Starna scientific
'Setting the Standard'

Visible Spectrophotometer Absorbance Qualification

Neutral Density Glass Filters

Purpose

These references can be used to qualify the absorbance accuracy and linearity of visible spectrophotometers with a spectral bandwidth of 6.5 nm or less, over the wavelength range 440 -635 nm.

Measurements made with these references will be accepted as evidence of instrument qualification by:

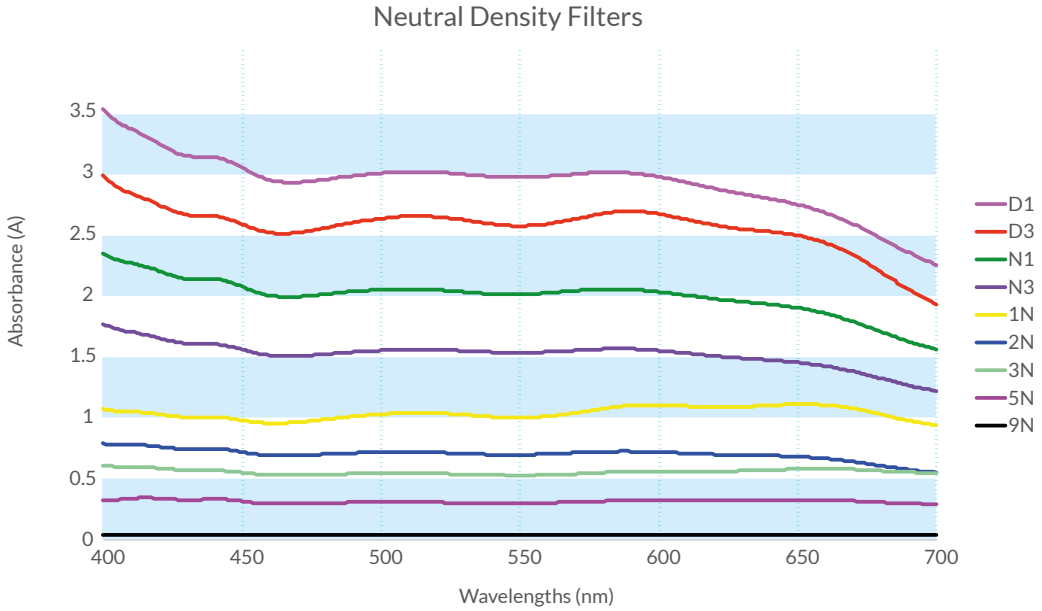
- United States Pharmacopeia
- American Society for Testing and Materials
- Therapeutic Goods Administration (Australia)
- British Pharmacopoeia

Description and Discussion

Glass filters mounted 'stress free' in an anodised aluminium holder. The use of Schott NG-type glasses has been used for over thirty years for the validation of the absorbance scale and linearity of spectrophotometers in the visible region.

Filters with a wide range of transmission and absorbance values can be produced.

The spectrum of these filters is essentially flat over the range of calibration.



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Neutral Density Glass Filters

A range of 18 filters is available from Starna, covering absorbance values from approximately 0.04 A to 3.5 A (see How to Order, below). Originally, these filter were manufactured with selected transmission values. Available transmission values and equivalent absorbances are:
All Starna neutral density filters are manufactured and certified in accordance with the 'Technical Specification for Certification of Spectrophotometric NIST Traceable Reference Materials' (NIST Special Publication 260-140).

% Transmission	Absorbance
92	0.04
79.4	0.10
73	0.14
60	0.22
56.5	0.25
50	0.30
40	0.40
30	0.52
25	0.60
20	0.70
10	1.00
6	1.22
3	1.52
1.5	1.82
1	2.00
0.3	2.52
0.1	3.00
0.06	3.22
0.03	3.52

This recommends calibration at 440 nm, 465 nm 546.1 nm 590 nm and 635 nm, and Starna filters are certified at these wavelengths.

NIST also lists three specifications for neutral density filter Standard Reference Materials (SRMs): SRM 930e, SRM 1930 and SRM 2930. These specifications also stipulate the maximum spectral bandwidth to be used at these wavelengths for certification measurements:

Wavelength (nm)	440	465	546.1	590	635
SBW (nm)	2.2	2.7	6.5	5.4	6.0

For those users wishing to work to these specifications, sets of filters equivalent to these SRMs are available (see How to Order). For convenience, but to comply with the SRM specifications, all certification measurements are made at a SBW of 1.0 nm. These sets consist of three filters together with an empty aluminium holder, to be used as a blank.

	SRM 930e		SRM 1930		SRM 2930	
	%T	A	%T	A	%T	A
Filter 1	10	1.0	1	2.0	0.1	3.0
Filter 2	20	0.7	3	1.5	0.3	2.5
Filter 3	30	0.5	50	0.3	92	0.04

These SRMs were originally specified in transmittance, the specified nominal transmittance and approximate absorbance values are given below:

Certificate values are given in both %T and Absorbance.

Certification and Documentation

A Certificate of Calibration and Traceability and full instructions for use are provided with each Reference Material. The certificate is supplied in electronic format, on a USB drive in the same box as the references, allowing hard copy to be produced on demand and giving easy interface to the user's own IT systems. Certification measurements are made on a reference spectrophotometer that has been qualified using Standard Reference Materials certified by the National Institute of Standards and Technology (NIST) in the USA, or against primary physical references such as elemental emission lines.

Accreditation

Starna Scientific is accredited to both ISO Guide 34 (4001) as a Reference Material producer, and ISO 17025 (0659) as a Calibration Laboratory for optical reference measurements. Starna Scientific's manufacturing facility is accredited to the ISO 9001 Quality Management System with BSI.

Warranty

STARNA offers a Lifetime Guarantee on all Starna Certified Reference Materials, unless otherwise stated, such that any reference material that moves outside its published uncertainty budget will be replaced free of charge. This guarantee is subject to the reference materials being re-certified at least every two years and that the references have not been physically, thermally or optically abused. The STARNA UKAS accredited calibration laboratory aims to re-certify and despatch references within five working days from receipt.

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How to Order

NIST Equivalent SRM Sets

Three specifications for neutral density filter Standard Reference Materials (SRMs) are listed by NIST: SRM 930e, SRM 1930 and SRM 2930. For those users wishing to work to these specifications, sets of filters equivalent to these SRMs are available:

	CATALOGUE NUMBER
SRM 930e equivalent set: 10, 20 & 30 %T (1.0, 0,7 & 0.5A) and blank holder	**RM-1N2N3N**
SRM 1930 equivalent set 1, 3 & 50 %T (2.0, 1.5 & 0.3 A) and blank holder	**RM-N1N35N**
SRM 2930 equivalent set 0.1, 0.3 & 92 %T (3.0, 2.5 & 0.04 A) and blank holder	**RM-D1D39N**
NIST SRM Set Set of all 9 above filters and blank holder	**RM-SRM9ND**

Visible Spectrophotometer Qualification Set

This is a convenient way of qualifying a visible spectrophotometer for photometric accuracy, linearity and wavelength accuracy.

	CATALOGUE NUMBER
Starna Transmission/Absorbance and Wavelength Set Neutral Density Filters: 1.00 ,0.50 &0.25 A (10, 30 & 52 %T) and blank holder & Holmium Glass Filter: **(see page nn for full details)**	**1N3N5DHG**

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How to Order

Starna selected sets and individual filters:

Any combination of references can be ordered as a set by combining the single filter catalogue numbers.

Nominal % Transmittance	Nominal Absorbance	CATALOGUE NUMBER			
		Set of 4 filters RM-4ND	Set of 6 filters RM-6ND	Set of 9 filters RM-9ND	Single filter
92	0.04			•	**RM-9N**
79.4	0.10				**RM-8N**
73	0.14			•	**RM-7N**
60	0.22			•	**RM-6N**
56.5	0.25	•	•		**RM-5D**
50	0.30				**RM-5N**
40	0.40				**RM-4N**
30	0.52	•	•	•	**RM-3N**
25	0.60				**RM-2D**
20	0.70				**RM-2N**
10	1.00	•	•	•	**RM-1N**
6	1.22				**RM-N6**
3	1.52		•	•	**RM-N3**
1.5	1.82				**RM-1D**
1	2.00	•	•	•	**RM-N1**
0.3	2.52			•	**RM-D3**
0.1	3.00		•	•	**RM-D1**
0.06	3.22				**RM-H6**
0.03	3.52				**RM-H3**

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