

Stockholm, 7 September 2018

COLOUR DEFINITION REPORT

Thank you for choosing NCS Colour Services, annually we help hundreds of companies to manage their colours. We hope this Colour Definition Report will support you in your colour management process and look forward to assisting you again in the future.

Colour to NCS Notation

This service includes instrumental measurement to determine the exact NCS value and visual assessment to determine the nearest standardised NCS colour.

Report data

Sample	Name/Notation of the measured sample.
NCS	Exact NCS Notation determined by colour measurement.
Nearest NCS	The closest colour sample available in the SS 19102:2004 NCS Atlas determined by visual colour matching.
X Y Z	CIE tristimulus values with one decimal (Y=light reflectance factor) evaluated in CIE standard illuminant D65 and CIE 10 degree standard observer.
s c ϕ	Exact value of NCS blackness (<i>s</i>), chromaticness (<i>c</i>) and hue (ϕ) with one decimal.

SAMPLE	NCS	NEAREST NCS	X	Y	Z	s	c	ϕ
Sample	6914-R89B	NCS S 7010-R90B	8.4	9.2	13.2	68.6	14.1	R89.4B

The Natural Colour System[®] (NCS) makes it possible to describe unambiguously any colour in the sense of a colour percept, in other words a colour perceived visually, i.e. the colour which one sees. The measured NCS values describe the colour perception of surface colours in a specified viewing condition (SS 01 91 04). The system does not include colours that appear to belong to translucent or luminescent objects (so-called volume colours and luminous colours), nor does it include other visual properties of the surface layer, such as gloss and texture. An NCS Notation does not describe the physical or chemical properties of an object.

*) Samples marked with an asterisk do not fulfil all of these conditions and the given NCS Notations can by this reason deviate from the colour percept. Nearest NCS sample is based on visual assessment in accordance with SS 01 91 04 and may also deviate from the NCS Notation due to these conditions.

Services and Solutions

If your measured colour should be communicated to other parties within your colour process we can assist you in duplicating the colour into colour standards with our NCS Precise Colour Sample service.

If you want to visually see the nearest standardised NCS colour please order a sample (A4, A6 or A9) of it on our [website](#).

If you want to translate your nearest standardised NCS colour into CMYK or RGB and export it to your architecture or design software, please use [NCS Navigator Premium](#).

Colour Difference

This service includes calculated colour difference(s) between a colour sample selected as standard (Standard) and your other colour sample(s), based on instrumental measurement.

Report data

Sample Name/Notation of the measured sample.
 $\Delta E_{CMC(l:c)}$ Calculated colour difference compared to the row marked "Standard".

SAMPLE	$\Delta E_{CMC(1:1)}$	$\Delta E_{CMC(2:1)}$
NCS7015-R90B	Standard	Standard
Sample	2.0	1.1

The ΔE value quantifies the difference between two colour samples. $\Delta E_{CMC(1:1)}=0$ is a perfect match, i.e. no difference in colour between the measured samples. The limit of visually perceptible colour difference is approximately $\Delta E_{CMC(1:1)}=0.3$ for a person with normal colour vision. $\Delta E_{CMC(1:1)}=1$ is in many industries considered a commercially acceptable match. For the calculated $\Delta E_{CMC(1:1)}$ value to correspond well with what one sees, samples with similar surfaces (texture and gloss) should be compared.

The ΔE value is calculated between the CIELAB coordinates from different measurements with the aim that the scale should correlate with small visually perceived colour difference. Due to historical reasons, many different ΔE formulas are in use by the industry. The newer formulas often correlate better than the older ones. The most used formula is the CIELAB ΔE^* , this formula was first recommended in 1976. The formula commonly used and recommended for textile purposes is the $\Delta E_{CMC(2:1)}$ formula, standardised in 1988 (British Standard, BS 6923:1988). In this report both $\Delta E_{CMC(1:1)}$ and $\Delta E_{CMC(2:1)}$ are given. For best performance of the formula, surfaces with the smallest possible differences in gloss and texture should be compared. Under these criteria, the limit for visually perceived colour difference is around 0.3 ΔE . For $\Delta E_{CMC(1:1)}$ values larger than 5 units the correlation should not be trusted.

Services and Solutions

NCS Colour's experts can help you in evaluating and defining colour tolerance area for your colour suitable in your specific industry, for your specific materials and production methods. They can also create visual tools for colour approval and/or Technical Colour Specifications for you to use when communicating your desired colour to internal and/or external parties.

For more information please contact us.

Visual Assessment

This service includes a visual assessment of the calculated colour difference(s) between a colour sample selected as standard (Standard) and your other colour sample(s).

Report data

Sample	Name/Notation of the assessed sample.
Visual assessment	Description of difference
Visual rating	Rating of the difference

SAMPLE	VISUAL ASSESSMENT	VISUAL RATING
7015-R90B	Very slight difference towards red, very slight darker and very slightly less chromatic	$\phi:1R, s: 1, c: 1$

VISUAL RATING Visual difference rating in close agreement with ISO 3668:1996

Rating	Degree of difference
0	No perceptible difference
1	Very slight, i.e. just perceptible, difference
2	Slight, but clearly perceptible, difference
3	Moderate difference
4	Considerable difference
5	Very major difference

VISUAL COMPONENTS NCS uses the visual components blackness (s), chromaticness(c) and hue(ϕ) to describe colour differences in close agreement with ISO 3668:1996.

Use the visual ratings defined above to describe if the components blackness or chromaticness in the match is larger or smaller (-) compared to the standard. The hue difference is described by notating the positive visual rating followed by one of the NCS primary hues Y, R, B and G in the direction of the difference.

Example:

A colour difference described in words as

Moderate difference towards red, slightly darker and very slightly more chromatic

would be described with components and ratings as follows:

$\phi:3R, s: 2, c: 1$

Reaching a small visually perceived colour difference is normally the most important criteria for accepting a colour match. Even though visual assessments are time consuming, have low repeatability and are difficult to make in an objective way they are of vital importance because it is the method the end customer will use to judge the colour match. Measured colour differences on the other hand are much simpler to perform in an objective and repeatable way but they are limited by the way the instrument simulating a very special visual viewing situation.

The measured colour differences acquired in different measurement geometries or with different instrument settings and calculation methods may differ considerably. In the same way, the visually assessed colour differences can also differ considerably if the viewing situations are changed. For these reasons it is very important to specify the viewing and measurement conditions actually used to accept the match. See specification on page 6.

If the colour standard and the match have the same gloss and surface structure, good correlation between the visually assessed and the measured colour differences is normally obtained. If the gloss or surface structure differs, visual and measured colour differences may not correlate well. In this situation, the precedence between visual and instrumental acceptance must be defined and clear specification of measurement and viewing conditions is important.

Services and Solutions

Human colour vision varies between individuals. It is important that all personnel involved in visual colour assessment have normal colour vision and good colour discrimination capability. For more information on colour vision testing please contact us.

Measurement Conditions for Colour Measurement

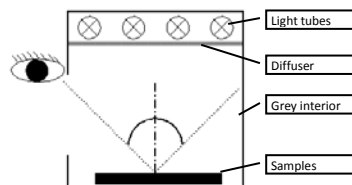
The colour measurement and analysis have been carefully made, checked and certified by NCS Quality Centre according to Swedish Standard, SS 01 91 04, in a spectrophotometer traceable to NCS reference instrument. The CIE measurement values in accordance with CIE publ. 15.2004 is based on the following specification:

- Measurement geometry: $d_i:8^\circ$, UV component included.
- CIE standard illuminants D65 and CIE 10 degree standard observer.
- Readings every 10 nm from 360 to 750 nm.
- NCS S 0500-N (white) is used as a sample backing for reflectance measurement.

Conditions for Visual Assessment

VIEWING CONDITIONS Viewing conditions in close agreement with ISO 3668:1998

- Diffuse illumination
- Illumination types: D65
- Illumination level 1000-4000 lx
- Illumination angle: normal to the sample
- Viewing angle: 45 degree from the sample normal
- Viewing distance 0.4-0.5 m
- Medium grey interior of viewing booth



Other services

Storage and archiving is not included in NCS Colour Services, neither of colour standards nor measurement data. If you are interested in us saving your vital colour information and also make it available to you and your suppliers in a reliable way in the future, please contact us about our new concept, NCS Core.

Normal colour vision and the ability to see small colour differences is a fundamental ability for personnel involved in colour control. Please contact us for more information on colour vision testing.

If you have any questions, please, do not hesitate to contact us.
We are always glad to be of service.

Please note that NCS - Natural Colour System® is a registered trademark and may only be used commercially after a license agreement has been signed with NCS Colour AB.

We look forward to hearing from you again.

With best regards,

NCS COLOUR AB



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