SKERIK GREY SCALE TEST –

Contrast Sensitivity Test

Date: 02.09.2015 • Rev: 02.05.2020

Developed by
TWI Ltd

A division of

Skerik grey scale test – contrast sensitivity test developed by TWI

Background information

International standards focused on inspection and non-destructive testing (NDT) require that visual acuity and colour perception of personnel shall be periodically verified. The requirement for contrast sensitivity in grey scale was introduced only recently.

Governing documents provide some guidance on which test shall be used and what the minimum requirements should be. For example, the Jaeger test is specified to assess an individual's near vision acuity to a specified level of Jaeger J1. **For grey scale perception, there is no defined test, nor a specific level.**

There are a large variety of contrast sensitivity tests available for optometric purposes. Unfortunately, not all are suitable for this purpose (the reasons may be technical, these tests do not cover grey scale in the range used by the individual, or practical, some test charts are dimensionally too big; in many cases the reason is economical, for example the price of the original test pattern).

This has resulted in the use of numerous different test charts and, as a consequence, it is hard to determine a common requirement for contrast sensitivity verification (as with Jaeger J1).

The Skerik grey scale test was developed to:

1. **Provide a simple and small test chart for industrial use;**
2. **Provide a test that can be viewed on paper or on a monitor;**
3. **Allow the definition of a common requirement for contrast sensitivity; and**
4. **Provide a test that will be easily available.**

To fulfil point four, considerable time was spent preparing a test pattern that allows for the control of quality in print or in projection, so that the test can be simply printed and its quality verified.

This test chart is published for use by industry; however, it is to be used only in its original state (with no modification).

How the Skerik grey scale test works

The pattern contrast sensitivity test covers the full range of grey scale. Considering the grey scale covers shades of grey between black and white (0% to 100%), an individual's ability to distinguish contrast is tested at three points (10%, 50% and 95%).

The contrast sensitivity of the human eye may be influenced by other factors (for example detail size, shade of background or angle of view). Therefore, it is complicated to express it using a single number. Some literary sources provide such information[1].

This Certification Scheme for Weldment Inspection Personnel (CSWIP) test provides a scale of various contrasts labelled using the 'SX' symbol, where 'X' represents the contrast level against the background.

Table 1. Contrast scale for the CSWIP test

Designation	S6	S5	S4	S3	S2	S1
Contrast level	6%	5%	4%	3%	2%	1%

During the evaluation period for this grey scale test (between 2008 and 2015), it was verified that the majority of healthy individuals are able to distinguish a contrast of 2% or 3%. The variation in the achieved results reflects not only an individual's ability but also the variation in the quality of test chart representation.

Therefore, it is recommended that a contrast sensitivity of 3% is to be agreed as the minimum. This shall be designated as 'Skerik S3' in the documentation.

Note:
Similar contrast requirements are common for verification of imaging systems for industry. For example, the SMPTE RP 133 test is working with a contrast of 5%[2].

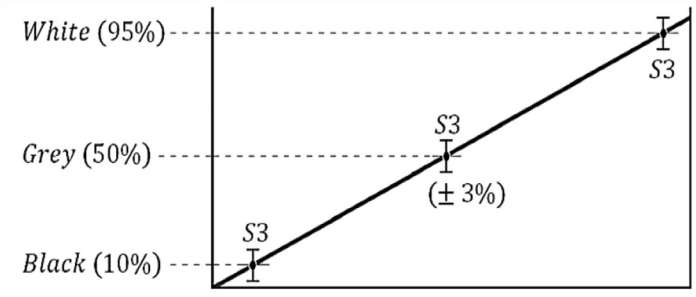

Figure 1. Contrast sensitivity chart

Printing the test pattern

This test may be printed on A4 paper and on a black and white printer (or a colour printer set up in black and white mode). To avoid any disturbing effects, the test pattern print shall be one sided. The set-up or printer may vary significantly (resolution, quality, etc). Please refer to the manufacturer's manual.

Projection of the test pattern on a monitor screen

The whole of the test pattern shall be shown on a monitor (at least the black, grey and white line). The magnification degree shall be selected to allow for comfortable reading of the symbols.

The quality of the printed, as well as the projected, test pattern shall be verified.

How to verify the test pattern quality

While printers tend to reduce contrast, monitors may enhance the image under certain circumstances. Therefore, a calibration pattern is provided and the quality of representation shall be verified.

- **Contrast modification**
  A stripped pattern is provided. The contrast between strips is continuously reduced from 6.5% to 0% with a step of 0.5%. It is required that a contrast of 2% and above shall be clearly discriminated on the pattern, while a contrast of less than 1% shall not be visible.
- **Dimensional distortion**
  A reference dimension (180 mm) is provided. A reduction in size is not acceptable. An enlargement in size is acceptable provided that the whole pattern can be observed.

The quality of the test pattern shall be verified prior to use. If it is intended to use the contrast sensitivity test in any protective cover (for example laminated in plastic pouches), the quality of the test shall be verified in its final state – after lamination or once in a protective cover.

Reading the Skerik grey scale test

The reading order shall follow columns starting with the highest contrast. The reading distance should not be less than 300 mm. Sufficient illumination is required (corresponding to the minimal requirements for the working condition).

References

1. S Kleven and L Hyvärinen, 'Vision testing requirements for industry', Materials Evaluation, Vol 57, No 8, pp 797-803,1999.
2. SMPTE RP 133:1991, 'Specifications for medical diagnostic imaging test pattern for television monitors', 1991.

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	S6 (±6%)	**S5** (±5%)	**S4** (±4%)	**S3** (±3%)	**S2** (±2%)	**S1** (±1%)
Black (10% of scale)	A	T	O	S	E	M
Grey (50% of scale)	B	W	D	R	Y	U
White (95% of scale)	C	I	K	X	E	D

The quality of the test pattern shall be verified on the calibration pattern prior to use. It is recommended that a record of verification is kept for audit purposes.

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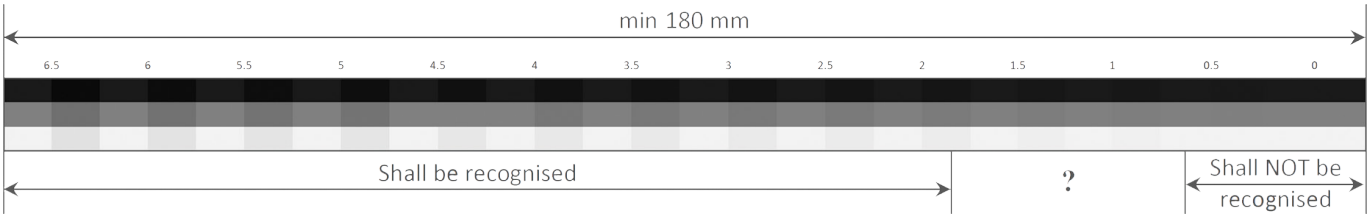

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Black (10% of scale)	S	T	R	E	G	E
Grey (50% of scale)	Q	C	L	P	E	U
White (95% of scale)	T	I	D	U	F	O

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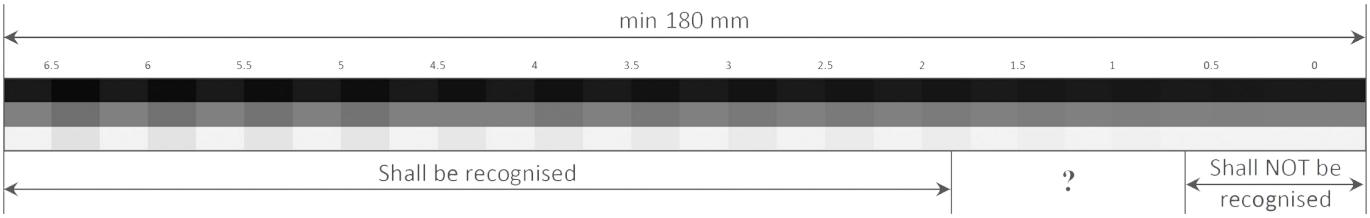

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	S6 (±6%)	S5 (±5%)	S4 (±4%)	S3 (±3%)	S2 (±2%)	S1 (±1%)
Black (10% of scale)	G	S	T	O	H	C
Grey (50% of scale)	R	D	N	A	E	Q
White (95% of scale)	O	J	P	E	F	D

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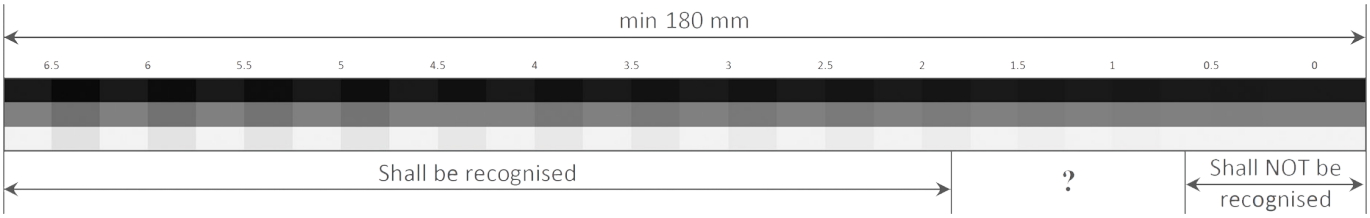

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	S6 (±6%)	S5 (±5%)	S4 (±4%)	S3 (±3%)	S2 (±2%)	S1 (±1%)
Black (10% of scale)	W	B	M	I	G	
Grey (50% of scale)	Y	X	N	F	E	
White (95% of scale)	O	S	U	A	K	

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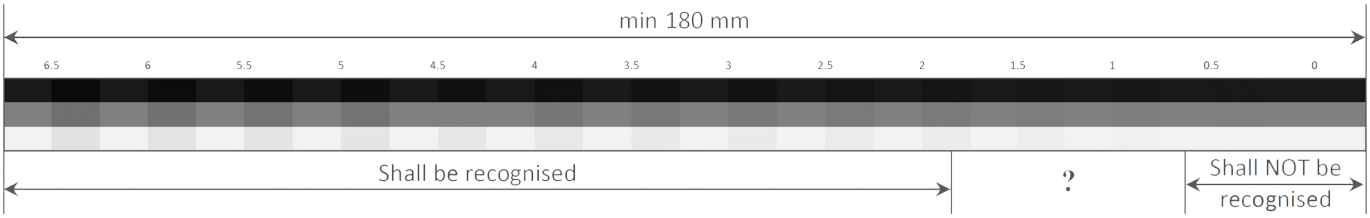

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	S6 (±6%)	S5 (±5%)	S4 (±4%)	S3 (±3%)	S2 (±2%)	S1 (±1%)
Black (10% of scale)	J	Y	D	R	T	
Grey (50% of scale)	K	T	S	E	H	
White (95% of scale)	L	R	A	O	H	

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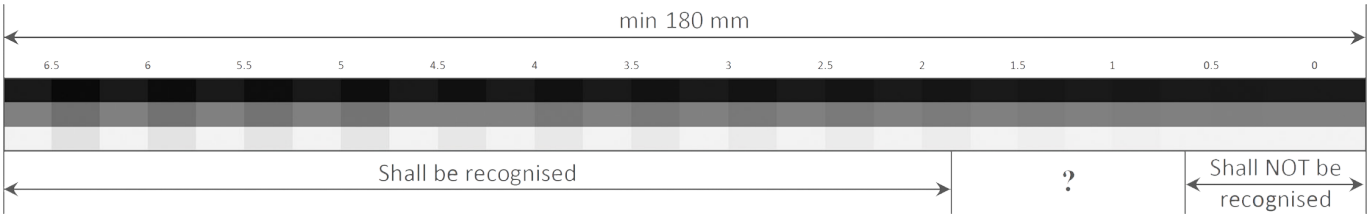

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Black (10% of scale)	H	R	W	Q	O	X
Grey (50% of scale)	Y	F	S	A	L	H
White (95% of scale)	N	V	X	Z	K	N

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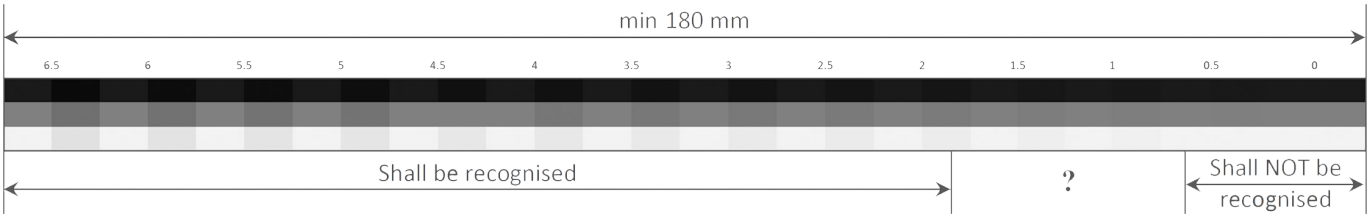

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Black (10% of scale)	C	V	B	I	E	W
Grey (50% of scale)	F	G	H	J	F	A
White (95% of scale)	T	Y	U	N	M	E

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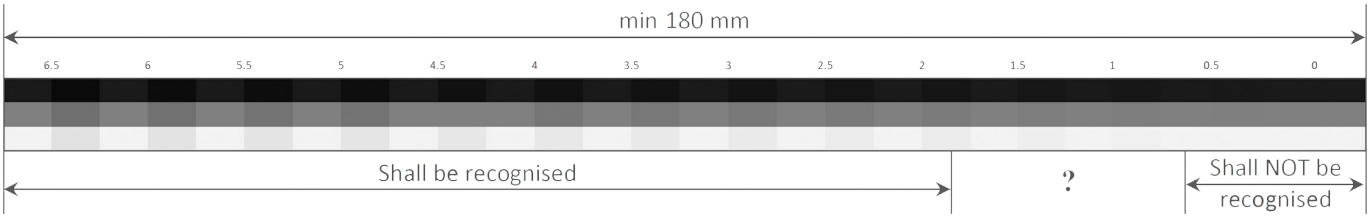

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Black (10% of scale)	W	V	B	V	I	O
Grey (50% of scale)	L	J	S	D	H	A
White (95% of scale)	P	Y	T	G	T	Q

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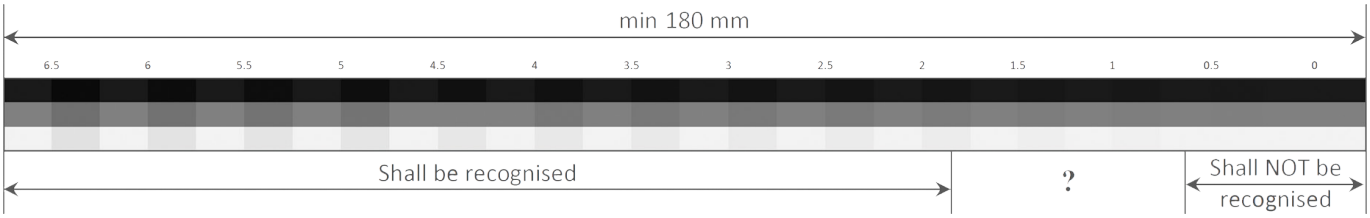

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Black (10% of scale)	E	V	S	R	O	
Grey (50% of scale)	L	F	S	G	K	W
White (95% of scale)	U	Y	Y	A	U	

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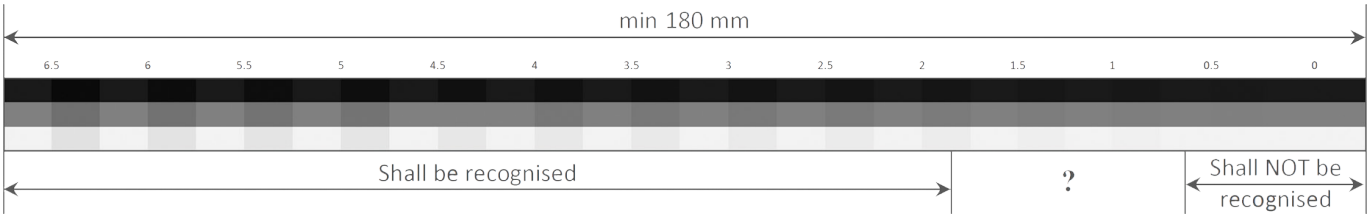

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Black (10% of scale)	R	K	D	I	E	
Grey (50% of scale)	J	Y	E	W	J	W
White (95% of scale)	U	G	O	C	O	

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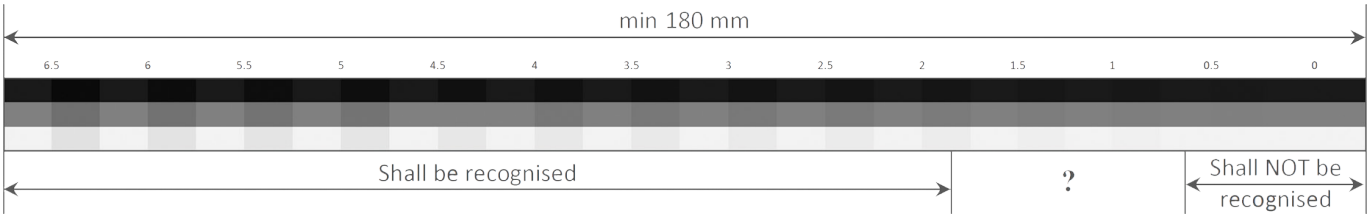

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