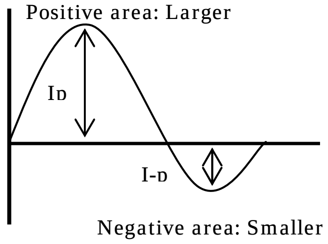
点灯波形と水銀偏り
Operating wave form and mercury migration



波高率を $0.9*\sqrt{2}*Irms < Ip$ & $I\text{-}p < 1.1*\sqrt{2}*Irms$ とする。
但し、IL、VL 波形の面積･ピーク値共に非対称率 10%以内でスパイク波の発生しない正負両波対称の正弦波のものをご使用下さい。
Ip：ランプ電流正側ピーク値　I-p：ランプ電流負側ピーク値

Required peak factor ratio: $0.9*\sqrt{2}*Irms < Ip$ & $I\text{-}p < 1.1*\sqrt{2}*Irms$
It is required to use symmetric sine wave form in positive area and negative area without spike with asymmetricity ratio of 10% or less in both the areas and the peak values of IL and VL wave forms.
Ip：Lamp current peak value on the positive area side
I-p：Lamp current peak value on the negative area side

冷陰極蛍光ランプ内には、水銀と希ガス(Ne,Ar)が封入されており、放電が開始すると、水銀が電離し、水銀イオンが生成されます。正弦波電圧で点灯する場合、正の半周期においては図1中の陽極から陰極に向かって移動しますが、電圧の極性が反転する負の半周期においては、移動方向が逆転し、図2中の右側電極（陰極）から左側電極（陽極）に向かって移動します。管電流（管電圧）の正と負の振幅が等しい場合は、正と負の半周期における水銀イオンの移動量は等しくなるので、1周期当りの見かけ上の移動距離は0となり、水銀イオンは放電容器内で移動しません。しかし、管電流（管電圧）の正と負の振幅が異なる非対称波形（上図）の場合、管電流（管電圧）が大きい正の半周期の水銀イオン移動量は、管電流（管電圧）が小さい負の半周期の移動量に比べて大きくなるため、1周期経過すると水銀イオンは図3中の左側電極から右側電極に向かって移動することになります。この水銀イオン移動現象が、点灯中に繰り返されると、水銀は右側電極に向かって偏り（カタホリシス現象）、左側電極の周辺に水銀が減少します。その結果、左側電極付近は、希ガス発光（発光色はピンク）し、最悪は短寿命に至る場合があります。
冷陰極蛍光ランプを駆動させる場合は、上記の様な波形条件を考慮したインバータ設計をお願い致します。尚、本条件は実装状態にてご確認のうえ、ご使用ください。

Mercury and mixed rare gases (i.e. Ne, Ar) are sealed inside the glass tube of a cold cathode fluorescent lamp. When discharge starts, mercury is ionizes. When lighting with sine wave voltage, ions move from the anode toward the cathode during the positive half cycle as shown in Fig.1. Then, during the negative half cycle with field polarity reversed, ions move in the opposite direction from the right side electrode (i.e. the cathode) toward the left side electrode (i.e. the anode) as shown in Fig.2. If the positive peak amplitude area and the negative peak amplitude area of the lamp current (tube voltage) are same, the moving distances of mercury ions during the positive and negative half cycle are also same resulting in the net movement in one whole cycle zero and mercury ions eventually do not move in the discharge tube.
However, in the case of asymmetric waveforms (shown in the figure above) where the positive and negative peak amplitudes area of the lamp current (or the lamp voltage) are different, the moving distance of mercury ions during the positive half cycle with the larger lamp current (or lamp voltage) is grater than that during the negative half cycle with the smaller lamp current (or lamp voltage). Then during one whole cycle, the mercury ion in Fig.3 moves from the left electrode toward the right electrode. If this phenomenon of mercury ion movement is repeated while the lamp is lit, mercury ions deviate toward the right electrode (i.e. cataphoresis phenomenon) causing the less density of mercury ions around the left side electrode. As a result, the luminescence of rare gas (in pink color) may occur around the left side electrode and cause extremely short life of the lamp in the worst case.
It is required to design the inverter taking the wave form conditions mentioned above into the consideration in the case of using it to drive cold cathode fluorescent lamps. It is also required to check these conditions by installed the lamps to the actual unit.

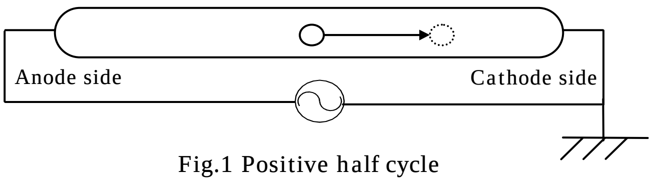


Fig.1 Positive half cycle

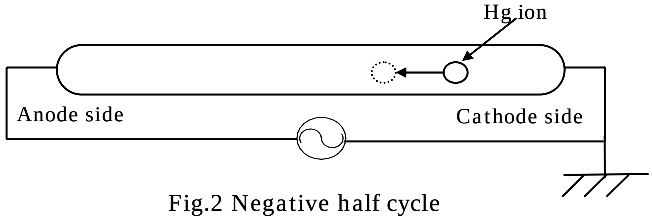


Fig.2 Negative half cycle

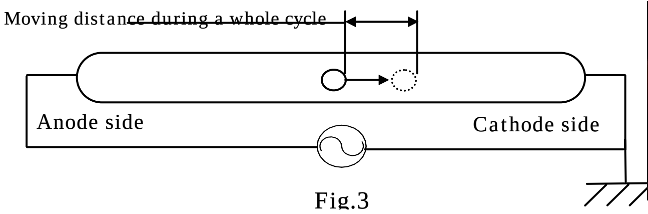


Fig.3