7 Classification and designation

7.1 General

The VMS shall be classified based on the test results obtained; the classes shall be indicated by performance codes as given in Annex B.

7.2 Continuous retro-reflective VMS

— Resistance to horizontal loads, expressed as

  — temporary deflections caused by wind loads WL0, WL1, WL2, WL3, WL4, WL5, WL6, WL7, WL8 or WL9

  — permanent deflections caused by dynamic snow load DSL0, DSL1, DSL2, DSL3 or DSL4

  — temporary bending deflections TDB0, TDB1, TDB2, TDB3, TDB4, TDB5 or TDB6

— Performance under Impact, expressed as

  — impact resistance CCM (compliance criterion met, no damage observed)

— Visibility characteristics , expressed as

a) Chromaticity coordinates and luminance, as

— daylight chromaticity and luminance factor CR1 and CR2

b) Retro reflectivity, as

— application classes / coefficient of retro reflection RA1 and RA2

— Durability, of:

  a) Mechanical characteristics, against

  — vibration CCM (compliance criterion met, no alterations observed)

  — corrosion SP0, SP1, SP2

  — extreme temperature T1, T2, T3 or T4

  — ingress of water and dust IP44, IP45, IP54, IP55 or IP56

  b) Visibility characteristics, against

  — accelerated weathering cause(natural, 3 years) CCM (compliance criterion met, no deviation observed)

7.3 Continuous, externally illuminated retro-reflective VMS

— Resistance to horizontal loads, expressed as

  — temporary deflections caused by wind loads WL0, WL1, WL2, WL3, WL4, WL5, WL6, WL7, WL8 or WL9

- permanent deflections caused by dynamic snow load DSL0, DSL1, DSL2, DSL3 or DSL4
- temporary bending deflections TDB0, TDB1, TDB2, TDB3, TDB4, TDB5 or TDB6

— Performance under impact, expressed as

- impact resistance CCM (compliance criterion met, no damage observed)

— Visibility characteristics , expressed as

a) chromaticity coordinates and luminance, as

- daylight chromaticity and luminance factor CR1 or CR2
- mean luminance L1, L2, L3 or LS
- uniformity luminance U1, U2 or U3

b) retro reflectivity, as

- application classes / coefficient of retro reflection RA1 orRA2

— Durability, of:

a) Mechanical characteristics, against

- vibration CCM (compliance criterion met, no alterations observed)
- corrosion SP0, SP1, SP2
- extreme temperature T1, T2, T3 or T4
- ingress of water and dust IP44, IP45, IP54, IP55 or IP56

b) Visibility characteristics, against

- accelerated weathering cause(natural, 3 years) CCM (compliance criterion met, no deviation observed)

7.4 Discontinuous VMS

— Resistance to horizontal loads, expressed as

- temporary deflections caused by wind loads WL0, WL1, WL2, WL3, WL4, WL5, WL6, WL7, WL8 or WL9
- permanent deflections caused by dynamic snow load DSL0, DSL1, DSL2, DSL3 or DSL4
- temporary bending deflections TDB0, TDB1, TDB2, TDB3, TDB4, TDB5 or TDB6

— Performance under impact, expressed as

- impact resistance CCM (compliance criterion met, no damage observed)

— Visibility characteristics, expressed as

- — colour C1 or C2 ;
- — luminance L1, L2, L3, L1(*), L2(*) or L3(*), L1(T), L2(T) or L3(T);
- — luminance ratio R1, R2 or R3;
- — beam width B1, B2, B3, B4, B5, B6 or B7;
- — uniformity of luminous intensity CCM (compliance criterion met, compliance with test A and B)
- — visible flicker CCM (compliance criterion met, no flicker observed)

— Durability, of:

a) Mechanical characteristics, against

- — vibration CCM (compliance criterion met, no alterations observed)
- — corrosion CCM (compliance criterion met, no corrosion observed)
- — extreme temperature T1, T2, T3 or T4
- — ingress of water and dust IP44, IP45, IP54, IP55 or IP56

b) Visibility characteristics, against

- — cause for degradation of colour, luminance and luminance ratio CCM (compliance criterion met, no change in classification)

8 Marking, labelling and packaging

Finished VMS shall be clearly, durably and visibly marked with all information in accordance with Annex B.

Product classification codes shall be in accordance with Clause 7.

Additional markings - as electrical and physical ratings for the connection to the supplies e.g. rated or ranged voltage, current, frequency, wattage, weight, etc. - shall be permitted, provided that they do not give rise to misunderstanding. Where symbols are used, they shall conform to ISO 7000:2014 or IEC 60417-1 where appropriate symbols exist.

The information given in markings shall be in characters legible at a normal reading distance such that the total area of the marking shall be at least 100 cm^2 and shall be sufficiently durable to last the expected life of the VMS. Marking shall not be placed on the front face or any removable parts of VMS, which can be replaced in such a way that the marking would become misleading.

In considering the durability of the marking, the effect of normal use shall be taken into account.

Where regulatory marking provisions require information on some or all items listed in this clause, the requirements of this clause concerning those common items are deemed to be met and the information needs not be repeated for the purpose of this clause.

9 Product information

The following documentation shall be made available for each VMS:

a) Instructions for the assembly and erection of VMS.

b) Details of any limitations on location or use.

c) Instructions for the handling, maintenance and cleaning of VMS, including component replacement.

d) Safety and environmental instructions and their eventually derived precaution measures in regards to the operating, installing, servicing, transporting or storing VMS.

e) Details of luminance control device (if required).

Product information related to safety shall be in a language which is acceptable in the country in which the VMS is intended to be installed.

Annex A
(normative)

Equivalent area

A.1 General

This annex defines the concept of equivalent area and the use of this concept in the lay-out of VMS messages. The following photometric calculations and design examples demonstrate this.

Aspects, characters and figures of light emitting matrix signs shall be created by single elements. The design objective is that the light intensity (cd) together with element spacing (m) gives the impression of solid lines and surfaces (see Figure A.1). When the sign is seen from the appropriate distance the elements appear to merge, this creates the impression that the elements are larger than their actual size. The area that the elements are apparently illuminating is defined as the “equivalent area” (m^2). To achieve this effect the combination of luminance and element spacing shall be balanced. The luminance, measured in cd/m^2, is the light intensity per illuminated area (in this case the equivalent area) of each element.

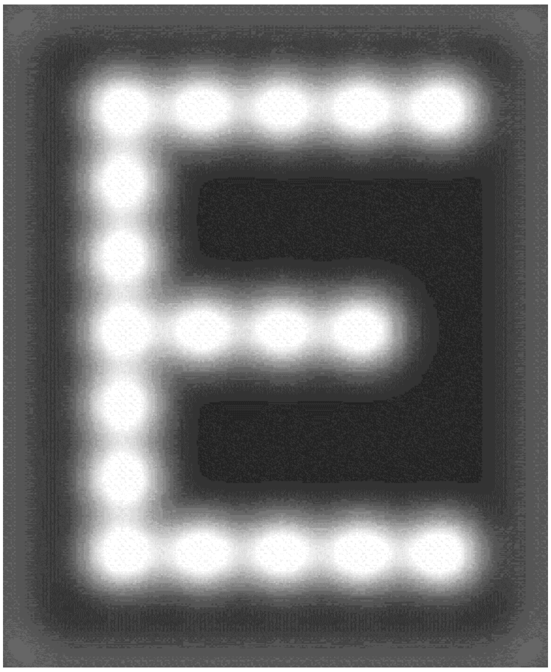


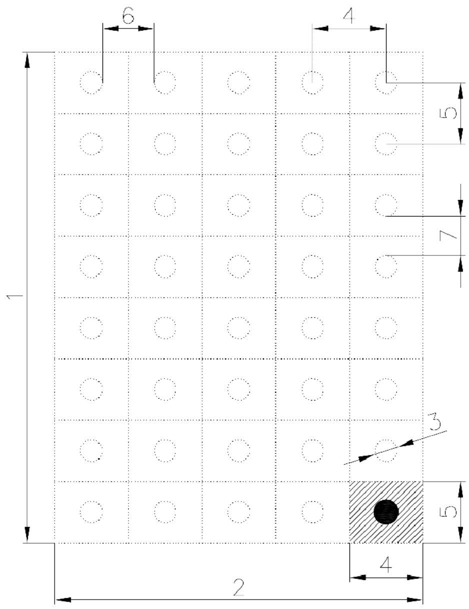
Figure A.1 — Merging of elements

In a regular matrix of a VMS, as in a test module, the equivalent area of an element is the area resulting from the product of the horizontal and the vertical element spacing (see Figure A.2).

A.2 Calculation of the luminance

VMS shall be produced by the compilation of a number of elements in a matrix on a surface. The luminous intensity of the elements shall be known. Therefore the desired luminance can be obtained by choosing the appropriate element spacing. The element spacing shall be calculated using the following method.

Consider an example character of a VMS with a regular orthogonal matrix of (5 × 8) elements (see Figure A.2). The horizontal element spacing is s_h and the vertical element spacing is s_v.



Key

1 equivalent height of the matrix (h_e)

2 equivalent width of the matrix (w_e)

3 physical diameter of the light source of the element

4 horizontal element spacing, width of equivalent of an element (s_h)

5 vertical element spacing, height of equivalent area of an element (s_v)

6 horizontal distance between the light sources of adjacent elements

7 vertical distance between the light sources of adjacent elements

NOTE The shaded area is showing the equivalent area of an element.

Figure A.2 — Character with a regular orthogonal matrix of (5 × 8) elements

The average luminance of the character can be calculated by Formula (A.1)

$$L = \frac{I}{s_h s_v} \tag{A.1}$$

where

L average luminance (cd/m²) measured in the direction of reference axis

I average luminous intensity of a single element (cd)

When the luminous intensity and the luminance are known the product of the element spacing in horizontal and vertical direction is

$$s_h s_v = \frac{I}{L} \tag{A.2}$$

where the product s_h s_v is the size of the equivalent element area (m²) - shaded area in Figure A.2.

The luminous intensity (cd) of a single element (I) shall be considered as distributed uniformly over the equivalent area of that element, resulting in an average sign luminance (L) (cd/m²). This is the luminance that will be seen when viewed from a distance such that the individual elements are indistinguishable. At this distance the elements appear to have the size of the equivalent element area.

NOTE The equivalent area of an element is the reciprocal of the element density (in terms of number of elements per unit of area).

EXAMPLE 1 Assume that the elements of the character emit white light and have a luminous intensity of 12 cd. In order to meet the requirements for luminance class L3, a luminance of at least 12 400 cd/m² shall be made.

According to Formula (A.2) the product of horizontal and vertical element spacing (s_h s_v) shall not be larger than

$$\frac{12\ \text{cd}}{12\ 400\ \text{cd/m}^2} = 0{,}000\ 968\ \text{m}^2$$

When the horizontal and vertical element spacing is the same, the spacing shall not exceed the square root of this area:

$$\sqrt{0{,}000\ 968\ \text{m}^2} = 0{,}0311\ \text{m} = 31{,}1\ \text{mm}$$

EXAMPLE 2 In Figure A.2 the horizontal element spacing is 50 % larger than the vertical element spacing.

In that case the vertical element spacing is

$$\sqrt{\frac{0{,}000\ 968\ \text{m}^2}{1{,}5}} = 0{,}025\ 4\ \text{m} = 25{,}4\ \text{mm}$$

and the horizontal element spacing is

$1{,}5 \times 25{,}4\ \text{mm} = 38{,}1\ \text{mm}.$

As a check on the calculation the luminance can be determined by dividing the total luminous intensity of the test matrix by the equivalent area of the test matrix:

The equivalent width of the test matrix (w_e) is

$5 \times 38{,}1\ \text{mm} = 190{,}5\ \text{mm}.$

The equivalent height of the test matrix (h_e) is

$8 \times 25{,}4\ \text{mm} = 203{,}2\ \text{mm}.$

The equivalent area of the test matrix is

$0{,}1905\ \text{m} \times 0{,}2032\ \text{m} = 0{,}0387\ \text{m}^2.$

The luminous intensity of the test matrix is

$5 \times 8 \times 12\ \text{cd} = 480\ \text{cd}.$

The luminance of the test matrix is

$$\frac{480\ \text{cd}}{0{,}038\ 7\ \text{m}^2} = 12\ 400\ \text{cd/m}^2\ q.e.d$$

A.3 Calculation of non-matrix equivalent areas

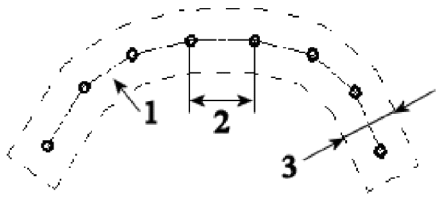
A.3.1 Equivalent area for a line of elements.

The symbol of the VMS message may not only be designed in a matrix system but also as a line of elements as shown in Figure A.3 and Figure A.4. The equivalent area A_e shall be calculated as following:

$$A_e = n \times (S_{av})^2$$

where

n	number of elements
S_{av}	average element spacing
W_s	stroke width ($W_s = S_{av}$)
S_i	element spacing of two elements i and $i+1$.



Key

1 A_e

2 s_i

3 w_s

Figure A.3 — Open line

where

$$S_{av} = \frac{\sum_{i=1}^{n-1} S_i}{n-1}$$

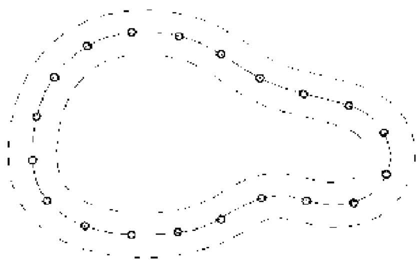


Figure A.4 — Closed line

For closed line

$$S_{av} = \frac{\sum_{i=1}^{n} S_i}{n}$$

A.3.2 Equivalent area for a symbol fully populated with elements

The symbol of the VMS message may not only be designed in a matrix but also as an area fully populated with elements as shown in Figure A.5.

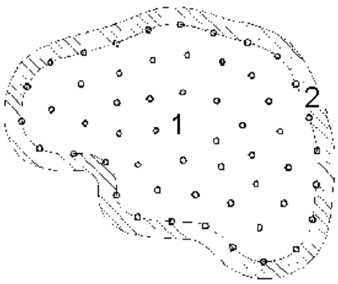
The equivalent area A_e will be calculated as following:

$A_e = S_1 + S_2$

where

S_1 inside area limited by the line of border elements;

S_2 half equivalent area of the border line elements.



Key

1 inside area fully populated with elements *(S_1)*

2 half equivalent area of the border line elements *(S_2)*

Figure A.5 — Example of symbol with an area fully populated with elements

A.3.3 Equivalent area for a symbol partially populated with elements

The symbol of the VMS message may not only be designed in a matrix but also as an area partially populated with elements as shown in Figure A.6.

The equivalent area A_e will be calculated as following:

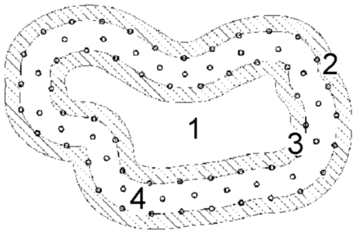
$A_e = S_1 + S_2 + S_3$

where

S_1 Inside area limited by the two lines of borders elements

S_2 Half equivalent area of outside border line elements

S_3 Half equivalent area of inside border line elements



Key

1 no element in this area

2 half equivalent area of outside border line elements *(S_2)*

3 half equivalent area of inside border line elements *(S_3)*

4 inside area fully populated with elements *(S_1)*

Figure A.6 — Example of symbol with an area partially populated with elements