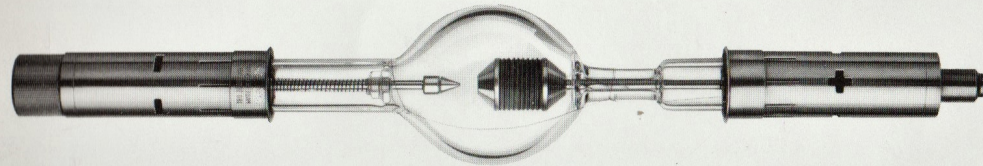


WOTAN XBO
xenon short-arc lamps
for cinema projection

**Guide to fitting,
operation, maintenance
and troubleshooting**



WOTAN

This brochure has been written for the film projectionist as an extra aid to operation and handling of WOTAN XBO xenon projector lamps. It describes in general terms various aspects of XBO lamp operation requiring special attention. To ensure trouble-free lamp operation, please read carefully the instructions for the control gear of the xenon lamps as well.

Every XBO lamp is supplied with an operating manual containing key information. Detailed design and performance data will be found in a separate list of WOTAN products for cinema projection, scientific and technical applications.

N. B.

In the following text, "xenon lamp" refers to the light source only, not to the entire lamphouse.

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Inserting the lamp

General

1. Choosing the right lamp

Make sure that the power rating of the xenon lamp fitted is suitable for the lamphouse and power supply equipment (rectifier).

2. Checking the contacts

Before inserting the lamp, make sure that all contacts are clean. Contacts must be renewed at the slightest sign of corrosion. Sanding or filing down corroded areas will only make the conducting surface between pin and lampholder smaller and cause the cap to overheat.

3. Insert lamp only with safety sleeve fitted

The inert gas (xenon) used in XBO lamps is under a pressure of several bar even when the bulb is cold. **For safety reasons the lamp may only be inserted into the lamphouse with the safety sleeve fitted.**

4. Avoid mechanical stresses

Do not twist or bend the fused quartz bulb when fitting the lamp.

5. Fastening the spring contacts

Make sure that the spring contacts firmly surround the pins on the cap of the lamp. Do not apply undue force when tightening the screws.

6. Lampholder

After inserting the lamp, make sure that it has enough axial play in the lampholder. The lamp must be capable of unimpeded expansion when it warms up to operating temperature. Mechanical forces must not be applied to the fused quartz bulb.

7. Air gap between leads

Electrical leads must be arranged in such a way that there is a sufficient air gap (approx. 40 mm) between them and the lamphouse to prevent flashovers from the ignition voltage. All flexible leads must have strain-relieving clamps.

8. Checking the polarity

Before putting the lamp into service for the first time, check the polarity of the electrical connections. Incorrect polarity will cause immediate destruction of the lamp.

9. Safety precautions

Before removing the safety sleeve, put on a face mask and gloves with wrist protection.

10. Do not touch the fused quartz bulb

Do not touch the fused quartz bulb with bare hands, as fingerprints will make the glass cloudy and cause a severe loss of light. This is also likely to cause recrystallization and thus weaken the bulb material.

Should the bulb be inadvertently touched, remove fingerprints with methylated spirit and a clean, soft paper towel. Then wipe with distilled water (**wear mask and gloves during cleaning**).

11. Removing the safety sleeve

Keep the safety sleeve and all packaging for reuse; they may be needed to return the lamp to the supplier.

Vertical operation of XBO lamps

1. Vertical burning position

The anode (positive cap marked "+") must be on top when the lamp is inserted. If the anode is not on top, the arc will be unstable, the bulb will blacken more quickly and the lamp will prematurely fail.

2. High-voltage connection

The negative feed "-" from the insulated high-voltage terminal of the ignitor must be connected to the cathode (negative cap marked "-"). If the lamp is connected with the wrong polarity, it will be irreparably damaged after a very short time.

Horizontal operation of XBO lamps

1. Magnetic stabilization

If the XBO lamp is operated in the horizontal burning position with additional magnetic stabilization, check arc alignment regularly to see if the arc is being properly stabilized. Adjust position of stabilizing magnets if necessary.

2. Turning the lamp half-way through service life

If mounted horizontally, xenon lamps must be turned 180° half-way through their service life. When fitting lamp types XBO 700 W/HS, XBO 700 W/HSC, XBO 1000 W/HS, XBO 1000 W/HSC, XBO 1600 W/HS and XBO 1600 W/HSC, make sure that the spacer disk supplied is slipped over the cathode thread. Removal of the tightly fitting spacer disk (after half the lamp's service life) makes it possible to turn the lamp through exactly 180°.

When screwing the lamp into place at the cathode end, use the safety sleeve as a tool. The sleeve has two recesses for this purpose which are engaged by the metal pins on the side of the cathode cap.

HSC types have the advantage that the lampholder contacts do not have to be tightened against the pins on the cap, thus preventing mechanical stress when the lamp is being fitted and avoiding undesirable contact resistance.

Operation

1. Closing the lamphouse

Always close the lamphouse before putting the lamp into operation.

2. Starting

In xenon lamps, unlike carbon arc lamps, the current should not be reduced during starting. A current between the rated and maximum values stated is advisable (see table).

3. Manual starting

To prevent damage to the ignitor during manual starting, do not press the start key for more than half a second.

4. Safety precautions

The lamphouse must remain closed during operation (because of high bulb pressure, glare, UV radiation). After switching the lamp off, wait at least ten minutes before opening the lamphouse. **Wear mask and gloves when opening lamphouse.**

5. Lamp current

The lamp current and hence the light output can be adjusted within a certain range. Current values will be noted from the table below.

6. Adjusting the brightness

Blackening of the fused quartz bulb reduces the light output of the xenon lamp in the course of its service life. To maintain uniform screen illumination throughout the very long service life of the xenon lamp, it is best to operate new lamps at a current between the minimum and rated values to begin with (see table). Screen brightness can then be kept constant by gradually increasing the lamp current. The maximum current

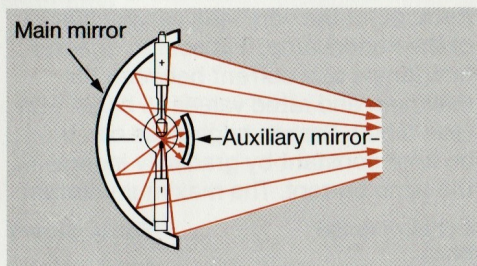
Lamp type	Current control range (min./max.)	Rated current
XBO 500 W/H	17 ... 30 A	28 A
XBO 700 W/HS & HSC	30 ... 45 A	37 A
XBO 900 W & W/CA	30 ... 53 A	45 A
XBO 1000 W/HS & HSC	30 ... 55 A	50 A
XBO 1000 W/HTP	30 ... 55 A	45 A
XBO 1600 W & ... W/CA	45 ... 75 A	65 A
XBO 1600 W/HS & HSC	45 ... 70 A	65 A
XBO 2000 W-types	50 ... 85 A	70 A
XBO 2500 W	60 ... 95 A	83 A
XBO 2500 W/HS	70 ... 100 A	90 A
XBO 3000 W-types	60 ... 110 A	100 A
XBO 4000 W	60 ... 140 A	120 A
XBO 4000 W/HS	80 ... 150 A	135 A
XBO 4000 W/HTP	100 ... 140 A	130 A
XBO 4200 W/CA	80 ... 160 A	140 A
XBO 6500 W	80 ... 160 A	160 A

For best results operate the lamp at the rated current to ensure high arc stability and long service life.

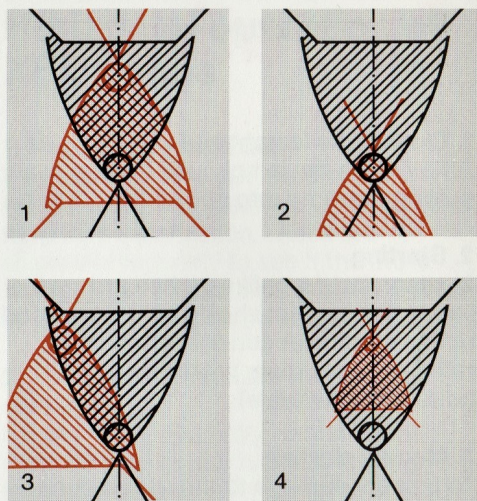
stated must not be exceeded under any circumstances, even if the screen appears to be too dark. Insufficient illumination may also be due to incorrect adjustment of the optical components.

7. Adjustment for vertical lamp operation

If the xenon lamp is used in conjunction with an auxiliary mirror, uniformity of screen illumination and the screen brightness attainable will depend on the position of the auxiliary mirror in relation to the arc. When the lamphouse is closed, the mirror image of the arc produced by the concave auxiliary mirror is observed via the image-forming optics and adjusted as shown in sketch 1.



Sketches 1 to 4 show in schematic form the electrodes and arc (marked in black) and the mirror images of them produced by the auxiliary mirror (marked in orange). The positions of the arc and the electrodes may also be transposed by the imaging optics. The auxiliary mirror is correctly adjusted in relation to the lamp when the arc and the mirror image of it are the same size (sketches 1 and 3). Sketch 1 shows the optimum position of the mirror image relative to the arc. Sketches 2, 3 and 4 show examples of incorrect adjustment. If the brightest part of the arc above the cathode tip



is focussed on itself (as in sketch 2) or on one of the two electrodes, permanent damage may result.

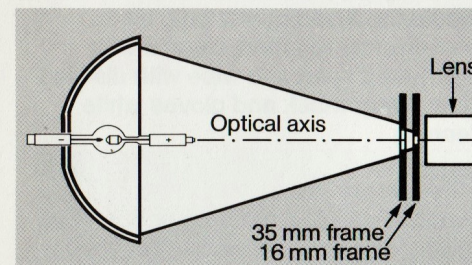
If the distance between the auxiliary mirror and the lamp is too great, the auxiliary mirror image will be smaller than the arc image (sketch 4); if it is too small, the auxiliary mirror image will be larger. In both cases the arc is liable to be focussed on the fused quartz discharge envelope. There is then a risk of the bulb being deformed or the lamp bursting.

8. Adjustment for horizontal lamp operation

Perfect screen illumination can be obtained if the following adjustments are made with the projector running and the lamp burning:

The xenon lamp is first adjusted along its optical axis until only a round spot of light of reduced area is seen on the screen. This round spot of light must be positioned exactly in the centre of the screen by adjusting the highly concave

mirror. The spot is then enlarged by readjusting the focal point (shifting the lamp along its optical axis) until the entire screen is evenly illuminated.



9. Projector cooling

The projector must be properly vented in such a way that no rain or condensation can drip onto the lamp. (Regular dusting is also recommended.) The flow of cooling air must not be obstructed by articles placed over the vents.

10. Service life

For safety reasons the lamp must be replaced at the latest when the mean service life listed has been exceeded by 25%, as the risk of bursting is much greater after this period. The loss of light caused by operation of the lamp beyond the time limit specified must not under any circumstances be compensated for by exceeding the maximum control current (cf. current rating table and technical data, pages 12, 13).

Removing the lamp

1. Switch off power

Switch off the power to the rectifier and ignitor at the mains.

2. Wait before opening lamphouse

Wait at least ten minutes after switching off the lamp before opening the lamphouse (the hot lamp is under a pressure of approx. 30 bar). If the projector has forced cooling, allow the blower to continue running for five minutes after the lamp has been switched off.

3. Safety precautions

Always put on a face mask and gloves before opening the lamphouse and place the safety sleeve over the lamp before handling it.

4. Warranty

Should a xenon lamp give cause for complaint despite the utmost care taken in manufacture and testing, it is advisable to return it to the supplier in the safety sleeve and original packaging. The card accompanying the lamp must be filled out if the fault is to be correctly and quickly assessed.

Please pack mechanically damaged lamps separately, i.e. without the safety sleeve, before returning them.

This warranty does not apply to XBO lamps which have been damaged by improper treatment, in particular by non-compliance with the operating instructions or by damage in transit.

Maintenance

1. Safety precautions

Place the safety sleeve over the lamp whenever working on the open lamphouse. Wear mask and gloves.

2. Checking the contacts

To avoid excessive contact resistance at the lamp terminals, check the contact surfaces regularly for corrosion and make sure that the spring contacts firmly surround the pins on the cap.

3. Poor contacts

Poor contact between cap pins and terminals will cause high contact resistance and overheating of the pins. Burnt or corroded terminals must be replaced to avoid premature lamp failure.

4. Cleaning the optical components

The constantly fluctuating temperatures inside the lamphouse and the flow of cooling air cause dust to collect on the optical components. These should be cleaned regularly.

5. Maintenance of focussing components

All moving parts for adjustment of the auxiliary mirror as well as components for adjustment of the concave mirror and lamp must be able to move freely.

6. Do not touch the bulb

Should the fused quartz bulb be inadvertently touched, clean it with methylated spirit and wipe with distilled water. Wear mask and gloves while cleaning.

7. Ammeters

The accuracy of ammeters or other measuring apparatus used should be checked regularly.

8. Power supply equipment

Have the power supply equipment inspected regularly. Current ripple must not exceed 10% under any circumstances. Ripple must not exceed 5% in lamps rated at 3000 W and above.

Excessive current ripple will not only damage the electrodes, but also make the arc unstable and cause the bulb to blacken prematurely.

Troubleshooting

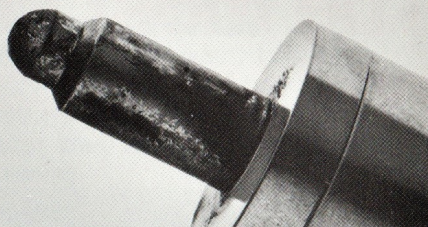
The most common faults and their causes

Fault	Possible causes
No light	Shutter does not open Failure of light source Failure of power supply to lamp Failure of cooling: Power supply to lamp interrupted Failure of ignitor No-load voltage of rectifier too low
Insufficient brightness	Current too low Bulb blackened Dirt or vapour on mirror Mirror and lamp incorrectly adjusted Dirt on lens or projection room window Screen dirty or darkened
Corners or edges of image dark	Lamp incorrectly adjusted Wrong field lens
Image flickers	Magnet for arc stabilization missing or incorrectly adjusted
Image generally out of focus	Lens faulty or incorrectly focussed Vapour or dirt on lenses, mirror system or projection room window Film out of focus
Top or bottom half of image out of focus (both cannot be focussed simultaneously)	Excessive inclination of optical axis not compensated for by tilting screen Projection room window defective Mirror system defective
Right or left half of image out of focus (both cannot be focussed simultaneously)	Projector inclined too much to one side Defective projection room window Film gate or velvet lining worn down on one side
Ghost (double image)	Mirror system defective (no front-surface mirror) Projection room window pane not parallel with lens surface or not perpendicular to optical axis
Aberrations 1 (colour fringes, symmetry errors, inadequate contrast)	Lens defective Mirror system defective
Aberrations 2 (geometrical, mainly trapezoidal distortions)	Oblique projection onto curved screen Mirror system incorrectly adjusted

Troubleshooting xenon lamps

Fault

- Cap overheated
- Cap temperature above 230°C



Cause

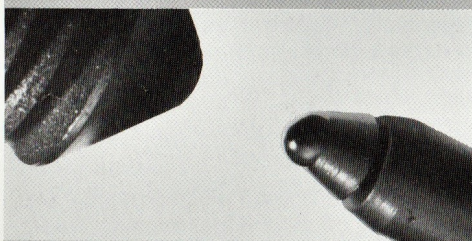
- Faulty contacts
- Cooling equipment defective

Remedy

- Check terminals – tighten or renew
- Check cooling equipment

Fault

- Wrong polarity



Cause

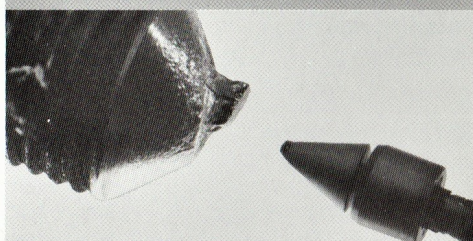
- Lamp incorrectly fitted
- Faulty wiring

Remedy

- Anode (large electrode) must always be on top in vertical burning position
- Check polarity, transpose connections if necessary

Fault

- Arc unsteady



Cause

- Lamp operated outside current control range
- Magnetic stabilization for horizontal operation defective

Remedy

- Correct current setting
- Check magnetic stabilization

Fault

- Bulb draws in air



Cause

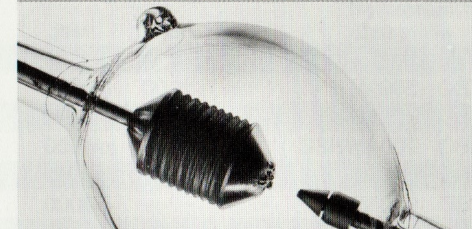
- Crack in graded seal caused by overheated cap
- Maximum cap temperature 230°C

Remedy

- Check terminals – tighten or renew

Fault

- Electrodes damaged
- Premature blackening



Cause

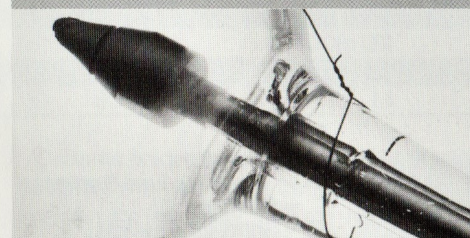
- Current ripple too high
- Auxiliary mirror incorrectly adjusted

Remedy

- Have power supply inspected
- Adjust auxiliary mirror

Fault

- Glass erosion on fused quartz bulb



Cause

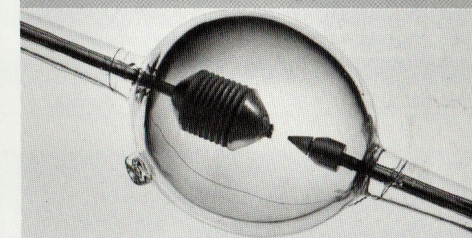
- Lamp operated outside current control range
- Lamp service life exceeded

Remedy

- Correct current setting
- Check meter

Fault

- Asymmetrical blackening of lamp (in horizontal burning position)



Cause

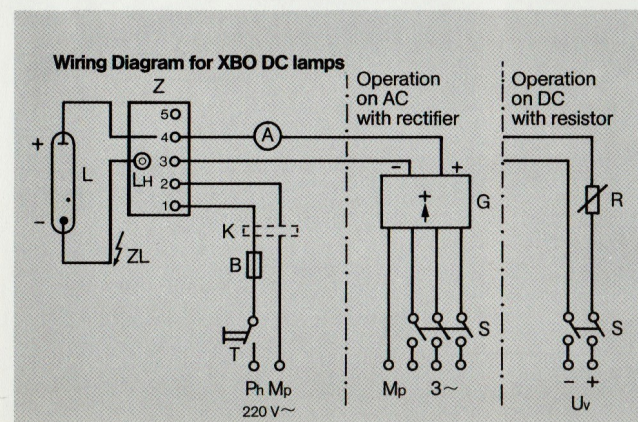
- Lamp operated too long in same position

Remedy

- Turn lamp 180° after half service life

Technical data

Lamp	Average life		Tube voltage (average value)	Operating current (rated value)
	horiz. h	vert. h		
Reference			V	A
XBO 500 W/H	2000	2000	18	28
XBO 700 W/HS	1500	1500	19	37
XBO 700 W/HSC	1500	1500	19	37
XBO 900 W	–	2000	20	45
XBO 900 W/CA	–	2000	20	45
XBO 1000 W/HS	1500	1500	20	50
XBO 1000 W/HSC	1500	1500	20	50
XBO 1000 W/HTP	2000	2000	22	45
XBO 1600 W	–	2000	25	65
XBO 1600 W/CA	–	2000	25	65
XBO 1600 W/HS	1500	1500	22	65
XBO 1600 W/HSC	1500	1500	22	65
XBO 2000 W/H	2000	2000	29	70
XBO 2000 W/HS	2000	2000	29	70
XBO 2000 W/HTP	2000	2000	29	70
XBO 2500 W	–	1500	30	83
XBO 2500 W/HS	1200	1500	28	90
XBO 3000 W/H	1200	1500	30	100
XBO 3000 W/HS	1200	1500	30	100
XBO 3000 W/HTP	1200	1500	30	100
XBO 4000 W	–	1000	33	120
XBO 4000 W/HS	800	800	30	135
XBO 4000 W/HTP	900	1200	31	130
XBO 4200 W/CA	–	500	30	140
XBO 6500 W	–	500	41	160



A = Ammeter
B = Slow blow fuse 6 amps
G = Rectifier
K = Short-time switch
L = Lamp XBO
LH = High voltage terminal
Mp = Neutral lead
Ph = Live lead
R = Series resistor
S = Switch
T = Pushbutton
Uv = Lamp supply voltage
Z = Ignitor
ZL = Ignition lead

Current control range for stable operation ¹⁾	Permissible burning position	Forced air cooling required	Magnetic field required for horizontal operation
A	–	–	–
17 ... 30	s 30/p 30	yes	yes
30 ... 45	s 20/p 20	yes	no
30 ... 45	s 20/p 20	yes	no
30 ... 53	s 30	no	–
30 ... 53	s 30	no	–
30 ... 55	s 20/p 20	yes	no
30 ... 55	s 20/p 20	yes	no
30 ... 55	s 30/p 30	no ²⁾	yes
45 ... 75	s 30	no	–
45 ... 75	s 30	no	–
45 ... 70	s 20/p 20	yes	no
45 ... 70	s 20/p 20	yes	no
50 ... 85	s 30/p 30	no	yes
50 ... 85	s 30/p 30	no	yes
50 ... 85	s 30/p 30	no ²⁾	yes
60 ... 95	s 30	no	–
70 ... 100	s 30/p 20	yes	no
60 ... 110	s 30/p 30	no	yes
60 ... 110	s 30/p 30	no	yes
60 ... 110	s 30/p 30	no ²⁾	yes
60 ... 140	s 15	yes	–
80 ... 150	s 20/p 20	yes	no
100 ... 140	s 20/p 20	yes ²⁾	yes
60 ... 160	s 15	yes	–
80 ... 160	s 10	yes	–

¹⁾ Currents below the current control range will result in erratic lamp starting, and in a certain arc instability; with currents above the current control range, reliable operation can no longer be warranted.

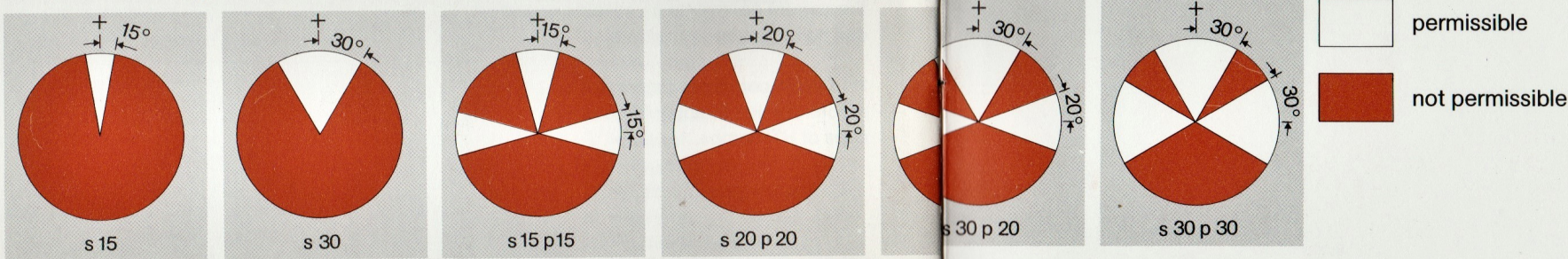
²⁾ To avoid contact resistance, it is recommended to apply forced cooling to the caps of HTP lamps.

Lamp reference table

WOTAN XBO	Philips CSX	Tungsrarn XHP	Ushio UXL	Toshiba XD (550 S/1)	Wacom KXO	ORC XM	Hanovia CH
500 W/H	500 W H	500 W/H	5-S				500/HS
700 W/HS	700 W HS	700/HS	7-S			XM 750 HS	700/HS
700 W/HSC	700 W HSC	700/HSC	7-SC				
900 W	900 W	900	900	900	900 F	XM 900 H/V	900/V
900 W/CA						XM 1000 H/VC	900 VWL
1000 W/HS	1000 W HS	1000/HS	10-S	1000 S/H (1000 S/HC)	1000 HSF	XM 1000 HS	1000/HS
1000 W/HSC	1000 W HSC	1000/HSC	10-SC				
1000 W/HTP				1000/H	1000 HTPF	XM 1000 HTP	1000/HTP
1600 W	1600 W	1600	1600	1600	1600 F	XM 1600 V	1600/V
1600 W/CA						XM 1600 H/VC	
1600 W/HS	1600 W HS	1600/HS	16-S	1600 S/H (1600 S/HC)	(1600 HMF)	XM 1600 HS	1600/HS
1600 W/HSC	1600 W HSC	1600/HSC	16-SC			XM 1600 HSC	1600/HWL
2000 W/H	2000 W HC	2000/H			2000 HF	XM 2000 H/VC	2000/HWL
2000 W/HS						XM 2000 HS	
2000 W/HTP	2000 W HTP	2000 HTP	2003 HKL	2000/H	2000 HTPF	XM 2000 HTP	2000/HTP
2500 W	2500 W	2500	2500	2500	2500 F	XM 2500 H/VC	2500/VWL
2500 W/HS	2500 W HSC		25-SC	2500 S/H	2500 HSF	XM 2500 HS	2500/HS
3000 W/H	3000 W HC				3000 HF	XM 3000 H/VC	3000/HWL
3000 W/HS						XM 3000 HS	
3000 W/HTP	3000 W HTP	3000/HTP	3000 HK		3000 HTPF	XM 3000 HTP	3000/HTP
4000 W		4000	4000 K		4000 F		4200/VWL
4000 W/HS	4000 W HSC	4000/HS	40-SC		4000 HSF	XM 4500 HS	4200/HS
4000 W/HTP	4000 W HTP		3601-HK		4000 HTPF	XM 4000 HTP	4200/HTP
4200 W/CA					4200 F	XM 4200 H/VC	
6500 W					6500 F		

() lamps are only interchangeable to a limited extent

Examples of burning positions:



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