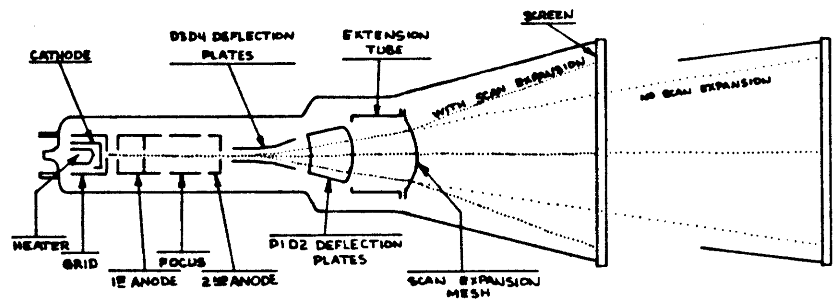
SECTION V MESH DEFECTS

INTRODUCTION

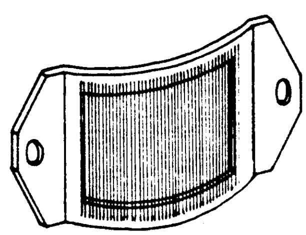
This section is on the scan expansion mesh and problems incountered in using this mesh. In early instruments, tubes did not have mesh and the instruments were large. As newer portable instruments were developed, a need for smaller and more sensitive tubes also developed. Part of these improvements were accomplished with the scan expansion mesh as shown below. This allowed the tube to be shorter as it improved its sensitivity.



SCAN EXPANSION

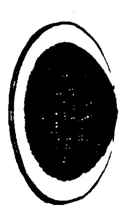
THE MESH

There are two types of mesh being used at Tektronix. The first mesh developed was the frame grid mesh. It provides expansion in the horizontal axis, only. It consists of a curved frame with very small wire stretched across the opening at 1000 lines per inch.



FRAME GRID MESH

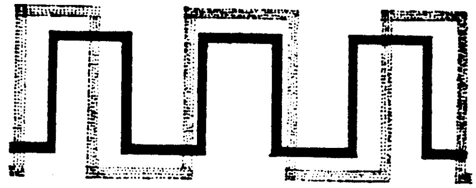
The second mesh developed was the electro-formed mesh. This mesh provides scan expansion in both vertical and horizontal axis. It consists of a 750 lines per inch mesh shaped into different profiles. The mesh is 0.35 mils thick and is made by electroplating nickel into the desired mesh pattern.



ELECTROFORM MESH

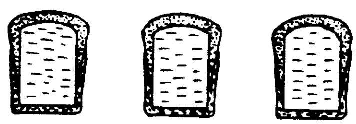
THE MESH

But the mesh has a side effect, it causes halo. Halo is a ghost or secondary image of the trace produced when electrons hit and bounce off the mesh.



TRACE WITH HALO

To suppress this halo, a MgO coating was added to one side of the mesh. Now the electrons are adsorbed when they hit the mesh, and a secondary electron is released which is then collected by the extension tube. If during the application of the MgO some gets on the other side of the mesh, an emission will appear on the screen and will not stop when the trace is turned off. This emission can be stopped with a conductive coating of aluminum covering the unwanted particles of MgO. The final mesh then looks like.



MESH STRUCTURE

REJECT CODES

R318 MESH DEFECT

Mesh defect is defined as defects other than mesh burrs which cause unacceptable distortion of the display. There are many things that cause these defects with the following to be rejected as R318 when present.

FOR FRAME GRID MESH

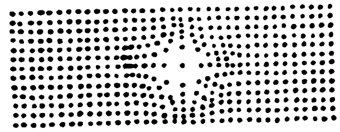
1. A dark line from the top to the bottom of the screen. It is caused by extra wires in the mesh.

2. A flashing on the screen. It is caused by a broken wire in the mesh. Care must be taken not to mix this with flashing from flaking aluminum on the screen. Focusing the mesh on the screen will typically show irregularities in the wires at the break.

REJECT CODES

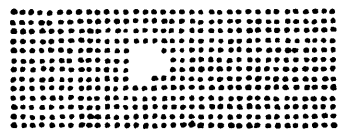
FOR ELECTROFORM MESH

1. A dark spot caused by a dent in the mesh. A dent can be seen when the trace is focused to see the mesh pattern. The dent is the area where the individual spots diverge. Note that there is still a spot in the center of the area of the defects. Dents are caused by handling.



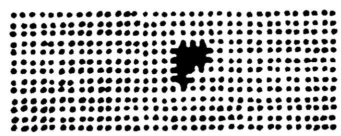
SPOT PATTERN OF A DENT

2. A dark spot caused by a plate-in in the mesh. The individual spots will be a straight line up to the defect. There will be no spots in the plate-in area.



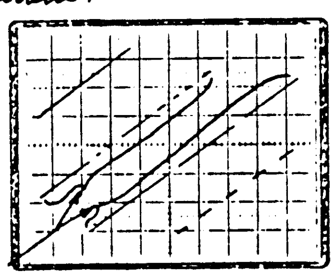
SPOT PATTERN OF A PLATE-IN

3. A bright spot caused by a hole in the mesh. The hole can be seen when the mesh pattern is brought into focus. The lines of spots will be straight up to the defect.

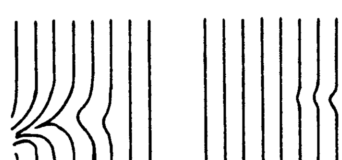


SPOT PATTERN OF A HOLE

4. Dark lines caused by scratches formed during cleaning. The scratches produce thick spots in the mesh wires. The defect is best seen when the screen is full flooded.



5. Crooked or bent lines or traces caused by wrinkled mesh. This is best seen when checking tube performance with time markers. The pattern of crooked lines should not exceed the geometry spec.

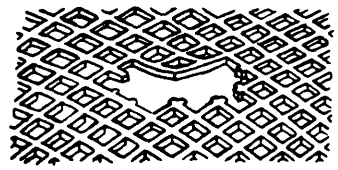


TIME MARKS OF WRINKLED MESH

REJECT CODES

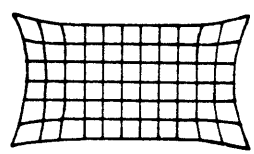
R 318 MESH DEFECT (CONT)

6. A bright spot with a reflection caused by a hole where some of the wires are bent out of the plain of the mesh. The detection of the hole is the same as above. The reflection comes from corners or parts of mesh wires not supported on 3 or more sides. Processing bend these corners as shown below.



HOLE WITH CAUSE FOR REFLECTION

7. A pincushion effect caused by mesh with a poor profile. Pincushion is the pattern shown below which can not be corrected by different control settings.

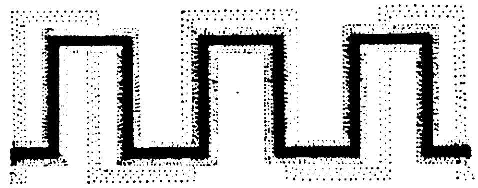


PINCUSHION PATTERN

8. If the tube has a problem with both vertical and horizontal sensitivity or deflection factor, than the cause is most likely to be the wrong mesh profile or the wrong mesh.

R 332 HALO SUPPRESSION

When the halo brightness is greater than the background brightness, the halo is considered unacceptable. Some tubes are supplied as reference samples. Here too, there are several things that cause halo.



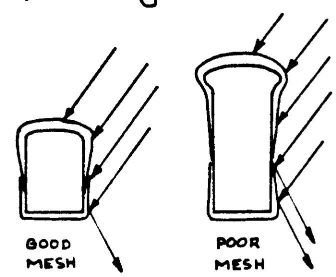
TRACE WITH BACKGROUND AND MESH HALO

1. Gross halo is typically caused by the wrong mesh being used.

REJECT CODES

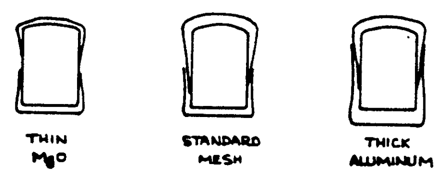
R 332 HALO SUPPRESSION (CONT)

2. Mild halo caused by mesh thickness being too thick. This produces increased area not protected by MgO. A cross-section of the mesh wire sometimes shows a "nailhead" where the nickel buildup exceed the photoresist. This increased exposed area allows more electrons to bounce off producing more halo.



3. Mild halo caused by a thin coating of MgO. This does not give good coverage on the sides of the wires.

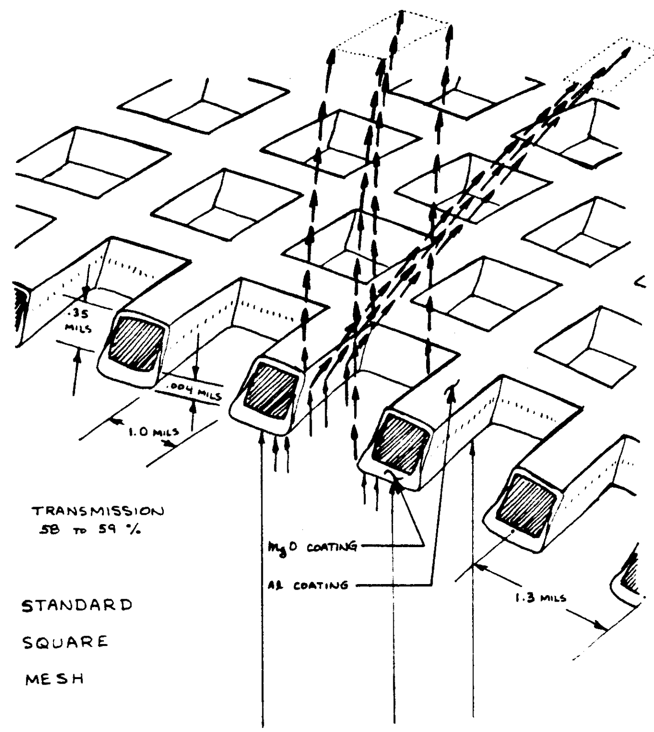
4. Mild halo caused by a thick coating of aluminum. This covers more of the MgO coating on the sides of the wires.

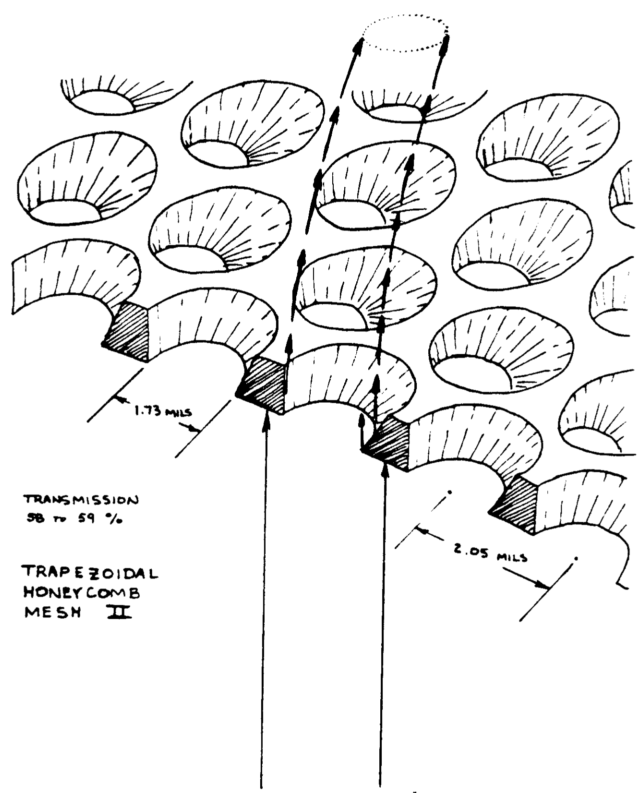


R 324 SPURIOUS MESH EMISSION

It appears as a glowing spot or area which persists after the beam is removed. They can persist or they can slowly fade out. Some will require a spot moved slowly over the problem area to make the glowing start. They are caused by MgO particles not properly covered by aluminum. It also appears if the aluminum is not conductive because of oxidation.

HALO SUPPRESSION





REJECT CODES

R 319 MESH GLOW

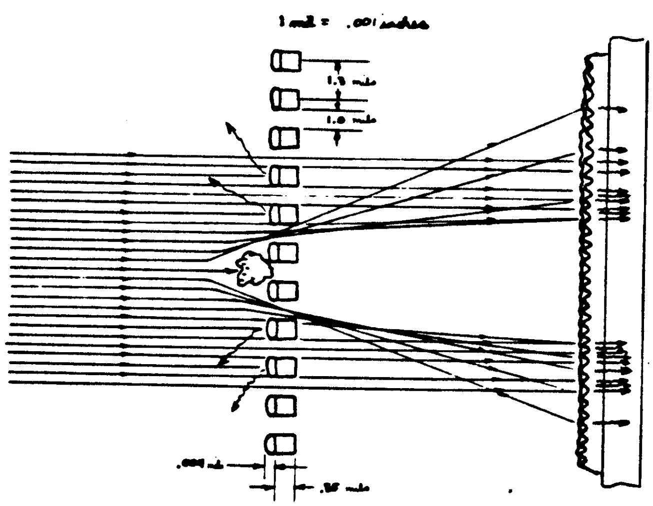
Mesh glow is defined as being a defect which causes a background glow or illumination. This defect code is being used to describe defects which glow and come from the mesh area. Contamination on the mesh ring is one. The 7901 is having a problem around the glass bead in the split extension tube.

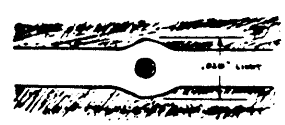
R 520 PHOSPHOR BURN

This is a defect found in the screen and the burned area appears brown. It comes most often from efforts to remove mesh burrs with a high intensity beam spot. Care must be taken to protect the phosphor.

R 320 MESH BURR

Mesh burr is defined as any type of foreign material causing out of specification reflections, defocus, or flaring of the trace. The effect of a mesh burr can best be described with the aid of the illustration below. The electron hits the contaminate and is adsorbed. These electrons cause the particle to charge. This charging then causes the electrons coming close to the particle to change their direction. These changes in direction of some electrons produce the effects seen on the screen. If the particle is on the MgO coating, the particle will charge more and have a greater effect on the screen. Some of the electrons hitting a particle will bounce off producing reflections.



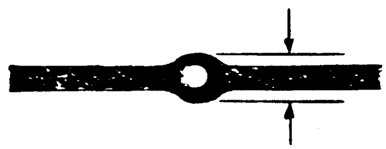


REJECT CODES

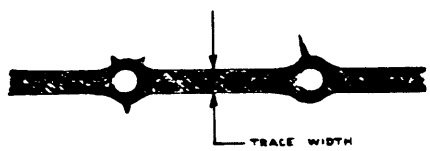
R320 MESH BURR (CONT)

Mesh burrs fall into a number of subclassifications

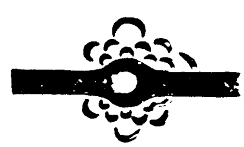
1. DEFOCUS is a dark spot which causes the trace to go around the defect. This defect is not to exceed the trace width spec. It is typically caused by smaller particles.



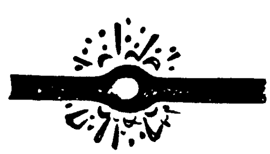
2. FLARE (Star Pattern) is a dark spot which has some flaring around the defect. The amount of flaring allowed is controlled by the CRT Component Spec and is measured in terms of the trace width. This defect is typically caused by smaller particles.



3. LARGE (Flower Pattern) is a dark spot which has a "flower" pattern of flare around the defect. It is always a scrap. It is typically caused by fibers.



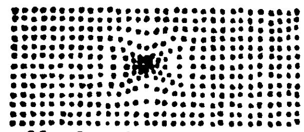
4. LARGE (Star/Flower) is a dark spot which has a combination of flare patterns around the defect. It is alway a scrap. It is typically caused by larger irregular particles.



REJECT CODES

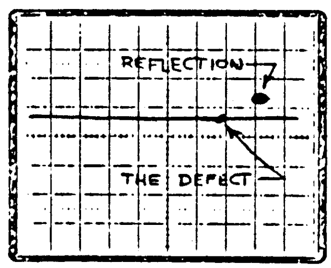
R 320 MESH BURR (CONT)

5. BRIGHT SPOT is typically caused by a glass particle. A bright spot contaminate can be seen by observing the convergence of the spot pattern of the focused mesh at the defect. The spot will be brighter than the rest of the trace.



SPOT PATTERN FOR BRIGHT SPOT

6. REFLECTION is a contaminate spot which may cause a dark spot but produces a reflection on the screen. It is caused by either metal balls or glass particles.



REWORK

Mesh burrs can reworked by several procedures.

1. TAPPING the faceplate with the plastic end of a screwdriver can cause the burr to disappear (fall off). But there are some precausions. Hitting the faceplate too hard cause the phosphor to fall off and/or the faceplate to break.

2. CYCLING with higher intensity spot. The spot or beam of electrons when it hits the defect can cause it to disappear. On some defects the beam will cause them to dissolve into the mesh. It will cause a slight pattern. This procedure also has its precaussions. Too high a beam current can burn the phosphor and in some tube types burn holes in the mesh.

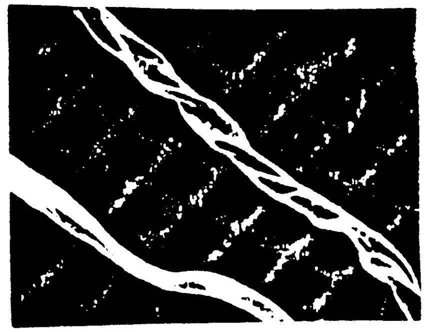
3. SPOT KNOCKING is a procedure which discharges an large amount of electrons to burn the burr off. All the procedure really does is shock the mesh causing the burr to fall off. Too many discharges may cause the feedthru to fail.

MESH BURRS

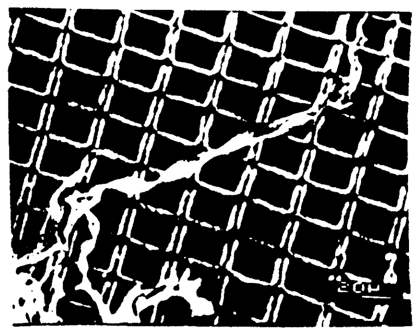
FIBERS

Early in the efforts to reduce mesh burrs, about 1/3 of the burrs were fibers. Many of the fibers have been identified. This has caused the fibers to decrease.

1. Cotton fibers were traced to cotton swabs used in the wiring area to clean deflection plates. The fiber caught on the edges or on weld burrs. A cellulose sponge was the subsitute.

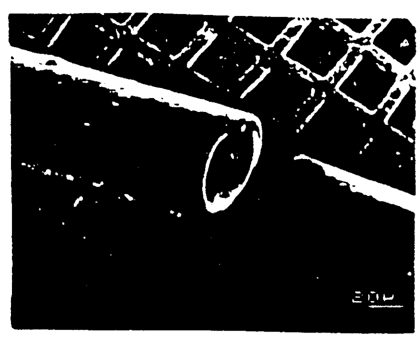


2. Clean room paper fiber was unknown for a long time. After identification, it was established that rework notes were being punched onto the snubber springs. This tearing released fibers.



3. Polyester fiber typically melt down as shown but some will show part of a round fiber. This fiber has been traced to "greenies" and bunny suits.

4. Hair is a fiber which was suspected but it has not been found in scrap tubes.



MESH BURRS

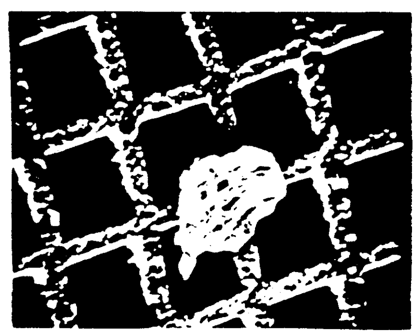
PARTICLES

Most of the particles producing "star" patterns were smaller than one mesh square in size. Many have been identified by basic elements but only a few have had the sources identified.

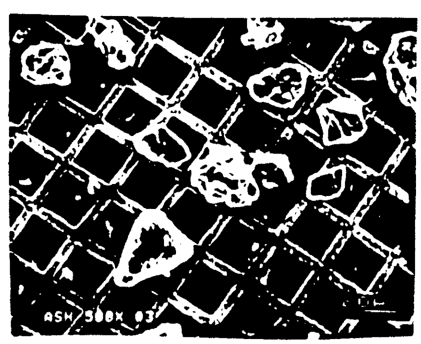
1. Aluminum flake from the screen. The final proof came when phosphor was also found on the flake. Much of the flaking is occurring around the edge of the screen.

2. Metal ball causing reflections. One metal was aluminum. It comes from the evaporation of aluminum onto the mesh. The second metal was stainless steel coming from laser rework splashing stainless onto the mesh.

3. Shiny particle causing star pattern spot. It has been identified as being stainless steel. But the source is not known.



4. One particle which has not been found in scrap tubes is volcanic ash. If it were to be present, it is expected to produce a bright spot because ash is glass.



MESH - BURRS

MgO SPOT

This is a gross blockage of the mesh by a film of MgO. Early spots were identified as being caused by spit from people talking over the mesh. Later spots were found forming after sealing. Moisture disolves the MgO, redistributes it, and dries out during pumping.