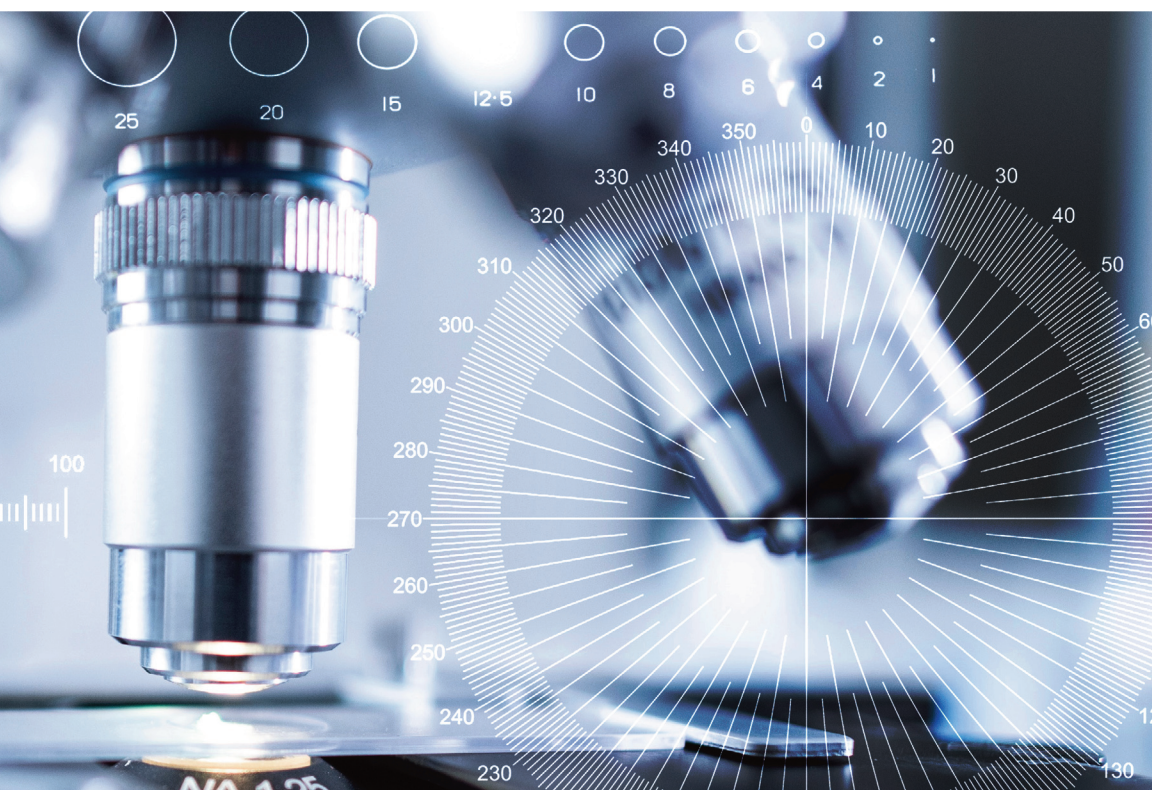


Graticules, Stage Micrometers, and Calibration Standards



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- Ten Educational Workshops
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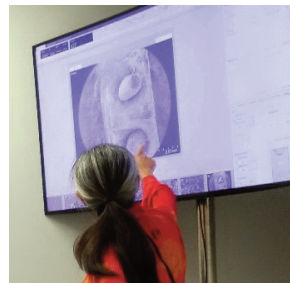
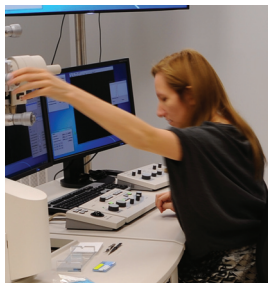
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Graticules, Stage Micrometers, and Calibration Standards

Table of Contents

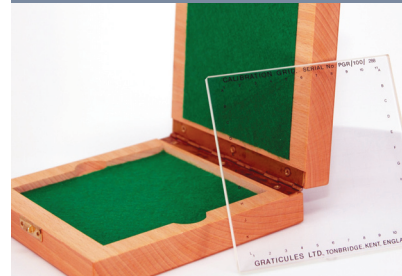
	PAGE NO.
Linear Reference Scales	2-6
■ SM SERIES STAGE MICROMETERS...	2-6
Image Analysis & Microscopy (IAM)	7-10
■ IAM SERIES STANDARDS, PATTERNS, AND TARGETS...	7-10
■ ACM-1 CALIBRATION MICROMETER...	10
Color Transmission Calibration	11
■ NIST TRACEABLE COLOR TRANSMISSION CALIBRATION SLIDE...	11
Standard Reticles	12-15
■ CROSS LINES...	12-13
■ SCALES...	13
■ INDEXED GRIDS...	13
■ CONCENTRIC CIRCLES AND PROTRACTORS...	14
Eyepiece Graticules	16-32
■ SIZE AND POSITION SCALES...	17-19
■ SQUARES AND GRIDS...	20-22
■ GAUGES...	23
■ PARTICLE SIZING AND DISTRIBUTING...	24-25
■ ASBESTOS FIBER ANALYSIS...	26
■ SPECIALIST DESIGNS...	27-29
■ STEREOLOGY...	30-31
■ METALLURGY...	31-32
Stage Graticules	33-44
■ SCALES AND MICROMETERS...	33-35
■ STAGE CALIBRATION STANDARDS...	36-39
■ LONG LINEAR SCALES...	40-41
■ CALIBRATION GRIDS...	41
■ VIBRATION...	43
■ VOLUME/COUNTING CELLS...	43
■ FINDER GRATICLES...	44
Optical Resolution Charts	45-47
■ USAF TEST CHARTS...	45-46
■ STAR TEST TARGETS...	47
■ NBS 25 RESOLUTION CHARTS...	47
■ R72 SAYCE LOGARITHMIC TEST CHART...	47
Grids	48
Ronchi Rulings	48

Newly Introduced Products...



Long Linear Reference Scales

In high definition and standard definition. See pages 40-41.



Calibration Grids

See page 41.

Electron Microscopy Sciences

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Graticules, Stage Micrometers, and Calibration Standards

EMS is proud to add to our already extensive line -- a new wide range of Microscopy Calibration Standards and Standard Graticules, which are manufactured in the USA. This new line adheres to extremely tight tolerances and all of them are available with or without Secondary or Direct NIST certification.

■ A. Linear Reference Scales

We offer Chrome-on-Glass (G) and Chrome-on-Opal glass (O) or Chrome-on Quartz (Q). The Opal and Quartz are offered as a special only and must be requested. **P:** positive image (mostly clear or white); **N:** negative image (mostly opaque or black)

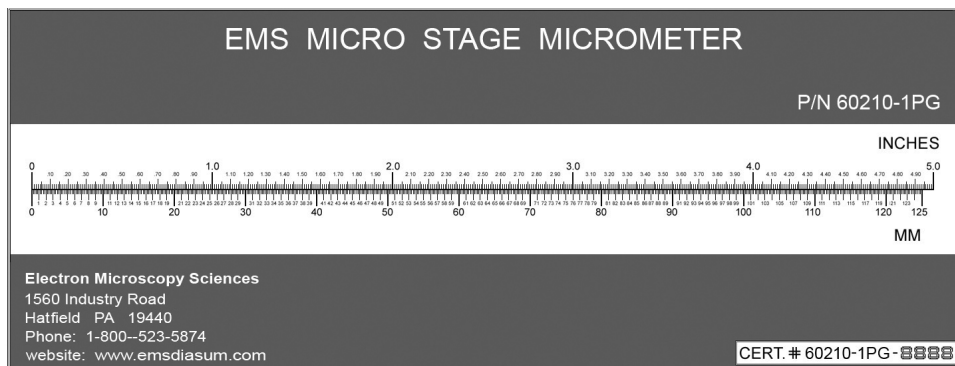
All EMS micrometers come in a sturdy wooden box.



Model SM-1

5 inch/125mm X-Axis Linear Stage Micrometer

The SM-1 linear stage micrometer is a versatile microscopy measurement scale. At 5in in length, with 100 μm divisions and NIST traceable calibration, the SM-1 offers a large measurement scale length with precise divisions in small increments. Labeling at 1mm and .1in intervals.



Specifications

Glass Size:	2" x 5.25" (50 mm x 132 mm)
Scale Length:	5 inch (English) X-axis only; 125 mm (Metric) X-axis only
Divisions:	English = 0.01"; Metric = 100 μm (0.1mm) With numerical labeling every 1mm and 0.1"

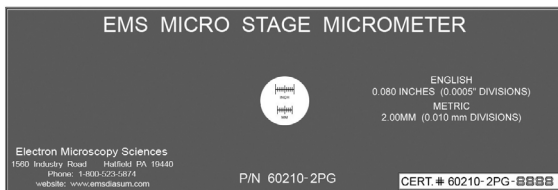
Ordering Information

Catalog #.	Description	Qty
60210-1PG	Stage Micrometer, SM-1, chrome on glass	each
60210-1PGC	Stage Micrometer, SM-1 with Calibration	each

A. Linear Reference Scales (continued)

Model SM-2**Labeled 0.08 inch/2mm X-Axis
Linear Stage Micrometer**

The SM-2 is a 2mm X-axis scale with .0127mm divisions, making ideal for higher magnification microscopes, or smaller fields of view. Labeling is every 0.01in.

**Specifications**

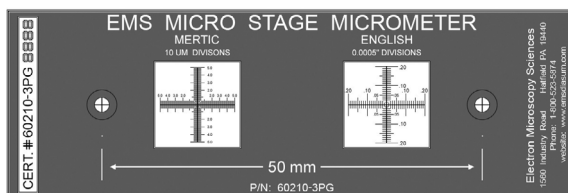
Glass Size:	1" x 3" (25 mm x 75 mm)
Scale Length:	0.08 in. (English) X-axis only; 2.0 mm (Metric) X-axis only
Divisions:	English = 0.0005"; Metric = 10µm

Ordering Information

Catalog #.	Description	Qty
60210-2PG	Stage Micrometer, SM-2, chrome on glass	each
60210-2PGC	Stage Micrometer, SM-2 with Calibration	each

Model SM-3**0.40 inch/10mm X&Y Axis Linear
Stage Micrometer**

The SM-3 is useful for calibration of magnification in microscopes and other optical magnification systems. Its auto-location features can be used for testing of an image analysis auto-location system.

**Specifications**

Glass Size:	1" x 3" (25mm x 75mm). ≥1.42 mm (0.056") thickness
Scale Length:	0.04 inch (English) X & Y axis; 10 mm (Metric) X & Y axis
Divisions:	English = 0.0005"; Metric = 10µm (0.01mm) With numerical labeling every 0.1 mm and 0.05"

Image Forming Material:	Chrome
Image Contrast/Density:	Chrome transmission density is ≥ 2.0
Flatness:	≤ 10 µm/100 mm
Feature Size Accuracy:	2 µm
Image Placement Accuracy:	0.001 mm/100 mm
Polarity:	Scales are opaque on a clear background
Reading Direction:	Right Read Chrome Up (RRCU)

Ordering Information

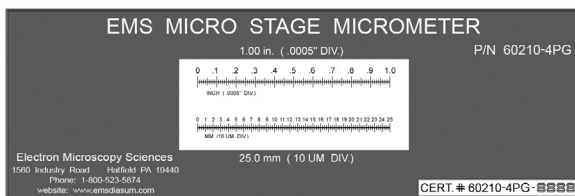
Catalog #.	Description	Qty
60210-3PG	Stage Micrometer, SM-3, chrome on glass	each
60210-3PGC	Stage Micrometer, SM-3 with Calibration	each

A. Linear Reference Scales (continued)

Model SM-4

1.0 inch / 25mm X-Axis Linear Stage Micrometer

The SM-4 is a one inch linear X axis scale and our most commonly used stage micrometer. Combined with NIST traceable calibration, the SM-4 allows you to be efficient and precise in your measurements. The superior line edge quality at 10 μ m divisions makes it the preferred choice for high power magnification.



Specifications

Glass Size:	1" x 3" (25mm x 75mm).
Scale Length:	1 inch (English) X-axis only 25 mm (Metric) X-axis only
Divisions:	English = 0.0005"; Metric = 10 μ m (0.01 mm) With numerical labeling every 0.1 mm and 0.05"

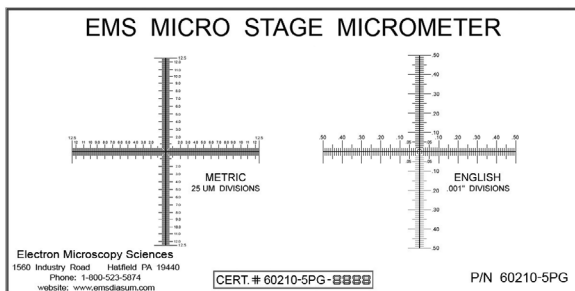
Ordering Information

Catalog #.	Description	Qty
60210-4PG	Stage Micrometer, SM-4, chrome on glass	each
60210-4PGC	Stage Micrometer, SM-4 with Calibration	each

Model SM-5

1.0 inch / 25mm X&Y Axis Linear Scale (0.001" / 25um div.)

The SM-5 is an ideal slide for measuring X & Y axis subjects at multiple power levels in either English or Metric scales. A truly versatile slide, it is precision imaged for the sharpest line edge quality and offered with NIST traceability to improve the accuracy and ease of your measurements.



Specifications

Glass Size:	1.5" x 3" (38mm x 75mm).
Scale Length:	1 inch (English) X & Y axis 25 mm (Metric) X & Y axis
Divisions:	English = 0.001"; Metric = 25 μ m (0.025 mm) With numerical labeling every 1 mm and 0.1"

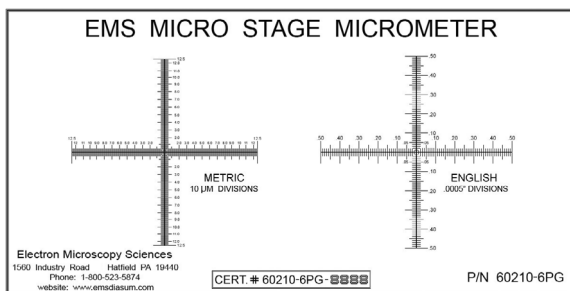
Ordering Information

Catalog #.	Description	Qty
60210-5PG	Stage Micrometer, SM-5, chrome on glass	each
60210-5PGC	Stage Micrometer, SM-5 with Calibration	each

A. Linear Reference Scales (continued)

Model SM-6**1.0 inch / 25mm X&Y Axis Linear Scale (0.0005" / 10um div.)**

Same scale as SM-5, but smaller division.

**Specifications**

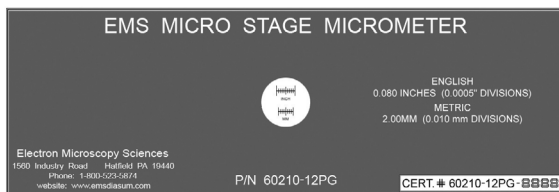
Glass Size:	1.5" x 3" (38mm x 75mm).
Scale Length:	1 inch (English) X & Y axis 25 mm (Metric) X & Y axis
Divisions:	English = 0.0005"; Metric = 10µm (0.01 mm) With numerical labeling every 0.1 mm and 0.05"

Ordering Information

Catalog #.	Description	Qty
60210-6PG	Stage Micrometer, SM-6, chrome on glass	each
60210-6PGC	Stage Micrometer, SM-6 with Calibration	each

Model SM-12**0.08 inch / 2.0mm X-Axis Linear Scale**

The SM-12 is useful for calibration of magnification in microscopes and other optical magnification systems.

**Specifications**

Glass Size:	1" x 3" (25mm x 75mm). ≥1.42 mm (0.056") thickness
Scale Length:	0.08 inch (English) X-axis only; 2.0 mm (Metric) X-axis only
Divisions:	English = 0.001"; Metric = 25µm (0.025 mm) No numerical scale labeling
Flatness:	≤ 10 µm / 100 mm
Image Forming	Chrome
Material:	
Image Contrast/Density:	Chrome transmission density is ≥ 2.0
Feature Size	2 µm
Accuracy:	
Image Placement Accuracy	0.001 mm / 100 mm
Polarity	Scales are opaque on a clear background
Reading Direction	Right Read Chrome Up (RRCU)

Ordering Information

Catalog #.	Description	Qty
60210-12PG	Stage Micrometer, SM-12, chrome on glass	each
60210-12PGC	Stage Micrometer, SM-12 with Calibration	each

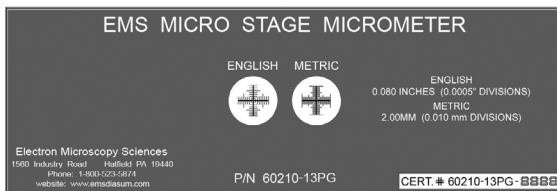
A. Linear Reference Scales (continued)

Model SM-13

0.08 inch / 2.0mm X&Y Axis

Linear Scale

No numerical scale labeling. The SM-12 is useful for calibration of magnification in microscopes and other optical magnification systems.



Specifications

Glass Size:	1" x 3" (25mm x 75mm)
Scale Length:	0.08 inch (English) X & Y axis; 2.0 mm (Metric) X & Y axis
Divisions:	English = 0.001"; Metric = 25µm (0.025 mm) No numerical scale labeling

Ordering Information

Catalog #.	Description	Qty
60210-13PG	Stage Micrometer, SM-13, chrome on glass	each
60210-13PGC	Stage Micrometer, SM-13 with Calibration	each

B. Image Analysis & Microscopy (IAM)

We are proud to introduce the first complete and true line of Image Analysis Microscopy Calibration Standards, specially designed to address the current needs of the new generation of image analysis and machine vision systems. These unique standards are designed to test multiple morphometric parameters to assure that your image analysis system is working properly; meeting the required calibration and certification requirements of your vision measurement systems. We offer Chrome-on-Glass (G) and Chrome-on-Opal glass (O) or Chrome on Quartz (Q). The Opal and Quartz are offered by request only as a custom.

P: positive image (mostly clear or white); N: negative image (mostly opaque or black)

Model IAM-1

Morphometric Image Analysis Standards

Ideal for morphological calibration where two dimensional shapes have to be measured precisely. Standard includes a set of eight test plates of various shapes, positions, angles and sizes. It also includes a linear measurement scale for calibrating your imaging system. Overall size: 1" x 3" (25mm x 75mm). Positive image/Chrome on glass (PG).

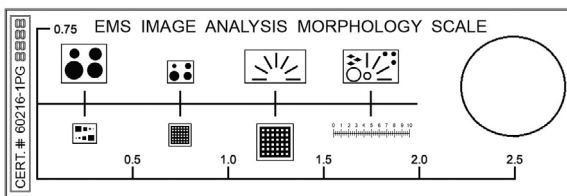


Plate	Frame Size	Description
1	4600 x 3500 µm	Circles – 2000, 1000, 500 & 250 µm Dia.
2	1000 x 800 µm	Circles – 500, 250, 125 & 62.5 µm Dia.
3	1000 x 800 µm	Bars – 200x20 µm at 30 degree increments
4	1000 x 800 µm	Various Shapes, Circles, Bars, Angular designs
5	1000 x 800 µm	Squares – 100, 40, 20 µm set of 2 each.
6	2050 x 1650 µm	Grid Patterns – 50 µm lines at 100 µm pitch
7	4200 x 3400 µm	Grid Patterns – 200 µm lines at 200 µm pitch
8	10 mm long	Scale with 10 µm divisions

Ordering Information

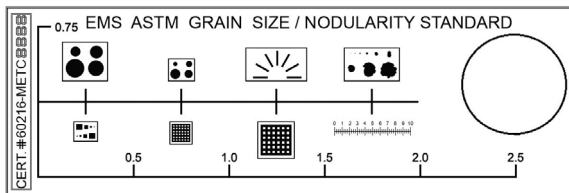
Catalog #.	Description	Qty
60216-1PG	Morphology Stage Micrometer, Model IAM-1	each
60216-1PGC	Morphology Stage Micrometer, Model IAM-1, T/L, Calibrated only plates 1, 2 & 8	each

B. Image Analysis & Microscopy (IAM) (continued)

Model IAM-MET

ASTM Grain Size / Nodularity Analysis Standard

Based on the IAM-1 Morphometric Image Analysis above, the IAM-MET is a multi-morphology calibration standard designed specifically for ASTM. The IAM-MET includes all plates as found in IAM-1 except for plate 4, which is pictured above. This plate contains 9 images of irregular shapes, simulating features commonly found in metallurgical applications. As required by the ASTM standard, the IAM-MET includes secondary certification of plates 1, 2 and 8.



Specifications

Overall Size:	76.2 mm x 25.4 mm (3" x 1")
Image:	Chrome on glass/positive. Calibrated 32 points.

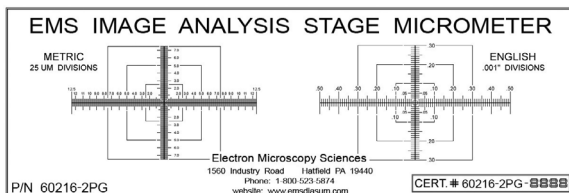
Ordering Information

Catalog #.	Description	Qty
60216-METC	Model IAM-MET, ASTM Grain Size, 32 pts Calibrated	each

Model IAM-2

Linear (X & Y axis) Scale

A dual axis linear micrometer that can accurately calibrate both X & Y directions without rotation, for optical magnification, and camera aspect ratio using single standard. In addition, it can be used to calibrate and check linear stage motion or related auto measuring systems. Scales are in both English and Metric measurements.



Specifications

Overall Size:	1" x 3" (25 mm x 75 mm)
Scale Image:	1" (right scale); 25 mm (left scale); Y = 0.60" (right scale); 15 mm (left scale)
Divisions:	English = 0.001", Metric = 25µm
Image:	Positive image/Chrome on glass (PG)

Ordering Information

Catalog #.	Description	Qty
60216-2PG	Linear (X&Y axis) Stage Micrometer, Model IAM-2	each
60216-2PGC	Linear (X&Y axis) Stage Micrometer, Model IAM-2, T/L, Calibrated	each

B. Image Analysis & Microscopy (IAM) (continued)

Model IAM-3

Ultra-High Image Analysis Resolution Target

Based on the NIST/NBS 1010A and conforming to ANSI/ISO#2 standard, this target is ideal for verifying focus and resolution of high powered optical systems. With direct read information, the exact capabilities of the system will instantly be established. The values (in cycles per mm) are displayed next to 5 vertical and 5 horizontal evenly spaced bars, from 5.6 to 512 cycles per mm (89.2 μm to 0.98 μm bar sizes)



Specifications

Overall Size: 1" x 3" (25 mm x 75 mm)
Resolution: 5.5 to 512 cy/mm

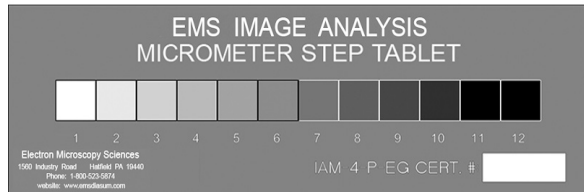
Ordering Information

Catalog #.	Description	Qty
60216-3PG	Ultra-High Image Analysis Resolution Target, Model IAM-3	each
60216-3PGC	Ultra-High Image Analysis Resolution Target, Model IAM-3, with Calibration	each

Model IAM-4

Image Analysis Neutral Density Step Tablet

Designed for illumination and detection calibration, which is needed for today's exacting imaging and vision systems. This tablet has 12 Transmission Steps, nominally ranging from 0 to 100% transmission. The neutral density step tablet is ideal for testing linearity of the sensing system.



Specifications

Overall Size: 1" x 3" (25 mm x 75 mm)
Material: Emulsion film on glass
Density Range: 0.08 to 2.00

Ordering Information

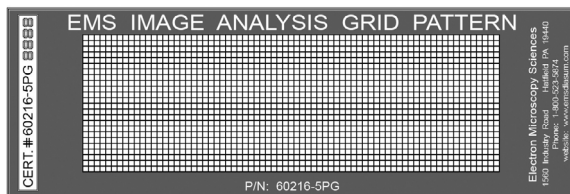
Catalog #.	Description	Qty
60216-4PG	Image Analysis Neutral Density Step Tablet, Model IAM-4	each
60216-4PGC	Image Analysis Neutral Density Step Tablet, Model IAM-4, Calibrated	each

B. Image Analysis & Microscopy (IAM) (continued)

Model IAM-5

Stage Mapping – Grid Pattern

This ideal standard is for verifying or qualifying multiple image analysis parameters such as optical distortion, alignment between systems or optical paths, and cell areas for particle counting. The image area is 20mm x 50mm.



Model No.	Clear Aperture	Opaque Lines	Pitch
IAM-5S	8.5 μm square	1.5 μm square	10 μm
IAM-5M	180 μm square	20 μm square	200 μm
IAM-5L	980 μm square	20 μm square	1000 μm

Specifications

Overall Size:	1" x 3" (25mm x 75mm)
Image Forming	Negative image/Chrome on glass (NG)
Material:	

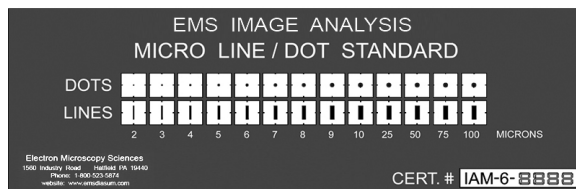
Ordering Information

Catalog #.	Description	Qty
60216-5SNG	Model IAM-5S, Grids, Small Size, 10 μm Pitch	each
60216-5SNGC	Model IAM-5S with Calibrated (12 pts)	each
60216-5MNG	Model IAM-5M, Grids, Medium Size, 200 μm Pitch	each
60216-5MNGC	Model IAM-5M with Calibrated (12 pts)	each
60216-5LNG	Model IAM-5L, Grids, Large Size, 1000 μm Pitch	each
60216-5LNGC	Model IAM-5L with Calibrated (12 pts)	each

Model IAM-6

Image Analysis Micro Line/ Dot Standard

A standard specifically designed to calibrate CCD, CMOS devices and other geometric measuring imaging systems where critical measurement is important. Electronic sensors often have spurious resolution created by pixel dithering. The IAM-6 limits this calibration problem by providing known dot and line sizes to test the sensor / optical capabilities.



Specifications

Overall Size:	1" x 3" (25 mm x 75 mm)
Image:	Positive image/Chrome on glass (PG)

Ordering Information

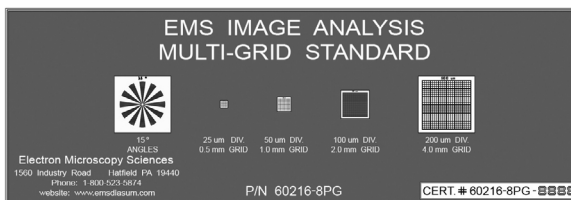
Catalog #.	Description	Qty
60216-6PG	Image Analysis Micro Line/Dot Standard, Model IAM-6	each
60216-6PGC	Image Analysis Micro Line/Dot Standard, Model IAM-6, Calibrated	each

B. Image Analysis & Microscopy (IAM) (continued)

Model IAM-8

Multi-Grid Image Analysis Standard

A uniquely designed standard with 4 different grid size patterns: 0.5 x 0.5 mm grid with 25 µm pitch; 1.0 x 1.0 mm grid with 50 µm pitch; 2.0 x 2.0 grid with 100 µm pitch; and 4.0 x 4.0 mm grid with 200 µm pitch. Also includes a Star Target with 15 degree angle increments. This standard can be used to test not only the overall frame distortion issue, but also linear distances for a wide variety of magnification ranges from 1x to 1000x power.



Specifications

Overall Size:	1" x 3" (25 mm x 75 mm)
Image:	Positive image/Chrome on glass (PG)

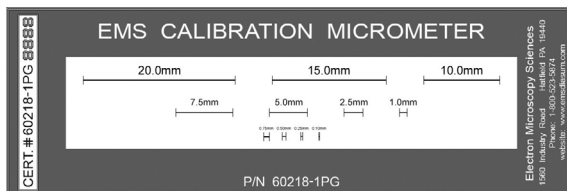
Ordering Information

Catalog #.	Description	Qty
60216-8PG	Ultra-High Image Analysis Resolution Target, Model IAM-8	each
60216-8PGC	Ultra-High Image Analysis Resolution Target, Model IAM-8, with Calibration	each

Model ACM-1

Calibration Micrometer

This ideal standard provides accurate calibration of any eyepiece, reticules, filar micrometers, or electronic measuring instrument. Features a series of 'H' shaped fiducials in a range of sizes from 0.1 mm through 20 mm, useful for calibration range from 1X to 1000X power.



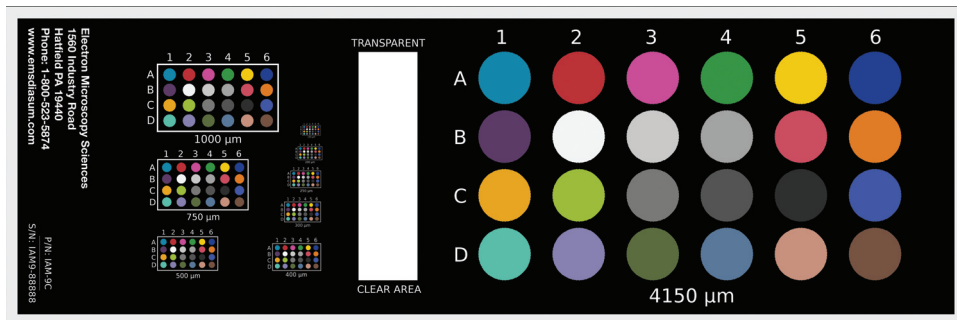
Specifications

Overall Size:	25 mm x 75 mm	
Substrate Type:	Transparent glass (G), 1.42 mm or thicker; Opal glass (O) is available per request.	
Image Forming Material:	Evaporated chromium on glass	
Image Description:	'H' shaped fiducials as follows, centerline to centerline	
<i>Pattern Length (mm)</i>	<i>Pattern Height</i>	<i>Line Width</i>
0.10, 0.25, 0.50, 0.75	0.50 mm	10 µm
1.00, 2.50, 5.00, 7.50	1.00 mm	20 µm
10.0, 15.0, 20.0	3.00 mm	40 µm
Polarity:	Positive	
Reading Direction:	Right Read Chrome Up (RRCU)	
Image Placement Accuracy:	3.0 microns or better	
Image Contrast/Density:	Chrome optical density greater than 2.0	

Ordering Information

Catalog #.	Description	Qty
60218-1PG	Calibration Micrometer, Model ACM-1	each
60218-1PGC	Calibration Micrometer with 11 pts Calibrated, Model ACM-1	each

■ C. Color Transmission Calibration



NIST Traceable Color Transmission Calibration Slide — Calibrated

Microscopy color patches for assessing color accuracy. NIST traceable calibration data for each large color patch is supplied as spectral transmission. By using the supplied spreadsheet, this data can be converted to the color space you need (such as Adobe RGB 1998, L*A*B*, XYZ, etc.)

- 24 color patches plus large clear area
- Black background to minimize flare
- The 4150 μm diameter patches are individually calibrated for spectral transmission. This allows accurate conversion (using the supplied spreadsheet) to other color space units.
- Smaller patches from 1000 μm diameter to 150 μm diameter are exposed and processed at the same time produce good correlation of the large calibrated patches to the smaller ones, but are not calibrated.
- Oil immersion objectives can be used because a standard 0.15 mm glass cover slip is permanently cemented over the color film.
- Film is permanently sandwiched between glass; atmospheric deterioration of the measured values is minimized.
- Each slide is individually serialized and calibrated.

Specifications

Overall Size	75mm x 25mm
Feature Array	24 unique color patches in 9 different sizes, ranging from 4.15 mm diameter to 0.15 mm diameter, and a large clear film area. Only the large patches (and clear area) are directly calibrated, but all patches are imaged and processed at the same time.
Polarity	Negative
Material	0.2 mm (0.007") thick polyester photo-film mounted onto 0.9 to 1 mm water white Soda-lime Glass with a 0.15 mm (0.006") glass coverslip for protection (exact thickness is subject to change)

Ordering Information

Includes

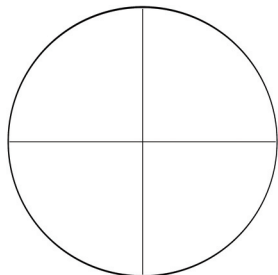
Calibrated IAM-9C color microscope slide, Calibration Certificate, Calibration Data Report, Conversion Spreadsheet, USB flash drive with data and spreadsheet, Protective case

Catalog #.	Description	Qty
79504	NIST Traceable Color Transmission Calibration Slide - Calibrated	each

■ Standard Reticles

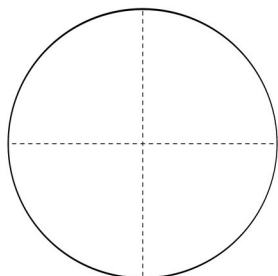
These standard reticles are manufactured to use with our microscope eyepieces. High quality, precision made with different designs and styles that help you do your work. We offer as a standard the following popular eyepiece diameters: 19 mm and 21 mm. Other eyepiece diameter sizes can be supplied as a special order.

All reticles are chrome on glass and positive polarity.



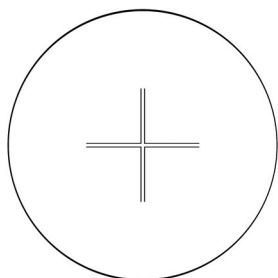
Single Solid Cross Lines

Catalog #.	Description	Diameter	Qty
60250-19	RET 42, 9µm wide	19mm	each
60250-21	RET 42, 9µm wide	21mm	each
60251-19	RET 41, 17µm wide	19mm	each
60251-21	RET 41, 17µm wide	21mm	each
60252-19	RET 43, 25µm wide	19mm	each
60252-21	RET 43, 25µm wide	21mm	each



Single Dashed Cross Lines

Catalog #.	Description	Diameter	Qty
60255-19	RET 50, 13 µm wide	19mm	each
60255-21	RET 50, 13 µm wide	21mm	each
60256-19	RET 51, 63 µm wide	19mm	each
60256-21	RET 51, 63 µm wide	21mm	each



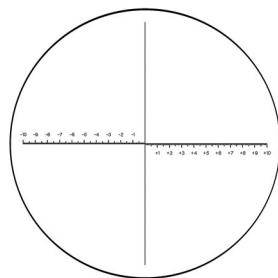
Double Cross Lines

Catalog #.	Description	Diameter	Qty
60260-19	RET 60, 0.025 mm gap	19mm	each
60260-21	RET 60, 0.025 mm gap	21mm	each
60261-19	RET 61, 0.075 mm gap	19mm	each
60261-21	RET 61, 0.075 mm gap	21mm	each
60262-19	RET 62, 0.125 mm gap	19mm	each
60262-21	RET 62, 0.125 mm gap	21mm	each
60263-19	RET 63, 0.50 mm gap	19mm	each
60263-21	RET 63, 0.50 mm gap	21mm	each
60264-19	RET 64, 1.0 mm gap	19mm	each
60264-21	RET 64, 1.0 mm gap	21mm	each
60265-19	RET 65, 2.0 mm gap	19mm	each
60265-21	RET 65, 2.0 mm gap	21mm	each

Standard Reticles (continued)

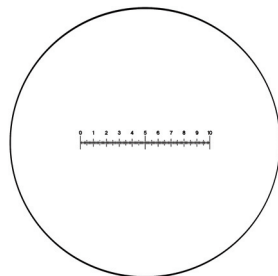
Cross Lines with Scale

Catalog #.	Description	Diameter	Qty
60267-19	RET 21, 20mm of 0.10mm Division Scale	19mm	each
60267-21	RET 21, 20mm of 0.10mm Division Scale	21mm	each



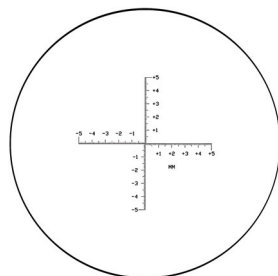
Scales

Catalog #.	Description	Diameter	Qty
60270-19	RET 14, Scale 2mm, 200 Div of 0.01mm	19mm	each
60270-21	RET 14, Scale 2mm, 200 Div of 0.01mm	21mm	each
60271-19	RET 15, Scale 5mm, 50 Div. of 0.1mm	19mm	each
60271-21	RET 15, Scale 5mm, 50 Div. of 0.1mm	21mm	each
60272-19	RET 11, Scale 5mm, 100 Div of 0.05mm	19mm	each
60272-21	RET 11, Scale 5mm, 100 Div of 0.05mm	21mm	each
60273-19	RET 10, Scale 10mm, 100 Div of 0.1mm	19mm	each
60273-21	RET 10, Scale 10mm, 100 Div of 0.1mm	21mm	each
60274-19	RET 16, Scale 10mm, 200 Div of 0.05mm	19mm	each
60274-21	RET 16, Scale 10mm, 200 Div of 0.05mm	21mm	each
60276-19	RET 12, Scale 20mm, 200 Div of 0.10mm	19mm	each
60276-21	RET 12, Scale 20mm, 200 Div of 0.1mm	21mm	each

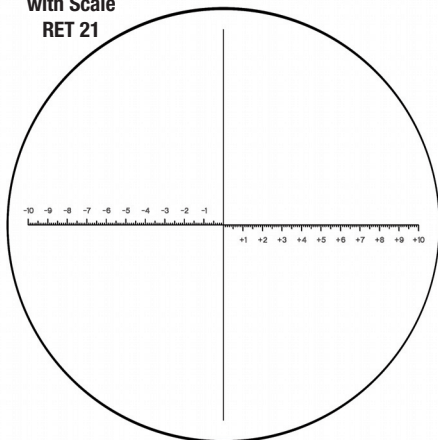


Crossed Scales

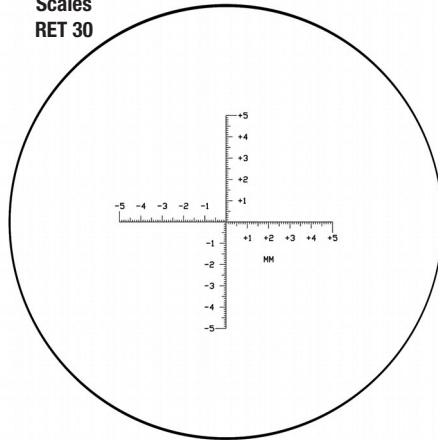
Catalog #.	Description	Diameter	Qty
60278-19	RET 30, Cross Scale 10mm, 100 Div of 0.10mm	19mm	each
60278-21	RET 30, Cross Scale 10mm, 100 Div of 0.10mm	21mm	each
60279-19	RET 32, Cross Scale 20mm, 200 Div. of 0.10mm	19mm	each
60279-21	RET 32, Cross Scale 20mm, 200 Div of 0.10mm	21mm	each



Cross Lines
with Scale
RET 21

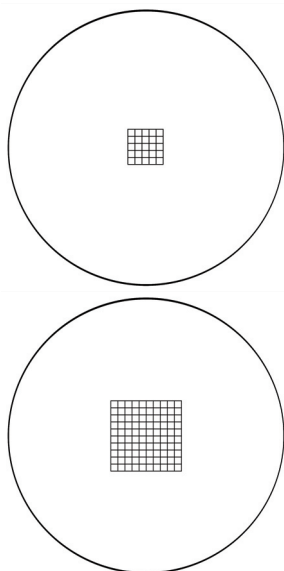


Crossed
Scales
RET 30



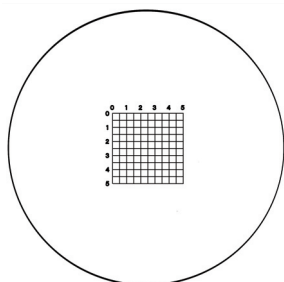
Standard Reticles (continued)

Simple Grid Scales



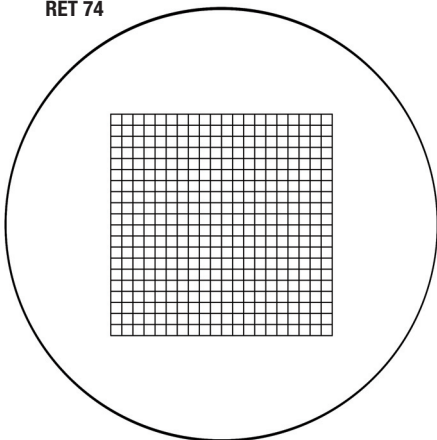
Catalog #.	Description	Diameter	Qty
60282-19	RET 71, Grid 5mm x 5mm x 0.5mm with 0.025mm Line	19mm	each
60282-21	RET 71, Grid 5mm x 5mm x 0.5mm with 0.025mm Line	21mm	each
60283-19	RET 73, Grid 10mm x 10mm x 1mm with 0.025mm Line	19mm	each
60283-21	RET 73, Grid 10mm x 10mm x 1mm with 0.025mm Line,	21mm	each
60284-19	RET 74, Grid 20mm x 20mm x 1mm with 0.025mm Line	19mm	each
60284-21	RET 74, Grid 20mm x 20mm x 1mm with 0.025mm Line	21mm	each

Indexed Grid Scales

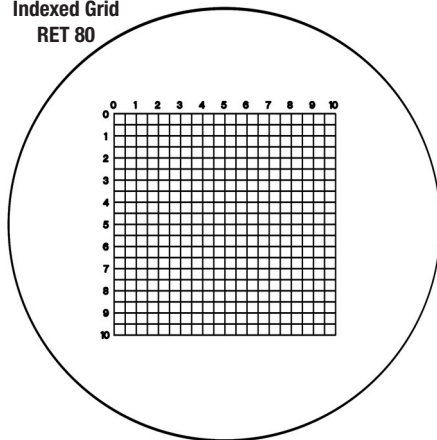


Catalog #.	Description	Diameter	Qty
60286-19	RET 83, Indexed Grid 5mm x 5mm x 1mm with 0.01mm Line, 1 - 5 horiz. / 1 - 5 vert.	19mm	each
60286-21	RET 83, Indexed Grid 5mm x 5mm x 1mm with 0.01m Line, 1 - 5 horiz. / 1 - 5 vert.	21mm	each
60287-19	RET 80, Indexed Grid 10mm x 10mm x 0.5mm with 0.025mm Line, 1 - 10 horiz. / 1 - 10 vert.	19mm	each
60287-21	RET 80, Indexed Grid 10mm x 10mm x 0.5mm with 0.025mm Line, 1 - 10 horiz. / A - Z vert.	21mm	each

20 x 20 Grid
RET 74



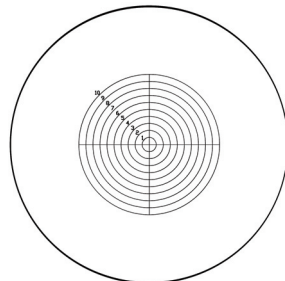
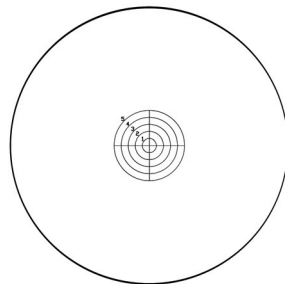
10 x 10
Indexed Grid
RET 80



Standard Reticles (continued)

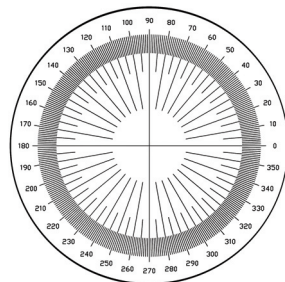
Concentric Circles with Crosshairs

Catalog #.	Description	Diameter	Qty
60280-19	RET 92, 10 Concentric Circles 0–5mm Dia., 0.5mm divisions with 10 micron width lines, labeling every 1mm	19mm	each
60280-21	RET 92, 10 Concentric Circles 0–5mm Dia., 0.5mm divisions with 10 micron width lines, labeling every 1mm	21mm	each
60281-19	RET 93, 10 Concentric Circles 0–10mm Dia., 0.5mm divisions with 10 micron width lines, labeling every 1mm	19mm	each
60281-21	RET 93, 10 Concentric Circles 0–10mm Dia., 0.5mm divisions with 10 micron width lines, labeling every 1mm	21mm	each

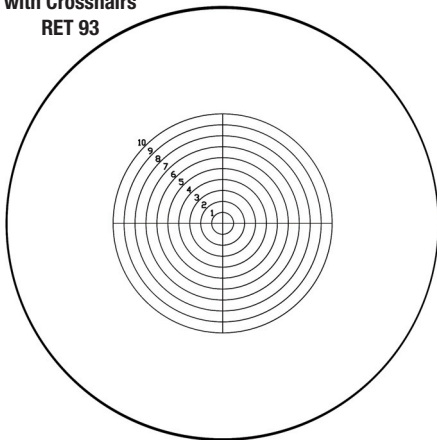


Protractor

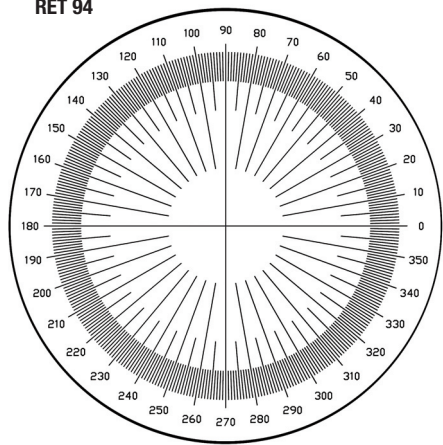
Catalog #.	Description	Qty
60288-19	RET 94, 360 Degrees at 1 Degree increments with every 10 degree labeling, 19mm Dia.	each
60288-21	RET 94, 360 Degrees at 1 Degree increments with every 10 degree labeling, 21mm Dia.	each



Concentric Circles
with Crosshairs
RET 93



Protractor
RET 94



■ Eyepiece Graticules

The standard sizes of eyepiece graticules used to be 16, 19, and 21 mm. For your convenience, this has been greatly expanded to accommodate a variety of equipment without the need to special order. The following table will assist you in determining appropriate eyepieces for common brands.

Olympus Eyepieces

Reticle Diameter	Marking on Eyepiece	
24mm	WHN10X, WHN10X-H	WH10X, WH10X-H, WH15X
	WHS10X-H, WHS15X-H	CWH10X, CWH10X-H, CWH30X
	GW10X	GWH10X
	GSWH10X, GSWH15X, GSWH20X, GSWH30X	WH12.5X, WH12.5X-H
	WHSZ10X-H, WHSZ15X-H, WHSZ20X-H, WHSZ30X-H	GSWH10X-H, GSWH15X-H, GSWH20X-H, GSWH30X-H
20.4mm	WHK8X, WHK10X, WHK15X	PE 2.5X/ 3.3X/ 4X/ 5X
	NWHK10X, (*WHK10X-H cannot be installed)	GWH15X-D, GWH15X-CD
	NFK 2.5X/ 3.3X/ 5X/ 6.7X	

Nikon Eyepieces

Reticle Diameter	Marking on Eyepiece	
27mm	CFI 10x, CFI 12.5x, CFI 15x, CFI UW 10x	CFUW10X, CFUWN 10X
	E1-CFI 10x, E2-CFI 10x, E2-CFI 15x	SME 10x /23, SME 10x /21
	SMZ 10 UW15x /17, SMZ 10 UW20x/15	
25mm	C-W 10x B/22 (C-W 10X A/22)	L-W10x ESD (FOV 22)
	SMZ U UW10x A/24, SMZ U UW15x	

Leica Eyepieces

Reticle Diameter	Marking on Eyepiece	
26mm	11507807 (S10x/22B.M)	11507808 (S10x/25Br.M)
	11507801 (10x/20Br.M)	11507802 (10x/20Br.M)
	11506515 (12.5x/16Br.M)	
23mm	10447160 (10x/21B)	10445301 (16x/14B)
	10445302 (25x/9.5B)	10445303 (40x/6B)
24.5mm	10450023 (10x/23B)	10450024 (16x /15B)
	10450025 (25x/9.5B)	10450026 (40x/6B)
	10 446 333 (10x/23,adjustable)	13 613 532 (10x/20, focusing)
	10 446 355 (16x/16,adjustable)	10 446 357 (20x/12,adjustable)
	10 446 329 (10x/23B,adjust.f/eyeglasses)	10 447 131 (10x/23,adjustable)
	10 447 133 (16x/16,adjustable)	10 447 135 (20x/126, adjustable)
	10 447 137 (for eyeglasses10x/23B, adjustable)	10 447 139 (for eyeglasses16x/15B,adjustable)
	10 445 302 (25x/9.5B,adjust.f/eyeglasses)	10 445 303 (40x/6B,adjust.f/eyeglasses)
10 447 280 (10x/20B,adjust.f/eyeglasses)		

Zeiss Eyepieces

Reticle Diameter	Marking on Eyepiece	
26mm	E-PL 10x/20 Br. Foc	PL 10x/21 Br Foc
	PL 10x/23 Br. Foc	
23mm	WF 10x/18	WF 10X/20
21mm	PL16x/16 Br. Foc	W 25x/10 foc
	Kpl-W 10x/18 [#46 40 43-9902]	

This list is not comprehensive so please inquire if your eyepiece or brand is not listed.

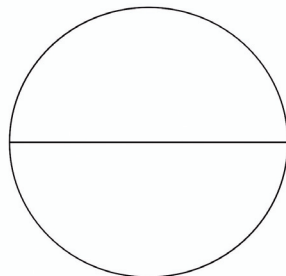
Eyepiece Graticules (continued)

A. Size and Position Scales

Single Lines — NE50

For measurement of large objects in conjunction with a graduated mechanical stage, and for alignment as well.

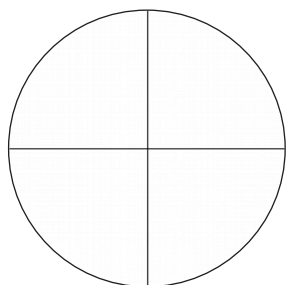
Pattern	Description	Dia.	Catalog #
NE50	Single Line, nominal width 0.02mm	16mm	67982-16
	Image covers entire field of view	19mm	67982-19
	Surface chrome image	21mm	67982-21



Cross Lines — NE8, NE81, NE82

Used as NE50 but for measurements in two directions and for sighting and alignment. Image covers the entire field of view.

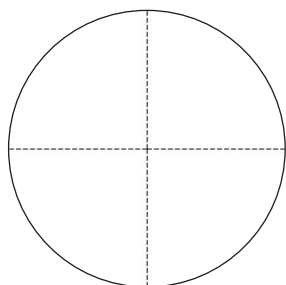
Pattern	Description	Dia.	Catalog #
NE8	Cross lines with surface chrome image. Nominal line width 0.020mm.	16mm	67983-01
		19mm	67983-05
		20.4mm	67983-20.4
		21mm	67983-10
		23mm	67983-23
		24.5mm	67983-24.5
		25mm	67983-025
NE81	Cross lines with surface chrome image. Nominal line width 0.04mm	16mm	67983-20
		19mm	67983-25
		21mm	67983-30
NE82	Cross lines with surface chrome image. Nominal line width 0.005mm	16mm	67984-16
		19mm	67984-19
		21mm	67984-21



Broken Cross Lines — NE56

Used as above. Broken lines enable fine detail to be seen at the breaks. A thin boundary would be lost behind a continuous line.

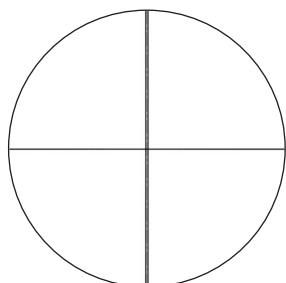
Pattern	Description	Dia.	Catalog #
NE56	Broken cross lines. Image covers the entire field of view. Surface chrome image.	16mm	67985-16
		19mm	67985-19
		21mm	67985-21



Crossed Gauge Lines — NE53, NE54

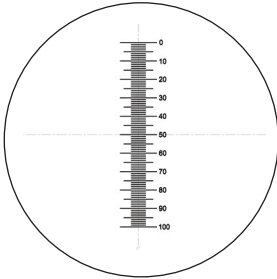
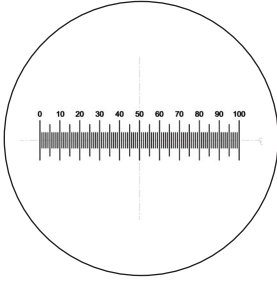
Use as crossed lines, but for the measuring of distances between the lines. Greater accuracy can be obtained by locating the specimen detail between the graticules gauge pair.

Pattern	Description	Dia.	Catalog #
NE53	Two vertical lines 0.1mm apart with horizontal line. Image covers the entire field of view. Surface chrome image.	16mm	67986-16
		19mm	67986-19
		21mm	67986-21
NE54	Two vertical lines 0.2mm apart	16mm	67975-16
		19mm	67975-19
		21mm	67975-21
		Custom	67975-50



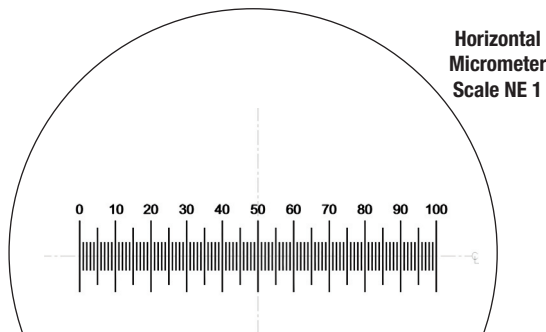
Eyepiece Graticules (continued)

Horizontal & Vertical Scales — NE1, NE2, NE5, NE20, NE28, NE31, NE41, NE120



These scales are used for the measuring of lengths of specimen or distances between points on a variety of different shaped objects. NE1 scale shown: This eyepiece graticule has an overall length of 10.00mm with 100 subdivisions of 0.1mm. When used with a x10 objective, each division will represent 10 microns on the specimen. By dividing the division of the chosen graticule by the magnification of the objective, one obtains an approximate value that each division will represent on the stage.

Pattern	Description	Dia.	Catalog #
NE1	Horizontal micrometer scale 10mm long with 0.1mm subdivisions Surface chrome image	16mm	68010-16
		19mm	68010-19
		20.4mm	68010-20.4
		21mm	68010-2
		23mm	68010-23
		24.5mm	68010-24.5
		25mm	68010-25
NE2	Vertical micrometer scale 10mm long with 0.1mm subdivisions Surface chrome image	16mm	68006-16
		19mm	68006-19
		21mm	68006-21
NE5	Horizontal micrometer scale 5mm long with 0.05mm subdivisions Surface chrome image	16mm	67988-16
		19mm	67988-19
		21mm	67988-21
NE20	Horizontal scale 0.1 inch long with 100 subdivisions Surface scale image	16mm	67987-16
		19mm	67987-19
		21mm	67987-21
NE28	Horizontal micrometer scale 1mm long with 100 subdivisions Surface chrome image	16mm	67992-16
		19mm	67992-19
		21mm	67992-21
NE31	Horizontal scale 0.5" long with 100 divisions of 0.0005"	16mm	67977-16
		19mm	67977-19
		21mm	67977-21
		Custom	67977-50
NE41	Horizontal micrometer scale 10mm long with 200 subdivisions Surface chrome image	16mm	67993-16
		19mm	67993-19
		21mm	67993-21
NE120	Horizontal Micrometer 20mm long with 100 divisions of 0.1mm	Custom	67976-21 67976-50



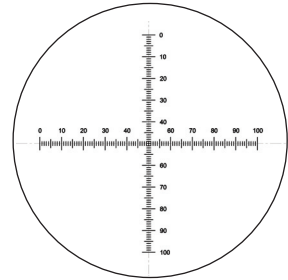
**Horizontal
Micrometer
Scale NE 1**

Eyepiece Graticules (continued)

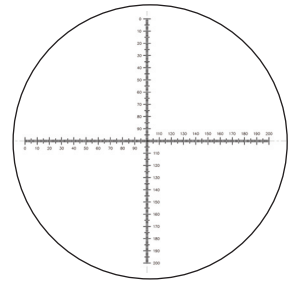
Crossed Scales — NE17, NE18, NE70, NE72

Used as a horizontal and a vertical scale, they are especially useful when interested in measurement in different axis.

Pattern	Description	Dia.	Catalog #
NE17	Crossed micrometer scales 10mm long with 0.10mm subdivisions Surface chrome image	16mm	67989-16
		19mm	67989-19
		20.4mm	67989-20.4
		21mm	67989-21
		23mm	67989-23
		24.5mm	67989-24.5
		25mm	67989-25
		26mm	67989-26
NE18	Crossed micrometer scales 5mm long with 0.05mm subdivisions Surface chrome image	16mm	67994-16
		19mm	67994-19
		21mm	67994-21
NE72	Crossed Micrometer scale 20mm long with 200 Divisions of 0.10mm	23mm	67978-23
		24mm	67978-24
		26mm	67978-26
		27mm	67978-27
		Custom	67978-50
NE70	Crossed micrometer scale (Imperial) 0.8" long with 400 divisions of 0.002"	21mm	67978-21
		23mm	67979-23
		24mm	67979-24
		26mm	67979-26
		27mm	67979-27
Custom	67979-50		



NE17

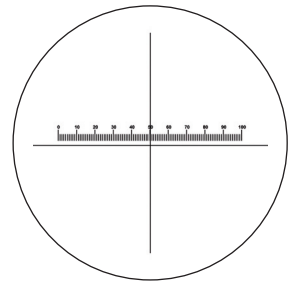


NE72

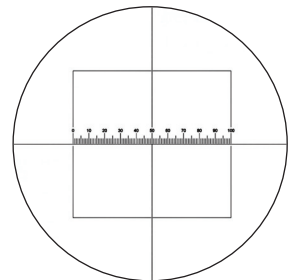
Scales with Cross Lines — NE7, NE77, NE777

Used as a horizontal and a vertical scale, they are especially useful when interested in measurement in different axis.

Pattern	Description	Dia.	Catalog #
NE7	Horizontal micrometer scale 10mm long with cross lines at 0.10mm spacing Surface chrome image	16mm	68013-16
		19mm	68013-19
		20.4mm	68013-20.4
		21mm	68013-21
		23mm	68013-23
		24.5mm	68013-24.5
		25mm	68013-25
		26mm	68013-26
NE7N	Horizontal Scale 10mm/0.10mm + Cross line + Square	16mm	67979-16
		19mm	67979-19
		21mm	67979-21
NE77	Horizontal micrometer scale 5mm long in 100 divisions with cross lines Surface chrome image	16mm	68012-16
		19mm	68012-19
		21mm	68012-21
NE777	Horizontal micrometer scale 0.5" long with divisions of 0.005" and cross lines	16mm	67980-16
		19mm	67980-19
		21mm	67980-21
		Custom	67980-50



NE7



NE7N

Eyepiece Graticules (continued)

B. Squares and Grids

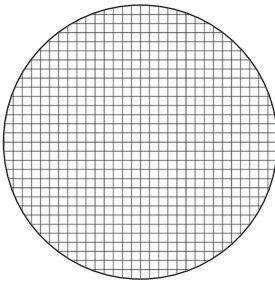
Note: These scales may need to be calibrated, according to intended use. There are a number of uses for the grids and squares listed and they will largely depend on the individual user's application.

Eyepiece Scales

Sectoring: A squared graticule might be used for the systematic examination of a specimen. Some of the squared patterns are numbered to aid in the identification of areas of interest. Sectioning is particularly useful for making drawings of specimens onto graph paper. The chess-board type of pattern helps the user to distinguish the position being examined: the darker squares are translucent, while the lighter ones are transparent, avoiding eyestrain in prolonged counting as may be necessary in hematology. These patterns provide the same advantages when used with image analysis and capture devices.

Counting: A squared graticule can be used for counting. Here, the basic principle is that a small area of the specimen is analyzed in order to obtain information about the total area. This minimizes wasteful work, enabling simple analysis of a particular area. An example of this would be the comparison of large to small particles in a specimen. By using the Miller graticule (NE57) only the smaller particles in the small square are counted, the result being multiplied by ten for comparison with the number of larger particles in the large square.

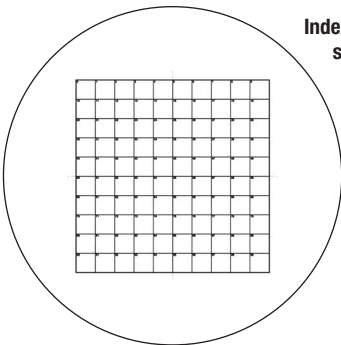
Squared Grids: Squared grids can be used in particle size analysis as simple technical aids where sophisticated image analysis systems are not required. The areas of the particles to be measured can be estimated by simply counting the number of squares occupied by those particles. It is necessary to estimate fractions of a square or make a rule (e.g. count as a square all partly covered squares at the right and bottom sides of the grid, and ignore partly covered squares at the left and upper sides of the squares). This method would only be useful for a fairly crude estimation of a large diameter.



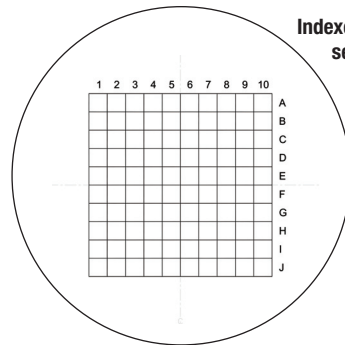
Squared Grids — NE10, NE11, NE34

Simple grids are convenient for making sketches of the observed specimen on graph paper. They are also useful for particle counting.

Pattern	Description	Dia.	Catalog #
NE10	Grid (net) 0.50mm pitch.	16mm	68011-16
	(Pitch: distance of center bar to center bar)	19mm	68011-19
	Surface chrome image	21mm	68011-21
NE11	Grid (net) 1.0mm pitch	16mm	68015-16
	(Pitch: distance of center bar to center bar)	19mm	68015-19
	Surface chrome image	21mm	68015-21
NE34	Grid (net) 0.10mm squares	16mm	68018-16
		19mm	68018-19
	Surface chrome image	21mm	68018-21



Indexed Grid NE35,
see page 21



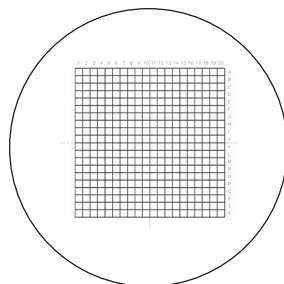
Indexed Grid NE11A,
see page 21

Eyepiece Graticules (continued)

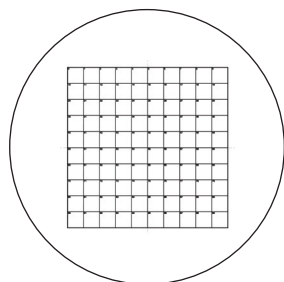
Indexed Grids — NE10A, NE11A, NE34A, NE71

Useful for particle counting, particularly when reference is needed between workers. Also, they are useful for area of specimen determinations.

Pattern	Description	Dia.	Catalog #
NE10A	Numbered grid 5mm x 5mm. 0.5mm pitch.	16mm	68011-16A
	Marked 1-10 and A-J	19mm	68011-19A
	Surface chrome image	21mm	68011-21A
NE11A	Numbered grid 10mm x 10mm. 1.0mm pitch.	16mm	68016-16
		19mm	68016-19
	Marked 1-10 and A-J	20.4mm	68016-20.4
		21mm	68016-21
	Surface chrome image	23mm	68016-23
		24.5mm	68016-24.5
		25mm	68016-25
NE34A	Numbered grid 1mm x 1mm. 0.1mm pitch.	16mm	68018-16A
		19mm	68018-19A
NE71	Index Pattern 20 x 20 Grid of 0.50mm squares	21mm	67981-21
		23mm	67981-23
		24mm	67981-24
		26mm	67981-26
		Custom	67981-50



NE71

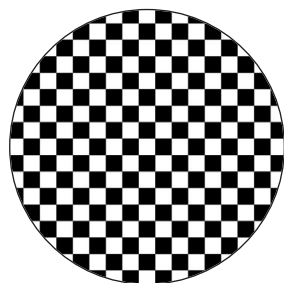


NE35

Indexed Grids — NE35

Useful for area of specimen determinations, especially rectangular shapes, also for particle counting.

Pattern	Description	Dia.	Catalog #
NE35	Numbered grid 10mm x 10mm	16mm	68014-16
	1mm indexed squares	19mm	68014-19
	Surface chrome image	21mm	68014-21



NE15

Chessboard Squares — NE15

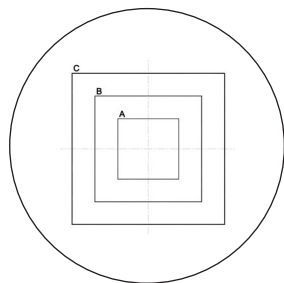
The dark squares are translucent. Used as an alternative to simple grids for area of specimen determination and particle counting. Alternative light and dark squares help reduce eyestrain.

Pattern	Description	Dia.	Catalog #
NE15	Chessboard (net) 2.0mm squares	16mm	68008-16
	Surface chrome image	19mm	68008-19
	.	21mm	68008-21

Squares — NE38

Combines three areas in one for convenience, giving area ratios A:B of 1:3 and B:C of 1:2.

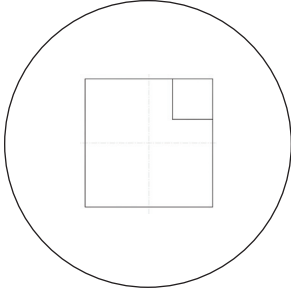
Pattern	Description	Dia.	Catalog #
NE15	Squares 10mm, 7mm & 4mm	16mm	68017-16
	Glass sandwich	19mm	68017-19
	.	21mm	68017-21



NE38

Eyepiece Graticules (continued)

Miller Squares — NE57



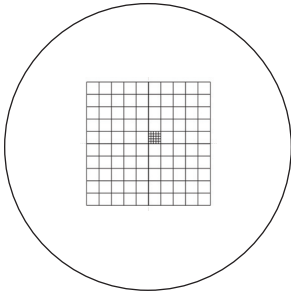
The ratio of large to small squares is 9:1. Originally designed for hematology, they can be utilized for rapid counting of any evenly spread field of particle.

References:

1. American J. of Clin. Pathol. Vol. 20, 1950, page 1079. "Time Saving Device For Counting Reticulocyte." G. Brescher and Schneiderman.
2. Practicle Haemotology. J.D. Dacy. Published by J.A. Churchill. 2nd Edition 1956 page 25.

Pattern	Description	Dia.	Catalog #
NE57	Miller 7 x 7mm grid. Glass sandwich.	16mm	68020-16
		19mm	68020-19
		20.4mm	68020-20.4
		21mm	68020-21
		23mm	68020-23
		24.5mm	68020-24.5
		25mm	68020-25
		26mm	68020-26
		27mm	68020-27

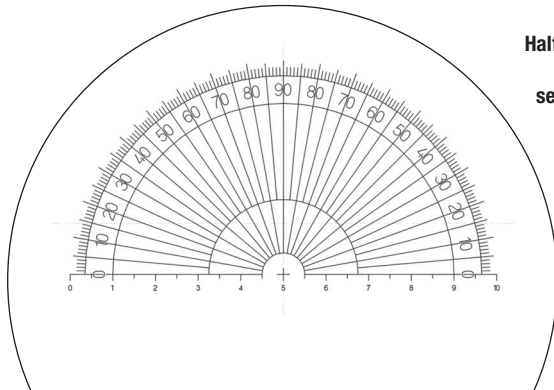
Whipple Grid — NE29



Originally designed for water particle analysis, but may be used for other aspects of particle counting. Grid shown: Ratio of full square to smallest is 50:1. Area is 2500:1.

Reference: Microscopy of Drinking Water.

Pattern	Description	Dia.	Catalog #
NE29	Whipple grid 100 squares in 7mm area. Surface chrome image.	16mm	68009-16
		19mm	68009-19
		20.4mm	68009-20.4
		21mm	68009-21
		23mm	68009-23
		24.5mm	68009-24.5
		25mm	68009-25
		26mm	68009-26
		27mm	68009-27



**Half Protractor
NE25,
see page 23**

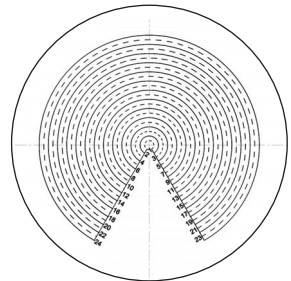
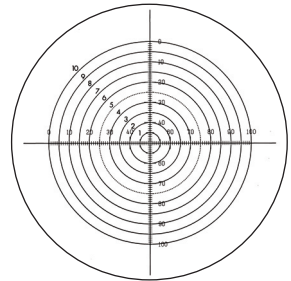
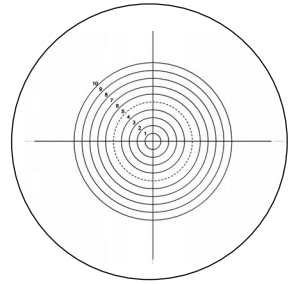
Eyepiece Graticules (continued)

C. Gauges

Concentric Circles — NE42, NE43, NE44, NE47

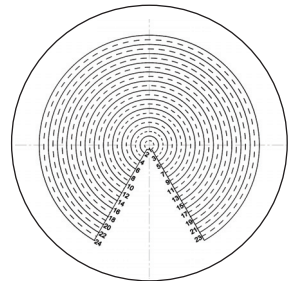
Can be used for two-way measurement when calibrated as a micrometer.

Pattern	Description	Dia.	Catalog #
NE42	Concentric circle 0.25mm – 2.5mm Dia. 10 circles. Surface chrome image.	16mm	68019-16
		19mm	68019-19
		21mm	68019-21
NE43	Concentric circle 0.5mm – 5mm Dia. 10 circles. Surface chrome image.	16mm	67997-16
		19mm	67997-19
		21mm	67997-21
NE44	Concentric circle 1mm – 10mm Dia. 10 circles. Surface chrome image.	16mm	67998-16
		19mm	67998-19
		21mm	67998-21
NE47	Concentric circle 2mm – 20mm Dia. 10 circles. Surface chrome image.	16mm	67999-16
		19mm	67999-19
		21mm	67999-21



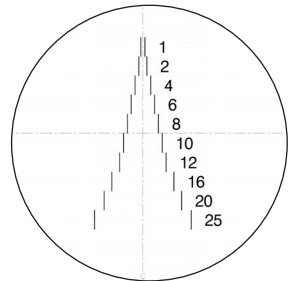
Concentric Circles and Cross Scales — NE48

Pattern	Description	Dia.	Catalog #
NE48	Concentric circles 1mm - 10mm 10 circles. Graduated cross hairs	16mm	67991-16
		19mm	67991-19
		21mm	67991-21
		23mm	67991-23
		Custom	67991-50



Concentric Circle — NE22

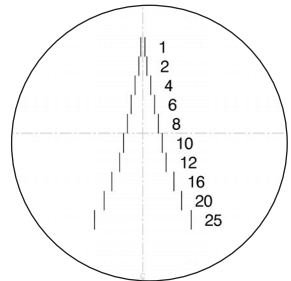
Pattern	Description	Dia.	Catalog #
NE22	Concentric circle 0.5mm – 12mm diameter. 24 circles. Surface chrome image.	16mm	68000-16
		19mm	68000-19
		21mm	68000-21



Gauge Pairs — NE19

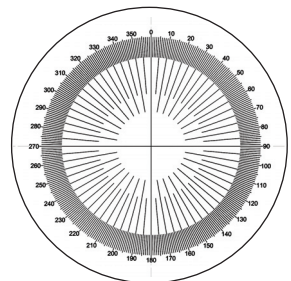
Gauge pairs occupying a field of view of 10mm. Each gauge is proportional to its adjacent number. The approximately size of the smallest pair = 0.1mm.

Pattern	Description	Dia.	Catalog #
NE19	Gauge pairs. Surface chrome image.	16mm	68001-16
		19mm	68001-19
		21mm	68001-21



Protractors — NE25, NE45

Pattern	Description	Dia.	Catalog #
NE25	Half protractor scale 10mm diameter divided in degrees. Surface chrome image.	16mm	67996-16
		19mm	67996-19
		21mm	67996-21
NE45	Full protractor scale 10mm diameter divided in degrees. Surface chrome image.	16mm	68002-16
		19mm	68002-19
		21mm	68002-21



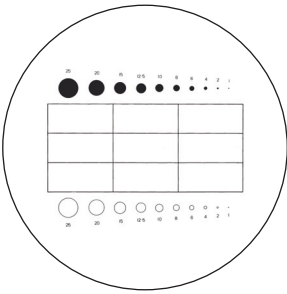
Eyepiece Graticules (continued)

D. Particle Sizing and Distributing

The use of the eyepiece graticules shown in this section makes it possible to analyze specimens containing particles as an alternative, or in addition to, sieving. Graticules for particle size analysis are particularly popular when there are only limited quantities of particles or where particles are smaller than 50 microns in diameter. Typical substances analyzed are sand grains, soil particles, plant seeds, fertilizers, abrasives, liquid droplets, pigments, pulverized coal, silica, fibers, and fine dust.

The basic principle employed is to compare particles to the globes and circles of varying sizes that appear on the graticule – dark particles being compared to solids globes, and light or transparent ones to the circles. Naturally the procedure varies with the graticule concerned, more information about which is given below.

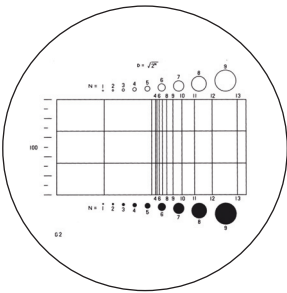
Please note that for calibration, the circles and globes will represent particles smaller in diameter by the magnification of the objective.



Paterson Globes and Circles — NG1

The graticule consists of a central rectangle, sub-divided into nine smaller rectangles, with a number of increasing circles outside the top and bottom horizontal edges. The marked figures are the diameters of the circles in units. 250 units represent the horizontal length of the large rectangle. Rectangle size is 4.5mm x 2.025mm. Circle sizes in microns are 450, 360, 270, 225, 180, 145, 110, 74, 37, and 18.

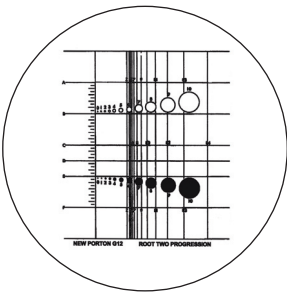
Pattern	Description	Dia.	Catalog #
NG1	Paterson globes/circles	16mm	68031-16
	Surface chrome image	19mm	68031-19
		21mm	68031-21



Porton — NG2

The circle areas of the Porton graticules increases with Root 2 progression, as do the divisions on the right hand side of the rectangle. These divisions are numbered for convenience. The rectangle size is 4.5mm x .25mm. Circle sizes in microns are 560, 400, 280, 200, 140, 100, 70, 50, and 35. The specimen is racked on the mechanical stage of the microscope and traverses are taken right across the deposit, sizing all the particles encountered.

Pattern	Description	Dia.	Catalog #
NG2	Original Porton globes/circles	16mm	68024-16
	Surface chrome image	19mm	68024-19
		21mm	68024-21



New Porton — NG12

The NG12 is particularly useful since the array of globes and circles are conveniently close to where the particles pass. At the end of each band of the sample the mechanical stage is traversed vertically to take in the next band until the whole sample has been covered.

Pattern	Description	Dia.	Catalog #
NG12	Modified Porton pattern globes/circles	16mm	68032-16
	Surface chrome image	19mm	68032-19
		21mm	68032-21

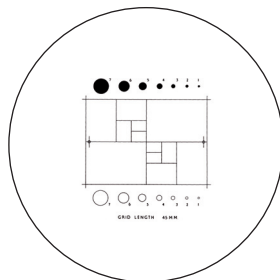
Eyepiece Graticules (continued)

British Standard Graticule — NG10

In this graticule the circle areas double progressively, hence the diameters alter by Root 2, so that the size classes can form a continuation of the standard series of sieves for particle sizing. Each particle is assigned to a size class defined by two adjacent circles, which represent the size limits of that class. Thus the distribution of size is obtained in terms of the diameter of circles having the same projected area as the particles. This method will cover particles in the range 150 micron to 0.38 micron. The size distributions with respect to their number and weight are determined separately. Final results are calculated as cumulative percents.

Originally designed by the National Coal Board for use in coal mining.

Pattern	Description	Dia.	Catalog #
NG10	British Standard (BS3625/BS3260)	16mm	68026-16
	Globes & Circles.	19mm	68026-19
	Surface chrome image	21mm	68026-21



Fairs — NG5

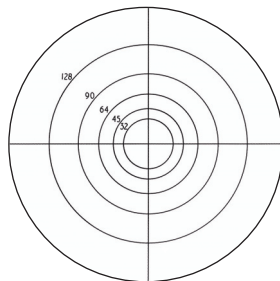
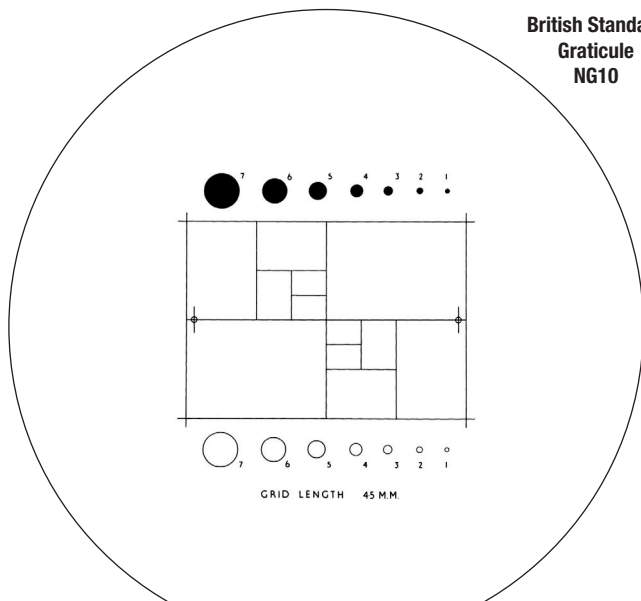
Designed to extend the sizing range of globe and circle graticules.

Example: Used in conjunction with NG2 the overall size range = 128:1.

The circles increase by 2.

Note: Both graticules would have to be used with the same microscope, eyepiece and objective..

Pattern	Description	Dia.	Catalog #
NG5	Fairs. Grid length 4mm. Glass Sandwich.	16mm	68033-16
		19mm	68033-19
		21mm	68033-21

British Standard
Graticule
NG10

Eyepiece Graticules (continued)

E. Asbestos Fiber Analysis

Walton and Beckett Graticule for Asbestos — G22, G24, G25

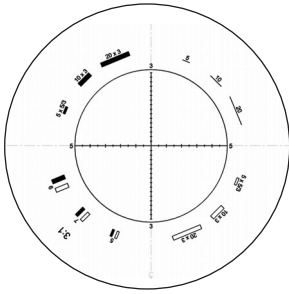
Calibration factors are required for each of these graticules. See note below.

The Walton and Beckett graticule is used for counting fibrous dust (e.g. asbestos or glass fibers) and is particularly useful where the majority of fibers to be counted are shorter than 5 microns. The circle is divided into four by two diametrical lines scaled in units of 5 and 3 microns respectively. 3 and 5 microns are the critical measurements of fiber lengths and diameters used in fiber counting. Unlike the usual globes of other particle graticules, the Walton and Beckett have a series of shapes to compare objects with. These shapes have been designed for comparison with fibers, especially since they incorporate an aspect ratio of 3:1 or 5:1 essential for such analysis.

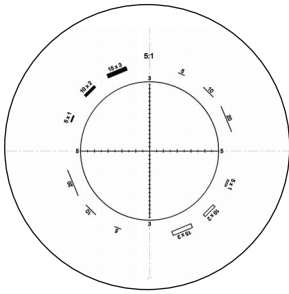
IMPORTANT NOTE: The circle on these Walton & Beckett graticules must represent 100 microns at the stage and each one must be manufactured to suit the individual instrument.

Therefore, the following details should be provided with your order:

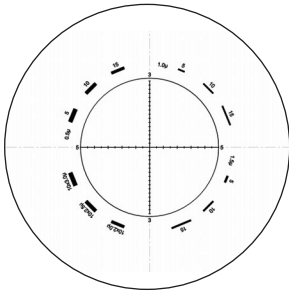
1. Calibration factor, if known
2. Objective magnification
3. Eyepiece magnification
4. Diameter of graticule disc required
5. Microscope make and model



G22



G24



G25

Pattern	Description	Dia.	Catalog #
G22	Walton & Beckett for asbestos. 3:1 ratio. Glass sandwich.	16mm	68028-16
		19mm	68028-19
		20.4mm	68028-20.4
		21mm	68028-21
		23mm	68028-23
		24.5mm	68028-24.5
		25mm	68028-25
G24	Walton & Beckett for asbestos. 5:1 ratio. Glass sandwich.	16mm	68029-16
		19mm	68029-19
		21mm	68029-21
G25	Based on the G22, the G25 is produced by the Institute of Occupational Health (1996). Glass sandwich.	16mm	68030-16
		19mm	68030-19
		21mm	68030-21

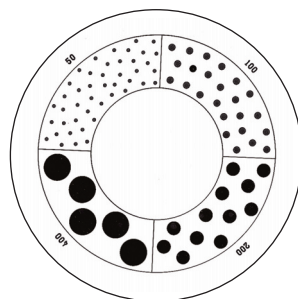
Eyepiece Graticules (continued)

F. Specialist Designs

Spray Droplet Sizing Reticle (Matthews) — NG30

For size and distribution assessments of aerosol droplets. Used in conjunction with a 40X Microscope for direct measurements of droplets from 50-400 micron diameters. The actual pattern sizes are 50, 100, 200, and 400 microns. W.H.O. (Details on Request) and G.A. Matthews. Imperial College.

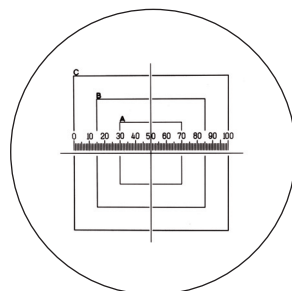
Pattern	Description	Dia.	Catalog #
NG30	Matthews Spray Droplet	16mm	68003-16
		19mm	68003-19
		21mm	68003-21
		23mm	68003-23
		Custom	68003-50



Thompson — G23

For counting particles in any of three areas of known size. The graticule is calibrated in the same manner as a normal eyepiece scale. The result is then used to calculate the area of any square.

Pattern	Description	Dia.	Catalog #
G23	Thompson for dust analysis	16mm	68090-16
	10mm, 7mm, and 4mm squares	19mm	68090-19
	Glass sandwich	21mm	68090-21

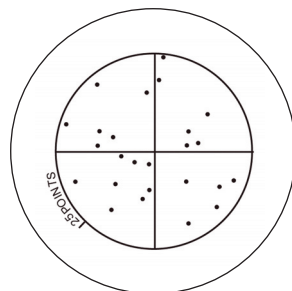


Chalkley Point Array — NG52

This is used to quickly determine the relationship of components to each other using random sampling. Curtis gives an example of its application, where a researcher may want to see whether or not a certain drug affects the volume proportion of cell types in a given organ. With this graticule the proportion of points lying over the image of one type of component is statistically proportional to the area occupied by that component. The 25 points of the array are placed over the field of view at random, so that a comparison can be made between the number of points touching one type of component, with the number touching the other type of component in each viewing. A series of observations will yield an increasingly accurate ratio of the comparative incidence of each type of particle.

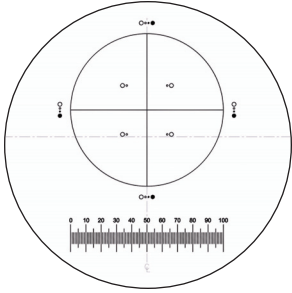
Reference: A.S.C. Curtis. Medical and Biological Illustration, Vol. 10. pp 261-266. "Area and Volume Measurements by Random Sampling Methods."

Pattern	Description	Dia.	Catalog #
NG52	Chalkley point array	16mm	68034-16
	Surface chrome image	19mm	68034-19
		21mm	68034-21



Eyepiece Graticules (continued)

Pharmaceutical PSA Pattern — G57

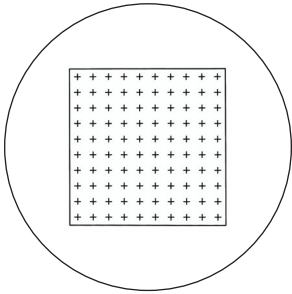


This graticule was designed for the pharmaceutical industry. However, it is also useful where particle size considerations are restricted to 10mm and 25mm. Dots and circles give quick references for these two sizes. In addition, a scale is incorporated.

The microscope must be calibrated when ordering this graticule, such that the circle must equate to 1mm on the microscope stage.

Reference: The United State Pharmaceutical Conventions, Inc. Pharmaceutical Forum. Vol. 19 No 6.

Pattern	Description	Dia.	Catalog #
G57	Pharmaceutical PSA Pattern Glass sandwich	19mm	68091-19
		20.4mm	68091-20.4
		21mm	68091-21
		23mm	68091-23
		24.5mm	68091-24.5
		25mm	68091-25
		26mm	68091-26
		27mm	68091-27

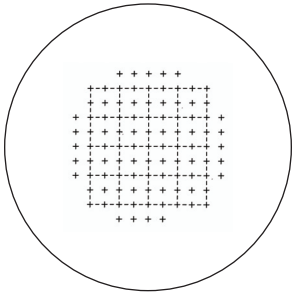


Counting Pattern — NG14

Simple counting for geological and soil analysis.

Reference: L.G. Briarty. "Stereology: Methods for Quantitative Light and Electron Microscopy." Sci. Prog. Oxf. 1975 62; 1-32.

Pattern	Description	Dia.	Catalog #
NG14	Counting pattern for soil analysis 10mm square Surface chrome image	16mm	68092-16
		19mm	68092-19
		21mm	68092-21



Lennox Grain Analysis — NG21

Reference: L.G. Briarty. "Stereology: Methods for Quantitative Light and Electron Microscopy." Sci. Prog. Oxf. 1975 62; 1-32.

Pattern	Description	Dia.	Catalog #
NG21	Lennox for Grain analysis	16mm	68004-16
		19mm	68004-19
		21mm	68004-21
		23mm	68004-23
		Custom	68004-50

Eyepiece Graticules (continued)

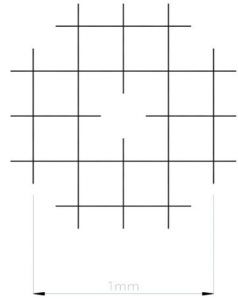
Kotter Pattern — G48

For analysis of bitumous coal and anthracite.

Reference: I.S.O. 7404-4: 1988 (E). Methods for Analysis of Bitumous Coal and Anthracite. Part 4 and Methods of Determining Microlithotype Composition.

Normally used with 20x objective = calibration factor of 1. For use with 40x objective, specify calibration factor of 2. For 50x specify 2.5. For other objective magnifications, the reticle will need to be custom made.

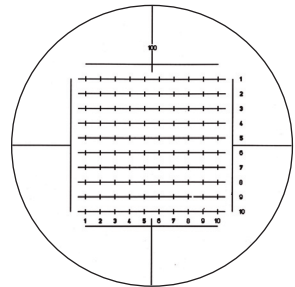
Pattern	Description	Dia.	Catalog #
G48	Kotter Pattern for bitumous coal and anthracite analysis.	16mm	67990-16
		19mm	67990-19
		20.4mm	67990-20.4
		21mm	67990-21
		23mm	67990-23
		24mm	67990-24
		24.5mm	67990-24.5
		25mm	67990-25
		26mm	67990-26
		27mm	67990-27
		Custom	67990-50



Zeiss Integrating Eyepiece Disc 100 Points — G47

Similar to G49, but extended to 100 points, which are indexed.

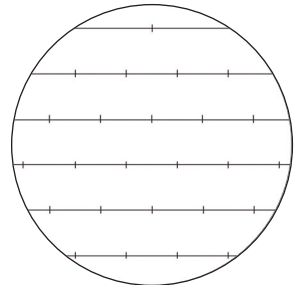
Pattern	Description	Dia.	Catalog #
G47	Zeiss integrating eyepiece disc Glass sandwich	16mm	68094-16
		19mm	68094-19
		21mm	68094-21



Zeiss Integrating Disc 1 or Henning Reseau Pattern 25 Points — G49

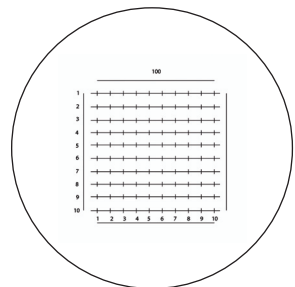
Reference: Zeiss Werkzeitschrift. No 30, page 80.

Pattern	Description	Dia.	Catalog #
G49	Henning Resseau pattern (Zeiss integrating disc 1) Glass sandwich	16mm	68093-16
		19mm	68093-19
		21mm	68093-21



Integrating Eyepiece, G50

Pattern	Description	Dia.	Catalog #
G50	Integrated EyePiece (Simplified)	19mm	68005-19
		21mm	68005-21
		23mm	68005-23
		24mm	68005-24
		Custom	68005-50



Eyepiece Graticules (continued)

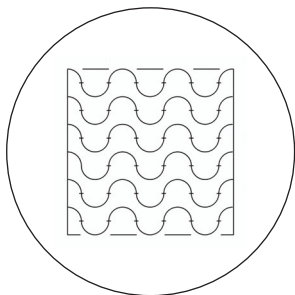
G. Stereology

In this simplest form, sterology is the science where information about a three dimensional object is obtained from only a two-dimensional section of that structure.

Measurements are usually made with these graticules in the following manner:

1. An adequate representation of sections of a specimen is obtained.
2. The graticule is superimposed upon the specimen (or micrograph/projected image of the section).
3. Finally, the interaction between the superimposed graticule and the test sections are recorded.

An overall introduction is given by: L.B. Briarty. "Stereology: Methods for Quantitative Light and Electron Microscopy."

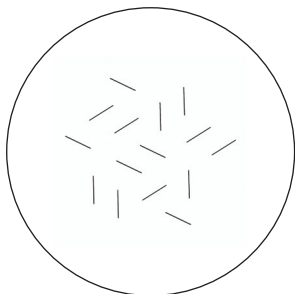


The Mertz Graticule (36 Points) — NGM1

Used to estimate the three-dimensional surface areas or the surface density of a component in a given volume, when the component does not have a random orientation. It comprises a test system with parallel curved lines used for measuring the intersection of points.

Reference: W.A. Mertz. "Mikroskopisch" Vol. 22 1967 pp 132-142.

Pattern	Description	Dia.	Catalog #
NGM1	Mertz for Stereology	16mm	68035-16
	Surface chrome image	19mm	68035-19
		21mm	68035-21

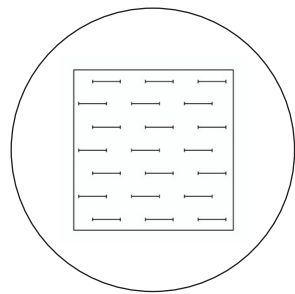


Weibel 1 — NGW1

Consists of 15 lines of equal length connecting the verticals of a regular hexagonal point network.

Reference: E.R. Weibel Lab. Invest. Vol. 22 pp 131-152. "Principal and Methods for the Morphometric Study of the Lung and other Organs."

Pattern	Description	Dia.	Catalog #
NGW1	Weibel Type 1 for Stereology	16mm	68022-16
	Surface chrome image	19mm	68022-19
		21mm	68022-21



Weibel 2 — NGW2

Used when making a surface to volume ratio of a structure per mass unit. This graticule consists of a number of short lines with interruptions as long as the lines. Basically, the number of intersections falling over the short lines is counted and the number of endpoints falling on the end of the structure is determined.

Reference: E.R. Weibel, Journal of Microscopy Vol. 95. pp 373-378.

Current Capabilities and Limitations of Available Stereological Technique, point counting method.

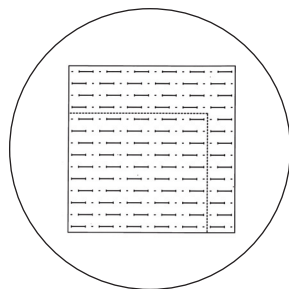
Pattern	Description	Dia.	Catalog #
NGW2	Weibel Type 2 for Stereology	16mm	68025-16
	Surface chrome image	19mm	68025-19
		21mm	68025-21

Eyepiece Graticules (continued)

Weibel 3 – GW3

Reference: E.R. Weibel, G.S. Kistler & W.F. Scherle. 1986. J. Cell Biology. 30, 23.

Pattern	Description	Dia.	Catalog #
GW3	Weibel Type 3 for Stereology	16mm	68023-16
	Glass sandwich	19mm	68023-19
		21mm	68023-21



H. Metallurgy

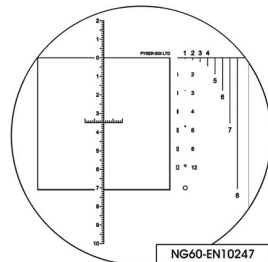
Standard pattern discs for metallurgical stereometric analysis of grain size in polished metal sections.

Grain Sizing Pattern EN10247/ISO4976

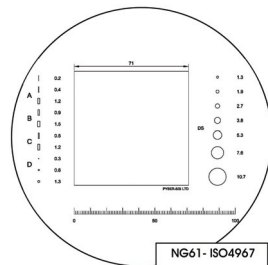
For the determination of non-metallic inclusion content of steel

NG60 meets EN 10247 and NG61 Meets ISO 4976. Both are scaled for use with 10x objective magnification.

Pattern	Description	Dia.	Catalog #
NG60	Grain Sizing Reticle to EN 10247	21mm	68007-21
		23mm	68007-23
		24.5mm	68007-24
		25mm	68007-25
		26mm	68007-26
		Custom	68007-50
NG61	Grain Sizing reticle to ISO 4967	21mm	68036-21
		23mm	68036-23
		24.5mm	68036-24
		25mm	68036-25
		26mm	68036-26
		Custom	68036-50



NG60-EN10247

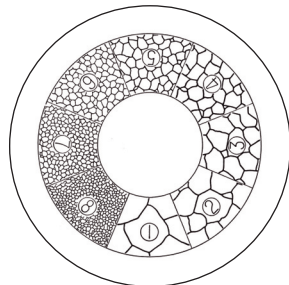


NG61-ISO4967

ASTM Austenite 1:1 Grain Sizing Disc – G41

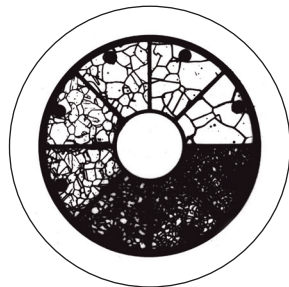
Reference: VDEH 1510-61.

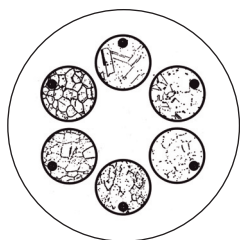
Pattern	Description	Dia.	Catalog #
G41	ASTM Grain Size austenite	19mm	68065-19
	Glass sandwich	21mm	68065-21



ASTM E112 Plate 1 Grain Sizing Disc – G42

Pattern	Description	Dia.	Catalog #
G42	Grain sizing (E112.)	19mm	68066-19
	Glass sandwich	21mm	68066-21

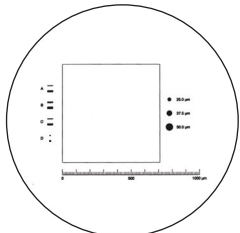




Eyepiece Graticules (continued)

ASTM Carbide Grain Sizing Chart – G43

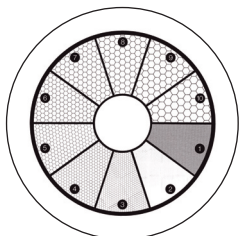
Pattern	Description	Dia.	Catalog #
G43	ASTM Grain Sizing carbide. Glass sandwich	19mm 21mm	68067-19 68067-21



ASTM E45 – G44

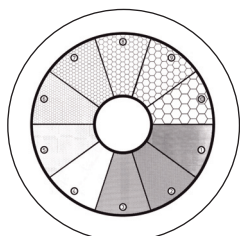
Reference: ASTM E45.

Pattern	Description	Dia.	Catalog #
G44	ASTM E45. Root 2 sides. 7.1mm square. 10mm scale	19mm 21mm	68068-19 68068-21



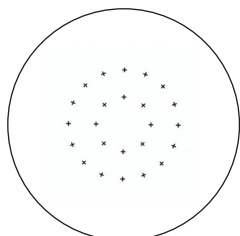
ASTM E19-46 Grain Sizing Disc – G45

Pattern	Description	Dia.	Catalog #
G45	ASTM Grain sizing E19-46 Glass sandwich	19mm 21mm	68069-19 68069-21



ASTM E19-46 Grain Sizing Disc Root 2 – G46

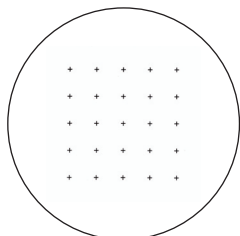
Pattern	Description	Dia.	Catalog #
G46	ASTM Grain sizing E19-46 Root 2 Glass sandwich	19mm 21mm	68070-19 68070-21



Circular Grid ASTM 24 Points – G54

Reference: ASTM G562.

Pattern	Description	Dia.	Catalog #
G54	ASTM 24 Point Circular Grid Glass sandwich	16mm 19mm 21mm	68084-16 68084-19 68084-21



Square Grid ASTM 25 Points – G55

Reference: ASTM G562.

Pattern	Description	Dia.	Catalog #
G55	ASTM 25 Point Square Grid Glass sandwich	16mm 19mm 21mm	68085-16 68085-19 68085-21

■ Stage Graticules

These stage graticules are intended for the routine calibration of eyepiece patterns, particularly when alternating between objectives on one microscope, or when using the same graticule in different microscopes. Their robust construction makes them ideal for student use and for instructional purposes. The scale or grid is centered on a glass disc mounted in a black anodized aluminum slide 75mm x 24mm x 2mm thick. For applications requiring traceable standards, see **B. Stage Calibration Standards**.

Two types are available:

Transmitted light

Reflected light, as is used with metallurgical microscopes



Table 1: Accuracy and Line Widths of Stage Micrometers.

Pattern	Line Width	Accuracy (overall)	Pattern	Line Width	Accuracy (overall)
S1 or PS1	0.005mm	± 0.002mm	S16 or PS16	0.0015mm	± 0.001mm
S2	0.005mm	± 0.00015mm	S20 or 21	0.0025mm	± 0.0015mm
S4 or PS4, S5 or PS5	0.002mm	± 0.0001"	S22	0.0025mm	± 0.0015mm
S8 or PS8	0.002mm	± 0.001mm	S48	0.0027mm	± 0.001mm
S11	0.001mm	± 0.00005"	S78 or PS78	0.003mm	± 0.001mm
S12 or PS12	0.001mm	± 0.001mm	—	—	—

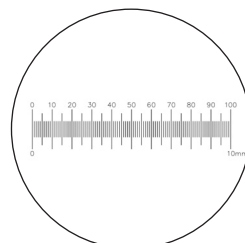
A. Scales and Micrometers

Standard and Crossed Patterns — S1, S2, S4, S5, S8, S11, S12, S16, S20, S21, S22, S48

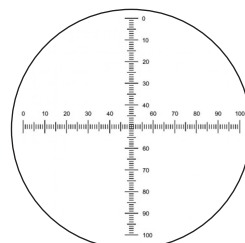
Pattern	Catalog #	Type, Length	Nos. Div.	Div. Size
S1	68040-01	Horizontal, 10mm	100	0.1mm
S2	68039-02	Horizontal, 5.0mm	100	0.05mm
S4	68039-04	Horizontal, 0.1"	100	0.001"
S5	68039-05	Horizontal, 20mm	200	0.01mm
S8	68042-08	Horizontal, 1.0mm	100	0.01mm
S11	68039-11	Horizontal, 0.005"	50	0.0001"
S12	68044-12	Horizontal, 0.1mm	50	0.002mm
S16	68039-16	Crossed Scale, 1.0mm	100	0.01mm
S20	68043-20	Double micrometer	10	0.01mm
S21	68043-21	Micrometer scale	100	0.5mm
S22	68039-22	Vertical Scale, 2.0mm	200	0.01mm
S48	68041-48	No Coverglass, 1.0mm	100	0.01mm

Certifications

Catalog #	Certification	Qty
68047-C	UKAS Certification for SI - S70	each
68047-Cert	NPL Certification for SI - S70	each



S1



S16

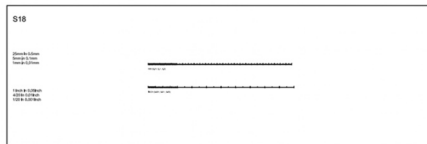
Stage Graticules (continued)

S18 Brightfield Stage Micrometer

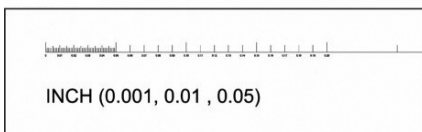
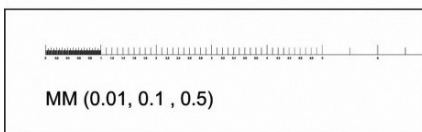
EMS is proud to introduce the S18 Brightfield Stage Micrometer: Graduated Metric and English Scales for the calibration of measurement instruments across a wide range of magnifications.

This flexible graduated scale stage micrometer is suitable for low magnification stereo inspection microscopes to higher magnification compound microscopes.

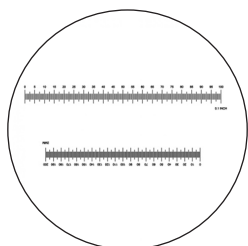
- **Dual Scales: 25mm and 1 Inch**
- **Graduated Divisions, fine for low magnifications, mid for medium magnifications and large for high magnifications:**
25mm/0.5mm, 5mm/0.1mm, 1mm/0.01mm
1"/0.05", 4/20"/0.01", 1/20"/0.001"
- **High Definition, chrome on glass image**
- **Ideal if you use both metric and English measurements**



Detail of Scales: The scales are centered on all glass slides 76mm x 25mm x 1.5mm thick.

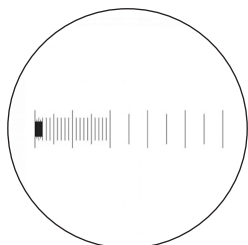


Pattern	Catalog #	Description	Qty
S18	68043-30	S18 with Graticules Certificate	each
S18	68043-35	S18 with UKAS Certificate	each
S18	68043-40	S18 with NPL Certificate	each



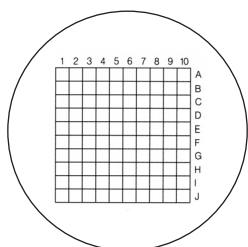
Combined Metric/Imperial Pattern

Pattern	Catalog #	Description	Qty
S20	68043-20	Double micrometer scale 2mm in 0.01mm divisions and 0.1 inch in 0.005 inch divisions	each



Grouped Graduation Pattern — S21

Pattern	Catalog #	Description	Qty
S21	68043-21	Micrometer scale 5mm in 0.5mm divisions, 2mm in 0.01mm divisions, and 0.2mm in 0.01mm divisions	each



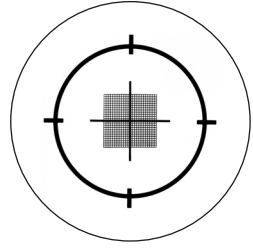
Counting Grids – S9, S10

Pattern	Catalog #	Description	Qty
S9	68045-09	Counting Slide 0.01mm squares.	each
S10	68045-10	Counting Slide 0.05mm squares	each

Stage Graticules (continued)

Counting Grids – S28, S29

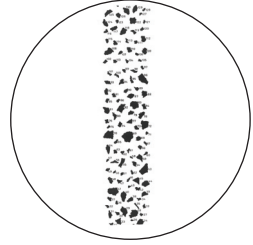
Pattern	Catalog #	Description	Qty
S28	68045-28	0.01mm grid / 0.2 x 0.2mm overall	each
S29	68045-29	0.01mm grid / 1.5 x 1.5mm overall	each



SG7 Particle Analysis Test Calibration Slide

Calibration Test Slide for Particle Sizing with 200 particles of various shapes and sizes.

Pattern	Catalog #	Description	Qty
SG7	68045-30	Calibration Test Slide for Particle Sizing	each



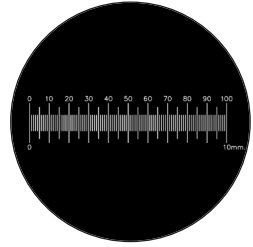
For Reflected Light

This scale is etched through highly reflective vacuum coated metal. When viewed under vertical illumination, as with a metallurgical microscope, the scale appears black against a bright background.

S1R Reflected Light Stage Micrometer, 10mm/0.1mm

Reflected light stage micrometer with 10mm scale subdivided into 100 divisions of 0.1mm (100µm).

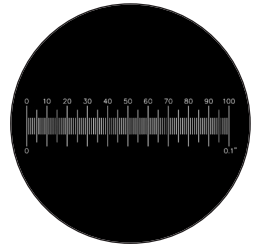
Pattern	Catalog #	Description	Qty
S1R	68047-1R-GR	S1R with Graticule Certificate	each
S1R	68047-1R-NA	S1R with UKAS Certificate	each
S1R	68047-1R-NP	S1R with NPL Certificate	each



S4R Reflected Light Stage Micrometer, 0.1 inch/0.001 inch

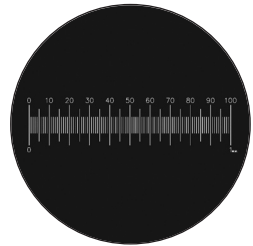
Reflected light stage micrometer with 0.1" scale subdivided into 0.001" divisions.

Pattern	Catalog #	Description	Qty
S4R	68047-4R-GR	S4R with Graticule Certificate	each
S4R	68047-4R-NA	S4R with UKAS Certificate	each
S4R	68047-4R-NP	S4R with NPL Certificate	each



Reflected Light — S78

Pattern	Catalog #	Description	Qty
S78	68043-78	Micrometer scale 1mm in 0.01mm divisions	each



Stage Graticules (continued)

B. Stage Calibration Standards

These stage micrometers differ from the standard stage micrometers in that they are available with a certificate giving precise details about their accuracy. These calibrated standards provide traceability for the precise calibration and confirmation of accuracy of optical measuring instruments, which is necessary under ISO provisions.

Micrometer Standards – PS1, PS4, PS4R, PS5, PS8, PS12, PS16, PS78

These standards are different from the stage micrometers listed in the previous section. The glass discs are mounted in stainless steel slides with engraved serial numbers. Each slide is supplied in a polished wooden storage case to distinguish it as a traceable standard of high value. We can arrange for the calibration of its scales and grids to be carried out by the most appropriate laboratory to suit the customers requirements – the choice of laboratory is normally dependent on the nature of the calibration and the accuracy required.



Calibration by NPL: The National Physical Laboratory carries out measurements at selected points on the scale and grids and issues a certificate of calibration. Order Code: **NP**. The NPL is the English equivalent of NIST.

Calibration by UKAS accredited laboratory: A UKAS accredited laboratory carries out measurements at selected points on the scales and grids and issues a calibration certificate. Order Code: **NA**

Measurement by Pyser-SGI, Graticules Division: For applications which do not require the accuracy or traceability provided by calibrations carried out by NPL or a UKAS accredited laboratory, we can provide a Certificate of Comparison. The scale or grid is compared with NPL calibrated in-house standards and a statement is provided on the accuracy of the item with respect to these standards. Order Code: **GR**

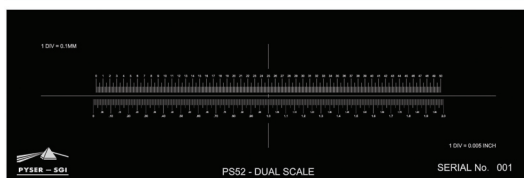
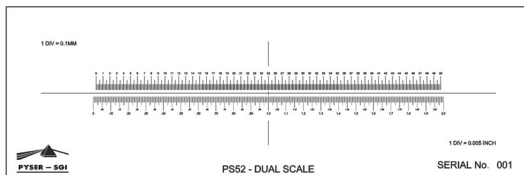
Catalog #	Pattern	Scale Specs	Description	Qty
68047-1GR	PS1	10mm in 0.1mm	PS1 with Graticules Certificate	each
68047-1NA			PS1 with UKAS Certificate	each
68047-1NP			PS1 with NPL Certificate	each
68047-4GR	PS4	0.1" in 0.001"	PS4 with Graticules Certificate	each
68047-4NA			PS4 with UKAS Certificate	each
68047-4NP			PS4 with NPL Certificate	each
68047-PS4R	PS4R	0.1" in 0.001"	Micrometer Scale 0.1"; in 0.001 inch divisions for reflected light	each
68047-PS4R-GR			PS4R (reflected) with Grats Certificate	each
68047-PS4R-NA			PS4R (reflected) with UKAS Certificate	each
68047-PS4R-NP			PS4R (reflected) with NPL Certificate	each
68047-5GR			PS5	20mm in 0.01mm
68047-5NA	PS5 with UKAS Certificate	each		
68047-5NP	PS5 with NPL Certificate	each		
68047-8GR	PS8	1mm in 0.01mm	PS8 with Graticules Certificate	each
68047-8NA			PS8 with UKAS Certificate	each
68047-8NP			PS8 with NPL Certificate	each
68047-12GR	PS12	0.1mm in 0.002mm	PS12 with Graticules Certificate	each
68047-12NA			PS12 with UKAS Certificate	each
68047-12NP			PS12 with NPL Certificate	each
68047-16GR	PS16	Crossed, 1mm in 0.01mm	PS16 with Graticules Certificate	each
68047-16NA			PS16 with UKAS Certificate	each
68047-16NP			PS16 with NPL Certificate	each
68047-78GR	PS78	1mm in 0.01mm	PS78 (reflected) with Graticules Certificate	each
68047-78NA			PS78 (reflected) with UKAS Certificate	each
68047-78NP			PS78 (reflected) with NPL Certificate	each

Stage Graticules (continued)

PS52P & PS52N Dual Scale Calibration Slides

Key Features

- New Dual-Scale Calibration Slides
- 2" Imperial (English) and 50mm Metric Scales on a Single Slide
- Positive and Negative Versions
- Unique Serial Number for Traceability
- Available with Internationally Traceable Certificates of Calibration



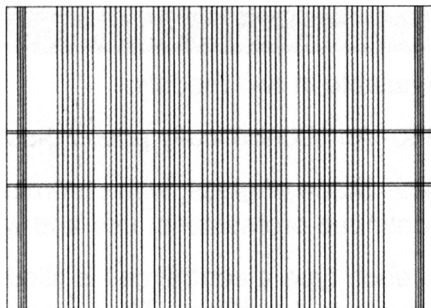
EMS has introduced two new calibration slides that have the benefit of dual imperial/metric scales. The PS52P is for transmitted light applications and has a bright chrome positive image. The PS52N has a negative pattern, formed in low reflective chrome for incident light applications, to give excellent contrast. Both are ideal for calibrating optical products with a large field of view, such as stereo microscopes or imaging systems.

Pattern	Catalog #	Description	Qty
PS52P	68040-05	Dual Micrometer Calibration Slide, 76mm x 25mm, positive image, 50mm in 0.1mm divisions and 2" in 0.005" divisions, serial numbered, supplied in wooden case	each
	68040-06	PS52P with UKAS Certificate	each
PS52N	68040-07	Dual Micrometer Calibration Slide, 76mm x 25mm, negative image, 50mm in 0.1mm divisions and 2" in 0.005" divisions, serial numbered, supplied in wooden case	each
	68040-08	PS52N with UKAS Certificate	each

H.S.E./N.P.L. Test Slide for Phase Contrast Microscopy – S84

This test slide is made in the UK and is under license from the National Physical Laboratory. It is an epoxy replica of a master slide produced and certified by that laboratory. The replicas are mounted on microscope slides of 1.2mm thickness with cover glass of 0.17mm thickness. This information is transferred to the accompanying table, which indicates the maximum phase change passing through test objects to test slide. A satisfactory system will detect block 5. Full details are supplied with the slide.

Block No.	Ridge Width (Micrometers)	Maximum Calculated Phase Change (in degrees) for light rays (wavelength = 530 nanometers) passing through test objects.
1	1.08	6.6
2	0.77	4.7
3	0.64	3.9
4	0.53	3.2
5	0.44	2.7
6	0.36	2.2
7	0.25	1.5



Pattern	Catalog #	Description	Qty
S84	68038-84H	HSE Test Slide for Calibration in Asbestos Analysis	each

Stage Graticules (continued)

Universal Calibration Slide – PS20

Calibration of microscopes and image analysis systems is becoming more sophisticated, with the requirement being for a variety of image patterns to satisfy the numerous parameters. We're now introducing a new multi-function calibration standard specifically for these applications.

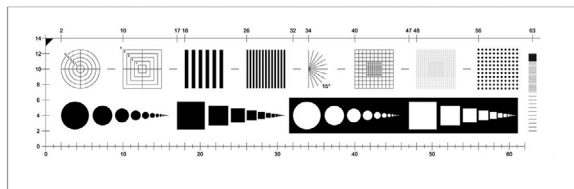
Multiple images on a slide provide the most cost-effective solution to calibration and resolution checking of microscopes and image analysis systems. The combination of scales, dots, circles, squares, rulings, grids and angles can be supplied with an internationally traceable certificate of calibration for those who require ISO conformity.

Each glass slide has a permanent serial number and can be supplied with full or partial UKAS certificate of accuracy.

Starting from a fixed 'Datum Point' mark, each individual pattern or array can be located using X, Y, coordinates.

General tolerance (microns)

Feature size	≤ 10	10 – 50	50 – 127	127 – 250	>250
Tolerance	0.5	1.0	1.3	1.9	2.54



Coating	Enduring evaporated chrome image
Optical density	>2.5
Substrate	Soda lime glass
Size	76mm x 25mm x 1.5mm
Package	Polished wooden case

PS20 Universal Calibration Slide Image Details

ID	Pattern Name	Location	Description
A*	Concentric Circles	X=2; Y=10	1, 2, 3, 4, 5mm Circles with Cross Line & circle identifier. Line width 20µm
B*	Concentric Squares	X=10; Y=10	1, 2, 3, 4, 5mm Squares with Cross Line & circle identifier. Line width 20 nm
C*	Line Grating	X=18; Y=10	12.5 Line Pairs per mm (40µm line 40µm space)
D*	Line Grating	X=26; Y=10	50 Line Pairs per mm (10µm line 10µm space)
E*	Half Protractor	X=34; Y=10	15 Spacing, Line width 20µm
F*	Grid Array Coarse	X=40; Y=10	5mm square array with 0.5mm divisions and central 2mm square with 0.25mm divisions. Line width 20µm
G*	Grid Array Fine	X=48; Y=10	5mm square array with 0.1mm divisions and central 2mm square with 0.05mm divisions. Line width 8µm divisions
H*	Dot Array	X=56; Y=10	Dot diameter 0.25mm, dot center to center spacing 0.050mm – 11x11 grid = 121 dots to center spacing 0.050mm – 11x11 grid = 121 dots
I*	Geometric progression of Opaque Dots	X=2; Y=4	Line array of dots or square shapes, of either clear or opaque. Reducing in size in a Root 2 progression for the purposes of edge threshold detection to enable an image analyzer to measure the size correctly, or general shape size comparison.
J*	Geometric	X=17; Y=4	Root 2 progression of 21 dots or square shapes, from 3.5µm to 3.5µm.
K*	Geometric progression of Clear Dots	X=32; Y=4	Nominal size in mm Dot/square size – Large to small in mm 3.5833; 2.5338; 1.7917; 1.2669; 0.8959; 0.6335; 0.4479; 0.3167; 0.2240; 0.1584; 0.1120; 0.0792; 0.0560; 0.0396; 0.0280; 0.0198; 0.0140; 0.0099; 0.0070; 0.0049; 0.0035
L*	Geometric progression of Clear Squares	X=47; Y=4	
M*	Vertical Scale Fine Variable	X=63	Overall Scale length 10mm. 5mm in 0.5mm divisions. Line width 20µm 4mm in 0.1mm divisions. Line width 10µm 1mm in 0.01mm divisions. Line width 3 µm
N*	Horizontal	X=0; Y=0	Scale length 62mm in 2mm Scale Coarse divisions, subdivided in 1mm divisions with a 20µm line width.

*If you require a calibration certificate for any or all of the points A-N, please state which points and we will send you a quote.

Ordering Information

Pattern	Catalog #	Description	Qty
PS20	68053-20	Universal Calibration Slide PS20	each

Stage Graticules (continued)

PS25 Hardness Tester Calibration Slides —
Vickers/Rockwell

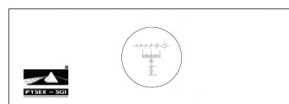
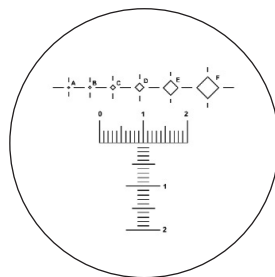
Reflected light calibration slide with diamond shapes and scales for calibrating Vickers and Rockwell hardness testers

For Vickers and Rockwell methods, we offer the PS25 which has a series of diamond shapes of varying size and x-y scales. Each of the markings on the slide is clearly identified with its size. The PS25 has a glass disc with the image precision marked in vacuum deposited chrome, and this is cemented into a stainless steel slide mount, making the item very durable. The slide has a unique serial number indelibly marked on the slide mount and can be supplied with an Internationally traceable certificate of calibration.

PS25 Pattern Detail:

Diamonds: (Point to point, mm) 0.5, 0.3, 0.2, 0.1, 0.05, 0.02
Scales: Horizontal & vertical, 2mm in 0.1mm divisions

This product is supplied in a polished wooden box.



Pattern	Catalog #	Description	Qty
PS25	68049-05	Calibration Slide for Hardness Testers - Vickers/Rockwell	each
	68049-06	PS25 with UKAS Certificate	each

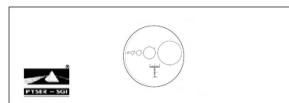
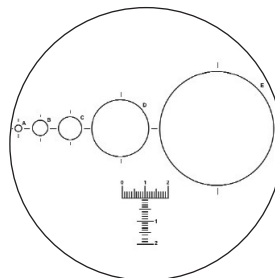
PS26 Hardness Tester Calibration Slides — Brinell

Reflected light calibration slide with circle shapes and scales for calibrating Brinell hardness testers

For Brinell methods, we offer the PS26 which has a series of circles to represent the ball indentation shape of varying size and x-y scales. The PS26 has a precision marked chrome deposition image on a glass slide. Each of the markings on the slide is clearly identified with its size. The slide can be supplied with an Internationally traceable certificate of calibration. This product is supplied in a polished wooden case.

PS26 Pattern Detail:

Circles: (Diameter, mm) 5.0, 2.5, 1.0, 0.7, 0.3
Scales: Horizontal & vertical, 2mm in 0.1mm divisions



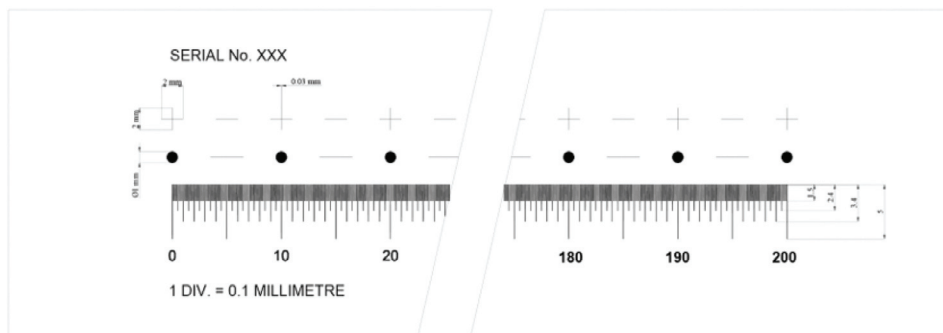
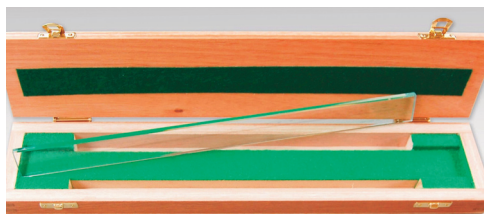
Pattern	Catalog #	Description	Qty
PS26	68049-15	Calibration Slide for Hardness Testers	each
	68049-18	Brinell PS26 with UKAS Certificate	each

Stage Graticules (continued)

High Definition Long Linear Combination Glass Scales

Superior PS-X0 Versions

- High definition images for accurate calibration – line edge or line center
- Bright chrome image on green float glass
- Line width 0.03mm
- 300mm, 200mm, 150mm and 100mm lengths, all in 0.1mm divisions
- Extended 0.5mm, 1.0mm and 5.0mm lines allow calibrations in those increments, too



Pattern	Catalog #	Description	Qty
PS300X0	68049-20	300mm combination scale, 330mm x 30mm x 6mm, 300mm ruling in 0.1mm divisions, 1mm dots at 10mm centers, crosses at 10mm centers	each
	68049-21	As above but with UKAS Certificate of Calibration, 10 points measured on scale	each
PS200X0	68049-22	200mm combination scale, 230mm x 30mm x 6mm, 200mm ruling in 0.1mm divisions, 1mm dots at 10mm centers, crosses at 10mm centers	each
	68049-23	As above but with UKAS Certificate of Calibration, 10 points measured on scale	each
PS150X0	68049-24	150mm combination scale, 180mm x 30mm x 6mm, 150mm ruling in 0.1mm divisions, 1mm dots at 10mm centers, crosses at 10mm centers	each
	68049-25	As above but with UKAS Certificate of Calibration, 10 points measured on scale	each
PS100X0	68049-26	100mm combination scale, 130mm x 30mm x 6mm, 100mm ruling in 0.1mm divisions, 1mm dots at 10mm centers, crosses at 10mm centers	each
	68049-27	As above but with UKAS Certificate of Calibration, 10 points measured on scale	each

High Definition Long Linear Glass Scales

- Parallax free readings - ideal for measuring systems and CMMs
- High levels of accuracy and pattern definition. Hard wearing scales in vacuum deposited chrome on substantial glass substrates. For measurement and calibration of instruments and standards.
- Line width 0.07mm
- Overall accuracy within 0.007mm

All available with Certificate of Calibration.

Pattern	Catalog #	Description	Qty
PS100HS MKII	68050-01	100mm long scale in 1mm divisions, 130mm x 30mm x 6mm	each
PS150HS MKII	68050-02	150mm long scale in 1mm divisions, 180mm x 30mm x 6mm	each
PS200HS MKII	68050-03	200mm long scale in 1mm divisions, 230mm x 30mm x 6mm	each
PS300HS MKII	68050-04	300mm long scale in 1mm divisions, 330mm x 30mm x 6mm	each

Stage Graticules (continued)

Standard Definition Long Linear Glass Scales

- Parallax free readings - ideal for profile projectors
- High levels of accuracy and pattern definition. Hard wearing scales in vacuum deposited chrome on substantial glass substrates. For measurement and calibration of instruments and standards.



Pattern	Catalog #	Description	Line Width	Accuracy	Qty
PS50	68051-10	50mm micrometer scale in 0.1mm divisions, 75mm x 75mm x 3mm	0.012mm	Within 0.007mm	each
PS100	68051-11	100mm long scale in 0.1mm divisions, 130mm x 30mm x 6mm	0.03mm	Within 0.015mm	each
PS150	68051-12	150mm long scale in 0.1mm divisions, 180mm x 30mm x 6mm	0.03mm	Within 0.015mm	each
PS300	68051-13	300mm long scale in 0.1mm divisions, 330mm x 30mm x 6mm	0.03mm	Within 0.025mm	each
PS500	68051-14	500mm long scale in 0.1mm divisions, 530mm x 30mm x 6mm	0.07mm	Within 0.025mm	each
PS1000	68051-15	1000mm long scale in 0.1mm divisions, 1060mm x 30mm x 6mm	0.07mm	Within 0.025mm	each

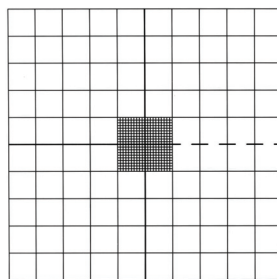
Measuring Scales

These are standard glass scales for in-contact measurements. Ideal for direct vision, for pocket magnifiers and for use in measuring profiles on projector screens.

Pattern	Catalog #	Description	Line Width	Qty
P6	68051-21	Contact nonparallax scale, 100mm in 0.1mm divisions, 125mm x 25mm x 3.0mm	0.025mm	each
P16	68051-22	Contact nonparallax scale, 300mm in 0.5mm divisions, 330mm x 30mm x 6.0mm	0.10mm	each

Calibration Grids

For checking two-dimensional instruments for straightness and accuracy. The patterns are produced in vacuum deposited chrome on glass. Lines are every 10mm with a central 20mm subdivided in 1mm rulings.



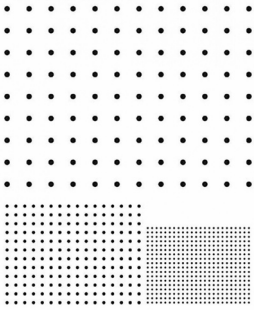
	PGR 100	PGR 200
Overall Divided Area	100 x 100mm	140 x 220mm
Glass Size	120 x 120mm	160 x 240mm
Glass Thickness	6mm	6mm
Line Width	0.008mm	0.008mm
Linear Straightness	0.002mm	0.002mm
Angular Accuracy	within 5 seconds	within 5 seconds

Catalog #	Description	Qty
68051-31	PGR100 Calibration Grid	each
68051-32	PGR200 Calibration Grid	each



Stage Graticules (continued)

The Grid Dot Array



Green Float glass, high reflective Chrome image

The ideal product for testing image area, distortion, field flatness, and other parameters in optical and imaging systems. The three array areas give options for different magnifications or field size.

The R76, a unique product with three dot arrays to suit different magnification or image areas.

12 x 9 array of 1mm dots at 5mm pitch

16 x 12 array of 0.5mm dots at 2mm pitch

24 x 18 array of 0.2mm dots at 1mm pitch

Catalog #	Description	Size	Qty
68073-R76	Grid Dot Array, 3 image areas	101 x 101 x 2.2mm	each



Image Analysis Standard (Reference Stage Graticule)

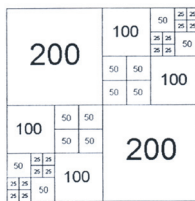
This high precision image analysis standard provides four test areas designed for calibrating image analysis systems and identifying deviations and distortions in optical imaging systems.

The standard, which can also be used as a high precision stage micrometer, is supplied with recommendations for its use and an individual certificate of calibration.

It is produced on a 75mm x 25mm slide and has a square grid accuracy of $\pm 0.1\mu\text{m}$ and a dot accuracy of $\pm 0.3\mu\text{m}$ (except for the smallest and largest two dots on the root-2 array, where accuracy is $\pm 0.5\mu\text{m}$).

The four test areas are:

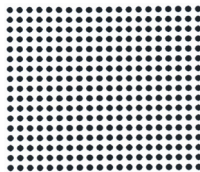
400 μm x 400 μm square grid which is subdivided into 200, 100, 50 and 25 micron squares provides a means of detecting gross image distortions, and can be used as an accurate two dimensional stage micrometer.



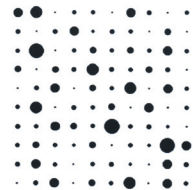
A root-2 array of spots from 3 μm to 48 μm diameter is used for determining the threshold levels of cameras and microscope systems.



A 20 x 17 array of nominally 15 μm diameter dots can be used to identify lens distortions. i.e. to set the field of view to eliminate edge distortion.



A log-normal distribution array of 100 spots ranging from 4.5 μm to 27 μm diameter enables the mean and standard deviation to be determined and compared with the certified values. This is an idealized distribution of maximum dynamic range for a full screen.



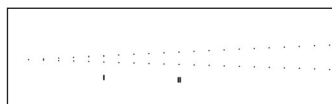
Catalog #	Description	Qty
68049	Reference Stage Graticule 75mm x 25mm slide	each

Stage Graticules (continued)

C. Vibration

FOE PPL Dot – S25

The pair of dots, which appear to merge into a single dot, determines the amount of vibration of the slide in the appropriate axis. The pattern on the S25 is an array of 20 pairs of dots converging on a single dot. The distance between each dot pair increases by 0.001 inch to a maximum of 0.02 inch, pairs being equispaced 0.25 inch.



Pattern	Catalog #	Description	Qty
S25	68038-25	FOE PPL Dot Vibration Test	each

D. Volume/Counting Cells

These are used to create precise volumes of liquid to enable counting of particles in a specified volume of liquid. A thick slide (glass or plastic) has an area cut into its surface that will hold precise volumes of bathing fluid. The shallow well facilitates easy counting of the contained particles. In use, a single drop of liquid is placed on the slide and a coverglass is placed on the platform, providing equal and accurate subdivisions of the fluid, each of which can be observed for particle counting.

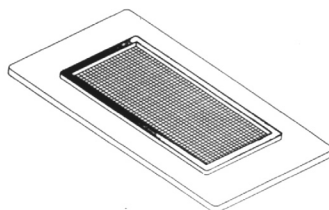
Sedgewick Rafter and Cover Glass — S50, S51, S52

For use in water analysis, culture inspection, and any fluid where particles per unit volume need to be determined. Available in two versions:

S50 is an economically priced plastic cell.

S52 is made from glass, with a chromium surface image. This is intended for professional use and when using phase contrast. In each type, a central cell is filled with fluid and a coverglass limits the volume to 1 milliliter. The grid subdivides this into micro-liters.

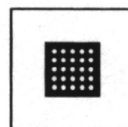
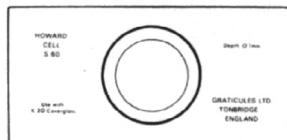
S51 is the spare cover glass for S50 and S52. Each cell is supplied with one cover glass.



Pattern	Catalog #	Description	Qty
S50	68050-50	S50, Sedgewick Rafter, Plastic	each
S52	68050-52	S52, Sedgewick Rafter, Glass	each
S51	68050-51	S51, Cover Glass for S50 & S52	each

Howard

The Howard cell is a glass slide 76mm x 35mm with a central circular island and is used for counting mold fibers and spores in fruit juices, especially from tomatoes. With the K20 coverglass in place, a 0.1mm thickness of liquid is contained over the central island. The coverglass has 25 calibrated fields of 1.382mm diameter through which to view the particles. This coverglass removes the necessity of precise adjustment of the microscope and eyepiece graticule in the original Howard method.



Pattern	Catalog #	Description	Qty
S60	68051-60	Howard Cell for Fruit Juices	each
K20	68051-20	K20 Calibrated Cover Glass	each

Stage Graticules (continued)

E. Finder Graticules

Finder graticules are used to swiftly and accurately give a position of reference to an area of interest on a specimen.

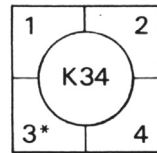
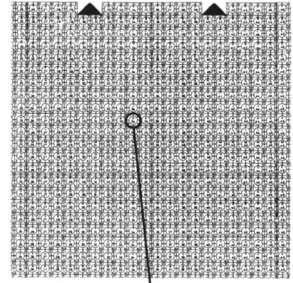
The England Finder – S7

S7 is a glass slide 75mm x 26mm (3 x 1") marked over the top surface in a way that a referenced position can be directly read relative to the locating edges. That means it is marked with a square grid at 1mm intervals. Each square contains a center ring bearing reference letters and numbers. The remainder of the square is subdivided into four segments numbered 1 to 4.

Reference numbers run horizontally 1 to 75, and letters vertically A to Z (omitting I). The main locating edge is the bottom of the slide, which is used in conjunction with either the left or right vertical edge of the slide.

All England Finders produced for over 40 years are identical. The purpose of the finder is to give the microscopist an easy method of recording the position of a particular field of interest, so that another person in another laboratory can relocate at a later date, or the same position, or when using any other England Finder on any other microscope.

The location of the arrows is identical for all England Finder slides. Mark a label on the left hand side of the specimen slide indicating the orientation to be repeated. By replacing the specimen slide with England Finder, taking care not to disturb the position, feature of interest can be noted. The feature can also be relocated at another place or time by reversing the procedure. A total of 100 positions on a slide can be accurately located.



Pattern	Catalog #	Description	Qty
S7	68048-07	The England Finder	each

The Halton Finder – S30

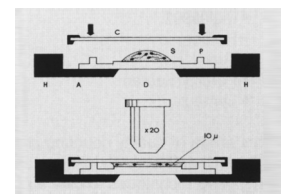
The Halton Finder features the same pattern as the England Finder but only covers a 5mm x 5mm area in the form of a stage graticule.

Pattern	Catalog #	Description	Qty
S30	68049-07	The Halton Finder	each

Makler

For Rapid Semen Analysis – The Makler counting chamber is only 10 microns deep, which is one tenth the depth of other hemacytometers, making it the shallowest of known chambers. This quality chamber is constructed from two pieces of optically flat glass: the first is the chamber, the second is the cover glass which has a fine grid pattern of 1mm squares and a center area further subdivided into 0.1mm squares. Four quartz pins of precise height hold the cover glass to give an exact trapped specimen depth of 10 microns.

Catalog #	Description	Qty
68052-01	Makler Counting Chamber	each



■ Optical Resolution Charts, Ronchi Rulings and Grids

The optical resolution charts are used to test characteristics such as resolution, contrast, distortion and modulation transfer function (MTF) of lenses, cameras and optical systems. Ronchi rulings and grids are used to create interference patterns, to measure distortion and for MTF measurements.

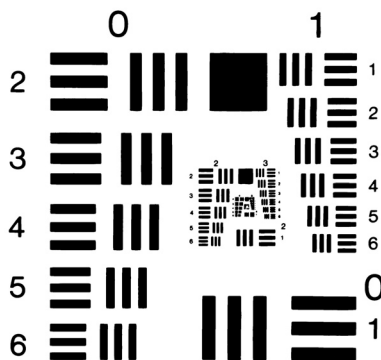
EMS offers a range of charts on glass and in metal foil. Customers often require special charts for specific applications and these can be made to your exact requirements.

In addition to these products, we also supply a specialist NPL/HSE test slide for checking the resolving power of phase contrast microscopes — see Page 37 ref S84 in stage micrometers.

USAF 1951 Test Chart

USAF resolution charts are recognized the world over as a universal standard for testing the vertical and horizontal resolution of imaging systems. Each element on the chart comprises three vertical bars and three horizontal bars, and the detail on these slides is as fine as 0.78 microns (644 line-pairs per mm). The resolution of the imaging system is normally specified as the Group and Element of the finest bars that can be clearly defined.

Catalog #	Description	Pattern	Qty
68098-01	USAF Test Chart Groups 0 to 7	R70	each

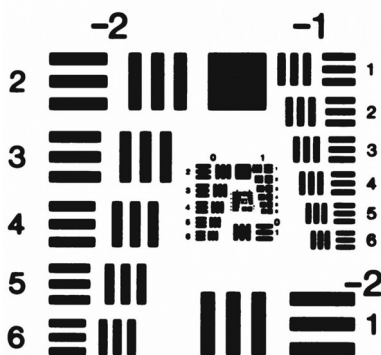


R71 USAF Test Chart Groups -2 to 7

USAF Test Chart. Positive image. Group -2 to Group 7, Element 6.

Large Positive Image ~ group -2 to 7
B270 glass, size 75mm x 75mm

Catalog #	Description	Pattern	Qty
68098-02	USAF Test Chart Groups -2 to 7	R71	each

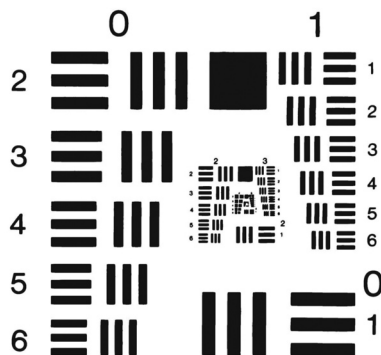


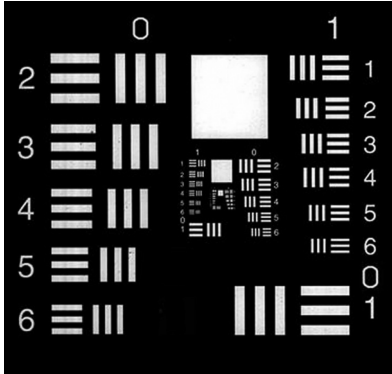
R75P High Resolution Positive Image

USAF Test Chart Group 0 to Group 9, Element 3

- Sub Micron smallest feature size:
bar width 0.00078mm [0.78µm]
- High Resolution Positive Image
- Soda Lime Glass, 50mm x 50mm x 2mm

Catalog #	Description	Pattern	Qty
68098-03	USAF Test Chart, Positive Image, Groups 0/1 to 9/3	R75P	each





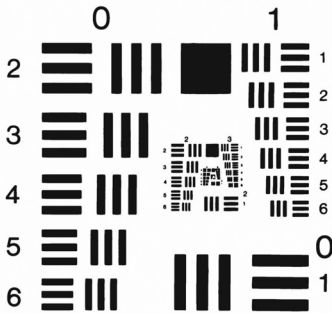
Optical Resolution Charts (continued)

R75N High Resolution Negative Image

USAF Test Chart Group 0 to Group 9, Element 3

- Sub Micron smallest feature size:
bar width 0.00078mm [0.78 μ m]
- High Resolution Negative Image
- Soda Lime Glass, 50mm x 50mm x 2mm

Catalog #	Description	Pattern	Qty
68098-04	USAF Test Chart, Negative Image, Groups 0/1 to 9/3	R75N	each

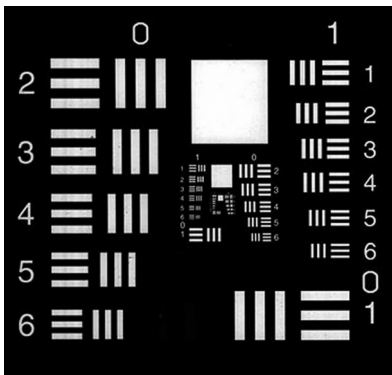


PS75P High Resolution Positive Image

USAF Test Chart Groups 2 to 9, Element 3

- Sub Micron smallest feature size:
bar width 0.00078mm [0.78 μ m]
- High Resolution Positive Image
- Soda Lime glass mounted in Stainless Steel Microscope Slide
- Engraved with unique serial number for traceability (75mm x 26mm)
- Supplied in Polished Wooden Box

Catalog #	Description	Pattern	Qty
68098-05	USAF Test Chart, Positive Image, Groups 2/1 to 9/3 on Stainless Steel slide with engraved serial number	PS75P	each



PS75N High Resolution Negative Image

USAF Test Chart Groups 2 to 9, Element 3

- Sub Micron smallest feature size:
bar width 0.00078mm [0.78 μ m]
- High Resolution Negative Image
- Soda Lime glass mounted in Stainless Steel Microscope Slide
- Engraved with unique serial number for traceability (75mm x 26mm)
- Supplied in Polished Wooden Box

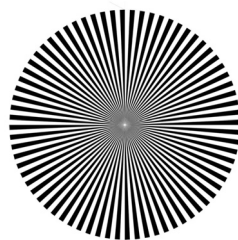
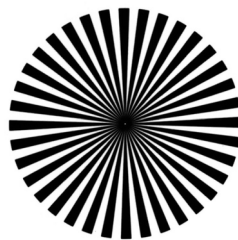
Catalog #	Description	Pattern	Qty
68098-06	USAF Test Chart, Negative Image, PS75N Groups 2/1 to 9/3 on Stainless Steel slide with engraved serial number	PS75N	each

Optical Resolution Charts (continued)

Star Test Targets

Specifications	R65	R66
Sector pitch:	10°	5°
Number of sectors:	36	72
Unresolved center core:	0.2mm	0.4mm
Outside diameter of image:	25mm	
Normal substrate:	B270 Glass	
Overall size:	50 x 50mm	
Image type:	Vacuum deposited chrome	

Catalog #	Description	Pattern	Qty
68098-08	Star Test Chart Sector Pitch 10	R65	each
68098-09	Star Test Chart Sector Pitch 5	R66	each



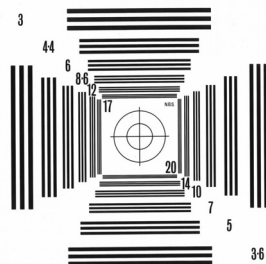
NBS 25 Resolution Charts

R60 NBS 25 Test Chart

3-30 Lines per mm Chrome surface image B270 Glass 50mm x 50mm

A series of gratings diminishing in size as they go towards the central target. Lines range from 3 lines per mm to 20 lines per mm. Supplied as a positive high contrast chrome image on glass substrate 50mm x 50mm. Also available in low contrast and negative form.

Catalog #	Description	Pattern	Qty
68098-10	NBS 25 Chart 20 Lines per mm	R60	each

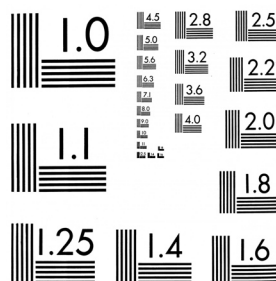


NBS5 Bar Test (BS4657)

1-18 lines per mm Chrome Surface Image B270 Glass 75mm x 75mm

This consists of elements of 5 bars ranging from 1 line per mm to 18 lines per mm, with adjacent numbers indicating the number of lines per mm. Produced as a vacuum deposited chrome image on 75mm x 75mm glass.

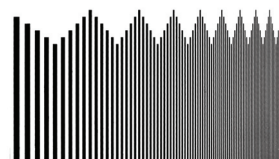
Catalog #	Description	Pattern	Qty
68098-11	NBS 5 Bar Test Ref 1963A BS 4657, Chrome on Glass	R67	each



R72 Sayce Logarithmic Test Chart

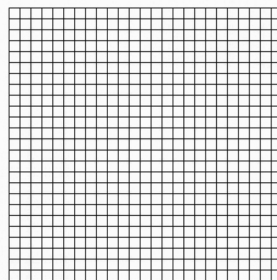
This chart is a photographic image featuring 90 lines and spaces of gradually decreasing width in logarithmic series. The charts have a base length of 100mm and are supplied on 0.175mm thick ester-based film. Typically in use, the image is examined to determine the finest detail that can be distinguished. The finest resolved line is then counted to define the resolution of the device. Includes 6 charts, resolution table and instructions for use.

Catalog #	Description	Pattern	Qty
68098-12	Sayce Logarithmic Test Chart	R72	each



Grids

Consists of elements of 5 bars ranging from 1 line per mm to 18 lines per mm, with adjacent numbers indicating the number of lines per mm. Produced as a vacuum deposited chrome image on 75mm x 75mm glass.



Catalog #	Description	Pattern	Qty
68098-20	Grid with line pitch of 2mm	R1	each
68098-21	Grid with line pitch of 1mm	R2	each
68098-22	Grid with line pitch of 0.5mm	R3	each
68098-23	Grid with line pitch of 0.25mm	R4	each
68098-24	Grid with line pitch of 0.1mm	R10	each

Gratings-Ronchi Rulings

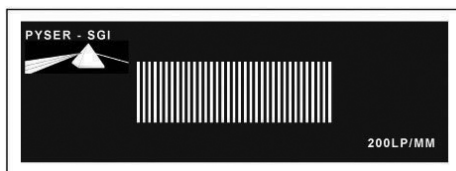
Metallic grating pattern on glass squares with opaque lines approximately 50% of the pitch. Stock items are on 50mm x 50mm squares of glass 1.5mm thick. The grating covers the entire plate with the exception of R25, R26 and R27, where the grating occupies a 30mm wide central strip. The glass is B270 with refractive index of 1.52.

Uses:

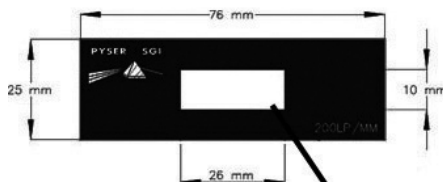
- Paired as light gates
- Demonstrate interference patterns
- Produce optical gradients

Mutually perpendicular pairs produce a screen of square apertures.

Vacuum deposited chrome gratings on glass substrate. Typically used for testing of resolution, field distortion and parfocal stability, but may be paired to provide interference patterns (fringe patterns) and as light gates.



R28 Pattern



R12 Pattern



Catalog #	Description	Pattern	Qty
68098-25	Grating – Ronchi ruling 2 lines per mm - 50mm x 50mm B270 glass, 1.5mm thick, ruled over full area	R12	each
68098-26	Grating – Ronchi ruling 8 lines per mm - 50mm x 50mm B270 glass, 1.5mm thick, ruled over full area	R15	each
68098-27	Grating – Ronchi ruling 20 lines per mm - 50mm x 50mm B270 glass, 1.5mm thick, ruled over full area	R16	each
68098-28	Grating – Ronchi ruling 40 lines per mm - 50mm x 50mm B270 glass, 1.5mm thick, ruled over full area	R17	each
68098-29	Grating – Ronchi ruling 50 lines per mm - 50mm x 50mm B270 glass, 1.5mm thick, ruled over 30mm wide central strip	R25	each
68098-30	Grating – Ronchi ruling 100 lines per mm - 50mm x 50mm B270 glass, 1.5mm thick, ruled over 30mm wide central strip	R26	each
68098-31	Grating – Ronchi ruling 125 lines per mm - 50mm x 50mm B270 glass, 1.5mm thick, ruled over 30mm wide central strip	R27	each
68098-32	Grating – Ronchi ruling 200 lines per mm - 26mm x 10mm soda lime glass grating mounted in anodized aluminum slide mount 76mm x 25mm. Supplied in a polished wooden box.	R28	each

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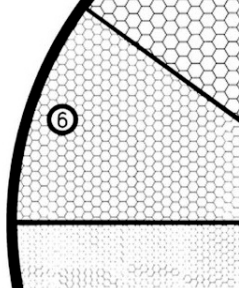
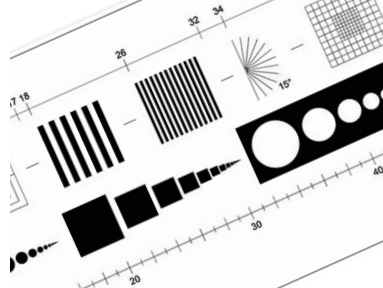
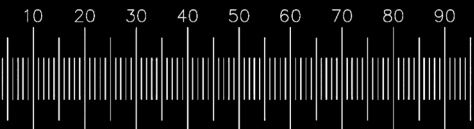
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