommended dosage	Comparator 2000+	Extraction tube AF 260 35 26 20	Percentage of marker in marked oil Warehouse test

Accessories

Genuine Lovibond® Colorimetry Cells

Accurate test results depend on high quality, clean cells. Precision fused cells are supplied in a range of dimensions and path lengths, made from optical glass to the highest standards at the Lovibond® factory.
For instruments equipped with a heater unit and whenever cells are subjected to thermal shock, it is recommended that borosilicate cells be used.



Certified Colour Reference Standards

- Ideal for routine calibration and verification of test data.
- Ensures good inter-laboratory and inter-instrument correlation.
- Supplied in a 500 ml bottle with a 12-month shelf life.
- Full traceability to internationally recognised standards (ASTM, Saybolt & Gardner Color standards certified under UKAS/ ISO 17025; Lovibond® RYBN & Pt-Co Colour certified under ISO 9001 quality system).
- All classified as non-hazardous according to EU directives.
- Each bottle supplied with full certification including MSDS.

Series	**W600 Optical**		**W600 Borosilicate**		**W680 Optical**	
Use	**PFX*i*-995/950/880/195 Series, Tintometer®**		**Model F**		**Comparator 2000/3000**	
Path Length	**Order Code**	**Type**	**Order Code**	**Type**	**Order Code**	**Type**
10 mm	60 59 60	W600/OG/10	65 59 60	W600/B/10	60 68 10	W680/OG/10
25 mm	60 59 90	W600/OG/25	65 59 90	W600/B/25	60 68 60	W680/OG/25
33 mm	60 60 10	W600/OG/33	65 60 10	W600/B/33	60 68 80	W680/OG/33
40 mm	60 60 20	W600/OG/40	65 60 20	W600/B/40	60 68 90	W680/OG/40
50 mm	60 62 00	W600/OG/50	65 62 00	W600/B/50	60 69 30	W680/OG/50
100 mm	60 60 30	W600/OG/100	65 60 30	W600/B/100		
1/16"	60 60 40	W600/OG/1/16"	65 60 40	W600/B/1/1"		
1/4"	60 60 60	W600/OG/1/4"	65 60 60	W600/B/1/4"		
1/2"	60 60 70	W600/OG/1/2"	65 60 70	W600/B/1/2"		
1"	60 60 80	W600/OG/1"	65 60 80	W600/B/1"		
2"	60 60 90	W600/OG/2"	65 60 90	W600/B/2"		
5 1/4"	60 61 30	W600/OG/5 1/4"	65 61 30	W600/B/5 1/4"		
6"	60 61 50	W600/OG/6"	65 61 50	W600/B/6"		

See website for other available path lengths – www.lovibond.com

Certified Colour Reference Standards

Colour Scale	**Nominal Certified Value**	**Code**	**Accreditation**
ASTM Color	<0.5	134290	ISO 17025
	1	134000	ISO 17025
	3	134010	ISO 17025
	5	134020	ISO 17025
Gardner Color	2	134200	ISO 17025
	5	134210	ISO 17025
	8	134220	ISO 17025
Lovibond® RYBN	0.4R 1.9Y 0.1N (5 1/4")	134080	ISO 9001
Colour	1.0R 4.3Y 0.1N (5 1/4")	134090	ISO 9001
	1.4R 7.3Y 0.2N (5 1/4")	134100	ISO 9001
	1.6R 11.0Y 0.1N (5 1/4")	134110	ISO 9001
	1.8R 14.0Y 0.3N (5 1/4")	134120	ISO 9001
	2.5R 24.0Y 0.5N (5 1/4")	134130	ISO 9001
	3.3R 33.0Y 0.3N (5 1/4")	134230	ISO 9001

Colour Scale	**Nominal Certified Value**	**Code**	**Accreditation**
Pt-Co/Hazen/APHA	5	134140	ISO 9001
Color	10	134150	ISO 9001
	15	134160	ISO 9001
	30	134170	ISO 9001
	50	134180	ISO 9001
	100	134190	ISO 9001
	500	462803	ISO 17025
Saybolt Color	-10	134040	ISO 17025
	0	134050	ISO 17025
	+12	134060	ISO 17025
	+25	134070	ISO 17025

Reference liquid standards and conformance filters are assigned a nominal value and Lovibond Tintometer always endeavours to match this value as closely as possible. On occasion, it may not be possible to match the requested value exactly. The value achieved and the expected performance tolerances will, of course, always be reported.

GB92/852

0630
ISO 17025

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