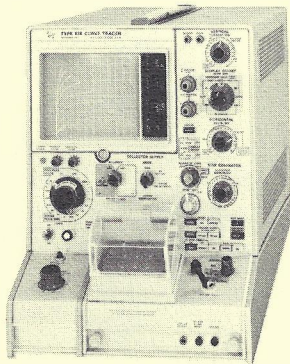


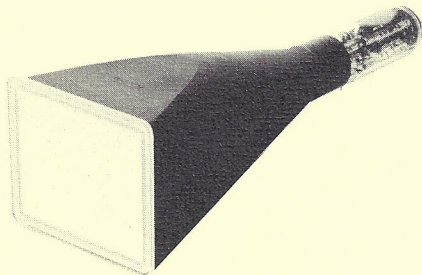
Cathode Ray Tube Manufacturing



TEKTRONIX BUILDS
oscilloscopes



We build cathode ray tubes



CRT

THE **HEART** OF THE OSCILLOSCOPE

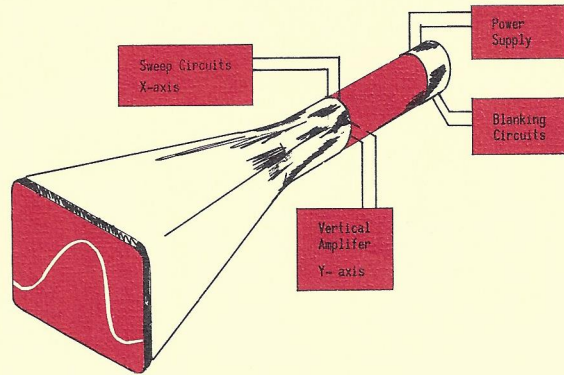
That's your job—Building CRTs
The CRTs you build are the finest in the world



Why is the CRT called the heart of the oscilloscope?

Because the task of everything else in an oscilloscope is to get the electrical signals shaped up for the user to look at on the CRT.

Without the CRT — there would not be an oscilloscope



What is a cathode ray tube ?

It's a special type of electron tube.

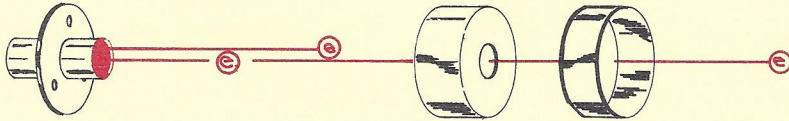
It has a **Cathode** in it.

A cathode is a device of special materials that gives off electrons when heated.

These electrons are formed into a single **Ray**.

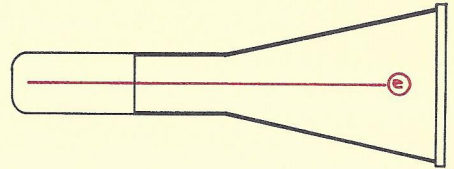
This ray of electrons is aimed at a phosphor screen, which gives off light when the electrons hit it.

The cathode and the electron ray won't work in air but must be kept in a vacuum **Tube**.



CATHODE

RAY



TUBE

Any CRT has three major parts

1. A GUN

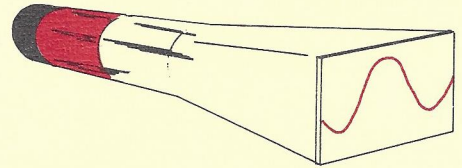
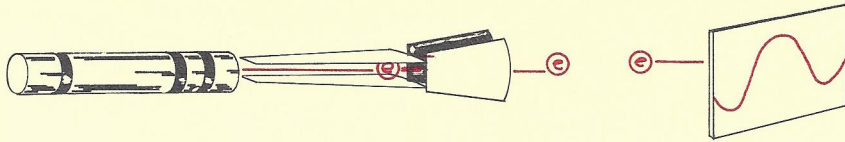
to give electrons, form the electron ray and direct it to any point on the phosphor screen.

2. A PHOSPHOR SCREEN

to give light when hit by the electron ray.

3. A TUBE

to keep the air out.



CRTs are hard to make

The Cathode materials
are easily poisoned — then
the cathode doesn't work at all
or dies quickly.

The electron Ray is easily
distorted — then the electron
ray doesn't go to the correct
place on the phosphor or it doesn't
have the correct size and shape.

The Tube is easily
weakened — then it won't
keep the air out — it leaks
or implodes.

You — the builder — have the greatest control over these things.

You — can make very good CRTs — if you are careful and follow instructions

Or

You — can make poisoned, distorted, and weak CRTs — if you are not careful.

Cathode poisoning
is caused by
Contamination

Electron Ray distortion
is caused by
Contamination
and Carelessness

Tube weakening
is caused by
Carelessness

Contamination and Carelessness

The biggest problems in building good CRTs.

The only way to build good CRTs

Cleanliness and Carefulness

and only you can do it

Contamination—What is it ?

it is **small particles**

Cardboard fibers . . . Wood chips . . . Paper lint
Floor wax . . . Glass wool fibers . . . Dust
Plastic scrapings

**from the
Building
and Equipment**

it is **chemicals**

Oil vapors . . . Solvents
Acid vapors . . . Silicones

Clothing fibers . . . Food crumbs . . . Skin flakes
Street dirt on shoes . . . Hair spray . . . Dandruff
Cigarette ashes & tobacco . . . Face powder

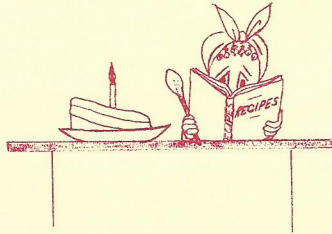
from People

Hand lotion . . . Perspiration
Cigarette smoke . . . Body salts

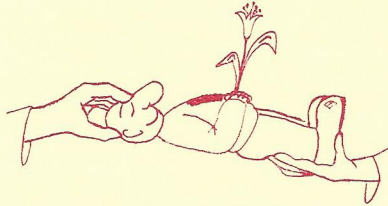
Since contamination is so many things and can do so much harm to CRTs, we must achieve cleanliness by controlling the materials, methods, and equipment used.

Carelessness—What is it?

Not following process specifications



Mishandling and bumping parts



Passing reject parts along



Cleanliness—How do we get it?

by employing **special people**

People who **know** what to do

why to do it

People who **care** to do their best

People who **do**

who use **special methods**

Clean Clothing

Clean Area Work Rules

Gloves and Finger Covers

Cleaning Processes for Parts

Work Area Clean-ups and Inspections

Special Authorized Cosmetics, Towels, Cleaners

Quality Controlled Materials

at work on **special equipment**

Clean Containers for Parts

Laminar Flow Clean Workbenches

Specially Designed Production Machines

in a **special building**

Filtered Air Conditioning

Washable Vinyl Coated Wall Panels

Dirt Traps — Chemically Treated Rugs

— Sticky Mats

Special Cleanings by Janitors

Carefulness—How do we get it?

It all depends on you

CRT parts are small & light

They are easily bent out of shape
or moved out of position.

Be gentle

CRT tolerances are tight usually less than 1%

The parts must be the correct shape
and in the correct position.
Don't drop or bump assemblies.

Be accurate

Some parts are fragile

Glass scratches, chips, or breaks easily.
Even tiny scratches are bad — they
concentrate the stress and cause breakage.
Scratches on face plate — light up with graticule.

Be careful

Tiny defects are expensive

Some defects that can only be seen
under a microscope can cause a
finished tube to be rejected.

CRTs can't be repaired.

**Rejects are thrown away
and they cost from \$30 to \$300**