

# VFD Quality Specifications

Sheet 1/7

TT-91-3331D

Noritake Itron Corp.

## 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<sup>2</sup>.

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

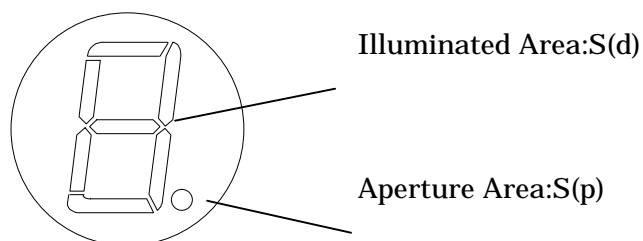


Fig.1

### 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.

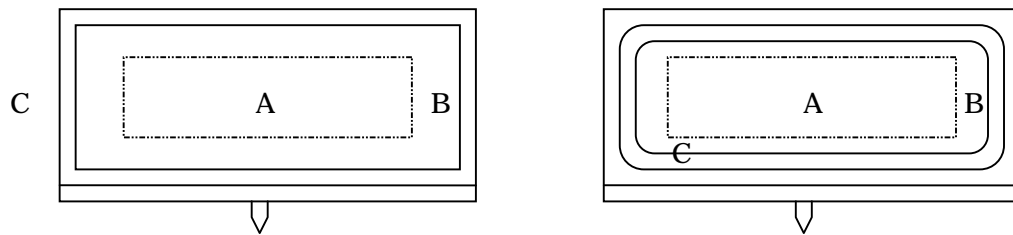


Fig.2

#### 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  $70\text{cd/m}^2$  spot.
- (2) Dim Spot: Brightness of dim spot is from  $70\text{cd/m}^2$  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.
- (7) Inflated Segment Edge: Bulge or Dent at segment pattern edge.

### 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.

## 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.

Table-1

unit:mm						
Width of scratch	Smaller than 0.05		0.05 ~ 0.1		0.1 or bigger	
Length	single scratch	accumulated length	single scratch	accumulated length	single scratch	accumulated length
Area of Face glass						
~ 3000mm <sup>2</sup>	Less than 20	Less than 25	Less than 5	Less than 5	0	0
3000mm <sup>2</sup> ~	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.

Table-2

unit:mm		
Segment width	Size of stain	Quantity of stains
W < 0.6	0.2 or bigger to 3/4 of segment width	Total quantity of stains shall not exceed the number of digits. 3 stains or more a digit / 2 stains or more a segment shall also be rejected.
0.6 W < 1.3	0.2 or bigger to 3/4 of segment width	
1.3 W < 2.0	0.3 or bigger to 3/4 of segment width	
2.0 W	0.5 or bigger to 3/4 of segment 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

Segment width	Average diameter(D)	Quantity of stains
W < 0.6	0.15 D 0.25	Total quantity of stains shall not exceed the number digits. 3 stains or more a digit / 2 stains or more a segment shall also be rejected .
0.6 W < 1.3	0.15 D 0.30	
1.3 W < 2.0	0.15 D 0.30	
2.0 W	0.20 D 0.30	

#### 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

Segment width	Average diameter(D)	Quantity of black spots
W < 0.6	0.15 D 0.25	Total quantity of black spots shall not exceed the number digits. 3 black spots or more a digit / 2 black spots or more a segment shall also be rejected .
0.6 W < 1.3	0.15 D 0.30	
1.3 W < 2.0	0.15 D 0.35	
2.0 W	0.20 D 0.40	

Note: 6 pieces or more black spots in a single digit shall be defect, even if the average diameter is smaller than the minimum specified size.

##### 5-2. Dim Spot

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

Table-5

unit:mm

Segment width	Size of dim spots	Quantity of dim spots
W < 0.6	0.2 or bigger to 3/4 of segment width	Total quantity of dim spots shall not exceed the number of digits. 3 dim spots or moor a digit / 2 dim spots or more a segment shall also be rejected.
0.6 W < 1.3	0.2 or bigger to 3/4 of segment width	
1.3 W < 2.0	0.3 or bigger to 3/4 of segment width	
2.0 W	0.5 or bigger to 3/4 of segment 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

Segment width	A	B	C	D
$W < 0.6$	A $2W$	B $1/2W$	C $1/3W$	D $1/2W$
$0.6 \leq W < 1.3$	A $2W$	B $1/3W$	C $1/3W$	D $1/2W$
$1.3 \leq W < 2.0$	A $2W$	B $1/3W$	C $1/3W$	D $1/3W$
$2.0 \leq W$	A $1.5W$	B $1/4W$	C $1/4W$	D $1/3W$

Note 1: Symbols A through D are defined the position where the dim portion appears as illustrated in Fig. 3 and 4.

Note 2: Symbol “W” in Table-6 means the width of segment.

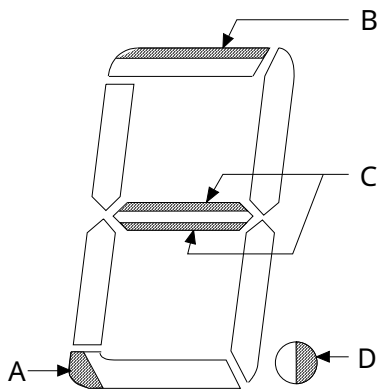


Fig.3

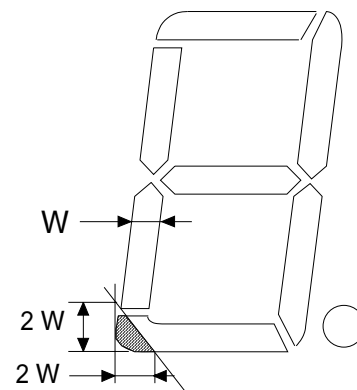


Fig.4

### 5-4. Different Brightness

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

Table-7

Luminance of the dimmest digit	Luminance Ratio of adjacent digits	Luminance Ratio of any digits
$350\text{cd/m}^2 \sim 500\text{cd/m}^2$	1:1.8	1:1.9
$501\text{cd/m}^2 \sim 700\text{cd/m}^2$	1:1.9	1:2.0
$701\text{cd/m}^2 \sim$	1:2.0	1:2.1

### 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.

#### 5-7. Inflated Segment Edge

Size and quantity of the bulge or dent at segment pattern shall be specified in Table-8.

Table-8

Segment width	Dent		Bulge	
	a	b	a	b
W < 0.6	a < 0.07	b < Segment length	a < 0.07	b < Segment length
	0.07 a < 0.15	b < 0.5	0.07 a < 0.15	b < 0.5
	0.15 a < 0.25	b < 0.25	0.15 a < 0.2	b < 0.2
	0.25 a	0	0.2 a	0
0.6 W < 1.3	a < 0.1	b < Segment length	a < 0.1	b < Segment length
	0.1 a < 0.2	b < 0.8	0.1 a < 0.15	b < 0.8
	0.2 a < 0.3	b < 0.3	0.15 a < 0.2	b < 0.2
	0.3 a	0	0.2 a	0
1.3 W	a < 0.15	b < Segment length	a < 0.15	b < Segment length
	0.15 a < 0.25	b < 1.5	0.15 a < 0.2	b < 1.0
	0.25 a < 0.35	b < 0.35	0.2 a < 0.25	b < 0.25
	0.35 a	0	0.25 a	0
Quantity of defects	4 defects or more a digit / 3 defects or more a segment shall also be rejected .			

Note 1: Dimensions “ a ” and “ b ” are defined in Fig 5 or 6.

Note 2: This specification shall not be applied to the special segment pattern like analog-bar.

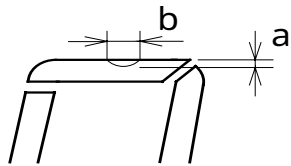


Fig.5

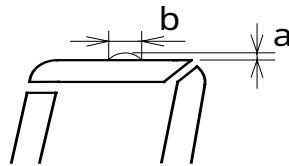


Fig.6

## 6. Other Requirements

### 6-1. Electro-static Charge

As illustrated in Fig. 7, 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.

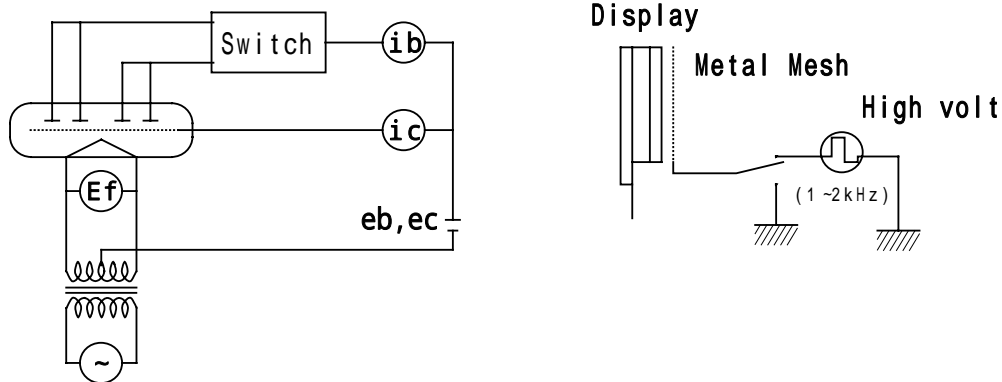


Fig.7

### 6-2. Viewing Angle

Normal viewing angle shall be within the value specified in Fig. 8, unless otherwise specified.

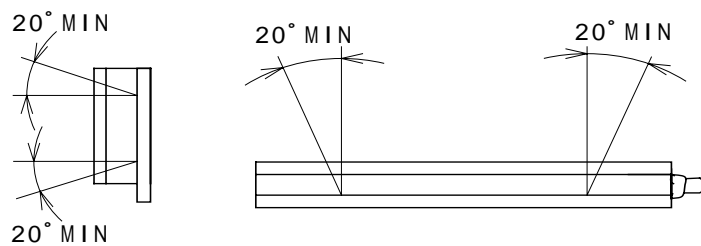


Fig. 8