

## Raport de încercare Nr. D8727 – Traducere în limba română

### 1. Client

SWARCO LIMBURGER LACKFABRIK GmbH, Robert-Bosch-Strasse 17, D-65582 Diez.

### 2. Obiect

Măsurarea și evaluarea coordonatelor de cromaticitate x, y, precum și a factorului de luminanță  $\beta$  pe aplicații de testare cu materiale de marcă de la SWARCO LIMBURGER LACKFABRIK GmbH, conform:

- EASA: Specificații de certificare și materiale de ghidare pentru proiectarea aerodromurilor (CS-ADR-DSN), Capitolul U – Culori pentru luminile, marcajele, semnele și panourile de pe sol, ediția 6, 2022
- ICAO, Anexa 14, Volumul 1, Proiectarea și operarea aerodromurilor, ediția a 9-a, 2022
- „Instrucțiuni pentru marcaje pe suprafețe de manevră”, FGSV Verlag, ediția 2018.

### 3. Informații generale privind marcajele (conform datelor furnizate de client)

Producător material: SWARCO LIMBURGER LACKFABRIK GmbH

I) Tip de marcaj: Vopsea pe bază de apă – LIMBOROUTE LW48F Flugplatz

II) Tip de marcaj: Vopsea 1-component high-solid – LIMBOROUTE K828F Flugplatz

III) Tip de marcaj: Vopsea 2-component high-solid – LIMBOROUTE 2-K K809F Flugplatz

IV) Tip de marcaj: Plastic pulverizat la rece – Limboplast KSP 120F Flugplatz

V) Tip de marcaj: Plastic la rece – Limboplast D480 F Flugplatz

Culoare: a) Albastru conform ICAO; b) Verde conform ICAO.

### 4. Rezultatele măsurărilor

La data de 27 aprilie 2023, coordonatele de cromaticitate x, y și factorul de luminanță  $\beta$  au fost măsurate pe aplicațiile de testare în combinațiile indicate, fiecare de trei ori, fiind calculată valoarea medie. S-au utilizat condițiile de măsurare prevăzute în reglementările menționate la punctul 2, cu iluminant standard D65, geometrie 45°/0° și observator standard de 2°.

Echipament utilizat: Hunterlab MiniScan EZ, Model 4500L, Număr serie MSEZ1401.

### 5. Evaluare

5.1 Specificații – Conform EASA, ICAO și „Instrucțiunilor pentru marcaje pe suprafețe de manevră” 2018, valorile minime ale factorului de luminanță  $\beta$  variază în funcție de culoare și tip (reflectorizant / nereflexorizant).

5.2 Evaluare conform EASA și ICAO – Specificațiile au fost îndeplinite pentru toate sistemele de marcă testate.

5.3 Evaluare conform „Instrucțiunilor pentru marcaje pe suprafețe de manevră” – Se recomandă utilizarea culorilor RAL 5015 (Albastru cer) sau RAL 6010 (Verde iarbă), deși acestea se află în afara zonelor de cromaticitate cerute de EASA și ICAO. Compararea vizuală

a arătat că albastrul conform ICAO este semnificativ mai închis decât RAL 5015, iar verdele conform ICAO este semnificativ mai deschis decât RAL 6010.

Acest raport de încercare conține 13 pagini și poate fi distribuit sau publicat doar integral, fără prescurtări.

Kassel, 24 aprilie 2023 – Dr. Claudia Drewes, Prüfdienst der DSGS e. V.

Prüfdienst der DSGS e.V.  
Dr. Claudia Drewes • Simmershäuser Str. 101a • D-34125 Kassel

SWARCO LIMBURGER LACKFABRIK GmbH  
Robert-Bosch-Strasse 17  
D-65582 Diez

**Prüfdienst der DSGS e.V.**

Office:  
Dr. Claudia Drewes  
Simmershäuser Str. 101a  
D-34125 Kassel  
Phone: +49 0561 8102599  
Fax: +49 0561 8102598

Bank details:  
Volksbank Kassel Göttingen e.G.  
BIC: GENODE51KS1  
IBAN: DE18 5209 0000 0000 1518 23  
Association register AG Kassel: VR 1151  
Association headquarters: Kassel  
Testing body-No. F 0186  
Tax-No.: 35 273 00726  
Vat ID No.: DE 113055741

Kassel, 24 April, 2023

**Test Report No. D8727**

**1. Client**

SWARCO LIMBURGER LACKFABRIK GmbH, Robert-Bosch-Strasse 17, D-65582 Diez.

**2. Brief**

Measurement and evaluation of the x, y chromaticity co-ordinates as well as the luminance factor  $\beta$  on test applications with marking materials from SWARCO LIMBURGER LACK-FABRIK GmbH according to

- EASA: Certification Specifications and Guidance Material for Aerodrome Design (CS-ADR- DSN), Chapter U – Colours for aeronautical ground lights, markings, signs and panels, Issue 6, 2022
- ICAO, Annex 14, Volume 1, Aerodrome Design and Operations, 9th Edition, 2022
- Hinweise für Markierungen auf Flugbetriebsflächen, FGSV Verlag, Ausgabe 2018 (Instructions for markings on manoeuvring areas, FGSV publishing company, edition 2018).

**3. General information on marking (according to information provided by the client)**

Material Producer: SWARCO LIMBURGER LACKFABRIK GmbH

I)  
Kind of marking: Water based paint  
Substance name: LIMBOROUTE LW48F Flugplatz

II)  
Kind of marking: 1-component high-solid paint  
Substance name: LIMBOROUTE K828F Flugplatz

III)

Kind of marking: 2-component high-solid paint  
Substance name: LIMBOROUTE 2-K K809F Flugplatz

IV)

Kind of marking: Cold spray plastic  
Substance name: Limboplast KSP 120F Flugplatz

V)

Kind of marking: Cold plastic  
Substance name: Limboplast D480 F Flugplatz

Colour: a) Blue according to ICAO  
b) Green according to ICAO

Layer thickness / drop-on material / drop-on material producer / amount of drop-on material:  
see 4. Measurement results.

The test applications were provided by SWARCO LIMBURGER LACKFABRIK GmbH.

#### 4. Measurement results

On April 27, 2023, the x, y chromaticity co-ordinates as well as the luminance factor  $\beta$  were measured on test applications in the combinations given below three times each and the mean value was formed.

As stipulated for the measurements in the regulations mentioned under 2., the following measurement conditions were used:

standard illuminant: D65  
Geometry: 45°/0°  
Standard observer: 2°

The following measuring device was used:

Hunterlab MiniScan EZ  
Model Number 4500L  
Serial Number MSEZ1401.

**Tab. 1a** Measurement results I) LIMBOROUTE LW48F Flugplatz non-reflective

| No. | Colour/Layer thickness                       | Name of drop-on material; drop-on material producer; amount of drop-on material | applies to BASt test certificate No./layer thickness |                 | Luminance factor $\beta$ | chromaticity co-ordinates |        | Evaluation according to regulations under 2. $\beta/x, y$ |
|-----|--|---|--|-----------------|--------------------------|---------------------------|--------|---|
|     |  |   |  |                 |                          | x                         | y      |   |
| 1   | Blue according to ICAO<br>400 $\mu\text{m}$  | without (non-reflective)  | 300 $\mu\text{m}$                                    | 2006 1DW 01.04  | 0,0969                   | 0,1899                    | 0,1444 | + / +   |
|     |  |   |  | 2013 1DW 07.14  |                          |                           |        |   |
|     |  |   |  | 2020 1DW 05.06  |                          |                           |        |   |
| 1   | Blue according to ICAO<br>400 $\mu\text{m}$  | without (non-reflective)  | 300 $\mu\text{m}$                                    | 2020 1VW 05.07* | 0,0969                   | 0,1899                    | 0,1444 | + / +   |
|     |  |   |  | 2021 1VW 05.14  |                          |                           |        |   |
|     |  |   |  | 2013 1DW 07.15  |                          |                           |        |   |
| 1   | Blue according to ICAO<br>400 $\mu\text{m}$  | without (non-reflective)  | 400 $\mu\text{m}$                                    | 2018 1VW 06.16  | 0,0969                   | 0,1899                    | 0,1444 | + / +   |
|     |  |   |  | 97 1W 12.07     |                          |                           |        |   |
|     |  |   |  | 2021 1DW 05.16  |                          |                           |        |   |
| 2   | Green according to ICAO<br>400 $\mu\text{m}$ | without (non-reflective)  | 300 $\mu\text{m}$                                    | 2006 1DW 01.04  | 0,2145                   | 0,2378                    | 0,4113 | + / +   |
|     |  |   |  | 2013 1DW 07.14  |                          |                           |        |   |
|     |  |   |  | 2020 1DW 05.06  |                          |                           |        |   |
| 2   | Green according to ICAO<br>400 $\mu\text{m}$ | without (non-reflective)  | 300 $\mu\text{m}$                                    | 2020 1VW 05.07* | 0,2145                   | 0,2378                    | 0,4113 | + / +   |
|     |  |   |  | 2021 1VW 05.14  |                          |                           |        |   |
|     |  |   |  | 2013 1DW 07.15  |                          |                           |        |   |
| 2   | Green according to ICAO<br>400 $\mu\text{m}$ | without (non-reflective)  | 400 $\mu\text{m}$                                    | 2018 1VW 06.16  | 0,2145                   | 0,2378                    | 0,4113 | + / +   |
|     |  |   |  | 97 1W 12.07     |                          |                           |        |   |
|     |  |   |  | 2021 1DW 05.16  |                          |                           |        |   |

\*Under the No. 2020 1VW 05.07 there is a confirmation present of the German Federal Highway Research Institute (BASt) on testing a marking system on the turntable wear simulator: The measurement results fulfil the requirements of "Hinweise für Markierungen auf Flugbetriebsflächen", Ausgabe 2018 ("Instructions for markings on manoeuvring areas", edition 2018). Therefore, this confirmation is evaluated as equivalent to a BASt test certificate.

Die BASt test certificates 2021 1VW 05.14 and 2021 1DW 05.16 also apply to non-reflective marking systems (without drop-on material) for the following colours according to the information in the respective test certificate:

- a) RAL 9016 Traffic white
- b) RAL 1023 Traffic yellow
- c) RAL 2009 Traffic orange
- d) RAL 3020 Traffic red
- e) RAL 5015 Sky blue
- f) RAL 6010 Grass green
- g) RAL 9017 Traffic black

**Tab. 1b** Measurement results I) LIMBOROUTE LW48F Flugplatz reflective

| No. | Colour/Layer thickness                       | Name of drop-on material; drop-on material producer; amount of drop-on material | applies to BASt test certificate No./layer thickness |                                   | Luminance factor $\beta$ | chromaticity co-ordinates |        | Evaluation according to regulations under 2. $\beta/x, y$ |
|-----|--|---|--|-----------------------------------|--------------------------|---------------------------|--------|---|
|     |  |   |  |                                   |                          | x                         | y      |   |
| 3   | Blue according to ICAO<br>400 $\mu\text{m}$  | Flughafenperle Typ I T14 GG30;<br>SWARCO; 400 g/m <sup>2</sup>                  | 300 $\mu\text{m}$                                    | 2020 1VW 05.07*<br>2021 1VW 05.14 | 0,0784                   | 0,1898                    | 0,1428 | + / +   |
|     |  |   | 400 $\mu\text{m}$                                    | 2018 1VW 06.16                    |                          |                           |        |   |
| 4   | Green according to ICAO<br>400 $\mu\text{m}$ | Flughafenperle Typ I T14 GG30;<br>SWARCO; 400 g/m <sup>2</sup>                  | 300 $\mu\text{m}$                                    | 2020 1VW 05.07*<br>2021 1VW 05.14 | 0,1755                   | 0,2386                    | 0,4122 | + / +   |
|     |  |   | 400 $\mu\text{m}$                                    | 2018 1VW 06.16                    |                          |                           |        |   |

\*Under the No. 2020 1VW 05.07 there is a confirmation present of the German Federal Highway Research Institute (BASt) on testing a marking system on the turntable wear simulator: The measurement results fulfil the requirements of “Hinweise für Markierungen auf Flugbetriebsflächen”, Ausgabe 2018 (“Instructions for markings on manoeuvring areas”, edition 2018). Therefore, this confirmation is evaluated as equivalent to a BASt test certificate.

Die BASt test certificates 2021 1VW 05.14 also applies to reflective marking systems for the following colours according to the information in the test certificate:

- a) RAL 9016 Traffic white
- b) RAL 1023 Traffic yellow
- c) RAL 2009 Traffic orange
- d) RAL 3020 Traffic red
- e) RAL 5015 Sky blue
- f) RAL 6010 Grass green
- g) RAL 9017 Traffic black

**Tab. 2a** Measurement results II) LIMBOROUTE K828F Flugplatz non-reflective

| No. | Colour/Layer thickness                       | Name of drop-on material; drop-on material producer; amount of drop-on material | applies to BAST test certificate No./layer thickness |  | Luminance factor $\beta$ | chromaticity co-ordinates |        | Evaluation according to regulations under 2. $\beta/x, y$ |
|-----|--|---|--|--|--------------------------|---------------------------|--------|---|
|     |  |   |  |  |                          | x                         | y      |   |
| 5   | Blue according to ICAO<br>400 $\mu\text{m}$  | without (non-reflective)  | 300 $\mu\text{m}$                                    | 2020 IDS 05.10   | 0,0738                   | 0,1826                    | 0,1242 | + / +   |
|     |  |   | 400 $\mu\text{m}$                                    | 2007 IDS 08.11<br>2009 IDS 03.11<br>2010 IDS 07.03<br>2012 IDS 01.06<br>2021 1VS 05.08 |                          |                           |        |   |
|     |  |   | 600 $\mu\text{m}$                                    | 2012 IDS 01.10<br>2012 1VS 01.09   |                          |                           |        |   |
| 6   | Green according to ICAO<br>400 $\mu\text{m}$ | without (non-reflective)  | 300 $\mu\text{m}$                                    | 2020 IDS 05.10   | 0,2045                   | 0,2304                    | 0,4156 | + / +   |
|     |  |   | 400 $\mu\text{m}$                                    | 2007 IDS 08.11<br>2009 IDS 03.11<br>2010 IDS 07.03<br>2012 IDS 01.06<br>2021 1VS 05.08 |                          |                           |        |   |
|     |  |   | 600 $\mu\text{m}$                                    | 2012 IDS 01.10<br>2012 1VS 01.09   |                          |                           |        |   |

Die BAST test certificate 2021 1VS 05.08 also applies to non-reflective marking systems (without drop-on material) for the following colours according to the information in the test certificate:

- a) RAL 9016 Traffic white
- b) RAL 1023 Traffic yellow
- c) RAL 2009 Traffic orange
- d) RAL 3020 Traffic red
- e) RAL 5015 Sky blue
- f) RAL 6010 Grass green
- g) RAL 9017 Traffic black

**Tab. 2b** Measurement results II) LIMBOROUTE K828F Flugplatz reflective

| No. | Colour/Layer thickness                       | Name of drop-on material; drop-on material producer; amount of drop-on material | applies to BAST test certificate No./layer thickness |                | Luminance factor $\beta$ | chromaticity co-ordinates |        | Evaluation according to regulations under 2. $\beta/x, y$ |
|-----|--|---|--|----------------|--------------------------|---------------------------|--------|---|
|     |  |   |  |                |                          | x                         | y      |   |
| 7   | Blue according to ICAO<br>400 $\mu\text{m}$  | Flughafenperle Typ I T14 GG30;<br>SWARCO; 400 g/m <sup>2</sup>                  | 400 $\mu\text{m}$                                    | 2021 1VS 05.08 | 0,0706                   | 0,1869                    | 0,1342 | +/+   |
| 8   | Green according to ICAO<br>400 $\mu\text{m}$ | Flughafenperle Typ I T14 GG30;<br>SWARCO; 400 g/m <sup>2</sup>                  | 400 $\mu\text{m}$                                    | 2021 1VS 05.08 | 0,1702                   | 0,2337                    | 0,4145 | +/+   |

**Tab. 3a** Measurement results III) LIMBOROUTE 2-K K809F Flugplatz non-reflective

| No. | Colour/Layer thickness                       | Name of drop-on material; drop-on material producer; amount of drop-on material | applies to BASSt test certificate No./layer thickness |  | Luminance factor $\beta$ | chromaticity co-ordinates |        | Evaluation according to regulations under 2. $\beta/x, y$ |
|-----|--|---|---|--|--------------------------|---------------------------|--------|---|
|     |  |   |   |  |                          | x                         | y      |   |
| 9   | Blue according to ICAO<br>400 $\mu\text{m}$  | without (non-reflective)  | 300 $\mu\text{m}$                                     | 2020 1VS 05.08   | 0,1137                   | 0,1914                    | 0,1524 | +/-   |
|     |  |   | 400 $\mu\text{m}$                                     | 2005 1DS 04.07<br>2007 1DS 08.10<br>2021 1VS 05.09                                     |                          |                           |        |   |
|     |  |   | 600 $\mu\text{m}$                                     | 2005 1DS 05.07<br>2006 1DS 02.08<br>2013 1DS 08.05<br>2012 1VS 01.12<br>2018 1DS 05.04 |                          |                           |        |   |
| 10  | Green according to ICAO<br>400 $\mu\text{m}$ | without (non-reflective)  | 300 $\mu\text{m}$                                     | 2020 1VS 05.08   | 0,2126                   | 0,2350                    | 0,4141 | +/-   |
|     |  |   | 400 $\mu\text{m}$                                     | 2005 1DS 04.07<br>2007 1DS 08.10<br>2021 1VS 05.09                                     |                          |                           |        |   |
|     |  |   | 600 $\mu\text{m}$                                     | 2005 1DS 05.07<br>2006 1DS 02.08<br>2013 1DS 08.05<br>2012 1VS 01.12<br>2018 1DS 05.04 |                          |                           |        |   |

Die BASSt test certificate 2021 1VS 05.09 also applies to non-reflective marking systems (without drop-on material) for the following colours according to the information in the test certificate:

- a) RAL 9016 Traffic white
- b) RAL 1023 Traffic yellow
- c) RAL 2009 Traffic orange
- d) RAL 3020 Traffic red
- e) RAL 5015 Sky blue
- f) RAL 6010 Grass green
- g) RAL 9017 Traffic black

**Tab. 3b** Measurement results III) LIMBOROUTE 2-K K809F Flugplatz reflective

| No. | Colour/Layer thickness                       | Name of drop-on material; drop-on material producer; amount of drop-on material | applies to BASt test certificate No./layer thickness |                | Luminance factor $\beta$ | chromaticity co-ordinates |        | Evaluation according to regulations under 2. $\beta/x, y$ |
|-----|--|---|--|----------------|--------------------------|---------------------------|--------|---|
|     |  |   |  |                |                          | x                         | y      |   |
| 11  | Blue according to ICAO<br>400 $\mu\text{m}$  | Flughafenperle Typ I T14 GG30;<br>SWARCO; 400 g/m <sup>2</sup>                  | 300 $\mu\text{m}$                                    | 2020 1VS 05.08 | 0,0899                   | 0,1948                    | 0,1571 | + / +   |
|     |  |   | 400 $\mu\text{m}$                                    | 2021 1VS 05.09 |                          |                           |        |   |
| 12  | Green according to ICAO<br>400 $\mu\text{m}$ | Flughafenperle Typ I T14 GG30;<br>SWARCO; 400 g/m <sup>2</sup>                  | 300 $\mu\text{m}$                                    | 2020 1VS 05.08 | 0,1724                   | 0,2371                    | 0,4144 | + / +   |
|     |  |   | 400 $\mu\text{m}$                                    | 2021 1VS 05.09 |                          |                           |        |   |

**Tab. 4a** Measurement results IV) Limboplast KSP 120F Flugplatz non-reflective

| No. | Colour/Layer thickness                       | Name of drop-on material; drop-on material producer; amount of drop-on material | applies to BAST test certificate No./layer thickness |                                  | Luminance factor $\beta$ | chromaticity co-ordinates |        | Evaluation according to regulations under 2. $\beta/x, y$ |
|-----|--|---|--|----------------------------------|--------------------------|---------------------------|--------|---|
|     |  |   |  |                                  |                          | x                         | y      |   |
| 13  | Blue according to ICAO<br>400 $\mu\text{m}$  | without (non-reflective)  | 300 $\mu\text{m}$                                    | 2020 1DY 09.01<br>2020 1VY 11.12 | 0,0661                   | 0,1890                    | 0,1396 | + / +   |
|     |  |   | 400 $\mu\text{m}$                                    | 2019 1VY 02.15                   |                          |                           |        |   |
|     |  |   | 600 $\mu\text{m}$                                    | 2012 1DY 08.10                   |                          |                           |        |   |
| 14  | Green according to ICAO<br>400 $\mu\text{m}$ | without (non-reflective)  | 300 $\mu\text{m}$                                    | 2020 1DY 09.01<br>2020 1VY 11.12 | 0,2288                   | 0,2347                    | 0,4147 | + / +   |
|     |  |   | 400 $\mu\text{m}$                                    | 2019 1VY 02.15                   |                          |                           |        |   |
|     |  |   | 600 $\mu\text{m}$                                    | 2012 1DY 08.10                   |                          |                           |        |   |

**Tab. 4b** Measurement results IV) Limboplast KSP 120F Flugplatz reflective

| No. | Colour/Layer thickness                       | Name of drop-on material; drop-on material producer; amount of drop-on material | applies to BAST test certificate No./layer thickness |                | Luminance factor $\beta$ | chromaticity co-ordinates |        | Evaluation according to regulations under 2. $\beta/x, y$ |
|-----|--|---|--|----------------|--------------------------|---------------------------|--------|---|
|     |  |   |  |                |                          | x                         | y      |   |
| 15  | Blue according to ICAO<br>400 $\mu\text{m}$  | Flughafenperle Typ I T18 GG30;<br>SWARCO; 400 g/m <sup>2</sup>                  | 300 $\mu\text{m}$                                    | 2020 1VY 11.12 | 0,0763                   | 0,2020                    | 0,1651 | + / +   |
|     |  |   | 400 $\mu\text{m}$                                    | 2019 1VY 02.15 |                          |                           |        |   |
| 16  | Green according to ICAO<br>400 $\mu\text{m}$ | Flughafenperle Typ I T18 GG30;<br>SWARCO; 400 g/m <sup>2</sup>                  | 300 $\mu\text{m}$                                    | 2020 1VY 11.12 | 0,1926                   | 0,2374                    | 0,4128 | + / +   |
|     |  |   | 400 $\mu\text{m}$                                    | 2019 1VY 02.15 |                          |                           |        |   |

**Tab. 5a** Measurement results V) Limboplast D480 F Flugplatz non-reflective

| No. | Colour/Layer thickness                         | Name of drop-on material; drop-on material producer; amount of drop-on material | applies to BASt test certificate No./layer thickness |  | Luminance factor $\beta$ | chromaticity co-ordinates |        | Evaluation according to regulations under 2. $\beta/x, y$ |
|-----|--|---|--|--|--------------------------|---------------------------|--------|---|
|     |  |   |  |  |                          | x                         | y      |   |
| 17  | Blue according to ICAO<br>3.000 $\mu\text{m}$  | without (non-reflective)  | 2.000 $\mu\text{m}$                                  | 2011 1DK 04.01   | 0,0753                   | 0,1862                    | 0,1382 | + / +   |
|     |  |   | 3.000 $\mu\text{m}$                                  | 2002 1DK 05.10<br>2002 1DK 07.07<br>2019 1VK 03.16<br>2020 1DK 12.17<br>2020 1VK 12.18 |                          |                           |        |   |
| 18  | Green according to ICAO<br>3.000 $\mu\text{m}$ | without (non-reflective)  | 2.000 $\mu\text{m}$                                  | 2011 1DK 04.01   | 0,1798                   | 0,2250                    | 0,4171 | + / +   |
|     |  |   | 3.000 $\mu\text{m}$                                  | 2002 1DK 05.10<br>2002 1DK 07.07<br>2019 1VK 03.16<br>2020 1DK 12.17<br>2020 1VK 12.18 |                          |                           |        |   |

**Tab. 5b** Measurement results V) Limboplast D480 F Flugplatz reflective

| No. | Colour/Layer thickness                         | Name of drop-on material; drop-on material producer; amount of drop-on material | applies to BASt test certificate No./layer thickness |                | Luminance factor $\beta$ | chromaticity co-ordinates |        | Evaluation according to regulations under 2. $\beta/x, y$ |
|-----|--|---|--|----------------|--------------------------|---------------------------|--------|---|
|     |  |   |  |                |                          | x                         | y      |   |
| 19  | Blue according to ICAO<br>3.000 $\mu\text{m}$  | Flughafenperle Typ I T18 GG30;<br>SWARCO; 450 g/m <sup>2</sup>                  | 3.000 $\mu\text{m}$                                  | 2019 1VK 03.16 | 0,0684                   | 0,1928                    | 0,1462 | + / +   |
| 20  | Green according to ICAO<br>3.000 $\mu\text{m}$ | Flughafenperle Typ I T18 GG30;<br>SWARCO; 450 g/m <sup>2</sup>                  | 3.000 $\mu\text{m}$                                  | 2019 1VK 03.16 | 0,1535                   | 0,2344                    | 0,4124 | + / +   |

## 5. Evaluation

### 5.1 Specifications

The following specifications are given by the regulations according to 2. for the x, y chromaticity coordinates and the luminance factor  $\beta$ :

**Tab. 6** Requirements for the luminance factor  $\beta$  according to EASA, ICAO and “Hinweise für Markierungen auf Flugbetriebsflächen”, Ausgabe 2018 (“Instructions for markings on manoeuvring areas”, edition 2018).

| Property                   | Minimum value / requirement      | Comments                          |
|----------------------------|----------------------------------|-----------------------------------|
| Day time visibility white  | $\beta = 0,75$<br>$\beta = 0,27$ | non-reflective<br>retroreflective |
| Day time visibility yellow | $\beta = 0,45$<br>$\beta = 0,16$ | non-reflective<br>retroreflective |
| Day time visibility orange | $\beta = 0,20$<br>$\beta = 0,14$ | non-reflective<br>retroreflective |
| Day time visibility red    | $\beta = 0,07$<br>$\beta = 0,03$ | non-reflective<br>retroreflective |
| Day time visibility blue   | $\beta = 0,01$                   | retroreflective                   |
| Day time visibility green  | $\beta = 0,10$<br>$\beta = 0,03$ | non-reflective<br>retroreflective |
| Day time visibility black  | $\beta = 0,03$ (maximum)         | non-reflective                    |

**Tab. 7** Requirements for the chromaticity boundaries according to EASA and ICAO

| Chromaticity boundaries for                      | Requirement   |
|--|---|
| <b>white</b><br>non-reflective                   | Purple boundary: $y = 0,010 + x$<br>Blue boundary: $y = 0,610 - x$<br>Green boundary: $y = 0,030 + x$<br>Yellow boundary: $y = 0,710 - x$ |
| <b>white</b><br>retroreflective                  | Purple boundary: $y = x$<br>Blue boundary: $y = 0,610 - x$<br>Green boundary: $y = 0,040 + x$<br>Yellow boundary: $y = 0,710 - x$         |
| <b>yellow</b><br>non-reflective                  | Orange boundary: $y = 0,108 + 0,707x$<br>White boundary: $y = 0,910 - x$<br>Green boundary: $y = 1,35x - 0,093$                           |
| <b>yellow</b><br>retroreflective                 | Orange boundary: $y = 0,160 + 0,540x$<br>White boundary: $y = 0,910 - x$<br>Green boundary: $y = 1,35x - 0,093$                           |
| <b>orange</b><br>non-reflective                  | Red boundary: $y = 0,285 + 0,100x$<br>White boundary: $y = 0,940 - x$<br>Yellow boundary: $y = 0,250 + 0,220x$                            |
| <b>orange</b><br>retroreflective <sup>1</sup>    | Red boundary: $y = 0,265 + 0,205x$<br>White boundary: $y = 0,910 - x$<br>Yellow boundary: $y = 0,207 + 0,390x$                            |
| <b>red</b><br>non-reflective and retroreflective | Purple boundary: $y = 0,345 - 0,051x$<br>White boundary: $y = 0,910 - x$<br>Orange boundary: $y = 0,314 + 0,047x$                         |
| <b>blue</b><br>retroreflective <sup>2</sup>      | Green boundary: $y = 0,118 + 0,675x$<br>White boundary: $y = 0,370 - x$<br>Purple boundary: $y = 1,65x - 0,187$                           |
| <b>green</b><br>non-reflective <sup>3</sup>      | Yellow boundary: $x = 0,313$<br>White boundary: $y = 0,243 + 0,670x$<br>Blue boundary: $y = 0,493 - 0,524x$                               |
| <b>green</b><br>retroreflective <sup>3</sup>     | Yellow boundary: $y = 0,711 - 1,22x$<br>White boundary: $y = 0,243 + 0,670x$<br>Blue boundary: $y = 0,405 - 0,243x$                       |
| <b>black</b><br>non-reflective                   | Purple boundary: $y = x - 0,030$<br>Blue boundary: $y = 0,570 - x$<br>Green boundary: $y = 0,050 + x$<br>Yellow boundary: $y = 0,740 - x$ |

Deviating from this, according to the "Hinweise für Markierungen auf Flugbetriebsflächen", Ausgabe 2018 ("Instructions for markings on manoeuvring areas", edition 2018)

<sup>1</sup> the RAL-colour RAL 2009 (Traffic orange) is recommended

<sup>2</sup> the RAL-colour 5015 (Sky blue) is recommended

<sup>3</sup> the RAL-colour 6010 (Grass green) is recommended

although these colours are outside the required chromaticity areas specified by EASA and ICAO.

## 5.2 Evaluation according to EASA und ICAO

The specifications according to EASA and ICAO were achieved with the examined marking systems.

## 5.3 Evaluation according to "Hinweise für Markierungen auf Flugbetriebsflächen" ("Instructions for markings on manoeuvring areas")

According to "Hinweise für Markierungen auf Flugbetriebsflächen", FGSV Verlag, Ausgabe 2018 ("Instructions for markings on manoeuvring areas", FGSV publishing company, edition 2018) the RAL colour 5015 Sky blue or 6010 Grass green is recommended, in deviation from the requirements of EASA and ICAO, although these colours are outside the required chromaticity areas.

A visual comparison of the RAL cards K5 Classic semi matt RAL 5015 Sky blue or RAL 6010 Grass green with the respective test applications yielded the following results:

The colour Blue according to ICAO (Nos. 1, 3, 5, 7, 9, 11, 13, 15, 17 and 19) appears significantly darker than RAL 5015 Sky Blue.

The colour Green according to ICAO (Nos. 2, 4, 6, 8, 10, 12, 14, 16, 18 and 20) appears significantly lighter than RAL 6010 Grass Green.

This test report consists of 13 pages of text and may only be circulated or published unshortened.

Kassel, 24 April, 2023  
Name of Testing Body / of inspector:  
Prüfdienst der DSGS e. V./ Dr. Claudia Drewes



(Signature of inspector)