

1. Scope

This Specification describes the Quality Requirements and the conditions of inspections of the Vacuum Fluorescent Display.

2. Conditions of Inspection

2-1. Ambient Condition

The displays shall be inspected under the 30 to 100 Lx ambient light.

2-2. Operating Conditions and Filter-Glass

The displays shall be inspected by eyes from the distance of 300 mm away from the luminescent surface, through the SMOKE-GRAY optical filter (for example, ACLILITE No.83, 2mm thickness), unless otherwise specified.

The displays shall be operated with typical ratings of specifications.

2-3. Workmanship

The reference samples shall be specified for the judgment of workmanship, if necessary.

The reference samples shall be prior to any specified requirements. The reference samples will be periodically reviewed.

2-4. Spot-Size judgment

The standard size gauge of the Electronic Industries Association of Japan recommendation (made in inside) is used.

2-5. Luminance Measurement

The Luminance shall be measured with the luminance meter of TOPCON BM type or equivalents.

As illustration of Fig. 1, the average luminance will be calculated from the reading of meter which apperture covers whole digit of the display. The unit of luminance is cd/m^2 .

$$\text{Average Luminance} = \text{Reading} \times S(p)/S(d)$$

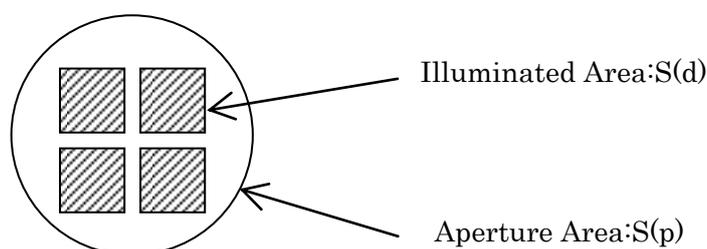


Fig.1

3. Terms and Definitions

3-1. Area Zone of face glass

Fig.2 shows the zone of the face glass of the display.

Zone A: specified viewing area (within viewing angle).

Zone B: window area except for zone A.

Zone C: other area of face glass.

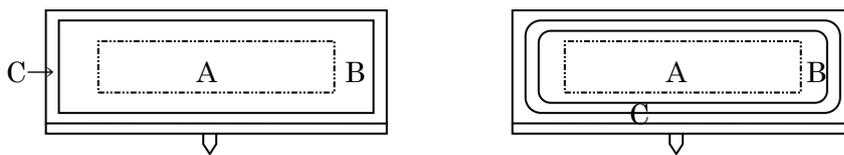


Fig.2

3-2. Terms of Face Glass Inspection

- (1) Scratches: Scratches seen like thread on glass which are made in the process of face glass assembly or VFD handling.
- (2) Stains: Stains or tarnishes on Face Glass which are made in the processes of face glass assembly or fabricating transparent-conductive layer. (Excepting for stains or tarnishes on outer-side of glass to be cleaned easily.)
- (3) Glass Point: Unmelted portion in glass which is made in the processes of glass fabrication. Or frit glass stuck to Face Glass which is made in the processes of face glass assembly.
- (4) Bubble in Glass: Air bubble in Face Glass which is made in the processes of glass fabrication.

3-3. Terms of Illuminated phosphor surface

- (1) Black Spot: Unlit or dim brightness less than 70cd/m^2 spot.
- (2) Dim Spot: Brightness of dim spot is from 70cd/m^2 to specified minimum luminance.
- (3) Dim Portion: Dim portion where the brightness is less than specified minimum luminance, which is seen like shadow.
- (4) Different Brightness: Brightness difference between digits.
- (5) Uneven Brightness: Brightness difference within a segment, excepting for Black Spot, Dim Spot, Dim Portion and Different Brightness.
- (6) Stray Illumination: Unexpected lit portion other than the specified phosphor area.

3-4. Others

- 1)Electro-Static Charge: Illumination fade-out phenomenon due to electro-static charge from outside of the display.
- 2)Viewing Angle: Against the perpendicular line, the angle where whole illuminating patterns shall be observed.
- 3)Alignment: Alignment of dots or characters.

4. Requirements of Face Glass

4-1. Scratches on Glass

In Zone A, width and length of scratches are shown in Table-1 below.
No specified requirements in other zones.

unit:mm

Width of scratch	Smaller than 0.05		0.05~0.1		0.1 or bigger	
Area of Face glass \ Length	single scratch	accumulated length	single scratch	accumulated length	single scratch	accumulated length
~3000mm ²	Less than 20	Less than 25	Less than 5	Less than 5	0	0
3000mm ² ~	Less than 30	Less than 40	Less than 8	Less than 8	0	0

Note: Area of face glass is calculated with face glass dimensions specified in drawing.

4-2. Stains on Face Glass

In Zone A, the largest size and quantity of stains are shown in Table-2 below.
No specified requirements in other zones.

unit:mm

Class	Dot width	Size of stain	Quantity of stains
I	$W < 0.5$	2/3 of dot width	Total quantity of stains shall not exceed the number of digits. Quantity of defects shall not exceed 2 pcs within 30mm diameter circular, or 1 piece within 10mm diameter circular.
II	$0.5 \leq W < 0.8$	2/3 of dot width	
III	$0.8 \leq W$	1/2 of dot width	

4-3. Glass Point and Bubble of Face Glass

In Zone A, the average diameter and quantity of points and bubbles are shown in Table-3 below. No specified requirements in other zones.

Table-3 unit:mm

Class	Dot width	Size of stain	Quantity of stains
I	$W < 0.5$	1/2 of dot width	Total quantity of stains shall not exceed the number of digits. Quantity of defects shall not exceed 2 pcs within 30mm diameter circular, or 1 piece within 10mm diameter circular.
II	$0.5 \leq W < 0.8$	Less than 0.3	
III	$0.8 \leq W$	Less than 0.4	

5. Requirements of Illuminated Area

5-1. Black Spot

Average diameter and quantity shall be less than the value specified in Table-4.

Table-4 unit:mm

Class	Dot width	Size of stain	Quantity of black spots
I	$W < 0.5$	1/2 of dot width	Total quantity of stains shall not exceed the number of digits. Quantity of defects shall not exceed 2 pcs within 30mm diameter circular, or 1 piece within 10mm diameter circular.
II	$0.5 \leq W < 0.8$	Less than 0.3	
III	$0.8 \leq W$	Less than 0.4	

5-2. Dim Spot

Average diameter and quantity shall be less than the value specified in Table-5.

Table-5 unit:mm

Class	Dot width	Size of stain	Quantity of dim spots
I	$W < 0.5$	2/3 of dot width	Total quantity of stains shall not exceed the number of digits. Quantity of defects shall not exceed 2 pcs within 30mm diameter circular, or 1 piece within 10mm diameter circular.
II	$0.5 \leq W < 0.8$	2/3 of dot width	
III	$0.8 \leq W$	1/2 of dot width	

5-3. Dim Portion

Dimension of the dim portion shall be smaller than the value specified in Table-6.
No requirements regarding to the number of dim portions shall not be specified.

Table-6 unit:mm

Class	Dot width	Allowable width of dim portion
I	$W < 0.5$	1/2 of dot width
II	$0.5 \leq W < 0.8$	1/2 of dot width
III	$0.8 \leq W$	1/3 of dot width

Note: Dot width means narrower side of dot.

5-4. Different Brightness

Brightness ratio shall be less than the value specified in Table-7.

Table-7

Luminance of the dimmest dot	Luminance Ratio of adjacent dots	Luminance Ratio of any dots
$350\text{cd/m}^2 \sim 500\text{cd/m}^2$	1 : 1.4	1 : 1.5
$501\text{cd/m}^2 \sim$	1 : 1.5	1 : 1.6

5-5. Uneven Brightness

Reference sample shall be made for uneven brightness, if necessary.

5-6. Stray Illumination

Awful stray illumination on unexpected area shall be rejected under the typical operation.

6. Other Requirements

6-1. Electro-static Charge

As illustrated in Fig. 3, the metal mesh which is applied 500 volts (1k to 2kHz frequency) shall contact to the display face glass. The light displayed shall not fade out or disappear for longer than 5 seconds.

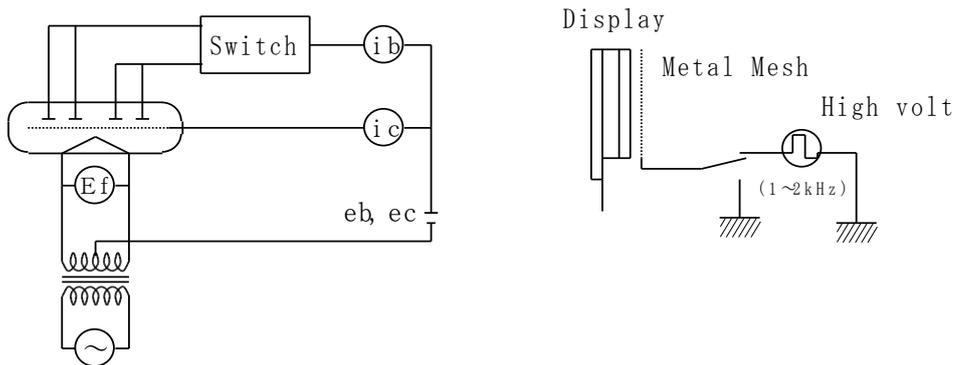


Fig.3

6-2. Viewing Angle

Normal viewing angle shall be within the value specified in Fig. 4, unless otherwise specified.

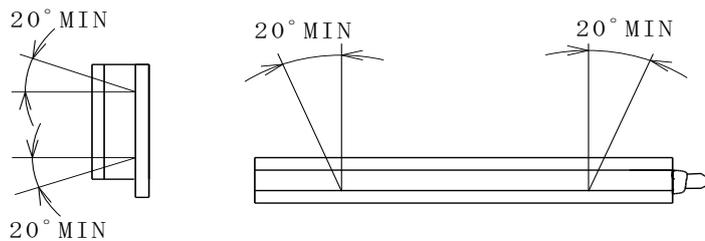


Fig. 4

6-3. Flickering

Tap 3(three) times the display operated under the typical ratings condition, with specified tapping (approximate 20~30G).

The flickering of illuminated face shall not exceed the reference sample.