Fire Inspector I & II

CHAPTER NINE
FIRE FLOW AND FIRE SUPPRESSION SYSTEMS

Part 3

Slide 1	Welcome to Chapter 9 Part 3 "Fire Flow and Fire Suppression Systems" In this part we will discuss: • The purpose of standpipe and hose systems • Who should use standpipe and hose systems • Three classes of standpipe systems • Five different operating methods for standpipes including automatic and manual wet systems, automatic and semi-automatic dry systems and manual dry systems • The Inspection, Testing and Maintenance of standpipe systems in conformance with NFPA 25 • The proper location of standpipes • The need for the owner to provide accurate records of inspections and testing performed on the system • Fire suppression system testing
Slide 2	We finished Part 2 of this Chapter by concluding our look at automatic sprinklers, so we are now ready to look at Standpipe and Hose systems. A standpipe system is a network of piping that is added to a structure in order to make firefighting water more accessible. Standpipe systems are typically connected to a municipal water supply and include fire department connection inlets to allow fire departments pumper vehicles to increase the volume and pressure of the water in the system. Fire department connections can have Storz type connections for connecting fire department supply hose or can have threaded connections. Where threaded connections are provided, the connections must be of female type. Standpipe outlets are placed at designated locations to allow for fire hose connection. Standpipes are typically required in multi-story buildings but can also be used to carry water to areas that are not readily accessible or protected by hydrants such as elevated roadways, bridges and tunnels. Sprinkler and standpipe systems used to be provided as separate systems, with separate fire department connections required for each system. Modern installations often combine sprinklers and standpipes into a single system.
Slide 3	Not all buildings are required to have standpipes. The National Building Code of Canada provides guidance on when they are required to be installed. A excerpt from the National Building Code section 3.2.5.8 is provided in the Additional Resources section of this Chapter which provides details about when a standpipe system is required.

	The building code also says that the design, construction, installation and testing of a standpipe system must conform to NFPA 14, the standard for the "Installation of Standpipe and Hose Systems." The building code does however provide a few exceptions which you must be aware of especially if you are dealing the approval of a new system.
Slide 4	Standpipe and hose systems are designed to deliver water for manual firefighting through a series of pipes that reduce the need for long hose lays and decrease the time to deliver water to the fire. Standpipe and hose systems are required by building and fire codes for certain occupancies based on the size, use and height of the building. They are a series of pipes and valves strategically located that provide suppression water for use by trained occupants or the fire department. Some older buildings only have standpipe systems while many newer buildings will have a combination system, which supplies the fire sprinkler system and the standpipe system. Standpipe systems are used in large buildings or multi-story buildings to prevent long lengths of hose in stairwells and floor areas. Firefighters can bring their own hose to the fire and connect to a standpipe system and, with not more than 100 to 200 feet of hose, fight a fire anywhere on a given floor.
Slide 5	Originally standpipe and hose systems were installed in buildings for the use of the occupants. However, with changes in the burning characteristics of modern materials they are now installed for the use of trained people. Standpipes are intended to be used by **trained** individuals when the fire is in the incipient stage and there is no need for protective clothing or breathing apparatus. At the incipient stage, the fire is very small or just started and is still localized. If the fire has grown to the size of a person every effort should be made to evacuate the building closing all doors and windows so the firefighting can be left to firefighters who have the experience and equipment to safely extinguish the fire. Occupants should only attempt to fight the fire if it is small, there is very little smoke, and the room temperature is normal. The fire department must be notified before any attempt is made to fight the fire by the occupants.
Slide 6	There are three classes of standpipe systems: Class I – A Class I Heavy Stream standpipe system provides a 64 mm or 2 1/2-inch hose connection for use by the fire department during initial response. This class has no hose attached. The fire department will usually carry hose packs to the floor level, typically a stairwell, where they will connect to the standpipe system and start their operations. You should check these connections to make sure the hose thread on the outlet matches the hose thread used by the fire department.

	Class I systems should be located at the main floor landing in exit stairs, on each side of the wall adjacent to exit opening for horizontal exits, and on the top landing of exit stair towers.
Slide 7	A Class II First Aid standpipe system provides 38mm or 1 ½ hose stations. The stations should be located so that all portions of each floor level are within 130 ft. or about 40 meters from the cabinet. Class II systems supply water for use by **trained** building occupants or by the fire department during initial response. These are typically found in cabinets with 100' of hose. Previously Class II standpipe and hose systems were intended for use by building occupants and firefighters. Changes to NFPA 14, the Standard for the Installation of Standpipe and Hose Systems, now restricts this type of system to use by **trained** personnel or the fire department. Retroactivity of this standard to require occupants to be trained in the use of the standpipe is determined by the local authority having jurisdiction. For safety reasons, most fire departments discourage occupants from using the standpipe system and the fire department will not use the hose that is provided in the cabinet. For these reasons, many jurisdictions allow the hose to be removed but they still require the standpipe system to be maintained and may also require an additional portable fire extinguisher to be placed in the cabinet. Where the building is fully protected by an NFPA 13 or NFPA 13R sprinkler system, Class II hose stations may not be required subject to the approval of the local fire department and the AHJ. Your fire department should have a policy clarifying their position on this.
Slide 8	Class III - Class III Combination standpipes provide a 1 ½ " or 38 mm hose connection to supply water for use by trained building occupants and a 2 ½ " or 64 mm hose connection to supply a larger volume of water for use by the fire department and those trained in heavy water streams. Many times these connections will provide a 2 ½ " to 1 ½" reducer so either size hose can be attached.
Slide 9	Standpipe systems are either wet systems or dry systems. A wet standpipe is always filled with water which can be used by firefighters or trained building occupants. Wet standpipes usually come with a 100 ' hose so that trained building occupants may fight fires quickly. Dry standpipe systems have no water in them and are used where the water has the potential of freezing. Manually activated dry systems require the

	water to be turned on so it floods the system or water is pumped in by the fire department. Automatic dry systems are filled with compressed air so when the control valve and hose nozzle are opened the air pressure drops which allows a flapper valve to open and water to flow into the piping system. Most if not all Canadian building codes will not accept dry standpipes that are not connected to a water supply. Reference: NBC 3.2.5.9
Slide 10	There are 5 ways in which standpipe and hose systems work. They are: • Automatic-Wet standpipe systems which are filled with water at all times and are connected to a permanent water supply that is capable of providing water flow and pressure requirements. • Manual-Wet standpipes are filled with water at all times and are connected to a water supply, but the water supply is not capable of meeting flow and pressure requirements for firefighting. The purpose of the water supply is to maintain water within the system which reduces the time it takes to get water to the hose station outlets. Manual-wet standpipe systems need water from a fire department pumper or another source to be pumped into the system to meet flow and pressure requirements.
Slide 11	• Automatic-Dry standpipe systems are filled with pressurized air and connected to a permanent water supply that is capable of meeting flow and pressure requirements. It uses a dry pipe valve, to admit water into the system piping automatically upon the opening of a hose valve. • Semi-automatic-Dry standpipe, with empty pipe, is connected to a permanent water supply that is capable of meeting flow and pressure requirements. It uses a device, such as a deluge valve, to admit water into the system piping upon activation of a remote-control device located at a hose connection. A remote-control activation device must be provided at each hose connection. • A Manual-Dry standpipe system is empty and not connected to a water supply. Manual-dry systems need water from a fire department engine to be pumped into the system in order to meet flow and pressure requirements. This type of system does not meet the requirements of Canadian building codes.
Slide 12	All standpipe systems are required to be maintained in compliance with the applicable fire code and or NFPA 25 Inspection, Testing and Maintenance of Water Based Fire Protection Systems. NFPA 25 requires a weekly, monthly, quarterly, annual, 5 year and 50-year inspection testing and maintenance.

	Weekly, monthly and quarterly inspections may be performed by onsite personnel who have been trained to do them. The weekly inspection requires air pressure gauges to be checked but if they are monitored, they only require monthly inspection.
Slide 13	On a monthly basis the hose cabinets must be visually inspected to ensure that the hose is in the proper position and that all of the equipment is in place. In addition, all gauges should be checked to make sure they display the proper pressure. A quarterly inspection of the pressure regulating devices, piping, and hose connections is required. An annual inspection of the cabinet, hose, nozzle, water flow alarm connection and hose storage device is required. The hose must be un-racked and physically inspected to ensure there is no damage to the couplings, mildew or delamination of the hose and liner and it must be retracked so the folds in the hose are in a different location.
Slide 14	The hose must be pressure tested five years after its manufacture date and every 3 years thereafter. Standpipe systems must be flow tested every 5 years. This will flush the system and insure the proper operation of all the valves, piping, and the main drain. Wet systems do not require hydrostatic testing because leaks will become obvious. Dry standpipe system must be hydrostatic tested every 5 years. The hydrostatic test is at 200 psi for 2 hours, or 50 psi in excess of the maximum working pressure. Fire inspectors should review the inspection, testing and maintenance records to ensure the appropriate service work has been completed.
Slide 15	When doing an inspection of the standpipe system it is important to check the hose cabinet for signs of usage, obstructions, and leaks. In this case the door to the cabinet was screwed shut. In this case the cabinet glass door is broken, and the hose has been tampered with. The hose should undergo annual inspection and be re-racked. Standpipes and hose cabinets should be located within 5 metres of an exit and at other locations to provide coverage for the entire floor area.

	A hose station located on one side of a horizontal exit is considered to serve only the floor area on that side of the horizontal exit. That is why they are often located on both sides of the horizontal exit which provides firefighters with a fire separation between them and the fire. Hose cabinets must be located so that the door, when fully opened, will not obstruct the required width of a means of egress.
Slide 16	Standpipe systems are designed to provide water at an amount and pressure based on code requirements at the time of construction. However, the amount and pressure of water available will depend on the condition of the system including pipes and water pumps. Water in a vertical pipe creates a backpressure, also known as head pressure, which can cause excessive pressure to lower floor levels. Therefore, limits are placed on the height of a single standpipe riser, and pressure reducing valves may also be required on lower floor levels. Proper installation and maintenance of pressure reducing valves is critical as an improperly installed or maintained valve could cause dangerously high pressures in the system or could severely restrict the flow to a hose line. For class I and class III systems the minimum flow rate for the most remote standpipe is 500 gallons per minute or around 1900 litres per minute through the 2 most remote 65mm outlets. Where a horizontal standpipe on a Class I or Class III system supplies three or more hose connections on any floor the minimum flow rate for the hydraulically most demanding standpipe is 750 gpm or 2840 litres per minute. If you need to determine the water flow requirements for any standpipe system you should refer to the building and fire codes first which will take you to the applicable NFPA 14 Standard for the Installation of Standpipe and Hose Systems.
Slide 17	Water supplies to standpipe systems are supplied in the same manner as sprinkler systems. Therefore, they are: • Connected to a public water supply • Often supported by fire pumps • Sometimes require a water tank for backup supply • Supported with a fire department connection Some States within the US permit the provision of a dry standpipe system. Most of these systems would not be connected to a public water supply and would require that water be provided to the system via a fire department connection. This type of dry standpipe system is not permitted in Canada.
Slide 18	Video.

Slide 19	Some jurisdictions in Canada have allowed the hose in type 2 standpipe and hose systems to be removed based on changes to NFPA 14. The standard now says the systems are provided for use primarily by trained personnel, and because most fire departments discourage there use by occupants and the fire department will not use the hose in the cabinet anyway, some jurisdictions allow the hose to be removed.
Slide 20	In some jurisdictions the fire inspector is expected to be present and observe testing at different installation stages of a fire suppression systems Including automatic sprinklers and standpipe and hose systems. In Canada, fire inspectors are not usually required to witness these tests but should review the documentation that is required to be completed by the installation contractor's representative and witnessed by the owner's representative. NFPA has sample forms like the one shown here that can be used to record the inspection and tests that can be signed by both the contractor and the owner's representatives. References: NFPA 14 BCBC Letters of assurance
Slide 21	The following tests are provided in the order in which they would be conducted during the installation of a fire suppression system: • Water supply evaluation • The underground flush tests • The Hydrostatic Test • The Air Test, and • The Main drain tests The water supply evaluation must be conducted on the water distribution system to determine the rate of flow and pressure available for system design and firefighting purposes. The underground flush test must be conducted before the system supply piping is connected to the fire suppression system. This is to clear any debris from the supply pipe before it can enter the system. Piping between the FDC and the check valve in the inlet pipe must be flushed with a sufficient volume of water to remove any construction debris and trash accumulated in the piping prior to completion of the system and prior to the installation of the FDC. Flushing should continue until there is no evidence of foreign materials coming out of the pipe. Reference:

	NFPA 14
Slide 22	A hydrostatic test is a pressure test to check if any of the system components leak. This test must be conducted before any the system piping gets covered over by other construction features such as drywall. For this test, the main control valve supplying the system must be closed before the pipes get pressurized. The system then gets pressurized to 200 psi for 2 hours and is checked for leaks. The hydrostatic pressure is measured at the low elevation point of the system or zone being tested. An air test is required for dry sprinkler systems only and is designed to see if the system will be able to hold air pressure. The test is conducted by pumping the system pressure to 40 psi and seeing if it can hold pressure for 24 hours.
Slide 23	The main drain test is the last test to be conducted. It is a flow of the system's main drain valve to test the water supply to the system. The static pressure is observed and recorded. The main drain is then opened, and the residual pressure is recorded. The two pressures are then compared. The difference between the static and residual pressures at this point should be minimal. The main drain test is required to be conducted annually. Any substantial change in residual pressure to the water supply should be investigated. The most common cause of a significant difference between static and residual pressures are partially closed valves. With a partially closed valve or other system blockage the static pressure within the systems piping could still read within design parameters; however, once water starts flowing, the partially closed valve inhibits water flow through the system. A main drain test can be seen in the following video.
Slide 24	Video.
Slide 25	There is little value in performing a fire safety inspection unless it is documented appropriately. Usually, the local fire inspector makes notes during the inspection and prepares a report afterwards or may use computer aided technology to complete the report on site. Deficiencies noted during the inspection may require further inspection(s). Additional inspections may be performed by the same inspector or another qualified person to confirm deficiencies have been properly addressed. A clear and concise report allows the nature of the deficiency to be communicated effectively to the building owner or their representative and to other fire inspectors that may be involved in follow up inspections. A critical part of the inspection is to review inspection records or tags created by qualified technicians showing the fire protection equipment is inspected and maintained in compliance with the applicable codes and standards.

Slide 26	The inspection record must include the following: • Identification of the device or item tested or inspected. • Pass or fail rating of the item inspected and any follow-up that is required • The date of the last regular inspection, testing and maintenance • The name of the person completing the test Canadian Fire Codes require records as follows: • Where the Code requires that tests, inspections, maintenance, or operational procedures be performed on a fire safety system, records shall be made and the original or a copy shall be retained at the premises for examination by the authority having jurisdiction • The initial verification or test reports for each system shall be retained throughout the life of the systems • Records of tests, inspections, maintenance, or operational procedures undertaken after the initial tests shall be retained so that at least the current and the immediately preceding records are available No record shall be destroyed within two years of having been prepared.
Slide 27	If you do witness system tests performed by installers or maintenance technicians, you should document and record what you witnessed. The specifics of what tests the fire inspector must witness, will differ between jurisdictions so you must be familiar with, and follow, the procedures prescribed by your organization. Testing documentation should include whether a test was witnessed and passed, or if additional work and another test will be required. Where a test involves pressure testing, all pressures relevant to the test should be recorded.
Slide 28	Part 3 of the building code applies to buildings classified as Group A, B, F – Division 1, and buildings exceeding 600 m2 in building area or exceeding 3 storeys in building height. Section 3.9 of the building code is entitled “Integrated Fire Protection and Life Safety Systems” and requires fire protection and life safety systems that are integrated with each other, to be tested as a whole in accordance with CAN/ULC-S1001, to verify that they have been properly integrated. This standard provides the methodology for verifying and documenting those interconnections between building systems satisfy the intent of their design and that the systems function as intended by the Code. The Standard prescribes the methodology for verifying and documenting that all interconnection functions are installed and operating as intended.

Slide 29	The verification reports document that the installation of fire safety systems is installed and functioning according to the intent of their design. They cover a wide range of installations such as: • Fire alarms • Automatic sprinklers • Standpipes • Smoke control, ventilation and pressurization • Door hold-open devices • Elevator recalls • Smoke and fire shutters and dampers • Emergency power and emergency lighting • Fire pumps, and emergency generators A document entitled "Commissioning Active and Passive Fire Protection Systems" is included in the additional Resources section of this Chapter.
Slide 30	Once the fire protection systems are operational, they must be regularly maintained. The Fire Code is often referred to as a "maintenance document" and Part 6 is entitled Fire Protection Equipment. Part 6 includes requirements for the inspection, testing, maintenance, and operation of portable extinguishers, water-based fire protection systems, special extinguishing systems, fire alarm systems, emergency electrical power supply, emergency lighting, and exit signs. For example, the fire code says that "portable extinguishers shall be inspected, tested and maintained in conformance with NFPA 10, "Portable Fire Extinguishers. Fire alarms systems shall be inspected and tested in conformance with CAN/ULC-S536, "Inspection and Testing of Fire Alarm Systems", and water-based fire protection systems shall be inspected, tested and maintained in conformance with NFPA 25.
Slide 31	From these examples you can see that the fire code often references another document. To know which edition of the document applies you need to go to Referenced Documents section in Part One of the fire code and look for the applicable document to identify the specific edition. One of the best tools for the fire inspector are checklists to make sure that complete inspections are performed. There are numerous checklist available and we have provided several in the additional resource section of this Chapter. We have also provided a pdf copy of the FM Global Pocket Guide to Inspecting, Testing and Maintaining Fire Protection Equipment which is a handy guide for fire inspectors and building owners.
Slide 32	In Part 3 we discussed:

	• The design, construction, installation and testing of a standpipe system must conform to NFPA 14, the standard for the "Installation of Standpipe and Hose Systems." The building code does however provide a few exceptions which you must be aware of especially if you are dealing the approval of a new system. • The purpose of standpipe and hose systems and that they must be designed, constructed, installed, and testing in conformance with NFPA 14, but the building code may have some exceptions. • Who should use standpipe and hose systems. They were originally designed for building occupants but with changes in the burning characteristics of modern materials they are now for the use of trained people. • Three classes of standpipe systems • Class 1 is for heavy hose streams used by fire department personnel and is usually located in the stair tower. • Class 2 are combination systems usually located in a hose cabinet in the exit corridor which have a 38mm hose connected. • Class 3 are also combination units that have both 38mm and 64mm connections for use by the fire department. In some cases, the authority having jurisdiction allows the removal of the 38mm hose from class 2 systems to discourage building occupants from using them.
Slide 33	• Five different operating methods for standpipes including automatic and manual wet systems, automatic and semi-automatic dry systems, and manual dry systems. Most if not all Canadian building codes will not accept dry standpipes that are not connected to a water supply • The inspection, testing and maintenance of standpipe systems must be performed in conformance with NFPA 25, the Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems • The proper location of standpipes and minimum flow requirements • The need for the owner to provide accurate records of inspections and testing performed on the system And we talked about: • Water supply evaluation • Fire suppression system testing including the underground flush test, hydrostatic tests, air and main drain tests. • Documenting your fire safety inspection and the critical part inspection tags and inspection records from qualified system technicians play in the process.

	Testing of integrated fire protection and life safety systems to verify that the systems function as designed
Slide 31	Chapter quiz.
Slide 32	That's the end of Chapter 9 Fire Flow and Suppression Systems. You are now ready to move on to Chapter 10 which deals with Portable Fire Extinguishers but please complete the quiz for Chapter 9 first. If you have any questions now is a good time to contact your instructor.