

Instruction  
Hardware Engineering

No. LMS 1-10

**Subject:** Optics

**APPROVED BY** Manager, Hardware Engineering

**STATUS** Maintenance Revision

**PURPOSE** Defines and specifies the mandatory techniques to be used in the handling and cleaning of optical elements such as lenses, mirrors (glass and plastic), beam splitters, cathode ray tube (CRT) assemblies, screens, and wide-angle collimating (WAC) windows. This instruction shall be utilized by personnel when handling and cleaning optics.

**AFFECTED FUNCTIONS** Hardware Engineering  
Manufacturing

**REFERENCES** L-3 Communications Corporation, Link Simulation & Training Division (hereafter referred to as Link) Supervisor's Personnel Policies and Procedures Manual

1. Requirements

- 1.1 General. The following precautions shall be strictly adhered to in the handling and cleaning of all optics (lenses, mirrors, beam splitters, CRT assemblies, screens, and WAC windows).
- a. All personnel handling or anticipating the handling of any of the chemicals referenced in this instruction shall read the applicable Material Safety Data Sheet (MSDS). The MSDS should be available from the responsible supervisors, but if not, may be obtained from the Safety Office. Additionally, hazardous solvents shall be used only in authorized areas with the aid of appropriate safety equipment in accordance with Section 9 of the Link Supervisor's Personnel Policies and Procedures Manual. Any personal protective equipment used shall be approved by the National Institute of Occupational Safety & Health (NIOSH).
  - b. When handling/cleaning purchased optics, personnel shall comply with the manufacturer's instructions.

- c. Lint-free gloves shall be worn when handling optics. Fingerprints (body acids) will etch glass. Cotton gloves are generally sufficient protection for small optics. Use plastic-palm gloves to prevent slippage when handling large plastic optics. However, use cotton gloves for final assembly. Plastic is covered with a minute film of oil.
- d. When cleaning, assembling, or disassembling optics on a bench or work table, the work surface shall be free of all grease, oil, dust, dirt, or any other form of contamination. Never lay an optic down on a work surface. It shall always be placed in its original container or other protector. Oil of any nature will destroy the optic surface.
- e. Optics shall not be permitted to remain uncovered for any period of time. Dust can be detrimental to any polished glass surface. Lens cleaning tissue must also be kept covered to keep off dust particles which may scratch optic surfaces.

Dust may be removed from optics by brushing very lightly (no pressure) with a camel hair or Static Master brush. Only allow the weight of the brush bristles to bear on the optical surface. When a camel hair brush becomes contaminated, it can be cleaned by washing with a mild detergent, rinsing with tap water, air drying, and then vacuuming thoroughly. If static is present, a Static Master brush shall be used in the same manner. When a Static Master brush becomes contaminated, it can be cleaned by rinsing in diethyl ether and blowing dry with pressurized dry nitrogen.

- f. Optics shall only be cleaned with optical cleaning tissues (Link part number 115227) or other such materials which have been approved by the optical lab.
- g. Any area containing optics should prohibit smoking. Smoke vapor deposits are difficult to remove from optical surfaces. Do not attempt to remove smoke deposits without assistance from the Optical Lab.
- h. Optic assembly areas should be a clean room area. All components must be scrupulously clean with absolutely no contamination of any nature. Never disassemble any optic instrument or system without authorization, and then only in a clean room area.

- i. Any purchased optical instrument known or suspected to be out of calibration or dirty shall be returned to the vendor for adjustment or cleaning. Critical optical angles or relationships can be destroyed through ignorance.
  - j. In cleaning optics, do not touch the surface except as defined herein. Never use a pressure air hose. The air scrubbing across the optic surface carries dust and particles that may mar the surface and substrate.
  - k. Do not perform cleaning as a matter of routine or for appearance purposes. Optics should be cleaned only immediately prior to assembly. Preventive maintenance schedules should be utilized, but cleaning should be done only as needed. Example: the mirror may only need to be dusted while the CRT and beam splitter may need dusting and washing. Unnecessary or excessive cleaning can eventually destroy the optic's usefulness, since small dust particles continuously brushed over the surface tend to scratch.
  - l. Unless otherwise noted, all methods of cleaning (vacuum, dry nitrogen, brush, cotton, and/or lens tissue) are performed from the center of the surface to its edges. The applicator (cotton, lens tissue) should be rotated as the cleaning advances, always presenting a clean surface to the object being cleaned.
- 1.2 Cleaning equipment/materials required:
- a. Cleaning tissue (Link part number 115227).
  - b. Camel hair brushes.
  - c. MS-260, CAGE Code No. 18598 (Link part number 115063), cleaner and double distilled toluene or acetone and pure grain alcohol.
  - d. Small vacuum cleaner with narrow nose adapter and hose extension.
  - e. Extension light.
  - f. Cotton and Q-tips with long stems.
  - g. Static Master brush.

- h. Duct tape.
- 1.3 Cleaning reflective and refractive surfaces.
- a. A strong light source directed at the reflective surface at an approximate angle of 45 degrees and viewed at a reflected angle of 45 degrees will reveal the presence of foreign matter, if any. Light dust can be removed with a high volume vacuum cleaner, taking care that the cleaner nozzle is not sucked against the surface being cleaned. Dry nitrogen is used whenever heavier particles are present. Direct the gas flow (approximately 20 psi pressure) across the surface toward the vacuum cleaner nozzle. Maintain a reasonable distance between the nitrogen hose/vacuum hose and surface being cleaned.
  - b. Any dust not removed by the above methods may be removed with light strokes of a Static Master or camel hair brush. Prior to use, clean the Static Master brush by rinsing in diethyl ether (U.S.P.) and drying in nitrogen pressure stream. Static Master brush cleaning must be done in a well-ventilated area. Avoid excessive fume inhalation.
- 1.4 Polacoat rigid lenscreen cleaning.

**CAUTION**

Do not use any solvent. Do not use excessive pressure.

Remove dust from the surface by use of a Static Master or camel hair brush.

- 1.5 Cleaning plastic lenses. Plexiglass lenses are extremely soft and subject to scratches. Extreme caution must be used in cleaning and handling. Cleaning may be accomplished as follows:

MS-260 cleaner is applied very sparingly with lens tissue and spread over the area to be cleaned. Use lens tissue to remove any excess wax and polish lightly. Observe the surface for cleanliness by placing the light source behind the observer or technician (at approximately 6 feet [1.83 m]) and observing the light reflected from the surface.

- 1.6 Fresnel lenses. Fresnel lenses are thin lenses composed of closely spaced circular grooves, each of which contribute to the magnification feature. This type of lens should never be touched. Each minute point of the grooves must remain perfectly sharp. Use only a Static Master or camel hair brush to remove dust.
- 1.7 WAC window cleaning procedures:
- a. Assemble a mosaic of camel hair brushes, 4 inches (10.16 cm) to 6 inches (15.24 cm) long by 1.5 inches (3.81 cm) deep, attached to a wooden or plastic extension. Cover the metal capture points on the brushes with duct tape (or equivalent).
  - b. Remove CRT and accessible side panels.
  - c. Clean mirror with camel hair brush and vacuum cleaner.
    - (1) Lightly dust the mirror with the camel hair brush, covering a 1 foot (0.09 m<sup>2</sup>) square starting at the top, working across the upper area, and then the next lower area. Clean the camel hair brush with the vacuum cleaner after each cleaning stroke.
    - (2) Repeat the dusting procedure for the beam splitter surface.
    - (3) Use the narrow nose of the vacuum cleaner to clean the area where the beam splitter meets the spherical mirror. Be extra careful not to touch the surface of either substrate.
  - d. Use the extension light to find blemishes of an extraordinary nature, such as cement, glue, etc.
    - (1) Try cleaning the spots with a small amount of MS-260 on a tissue pad. If they come off, proceed with step e.
    - (2) If the spots do not come clean, lightly apply pure grain alcohol on a Q-tip to clean each spot. If the alcohol does not clean the spots, apply the double distilled toluene or acetone with the Q-tips. If the spots come clean, with the normal exception of some residue, then proceed with the alcohol and then step e.
  - e. Cleaning the mirror requires a gentle action with the tools.

- (1) Spray the MS-260 liberally on a folded sheet of tissue (4 to 5 folds).
  - (2) Start at the top and wash about one square foot of mirror surface.
  - (3) Turn the pad to the dry side and lightly wipe away the contaminants that are in the MS-260 cleaner.
  - (4) Just before the area is completely dry, rapidly but lightly wipe the complete area with a clean pad.
  - (5) Overlap the cleaning areas.
- f. Repeat procedure in steps c through e for the beam splitter.
  - g. Use the extension light to find streaking that may remain and wipe it lightly with a dry clean pad. In some cases, applying a light mist of MS-260 to a pad will help to clean streaks.
  - h. Replace the CRT assembly and install all dust covers. Lightly dust all surfaces just before replacing the side panel.
2. Quality Assurance Provisions
- 2.1 The Quality Assurance Department shall be responsible for the requirements of optics cleanliness specified herein.

3. Preparation For Delivery

- 3.1 Mirror surfaces may be protected during packaging and shipping by an application of strippable lacquer or other suitable means.
- 3.2 Immediately after cleaning, each optical element shall be wrapped with four or more thicknesses of lens tissue. The tissue shall be secured in place with pressure-sensitive tape. The tape shall not be applied to the optical element.
  - a. Each wrapped optical element shall be cushioned by overwrapping with cellulosic cushioning material. The cushioning material shall not be compressed to the degree that it will result in a loss of cushioning properties. The cushioning material shall be secured in place with pressure-sensitive tape.
  - b. If practical, each cushioned optical element shall be placed in a close-fitting plastic bag.
- 3.3 For WAC windows.
  - a. The CRT assembly shall be removed from the window assembly and packed in a special carton (Link part number 115235).
  - b. The void created by removing the CRT assembly shall be covered with a suitable material (example: heavy duty cardboard) cut to fit and temporarily sealed. Prior to closure, reflective surfaces may be cleaned by light dusting and vacuuming. However, keep in mind that excessive cleaning may damage the reflective surfaces.

4. Notes

- 4.1 Parenthetical identities are for reference only.