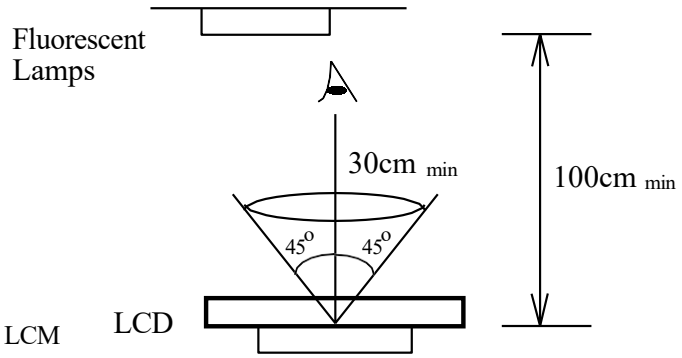
LCD Quality Inspection Standards

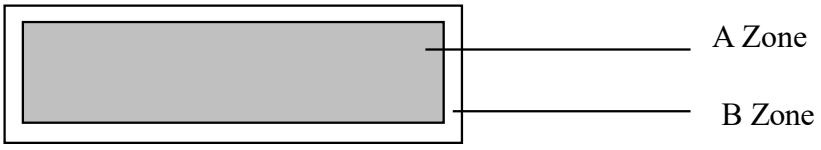
Product Appearance Testing Standard

Manner of appearance test: The inspection should be performed in using 20W x 2 fluorescent lamps. Distance between LCM and fluorescent lamps should be 100 cm or more. Distance between LCM and inspector eyes should be 30 cm or more.

Viewing direction for inspection is 45° from vertical against LCM.



Definition of zone:



A Zone: Active display area (minimum viewing area).

B Zone: Non-active display area (outside viewing area).

Sampling Plan

According to MIL-STD-105E, Level II, Single Sampling

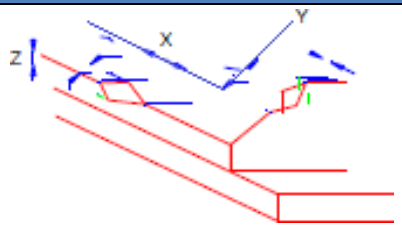
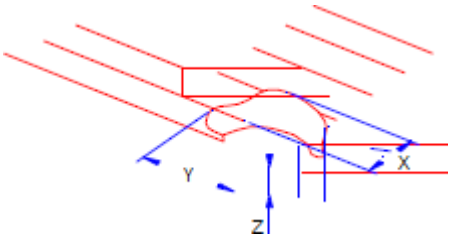
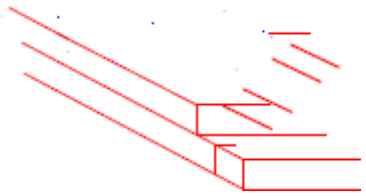
Major defect	Minor defect
0.65	1.0

LCD: Liquid Crystal Display, TP: Touch Panel, LCM: Liquid Crystal Module

No	Items to be inspected	Criteria	Classification of defects
1	Functional defects	1. Short or Open Circuit 2. LC Leakage 3. Flickering 4. No Display 5. Wrong Viewing Direction 6. Contrast Defect 7. Backlight Defect 8. Flat Cable or Pins Reversed	Major
2	Missing	Missing Components	
3	Outline dimension	Overall outline dimension beyond the drawing is not allowed	
4	Display State	Color unevenness, refer to limited sample	Minor
5	Polarizer	Light dot, Dim spot, Polarizer Bubble; Polarizer accidented spot.	
6	Soldering	Good connection, peeling off is not allowed.	
7	Wire / TAB	Poor Connection / Position & Bonding Strength	

Criteria Visual

LCD Broken/Crack

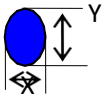
No.	Description	Criteria	Visual
1	Edge of LCD Broken	X ≤ 3mm Y < border line seal Z ≤ T	
2	LCD Corner Broken	X ≤ 3mm Y < L Z ≤ T	
3	LCD Crack	Not allowed	

Note: X=Length, Y=Width, Z=Height, L=Length of ITO, T=Height of LCD

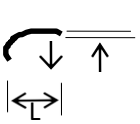
Number	Items	Criteria
1	No display	Not allowed
2	Missing segment	Not allowed
3	Short	Not allowed
4	Backlight not lighting	Not allowed
5	TP not functioning	Not allowed

Spot Defect

<table>
<tr><th>No</th><th>Description</th><th>Acceptable Quality</th></tr>
<tr><td rowspan="6">1</td><td>Short or open circuit</td><td rowspan="6">Not allowed</td></tr>
<tr><td>LC leakage</td></tr>
<tr><td>Flickering</td></tr>
<tr><td>No display</td></tr>
<tr><td>Wrong viewing direction</td></tr>
<tr><td>Wrong Back-light</td></tr>
<tr><td>2</td><td>Contrast defect
Background color deviation</td><td>Refer to approval sample</td></tr>
<tr><td>3</td><td>Point defect,
Black spot, dust
(including Polarizer)

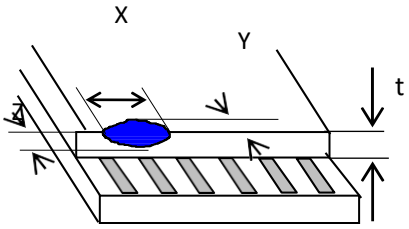
Φ = (X+Y)/2</td><td> 

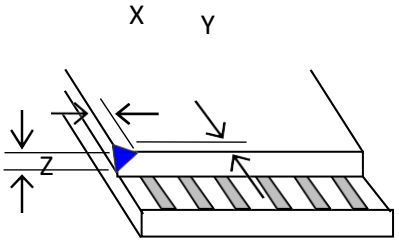
<table>
<tr><th>Point Size</th><th>Acceptable Qty.</th></tr>
<tr><td>0.10 ≤ Φ</td><td>Disregard</td></tr>
<tr><td>0.10≥0.20</td><td>3</td></tr>
<tr><td>0.20≥0.25</td><td>2</td></tr>
<tr><td>0.25≥0.30</td><td>1</td></tr>
<tr><td>0.30< Φ</td><td>0</td></tr>
</table>
Unit： mm</td></tr>
<tr><td>4</td><td>Line defect,

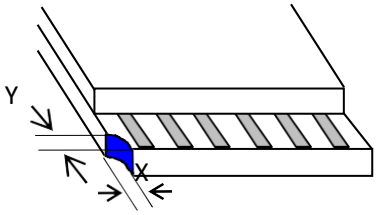
Scratch</td><td> 

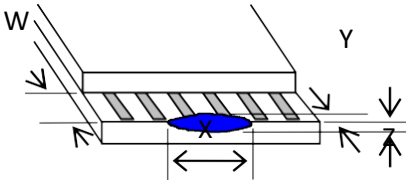
<table>
<tr><th colspan="2">Line</th><th>Acceptable Qty.</th></tr>
<tr><td>L</td><td>W</td><td></td></tr>
<tr><td>---</td><td>0.015≥W</td><td>Disregard</td></tr>
<tr><td>3.0≥L</td><td>0.03≥W</td><td rowspan="2">2</td></tr>
<tr><td>2.0≥L</td><td>0.05≥W</td></tr>
<tr><td>1.0≥L</td><td>0.1＞W</td><td>1</td></tr>
<tr><td>---</td><td>0.05W</td><td>Applied as point defect</td></tr>
</table>
Unit: mm</td></tr>
<tr><td>5</td><td>Rainbow</td><td>Not more than two color changes across the viewing area.</td></tr>
</table>

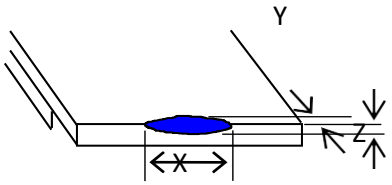
<table>
<tr><th>No.</th><th>Description</th><th>Acceptable Quality</th></tr>
<tr><td>6</td><td>Chip

Remark:
X: Length direction
Y: Short direction
Z: Thickness direction
t: Glass thickness
W: Terminal Width</td><td>


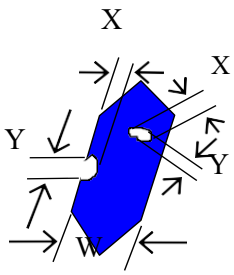
Acceptable criterion
<table>
<tr><th>X</th><th>Y</th><th>Z</th></tr>
<tr><td>≤2</td><td>0.5mm</td><td>≤t/2</td></tr>
</table>


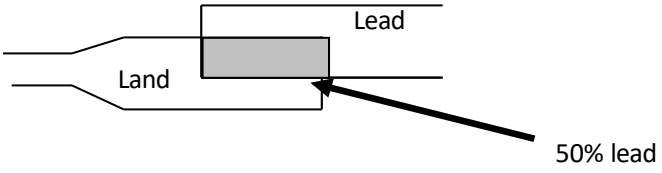
Acceptable criterion
<table>
<tr><th>X</th><th>Y</th><th>Z</th></tr>
<tr><td>≤2</td><td>0.5mm</td><td>≤t</td></tr>
</table>


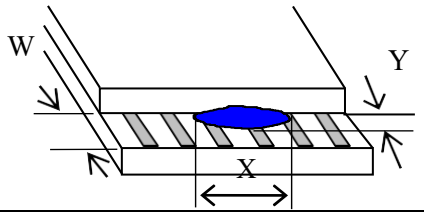
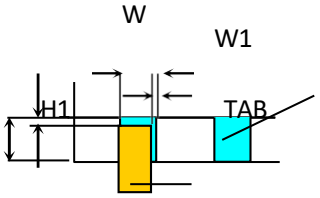
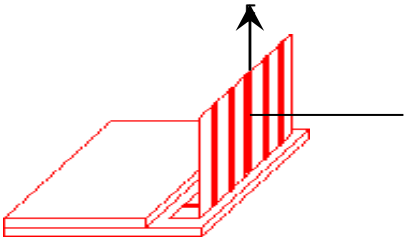
Acceptable criterion
<table>
<tr><th>X</th><th>Y</th><th>Z</th></tr>
<tr><td>≤3</td><td>≤2</td><td rowspan="2">≤t</td></tr>
<tr><td colspan="2">shall not reach to ITO</td></tr>
</table>


Acceptable criterion
<table>
<tr><th>X</th><th>Y</th><th>Z</th></tr>
<tr><td>Disregard</td><td>≤0.2</td><td>≤t</td></tr>
</table>


Acceptable criterion
<table>
<tr><th>X</th><th>Y</th><th>Z</th></tr>
<tr><td>≤5</td><td>≤2</td><td>≤t/3</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>No.</th><th>Description</th><th>Acceptable Quality</th></tr>
<tr><td>7</td><td>Segment pattern
W = Segment width φ
= (X+Y)/2</td><td>(1) Pin hole
φ < 0.10mm is acceptable.
 

<table>
<tr><th>Point Size</th><th>Acceptable Qty</th></tr>
<tr><td>φ≤1/4W</td><td>Disregard</td></tr>
<tr><td>1/4Wφ <≤1/2W</td><td>1</td></tr>
<tr><td>φ>1/2W</td><td>0</td></tr>
</table>
Unit: mm</td></tr>
<tr><td>8</td><td>Back-light</td><td>(1) The color of the backlight should correspond to its specification
(2) No flickering</td></tr>
<tr><td>9</td><td>Soldering</td><td>(1) Not allow heavy dirty and solder ball on PCB.(The size of dirty refer to point and dust defect) (2) Over 50% of lead should be soldered on Land.
 
</td></tr>
<tr><td>10</td><td>Wire</td><td>(3) Copper wire should not be rusted
(4) Not allow crack on copper wire connection.
(5) Not allow reversing the position of the flat cable.
(6) Not allow exposed copper wire inside the flat cable.</td></tr>
<tr><td>11*</td><td>PCB</td><td>(1) Not allow screw rust or damage.
(2) Not allow missing or wrong putting of component.</td></tr>
</table>

No.	Description	Acceptable Quality
12	Protruded W: Terminal Width	 Acceptable criteria: $Y \leq 0.4$
13	TAB	1.P osition  ITO W1</ 1/3w; H1 </ 1/3H 2 TAB bonding strength test  P (=F/TAB bonding width) ≥650gf/cm ,(speed rate: 1mm/min) 5pcs per SOA (shipment)
14	Total no. of acceptable Defect	A. Zone Maximum 2 minor non-conformities per one unit. Defect distance: each point to be separated over 10mm B. Zone It is acceptable when it is no trouble for quality and assembly in customer's end product.

Reliability Test Result

Condition

Item	Condition
High Temperature Operating	70℃,96H
Low Temperature Operating	-20℃, 96HR
High Temperature Storage	80℃, 96HR
Low Temperature Storage	-30℃, 96HR
High Temperature & High Humidity Storage	+40℃, 90% RH, 96 hours.
Temp. Cycle	30℃,30 min ↔ 80℃,30 min Change time:5min 20CYC.

Recovery time should be 24 hours minimum. Moreover, functions, performance and appearance shall be free from remarkable deterioration within 50,000 hours under ordinary operating and storage conditions room temperature (20+8□C), normal humidity (below 65% RH), and in the area not exposed to direct sun light.

Precautions

LCD/LCM is assembled and adjusted with a high degree of precision. Do not attempt to make any alteration or modification.

General Precautions:

1. LCD panel is made of glass. Avoid excessive mechanical shock or applying strong pressure onto the surface of display area.
2. The polarizer used on the display surface is easily scratched and damaged. Extreme care should be taken when handling. To clean dust or dirt off the display surface, wipe gently with cotton, or other soft material soaked with isopropyl alcohol, ethyl alcohol or trichlorotriflorothane, do not use water, ketone or aromatics and never scrub hard.
3. Do not tamper in any way with the tabs on the metal frame.
4. Do not make any modification on the PCB without consulting Focus LCDs
5. When mounting a LCM, make sure that the PCB is not under any stress such as bending or twisting. Elastomer contacts are very delicate and missing pixels could result from slight dislocation of any of the elements.
6. Avoid pressing on the metal bezel, otherwise the elastomer connector could be deformed and lose contact, resulting in missing pixels and also cause rainbow on the display.
7. Be careful not to touch or swallow liquid crystal that might leak from a damaged cell. Any liquid crystal adheres to skin or clothes, wash it off immediately with soap and water.

Static Electricity Precautions:

1. CMOS-LSI is used for the module circuit; therefore operators should be grounded whenever he/she comes into contact with the module.
2. Do not touch any of the conductive parts such as the LSI pads; the copper leads on the PCB and the interface terminals with any parts of the human body.
3. Do not touch the connection terminals of the display with bare hand; it will cause disconnection or defective insulation of terminals.
4. The modules should be kept in anti-static bags or other containers resistant to static for storage.
5. Only properly grounded soldering irons should be used.
6. If an electric screwdriver is used, it should be grounded and shielded to prevent sparks.
7. The normal static prevention measures should be observed for work clothes and working benches.
8. Since dry air is inductive to static, a relative humidity of 50-60% is recommended.

Soldering Precautions:

1. Soldering should be performed only on the I/O terminals.
2. Use soldering irons with proper grounding and no leakage.
3. Soldering temperature: 280C+10C
4. Soldering time: 3 to 4 second.
5. Use lead free solder with no-clean flux.
6. If flux is used, the LCD surface should be protected to avoid spattering flux.
7. Flux residue should be removed.

Operation Precautions:

1. The viewing angle can be adjusted by varying the LCD driving voltage Vo.
2. Since applied DC voltage causes electro-chemical reactions, which deteriorate the display, the applied pulse waveform should be a symmetric waveform such that no DC component remains. Be sure to use the specified operating voltage.
3. Driving voltage should be kept within specified range; excess voltage will shorten display life.

4. Response time increases with decrease in temperature.
5. Display color may be affected at temperatures above its operational range.
6. Keep the temperature within the specified range usage and storage. Excessive temperature and humidity could cause polarization degradation, polarizer peel-off or generate bubbles.
7. For long-term storage over 40 C is required, the relative humidity should be kept below 60%, and avoid direct sunlight.

Limited Warranty

Focus LCDs and modules are not consumer products, but may be incorporated by customers into consumer products or components thereof, Focus LCDs does not warrant that its LCDs and components are fit for any such particular purpose.

1. The liability of Focus LCDs is limited to repair or replacement on the terms set forth below. Focus LCDs will not be responsible for any subsequent or consequential events or injury or damage to any personnel or user including third party personnel and/or user. Unless otherwise agreed in writing between Focus LCDs and the customer, Focus LCDs will only replace or repair any of its LCD which is found defective electrically or visually when inspected in accordance with Focus LCDs general LCD inspection standard. (Copies available on request)
2. No warranty can be granted if any of the precautions state in handling liquid crystal display above has been disregarded. Broken glass, scratches on polarizer mechanical damages as well as defects that are caused accelerated environment tests are excluded from warranty.
3. In returning the LCD/LCM, they must be properly packaged; there should be detailed description of the failures or defect.

DISCLAIMER

Buyers and others who are developing systems that incorporate Focus LCDs products (collectively, “Designers”) understand and agree that Designers remain responsible for using their independent analysis, evaluation and judgment in designing their applications and that Designers have full and exclusive responsibility to assure the safety of Designers' applications and compliance of their applications (and of all Focus LCDs products used in or for Designers’ applications) with all applicable regulations, laws and other applicable requirements.

Designer represents that, with respect to their applications, Designer has all the necessary expertise to create and implement safeguards that:

(1) anticipate dangerous consequences of failures

(2) monitor failures and their consequences, and

(3) lessen the likelihood of failures that might cause harm and take appropriate actions.

Designer agrees that prior to using or distributing any applications that include Focus LCDs products, Designer will thoroughly test such applications and the functionality of such Focus LCDs products as used in such applications.