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Monochrome Cathode Ray Tube Bulb Criteria

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(TEPAC)

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MONOCHROME
CATHODE RAY TUBE BULB CRITERIA
EIA PUBLICATION TEP-110-A

This publication was prepared by the JT-20 Committee on Electro-Optic Devices and approved by the Tube Engineering Panel Advisory Council (TEPAC).

PURPOSE

This document establishes general quality criteria for monochrome CRT bulbs. General Quality Criteria No. 1, 2, and 3 were originally published in 1956 in JETEC Publication No. 10, which is no longer available; they are republished in this document without any revision or modification, because they have been incorporated by reference in other published materials.

General Quality Criteria No. 4, while in use informally for many years, has not previously been formally published. It was adopted in its present form by TEPAC in 1979 and is being formally published at this time. General Quality Criteria No. 5 was prepared by the JT-20 Committee and also approved for use in 1979 by TEPAC; it is being published here for the first time.

SCOPE

The usual applicability of the five General Quality Criteria is as established below:

Criteria No. 1 - Monochrome (Black & White), entertainment, direct-view television picture tube bulbs.

Criteria No. 2 - Earlier blown type industrial and military bulbs.

Criteria No. 3 - Pressed face industrial and military bulbs.

Criteria No. 4 - Optical quality face industrial and military bulbs.

Criteria No. 5 - Pressed face rectangular bulbs for display terminal applications such as video data units and alphanumeric displays.

General quality criteria for color, direct-view, television picture tube bulbs are covered in EIA/TEPAC Publication No. 31 (Color). TEPAC Publication No. 123 is a glossary of terms used in the description of glass components and of their defects.

Note: Defects marked with an asterisk (*) are described in EIA Publication No. 123, Glossary of Terms used in the Description of Glass components and Their Defects. The limits for these defects should be as agreed upon between the glass manufacturer and the user.

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General Quality Criteria No. 1

The following criteria, known as General Quality Criteria No. 1 is usually applied to monochrome picture tube bulbs. It contains the following sections:

- I. Applicability
- II. Definitions
- III. Criteria Within Quality Area
- IV. Criteria Outside Quality Area
- V. Finish

I. APPLICABILITY

A general quality criteria is one which supplements one or more individual bulb criteria and one whose requirements shall be met in addition to those of the individual bulb criteria. The applicable general quality criteria will be noted on the individual bulb criteria. When there is a difference between the requirements of the individual bulb criteria and the general quality criteria, the requirements of the individual bulb criteria shall rule.

II. DEFINITIONS

1. The equivalent diameter of an elongated defect (blisters, stones, etc) is $\frac{\text{length} + \text{width}}{2}$.
2. The quality area is defined as that area of the face which forms the screen area of a completed tube viewed parallel to the longitudinal axis of the tube.

For certain criteria items, the quality area is further divided into zones whose dimensions are given in the following table:

<u>Bulb Size</u>	<u>Zone A</u>	<u>Zone B</u>
10" Round	7" Dia. Circle	Remainder
12-1/2" Round	8" Dia. Circle	Remainder
10" - 14" Rect.	5" x 7"	Remainder
15" - 19" Rect.	5-1/2" x 7-3/4"	Remainder
20" - 23" Rect.	6-1/2" x 8-3/4"	Remainder
24" - 26" Rect.	7-1/2" x 10"	Remainder

- Notes:**
1. Major area of zone rectangle to coincide with major axis of face plate.
 2. Centers of Zones "A" and "B" to coincide with center of face plate.
 3. Zone "B" - Area enclosed by Zone "B" boundary dimensions less area of Zone "A".

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III. CRITERIA WITHIN QUALITY AREA

1. 2" DIAMETER CIRCLE LIMITATION (for Small Defects)

Applicable to those defects with equivalent diameter over .010" through .030". Defects with equivalent diameter .010" and under are not considered.

The allowable area, size and number of this type of defect are as follows:

<u>AREA</u>	Any 2" diameter circle.
<u>SIZE</u>	Stones and Opaque spots over .010" through .025" Seeds, blisters, etc. over .010" through .030".
<u>NUMBER</u>	Total of 8, of which not more than 2 (seeds and blisters only) may be over .025.

2. WIDTH AND LENGTH LIMITATION (For elongated type defects, such as closed blisters, stones and opaque spots etc.)

Applicable to those defects with widths over .005" through .020". Defects with widths .005" and under are not considered.

The allowable width and length by zone is given in the table below:

<u>ZONE</u>	<u>WIDTH</u>	<u>MAXIMUM ALLOWABLE LENGTH</u>
A	Over .005" through .010"	1"
A	Over .010" through .020"	1/2"
B	Over .005" through .010"	1-1/2"
B	Over .010" through .020"	3/4"

Further qualified as follows:

If the maximum allowable length, for those defects include above, is exceeded the bulb is rejectable.

If the length, for those defects included above, is less than the maximum allowable length, compute the equivalent diameter. If this is .030" or under, apply 2" DIAMETER CIRCLE LIMITATION (Item 1).

If this is over .030", count as a defect under Item 3, maximum allowable defects in quality area for entire bulb. The equivalent diameter, zone restrictions and minimum separation limits of item 3 do not apply.

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III. CRITERIA WITHIN QUALITY AREA (continued)

Open elongated blisters, on inside or outside surface, are considered on the basis of equivalent diameter, regardless of length or width.

3. EQUIVALENT DIAMETER LIMITATION (For Large Type Defects)

Applicable to all measurable defects not covered by Items 1 and 2, such as: Blisters, etc. with equivalent diameter over .030" through .050", and stones and opaque spots over .025" through .050".

For smaller defects, see 2" DIAMETER CIRCLE LIMITATION (Item 1). Larger defects are not allowed.

The allowable number and size of such defects by zones are as follows:

ZONE A

Bulb sizes 10" through 26" - None allowed.

ZONE B

<u>Bulb Size</u>	<u>Maximum Allowable Defects</u>
10", 12-1/2" Round	4 Total, of which only 1 may exceed .040"
10" - 14" Rect.	4 Total, of which only 1 may exceed .040"
15" - 19"	5 Total, of which only 1 may exceed .040"
20" - 23"	6 Total, of which only 2 may exceed .040"
24" - 26"	7 Total, of which only 3 may exceed .040"

The minimum separation for any two defects (blisters over .030", and stones and opaque spots over .025") shall be 3".

4. Adhered Glass - None permitted that cannot readily be removed. If adhered glass is removed, apply opaque spot limitations.
5. Rust, Rouge and Unglazed Scale - None permitted that cannot be removed in washing process.
6. Bruises or Chips - None permitted that is readily identifiable to the unaided eye.
7. Chill Wrinkle - (*)
8. Cords - Buried or Inside - (*)
9. Dirty Mold - (*)
10. Mold Haze (Outside Surface) - (*)

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III. CRITERIA WITHIN QUALITY AREA (continued)

11. Gob Mark (Inside Surface) - (*)
12. Carbonized Mold - (*) and shall not extend more than 1/4" into the quality area.
13. Pits - (*)
14. Laps (Inside Surface) - (*)
15. Oil Spots - (*)
16. Scratch - Width of .002" or under - Unlimited length
Over .002" through .004" width, maximum length 1"
Over .004" through .006" width, maximum length 1/2"
Over .006" width - None allowed.
17. Spew - (*)
18. Scuff - Shall be considered as an opaque spot, See Items 1, 2 and 3 for allowable number and size.
19. Shear Mark - None permitted within the quality area on the inside or outside surface.
20. Suck-up - Round Bulbs - (*)
Rectangular Bulbs - (*) intensity and location
21. Color Streak - Cord - Shall be considered as opaque spot, see Items 1, 2 and 3 for allowable number and size.

Tail - None permitted.

Low density -
color streak (*)

22. Transmission - the transmission of the center of the bulb face shall be the value shown on the individual bulb criteria.
23. Chromaticity - In combination with the sulfide type standard P4 phospor, with a color temperature of 7000°K, the CIE coordinates at the center of the color hexagon shall be x=0.3044, y=0.3177. The 6 corners of the color hexagon are at:

x	y
.2996	.3129
.2996	.3161
.3060	.3225
.3092	.3225
.3092	.3193
.3028	.3129



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IV. CRITERIA OUTSIDE QUALITY AREA

1. Blisters - (0.030" and under not considered)

A. Buried - There shall be no blisters over 0.375" round or 0.125" x 1.250" elliptical or 0.250" x 0.750" elliptical. There shall be no blisters over 1.250" in length. In any 2" diameter circle, there shall be no more than 11 blisters over 0.030" diameter or equivalent of which not more than 3 shall be over 0.310" in diameter or equivalent and not more than 2 shall be over 0.750" in length.

B. Open - There shall be no blisters over 0.090" diameter or equivalent. There shall be no more than 3 open blisters in the sealed bulb.

2. Bruises - (*)

There shall be none visible to the unaided eye on the panel between the mold seam and the quality circle.

3. Stones -

There shall be no stones over 0.120". There shall be no exposed (not glazed over) stones over 0.030" on outside glass surface.

In the sealing zone - There shall be no stones over 0.015".

There shall be no more than 5 stones total.

The separation shall not be less than 0.380".

4. Checks - There shall be no checks or cracks of any degree beyond 1/4" from the open end of the neck other than mentioned under "bruises".

5. Chips - There shall be no chips on neck flare that extend more than 1/8" from the edge. All chips visible to the unaided eye shall be glazed over.

6. Glass Knots - There shall be no knots over 0.190" and they shall not protrude more than 0.030".

7. Laps - Radius - (*)

Cast Funnels - All degrees of circumferential laps within 1" of reference line 0.031" to 0.062" deep - 3 permitted, laps over 0.062" deep are not acceptable.