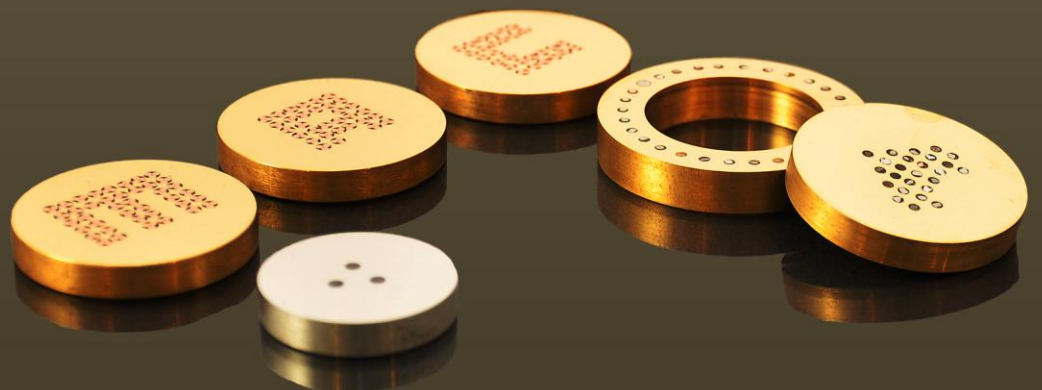




# Reference Standards

for

# X-Ray Microanalysis



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# Micro-Analysis Consultants Limited

For the past 30 years, M.A.C. has produced Reference and Calibration standards for Electron Microscopy users worldwide. We are recognised as a leading supplier of EDX, WDX and SEM standards, as well as supplying standards for Auger, TEM, STEM, XRF and BSED based microanalysis systems.

M.A.C. only purchases reference samples from leading suppliers to ensure consistently high quality. With samples mounted into brass blanks in our own modern factory; diamond polished to a ¼ micron finish and coated with carbon by our experienced team.

Each block of standards has its own unique number allocated to it, and comes with a map for standard identification. As a result of these tight controls, we are able to trace each of our manufactured blocks right back to the first block of standards produced in 1981.

All the standards are supplied with a certificate of analysis with a large number of these standard materials traceable to a national institution, as a standard reference material (SRM). All standards manufactured are tested with our own analysis/SEM equipment prior to shipping.

With this attention to detail M.A.C. has gained a reputation for unsurpassed technical excellence and whilst uncompromising on its approach to quality, appreciates the importance of realistic delivery schedules. In April 1997 we also proudly attained ISO 9001 accreditation.

Whilst we have over 500 different standard materials to choose from; which includes Rare Earth, Synthetic Compounds, Pure materials, Natural Minerals, Steels and Alloys, we are realistic that we may not have the material you require. In these instances, every endeavour will be made to try and source it.

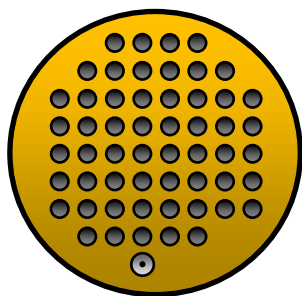
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# Universal Standard Blocks

Our Universal Standard blocks have been produced to incorporate an extensive selection of elements from across the periodic table, with a number of them focusing on specialized areas. With input from leading manufacturers, respected professionals, analysts and Electron Microscopy Users worldwide, these standard blocks provide the end user with a comprehensive catalogue of reference materials.

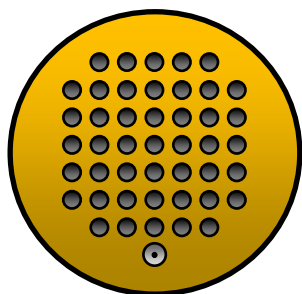
The Universal Standard blocks are usually manufactured on either a 25mm or 32mm diameter brass block, although, it is possible to mount them on alternative sizes depending on the requirements of our customer.



## Universal Block

55 Standards + Faraday Cup

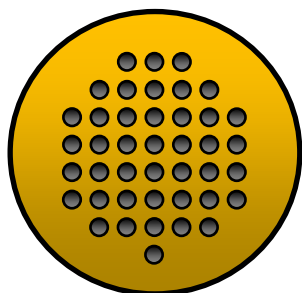
Available as: [UNI5532 - 32mm diameter block](#)



## Universal Block

45 Standards + Faraday Cup

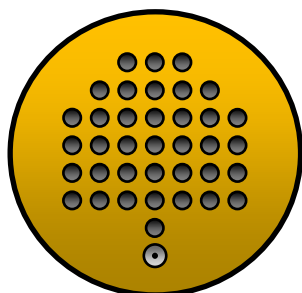
Available as: [UNI4532 - 32mm diameter block](#)  
[UNI4525 - 25mm diameter block](#)



## Universal Block

42 Standards

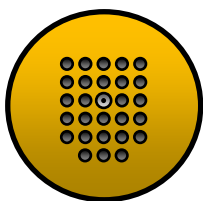
Available as: [UNI4232 - 32mm diameter block](#)  
[UNI4225 - 25mm diameter block](#)



## Universal Block

37 Standards + Faraday Cup

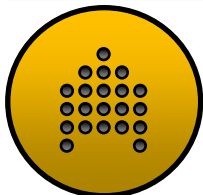
Available as: [UNI3732 - 32mm diameter block](#)  
[UNI3725 - 25mm diameter block](#)



## Mineral Block

27 Standards + Faraday Cup

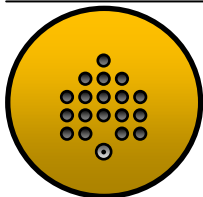
Available as: MIN32 - 32mm diameter block  
MIN25 - 25mm diameter block



## Semi-Conductor Block

21 Standards

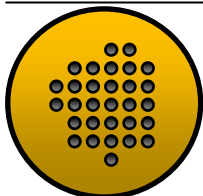
Available as: SCR32 - 32mm diameter block  
SCR25 - 25mm diameter block



## Biological Block

18 Standards + Faraday Cup

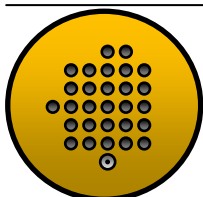
Available as: BGL32 - 32mm diameter block  
BGL25 - 25mm diameter block



## Sulphide Minerals/Heavy Metals Block

30 Standards

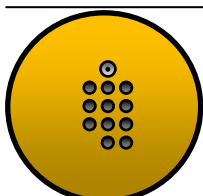
Available as: SMH32 - 32mm diameter block  
SMH25 - 25mm diameter block



## Geo Mk II Block

28 Standards + Faraday Cup

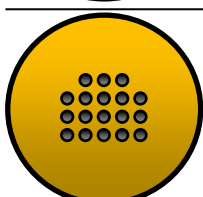
Available as: GGL32 - 32mm diameter block  
GGL25 - 25mm diameter block



## Low Carbon Analysis Block

11 Standards + Faraday Cup

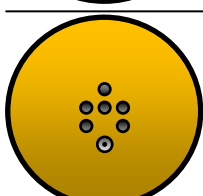
Available as: LCA32 - 32mm diameter block  
LCA25 - 25mm diameter block



## Rare Earth Block

18 Standards

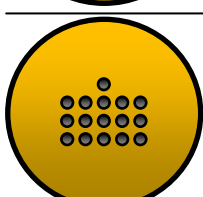
Available as: REE32 - 32mm diameter block  
REE25 - 25mm diameter block



## Rare Earth REE-glass Block (multi 4% each)

6 Standards + Faraday Cup

Available as: REM32 - 32mm diameter block  
REM25 - 25mm diameter block



## Rare Earth REE-glass Block (12% each)

16 Standards

Available as: RES32 - 32mm diameter block  
RES25 - 25mm diameter block

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# Customised Blocks

Although our Universal Standard blocks are extremely comprehensive, M.A.C. are aware that they do not always provide the specialization that some users require. This is why M.A.C. is happy to work directly with you to help to produce a set of standards as unique as the environment in which they are to be used and reflect the requirements which have been identified.

We are able to produce/manufacture blocks for all microanalysis instrumentation or customised mounts specially designed and manufactured. Block material can be as specific as the standards which are mounted and we are able to offer blocks in Brass, Aluminium or Stainless Steel.

When enquiring about custom built blocks, we would ask that the following information is provided, to help you with the most appropriate solution.

1. **Make and model of instrument in which standards are to be used.**
2. **Specify quantity and standard materials required.**
3. **Outer diameter of block or individual required.**
4. **Inner diameter where appropriate.**
5. **Thickness of block (5mm normally supplied).**
6. **Material of the block to be used (normally Brass)**
7. **Whether a Faraday Cup is required.**
8. **Any limitation of the X and Y- movements of the stage.**
9. **The Standard Block type number where possible**
10. **Any additional requirements.**

## **Customised Standards – Single**

Individual standards are usually supplied as 2, 3 or 5mm diameter brass tube. Although they can be mounted in any size block.

## **Unmounted standards**

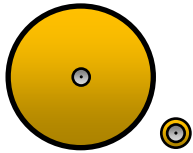
We are also able to offer unmounted samples/grains of certified materials which are available. Grains are usually 2mm<sup>3</sup> in size.

## **Customised Standards - Multiple**

Multiple standards mounted in a single block. The numbers of standards mounted are dependent on the dimensions of the block. These range from 10mm - 32mm are usually 5mm thick, although, blocks can be manufactured to your specific requirements.

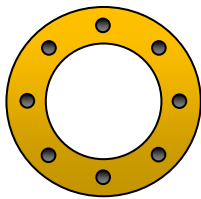
## **Auger Standards**

Auger Blocks are manufactured from AISI 304 austenitic Stainless Steel with standards embedded with woods metal (Bismuth, Lead, Tin and Cadmium Alloy). Up to 50 standards can be set into one of these blocks, however, the actual number achievable will be dependent on the shape and size of the block.



## Faraday Cup

A Faraday Cup is used for measuring the beam current at the specimen plane. The beam of electrons is focused inside the hole by increasing magnification so that when the hole fills the screen all the electrons are trapped and a true measure of current is achieved. The hole size of the Faraday Cup is 150µm. The Faraday Cup can be added to a block of standards or can be supplied as a single; as a single it can be set in any size block required.



## Carousel Configuration

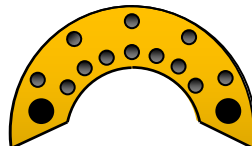
These blocks offer the user the opportunity to extend the current block of standards by adding one or more standards to their existing set of standards. The carousel is able to nestle around the outside of the users original block. These blocks are custom made and therefore the original block dimensions are required. The number of standards which can be embedded in this type of standard is dependent on the dimensions required.

## Specially Manufactured Block

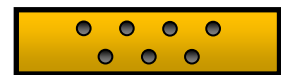
If our range of mounts do not accommodate your requirements, we would be happy to work with you to provide your exact requirements. Examples are detailed below.



Available as: JL-01



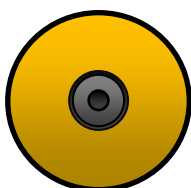
Available as: JL-03



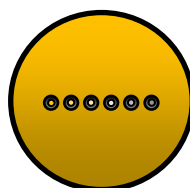
Available as: JL-02

## NIST Standard Sets

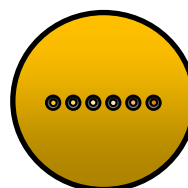
The following sets are only available as sets of standards. These can be ordered as an individual set of standards (as shown) or be added to a block of standards.



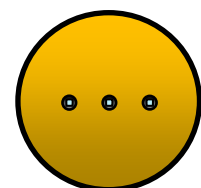
SRM 480



SRM 481



SRM 482



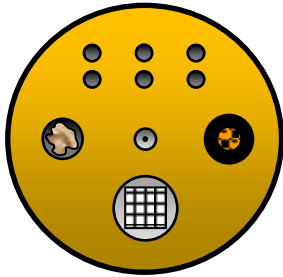
SRM 1872

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# Calibration Standards

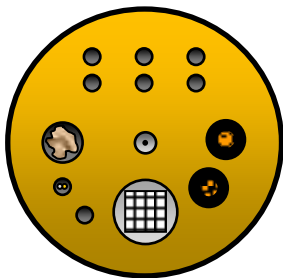
These standards allow users of a Scanning Electron Microscope to check the performance of their instrument, ensuring that it is working within the specifications set out by the manufacturer. These standards are extremely useful and allow users such as Researchers, Technologists, Quality Assurance Departments and SEM users with Energy Dispersive or Wavelength Dispersive X-ray systems fitted, to quickly assess their current operating conditions and adjust parameters to optimize them.



## Quality Control Testing Block - A

Available as: [QCT/A - 32mm diameter x 8mm block](#)

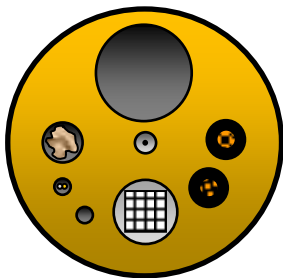
6 Standards (customer choice), Faraday Cup<sup>\*1</sup>, Silicon Grid<sup>\*2</sup>, Duplex Brass<sup>\*3</sup> & Resolution Standard (low, medium or high)<sup>\*4</sup>



## Quality Control Testing Block - B

Available as: [QCT/B - 32mm diameter x 8mm block](#)

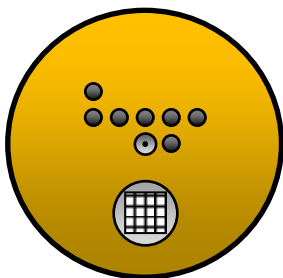
6 Standards (customer choice), Faraday Cup<sup>\*1</sup>, Silicon Grid<sup>\*2</sup>, Duplex Brass<sup>\*3</sup>, Resolution Standard (low, medium, high)<sup>\*4</sup>, BSD Reference Standard<sup>\*5</sup> & 3mm Accessory Hole



## Quality Control Testing Block - C

Available as: [QCT/C - 50mm diameter x 8mm block](#)

Block of Standards<sup>\*6</sup>, Faraday Cup<sup>\*1</sup>, Silicon Grid<sup>\*2</sup>, Duplex Brass<sup>\*3</sup>, Resolution Standard (low, medium, high)<sup>\*4</sup>, BSD Reference Standard<sup>\*5</sup> & 3mm Accessory Hole



## Quality Control Testing Block - EDX

Available as: [QCT/A - 25mm diameter x 5mm block](#)

7 Standards (Mn, Cr, C, Ni, PTFE, Co, Almandine Garnet), Faraday Cup<sup>\*1</sup> & Silicon Grid<sup>\*2</sup>

- 
- 
1. A Faraday Cup is used for measuring the beam current at the specimen plane. The beam of electrons is focused inside the hole by increasing magnification so that when the hole fills the screen all the electrons are trapped and a true measure of current is achieved. The hole size of the Faraday Cup is 150 $\mu$ m
  2. The Silicon Test Specimen is made of single crystal silicon of overall dimension 5mm x 5mm. It is marked with clearly visible squares of periodicity 10 $\mu$ m. The dividing lines are about 1.9 $\mu$ m in width and are formed by electron beam lithography. A broader marking line is written every 500 $\mu$ m, which is a very useful additional feature for light microscopy.
  3. The Duplex Brass standard allows for checking the resolution and performance of the Backscattered Electron Detector. The resolution of a detector is usually quoted as 0.1 (Z) where the atomic number (Z)=30. This is obtained in our standard by the mean atomic number between phases of  $\alpha/\beta$  Brass, being 0.1Z
  4. Resolution standards are used for testing the resolved gaps and the number of grey levels in an image. This is to ensure that the resolution has not been distorted by using contrast to maximise the visibility of edges. These are available as either gold crystals or tin spheres on a carbon substrate. Gold on carbon is available in different particle size ranges, enabling it to cover the full resolution range.
  5. The BSD reference standards are used for checking the contrast efficiency of Backscattered Detectors. Each of the reference specimens consists of two high purity elements that have an atomic number difference of 1.
  6. Standard hole, allows for the insertion of a block of standards 25mm or 32mm diameter x 5mm thick brass block which allows calibration and test standards to be kept together

All of the items listed 1 - 5 can be included in any custom built block



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# Backscattered Electron Detector Standards

An electron microscope, when equipped with a Backscattered Electron Detector, has the capacity to produce images in which contrast is controlled by the differences in atomic numbers ( $Z$ ) across the specimen. We currently have four reference specimens which are available for testing the atomic number contrast performance of backscattered electron detection systems.

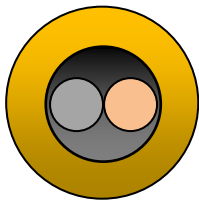
Each of the reference specimens consists of two high purity elements that have an atomic number difference of 1. They are embedded side by side in a contrasting matrix and are available as a single mount or can be incorporated into a block of standards.



## **Atomic Number Contrast Reference Standard**

Aluminium / Silicon (atomic numbers 13/14)

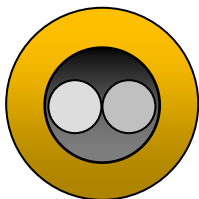
Available as: [ANC1314 - 5mm diameter x 5mm Brass Tube](#)



## **Atomic Number Contrast Reference Standard**

Nickel / Copper (atomic numbers 28/29)

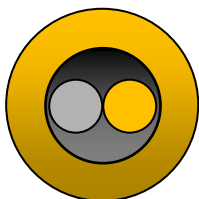
Available as: [ANC28/29 - 5mm diameter x 5mm Brass Tube](#)



## **Atomic Number Contrast Reference Standard**

Palladium / Silver (atomic numbers 46/47)

Available as: [ANC4647 - 5mm diameter x 5mm Brass Tube](#)



## **Atomic Number Contrast Reference Standard**

Platinum / Gold (atomic numbers 78/79)

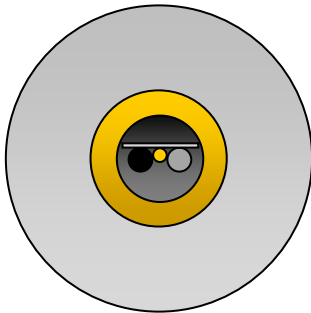
Available as: [ANC7879 - 5mm diameter x 5mm Brass Tube](#)



## Duplex Brass Standard

Available as: [ANC7879 - 5mm diameter x 5mm Brass Tube](#)

This standard allows for checking the resolution and performance of the Backscattered Electron Detector. The resolution of a detector is usually quoted as 0.1 (Z) where the atomic number (Z)=30. This is obtained in our standard by the mean atomic number between phases of  $\alpha/\beta$  Brass, being 0.1Z



## Particle Analysis Standard

Available as: [ANC7879 - 13mm diameter Aluminium Pin Stub](#)

This standard allows the user to set the grey levels for Backscatters as it goes across all grey areas.



## B. S. E. Detector Calibration Standard

Available as: [BSE30C - 30mm diameter x 5mm Carbon Block](#)

The test sample enables the performance of Backscattered Detectors to be verified. The test sample consists of Carbon, Duplex Brass, Faraday Cup and the 4 atomic number reference standards which can be used to verify the performance or act as a quantitative reference.

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# X-ray Fluorescence Spectroscopic Standards

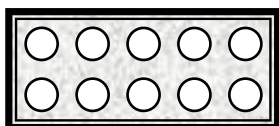
A large range of high purity single element standards for the setting up, calibration and routine instrument monitoring of X-ray Fluorescence spectrometers are available.

These standards are supplied as 1 ¼" diameter pressed pellets or where appropriate metal foils and are prepared from carefully selected elements and compounds to ensure interference free spectra. Each pellet is supported by a thin-walled aluminium cup which affords protection from damage during handling. The precious metal foils are approximately 0.125mm thick and are stretched across plastic supports.

Standards are available for 60 elements and can be purchased individually or as a set.



Single Standard

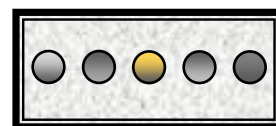


XRF Standard Set

Rare Earth

10 standards

Available as: [XRFRE](#)

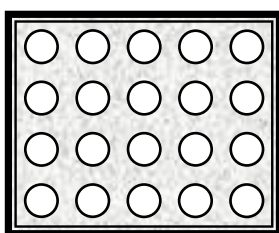


XRF Standard Set

Precious Metal

5 standards

Available as: [XRFPM](#)

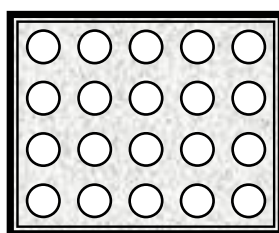


XRF Standard Set

Universal

20 standards

Available as: [XRFUNI](#)

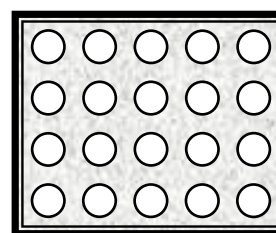


XRF Standard Set

Set A

20 standards

Available as: [XRFA](#)



XRF Standard Set

Set B

20 standards

Available as: [XRFB](#)

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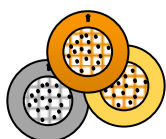
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# Transmission Electron Microscopy

## Thin Films

These standards are supplied as fine powders dispersed onto holey carbon films and are selected from a range of certified materials and synthetic compounds. They are supplied on 3.05mm grids.

Normally the holey carbon films are supported by 400 mesh copper grids although alternative grid materials can be specified



### Thin Film Standards - Single

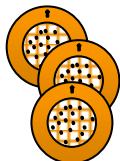
Available as: [FILM1](#)



### Thin Film Standards Set - Universal

25 Standards

Available as: [FILM25](#) - 3.05mm diameter grids



### Thin Film Standards Set - Rare Earth

15 Standards

Available as: [FILM15](#) - 3.05mm diameter grids

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## Thin Foils

These are high purity metal foils, each measuring 3mm diameter x 0.1mm thick which fit into TEM grid holders for use in the STEM mode.



### Thin Foil Standards - Single

Available as: [FILM1](#)



### Thin Foil Standards Set - Rare Earth

25 Standards

Available as: [FOIL25](#) - 3mm diameter x 0.1mm foil

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## Refurbishment Service

Our refurbishment service includes the re-polishing of the standard block, reapplication of the carbon coating and checking the certificate of analysis.

Once your standard has been received at M.A.C. a full inspection is carried out to identify any imperfections which may have occurred since the blocks original manufacture, or since a previous refurbishment. You will then be advised of any additional work required, as a result of the inspection, to enable us to return the block of standards to its original condition prior to the commencement of any work. Only work which has been authorized will be carried out.

We recommend that standards are returned every 2 years to ensure that they consistently deliver the results that are expected. With ISO certification playing a larger role in businesses worldwide, the returning of the standard for refurbishment can show your commitment to delivering part of the servicing requirement of this certification.

# Certificate of Registration



This is to certify that the Quality Management System of

**Micro-Analysis Consultants Ltd**

19 Edison Road, St. Ives, Cambridgeshire, PE27 3LF

applicable to

**Manufacture of standards for micro analysis**

has been assessed and registered by NQA against the provisions of

**BS EN ISO 9001 : 2008**

This registration is subject to the company maintaining a quality management system, to the above standard, which will be monitored by NQA.

*Adam Weir*

Certification Director



Certificate No:  
Date:  
Reissued:  
Valid Until:  
EAC Code:

8960  
10 September 1997  
12 October 2012  
12 October 2015  
19



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[www.micro-analysis.com](http://www.micro-analysis.com)

