

## SAFETY PRECAUTIONS

### CATHODE RAY TUBES

#### 1. GENERAL

**1.01** This section provides information concerning the dangers involved and the precautions necessary in the handling of cathode ray tubes.

**WARNING: EXTREME CAUTION MUST BE TAKEN TO AVOID CONTACT BETWEEN SKIN ABRASIONS OR OPEN WOUNDS AND BROKEN FRAGMENTS OF A CATHODE RAY TUBE. THE INNER COATING OF THE FACE OF A CATHODE RAY TUBE MAY CONTAIN SUBSTANCES WHICH ARE HIGHLY POISONOUS.**

**1.02** This section is reissued to include the procedure for the proper and safe disposal of cathode ray tubes and the deletion of leather gloves when handling tubes. Since this reissue is a general revision, arrows ordinarily used to indicate changes have been omitted.



*Cathode ray tubes are highly evacuated. Because of their large surface area, they are subjected to considerable air pressure on the outside of the glass envelope. If dropped, scratched, or hit sharply, the tube may collapse with considerable force. The sudden rush of air displacing the vacuum may exert sufficient force to propel the shattered glass over a radius of approximately 20 feet.*

**1.03** *Implosion* is the complete collapse of the glass envelope because of structural weakness or external force.

**1.04** Tests performed to study the behavior of tubes broken by impact clearly show that all tubes do not behave alike. It was quite generally demonstrated, however, that when the tube

shattered, pieces of glass were imbedded in the side of wooden enclosures used in the test.

**1.05** Fig. 1 through 6 illustrate progressive stages in the breaking of a cathode ray tube under test conditions. These figures are shown at the end of this section. Note the size of the fragments and that they generally move toward the base of the tube.

**1.06** It is not known how much impact a cathode ray tube can stand without breaking. However, by use of proper procedures when working in close proximity to exposed tubes and in handling them during installation or removal operations, the possibility of personal injury is negligible.

#### 2. TOOLS

CODE OR  
SPEC NO.

DESCRIPTION

##### TOOLS

AT-8350	B Plastic Goggles
—	Screwdriver, as required
—	Cord, W1U, or as required for local conditions

#### 3. PRECAUTIONS

**3.01** Do not unpack or remove a cathode ray tube from the special carton in which it is shipped until the tube is required for use. It is recommended that the new tube be taken in the shipping carton to the equipment location where it is to be installed. The old tube should be placed in this carton as soon as practicable.

**3.02** Always wear shatterproof (impact) goggles when unpacking or handling exposed tubes in any manner.

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- 3.03** Persons not equipped with safety goggles should remain at a safe distance while tubes are being handled.
- 3.04** Do not pick up a tube by the neck. This is the weakest point and may break under weight of the tube.
- 3.05** Always carry the tube with both hands firmly around the sides at its largest diameter and with the socket end pointing away from the body.
- 3.06** Do not force a tube into or out of a socket or other fittings. If the tube fails to slip smoothly into or out of its mountings, investigate and remove the cause of the difficulty.
- 3.07** Where wing nuts are provided in the mechanism for positioning and holding the tube, these wing nuts should be tightened with fingers only.
- 3.08** Avoid any sharp blows on the rear of the cathode ray tube. This possibility may occur when removing smaller tubes which are mounted in the chassis adjacent to the rear of the tube.
- 3.09** Except for maintenance operations, do not remove the metal mesh screens or equivalent covers provided as rear covers on monitoring oscilloscopes.
- 3.10** The inside of the viewing screen may be coated with phosphorus and beryllium in varying quantities. Wounds caused by broken glass containing these ingredients may heal very slowly and such a wound should be placed under the treatment of a physician immediately.
- 3.11** Dangerous voltages are always associated with cathode ray tubes and great caution should be used.
- 3.12** Disconnect the power supply before attempting to replace a tube or uncover and expose the associated chassis.
- 3.13** Do not rely solely on safety switches or power switch to disconnect the power supply. Disconnect the power supply cord on portable equipment or remove the fuses on fixed equipment.

- 3.14** Since a cathode ray tube may hold a charge within itself for a considerable time after being removed from service, clip a ground lead to the chassis and clip the other end to the high voltage lead before attempting to handle, adjust, or remove the tube.

*Note:* Momentarily shorting the high voltage lead to ground with an insulated screwdriver is not sufficient since there is energy stored in the power supply and stray capacitance to ground may cause another charge to appear even after the high voltage has been discharged.

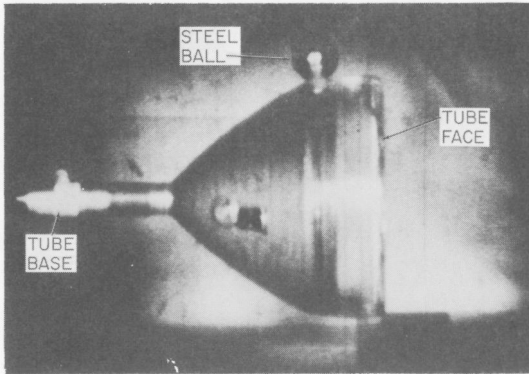
- 3.15** Avoid touching the high voltage contact button on the side of the tube.

*Note:* Discharge any voltage stored within the tube by grounding the button to the chassis with an insulated screwdriver. This may be necessary more than once to completely discharge the voltage stored in the tube.

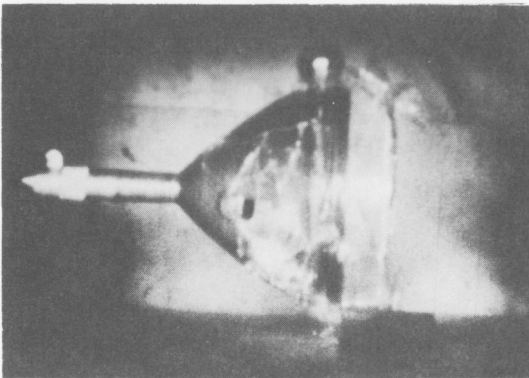
- 3.16** Always lay a cathode ray tube on its face, never on its side.
- 3.17** Only experienced personnel should perform circuit tests with the power supply turned on.

## 4. DISPOSAL

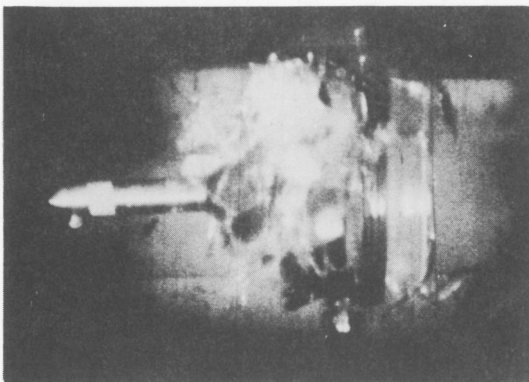
- 4.01** If practicable, tubes should be returned to the tube manufacturer.
- 4.02** Because of the danger of implosion, cathode ray tubes must not be discarded with the regular trash.
- 4.03** Cathode ray tubes should be destroyed in the following manner:
- (1) Gently place the cathode ray tube into a suitable container which is strong enough to withstand flying glass and has a lid that can be fastened securely, and seal the box. The original shipping carton can be used. See 3.01.
  - (2) Insert a steel rod through the side of the container so as to break the tube at its cone shaped portion.
  - (3) After breakage, the tube may then be disposed of by marking the container "broken glass" and placing it in an area provided for disposal, of this type of material.



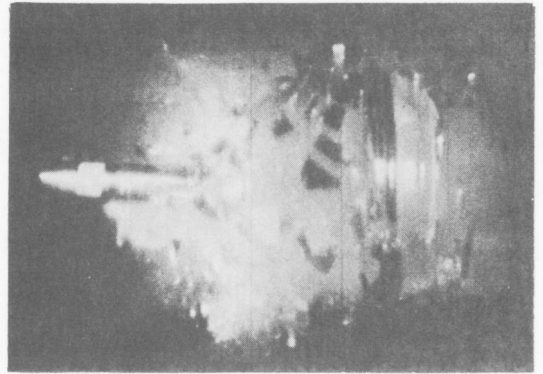
**Fig. 1 — Instant of Impact**



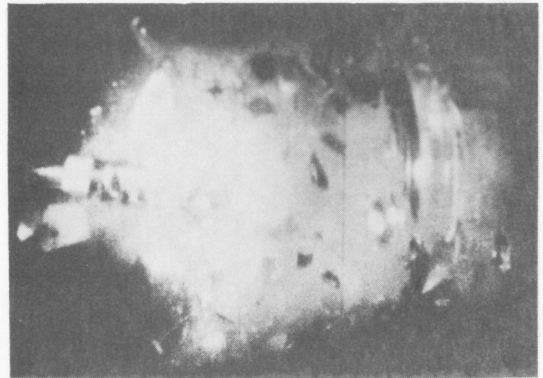
**Fig. 2 — Elapsed Time — .0075 Second**



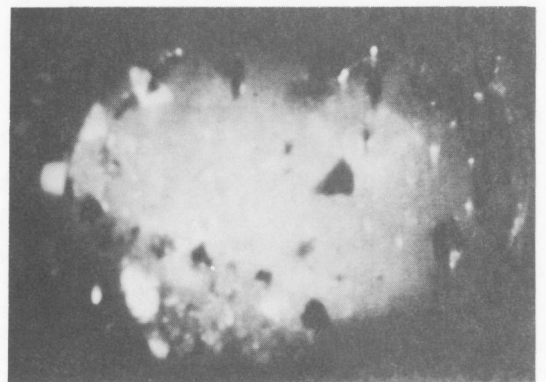
**Fig. 3 — Elapsed Time — .01075 Second**



**Fig. 4 — Elapsed Time — .0155 Second**



**Fig. 5 — Elapsed Time — .02625 Second**



**Fig. 6 — Elapsed Time — .041 Second**