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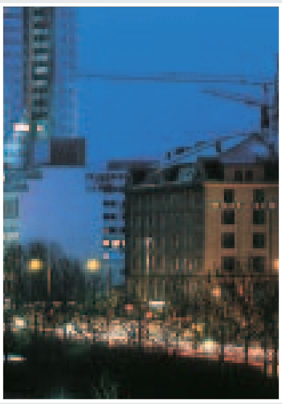
Switchgear for Luminaires



Technical Paper

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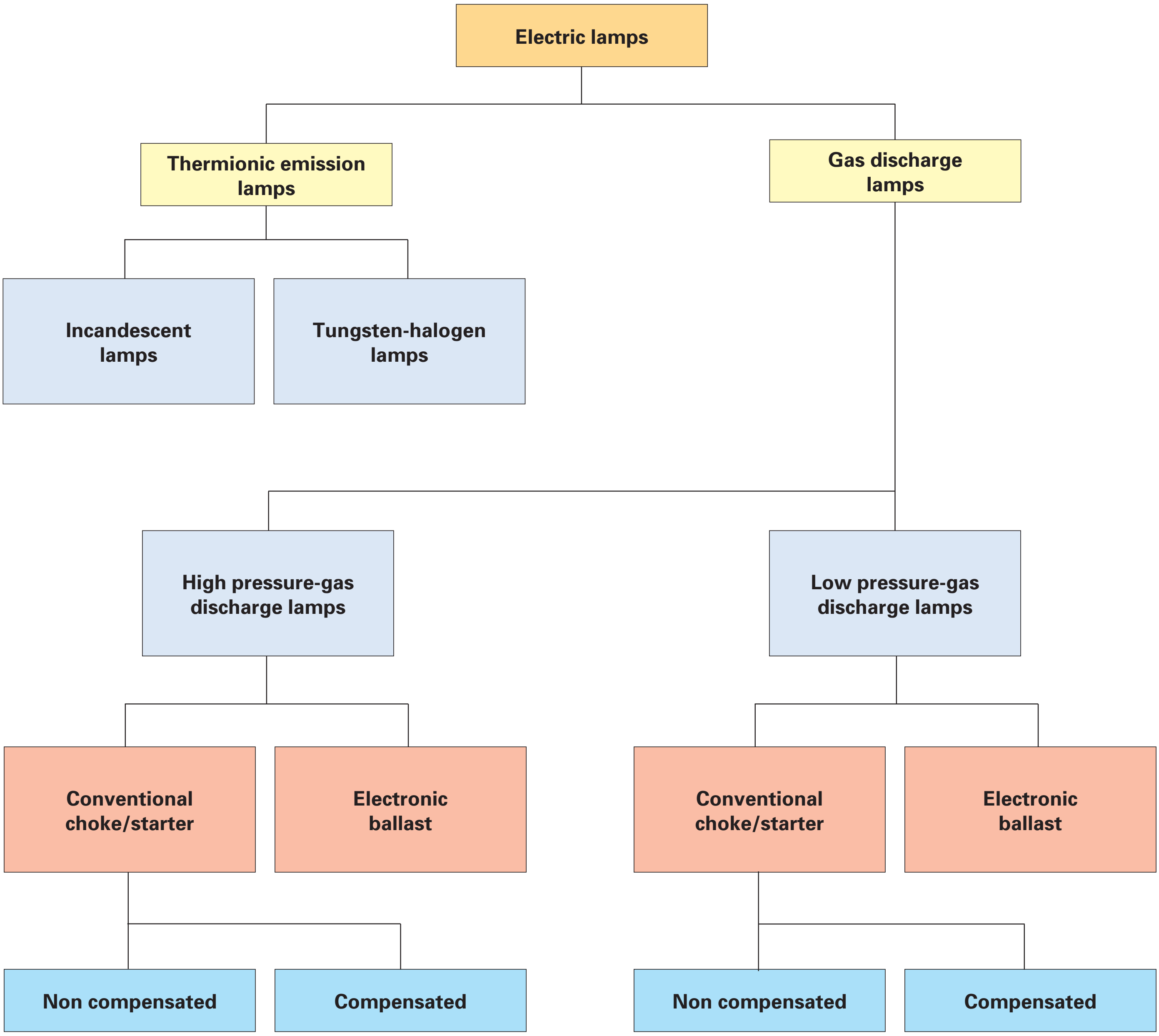
Switchgear for Luminaires

When dimensioning switchgear for luminaires it is important to consider the peculiarities of luminaires when they are switched on and when operating continuously. Depending on the lamp type used overcurrents may occur for a relatively long time in the preheating phase or extremely high current peaks in the ms range due to capacitor loading processes may occur. These currents must be correlated with the continuous current and the making capacity of the switchgear.

Particular attention should be paid to the switching capacity with capacitive a load if gas discharge lamps are compensated in parallel on the mains.



Incandescent lamps, Tungsten-halogen lamps

On incandescent lamps light is generated by thermionic emission on the filament. In the cold state, the filament of incandescent lamps has an extremely low ohmic resistance. Accordingly peak inrush currents which are up to 16 times lamp operating current can result. The operating current is only simply disconnected when switched off.

Fluorescent lamps

On fluorescent lamps, the layer of fluorescent material applied to the inner surface of the glass bulb is excited by the UV radiation from the metal vapour discharge. The gas discharge is ignited by a high voltage pulse.

The starting behaviour of fluorescent lamps is essentially determined by the ballast. With conventional choke/starter switching, a slightly increased preheating current (1.25 times operating current) flows for a few seconds before it is reduced to operating current after ignition of the lamp. Power factor correction capacitors are frequently used for compensation of the reactive current caused by the choke. At the instant they are switched on, these capacitors can cause an extremely
high switch-on peak which decreases very quickly. Hereby, the making capacity with a capacitive load must be considered. Particularly when the capacitors are connected in parallel the number of lamps per switching device may be considerably reduced. In this case, series compensation (e.g. twin-lamp) is more favourable.

When electronic ballasts are used to stabilize the lamp current, short but high current peaks occur as well which are caused by the capacitor charging process in the lamp electronics. Compact fluorescent lamps, well-known as energy-saving lamps, are also fluorescent lamps with electronic ballasts.



Sodium-vapour lamps, Mercury-vapour lamps

For these gas discharge lamps, special high-reactance transformers are also available, in addition to choke circuitry. The start-up phase of these lamps, during which the current can reach 2.2 times the operating current, is longer (max. 10 minutes). This ballast is frequently also compensated, the rating of the capacitor must however not exceed the capacitive making capacity.

Metal-halide lamps

In these high-pressure gas discharge lamps, halides are added to the metal vapours which increase the luminance yield and also have an effect on the emitted light colour.

For these lamps, special starters must be used to provide the high-voltage starting pulse. Chokes are mainly used for limitation of the operating current.

During the start-up phase, a starting current of up to 2.2 times the operating current will flow for a maximum of 10 minutes in these lamps.

Mercury blended lamps

Mercury blended lamps are metal-vapour lamps without integrated ballasts. Here a filament has a current limiting effect and emits light, and the discharge of metallic vapour excites the layer of fluorescent material by emission of UV radiation. The starting behaviour of mercury blended lamps is similar to that of incandescent lamps.

Selection of contactors for the actuation of electrical lamps

Special DILL… contactors are available for switching of electrical lamps. The DILM… contactors can also be used for this application. In the following tables you will find the current values and the maximum capacitor load for power factor corrected lamps.

These two limits have to be taken into consideration for the selection of the switchgear:

1. Maximum capacitor load that can be switched (with compensated lamps)

	DIL	L12	L18	L20	M7	M9	M12	M17	M25	M32
Permissible compensation capacitance	C_{max} [μF]	470	470	470	47	80	100	220	330	470

2. Maximum loading of contacts when switching electrical lamps

	DIL	L12	L18	L20	M7	M9	M12	M17	M25	M32
Permissible compensation capacitance	C_{max} [μF]	470	470	470	47	80	100	220	330	470
Permissible compensation capacitance	I_e [A]	14	21	27	6	7,5	10	14	21	27
Mercury blended lamps	I_e [A]	12	16	23	5	6,5	8,5	12	16	23
Fluorescent lamps, conventional choke/starter	I_e [A]	20	26	35	9	10	15	20	26	35
Fluorescent lamps, twin-lamps, (series compensation)	I_e [A]	20	26	35	5,5	8	13	15	22,5	29
Electronic ballasts	I_e [A]	12	18	20	5	6,5	8,5	12	17,5	22,5
High-pressure mercury-vapour lamps	I_e [A]	12	18	20	3,5	6	10	12	17,5	20
Metal-halide lamps	I_e [A]	12	18	20	3,5	6	10	12	17,5	20
High-pressure sodium lamps	I_e [A]	12	18	20	3,5	6	10	12	17,5	20
Low-pressure sodium lamps	I_e [A]	7,5	10	12	3	4	6	7,5	10	12

With all configurations with parallel compensation, the sum of the compensation capacitances must not exceed the value specified under the first value stated above.

M40	M50	M65	M80	M95	M115	M150	M185A	M225A	M250	M300A	M400	M500
470	500	500	550	620	830	970	2055	2300	2600	3000	3250	3500

M40	M50	M65	M80	M95	M115	M150	M185A	M225A	M250	M300A	M400	M500
470	500	500	550	620	830	970	2055	2300	2600	3000	3250	3500
33	42	55	67	79	95	125	153	187	208	249	332	415
30	38	45	65	67	80	110	123	150	167	200	266	332
41	45	55	95	100	125	145	207	237	263	300	375	525
36	47	59	71	95	100	138	186	213	236	270	338	473
28	35	45,5	56	66,5	80,5	105	130	158	175	210	280	350
25	30	36	55	60	80	95	138	158	175	200	250	350
25	30	36	55	60	80	95	138	158	175	200	250	350
25	30	36	55	60	80	95	138	158	175	200	250	350
15	22	25	35	40	50	70	100	111	123	140	175	245

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