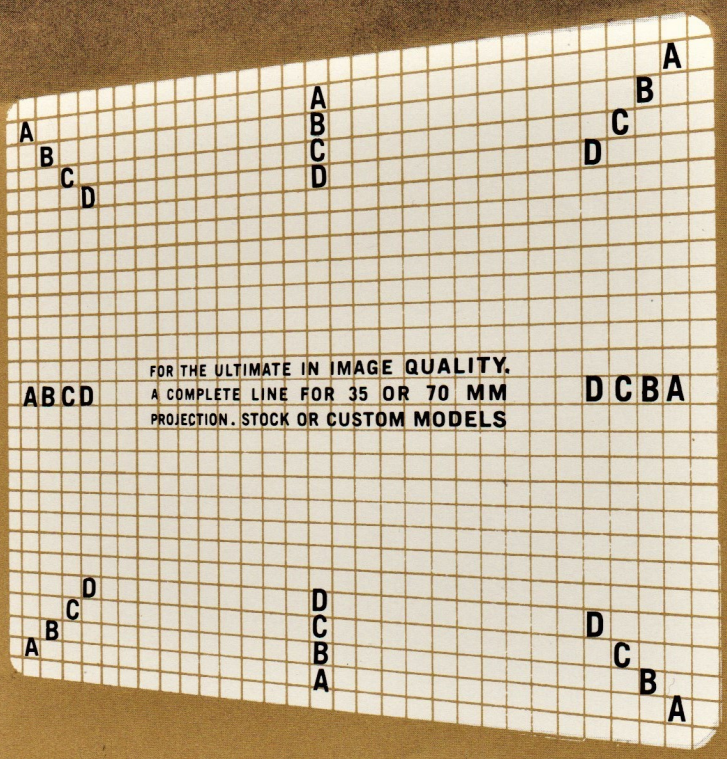
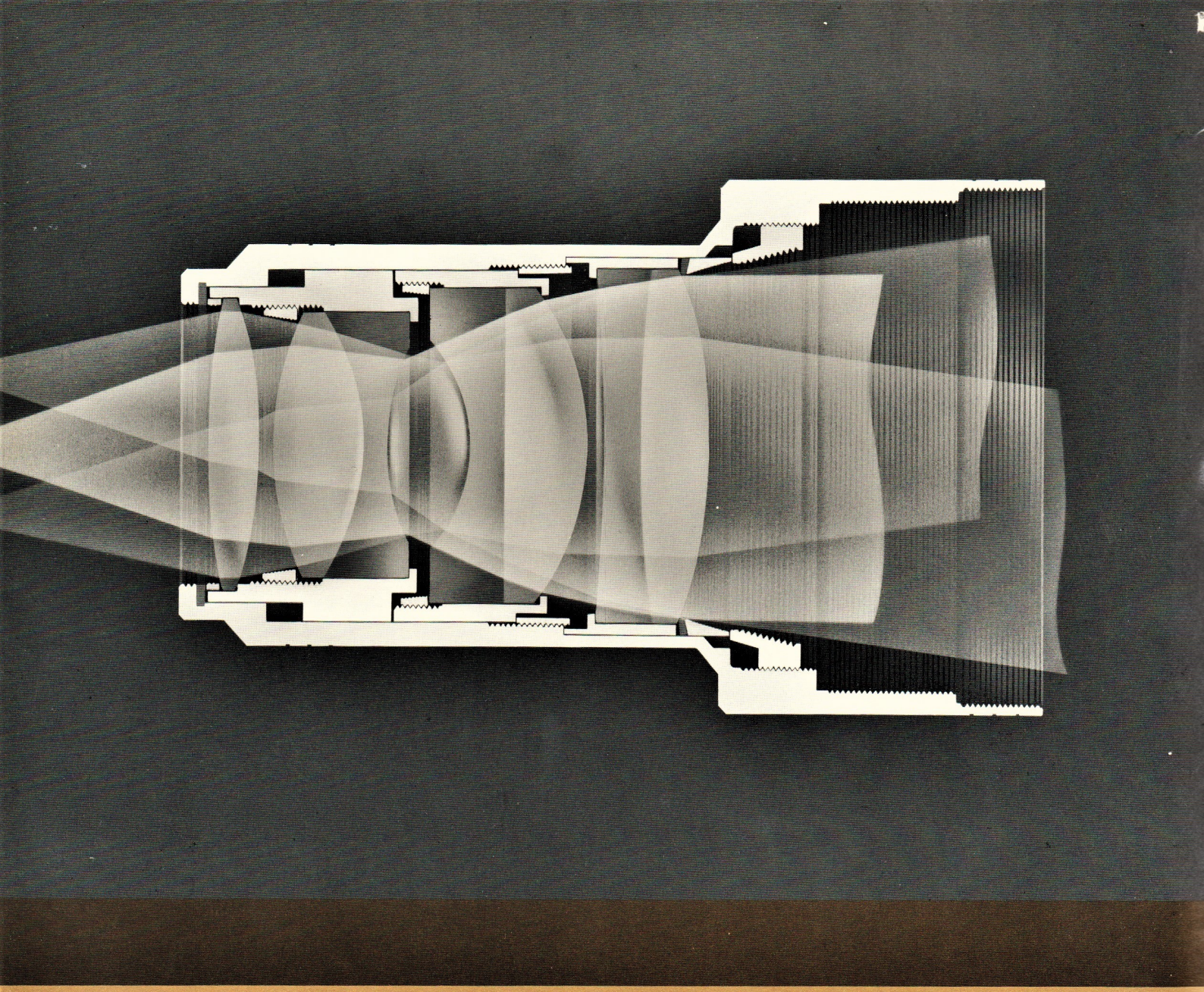
BULLETIN K 701

KOLLMORGEN PROJECTION LENSES





The well designed path to image quality.

KOLLMORGEN CORPORATION, a leader in precision optical instrumentation, Kollmorgen is the prime supplier of periscopes for the Navy's nuclear submarine fleet. Optical, electronic and mechanical design talents are combined to create such diverse and exacting products as catadioptric objectives, projection lenses, ships' binoculars, telescopes, optical alignment equipment, industrial and scientific periscopes and other special electro-optical instrumentation. In the submarine periscope field, Kollmorgen has been primary supplier for half a century; the Polaris Celestial Reference periscope is perhaps the most sophisticated optical system in use today. This booklet will discuss one aspect of the overall Kollmorgen optical capability, the design and manufacture of Projection Lenses for the entire Professional Entertainment Field.

IN THE MOTION PICTURE INDUSTRY, the name Kollmorgen has been synonymous with excellence in projection optics for nearly half a century. Since 1919. the reputation for quality has been augmented, with a continual policy of product leadership, prompt, efficient handling of stock orders, custom modifications and dependable repair services. Beginning with the Series I Snaplites, through Series II, to the f 1.9 and the f 1.7 Super Snaplites, and now to the higher magnifications of extra short focal lengths and custom requirements, Kollmorgen has constantly kept abreast of the exacting demands of modern theater projection. It is noteworthy that the total of Kollmorgen theater lenses approaches the 100,000 mark (the equivalent of 4 sets for every existing theater in the country). The vast majority of these are new since 1946 and in regular use.

CUSTOM PROJECTION OPTICS, have been developed for complex projection techniques such as Talaria large screen projected color television, three panel Cinerama, ARC-120 and RCA-TV. With this reputation and hundreds of multiple-element lens designs as a base, plus automatic computers and test facilities, Kollmorgen has actively sought and been frequently selected for challenging development programs. The Kollmorgen engineering design talents, are available for the challenge of your optical or electro-optical developments. Contact the Director of Instrument Sales, Kollmorgen Corporation, Northampton, Mass.

Over 50 separate lens designs.

CHECK THESE FEATURES:

GENERAL SPECIFICATIONS FOR ALL SNAPLITE LENSES

SUPERB OPTICAL DESIGN To obtain an exacting, professional image having sharp focus, proper contrast and uniform illumination, requires a highly corrected, multiple element lens system. In keeping with its long tradition of high precision optics, all Kollmorgen projection lens systems are computer designed and optically corrected to provide the ultimate in image quality. All Series II Snaplites incorporate 4 elements of varying types of optical glass with special contours to correct the three basic optical abberations, resulting in an "aplanatic" lens. The optical design is carried much further in the *Super* Snaplites which incorporate 2 or more extra elements, permitting full correction for astigmatism, with special attention to eliminating distortion, resulting in a series of true *anastigmatic* lens.

SUPERIOR IMAGE QUALITY The projected image with Series II lenses, displays excellent contrast, high definition, flatness of field, and freedom from color fringes. These virtues are maintained in the *Super* Snaplites at even higher magnification and improved speed, plus the significant benefits of superior image quality, and fully uniform illumination. These advantages are achieved by added optical elements with increased lens correction effort.

COATED OPTICS All Kollmorgen Snaplite lens surfaces are treated with a hard, durable anti-reflection coating to eliminate surface reflections and internal losses, thus yielding both improved image contrast and increased light transmission.

MATCHED LENS SETS Pairs of lenses are matched for performance and magnification prior to shipment to give exact results at time of reel change.

ALUMINUM LENS MOUNT The entire lens barrel is made of high-strength, light-weight aluminum alloy, for easy handling and to improve heat transmission, safeguarding lenses from the effects of high-intensity projection lamps.

AIR SPACED REAR ELEMENTS To assure full performance over long service, all rear elements, in Kollmorgen Snaplites, are air-spaced, rather than cemented, avoiding high heat damage in this area. Center and front elements are usually cemented doublets, although fully air spaced lenses are available.

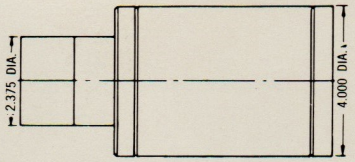
ONE PIECE SEALED DESIGN The entire lens barrel is machined from a single piece, with no threaded assembly joints which might upset the exact spacing between the lenses. In addition, the front and rear lens elements are sealed with special gaskets to prevent fogging from the entry of moisture, dust or oil. Maintenance is never required in normal service. This feature assures a continued clear, bright image.

ANODIZED FINISH The hard, anodized aluminum finish provides long term surface protection that will neither chip, rust, peel nor tarnish in normal use. Unlike lacquer or painted coatings, the anodized finish is a permanent and integral part of the metal surface.

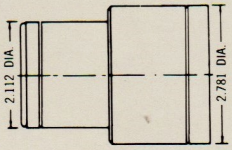
ADDED SERVICES *Trial lens sets:* to assure best possible selection, for the application. *Repair and Loan service:* Prompt service from periodic checking to replacement of broken elements. Loan lenses available during repairs.

f/1.9

SIX ELEMENT SERIES



BX 265



BX 241

BX 265 4″ dia.
5″ to 7″ E.F.

BX 241 2.78″ dia.
2″ to 5″ E.F.

SUPERIOR IMAGE — TRUE ANASTIGMATS — SIX ELEMENTS

The f 1.9 Super Snaplite series is based on the "Biotar" lens concept providing superior image quality and improved lens speeds from 2 inches to 7 inches. This series is designed not only for the utmost image quality at higher speeds, but also to meet current requirements of wider projection angle and shorter focal lengths. The six element design concept provides virtually perfect flatness of field with higher uniformity of illumination and superior images as compared to the four element f 2.0 Series. The 4 inch diameter series utilizes larger lenses to maintain higher speed in the 5 inch to 7 inch range. True anastigmats, the f 1.9 series lenses are comparable to the finest of professional camera lenses. (With focus drift directly related to lens speed, extra fast lenses may be replaced with the f 1.9 series lenses.)

Recommended for all professional projection requirements, including backup for anamorphic adapters, particularly for medium and larger screen applications. The 4 inch dia. BX265 lenses are specially suited for long throw projection and drive-in requirements and recommended for 70 mm application. All general specifications apply and lenses are housed in a gold-anodized barrel. Fittings and adaptors are listed on page 7.

ANASTIGMATS BY KOLLMORGEN

BX 290

f/1.7

SEVEN + ELEMENT SERIES

BX 290 2.78″ dia.
2½″ to 4″ E.F.

BX 294 2.78″ dia.
1¾″ to 3″ E.F.

HIGHEST QUALITY IMAGE — TRUE ANASTIGMAT SEVEN PLUS ELEMENTS

With an additional optical element, (as compared to the f 1.9 series,) the f 1.7 series achieves exceptionally uniform screen illumination and razor sharp definition in a faster lens. The added element assures greater light gathering power, and provides an additional optical correction for a more perfect image. Recommended particularly for the larger screen applications, even with some curvature, and all applications requiring perfection in image quality.

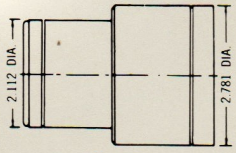
The unique X-tended barrel BX 294 series couples the superb optics of the BX 290 series with a multi-element telescopic "light pipe". This converts the excellence of longer focal length optics for the shorter focal length applications between 1¾ inches and 3 inches. The reduced field angle coupled with full diameter lenses, results in probably the highest image quality and definition obtainable for motion picture use. The X-tended barrel lens is also designed to increase back focus distance while eliminating lens mount interference which might introduce vignetting. The BX 294 X-tended barrel series is considered by many projection experts to be the highest quality lens available to the motion picture industry.

All general specifications apply and lenses are housed in a gold anodized housing. Fittings and adapters are listed on page 7.

Series II, BX 163 2.78″ dia.
3½″ to 7″ E.F.

f/2.0

FOUR ELEMENT SERIES



BX 163

A HIGH VALUE IN PRECISION LENSES:

QUALITY PERFORMANCE — HIGH VALUE FOR PRICE

The Series II Snaplites are based on the "Petzval" lens concept, utilizing optics of large aperture. Total design incorporates four lens elements, carefully computed to combine brilliant illumination with freedom from abberations. Projected images display excellent contrast, definition, flatness of field, and freedom from color fringes. Lens speed of f/2.0 is achieved for focal lengths from 3½ inches to 5 inches. From 5¼ inches to 7 inches slower speeds are due to limited diameter and four element design. (Use BX 265 for more light). Recommended for standard 35 mm and anamorphic back-up lens use when applied to medium and smaller screen applications. Use Super Snaplites for larger screens and more exacting requirements.

General specifications apply and lenses are housed in satin black anodized barrel. Standard fittings and adapters are listed on page 7.

BX-69X Adapter

MAGNA-COM FOCAL LENGTH ADAPTER

(To reduce E.F. and increase magnification)

The Focal Length Adapter is a magnifying "light pipe" which modifies the lens E.F. by a 11/16 ratio (see table). Particularly useful for very short focal lengths and for E.F.'s between the standard steps. The Adapter permits use of long focal length optics in a short focal length application. Image quality of the combination is equal or superior to a single lens of the same focal length. Design and application has been proven in BX 294 Series. Applicable to BX 163, BX 241, and BX 290 lenses. General specifications apply and lenses are sealed in a gold anodized barrel.

Use Lens of This E.F. with Adapter	To obtain this Resulting E.F.:
2	1.38″
2¼	1.55″
2½	1.73″
2¾	1.90″
3	2.07″
3¼	2.25″
3½	2.42″
3¾	2.59″
4	2.75″
4¼	2.94″
4½	3.11″
4¾	3.28″

Use Lens of This E.F. with Adapter	To obtain this Resulting E.F.:
5	3.45″
5¼	3.62″
5½	3.80″
5¾	3.98″
6	4.15″
6¼	4.32″
6½	4.50″
6¾	4.65″
7	4.84″

BX-69X ADAPTER

INFORMATION FOR ORDERING LENSES AND FITTINGS

1. Refer to Screen Chart and Formulas. (back cover). Select required E.F. Consider E.F. Adapter.
2. Refer to Recommendations of application with lens description. Select lens.
3. Refer to lamp specifications. Kollmorgen f 1.7 and f 1.9 lens are matched to most current lamps. We will recommend optimum combinations.
4. If exact screen size is required, consider lens of custom magnification.
5. If extra high intensity projection lamp is used, consider air spaced lens.
6. Refer to charts below for lens, mountings or fittings data.
7. If any question, specify make and model of projector with lens order.

35 MM PROJECTORS WITH 4" DIA. MOUNTS

MAKE	MODEL	4" DIA. LENS FIG. NO.	2.78 DIA. LENS NOTE
Ballantyne	4" dia. mount	7	See Fig. No. 1 Shade-Tube AX-196 required if BX-163, BX-290 or BX-241 lenses are used.
Brenkert	RCA 100	7	
Century	4" dia. mount	6	
International	XL	6	
Motiograph	4" dia. mount	7	
Wenzel	4" dia. mount	7	

35/70 MM PROJECTORS (4" DIA. MOUNTS)

MAKE	MODEL	4" DIA. LENS FIG. NO.	2.78 DIA. LENS NOTE
Century	J, JJ	6	See Fig. No. 1 Shade-Tube AX-196 required if BX-163, BX-290 or BX-241 lenses are used.
Cinemeccanica	Victoria-8-X	6	
National 70	Bauer U-2	6	
Norelco	Universal	6	

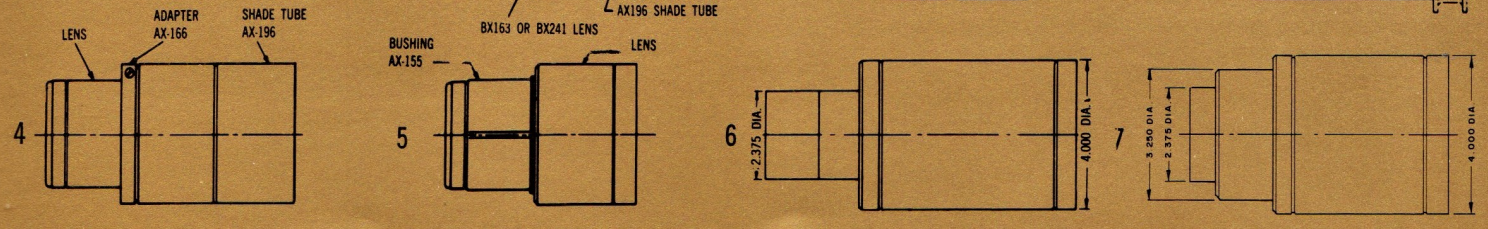
35 MM PROJECTORS WITH 2.78" DIA. MOUNTS

MAKE	MODEL	FITTINGS	FIG. NO.	LENS NOTES
Ballantyne	"W"	None		
Ballantyne	"W" Large lens mount	AX-155	5	
Ballantyne	"G" (Gardiner with reg. lens mount)	None		
Ballantyne	"G" (Gardiner with large lens mount)	AX-155	5	
Brenkert	BX-40, BX-80 BX-60, BX-62	AX-196 AX-170*	3	**Use BX294 or E.F. Adapter
Century	C, CC, K Super	AX-196 AX-166	4	
Century	C, CC, K Super (Using 2 clamp rings)	AX-196 AX-166	4	**Use BX294 or E.F. Adapter
Century	K (or Kaplan)	None		
Century	K with C-62 modification	AX-155	5	
Holmes	Type 8 Educator	AX-196	2	Will take lenses 5" E.F. and longer only or use E.F. Adapter
Holmes	Type G.P.	AX-196	2	
Holmes	Type D	AX-196	2	Will take lenses 5" E.F. and longer only or use E.F. Adapter
International Projector Corp.	Simplex E-7	AX-196 AX-170*	3	Use BX294 or E.F. Adapter
International Projector Corp.	Simplex, Regular	None†		
International Projector Corp.	Simplex, with C-62 modifications	AX-155	5	
International Projector Corp.	Simplex International	None		Will take lenses 4" E.F. and longer only or use E.F. Adapter
International Projector Corp.	Simplex Semi-professional	AX-196 AX-170*	3	Will take lenses 4" E.F. and longer only or use E.F. Adapter
International Projector Corp.	Super Simplex	AX-196 AX-170*	3	**Use BX 294 or E.F. Adapter
Motiograph	AA	AX-196	2	**Use BX 294 or E.F. Adapter
Motiograph	F	None		
Motiograph	HU, HK, K Deluxe	AX-155	5	
Powers		AX-196	2	Will take lenses 5" E.F. and longer only or use E.F. Adapter
Powers	With heavy duty focusing front	AX-196	2	Will take lenses 5" E.F. and longer only or use E.F. Adapter
Wenzel	Pro-4, Pro-6	None†		
Wenzel	Pro-4 with large lens mount	AX-155	5	

*Not regularly furnished, but can be supplied if desired. **To avoid vignetting. †.0065" shims furnished at no cost when this projector is specified.

LENS FITTINGS:

(for sketches of lens, see pgs. 4, 5, & 6)



SCREEN CHART

1. Select film format and projection distance.
2. Read picture width from table.
3. Pick off lens E.F. in inches. (Correction for excessive "Keystone" angle may be required).
4. Refer to pages 4, 5, and 6 for recommendations of lenses for your application.

35 mm (with .825 aperture)

LENS E.F. IN INCHES

Throw in feet	35 mm	1¾	1⅞	2	2¼	2½	2¾	3	3¼	3½	3¾	4	4¼	4½	4¾	5	5¼	5½	5¾	6	6¼	6½	6¾	7
	80	37.7	35.2	33.0	29.3	26.3	24.0	22.0	20.3	18.8	17.6	16.5	15.5	14.7	13.9	13.2	12.6	12.0	11.5	11.0	10.5	10.2	9.8	9.4
	90	42.4	39.6	37.1	33.0	29.7	26.9	24.9	22.8	21.2	19.8	18.6	17.6	16.5	15.7	14.8	14.1	13.5	12.9	12.4	11.9	11.4	11.0	10.6
	100	47.2	44.1	41.3	36.7	33.0	30.0	27.5	25.4	23.6	22.0	20.7	19.4	18.3	17.4	16.5	15.7	15.0	14.3	13.7	13.2	12.7	12.2	11.8
	110	51.8	48.3	45.4	40.3	36.3	33.0	30.3	27.9	25.9	24.2	22.7	21.3	20.2	19.1	18.2	17.3	16.5	15.8	15.1	14.5	14.0	13.4	13.0
	120	56.6	52.8	49.5	44.0	39.6	36.0	33.0	30.4	28.3	26.4	24.7	23.2	22.0	20.8	19.8	18.9	18.0	17.2	16.5	15.8	15.2	14.7	14.1
	130	61.3	57.2	53.7	47.6	42.9	39.0	35.7	33.0	30.6	28.5	26.8	25.2	23.8	22.6	21.4	20.4	19.5	18.6	17.9	17.1	16.5	15.9	15.3
	140	66.1	61.6	57.8	51.4	46.2	42.0	38.5	35.5	33.0	30.8	28.8	27.2	25.6	24.3	23.1	22.0	21.0	20.1	19.3	18.5	17.8	17.1	16.5
	150	70.8	66.0	62.0	55.1	49.5	45.0	41.3	38.1	35.4	33.0	31.0	29.2	27.5	26.1	24.8	23.6	22.5	21.5	20.6	19.8	19.1	18.3	17.7
	160	75.5	70.5	66.0	58.8	52.8	48.1	44.1	40.6	37.7	35.2	33.0	31.1	29.4	27.8	26.4	25.2	24.1	23.0	22.0	21.2	20.3	19.6	18.9
	170	80.1	74.9	70.1	62.2	56.1	51.1	46.8	43.2	40.1	37.4	35.1	33.0	31.1	29.5	28.1	26.7	25.5	24.4	23.4	22.5	21.6	20.8	20.0
	180	84.9	79.2	74.2	66.0	59.6	54.0	49.5	45.6	42.5	39.6	37.1	34.9	33.0	31.2	29.7	28.3	27.0	25.8	24.8	23.7	22.8	22.0	21.2

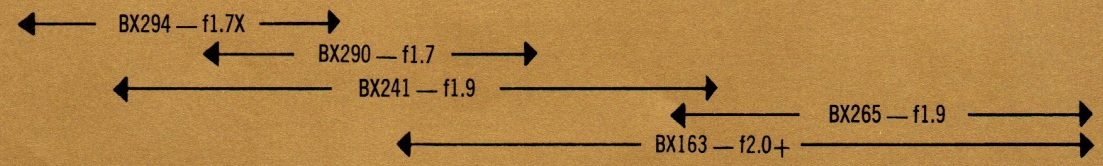
NOTES:

1. For throw or picture widths not on chart, multiply figures by 2, and read lens. (e.g. for 35 mm, 120′ throw × 2 & 30′ width × 2 for 3¼″ lens used for 240′ & 60′ width.
2. Lenses with E.F.'s between 7¼″ and 11″ are available on custom order in both BX-265 and BX163 series. (Check for possible stock.)
3. For exacting picture widths compute with formulas.

ANAMORPHIC & 70 mm (with 2x.839 & 1.913 apertures)

LENS E.F. IN INCHES

Throw in feet	ANA	70 mm	1¾	1⅞	2	2¼	2½	2¾	3	3¼	3½	3¾	4	4¼	4½	4¾	5	5¼	5½	5¾	6	6¼	6½	6¾	7
	80	70	76.6	71.5	67.0	59.6	53.6	48.7	44.7	41.2	38.3	35.8	33.5	31.5	29.8	28.2	26.8	25.5	24.4	23.3	22.3	21.5	20.6	19.8	19.2
	90	79	86.2	80.5	75.5	67.0	60.4	54.9	50.3	46.5	43.2	40.2	37.8	35.5	33.6	31.6	30.2	28.8	27.4	26.3	25.2	24.2	23.2	22.3	21.6
	100	88	95.8	89.5	83.8	74.6	67.1	61.0	55.9	51.6	48.0	44.7	42.0	39.5	37.3	35.3	33.5	31.9	30.5	29.2	28.0	26.9	25.8	24.9	24.0
	110	96	106	98.4	92.2	82.1	73.8	67.1	61.5	56.8	52.8	49.2	46.2	43.4	41.1	38.9	36.9	35.1	33.6	32.1	30.8	29.5	28.4	27.4	26.5
	120	105	115	108	101	89.5	80.5	73.2	67.1	62.0	57.5	53.6	50.3	47.4	44.7	42.4	40.3	38.3	36.6	35.0	33.5	32.2	31.0	29.9	28.8
	130	114	125	116	109	96.8	87.1	79.2	72.6	67.1	62.3	58.2	54.5	51.3	48.5	45.9	43.6	41.5	39.6	37.9	36.3	34.8	33.5	32.3	31.1
	140	123	134	125	117	104	93.8	85.3	78.2	72.2	67.0	62.5	58.6	55.2	52.2	49.4	46.8	44.6	42.6	40.8	39.1	37.5	36.1	34.7	33.5
	150	131	144	134	125	112	101	91.5	83.8	77.4	71.9	67.1	62.9	59.3	55.9	53.0	50.4	47.9	45.7	43.7	41.9	40.2	38.7	37.3	35.9
	160	140	153	143	134	119	107	97.5	89.3	82.3	76.5	71.3	67.0	63.0	59.5	56.4	53.6	51.0	48.8	46.6	44.6	42.9	41.2	39.6	38.3
	170	149	163	152	143	126	114	104	95.1	87.7	81.5	76.2	71.3	67.1	63.3	60.0	57.0	54.3	51.8	49.6	47.5	45.6	43.9	42.2	41.8
	180	158	172	161	151	134	121	110	101	92.8	86.2	80.5	75.5	71.0	67.1	63.5	60.3	57.5	54.9	52.5	50.3	48.6	46.4	44.7	43.1



PROJECTION FORMULAS:

P = Proj. Dist. in feet W = Picture Width in feet H = Picture Height in feet E.F. & aperture in inches

(1) for 35 mm (1.75* ratio = $\frac{.825}{.472}$)

$$E.F. = \frac{.825 \times P}{W}$$

$$H = \frac{.472 \times P}{E.F.}$$

(2) for 35 Anamorphic (2.35* ratio = $\frac{2 \times .839}{.715}$)

$$E.F. = \frac{2^* \times .839 \times P}{W}$$

$$H = \frac{.715 \times P}{E.F.}$$

(3) for 70 mm (2.35* ratio = $\frac{1.913}{.814}$)

$$E.F. = \frac{1.913 \times P}{W}$$

$$H = \frac{.814 \times P}{E.F.}$$

*Ratios and apertures may vary. Check Anamorphic lenses and film formats to be used.

EQUIVALENT FOCUS FACTORS (using ratios in formulas above, and maintaining constant picture height).

(1) 70 mm E.F. = 35 Ana.*E.F. × 1.14 = 35 std E.F. × 1.72.

(2) 35 Ana.* E.F. = 70 mm E.F. × 0.88 = 35 std E.F. × 1.52.

(3) 35 Std E.F. = 70 mm E.F. × 0.58 = 35 Ana.* E.F. × 0.66.

CUSTOM MODIFICATIONS: Special magnifications (E.F.'s) are available to custom order.

AIR SPACED LENSES: (to resist high intensity lamp heat) available on custom order.

* Anamorphic

REPAIR AND ADJUSTMENT SERVICES: Recoating, repair and rebuilding of Kollmorgen lenses is a regular service. Loan lenses are available during such repairs. Estimates are available from your dealer.

CARE AND CLEANING OF KOLLMORGEN SUPER SNAPLITES AND SNAPLITE LENSES: Remove dust or grit particles from lens surfaces with a clean camel's hair brush; then clean lenses with lens tissue and grain alcohol. (Never use treated tissue, cloth, soap, water, powders or glass cleaners). *Lenses are sealed and should not be disassembled.*

KOLLMORGEN
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