



End of Life (EOL)

What is EOL and what effects can it have?



What is EOL?

- A lamp reaches End of Life when it no longer operates correctly, this may be for two reasons:
 - The gas inside the lamp becomes degraded and will no longer support the discharge.
 - There is insufficient emissive material on the cathode to initiate the discharge.
- **In both instances, the lamp goes out and/or will not restart.**



Normal EOL



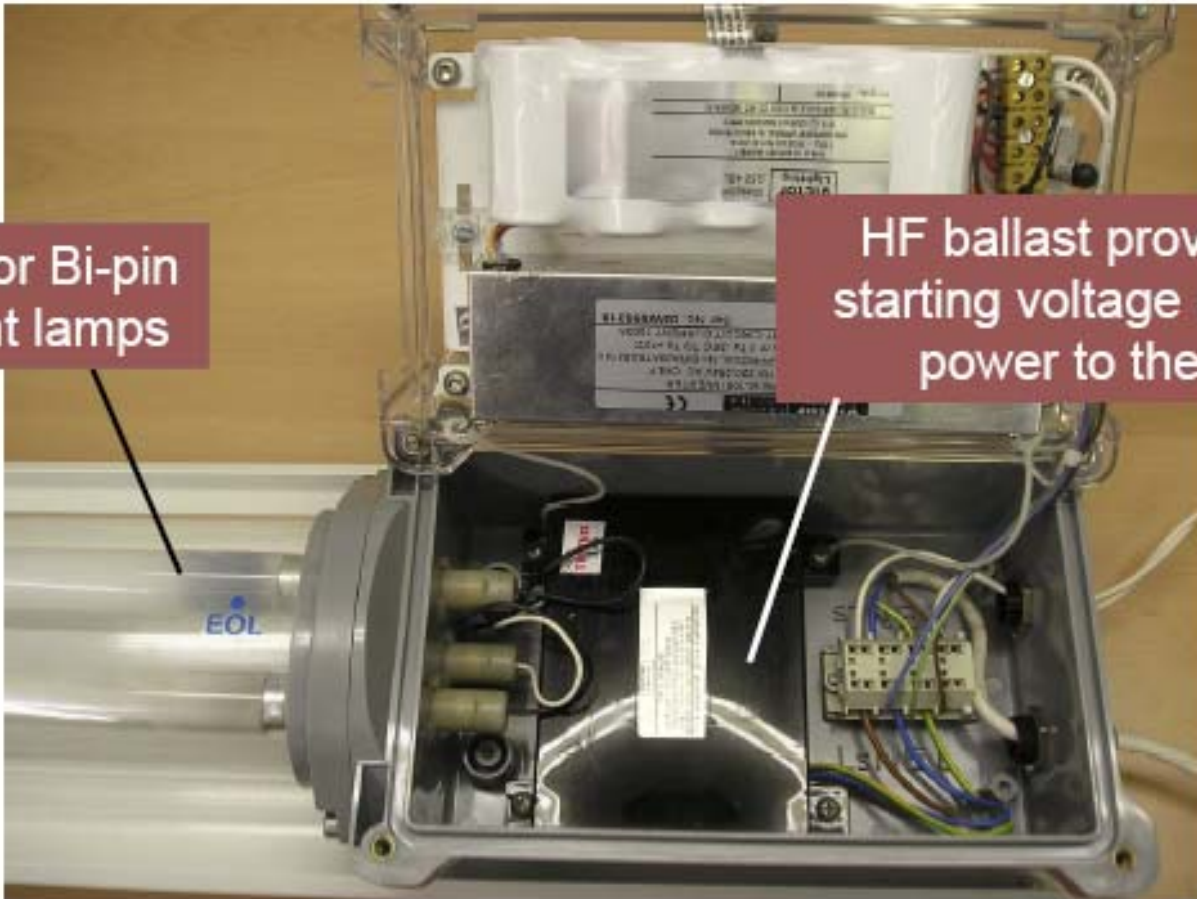
- This picture shows lamps which have reached (or are reaching) the end of their useful life
- All fluorescent discharge lamps will look like this as they age. It should not be assumed that this is an immediate problem.



How Ex e Luminaires Work

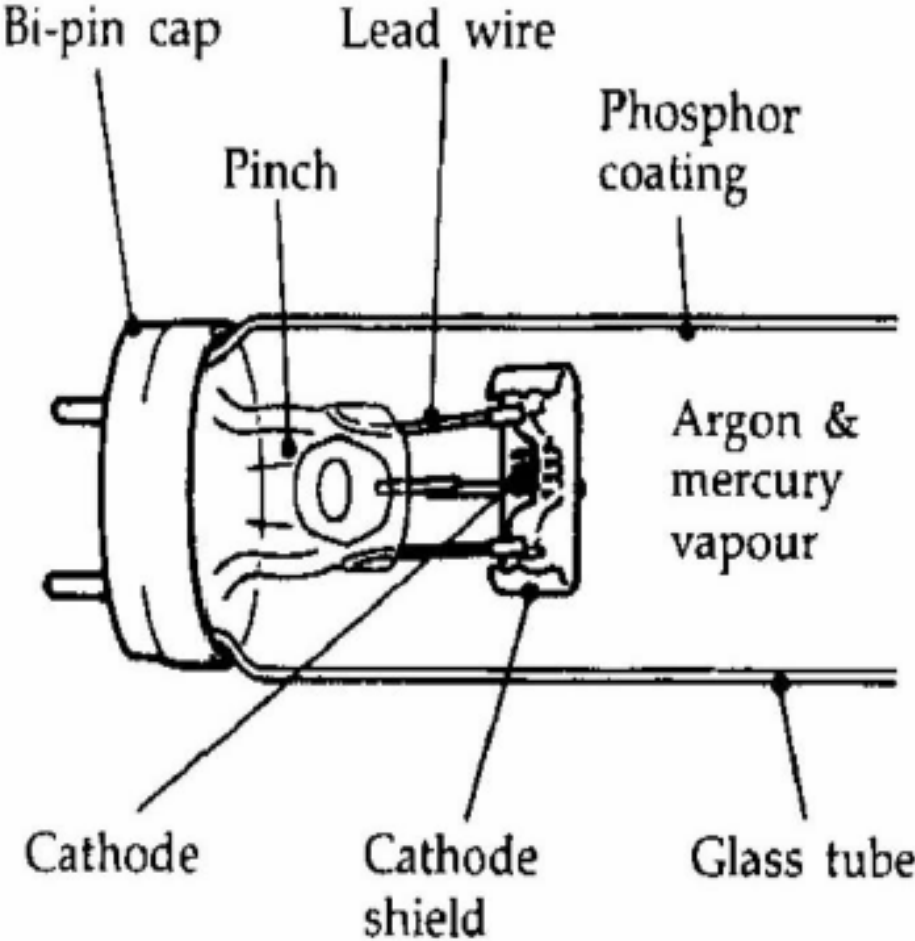
Mono Pin or Bi-pin
fluorescent lamps

HF ballast provides high
starting voltage & constant
power to the lamps





Fluorescent Lamps





Ex e Luminaires

- Modern Ex e luminaires typically use T8 (25mm dia) lamps
- In Ex e luminaires the lamps require to be COLD started as opposed to the normal method of warm start commonly used in commercial HF ballasts.
- Cold starting these lamps requires a greater starting voltage
- This voltage is provided and controlled using the HF ballast.
- During lamp start, this higher voltage results in extra stress on the ballast circuits and lamp cathode.



Ex Electronic Ballasts

- Electronic ballasts work on the constant current principle. The circuit increases or reduces the voltage to keep the current through the lamp constant
- Until this voltage reaches an inbuilt limit designed into the ballast the constant current is maintained
- When the lamp cathode becomes exhausted or breaks, a higher voltage (supplied by the ballast) is needed at the cathode in order to keep the lamp running.



What effects can EOL have?

- In most instances one cathode becomes depleted or broken before the other
- The extra voltage supplied by the ballast is concentrated at the one cathode. This means that excess power can be generated locally which overheats the surrounding lamp tube and the connections into the lamp and spreads to the lampholder.
- This is commonly known as ‘the rectifier effect’



What effects can EOL have?

- Usually the local overheating at the cathode is a brief event, quickly destroying the remains of the cathode and the gas in the discharge tube.
- The lamp goes out and can not be re-started. This is a normal passive failure.
- If the condition persists the lamp overheats, sometimes sufficiently to melt the glass tube, (the lamp then goes out) or causes damage to the lamp cap and lampholder.
- Overheating of the surface of the lamp also means that the temperature can be above the surface ignition temperature “T rating” of the equipment



Why is EOL now an issue?

- A number of our European competitors have experienced serious failures in the field.
- These failures have led to dangerous conditions which could potentially have been catastrophic.
- Because of this the German manufacturers and PTB, a German notified body, started investigations into the so called “End of Lamp Life” effect on Ex e luminaires.



Why is EOL now an issue?

- It was only when PTB asked for additional tests to be added to the Ex e standard that the rest of the European manufacturers were alerted to this issue
- To date, details of the results from these investigations by PTB have not been made public, although the following website has some information:
 - <http://www.explosionsschutz.ptb.de/pruefung-plex-komp-langfeld-engl.htm>
- The PTB investigation concluded that there was no need for widespread replacement of existing ballasts as the estimated risk of an incident compared to the numbers installed was small



New Ex e Requirements

- The standard covering Ex e lighting (IEC 60079-7) is in the process of being changed to include additional testing on the ballast to simulate EOL parameters.
- These changes introduce type tests limiting the power potentially dissipated at the end of the lamp to 10W maximum.
- This is considered to be a safe value for a T rating of T4 and a maximum fluorescent luminaire operating Tamb of 60°C.



New EOL Ballast Requirements

- Ballasts meeting the new draft standard must have two distinct methods of detecting that a lamp is reaching, or has reached the end of its useful life:
 1. At switch on it shall attempt for a few seconds to start a lamp. If it cannot strike the lamp it must shut off the power to that lamp.
 2. In luminaires that are never switched off, it must sense that a lamp is starting to run outside the set parameters known to the ballast and subsequently shut down the lamp before any damage is done to the ballast or lampholders.
- Victor Lighting high frequency Ex ballasts have, since Nov 2000, been designed to shut down when trying to start failed lamps



- All Victor Lighting Ex ballasts have now been re-certified to meet the new draft IEC 60079-7 standard.
- These ballasts are now used in every Victor Ex e luminaire:

- Excalibur
- Trident
- VL77/VL78
- VL104C





making hazardous environments work



EOL Ballast Certificates



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EC TYPE-EXAMINATION CERTIFICATE VARIATION

CERTIFICATE NUMBER SA/04762(2)SU Dated 20 November 2000

SIRA VARIATION NUMBER 1 (THREE) Dated 18 February 2006

VARIATION TO COMPONENT

To permit:

- The introduction of an alternative circuit design with lamp end of life detection that, not only complying with the original assessment standards, also complies with the draft requirements of IEC 60779-7 Edition 4, Annex H.

DESCRIPTIVE DOCUMENTS

Number	Sheet	Rev	Date	Description
2 P 220 72 0	1 and 2	0	30 Feb 06	Circuit diagram 2 x 50 W T8/230 V
3 Q 218 72 0	1 and 2	1	30 Feb 06	Circuit diagram 2 x 36 W T8/230 V, 2 x 18 W 310/230 V
5 M 258 72 0	1 and 2	0	30 Feb 06	Circuit diagram 2 x 36 W T8/130/127 V

ADDITIONAL CONDITIONS OF CERTIFICATION

None

File No. S1A14457
Report No. R51A14457A

C. Staley
Certification Officer

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EC TYPE-EXAMINATION CERTIFICATE VARIATION

CERTIFICATE NUMBER SA/04762(2)SU Dated 20 November 2000

SIRA VARIATION NUMBER 1 (ONE) Dated 16 February 2006

VARIATION TO COMPONENT

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EOL Ballast Identification





EOL Product Marking





EOL Summary

- All Victor Lighting Ex e fluorescent luminaires and ballasts are now certified to the requirements of Annex H of draft standard IEC 60079-7 edition 4 for both Asymmetric Pulse Test and Asymmetric Power Test
- These can be easily identified by the blue dot and “EOL” lettering shown on the product.
- EOL ballasts can be retro-fitted into existing Ex e fluorescent luminaires