Lovibond® Colour Measurement

Oils & Fats

Edible Oils & Fats, Oleochemicals & Surfactants, Industrial Oils & Resins,
Liquid Chemicals, Transparent Liquids

Lovibond®
www.tintometer.com

Colour Management for Industry

Contents

Oils & Fats

High quality processing in the edible oils and fats industry depends on reliable testing. As a large proportion of the production is traded internationally, both suppliers and buyers need a common, easily understood language to determine product quality. One of the key determinants of quality is the colour of the product. Using Lovibond® colour measurement instruments ensures this essential communication.

Colour is measured from receipt of raw material right through to finished product, and for over a century, Lovibond® instruments have been helping the industry to achieve its quality goals.

The Lovibond® colour scale provides an easily understood method for communicating colour values locally and internationally. This is because the scale is simple to understand and communicate, and permits easy assessment by the plant operator. It is the only internationally accepted 3 dimensional colour scale that is offered in both a visual as well as an electronic instrument.

Reliable and repeatable test results are the key to ensuring final product quality, and also to minimise production costs. Speed of analysis can also be vital for efficient process control. Simplicity of operation helps to reduce error, and increase productivity.

Lovibond® colour measurement instruments have a close association with the oils and fats industry, dating back to the late 1800's. Reliable and well suited to the robust demands of edible oil factories, every instrument is designed to make testing easy, accurate and repeatable.

Many thousands of Lovibond® instruments are currently installed in oils and fats refineries and service providers worldwide. They ensure this vital industry continues to grow and prosper.

Lovibond® instruments are specified in international standards – ISO15305 – AOCS Cc 13e-92 – AOCS Cc 13j-97 – BS684 – JJG758.

The Tintometer Limited

UKAS CALIBRATION 0630
ISO 17025

ISO 9001 Q852

Why Measure Colour?

Many circumstances exist where some form of colour measurement is necessary to quantify and assess a product's colour or where colour is an indirect measure of product quality or processing performance:

To Ensure Uniformity of Colour in Production

If the colour of a product varies from one batch to another, it may be perceived as being an inferior product.

To Achieve Aesthetic Quality

Presentation of an acceptable and consistent colour is of tremendous importance to consumers.

As a Performance Indicator

For example, to assess the performance of decolorising materials or to determine a product's suitability for a particular purpose.

To Indicate Product Condition

For example, as an indication of the level of purity, the degree of deterioration over time, adverse growing conditions experienced by natural raw materials or the condition of used product.

To Indicate the Level of Refining/Processing Undergone

In oil refining processes, the colour provides a good indication of the degree of refinement and allows optimisation of the refining process.

As a Content Indicator

There is often a correlation between colour and chemical/physical content (for example, the amount of chlorophyll in oil). In these cases, colour measurement may offer a simple alternative to more complex means of testing.

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 selection of traditional colour grading scales that have been adopted as industry standards and are still in common use today. In particular, the Lovibond® Colour scale and its variant AOCS Tintometer® Colour have gained international acceptance for oils and oil derivatives.

Colour Scale	References	Scope	Range
AOCS Tintometer® Colour	AOCS Cc 13b-45 the Wesson Method, AOCS Cc 8d-55, AOCS Cc 13j-97	Modified red and yellow version of the Lovibond® RYBN colour scale used for oils, fats and derivatives	0.1 – 20 Red 1.0 – 70 Yellow
beta Carotene	BS684 Section 2.20	Direct measurement of beta carotene content	Parts per million
Chlorophyll A & B	AOCS Cc 13d-55	Direct measurement of chlorophyll content	Parts per million
Dichromate Colour Index	DGF C-IV 4d (discontinued)	Oils and fats where colours are similar to potassium dichromate solutions	0 – 10
FAC Colour	AOCS Cc 13a-43	Approved by the Fats Analysis Committee of the American Oil Chemists Society for grading dark coloured oils, fats and tallows	1 – 45 (odd numbers)
Gardner Color	ASTM D 1544,ASTM D 6166, AOCS Td 1a-64	Oils & chemicals ranging from pale yellow to red, including lecithins, resins, drying oils & fatty acids	1 – 18 units
Hess-Ives Color Units		Chemicals and surfactant liquids	
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 Colour scale is applicable	1 – 500 units
Klett Color (blue filter KS-42)	AOCS Dd 5-92	Detergents and surfactants	0 – 1000 units
Kreis Value		Colorimetric test for quality control of fats and oils for oxidative rancidity which uses Lovibond® Red units	Depends on concentration & pathlength
Lovibond® RYBN Colour	ISO 15305, BS 684, AOCS Cc 13e-92, AOCS Cc 13j-97	Based on calibrated series of coloured glasses in each of the colours red, yellow and blue, going from very pale to dark. It is widely used for oils, fats, chemicals, resins and other transparent liquid products; it is also used for some light-reflecting products such as fats and waxes	0.1 – 70 Red, Yellow; 0.1 – 40 Blue; 0.1 – 3.0 Neutral
Platinum-Cobalt/Hazen/ APHA Color	ISO 6271, AOCS Ea 9-65, AOCS Td 1b-64	Clear oils, chemicals and petrochemicals such as glycerine, solvents, carbon tetrachloride, and petroleum spirits	0 – 500 mg Pt/l
Rosin,US Naval Stores	ASTM D 509	Rosins varying in colour from yellow to reddish orange	XC – D + FF
Yellowness Index	ASTM D 1925, ASTM E 313	Determination of the degree of yellowness under daylight illumination Calculated from X Y Z tristimulus values	

Lovibond® Instrument Selection Guide

Colour Scales

Spectrophotometric Colorimeters[1)]

	PFX*i*-995	PFX*i*-950	PFX*i*-880/L	PFX*i*-880/AT	PFX*i*-195/1	PFX*i*-195/3
						
AOCS Tintometer® Scale	● [2)]	●	○	●		
beta Carotene	●	○	○	○		
Chlorophyll A&B	●	○	○	○		
Dichromate Index			○			
FAC	●	○		○		●
Gardner Color	●	●	○	○	●	●
Hess-Ives Color Units	●				○	○
Iodine	●	○	○	○	●	
Klett Color (blue filter KS-42)	●	○	○	○	○	○
Kreis Value	●		○			
Lovibond® RYBN Colour	● [3)]	●	●			
Pt-Co/Hazen/APHA	●	○	○	○	●	○
Rosin, US Naval Stores[4)]					●	○
Yellowness Index	○	○	○	○	○	○
RCMSi Technology	●	●	●	●	●	●
XYZ tristimulus values	●	●	●	●	●	●
xyz 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	●				●	●
Path Length	Up to 6"(153 mm)	Up to 6"(153 mm)	Up to 6"(153 mm)	Up to 6"(153 mm)[3)]	Up to 50 mm	Up to 50 mm
Windows™ Software[6)]	●	○	○	○	●	●
Integrated heater unit	○	○	○	○		

● included as standard
○ optional upgrade

1) Colour scale upgrade kits for Saybolt and ASTM Color are available for spectro- photometric colorimeters
2) Includes AF960 AOCS 3) Includes AF960 Lovibond® 4) Glass colour standards for US Naval Stores Rosin Colour are also available

Visual Colorimeters

Visual Comparators

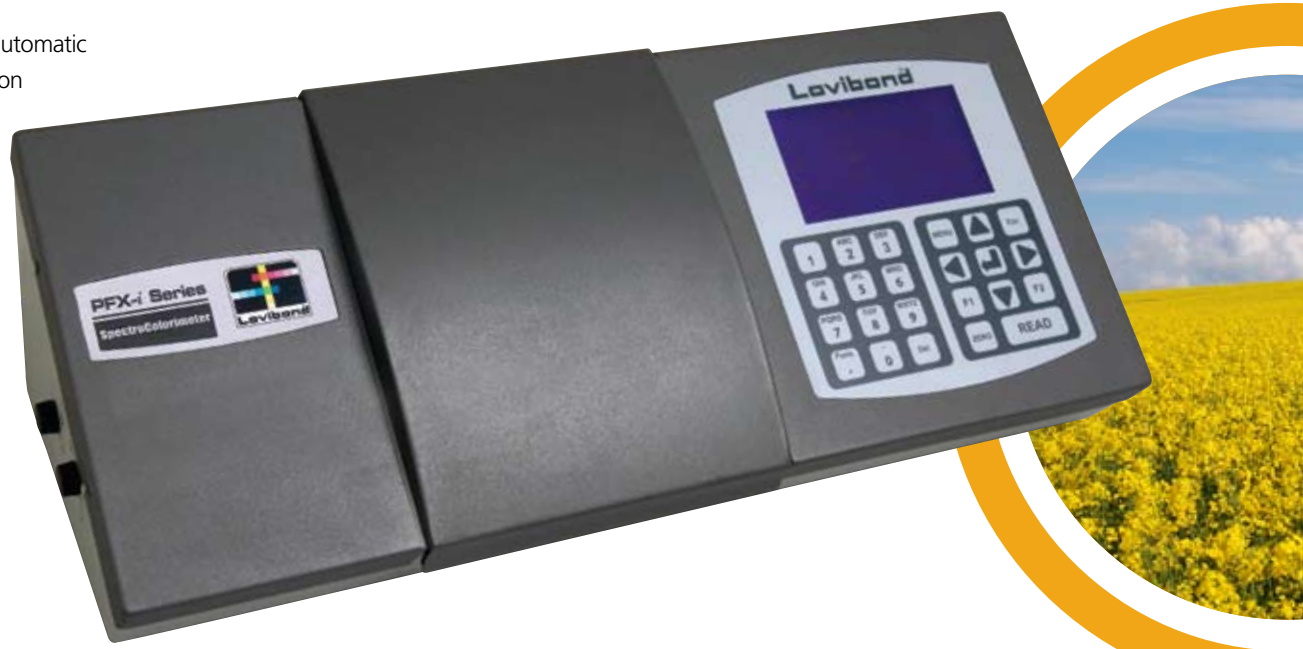
	PFX*i*-195/6	Tintometer® Model F Colorimeter	Tintometer® Model AF710-3 Colorimeter	Comparator 3000	Comparator 2000+	Nessleriser 215/2250 /1209
						
AOCS Tintometer® Scale			●			
beta Carotene				●		
Chlorophyll A&B				●	●[5]	
Dichromate Index						
FAC					●	
Gardner Color	○					
Hess-Ives Color Units	●					
Iodine						
Klett Color (blue filter KS-42)	●					
Kreis Value		●				
Lovibond® RYBN Colour						
Pt-Co/Hazen/APHA	●				●	●
Rosin, US Naval Stores[4]	○			●		
Yellowness Index	○					
RCMSi Technology	●					
XYZ tristimulus values	●					
xyz chromaticity co-ordinates	●					
CIE L*a*b* colour space	●					
L*C*h colour space	○					
Hunter L a b colour space						
ΔE* Color difference	●					
Transmittance	●					
Optical density	●					
Path Length	Up to 50 mm	Up to 6"(153 mm)	5 1/4 (133 mm) Rosin	Up to 7/8 (10 mm)	Up to 40 mm	Up to 288 mm
Windows™ Software[6]	●					
Integrated heater unit						

5) The current Gardner scale was specified in 1963; Lovibond® glass filters are also available for earlier 1953 and 1933 versions.
6) Windows™ is a registered trademark of Microsoft Corporation in the United States and other countries

● included as standard
○ optional upgrade

Colour Analysis Made Simple

The four colorimeters shown 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 Lovibond® Colour, the unique 5¼ inch path length ensures precise colour measurements, without multiplying errors.



PFX*i*-995: Comprehensive Colour Data Requirements

The PFX*i*-995 provides objective, unbiased colour data according to a comprehensive range of established industry scales, spectral data and CIE values. 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: Core Colour Scales for Oils and Oil Derivatives

The PFX*i*-950 is a Colorimeter version of the PFX*i*-995 incorporating the popular scales that meet the colour analysis requirements of many oil processors. It includes both Lovibond® Colour and AOCS Tintometer® Colour scales that are accepted internationally for oil analysis – as well as Gardner Color for industrial oils, derivatives and specific products such as sunflower oil.

PFX*i*-880: Automated Lovibond® Colour or AOCS-Tintometer® Colour

The PFX*i*-880/L and PFX*i*-880/AT are automatic versions of visual Lovibond® instruments, which are designed to meet a growing demand for consistent and objective colour data. The PFX*i*-880/L expresses colour in terms of the Red, Yellow, Blue and Neutral units that make up the Lovibond® Colour scale; the PFX*i*-880/AT gives colour data according to the AOCS Tintometer® Colour scale, a modified red and yellow version of the Lovibond® scale. On both instruments, results can also be displayed in terms of CIE values and spectral data.

RCMSi Technology – Internet Calibration Capability

The PFX*i* includes 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 e-mailed 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, PFX*i*-950, PFX*i*-880/AT and PFX*i*-880/L 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 allows users to conduct periodic checks on the instrument.

Colour Scale[1]	Range	Path length	PFX*i*-995	PFX*i*-950	PFX*i*-880/L	PFX*i*-880/AT
Lovibond® RYBN Colour	0 – 70 Red,Yellow; 0 – 40 Blue; 0 – 3.9 Neutral	1/16" – 6"	●[2]	●	●	○
AOCS Tintometer® Colour	0 – 20 Red; 0 – 70 Yellow	1", 5 1/4"	●[2]	●	○	●
Gardner Color	1 – 18 units	10 mm	●	●	○	○
Pt-Co/Hazen/APHA Color	0 – 500 mg Pt/l	100 mm	●	○	○	○
FAC Color	1 – 45 (odd numbers)	10 mm	●	○	○	○
Chlorophyll A & B	0 – 100 ppm	10 mm	●	○	○	○
beta Carotene	0 – 1000 ppm	10 mm	●	○	○	○
Iodine Colour	1 – 500 units	10 mm	●	○	○	○
Hess-Ives Color Units		10, 25, 50 mm	●			
Klett Color (blue filter KS-42)	0 – 1000 units	40 mm	●	○	○	○
Kreis Value	Depends on concentration and pathlength	1/16" – 6"	●			
CIE Values Defined by spectrum locus		Depends on				
– X Y Z tristimulus values		saturation of	●	●	●	●
– x y Y chromaticity co-ordinates		sample colour	●	●	●	●
– CIE L*a*b* colour space			●	●	●	●
– L*C*h colour space			●	○	○	○
– Hunter L a b color space			●	○	○	○
– ΔE* colour difference			●	●	●	●
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						
Integrated heater unit	A factory fitted option for maintaining samples such as fats and waxes in a liquid state		○	○	○	○
Windows™ software for data	Allows data sets to be automatically downloaded to a PC computer where they can be processed or stored It also permits remote control of the instrument		●	○	○	○
Conformance filter sets	Sets of graded glass filters, representing a spread of colours from the main scales for quick and simple calibration checks (page 11)		○	○	○	○
Certified colour reference	Ideal for routine calibration and verification of test data (page 11)		○	○	○	○

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

1) Colour scale upgrades are also available for Saybolt and ASTM Colour 2) The Lovibond® PFX995 also includes: the AF960 Lovibond® Scale, an abridged red and yellow scale which was introduced on the AF960, an early electronic colorimeter; the AF960 AOCS scale, which is similar to AOCS Tintometer® Colour but modified for use on the AF960

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

Measuring principle	16 interference filters
Spectral response	420 – 710 nm
Bandwidth	20 nm
Repeatability	
• Chromaticity	+/– 0.0002
• ΔE	0.02
Measurement time	Less than 20 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 (.004" – 6")
Interface	USB, LAN, RS232
Data storage	100,000+ Measurements
Input voltage	Universal (90 – 240 Vac), via external power supply
Approvals	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
Instrument housing	Fabricated steel with tough, textured paint finish
Dimensions	Width 515 mm, depth 195 mm, height 170 mm
Weight	7.7 kg

The precision filament lamp is easily accessed and changed from outside the instrument.

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

Lovibond® PFX*i*-195 Automatic Colorimeter

Automatic Grading of One Dimensional Colour Scales

The PFX*i*-195 is a highly efficient 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 is used in a specific industry sector: the PFX*i*-195/1 for chemicals, industrial oils and fatty acids and the PFX*i*-195/3 for dark oils and fats and the PFX*i*-195/6 for industrial oils and surfactants. 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 25 seconds to complete. Data sets can be saved in the instrument, printed out or automatically down loaded to a PC computer 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.

Colour Scale	Range	Path length	PFX*i*-195/1	PFX*i*-195/3	PFX*i*-195/6
Pt-Co/Hazen/APHA Color	0 – 500 mg Pt/l	50 mm	●	○	●
Gardner Color	1 – 18 units	10 mm	●	●	○
FAC Color	1 – 45 (odd numbers)	10 mm		●	
Iodine Colour	1 – 500 units	10 mm	●		
Hess-Ives Color Units		10, 25, 50 mm	○	○	●
Klett Color (blue filter KS-42)	0 – 1000 units	40 mm	○	○	●
Rosin, US Naval Stores	XC – D + FF	$^{7}/_{8}$"	○	○	○
Yellowness Index		10, 25, 50 mm	○	○	○
CIE Values – X Y Z, x y Y, CIE L*a*b*, ΔE*	Defined by spectrum locus	Depends on saturation of sample colour	●	●	●
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					
Conformance filter sets of graded glass filters, representing a spread of colour from each of the main scales, are available for quick and simple calibration checks (see page 11)			○	○	○
Certified colour reference standards Ideal for routine calibration of and verification of test data (see page 11)			○	○	○

• included as standard o available as an optional upgrade

PFX*i*–195 Technical Specification

Measuring principle	9 interference filters
Spectral response	420 – 710 nm
Bandwidth	20 nm
Repeatability	
• Chromaticity (x y)	+/– 0.0004
• ΔE	0.04
Measurement time	Less than 20 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
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

Instructions	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, optical glass cells for the colour scales included, a spare lamp and instructions.

Tintometer® Model F Colorimeter

Operating Principle

The Tintometer® Model F Colorimeter is a visual instrument that allows matching of samples against 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. It is arranged with two adjacent fields of view, seen through the viewing tube, so that the product in the sample field and a white reflective surface in the comparison field are observed side by side, suitably illuminated. The Lovibond® colour standards are introduced into the comparison field by a simple system of sliding racks, allowing the user to compare the colour of the sample with the standards. A series of neutral glasses in racks is also supplied; these can be introduced into the sample field to dull the colour of products which are too bright to obtain a good colour match using Lovibond® Red, Yellow or Blue glasses. The racks are adjusted until a visual colour match is found for the sample and its colour can then be expressed in Lovibond® units.

A Major Advance in Visual Colorimetry

The Model F is the latest in a unique distinguished series of Lovibond® colorimeters, widely used for colour measurement for more than a century. The advance stems from the introduction of modern technology to enhance a traditional visual colorimeter:

- Individual housing of colour standards affords excellent protection of the glass filters, allows easy distinction between adjacent standards, simplifies cleaning and allows replacement of single glasses if required.
- Prismatic optical system for accurate and repeatable colour matching.
- Standardised and diffused tungsten-halogen light source.
- A removable sample chamber insert simplifies cleaning if a spillage takes place; it can be replaced at intervals to maintain the whiteness of the interior, an essential feature for accurate visual colour matching.

Versatile Applications

A versatile instrument, the Model F can be used for colour measurement of products that transmit light as well as opaque solids, powders and pastes (an optional 'solid' sample accessory pack may be required for measuring light-reflecting products).

Fats are measured for colour, either by transmitted light when in a molten condition, or by reflected light when solid.

The Model F is available in two formats to meet the requirements of different applications and the national and international standardising bodies which specify the instrument in their official methods for colour measurement: Model F (order code 180000) and Model F (BS684) (order code 180270).

Technical Specification

Measuring principle	Visual, in terms of Lovibond® units	Light source	2 x 12 Volt, 10 Watt tungsten halogen lamp
Modes	Transmittance, reflectance	Illuminant	Approximates to daylight
Range	0.1 – 70 Red, Yellow; 0.1 – 40 Blue; 0.1 – 3.9 Neutral	Path length	0.1 – 153 mm (0.004" – 6")
Resolution	0.1 Lovibond® unit	Power pack	Universal, via external power supply
Optical system	11 glass-filled nylon racks containing a graduated range of Lovibond® colour standards	Approvals	CE
		Instrument housing	Fabricated sheet steel with a tough, textured paint finish
Viewing system	Fully adjustable, prismatic with integral blue filter for light standardisation	Dimensions	Width 330 mm, Depth 410 mm, Height 230 mm
		Weight	8.3 kg

Instrument	Scope
Model F	Standard model for applications including fats and fatty oils, bleached lac, liquid chemicals and pharmaceuticals
Model F (BS684)	Version for grading animal and vegetable fats and oils according to BS 684 Section 1.14, ISO 15305 and AOCS Method Cc 13e-92. Racks are fitted with colourless glass compensating slides in the sample field. The instrument also includes a black sheath to prevent light entering the sides of the sample cell
Optional Items for Individual Applications	
Replacement sample chamber insert	Available as single units or in a pack of 3
'Solid' sample accessory pack	A selection of sample holders for various types of light reflecting products: a short optical cell (W560/OG/10 mm), holders for powders and opaque liquids, solid sample clamp and detachable magnetic white reference. Individual holders can be ordered separately if required
Conformance filter sets	Sets of graded glass filters, representing a spread of colours from the Lovibond® Colour scale are available for quick and simple calibration checks

Tintometer® AF710-3 Colorimeter

Colour Measurement according to the AOCS Tintometer® Colour Scale. The AF 710-3 is a visual colorimeter approved by the American Oil Chemists Society (AOCS) for colour measurement of oils and fats according to AOCS Official Method Cc 13b-45, the Wesson Method. Colour is determined by obtaining a visual colour match for the light transmitted through a column of the sample compared with that transmitted through a series of red and yellow colour standards calibrated in accordance with the AOCS Tintometer® Colour Scale. The glasses are varied until a colour match is found for the light passing through the sample and this colour is then expressed in AOCS Tintometer® Colour units.

The Tintometer® AF 710-3 instrument is supplied complete with a set of AOCS Tintometer® Colour glasses (Red 0.1 – 0.9; 1.0 – 7.0; 7.6, 8.0, 9.0, 10.0, 11.0, 12.0, 16.0, 20.0; Yellow 1.0 – 9.0; 10.0, 15.0, 20.0, 35.0, 50.0, 70.0) and two flat-bottomed, glass sample tubes, which are marked to indicate an oil column of ½", 1" and 5¼".

Lovibond® Comparator 3000 Series

Visual Grading of Gardner, FAC or US Naval Stores Rosin Colour Scales

Single scale, 3-field instruments 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. Versions of the Comparator 3000 are available for the Gardner, FAC and US Naval Stores Rosin Colour scales, each supplied with the appropriate range of coloured glass filters. In each instrument the tungsten halogen light source is colour corrected to CIE standard illuminant C, which guarantees constant lighting conditions for colour grading. Samples are measured in clear glass tubes or Rosin cells as appropriate.

Version	Colour Scale	Range	Path Length
AF228	Gardner Color	1 – 18	10 mm
AF229	FAC Color	1 – 45 (odd numbers)	10 mm
AF670	Rosin, US Naval Stores	XC – D	7/8"

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 Nessler cylinder with Lovibond® glass filters; 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 below[1].

Test	Disc	Range Covered	Instrument	Accessories Required
Gardner Color	4/30AS	1, 2, 3, 4, 5, 6, 7, 8, 9 units	Comparator 2000+	10 mm cell W680/OG/10
	4/30BS	10, 11, 12, 13, 14, 15, 16, 17, 18 units	Comparator 2000+	10 mm cell W680/OG/10
Pt-Co/Hazen/APHA Color	4/28	50, 75, 100, 150, 200, 250, 300, 400, 500 mg Pt/l	Comparator 2000+	40 mm cell W680/OG/40
	4/28A	200, 225, 250, 300, 350, 400, 450, 500	Comparator 2000+	40 mm cell W680/OG/40
	NSH	10, 20, 30, 40, 50, 60, 70, 80, 90 mg Pt/l	Nessleriser 2150	Nessler cylinders AF 306/P
	NSB	70, 85, 100, 125, 150, 175, 200, 225, 250 mg Pt/l	Nessleriser 2150	Nessler cylinders AF 306/P
	NSX	50, 60, 70, 80, 100, 150, 200, 250, 300 mg Pt/l	Nessleriser 2150	Nessler cylinders AF 306/P
	CAA	0, 2.5, 5.0, 7.5, 10, 15, 20, 25, 30 mg Pt/l	Nessleriser 2250	250 mm cylinders DB 420
	CBB	30, 35, 40, 45, 50, 55, 60, 65, 70 mg Pt/l	Nessleriser 2250	250 mm cylinders DB 420
	1209/1	0, 2.5, 5.0, 7.5, 10, 15, 20, 25, 30 mg Pt/l	Nessleriser 1209	100 ml cylinders DB 423
	1209/2	30, 35, 40, 45, 50, 55, 60, 65, 70 mg Pt/l	Nessleriser 1209	100 ml cylinders DB 423
Iodine Colour	4/57	1, 2, 3, 4, 5, 6, 7, 8, 9 mg/100 ml	Comparator 2000+	25 mm cell W680/OG/25
	4/58	10, 15, 20, 25, 30, 35, 40, 45, 50 mg/100ml	Comparator 2000+	10 mm cell W680/OG/10
	4/59	60, 70, 80, 100, 125, 150, 200, 250, 300 mg/100ml	Comparator 2000+	10 mm cell W680/OG/10
	4/60	400, 500, 600, 700, 800, 900, 1000 mg/100 ml	Comparator 2000+	2.5 mm cell W680/OG/2.5
Dichromate Colour Index	4/62	0.5, 0.75, 1. 1.5, 2, 2.5, 3, 3.5, 4	Comparator 2000+	25 mm cell W680/OG/25
	4/63	4.5, 5, 5.5, 6, 7, 8, 9, 10	Comparator 2000+	25 mm cell W680/OG/25
Recommended Items for 2000+ Comparator System:				
Daylight 2000 Lighting Unit		A standardised benchtop light source to guarantee constant lighting conditions for accurate colour grading, particularly when the sample is very pale in colour		

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.

Type	Colour Scale	Range	Apparatus Included
AF 334	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 cell.
AF 329	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	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	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	Pt-Co/Hazen/APHA Color, Low Range, ISO 6271	0 – 70 mg Pt/l	Nessleriser 1209 with Daylight 2000 Lighting Unit and 100 ml (288 mm) Nessler cylinders, Pt-Co/Hazen discs 1209/1 & 1209/2, deionised water

[1] for a wider selection of tests, visit our website

Accessories

Genuine Lovibond® Colorimetry Cells

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

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
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/1/16″		
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 pathlengths – www.tintometer.com

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
- All classified as non-hazardous according to EU directives
- Each bottle supplied with full certification including MSDS
- Manufactured to UKAS/ISO17025 or ISO9001 standards

Colour Scale	Certified Value	Order Code	Accreditation
AOCS Tintometer®	0.3R 2.0Y (5 1/4″)	134240	ISO 9001
Colour	1.0R 9.0Y (5 1/4″)	134250	ISO 9001
	1.2R 12.0Y (5 1/4″)	134260	ISO 9001
	2.2R 22.0Y (5 1/4″)	134270	ISO 9001
	3.4R 28.0Y (5 1/4″)	134280	ISO 9001
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
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

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ISO 17025

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Lovibond®
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Lovibond® – Colour Management for Industry

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