



# New Construction Specification Guideline

Prepared for HIROC  
Healthcare Insurance Reciprocal of Canada

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## 1.0 Overview and Introduction

FM Global believes that the majority of all loss is preventable. Putting this principle into practice requires inherent and sometimes hidden hazards to be identified, quantified and an appropriate customized solution to be developed. The FM Global Plan Review process is an integral part of the project planning process through which FM Global assists clients in identifying potential risk and exposures associated with new construction projects, expansions or acquisitions so they can then make the best, most cost-efficient and effective property loss protection and insurance decisions. The Healthcare Insurance Reciprocal of Canada (HIROC) believes in these principles and subscribes to involving FM Global in the project planning process.

Identifying risks during the design stage of new construction and renovations allows for recommendations to be made and changes implemented well ahead of construction. It is much more difficult to make changes after a facility has begun construction or has been completed than during initial stages.

This document provides information for designers, engineers and contractors relating to the construction or renovation of locations insured through the Healthcare Insurance Reciprocal of Canada. The information contained within this document is based on FM Global standards and identifies areas of potential risk that will require specific focus, preliminary design criteria and the process to be followed for the submission of plans to FM Global for review.

In some situations FM Global standards may surpass or differ from requirements set out by local authorities having jurisdiction. There are various reasons why FM Global standards differ from other codes and requirements. The focus of FM Global standards is to prevent loss at FM Global insured locations by applying 180 years of experience, research, testing and lessons learned by losses to effectively control any incidents which occur, and minimizing their impact on the normal business operations of these locations. In cases where FM Global requirements differ from local codes the more demanding requirement should be met. Any cases of conflicting requirements will need to be resolved case by case.

FM Global review will be relative only to compliance with FM Global standards.

## 2.0 Plan Review Submittal

FM Global will provide plan review feedback at the earliest stages of a project and on-going as details become available or changes to the project occur. FM Global review of plans and specifications should be obtained starting as early as possible and always in advance of these being submitted for tender or purchase.

The following information should be provided when submitting plans to FM Global's Plan Review department:

- **Construction Drawings and Specifications**

Including:

- Project overview details
- Scaled site, plan and elevation drawings
- Roof Specifications (including RoofNav Number and layer cut-sheets)
- Wall Specifications
- Fire Rated Partition details
- Suspended ceiling and raised floor details
- Underground Mains for Fire Protection

- **Fire Protection Drawings and Specifications**

Including:

- As-calculated sprinkler drawings indicating design areas
- Hydraulic calculations
- Water Supply Information
- Fire protection pump drawings and specifications including all pump room equipment and electrical power supply arrangement
- Specification sheets for all fire protection system components including extinguishing control panel, related site programming, related detection systems, related interlocks, valve assemblies, valves, piping, fittings, and sprinklers
- Specification sheets for all fire detection system components including detectors, control panels, associated programming and interlocks.
- Special protection system drawings, calculations, and product specification sheets

- **Occupancy Drawings/Specifications**

Information on occupancies should be provided as mentioned within this document.

The number of drawings and calculations required by FM Global to review is one set, however individual locations and/or governing agencies may require stamped copies to be returned. FM Global will need to be provided with as many copies as need to be returned, plus one additional copy to be kept on record.

## 3.0 Construction

This section discusses construction items such as Roof Construction, Wall Construction, and Building Materials. FM Global Data Sheets in the 1 series will be the primary sources of information for this section.

### 3.1 Roof Construction

Selection of an FM Approved Roofing System should be performed utilizing RoofNav software. A RoofNav Number should be submitted along with a list of which components are selected within the indicated RoofNav assembly. RoofNav can be accessed online at [www.RoofNav.com](http://www.RoofNav.com). Instructional media can also be found at this website.

Roof layer securement as well as decking securement should be provided as per Data Sheet 1-28 and 1-29. Special attention should be given to ensure that perimeter and corner securement configurations are adequate.

Where possible, an FM Approved flashing system should be utilized and installed as per Data Sheet 1-49 ([www.fmglobalsdatasheets.com](http://www.fmglobalsdatasheets.com)). Flashing executed in accordance with Data Sheet 1-49 is an acceptable alternative.

### 3.2 Wall Construction

Wall construction should be non-combustible. Where wall panels are utilized, they should be FM Approved or of non-combustible components.

If using an Exterior Insulation Finishing System (EIFS), a non-combustible insulation should be used.

Interior walls should also be non-combustible. Any fire rated walls should be identified on submitted plans.

Penetrations through fire-rated walls (and floors) should be of an FM Approved fire-stop material or assembly, with a fire rating equal to that of the wall (or floor).

### 3.3 Suspended Ceiling and Raised Floor Construction

Suspended ceilings and raised floors should be non-combustible or Class 1 materials. Non-plastic materials having an ASTM E-84 flame spread rating of 25 or less can qualify as Class 1 materials.

### 3.4 Green/L.E.E.D Buildings

When a new facility is being built with “Green” features not typical to normal construction, or is to be certified as a LEED (Leadership in Energy and Environmental Design) building, FM Global should be notified with preliminary plans and construction details in advance of a typical submission. This will allow for plans to be reviewed as well as any changes to construction to be discussed in advance of the project.

### 3.4.1 Green Roof Systems

Although there are currently no complete green roof assemblies that are FM Approved, use an FM Approved roofing base assembly (see 3.1 above) as part of the green roof system. The roof should be designed in accordance with Data Sheet 1-35.

### 3.5 Flood/ Storm-water Considerations

For locations which may be exposed to flooding due to their proximity to flooding waterways, FM Global can help quantify the extent of this exposure and offer recommendations to help reduce the impact that this event would have on the facility. Finished floor elevations (FFE) should be provided for each building, along with any planned changes to surrounding topography.

## 4.0 Fire Protection and Detection

This section summarizes automatic sprinkler protection requirements which are taken primarily from Data Sheets 3-26, 2-0, and 8-9 as of September 2016.

### 4.1 Automatic Sprinkler Requirements Using Non-Storage Sprinklers

Table 1 provides sprinkler density and operating area along with other recommended technical specifications for wet-pipe automatic sprinkler systems. Table 2 provides sprinkler density and operating area along with other recommended technical specifications for dry-pipe systems.

**Table 1: Typical Sprinkler Demands for Wet Sprinkler Systems**

Occupancy	Water Demand ( <i>gpm/ft<sup>2</sup></i> )/ <i>ft<sup>2</sup></i>	Minimum K Factor	Hose Demand ( <i>gpm</i> )	Duration ( <i>minutes</i> )
Atriums, Hospital Rooms, Office Areas & Laboratories (Ceilings up to 30 ft.)	0.10/1500	5.6 or 5.6EC	250	60
Machine Shops, Power House, Mechanical Rooms, Large Multipurpose Rooms, Auditoriums, and Utility and Equipment Rooms (Ceilings up to 30 ft.)	0.2/2500 <sup>1</sup>	8.0	250	60
	0.3/1500 <sup>2</sup>	11.2EC Upright		
	0.3/1000 <sup>2</sup>	14.0EC Upright		
	0.2/2500 <sup>2</sup>	14.0EC Pendent		
Loading Dock & Ambulance Bay (Ceilings up to 30 ft.)	0.3/2500	11.2	500	90
	0.3/1500 <sup>2</sup>	11.2EC Upright		
	0.3/1000 <sup>2</sup>	14.0EC Upright		
	0.3/2500 <sup>2</sup>	14.0EC Pendent		

<sup>1</sup> Ceilings up to 60 ft.

<sup>2</sup> Sprinklers must have a nominal temperature rating of 160°F. Also, ensure that the number of sprinkler heads in the design area does not drop below a minimum of 6 sprinklers for K11.2EC and 4 sprinklers for K14.0EC. Minimum end-head pressures for K11.2EC heads are 12psi and 18psi for K14.0EC heads, regardless of sprinkler demands.

Automatic sprinklers for areas cited in Table 1 should be classified as non-storage with a nominal temperature rating of 160°F, of any orientation unless otherwise noted. Sprinklers with a temperature rating of 212°F may be used only in locations where the ambient temperature exceeds 110°F.

**Table 2: Typical Sprinkler Demands for Dry Sprinkler Systems**

<b>Occupancy</b>	<b>Water Demand (gpm/ft<sup>2</sup>)/ ft<sup>2</sup></b>	<b>Minimum K Factor</b>	<b>Hose Demand (gpm)</b>	<b>Duration (mins)</b>
Atriums, Hospital Rooms, Office Areas, Laboratories (Ceilings up to 30 ft.)	0.10/1500	5.6 or 5.6EC	250	60
Machine Shops, Power House, Mechanical Rooms, Large Multipurpose Rooms, Auditoriums, and Utility and Equipment Rooms (Ceilings up to 60 ft.)	0.2/3500	8.0 or 11.2EC	250	60
Loading Dock/ Ambulance Bay (Ceilings up to 30 ft.)	0.3/3500	11.2 or 11.2EC	500	90

Automatic sprinklers for dry systems cited in Table 2 should also have a nominal temperature rating of 280°F.

Areas which are not listed above should be provided with protection as per the appropriate Data Sheets.

Quick-response (QR) sprinklers should only be used in wet systems.

Sprinkler spacing requirements are provided in Data Sheet 2-0.

Only FM Approved components (valve assemblies, valves, piping, fittings, and sprinklers) should be used.

## 4.2 Pre-Action/ Dry-Pipe Sprinkler Systems

Pre-action sprinkler systems are common throughout a large portion of hospital areas including operating rooms, diagnostic equipment rooms, and computer data centers.

All pre-action systems and dry-pipe sprinkler systems should be designed as per Table 2 with galvanized piping to limit internal pipe corrosion. All pre-action systems should be provided with high temperature sprinkler heads (nominal 280°F).

Where detectors for pre-action systems are to be installed, provide heat detectors rather than smoke wherever possible. Also provide sensor spacing and layouts.

Only FM Approved components (valve assemblies, extinguishing control panel, related site programming and related detection systems) should be used.

## 4.3 Extended Coverage Sprinkler Systems

Extended Coverage sprinkler systems (EC) are commonly used in healthcare occupancies. Flat, open ceilings should be provided. For example, joists will cause an obstruction and therefore limit the distance the water can travel. Guidelines for installation of EC heads are available for each FM Approved EC sprinkler head. These are available at [www.approvalguide.com](http://www.approvalguide.com).

Design of systems using EC sprinklers should be in accordance with 2.1.1.10 of Data Sheet 3-26.

## 4.4 Automatic Sprinkler Protection for Storage Occupancies

Although un-common in healthcare facilities, storage areas such as large library stacks, large file rooms, and stock rooms should be provided with sprinkler protection as per FM Global Data Sheet 8-9. Typically any locations where storage meets or exceeds 5 ft. in height, over an area of more than 200 sq. ft. should be considered storage. If any of these areas are planned within a facility, FM Global's Plan Review department should be contacted in order to determine specific requirements.

## 4.5 Fire Pumps/ Booster Pumps

Fire pump installations should be installed as per FM Global Data Sheet 3-7. Pump and pump-driver specification sheets should be submitted for review, along with drawings of the pump installation. This should include all associated valves, controllers, and power distribution (for electric drivers).

Fire pumps and associated equipment should be FM Approved.

## 4.6 Sprinkler Divisional and Isolation Valves

Sprinkler systems installed in healthcare locations typically have many shut-off valves to isolate small areas of sprinkler systems. These valves should be located in an easily accessible area (i.e. not in above-ceiling spaces). Valves should be provided with a lock and chain, providing keys to

only those responsible for fire protection at the facility, and emergency personnel. As an alternative, the valves may be located in a locked cabinet.

These valves will require frequent visual inspections as per FM Global standards, even when provided with electronic monitoring; installing the valves in an easily visible and accessible location will help simplify this process from an operational standpoint.

#### 4.7 Special Protection Systems

Special fire protection systems (i.e., FM 200, Inergen) should be reviewed by FM Global. Manufacturer specification sheets are required for all components of the systems, along with system engineering calculations and drawings. Control logic for the system along with other interlocked functions should be submitted for review. An example of this is interlocking louvers to close. Room dimensions along with detailed drawings of any room penetrations should also be submitted for review. All systems, components, and calculation software should be FM Approved.

#### 4.8 Fire Detection Systems

Plans for fire detection and notification systems should be FM Approved. Plans for fire detection systems and component specification sheets should be submitted for review.

## 5.0 Occupancy Hazards

This section discusses typical occupancy hazards commonly found at healthcare locations.

### 5.1 Backup/Emergency Power Systems

Healthcare facilities which are provided with diesel-fueled backup/emergency power systems typically have a fuel tank and a generator in the same room. Another common layout is to have a primary tank located on a lower floor or basement, which automatically pumps fuel to a day tank and generator located on a high-floor or rooftop installation. All such installations should be designed in accordance with Data Sheet 5-23.

Locating the generator in a separate building, or outdoors is ideal. If the installation must be inside the main envelope of the building the following items should be considered:

Fire-rated partitions should be provided.

Room containment should be provided with a volume which can contain the largest foreseeable spill plus 2 inches of freeboard. Containment and curbing should be of non-combustible construction. This applies for the diesel generator room, the diesel storage room and the diesel pumping room. Design should be in accordance with Data Sheet 7-83.

Drainage should be provided for these rooms. Drainage should be to a contained system, or to a safe location outdoors. Design should be in accordance with Data Sheet 7-83.

Automatic sprinkler protection should be provided within the diesel generator rooms as well as the main tank and pump rooms.

Arrange the fuel transfer system to automatically shut down the flow of fuel in the event of a fire that exposes the tank room, pump room, generator room, or fuel piping along its path. Safety shutoff valves and/or positive displacement pumps should be used for this application.

FM Approved leak detection devices should be provided at the floor level of the main tank, pumping, and generator rooms. For hospital locations, this should shut off the flow of fuel and send an alarm to a constantly attended location with an appropriate, practiced, Emergency Response Procedure in-place.

If a diesel transfer system is being installed, other items should be provided in accordance with FM Global standards. Submit plans for all diesel fuel systems to FM Global's Plan Review Department for review.

## 5.2 Power House Generating Equipment/ Electrical Equipment

### 5.2.1 Generating Equipment

This new construction specification guide does not address risks or hazards associated with power-generation facilities located within some healthcare facilities. If any new power-generation systems are to be constructed or existing ones renovated or expanded, an FM Global Field Engineer who specializes in power generation will be assigned to review various aspects of the project throughout its duration.

### 5.2.2 Transformers

Often at healthcare facilities, large transformers will be provided with a second, redundant transformer which is capable of handling the load of the entire facility by itself. It is then crucial that a loss of one transformer does not lead to a loss of both, or any necessary switchgear. FM Global's recommendation is to use FM Approved transformers installed as per Data Sheet 5-4. If this cannot be provided, the next recommended option is to utilize FM Approved, non-flammable, or less-flammable insulating fluid in the transformers. These transformers should then be installed in accordance with Data Sheet 5-4. Specification sheets on the transformer, and insulating fluid should be provided. Use of an FM Approved transformer can reduce or eliminate the need for containment.

Use of an FM Approved less-flammable or non-flammable liquid which is also certified/ approved as being bio-degradable can further reduce the need for containment.

Physical layout and electrical drawings of transformer installations should be submitted for review by FM Global.

### 5.2.3 Boilers and HVAC Systems

Boilers should be provided with fuel-train combustion safeguards and safety devices as per FM Global Data Sheets 6-4, 6-5, 6-12, 6-22 and 6-23, depending on what type of boiler is being used.

Any high-pressure systems should be submitted along with specification packages of the boilers which power them.

## 5.3 High-Value Medical and Diagnostic Imaging Equipment

The location of high-value and highly sensitive medical equipment, including diagnostic imaging equipment should be considered early-on in the design phase as re-designs of layouts can affect many parties involved within the project.

Placing this equipment in basement levels or below grade spaces should be avoided as these areas are the first to be damaged during a flood or surface water exposure. Locating them on floors which are above grade can greatly reduce the risk associated with damaging this highly sensitive equipment.

Ensure that all building system utility lines (i.e., domestic water lines, cooling lines, sprinkler piping, medical gas lines, and vacuum lines) are not located within high-value medical and diagnostic imaging equipment rooms.

## 5.4 Maintenance Area/ Laboratory Exposures

The following sections describe some typical hazards present within healthcare facilities relating to maintenance and laboratory area exposures. These hazards should be addressed during the plan review stage by notifying FM Global's Plan Review department of any of the following areas and their specific occupancy details.

### 5.4.1 Welding

Designated welding areas or shops should be provided with a cutoff room constructed of fire rated walls. Any designated hot-work areas should be identified and submitted to FM Global for review.

### 5.4.2 Chemical Laboratories

Although storage amounts are typically small, ignitable liquids and gasses are common within chemical laboratories and classrooms within some healthcare facilities. Any ignitable liquids should be stored in FM Approved Flammable Liquids Cabinets. If drums of oil and/or ignitable liquids are planned on being stored or used within an area of the facility, detailed information of the liquids, storage arrangement and quantity should be provided to FM Global during the plan review stage of the project. Data sheet 7-29 will provide information on storage of ignitable liquids in portable containers, while Data sheet 7-50 will provide information on compressed gases in portable cylinders.

### 5.4.3 Kitchens

Details on vent ducting and special protection systems should be submitted with plans for any formal kitchen areas (cafeteria, culinary class room, etc.). Special protection systems should be in accordance with FM Global Data Sheet 4-0 and any other Data Sheets within the 4 series as applicable.

Use of plastic surfacing materials (ex. fiberglass reinforced plastic panels) should be avoided. Otherwise, only FM Approved panels should be used.

### 5.4.4 Sterilization Equipment

Dedicated sterilization areas should be identified as well as what typical sterilization methods will be used. If autoclaves are to be used, their size, usage frequency, and safety devices should be submitted within the review package to FM Global. Special attention should be given to the use or presence of Ethylene Oxide as this substance is highly flammable and can pose an explosion

hazard. If this chemical is going to be used in any quantity, its storage location, handling procedures and usage areas should be identified and submitted to FM Global for review.

#### 5.4.5 Walk-in Refrigeration Areas

Both medical use, and non-medical use refrigerated areas should be identified. Their construction should be either non-combustible or utilize FM Approved insulation panels for walls and ceiling. Sprinkler protection should be provided within these areas via either: a dry system, a pre-action dry system, dry-pendant heads attached to a wet sprinkler system, or an antifreeze system.

#### 5.4.6 Data Centers / Centralized Computer Areas

These areas typically will be protected with both a special fire protection system as well as a pre-action sprinkler system. Having a special protection system installed does not substitute the need to provide sprinkler protection for these areas.

Often these areas have a raised floor and a suspended ceiling. If special protection is to be provided, detectors and discharge nozzles for special protection systems should be located within these spaces. Automatic sprinkler protection for these areas may also be warranted depending on the loading of cables in the area. Drawings of these installations should be submitted for review by FM Global.

## 6.0 Liquid Damage Guidelines

This section discusses typical precautions that should be taken from the perspective of mitigating the potential for liquid damage related losses in the healthcare industry.

It is recommended to utilize these guidelines in the design and construction of all new facilities to reduce the potential for liquid damage to high-value equipment. Examples of high value equipment include: MRI, CAT scan, Gamma Knife, Ultrasound, computer servers, mainframes, telephone and data transmission equipment, electrical and alarm system components.

### 6.1 Location

- Do not locate high-value equipment below grade or in basements.
- Avoid placing high-value equipment directly below floors and occupancies where liquid spills can frequently occur, such as cafeterias, rest rooms, and mechanical rooms. Where unavoidable, provide protection (see below).
- Seal wall and ceiling penetrations with fire resistant and water tight materials.

### 6.2 Roofing Systems

- Use FM Approved roofing systems designed for local wind speeds to assure integrity during windstorms. Refer to FM Global Data Sheets 1-28 and 1-29 for design criteria.
- Conduct wind uplift test on new adhered roofing systems after installation to assure proper installation. Test procedures are outlined in Data Sheets 1-52.
- Size roof drains for local maximum rainfall intensity and provide secondary emergency drainage. Refer to FM Global Data Sheet 1-54 for design criteria.
- Do not run roof drain piping above or through rooms containing high-value equipment.

### 6.3 Domestic and Chilled Water Lines

- Avoid running domestic and chilled water lines in ceilings above critical equipment. Where unavoidable, provide protection (see below).
- Avoid use of threaded, flanged, gasketed, or compression fitting in rooms containing high value and electrical equipment. Piping systems should be welded, brazed or soldered.
- Provide each floor with a common supply line with a well-marked, easily accessible shut off valve. Avoid multiple interconnections. Use polytetrafluoroethylene (PTFE) lined ¼-turn valves for floor shut off.
- Label supply lines for domestic and chilled water services indicating the direction of water flow.
- Post a diagram of the domestic and chilled water lines and shut off valve locations for first responder use.

### 6.4 Automatic Sprinkler Systems

- Air test new sprinkler systems in areas with high-value equipment briefly at low pressure prior to hydrostatic testing.

- Post a layout of the sprinkler system along with the location of the control valves for use by first responders.
- Label sprinkler control valves to identify area controlled.

## 7.0 References and Resources

Data Sheet 1-28, *Wind Design*  
Data Sheet 1-29, *Roof Deck Securement and Above-Deck Roof Components*  
Data Sheet 1-35, *Green Roof Systems*  
Data Sheet 1-49, *Perimeter Flashing*  
Data Sheet 1-52, *Field Verification of Roof Wind Uplift Resistance*  
Data Sheet 1-54, *Roof Loads for New Construction*  
Data Sheet 2-0, *Installation Guidelines for Automatic Sprinklers*  
Data Sheet 3-26, *Fire Protection Water Demand for Non-storage Sprinklered Properties*  
Data Sheet 4-0, *Special Protection Systems*  
Data Sheet 5-4, *Transformers*  
Data Sheet 5-23, *Emergency and Standby Power Systems*  
Data Sheet 6-4, *Oil- and Gas-Fired Single Burner Boilers*  
Data Sheet 6-5, *Oil- and Gas-Fired Multiple Burner Boilers*  
Data Sheet 6-12, *Low-Water Protection for Boilers*  
Data Sheet 6-22, *Firetube Boilers*  
Data Sheet 6-23, *Watertube Boilers*  
Data Sheet 7-29, *Ignitable Liquid Storage in Portable Containers*  
Data Sheet 7-50, *Compressed Gases in Portable Containers*  
Data Sheet 7-83, *Drainage System for Ignitable Liquids*  
Data Sheet 8-9, *Storage of Class 1, 2, 3, 4 and Plastic Commodities*

FM Global Data Sheets are available at: [www.fmglobaldatasheets.com](http://www.fmglobaldatasheets.com)  
Approval Guide is available at: [www.approvalguide.com](http://www.approvalguide.com)  
RoofNav is available at: [www.RoofNav.com](http://www.RoofNav.com)  
FM Global Website: [www.FMGlobal.com](http://www.FMGlobal.com)

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Healthcare Industry Team

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