The NFPA 1901 standard was revised in 2009 and new illumination requirements added for several applications. This guide assists you with installing Havis fixtures to meet these requirements. Havis also provides recommendations for optimal illumination for many applications. To learn more, please contact us at 800-524-9900 or at NFPA@havis.com.
The goal of any lighting application is to provide the right amount of light to allow emergency responders to perform their jobs as safely as possible. NFPA 1901 identifies specific areas where lighting must be provided. Below are recommendations regarding each requirement:

**Work area lighting** (Section 13.10.1.1): 3 fc at 10’ x 10’ area behind vehicle.
- Any Havis Magnafire or Kwik-Strike fixture in any configuration will meet this requirement, so long as the installed height is at least 6’ above the ground and the fixture is aimed suitably.
- Although it is technically possible to meet this requirement with the KR-CCL Series fixture, it is not recommended since it will only illuminate the ground, and not provide useful work lighting to emergency responders.
- Note that 3 fc is a relatively low illumination level, and is best suited for egress lighting. We recommend increasing the illumination level to at least 5 fc for general-purpose illumination, or 10 fc for working (e.g. operating equipment.) Magnafire fixtures with either HID lamps or 750W and above halogen lamps are optimal for this application.

**Perimeter lighting** (Section 13.10.1.2): 2 fc up to 30” from vehicle.
- Only egress illumination is required, then the optimal solution is to space KR-CCL Series fixtures at regular intervals. Recommended linear spacing is 84” at a mounting height of 20”. Recommended linear spacing is 108” at a mounting height of 30”.
- If additional lighting is needed, such as areas where equipment will be taken out of compartments, the Kwik-Strike 4000 Series can also provide effective perimeter lighting to an area of about 20’ x 20’ when mounted at about 8’ above the ground.

**Hose Bed Lighting** (Section 13.10.2.1): 3 fc
- For strict adherence to the requirement, uniform diffuse illumination will be required, and the KR-CCL Series fixture spaced at regular intervals will provide optimal results. Recommended linear spacing of KR-CCL Series fixtures is 84” at a mounting height of 30”. Hosebeds of 36” width or narrower will require only one row of lighting. Hosebeds of 36” to 96” wide should include two rows of lighting.
- Illuminating a hosebed is definitely recommended good practice, and 3 fc is reasonable for uniform diffuse illumination.
- If strict adherence to the NFPA is not necessary, then a single floodlight can be used. Any Havis Magnafire or FX flood fixture will work acceptably. However, if the illumination is not uniformly diffused, then we would recommend increasing the average illumination level to at least 5 fc.
Gauge and Control Lighting
All exterior control panels
5 fc minimum
Per Section 4.10.1.1 and 16.9.2

Water Stream Lighting (Section 19.18.6): 75,000 cp spot or 10,500 lm flood.

- All Havis spotlights meet this minimum requirement, including all CD-FX spotlights.
- Magnafire 3000 and 5000 Series floodlights equipped with 10,500 lm lamps and higher will meet the requirement. This includes 500W halogen and above, and 150W Metal Halide HID.
- We recommend that every fixture include a lamp rated to at least 1,500 lumens for most applications, and at least 3,000 lumens for lights used at the tips of aerials. In addition to that, we recommend using spot lights with at least a 200,000 cp beam for most applications, and at least 400,000 cp for lights at the tips of aerials.
- All Havis FX fixtures with spot reflectors will meet the higher recommended illumination level. Note that the CD-FX-HID fixture will provide 50% better light quality and visibility compared to other lights, since it is HID.

Gauge and control lighting (Sections 4.10.1.1 and 16.9.2): 5 fc on controls.

- The KR-CCL provides optimal lighting quality from a diffused source, so it is recommended to use the KR-CCL at spaced intervals for best illumination effect.
- Recommended spacing for KR-CCL fixtures mounted directly against a control panel is 34” side-to-side by 56” top-to-bottom.
- Due to the irregular shape of gauges and controls, KR-CCL fixtures should be offset from the control panel surface whenever possible. The spacings above can be increased by 5% per inch offset from the surface, up to 10” maximum offset.
- Please note that the NFPA recommended illumination level is reasonable, but may be higher than necessary in some applications. If the surrounding scene is brightly lit and glare may be an issue, then the NFPA-recommended 5 fc level is sufficient. For most applications, 2 fc is adequate, and will reduce the number of fixtures required by about half.
- Back-lighted gauges are recommended regardless of what illumination level is provided by gauge and control lighting.
**Surface lighting** (Section 13.10.3): 2 fc on all surfaces.
- A single KR-CCL Series fixture will illuminate a 30” x 30” x 108” area to at least 2 fc, and will provide excellent diffused illumination.
- It is good practice to illuminate surfaces, and 2 fc is reasonable for diffuse illumination.
- If other (non-diffused) light sources, such as floodlights, are used for this application, then we would recommend increasing the illumination level. The maximum should not exceed 10 fc and the minimum should not be less than 3 fc.

**Interior lighting** (Section 13.10.4): Average of 2 fc at seating area.
- A single KR-CCL Series fixture will illuminate a surface up to 45” below to 2 fc.
- A KR-DL fixture can be used in the same application with one lamp lit and a clear lens installed.
- For reading, we recommend supplemental illumination to at least 5 fc by using additional fixtures over the reading areas, or by installing C-MAP maplights at reading areas.
- The KR-DL is very useful for over-seat lighting, as it already has two lamps, so one lamp can be used to meet egress requirements, while both lamps can be used when needed for reading.
Compartment lighting (Section 13.10.5.1): 2 fc on the floor.

- The NFPA recommendation is inadequate, because it ignores the importance of using diffused light sources, it does not address the fact that lighting must be on each shelf, and the illumination level recommended should be higher for adequate visibility.
- In order to provide adequate illumination while also meeting the standard, KR-CCL Series fixtures can be installed and spaced suitably.
- In order to compute the number of fixtures needed, measure the size of the compartment (L x W) and add them together in feet. Use one KR-CCL Series for every 8’ measured. Round to the nearest whole number. For compartments, add one additional light for every 10’ measured. For example, a 2’ x 4’ standard compartment needs one light, and 8’ x 4’ needs two lights.
- The calculation above assumes an empty compartment with no shelves. For proper visibility, one light is recommended for each full-compartment shelf installed. This does not necessarily mean additional lights are needed; it only means that the lights should be positioned so that at least one light illuminates each shelf. If there are more shelves than lights, then additional lights would be needed.
- It is best to space the KR-CCL Series so that half of the light is above one shelf, and the other half is below, and to light each shelf from both sides.
- For adequate illumination in a compartment that is at least 30% full, a minimum of 5 fc of illumination should be provided on most surfaces. In order to meet the recommended 5 fc level, add one additional KR-CCL Series fixture for every 8’ measured using the calculation above.
1. In-Wall/Perimeter Lighting
   - KR-4xxx
   - KR-18xx/26xx
   - KR-19xx/27xx
   - KR-21xx/28xx
   - KR-22xx/29xx
   - KR-23xx/31xx

2. Water Stream/Aerial Tip Lighting
   - Spotlights:
     - CD-FX-12
     - CD-FX-HID-1
   - Floodlights:
     - KR-SB-6xx
     - KR-13xx
     - KR-14xx

3. Poles
   - KR-SB-100
   - KR-SB-200
   - KR-SB-300
   - KR-SB-400
   - KR-SB-500
   - KR-SB-800-TM
   - KR-SB-1100
   - KR-SB-1200
Perimeter/Scene Lighting

Fixed Mounts:
- KR-SB-6xx
- KR-13xx
- KR-14xx
- KR-35xx
- KR-36xx

Interior Lighting


xx = Lightheads Available

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Lighting Terms

It is important to understand some basic lighting principles while explaining how to use them in this manual. These are some key definitions:

**Footcandle (fc):** This is a level of light on a surface, such as the ground. Below are some examples of what illumination levels are needed for various applications:

- **2 fc:** Enough light to walk safely without tripping (egress) in most circumstances.
- **5 fc:** Enough light to read while sitting or standing still, or perform very basic tasks.
- **10 fc:** Enough light to operate most equipment.
- **30 fc:** Minimum required for typical office-type work.
- **70 fc:** Minimum required for intricate or complex tasks.

Note that footcandle levels are not perceived by the human eye in a linear manner. In other words, 2 fc is not necessarily perceived by the human eye to be twice as bright as 1 fc.

**Lumen (lm):** This is a quantity of light, defined at a specific wavelength (color.) This defines how much light is present, although it does not say anything about how well the human eye can actually see the light. A lumen rating also does not indicate how much light will be provided on the ground at any particular location, nor does it indicate the intensity of the light at any location.

**Candlepower (cp):** This is an intensity of light in one direction. Candlepower ratings are only applicable to spot fixtures, and must be used in conjunction with lumen and other ratings to determine if the fixture will produce enough light as well as enough intensity.

**Key concept:** Light quality is just as important as light quantity. Having a large quantity of light is only good if your eyes can actually see the light. Metal Halide HID and CCFL fixtures are capable of producing much higher quality light than halogen/incandescent and some LED fixtures. All Havis fixtures are optimized for maximum visibility, and all recommendations contained herein take that into consideration. If using a competitor's fixture, please note that higher illumination levels may be required in order to achieve the same visibility. For a detailed explanation of lighting technologies and human vision, please visit the Havis website (www.havis.com).

Summary

This technical bulletin is intended to assist fire departments and vehicle manufacturers with installing Havis fixtures. It is also intended to provide recommendations and guidelines for good illumination in many applications. However, it is not possible to cover every possible installation application, so these guidelines must be considered as reference information only. It is solely the installer's responsibility to ensure that lighting levels are adequate, and if requested by the customer, that all NFPA requirements are met for each application. If any additional assistance is required with a specific application, please contact your local sales representative.

For more information, contact NFPA@havis.com.