



A NEMA Lighting Systems Division Document

Questions and Answers About Lamp Ruptures In Metal Halide Lighting Systems

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Questions and Answers about Lamp Ruptures in Metal Halide Lighting Systems

Q: Why is NEMA publishing this White Paper?

A: NEMA manufacturers want to ensure that any potential lamp rupture risk from metal halide lighting systems remains low. Manufacturers will periodically update important information related to safety and reinforce the importance of following all the instructions and warnings associated with any product, and metal halide lighting systems are no different. Although each manufacturer individually provides and stresses the information related to safe operation of metal halide systems, NEMA members believe a collective industry effort will result in an even greater level of overall safety since more of the best practices will be followed by the end user.

Q: Is there an actual risk associated with metal halide lighting systems?

A: The use of any electrical product poses some degree of risk. Metal halide lamps contain an arc tube that operates under high pressure and can rupture unexpectedly. If a rupture occurs that is strong enough to break the outer envelope, hot pieces from the lamp could conceivably become an ignition source in some applications. This is why most metal halide lamp types are either specified for use in enclosed luminaires that provide a protective lens or are lamp types that are specially designed to contain lamp particles if such a rupture occurs. S-type metal halide lamps, without internal lamp shielding, have been rated for use in open luminaires *provided that* all the lamp manufacturers' instructions and warnings are followed.

Q: Why are S-type lamps used today despite the availability of other options?

A: Over 30 years of field history has shown that S-type lamps, when operated according to manufacturers' instructions and warnings, represent a very small risk in most applications and provide many end user benefits in a cost effective manner. Where it makes sense for S-type lamps to be used in open luminaires depends very much on the specific application and whether end users intend to follow manufacturers' instructions. These lamps should not be used in open luminaires unless ALL warnings and instructions of the lamp and luminaire manufacturers are completely followed. If there is any doubt that operators or maintenance personnel will completely follow manufacturers' instructions, then S-type lamps should not be used in open luminaires.

Q: Why do group re-lamping and lamp cycling reduce the potential for metal halide lamp rupture?

A: *Group re-lamping* at or before lamps reach their published rated life removes these lamps from service before the point in time when the probability of arc tube rupture increases. Although many lamps will last thousands of hours beyond their published rated life, the quartz arc tube and internal chemicals (metal halide salts) continue to react at the high temperatures inside the arc tube. Thus, deterioration (devitrification) of the quartz tube continues to the point where violent arc tube failure may occur. In addition, beyond the published rated life, light output diminishes further and color shifts occur so the lamps no longer operate with their designed performance characteristics.

Cycling the lamps helps to cause the lamps nearing end-of-life to fail benignly.¹ As lamps age, stresses in the quartz gradually increase due to quartz devitrification. If the stresses are severe enough, they can cause the arc tube to crack. Under operating conditions, the combination of a crack and high pressure in the arc tube can cause a rupture. However, if the lamp is periodically cycled, the cooling down or heating up of the arc tube can cause those cracks to propagate while the internal arc tube pressure is low, preventing a violent failure.

Q: Are there similar rupture risks from other high-pressure discharge systems?

A: Mercury vapor lamps also contain arc tubes, which operate at high pressures. However, the pressures and temperatures are not as high as those of metal halide arc tubes; and there are no chemicals to cause severe stresses in the quartz. Nevertheless, some ruptures have occurred due to thermal or mechanical stresses on the arc tube.

High-pressure sodium (HPS) arc tubes operate at lower internal pressures than either metal halide or mercury vapor arc tubes. In fact, the operating pressure of an HPS arc tube is very close to one atmosphere, so that even if a crack occurs, there is no high pressure to cause a violent rupture.

Q: How should I treat “pulse starting” metal halide systems?

A: Pulse starting metal halide lamps operate the same as standard MH systems, except an electronic igniter, external to the lamp, is used to start the lamp. These lamps should not be treated any differently than standard metal halide lamp systems in terms of application and potential for arc tube rupture. The manufacturer’s warnings and instructions, as usual, should be read and followed.

¹ By cycling it is meant turning off lamps at least once a week for a minimum of fifteen (15) minutes when they are in continuous operation.

Q: Should I use exclusionary sockets with O-type lamps?

A: Although O-type lamps will operate in standard sockets, exclusionary sockets are strongly recommended to prevent a non-O-type lamp from being installed. S- and E-type lamps will not start if installed in exclusionary sockets.

Q: How can I tell if I have an O- or S-type lamp?

A: The only correct way to determine if a lamp is O- or S-type is to check with the lamp manufacturer. Currently, O-type lamps have glass cylinders or shrouds around the arc tubes, but a shroud does not guarantee an O-rating. S-type lamps are restricted to vertical operation and normally do not contain shrouds.

Q: What tests are performed to verify the O-type rating?

A: The American National Standard test procedure for metal halide lamps, made with quartz arc tubes, is described in document C78.387.² The test forces a small number of arc tubes to rupture by discharging a high voltage capacitor. The subsequent ruptures must be totally contained within the outer bulbs to meet the requirements of the O-type rating. Lamp manufacturers use this test procedure before applying the O-type rating to their lamps. Procedures for testing the containment of ceramic metal halide lamps are under development in ANSI.

Q: What does it mean when a luminaire is “third party listed”?

A: In order to comply with the *National Electrical Code* (NFPA-70)³ and the majority of local ordinances, luminaires must be examined by a qualified electrical testing laboratory and found to meet nationally recognized safety standards or be tested for a specific purpose. The testing laboratory must be acceptable to the authority having jurisdiction (local building/electrical inspector), publish a record of the examination and conduct ongoing inspections of the luminaire model at the production facility. Most testing laboratories authorize the use of a special label on compliant luminaires that indicates that the luminaire is listed.

Q: How do I match the correct metal halide lamp to a metal halide luminaire?

A: A third party listed luminaire stipulates its lamping/re-lamping information on labeling applied to the luminaire. This information prescribes the specific lamp wattage, lamp type and enclosure details necessary to correctly match the proper lamp that is intended for use with a specific metal halide luminaire. This information may or may not also be included in part or in its entirety on an instruction sheet provided with the

² ANSI C78.387, *American National Standard for Electric Lamps—Metal Halide Lamps, Methods of Measuring Characteristics*, American National Standards Institute, New York.

³ For the *National Electrical Code* definition of listed, see Article 100, page 70-22 of the 1999 edition.

luminaire. End users should always adhere to the precise labeling and instructional information provided with each and every luminaire.

Q: How do I know what the temperature rating is for a luminaire?

A: Many luminaires are designed and tested with the assumption that they will be installed at locations maintained at a maximum ambient temperature of 25°C (77°F). Some luminaires are specially engineered and evaluated for installation where elevated ambient temperatures are anticipated. Luminaires listed for elevated ambient temperature have labels that indicate the maximum suitable ambient temperature and sometimes include special installation instructions that must be followed.

Q: Does the environment in which the luminaire operates affect lamp containment?

A: The environmental application of the luminaire must be considered over the life of the product. The environmental conditions surrounding the luminaire can degrade the luminaire materials used for lamp containment. Environmental compatibility in conjunction with acrylic or polycarbonate lamp containment enclosures must be evaluated when airborne chemicals are present in the environment. The materials used in construction for the lamp containment barrier can be impacted by the presence of these chemicals when they become airborne and attach to the luminaire. Each application is different, and it is best to consult the manufacturer on individual questions when these types of conditions exist.