

**MIL-STD-34**  
**3 November 1960**

**MILITARY STANDARD**

**PREPARATION OF DRAWINGS FOR  
OPTICAL ELEMENTS AND OPTICAL SYSTEMS;  
GENERAL REQUIREMENTS FOR**



**UNITED STATES  
GOVERNMENT PRINTING OFFICE  
WASHINGTON: 1960**

**MIL-STD-34**  
**3 November 1960**

**ARMED FORCES SUPPLY SUPPORT CENTER**

**WASHINGTON 25, D. C.**

**Preparation of Drawings for Optical Elements  
and Optical Systems; General Requirements for**

**MIL-STD-34**

**3 NOVEMBER 1960**

1. This standard has been approved by the Department of Defense and is mandatory for use by the Departments of the Army, the Navy, and the Air Force, effective 3 November 1960.

2. Recommended corrections, additions, or deletions should be addressed to the Standardization Division, Armed Forces Supply Support Center, Washington 25, D. C.

**MIL-STD-34**  
**3 November 1960**

## CONTENTS

		Page
1.	GENERAL.....	1
1.1	Scope.....	1
2.	REFERENCE DOCUMENTS.....	2
2.1	Standards.....	2
3.	DEFINITIONS.....	3
3.1	Photographic terms.....	3
4.	GENERAL REQUIREMENTS.....	4
4.1	Types of drawings.....	4
4.2	Drawing format.....	4
4.3	Dimensioning and tolerancing.....	4
4.3.1	General.....	4
4.3.2	Mechanical tolerance.....	4
4.3.3	Irregularity tolerance.....	4
4.3.4	Spherical optical surfaces.....	4
4.3.5	Flat optical surfaces.....	4
4.3.6	Aspheric optical surfaces.....	4
4.3.6.1	Parabolic.....	4
4.3.6.2	Hyperbolic.....	4
4.3.6.3	Elliptical.....	4
4.3.7	Chamfers.....	4
4.3.8	Bevels.....	4
4.4	Orientation.....	4
4.4.1	Optical system drawings.....	4
4.4.2	Optical elements and component drawings.....	5
4.5	Standard notes.....	5
4.6	Coating, blackening, cementing, and sealing.....	5
4.6.1	Coated surfaces.....	5
4.6.2	Blackening.....	5
4.6.3	Cementing.....	5
4.6.4	Sealing.....	5
4.7	Materials block.....	5
4.7.1	Standard specification reference.....	5
4.7.2	Modified specification reference.....	6
4.7.3	Special materials.....	6
4.8	Pressing blanks.....	6
4.9	Special requirements.....	6

**MIL-STD-34**  
**3 November 1960**

	Page
5. DETAILED REQUIREMENTS.....	7
5.1 Lenses.....	7
5.1.1 Number of views.....	7
5.1.2 Dimensions to be shown.....	7
5.1.3 Standard notes.....	7
5.2 Prisms.....	7
5.2.1 Number of views.....	7
5.2.2 Compound prisms.....	7
5.2.3 Dimensions to be shown.....	7
5.2.4 Standard notes.....	7
5.3 Wedges.....	7
5.3.1 Number of views.....	7
5.3.2 Dimensions to be shown.....	7
5.3.3 Standard notes.....	7
5.4 Reticles.....	7
5.4.1 Number of views.....	7
5.4.2 Dimensions to be shown.....	7
5.4.3 Reticle lenses.....	8
5.4.4 Reticle markings.....	8
5.4.5 Standard notes.....	8
5.5 Windows and filters.....	8
5.5.1 Number of views.....	8
5.5.2 Dimensions to be shown.....	8
5.5.3 Orientation.....	8
5.5.4 Standard notes.....	8
5.5.4.1 Elements in or near focal planes.....	8
5.5.4.2 Elements in or near aperture planes.....	8
5.6 Plane mirrors.....	8
5.6.1 Number of views.....	8
5.6.2 Dimensions to be shown.....	8
5.6.3 Standard notes.....	8
5.7 Curved mirrors.....	8
5.7.1 Number of views.....	8
5.7.2 Dimensions to be shown.....	8
5.7.3 Standard notes.....	9
5.8 Cemented assemblies.....	9
5.8.1 Number of views.....	9

**MIL-STD-34**  
**3 November 1960**

	Page
5.8.2 Dimensions to be shown.....	9
5.8.3 Standard notes.....	9
5.9 Optical system drawings.....	9
5.9.1 Definition.....	9
5.9.2 Purpose.....	9
5.9.3 Format.....	9
5.9.4 Parts to be shown.....	9
5.9.5 Number of views.....	10
5.9.6 Identification of parts.....	10
5.9.7 Dimensions to be shown.....	10
5.9.8 Symbols.....	10
5.9.9 Notes.....	10
5.9.10 Characteristics.....	10
5.9.10.1 Characteristics of a general telescopic system.....	10
5.9.10.2 Characteristics of a variable power telescopic system.....	10
5.10 Optical system schematics.....	10
5.10.1 Definition.....	10
5.10.2 Purpose.....	10
5.10.3 Format.....	10
5.10.4 Parts to be shown.....	10
5.10.5 Number of views.....	11
5.10.6 Identification of parts.....	11
5.10.7 Notes.....	11

## FIGURES

**Figure**

1. Sample material block.
2. Single lens.
3. Prism.
4. Wedge.
5. Reticle.
6. Window.
7. Curved mirror.
8. Cemented assembly.
9. Optical system.
10. Optical schematic.



**MIL-STD-34**  
**3 November 1960**

## **1. GENERAL**

**1.1 SCOPE.** This standard describes the preparation of drawings for optical elements, components, and systems. special drafting practices to be used in the preparation of drawings for optical elements, components, and systems.

**MIL-STD-34**  
**3 November 1960**

## **2. REFERENCE DOCUMENTS**

**2.1 STANDARDS.** The following Military Standards, of the issue currently in effect, shall form a part of this standard:

MIL-STD-2 —Engineering Drawings,

Sizes, and Formats.

MIL-STD-8 —Dimensioning and Tolerancing.

MIL-STD-150—Photographic Lenses.



**MIL-STD-34**  
**3 November 1960**

### **3. DEFINITIONS**

**3.1 PHOTOGRAPHIC TERMS.** The terms MIL-STD-150, Photographic Lenses, peculiar to photographic optics will be found in

**MIL-STD-34**  
**3 November 1960**

## 4. GENERAL REQUIREMENTS

**4.1 TYPES OF DRAWINGS.** Mono detail drawings are preferred and will be used unless specific deviation is authorized.

**4.2 DRAWING FORMAT.** Drawing format, not shown in the illustrations, shall be in accordance with MIL-STD-2.

### 4.3 DIMENSIONING AND TOLERANCING.

**4.3.1 General.** Dimensioning and tolerancing on optical drawings shall be in accordance with MIL-STD-8, and the special practices described in this standard. Either the English or metric system of measurement may be used, provided such usage is consistent throughout the drawing, and that the exceptions are clearly identified. Where it is necessary to convert from one system to the other, the dimension affected shall be given in both English and metric units. If such dimensions are numerous, and the use of the dual system would result in a confusing arrangement, a special "CONVERSIONS" block shall be entered on the drawing.

**4.3.2 Mechanical tolerance.** The mechanical tolerance shall indicate the allowable departure from the specified dimension insofar as it affects size but not geometric shape. The mechanical tolerance shall generally be specified in the same units of measure as the dimension to which it is applied, however, in special cases such as large radii or small tolerances, it may be specified in fringes.

**4.3.3 Irregularity tolerance.** The irregularity tolerance shall specify the allowable deviation from the geometric shape and shall be expressed in fringes. Unless otherwise noted it shall refer to the allowable deviation over the entire surface. Where necessary, the wavelength of the test light shall be specified.

**4.3.4 Spherical optical surfaces.** Spherical optical surfaces shall be dimensioned in the form of a radius which has both a mechanical tolerance and an irregularity tolerance.

**4.3.5 Flat optical surfaces.** Flat optical surfaces shall be dimensioned by a radius of infinity in which the radius is drawn to indicate the di-

rection of most tolerable curvature if there is a preference, and in a direction opposite to the other lens surface if there is no preference. Radius and irregularity tolerances shall be expressed in fringes, i.e.,

$$\infty R \pm 15 \text{ FRNG}, 2 \text{ FRNG IRREGTY}$$

The radius for a flat optical surface shall be indicated by a broken line (Fig. 2).

**4.3.6 Aspheric optical surfaces.** Aspheric optical surfaces shall be dimensioned by indicating the equation of the curve from which the surface is developed, or in the case of simple sections, the parameters and orientation. Aspheric surfaces shall not be defined through the use of offsets, unless prior approval is granted by the agency concerned.

**4.3.6.1 Parabolic.** Parabolic surfaces shall be dimensioned by showing the orientation of the axis, and the location of the focus as shown in figure 7.

**4.3.6.2 Hyperbolic.** Hyperbolic surfaces shall be dimensioned by indicating the orientation of the axis, and the location of the foci.

**4.3.6.3 Elliptical.** Elliptical surfaces shall be dimensioned by showing the orientation of the major axis, and the semimajor and semiminor diameters.

**4.3.7 Chamfers.** Chamfers shall be indicated by a field of the drawing note with a leader line terminated by an arrow pointing to the edge(s) to be chamfered. Chamfer information may be carried as a standard note if all or many edges are to be chamfered. The word CHAM shall be followed or preceded by the permissible angular deviation, bilateral dimension, and tolerance.

**4.3.8 Bevels.** Bevels shall be dimensioned in the manner prescribed as the preferred method for chamfers in MIL-STD-8.

### 4.4 ORIENTATION.

**4.4.1 Optical system drawings.** Optical system drawings will be oriented so that the light is assumed to enter from the left.

**MIL-STD-34**  
**3 November 1960**

#### **4.4.2 Optical elements and component drawings.**

**4.4.2.1** All optical elements and components for simple systems shall be oriented so that the light is assumed to enter from the left.

**4.4.2.2** For optical elements and components of complex optical systems, orient the element or component on the drawing as it appears in the system drawing, except that it shall be rotated clockwise the minimum amount necessary to bring the optical axis horizontal on the drawing. In addition, the direction of light shall be indicated by arrows along the optical axis, if the light does not enter from the left.

**4.5 STANDARD NOTES.** The standard notes shall contain the information which will not be presented on the field of the drawing. Examples of typical standard notes are shown in section 5. In general, these standard notes will be grouped in categories as follows:

First category: specification references.

Second category: Basic optical characteristics.

Third category: optical tolerances.

Fourth category: other pertinent information.

#### **4.6 COATING, BLACKENING, CEMENTING, AND SEALING.**

##### **4.6.1 Coated surfaces.**

**4.6.1.1** Surface(s) to be coated in accordance with a specification shall be indicated by a field of the drawing note with a leader line terminated by an arrow touching on the surface(s) to be coated as follows:

CTD PER SPEC 000-X-00000

**4.6.1.2** When a surface is to be provided with a special coating not covered by a specification, necessary information such as coating material, method of application and thickness; light characteristics, and color shall be included, as applicable, as a fourth category entry in the standard notes. For example:

CTG MATL \_\_\_\_\_  
 CTG THK \_\_\_\_\_ MU  
 LT CHAR. \_\_\_\_\_ % REFLD \_\_\_\_\_ % TRANSD  
 COLOR \_\_\_\_\_

**4.6.1.3** Where thickness of the coating is to be expressed in wavelengths, the color or wavelength of the test light must also be specified.

**4.6.2 Blackening.** The areas to be blackened shall be indicated by the field of the drawing note, BLKN-SEE NOTE \_\_\_\_\_, with a leader line terminated by an arrow touching on the area to be blackened. Reference in the field of the drawing note will be made to the standard notes, and the necessary information will be included in the standard notes, as a fourth category entry. For example:

BLKN MATL: (composition or trade designation)

##### **4.6.3 Cementing.**

**4.6.3.1** When the cementing procedures and adhesive are covered by an existing specification, the required information shall be carried as a standard note, as a first category entry as follows:

CEM IN ACCORD W/ SPEC  
 XXX-0-XXXXX.

USING (Specify adhesive name and specification).

**4.6.3.2** When the cementing procedures and adhesive are not covered by an existing specification, the area of the assembly to be cemented shall be indicated by a field of the drawing note which specifies the trade designation or composition of the adhesive and any special procedures involved in cementing.

##### **4.6.4 Sealing.**

**4.6.4.1** When sealing in accordance with an existing specification is required, the necessary information shall be included in the standard notes as a first category entry, as follows:

SEAL PER SPEC XXX-0-XXXXX

**4.6.4.2** When special sealing materials are required, the appropriate information shall be entered as a fourth category entry in the standard notes.

#### **4.7 MATERIAL BLOCK.**

**4.7.1 Standard specification reference.** The material block of the drawing shall reference the

**MIL-STD-34**  
**3 November 1960**

title of the specification, the type of material by name and code, and the special requirements not

covered in the code and specification number, as illustrated in figure 1.

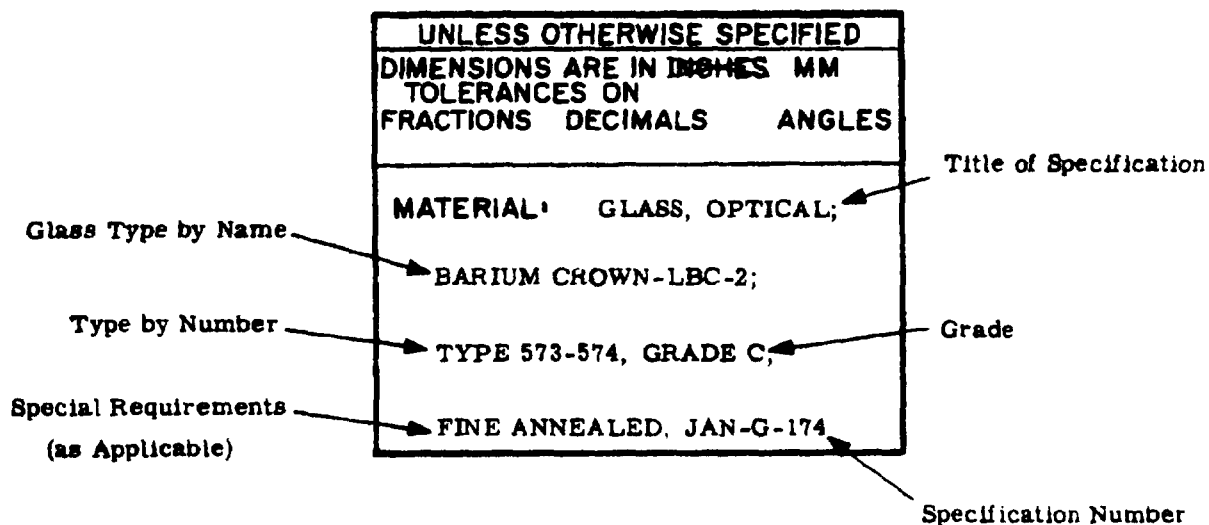


FIGURE 1.

**4.7.2 Modified specification reference.** Where the existing glass specification does not adequately specify the material, a reference in the material block will be made to the standard notes. The following note will then be included in the standard notes as a first category entry:

MATL: SAME AS OPT GL SPEC MIL-XXX-OO-XXX. TYPE X, GR Y, EXCEPT (cover all applicable exceptions).

**4.7.3 Special materials.** For special types of optical material such as crystals and plastics, not covered by a specification, the material shall be clearly identified by applicable specification composition, or nonproprietary trade designation. This identification shall include the index of refraction, Abbe Constant and other characteristics affecting the function of the lens. Tolerances for these dimensions shall also be given. The following is a typical example of a material requirement for an optical element not covered by a material specification:

**Notes.**

1. ELEM IN ACCORD W/SPEC XXX-O-XXXXXX
2. MATL: OPT GL, MED Ba CROWN: TYPE 573-568.  $n_D$ , 1.56954;  $n_D$ , 1.57250;  $n_F$ , 1.57962;  $n_C$ , 1.5854;  $n_F n_D$ , 0.01008; V VALUE, 56.8. TOLERANCES: V VALUE: 0.04;  $n_D$ , 0.0010. ALL OTHER REQ IN ACCORD W/JAN-G-174. ORIG SOURCE; CORNING GLASS WORKS (\*14674), CORNING OPT GL CODE 8345.

\* Federal Supply Code for Manufacturers—Obtain from Cataloging Handbook H4-1.

**4.8 PRESSING BLANKS.** Pressing blanks, and references to pressing blanks, will not appear on Military drawings without the prior approval of the proper authority.

**4.9 SPECIAL REQUIREMENTS.** Any special requirements not covered by this standard, shall be entered on the drawing in the form of a concise standard note, or field callout, stating the nature of the requirements and the limits of acceptability.

MIL-STD-34  
3 November 1960

## 5. DETAILED REQUIREMENTS

### 5.1 LENSES.

**5.1.1 Number of views.** A single sectional view of a lens shall be entered on a single detail drawing. Lenses of unusual configuration, or those having special requirements, may be presented in as many views as may be required to depict the necessary details. Sections shall show the conventional hatching for glass.

**5.1.2 Dimensions to be shown.** The dimensions to be shown shall be in accordance with paragraph 4.3, Dimensioning and tolerancing (see fig. 2).

#### 5.1.3 Standard notes.

**5.1.3.1** The following standard notes apply to single element lenses:

ELEM IN ACCORD W/SPEC XXX-0-XXXXX  
CA: ENT \_\_\_\_\_ MM, EXIT \_\_\_\_\_ MM  
SURF. QUAL: CTL Z \_\_\_\_\_, OUTER Z \_\_\_\_\_  
CTRG ERROR \_\_\_\_\_ MINUTES  
SURF. MKD "P" POL, ALL OTHERS GRD

**5.1.3.2** When the focal lengths are essential or required, such information shall be included in the standard notes, preceding CA (clear aperture), as follows:

EFL (NOM) \_\_\_\_\_  
BFL \_\_\_\_\_  
FFL \_\_\_\_\_

### 5.2 PRISMS.

**5.2.1 Number of views.** The drawing shall contain as many views as may be required to present all the necessary details. Polished surfaces shall show the conventional hatching for glass.

**5.2.2 Compound prisms.** If a prism is composed of two or more elements cemented together, a separate monodetailed drawing shall be prepared for each element, and an assembly drawing shall be prepared for the cemented assembly. Cemented assembly drawings shall be constructed in the manner prescribed in paragraph 5.8 of this standard, and shall specify pertinent performance requirements.

**5.2.3 Dimensions to be shown.** The dimensions to be shown shall be in accordance with

paragraph 4.3, Dimensioning and tolerancing (see fig. 3).

**5.2.4 Standard notes.** The following standard notes apply to prisms:

ELEM IN ACCORD W/SPEC XXX-0-XXXXX  
CA: ENT \_\_\_\_\_ MM; EXIT \_\_\_\_\_ MM  
SURF. QUAL: CTL Z \_\_\_\_\_, OUTER Z \_\_\_\_\_  
RESOLN \_\_\_\_\_ SEC OR BETTER  
ASTIG \_\_\_\_\_ MILLIDIOPT MAX  
SPHER PWR \_\_\_\_\_ MILLIDIOPT MAX  
ERROR DUE TO PYRAMID \_\_\_\_\_ MINUTES MAX  
SURF. MKD "P" POL, ALL OTHERS GRD

### 5.3 WEDGES.

**5.3.1 Number of views.** The drawing shall contain as many views as may be required to present all necessary details. The wedge shall be drawn with its thickest portion at the bottom and the maximum thickness given.

**5.3.2 Dimensions to be shown.** The dimensions to be shown shall be in accordance with paragraph 4.3, Dimensioning and tolerancing (see fig. 4).

**5.3.3 Standard notes.** The following standard notes apply to wedges:

ELEM IN ACCORD W/SPEC XXX-0-XXXXX  
CA: ENT \_\_\_\_\_ MM, EXIT \_\_\_\_\_ MM  
SURF. QUAL \_\_\_\_\_  
ASTIG \_\_\_\_\_ MILLIDIOPT MAX  
SPHER PWR \_\_\_\_\_ MILLIDIOPT MAX  
ANGLE BET. FACES \_\_\_\_\_ DEG \_\_\_\_\_ MIN \_\_\_\_\_ SEC  
SURF. MKD "P" POL, ALL OTHERS GRD

### 5.4 RETICLES.

**5.4.1 Number of views.** The drawing shall contain as many views as may be required to present all the necessary details. Reticle markings shall be shown in the drawing and shall be fully portrayed and dimensioned. An enlarged view of the markings may be used if necessary.

**5.4.2 Dimensions to be shown.** The dimensions to be shown shall be in accordance with paragraph 4.3, Dimensioning and tolerancing (see Fig. 5). General tolerances, such as line widths, may be covered by a field of the drawing note. Where necessary, marking dimensions and tolerances may be set up in tabular form.

# MIL-STD-34

## 3 November 1960

**5.4.3 Reticle lenses.** If a reticle pattern is applied to a lens surface, the drawing practices described for lenses shall be followed, as well as the applicable practices described in these subparagraphs.

### 5.4.4 Reticle markings.

**5.4.4.1** The side of the reticle to be marked shall be identified by the note, PATT (or ETCH) on this side, with a leader line terminated by an arrow touching on the surface to be marked.

**5.4.4.2** The material to be used in filling etched markings shall be identified by a special note referring to the applicable specification, or describing the material.

**5.4.5 Standard notes.** The following standard notes apply to reticles:

ELEM IN ACCORD W/SPEC XXX-O-XXXXXX  
CA: ENT \_\_\_\_\_ MM, EXIT \_\_\_\_\_ MM  
SURF. QUAL: CTL Z \_\_\_\_\_, OUTER Z \_\_\_\_\_  
LT DEV NOT TO EXCEED \_\_\_\_\_ MINUTES OF ARC  
SURF. MKD "P" POL, ALL OTHERS GRD

## 5.5 WINDOWS AND FILTERS.

**5.5.1 Number of views.** A single sectional view of a window or filter shall be entered on a single detail drawing. Windows or filters of unusual configuration, or those having special requirements, may be depicted in as many views as may be required to show the necessary details.

**5.5.2 Dimensions to be shown.** The dimensions to be shown shall be in accordance with paragraph 4.3, Dimensioning and tolerancing (see Fig. 6).

**5.5.3 Orientation.** Where a special orientation of an element is required, as in the case of a polarizing filter or beam splitter window, the required orientation shall be stated in a field of the drawing note describing the orientation and permissible deviation limits.

### 5.5.4 Standard notes.

**5.5.4.1 Elements in or near focal planes.** When the element is to be used at, or near, a focal plane, the following standard notes shall apply:

ELEM IN ACCORD W/SPEC XXX-O-XXXXXX  
CA: ENT \_\_\_\_\_ MM, EXIT \_\_\_\_\_ MM  
SURF. QUAL: CTL Z \_\_\_\_\_, OUTER Z \_\_\_\_\_

LT DEV NOT TO EXCEED \_\_\_\_\_ MINUTES OF ARC  
SURF. MKD "P" POL, ALL OTHERS GRD

**5.5.4.2 Elements in or near aperture planes.** When the element is to be used at, or near, the aperture plane, the following standard notes shall apply:

ELEM IN ACCORD W/SPEC XXX-O-XXXXXX  
CA: ENT \_\_\_\_\_ MM, EXIT \_\_\_\_\_ MM  
SURF. QUAL: CTL Z \_\_\_\_\_, OUTER Z \_\_\_\_\_  
RESOLN \_\_\_\_\_ SEC OR BETTER  
ASTIG \_\_\_\_\_ MILLIDIOPT \_\_\_\_\_ X  
SPHER PWR \_\_\_\_\_ MILLIDIOPT MAX  
LT DEV NOT TO EXCEED \_\_\_\_\_ MINUTES OF ARC  
SURF. MKD "P" POL, ALL OTHERS GRD

## 5.6 PLANE MIRRORS.

**5.6.1 Number of views.** A single sectional view of a plane mirror shall be entered on a single detail drawing. Plane mirrors of unusual configuration, or those having special requirements, may be presented in as many views as may be required to depict the necessary details.

**5.6.2 Dimensions to be shown.** The dimensions to be shown shall be in accordance with paragraph 4.3, Dimensioning and tolerancing.

**5.6.3 Standard notes.** The following standard notes apply to plane mirrors:

ELEM IN ACCORD W/SPEC XXX-O-XXXXXX  
CA: ENT \_\_\_\_\_ MM, EXIT \_\_\_\_\_ MM  
SURF. QUAL: CTL Z \_\_\_\_\_, OUTER Z \_\_\_\_\_  
RESOLN \_\_\_\_\_ SEC OR BETTER  
ASTIG \_\_\_\_\_ MILLIDIOPT MAX  
SPHER PWR \_\_\_\_\_ MILLIDIOPT MAX  
MINIMUM REFL \_\_\_\_\_ % FOR \_\_\_\_\_ WAVE LENGTH\*  
SURF. MKD "P" POL, ALL OTHERS GRD

\* If the required percentage of reflectance is governed by a limiting angle of incidence, the limiting angle shall also be given.

## 5.7 CURVED MIRRORS.

**5.7.1 Number of views.** A single sectional view of a curved mirror shall be entered on a single detail drawing. Curved mirrors of unusual configuration, or those having special requirements, may be presented in as many views as may be required to depict the necessary details.

**5.7.2 Dimensions to be shown.** The dimensions to be shown shall be in accordance with paragraph 4.3, Dimensioning and tolerancing (see fig 7).



**MIL-STD-34**  
**3 November 1960**

### 5.7.3 Standard notes.

5.7.3.1 The following standard notes apply to curved mirrors:

ELEM IN ACCORD W/SPEC XXX-O-XXXXX  
 CA: ENT \_\_\_\_\_ MM, EXIT \_\_\_\_\_ MM  
 SURF. QUAL: CTL Z \_\_\_\_\_, OUTER Z \_\_\_\_\_  
 LT DEV NOT TO EXCEED \_\_\_\_\_ MINUTES OF ARC  
 CTRG ERROR \_\_\_\_\_ MINUTES MAX  
 MINIMUM REFL \_\_\_\_\_ % FOR \_\_\_\_\_ WAVE LENGTH  
 MEASURED NORMAL TO SURFACE  
 SURF. MKD "P" POL, ALL OTHERS GRD

5.7.3.2 When the focal lengths are essential or required, such information shall be included in the standard notes, preceding CA.

EFL (NOM) \_\_\_\_\_  
 BLF \_\_\_\_\_  
 FFL \_\_\_\_\_

5.7.3.3 When resolution, astigmatism, and spherical power are essential, or required, such information shall be included in the standard notes, preceding SURF. QUAL as follows:

RESOLN \_\_\_\_\_ SEC OR BETTER  
 ASTIG \_\_\_\_\_ MILLIDIOPT MAX  
 SPHER PWR \_\_\_\_\_ MILLIDIOPT MAX

### 5.8 CEMENTED ASSEMBLIES.

5.8.1 *Number of views.* A single sectional view of a cemented assembly shall be entered on a single detail drawing. Cemented assemblies of unusual configuration, or those having special requirements, may be presented in as many views as may be required to depict the necessary details. Sections shall show the conventional hatching for glass.

5.8.2 *Dimensions to be shown.* The dimensions to be shown shall be in accordance with the requirements of paragraph 4.3. Dimensioning and tolerancing, except as noted below.

5.8.2.1 If the overall diameter of a cemented assembly is to be ground to a finished diameter, the finished dimension shall be indicated as a field of the drawing note with the words AFT. ASSEM added, as shown in figure 8.

5.8.2.2 If the overall diameters of the elements of the assembly are ground to a finished diameter before assembly, the allowable mismatch of outer diameters shall be indicated as specified in MIL-STD-8 (concentricity).

5.8.3 *Standard notes.* The following standard notes apply to cemented assemblies.

ELEM IN ACCORD W/SPEC XXX-O-XXXXX  
 CEM IN ACCORD W/SPEC YYY-O-YYYYY  
 USING (Specify adhesive name and specification)  
 SEAL IN ACCORD W/SPEC ZZZ-O-ZZZZZ  
 EFL (NOM) \_\_\_\_\_  
 BLF \_\_\_\_\_  
 FFL \_\_\_\_\_  
 CA: ENT \_\_\_\_\_ MM, EXIT \_\_\_\_\_ MM  
 RESOLN \_\_\_\_\_ SEC OR BETTER  
 ASTIG \_\_\_\_\_ MILLIDIOPT MAX  
 CTRG ERROR \_\_\_\_\_ MINUTES MAX

### 5.9 OPTICAL SYSTEM DRAWINGS.

5.9.1 *Definition.* An optical system drawing shows the relative positions of all the optical components of an instrument or device. The arrangement shown must be followed in order to provide the optical performance required of the given optical system.

5.9.2 *Purpose.* The purpose of an optical system drawing is to provide the information necessary for the design, manufacture, and inspection of the instrument to which the system drawing pertains. Basic uses of the system drawing are as follows:

5.9.2.1 In the assembly of the instrument, the optical system drawing will be used to govern the adjustment and alignment of the optical components to obtain the desired performance characteristics.

5.9.2.2 The optical system drawing will be used for system analysis.

5.9.2.3 The optical system drawing will be used as a basis for designing test fixtures for the inspection of the assembled instrument, an optical element, or an optical system procured un-assembled.

5.9.3 *Format.* Optical system drawings shall be prepared on the smallest size drawing sheet required to adequately depict the entire system.

5.9.4 *Parts to be shown.* The only parts or items to be shown on an optical system drawing are the optical elements which comprise the optical system of the device or instrument. All the optical elements of the system shall be shown in the position they will occupy in the assembled in-

**MIL-STD-34**  
**3 November 1960**

strument. When mechanical parts, such as sunshades, diaphragms, lamps, and illuminating rods, have a definite effect on the light path or the image, they shall be shown on the system drawing in their correct positions (see fig. 9).

**5.9.5 Number of views.**

**5.9.5.1** The optical system drawing shall contain as many views as may be required to present all the necessary system details. Additional sheets shall be used as required to maintain clarity of detail and to prevent confusion between different views.

**5.9.5.2** Where the light path through a system reverses itself, or travels in several different planes, sufficient auxiliary views shall be provided so that the true length of any portion of the light path may be readily determined. The light path shall not be folded back on any part of itself unless an auxiliary view is provided to show the obscured portion of the light path.

**5.9.6 Identification of parts.** Components or elements shall be identified by quantity, basic name, and part number. If subassemblies are identified, and the individual parts of a subassembly have been identified on a subassembly drawing, the individual parts shall not be re-identified.

**5.9.7 Dimensions to be shown.** The dimensions and tolerances, which must be maintained to obtain the desired optical performance of the system, shall be in accordance with paragraph 4.3, Dimensioning and tolerancing.

**5.9.8 Symbols.**

**5.9.8.1** A diaphragm shall be indicated by a symbol consisting of two solid triangles with the points connected by a heavy solid line.

**5.9.8.2** When necessary, a representation of the human eye with its position dimensioned in relation to the optical system may be shown on the drawing. The dimension shown shall indicate the clear eye distance.

**5.9.9 Notes.** Notes shall be used on the optical system drawing to explain the functions, relations, and other general information not generally evident from the drawing.

**5.9.10 Characteristics.** The required characteristics of the optical system shall be entered on the system drawing. These characteristics shall define the performance requirements of the system. The following examples are provided as guides:

**5.9.10.1 Characteristics of a general telescopic system.**

Magnification:	3X
True field of view:	13° 20'
Diameter of exit pupil:	0.30 inch.
E. F. L. of Objective:	4.122 inches.
E. F. L. of Eyepiece:	1.374 inches.

**5.9.10.2 Characteristics of a variable power telescopic system.**

Magnification:	10X	20X
True field of view:	6° 9'	3° 5'
Diameter of exit pupil:	0.25 inch	0.125 inch.
E. F. L. of Objective	12.5 inch	12.5 inch.
E. F. L. of Eyepiece:	1.0 inch	1.0 inch.

**5.10 OPTICAL SYSTEM SCHEMATICS.**

**5.10.1 Definition.** An optical system schematic is a drawing illustrating the relationship of optical system components to each other, and to the operation of the instrument or device.

**5.10.2 Purpose.** The purpose of the optical system schematic is to show the optical elements of the system in relation to the function of the device or instrument. Basic uses of the optical system schematic are as follows:

**5.10.2.1** A system schematic shall be prepared when the complexity of the light path through the instrument is such as to prevent a ready understanding of the system from the details given in the optical system drawing.

**5.10.2.2** A system schematic shall be prepared when mechanical linkages are used to alter the positions of optical elements or components, and when the effect of such linkage movements will not be presented on the optical system drawing.

**5.10.3 Format.** Optical system schematics shall be prepared on the smallest size drawing sheet required to adequately depict the entire system.

**5.10.4 Parts to be shown.** All optical ele-



**MIL-STD-34**  
**3 November 1960**

ments or components of the systems shall be shown in their approximate positions within the device or instrument. The alternate positions of optical elements or components within the device or instrument shall be indicated by phantom lines. When mechanical elements, which affect the movement of the optical elements, are necessary to illustrate the relationship to the overall instrument, they be included as required. For example, shafts, levers, or gearing used to change the position of optical elements in a rangefinder may be shown in sufficient detail to indicate their purpose (see fig. 10).

**5.10.5 Number of views.** Preferably, the optical system schematic shall contain only one view. Additional sheets may be used to prevent confusion, providing some method is employed to indicate continuity.

**5.10.6 Identification of parts.** Parts or element on optical system schematics shall be identified in the manner prescribed in paragraph 5.9.6

**5.10.7 Notes.** Descriptive notes may be used to simplify the optical system schematic.

**Custodians:**

Army—Ordnance Corps  
 Navy—Bureau of Naval Weapons  
 Air Force—AMC

**Notice.** When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

(Copies of specifications, standards, drawings, and publications required by contractors in connection with specific procurement functions should be obtained from the procuring agency or as directed by the contracting officer.)

(Copies of this standard for Military use may be obtained as indicated in the foreword to the Index of Military Specifications and Standards.)

(Copies of this standard may be obtained for other than official use by individuals, firms, and contractors from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D. C.)

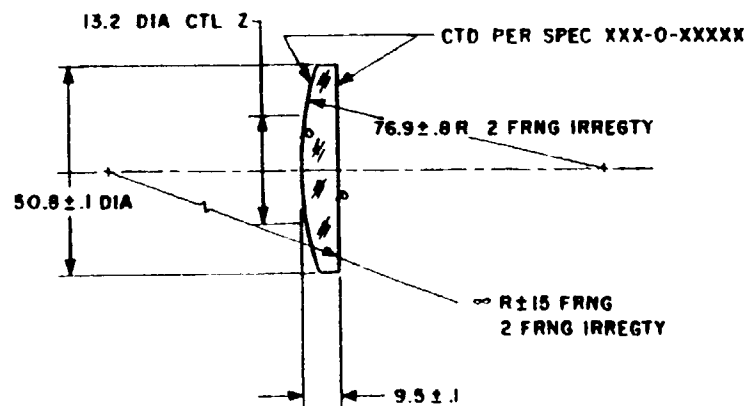
(Both the title and identifying symbol number should be stipulated when requesting copies of Military Standards.)

**Preparing activity:**

Army—Ordnance Corps

MIL-STD-34  
3 November 1960

ELEM IN ACCORD W/SPEC XXX-O-XXXXX  
EFL (NOM) \_\_\_\_  
BFL \_\_\_\_  
FFL \_\_\_\_  
CA: ENT \_\_\_\_ MM, EXIT \_\_\_\_ MM  
SURF. QUAL: CTL Z \_\_\_\_, OUTER Z \_\_\_\_  
CTRG ERROR \_\_\_\_ MINUTES  
CHAM .5 ± .3 × 45° ALL EDGES  
SURF. MKD "P" POL, ALL OTHERS GRL



DWG FORMAT  
PER MIL-STD-3 2

FIGURE 2. Single lens.

MIL-STD-34  
3 November 1960

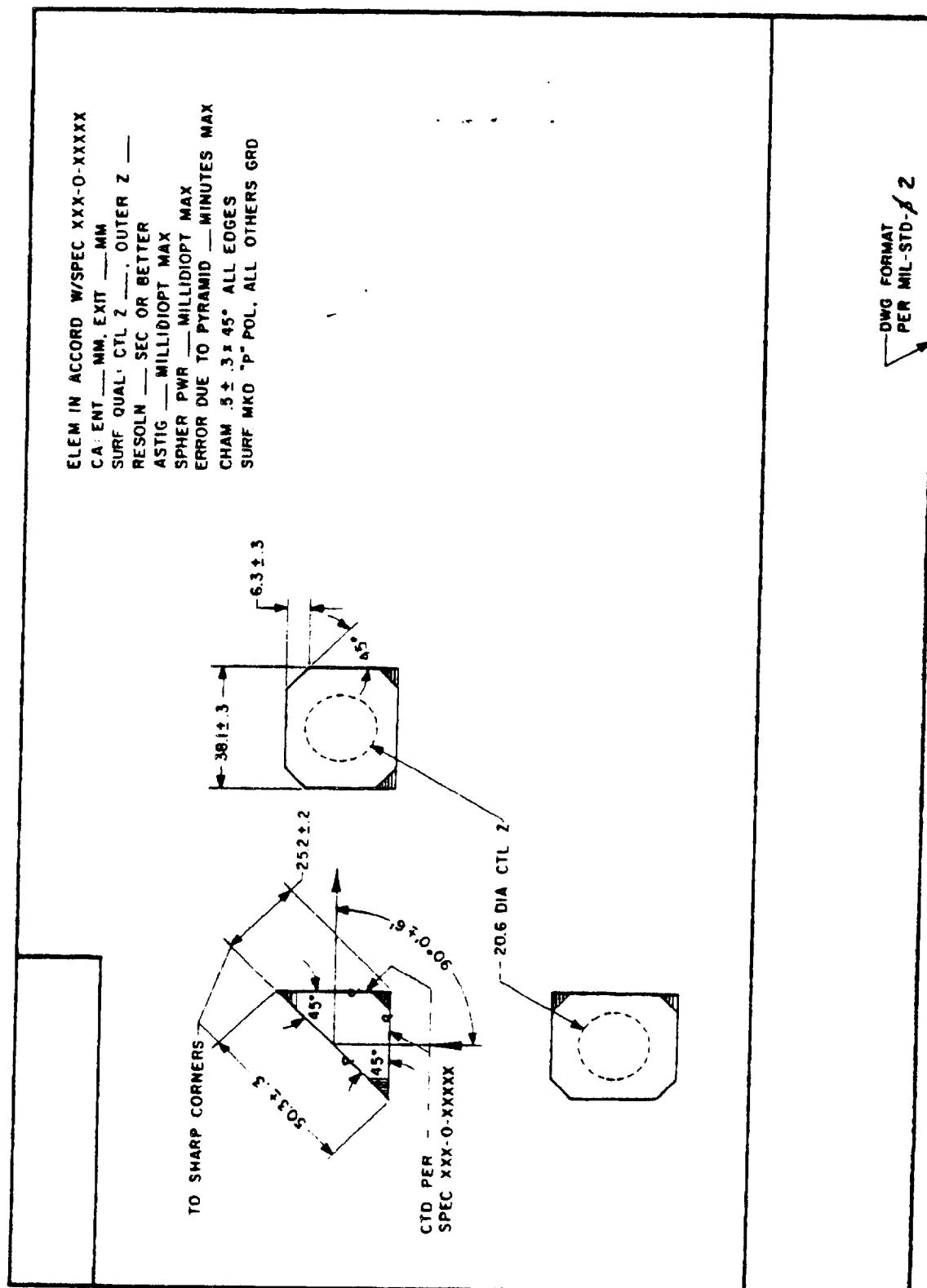
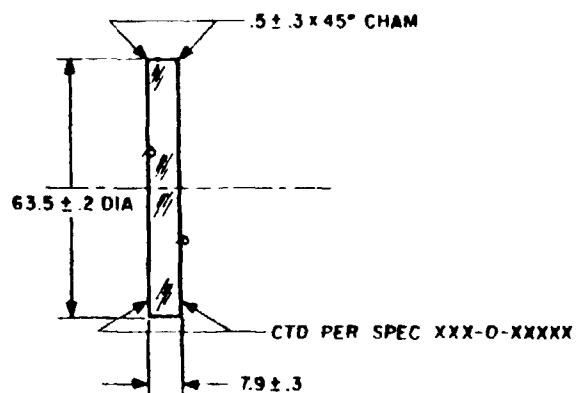


FIGURE 3. Prism.

MIL-STD-34  
3 November 1960

ELEMENT IN ACCORD W/SPEC XXX-O-XXXXX  
CA: ENT \_\_\_\_ MM, EXIT \_\_\_\_ MM  
SURF. QUAL \_\_\_\_  
ASTIG \_\_\_\_ MILLIDIOPT MAX  
SPHER PWR \_\_\_\_ MILLIDIOPT MAX  
ANGLE BET. FACES \_\_\_\_ DEG \_\_\_\_ MIN \_\_\_\_ SEC  
SURF MKD "P" POL, ALL OTHERS GRO



DWG FORMAT  
PER MIL-STD-2

FIGURE 4. Wedge.

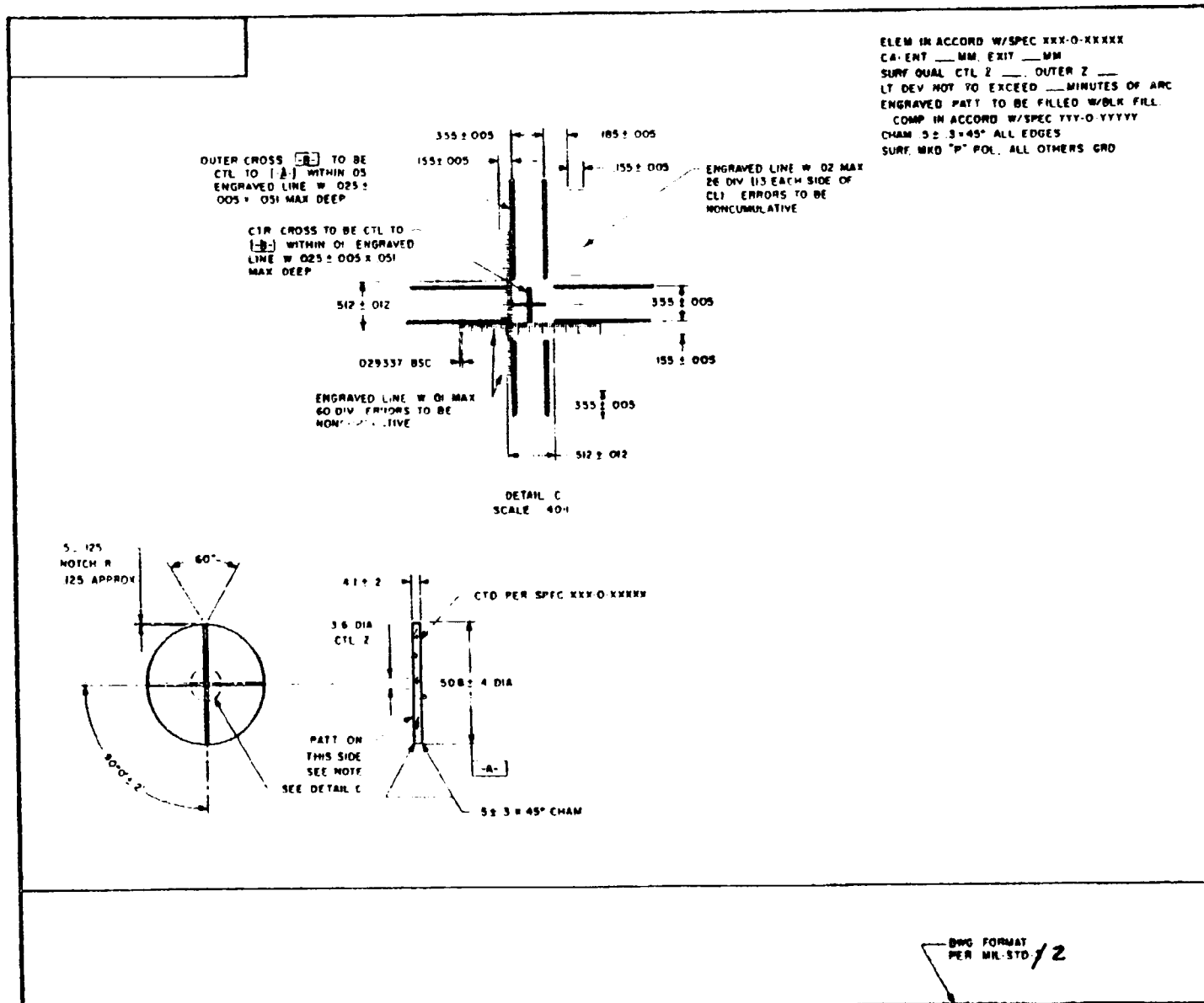
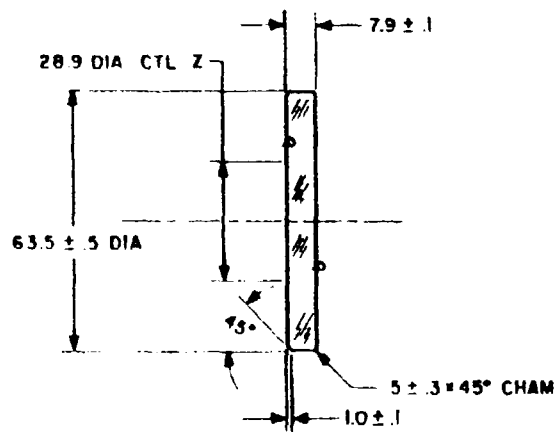


FIGURE 3. Reticle

MIL-STD-34  
3 November 1960

ELEMENT IN ACCORD W/SPEC XXX-O-XXXXX  
CA: ENT \_\_\_ MM, EXIT \_\_\_ MM  
SURF. QUAL: CTL Z \_\_\_, OUTER Z \_\_\_  
RESOLN \_\_\_ SEC OR BETTER  
ASTIG \_\_\_ MILLIDIOPT MAX  
SPHER PWR \_\_\_ MILLIDIOPT MAX  
LIGHT DEV NOT TO EXCEED \_\_\_ MINUTES OF ARC  
SURF MKD "P" POL, ALL OTHERS GRD



DWG FORMAT  
PER MIL-STD-2

FIGURE 1. 11 in/dia

MIL-STD-34  
3 November 1960

ELEM IN ACCORD W/SPEC XXX-0-XXXXX

EFL (NOM) —

BFL  $10.2 \pm .XX$

FFL —

CA: ENT — MM, EXIT — MM

RESOLN — SEC OR BETTER

ASTIG — MILLIDIOPT MAX

SPHER PWR — MILLIDIOPT MAX

SURF QUAL: CTL Z — OUTER Z —

LT DEV NOT TO EXCEED — MINUTES OF ARC

CTRG ERROR — MINUTES MAX

MINIMUM REFL — % FOR — WAVE LENGTH

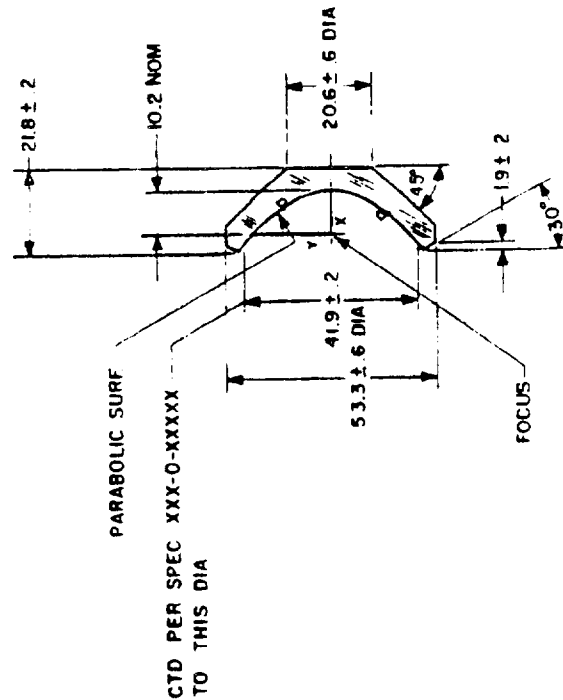
MEASURED NORMAL TO THE SURF

CHAM  $.5 \pm 3 \times 45^\circ$  ALL EDGES

SURF MKD "P" POL, ALL OTHERS GRD

SURF IRREGTY SPECIFIED BY ZONES AS FOLLOWS:

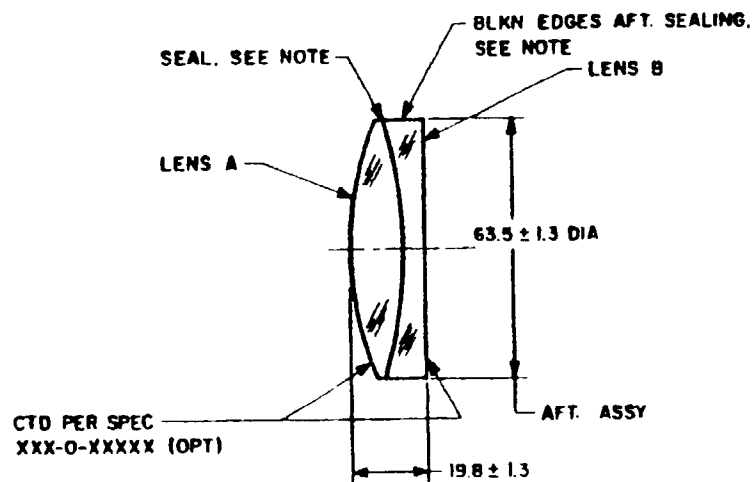
Y	X
5	$\pm$
10	$\pm$
15	$\pm$
20	$\pm$



DWG FORMAT  
PER MIL-STD-82

FIGURE 1. (Contd from front)

MIL-STD-34  
3 November 1960



ELEM IN ACCORD W/SPEC XXX-O-XXXXX  
CEM IN ACCORD W/SPEC YYY-O-YYYYY USING \_\_\_\_  
SEAL IN ACCORD W/SPEC ZZZ-O-ZZZZZ  
EFL (NOM) \_\_\_\_  
BFL \_\_\_\_  
FFL \_\_\_\_  
CA: ENT \_\_\_\_MM, EXIT \_\_\_\_MM  
RESOLN \_\_\_\_SEC OR BETTER  
ASTIG \_\_\_\_MILLIDIOPT MAX  
CTRG ERROR \_\_\_\_MINUTES MAX  
BLKN IN ACCORD W/SPEC VVV-O-VVVVV  
CHAM .5 ± .3 x 45° ALL EDGES

DWG FORMAT  
PER MIL-STD-~~2~~ Z

FIGURE 8. Cemented assembly.



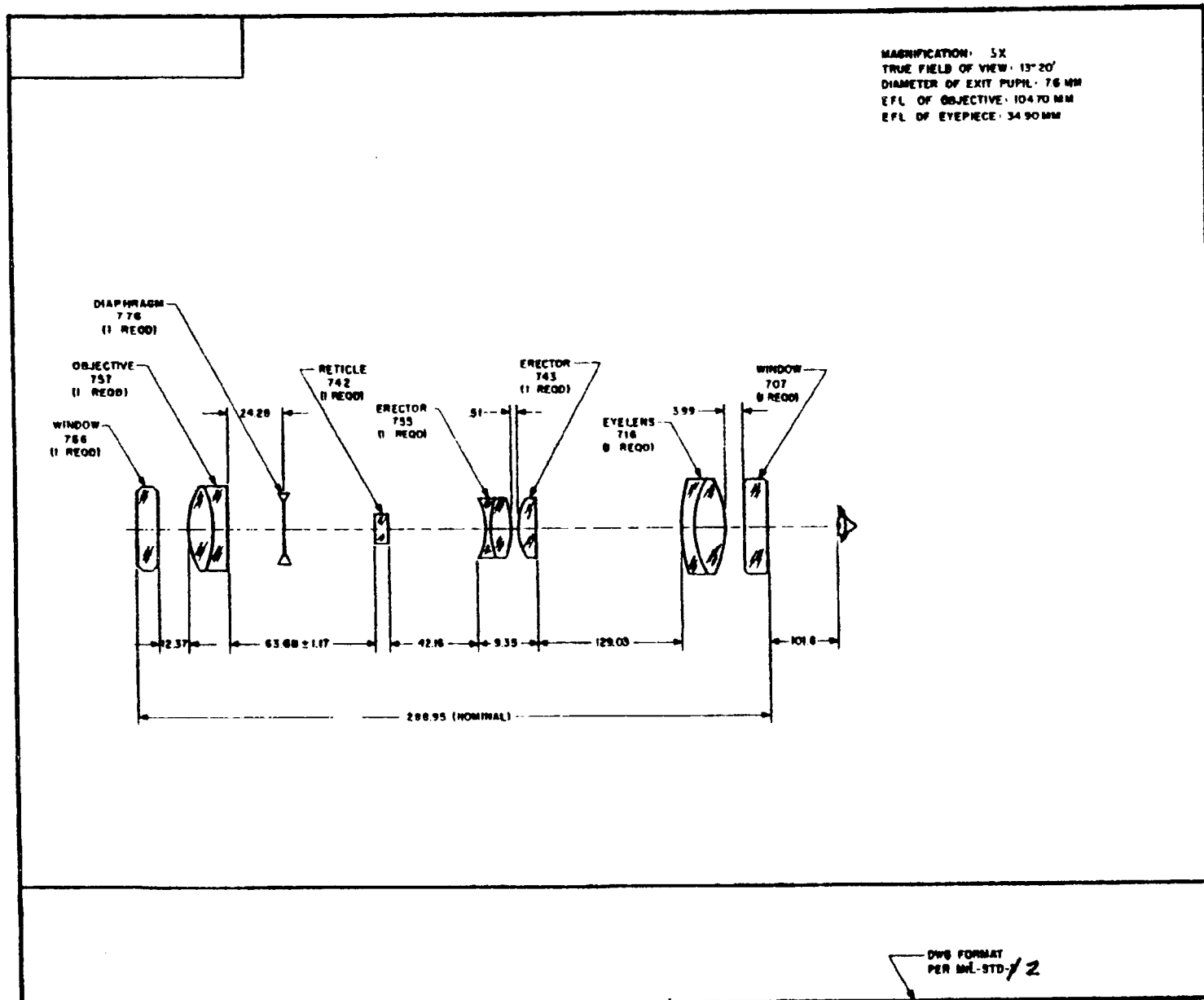


FIGURE 9. Optical system.

MIL-STD-34  
3 November 1960

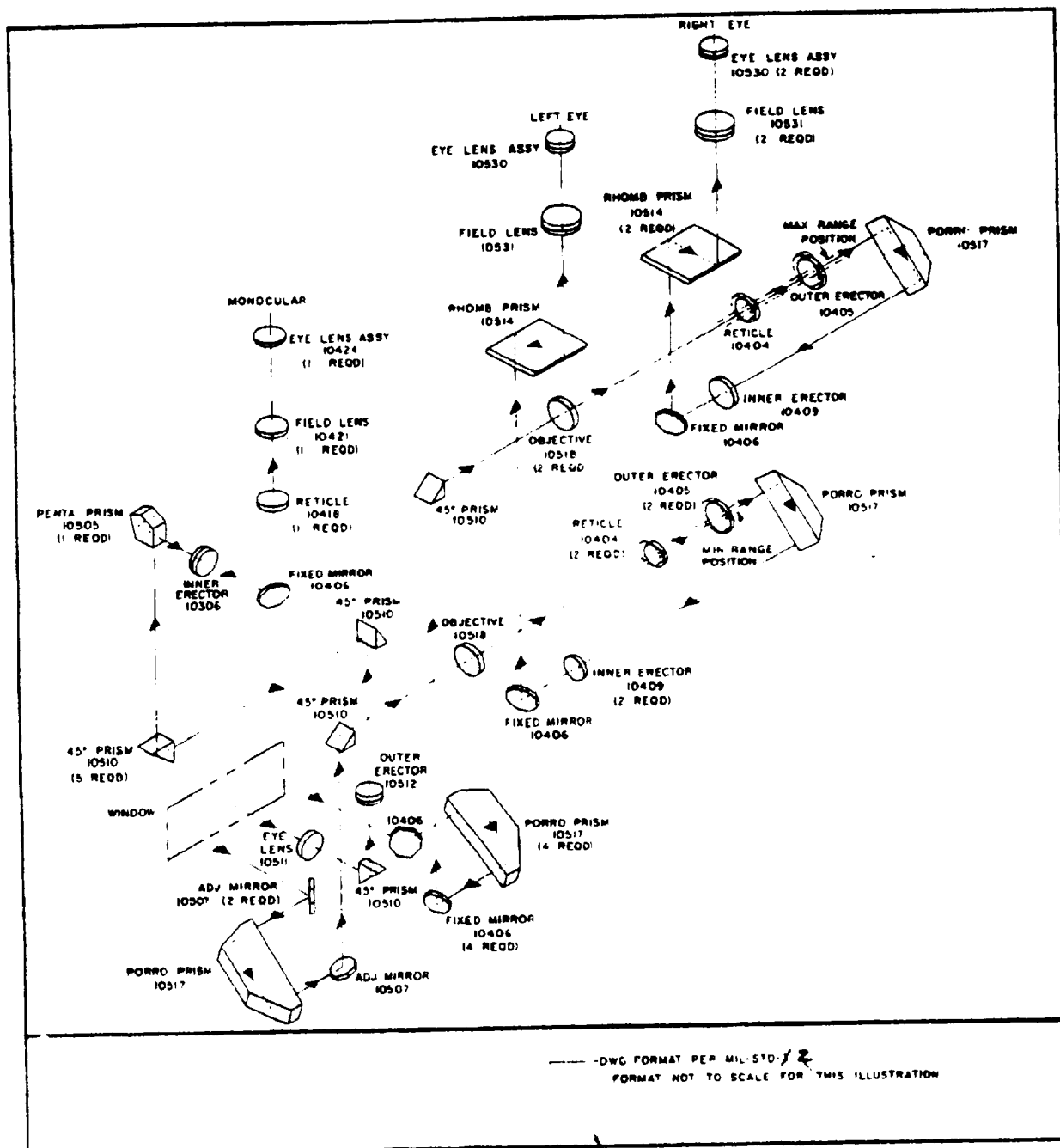


FIGURE 10 Optical schematic.



FOLD

POSTAGE AND FEES PAID



OFFICIAL BUSINESS  
PENALTY FOR PRIVATE USE \$300

Commander  
Frankfor Arsenal  
ATTN: SARFA-MDM  
Philadelphia, PA 19137

FOLD