The Adams & Westlake Company

CHICAGO General Office and Works ELKHART, INDIANA NEW YORK

SIGNAL GLASS

ADLAKE

SIGNAL GLASS

For Railroad Use

LENSES

Lenses are available of such designs as to serve practically any requirement found in modern railway signaling. A variety of types, sizes and combinations ranging in diameter from 2½" to 36" is available.

With a given light source, the character of the beam may be changed as desired by simply using a lens of proper design to produce the desired result.

Lenses of different types and of the same diameter are interchangeable.

The Focal Distance of a lens is the distance between the plane of its seating surface and the light source, (See Fig. 1). F—Lens Focal Distance, RF—The prismatic reflector Focal Distance, and LS—the Light source.

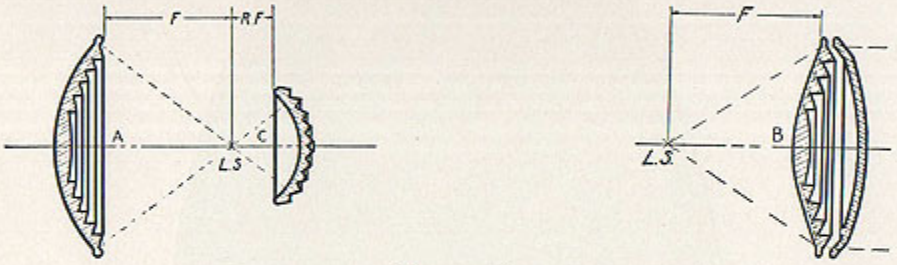


Figure 1

NOTES

A—An Optical Lens
B—An Inverted Lens with Cover Glass
C—Prismatic Reflector

Concentrated light sources are most effective and economical for use with lenses as only the light within a small focal area is useful.

The spread of a beam is directly proportional to the area of the light source and the intensity of a light beam is inversely proportional to its spread.

Optical lenses designed for use with a kerosene flame will not project a beam of similar character when used with a low voltage concentrated electric source because of the difference in area of the two light sources.

An electric lens for use with an electric light source, in switch, signal, marker and classification lamps has been developed and when used with a 3½ volt ½ ampere lamp projects a beam of much higher intensity and of similar dimensions to that projected by an optical lens with a Long Time Burner kerosene flame.

The following table involving 5⅜" lenses 3½" focus and a Long Time Burner of approximately one candle power offers a means of

directly comparing the beam candle power projected and the spread produced by the four types of lenses commonly used.

	Optical	Inverted with Cover Glass	Spreadlite	Wide Angle
Beam Candle Power	69	59.0	27	11.5
Spread in feet per 100 feet	14	19.3	60	34.0

It will be noted that the beam candle power and spread are inversely proportional.

The optical lens projects the most powerful beam over the smallest area.

The inverted lens with a cover glass projects slightly less beam candle power over a slightly greater area.

The Spreadlite lens, due to the vertical flutes on the outer surface, projects less than half the beam candle power, but covers more than four times the horizontal area. The vertical spread is the same as that of the optical lens.

The wide angle lens projects one-sixth the beam candle power over twice the area both vertical and horizontal.

In considering suitable lenses for standard or special purposes, the diameter should be the first consideration, bearing in mind that since the beam intensity varies directly with the free area of the lens, a small difference in diameter seriously affects the beam candle power with a given light source.

The beam candle power of the 5″ and 5⅜″ optical lenses are 57 and 69 respectively, or a difference of 20 per cent. The inverse square law applied to intensity governs the difference in range of visibility.

The second consideration, when a definite spread of beam is essential, is the selection of a lens that restricts the spread to the minimum required, to avoid unnecessarily sacrificing beam intensity. The beam intensity of a one candle power kerosene light source varies between 9.1 candle power over an angle of 360° when used with a Marine Fresnel Lens to 69 beam candle power over an angle of 7½° when used with a 5⅜″ optical lens 3½″ focus.

The Spreadlite lens fulfills practically every requirement where the range of visibility must cover a wide horizontal area. Spreadlite lenses are commonly used in switch, signal, marker and classification kerosene lamps. The electric or Spreadlite lenses are recommended for electric light sources.

PRISMATIC REFLECTORS

Prismatic reflectors are not silvered but depend upon complete refraction of the rays through prisms located on the convex surface. The refracted light passes through the light source and the lens, thereby substantially increasing the beam candle power and spread.

ROUNDELS AND COVER GLASSES

Roundels and cover glasses should not be confused with lenses as they have no focal point, but utilize the parallel rays from an

inverted lens or reflector and either serve as a clear cover glass, a color screen, a deflecting or diffusing glass, or may perform two or more of these functions.

COLORS

All signal glassware furnished by The Adams & Westlake Company is in accordance with the latest specification of the Signal Section of the Association of American Railroads. Through continued research by the Signal Section and the glass manufacturer, signal colors have been improved and closely defined to provide maximum light transmission and distinct color indications. To meet the A.A.R. specification requires technical supervision in manufacture and rigid inspection which includes photometric measurement of each colored glass to insure its being within the A.A.R. limits.

EFFECT OF COLORED EYE GLASSES UPON THE VISIBILITY AND COLOR OF SIGNAL INDICATONS

Visibility of a white light through any glass is decreased by losses due to reflection and absorption. The reflection loss is approximately eight (8) per cent and the absorption loss varies from practically nothing in clear glass to a considerable amount in colored glass, depending on the color and its density as may be better determined by studying the following transmission table.

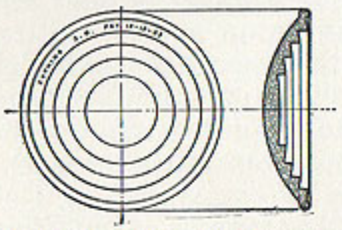
Color	Photometric Medium A.A.R Scale	Kerosene Light Source Transmission	Acetylene or Electric Light Source Transmission
Clear	92	92	92
Red	130	12.2	9.1
Yellow	187	49.0	46.9
Green	175	18.0	21.1
Lunar White	100	17.8	.....
Blue	100	1.5	2.2
Purple	100	1.0	.....

High intensity, maximum range signal indications seem popular. Therefore, spectacle glasses for the use of observers should be ground, polished, most transparent and contain the least possible amount of color. Unsurfaced glasses cause eye strain. Unsurfaced cab window glasses will distort the angle of semaphore or position light signal aspects, just as ordinary window glass distorts objects viewed through them. Colored Signal Light Indications viewed through glasses containing color will be reduced in intensity and may become invisible if viewed through complimentary colors of certain hue density.

The above table may also serve the purpose of calculating the approximate variation in range of visibility as between different colors.

We acknowledge the assistance of the Corning Glass Works in furnishing a large portion of the information and illustrations in this bulletin.

STANDARD LENSES

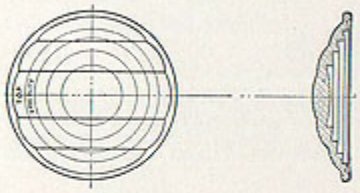


Optical, Wide Angle, or Electric Lens

The "OPTICAL LENS" transmits a powerful beam of light visible a maximum distance over a limited area, and is the recognized standard for general use.

The WIDE ANGLE LENS is designed for an extreme spread in all directions and consequently has a much shorter range than other types.

The ELECTRIC LENS is designed for electric lamps with a small, concentrated filament. The spread is 2½° vertical and 5° horizontal.



Spreadlite Lens

The SPREADLITE LENS transmits a moderately intense beam having a wide fan shaped horizontal spread and is useful where due to curves or wide streets a wide spread of light is essential. All lenses of a given diameter are interchangeable.

SPREADLITE TYPE

Diameter Inches	Focus Inches	Spread in Degrees
3½	¾	30
3⅞	2¾	30
4	2¾	30
4	3½	30
4⅛	2¾	30
4½	3	30
4½	3½	30
5	2¾	15
5	3½	30
5	3½	7½
5⅜	3½	30
5⅜	3½	7½
6	3¾	30
6⅜	3¾	30
8⅜	5	30
12	7	30
18	9	6

WIDE ANGLE TYPE

Sizes on application

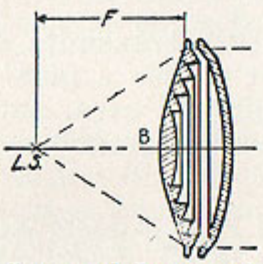
OPTICAL TYPE

Diameter Inches	Focus Inches
2½	2¾
3	2¾
3	3
3½	¾
3½	2¼
3¾	2½
3⅞	2¾
4	2¾
4	3⅛
4	3½
4⅛	2¾
4⅛	3
4⅛	3½
4¼	2¾
4½	3
4½	3½
5	3½
5⅜	3½
5⅜	5⅝
6	3¾
6⅜	3¾
7	4
7⅜	1¾
8	1½
8	4½
8⅜	1¾
8⅜	5
9	5½
10	2¾
10	6
10½	12
12	7
16	9
18	9

ELECTRIC TYPE

4	2¾
4	3½
4½	3
4½	3½
5	3½
5⅜	3½

STANDARD LENSES



Inverted Lens and Cover Glass

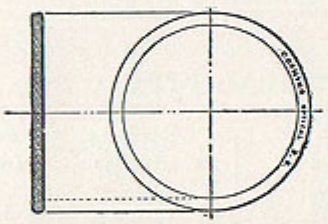
The INVERTED LENS transmits a powerful beam of light of somewhat greater spread and visible approximately the same as the optical lens. This lens is used with a cover glass, which protects the corrugations from accumulation of dirt; provides two outside smooth surfaces and the air space between the glasses reduces the accumulation of moisture by condensation. Colors are available either in the lens or cover glass.

INVERTED and INVERTED SPREADLITE LENSES
Cover Glasses for inverted lenses
Sizes on application

STANDARD ROUNDELS

Roundels should not be confused with lenses as they have no refracting prisms and no focal point. Where "reflected light" may be objectionable, convex roundels should be used. A.A.R. and traffic signal specifications govern the manufacture and inspection of roundels.

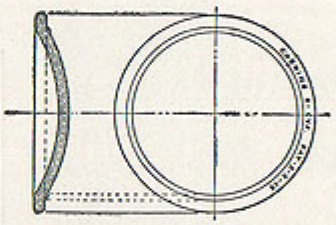
Flat Type ¼" Thick



Diameter, inches

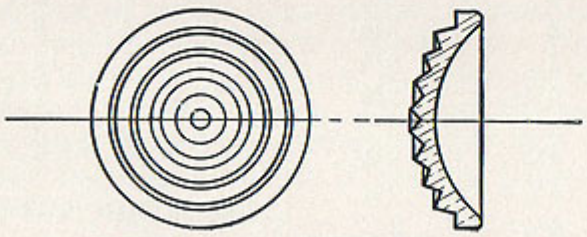
2½	4⅛	6	8⅜
3	4¼	6⅜	9⅝
3½	4½	6½	10½
3¾	5	7	.....
4	5⅜	8	.....

Convex Type ¼" Thick



Diameter, inches

3½	6½
4	7
5	8⅜
5⅜	11¼



PRISMATIC REFLECTORS

PRISMATIC REFLECTORS are located back of the light source and redirect the light rays, that would otherwise be wasted, through the lens, thereby considerably increasing the efficiency.

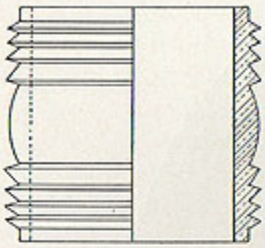
Diameter, inches	3⅜	6	8¼
Focus, inches	1¼	3	3½

THIN ROUNDELS and SLIDES ⅛" THICK
Diameter, inches

3⅛
3½
3⅞
4
4¼
4⅜
3¼ x 3 13/16
3⅞ x 4¼

MARINE LENSES

Fresnel Type



Marine Fresnel Lenses Can Be Supplied in Whole (360°) Lenses or in Sections, 90°, 120°, 180° and 225°. Sizes listed at right.

Tolerance—$\frac{1}{16}$" plus or minus on height
$\frac{1}{8}$" plus or minus on diameters

DIMENSIONS IN INCHES

Height	Diameters Inside Rim		Diameters Outside Rim		Old Designation
	Top	Bottom	Top	Bottom	
3⅜	2⅞	2¾	3 3/16	3 3/16	E-21
4¼	3½	3⅜	4	3⅞	178-J
5¼	4⅝	4 7/16	5 3/16	5⅛	181-J
5⅝	4 11/16	4 7/16	5⅜	5 3/16	180-J
5⅝	5 1/32	4⅞	5½	5½	6 inch
6⅛	6	5¾	6½	6½	150 mm. —A.G.A.
7⅜	6 31/32	6 25/32	7½	7½	8 inch
7¾	6 13/32	6⅛	7 3/16	7⅛	150 mm.—L.H.
6⅞	7 13/16	7½	8 5/16	8 5/16	200 mm.—L.H.
7½	8⅝	8 5/16	9¼	9 3/16	7½" x 9¼"

MIRRORS

Corning Lebby Decentered Mirrors
Sizes
4½" and 6½" Diameter
See Bulletin B-93A

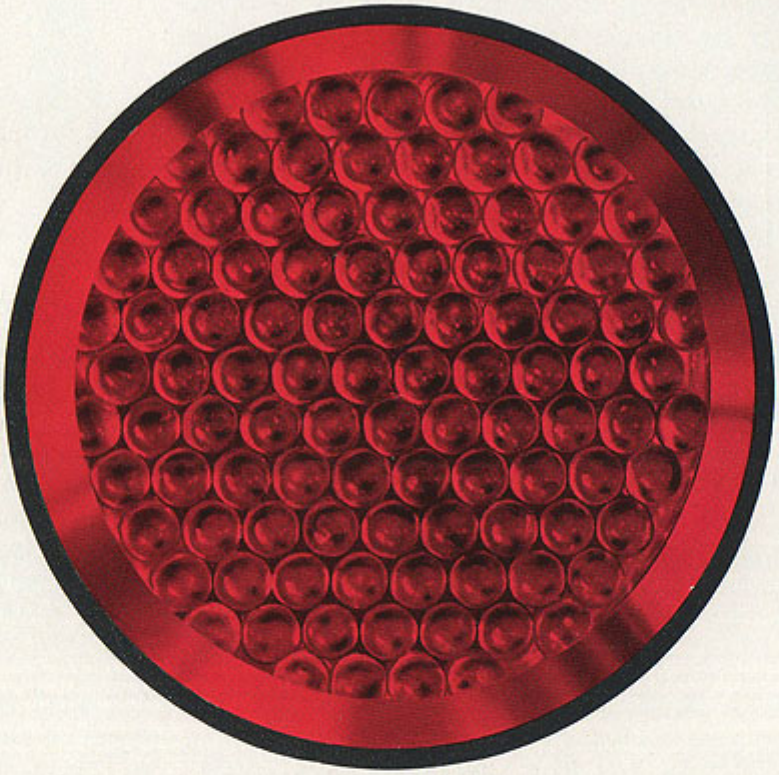
Mangin Mirrors
Sizes
3¾" 4½" 5" and 7" Diameter
See Bulletin B-101

Roundels and Cover Glasses

For Use With Mirrors

5⅜" cover glass 40° downward deflecting.
5⅜" cover glass 25° spreadlite with downward deflection.
5⅜" convex roundel, diffusing type or 20° spreadlite.
6⅜" cover glass 25° downward deflecting.
6⅜" cover glass 25° spreadlite with downward deflection.
8⅜" convex roundel, diffusing type, plain or lettered STOP or GO.
8⅜" convex roundel, 30° spreadlite.
8⅜" convex roundel, 30° spreadlite with downward deflection.
8⅜" flat roundel, 8° or 30° spreadlite.

REFLECTING LENS



Pat. No. 2,009,769

A new development in railroad signal glass is the Corning Doublet Reflecting Lens. Test installations have proved satisfactory and several railroads are now using large quantities in switch lamps. They are also suitable for Crossing Gates, Slow Post Signs, Yard Limit Boards and for other purposes where the light from locomotive or automobile headlights produces a satisfactory indication. The installation cost of these reflecting lenses is rapidly absorbed since the average cost of servicing an oil lamp is approximately $12.00 per year.

The Corning Doublet Reflecting Lens consists of two lenses of special design, sealed in a brass housing which protects the silvered reflecting surface. It is manufactured in accordance with A.A.R. specifications and each unit is tested to insure uniform color and reflecting value.

This lens is made in 5⅜" diameter only, for the purpose of providing uniform range of visibility. In converting oil lamps, lenses of smaller diameter can be replaced by using expanding lens holders and coupling rings. See Adlake Bulletin B-96-A on Reflex Switch Lamps.

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