HSL/ULO OPTICS TEST SLIDE

Description and Manufacture

The Phase Contrast Test Slide was developed by the Health and Safety Laboratory (HSL), on behalf of the Health and Safety Executive, in collaboration with ULO Optics (formerly PTR Optics) and the National Physical Laboratory (NPL). [The slide was previously known as the HSE/NPL Test Slide]. Its purpose is to provide a reproducible phase object to check microscope system performance prior to counting asbestos fibre samples.

The master engraving was produced by the NPL using a ruling engine. It consists of seven bands lines, with 20 lines in each band, progressively reducing in width and depth, from 1.1um to 0.25um wide. The lines were produced using a V shaped inscriber with a depth to width ratio of approximately 1:10. The bands are separated by 20um gaps. A test zone is delineated by a rectangle bounded by deep grooves, which can be viewed using a microscope with x100 magnification in either dark field or phase contrast mode. Figure 1 illustrates the bands of lines on a test slide and Table 1 gives the widths of the lines within each band and the associated phase contrast induced.

Figure 1 An illustration of the bands of lines that form the basis of the HSE/NPL Mark II Test Slide

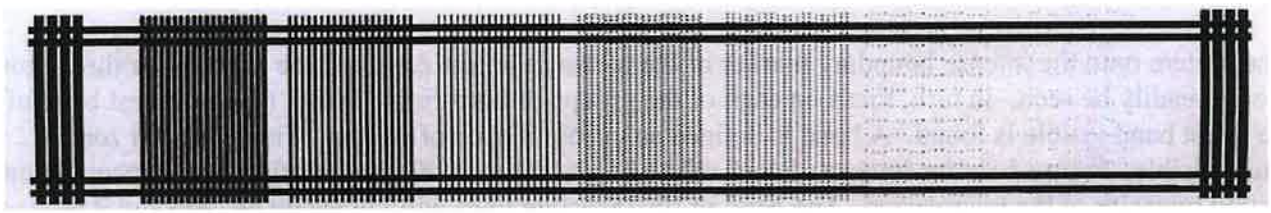

Table 1 The width of the lines within each band and the associated phase contrast introduced when green light (Lambda = 530nm) passes through a line.

Band Numbers	Line Width (um)	Maximum theoretical phase change for light (lambda=530nm)passing through a test line
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°

Each of the HSE standard test slides is an epoxy replica of the NPL Master. An impression of the lines is produced in a resin of refractive index 1.58 and is mounted on a standard glass microscope slide (76 x 25 x 1.2mm). This impression is sealed in another resin of refractive index 1.485 and covered with a standard (0.17mm thick) glass cover slip. To maintain a steady level of quality between slides HSL assesses each one. Only the test zone bound by the four sets of intense lines (figure 1) is examined to assess the contrast of the band 4, 5, 6 & 7 and inspected for dust deposits that may cause light or dark spots. The whole slide is inspected for cracks, splits and other defaults in manufacture. Although these defects cannot be eliminated, all slides are considered to be satisfactory.

HSL certifies the test slides as satisfactory for use to set up phase contrast microscope and categorises them into three sets:

(i) those that have band 4 fully visible and band 5 partially visible (red documents)
(ii) those that have band 5 fully visible and band 6 partially visible (green documents)
(iii) those that have band 6 fully visible and band 7 partially visible (yellow documents)

Each slide is allocated a unique number and this is shown on the accompanying certificate. Records and computer images of each slide inspected are kept by the HSL. Anyone experiencing difficulty in using the test slide may contact the Minerals and Fibres Section of the HSL at the address given below.

Using the HSE/ULO Optics Mark III Test Slide.

The correct method for using the slide follows. Adjust the microscope in phase contrast mode according to the manufacturer's guidelines using a 40x objective lens and a 12.5x eyepiece. Place the test slide on the microscope stage with the aluminium label strip uppermost, the circular clear area contains the test zone, but this zone may not be centrally located. If difficulty is experienced in finding the test zone then try searching the circular area using x10 objective with the phase annulus that matches the x40 objective. This will imitate a "dark ground system". On some microscopes it is necessary to use a different phase annulus to obtain this effect (e.g. that provided for use with x100 objective). After locating the test zone shown in figure 1, revert to the x40 phase objective and matching phase annulus.

Focus the system onto the intense boundary marker of the rectangular test zone and the first two or three groups of lines should readily be seen. In turn, focus on each of the groups of lines from Band 1 (the strongest band of lines) until the finest band visible is found. A band is defined as visible if each of its lines within the test zone is completely visible. Figure 1 shows images of each of the bands. These will vary in brightness depending on the illumination intensity of the microscope. The band of finest visible lines will not easily be seen and it may take some time to determine the limit. It is unlikely that all the bands will be visible but observers with medium to good eyesight and well adjusted microscopes should see either band 4 (on a band 4 slide), band 5 (on a band 5 slide) or band 6 (on a band 6 slide). It may be necessary to focus during the operation. Judging the limit of visibility will become easier as the operator becomes more familiar with the appearance of the slide when the microscope system is correctly adjusted. The microscope will now be correctly set up for use in asbestos fibre counting.

The use of this test slide is recommended in many international and national methods.

Daily use of a test slide is required in the method attached to the European Directive on Worker Protection against Asbestos (official Journal on the European Communities, L263, 24thSeptember 1983). The use of the HSE/NPL Slide is also required by the HSE to ensure microscopes are properly adjusted when testing for compliance with the UK asbestos control limits. This is described in HSG 248.[1] (A1.32).

Contact Addresses:

Minerals & Fibres Section
Health & Safety Laboratory
Group 5 Registration Clerk
Harpur Hill
Buxton
SK17 9JN
Phone +44 (0) 129 821 8552
Fax +44 (0) 129 821 8571
Email: minfib@HSL.win-net.uk

ULO Optics Limited
Unit 2 Caxton Place
Caxton way
Stevenage
Herts
SG1 2UG
Phone +44 (0) 1438 767500
Fax +44 (0) 1438 767555
email: info@ULOoptics.com

[1] HSG 248 (1st Edition 2006) Asbestos:The Analysts' Guide for Sampling, Analysis and Clearance Procedures. ISBN: 978 0 7176 2875 9.