Inspection Standard: LCDs, Bonded Assemblies, Displays

Quality

Document #: 24-01550-W
Revision: C

Revision History:

Rev	Change Order	Description	Date	Prepared By	Approved By
A	C3-02021	Initial Release	7/20/2021	Kari Niebell	Sara Liddi, Michael Watkins
B	C3-02593	Updated section 4 Responsibilities to include supplier responsibilities. Also added general communication and compliance responsibilities. Updated section 5.4 General Acceptance Criteria Updated section 12 Bonding Agent to remove the requirement for no gaps and to add the requirement for no visible bonding agent in the viewing area. Updated section 13 Bruising and Shadowing to include criteria for wrinkled film. Updated section 16, Luminance to include reporting requirements	6/16/2022	Kelsey Richer	Michael Watkins Kari Niebell
C	C3-04937	Updated Part Number to include the -W suffix. Updated Section 1 - Purpose to add a reference to 24-01601, Work Instruction: LCD, Bonded Assembly, Display Inspection and Test Setup, and product-specific ATPs. Updated Section 2 – Scope to include Customer Service and Production Test. Added Section 4 – References Updated Section 5 – Responsibilities to include Customer Service and Manufacturing Test Updated Section 20 – Related Documents to include all related documents	4/21/2026	Kari Niebell	Michael Watkins

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1 Purpose

This standard defines the visual and cosmetic acceptance criteria for display-related components and assemblies, including LCDs, bonded assemblies, finished products, and returned material (RMA).

Inspection setup and execution methods are defined in 24-01601, LCD, Bonded Assembly, Display Inspection and Test Setup, which establishes the baseline inspection configuration and methodology. In addition, part number-specific Acceptance Test Procedures (ATPs) define detailed test requirements and acceptance criteria unique to each product configuration.

2 Scope

This procedure applies to all LCDs, bonded assemblies, and displays that enter and exit ZMicro. This includes raw LCDs, and bonded assemblies at the component level as well as when installed in a chassis. It is intended for the use of the Quality Department, Manufacturing Test, and Customer Service, and outlines inspection criteria that Quality personnel must follow during the inspection process at ZMicro. This includes incoming, in-process, final, and any other type of inspection that may occur. ZMicro personnel should refer to this procedure if they discover product that causes them to question its conformance. As with all material/product with anomalies, Quality must be alerted so they may make the final disposition decision.

- Optical Shield part number prefix: 17
- LCD and Display part number prefix: 16

3 Definitions

Foreign Object Debris (FOD): A substance, debris, or article alien to a system that would potentially cause damage.

LCD: COTS component. Unbonded. ZMicro P/N 16-XXXXX

Bonded Assembly: LCD with front glass bonded. ZMicro P/N 16-XXXXX.XX where .XX represents the bonded layers.

Sub-Assembly Display: Bonded Assembly installed in chassis. ZMicro P/N 14-XXXXX. This typically reports directly to the finished goods part number or model number.

4 References

- IPC-A-610 Acceptability of Electronic Assemblies

5 Responsibilities

Customer Service: Ensure that all returned material (RMA) is evaluated in accordance with the visual and cosmetic acceptance criteria defined in this standard when coordinating customer returns and communicating disposition.

Manufacturing Test**:** Adhere to the visual and cosmetic acceptance criteria defined in this standard during production testing and handling of display-related assemblies, ensuring any nonconformances are identified and properly documented. Quality Assurance Leadership: Establish, maintain, andenforce the requirements as defined in this document.

Quality Control Inspectors: Use the criteria defined in this document when performing inspection of applicable components, assemblies, finished products, and returned material (RMA).

Quality Engineering: Use the criteria defined in this document when developing and maintaining inspection procedures, work instructions, and test methods.

Supplier: Provide all parts and services in accordance with Purchase Orders, drawings, specifications, and this standard.
Supplier Quality Representative:

- Communicates product quality requirements to suppliers
- Serves as the primary interface with suppliers
- Coordinates process improvements, non-conforming material dispositions, corrective actions, and surveillance auditing as needed.

ZMicro Employees: Use the criteria defined in this document when working with ZMicro products and inform QA of any discrepancies found.

5.1 Communication

All product-quality related communication between ZMicro and its suppliers, including questions or requests for additional information, should include the Supplier Quality representative.

5.2 Compliance

Full compliance from all organizations within scope is expected at the time of issuance of this document. Any specification exceptions to references in this document by the supplier must be submitted by the supplier and approved by the appropriate ZMicro representative and documented accordingly. **In the event of a conflict between this document and the manufacturer's COTS specification (ie LCD datasheets or glass manufacturer specification), the manufacturer's documentation takes precedence.**

6 Inspection Requirements

- Cosmetic inspection at ZMicro shall use the Time and Distance method of inspection described in this document.
- The requirements defined in this document should be used for training personnel who perform assembly, inspection, and test of LCDs, bonded assemblies and displays.
- If a non-conformity as defined in the sections below is identified at ZMicro, it must be documented on the corresponding traveler and processed per 22-0034P, Non-Conforming Material.

6.1 Viewing Conditions

- Inspection shall be conducted using the unaided eye. Magnification may be used as an aid to evaluate an observed condition.
- Viewing distance shall be as specified by the corresponding surface class.
- Viewing time shall be as specified by the corresponding surface class.
- Viewing angle shall be 45° left, right and center line to the surface, unless otherwise specified.

- Lighting: Ambient Production floor lighting. If shadows are present, a light source may be positioned and distanced to provide optimal viewing and minimized glare and shadowing of the component under inspection.
- Light source shall be cool white fluorescent light; the light source shall be positioned and distanced to provide optimal viewing and minimized glare and shadowing of the component under inspection.
- Light source may differ in certain luminance test cases, where a dark room or blackout tent may be required.
- In the case where black light or other special lighting is required to detect or accent defects, the specifics in this procedure shall prevail, unless exempted in writing by the customer.
- In the case of subjectivity, ZMicro Quality Leadership must be notified for a disposition determination. Form/fit/function will be considered and take precedence. ZMicro may contact the customer at the discretion of management.
- During cosmetic inspection, only appearance of the part surface shall be considered.
- Unit under test shall be powered on unless otherwise specified.

6.2 Surface Classes

The surface of all parts is classified into specific areas to differentiate between the different levels of part visibility on a finished product. These areas are referred to as surface classes. The four different zones used by ZMicro are defined as A, B, C, and D.

The following assumes the display being viewed is an assembled unit as it would appear in an operational environment.

Unless otherwise stated, viewing distance and duration shall be based on part classification. Displays will only fall within two surface classes at ZMicro: A and D.

Class A	This is the area that is directly exposed to the view of the user during operation. Examples include: Front screen of display.
Class B	N/A for LCDs.
Class C	N/A for LCDs.
Class D	This is the area that is out of view in the finished product. Examples include: Sides/edges/corners of glass that are not visible when installed in bezel. Rear of LCD where connectors are located.

Viewing Surface	Class A	Class B	Class C	Class D
Viewing Distance	18 inches	N/A for LCDs	N/A for LCDs	N/A
Viewing Time	10 seconds	N/A for LCDs	N/A for LCDs	N/A

6.3 Inspection Tools

Luminance Meter: Various stages of production may utilize any of the three types of luminance meters listed below:

Gossen Mavo-Monitor USB. Incoming and Test for product acceptance

Minolta LS-100. (Darkroom)

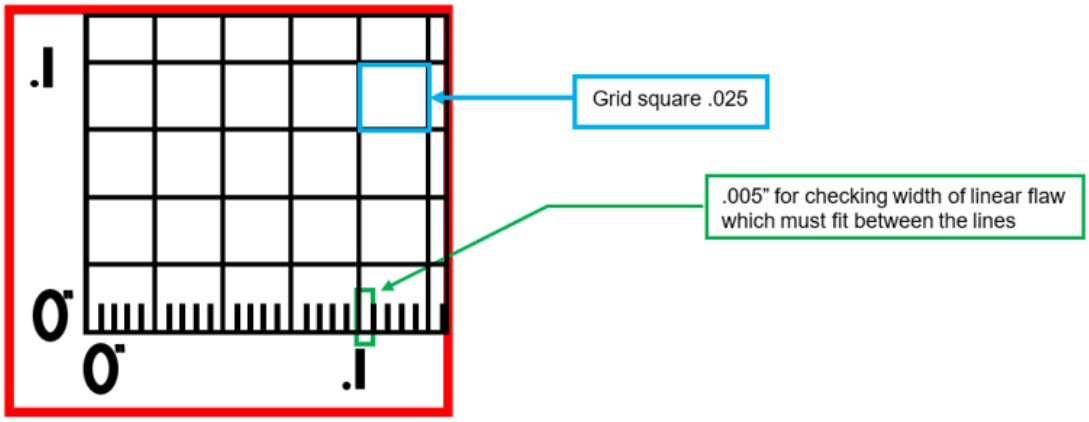
Luminance test templates:

5-point: Used for 3.5” display

9-point: Used for all displays greater than 3.5”

Reticle: A series of fine lines or fibers in the eyepiece of an optical device, such as a telescope or microscope, or on the screen of an oscilloscope, used as a measuring scale or an aid in locating objects.

- All dimensions will be measured using the reticle grid shown below. Widths required to be .004 or below will be measured using the .005 grid markers. You can see in this enlarged reticle view below the .025 squares and the .005 grid markers.



6.4 General Acceptance Criteria

- Products must meet requirements specified in this document and the drawing.
  - Note: When a discrepancy exists between this document and the drawing, the drawing takes priority.
- Acceptable defects shall not affect the fit, form, or function of the product.
- Dimensions on drawing apply to the finished part.
- Cleanliness of parts:
  - Product should be free of dirt, grease, oils, contaminants, and any removable foreign material. The exception to this is mylar/protective film used to protect LCD screens during the manufacturing/handling/shipping process.
  - ZMicro may clean or reject material for unacceptable cleanliness. Screen should not become damaged when cleaned with isopropyl alcohol.

7 Dimensional Verification

Supplier - The part shall match the drawing requirements.

ZMicro - Verify and inspect per Incoming Inspection Procedure (24-0031P) and Incoming Inspection Checklist (24-01482).

8 Mechanical Verification

Ensure that connectors are fully intact and seated, with no bent/broken pins.

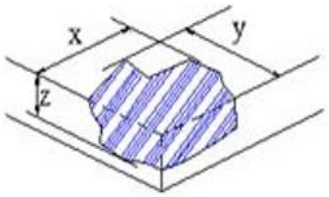
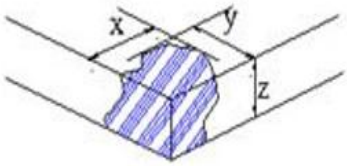
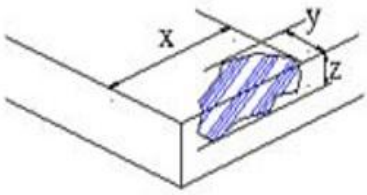
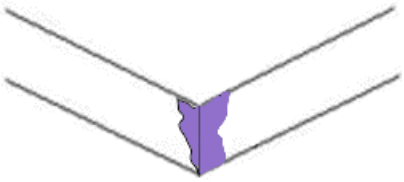
Ensure that any exposed boards are not damaged, missing components, or have exposed traces.

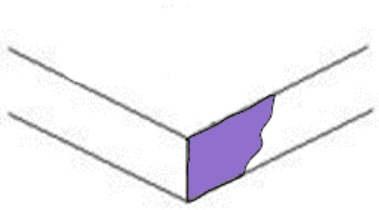
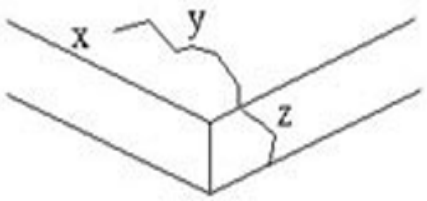
Ensure that rear of unit has a clean surface, free of any bonding process residue that may impede continuity.

9 Glass Anomalies

9.1 Acceptance Criteria

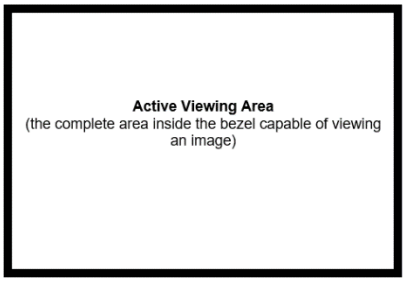
When evaluating cracks, chips, or corner displacement, use the figure below to measure the anomaly. Chip shall not extend into the area visible to user. Chips shall only be accepted if they are not visible on the final product, such as when they remain under the bezel.

	
<u>Chip on all 3 planes (2 partial edges + front)</u> X: Accept max of 0.5” Y: Accept max of 0.5” Z: Accept max of glass thickness (Chip can be the full thickness)	<u>Chips on all 3 planes (2 full edges + front)</u> X: Accept max of 0.5” Y: Accept max of 0.5” Z: Accept max of glass thickness
	
<u>Chip on 2 planes (1 partial edge + front)</u> X: Accept max of 0.5” Y: Accept max of 0.5” Z: Accept max of glass thickness	<u>Chip on 2 planes (2 full edges)</u> X: Accept max of 0.5” Y: Accept max of 0.5” Z: Accept max of glass thickness

	
<u>Chip on 1 plane (1 full edge)</u> X: Accept max of 0.5” Y: Accept max of 0.5” Z: Accept max of glass thickness A chip may exceed 0.5” in length up to 1” if it exists only on the plane shown (glass thickness) and at least half the length is shallow (up to depth of 0.1”).	<u>Cracks: Reject</u> <u>Circular chips: Reject</u>

10 Pixel Flaws

All specifications apply to the active viewing area regardless of display size.



10.1Definitions

Stuck sub-pixels: When a pixel is black or different from the primary color on the screen.

Examples include: A black pixel on a red screen or a red pixel on a white screen.

Bright sub-pixel: Visible as a colored dot on a black screen.

Bright dots: When a pixel is displayed as a white dot on a black screen.

Dark pixel flaws: When a pixel is displayed as a black dot on a white screen.

The size of a defective area over 1/2 of a whole dot is regarded as one defective dot.

10.2Acceptance Criteria

Pixel Flaw Type	Group 1	Group 2	Group 3	Group 4	Group 5
Example display sizes	3.5”	10.1”	15.6” 17” 19” 21.3”	24” 32”	N/A
D (mm)	Area cm² <100	Area cm² 100<400	Area cm² 400<1600	Area cm² 1600<3600	Area cm² 3600+
D (in)	Area in² <15.5	Area in² 15.5<62	Area in² 62<248	Area in² 248<558	Area in² 558 +
Stuck sub-pixel	2	5	5	5	5
Stuck single pixel	1	3	3	3	3
Stuck pixel group (two adjacent)	0	1	1	1	1
Bright dots	1	4	4	4	4
Dark pixel flaws	1	3	3	3	3
Maximum allowable pixel flaws	2	5	5	5	5

11 Inclusion Anomalies

These are anomalies within the laminate or materials of the laminate.

Note: All measurements are specified as metric and imperial units: millimeters (mm) centimeters (cm) and inches (in). Defect criteria is specified as thousandths of an inch.

11.1 Opaque Anomalies

This class of defect pertains to those which are visible, but do not allow the transmission of light. Opaque/dark anomalies are seen under transmitted light. If above a certain size these anomalies will cause distraction and interference when the display is in use.

11.1.1 Opaque Circular and/or Non-Linear Anomalies

The effective diameter of a non-circular defect will be the average of the defect's length and width (equivalent diameter = (L+W)/2)

Examples: dirt spots, dust, bubbles

11.1.2 Acceptance Criteria

Defect Size	Group 1	Group 2	Group 3	Group 4	Group 5
Example display sizes	3.5"	10.1"	15.6" 17" 19" 21.3"	24" 32"	N/A
D (mm)	Area cm^2 <100	Area cm^2 100<400	Area cm^2 400<1600	Area cm^2 1600<3600	Area cm^2 3600+
D (in)	Area in^2 <15.5	Area in^2 15.5<62	Area in^2 62<248	Area in^2 248<558	Area in^2 558 +
D ≤ .20 mm	Ignore	Ignore	Ignore	Ignore	Ignore
D ≤ .008 in	Ignore	Ignore	Ignore	Ignore	Ignore
D between .20 mm and .30 mm	3	Ignore	Ignore	Ignore	Ignore
D between .008 in and .012 in	3	Ignore	Ignore	Ignore	Ignore
D between .30 mm and .40 mm	1	3	5	5	Ignore
D between .012 in and .016 in	1	3	5	5	Ignore
D between .40 mm and .50 mm	0	1	3	5	10
D between .016 in and .020 in	0	1	3	5	10
D between .50 mm and 1.0 mm	0	0	3	5	5
D between .020 in and .040 in	0	0	3	5	5
D > 1.0 mm	0	0	0	0	0
D > .040 in	0	0	0	0	0
Separation of defects mm	>10	>10	>10	>10	>10
Separation of defects in	>.400	>.400	>.400	>.400	>.400
Total defects allowed	**3**	3	5	7	10

**Opaque Circular and/or Non-Linear Anomalies outside of the viewing area are acceptable.*

11.1.3 Opaque Linear Anomalies

Examples: dark mesh fragments, hair

11.1.4 Acceptance Criteria

Defect Size	Group 1	Group 2	Group 3	Group 4	Group 5
Example display size	3.5”	10.1”	15.6” 17” 19” 21.3”	24” 32”	N/A
D (mm) **(W=width, L=Length)**	Area cm^2 <100	Area cm^2 100<400	Area cm^2 400<1600	Area cm^2 1600<3600	Area cm^2 3600+
D (in)	Area in^2 <15.5	Area in^2 15.5<62	Area in^2 62<248	Area in^2 248<558	Area in^2 558 +
W ≤ 0.025	Ignore	Ignore	Ignore	Ignore	Ignore
W ≤ 0.001	Ignore	Ignore	Ignore	Ignore	Ignore
W between 0.025 and 0.050 x L	3 x < 3	5 x <5	5 x <10	5 x <10	5 x <10
W between 0.001 and .002 x L	3 x < .118	5 x <.197	5 x <.40	5 x <.40	5 x <.40
W > 0.050 x L	0	0	5 x <10	5 x <10	5 x <10
W > 0.002 x L	0	0	5 x <.40	5 x <.40	5 x <.40
Separation of defects mm	>10	>10	>10	>10	>10
Separation of defects in	>.40	>.40	>.40	>.40	>.40
Total defects allowed	3	5	5	10	10
Accumulated length mm	<10	<30	<50	<100	<100
Accumulated length in	<.394	<1.181	<1.969	<3.937	<3.937

**Opaque Linear Anomalies outside of the viewing area are acceptable.*

11.2 Translucent Anomalies

This class of anomalies are generally not visible when the display is in use but above a certain size, they may be cosmetically unacceptable to the appearance of the display in the off state.

11.2.1 Translucent Circular and/or Non-Linear Anomalies

Examples: watermarks, adhesive bubbles

11.2.2 Acceptance Criteria

Defect Size	Group 1	Group 2	Group 3	Group 4	Group 5
Example display sizes	3.5”	10.1”	15.6” 17” 19” 21.3”	24” 32”	N/A
D (mm)	Area cm^2 <100	Area cm^2 100<400	Area cm^2 400<1600	Area cm^2 1600<3600	Area cm^2 3600+
D (in)	Area in^2 <15.5	Area in^2 15.5<62	Area in^2 62<248	Area in^2 248<558	Area in^2 558 +
D ≤ .20	Ignore	Ignore	Ignore	Ignore	Ignore
D ≤ .008	Ignore	Ignore	Ignore	Ignore	Ignore
D between .20 and .76	3	5	5	5	5
D between .008 and .030	3	5	5	5	5
D > .762	0	0	0	0	0
D > .030	0	0	0	0	0
Separation of defects mm	>10	>10	>10	>10	>10
Separation of defects in	>.400	>.400	>.400	>.400	>.400
Total defects allowed	3	5	5	5	5

**Translucent Circular and/or Non-Linear Anomalies outside of the viewing area are acceptable.*

11.2.3 Translucent Linear Anomalies

Examples: white fibers, lint

11.2.4 Acceptance Criteria

Defect Size	Group 1	Group 2	Group 3	Group 4	Group 5
Example display sizes	3.5”	10.1”	15.6” 17” 19” 21.3”	24” 32”	N/A
D (mm) **(W=width, L=Length)**	Area cm^2 <100	Area cm^2 100<400	Area cm^2 400<1600	Area cm^2 1600<3600	Area cm^2 3600+
D (in)	Area in^2 <15.5	Area in^2 15.5<62	Area in^2 62<248	Area in^2 248<558	Area in^2 558 +
D = W ≤ .025 and L < 5 **D = W ≤ .025 and L between 5 and 25**	Ignore 0	Ignore 2	Ignore 5	Ignore Ignore	Ignore Ignore
D = W ≤ .001 and L < .19 **D = W ≤ .001 and L between .19 and .984**	Ignore 0	Ignore 2	Ignore 5	Ignore Ignore	Ignore Ignore
D = W between .025 and .050 x L	5 x <10	5 x <10	10 x <15	10 x <25	10 x <25
D = W between .001 and .002	5 x <.39	5 x <.39	10 x <.591	10 x <.984	10 x <.984
D = W > 0.050 x L	0	0	0	1 x <25	3 x <25
D = W > .002 x L	0	0	0	1 x < .984	3 x < .984
Separation of defects mm	>10	>10	>10	>10	>10
Separation of defects in	>.400	>.400	>.400	>.400	>.400
Total defects allowed	3	5	10	10	10
Accumulated length mm	<20	<50	<100	<150	<200
Accumulated length in	<.787	<1.969	<3.937	<5.906	<7.874

**Translucent Linear Anomalies outside of the viewing area are acceptable.*

12 Surface Anomalies

These are generally only visible under reflected light. Any surface anomalies which are visible under transmission, when the display is in use, are unacceptable.

12.1 Viewing Conditions

- The display must be off for verification of compliance to the dimensional criteria.
- The display must be powered on for verification of any previously identified anomalies for visibility under transmission.

12.2 Scratches

12.2.1 Acceptance Criteria

Defect Size	Group 1	Group 2	Group 3	Group 4	Group 5
Example display sizes	3.5”	10.1”	15.6” 17” 19” 21.3”	24” 32”	N/A
D (mm)	Area cm^2 <100	Area cm^2 100<400	Area cm^2 400<1600	Area cm^2 1600<3600	Area cm^2 3600+
D (in)	Area in^2 <15.5	Area in^2 15.5<62	Area in^2 62<248	Area in^2 248<558	Area in^2 558 +
W ≤ .010	Ignore	Ignore	Ignore	Ignore	Ignore
W ≤ .0004	Ignore	Ignore	Ignore	Ignore	Ignore
W between .010 and .10 x L	3 x <10	3 x <25	5 x <25	5 x <25	5 x <25
W between .0004 and .004 x L	3 x <.394	3 x <.984	5 x <.984	5 x <.984	5 x <.984
W > .10	0	0	5 x <5	5 x <10	5 x <10
W > .004	0	0	5 x <.197	5 x <.394	5 x <.394
Separation of defects	>10	>5	>5	>5	>5
Separation of defects	>.400	>.197	>.197	>.197	>.197
Total defects allowed	3	3	5	5	10
Accumulated length mm	<20	<50	<100	<100	<100
Accumulated length in	<.787	<1.969	<3.937	<3.937	<3.937

**Surface Anomalies outside of the viewing area are acceptable.*

12.3 Coating Anomalies

Examples: pin-holes, voids

12.3.1 Acceptance Criteria

Defect Size	Group 1	Group 2	Group 3	Group 4	Group 5
Example display sizes	3.5”	10.1”	15.6” 17” 19” 21.3”	24” 32”	N/A
D (mm)	Area cm^2 <100	Area cm^2 100<400	Area cm^2 400<1600	Area cm^2 1600<3600	Area cm^2 3600+
D (in)	Area in^2 <15.5	Area in^2 15.5<62	Area in^2 62<248	Area in^2 248<558	Area in^2 558 +
Irregular patches missing	0	0	0	0	0
Bright circles. D < 0.30	Ignore	Ignore	Ignore	Ignore	Ignore
Bright circles. D (in) < .012	Ignore	Ignore	Ignore	Ignore	Ignore
Bright circles. D between 0.30 and 1.0	3	5	5	15	Ignore
Bright circles. D between .012 and .039.	3	5	5	15	Ignore
Bright circles. D between 1.0 and 2.0	0	0	5	10	15
Bright circles. D between .039 and .079.	0	0	5	10	15
Bright circles D between 2.0 and 5.0	0	0	0	5	10
Bright circles. D between .079 and .197.	0	0	0	5	10
Bright circles D > 5.0	0	0	0	0	0
Bright circles. D > .197	0	0	0	0	0
Total defects allowed	3	5	5	15	15

**Coating Anomalies outside of the viewing area are acceptable.*

12.4 Surface Distortion

Examples: ripples, pillowing, dimples

12.4.1 Viewing Conditions

- Viewing Angle: Center line
- The display must be powered off
- The display must be acclimated to ambient “room” temperature

12.4.2 Acceptance Criteria

Defect Size	Group 1	Group 2	Group 3	Group 4	Group 5
Example display sizes	3.5”	10.1”	15.6” 17” 19” 21.3”	24” 32”	N/A
D (mm)	**Area cm²** **<100**	**Area cm²** **100<400**	**Area cm²** **400<1600**	**Area cm²** **1600<3600**	**Area cm²** **3600+**
D (in)	**Area in²** **<15.5**	**Area in²** **15.5<62**	**Area in²** **62<248**	**Area in²** **248<558**	**Area in²** **558 +**
*** Ripples:** Waves in the top layer in a specific area <50% of the Surface Area	No distortion under transmission	No distortion under transmission	No distortion under transmission	No distortion under transmission	No distortion under transmission
*** Pooling Ripples: -** Ripples that originate at a specific spot and emanate with concentric circles	No distortion under transmission	No distortion under transmission	No distortion under transmission	No distortion under transmission	No distortion under transmission
*** Pillowing:** Wave in the top layer >50% of the Surface Area	0	0	0	0	0
Dimples: Circular distortions in the reflected image that cause distortion under transmission	No distortion under transmission	No distortion under transmission	No distortion under transmission	No distortion under transmission	No distortion under transmission
Hollow or protuberance spot: Void or bump	Diameter <.025	Diameter <.025	Diameter <.025	Diameter <.030	Diameter <.030

**Note: 24-01499 Ripple Inspection: GCS takes precedence over this document for all GCS displays and bonded assemblies destined for GCS displays.*

13 Bonding Agent

The bonding agent may not extend beyond the edges of float glass.

13.1Acceptance Criteria

No visible bonding agent in the viewing area.

14 Bruising and Shadowing

Bruising – White spots on a black (or very dark) screen

Shadowing – Dark spots on a white (or very light) screen. Dark shadows can appear on an LCD screen when a static image has been displayed for an extended period of time.

Wrinkled films may also appear as a shadow.

14.1 Acceptance Criteria

No bruising or shadowing visible at 45° left, right and center line to the surface is permitted.

Reference Image Gallery for examples

15 Yellowing

15.1 Acceptance Criteria

No yellowing

Reference Image Gallery for examples

16 Backlight Bleed (Light Leak)

In some LCD's, light can be seen leaking from the edges or corners of the screen

16.1 Test Parameters

Measurement Location: Brightest area of the display

Test Pattern: Black screen

16.2 Acceptance Criteria

Defect Size	Group 1	Group 2	Group 3	Group 4	Group 5
Example display sizes	3.5"	10.1"	15.6" 17" 19" 21.3"	24" 32"	N/A
D (mm)	Area cm^2 <100	Area cm^2 100<400	Area cm^2 400<1600	Area cm^2 1600<3600	Area cm^2 3600+
D (in)	Area in^2 <15.5	Area in^2 15.5<62	Area in^2 62<248	Area in^2 248<558	Area in^2 558 +
Backlight Bleed	≤10 nits *variance	<3 nits *variance	< 3 nits *variance	< 3 nits *variance	< 3 nits *variance

*Variance between the darkest background (typically a black screen) and the brightest areas on the dark/black background.

Backlight bleed that is visible when the display is in use is unacceptable.

17 Luminance

17.1 Acceptance Criteria

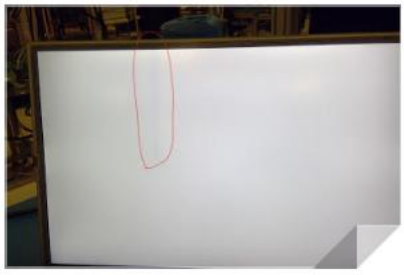
- Refer to the bonded assembly drawing for minimum luminance requirements, and non-uniformity.
- Refer to the LCD data sheet for native resolution.
- Place the display size specific template on the LCD/bonded assembly and measure the luminance of each of the specified locations.
- The minimum luminance value is calculated as an average of all points measured.

Note for Suppliers: Unit specific luminance data shall be documented and forwarded to ZMicro along with the corresponding units. This may be in the form of an LCD/Display Inspection Worksheet, or electronic file forwarded at the time of shipment.

18 Image Gallery

This section contains images of acceptable and rejectable conditions. This section does not contain images of all failure modes, however many of the more frequently encountered defects are represented.

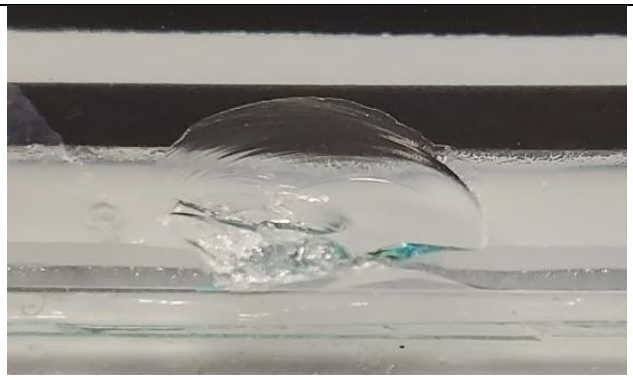
Reject	Backlight Bleed (aka Light Leak)
 *Figure 1*	Reject for ≥ 3 nits variance Reject for > 10 nits variance (3.5” only) Refer to 16.2 Backlight Bleed Acceptance Criteria

Reject	Bruising and Shadowing
  *Figure 3*	Reject for visible bruising or shadowing Refer to 0 Bruising and Shadowing

	Bright Circles
 *Figure 4*	Refer to 12.3 Coating Anomalies for acceptance criteria

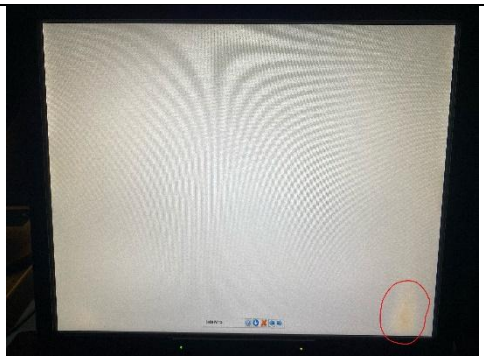
Reject	Chips
 *Figure 5*	Reject for existence on all 3 planes Reject for exceeding a depth of 0.1” Refer to 9 Glass Anomalies

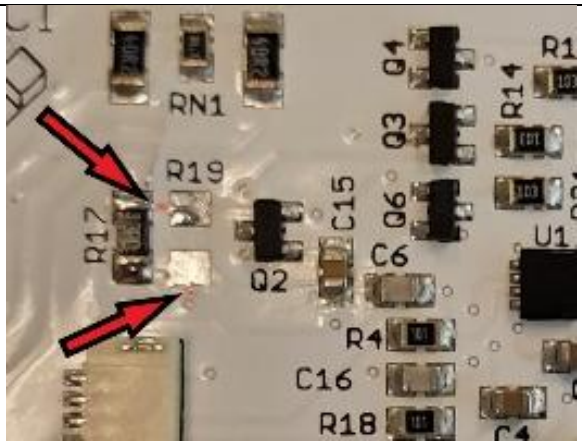
Accept	Chips
 *Figure 6*	Accept for existence on only 1 plane Accept for depth of < 0.1” Refer to 9 Glass Anomalies

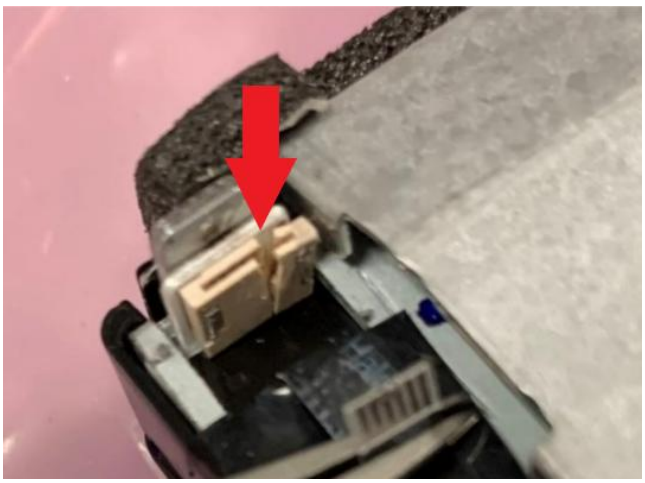
Reject	Chips
 *Figure 7*	Reject for large circular Refer to 9 Glass Anomalies

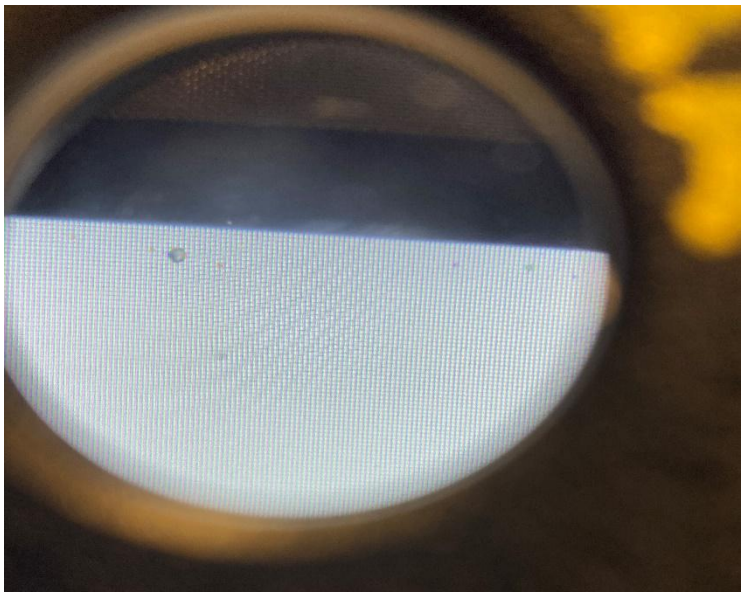
Reject	Ripples
 *Figure 8*	Reject for visible ripples Refer to 12.4 Surface Distortion

Reject	Pooling Ripples
 *Figure 9*	Reject for visible pooling ripples Refer to 12.4 Surface Distortion

Reject	Yellowing
 *Figure 10*	Reject for visible yellowing Refer to 15 Yellowing

Reject	Exposed Copper/Tears over Traces
 *Figure 11*	Reject for exposed copper and torn areas over traces Refer to IPC-A-610

Reject	Cracked Connectors
 *Figure 12*	Reject for cracked connectors Refer to IPC-A-610

Reject	Bubbles
 *Figure 13*	Reject for quantity and spacing Refer to 11.1.2 Opaque Circular Defects

19 Record Retention

Records required by this procedure are maintained per 30-0007P, Control of Records.

20 Related Documents

- QA Inspection Procedures (Visual Factory)
- Bonded Assy Drawings
- 24-0031P Incoming Inspection
- 24-01482 Incoming Inspection Checklist
- 24-01499 GCS Ripple Inspection
- 24-01518 LCD Incoming Log
- 24-01601 Work Instruction, LCD, Bonded Assembly, Display Inspection and Test Setup
- 30-0007P Control of Records