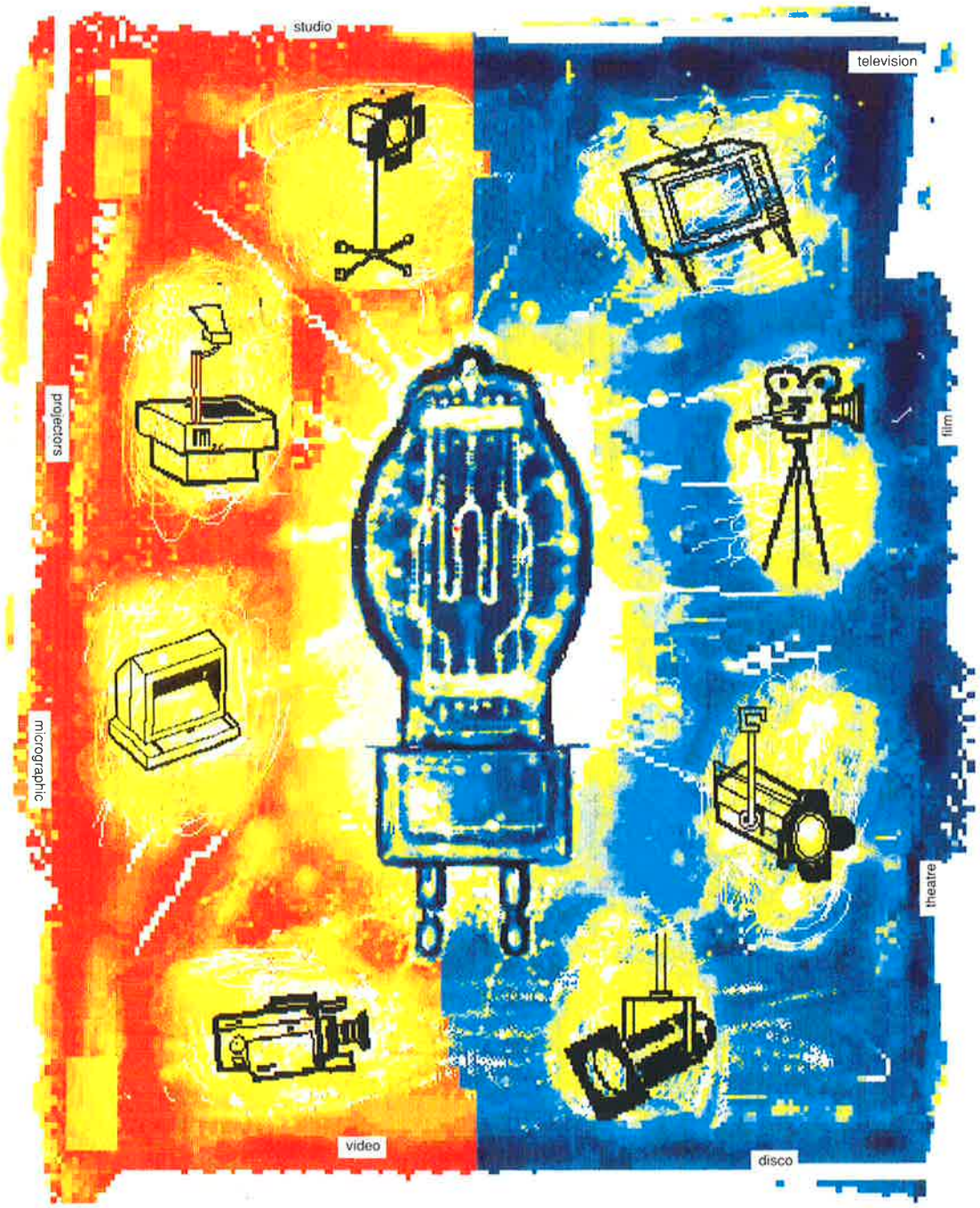
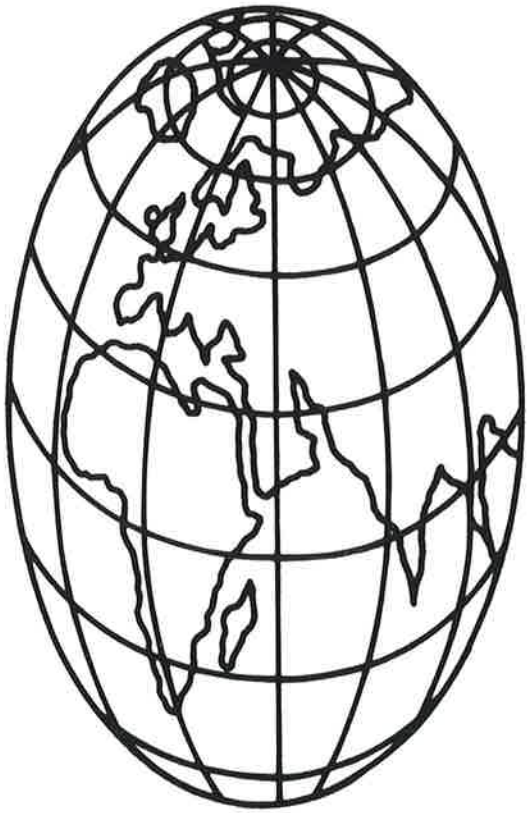
THORN



PHOTO, STAGE & STUDIO LIGHT SOURCES



worldwide

Thorn Lighting Ltd. operates worldwide, with operations in 22 countries, 11 of which house manufacturing plants. Through a network of agents Thorn cover 140 national markets, employing over 13,000 people.
Recent aquisitions have boosted Thorn's international strength, placing Thorn as one of the largest lighting companies in the world. In April 1990, Thorn's successful strategic growth was recognised by winning two business awards in the "best industrial company" and the "best overall" categories.

total lighting solutions

This world growth programme has placed Thorn in the enviable position of being an international provider of total lighting solutions.
To optimise customer service, Thorn's commercial operations include specialist outlets like Thorn EMI Lamps and Components Ltd., with expertise in light sources and accessories, and in particular, working closely with original equipment manufacturers.

photographic and studio

Thorn offers an extensive range of photographic and studio lamps, manufactured at Thorn's UK plants, Enfield and Leicester. Thorn EMI Lamps and Components Ltd. distributes these lamps worldwide through local agents and subsidiary companies. With a wealth of product expertise, Thorn EMI Lamps and Components Ltd. is ideally suited to serving this specialist area of lighting. If Thorn does not have a local operation in your area, please contact Thorn EMI Lamps and Components Ltd. for details of specialist distributors.

United Kingdom

THORN EMI LAMPS & COMPONENTS LTD.
Photographic & Studio Division
Miles Road Mitcham Surrey CR4 3YX
Telephone 081 640 1221 Facsimile 081 640 9760 Telex 25534

subsidiaries

Australia THORN ALI LIGHTING LTD 13 Cooper Street PO Box 188 Smithfield NSW 2164
Telephone (02) 604 4300 Facsimile (02) 604 4588 Telex 24894

Austria THORN LICHT GMBH Erzherzog Karl Strasse 57 A - 1220 Vienna
Telephone (0222) 22 15 11 Facsimile (0222) 22 99 40 Telex 136128

Canada THORN LIGHTING CANADA LTD. 1400 Merseyside Drive Mississauga Ontario L5T 1H2
Telephone (416) 670 4248 Facsimile (416) 670 4262 Telex 06 - 968569

Denmark THORN BELYSNING AS Brogrenen 6 DK 2635 Ishoj
Telephone 43 54 0677 Facsimile 43 54 4595 Telex 21145

Finland THORN ORNO OY Santaniitynkatu 11 PO BOX 11 SF - 04201 Kerava
Telephone 358 0 246 901 Facsimile 358 0 245 064 Telex 1001559

France THORN EUROPHANE 156 Boulevard Haussman 75379 Paris Cedex 08
Telephone (331) 45 62 22 80 Facsimile (331) 45 63 29 62 Telex 280261

Germany GLUHLAMPENFABRIK JAHN GMBH Carl Zeiss Strasse 15
Postfach 1509 D-4460 Nordhorn
Telephone 05921 1770 Facsimile 05921 17733 Telex 98216

Hong Kong THORN LIGHTING (HK) LTD. Jardine Engineering House
260 King's Road PO Box 517 GPO
Telephone 852 578 4303 Facsimile 852 887 0247 Telex 74382

Ireland THORN LIGHTING (IRELAND) LTD 320 Harolds Cross Road Dublin 6W.
Telephone (01) 961 877 Facsimile (01) 961 724 Telex 93448

Italy SIVI ILLUMINAZIONE SPA Casella Postale 604 36100 Vicenza
Telephone (0) 444 595 100 Facsimile (0) 444 597 858 Telex 480049

Malaysia THORN LIGHTING MANUFACTURING INDUSTRIES SDN BHD Lot 12 Persiarean Kemajuan Off Jalan Halba 16/16 40000 Shah Alam Selangor Darul Ehsan Telephone (03) 550 3311 Facsimile (03) 550 2355

Netherlands THORN LIGHTING BV PO Box 97 3640 AB Mijdrecht
Telephone 02 979 88941 Facsimile 02 979 89166

New Zealand THORN LIGHTING LTD 399 Rosebank Road Avondale PO Box 71134 Rosebank Auckland 7
Telephone (09) 887 155 Facsimile (09) 887 591 Telex 2648

Norway THORN SCANLUX AS Industrivn 11 Boks 63 1481 Hagan
Telephone (02) 76 03 50 Facsimile (02) 76 18 34 Telex 76928

Singapore THORN LIGHTING SINGAPORE 29 Tannery Road
Singapore 1334
Telephone 748 4949 Facsimile 745 7707 Telex 26181

South Africa THORN LIGHTING (SA) PTY LTD. 26 Blumberg Street Industria 2042 Johannesburg Transvaal.
Telephone (011) 474 0161 Facsimile (011) 474 8491 Telex 4-25736

Sweden THORN BELYSNING AB Anderstorpsvagan 4 Box 4203 17104 Solna
Telephone (08) 83 41 00 Facsimile (08) 82 27 31 Telex 10106

Taiwan THORN LIGHTING TAIWAN Room 802 World Trade Building 50 Sec.1 Hsin Sheng S. Road Taipei Taiwan R.O.C.
Telephone (02) 393 9308 Facsimile (02) 321 4143 Telex 11391

contents

notes

A. Designed for ellipsoidal mirror spotlights. May not be suitable for fresnels.

B. 100V rating available to special order.

C. 120V rating available to special order.

D. Twin filament lamp. Filament sizes relate to major and minor coils.

E. Specially designed for searchlight applications.

F. Twin filament lamp. Lumen figures relate to single and twin filament options.

G. Non-stock item available to special order.

H. Silica coated bulb.

J. Obscured top.

K. Dual voltage.

L. Tungsten halogen - minimum bulb wall temperature 250˚C.

M. Due to integral reflector, nominal lumens not shown.

N. Internal proximity reflector.

P. Integral dichroic reflector.

R. 3 or 4 amp HBC fuse necessary.

S. 5 or 6 amp HBC fuse necessary.

T. 6 or 7 amp HBC fuse necessary.

W. 10 amp HBC fuse necessary.

X. Biplane filament.

Y. No filament support rod.

All lamp dimensions in this catalogue are measured in millimetres

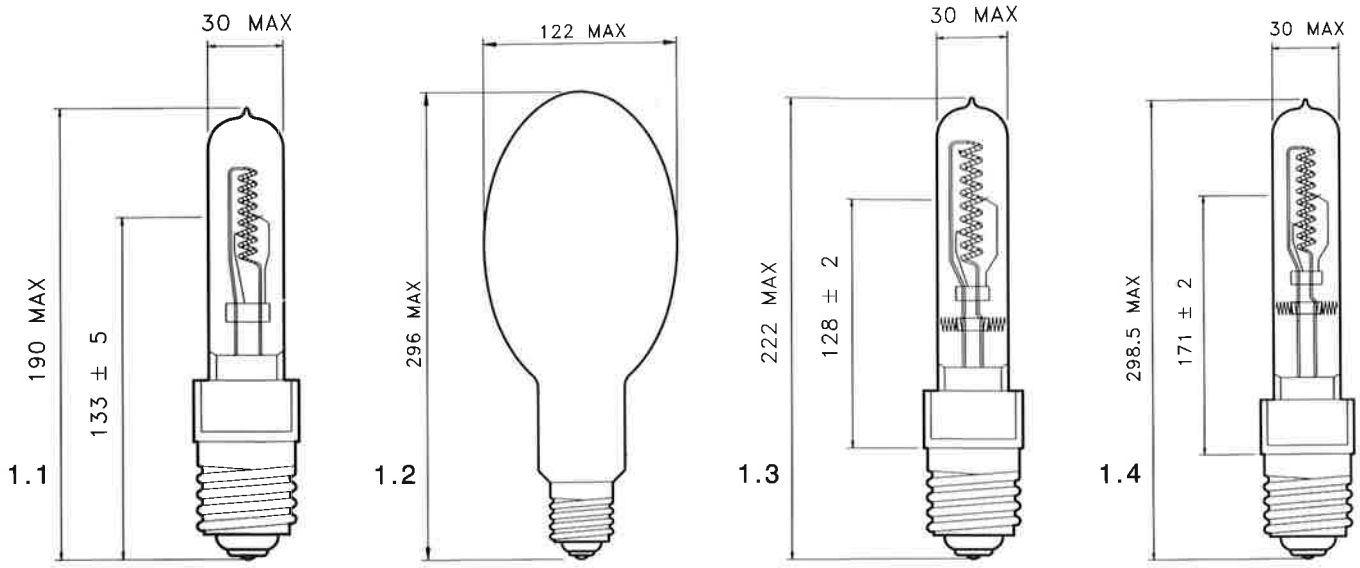
studio

theatre

and

television

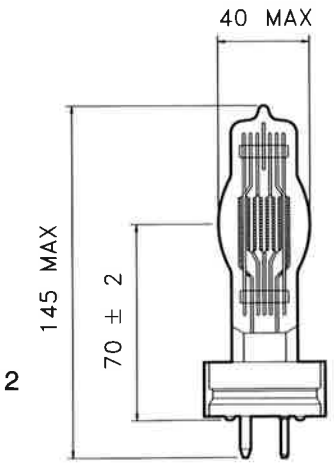
lamps



E40s base *(mogul screw)*

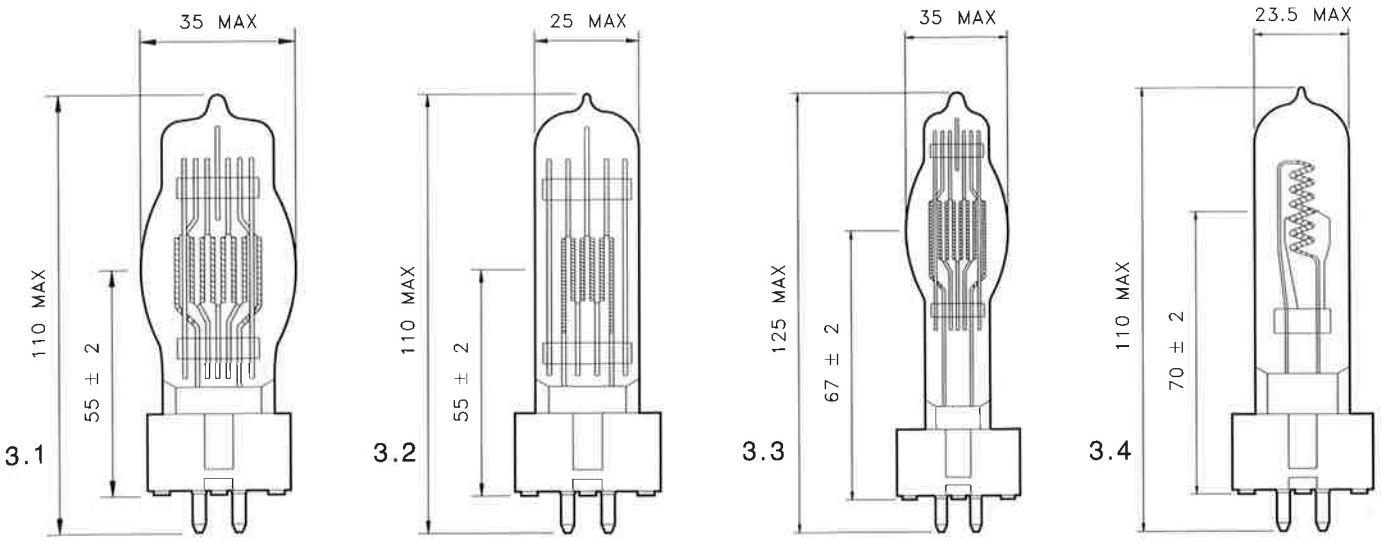
watts	*lamp code*	ANSI code	*voltage*	colour temp. K	lumens X 1000	ave. life hrs	filament form	filament H x W	burning position	notes	fig. no.
1000		DSE	***120***	3200	26	500	CC		ANY	H	1.2
1500		DSF	***120***	3200	41	750	CC		ANY	H	1.2
2000	***CP59***		***220/230,240***	3200	50	300	CC	40x7	*		1.1
2000		BWF	***120***	3200	59	400	CC	40x8	*		1.1
2000		BWG	***120***	3200	56	400	CC	40x8	*	frost	1.1
2000		FWG	***120***	3200	58	500	CC	40x9	*		1.3
2000		FWJ	***120***	3200	56	500	CC	40x9	*	frost	1.3
2000		FWH	***120***	3200	58	500	CC	40x9	*		1.4
2000		BWL	***120***	3200	56	500	CC	40x9	*	frost	1.4

* see fig. 21 page 56



GY16 base

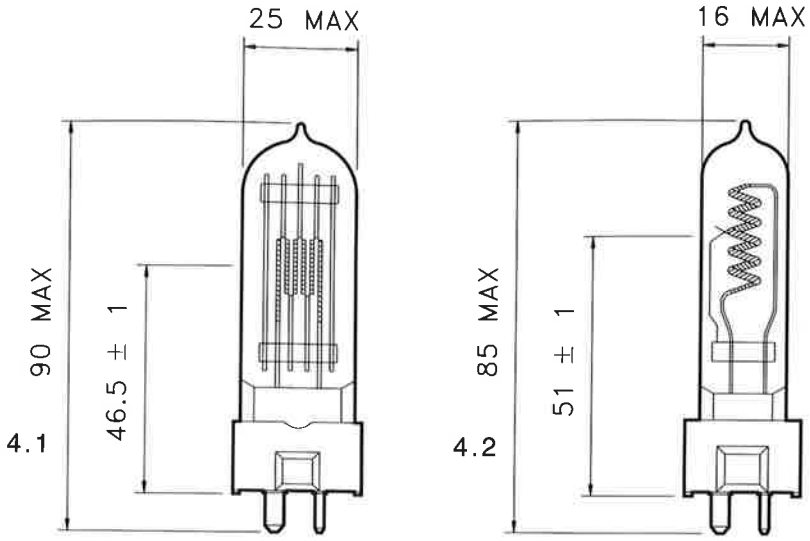
watts	*lamp code*	ANSI code	*voltage*	colour temp. K	lumens X 1000	ave. life hrs	filament form	filament H x W	burning position	notes	fig. no.
2000	***CP43***	FTM	***220***	3200	54	400	MP	22x22.5	VBD±90		2
2000	***CP43***	FTL	***240***	3200	54	400	MP	22x22.5	VBD±90		2
2000	***CP43***		***115/120***	3200	54	400	MP	24x21.5	VBD±90		2
2000	***CP79***		***220,240***	3200	54	350	BP	18.5x17	VBD±90	BC	2



GX9.5 base

watts	lamp code	ANSI code	voltage	colour temp. K	lumens X 1000	ave. life hrs.	filament form	filament H x W	burning position	notes	fig. no.
650	T12		220,240	3000	13.5	750	MP	15.5x14.5	VBD±90		3.2
650	CP23		220,240	3200	16.9	100	MP	12x14.5	VBD±90		3.2
650	CP23		115/120	3200	16.9	100	MP	14x11.5	VBD±90	21 max bulb	3.2
750	HX144		55/60	3150	20	200	CC	12x7.5	*	G	3.4
1000	CP24		220,240	3200	26	200	MP	18.5x17.5	VBD±90		3.1
1000	CP24		115/120	3200	27	200	MP	14.5x14	VBD±90		3.1
1000	T11		220,240	3050	23	750	MP	17.5x17.5	VBD±90		3.1
1000	T11		115/120	3050	23	750	MP	16x14	VBD±90	G	3.1
1000	T19	FWP	220	3050	21	750	BP	15x12	VBD±90	BC	3.1
1000	T19	FWR	240	3050	21	750	BP	15x12	VBD±90	BC	3.1
1000	CP70	FVA	220	3200	25	200	BP	15x12	VBD±90	BC	3.1
1000	CP70	FVB	240	3200	25	200	BP	15x12	VBD±90	BC	3.1
1200	T29		120	3050	30.5	400	BP	15x13	VBD±90	G	3.3
1200	T29	FWS	220	3050	29	400	BP	16x13	VBD±90		3.3
1200	T29	FWT	240	3050	29	400	BP	16x13	VBD±90		3.3
1200	CP90		120	3200	34.5	200	BP	15x12	VBD±90	G	3.3
1200	CP90		220,240	3200	33	200	BP	16x12	VBD±90		3.3

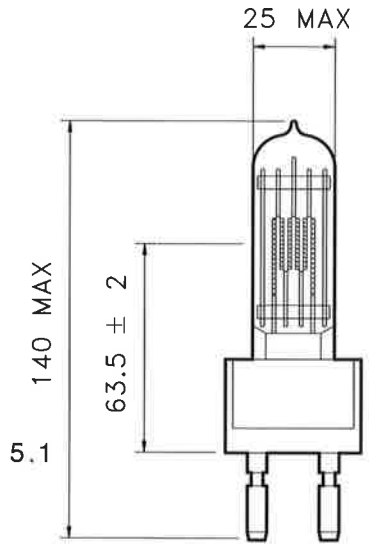
* see fig. 21 page 56

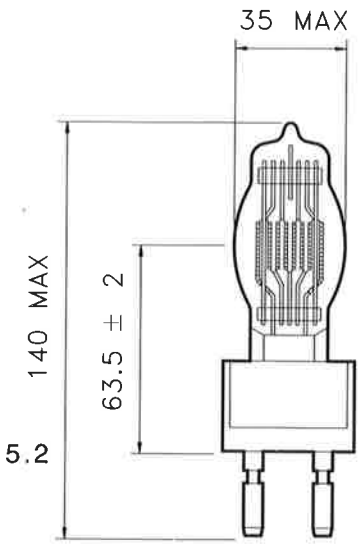


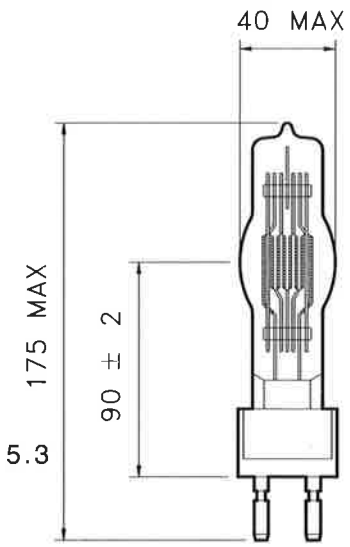
GY9.5 base

watts	*lamp code*	ANSI code	*voltage*	colour temp. K	lumens X 1000	ave. life hrs.	filament form	filament H x W	burning position	notes	fig. no.
300	***CP81***	FKW	***120***	3200	7.2	150	MP	12x9	VBD±90		4.1
300	***CP81***	FSL	***220/230***	3200	6.9	150	†	11x10	VBD±90		4.1
300	***CP81***	FSK	***240/250***	3200	6.9	150	†	11x10	VBD±90		4.1
500	***CP82***	FRG	***120***	3200	13	150	MP	12.5x11.5	VBD±90		4.1
500	***CP82***	FRH	***220***	3200	12.5	150	MP	13x13	VBD±90		4.1
500	***CP82***	FRJ	***240***	3200	12.5	150	MP	13x13	VBD±90		4.1
500	***T18***	FRF	***120***	3050	12	400	MP	12.5x11.5	VBD±90		4.1
500	***T18***	GCV	***220***	3050	11	400	MP	13.5x13	VBD±90		4.1
500	***T18***	GCW	***240***	3050	11	400	MP	13.5x13	VBD±90		4.1
600		FMR	***120***	3000	12.6	2000	CC	16x6	*		4.2
650	***T26***	FRE	***120***	3050	15	400	MP	13.5x13.5	VBD±90		4.1
650	***T26***	GCT	***220***	3050	15	400	MP	13.5x15.5	VBD±90		4.1
650	***T26***	GCS	***240***	3050	15	400	MP	13.5x15.5	VBD±90		4.1
650	***CP89***	FRK	***120***	3200	16.9	200	MP	12.5x11.5	VBD±90		4.1
650	***CP89***	FRL	***220***	3200	16.25	150	MP	13x13	VBD±90		4.1
650	***CP89***	FRM	***240***	3200	16.25	150	MP	13x13	VBD±90		4.1

† staggered filament
* see fig. 21 page 56

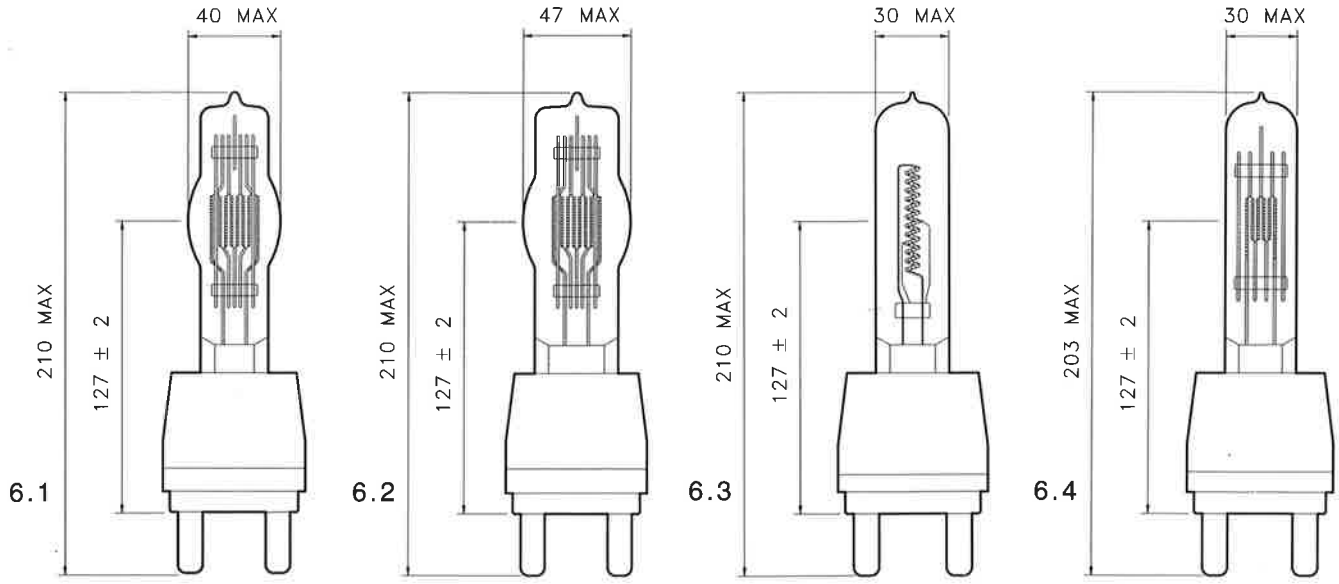






G22 base *(medium bipost)*

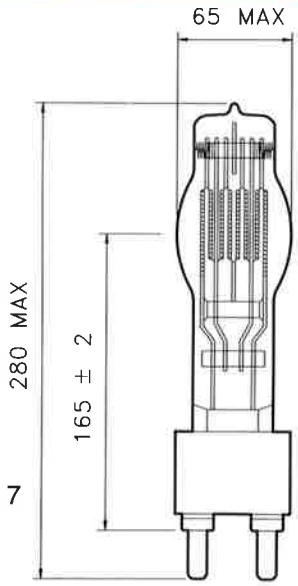
watts	*lamp code*	ANSI code	*voltage*	colour temp. K	lumens X 1000	ave. life hrs	filament form	filament H x W	burning position	notes	fig. no.
500		EGN	***120***	3200	13	150	MP	12x11.5	VBD±90	21max bulb	5.1
650	***CP39***	FKG	***115/120***	3200	16.9	100	MP	14x11.5	VBD±90	21max bulb	5.1
650	***CP39***	FKH	***220,240***	3200	16.9	100	MP	12x14.5	VBD±90		5.1
750		EGR	***120***	3200	20.5	200	MP	12.5x14	VBD±90		5.1
1000		EGT	***120***	3200	28	250	MP	14.5x14	VBD±90		5.2
1000	***CP40***	FKJ	***220,240***	3200	26	200	MP	18.5x17.5	VBD±90		5.2
1000	***T30***		***220,240***	3000	21	750	BP	15x12	VBD±90		5.2
1200	***CP93***		***120***	3200	34	200	BP	15x12	VBD±90	G	5.2
1200	***CP93***		***220,240***	3200	33	200	BP	16x12	VBD±90		5.2
1200	***T31***		***220,240***	3050	29	400	BP	16x13	VBD±90		5.2
2000	***CP92***		***220,240***	3200	52	400	BP	18.5x17	VBD±90		5.3
2500	***CP91***		***220,240***	3200	67.5	400	BP	24x18	VBD±90		5.3



G38 base *(mogul bipost)*

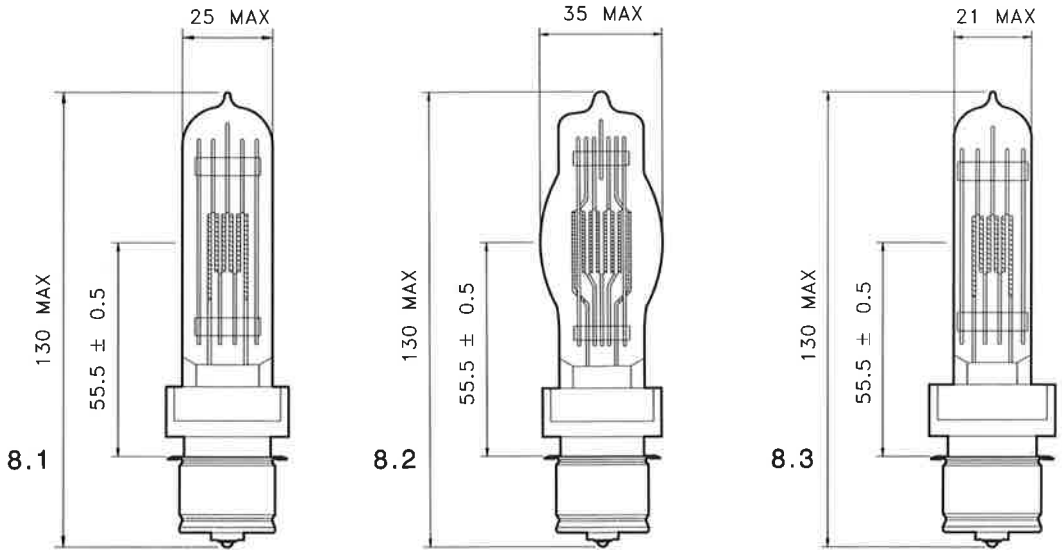
watts	***lamp code***	ANSI code	***voltage***	colour temp. K	lumens X 1000	ave. life hrs.	filament form	filament H x W	burning position	notes	fig. no.
1000		CYV	***120***	3200	28	250	MP	17.5x16	VBD±90		6.4
1500		CXZ	***120***	3200	41	300	MP	19x17	VBD±90		6.1
2000		BWA	***120***	3200	59	400	CC	40x8	*		6.3
2000		CYX	***120***	3200	56	400	MP	21.5x20.5	VBD±90		6.1
2000	***CP41***	FKK	***220,240***	3200	54	400	MP	22x22.5	VBD±90		6.1
2500	***CP94***		***220,240***	3200	67.5	400	BP	24x18	VBD±90		6.1
3000	***HX48***		***110/115***	3200	82	400	MP	24x26	VBD±45	EG	6.2
3000	***HX48***		***220,240***	3200	82	400	MP	24x26	VBD±45	EG	6.2

* see fig. 21 page 56



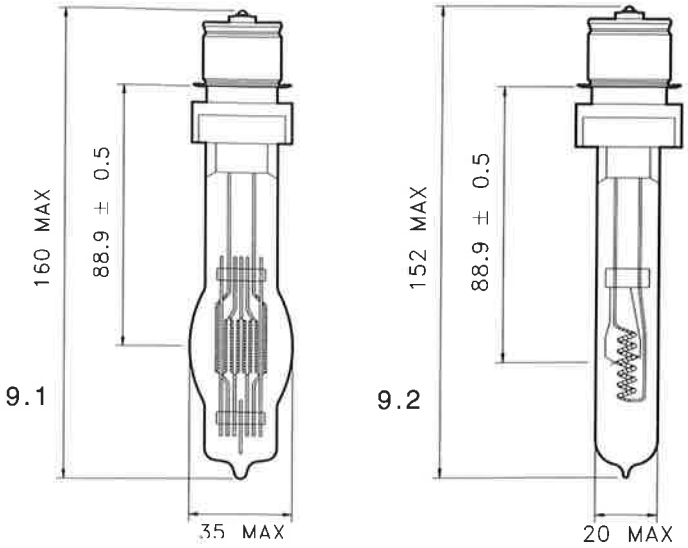
G38 base *(mogul bipost)*

watts	***lamp code***	ANSI code	***voltage***	colour temp. K	lumens X 1000	ave. life hrs.	filament form	filament H x W	burning position	notes	fig. no.
5000	***CP29***		***220,240***	3200	135	500	MP	36x33	VBD±90		7
5000		DPY	***120***	3200	145	500	MP	31x36	VBD±90		7



P28s base *(medium prefocus)*

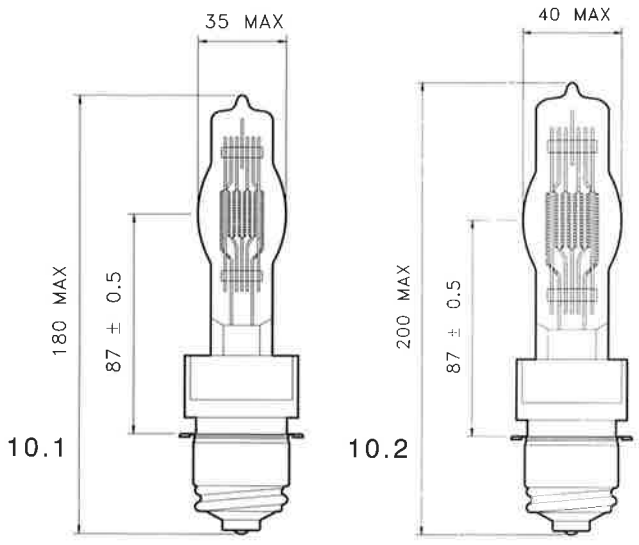
watts	*lamp code*	ANSI code	*voltage*	colour temp. K	lumens X 1000	ave. life hrs.	filament form	filament H x W	burning position	notes	fig. no.
500		BTL	***120***	2950	11	750	MP	13.5x11.5	VBD±90		8.3
500		BTM	***120***	3200	13	150	MP	12x11.5	VBD±90		8.3
500	***T28***		***220,240***	3000	11	300	MP	15x12	VBD±90		8.3
500	***T17***	FKF	***220,240***	2950	9.5	750	MP	13.5x14.5	VBD±90		8.3
650	***T13***	FKA	***115/120***	3000	13.5	750	MP	13x14	VBD±90		8.1
650	***T13***	FKB	***220,240***	3000	13.5	750	MP	15.5x14.5	VBD±90		8.1
650	***CP51***	FKL	***115/120***	3200	17	100	MP	14x11.5	VBD±90		8.3
650	***CP51***	FKM	***220,240***	3200	16.9	100	MP	12x14.5	VBD±90		8.1
750		BTN	***120***	3000	17	750	MP	14x14	VBD±90		8.1
750		BTP	***120***	3200	20.5	200	MP	12.5x14	VBD±90		8.1
1000		BTR	***120***	3200	28	250	MP	14.5x14	VBD±90		8.2
1000	***T14***		***115/120***	3050	23	750	MP	16x14	VBD±90		8.2
1000	***T14***	FKD	***220,240***	3050	23	750	MP	17.5x17.5	VBD±90		8.2
1000	***CP52***	FKN	***220,240***	3200	26	200	MP	18.5x17.5	VBD±90		8.2



P28s base *(medium prefocus)*

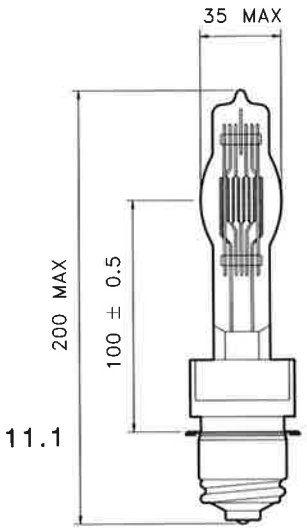
watts	*lamp code*	ANSI code	*voltage*	colour temp. K	lumens X 1000	ave. life hrs.	filament form	filament H x W	burning position	notes	fig. no.
500		EGE	***120***	2900	10	2000	CC	18x5	VBU±90	A 15max bulb	9.2
750		EGG	***120***	2900	15	2000	CC	19x7	*	A	9.2
1000		EGJ	***120***	3200	27.5	500	CC	19x7	*	A	9.2
1000	***T15***	FKE	***220,240***	3050	23	750	MP	17.5x17.5	VBU±90	A	9.1
1000		EWE	***220,240***	3200	26.5	250	CC	24x6	*	A	9.2
1000		EGK	***120***	3200	26.5	500	CC	19x7	*	A frost	9.2

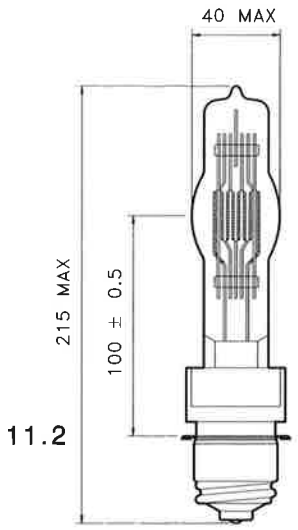
* see fig. 21 page 56



P40s base *(mogul prefocus)*

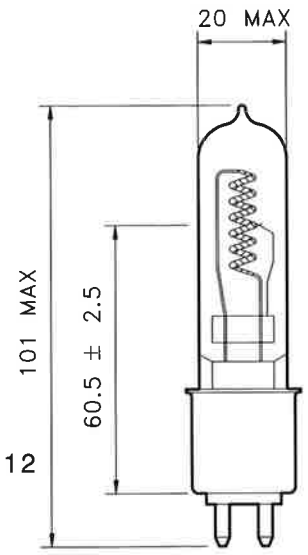
watts	*lamp code*	ANSI code	*voltage*	colour temp. K	lumens X 1000	ave. life hrs	filament form	filament H x W	burning position	notes	fig. no.
1000	***T16***		***220,240***	3050	23	750	MP	17.5x17.5	VBD±90		10.1
1500		DTA	***120***	3200	41	300	MP	19x17	VBD±90		10.2
2000	***CP53***		***115/120***	3200	54	400	MP	24x21.5	VBD±90		10.2
2000	***CP53***		***220,240***	3200	54	400	MP	22x22.5	VBD±90		10.2





P40s base *(mogul prefocus)*

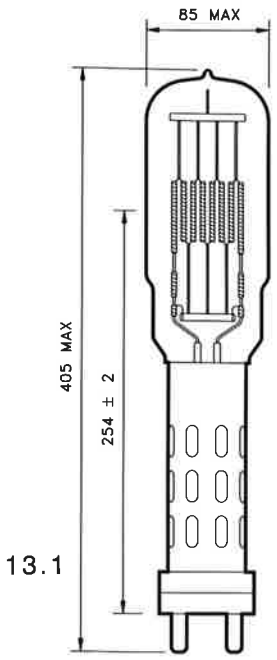
watts	ANSI code	*voltage*	colour temp. K	lumens X 1000	ave. life hrs.	filament form	filament H x W	burning position	notes	fig. no.
1000	BVT	***120***	3050	24.5	500	MP	16x14	VBD±90		11.1
1000	BVV	***120***	3200	28	250	MP	14.5x14	VBD±90		11.1
1500	CWZ	***120***	3200	41	300	MP	19x17	VBD±90		11.2
2000	BVW	***120***	3200	56	400	MP	24x21.5	VBD±90		11.2



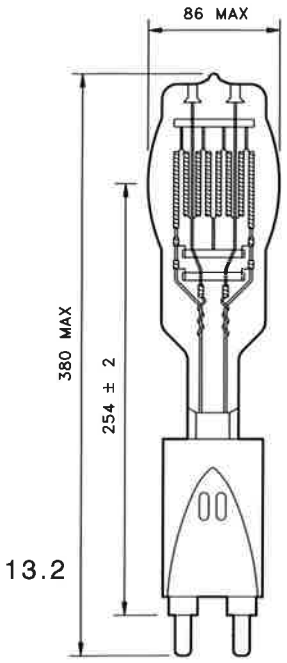
G9.5 base *(medium 2 pin)*

watts	*lamp code*	ANSI code	*voltage*	colour temp. K	lumens X 1000	ave. life hrs.	filament form	filament H x W	burning position	notes	fig. no.
500		EHC	***120***	3200	13	300	CC	19x5	*	15max bulb	12
500		EHD	***120***	2900	10	2000	CC	18x5	*		12
650		FKR	***220,240***	3100	15	300	CC	24x5	*		12
650		FKV	***120***	3150	17	300	CC	12x8	*		12
750		EHG	***120***	3000	15	2000	CC	19x7	*		12
750		EHF	***120***	3200	20	300	CC	19x7	*		12
1000	***CP77***	FEP	***220,240***	3200	25	300	CC	24x7	*		12
1000	***CP77***	FEL	***120***	3200	27.5	300	CC	19x7	*		12
1000		FCV	***120***	3200	26.5	300	CC	19x7	*	frost	12

* see fig. 21 page 56



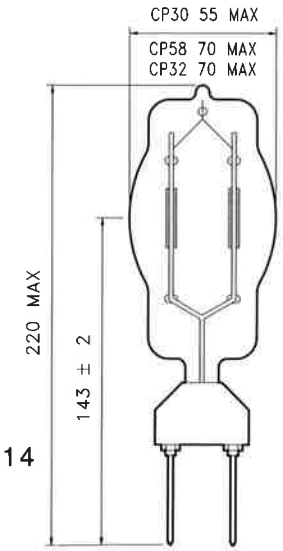
13.1



13.2

G38 base *(mogul bipost)*

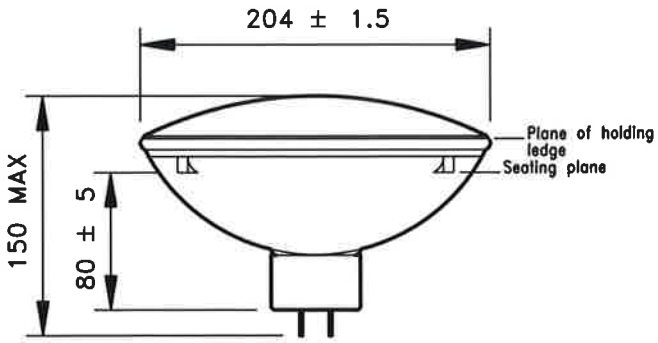
watts	*lamp code*	ANSI code	*voltage*	colour temp. K	lumens X 1000	ave. life hrs.	filament form	filament H x W	burning position	notes	fig. no.
10,000		DTY	***120***	3200	290	500	MP	38x55	VBD±45		13.1
10,000	***CP83***		***220,240***	3200	290	500	MP	41x52	VBD±45		13.2

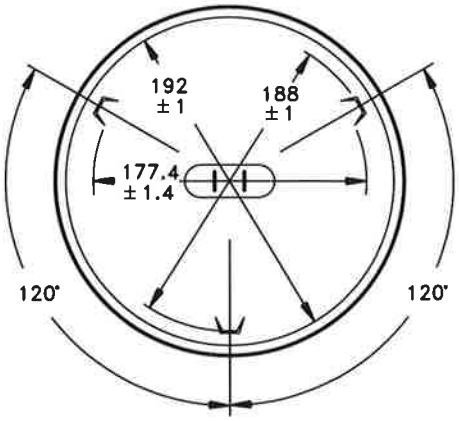


14

GX38q base (medium 2 pin)

watts	*lamp code*	*voltage*	colour temp. K	lumens X 1000	ave. life hrs.	filament form	filament H x W	burning position	notes	fig. no.
1250/1250	***CP30***	***220,240***	3200	27/56	300	TF	24x18.5 24x18.5	VBD±45	F	14
1250/2500	***CP58***	***220,240***	3200	27/59/91	300	TF	27.5x25 24x22	VBD±45	FD	14
2500/2500	***CP32***	***220,240***	3200	59/127	300	TF	27.5x25 27.5x25	VBD±45	F	14





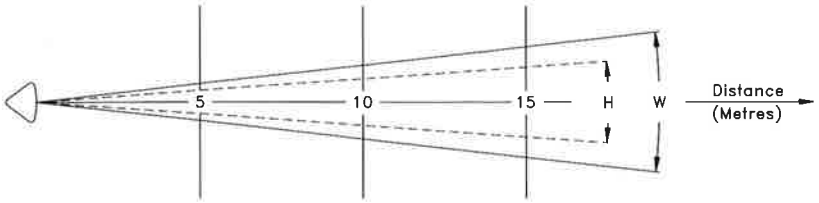
15

GX16d base *(E M E P)*

lamp code	CP60,CP61,CP62,HX134,CP95
volts	220, 240
watts	1000
ave. life hours	300
operating position	ANY
colour temp. K	3200
fig. no.	15

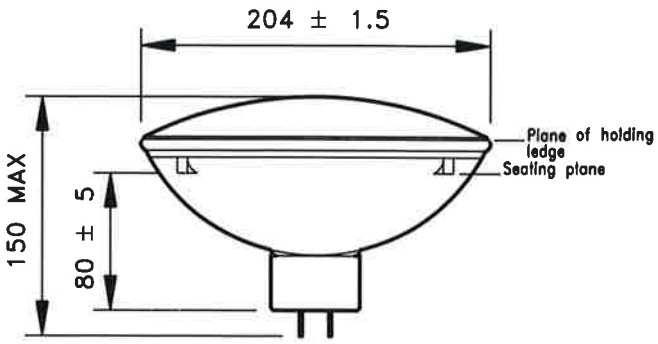
lamp code	CP60	CP61	CP62	HX134	CP95
ANSI code	EXC	EXD	EXE	EXG	-
	clear	stipple	lens	lens	prismatic
	'very narrow spot'	'narrow spot'	'medium flood'	'wide flood'	'extra wide flood'
Pk beam candelas	320,000	270,000	125,000	38,000	15,000
beam spread 1/2 Pk	9°Hx12°W	10°Hx14°W	11°Hx24°W	21°Hx57°W	70°Hx70°W
beam spread 1/10 Pk	17°Hx20°W	20°Hx22°W	20°Hx38°W	36°Hx73°W	125°Hx95°W

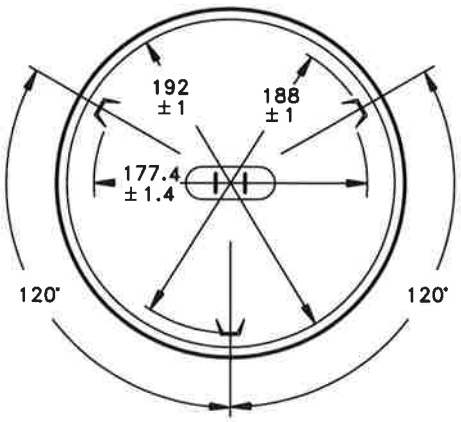
type	field size for 50% peak (metres HxW)		
CP60	0.8x1.1	1.6x2.1	2.4x3.2
CP61	0.9x1.2	1.7x2.5	2.6x3.7
CP62	1.0x2.1	1.9x4.3	2.9x6.4
EXG	1.9x5.4	3.7x10.9	5.6x16.4
CP95	7.0x7.0	14.0x14.0	21.0x21.0



peak illumination (LUX)

CP60	12800	3200	1420
CP61	10800	2700	1200
CP62	5000	1250	556
EXG	1520	380	169
CP95	600	150	67





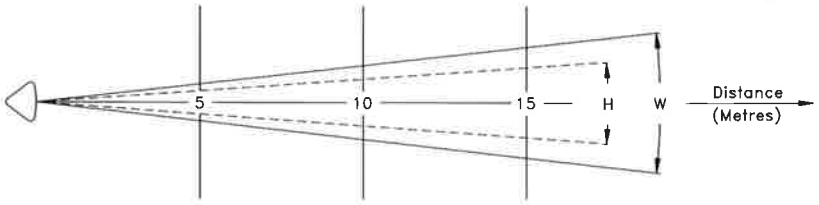
16

GX16d base *(E M E P)*

lamp code	CP86,CP87,CP88,HX115
volts	220,240
watts	500
ave. life hours	300
operating position	ANY
colour temp. K	3200
fig. no.	16

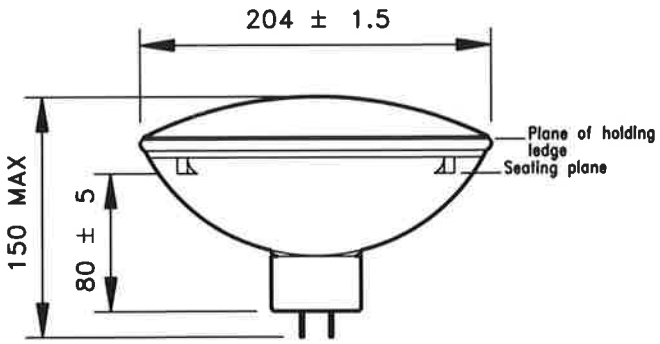
lamp code	CP86	CP87	CP88	HX115
	clear	stipple	lens	prismatic
	'very narrow spot'	'narrow spot'	'medium flood'	'extra wide flood'
Pk beam candelas	240,000	140,000	65,000	7,000
beam spread 1/2 Pk	7°Hx10°W	9°Hx11°W	10°Hx21°W	66°Hx66°W
beam spread 1/10 Pk	13°Hx16°W	16°Hx19°W	19°Hx32°W	85°Hx85°W

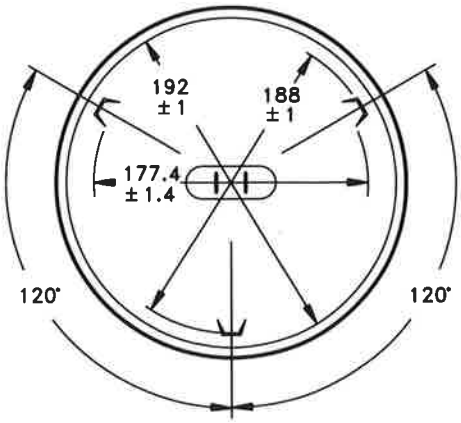
type	field size for 50% peak (metres HxW)		
CP86	0.6x0.9	1.2x1.7	1.8x2.6
CP87	0.8x1.0	1.6x1.9	2.4x2.9
CP88	0.9x1.9	1.7x3.7	2.6x5.6
HX115	6.5x6.5	13.0x13.0	19.5x19.5



peak illumination (LUX)

CP86	9600	2400	1070
CP87	5600	1400	620
CP88	2600	650	290
HX115	280	70	31





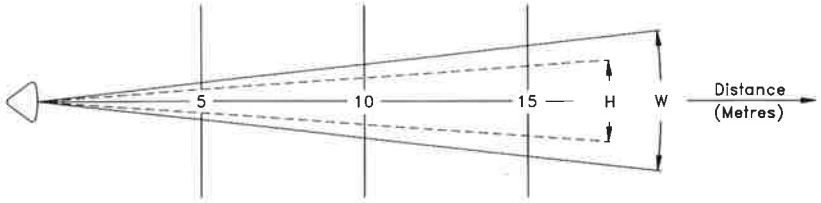
17

GX16d base *(E M E P)*

lamp code	FFN,FFP,FFR,FFS,GFF
volts	120
watts	1000
ave. life hours	400
operating position	ANY
colour temp. K	3200
fig. no.	17

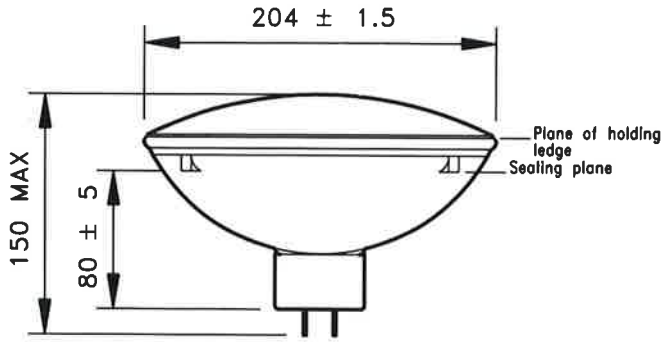
ANSI code	FFN	FFP	FFR	FFS	GFF
	clear	stipple	lens	lens	prismatic
	'very narrow spot'	'narrow spot'	'medium flood'	'wide flood'	'extra wide flood'
Pk beam candelas	400,000	330,000	125,000	40,000	16,000
beam spread 1/2 Pk	6°Hx12°W	7°Hx14°W	12°Hx28°W	24°Hx48°W	67°Hx68°W
beam spread 1/10 Pk	10°Hx24°W	14°Hx26°W	21°Hx44°W	45°Hx71°W	135°Hx130°W

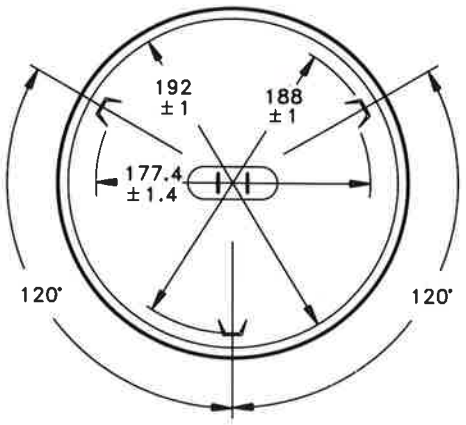
type	field size for 50% peak (metres HxW)		
FFN	0.5x1.1	1.0x2.1	1.6x3.2
FFP	0.6x1.2	1.2x2.5	1.8x3.7
FFR	1.1x2.5	2.1x5.0	3.2x7.5
FFS	2.1x4.5	4.3x8.9	6.4x13.4
GFF	6.6x6.7	13.2x13.5	19.9x20.2



peak illumination(LUX)

FFN	16000	4000	1780
FFP	13200	3300	1470
FFR	5000	1250	556
FFS	1600	400	178
GFF	640	160	71





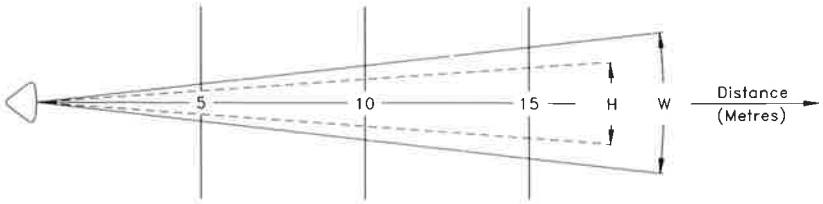
18

GX16d base (E M E P)

lamp code	HX154
volts	120
watts	1000
ave. life hours	4000
operating position	ANY
colour temp. K	2950
fig. no.	18

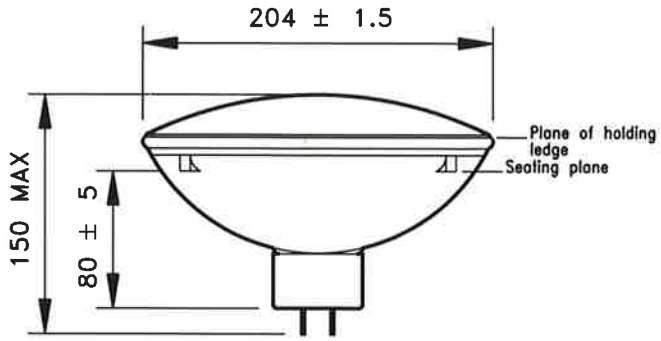
lamp code	HX154NS stipple 'narrow spot'	HX154MF lens 'medium flood'	HX154WF lens 'wide flood'	HX154XWF prismatic 'extra wide flood'
Pk beam candelas	220,000	100,000	35,000	13,000
beam spread 1/2 Pk	8°Hx16°W	12°Hx24°W	20°Hx56°W	66°Hx70°W
beam spread 1/10 Pk	15°Hx30°W	24°Hx44°W	56°Hx88°W	144°Hx148°W

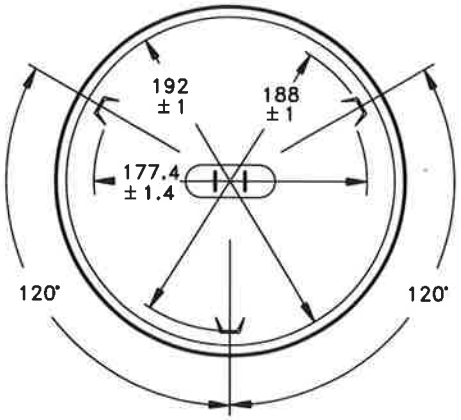
type	field size for 50% peak (metres HxW)		
HX154NS	0.7x1.4	1.4x2.8	2.1x4.2
HX154MF	1.1x2.1	2.1x4.3	3.2x6.4
HX154WF	1.8x5.3	3.5x10.6	5.3x16.0
HX154XWF	6.5x7.0	13.0x14.0	19.5x21.0



peak illumination (LUX)

HX154NS	8800	2200	978
HX154MF	4000	1000	444
HX154WF	1400	350	156
HX154XWF	520	130	58





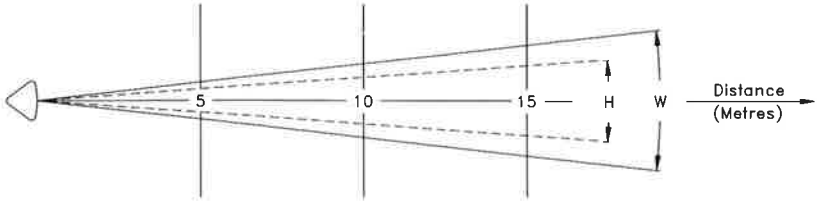
19

GX16d base *(E M E P)*

lamp code	HX156
volts	120
watts	1200
ave. life hours	400
operating position	ANY
colour temp. K	3200
fig. no.	19

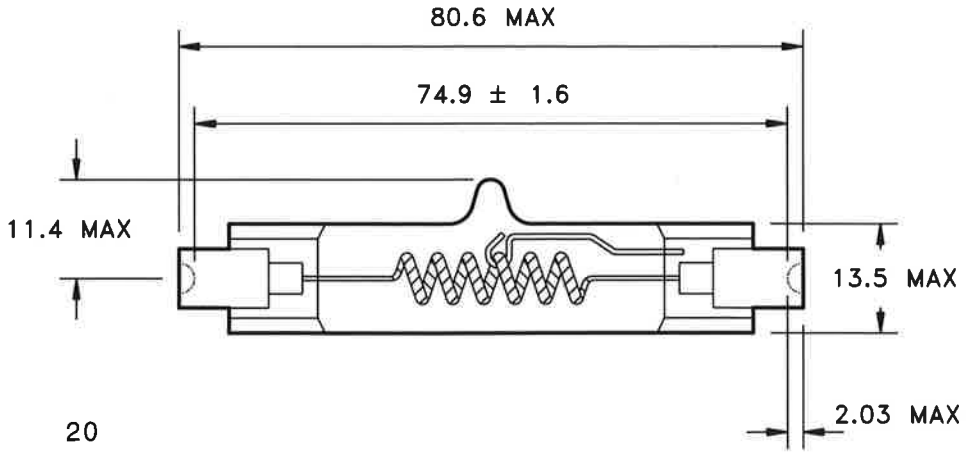
lamp code	HX156	HX156	HX156	HX156
ANSI code	GFB	GFA	GFE	GFD
	stipple	lens	lens	prismatic
	'narrow spot'	'medium flood'	'wide flood'	'extra wide flood'
Pk beam candelas	450,000	160,000	45,000	20,000
beam spread $^1/_2$ Pk	8°Hx10°W	13°Hx24°W	20°Hx58°W	65°Hx65°W
beam spread 1/10 Pk	16°Hx18°W	22°Hx36°W	34°Hx71°W	95°Hx145°W

type	field size for 50% peak (metres HxW)		
GFB	0.7x0.9	1.4x1.7	2.1x2.6
GFA	1.1x2.1	2.3x4.3	3.4x6.4
GFE	1.8x5.5	3.5x11.1	5.3x16.6
GFD	6.4x6.4	12.7x12.7	19.1x19.1



peak illumination (LUX)

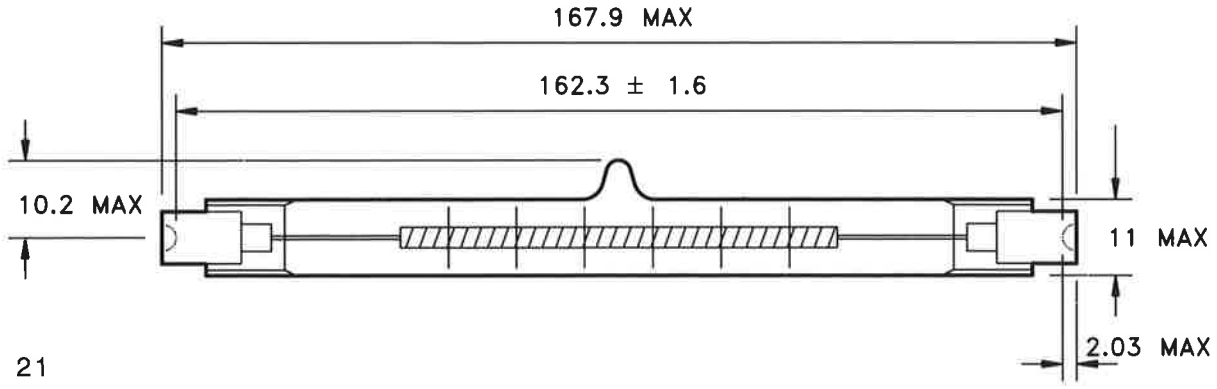
GFB	18000	4500	2000
GFA	6400	1600	710
GFE	1800	450	200
GFD	800	200	89



20

R7s base *(recessed single contact)*

watts	*lamp code*	ANSI code	*voltage*	colour temp. K	lumens X 1000	ave. life hrs.	filament form	filament max. lit length	max. clearance length	burning position	notes	fig. no.
400		EHR	***120***	2900	7.5	2000	CC	22	78.3	ANY		20
650	***P2/6***	FAD	***120***	3200	16.5	100	CC	25	78.3	ANY		20
650	***P2/6***	FBX	***120***	3200	16.5	100	CC	25	78.3	ANY	frost G	20
800	***P2/13***	DXX	***220/230 240/250***	3200	20.5	75	CC	25	78.3	ANY		20

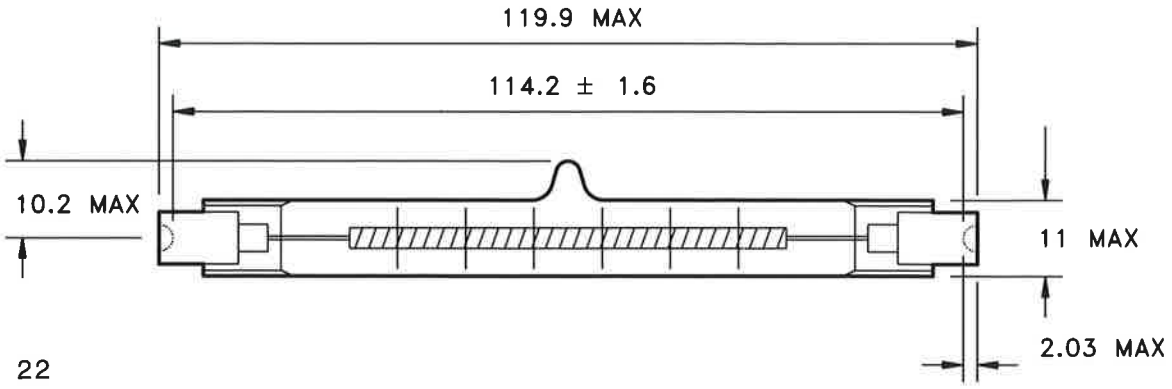


21

R7s base *(recessed single contact)*

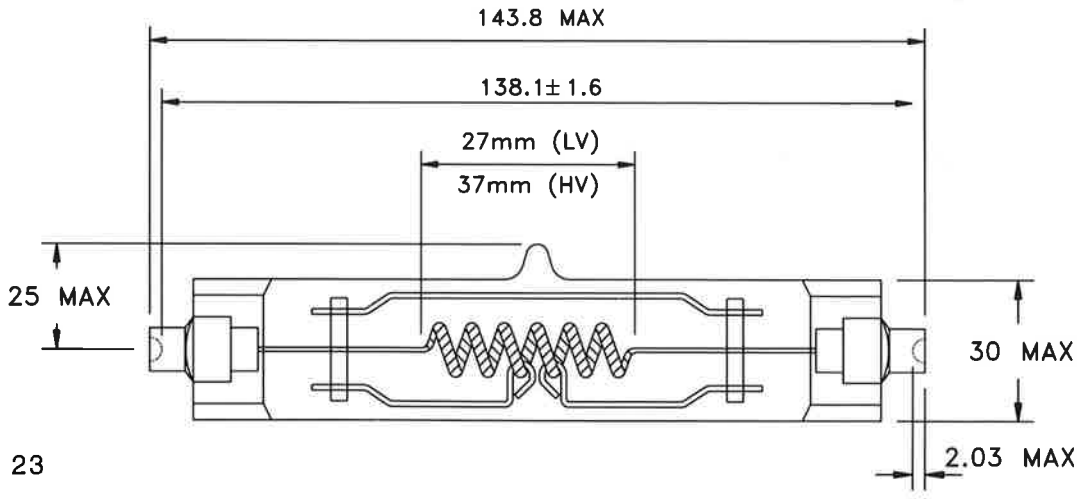
watts	ANSI code	*voltage*	colour temp. K	lumens X 1000	ave. life hrs	filament form	filament max. lit length	max. clearance length	burning position	notes	fig. no.
1000	FFT	***120***	3200	26	500	SC	75	165.6	HOR±4		21
1000	FDB	***120***	3200	41	400	SC	80	165.6	HOR±4	dia.13.5 max. G	21

FDB - dimension from centre line to top of exhaust tip off is 11.5 max.



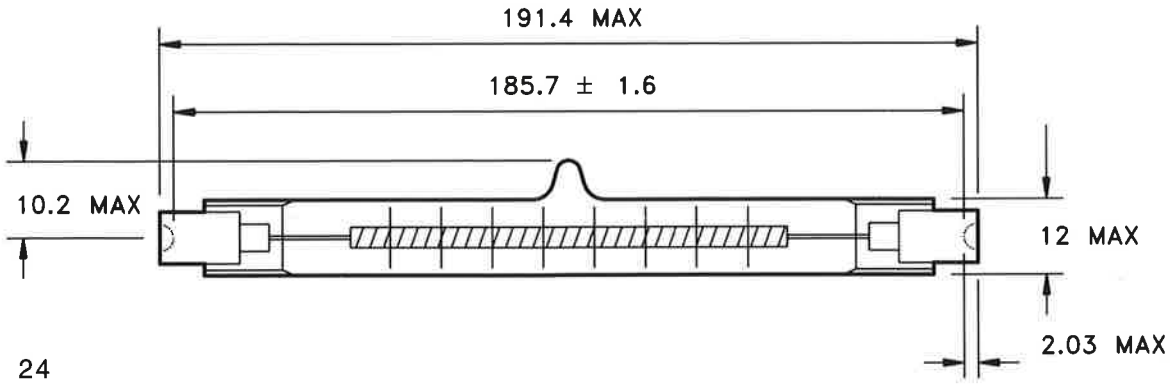
R7s base *(recessed single contact)*

watts	*lamp code*	ANSI code	*voltage*	colour temp. K	lumens X 1000	ave. life hrs	filament form	filament max. lit length	max. clearance length	burning position	notes	fig. no.
500	***P2/30***	FDF	***120***	3200	13.25	400	SC	60	117.6	HOR±4		22
500	***P2/31***	FDN	***120***	3200	12.5	400	SC	60	117.6	HOR±4	frost	22
750		EJG	***120***	3200	20	400	SC	62	117.6	HOR±4		22
750		EMD	***120***	3200	19.5	400	SC	62	117.6	HOR±4	frost	22
800	***P2/11***	EME	***220/230***	3200	22	150	CC	68	117.6	HOR±4		22
800	***P2/11***	EME	***240/250***	3200	22	150	CC	68	117.6	HOR±4		22
800	***P2/11***	EMF	***220/230***	3200	21.4	150	CC	68	117.6	HOR±4	frost G	22
800	***P2/11***	EMF	***240/250***	3200	21.4	150	CC	68	117.6	HOR±4	frost G	22
1000	***P2/28***	FCM	***120***	3200	27	300	SC	68	117.6	HOR±4		22
1000	***P2/28***		***220***	3200	25.5	300	CC	72	117.6	HOR±4		22
1000	***P2/29***	FHM	***120***	3200	26	300	SC	68	117.6	HOR±4	frost	22



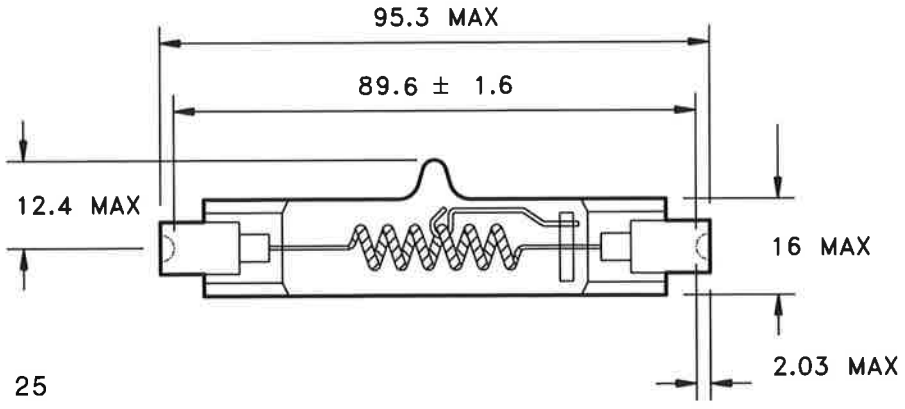
RX7s base *(recessed single contact)*

watts	*lamp code*	ANSI code	*voltage*	colour temp. K	lumens X 1000	ave. life hrs	filament form	filament max. lit length	max. clearance length	burning position	notes	fig. no.
2000		FEY	***120***	3200	56.6	300	CC	27	141.5	ANY		23
2000	***P2/27***	FEX	***220/230***	3200	50	300	CC	37	141.5	ANY		23
2000	***P2/27***	FEX	***240***	3200	50	300	CC	37	141.5	ANY		23



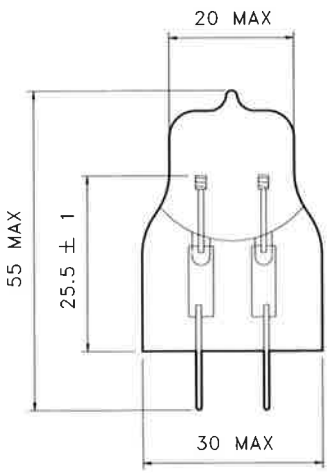
R7s base *(recessed single contact)*

watts	*lamp code*	ANSI code	*voltage*	colour temp. K	lumens X 1000	ave. life hrs.	filament form	filament max. lit. length	max. clearance length	burning position	notes	fig. no.
625	***P2/10***		***220/230***	3200	15.5	200	SC	120	189.1	HOR±4		24
625	***P2/10***		***240/250***	3200	15.5	200	SC	120	189.1	HOR±4		24
1000	***P2/7***	EKM	***220/230***	3200	26	200	SC	120	189.1	HOR±4		24
1250	***P2/12***		***220/230***	3200	35	200	SC	120	189.1	HOR±4		24
1250	***P2/12***		***240/250***	3200	35	200	SC	120	189.1	HOR±4		24

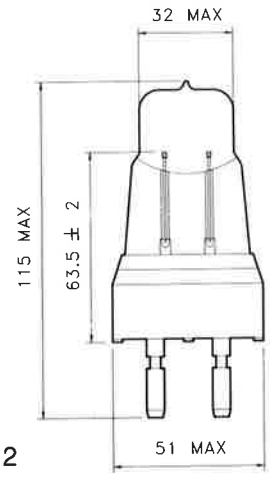


R7s base *(recessed single contact)*

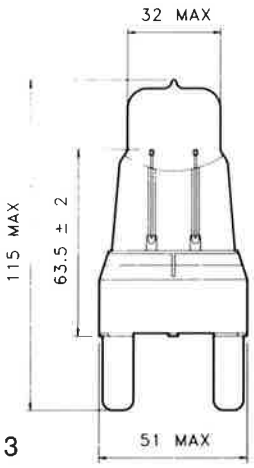
watts	*lamp code*	ANSI code	*voltage*	colour temp. K	lumens X 1000	ave. life hrs	filament form	filament max. lit. length	max. clearance length	burning position	notes	fig. no.
1000		DXW	120	3200	28	150	CC	25	93	ANY	GY	25
1000		FBY	120	3200	26	150	CC	25	93	ANY	frost GY	25
1000	***P2/35***		220,240	3200	26.5	150	CC	28.5	93	ANY		25



26.1



26.2



26.3

special bipin base

watts	code ref.	lumens 100 hrs.	maintenance	ave. life hrs.	colour temp. K	colour chromaticity co-ordinates	colour rendering index Ra	burning position	arc gap width	base	fig. no.
400	99-0201 CSI	32000	85% at 500 hrs	500	4000±400	x0.395 y0.395	80	VBD±90	9±1	2 pin 9mm ±0.5 spacing 0.76 dia	26.1
		lamp volts	current (amps)	run up time sec. (max)	starting pulse (nom) KV	restrike time minutes	ignitor	ballast choke		capacitor	
		100	5	60	9 peak	5	G53444 or Bag Turgi SE15/7U	G53371.T		2xGC2331 40µF 250V	

G22 base *(medium bipost)*

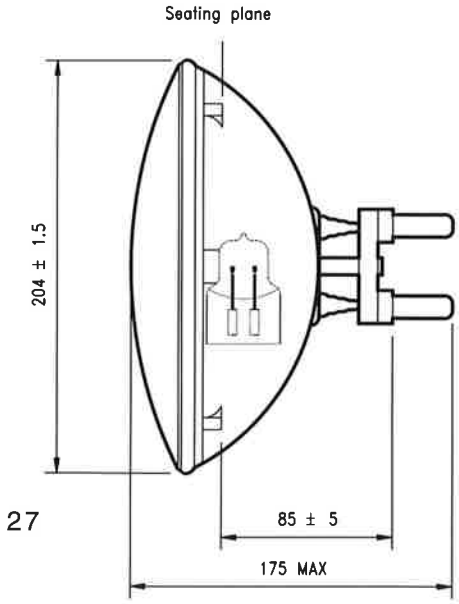
watts	code ref.	lumens 100 hrs	maintenance	ave. life hrs.	colour temp. K	colour chromaticity co-ordinates	colour rendering index Ra	burning position	arc gap width	fig. no.
1000	99-0221 CSI	90000	85% . at 500 hrs.	500	4000±400	x0.385 y0.395	80	VBD±90	15±1.5	26.2
		lamp volts	current (amps)	run up time sec. (max)	starting pulse (nom) KV	restrike time	ignitor	ballast choke	capacitor	
		77	15	60	9 peak	5	G53444 or Bag Turgi SE15/7U	G53307.T	7xGC2346 175µF 250V	

G38 base *(mogul bipost)*

watts	code ref.	lumens 100 hrs	maintenance	ave. life hrs.	colour temp. K	colour chromaticity co-ordinates	colour rendering index Ra	burning position	arc gap width	fig. no.
1000	99-0421 CSI	90000	85% at 500 hrs.	500	4000±400	x0.385 y0.395	80	VBD±90	15±1.5	26.3
		lamp volts	current (amps)	run up time sec. (max)	starting pulse (nom) KV	restrike time	ignitor	ballast choke	capacitor	
		77	15	60	25*	instant (hot restrike)	G53352.T or IREM AD1540	G53307.T	7xGC2346 175µF 250V	

* measured between sphere gap of 7.5mm in air

circuit diagrams for these lamps can be found on pages 32 & 33 this includes other essential components.



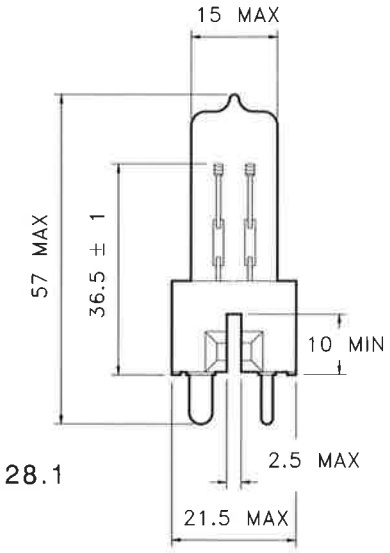
G38 base *(mogul bipost)*

watts	*code ref.*	axial intensity cd.	angle 1/2 peak degrees	angle 1/10 peak degrees	ave. life hrs.	colour temp. K	colour chromaticity co-ordinates	colour rendering index Ra	burning position	arc gap width	fig. no.
1000	*99-1222 CSI*	1350000	6	18	3500	4000±400	x0.393 y0.395	80	HOR±90	15±1.5	27
		lamp volts	current (amps)	run up time sec. (max)	starting pulse (nom) KV	restrike time	ignitor	ballast choke		capacitor	
		77	15	60	9 peak	10	G53444 or Bag Turgi SE15/7U	G53307.T		7xGC2346 175µF 250V	

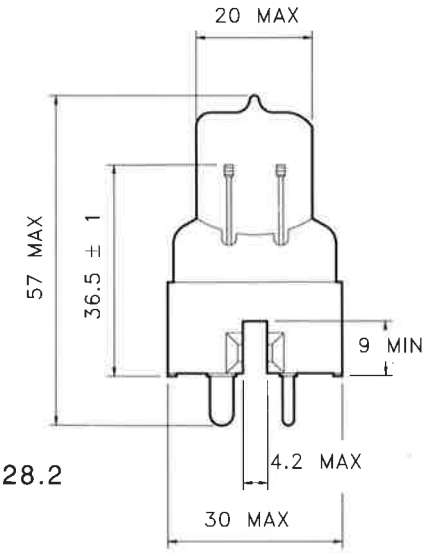
watts	*code ref.*	axial intensity cd.	angle 1/2 peak degrees	angle 1/10 peak degrees	ave. life hrs.	colour temp. K	colour chromaticity co-ordinates	colour rendering index Ra	burning position	arc gap width	fig. no.
1000	*99-1422 CSI*	1350000	6	18	3500	4000±400	x0.393 y0.395	80	HOR±90	15±1.5	27
		lamp volts	current (amps)	run up time sec. (max)	starting pulse (nom) KV	restrike time	ignitor	ballast choke		capacitor	
		77	15	60	25*	instant (hot restrike)	G53352.T or IREM AD1540	G53307.T		7xGC2346 175µF 250V	

* measured between sphere gap of 7.5mm in air

circuit diagrams for these lamps can be found on pages 32 & 33 this includes other essential components.



28.1

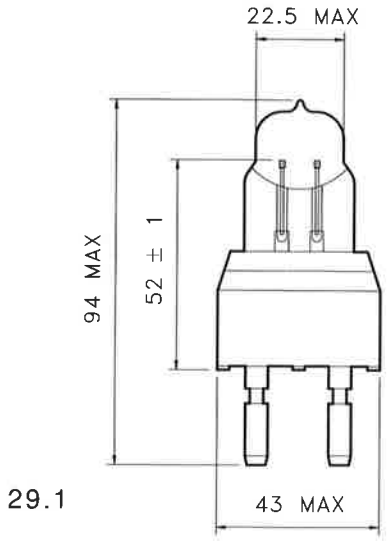


28.2

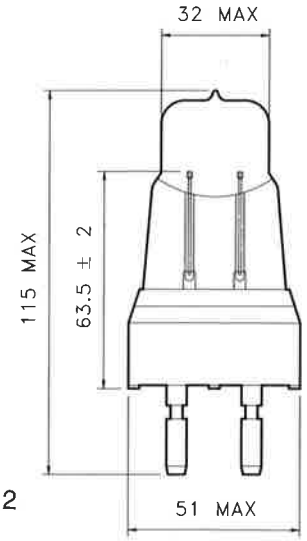
special bipin base

watts	*code ref.*	lumens 100 hrs	maintenance	ave. life hrs.	colour temp. K	colour chromaticity co-ordinates	colour rendering index Ra	burning position	arc gap width	fig. no.
200	***99-0211 CID***	14000	90% at 150 hrs.	150	5500±400	x0.332 y0.341	85	VBD±90	5.5±1	28.1
		lamp volts	current (amps)	run up time sec. (max)	starting pulse (nom) KV	restrike time	ignitor	ballast choke	capacitor	
		70	3.3	60	12 peak	instant (hot restrike)	IREM AD312R	G53398.T	GC2382 35µF 250V	
watts	***code ref.***	lumens 100 hrs	maintenance	ave. life hrs.	colour temp. K	colour chromaticity co-ordinates	colour rendering index Ra	burning position	arc gap width	fig. no.
300	***99-0413 CID***	21000	90% at 350 hrs.	350	5500±400	x0.332 y0.341	85	VBD±90	9±1	28.2
		lamp volts	current (amps)	run up time sec. (max)	starting pulse (nom) KV	restrike time	ignitor	ballast choke	capacitor	
		100	3.5	60	15 peak	instant (hot restrike)	IREM AD415/EB		GC2382 35µF 250V	

circuit diagrams for these lamps can be found on pages 32 & 33 this includes other essential components.



29.1



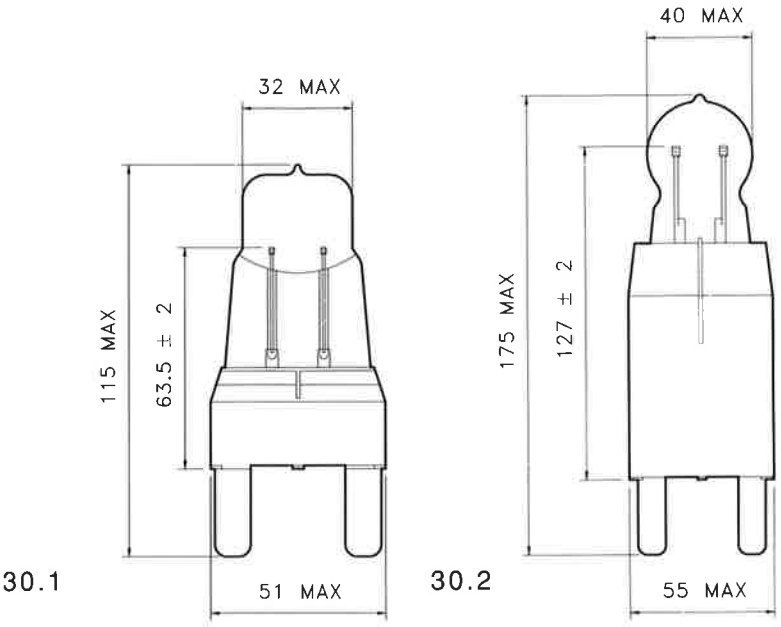
29.2

G22 base *(medium bipost)*

watts	*code ref.*	lumens 100 hrs	maintenance	ave. life hrs.	colour temp. K	colour chromaticity co-ordinates	colour rendering index Ra	burning position	arc gap width	fig. no.
575	*99-0415 CID*	40250	90% at 500 hrs	500	5500±400	x0.322 y0.341	85	VBD±90	9±1	29.1
		lamp volts	current (amps)	run up time sec. (max)	starting pulse (nom) KV	restrike time minutes	ignitor	ballast choke	capacitor	
		95	7	60	9 peak	5	G53444 or Bag Turgi SE15/7U	IREM ZA57	4xGC2331 80µF 250V	

watts	*code ref.*	lumens 100 hrs	maintenance	ave. life hrs.	colour temp. K	colour chromaticity co-ordinates	colour rendering index Ra	burning position	arc gap width	fig. no.
1000	*99-0222 CID*	70000	90% at 500 hrs	500	5500±400	x0.332 y0.341	85	VBD±90	15±1.5	29.2
		lamp volts	current (amps)	run up time sec. (max)	starting pulse (nom) KV	restrike time minutes	ignitor	ballast choke	capacitor	
		77	15	60	9 peak	5	G53444 or Bag Turgi SE15/7U	G53307.T	7xGC2346 175µF 250V	

circuit diagrams for these lamps can be found on pages 32 & 33 this includes other essential components.



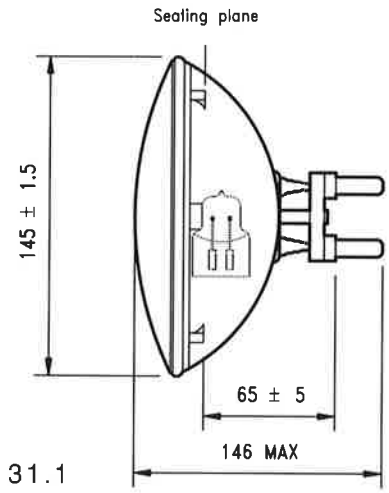
30.1 30.2

G38 base *(mogul bipost)*

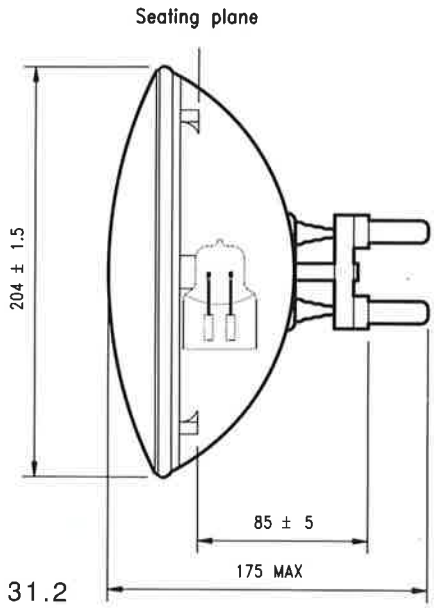
watts	*code ref.*	lumens 100 hrs	maintenance	ave. life hrs.	colour temp. K	colour chromaticity co-ordinates	colour rendering index Ra	burning position	arc gap width	fig. no.
1000	*99-0422 CID*	70000	90% at 500 hrs	500	5500±400	x0.332 y0.341	85	VBD±90	15±1.5	30.1
		lamp volts	current (amps)	run up time sec. (max)	starting pulse (nom) KV	restrike time	ignitor	ballast choke	capacitor	
		77	15	60	25*	instant (hot restrike)	G53352.T or IREM AD1540	G53307.T	7xGC2346 175µF 250V	
watts	*code ref.*	lumens 100 hrs	maintenance	ave. life hrs.	colour temp. K	colour chromaticity co-ordinates	colour rendering index Ra	burning position	arc gap width	fig. no.
2500	*99-0431 CID*	200000	90% at 350 hrs	350	5500±400	x0.332 y0.341	85	VBD±90	18±1	30.2
		lamp volts	current (amps)	run up time sec. (max)	starting pulse (nom) KV	restrike time	ignitor	ballast choke	capacitor	
		100	28	60	50**	instant (hot restrike)	IREM AD30/50	2x G53307.T	11x GC2346 275µF 250V	

* measured between sphere gap of 7.5mm in air
** measured between sphere gap of 17mm in air

circuit diagrams for these lamps can be found on pages 32 & 33 this includes other essential components.



31.1



31.2

G38 base *(mogul bipost)*

watts	*code ref.*	axial intensity cd.	angle 1/2 peak degrees	angle 1/10 peak degrees	ave. life hrs.	colour temp. K	colour chromaticity co-ordinates	colour rendering index Ra	burning position	arc gap width	fig. no.
575	*99-1415 CID*	425000	8	18	1000	5500±400	x0.322 y0.341	85	HOR±90	9±1	31.1
		lamp volts	current (amps)	run up time sec. (max)	starting pulse (nom) KV	restrike time	ignitor	ballast choke		capacitor	
		95	7	60	25*	instant (hot restrike)	IREM AD825	IREM ZA57		4xGC2331 80µF 250V	
watts	*code ref.*	axial intensity cd.	angle 1/2 peak degrees	angle 1/10 peak degrees	ave. life hrs.	colour temp. K	colour chromaticity co-ordinates	colour rendering index Ra	burning position	arc gap width	fig. no.
1200	*99-1435 CID*	820000	10	20	1000	5500±400	x0.332 y0.341	85	HOR±90	18±1	31.2
		lamp volts	current (amps)	run up time sec. (max)	starting pulse (nom) KV	restrike time	ignitor	ballast choke		capacitor	
		100	14	80	50**	instant (hot restrike)	IREM AD1550	G53307.T		6xGC2346 150µF 250V	

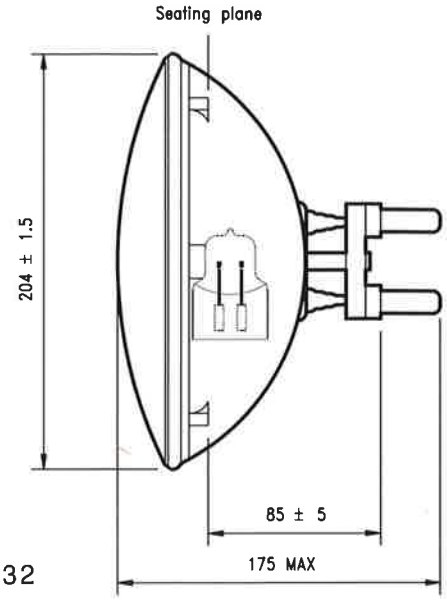
* measured between sphere gap of 7.5mm in air
** measured between sphere gap of 17mm in air

circuit diagrams for these lamps can be found on pages 32 & 33 this includes other essential components.

separate front lenses are available for luminaires (fixtures) using the 99-1435 1200W PAR 64 CID lamp

code ref:

OMC	-	clear	very narrow spot
OMS	-	stipple	narrow spot
OMP	-	8 section lens	medium flood
OMW	-	12 section lens	wide flood
OME	-	prismatic	extra wide flood



32

G38 base *(mogul bipost)*

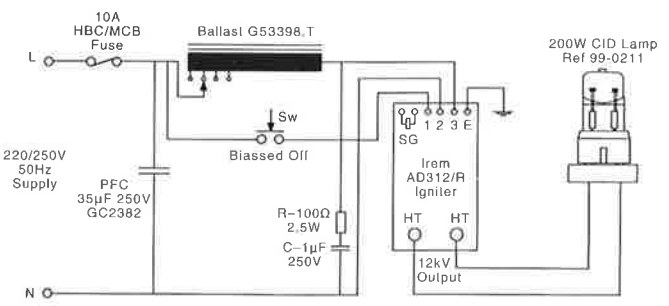
watts	*code ref.*	axial intensity cd.	angle 1/2 peak degrees	angle 1/10 peak degrees	ave. life hrs.	colour temp. K	colour chromaticity co-ordinates	colour rendering index Ra	burning position	arc gap width	fig. no.
1000	***99-1225 CID***	850000	8	20	1500	5500±400	x0.322 y0.341	85	HOR±90	15±1.5	32
		lamp volts	current (amps)	run up time sec. (max)	starting pulse (nom) KV	restrike time	ignitor	ballast choke		capacitor	
		77	15	60	9 peak	10	G53444 or Bag Turgi SE15/7U	G53307.T		7xGC2346 175µF 250V	

watts	*code ref.*	axial intensity cd.	angle 1/2 peak degrees	angle 1/10 peak degrees	ave. life hrs.	colour temp. K	colour chromaticity co-ordinates	colour rendering index Ra	burning position	arc gap width	fig. no.
1000	***99-1425 CID***	850000	8	20	1000	5500±400	x0.322 y0.341	85	HOR±90	15±1.5	32
		lamp volts	current (amps)	run up time sec. (max)	starting pulse (nom) KV	restrike time	ignitor	ballast choke		capacitor	
		77	15	60	25*	instant (hot restrike)	G53352.T or IREM AD1540	G53307.T		7xGC2346 175µF 250V	

* measured between sphere gap of 7.5mm in air

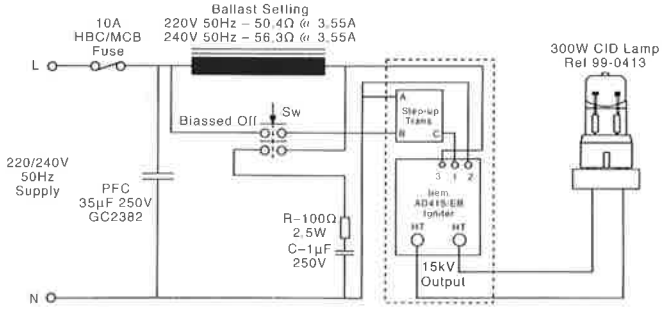
circuit diagrams for these lamps can be found on pages 32 & 33 this includes other essential components.

200 Watt CID Hot-Restart Lamp Circuit Diagram



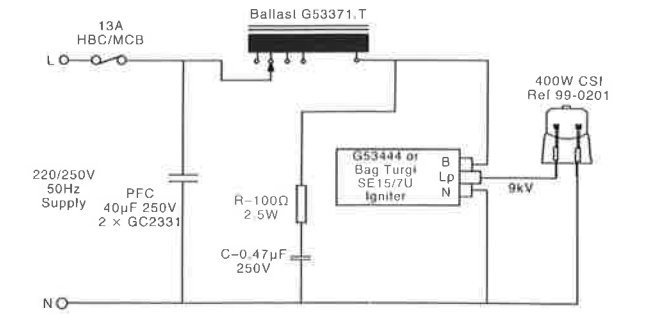
Sw – Normally open contacts – Manual switch or 2 second ON timer
Maximum cable capacitance between igniter and lamp – 30pF (200mm length)

300 Watt CID Hot-Restart Lamp Circuit Diagram



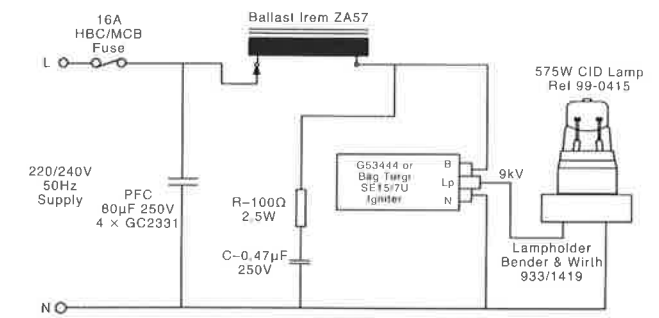
Sw – Normally open contacts – Manual switch or 4 second ON timer
Maximum cable capacitance between igniter and lamp – 30pF (200mm length)

400 Watt CSI Lamp Circuit Diagram



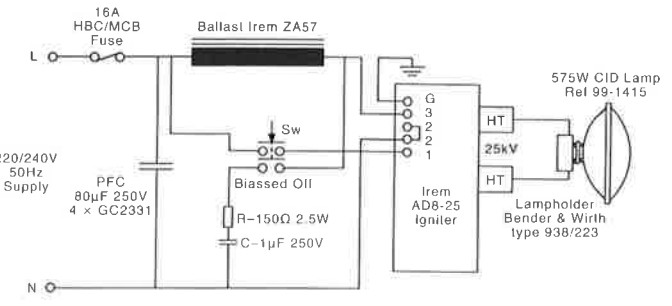
Maximum cable capacitance between igniter and lamp – 50pF (300mm length)

575 Watt CID Lamp Circuit Diagram



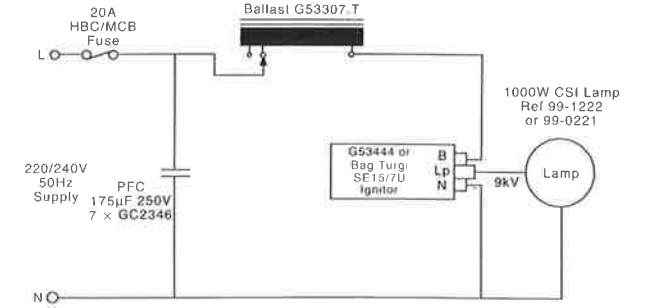
Maximum cable capacitance between igniter and lamp – 50pF (300mm length)

575 Watt CID Hot-Restart Lamp Circuit Diagram



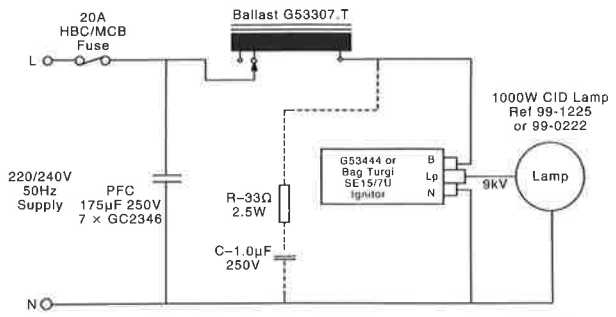
Sw – Normally open contacts – Manual switch or 2 second ON timer
Maximum cable capacitance between igniter and lamp – 30pF (200mm length)

1000 Watt CSI Lamp Circuit Diagram



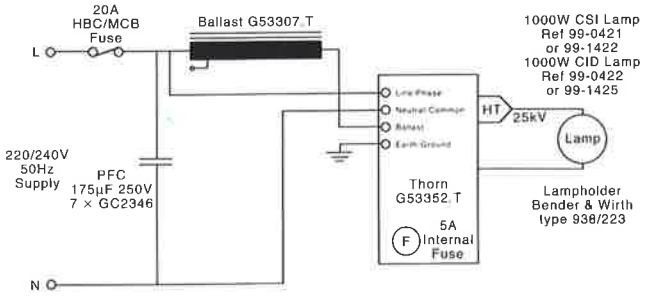
Lampholder for 99-1222 – Bender & Wirth 938/223 and for 99-0221 – Bender & Wirth 933/1419
Maximum cable capacitance between igniter and lamp – 50pF (300mm length)
Replace G53445 (or Bag Turgi SE600/D) igniter sparkgap element when replacing a failed lamp

1000 Watt CID Lamp Circuit Diagram



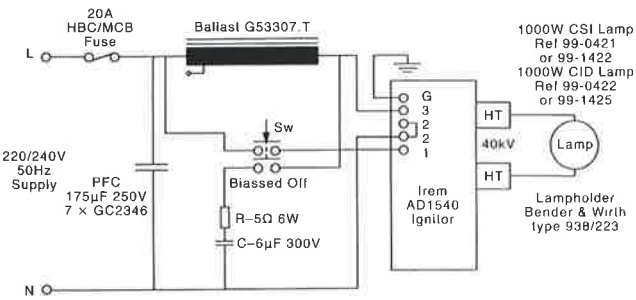
Lampholder for 99-1225 – Bender & Wirth 938/223 and for 99-0222 – Bender & Wirth 933/1419
R/C components necessary ONLY when used on a 220V rate supply
Maximum cable capacitance between igniter and lamp – 50pF (300mm length)
Replace G53445 (or Bag Turgi SE600/D) igniter sparkgap element when replacing a failed lamp

1000 Watt CSI/CID Hot-Restart Lamp Circuit Diagram



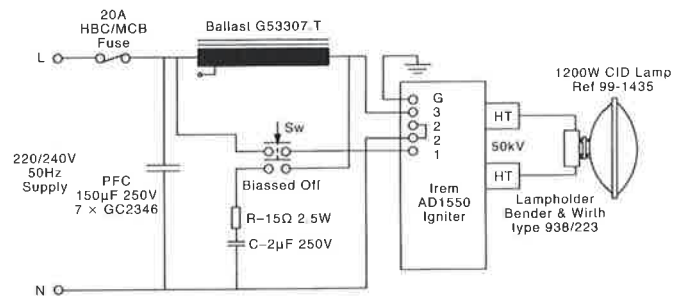
Igniter incorporates a 2 second timer which automatically re-operates
following restoration of the supply after a break >3ms
Maximum cable capacitance between igniter and lamp – 50pF (300mm length)

1000 Watt CSI/CID Hot-Restart Lamp Circuit Diagram



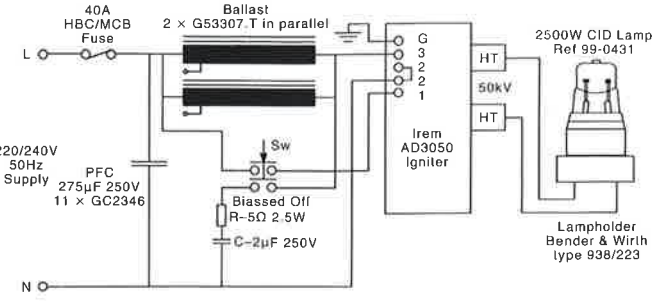
Sw – Normally open contacts – Manual switch or 2 second ON timer
Maximum cable capacitance between igniter and lamp – 30pF (200mm length)

1200 Watt CID Hot-Restart Lamp Circuit Diagram



Sw – Normally open contacts – Manual switch or 2 second ON timer
Maximum cable capacitance between igniter and lamp – 30pF (200mm length)

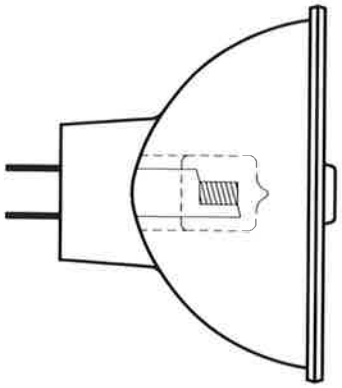
2500 Watt CID Hot-Restart Lamp Circuit Diagram



Sw – Normally open contacts – Manual switch or 2 second ON timer
Maximum cable capacitance between igniter and lamp – 30pF (200mm length)

photographic

lamps



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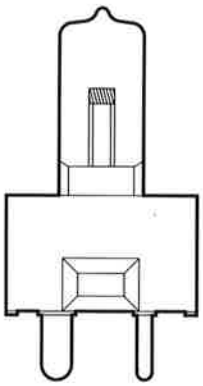

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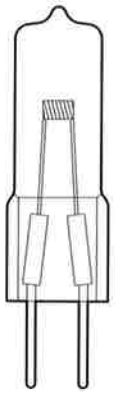

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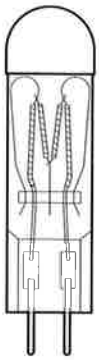

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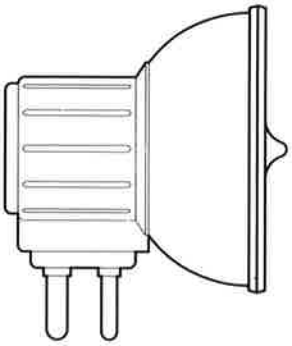

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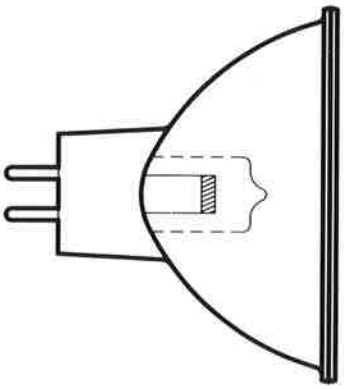

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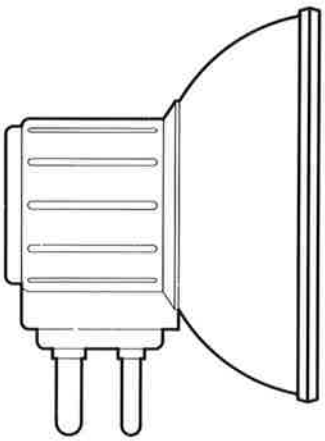

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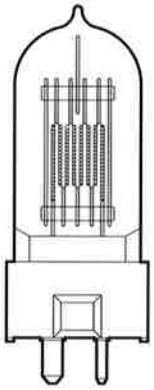

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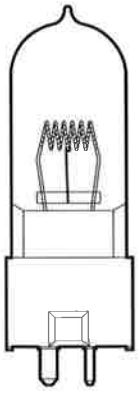

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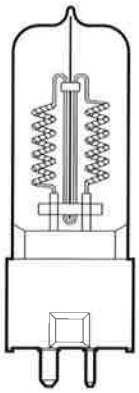

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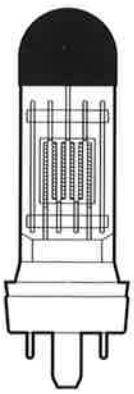

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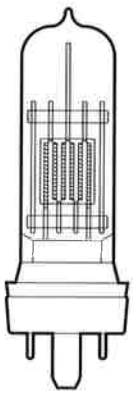

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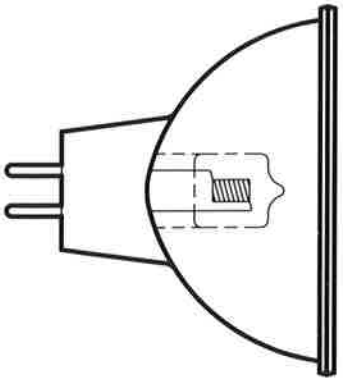
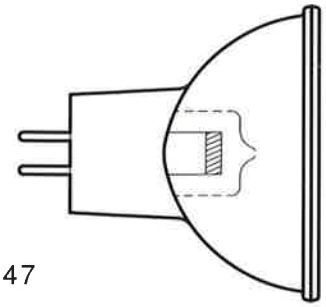


46

A1 class projector lamps

lamp code	ANSI code	*volts*	*watts*	lamp cap	ave. life hrs.	nominal lumens	light centre length	focal distance	max. overall length	max. overall diameter	burning position	notes	fig. no.
A1/209	FDX	***12***	***100***	GY6.35 ceramic	50	3000	24±0.5		44	11	VBD±90	L	34
A1/215	FCR	***12***	***100***	GY6.35	50	3400	30±0.25		44	11	VBD±90	L	36
A1/216	FCS	***24***	***150***	G6.35	50	5200	32±0.5		50	13.5	VBD±90	L	36
A1/220	BRL	***12***	***50***	G6.35	50	1500	30±0.25		44	11.5	VBD±90	L	36
A1/223	EHJ	***24***	***250***	G6.35	50	9400	33±0.25		55	13.5	VBD±90	L	36
A1/230	EFN	***12***	***75***	GZ6.35	50			32	42	50	VBD±105	LMP	33
A1/231	EFP	***12***	***100***	GZ6.35	50			32	42	50	VBD±105	LMP	33
A1/232	EFR	***15***	***150***	GZ6.35	50			32	42	50	VBD±105	LMP	33
A1/233	DYR	***220/230***	***650***	GY9.5	75	16500	36.5±1		64.5	22.5	VBD±90	KLR	43
		240/250				16500							
A1/234	BRJ	***15***	***150***	G6.35	50	5000	30±0.25		44	11.5	VBD±90	L	36
A1/241	BCK	***115/120***	***500***	G17T	50		39.7±1		94	30.5	VBD	JKLMNRSX	44
		220/230											
		240/250											
A1/244		***220/230***	***500***	GY9.5	75	13000	36.5±0.5		75	28.5	VBD±90	KLR	41
		240				13000							
A1/245		***220/230***	***800***	GY9.5	75	21500	44.5±0.5		87	28.5	VBD±90	KLSW	41
		240				21500							
A1/247		***120***	***650***	GY9.5	75	18500	36.5±0.5		75	28.5	VBD±90	KLST	41
		220/230				17750							
		240				17750							
A1/248		***115/120***	***150***	G6.35	50	3150	40±0.5		62	16.3	VBD±90	KL	37
		220/230				3000							
		240				3000							
A1/249		***115/120***	***300***	G6.35	50	7350	40±0.5		62	16.3	VBD±90	JKLR	37
		220/230				7200							
		240				7200							
A1/252	EJL	***24***	***200***	GX5.3	50			32	44.45	50.67	VBD±105	LMP	39
A1/258	EMM	***24***	***250***	GX7.9	50			65.8	43	44	VBD±90	LMPT	38
A1/259	ELC	***24***	***250***	GX5.3	50			32	44.45	50.67	VBD±105	LMP	46
A1/261	FDT	***12***	***100***	GY9.5	50	3000	27±0.25		57	22	VBD±90	L	35
A1/262	DZE/ FDS	***24***	***150***	GY9.5	50	4900	33.3±0.25		60	22	VBD±90	L	35
A1/264	DYS	***120***	***600***	GY9.5	75	16000	36.5±1		64.5	22.5	VBD±90	LT	42
A1/266	DNF	***21***	***150***	GX7.9	50			69.1	43	50.67	VBD±90	LMP	40
A1/268	EPS	***220/230***	***500***	G17T	50		39.7±1		94	30.5	VBD±90	KLMNRX	45
		240											

During operation, the temperature of the lamp pinch seal should not exceed 350˚C whilst the bulb wall temperature must not drop below 250˚C in order to maintain the tungsten halogen cycle.



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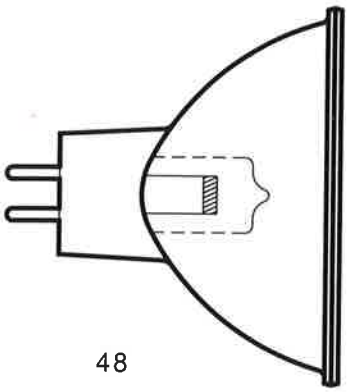

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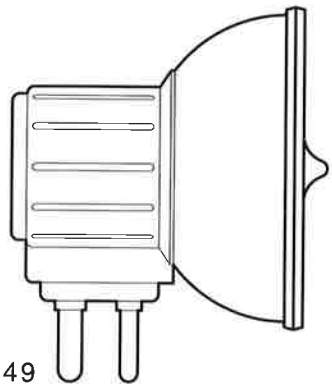

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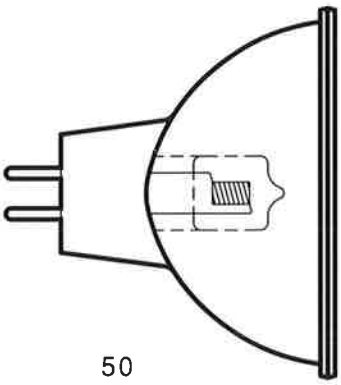

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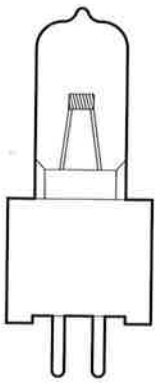


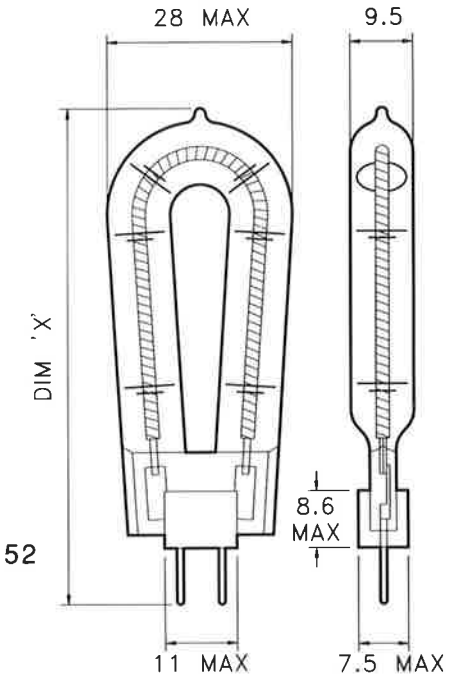
51

ANSI coded micrographic, fibre optic and projector lamps

ANSI code	*volts*	*watts*	lamp cap	ave. life hrs.	nominal lumens	light centre length	focal distance	max. overall length	max. overall. diameter	burning position	notes	fig. no.
DDL	***20***	***150***	GX5.3	500			194.5	44.45	50.67	VBD±90	LMP	48
DDM	***19***	***80***	GX5.3	50			152	44.45	50.67	VBD±90	LMP	48
DDS	***21***	***80***	GX5.3	500			165	44.45	50.67	VBD±90	LMP	48
DED	***13.8***	***85***	GX5.3	1000			165	44.45	50.67	VBD±90	LMP	50
ELD/EJN	***21***	***150***	GX5.3	40			165.1	44.45	50.67	VBD±90	LMP	48
ELH	***120***	***300***	GY5.3	35			152.4	44.45	50.67	VBD±90	LMP	50
ELS/ELR	***16***	***50***	GX7.9	650			205	43	44	VBD±90	LMP	49
ENH	***120***	***250***	GY5.3	175			152.4	44.45	50.67	VBD±90	LMP	50
ENL	***12***	***50***	GX5.3	3000			38.1	44.45	50.67	ANY	LMP	50
ENX	***82***	***360***	GY5.3	75			298.5	44.45	50.67	VBD±90	LMP	50
EPV	***14.5***	***90***	GX5.3	500			155.2	44.45	50.67	VBD±90	LMP	50
EPX	***14.5***	***90***	GX5.3	500			165	44.45	50.67	VBD±90	LMP	50
EWF	***24***	***200***	GX5.3	50			298.5	44.45	50.67	ANY	LMP	48
FHR	***12***	***50***	G5.3	50	1300	29.4±0.25		48.75	11	VBD±90	L	51
FHX	***13.8***	***25***	GX5.3	250			108	44.45	50.67	VBD±90	LMP	48
FLS	***12***	***28***	GZ4	1000			216	40	35.3	ANY	LMP	47
FLT	***13.8***	***25***	GZ4	500			76 or 175*	40	35.3	ANY	LMP	47

* according to reader optics

During operation, the temperature of the lamp pinch seal should not exceed 350°C whilst the bulb wall temperature must not drop below 250°C in order to maintain the tungsten halogen cycle.



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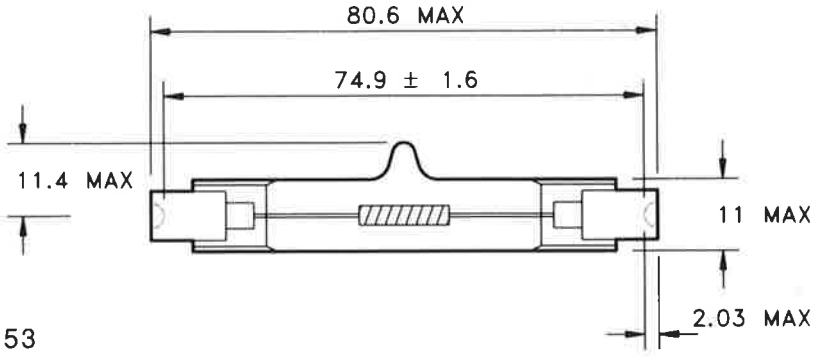

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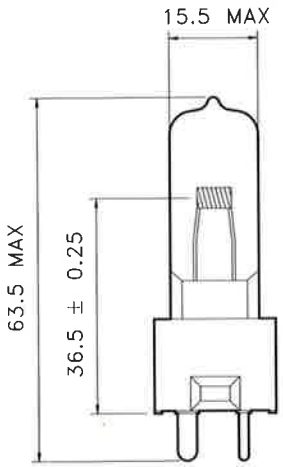

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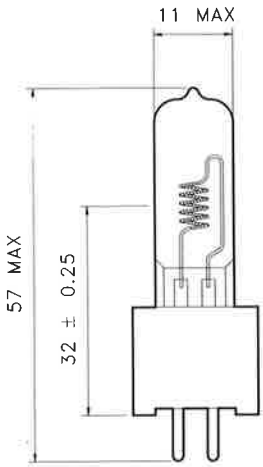

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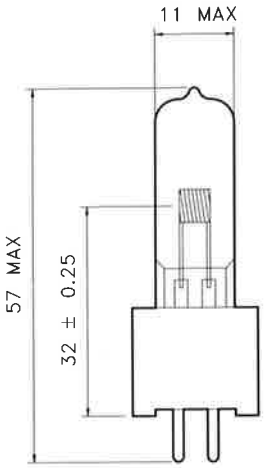


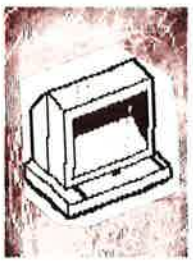
56

P class video and cine sun gun lamps

lamp code	ANSI code	*voltage*	*watts*	lamp cap	colour temp. K	lumens	ave. life hrs.	maximum overall length (or DIM 'X')	burning position	notes	fig. no.
P2/16		***220/230,240/250***	***650***	G6.35	3200	17500	50	65	VBD±90	KLR	52
P2/17		***220/230,240/250***	***1000***	G6.35	3200	28000	50	71	VBD±90	KLS	52
P2/26		***220/230,240/250***	***1250***	G6.35	3200	35000	50	75	VBD±90	GKLT	52
P1/8		***30***	***250***	R7s	3400	8000	15	80.6	ANY	L	53
P1/13	BVM	***220/230,240/250***	***650***	G6.35	3400	20000	15	65	VBD±90	GKLR	52
P1/15		***220/230, 240/250***	***1000***	G6.35	3400	32000	15	65	VBD±90	GKLS	52
	DYG	***30***	***250***	GY9.5	3400	8000	15	63.5	VBD±90	L	54
	GCA	***120***	***250***	G5.3	3200	5700	200	57	ANY	L	55
	GCB	***30***	***200***	G5.3	3200	5300	200	57	ANY	L	56

During operation, the temperature of the lamp pinch seal should not exceed 350°C whilst the bulb wall temperature must not drop below 250°C in order to maintain the tungsten halogen cycle.

lampholders

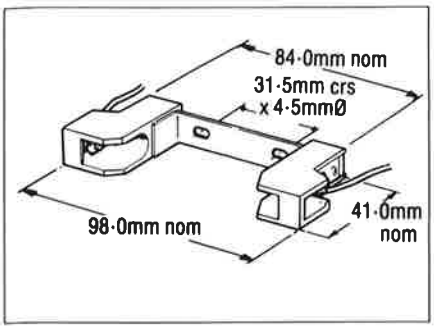


lampholder	lead length (mm)	description
SUL150		**Lamp base R7s**
SUL150	220	With flying leads. Silver contacts, steatite ceramic body. Polytetrafluoroethylene (PTFE) lead wire insulation. Lead – 19 strand 0.25mm nickel plated copper. Maximum rating 250V, 6A.
SUL500		**Lamp base R7s**
SUL500	220	With flying leads. Silver contacts, steatite ceramic body. Polytetrafluoroethylene (PTFE) lead wire insulation. Lead – 19 strand 0.25mm nickel plated copper. Maximum rating 250V, 6A.
GL1079W		**Lamp base G6.35**
GL1079W	165	With flying leads. Solid nickel contacts, steatite ceramic body. Polytetrafluoroethylene (PTFE) lead wire insulation. Lead – 19 strand 0.25mm nickel plated copper. Maximum rating 35V, 6A.
GL1079SLW		**Lamp base G6.35**
GL1079SLW	165	With flying leads and lamp support clips. Solid nickel contacts, steatite ceramic body. Polytetrafluoroethylene (PTFE) lead wire insulation. Lead – 19 strand 0.25mm nickel plated copper. Maximum rating 35V, 6A.
GL1123A		**Lamp base G4**
GL1123A	N/A	With lamp support clips. Solid nickel contacts, steatite ceramic body. Maximum rating 35V, 6A.
GL1177		**Lamp base GY9.5**
GL1177	240	With flying leads and lamp support clips. Nickel contacts, steatite ceramic body. Polytetrafluoroethylene (PTFE) lead wire insulation. Lead – 19 strand 0.25mm nickel plated copper. Maximum rating 250V, 5A
GL1210		**Lamp base GX5.3**
GL1210L (lever left)	130	With flying leads and lamp bracket. Nickel contacts, steatite ceramic body. Silicone lead wire insulation. Lead – 23 strand 0.75mm tinned copper. Maximum rating 250V, 10A.
GL1210R (lever right)	130	
GL1211		**Lamp base G4 or GZ4 or GU4**
GL1211/70	70	With flying leads. Solid nickel contacts, steatite ceramic body. Polytetrafluoroethylene (PTFE) lead wire insulation. Lead – 19 strand 0.25mm nickel plated copper.
GL1211/110	110	
GL1211/165	165	
GL1211/250	250	

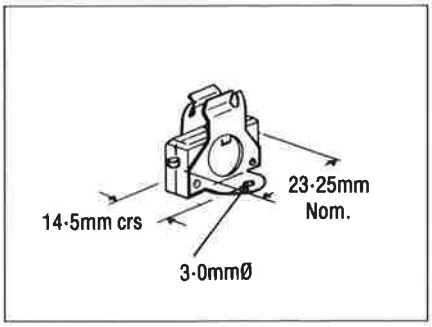
lampholder	lead length (mm)	description
GL1212		**Lamp base G4 or GZ4 or GU4**
GL1212/70	70	With flying leads and mounting lugs. Solid nickel contacts, steatite ceramic body. Polytetrafluoroethylene (PTFE) lead wire insulation. Lead – 19 strand 0.25mm nickel plated copper. Maximum rating 35V, 10A.
GL1212/110	110	
GL1212/150	150	
GL1212/250	250	
GL1212/400	400	
GL1212/2000*	2000	
GL1218		**Lamp base GX5.3 or GU5.3**
GL1218/70	70	With flying leads. Solid nickel contacts, steatite ceramic body. Polytetrafluoroethylene (PTFE) lead wire insulation. Lead – 19 strand 0.25mm nickel plated copper. Maximum rating 35V, 10A.
GL1218/110	110	
GL1218/165	165	
GL1218/250	250	
GL1218/400	400	
GL1219		**Lamp base GX5.3 or GU5.3**
GL1219/70	70	With flying leads and mounting lugs. Solid nickel contacts, steatite ceramic body. Polytetrafluoroethylene (PTFE) lead wire insulation. Lead – 19 strand 0.25mm nickel plated copper. Maximum rating: 35V, 10A.
GL1219/110	110	
GL1219/110	165	
GL1219/250	250	
GL1219/400	400	
GL1228		**Lamp base GX5.3 or GU5.3**
GL1228/70	70	With flying leads and lamp support clips. Solid nickel contacts, steatite ceramic body. Nickel plated steel side spring. Polytetrafluoroethylene (PTFE) lead wire insulation. Lead – 19 strand 0.25mm nickel plated copper. Maximum rating: 35V, 10A.
GL1228/110	110	
GL1228/150	150	
GL1228/250	250	
GL1228/400	400	
GL1228/2000*	2000	
GL1241		**Lamp base G4 or GZ4 or GU4**
GL1241/70A	70	With flying leads and lamp support clips. Solid nickel contacts, steatite ceramic body. Nickel plated steel side spring. Polytetrafluoroethylene (PTFE) lead wire insulation. Lead – 19 strand 0.2mm nickel plated copper. Maximum rating: 35V, 6A.
GL1241/120A	120	
GL1241/150A	150	
GL1241/250A	250	
GL1241/400A	400	

* Non-stock item – availiable to special order

Note: All the lampholders are designed to operate with a maximum lamp pinch temperature of 350°C.
For lamp pinch temperature limits see IEC Pub. 357.



SUL 150



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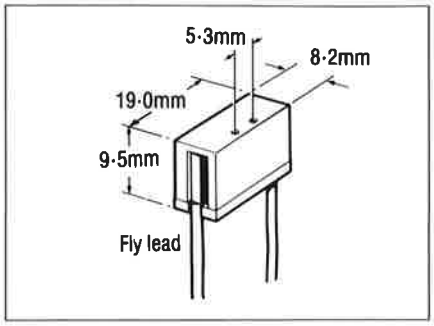

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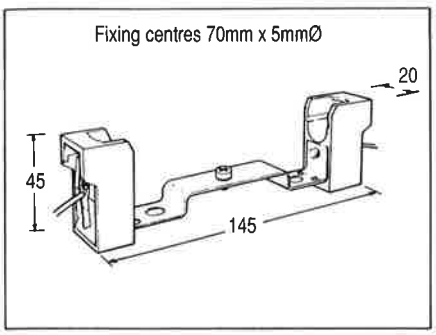

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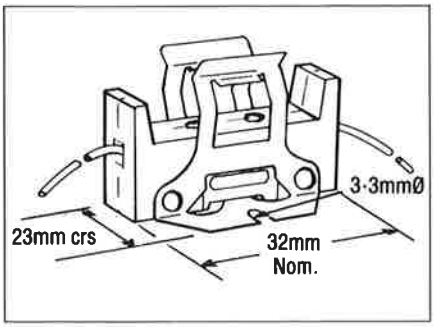

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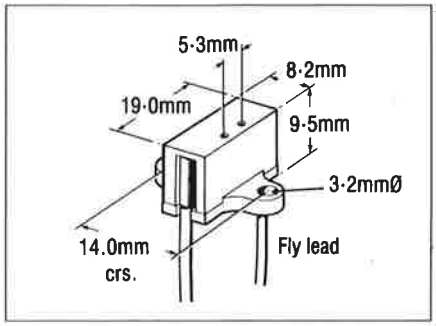

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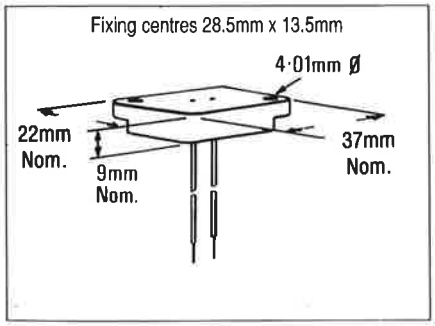

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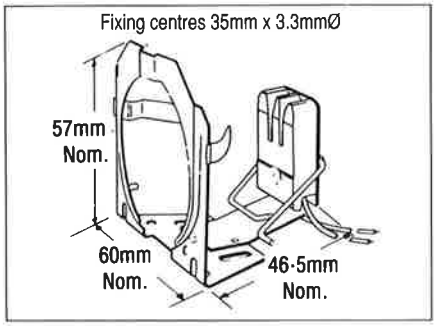

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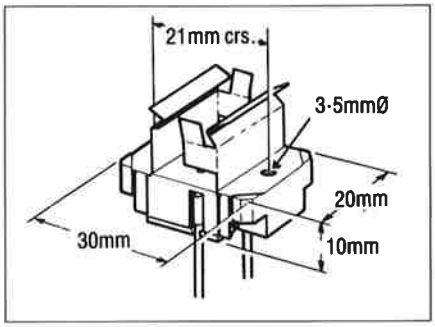

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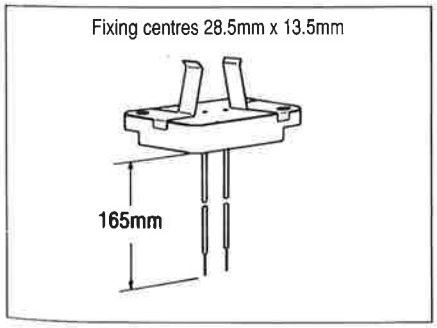

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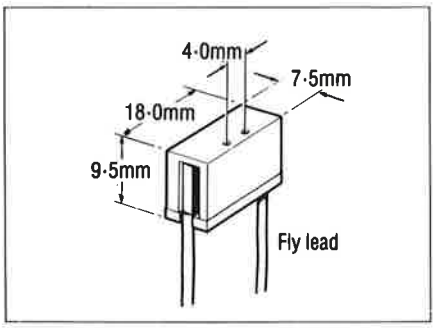

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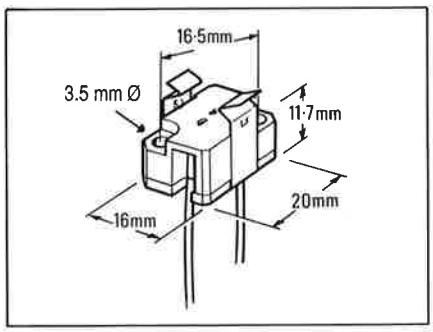

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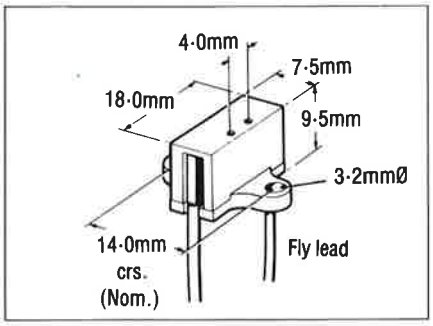


GL 1212

technical

digest

introduction

Explanation of Lamp Codes Used

Lamps listed in this catalogue are those designed for use as follows:

"A1" Prefix - Lamps intended for use with slide and overhead projectors .

"CP" Prefix - Lamps designed for use in conjunction with film balanced for 3200 K. These are single ended types intended for use in Fresnel/ellipsoidal luminaires etc.

"P2" Prefix - Again for use with 3200 K film stock for open faced luminaires and video sun guns.

"P1" Prefix - For use with 3400 K film stock.

"T" Prefix - Lamps intended for theatre luminaire applications. These are of lower colour temperature (2900 - 3050 K) and longer life than the often similar CP types above.

C.S.I.
Discharge lamps with a colour temperature of 4000 K for outside broadcast and follow spot use.

C.I.D.
Discharge lamps with a daylight colour temperature of 5500 K for location filming

ANSI Codes
A number of types are available made to American ANSI Specification and these use the random 3 letter codes allocated by the American National Standards Institute where performance specifications are on file. Lamps carrying the ANSI code are directly interchangeable with similarly coded US domestic products.They are generally rated for 120V.

Special and Experimental Lamps
In addition to these standard ranges, a number of similar types are available to special order and in most cases, a minimum order quantity will apply. These include non-standard voltage ranges of some types e.g. 100V, 100/115V, 120V and also a number of experimental types which have the THORN "HX" prefix.

Lamp Bases

The listings use the IEC International designations for lamp bases. Where appropriate, alternative local descriptions are appended.

incandescent tungsten halogen lamps

Filament Format

The listings use the following codings for filament shape:

S.C. - Axial Single Coil - equivalent to ANSI C8.

C.C. - Axial Coiled Coil - equivalent to ANSI CC8.

M.P. - Monoplane Grid - equivalent to ANSI C13.

B.P. - Biplane Grid - equivalent to ANSI C13D.

T.F. - Twin Monoplate Grid - Equivalent to ANSI 2C13.

CP Range of Lamps for Fresnel & Spotlight Fittings

As the result of extensive and sustained development work, much of it original, THORN are able to offer a comprehensive range of lamps of quartz construction, operating on the tungsten halogen principle for all Television Studio, 'motion picture', and Theatre lighting purposes.

THORN has been strongly supported by the television and film industries in its decision to discontinue glass lamps for studio lighting purposes. This is because the industry has appreciated the financial advantages of quartz halogen lamps, and also their reliability and virtually constant colour temperature.

The increase in the use of the lamps we now manufacture is due to the THORN policy of exploiting the important advantages of compact size offered by quartz halogen construction.

As a result THORN are able to supply quartz halogen lamps for use in Fresnel and spotlight fittings from 300 watts to 10,000 watts. These lamps employ a wide range of commonly accepted bases. This gives fittings manufacturers a comprehensive range of compact lamps and permits the construction of smaller, lighter and more efficient luminaires.

'T' Class Lamps for Theatre Spotlight Fittings

With this group of lamps THORN are continuing their policy of developing quartz halogen lamps.

These lamps operate at a lower colour temperature than the CP range. An average life of a remarkable 750 hours is achieved for most of the THORN range.

Similar cost savings to those offered by quartz halogen CP lamps are now presented by the quartz halogen 'T' range.

Lamps for Ellipsoidal Spotlights

A problem is encountered with some ellipsoidal spotlight luminaires due to the fact that a portion of the reflected beam of light is directed onto the cap of the lamp designed for Fresnel fittings. This leads to overheating of the cap and seal which may result in premature lamp failure.

THORN have therefore designed lamps intended for use in ellipsoidal spotlights where the size of the cap has been reduced and the neck length correspondingly increased, thus removing the critical seal area from the reflected radiation and ensuring that optimum lamp life is obtained.

Linear and 'U' Lamps - for Studio Lighting 3200 K

Whilst a comprehensive selection of lamps for spotlight fittings is important to the lighting director of almost equal importance is a range suitable for the many different fittings now on the market which use tungsten halogen lamps of tubular construction. THORN believe their range gives a wide choice and is unmatched in performance and reliability.

The THORN range of lamps of this type is also exceptional in as much as it offers lamps in an original 'U' shape. Developed by THORN engineers to meet the demand for high wattage lamps of compact construction these lamps are widely used in a variety of light weight portable fittings.

Hardglass Halogen compared with Quartz Halogen

The tungsten halogen principle is now so well known and documented elsewhere that it is considered unnecessary to describe it here. However should you require details of this principle then please contact THORN EMI Lamps and Components or your nearest Subsidiary Company. It is important to distinguish between hard glass lamps that merely have a halogen compound added to the filling gas and lamps such as those enumerated, which are of quartz construction. The former are from the point of view of life and performance identical to conventional glass lamps of the same rating, the halogen only serving to prolong the usefulness of the lamp by preventing internal blackening due to evaporated tungsten. However, once a lamp is constructed from quartz with its higher melting point, instead of glass, the designer can make use of the much greater strength of the small envelope. It is then possible to increase the filling pressure which by reducing tungsten evaporation from the filament prolongs the life of the lamp to at least twice that of a glass lamp of equivalent efficacy.

Biplane or Monoplane?

The filament format of a lamp will have an effect on the beam performance of a luminaire.

In Fresnel optics a biplane filament will, due to its smaller area, produce a narrower spot of slightly increased peak intensity, compared to an equivalent monoplane filament. However, in intermediate and flood positions better light collection is obtained from a monoplane source, as the additional light collected by the rear mirror is largely obscured with a biplane source. A wider angle beam for a given intensity is thus provided by a monoplane filament.

Ellipsoidal optics are designed around a specific filament area. Larger areas will allow some of the light to fall outside the gate and be lost. A smaller filament area will concentrate the light on the centre of the gate producing a hot spot. The choice between a monoplane and a smaller equivalent biplane is, therefore, dependent on luminaire design and customer preference.

THORN pursue a policy of allowing the customers to make this choice by offering both monoplane and biplane versions of relevant lamp types.

Arc Prevention in Tungsten Halogen Studio Lamp Applications

Almost all production personnel in the film and television industry have, at some time encountered sudden failure of incandescent studio lamps. When this occurs at a crucial moment and forces a re-shoot the cost can be considerable.

The significant features of these failures were that they almost always occurred during the first 20 hours of use, and the incidence of failure increased with operating temperatures. Failure invariably resulted from an arc across the filament plugs, which destroyed the tails of the filament.

Tungsten halogen lamps are gas filled. The introduction of hydrogen is predicted to react with the halogen to 'slow down' the tungsten halogen cycle. In addition it is known that hydrogen will slowly diffuse through the hot quartz bulb, so that the hydrogen concentration would gradually diminish.

However, there is a narrow range of hydrogen addition which offers adequate arcing protection without significantly interfering with the halogen cycle. The rate of loss of hydrogen during lamp operation is less than previously predicted and based upon spectraradiometer measurements and calculations, maximum protection is only required during the initial 50 hours of life. Hence, the use of hydrogen additions is the most advantageous method of ensuring reliable operation of lamps during early life, particularly in demanding operating conditions.

fig. 1a
construction of a typical high wattage studio lamp.

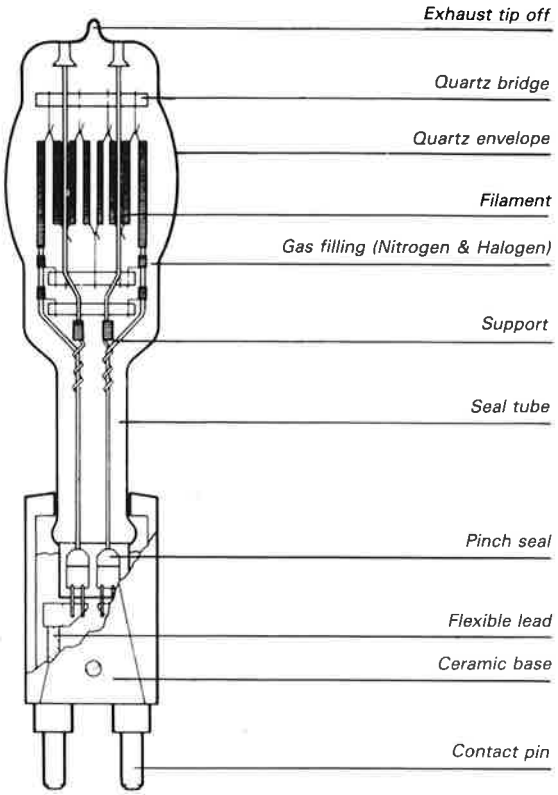


fig. 1b
construction of a typical 4 pin twin filament studio lamp

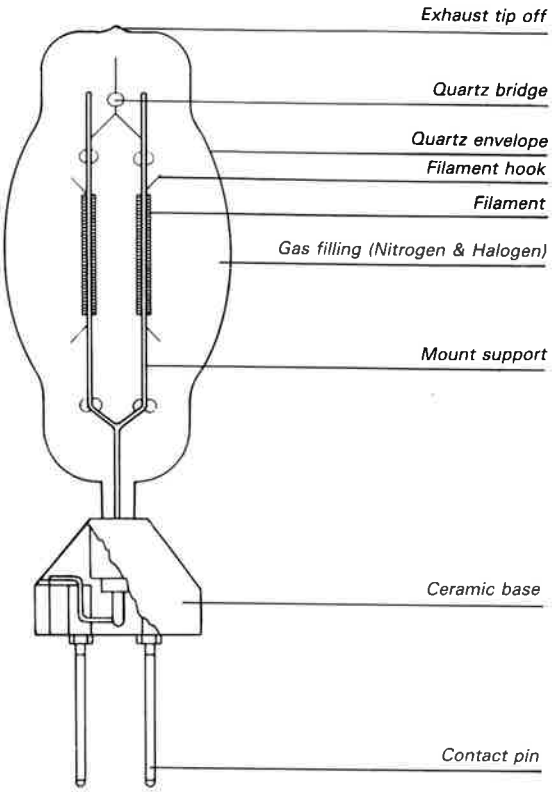


fig. 1c
construction of a typical low wattage theatre class tungsten halogen lamp

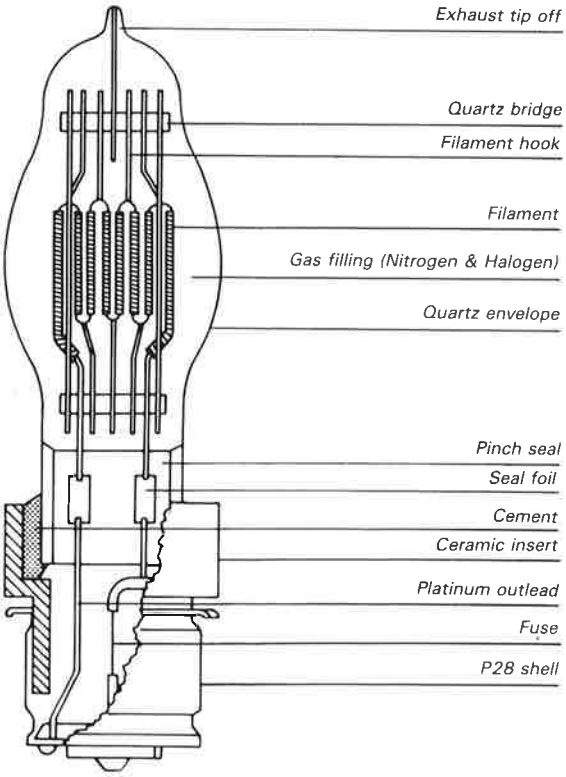


fig. 1d
construction of end section of a typical quartz linear tungsten halogen lamp

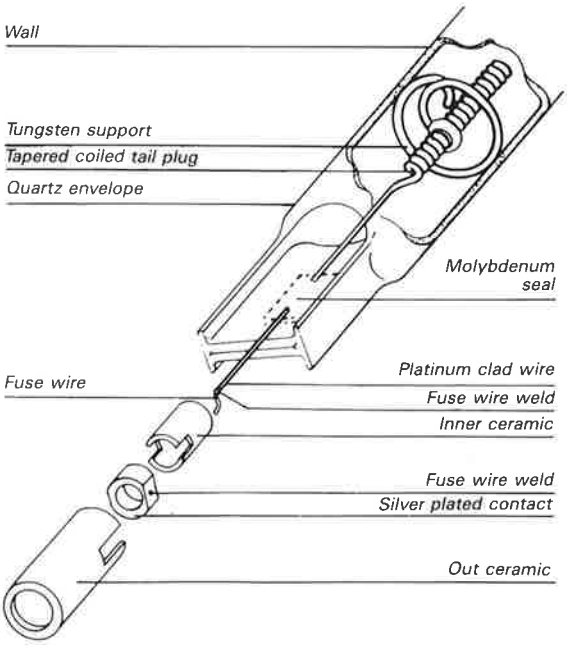


fig. 2
variation of light output and wattage with applied voltage for a typical studio lamp

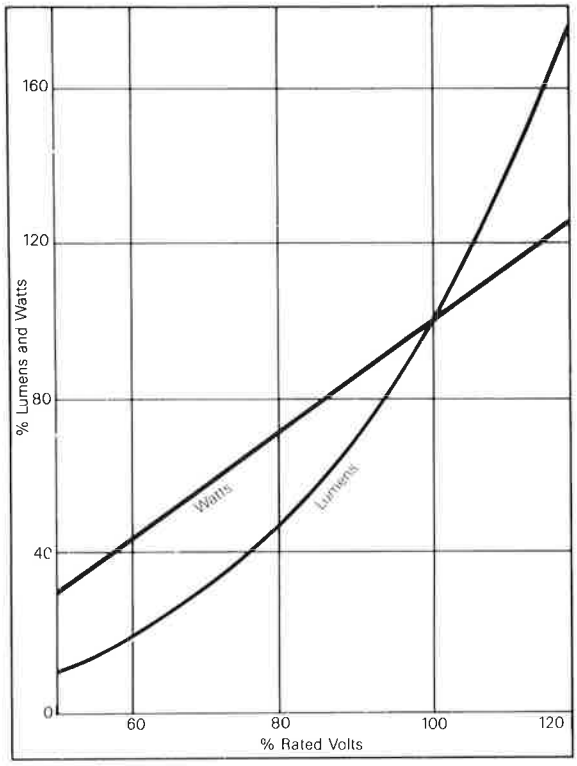


fig. 3
colour temperature variation with voltage for typical studio lamp

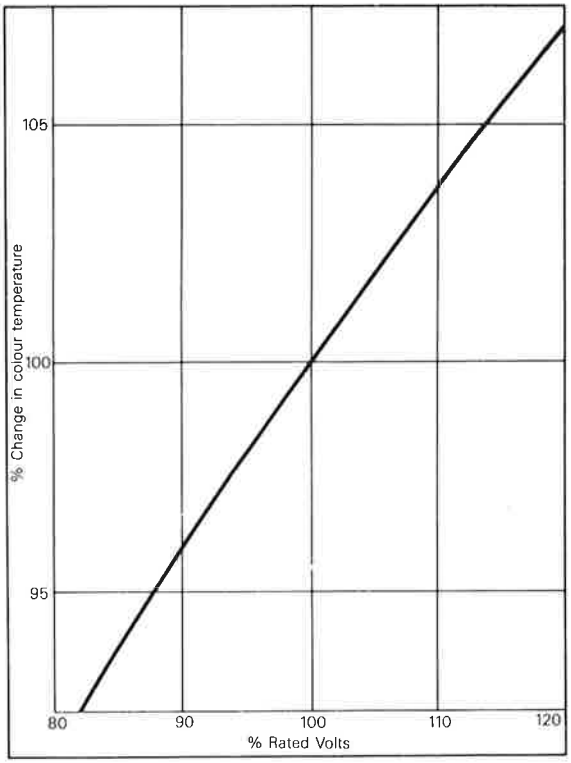


fig. 4
typical life variation against operation voltage

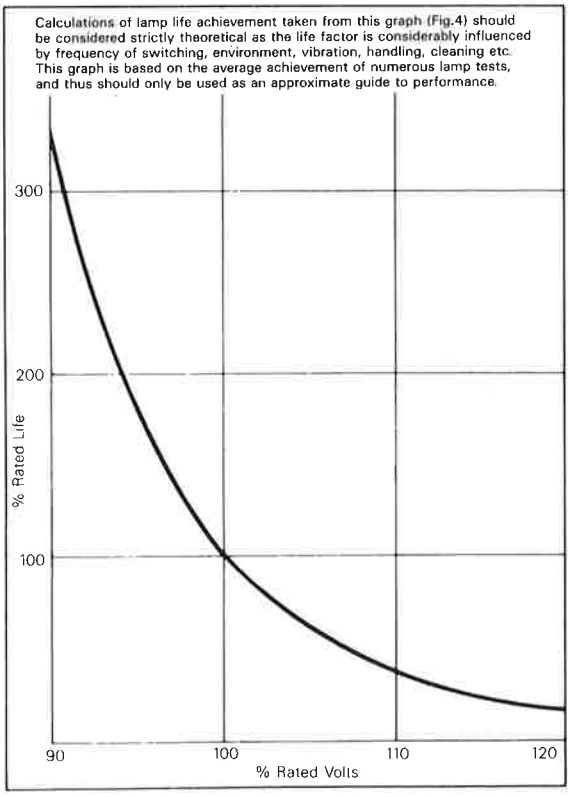


fig. 5
spectral distribution of luminous flux (lumens) for typical theatre and studio lamp

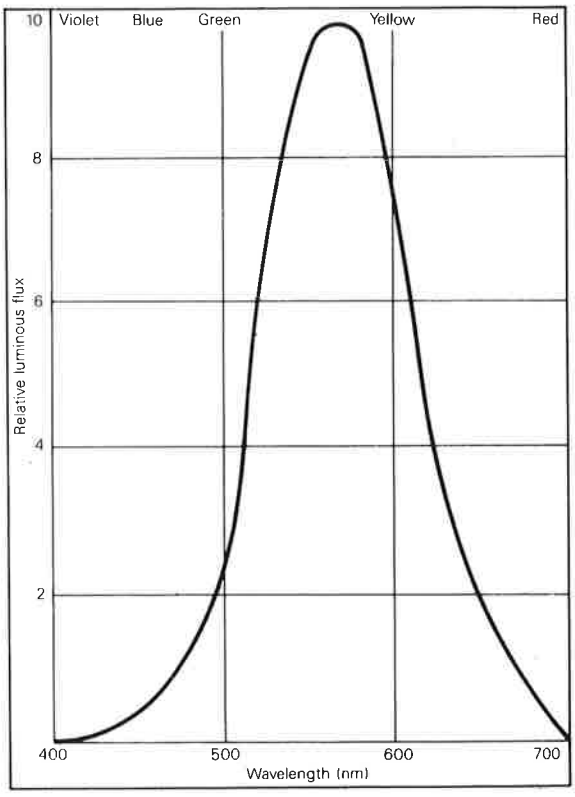
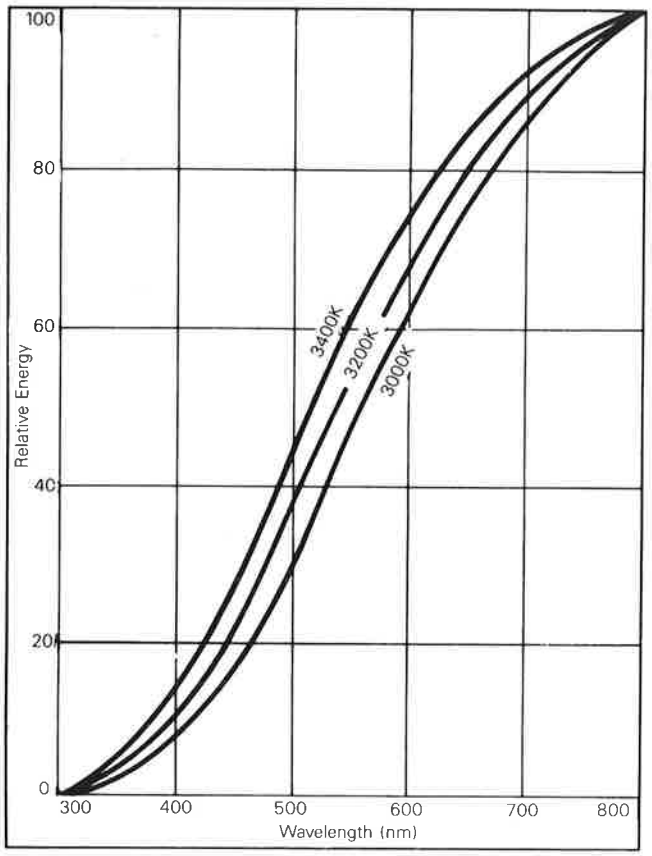


fig. 6
total spectral energy distribution of typical studio lamp



Spectral energy distribution can be shown in absolute terms (fig. 6) whereas radiation in terms of visible light is related to the response of the human eye (fig.5)

Operating Temperatures of Tungsten Halogen Studio Lamps

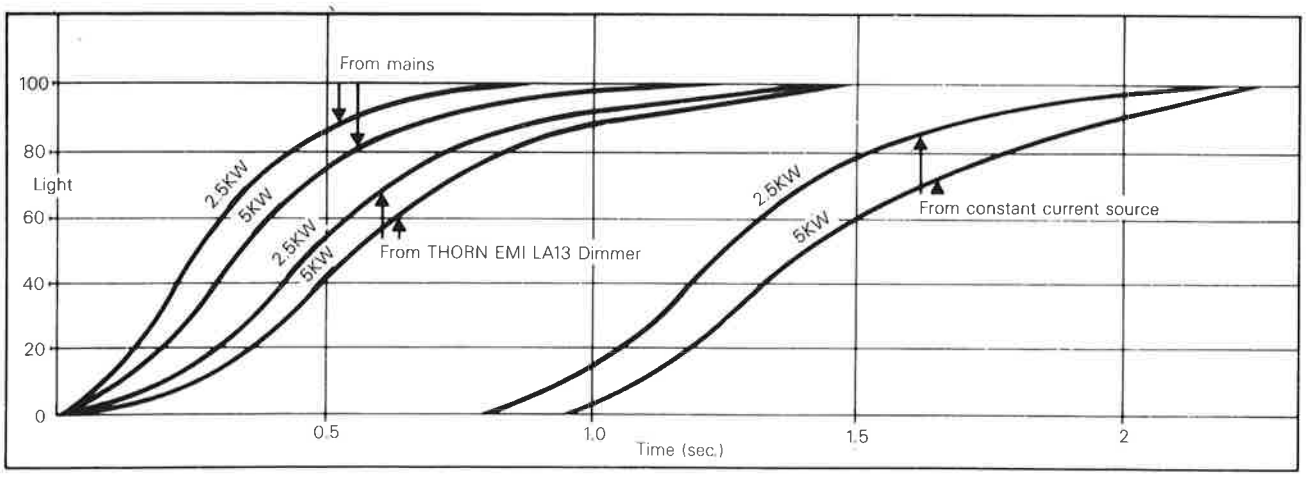
The following maximum and minimum temperatures are suggested for optimum life. Operation outside these figures will not necessarily cause immediate failure but will affect life adversely to an increasing extent.

Seal - 450°C maximum
Above this figure the sealing foil oxidises at a rate increasing with temperature and is frequently the cause of short life due to seal failure.

Bulb - 250°— 800°C
Outside this range the halogen cycle becomes less efficient and blackening may occur. Temperatures above 1200°C will cause the bulb to soften.

Pins - 350°C Maximum
Above this figure the plating on the pins may lose adhesion and the contact will deteriorate. Such deterioration may form local hot spots which rapidly worsen and may result in arcing and irreparable damage to both lamp and holder. Should signs of this be evident on removal of a failed lamp, it is important that a good contact is restored by replacing the lampholder before the next lamp is fitted. otherwise the new lamp will rapidly fail in a similar manner.

fig. 7
turn on time of studio lamps



Surge Current

The cold resistance of a halogen studio lamp is approx. 1/17 of its value in normal operation. On switch on, theoretically a surge current of $17\sqrt{2}$ x the normal current would flow and depending on the thermal mass of the filament* this will fall to the lamp normal current in approx. 1 sec. In practice this maximum theoretical current does not appear due to (a) switch on does not always occur at the peak of the AC voltage, (b) the supply has some impedance which is comparable with the cold resistance of high wattage lamps, i.e.

maximum possible surge current= $\frac{V\sqrt{2}}{Z}$ where V is the applied voltage and Z is the sum of the lamp cold resistance and the supply impedance.

Typically supply impedance is the order of 0.3 ohm and lamp life is based on testing with such a supply. In the rare cases where the line impedance is lower than this figure, an adverse effect on life may be encountered particularly with high wattage types, due to the then extremely high surge current on switching.

lamp	type	cold resistance (ohms)	max.surge current (amps) line impedance = 0 ohms	0.1 ohms	0.3 ohms	0.5 ohms	normal operating current
240V	10KW	0.34	1000	774	530	405	41.5
240V	5KW	0.7	486	424	340	283	20.8
115V	5KW	0.15	1085	650	360	250	43.5
240V	2KW	1.7	200	189	170	154	8.35
117V	2KW	0.41	404	324	233	182	17.1
240V	1KW	3.4	100	97	92	87	4.15

**It should be noted that as the rated wattage is increased and/or the rated voltage decreased, the thermal mass of the filament is increased and it takes longer to reach operating temperature. The surge current will similarly take longer to fall to the normal operating current.*

Fusing of Tungsten Halogen Studio and Theatre Lamps

A lamp normally fails at end of life by fusing of the filament. Often an arc then forms and as there is little resistance to limit the current this rises to a very high value which if maintained can result in a serious overload on the envelope and seals. This might result in the lamp shattering. A quick acting high breaking capacity fuse must be connected in the supply line in all applications. Suitable types are given in BS88 (IEC 269), IEC 127 or IEC 241.

lamp power (watts)	fuse (rated current) (amps) 100-115V	115-130V	220-250V
500	6	6	4
650	10	6	4
1000	16 (15 UK)	10	6
1500	20	16 (15UK)	10
2000	25 (30 UK)	25 (20 UK)	10
2500	35 (30 UK)	25 (30 UK)	16 (15 UK)
5000	63 (60 UK	50	25 (30 UK)
10000	125	100	50

discharge lamps

Introduction

Even with all the advances which have been made in tungsten halogen technology in recent years there are still occasions, particularly whilst working on location, when handling the number of fittings required to give an acceptable illumination level can be a logistical headache.

One Thorn metal halide discharge lamp can provide more light than three tungsten halogen lamps of the same rating. That means one third the power consumption and one third the number of fittings to transport and aim. The potential for major cost savings is clear.

Thorn Lighting has led the way in adapting discharge lamps for use in the performing arts. The company was the first and for many years the only manufacturer to offer metal halide lamps in the compact, single ended capsule format. The minimal dimensions of these lamps can be incorporated into fittings which are much smaller than corresponding luminaires using double ended lamps of the same power. With a near point light source excellent optical control is possible.

Compact iodide lamps are also available in a sealed beam format. With the light source carefully positioned in the reflector, optimum optical performance is guaranteed. The nitrogen filling gas in the outer bulb prevents oxygen attacking the seal of the inner capsule and so increases the life of the lamp dramatically.

All CID discharge studio and stage lamps are dimmable to 50% of peak lumens and the great majority are available in hot re-strike versions for applications where frequent changes in lighting levels are required. All lamps will re-strike within ten minutes of switch off.

Compact Iodide Daylight (CID) Discharge Lamps

With a colour temperature of 5500 K these lamps provide an excellent simulation of daylight. For location filming, colour matching with natural light presents no problem.

In the studio, interior scenes can be given a realistic appearance. As relatively small numbers of lamps are required the amount of heat generated is substantially less than under tungsten halogen lamps giving the same illumination. For all personnel the working environment is much more comfortable. Of course, the running costs are correspondingly lower too.

In the theatre CID discharge lamps are particularly useful in follow spotlights. The very high light output from a point source creates a very intense, sharp beam.

Compact Source Iodide (CSI) Discharge Lamps

CSI lamps offer all the advantages of the CID range, but operate at the lower colour temperature of 4000 K. This allows the lamps to be readily blended with tungsten halogen lighting.

fig. 8
construction of a typical compact iodide lamp

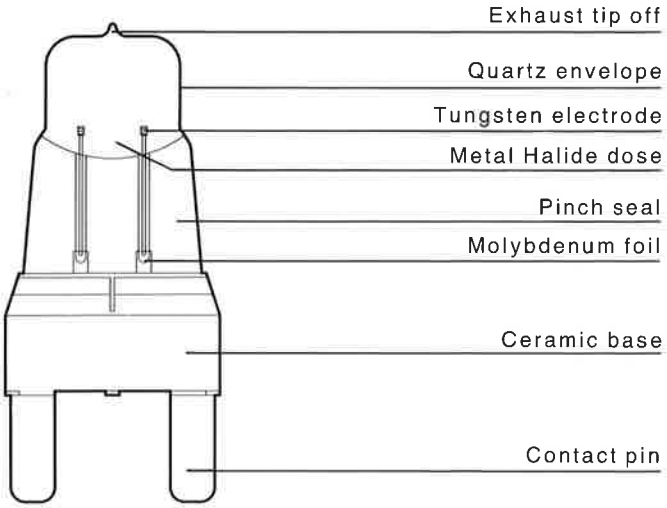
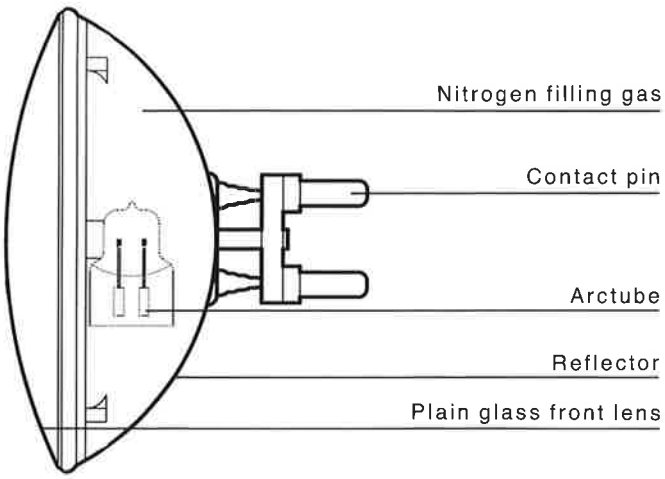


fig.9
construction of a typical PAR sealed beam compact iodide lamp



Operating Temperature of Discharge Studio Lamps

The following maximum and minimum temperatures are suggested for optimum life. Operation outside of these figures will not necessarily cause immediate failure but will effect life adversely to an increasing extent.

Cap/bulb interface capsule lamps - 450°C maximum
Above this figure the sealing foil oxidises at a rate increasing with temperature and is frequently the cause of short life due to seal failure.

Bulb - capsule lamps 700° - 1000°C
- sealed beam lamps 150° - 400°C
Above 1000°C, quartz may devitrify, which will cause the arc tube to leak and the dose will leak below the minimum temperature, the metal halides will not vaporise as required, and lamp performance will be impaired.

Pins - 350°C Maximum
Above this figure the plating on the pins may lose adhesion and the contact will deteriorate. Such deterioration may form local hot spots which rapidly worsen and may result in arcing and irreparable damage to both lamp and holder. Should signs of this be evident on removal of a failed lamp, it is important that a good contact is restored by replacing the lampholder before the next lamp is fitted. otherwise the new lamp will rapidly fail in a similar manner.

N.B.

For sealed beam lamps - to ensure that the above conditions are met, the temperature in the immediate environment of the lamps should not exceed 400°C.

Fusing of Discharge Studio and Theatre Lamps

A quick acting high breaking capacity fuse must be connected in the supply line in all applications. Suitable types are given in BS88 (IEC 269), IEC 127 or IEC 241.

See pages 32 & 33 for suitable fuse ratings.

fig. 10
spectral distribution of luminous flux (lumens) for CSI discharge lamps

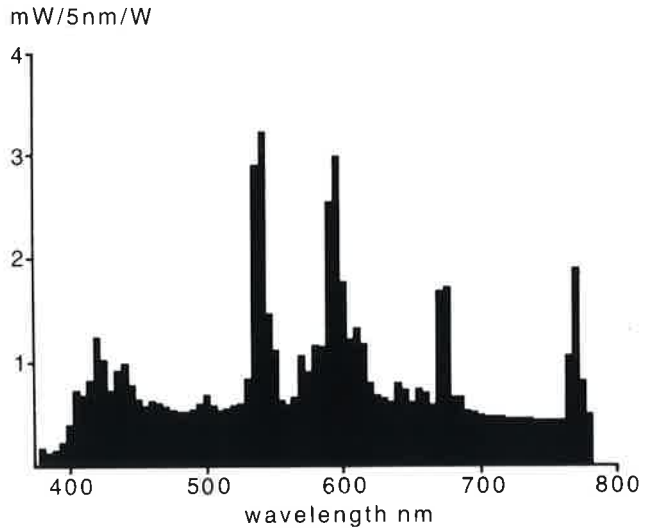
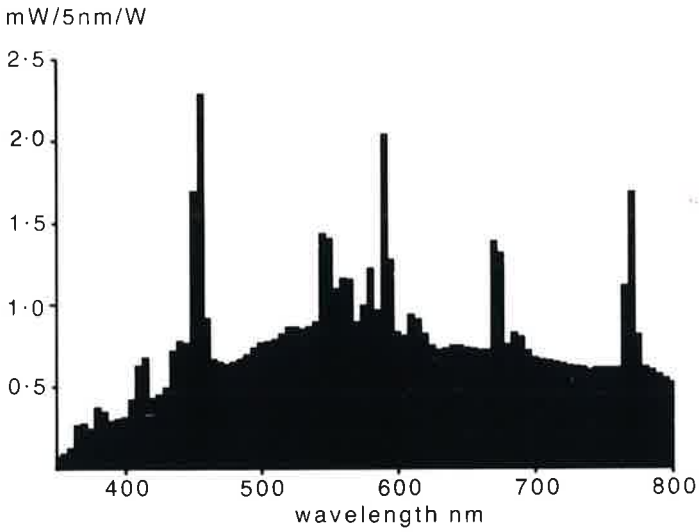


fig. 11
spectral distribution of luminous flux (lumens) for CID discharge lamps



optics

When a ray of light passing through air meets the surface of some translucent material in its path the energy of the light is divided up. Part of the light will be reflected, part absorbed, and part transmitted, and the relative amounts of these three parts will depend on the nature and geometry of the material. If the surface is flat and smooth (polished) it will act as a plain mirror and the laws of reflection will be obeyed (for example, the angle at which the ray meets the surface will equal the angle at which the reflected light leaves the surface). If the surface is rough (matt) the reflected light will be reflected in many directions, the latter form of reflections being known as diffuse, while the former is specular reflection. The material may have either matt or smooth surfaces and also be opaque, when no light will pass through, or transparent, when a great deal of light is transmitted, or something between transparent and opaque which is termed translucent, where a reduced amount of light is transmitted.

A piece of window glass would reflect specularly and would transmit a large proportion of light falling on it because of its transparency, and images could be formed or seen through it. It could be frosted, which would make the reflection diffuse, and the glass would also become translucent, and images could not be clearly formed or seen through it as a result, or the glass can be opaque, reflecting or transmitting selectively as to colour, as with many other substances which have 'colour' by absorbing all colours except the one reflected or transmitted. A red signal lamp glass transmits only red, while absorbing blue, green etc., and an emerald reflects green but absorbs all other colours.

These properties of reflecting, transmitting or absorbing can be specified by the terms reflectance, transmission or absorbance, and are a measure of the proportion of the total light falling upon the material which is reflected, transmitted, or absorbed.

Dealing now with polished transparent materials, a further effect has to be taken into account. As the ray of light leaves or enters the surface between, say, air and glass, it changes direction: if the ray passes right through the glass it will be diverted twice. The amount by which it is diverted will depend on the angle at which it meets the surface and a property of the glass known as its refractive index. As shown in the diagram fig. 12(a), if the ray is directed perpendicularly towards glass, it passes through without refraction (or bending).

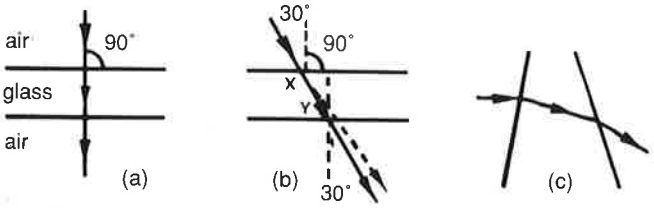


fig. 12

The ray is said to be 'normal' to the surface, and angles of meeting the surface are measured from the normal position, as shown in fig. 12(b) where the angle of incidence is 30° (to the dotted line normal). In this case refraction takes place at X and again at Y and if the two surfaces are parallel to each other the direction of the ray in air is the same on both sides of the glass, but a sideways displacement takes place. It is evident that the two surfaces can be made other than parallel, in which case the final direction of the ray is not the same as the direction of the ray entering the glass. This is shown in fig.12(c) and the two surfaces might well be imagined as those of a prism or part of a simple lense. A lense is essentially a piece of transparent material which has front and back surfaces curved so that light rays passing through them are refracted in a predetermined manner. If the curved surfaces are practically part of a sphere, which is the most usual shape, the almost parallel rays from a distant object will be refracted so as to meet at a point some way from the lens. This point is called the focus, and the distance from the lens, the focal length. This is shown in fig. 13A and it is fairly evident that the deeper the curvature the shorter will be the focal length, and also the double convex lens with both sides curved will have a shorter focal length than a similar lens with one surface plain or flat (plano-convex) fig. 13B.

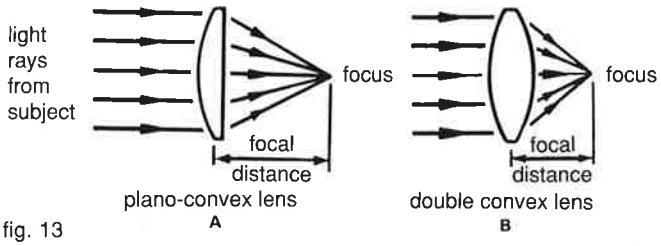


fig. 13

It is also evident that if the source of light were placed at the focus, the rays passing through the lens would form a parallel beam. This is the basis of design of a spotlight. When the source is further away from the lens than the focus a converging beam is formed, and an image of the source can be produced on a screen. When the source is closer than the focal point a divergent beam is produced and this is the effect obtained with a floodlight.

A lens for a high-powered studio fitting would need to be about 12 inches in diameter, and a plano - or bi-convex lens of this diameter would be heavy and difficult to make. The thickness of the lens in the centre can, however, be greatly reduced without altering substantially the optical 'power' of the lens. This may be achieved by taking the convex surface of the lens and dividing this theoretically into circular sections, reducing the thickness of all sections to a common minimum acceptable, and sliding them back to the level of the original flat surface. Such a lens is called a 'Fresnel' lens and is usually as shown in the diagram fig.14.

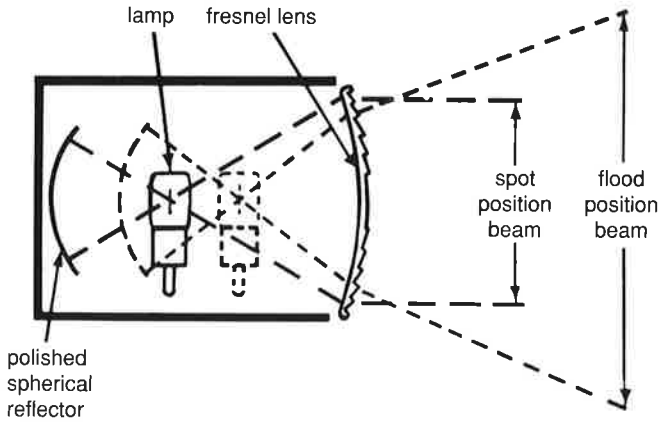


fig. 14

A degree of compensation is needed to correct for the change in position of the annular sections relative to the focal point, and this is greatly helped by making the plano surface slightly concave, as shown in fig. 14 (drawing of Fresnel studio housing).

The reflector behind the lamp in this fitting is a spherical curvature, and is used to collect light rays directed away from the lens, which would thus be wasted, and reflect them back through the source towards the lens, The source is at the centre of curvature of this mirror, and moves in fixed spacial relationship with the mirror from the 'spot' to the 'flood' position, as required.

luminaires

The method which originated in the United States of America to measure the performance of luminaires is becoming more and more generally accepted internationally. The characteristics are expressed in terms of beam angle and field angle (see fig 15). The limit of the beam angle is the points on the curve where the candle power is 50% of the maximum and the field angle is limited by those points of the curve where the candle power is 10% of the maximum.

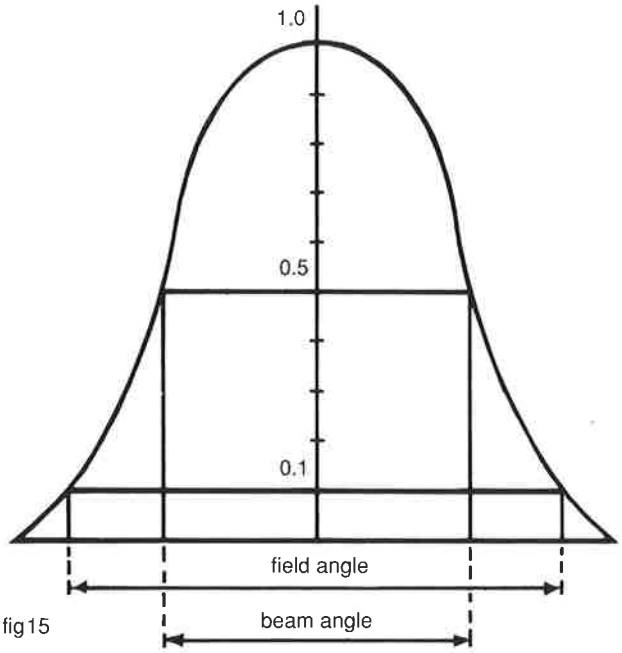
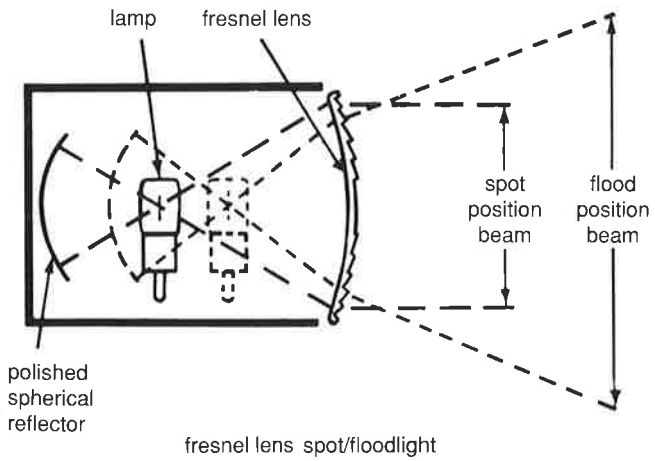


fig15

The efficiency of luminaires is expressed as a ratio of the luminous flux leaving the fitting to the lumens given out by the light source. Beam efficiency is the ratio of lumens within the beam angle to that given out by the light source. Field efficiency is the ratio of lumens within the field angle to that given out by the light source.Efficiencies of typical luminaires calculated from the luminous flux in the field angle for various types of fittings are:-

Fresnel Spotlights (fig 16)

Efficiencies of 0.08 in the spot position to 0.28 in the flood position are usual for this type of fitting. The average for a group of Fresnel spots is approximately 0.18 or 18%.



fresnel lens spot/floodlight

fig 16

Ellipsoidal Spotlights (fig 17)

Efficiencies range between 0.28 and 0.40 and for a group of fittings is approximately 0.35 or 35%.

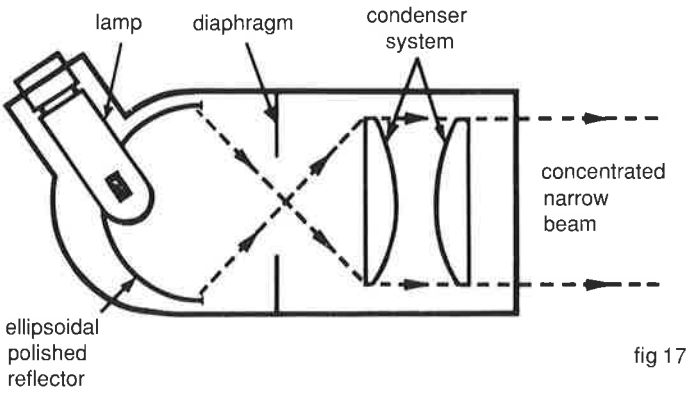


fig 17

Soft Lights and Cyclorama (fig 18)

Efficiencies for this type of lighting vary between 0.40 and 0.64, and for a group of fittings is approximately 0.50 or 50%.

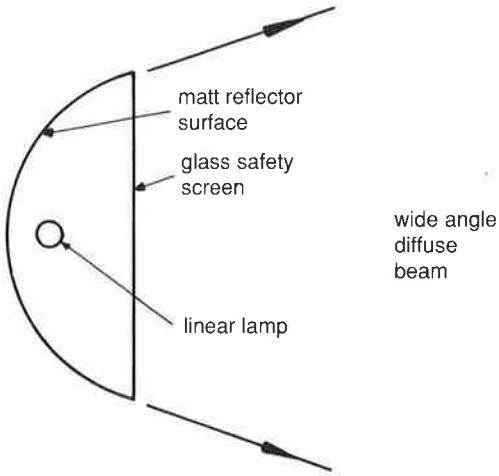


fig 18

PAR Lamps (fig 19)

Efficiencies of 0.40 for spot to 0.50 in flood are typical. Note for applications where a non-variation of beam pattern is acceptable, this high efficiency can give significant savings in power required for a given lighting level.

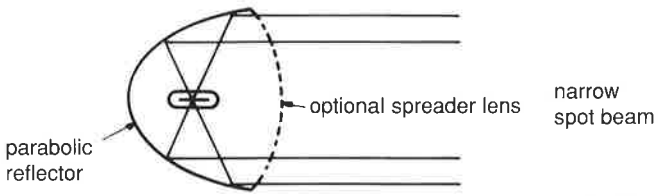


fig 19

Note. The foregoing values can only be expressed as averages and due consideration must be given to the effect of oxidation of reflecting surfaces, and during the course of time lamp envelopes and fitting lenses may transmit less light if dust is allowed to accumulate, therefore regular maintenance should be carried out to ensure that best performance is achieved.

operating notes

Caution notices are included with all lamps. Users are urged to read and comply with these.

1. Handling precautions

Lamps with quartz envelopes should not be handled without suitable precautions. If accidentally touched with the skin, the lamp must be cleaned with alcohol applied with a soft clean cloth. Failure to observe this precaution will permanently mark the bulb.

2. Operating precautions

All lamps in this catalogue must be operated with a series fuse in the circuit, as directed in the Technical Digest.

Lamps of quartz construction use a gas filling at a pressure higher than atmospheric, and as the lamp can in rare instances shatter in use, suitable shielding techniques should be employed where appropriate. Also protect the lamp from mishandling, scratches and abrasions, and do not operate at above correct rated voltage.

3. Operating position

The correct operating position for the lamps in this catalogue are included in the specifications given. These should be observed to ensure optimum performance and life.

As can be seen from fig. 20, the lamp must not be rotated in the filament plane (or electrode plane).

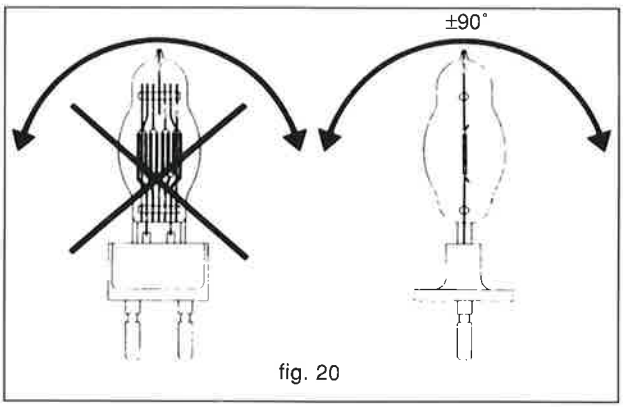


fig. 20

Coiled coil (see pages 8, 9, 10, 12, 14 & 15)

Axial coiled coil single ended lamps will generally give better reliability against premature arcing if orientations in which the main support spine is under the filament are avoided. See fig. 21.

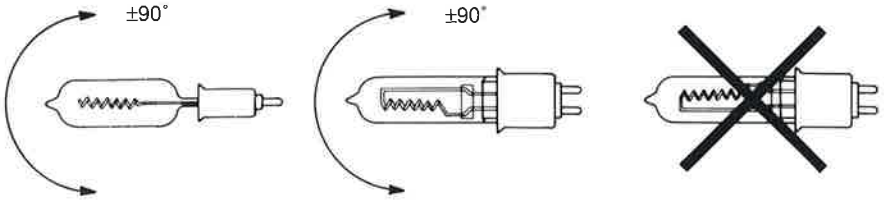
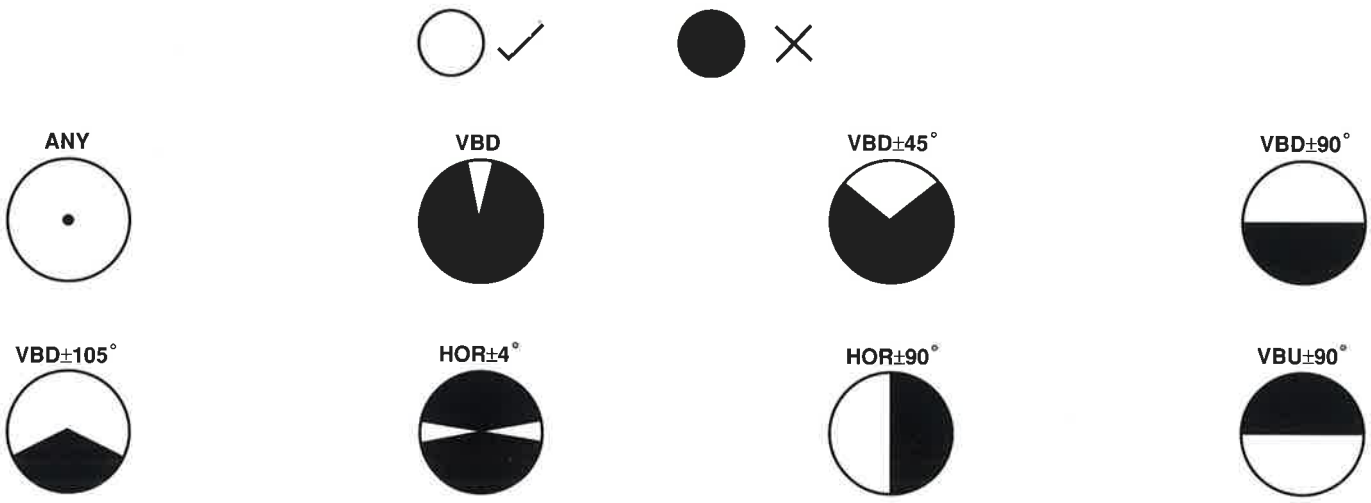


fig. 21

operating positions



health and safety guide

Special Precautions for Quartz Halogen and Discharge Lamps

1. To avoid any possibility of electrical shock, disconnect the equipment from the power supply before removing and/or replacing the lamp or fuse.

2. Articles fabricated from quartz or glass are inherently fragile and there is a remote possibility of a lamp shattering violently if subjected to mechanical/thermal shock or abrasion. Inserting the lamp into the holder, by holding the bulb, could cause mechanical breakage of the envelope and/or seal. For your safety, install by holding the lamp cap and use eye protection where appropriate.

3. Oils/grease or handling of the quartz envelopes may contaminate the surface on operation and reduce performance. If the quartz is handled, clean before operation with a lint free cloth moistened with alcohol or Methylated Spirit.

4. Avoid improper operation of the lamp, e.g. at over voltage, in equipment (or at burning angles) not designed for the lamp type or rating. Operate in series with a quick acting, high breaking capacity fuse of suitable rating. Non-observation of these points may damage the lamp or equipment.

5. In operation,
a) lamps develop a high internal pressure and could shatter.
b) lamps develop a high surface temperature.
c) direct exposure may cause ultra-violet irritation to skin and eyes.
The use of glass or other UV filters is advised if the lamp is used in close proximity or for a prolonged period. When reflectors are used to concentrate the light the safe exposure period will be reduced. Appropriate screening for people and surroundings must be provided. Avoid operation in proximity to combustibles. Allow to cool before attempting replacement.

6. Life expired lamps should be broken in a suitable robust container, or wrapping, to retain flying fragments. There is a toxic content in the fill gas and larger quantities should only be broken in a well ventilated area.

Additional Special Precautions for the Operation of Metal Halide Discharge Lamps

7. Check that replacement lamp is correct type for the application, that rating, cap and control gear are correct.

8. Lamps having outer bulbs must not be operated if the outer glass is broken.

9. Instructions given with metal halide lamps must be carefully followed in all respects. Protection against the explosion of lamp must be maintained, do not remove any covering or shields until the lamp is located in an approved enclosed housing.

10. Certain lamps generate ozone in use and should be operated only in well ventilated locations.

11. Metal halide lamps with quartz envelopes without glass outer bulbs may emit short wave ultra violet radiation which is harmful to eyes and skin. Operators must be shielded from direct or indirect short wave ultra violet radiation.

studio, theatre and television lamps

single ended tungsten halogen incandescent lamps

watts	lamp code	ANSI code	volts	base	page
300	CP81	FKW	120	GY9.5	10
	CP81	FSL	220/230	GY9.5	10
	CP81	FSK	240/250	GY9.5	10
500	T17	FKF	220,240	P28s	13
	T18	FRF	120	GY9.5	10
	T18	GCV	220	GY9.5	10
	T18	GCW	240	GY9.5	10
	T28		220,240	P28s	13
	CP82	FRG	120	GY9.5	10
	CP82	FRH	220	GY9.5	10
	CP82	FRJ	240	GY9.5	10
		BTL	120	P28s	13
		BTM	120	P28s	13
		EGE	120	P28s	14
		EGN	120	G22	11
		EHC	120	G9.5	15
		EHD	120	G9.5	15
600		FMR	120	GY9.5	10
650	T12		220,240	GX9.5	9
	T13	FKA	115/120	P28s	13
	T13	FKB	220,240	P28s	13
	T26	FRE	120	GY9.5	10
	T26	GCT	220	GY9.5	10
	T26	GCS	240	GY9.5	10
	CP23		115/120	GX9.5	9
	CP23		220,240	GX9.5	9
	CP39	FKG	115/120	G22	11
	CP39	FKH	220,240	G22	11
	CP51	FKL	115/120	P28s	13
	CP51	FKM	220,240	P28s	13
	CP89	FRK	120	GY9.5	10
	CP89	FRL	220	GY9.5	10
	CP89	FRM	240	GY9.5	10
		FKR	220,240	G9.5	15
		FKV	120	G9.5	15
		DTA	120	P40s	14
750		BTN	120	P28s	13
		BTP	120	P28s	13
		EGG	120	P28s	14
		EGR	120	G22	11
		EHF	120	G9.5	15
		EHG	120	G9.5	15
	HX144		55/60	GX9.5	9
1000	T11		115/120	GX9.5	9
	T11		220,240	GX9.5	9
	T14		115/120	P28s	13
	T14	FKD	220,240	P28s	13
	T15	FKE	220,240	P28s	14
	T16		220,240	P40s	14
	T19	FWP	220	GX9.5	9
	T19	FWR	240	GX9.5	9
	T30		220,240	G22	11
	CP24		115/120	GX9.5	9
	CP24		220,240	GX9.5	9
	CP40	FKJ	220,240	G22	11
	CP52	FKN	220,240	P28s	13
	CP70		220,240	GX9.5	9
	CP77	FEL	120	G9.5	15
	CP77	FEP	220,240	G9.5	15
		BTR	120	P28s	13
		BVT	120	P40s	15
		BVV	120	P40s	15
		CYV	120	G38	12
		DSE	120	E40s	8
		EGJ	120	P28s	14
		EGK	120	P28s	14
		EGT	120	G22	11
		EWE	220,240	P28s	14
		FCV	120	G9.5	15
1200	T29		120	GX9.5	9
	T29	FWS	220	GX9.5	9
	T29	FWT	240	GX9.5	9
	T31		220,240	G22	11
	CP90		120	GX9.5	9
	CP90		220,240	GX9.5	9
	CP93		120	G22	11
	CP93		220,240	G22	11

watts	lamp code	ANSI code	volts	base	page
1500		CWZ	120	P40s	15
		CXZ	120	G38	12
		DSF	120	E40s	8
		DTA	120	P40s	14
2000	CP41	FKK	220,240	G38	12
	CP43		115/120	GY16	8
	CP43	FTM	220	GY16	8
	CP43	FTL	240	GY16	8
	CP53		115/120	P40s	14
	CP53		220,240	P40s	14
	CP59		220,240	E40s	8
	CP79		220,240	GY16	8
	CP92		220,240	G22	11
		BVW	120	P40s	15
		BWA	120	G38	12
		BWF	120	E40s	8
		BWG	120	E40s	8
		BWL	120	E40s	8
		CYX	120	G38	12
		FWG	120	E40s	8
		FWH	120	E40s	8
		FWJ	120	E40s	8
2500	CP30		220,240	GX38q	16
	CP91		220,240	G22	11
	CP94		220,240	G38	12
3000	HX48		110/115	G38	12
	HX48		220,240	G38	12
3750	CP58		220,240	GX38q	16
5000		DPY	120	G38	12
	CP29		220,240	G38	12
	CP32		220,240	GX38q	16
10000		DTY	120	G38	16
	CP83		220,240	G38	16

double ended tungsten halogen incandescent lamps

400		EHR	120	R7s	22
500	P2/30	FDF	120	R7s	23
	P2/31	FDN	120	R7s	23
625	P2/10		220,240	R7s	24
650	P2/6	FAD	120	R7s	22
		FBX	120	R7s	22
750		EJG	120	R7s	23
		EMD	120	R7s	23
800	P2/11	EME	220,240	R7s	23
	P2/11	EMF	220,240	R7s	23
	P2/13	DXX	220,240	R7s	22
1000	P2/7	EKM	220/230	R7s	24
	P2/28	FCM	120	R7s	23
	P2/28		220	R7s	23
	P2/29	FHM	120	R7s	23
	P2/35		220,240	R7s	24
		DXW	120	R7s	24
		FBY	120	R7s	24
		FFT	120	R7s	22
1250	P2/12		220,240	R7s	24
1500		FDB	120	R7s	22
2000	P2/27	FEX	220,240	RX7s	23
		FEY	120	RX7s	23

studio, theatre and television lamps

tungsten halogen PAR 64 sealed beam lamps

watts	lamp code	ANSI code	volts	base	page
500	CP86		220,240	GX16d	18
	CP87		220,240	GX16d	18
	CP88		220,240	GX16d	18
	HX115		220,240	GX16d	18
1000	CP60	EXC	220,240	GX16d	17
	CP61	EXD	220,240	GX16d	17
	CP62	EXE	220,240	GX16d	17
	HX134	EXG	220,240	GX16d	17
	CP95		220,240	GX16d	17
		FFN	120	GX16d	19
		FFP	120	GX16d	19
		FFR	120	GX16d	19
		FFS	120	GX16d	19
		GFF	120	GX16d	19
	HX154NS		120	GX16d	20
	HX154MF		120	GX16d	20
	HX154WF		120	GX16d	20
	HX154XWF		120	GX16d	20
1200	HX156	GFA	120	GX16d	21
	HX156	GFB	120	GX16d	21
	HX156	GFD	120	GX16d	21
	HX156	GFE	120	GX16d	21

discharge lamps

CSI

watts	lamp code	description	base	page
400	99-0201	-	special	25
1000	99-0221	-	G22	25
	99-0421	hot restrike	G38	25
	99-1222	PAR	G38	26
	99-1422	hot restrike PAR	G38	26

CID

200	99-0211	hot restrike	special	27
300	99-0413	hot restrike	special	27
575	99-0415	-	G22	28
	99-1415	hot restrike PAR	G38	30
1000	99-0222	-	G22	28
	99-0422	hot restrike	G38	29
	99-1225	PAR	G38	31
	99-1425	hot restrike PAR	G38	31
1200	99-1435	hot restrike PAR	G38	30
2500	99-0431	hot restrike	G38	29

photographic lamps

watts	lamp code	ANSI code	volts	base	page
25		FHX	13.8	GX5.3	38
		FLT	13.8	GZ4	38
28		FLS	12	GZ4	38
50	A1/220	BRL	12	G6.35	37
		ELS/ELR	16	GX7.9	38
		ENL	12	GX5.3	38
		FHR	12	G5.3	38
75	A1/230	EFN	12	GZ6.35	37
80		DDM	19	GX5.3	38
		DDS	21	GX5.3	38
85		DED	13.8	GX5.3	38
90		EPV	14.5	GX5.3	38
		EPX	14.5	GX5.3	38
100	A1/209	FDX	12	GY6.35C	37
	A1/215	FCR	12	GY6.35	37
	A1/231	EFP	12	GZ6.35	37
	A1/261	FDT	12	GY9.5	37
150	A1/216	FCS	12	G6.35	37
	A1/232	EFR	15	GZ6.35	37
	A1/234	BRJ	15	G6.35	37
	A1/248		115/120	G6.35	37
	A1/248		220,240	G6.35	37
	A1/262	DZE/FDS	24	GY9.5	37
	A1/266	DNF	24	GX7.9	37
		DDL	20	GX5.3	38
		ELD/EJN	21	GX5.3	38
200	A1/252	EJL	24	GX5.3	37
		EWF	24	G5.3	38
		GCB	30	G5.3	39
250	A1/223	EHJ	24	G6.35	37
	A1/258	EMM	24	GX7.9	37
	A1/259	ELC	24	GX5.3	37
		DYG	30	GY9.5	39
		ENH	120	GY5.3	38
		GCA	120	G5.3	39
	P1/8		30	R7s	39
300	A1/249		115/120	G6.35	37
	A1/249		220,240	G6.35	37
		ELH	120	GY5.3	38
360		ENX	82	GY5.3	38
500	A1/241	BCK	115/120	G17T	37
	A1/241		220,240	G17T	37
	A1/244		220,240	GY9.5	37
	A1/268	EPS	220,240	G17T	37
600	A1/264	DYS	120	GY9.5	37
650	A1/233	DYR	220,240	GY9.5	37
	A1/247		120	GY9.5	37
	A1/247		220,240	GY9.5	37
	P1/13	BVM	220,240	G6.35	39
	P2/16		220,240	G6.35	39
800	A1/245		220,240	GY9.5	37
1000	P1/15		220,240	G6.35	39
	P2/17		220,240	G6.35	39
1250	P2/26		220,240	G6.35	39

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