

## NIST Traceable UV/Vis/NIR Reference Sets

Accredited to ISO/IEC 17025 and ISO Guide 34  
including Instrument Qualification  
to new USP Chapter <857>

Winter 2015/16



A USB Drive supplied with each set contains the calibration certificate and all necessary user information. Hard copy available on request.

## Why do you need to use reference materials?

Ultraviolet, visible and NIR spectrophotometers are fundamentally accurate, however it is vital to check instrument performance on a regular basis to ensure operation is within acceptable parameters. Certified references provided by Starna are based on materials, which have been used or produced by a National Metrology Institute (NMI), such as the National Institute of Standards and Technology (NIST) or fundamental metrological principles. When used in routine testing of instrument performance, a quality control database of the operating characteristics for a specific instrument can be built. This database can then be used for the following purposes:

- \* Demonstration of satisfactory instrument performance to any inspection or regulatory agency.
- \* Detection of instrument malfunction.
- \* Provide data to a service technician allowing detection of instrument faults and assistance in repair.
- \* Construction of Process Control Charts

Each spectrophotometer has specific operating characteristics based on the geometry and basic design of the optical system. These reference materials become your guide to the efficient operation of your instrument.

## What makes Starna reference materials unique?

References are supplied in either heat fusion sealed quartz cells or, in the case of the glass or Metal on Quartz filters, in an aluminum holder with the same external dimensions as a standard spectrophotometer cell.

All sealed cells, glass filters or Metal on Quartz reference materials produced by Starna are "Ready to Use".

Starna's sealed references are environmentally friendly as they eliminate the need to open an ampoule, use it once and throw it away. Wet chemistry methods are no longer required to make up

the references from raw materials. With care, the sets will last for many years. All certified sets can be recertified.

Properties of Starna heat fusion sealed quartz cells, glass or Metal on Quartz references:

- 1) Sealed cells ensure cleanliness, repeatability and reliability
- 2) They can be used multiple times over many years
- 3) The range covers the Far UV, UV, Visible and NIR
- 4) All calibrated & NIST traceable references can be recertified.

## Construction of reference materials

Starna has almost fifty years of experience pioneering the technology of sealing reference materials into quartz spectrophotometer cells. The technology allows the use of materials in the UV range where glass filters are not usable. The sealed reference cells have the same optical characteristics as cells used in normal analysis thus removing many variables,

which might be introduced using any other form of optical configuration or reference preparation. The references have a lifetime guarantee subject to specified conditions and are supplied in suitable storage containers. The glass filters are made to the highest industry standards with raw material of known characteristics.

## UKAS ISO/IEC 17025 Accredited / NIST Traceable

NIST (National Institute for Standards and Technology in Washington DC, USA) traceability applies to all our reference materials, unless otherwise indicated. Traceability is established during the calibration of each of our five reference spectrophotometers using NIST primary standards, both before and after calibrating Starna reference materials. Documentation supplied with Starna references details the analysis procedure, NIST traceability, the analyzed values of the reference and the confidence limits. Certification supplied with Starna reference materials is suitable for use with all inspecting agencies when

used in the context of standard operating procedures for quality control, established in your laboratory. Our calibration laboratory is inspected and accredited by UKAS (United Kingdom Accreditation Service) under ISO/IEC 17025 for the Starna Calibration Laboratory and under ISO Guide 34 as a reference material producer. This level of accreditation assures the user that the certification of our reference materials is of the highest standard and may be used to validate instrument performance in all ISO/IEC 17025 regulated environments.

## Should I use accredited NIST Traceable References? Yes, to comply with USP <857>!

USP <857> states that: "CRMs should be obtained from a recognized **accredited** source and include independently verified traceable value assignments with associated calculated uncertainty."

Virtually all the Certified Reference Materials in this catalog are traceable to NIST, as shown opposite. The raw materials used to prepare the references are either purchased from NIST (where available) or directly tested against a NIST supplied reference. The instruments used to generate the certified values

and uncertainties are themselves qualified against NIST primary standards or SRMs. The most important element of NIST traceability is the Starna certificate of analysis and traceability. This certificate details the method of analysis and the certified results. You can use these certified results as the basis of your quality program. If your laboratory is routinely monitored by a certifying agency, then the Starna level of accreditation and NIST traceability will meet all your regulatory requirements.

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## Ultraviolet References

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## Qualification Sets for easier Compliance (USP, EP, ASTM, etc.)

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## References for International Compliance

References described in this catalog comply with the requirements for instrument qualification of UV and visible spectrophotometers recommended by national and international regulatory authorities worldwide including:

United States Pharmacopeia	USP	Deutsches Arzneibuch (German Pharmacopoeia)	DAB
European Pharmacopoeia	EP (Ph. Eur)	Therapeutic Goods Administration (Australia)	TGA
American Society for Testing and Materials	ASTM	Japanese Pharmacopoeia	JP
British Pharmacopoeia	BP	Pharmacopoeia of the Peoples Republic of China	PPRC

# Potassium Dichromate - UV - Absorbance/Linearity up to 1.5 A

## Description & NIST Traceability:

Potassium dichromate from NIST (SRM 935a), permanently sealed by heat fusion in quartz cells, NIST Traceable complete with UKAS ISO/IEC 17025 accredited certificate of calibration.

## Primary Usage:

Testing absorbance and linearity scale in the UV region of the spectrum up to 1.5 absorbance.

## Certified Wavelengths:

235, 257, 313 and 350 nm for 20 mg/l to 100 mg/l. 430 nm for 600 mg/l.

## Physical Configuration:

UV quartz cells that have been permanently sealed by heat fusion.

## Product Description:

Potassium dichromate solvated in dilute perchloric acid is the recognized method for testing the absorbance scale and linearity of spectrophotometers in the UV. Solid potassium dichromate used by Starna is purchased directly from NIST (SRM 935a). Solutions are made up in accordance to NIST certification and then permanently sealed by heat fusion in Far UV quartz spectrophotometer cells.

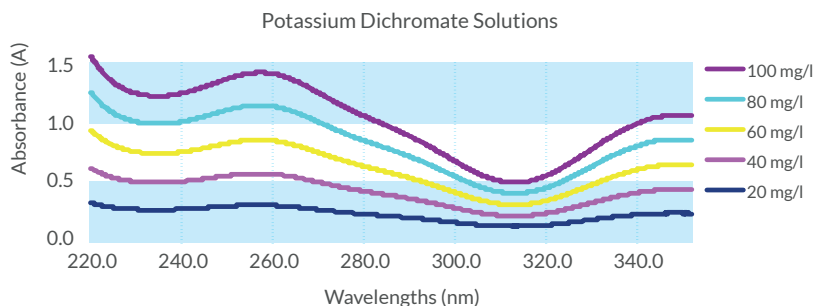
The filled cells are tested and certified against the expected values from NIST. A certificate is provided with each set of cells, which has the certified absorbance values for each cell and the confidence limit.

The certificate supplied is suitable for use with inspecting agencies when used in the context of a standard operating procedure for quality control, established in your laboratory.

Each set is supplied with the sealed blank cell used to obtain the certified measurements.

The following chart is a listing of approximate absorbance values for each concentration based on the wavelength at which the potassium dichromate cells are to be read:

Concentration	235 nm	257 nm	313 nm	350 nm	430 nm
20 mg/l	0.243	0.281	0.095	0.209	n/a
40 mg/l	0.492	0.572	0.192	0.426	n/a
60 mg/l	0.741	0.862	0.289	0.634	n/a
80 mg/l	0.996	1.159	0.385	0.853	n/a
100 mg/l	1.243	1.448	0.480	1.069	n/a
European Pharmacopoeia compliance requires the following additional reference:					
600 mg/l	n/a	n/a	n/a	n/a	0.950



## Spectral scan:

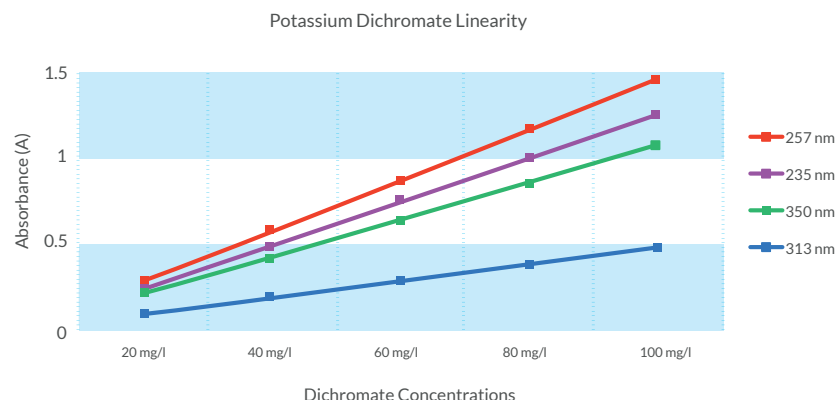
The graph to the left is a scan of five different concentrations of potassium dichromate. It clearly shows the peaks and troughs in absorbance and the differences due to potassium dichromate concentration.

**Peaks: 257 and 350 nm**  
**Troughs: 235 and 313 nm**

The certificate supplied with the NIST traceable sets lists the absorbance values for each peak and trough at the four wavelengths measured against the perchloric acid blank at the four wavelengths. When measured in your spectrophotometer you can validate your transmittance/absorbance scale for accuracy and linearity using the set with five different concentrations and the blank.

## Linearity:

Plotting concentration against absorption using the set of five cells against the blank, you can test your spectrophotometer for linearity through the UV range. The use of the NIST traceable set with five different concentrations and a blank is recommended for best results.





## RM-0204060810 set:

This NIST traceable set of one blank and five increasing concentrations of potassium dichromate is our most useful and widely purchased set consisting of 6 cells with the following materials:

Cell#	Containing	Concentration
1	Perchloric acid blank	0.001M
2	Potassium Dichromate	20 mg/l
3	Potassium Dichromate	40 mg/l
4	Potassium Dichromate	60 mg/l
5	Potassium Dichromate	80 mg/l
6	Potassium Dichromate	100 mg/l



## Suggestions for Use:

Scan the absorbance of the potassium dichromate cells over the certified wavelength range, against the blank supplied.

Compare the spectrophotometer absorbance values to the certified absorbance values. Taking the expanded uncertainty budget† of the certified references into consideration: if the absorbance values fall within the expected parameters† of your instrument then your instrument is working correctly.

†for expanded uncertainty budget and expected parameters see p 37

To evaluate instrument linearity, plot a graph of concentration against absorbance for each of the four wavelengths.

If you determine that your instrument is not giving you the correct values, consult your service technician for advice on how to determine and correct any problem, which this reference may have detected.

## Ordering Information:

Description	Part Number, NIST Traceable	Price
<b>Linearity Dichromate set:</b>		
Potassium Dichromate, 5 concentrations & Blank Cell 20, 40, 60, 80 & 100 mg/l & Blank Cell	RM-0204060810	\$ 2275.00
<b>Linearity Dichromate set, with additional concentration for European Pharmacopoeia Compliance:</b>		
Potassium Dichromate, 6 concentrations & Blank Cell 20, 40, 60, 80, 100 & 600 mg/l & Blank Cell	RM-020406081060	\$ 2630.00
<b>Single Concentrations:</b>		
Potassium Dichromate, 20 mg/l & Blank Cell	RM-02	\$ 855.00
Potassium Dichromate, 40 mg/l & Blank Cell	RM-04	\$ 855.00
Potassium Dichromate, 60 mg/l & Blank Cell	RM-06	\$ 855.00
Potassium Dichromate, 80 mg/l & Blank Cell	RM-08	\$ 855.00
Potassium Dichromate, 100 mg/l & Blank Cell	RM-10	\$ 855.00
<b>Additional concentration required for European Pharmacopoeia Compliance:</b>		
Potassium Dichromate, 600 mg/l & Blank Cell	RM-60	\$ 855.00

Any combination of references, including those from page 7, can be ordered by combining the individual part numbers eg RM-081624 is 3 references 80, 160 and 240 mg/l and Blank :

Potassium Dichromate, 1 concentration & Blank	\$ 855.00
Potassium Dichromate, 2 concentrations & Blank	\$ 1210.00
Potassium Dichromate, 3 concentrations & Blank	\$ 1565.00
Potassium Dichromate, 4 concentrations & Blank	\$ 1920.00
Potassium Dichromate, 5 concentrations & Blank	\$ 2275.00
Potassium Dichromate, 6 concentrations & Blank	\$ 2630.00
Potassium Dichromate, 7 concentrations & Blank	\$ 2985.00

# Potassium Dichromate - UV - Absorbance/Linearity up to 3.3 A

## Description & NIST Traceability:

Potassium dichromate from NIST (SRM 935a), permanently sealed by heat fusion in quartz cells, NIST Traceable complete with UKAS ISO/IEC 17025 accredited certificate of calibration.

## Primary Usage:

Testing absorbance and linearity scale in the UV region of the spectrum up to 3.3 absorbance.

## Certified Wavelengths:

235, 257, 313 and 350 nm for 20 mg/l to 240 mg/l.

## Physical Configuration:

UV quartz cells that have been permanently sealed by heat fusion.

## Product Description:

Potassium dichromate solvated in dilute perchloric acid is the recognized method for testing the absorbance scale and linearity of spectrophotometers in the UV. Solid potassium dichromate used by Starna is purchased directly from NIST (SRM 935a). Solutions are made up in accordance to NIST certification and then permanently sealed by heat fusion in Far UV quartz spectrophotometer cells.

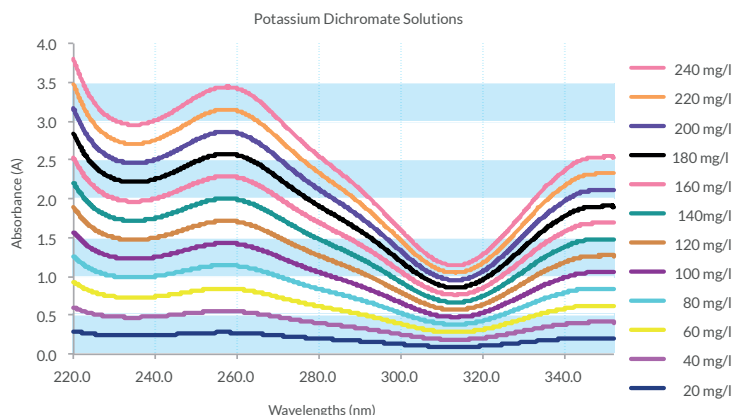
The filled cells are tested and certified against the expected values from NIST. A certificate is provided with each set of cells, which has the certified absorbance values for each cell and the confidence limit.

The certificate supplied is suitable for use with inspecting agencies when used in the context of a standard operating procedure for quality control, established in your laboratory.

Each set is supplied with the sealed blank cell used to obtain the certified measurements.

The following chart is a listing of approximate absorbance values for concentrations 120 mg/l or higher, at the wavelengths at which the potassium dichromate cells are calibrated:

Concentration	235 nm	257 nm	313 nm	350 nm
120 mg/l	1.501	1.749	0.582	1.290
140 mg/l	1.758	2.050	0.679	1.506
160 mg/l	2.016	2.351	0.777	1.723
180 mg/l	2.275	2.655	0.875	1.940
200 mg/l	2.536	2.960	0.974	2.157
220 mg/l	2.790	3.256	1.071	2.373
240 mg/l	3.043	3.552	1.168	2.589



## Spectral scan:

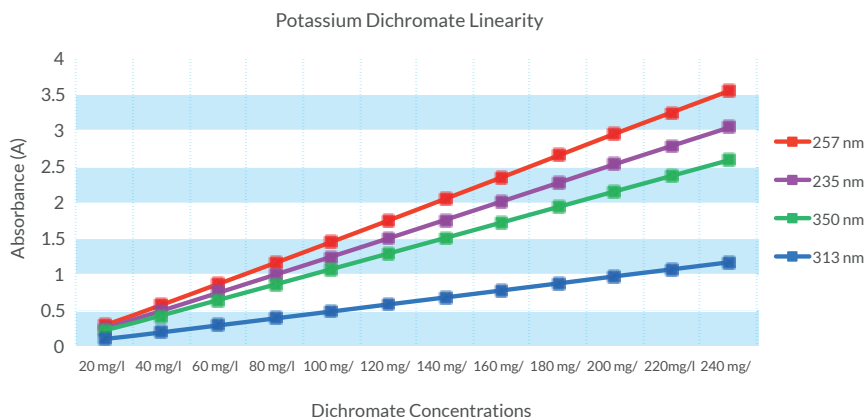
The graph to the left is a scan of 12 different concentrations of potassium dichromate. It clearly shows the peaks and troughs in absorbance and the differences due to potassium dichromate concentration.

**Peaks: 257 and 350 nm**  
**Troughs: 235 and 313 nm**

The certificate supplied with these NIST traceable sets lists the absorbance values for each peak and trough at the four wavelengths measured against the perchloric acid blank at the four wavelengths.

When measured in your spectrophotometer you can validate the transmittance/absorbance scale for accuracy and linearity through the UV range for up to 12 different concentrations and absorbance values up to 3.5 A.

The use of the NIST traceable set with six different concentrations and a blank is recommended for best results.



## RM-121416182224 set:

This NIST traceable set of one blank and six increasing concentrations of potassium dichromate is a convenient route to instrument qualification at higher absorbance values, and contains seven cells with the following materials:

Cell#	Containing	Concentration
1	Perchloric acid blank	0.001N
2	Potassium Dichromate	120 mg/l
3	Potassium Dichromate	140 mg/l
4	Potassium Dichromate	160 mg/l
5	Potassium Dichromate	180 mg/l
6	Potassium Dichromate	220 mg/l
7	Potassium Dichromate	240 mg/l

An alternative set, RM-040812162024, covers the whole absorbance scale from 0.2 A to 3.5 A.



## Suggestions for Use:

Scan the absorbance of the potassium dichromate cells over the certified wavelength range, against the blank supplied.

Compare the spectrophotometer absorbance values to the certified absorbance values. Taking the expanded uncertainty budget† of the certified references into consideration: if the absorbance values fall within the expected parameters† of your instrument then your instrument is working correctly.

†For expanded uncertainty budget and expected parameters see page 37

To evaluate instrument linearity, plot a graph of concentration against absorbance for each of the four wavelengths.

If you determine that your instrument is not giving you the correct values, consult your service technician for advice on how to determine and correct any problem, which this reference may have detected.

## Ordering Information:

Description	Part Number, NIST Traceable	Price
Linearity Dichromate set from 1.5 to 3.5A Potassium Dichromate, 6 concentrations & Blank Cell 120, 140, 160, 180 & 220 & 240 mg/l & Blank	RM-121416182224	\$ 2630.00
Linearity Dichromate set from 0.19 to 3.5A Potassium Dichromate, 6 concentrations & Blank Cell 40, 80, 120, 160, 200 & 240 mg/l & Blank	RM-040812162024	\$ 2630.00
Single Concentrations:		
Potassium Dichromate, 120 mg/l & Blank Cell	RM-12	\$ 855.00
Potassium Dichromate, 140 mg/l & Blank Cell	RM-14	\$ 855.00
Potassium Dichromate, 160 mg/l & Blank Cell	RM-16	\$ 855.00
Potassium Dichromate, 180 mg/l & Blank Cell	RM-18	\$ 855.00
Potassium Dichromate, 200 mg/l & Blank Cell	RM-20	\$ 855.00
Potassium Dichromate, 220 mg/l & Blank Cell	RM-22	\$ 855.00
Potassium Dichromate, 240 mg/l & Blank Cell	RM-24	\$ 855.00

Any combination of references, including those from page 5, can be ordered by combining the individual part numbers e.g. RM-081624 is three references 80, 160 and 240 mg/l and Blank :

Potassium Dichromate, 1 concentration & Blank	\$ 855.00
Potassium Dichromate, 2 concentrations & Blank	\$ 1210.00
Potassium Dichromate, 3 concentrations & Blank	\$ 1565.00
Potassium Dichromate, 4 concentrations & Blank	\$ 1920.00
Potassium Dichromate, 5 concentrations & Blank	\$ 2275.00
Potassium Dichromate, 6 concentrations & Blank	\$ 2630.00
Potassium Dichromate, 7 concentrations & Blank	\$ 2985.00

# Nicotinic Acid - Far UV - Absorbance/Linearity

## Description & NIST Traceability:

Four concentrations of Nicotinic acid in dilute hydrochloric acid together with a blank, permanently sealed by heat fusion in quartz cells.

## Primary Usage:

NIST Traceable complete with UKAS ISO/IEC 17025 accredited certificate of calibration

## Certified Wavelengths:

Testing absorbance scale and linearity in the Far UV region of the spectrum.

## Physical Configuration:

Far UV quartz cells that have been permanently sealed by heat fusion

## Product Description:

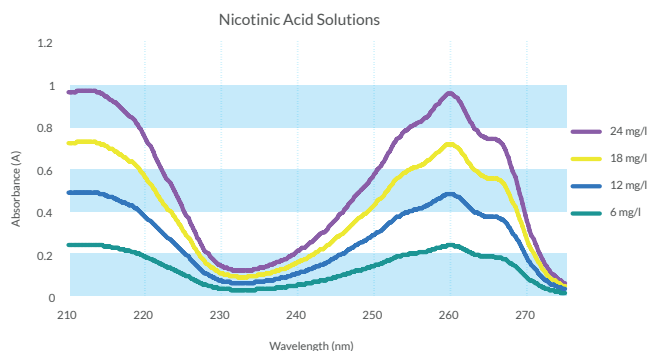
Nicotinic acid solvated in dilute hydrochloric acid is a well documented method for validation of the absorbance scale and the linearity of a spectrophotometer in the Far UV region. Prepared in 0.1M hydrochloric acid, nicotinic acid gives a spectral scan containing characteristic peaks at approx. 210 nm and 260 nm. Within the concentration range 5-25 mg/l, if the absorbance scale of a spectrophotometer at 2 nm SBW is linear, the absorbances of a series of concentrations will be a linear function of concentration, at the specified SBW.

The filled cells are tested and certified against the calculated values. A certificate is provided with each set of cells, which shows the certified absorbance values and confidence limit for each cell. The certificate is suitable for use with inspecting agencies when used in the context of a standard operating procedure for the quality control established in your laboratory.

The following is a list of approximate absorbance values for each concentration at 1 nm SBW\* at the calibration wavelengths

Concentration	213 nm	261 nm
6 mg/l	0.243	0.281
12 mg/l	0.492	0.572
18 mg/l	0.741	0.862
24 mg/l	0.996	1.159

\* Alternative SBW values available on request.



## Suggestions for Use:

Scan the absorbance of the nicotinic acid cells over the certified wavelength range against the blank supplied.

Compare the spectrophotometer absorbance values to the certified absorbance values. Taking the expanded uncertainty budget† of the certified references into consideration, if the absorbance values fall within the expected parameters† of your instrument then your instrument is working correctly.

†for expanded uncertainty budget and expected parameters see p 37

To evaluate instrument linearity, plot a graph of concentration against absorbance for each of the two wavelengths.

If you determine that your instrument is not giving you the correct values, consult your service technician for advice on how to determine and correct any problem, which this reference may have detected.

## Ordering Information:

### Description

### Part Number, NIST Traceable

### Price

#### Single Concentrations:

Nicotinic Acid, 6 mg/l & Blank Cell

RM-1A

\$ 910.00

Nicotinic Acid, 12 mg/l & Blank Cell

RM-2A

\$ 910.00

Nicotinic Acid, 18 mg/l & Blank Cell

RM-3A

\$ 910.00

Nicotinic Acid, 24 mg/l & Blank Cell

RM-4A

\$ 910.00

#### Linearity Nicotinic Acid set:

Nicotinic Acid, 4 concentrations & Blank Cell

RM-1A2A3A4A

\$ 2040.00



# Starna TS8\* Deep UV - Wavelength/Absorbance 190 - 230 nm

<b>Description &amp; NIST Traceability:</b>	An ultra-stable solution permanently sealed by heat fusion in quartz cells. NIST traceable complete with UKAS ISO/IEC 17025 accredited certificate of calibration
<b>Primary Usage:</b>	Testing absorbance scale and wavelength accuracy in the Deep UV region.
<b>Certified Wavelengths:</b>	191, 209 and 226 nm.
<b>Physical Configuration:</b>	Far UV quartz cells that have been permanently sealed by heat fusion.

## Product Description:

Qualifying a UV spectrophotometer in the Deep UV presents particular problems associated with the short wavelengths, reduced energy and sensitivity as well as the variability in transmission characteristics of UV grade quartz below 200 nm.

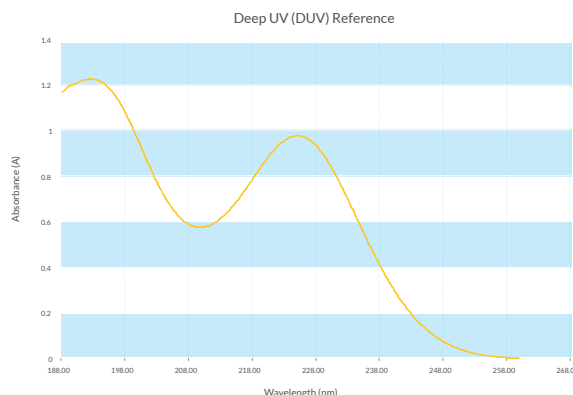
These problems have been overcome with this unique stable reference by using innovative design and manufacturing protocols.

The reference consists of a TS8\* solution, which has distinct absorption/transmittance and peak characteristics in the deep UV, supplied together with a solvent blank permanently sealed by heat fusion into physically identical Far UV quartz cells.

In addition to absorbance qualification this reference is also certified for wavelength qualification. This allows user flexibility as the reference is supplied with certified wavelength and absorbance values at two different spectral bandwidths, 1.0 and 5.0 nm.

The Starna TS8 Deep UV reference set of proven stability is supplied with a Certificate of Calibration valid for two years by the Starna Calibration Laboratory, which is accredited by UKAS under ISO/IEC 17025, and ISO Guide 34.

\*TS8 is a proprietary matrix with the necessary spectral characteristics and stability to be used as a reference material.



## Suggestions for Use:

The peak wavelengths should first be identified by performing a wavelength scan at over the range from 190 to 260 nm at the required spectral bandwidth. These peaks should be verified as being within the expected wavelength tolerance.

The spectrophotometer absorbance values at these peak wavelengths can then be measured and compared to the certified absorbance values taking the expanded uncertainty budget† of

†for expanded uncertainty budget and expected parameters see p 37

the certified references into consideration.

If the absorbance values fall within the expected parameters of your instrument then your instrument is working correctly.

If it is determined that your instrument is not giving you the correct values, consult your service technician for advice on how to determine and correct any problem, which this reference may have detected.

## Ordering Information:

Description	Part Number, NIST Traceable	Price
Starna TS8, Deep UV & Blank Cell	RM-DUV/195	\$ 3995.00

# Metal on Quartz UV/Vis Absorbance/Linearity

## Description & NIST Traceability:

Metal on Quartz Visible filter for absorbance and linearity in the UV and Visible area of the spectrum. NIST Traceable complete with UKAS ISO/IEC 17025 accredited certificate of calibration

## Certified Wavelengths:

250, 280, 340, 360, 400, 465, 500, 546.1, 590 and 635 nm at spectral bandwidth of 5 nm or less.

## Physical Configuration:

Metal coated quartz filter with coated side protected by an optically contacted quartz window. The filters are mounted in protective aluminum holders that will fit a standard instrument cell holder.

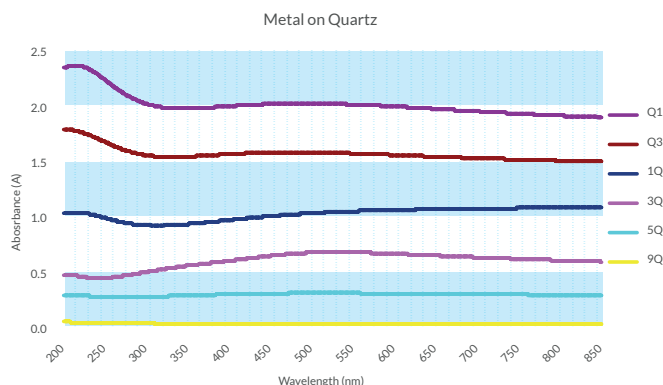
## Product Description:

The Starna RM-1Q3Q9Q is a direct equivalent to the NIST SRM 2031, with a standard range of Metal on Quartz absorbance standards for the UV/Visible area of the spectrum.

All Starna Metal on Quartz filters have an optically contacted quartz cover plate to protect the metalized surface and facilitate easy cleaning. This was also a feature of the original NIST SRM 2031.

The filters allow absorbance and linearity at the ten wavelengths across the range and the relative values are shown on the table below. They can be certified at wavelengths other than those

shown above, on request. The filters are manufactured in our ISO 9001 accredited production facility, under ISO Guide 34 as a reference material producer and calibration is carried out in our ISO/IEC 17025 accredited calibration laboratory.



## Metal on Quartz Filters:

Part No.	%T Transmittance	Absorbance
RM-Q1	1%	2.00 A
RM-Q3	3%	1.52 A
RM-1Q	10%	1.00 A
RM-3Q	30%	0.52 A
RM-5Q	50%	0.30 A
RM-9Q	90%	0.06 A

## Suggestions for Use:

The UV/Visible Metal on Quartz filters have a relatively flat profile across all UV/Visible wavelengths. Normally three representative absorption filters would be chosen for any given application but the filters may be bought individually, in sets as shown below or any combination from the standard range.

Compare the spectrophotometer absorbance values to the certified absorbance values. Taking the expanded uncertainty budget† of the certified references into consideration, if the

†for expanded uncertainty budget and expected parameters see p 37

absorbance values fall within the expected parameters† of your instrument then your instrument is working correctly.

It is important to confirm that Metal on Quartz filters are suitable for use with your instrument as they have a highly reflective surface and some instruments are sensitive to back reflection within the sample compartment.

## Ordering Information (Let us know what combination you require):

### Description

Single Metal on Quartz Reference, & Blank Holder  
Two Metal on Quartz References, & Blank Holder  
Three Metal on Quartz References, & Blank Holder  
Prices for other quantities available on request

### Part Number, NIST Traceable

RM-XX e.g. RM-3Q  
Sets can be constructed by combining the part numbers  
e.g. RM-1Q3Q9Q (Equivalent to NIST 2031a)

### Price

\$ 1290.00  
\$ 1890.00  
\$ 2450.00

# Starna Green Broadband - Wavelength, Absorbance/Linearity

<b>Description &amp; NIST Traceability:</b>	A mixed ultra stable dye solution permanently sealed by heat fusion in quartz cells. NIST traceable complete with UKAS ISO/IEC 17025 accredited certificate of calibration
<b>Primary Usage:</b>	Testing wavelength accuracy, absorbance scale and linearity in UV/Vis region.
<b>Certified Wavelengths:</b>	257, 416, and 630 nm with a SBW up to 12 nm
<b>Physical Configuration:</b>	Far UV quartz cells that have been permanently sealed by heat fusion. Also available in 1.5 ml screw-cap vials.

## Product Description:

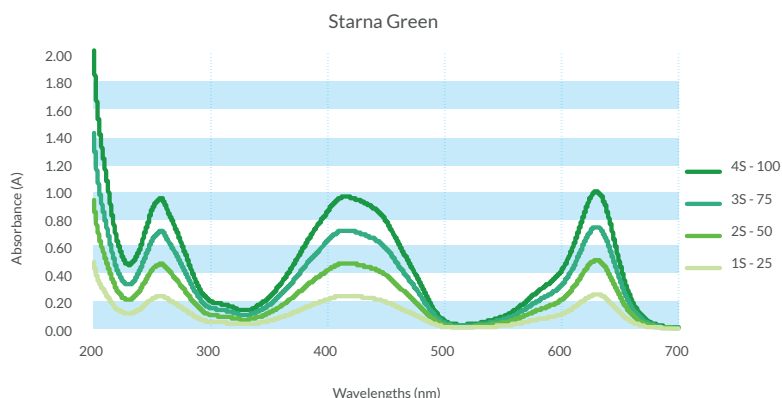
The use of stable aqueous dye solutions is an established and well recognized method for the validation of the absorbance scale and linearity of a spectrophotometer.

When prepared at the appropriate concentrations, these references have spectral characteristics that allow both the certification of the wavelength (257, 416, and 630 nm) and absorbance scale (0.25, 0.5, 0.75 or 1.0 A) in one discrete reference. Within the concentration range available, if the absorbance scale of the spectrophotometer is linear, the apparent absorbencies of a series of concentrations will be a linear function of concentration.



Starna Green is also available in 1.5 ml screw cap vials, for use in microvolume devices. The concentration 10X is matched to give absorbance readings of approximately 1A at a 1 mm path length.

The Starna Green reference is supplied with a Certificate of Calibration valid for two years by the Starna Calibration Laboratory, which is accredited by UKAS under ISO/IEC 17025, and ISO Guide 34.



## Suggestions for Use:

Scan the absorbance of the Starna Green cells over the certified wavelength range against the blank supplied.

Compare the spectrophotometer absorbance values to the certified absorbance values. Taking the expanded uncertainty budget† of the certified references into consideration, if the absorbance values fall within the expected parameters† of your instrument then your instrument is working correctly.

†for expanded uncertainty budget and expected parameters see p 37

To evaluate instrument linearity, plot a graph of concentration against absorbance for each of the three wavelengths.

If you determine that your instrument is not giving you the correct values, consult your service technician for advice on how to determine and correct any problem, which this reference may have detected.

## Ordering Information:

Description	Part Number, NIST Traceable	Price
Starna Green, Blank, 25X concentration	RM-1SG	\$ 770.00
Starna Green, Blank, 50X concentration	RM-2SG	\$ 770.00
Starna Green, Blank, 75X concentration	RM-3SG	\$ 770.00
Starna Green, Blank, 100X concentration	RM-4SG	\$ 770.00
Starna Green, Blank, 4 concentrations	RM-1SG2SG3SG4SG	\$ 1720.00
Starna Green, 1 x 1.5 ml vial, screw cap	RM-SG10-SC1	\$ 180.00
Starna Green, 2 x 1.5 ml vials, screw cap	RM-SG10-SC2	\$ 340.00
Starna Green, 4 x 1.5 ml vials, screw cap	RM-SG10-SC4	\$ 590.00

# Liquid Wavelength References – UV and Far UV

- Traceability:** All Starna liquid wavelength references are NIST traceable and supplied with UKAS ISO/IEC 17025 accredited certificate of calibration.
- Description:** Liquid references permanently sealed by heat fusion into far UV quartz cells. This ensures the optical configuration method used for quality control is identical to that for normal analysis. They also have narrower bandwidths than glass filters, providing more accurate location of the peaks.
- Primary Usage:** These solutions can be used to confirm that the wavelength scale of your instrument is within the manufacturer's tolerances for any given wavelength. Four references cover wavelengths from UV to Far UV.
- Spectral Band Width:** Because the absorption bands are asymmetric, wavelength values will be dependent on spectral bandwidth. For this reason the certified wavelength values given below are approximate. The certificate supplied with each reference gives actual wavelength values measured at 0.1, 0.25, 0.5, 1, 2, and 3 nm. Values at other SBWs can be supplied on request.

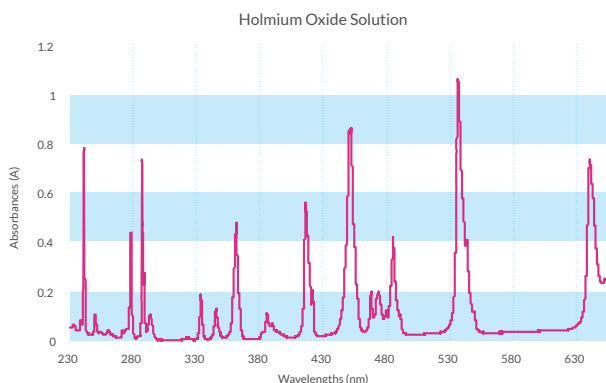


## Holmium Oxide (Holmium oxide in perchloric acid)

**Certified Wavelengths:** 241, 250, 278, 288, 334, 346, 361, 385, 417, 451, 468, 485, 537, 641 nm

Holmium oxide (4% m/v) in 10% v/v perchloric acid, permanently sealed by heat fusion into a 10 mm far UV quartz cuvette. When prepared in perchloric acid, holmium oxide gives a spectral scan containing a series of 14 sharp and well-defined peaks covering the wavelength range from 240 to 650 nm.

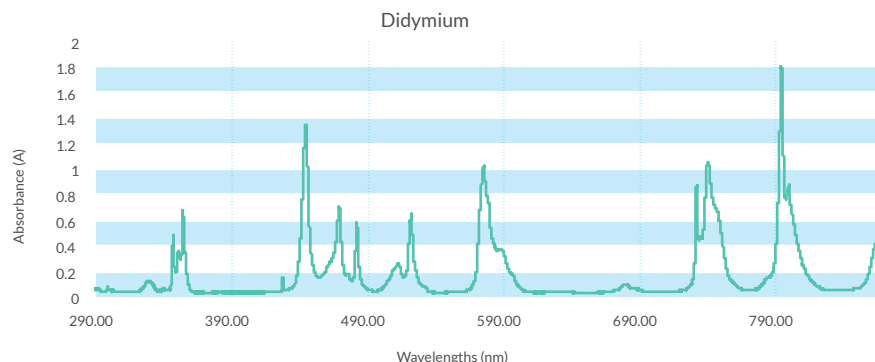
It is the most widely used reference for validating the wavelength scale of UV/Vis spectrophotometers



## Didymium Oxide (Didymium oxide in perchloric acid)

**Certified Wavelengths:** 298, 329, 354, 444, 469, 482, 512, 522, 575, 732, 740, 794, 799, 864 nm

Didymium is a mixture of two Rare Earth elements, neodymium and praseodymium. It is popular as a visible wavelength standard in the form of doped glass. This Starna liquid reference extends the range of the reference into the UV region, and gives 14 sharp peaks over the range 290 to 870 nm.

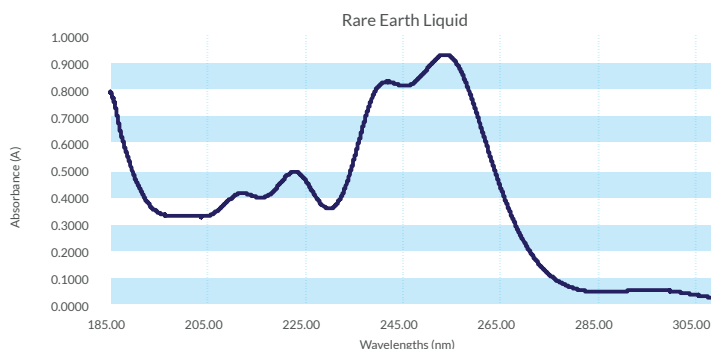




## Far UV Reference (Rare Earth oxide in sulfuric acid)

**Certified Wavelengths:** 201, 212, 223, 240, 253 nm

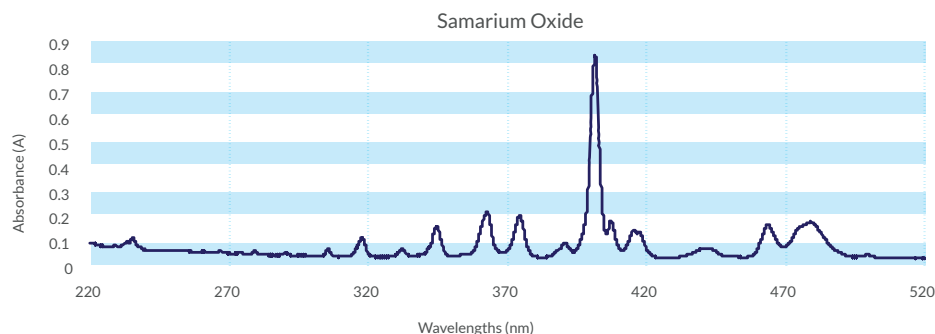
The validation of the wavelength scale in the Far UV is difficult because of the lack of suitable reference materials. This material, developed by Starna, allows wavelength scale validation down to 200 nm. The Rare Earth oxide is dissolved in very dilute sulfuric acid and provides five peaks for wavelength qualification over the range 200 – 270 nm.



## Samarium Oxide (Samarium oxide in perchloric acid)

**Certified Wavelengths:** 235, 279, 290, 305, 318, 332, 344, 362, 374, 391, 401, 415, 464, 479 nm

Samarium oxide is a particularly suitable reference material for checking the wavelength scale of a spectrophotometer over the commonly used range of 200 to 500 nm, as it has peaks throughout this region. Many of the peaks are very narrow, not only providing very accurate location of the peak wavelengths, but a useful indication of the spectral bandwidth of the instrument.



## Suggestions for Use

Scan the filter over its usable range and identify the peaks whose wavelength values are given in the calibration certificate, having regard to the bandwidth of the instrument. Compare the measured values to the certificate values. Taking the expanded uncertainty budget† of the references into consideration, then the wavelength values should fall within the expected parameters† of your instrument if it is working correctly.

The results may be used to build up a data log of the instrument's wavelength accuracy over time. This may be used for certification purposes and for troubleshooting should the correlation change. The data will also be useful to a service technician to diagnose and correct any problems that may develop with your instrument.

†for expanded uncertainty budget and expected parameters see p 37

## Ordering Information:

Description	Part Number, NIST Traceable	Price
Holmium Wavelength Reference Cell	RM-HL	\$ 565.00
Didymium Wavelength Reference Cell	RM-DL	\$ 795.00
Samarium Wavelength Reference Cell	RM-SL	\$ 795.00
Far UV Wavelength Reference Cell	RM-RE	\$ 875.00

# Stray Light Reference Materials

## Description & NIST Traceability:

Materials with sharp transmission cutoffs at specified wavelengths. Traceable to NIST SRM 2032. Complete with UKAS ISO/IEC 17025 certificate of validity as an indicator of stray light

## Primary Usage:

Detection of instrumental stray light in the UV and visible regions. Measurements made with these references are accepted by the US Pharmacopeia (USP) for instrument qualification.

## Usable Range:

200 to 390 nm, depending on the material

## Physical Configuration:

Liquid filters in 10 mm Far UV quartz cells that have been permanently sealed by heat fusion. Supplied with 5 mm cell of the same solution to be used as blank

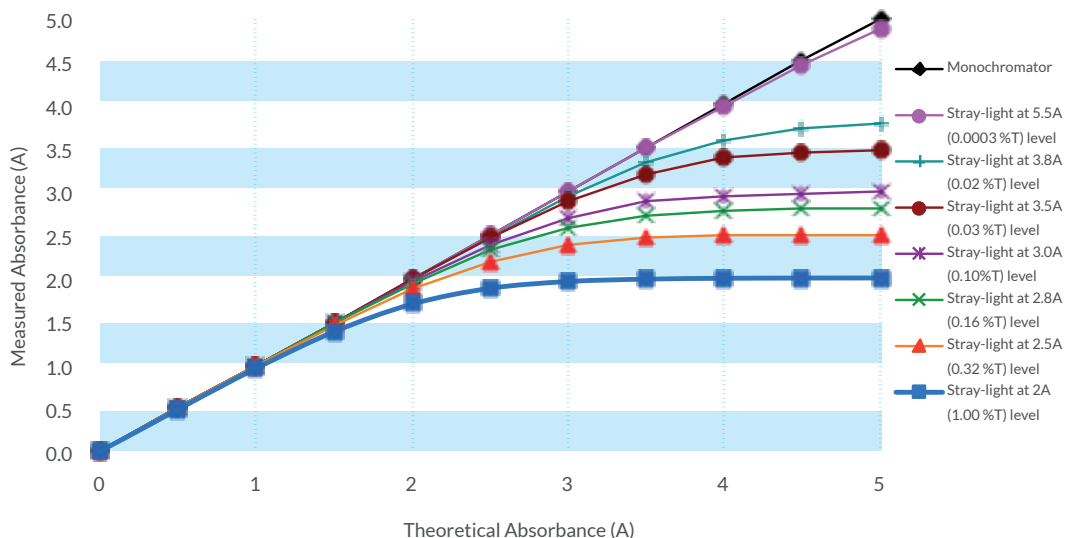
## Product Description:

Stray light, also called Stray Radiant Energy or Power, is any light reaching the instrument detector other than that selected by the monochromator. It can be due to optical imperfections or stray reflections within the monochromator itself or to light leaks in the optical system. The detector cannot discriminate between the analytical wavelength and the stray light, so the stray light introduces an error in the measured absorption. The stray light is not absorbed even at high concentrations of the absorbing species, so its effect is a negative deviation from the linear relationship between concentration and absorbance (the Beer-Lambert law) on which most quantitative determinations are based.

Stray light is wavelength and instrument dependant. It can be present at any wavelength but is most noticeable when the energy throughput of the system is relatively low, for example in the far UV region. At these wavelengths, any deterioration in the instrument optics or UV light source will exaggerate the apparent stray light. Checking the instrument in the far UV region, even if this is not the area for which it will be primarily used, is an excellent way to monitor the condition of the instrument optics.



Effects of Stray Light on Instrument Linearity



# USP/ASTM Solution Filter Ratio Method



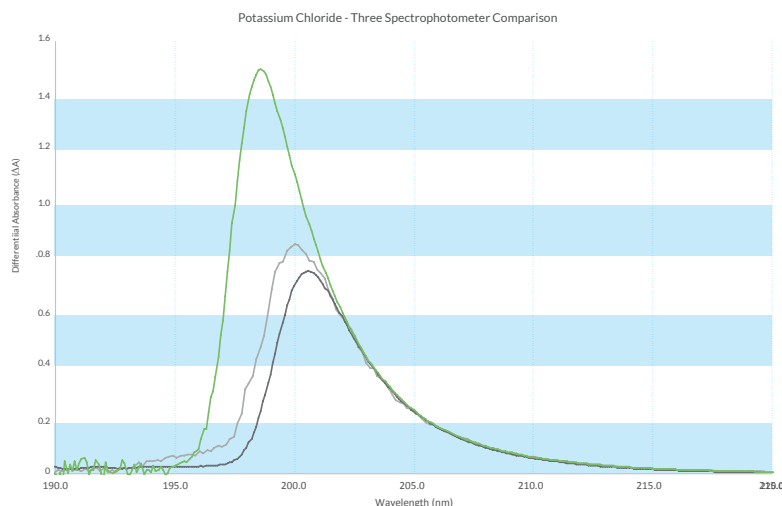
A range of materials allows stray light to be estimated at different wavelengths:

Material	Concentration	Usable Range
Potassium Chloride	1.2% aqueous	190 - 205 nm
Potassium Iodide	1% aqueous	210 - 259 nm
Sodium Iodide	1% aqueous	210 - 259 nm
Acetone	Spectroscopy grade	250 - 320 nm
Sodium Nitrite	5% aqueous	300 - 385 nm

These reference materials allow you to detect the presence of stray light in your instrument. Each material cuts off all light below a specified wavelength. Any light detected by the instrument

below that wavelength must, by definition, be stray light.

In this USP approved method of estimating stray light, also known as the Meilenz method, the 10 mm reference material cell is scanned using the 5 mm cell as a blank. The resulting spectrum is in the form of a peak. The peak wavelength will vary according to the optical configuration and stray light characteristics of the instrument under test, but the absorbance value at the peak must exceed 0.7 A to meet the requirements of the USP. This graph shows scans of the 10mm potassium chloride reference cell on three different instruments, using the 5 mm potassium chloride cell as blank. The peak wavelength is different on each instrument due to their different stray light characteristics, but in all three cases the absorbance maximum is greater than 0.7 A, so all three instruments satisfy the USP stray light requirement .



## Suggestions for Use:

The procedure for using the stray light references is similar for all materials. Insert the 10 mm stray light reference cell in the sample beam cell holder and the supplied 5 mm blank cell in the reference beam cell holder of the spectrophotometer. Scan over the stated usable range and note the absorbance at the peak. This absorbance value at the peak must exceed 0.7 A to meet the requirements of USP Chapter <857>.

Periodically scan with the same instrument configuration and compare the results. Over time you will have a data trail for your instrument that will make the detection and correction of any problems relating to stray light much more effective.

## Ordering Information:

Description	Part Number, NIST Traceable	Price
Potassium Chloride, 10mm & 5 mm cells	RM-KC/5	\$ 875.00
Potassium Iodide, 10mm and 5 mm cells	RM-KI/5	\$ 875.00
Sodium Iodide, 10mm and 5 mm cells	RM-SI/5	\$ 875.00
Acetone, 10mm and 5 mm cells	RM-AC/5	\$ 875.00
Sodium Nitrite, 10mm and 5 mm cells	RM-SN/5	\$ 875.00
2 Stray Light set	Sets can be configured by combining individual	\$ 1625.00
3 Stray Light set	part numbers: RM-ACKCSI/5 would be Acetone,	\$ 2375.00
4 Stray Light set	Potassium Chloride and Sodium Iodide	\$ 3125.00

Note: Potassium Iodide and Sodium Iodide have identical cut-off characteristics and are effectively identical and interchangeable.

# Stray Light Reference Materials (Except USP)

<b>Description &amp; NIST Traceability:</b>	Materials with sharp transmission cutoffs at specified wavelengths. Traceable to NIST SRM 2032. Complete with UKAS ISO/IEC 17025 certificate of calibration
<b>Primary Usage:</b>	Detection of instrumental stray light in the UV and Visible regions. Measurements made with these references are accepted by the European Pharmacopoeia for instrument qualification.
<b>Usable Range:</b>	200 to 390 nm, depending on the material
<b>Physical Configuration:</b>	Liquid filters in far UV quartz cells that have been permanently heat fusion sealed. A blank cell is supplied with each reference or set of references.

## Product Description:

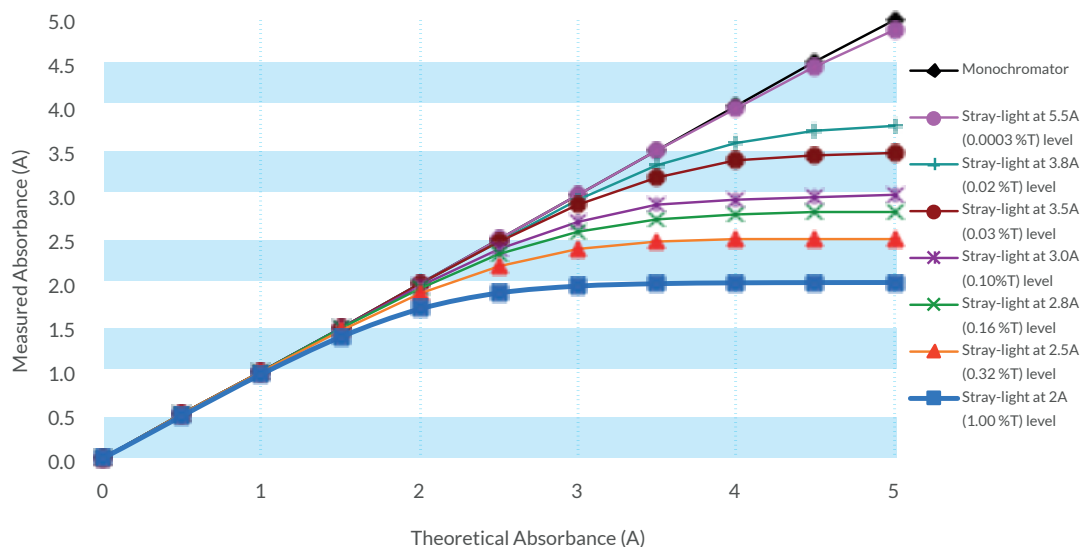
Stray light, also called Stray Radiant Energy or Power, is any light reaching the instrument detector other than that selected by the monochromator. It can be due to optical imperfections or stray reflections within the monochromator itself or to light leaks in the optical system. The detector cannot discriminate between the analytical wavelength and the stray light, so the stray light introduces an error in the measured absorption. The stray light is not absorbed even at high concentrations of the absorbing species, so its effect is a negative deviation from the linear relationship between concentration and absorbance (the Beer-Lambert law) on which most quantitative determinations are based.

Stray light is wavelength and instrument dependant. It can be present at any wavelength but is most noticeable when the energy throughput of the system is relatively low, for example in the Far UV region. At these wavelengths, any deterioration in the instrument optics or UV light source will exaggerate the apparent stray light. Checking the instrument in the far UV region, even if this is not the area for which it will be primarily used, is an excellent way to monitor the condition of the instrument optics.



These reference materials allow you to detect the presence of stray light in your instrument. Each material cuts off all light below a specified wavelength. Any light detected by the instrument below that wavelength must, by definition, be stray light. The cut-off wavelength is defined as the wavelength at which the absorbance spectrum transitions through 2 A.

Effects of Stray Light on Instrument Linearity



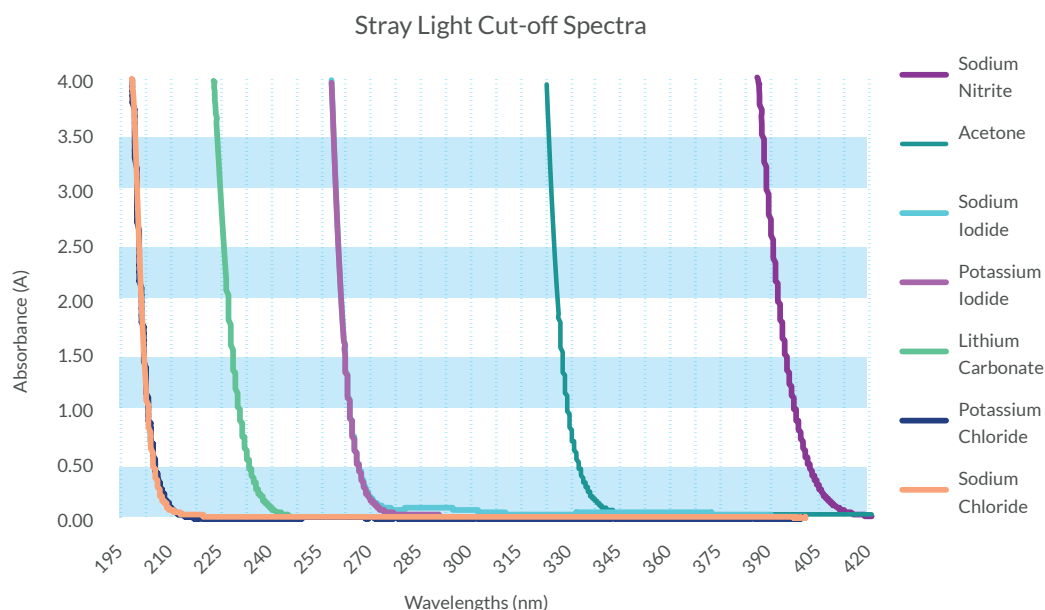


# ASTM 387 Specified Wavelength Method

A range of materials allows stray light to be estimated at different wavelengths:

Material	Concentration	Cut-off	Usable Range
Potassium Chloride	1.2% aqueous	200 nm	175 - 200 nm
Sodium Chloride	1% aqueous	205 nm	175 - 200 nm
Lithium Carbonate	Saturated aqueous	227 nm	210 - 225 nm
Potassium Iodide	1% aqueous	260 nm	210 - 259 nm
Sodium Iodide	1% aqueous	260 nm	210 - 259 nm
Acetone	Spectroscopy grade	326 nm	250 - 320 nm
Sodium Nitrite	5% aqueous	391 nm	300 - 385 nm

Starna stray light CRMs have very sharp transitional (cut-off) spectra, giving excellent filtering characteristics:



## Suggestions for Use:

The procedure for using the stray light references is similar for all materials. Set your spectrophotometer's wavelength 20 nm above the cutoff wavelength (for Potassium Iodide you would start at 280 nm). Insert the stray light reference cell in the sample beam cell holder of the spectrophotometer and the supplied blank cell in the reference beam cell holder. Scan down into the UV to the lowest wavelength of the usable range of the reference material. Any light transmitted below the cutoff wavelength will be stray

light. If the amount of stray light is greater than the specification given in your instrument manual, a service technician may be required to investigate and correct the problem.

Periodically scan with the same instrument configuration and compare the results. Over time you will have a data trail for your instrument that will make the detection and correction of any problems relating to stray light much more reliable.

## Ordering Information:

Description	Part Number, NIST Traceable	Price per set
Potassium Chloride & Blank Cell	RM-KC	\$ 835.00
Sodium Chloride & Blank Cell	RM-SC	\$ 835.00
Lithium Carbonate & Blank Cell	RM-LC	\$ 835.00
Potassium Iodide & Blank Cell	RM-KI	\$ 835.00
Sodium Iodide & Blank Cell	RM-SI	\$ 835.00
Acetone & Blank Cell	RM-AC	\$ 835.00
Sodium Nitrite & Blank Cell	RM-SN	\$ 835.00

# Ultraviolet Bandwidth - Toluene in Hexane

NEW  
USP 857  
REFERENCE

## Description & NIST Traceability:

Quartz cell filled with toluene in hexane and permanently sealed by heat fusion, NIST traceable complete with UKAS ISO/IEC 17025 accredited certificate of calibration

## Primary Usage:

Determination of bandwidth and resolution in the UV region

## Usable Range:

267 to 270 nm

## Physical Configuration:

Far UV quartz cells that have been permanently sealed by heat fusion

## Product Description:

The Spectral Bandwidth (SBW) of a spectrophotometer is the basis of establishing its ability to resolve spectral features separated by small differences in wavelength. If the spectrum of a sample to be measured is suspected of having an interfering peak within the stated spectral bandwidth of the instrument then it should

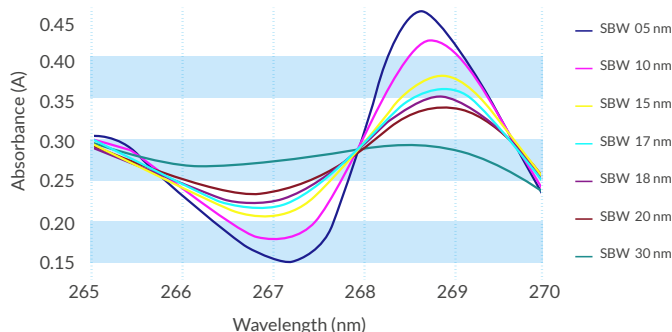
be established whether or not the spectrophotometer is able to resolve the two peaks separately or "mixes" the two absorption peaks into a single peak, leading to erroneous results.

Toluene in hexane is used as a reference for the calculation of SBW. The ratio of the absorbance values of the solution at the peak at 268.7 nm and the trough at 266.8 nm relates directly to the SBW of the instrument being assessed. Regular use of this technique will ensure that the resolution of your instrument is within the required range for your work.

The toluene in hexane reference consists of two far UV quartz spectrophotometer cells with the solution permanently sealed



Toluene in Hexane



in the cells by heat fusion. One cell contains 0.02% toluene in hexane, the other is a hexane only blank. The Toluene in hexane cell is traceable to SRM 935a which is a transmittance/absorbance reference material.

### Table of Approximate Ratios

SBW:	0.5	1.0	1.5	2.0	3.0
Ratio:	2.5	2.1	1.6	1.4	1.0

## Suggestions for Use:

Scan the toluene in hexane cell against the hexane blank cell from 265 nm to 270 nm at a bandwidth setting appropriate to your analysis. Calculate the ratio of the absorbance values at the peak at 268.7 nm and the trough at 266.8 nm and compare the result with the values in the certificate to determine the spectral bandwidth of your instrument. If the spectral bandwidth is greater than the specification given in your instrument

manual, a service technician may be required to investigate and correct the problem.

Periodically scan with the same instrument configuration and compare the results. Over time you will have a data trail for your instrument that will make the detection and correction of any problems relating to spectral bandwidth much more reliable.

## Ordering Information:

### Description

Toluene in Hexane cell with blank

### Part Number, NIST Traceable

RM-TX

### Price

\$ 885.00

# Ultraviolet Bandwidth – Derivative Spectrophotometry-Toluene in Methanol

## Description & NIST Traceability:

0.020% v/v solution of toluene in methanol, permanently sealed by heat fusion into a far UV quartz cell. Supplied with a methanol blank. Traceable to NIST SRMs and supplied with UKAS ISO/IEC 17025 accredited certificate of calibration.

## Primary Usage:

Qualification of UV spectrophotometers for bandwidth (resolution) in derivative spectroscopy

## Usable Range:

230 to 290 nm

## Physical Configuration:

Far UV quartz cells that have been permanently sealed by heat fusion

## Product Description:



This reference is described in the European Pharmacopoeia as a resolution test for use in derivative spectroscopy.

In derivative spectroscopy, absorption spectra are transformed into first- second- or higher-order derivatives. This technique facilitates the resolution of two or more peaks that overlap and become merged into a composite curve, and are represented by shoulders on that curve rather than as individual peaks. By calculating the derivative, the underlying individual spectra can be more readily identified.

The reference consists of 0.020% v/v solution of toluene in methanol, permanently sealed by heat fusion into a far UV quartz cell and supplied with a methanol blank.

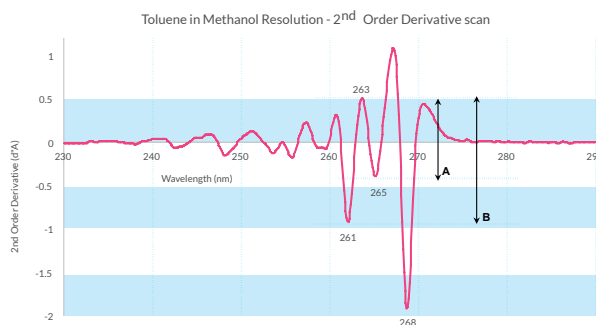
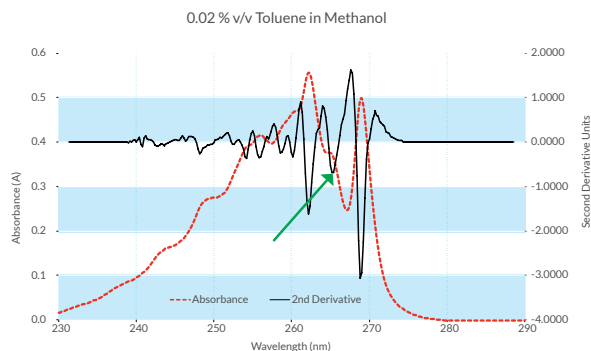
## Suggestions for Use:

The spectrophotometer to be tested must have the ability to produce second-order derivative spectra. The procedure will be described in the instrument's operating manual.

Scan the toluene in methanol reference cell in second-derivative mode using the methanol cell as a blank. The derivative spectrum should be similar to that shown, with a small negative extremum (→) between two larger negative extrema at 261 nm and 268 nm.

To comply with the requirements of the European Pharmacopoeia, the ratio A/B should be not less than 0.2.

If the test fails, a service technician may be required to investigate and correct the problem. In any case, repeating the test at intervals will allow the creation of an audit trail that will assist with certification and the rectification of any instrument problems.



## Ordering Information:

### Description

Toluene in Methanol cell with blank

### Part Number, NIST Traceable

RM-TM

### Price

\$ 885.00

# Ultraviolet Resolution – Benzene Vapor

Description:	0.01 ml Benzene in a vapor state sealed in a quartz cell
Primary Usage:	Test the resolution at various bandwidths of grating based instruments in the UV
Usable Range:	240 to 265 nm
Physical Configuration:	Far UV quartz cell that has been permanently sealed by heat fusion

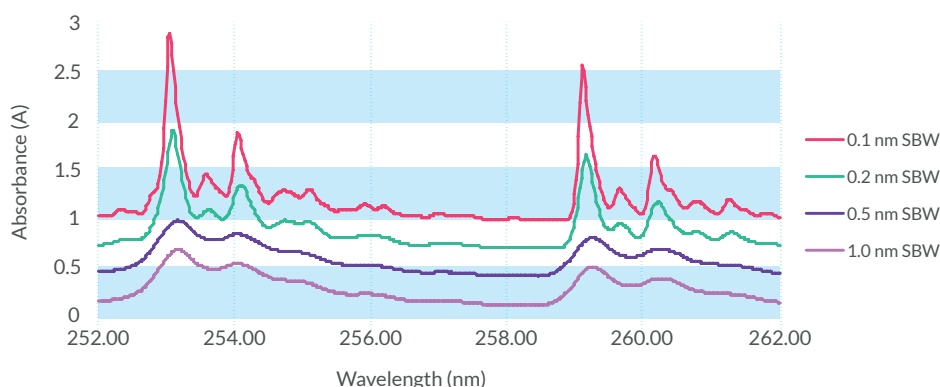
## Product Description:

The ability of your spectrophotometer to resolve absorption peaks is the basis of its theory of operation. If absorption peaks cannot be resolved adequately, then interfering peaks will be integrated with the correct peaks, thus giving an inaccurate measurement.

Benzene vapor is an effective material for the detection of a grating based spectrophotometer's resolving power, as it has a great number of close but distinct absorption peaks.

Benzene vapor may not work well with a photodiode array spectrophotometer.

Benzene Vapor Spectra at various Spectral Bandwidths (SBWs) - offset for clarity



## Suggestions for Use:

Set your spectrophotometer to a Spectral Bandwidth (SBW) and a scan rate and note the settings. Scan from 240 to 265 nm and compare the peaks to the two charts and determine what changes need to be made to the setting of your spectrophotometer to improve the resolution of the scan. Continue to alter the bandwidth setting until you have optimized

the resolution. Make a note of the settings in your quality procedures.

Each time that the scan is repeated you can compare the new scan with previous scans to check for any variance. If your instrument needs service because of a drop in resolution, the historical data will greatly assist the service technician.

## Ordering Information:

Description	Part Number	Price
Instrument Resolution reference cell, Benzene Vapor	RM-BZ	\$ 465.00



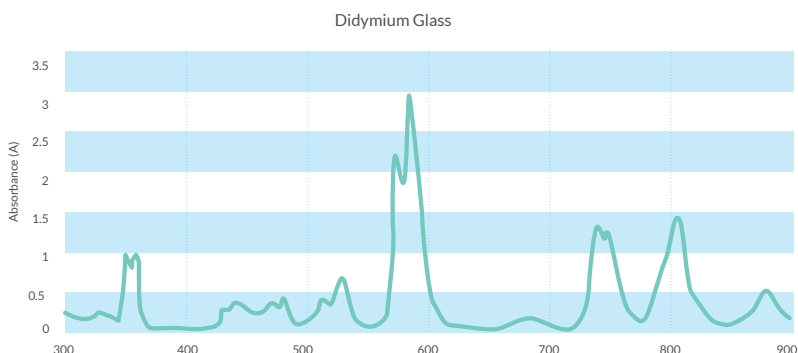
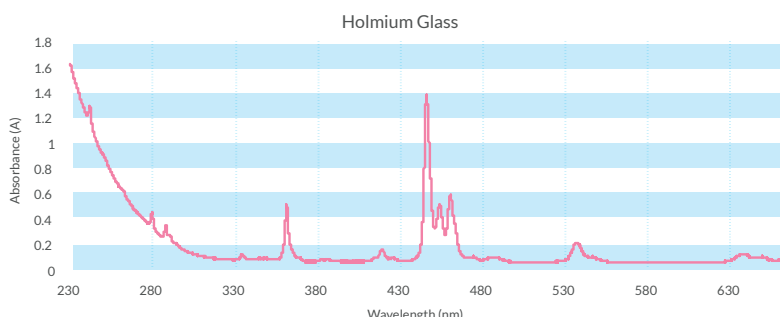
# UV-Visible Wavelength - Holmium & Didymium Glass

<b>Description &amp; Traceability:</b>	Holmium glass filter and Didymium glass filter, NIST traceable complete with UKAS ISO/IEC 17025 accredited certificate of calibration
<b>Primary Usage:</b>	Verification of wavelength scale accuracy in both UV and visible
<b>Usable Range:</b>	241 nm to 640 nm (Holmium). 430 nm to 890 nm (Didymium)
<b>Spectral Band Width:</b>	The certificate indicates the above wavelength measured at 0.1, 0.25, 0.50, 1, 1.5, 2, and 3 nm. Other SBWs can be provided on request.
<b>Physical Configuration:</b>	Stress free glass filter mounted in an anodized aluminum holder

## Product Description:

Both Holmium and Didymium provide distinctive peaks that make each suitable for use as a wavelength standard. These robust Starna filters are more suitable for some environments than the liquid cells. They are mounted in an anodized aluminum housing to protect the polished surfaces.

The Holmium and Didymium glass filters are used to ensure that the instrument wavelength scale is within the expected tolerances for the actual wavelength being measured.



## Suggestions for Use:

Holmium and Didymium filters present a wide range of peaks that can be resolved. The number of peaks resolved will depend on the spectral bandwidth used. The wavelength peaks can then be used to compare the wavelength indicated by your spectrophotometer to the known peaks.

The initial procedure should be to scan the filter over the usable range to identify all the peaks that can be resolved at the specified SBW of the instrument. Adjust the Spectral Bandwidth and scan rate to produce a usable spectra. Check each peak

to ensure that the reading on your spectrophotometer is within the manufacturer's tolerances of the wavelength readout. If not, a service technician may be required to check or adjust your instrument. The filters should be measured against air.

Spectra should be checked regularly, at a minimum in the area of regular analysis. Periodic use of the Holmium or Didymium reference will enable the user to build a data log of the instrument's spectral accuracy for use with certification and troubleshooting should the correlation change over time.

## Ordering Information:

Description	Part Number, NIST Traceable	Price
Holmium Glass, Wavelength reference filter, NIST traceable	RM-HG	\$ 350.00
Didymium Glass, Wavelength reference filter, NIST traceable	RM-DG	\$ 480.00

# Neutral Density Filters - Visible

## Description & NIST Traceability:

Neutral density glass filters calibrated for absorbance/transmission in the visible region of the spectrum. Traceable to NIST SRMs and supplied with UKAS ISO/IEC 17025 accredited certificate of calibration.

## Primary Usage:

Validating the photometric accuracy and linearity of spectrophotometers in the visible region.

## Certified Wavelengths:

440.0, 465.0, 546.1, 590.0, 635.0 nm

## Physical Configuration:

Glass filters mounted "stress free" in anodized aluminum holder

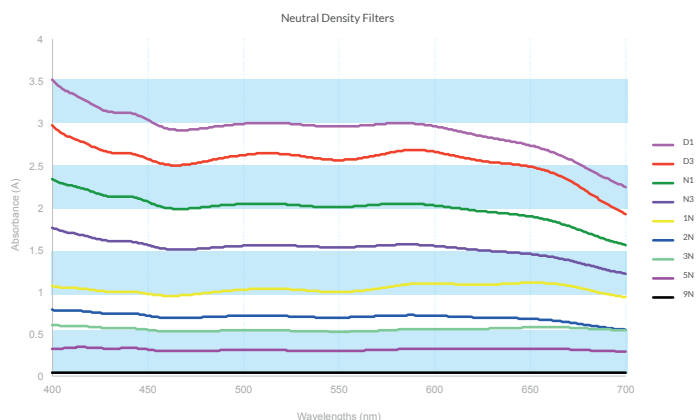
## Product Description:

These filters are traceable to NIST SRMs, including sets SRM 930e, SRM 1930 and SRM 2930. They are used to validate the photometric scales of visible spectrophotometers in both transmission and absorbance.



Manufactured from Schott NG type glass, the thickness and glass type are calibrated to produce filters with known absorbance and transmittance values. The filters are mounted "stress free" in a black anodized aluminum holder compatible with all standard spectrophotometer cell holders. Each NIST traceable filter is individually tested and certified.

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



18 filters cover absorbance values from 0.04 A to 3.5 A (92 %T to 0.03 %T). They are available individually or in convenient sets – see opposite page for details. An empty filter holder is supplied as a measurement blank.

## Suggestions for Use:

Zero the instrument using the empty filter holder supplied and measure the filters at the certified wavelengths. Compare the measured values to the certificate values. Taking the expanded uncertainty budget† of the references into consideration, then the absorbance values should fall within the expected parameters† of your instrument if it is working correctly. If more than two filters with different absorbance values are available, the values may be used to plot a graph to establish the instrument's linearity.

The results may be used to build up a data log of the instrument's photometric accuracy over time. This may be used for certification purposes and for troubleshooting should the correlation change. The data will also be useful to a service technician to diagnose and correct any problems that may develop with your instrument.

†for expanded uncertainty budget and expected parameters see p 37

## NIST Compliance

NIST 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. These sets consist of three filters together with an empty aluminum holder, to be used as a blank.

These SRMs were originally specified in transmission, the specified nominal transmission and approximate absorbance values are shown in the table:

	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

For convenience, all certification measurements are made at a SBW of 1.0 nm. This complies fully with the SRM specifications. Actual certificate values are given in both Transmission (%T) and Absorbance (A).



## Ordering Information:

### NIST SRM Equivalent Sets, referenced in USP <857>:

#### Description

SRM 930e Set: 10, 20 & 30 %T Neutral Density Filters and blank holder  
 SRM 1930 Set: 1, 3 & 50 %T Neutral Density Filters and blank holder  
 SRM 2930 Set: 0.1, 0.3 & 92 %T Neutral Density Filters and blank holder  
 Combined SRM Set: All 9 Neutral Density Filters listed above and blank holder

#### Part Number, NIST Traceable

RM-1N2N3N \$ 1190.00  
 RM-N1N35N \$ 1190.00  
 RM-D1D39N \$ 1190.00  
 RM-SRM9ND \$ 3190.00

#### Price

### Transmittance/Absorbance and Wavelength Set (USP <857> compliant):

This set combines three neutral density filters (with blank holder) and a holmium glass filter and is a convenient way of qualifying a visible spectrophotometer for photometric, linearity and wavelength accuracy. Approximate values are:

Neutral Density Filters 1.00, 0.50 & 0.25 A (10, 30 & 52 %T)  
 Holmium Glass Filter (see page 21) 11 peaks from 240 nm to 640 nm.



#### Description

#### Part Number, NIST Traceable

#### Price

Neutral Density and Holmium Filter Set

RM-1N3N5DHG

\$ 1520.00

### Starna Neutral Density Filters

Available individually or as sets of 4, 6 and 9 filters. The Catalogue numbers and contents of these kits are given in the table below:

% Transmittance	Absorbance	Part Number				
		Single filter	Set of 4 filters RM-4ND	Set of 6 filters RM-6ND	Set of 9 filters RM-9ND	Set of 9 filters RM-SRM9ND
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				•
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				
Price		\$ 630.00	\$ 1580.00	\$ 2220.00	\$ 3190.00	\$ 3190.00

**Note:** Any choice of filters can be combined in a set simply by combining the individual part numbers. For example RM-1N2N3N is a set of 3 filters with transmittance values 10, 20 and 30% T.

# Microplate Reader Visible Reference Plate

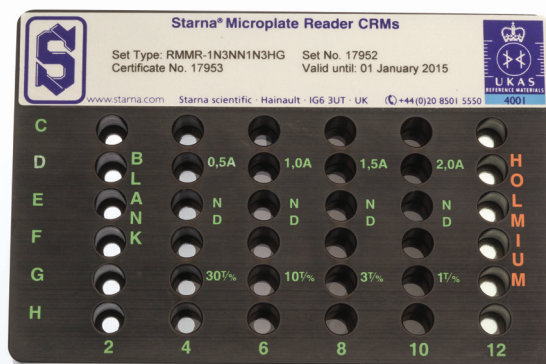
<b>Description:</b>	96 well microplate validation filters for wavelength and absorbance scales, NIST Traceable complete with UKAS ISO/IEC 17025 accredited certificate of calibration
<b>Primary Usage:</b>	Validation of the visible photometric and wavelength scale of 96 well microplate readers.
<b>Certified Wavelengths:</b>	Wavelength and Holmium - 360, 418, 445, 453, 460, 536, 637 nm, Neutral Density - 440.0, 465.0, 546.1, 590.0, 635.0 nm
<b>Physical Configuration:</b>	Glass Filters mounted in 96 well format anodized aluminum holder

## Product Description:

This microplate is used to test the photometric scale and wavelength accuracy of 96 well plate readers in the visible wavelength range.

The absorbance filters are made from Schott NG-type glass, which absorbs a known percentage of the light passing through it. They are based on the NIST sets SRM 930e, SRM 1930 and SRM 2034. The thickness of the particular glass type used is calculated to produce filters of approximate transmittance/absorbance values; the approximate values are shown below. Each NIST traceable filter is individually tested and certified.

The Holmium Glass filter has peaks from 360 nm to 637 nm.



## Specifications:

### Certified Wavelengths:

#### Neutral Density Absorbance Filters:

440.0 nm 465.0 nm 546.1 nm 590.0 nm 635.0 nm

#### Holmium Wavelength Filter (approximate wavelengths):

637 nm 536 nm 460 nm 453 nm 445 nm 418 nm 360 nm

## Filters in reference plate:

### Configuration of Reference Plate:

Well Positions	Filter Type	Filter Values
C2 - H2	Air Blank	
C4 - H4	Neutral Density	30%T (0.5 Absorbance)
C6 - H6	Neutral Density	10%T (1.0 Absorbance)
C8 - H8	Neutral Density	3%T (1.5 Absorbance)
C10 - H10	Neutral Density	1%T (2.0 Absorbance)
C12 - H12	Holmium	Peaks from 360 to 637 nm

## Ordering Information:

Description	Part Number, NIST Traceable	Price per set
96 Well Microplate Reader Validation Plate	RMMR-1N3NN1N3HG	\$ 2250.00



# Starna References to 96 Well Microplate Adaptor

<b>Description:</b>	A patented adaptor plate (Patent Number US8115922), which allows the use of either Starna glass or liquid references in the validation of a 96 well microplate reader.
<b>Primary Usage:</b>	Performance validation of your microplate reader with Starna Reference sets
<b>Usable References:</b>	All standard references and filters produced by Starna.
<b>Usable Cells</b>	Specially designed screw-top cells manufactured by Starna to fit the adaptor plate. These may be used with any solution for analysis.
<b>Physical Appearance:</b>	Injection molded polymer tray with slots for 8 references or cuvettes
<b>Compatible Readers:</b>	The adaptor is compatible with all 96 well plate readers

## Product Description:

Hole alignment of the CuvettePlate conforms to the international standard and precise location of the wells in a 96 well microplate. Slots precisely align the cuvettes over the available holes through the bottom plate. A small ridge in the center of the CuvettePlate slightly tilts the cuvettes so that the bubble in a liquid sample does not interfere with the light beam of the microplate reader.



Validating your microplate reader with liquid filled cuvettes is easy with the CuvettePlate. Place your NIST traceable references in the CuvettePlate and they will be aligned into the format for your reader and held so that the bubble in the reference cell will not interfere with the analysis. You can use any of the Starna validation references as well as the NIST SRM-2034 Holmium.

Microplate readers can be validated using exactly the same NIST traceable filters either liquid or for instance Neutral Density Filters such as our Part Number RM-1N2N3N or NIST SRM-930), that you may already be using to calibrate other spectrophotometers in your laboratory.

Under these circumstances it is not necessary to purchase extra reference materials. This also allows laboratories to cross-validate and make comparisons between different types of spectrophotometer instruments.



## Ordering Information:

Description	Part Number	Price
CuvettePlate, 96 well microplate adaptor	SCP-96-8R	\$ 99.00
10 mm Quartz Cell with PTFE screw-cap	1.30-Q-10-ST	\$ 249.00

# 260/280 nm Validation Reference for DNA and RNA

<b>Description:</b>	Standard solution which gives a stable 260/280 nm ratio of 1.8 to 2.0, NIST Traceable complete with UKAS ISO/IEC 17025 accredited certificate of calibration
<b>Primary Usage:</b>	Control the quality of DNA/RNA purity analysis
<b>Certified Wavelengths:</b>	260 nm and 280 nm
<b>Physical Configuration:</b>	Far UV quartz cell that has been permanently sealed by heat fusion. The reference is also available in vials containing 1.5 ml, with a screw cap.

## Product Description:

When running DNA or RNA purity analysis on a spectrophotometer, it is important to ensure that the instrument is working correctly. The Starna DNA/RNA validation reference (DNA CON) is a stable solution, which mimics the 260/280 nm ratio of DNA and RNA.

The RM-DNA (permanently sealed reference) is supplied with a certificate which lists the expected 260/280 nm ratio and the confidence limit of the ratio. The validation analysis is performed

by our ISO/IEC 17025 accredited laboratory and is traceable to NIST.

The screw cap vials reseal to maintain the integrity of the DNA CON. This format allows for the removal of the DNA CON by pipette or syringe for use in microvolume devices.

The vials are available in concentrations of 5x and 10x as listed below.

RM-DNA

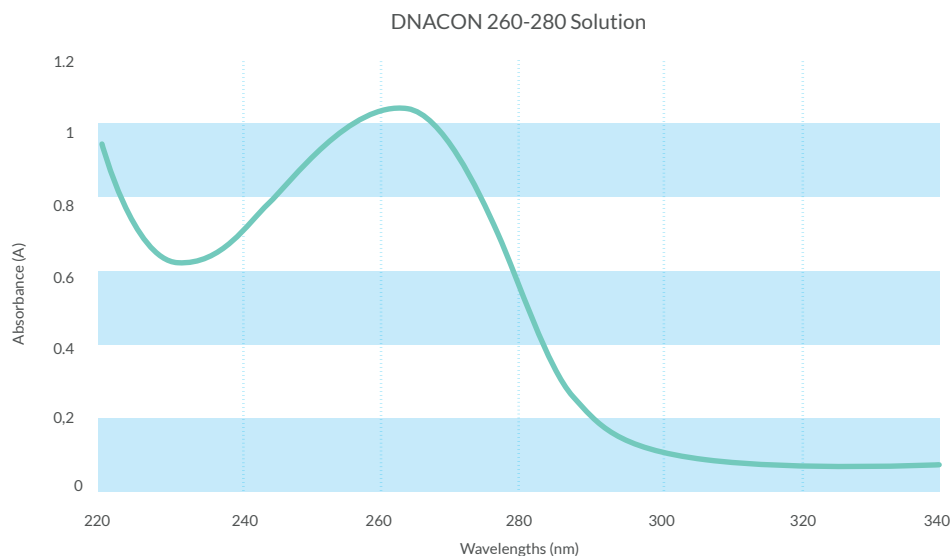


DNA CON 1.5 ml Vials



### Typical Uncorrected Absorbance Values:

260 nm 0.765 A  
280 nm 0.405 A  
Ratio: 1.89



## Suggestions for Use:

The importance of this reference is that it allows the user to validate an instrument's performance in real time. When measuring unknown samples the user can verify that the instrument is working correctly by reading the validation standard both before, during and after each run of unknowns.

When using a spectrophotometer which automatically calculates the 260/280 ratio, place the DNA/RNA validation reference in the spectrophotometer and run the instrument's routine for the 260/280 ratio. If the ratio is valid when compared to the certificate then the user can be assured that the instrument is calculating the ratio correctly. In a spectrophotometer without an automatic calculation feature, simply use the DNA/RNA validation reference as a normal sample to validate your analytical procedure.

With the vial references, the 5x concentration is suitable for the NanoDrop™ instrument while the 10x concentration is suitable for micro drop systems such as Jenway/Bibby.

Additionally, at 260 nm, results are approximately as follows:

Path length (mm)	5X Concentration	10X Concentration
0.2	0.1 A	0.2 A
0.5	0.25 A	0.5 A
1	0.5 A	1 A
10	5 A	10 A

NanoDrop™ is a trade mark of Thermo Fisher Scientific Inc

## Ordering Information:

Description	Part Number, NIST Traceable	Price
DNACON reference, 10 mm cell	RM-DNA	\$ 990.00
5X concentration, 1 Screw Cap Vial	DNACON5X-SC1	\$ 180.00
5X concentration, 2 Screw Cap Vials	DNACON5X-SC2	\$ 340.00
5X concentration, 4 Screw Cap Vials	DNACON5X-SC4	\$ 590.00
10X concentration, 1 Screw Cap Vial	DNACON10X-SC1	\$ 180.00
10X concentration, 2 Screw Cap Vials	DNACON10X-SC2	\$ 340.00
10X concentration, 4 Screw Cap Vials	DNACON10X-SC4	\$ 590.00

# Neutral Density Filters - Near Infra Red

## Description & Traceability:

Neutral Density Glass Filters for use in the NIR region of the spectrum.  
Traceable to NRC (Canada) primary references and supplied complete with UKAS/IEC 17025 certificate of calibration

## Primary Usage:

Validation of the photometric scale of near infrared spectrophotometers

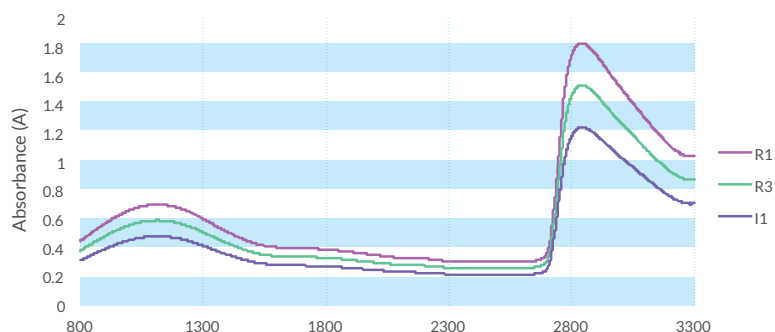
## Certified Wavelengths:

1100, 1700, 2210, 2500 & 2850 nm

## Physical Configuration:

Glass filters mounted "stress-free" in anodized aluminum holder

## Product Description:



The filters are traceable to Primary references calibrated by NRC (National Research Council) of Canada, with accreditation to ISO/IEC 17025 and ISO Guide 34, and approval through the APLAC/ILAC Mutual Recognition Agreement (MRA). They can be used to validate the photometric scale of near infrared spectrophotometers.

Manufactured from Schott NG type glass, the thickness and glass type are calibrated to produce filters with known

absorbance and transmittance values. The filters are mounted "stress-free" in a black anodized aluminum holder compatible with all standard spectrophotometer cell holders.

The spectrum of these filters is relatively flat over most of the range of calibration, but with significant deviation above 2700 nm. Approximate values are given below: actual values are given in the certificate supplied with the filters.

Wavelength Scale	1100nm		1700nm		2210 nm		2500 nm		2850 nm	
	%T	A	%T	A	%T	A	%T	A	%T	A
<b>R1</b>	20	0.70	40	0.40	47	0.32	49	0.31	2	1.83
<b>R3</b>	25	0.59	46	0.34	53	0.28	55	0.26	3	1.54
<b>I1</b>	33	0.48	53	0.28	59	0.23	60	0.22	6	1.25

## Suggestions for Use:

Zero the instrument using the empty filter holder supplied and measure the filters at the certified wavelengths. Compare the measured values to the certificate values. Taking the expanded uncertainty budget† of the references into consideration, then the absorbance values should fall within the expected parameters† of your instrument if it is working correctly. If more than two different filters are available, the values may be used to plot a linearity graph.

The results may be used to build up a data log of the instrument's photometric accuracy over time. This may be used for certification purposes and for troubleshooting should the correlation change. The data will also be useful to a service technician to diagnose and correct any problems that may develop with your instrument.

†for expanded uncertainty budget and expected parameters see p 37

## Ordering Information:

### Description

### Part Number, NRC (Canada) Traceable

### Price

Neutral Density Filter, 20 %T @ 1100nm & Blank holder

RM-R1

\$ 980.00

Neutral Density Filter, 25 %T @ 1100nm & Blank holder

RM-R3

\$ 980.00

Neutral Density Filter, 33 %T @ 1100nm & Blank holder

RM-I1

\$ 980.00

Neutral Density Filter set, 20, 25 & 33 %T @ 1100nm & Blank holder

RM-R1R3I1

\$ 1750.00



# Metal on Quartz Near Infra Red (NIR) Absorbance/Linearity

<b>Description &amp; Traceability:</b>	Metal on Quartz filter for absorbance/linearity in the NIR area of the spectrum. NIST/NRC (Canada) Traceable, complete with UKAS ISO/IEC 17025 accredited certificate of calibration
<b>Certified Wavelengths:</b>	250.0, 360.0, 465.0, 546.1, 635.0, 1100, 1700, 2210, 2500, 2800 nm
<b>Physical Configuration:</b>	Metal coated quartz filter with coated side protected by an optically contacted quartz window. The filters are mounted in protective aluminum holders that will fit a standard instrument cell holder.
<b>ISO Accredited:</b>	ISO/IEC 17025, ISO Guide 34 by UKAS & ISO 9001 by BSI.

## Product Description:

A standard range of Metal on Quartz absorbance standards for the NIR area of the spectrum to facilitate full compliance with USP requirements.

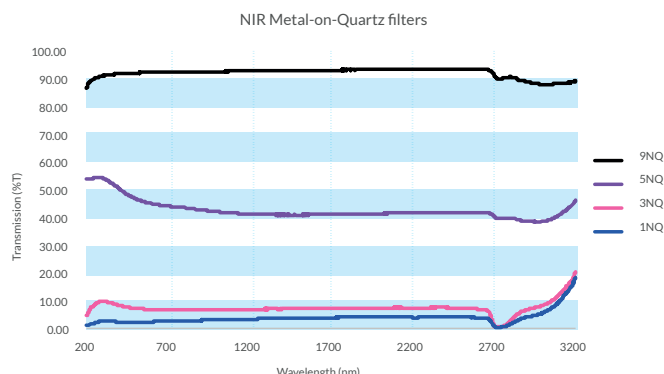
All Starna Metal on Quartz Filters have an optically contacted quartz cover plate to protect the metalized surface and facilitate easy cleaning.

The filters allow absorbance and linearity at certified wavelengths across the range from 250 nm to 2800 nm and the relative values are shown on the table to the right. They can be certified at wavelengths other than those shown above, on request.

The filters are produced in our ISO 9001 accredited production facility under ISO Guide 34 as a reference material producer and calibrated in our ISO/IEC 17025 accredited calibration laboratory.



RM-1NQ3NQ9NQ



### Metal on Quartz NIR Filters:

Part No.	%T Transmittance	Absorbance
NQ1	1%	2.00 A
NQ3	3%	1.52 A
1NQ	10%	1.00 A
3NQ	30%	0.52 A
5NQ	50%	0.30 A
9NQ	90%	0.06 A

## Suggestions for Use:

The NIR Metal on Quartz Filters are intended for use across a broad spectrum including the NIR with a relatively flat transmission profile across all wavelengths. Normally three representative absorption filters would be chosen for any given application but, the filters may be bought individually, in sets as shown below, or any combination from the standard range.

Compare the spectrophotometer absorbance values to the certified absorbance values. Taking the expanded uncertainty

†for expanded uncertainty budget and expected parameters see p 37

budget† of the certified references into consideration, if the absorbance values fall within the expected parameters† of the instrument then the instrument is working correctly.

It is important to confirm that Metal on Quartz filters are suitable for use with the instrument under test as they have a highly reflective surface and some instruments are sensitive to the positioning of such materials in the sample holder.

## Ordering Information:

Description	Part Number, NIST/NRC (Canada) Traceable	Price
Metal on Quartz NIR Reference, 1% & Blank Holder	RM-NQ1	\$ 1500.00
Metal on Quartz NIR Reference, 3% & Blank Holder	RM-NQ3	\$ 1500.00
Metal on Quartz NIR Reference, 10% & Blank Holder	RM-1NQ	\$ 1500.00
Metal on Quartz NIR Reference, 30% & Blank Holder	RM-3NQ	\$ 1500.00
Metal on Quartz NIR Reference, 50% & Blank Holder	RM-5NQ	\$ 1500.00
Metal on Quartz NIR Reference, 90% & Blank Holder	RM-9NQ	\$ 1500.00
Metal on Quartz NIR Reference, 3%, 50% & Blank Holder	RM-NQ35NQ	\$ 2200.00
Metal on Quartz NIR Reference, 10%, 30%, 90% & Blank Holder	RM-1NQ3NQ9NQ	\$ 2850.00
Metal on Quartz NIR Reference, 1%, 3%, 50%, Blank Holder	RM-NQ1NQ35NQ	\$ 2850.00



# Near Infrared - Wavelength Reference

<b>Description &amp; NIST Traceability:</b>	Quartz cell in either Transmittance or Transmittance/Transflectance format. Traceable to NIST SRM 2065, complete with UKAS ISO/IEC 17025 accredited certificate of calibration
<b>Primary Usage:</b>	Verification of wavelength scale accuracy in the NIR spectrum
<b>Certified Wavelengths:</b>	990.7, 1154.9, 1446.6, 1652.3, 1693.1, 1948.0, 2060.1, 2111.0, 2248.2, 2353.3, 2373.4, 2385.4, 2537.5 nm
<b>Spectral Band Width:</b>	The certificate indicates the above wavelength measured at 0.1, 0.25, 0.5, 1, 1.5, 2 and 3 nm. Other SBWs can be provided on request.
<b>Physical Configuration:</b>	Filled near IR quartz cell that has been permanently sealed by heat fusion

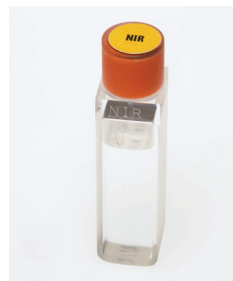
## Product Description:

The reference is used to validate the wavelength scale of a NIR spectrophotometer. With 13 certified peaks from 990 to 2537 nm that include some complex peaks, which may be used for instrument resolution evaluation. The reference is available in two formats:

**Transmittance:** - 10 mm optical pathlength with two clear windows (opposite windows to allow light to pass through the cell).

**Transmittance/Transflectance** - 5mm or 10mm optical path length, depending on orientation. In 5 mm configuration, the rear window is mirror coated to provide reflectance optical return so pathlength is effectively 10 mm ( 2 x 5 mm).

Each reference set is supplied with full certification and traceability to NIST through SRM 2065. The reference material is produced and certified in our ISO Guide 34 and ISO/IEC 17025 accredited laboratory. The reference can also be recertified as required.



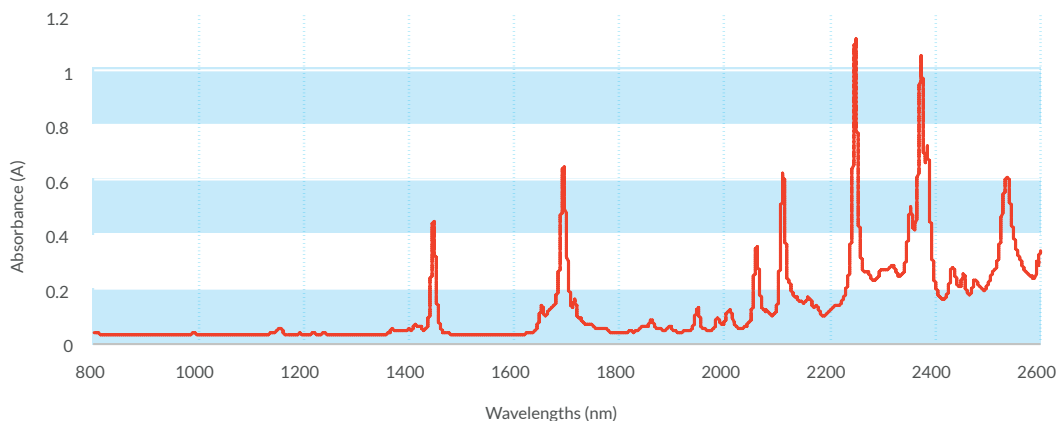
**Transmittance**



**Transmittance/  
Transflectance**

### Resolvable Peaks

990.7 nm  
1154.9 nm  
1446.6 nm  
1652.3 nm  
1693.1 nm  
1948.0 nm  
2060.1 nm  
2111.0 nm  
2248.2 nm  
2353.3 nm  
2373.4 nm  
2385.4 nm  
2537.5 nm



## Suggestions for Use:

Scan the cell over its usable range and identify the peaks whose wavelength values are given in the calibration certificate, having regard to the bandwidth of the instrument. Compare the measured values to the certificate values. Taking the expanded uncertainty budget† of the references into consideration, then the wavelength values should fall within the expected parameters† of your instrument if it is working correctly. The results may be used

to build up a data log of the instrument's wavelength accuracy over time. This may be used for certification purposes and for troubleshooting should the correlation change. The data will also be useful to a service technician to diagnose and correct any problems that may develop with your instrument.

†for expanded uncertainty budget and expected parameters see p 37

## Ordering Information:

Description	Part Number, NIST Traceable	Price
NIR Wavelength Reference, Transmittance	RM-NIR	\$ 1290.00
NIR Wavelength Reference, Transmittance and Transflectance	RM-NIR/T	\$ 1480.00

# Chloroform NIR Stray Light Reference

<b>Description and NIST Traceability:</b>	Material with sharp transmission cut - off (i.e. absorbance > 2.0 A) at approximately 2365 nm. Traceable to NIST SRM 2065, complete with UKAS ISO/IEC 17025 Certificate of Calibration.
<b>Primary Usage:</b>	Detection of instrumental stray light in the near infrared region.
<b>Usable Range:</b>	2345 to 2385 nm
<b>Physical Configuration:</b>	Liquid filter in 10 mm near IR quartz cell that has been permanently sealed by heat fusion.

## Product Description:



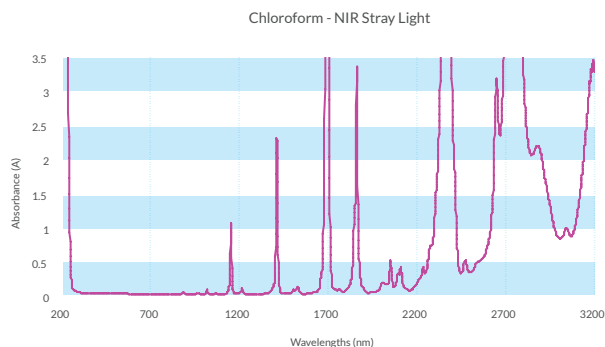
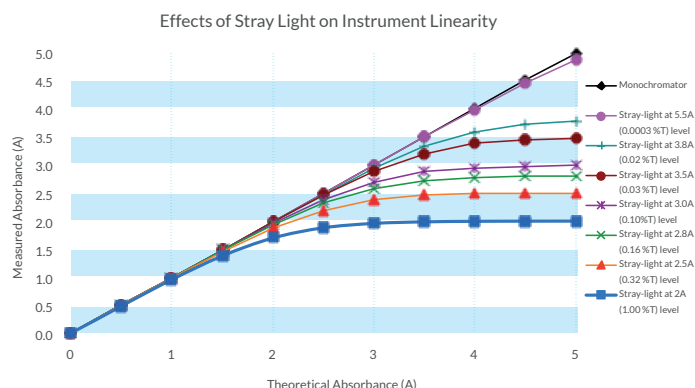
Stray light, also called Stray Radiant Energy or Power, is any light reaching the instrument detector other than that selected by the monochromator. It can be due to optical imperfections or stray reflections within the monochromator itself or to light leaks in the optical system. The detector cannot discriminate between the analytical wavelength and the stray light, so the stray light introduces an error in the measured absorbance. Its effect is a negative deviation from the linear relationship between concentration and absorbance (the Beer-Lambert Law) on

which most quantitative determinations are based.

Stray light is wavelength and instrument dependant. It can be present at any wavelength but is most noticeable when the energy throughput of the system is relatively low, when any deterioration in the instrument optics or light source will exaggerate the apparent stray light. Regular stray light checks are an excellent way of monitoring the condition of the instrument optics.

This reference material consists of spectroscopic grade chloroform, permanently sealed by heat fusion in a high quality near IR quartz cell. Sealing the cell by this method eliminates the risks associated with handling this volatile, hazardous substance.

The spectrum shows a cut - off (i.e. Absorbance > 2.0 A) at approximately 2365 nm. Any light detected within  $\pm 20$  nm of this wavelength will be stray light.



## Suggestions for Use:

Scan the chloroform reference over a range  $\pm 20$  nm either side of the certified cutoff wavelength. The indicated absorbance at the certified wavelength should be < 2 A.

**Note:** This assumes that the measurement has been performed on a NIR spectrophotometer with appropriate resolution, i.e. at the spectral bandwidth set on the instrument

the wavelength distribution at 2365 nm does not exceed  $\pm 20$  nm. If this does occur, the stray light will be over-estimated.

Periodically scan with the same instrument configuration and compare the results. Over time you will have a data trail for your instrument that will make the detection and correction of any problems relating to stray light much more effective.

## Ordering Information:

Description	Part Number, NIST Traceable	Price per set
Chloroform Stray Light Cell	RM-CHCL3	\$ 1350.00

# Mid Infrared Wavelength Reference – Polystyrene

<b>Description and Traceability:</b>	38 $\mu\text{m}$ polystyrene film in a card holder. Traceable to NIST SRM 1921b. Supplied complete with UKAS ISO/IEC 17025 accredited certificate of calibration.
<b>Primary Usage:</b>	Qualification of the wavelength scale of mid infrared spectrophotometers.
<b>Usable Range:</b>	540 $\text{cm}^{-1}$ to 3125 $\text{cm}^{-1}$ (3.2 $\mu\text{m}$ to 18.5 $\mu\text{m}$ ).
<b>Wavenumber Resolution:</b>	2 $\text{cm}^{-1}$ or better
<b>Certified Wavelengths:</b>	539, 842, 907, 1028, 1069, 1155, 1583, 1601, 1943, 2849, 3001, 3026, 3060, and 3082 $\text{cm}^{-1}$
<b>Physical Configuration:</b>	Polystyrene film mounted in card holder compatible with the sample holders of most infrared spectrophotometers

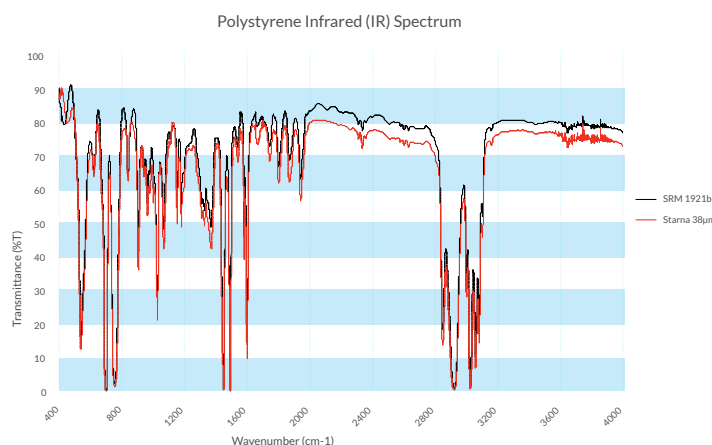
## Product Description:

Polystyrene film has been a popular wavelength reference for mid-infrared spectrometers for many years. These new NIST-traceable Starna Reference Materials can be used to qualify Mid IR - FTIR spectrophotometers for wavelength accuracy over the range 3.2  $\mu\text{m}$  to 18.5  $\mu\text{m}$  (3125  $\text{cm}^{-1}$  to 540  $\text{cm}^{-1}$ ).

Traceable to NIST SRM 1921b, 14 certified peaks are available for wavelength qualification purposes in the mid infrared. Approximate peak wavelength values are:

539, 842, 907, 1028, 1069, 1155, 1583, 1601, 1943, 2849, 3001, 3026, 3060, and 3082  $\text{cm}^{-1}$ .

Actual values are given in the calibration certificate supplied with the reference.



## Suggestions for Use:

The instrument to be qualified should have a wavenumber resolution of 2  $\text{cm}^{-1}$  or better. Scan the filter over its usable range and identify the peaks whose wavelength values are given in the calibration certificate. Compare the measured values to the certificate values. Taking the expanded uncertainty budget† of the references into consideration, then the wavelength values should fall within the expected parameters† of your instrument if it is working correctly.

The results may be used to build up a data log of the instrument's wavelength accuracy over time. This may be used for certification purposes and for troubleshooting should the correlation change. The data will also be useful to a service technician to diagnose and correct any problems that may develop with your instrument.

†for expanded uncertainty budget and expected parameters see p 37

## Ordering Information:

Description	Part Number, NIST Traceable	Price per set
Mid IR-FTIR Polystyrene Reference, NIST Traceable	RM-1921/38	\$ 265.00

# Mid & Near Infrared Wavelength Reference – Polystyrene

<b>Description and Traceability:</b>	65 $\mu\text{m}$ polystyrene film in a card holder. Traceable to NIST SRM 1921b and NIST SRM 2065. Supplied complete with UKAS ISO/IEC 17025 accredited certificate of calibration.
<b>Primary Usage:</b>	Qualification of the wavelength scale of mid- and near infrared FTIR spectrophotometers.
<b>Usable Range:</b>	540 $\text{cm}^{-1}$ to 9000 $\text{cm}^{-1}$ (1.1 $\mu\text{m}$ to 18.5 $\mu\text{m}$ ).
<b>Wavenumber Resolution:</b>	2 $\text{cm}^{-1}$ or better
<b>Certified Wavelengths:</b>	539, 842, 907, 1028, 1069, 1155, 1583, 1601, 1943, 2849, 3001, 3026, 3060, and 3082 $\text{cm}^{-1}$ (Mid IR); 3064, 3647, 4039, 4250, 4335, 4608, 5952, 8749 $\text{cm}^{-1}$ (Near IR)
<b>Physical Configuration:</b>	Polystyrene film mounted in card holder compatible with the sample holders of most infrared spectrophotometers

## Product Description:

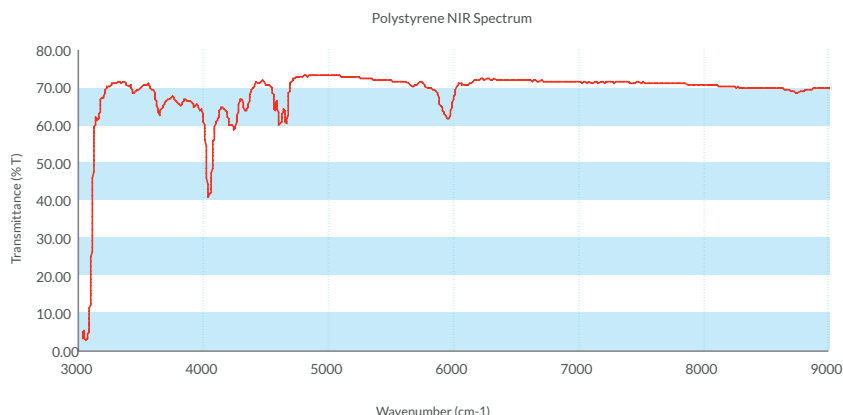
Polystyrene film has been a popular wavelength reference for infrared spectrometers for many years. These new NIST-traceable Starna Reference Materials can be used to qualify Mid IR and Near IR-FTIR spectrophotometers for wavelength accuracy over the range 540  $\text{cm}^{-1}$  to 9000  $\text{cm}^{-1}$  (1.1  $\mu\text{m}$  to 18.5  $\mu\text{m}$ ).

14 certified peaks, traceable to NIST SRM 1921b, are available for wavelength qualification purposes in the mid infrared. Approximate peak wavelength values are:

539, 842, 907, 1028, 1069, 1155, 1583, 1601, 1943, 2849, 3001, 3026, 3060, and 3082  $\text{cm}^{-1}$ . (see spectrum on p 32)

In addition, eight peaks, traceable to NIST SRM 2065, can be used for wavelength qualification in the near infrared. Approximate peak wavelength values are:

$\text{cm}^{-1}$	3064	3647	4039	4250	4335	4608	5952	8749
nm	3264	2742	2476	2353	2307	2170	1680	1143



## Suggestions for Use:

The instrument to be qualified should have a wavenumber resolution of 2  $\text{cm}^{-1}$  or better. Scan the filter over its usable range and identify the peaks whose wavelength values are given in the calibration certificate. Compare the measured values to the certificate values. Taking the expanded uncertainty budget† of the references into consideration, then the wavelength values should fall within the expected parameters† of your instrument if it is working correctly.

The results may be used to build up a data log of the instrument's wavelength accuracy over time. This may be used for certification purposes and for troubleshooting should the correlation change. The data will also be useful to a service technician to diagnose and correct any problems that may develop with your instrument.

†for expanded uncertainty budget and expected parameters see p 37

## Ordering Information:

Description	Part Number, NIST Traceable	Price per set
Mid IR-FTIR/NIR Polystyrene Reference, NIST Traceable	RM-1921/65	\$ 265.00

# High Purity Water – Fluorescence Sensitivity

<b>Description:</b>	Ultra-high pure water, permanently sealed by heat fusion in a high quality quartz fluorometer cell.
<b>Primary Usage:</b>	Evaluation of sensitivity in the qualification of fluorescence spectrophotometers specifically the instrument signal-to-noise ratio near the detection limits using the Raman band emission at specific wavelengths.
<b>Usable Range:</b>	250 to 600 nm
<b>Physical Configuration:</b>	Far UV quartz fluorescence cell that has been permanently sealed by heat fusion.
<b>ISO/IEC Accreditation:</b>	Produced and manufactured under ISO/IEC 17025, ISO Guide 34 by UKAS protocols

## Product Description:



When excited at appropriate wavelengths, pure water exhibits a Raman shift spectrum analogous to fluorescence. This spectrum can be used to evaluate the signal-to-noise ratio of fluorescence spectrophotometers near the detection limit.

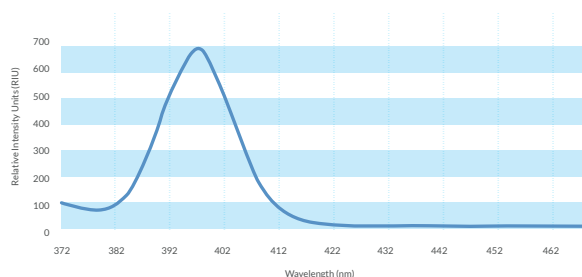
The signal-to-noise ratio for a given excitation wavelength may be calculated using the instrument software. Note that the calculated ratio will depend on the calculation

protocol employed by the instrument manufacturer and therefore 'compliance to specification' limits will be specific to the spectrofluorometer type under test.

This reference with a Certificate of Validation from the Starna Calibration Laboratory which is supplied accredited by UKAS under ISO 9001, ISO/IEC 17025, and ISO Guide 34.

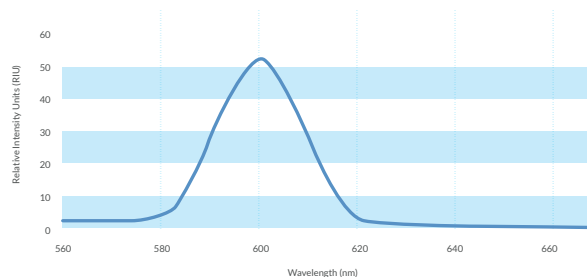
### Molecular Emission Spectrum

Fluorescence Sensitivity – Water Raman peak  
Excitation: 350 nm Emission peak: 398 nm



### Molecular Emission Spectrum

Fluorescence Sensitivity – Water Raman peak  
Excitation: 500 nm Emission peak: 600.4 nm



## Suggestions for Use:

Record the emission spectrum of the water reference using excitation wavelengths of 350 nm or 500 nm depending on the wavelength range of interest. By reference to the appropriate section of the instrument control software, calculate the signal-to-noise ratio for a given excitation wavelength and compare it with the instrument specification.

## Ordering Information:

Description	Part Number	Price
Ultra-pure Water Reference	RM-H2O	\$ 850.00



# Quinine Sulfate Fluorescence Reference

<b>Description &amp; NIST Traceability:</b>	Solution of quinine sulfate in 0.105 mol/L perchloric acid. The reference material is permanently sealed by heat fusion in quartz fluorometer cells, NIST Traceable complete with UKAS ISO/IEC 17025 accredited certificate of calibration.
<b>Primary Usage:</b>	Calibration and evaluation of methods used on a fluorescence spectrophotometer.
<b>Usable Range:</b>	375 nm to 675 nm
<b>Physical Configuration:</b>	Far UV quartz fluorescence cell that has been permanently sealed by heat fusion. The reference is also available with a blank if required.

## Product Description:

NIST SRM 936a is supplied as a crystalline material and is made into a solution as described in the Certificate of Analysis supplied with NIST SRM 936a. Starna then fills a high quality far UV quartz fluorometer cell with the SRM solution and permanently seals the cell by heat fusion alone. The reference is designed for multiple use over time and for inter-instrument comparisons. Quinine sulfate references can also be supplied with a perchloric acid blank.

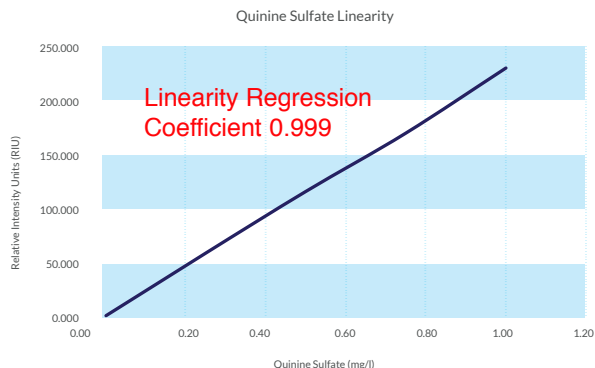
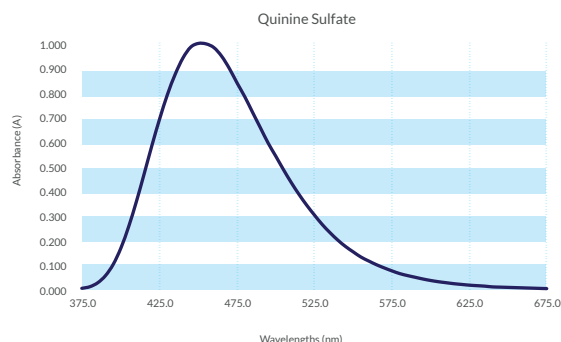
Where instrument linearity needs to be established, sets with different concentrations of quinine sulfate and a blank are available in the following concentrations, 0.25, 0.5, 0.75 & 1.0 mg/l.

The Starna reference set is supplied with a Certificate of Validation by our calibration laboratory which is accredited by UKAS to ISO 9001, ISO/IEC 17025, and ISO Guide 34. The certificate is valid for a period of two years.



RM-QS

## Corrected molecular emission spectrum



## Suggestions for Use:

Record the emission spectrum of the quinine sulfate reference using an excitation wavelength of 347.5 nm and use the results to calculate the correction factor for your instrument at the wavelength of interest by using the formula and reference

values given in the calibration certificate. To evaluate instrument linearity, plot a graph of concentration against emission at 450 nm for each quinine sulfate concentration.

## Ordering Information:

Description	Part Number, NIST Traceable	Price
Quinine Sulfate Reference (1 concentration 1.0 mg/l, without blank)	RM-QS	\$ 1050.00
Quinine Sulfate Reference (1 concentration 1.0 mg/l & blank)	RM-QS00	\$ 1400.00
Quinine Sulfate Reference (2 concentrations, & blank)	RM-2QS00	\$ 2190.00
Quinine Sulfate Reference (3 concentrations, & blank)	RM-3QS00	\$ 2980.00
Quinine Sulfate Reference (4 concentrations, & blank)	RM-4QS00	\$ 3770.00

# Cyclohexane – Raman Spectroscopy Wavelength Reference

<b>Description:</b>	Cyclohexane may be used to qualify the wavelength scale of Raman Spectrometers as described in ASTM E1840 - 96 (2014). Complete with ISO Guide 34 certificate of validation
<b>Primary Usage:</b>	Wavelength qualification of Raman spectrometers
<b>Usable Range:</b>	380 $\text{cm}^{-1}$ to 3000 $\text{cm}^{-1}$ when using an excitation wavelength of 514.5 nm.
<b>Certified Values:</b>	384.1, 426.3, 801.3, 1028.3, 1157.6, 1266.4, 1444.4, 2664.4, 2852.9, 2923.8, 2938.3 $\text{cm}^{-1}$
<b>Physical Configuration:</b>	High purity cyclohexane in 10 mm far UV quartz cell that has been permanently sealed by heat fusion.

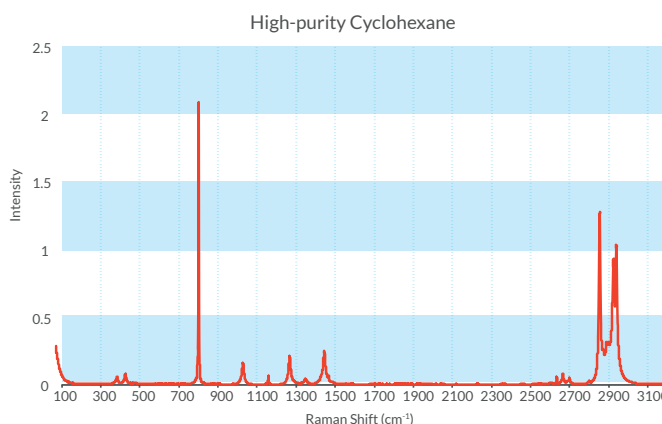
## Product Description:

Compared to atomic emission lines, Raman shift standards offer an easier-to-use alternative for qualifying the wavelength scale of Raman Spectrometers. They are also independent of laser frequency. The Raman shift values for cyclohexane have been accurately measured and it is widely used as a reference material.

Using an excitation wavelength of 514.5 nm, 11 shift values covering a range from 384 to 2938  $\text{cm}^{-1}$  can be identified. Values (in  $\text{cm}^{-1}$ ) are:

384.1, 426.3, 801.3, 1028.3, 1157.6, 1266.4, 1444.4, 2664.4, 2852.9, 2923.8, 2938.3

The permanently sealed cell eliminates the hazards associated with handling this volatile, toxic and highly flammable material.



## Suggestions for Use:

Determine the Raman shift spectrum of the reference and identify the peaks whose wavelength values are given in the calibration certificate. Compare the measured values to the certificate values. Taking the expanded uncertainty budget† of

the references into consideration, then the wavelength values should fall within the expected parameters† of your instrument if it is working correctly.

†for expanded uncertainty budget and expected parameters see p 37

## Ordering Information:

Description	Part Number, NIST Traceable	Price per set
Cyclohexane Cell	RM-C6H12	\$ 1050.00

# Calibration Services

## Calibration Production Experience & Accreditation History

Starna has over forty-five years experience in the production of both glass filters and permanently sealed by heat fusion liquid reference materials.

Calibration accreditation through UKAS to ISO/IEC17025 was achieved in 2001. This was followed in 2006 by Starna also achieving ISO/IEC Guide 34 as a Reference Material Producer. Calibration is carried out on any one of five fully qualified reference spectrophotometers.

The above accreditation, experience and accumulated data puts Starna in a unique position with regard to certified reference materials ranging from the Deep UV to the NIR

The scope detailing specifically what the Starna accreditation covers, including uncertainty values, can be viewed at the following URL on the UKAS web site.

[www.ukas.org/AccreditationOthers/schedules/4001%20RMP%20Single.pdf](http://www.ukas.org/AccreditationOthers/schedules/4001%20RMP%20Single.pdf)

[www.ukas.org/calibration/schedules/Actual/0659Calibration%20Single.pdf](http://www.ukas.org/calibration/schedules/Actual/0659Calibration%20Single.pdf)

The above indicated links to the Starna Scientific accreditation scopes are provided so that customers may view the latest accreditation information.

Customers are advised that they should always check that the scope of any supplier accreditation includes the references they intend to purchase.

References not included in the published scope may not be recognized for instrument qualification purposes by regulatory bodies.



## † Expected Parameters and Expanded Uncertainty Budgets

The expanded uncertainty budget ( $k=2$ ) is the tolerance that we could expect to measure in the assigned value on any one of our reference spectrophotometers during the 2 year period of certification.

When used to verify the performance of any given spectrophotometer this certificate tolerance must be added in a simple linear manner to the stated appropriate specification accuracy of the instrument on the test, see following example:

	Wavelength	Absorbance
Certificate	$\pm 0.10$ nm	$\pm 0.0049$ A
Instrument	$\pm 0.30$ nm	$\pm 0.0050$ A
Total	$\pm 0.40$ nm	$\pm 0.0099$ A

## Certification Provided in USB Electronic Format

As a result of increased customer requests for certificates and associated data to be supplied in electronic format, especially from those customers working in controlled environments, in 2013 Starna changed certificates to an electronic format.

This advancement in presentation has helped the efficiency of pharmaceutical companies, instrument manufacturers and other customers worldwide, another example of Starna taking the lead in reference material presentation. This environmentally friendly approach allows greater customer flexibility in the use and circulation of calibration certificates, allowing data to be input directly into other databases.

For customers for whose protocols do not allow the transfer of data by USB stick, printed/soft copy can be provided at no additional cost on request.

# Calibration Services

The Starna Calibration and Recalibration Laboratory offers a calibration and re-calibration service to ISO/IEC 17025, which is the highest level of accreditation currently available.

This calibration service is not only available for reference materials manufactured by Starna, but also for similar materials manufactured by third parties, such as NIST and other commercial organizations.

Starna is also able to extend the service to cover a wide range of optical products within the UV-Visible-NIR range. We welcome enquiries for all types of similar product, even though in some instances they may not have been produced in the first instance as certified references.

Among the many products that Starna Scientific certify are a wide

variety of reference plates for plate reader instruments from a number of manufacturers.

Starna normally completes the certification of all references within a period of five working days from receipt of the references at the Starna Calibration Laboratory.

In urgent situations completion time may be reduced.

Transportation time to and from the calibration laboratory should be allowed for to minimize disruption to continuity of compliance.

Regulated laboratories are encouraged to hold two sets of references, purchased twelve months apart.

This ensures total continuity of compliance whilst references are returned for revalidation. It also acts as an insurance against accidental breakage.

# Tools for Easier Compliance

In a regulated environment, the responsibility of proof is on the user to justify and demonstrate, by the qualification of the system, that a spectrophotometer is 'fit for purpose' and capable of providing the required accuracy and precision of data.

Based on many years experience, Starna has developed sets of Certified Reference Materials, carefully selected to demonstrate compliance to national and international norms with confidence.

Sets are available to suit all needs, ranging from the user with just one instrument to large laboratories, quality control departments and support and service organizations. In addition to the convenience they provide, Starna CRM sets also offer cost savings when compared to the purchase of individual references.

## USP Chapter <857>

In May 2015 the US Pharmacopeia published a new Chapter <857> containing new instrument performance test specifications for ultraviolet and visible spectrophotometers. These become mandatory from 1st May 2016. New instrument qualification references from Starna allow laboratories to meet these new regulations.

The new chapter includes requirements for Operational Qualification (OQ) and Performance Qualification (PQ):

**Operational Qualification (OQ) is required to demonstrate that the instrument under test is suitable for the intended use and analytical procedures for which it is employed.**

**Performance Qualification (PQ) requires that that it can be demonstrated on an ongoing basis that the instrument continues to meet that standard.**

The new regulations for OQ and PQ require that laboratories can demonstrate to the regulatory authority that the spectrophotometric devices being used are qualified for wavelength and photometric accuracy, stray light and instrument resolution. New stray light and resolution tests are described that

require the use of reference materials not previously specified by the USP.

It is also stated in Chapter <857> that Certified Reference Materials should be obtained from a **recognized** and **accredited** source, and have value assignments with associated calculated uncertainty. Certified values must be **traceable** to internationally recognized primary standards. The references must be periodically recertified to maintain validity of the certification.

Starna's production and calibration facilities are accredited to ISO/IEC 17025 and ISO Guide 34, meeting all international standards and regulatory requirements. Starna can supply all the Certified Reference Materials required to meet the new regulations in convenient, ready to use sets.

There is also a pathway to upgrade an existing USP set if manufactured by Starna.

It may be possible to provide an upgrade for third party references, but this would need to be assessed on an individual basis. Please contact Starna for more information.

## US Pharmacopeia

Starna has developed sets of Certified Reference Materials designed to help instrument users demonstrate compliance to national and international norms with confidence.

Sets are available to suit all needs, from the user with just one instrument to large laboratories, quality control departments and support and service organizations. In addition to the convenience they provide, Starna CRM sets also offer cost savings when compared to the purchase of individual references.



## Instrument Qualification Sets - USP

**NEW**  
USP 857  
REFERENCES

Only Certified Reference Materials recommended by the USP for instrument qualification, and traceable to NIST, are supplied in these sets. More details of the individual materials may be found elsewhere in this catalog.

### USP Instrument Qualification Set

Potassium Dichromate 60 mg/l & blank cell	Photometric Accuracy	235 - 350 nm
Holmium Oxide Solution cell	Wavelength Accuracy	240 - 640 nm
Potassium Chloride 10 & 5 mm cells	Stray Light	190 - 205 nm
Sodium Iodide 10 & 5 mm cells	Stray Light	210 - 259 nm
Acetone 10 & 5 mm cells	Stray Light	250 - 320 nm
Sodium Nitrite 10 & 5 mm	Stray Light	300 - 385 nm
Toluene in Hexane & blank cell	Resolution	267 - 269 nm
<b>Description</b>	<b>Part Number, NIST Traceable</b>	<b>Price</b>
Starna USP Instrument Qualification Set	RM-USP	\$ 4950.00

### USP Instrument Qualification Set with Linearity Check

As RM-USP but with two additional Potassium Dichromate cells	Photometric Accuracy	235 - 350 nm
Potassium Dichromate 20 mg/l	Photometric Accuracy	235 - 350 nm
Potassium Dichromate 60 mg/l & blank cell	Photometric Accuracy	235 - 350 nm
Potassium Dichromate 100 mg/l	Wavelength Accuracy	240 - 640 nm
Holmium Oxide Solution cell	Stray Light	190 - 205 nm
Potassium Chloride 10 & 5 mm cells	Stray Light	210 - 259 nm
Sodium Iodide 10 & 5 mm cells	Stray Light	250 - 320 nm
Acetone 10 & 5 mm cells	Stray Light	300 - 385 nm
Sodium Nitrite 10 & 5 mm	Resolution	267 - 269 nm
Toluene in Hexane & blank cell		
<b>Description</b>	<b>Part Number, NIST Traceable</b>	<b>Price</b>
Starna USP Instrument Qualification Set with linearity	RM-USP/3LIN	\$ 5650.00

### USP Visible Transmittance/Absorbance and Wavelength Set:

This set combines three neutral density filters (with blank holder) and a holmium glass filter and is a convenient way of qualifying a visible spectrophotometer for photometric accuracy and linearity, and wavelength accuracy.

Neutral Density Filters (1.00, 0.50 & 0.25 A)	Absorbance Accuracy	440-635nm
Holmium Glass Filter	Wavelength Accuracy	240 - 640 nm
<b>Description</b>	<b>Part Number, NIST Traceable</b>	<b>Price</b>
Starna Neutral Density and Holmium Filter Set	RM-1N3N5DHG	\$ 1520.00

### NIST SRM Equivalent Sets:

These SRMs are specifically cited in USP <857> as evidence of NIST traceability

<b>Description</b>	<b>Part Number, NIST Traceable</b>	<b>Price</b>
SRM 930e Set: 10, 20 & 30 %T Neutral Density Filters and blank holder	RM-1N2N3N	\$ 1190.00
SRM 1930 Set: 1, 3 & 50 %T Neutral Density Filters and blank holder	RM-N1N35N	\$ 1190.00
SRM 2930 Set: 0.1, 0.3 & 92 %T Neutral Density Filters and blank holder	RM-D1D39N	\$ 1190.00
Combined SRM Set: All 9 Neutral Density Filters listed above and blank holder	RM-SRM9ND	\$ 3190.00

### UV Absorbance Scale & Linearity validation

For method validation, USP <857> recommends that absorbance linearity is checked with five or more analyte concentrations. The following Potassium Dichromate sets allow linearity to be checked over the relevant absorbance range from 235 nm - 350 nm.

<b>Photometric Linearity Set, 0.095A -1.5A</b>	<b>Part Number, NIST Traceable</b>	<b>Price</b>
Potassium Dichromate 20, 40, 60, 80, 100 mg/l & blank cell	RM-0204060810	\$ 2275.00
<b>Photometric Linearity Set, 1.5A- 3.3A</b>		
Potassium Dichromate 120, 140, 160, 180, 220 & 240 mg/l & blank cell	RM-121416182224	\$ 2630.00
<b>Photometric Linearity Set, 0.19A - 3.3A</b>		
Potassium Dichromate 40, 80, 120, 160, 200 & 240 mg/l & blank cell	RM-040812162024	\$ 2630.00



# Tools for Easier Compliance

Many of the references recommended by the US Pharmacopeia are also suitable for working to the standards of regulatory authorities, such as the ASTM, European Pharmacopoeia and other national bodies.

## European Pharmacopoeia

Only Certified Reference Materials recommended by the European Pharmacopoeia for instrument qualification, and traceable to NIST, are supplied in these sets. More details of the individual materials may be found elsewhere in this catalog.

### EP Instrument Qualification Set

Potassium Dichromate 60 mg/l & blank cell  
Potassium Dichromate 600 mg/l  
Holmium Oxide Solution cell  
Potassium Chloride 10 mm cell & blank cell  
Toluene in Hexane & blank cell

#### Description

Starna EP Instrument Qualification Set

Photometric Accuracy	235 - 350 nm
Photometric Accuracy	430 nm
Wavelength Accuracy	240 - 640 nm
Stray Light	200 nm
Resolution	267 - 269 nm
<b>Part Number, NIST Traceable</b>	<b>Price</b>
RM-EP	\$ 3275.00

### EP Instrument Qualification Set with Linearity Check

As RM-EP but with two additional Potassium Dichromate cells:

Potassium Dichromate 20 mg/l  
Potassium Dichromate 60 mg/l & blank cell  
Potassium Dichromate 100 mg/l  
Potassium Dichromate 600 mg/l  
Holmium Oxide Solution cell  
Potassium Chloride 10 mm cell & blank cell  
Toluene in Hexane blank cell

#### Description

Starna EP Instrument Qualification Set with Linearity

Photometric Accuracy	235 - 350 nm
Photometric Accuracy	235 - 350 nm
Photometric Accuracy	235 - 350 nm
Photometric Accuracy	430 nm
Wavelength Accuracy	240 - 640 nm
Stray Light	200 nm
Resolution	267 - 269 nm
<b>Part Number, NIST Traceable</b>	<b>Price</b>
RM-EP/3LIN	\$ 3970.00

### EP Instrument Qualification Set with Derivative Resolution Check

As RM-EP but with additional resolution reference for Derivative Spectroscopy

Potassium Dichromate 60 mg/l & blank cell  
Potassium Dichromate 600 mg/l  
Holmium Oxide Solution cell  
Potassium Chloride 10 mm cell & blank cell  
Toluene in Hexane & blank cell  
Toluene in Methanol & blank cell

#### Description

Starna EP Instrument Qualification Set with Derivative

Photometric Accuracy	235 - 350 nm
Photometric Accuracy	430 nm
Wavelength Accuracy	240 - 640 nm
Stray Light	200 nm
Resolution	267 - 269 nm
Derivative resolution	267 - 270 nm
<b>Part Number, NIST Traceable</b>	<b>Price</b>
RM-EP/TM	\$ 4070.00



# European Pharmacopoeia, ASTM etc

## EP Instrument Qualification Set with two Stray Light References

Potassium Dichromate 60 mg/l & blank cell	Photometric Accuracy	235 - 350 nm
Potassium Dichromate 600 mg/l	Photometric Accuracy	430 nm
Holmium Oxide Solution cell	Wavelength Accuracy	240 - 640 nm
Potassium Chloride 10 mm cell & blank cell	Stray Light	200 nm
Sodium Iodide 10mm cell	Stray Light	260 nm
Toluene in Hexane & blank cell	Resolution	267 - 269 nm

### Description

Starna EP Instrument Qualification set with two Stray Light References

### Part Number, NIST Traceable

RM-EP/2SL

### Price

\$ 3770.00

## EP Instrument Qualification Set with three Stray Light References

Potassium Dichromate 60 mg/l & blank cell	Photometric Accuracy	235 - 350 nm
Potassium Dichromate 600 mg/l	Photometric Accuracy	430 nm
Holmium Oxide Solution cell	Wavelength Accuracy	240 - 640 nm
Potassium Chloride 10 mm cell & blank cell	Stray Light	200 nm
Sodium Iodide 10mm cell	Stray Light	260 nm
Sodium Nitrite 10 mm cell	Stray Light	391 nm
Toluene in Hexane & blank cell	Resolution	267 - 269 nm

### Description

Starna EP Instrument Qualification set with three Stray Light References

### Part Number, NIST Traceable

RM-EP/3SL

### Price

\$ 4270.00

## Combined Instrument Qualification Sets - USP & EP

These kits will be useful for laboratories working to international regulations and for service organisations

### Combined USP/EP Set

Potassium Dichromate 60 mg/l & blank cell	Photometric Accuracy	235 - 350 nm
Potassium Dichromate 600 mg/l	Photometric Accuracy	430 nm
Holmium Oxide Solution cell	Wavelength Accuracy	240 - 640 nm
Potassium Chloride 10 & 5 mm cells	Stray Light	190 - 205 nm
Sodium Iodide 10 & 5 mm cells	Stray Light	210 - 259 nm
Acetone 10 & 5 mm cells	Stray Light	250 - 320 nm
Sodium Nitrite 10 & 5 mm cells	Stray Light	300 - 385 nm
Water blank 10 mm cell	Stray Light	190 - 400 nm
Toluene in Hexane & blank cell	Resolution	267 - 269 nm

### Description

Starna USP/EP Instrument Qualification Set

### Part Number, NIST Traceable

RM-USP/EP

### Price

\$ 6500.00

### Combined USP/EP Set with Linearity Check

Potassium Dichromate 20 mg/l	Photometric Accuracy	235 - 350 nm
Potassium Dichromate 60 mg/l & blank cell	Photometric Accuracy	235 - 350 nm
Potassium Dichromate 100 mg/l	Photometric Accuracy	235 - 350 nm
Potassium Dichromate 600 mg/l	Photometric Accuracy	430 nm
Holmium Oxide Solution cell	Wavelength Accuracy	240 - 640 nm
Potassium Chloride 10 & 5 mm cells	Stray Light	190 - 205 nm
Sodium Iodide 10 & 5 mm cells	Stray Light	210 - 259 nm
Acetone 10 & 5 mm cells	Stray Light	250 - 320 nm
Sodium Nitrite 10 & 5 mm cells	Stray Light	300 - 385 nm
Water blank 10 mm cell	Stray Light	190 - 400 nm
Toluene in Hexane & blank cell	Resolution	267 - 269 nm

### Description

Starna USP/EP Instrument Qualification Set with linearity check

### Part Number, NIST Traceable

RM-USP/EP/3LIN

### Price

\$ 7160.00

# Product Summary and Price List

Description:	Part No.	Price US\$	Description:	Part No.	Price US\$
<b>Photometric Scale Verification UV</b>			<b>UV/VIS Wavelength Accuracy</b>		
<b>Potassium Dichromate (PDC)</b>			Holmium Oxide	RM-HL	\$ 565.00
20 mg/l	RM-02	\$ 855.00	Didymium Oxide	RM-DL	\$ 795.00
40 mg/l	RM-04	\$ 855.00	Samarium Oxide	RM-SL	\$ 795.00
60 mg/l	RM-06	\$ 855.00	<b>Far UV Wavelength Accuracy</b>		
80 mg/l	RM-08	\$ 855.00	Rare Earth	RM-RE	\$ 875.00
100 mg/l	RM-10	\$ 855.00	<b>Stray Light USP</b>		
120 mg/l	RM-12	\$ 855.00	Potassium Chloride	RM-KC/5	\$ 875.00
140 mg/l	RM-14	\$ 855.00	Potassium Iodide	RM-KI/5	\$ 875.00
160 mg/l	RM-16	\$ 855.00	Sodium Iodide	RM-SI/5	\$ 875.00
180 mg/l	RM-18	\$ 855.00	Acetone	RM-AC/5	\$ 875.00
200 mg/l	RM-20	\$ 855.00	Sodium Nitrite	RM-SN/5	\$ 875.00
220 mg/l	RM-22	\$ 855.00	2 Stray Light set		\$ 1,625.00
240 mg/l	RM-24	\$ 855.00	3 Stray Light set		\$ 2,375.00
600 mg/l	RM-60	\$ 855.00	4 Stray Light set	RM-ACKCSISN/5	\$ 3,125.00
PDC 2 concentrations & blank		\$ 1,210.00	<b>Stray Light EP</b>		
PDC 3 concentrations & blank		\$ 1,565.00	Sodium Iodide	RM-SI	\$ 835.00
PDC 4 concentrations & blank		\$ 1,920.00	Potassium Iodide	RM-KI	\$ 835.00
PDC 7 concentrations & blank		\$ 2,985.00	Lithium Carbonate	RM-LC	\$ 835.00
PDC 5 Linearity set	RM-0204060810	\$ 2,275.00	Potassium Chloride	RM-KC	\$ 835.00
PDC 6 Linearity set	RM-020406081060	\$ 2,630.00	Sodium Chloride	RM-SC	\$ 835.00
PDC 6 Linearity set	RM-121416182224	\$ 2,630.00	Sodium Nitrite	RM-SN	\$ 835.00
PDC 6 Linearity set	RM-040812162024	\$ 2,630.00	Acetone	RM-AC	\$ 835.00
<b>Far UV Photometric Scale Verification</b>			<b>SBW Bandwidth Calibration</b>		
<b>Nicotinic Acid</b>			Toluene in Hexane	RM-TX	\$ 885.00
6mg/l	RM-1A	\$ 910.00	<b>UV Bandwidth Derivative Spectroscopy</b>		
12mg/l	RM-2A	\$ 910.00	Toluene in Methanol	RM-TM	\$ 885.00
18mg/l	RM-3A	\$ 910.00	<b>Instrument Resolution</b>		
24mg/l	RM-4A	\$ 910.00	Benzene Vapor	RM-BZ	\$ 465.00
4 concentration set	RM-1A2A3A4A	\$ 2,040.00	<b>UV/VIS Wavelength Accuracy Filters (Glass)</b>		
<b>Deep UV Photometric Scale Verification</b>			Holmium Glass filter	RM-HG	\$ 350.00
<b>Starna TS8</b>			Didymium Glass filter	RM-DG	\$ 480.00
TS8 & Blank	RM-DUV/195	\$ 3,995.00	<b>Absorbance scale &amp; Linearity Visible</b>		
<b>Photometric Scale Verification UV/VIS</b>			<b>Neutral Density Filter sets &amp; NIST equivalents</b>		
<b>Metal on Quartz</b>			10, 20, 30%T (SRM930e)	RM-1N2N3N	\$ 1,190.00
1% & Blank	RM-Q1	\$ 1,290.00	1, 3, 50%T (SRM1930)	RM-N1N35N	\$ 1,190.00
3% & Blank	RM-Q3	\$ 1,290.00	0.1, 0.3, 92%T (SRM2930)	RM-D1D39N	\$ 1,190.00
10% & Blank	RM-1Q	\$ 1,290.00	Combined SRM Neutral		
30% & Blank	RM-3Q	\$ 1,290.00	Density Set.	RM-SRM9ND	\$ 3,190.00
50% & Blank	RM-5Q	\$ 1,290.00	10, 30, 52%T, HG	RM-1N3N5DHG	\$ 1,520.00
90% & Blank	RM-9Q	\$ 1,290.00	Single Filter	RM-xx	\$ 630.00
3%, 50% & Blank	RM-Q35Q	\$ 1,890.00	Four ND Filter set	RM-4ND	\$ 1,580.00
10%, 30%, 90% & Blank	RM-1Q3Q9Q	\$ 2,450.00	Six ND Filter set	RM-6ND	\$ 2,220.00
<b>Starna Green</b>			Nine ND Filter set	RM-9ND	\$ 3,190.00
25X concentration & Blank	RM-1SG	\$ 770.00	<b>Microplate Absorbance scale</b>		
50X concentration & Blank	RM-2SG	\$ 770.00	<b>and Wavelength Accuracy Visible</b>		
75X concentration & Blank	RM-3SG	\$ 770.00	Microplate Reference	RMMR-1N3NN1N3HG	\$ 2,250.00
100X concentration & Blank	RM-4SG	\$ 770.00	Microplate Cell Adaptor	SCP-96-8R	\$ 99.00
4 concentrations & Blank	RM-1SG2SG3SG4SG	\$ 1,720.00	10 mm Quartz Cell with		
<b>Screw Cap Vials</b>			PTFE Screw Cap	1.30-Q-10-ST	\$ 249.00
1 Vial 10X concentration	RM-SG10-SC1	\$ 180.00			
2 Vials 10X concentration	RM-SG10-SC2	\$ 340.00			
4 Vials 10X concentration	RM-SG10-SC4	\$ 590.00			

Description:	Part No.	Price US\$	Description:	Part No.	Price US\$
<b>Validation of 260/280 ratio</b>			<b>Fluorescent Sensitivity Reference</b>		
DNACON Sealed Cell	RM-DNA	\$ 990.00	Ultra Pure Water	RM-H2O	\$ 850.00
<b>Screw Cap Vials</b>			<b>Fluorescent Wavelength Reference</b>		
1 Vial 5X concentration	DNACON5X-SC1	\$ 180.00	<b>Quinine Sulfate</b>		
2 Vials 5X concentration	DNACON5X-SC2	\$ 340.00	1 x 1.0 mg/l,	RM-QS	\$ 1,050.00
4 Vials 5X concentration	DNACON5X-SC4	\$ 590.00	1 x 1.0 mg/l & blank	RM-QS00	\$ 1,400.00
1 Vial 10X concentration,	DNACON10X-SC1	\$ 180.00	2 concentrations, & blank	RM-2QS00	\$ 2,190.00
2 Vial 10X concentration,	DNACON10X-SC2	\$ 340.00	3 concentrations, & blank	RM-3QS00	\$ 2,980.00
4 Vial 10X concentration,	DNACON10X-SC4	\$ 590.00	4 concentrations, & blank	RM-4QS00	\$ 3,770.00
<b>Absorbance scale &amp; Linearity NIR</b>			<b>Raman Wavelength Reference</b>		
<b>Neutral Density Filter sets</b>			Cyclohexane	RM-C6H12	\$ 1,050.00
20%T	RM-R1	\$ 980.00	<b>Instrument Qualification Sets USP</b>		
25%T	RM-R3	\$ 980.00	Basic USP set	RM-USP	\$ 4,950.00
33%T	RM-I1	\$ 980.00	Basic USP set, Linearity	RM-USP/3LIN	\$ 5,650.00
20, 25 & 33%T	RM-R1R3I1	\$ 1,750.00	Visible T/A & Wavelength	RM-1N3N5DHG	\$ 1,520.00
<b>Photometric Scale Verification NIR</b>			10, 20, 30%T (SRM930e)	RM-1N2N3N	\$ 1,190.00
<b>Metal on Quartz</b>			1, 3, 50%T (SRM1930)	RM-N1N35N	\$ 1,190.00
1% & Blank	RM-NQ1	\$ 1,500.00	0.1, 0.3, 92%T (SRM2930)	RM-D1D39N	\$ 1,190.00
3% & Blank	RM-NQ3	\$ 1,500.00	Combined SRM Neutral		
10% & Blank	RM-1NQ	\$ 1,500.00	Density Set	RM-SRM9ND	\$ 3,190.00
30% & Blank	RM-3NQ	\$ 1,500.00	<b>USP Absorbance scale and linearity validation</b>		
50% & Blank	RM-5NQ	\$ 1,500.00	Linearity set 0.095A - 1.5A	RM-0204060810	\$ 2,275.00
90% & Blank	RM-9NQ	\$ 1,500.00	Linearity set 1.5A - 3.3A	RM-121416182224	\$ 2,630.00
3%, 50% & Blank	RM-NQ35NQ	\$ 2,200.00	Linearity set 0.19A - 3.3A	RM-040812162024	\$ 2,630.00
10%, 30%, 90% & Blank	RM-1NQ3NQ9NQ	\$ 2,850.00	<b>Instrument Qualification Sets EP &amp; other Pharmacopoeia</b>		
1%, 3%, 50% & Blank	RM-NQ1NQ35NQ	\$ 2,850.00	Basic EP set	RM-EP	\$ 3,275.00
<b>Wavelength Accuracy NIR</b>			Basic EP set with Linearity	RM-EP/3LIN	\$ 3,970.00
NIR transmittance	RM-NIR	\$ 1,290.00	Basic EP set with Derivative	RM-EP/TM	\$ 4,070.00
NIR transmittance/reflectance	RM-NIR/T	\$ 1,480.00	Basic EP set 2 Stray Lights	RM-EP/2SL	\$ 3,770.00
<b>Stray Light NIR</b>			Basic EP set 3 Stray Lights	RM-EP/3SL	\$ 4,270.00
Chloroform	RM-CHCL3	\$ 1,350.00	<b>Combined Instrument Qualification Sets USP, EP &amp; other Pharmacopoeia</b>		
<b>Mid Infrared Wavelength Reference</b>			Basic combined set	RM-USP/EP	\$ 6,500.00
Polystyrene 38 um	RM-1921/38	\$ 265.00	Basic combined set with Linearity	RM-USP/EP/3LIN	\$ 7,160.00
<b>Mid &amp; Near Infrared Wavelength Reference</b>					
Polystyrene 65 um	RM-1921/65	\$ 265.00			



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93930  
Permit No. 34

## Product Warranty

All Starna® certified reference materials (CRMs) are warranted to meet the specifications defined in this brochure, when received by the customer. We offer a Lifetime Guarantee on all CRMs, providing that they are not physically, optically or thermally abused and that they have been re-certified at least every two years by Starna.

Any CRM that changes value to outside its expanded uncertainty budget ( $k=2$ ), within a time frame of two years or less since its last certification by Starna, will be replaced free of charge. Warranty does not cover breakage. Any references to be returned under warranty require a Return of Merchandise Authorization (RMA) number. The RMA can be obtained by calling our customer service department.

## Recertification

All Starna NIST traceable references can be re-certified and certificates issued for re-certified sets are identical in form to the certificates issued with new sets. Calculated uncertainty values are based on over fifteen years of Starna accredited data and over forty-five years production data.

Certificates are valid for a period of two years from date of issue and re-certification is recommended at either one or two year intervals depending on customer protocols. Please call for current pricing and return instructions. We also recertify references from NIST such as SRM 930, SRM 1930, SRM 2031 and SRM 2034 as well as other third party manufactured references.

## Terms of Sale

Our terms of sale are Mastercard, VISA, American Express or net 30 days to recognized accounts. If you are unsure of your account status, please call for verification of your account. The prices published in this brochure are in US\$ and are current at the time of publication. They are subject to change without notice. The prices and our terms of shipment are calculated as FOB Atascadero, CA USA. We prepay shipping charges and add them to your charge card, invoice or UPS account.

## World Wide Web:

[www.starnacells.com](http://www.starnacells.com)

## Method of Shipment

We usually ship via United Parcel Service and have all levels of service available including Red (overnight).

If required we can also ship via Federal Express. Orders for delivery outside of the USA are shipped via UPS or Fedex using either the customer's account or by prepaying shipping charges and adding them to the customer invoice.

## Technical Information

We have technical staff available to assist you with any information that you may need for the selection of a reference or its use. The best method of inquiry is via e-mail at: [sales@starnacells.com](mailto:sales@starnacells.com). We are usually able to answer your inquiries within 24 hours via return e-mail.

Starna Cells Inc. hours of business are:  
8:30AM to 4:30PM, USA Pacific Time

## Delivery

Delivery of new certified reference materials is usually within two weeks from receipt of order. Delivery of re-calibrated sets of CRMs is approximately two weeks from receipt of the returned set at the Atascadero facility. All reference sets are calibrated immediately prior to dispatch from the accredited Starna Calibration Laboratory.

It is best practice to call for price and delivery verification either prior to or on placement of order. Every effort is made to keep delivery times to a minimum but, due to the certified nature of the product, we must do all that is necessary to assure that the reference materials are accurate, stable and properly documented as a priority.

Please call us at any time for a delivery estimate.

### Mail orders:

Starna Cells, Inc  
PO Box 1919  
Atascadero, CA 93423

### Phone Orders:

(800) 228-4482  
or  
(805) 466-8855

### E-Mail Address:

[sales@starnacells.com](mailto:sales@starnacells.com)

### FAX Orders:

(805) 461-1575