STUDY GUIDE

ASCR2, ASCR4, ASC2, ASR2, ASD2

SPRINKLER ASSESSMENTS

UPDATED March 4, 2025

Incorporates 2025 updates and new study material for Request Assessments processed after April 1, 2025.

This document contains sample questions, exam subjects, and study tips to help participants prepare for the Automatic Sprinkler assessments. Other documents are required for the exams.

If you intend to take this booklet into the test, make sure it is bound in a binder or stapled. You will not be allowed to take this material into the test center if it is not bound.

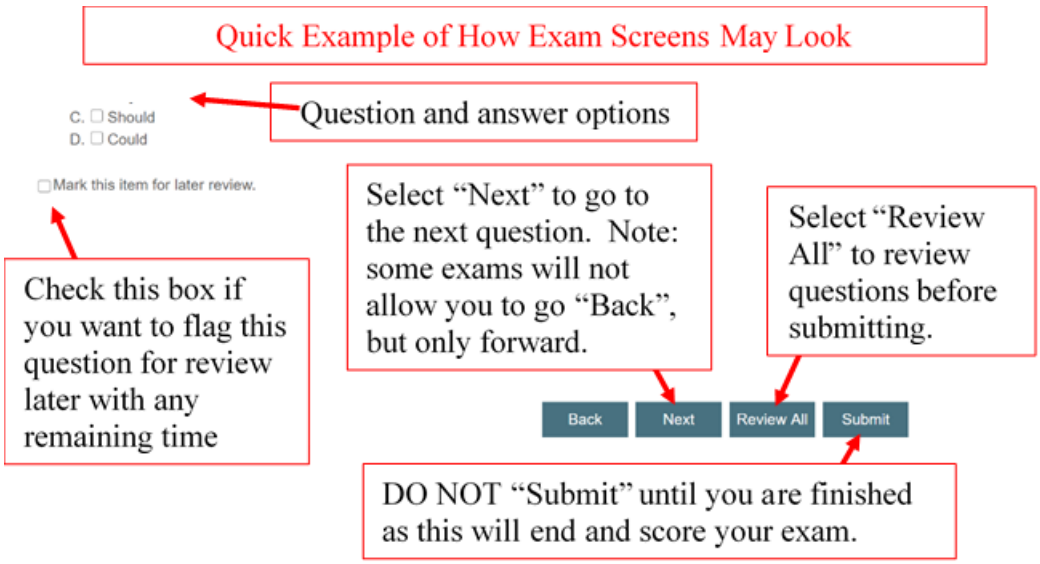
(IMPORTANT: Material provided is not intended to endorse, represent quality, recommend a particular product, or single out any product. Material may be used to provide standardized content for test questions to ensure that participants know how to use data sheets and manufacturer materials to establish listing and installation limitations of these types of products. There is no implied or other relationship between CSA and the manufacturers or suppliers of information used. CSA is not liable for accuracy or content of material contained within these documents. Material in this booklet is for testing purposes only and is not to be used for installation of these systems / components. Check with suppliers for current and specific information to be used in actual design and installation conditions.)

Important Note: NFPA 13 2019 edition was totally reorganized. Several things have moved between 2022 and 2025 editions as well. Thus, where you used to find something in previous editions it will likely be in a new location. Study accordingly.

THE FOLLOWING ARE THE ONLY MATERIALS ALLOWED IN AN EXAM COVERED BY THIS STUDY GUIDE

- CSA Study Guide ASCR2, ASCR4, ASC2, ASR2, ASD2 Sprinkler Assessments
- CSA Supplemental Sprinkler Exam Material
- NFPA 13 Standard for the Installation of Sprinkler Systems
- NFPA 13D - Standard for the Installation of Sprinkler Systems in One and Two-Family Dwellings and Manufactured Homes
- NFPA 13R - Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies
- NFPA 14 – Standard for the Installation of Standpipe and Hose Systems
- NFPA 20 – Standard for the Installation of Stationary Pumps for Fire Protection
- NFPA 25 – Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems
- International Building Code
- OSHA Control of Hazardous Energy – Lockout / Tagout
- Non-programmable calculator (at a proctoring center only)

Your exam may not require all these items, but these are the only items allowed during an exam covered by this study guide. Page 3 provides a list of what materials are required for each exam.



About the Assessments:

Assessment Abbreviation: ASCR2 (Automatic Sprinkler Commercial Residential On-Site)

Number of Questions: 101

Amount of Time for Test: 2.5-hours

Assessment Abbreviation: ASCR4 (Automatic Sprinkler Commercial Residential Business Representative)

Number of Questions: 121

Amount of Time for Test: 3-hours

Assessment Abbreviation: ASC2 (Automatic Sprinkler Commercial On-Site)

Number of Questions: 80

Amount of Time for Test: 2-hours

Assessment Abbreviation: ASR2 (Automatic Sprinkler Residential On-Site)

Number of Questions: 40

Amount of Time for Test: 1-hour

Assessment Abbreviation: ASD2 (Automatic Sprinkler Domestic On-Site)

Number of Questions: 30

Amount of Time for Test: 1-hour

Exam format: Open book (bring your own books); You are allowed to provide your own basic non-programmable calculator for pressure loss calculations at a physical testing center (not online). Scratch paper or an online split screen will be provided for calculations at a physical center. Any books or exam documents brought into exam must be bound as no loose papers are allowed. Your books may be highlighted and pages tabbed with permanent tabs before the exam. Do not mark in books during exam.

Passing Score: 80%

Cell Phones: Do not bring cell phones, pagers, or radios into the test center/room.

Code editions are applicable to exams that were "REQUESTED" on or after April 1, 2025. If you submit a REQUEST prior to April 1, use the older editions from older study guide.

Codes / Materials Used for Exam and Editions: Questions are validated to these editions.

- NFPA 13 2022 / 2025 - Used on ASCR2, ASCR4, ASC2
- NFPA 13R 2022 / 2025 – Used on ASCR2, ASCR4, ASC2, ASR2
- NFPA 13D 2022 / 2025 – Used on ASCR2, ASCR4, ASR2, and ASD2
- NFPA 14 2024 – Used on ASCR2, ASCR4, ASC2
- NFPA 25 2023 – Used on ASCR2, ASCR4, ASC2, ASR2
- NFPA 20 2022 / 2025 – Used on ASCR4
- Non-programmable calculator (for physical testing locations only) Online calculator is provided.
- **Supplemental Sprinkler Exam Material** from our web site. This document includes CPVC installation manual, sprinkler data sheets, other data sheets, and Occupational Safety and Health related material on confined spaces and Lock-Out-Tag-Out. Used on ASCR2, ASCR4, ASC2, ASR2, & ASD2.
- Either 2021 or 2024 International Building Code is used on ASCR4 only. Questions are based on the model code and do not reflect local amendments or changes.

Important Candidate Information

YOUR SCORE & PRINTING SCORE REPORTS

All scores provided at the end of your exam and in your score email are "preliminary". Exams are subject to review of audio / video recordings, or concerns raised by proctors.

Your preliminary score will be automatically emailed following the exam. Candidates may also log into their Webassessor account to view/print score reports. Use the link and info in your scheduling emails.

Score reports for failed exams will provide a breakdown of scores by topics/subjects within the exam. Your overall score determines Pass/Fail. However, the topic scores help to identify areas that need more attention when studying. Topic scores will not be provided on Pass emails.

Taking Materials Into Exams

CSA exams are open book. You must provide your own books and required exam materials. Check this guide to verify what editions exams are based on. All material must be bound (no loose papers). Other than items listed on Page 2 of this guide, do not take other items into the exam. You can take basic non-programmable calculator into a physical location. On-line exams will have calculator on screen.
Page tabs must be of permanent type. Do not mark in any materials during an exam.
Phones, radios, pagers are not allowed in exam rooms, please leave these in your vehicles.

Photographs

Your photo is required to be submitted to CSA with your initial registration request. This photo may be used by proctors to verify who is scheduled for the exam. Although not required, you may want to wear a company shirt/logo for your picture. Pictures are cropped to best fit ID card, so there is no guarantee the logo will show. You will be recorded and a photo may be taken during exam sessions.

Respectful of Others

At a proctoring center, please be respectful of others taking exams by minimizing noise and interruptions. If you have any exam or computer problems, please notify the proctor so they can assist. If necessary, the proctor can log a report for further investigation. Please notify CSA so we can look into the problem.
If taking an Online proctored exam, please make sure others know to not interrupt. Your exam may be terminated and require new payments for interruptions or suspicious behavior.

Proctoring Options

You have two options for proctoring. Online proctoring where you use your computer and USB webcam to take the exam with a proctor watching you via camera, or at a physical proctoring center. See website for info.

How to Request Your First Exam / Assessment

First, download study material and get the required codes / standards needed for your exam.
Then, review our website to understand the options for proctoring, and decide which option works best for you.
You are required to pay for your assessment and submit a picture at the time of submitting the request. Have payment and a photo file ready.

To start the process, you must "Request an Assessment" from www.CSAexams.com. Within 1-3 days you should receive an email with information to schedule your exam. Make sure you are requesting and paying for the correct exam as there are no refunds.

Cancel or Rescheduling an Exam

To cancel or reschedule an exam you must log back into the system where you scheduled the exam, or using links at www.CSAexams.com under Contractor Info. Online Proctored exams require 24 hrs and Proctoring Centers require 72 hrs notice. If the system will not give you the option to Cancel / Reschedule than you must show up or forfeit your fees. There are no refunds.

If You Fail an Exam

If you fail an exam, you must Request a new Assessment and make full payment from www.CSAexams.com. Within 1-3 days you will get an email to schedule your exam.

When you Pass an Exam

ID cards and certificates will generally be mailed out within three weeks. They will be mailed to the address provided when requesting the assessment. If the address has changed, please email CSA with new address.

If You Need a New ID Card

To change the company name, change your last name, or if you have lost your card, go to www.CSAexams.com and select Replacement ID link. Exams are good for 3 years. Then a new exam is required for renewal.

Please report cheating to the proctor or CSA.

General Assessment Information:
About the Questions: Questions are randomly selected from respective topics within a larger database.

Exam Format: Questions are computer based and will be delivered one at a time. You will have the opportunity to go back and review all questions after you are finished. You can also "check" a box within each question which will flag it for later review. During the review, checked questions will be marked for easier identification.

Time Clock: Most assessments will have a count-down timer displayed on the screen. Do not steadily watch the clock, but rather use it as a general guide.

Correct Exam: When requesting an exam, make sure to select the correct exam. There are generally no refunds for requesting and paying for the wrong exams. Make sure the exam is correct for the jurisdiction you will be submitting qualifications to. The most common exam required by jurisdictions is the ASCR2.

Renewal: All CSA qualifications expire in three years from the month taken. Make sure to keep up with your expiration dates. Retesting is required to renew your qualifications. So, make sure to allow enough time to study and schedule your exams before expiration.

Calculators: You are allowed to take a basic non-programmable calculator into a physical proctoring location. You cannot use your own calculator for an online exam. An on-screen calculator and note section will be provided for the online exam.

Online Exams: Online exams have risks that CSA cannot control. Due to the high-stakes nature of our exams, a specific software is required to lock-down the candidate's computer and provide a video signal to the proctors. It is very possible and a good chance that an internet blip during an exam may drop the video signal. If this occurs, the candidate will be instructed to exit the exam and reboot the computer. You will not lose time and you will start where you left off. However, you will be required to wait in queue again for the initial security screening of your ID, books, the room, etc. This can take on average 15-45 minutes each time. We are aware of exams where this has occurred a couple times. It is frustrating / stressful for the candidate and resulted in a considerably longer exam. CSA strongly encourages candidates to take exams at a physical proctoring location whenever possible to avoid these challenges. If you select online exams, you assume the risk that comes with it. CSA is not liable for lost work time, or lost fees to retake the exam. Before taking any online exam you must review all requirements and required equipment on the website under Proctoring Options and Webcam Tips pages.

ASD2 Notes: Those taking the ASD2 will be tested on NFPA 13D, calculations, sprinkler head spacing questions, and materials from our Supplemental Sprinkler Exam Materials document from our website. The Supplemental Materials document includes the CPVC installation manual and sprinkler head data sheets. Much of the information in this study guide will not apply to your exam. Although all of it will help better understand sprinkler system requirements, you will want to go through it and focus on content related to NFPA 13D, calculations of friction loss and elevation, and sprinkler spacing concepts and limits. Critical ASD2 criteria is up through #18 on Page 8.

Following each assessment, the score report will provide a score for each of the topics used in a particular exam. The number of questions within a topic will vary. Some topics may have 2 questions or 20 questions. Here are sample question topics for the ASCR2 exam.

NFPA 13 General
NFPA 13 Spacing
NFPA 13 Systems
NFPA 13 Sprinklers
Calculations
NFPA 13 Hangers
NFPA 13 Definitions
NFPA 13 Seismic
Manufacturer Listings (Datasheets)
NFPA 25 General
NFPA 14 Definition
NFPA 14 General
CPVC
NFPA 13D General
NFPA 13R General
NFPA 13R Sprinkler
OSHA

The following questions are related to the sprinkler assessments. Some of these sample questions will have the answers, and most will not. Some will provide an explanation on how to calculate. There is also information that describes topics to study without any specific questions. Questions will often start off with an indication of the book or standard that the question is based out of, such as [NFPA 13]. We suggest that you tab sections of your code books with permanent tabs to help find them faster. We recommend that you purchase and use "handbooks" when available, such as the NFPA 13 handbook. These handbooks provide the code language in addition to other beneficial theory, examples, figures, and more. Many items can be searched on the internet and you can find examples or discussions. Use judgement and be careful as there are things on the internet that are not correct per code or current code. Exams are validated on the editions identified on page 3.

1. [NFPA 13] A contractor is allowed to make deviations from approved plans without getting the permission of the Authority Having Jurisdiction (AHJ).
   True
   False

2. Understand Response Time Index (RTI) – Also see "Thermal Sensitivity", and General Sprinkler Characteristics" in definitions to understand how it impacts sprinklers and heat detectors, such as used for elevator shunt-trip vs. sprinkler activation. See A.3.3.223.2 in 2025 edition. Understand quick response vs. standard response, vs. fast response (residential). Understand the Primary function of Residential Sprinklers (see annex for residential sprinklers).

3. Review and print the datasheets in the Supplemental Sprinkler Exam Material on the CSA website under Assessment Subjects – Sprinklers. This document will be required for the exam. In it you will find several datasheets for particular products, along with other materials. The intent of these questions are to verify that the candidate can interpret the specific listing limitations for a particular product based on the information asked in questions. Example, distances from the deflector to the ceiling may be different than NFPA criteria. The minimum head pressures (pressure at the remote head) vary based on the size of the room to be protected. The spacing between sprinklers and walls are impacted by extended coverage heads and the area they cover. The number of bends allowed in a flexible sprinkler hose are restricted based on the length and criteria applicable to the project. Although these items should have been identified and addressed by the designer and clearly communicated to the installer on shop drawings,

this often is not the case. Therefore, many issues and failed inspections can be avoided if the installers understand these limitations specific to a products listing.

4. Most exams have questions from NFPA 13D and 13R related to sprinkler spacing, limitations, FDC's, flow alarms, garage sprinklers, temperature ratings around sources of heat, pressure testing, inspector tests, and other material that are different than NFPA 13 criteria. Candidate needs to understand the difference and scope of NFPA13D and 13R from that of NFPA 13. By understanding what each of these codes is intended for will help to understand why they have the differences. Reading and understanding the Scope of each standard in 1.1, the Purpose in 1.2, and the Annex material to the Scope and Purpose will help understand the intend and thus trade-offs.

5. For NFPA 13D make sure to review Chapters 3, 5, 6, 7, 8, 9, 11. Understand the difference in isolation valves, temperature ratings, spacing, obstructions such as ceiling fans, system pressures.

6. For NFPA 13R make sure to review Chapters 1, 3, 5, 6, 9, 10, 11. Understand the differences between 13 and 13R, sprinkler placement including sidewall heads, temperature ratings around sources of heat, water supplies and connections, obstructions, soffits and cabinets. A change in 2025 adds 6.9.2.1 which requires that 13R risers sized 2.5" or larger have drains in accordance with NFPA 13 based on riser size.

7. [NFPA 13] The maximum allowable area of coverage for an individual standard spray pendent or upright sprinkler in an open office environment is (10.2.4 – 2025): [candidate needs to identify if this would be a light hazard or ordinary hazard space based on description.]
   200 sq ft
   225 sq ft
   400 sq ft
   130 sq ft

8. The question above provides a code reference (10.2.4) and lists the code edition 2025. A few questions will provide a reference such as to a table to help you find the table quickly. Some questions might provide a more general reference such as (10.2) and you would have to review the sub sections to find that 10.2.4 is the applicable statement. Most questions will not have such a reference, so do not plan on this being provided. Make sure to review and tab your book (with permanent tabs) to help find critical tables as you study. Use such references as a tool and do not rely on them due to their limited use.

9. Be able to recognize the differences between the area a sprinkler covers, the distances between branch lines and along the branch lines, and the distances from a wall that are all related to this area of coverage for a particular sprinkler in a particular hazard. Example: If a sprinkler only covers a certain square footage, then if the sprinklers are closer in one direction they may be further in the other direction (to a limit). There is also a limit as to the spacing from a wall, including irregular shaped rooms or corners.

10. When looking at a code section, **ALWAYS continue to read past the particular section**. OFTEN there will be an exception to the rule within the next few paragraphs that changes the condition or allowance. So do not stop at the first paragraph without looking down to see if there is an exception or other related condition.

11. The test may have many questions related to hangers, hanger attachments, lag bolts, pre-drilling, screws, anchors, trapeze hangers, etc. This includes post installed hangers in concrete. When hangers are required for flexible hose.

12. The use and application of dry-barrel sprinklers. Where they could be used. The length of the barrel based on the temperatures of the pipe and the sprinkler. Sealing around the penetration. NFPA 25 requirement for replacement of the heads and frequency. Consideration of how the heads will be replaced – such as how will you get a wrench on the back fittings to replace as required by NFPA 25 when they are concealed in walls or not accessible.

13. [NFPA 13] A sprinkler is listed to have a spacing of 15 feet between sprinklers. The maximum spacing this sprinkler may be from the corner of a room is:
    7.5 feet
    10 feet
    11.2 feet
    15 feet

14. Many of the limitations regarding CPVC pipe are found within the manufacturer listings. Download the Supplemental Sprinkler System Manual from our site and be familiar with the Spears requirements in it. Some common questions include deflection, hangers, cure time, and other material.

15. Pay close attention to CPVC cure times for new installation vs Cut-in or repair of existing systems.

16. Pay close attention to the CPVC diagrams as there may be a requirement in the diagram to take 1/2 of the dimension used in a table.

17. The CPVC tightening of flanges are typical concept when tightening any round object such as a flange or installing a tire on your car. Understand the concept related to the sequence of tightening the bolts.

18. NFPA standards, such as NFPA 13, 13D, 13R, apply to the installation of a system once another code such as the building code requires the system to be installed. Building codes may also provide exceptions to or additional specific criteria when something can be omitted based on certain conditions. This could include protection on balconies, or similar locations. Local amendments can also have specific requirements such as for garages of residential homes, requirements due to grade or access limitations for the fire department to reach a house, monitoring of systems, isolation valves for shared sprinkler and domestic systems, or similar conditions.

19. Be able to identify specific limitations and criteria of the NFPA 13 small room rule, including area, distances, openings, etc. This criteria is found in multiple locations in code. There are several questions related to this. Review the following sections at minimum:

    a. 3.3.38 Compartment (and FAQ 3.3.38 in Handbook) [3.3.43 in 2025]
    b. 3.3.196 Small Room [3.3.214 in 2025]
    c. 10.2.4.1.2 (and FAQ 10.2.4.1.2.1 in Handbook)

d. 10.2.5.2.3 (including Figures in handbook) [10.2.6.2.3 in 2025]

20. Be able to identify the different types of systems including dry-pipe, preaction, deluge, single-interlock, double-interlock, etc. What are pilot line detection systems – water and air pilot lines. Return bends and when / why required. Review annex material to identify where dry pipe systems are intended.

21. Identify the types of air supply, regulators, monitoring pressure, wiring, switches, etc. for dry-pipe and preaction systems. Includes how they are to be connected by power and the air connection. Criteria for using nitrogen vs. compressed air. Trip pressure per NFPA 13 vs minimum indicated on mfg datasheets. Be careful of what the question is asking, such as per NFPA 13 or minimum per the datasheet.

22. Be able to identify the time-to-water and volume limitations of dry-pipe systems. How many test points are required based on size of systems.

23. Seismic requirements are heavily based on soil conditions that the building is constructed on, and not just seismic activity locations. As such, seismic criteria often apply even far from active faults. Be able to identify criteria related to hanger bracing, flexible fittings vs. rigid fittings, over-size of holes through floors and walls, understand "frangible construction" for holes, etc. Understand flexible couplings and the amount of axial displacement, rotation, and angular movement allowed (3.3.83-2022; 3.3.87-2025; 18.2). See Chapter 18. Also review Annex A material to Chapter 18.

24. Understand criteria and limitations of Ceiling Pockets. See 3.3.25 [3.3.30 in 2025], Annex material to this section, and commentary in the Handbook. Also see 10.2.9; 11.2.8; and 19.3.3.2.3.1(4).

25. [NFPA 13] "A sprinkler system employing automatic sprinklers attached to a piping system containing water and connected to a water supply so that water discharges immediately from sprinklers opened by heat from a fire", is the definition of:
    Preaction system
    Dry Pipe system
    Wet system
    Deluge system

26. When installing threaded fittings, thread compound should only be installed on the male threads. (Refer to mfg instructions for thread compounds.)
    True
    False

27. [NFPA 13] If a section of pipe has a friction loss of 0.3 psi per foot, how much pressure would be lost in a 60 foot horizontal section of pipe? {It is critical for the installer to understand how friction loss impacts a system. Installing the wrong size or type of fitting in a system could drastically impact the pressure and thus performance within the system.}
    30 psi
    0.43 psi
    42 psi
    18 psi

28. [NFPA 13] You are installing a 3-foot flexible sprinkler drop with a friction loss equal to 53' equivalent length 1"-inch schedule 40 pipe. Based on the flow, if the friction loss in 1" schedule 40 pipe is 0.13 psi/ft, what will be the total friction loss through the flexible line?
    5.3 psi
    6.89 psi (correct)
    6.0 psi
    7.0 psi

29. A standpipe riser is 150 feet tall and full of water. Assuming that the pipe is not connected to a water supply, what would be the pressure at the bottom of the riser due only to elevation of the column of water? (The intent of this question is to identify how elevation impacts pressure.)
    43 psi
    65 psi (correct)
    100 psi
    4.3 psi
    {Tip: Every foot in elevation adds 0.433 psi of pressure.}

30. Understand how to apply the "three times rule" with respect to sprinkler spacing around obstructions such as a column within 8 inches of a sprinkler, or an upright sprinkler located on an 8" main. In 2022 see 10.2.7.2.1.3, 10.2.7.2.1.4, and other sections in 10.2.7.2. In 2025 see similar criteria but moved to 10.2.8.3.1.4. Also see Annex A material to these sections and commentary in Handbook.

31. A menu board is hanging from a ceiling and creates an obstruction from the ceiling to 14 inches below the ceiling. How far must a standard spray sprinkler be located from the menu board to avoid obstructing the spray pattern?

32. [NFPA 13] A solid privacy curtain in a hospital is located 26 inches to the side (horizontally) of a sprinkler. What is the minimum distance (vertically) below the deflector that the top (solid portion) of the curtain must be to avoid an obstruction?

33. A sprinkler is located 6 feet in front of an electric unit heater. What should the temperature rating of the sprinkler be? There are a number of questions related to sprinkler temperature ratings around sources heat and these are frequently missed, but real-life problems for inspectors with field conditions.

34. In what direction should the frame arms of upright sprinklers be orientated with respect to the pipe they are installed.

35. Where sprinklers are allowed to be omitted from bathrooms, NFPA 13 has a specific requirement that should be verified in the field during installation. See 9.2.3.1.1 and annex A.

36. Protection for elevators. When sprinklers are required and where they are required. **Note that there was a significant change in the 2025 edition of NFPA 13 for elevator pits in that sprinklers are no longer required in elevator pits (deleted from 9.3.6.2 and handbook commentary).** Also understand how elevator pits are treated by OSHA. See supplemental sprinkler document on CSA website for OSHA criteria.

37. Vacuum Dry and Preaction systems are new and have been incorporated into the 2025 edition under 3.3.222.10 and 8.11. This will not be tested in the 2025 exams.

38. The 2025 edition has considerable changes for Supplemental Sprinklers, such as under obstructions over 4' (9.5.5.3.3 and in definitions). This will not be tested on in 2025 exams.

39. Since January 2021 new actuator requirements exist for pre-action and deluge actuators.

40. The 2025 edition has changes impacting K-factors and area increase for ceiling heights over 30' (19.2.3.2.5; 19.2.3.5.2). These will not be tested on in 2025 exams.

41. The 2025 section on dry pipe systems was rewritten for better sequence. It also incorporates new requirements for air compressors and nitrogen generators which includes that cord-and-plug or general purpose switches can no longer be used for disconnecting means, and new wiring requirements per NEC.

42. Effective with the 2025 edition of NFPA 13, an as-built documentation cabinet is required to be provided at an approved location.

43. Understand concepts of storage commodities, encapsulated vs. non-encapsulated, how temperature ratings of sprinklers can impact protection of high-piled storage, what a draft curtain is, how elevation of racks impacts protection, impact of plastics, expanded vs. nonexpanded plastics, idle pallets, wood vs. plastic pallets, sprinkler protection of columns within racks, etc. We recognize that installers are not designers and rack storage systems get very complex. However, it is critical that an installer recognizes that conditions on the job site may not match what the system was designed for. Therefore, it is important to understand general concepts to be able to recognize potential problems needing the designer's attention. We recommend review of Handbook commentary for storage starting in Chapter 20. A candidate will not fail an exam due to storage related questions. However, there are questions related to general storage concepts that could be missed.

44. Rack storage zone valves, shielded sprinklers and where to be used, temperature and response for general storage sprinklers (9.4.2.7). Objectives of ESFR sprinklers and obstruction rules. Most ESFR systems are installed improperly due to obstruction rules.

45. Rules regarding sprinkler installation in spaces with High Volume Low Speed Fans.

46. The third floor of a five story building has doors that open into the stairway from both the left and the right side of the stair. The second, fourth, and fifth floor each have one door opening into the stair. The first floor has one door opening into the stair, and one door to the outside. Which landings are required to have sprinklers installed? The stair is non-combustible and has non-combustible stairs.

47. There will be several questions related to obstructions around sprinklers. They may include soffits, suspended objects, walls that do not go all the way to the ceiling, curtains in hospital exam rooms, etc.

48. Depth of bury for underground fire main supply to sprinklers per NFPA 13.

49. Flushing of underground mains and what flow / velocity is required based on pipe size. When the flushing must occur. Flushing systems with fire pumps. What tools / equipment are used to verify the flow rate. Although it is common in some regions for utility contractors to install and flush undergrounds, sprinkler contractors do the work in some regions. Because most regions do not test/train the utility contractors, we see that flushing is seldom done properly. This leaves rocks and trash in the system for the sprinkler contractor when you perform the backflow forward flow test which requires the same tools and procedures.

50. Backflow preventer forward flow testing and how to measure the flow per 6.11.2.5. Provisions for performing this test per 16.14.5.

51. There will be questions related to obstructions such as beams, bar joists, and wood trusses. Review and understand “obstructed construction” and “unobstructed construction” including explanations in Annex A.3.3.46.1 and A.3.3.46.2 in 2025. Review smooth ceiling conditions with obstructions.

52. [NFPA 13] Bending of pipe is permitted as long as it complies with all the criteria of NFPA 13 providing there are no kinks, ripples, distortions, reductions in diameter or any noticeable deviations from round.
    True
    False

53. [NFPA 13] The depth of underground pipe such as under driveways, railroad tracks, and with respect to frost lines.

54. [NFPA 13] In supporting 5" pipe with a Threaded Bolt Connection (TBC), all-thread rod and ring hangers, the all-thread rod diameter shall be at least:
    1/4"
    1/2"
    3/8"
    3/4"
    5/8"

55. [NFPA 13] The code requires that unless certain conditions are satisfied for obstructions, the sprinkler must be spaced a minimum distance equal to (#) times the maximum dimension of the obstruction. An upright sprinkler is to be installed into the top of a section of pipe having an outside diameter of 3 inches. What is the minimum distance the deflector must be located above the pipe?
    18 inches
    No minimum, just distance of fitting.
    4 inches
    24 inches
    9 inches

56. There are questions with respect to pipe-schedule systems, including the number of sprinklers served by respective size pipes. This is critical in renovating existing systems and also related to understanding hydraulic sizing getting larger towards riser.

57. Spacing of sprinklers under slopped ceilings and peaks.

58. Identify the sizing of drains from risers and when multiple risers tie into a common drain riser.

59. The maximum floor area on any one floor protected by a single riser or zone control valve based on hazard. Understand limitations of areas that can be isolated as well as limiting the area covered by a sprinkler flow switch for quick notification. This also impacts systems serving mezzanines and rack sprinklers. See 4.5.

60. Understand anti-flooding devices, quick-release devices, air-regulators, air maintenance devices, etc.

61. Understand the roles of the AHJ, who can be an AHJ, the roles of NFPA, UL, Factory Mutual, etc. Review NFPA 13, 3.2.2 and A.3.2.2, along with 3.2.3.

62. See the CSA Sprinkler Assessment Subject page (at bottom) for additional information on Listings and Approvals.

63. Some tests including ASCR2 will have questions from NFPA 25 related to Inspection, Testing, Maintenance (ITM) of water-based suppression systems. Review this information and be familiar with what is required to maintain systems. Better understanding of ITM can significantly improve reliability of a system and future service and maintenance. Review in detail about Impairment plans and procedures for working on systems. We recognize that a lot of installers do not do inspections and maintenance – normally. However, they do get involved in additions and renovations, along with repairs of existing systems or frozen / damaged systems. In addition, all new installations are required to include/provide the owner with a copy of NFPA 25. Installers should be familiar with what NFPA 25 is and its intended scope.

64. Common NFPA 25 questions include impairments, hydrants, preaction and dry valves, diesel fuel and testing, bypass flow meters, operation of valves, fire pump run times and frequency, damaged / impaired sprinklers, internal inspection for corrosion / plugs, signage, quick-opening devices. At minimum, review Chapters 3, 4, 5, 6, 7, 8, 13, 14, and 15.

65. There are several questions from NFPA 14 regarding standpipes, Class I/II/III, types, automatic vs. manual, wet vs. dry, location of valves. At minimum review Chapters 3, 7, and 8.

66. ASCR4 assessments will have questions from the International Building Code (IBC) with respect to sprinkler system requirements, standpipe requirements, water supplies, type of system required for area increase (IBC 506), etc.

The above provides a representation of sample materials on the test. The participant is responsible for reviewing all relevant code criteria. Some material may be taken from Annex "A" of the respective code. Make sure to understand how to identify material in Annex "A". Handbooks will contain this Annex material adjacent to the applicable code paragraph making it easier to find.

The following are the most commonly missed items:

- Seismic fittings and pipe penetrations
- Temperature rating of sprinklers around sources of heat
- Obstructions to sprinkler discharge such as columns, signs, exam room curtains
- Sprinkler spacing, area of coverage, spacing between, spacing from walls
- Small Room rules and compartments
- CPVC cure times new vs. cut-in
- CPVC Basement / exposed installation
- CPVC hanger spacing and bracing
- NFPA 25 Impairments
- NFPA 14 Class of standpipes
- Calculations understanding friction loss and elevation pressure

LEASONS LEARNED:

It is frustrating to take these exams multiple times and not pass. Here are some thoughts that we have heard/shared with candidates that struggle with exams.

- Don't focus on just getting an 80% passing score. To your customers you still installed 20% of the system wrong! Aim for 95%.
- Put your eyes on every single item identified in this study guide. Even if you think you know. Often, we learn the wrong things from others passed down through the years, and things have changed from 20 years ago. Make sure you personally have reviewed the specific requirement in the code and the exceptions to the rules. Always read past the first code section to see what the exceptions or alternatives are.
- Don't read more into the question than what is provided. We are not trying to trick you with questions, so focus on what is provided. Mose items are nearly word for word from the code.
- Read the questions carefully. There are some questions that have extra information to help draw a picture of the condition, and some of that information may not be relevant to the final question and answer. Focus on what the question is asking, and you may be able to ignore some of the other information helping to set the scenario.
- Have weekly training sessions within your company. With weekly safety toolbox meetings, incorporate items from the code. Have each installer research and present on a weekly code topic. Every code expert will tell you they learn something new every time they get into the code. Items can even be discussed to/from jobsites or during breaks. Quiz each other during the day.
- If you struggle with test anxiety, research calming methods. There are great resources online and YouTube videos with concepts and approaches to help with test anxiety and to improve test taking skills. The best calming method is to study ahead of time and being prepared.
- See if your employer has incentives for getting high scores, such as above 90%. Maybe extra pay, half-day off for a 90%, and full day for a 95% (if you pass the test the first time). Your code knowledge saves companies money in identifying issues early vs. failing inspections.
- Be able to recognize problems during the installation and take steps to fix the problem before inspections. Such as spacing, obstructions, filed changes, etc. There is nothing more rewarding to an inspector than a contractor showing them a problem that you the

installer identified and what steps you took to correct it before they got there. Minor things can typically be addressed in the field and marked up on as-built drawings. Others involve a call to the designer. Either way, the objective of your exam is to be able to identify and correct the situation.

- Go look at other jobs within your company. Take turns providing quality control inspections of each other's jobs. Another set of eyes often identifies concerns and/or learning opportunities.
- Make sure designers are getting out in the field to see and learn from the installers about field challenges. This helps the designer to better detail and identify concerns in their designs. It also helps installers to understand what the designer was anticipating, or thought was happening. Many designers work remotely and have not been in the field in years. Designers should always ask the installers at the end of a project "What could I have done differently?" This allows the installers the opportunity to identify challenges they faced that were not anticipated, should have been identified, or could have been clearer on the drawings.

<u>The following are some additional questions that may be found on the ASCR4 exam but would be useful for others to understand.</u>

FIRE PUMP AND PRESSURES

You are installing an underground fire main between a remotely located private fire pump and the buildings sprinkler riser. The civil plans require that you provide a pipe with a pressure rating for the normally anticipated pressure on the system once the sprinkler contractor sizes the pump. The sprinkler contractor will not be installing any pressure control devices.

The normal static city supply pressure to the pump is 40 psi.
The sprinkler contractor is providing a pump rated at 75 psi at 1,000 gpm.
The fire pump will deliver a normal churn pressure (pressure when water is not flowing) of 120%.

What pressure rating of pipe is required between the pump and the building riser?
150 psi
175 psi
200 psi

Answer:
The pump is rated at 75 psi. Churn pressure is the pressure that a fire pump will deliver when it is running and not flowing any water. This pressure will often be around 120% of the rated pressure. Thus, if the pump is rated at 75 psi and has a churn of 120% it will produce a discharge pressure of 90 psi. This is the pressure with no added pressure on the suction side of pump. Now you must add the suction pressure to the pump pressure to get the final discharge pressure. Thus:

Final discharge pressure at churn is (40 psi city pressure) + (90 psi churn pressure) = 130 psi.
The piping running between the pump and the building must be rated at least as high as the city + pump pressure. Therefore, the piping must be rated for at least **150 psi**. The pipe rating must be above the final discharge pressure.

If the city supply was 70 psi and the fire pump was rated at 100 psi with a 120% churn, the following would apply.
(100 psi x 1.2 churn) + (70 psi city pressure) = final discharge
(120 psi at churn) + (70 psi city) = 190 psi which would require a minimum 200 psi rated pipe.

FIRE PUMPS AND PRESSURES
A fire pump has been installed on a supply pipe between the street tap and the building. The fire flow at the street has a static pressure of 70 psi and a residual flow of 55 psi at 1,000 gpm. The sprinkler contractor has selected a fire pump rated at 90 psi at 1,000 gpm. No pressure reducing valves have been provided. Assuming the sprinkler system is flowing 1,000 gpm, what is the discharge pressure at the pump? The pump has a churn pressure of 120%.

Answer: Pumps boost pressure. In this question the flows are consistent, and the question is based on flowing water or residual pressures. If the flows are the same you simply add the pressures of 55 psi suction + added pressure the pump provides. However, if a pump is rated at ## psi at a flow of #### gpm, then that same pump will produce a higher pressure at churn, or no flow. Churn is the condition when the pump is running, but no water is flowing. As such, the pump places a higher pressure on the pipe system.

a. Using the information in the question above calculate the following: The fire pump develops a churn pressure of 120% of the rated pressure. What is the discharge pressure of the pump at churn during the weekly automatic pump test?

   Answer: The churn pressure of the pump by itself (no city pressure) is 90 psi x 1.20 (or 120%) = 108 psi. The question asks for the discharge pressure during the weekly automatic pump test. This indicates that the system is open to the street pressure which provides a static pressure of 70 psi on the suction side of the pump. Thus, you have to add the static pressure of 70 psi to the pump churn pressure of 108 psi to get 178 psi discharge pressure.

b. The civil engineer did not specify a pressure rating for the pipe as he/she did not know what size pump the sprinkler contractor was going to select. Using the information above, what is the required minimum pressure rating of the underground pipe between the pump and the building? Select the appropriate option below.
   1.) 100 psi
   2.) 150 psi
   3.) 200 psi

   Answer to 6b: Based on the answer from question “a“ we identified that the pump churn during the weekly testing will be 178 psi, which is above 150 psi. Therefore, the pipe must be rated for 200 psi. (This churn pressure of 178 can also create issues for the sprinkler contractor as many of his fittings/sprinklers are only rated for 175 psi. This issue is not addressed here).

FRICTION LOSS
A sprinkler system has a hydraulically calculated demand of 250 gpm at 50 psi at the riser. The available flow at the street is 250 gpm at 60 psi. The equivalent length of run (including fittings, valves, etc.) from the street to the riser is 200 ft.

Using the information below, what is the minimum size supply pipe needed to supply this system? Assume that any safety factors have already been included in the riser demand.
Friction loss:
3" = 0.0426 psi/ft
4" = 0.0107 psi/ft

a) 3 inch
b) 4 inch

Answer:
From the information in the question we see that the street pressure is 60 psi and that the riser must have at least 50 psi to work. This tells us that we cannot lose more than 10 psi between the street connection and the riser (60 psi – 50 psi = 10 psi). Therefore, we have to select a pipe that will not drop the pressure more than 10 psi over the 200 feet. The best approach is to calculate the friction loss for each pipe size over the 200 feet and see what the smallest pipe size can be without going over 10 psi.

3" pipe (0.0426 psi/ft x 200 ft = 8.52 psi
4" pipe (0.0107 psi/ft x 200 ft = 2.14 psi

We see that the 4 inch pipe only has a pressure loss of 2.14 psi so this pipe results in the least friction loss. However, the question specifically asked <u>what is the minimum size supply pipe needed to supply the system</u>? Because the 3" pipe friction loss is less than 10 psi it will work. **Thus, 3" is the correct answer for minimum size pipe**.

If the question asked which pipe provides for the least amount of friction loss, then the 4" pipe would be correct.

FRICTION LOSS
A new 6" fire main is being installed to supply a warehouse. Based on the anticipated fire flow demand of the sprinkler system the friction loss will be 0.03 psi/ft (psi per foot). The new section of pipe will be 125' long. What is the friction loss (in psi) within this new section of pipe?

Answer: A friction loss of 0.03 psi/ft x 125' of pipe results in a total loss of 3.75 psi.

FRICTION LOSS
If a 200' section of pipe has a total friction loss of 4 psi, what is the friction loss per foot of pipe (psi/ft)?

Answer: Divide the friction loss by the total length of pipe to get the loss per foot of pipe. 4 psi / 200' = 0.02 psi/ft

SECONDARY CONTAINMENT CALCULATIONS

When facilities involve hazardous materials, there are frequently requirements for containment of sprinkler water and the hazardous materials involved. The requirement for secondary containment will frequently come out of the International Fire Code (IFC) in chapters dealing with hazardous materials. When required, secondary containment will usually need to be sized to accommodate spillage of the single largest container and 20 minutes of sprinkler discharge.

A key in calculating the secondary containment volume (gallons) is to identify the following:

- Identify the area for secondary containment
    - The entire room or building
    - A smaller diked containment area around a tank or tanks
    - A smaller room located within a larger storage or building area
    - If double-walled tanks are used, secondary containment may not be required

Example concept of a dike: If a 300 gallon chemical tank and a 100 gallon chemical tank are provided within a diked wall (10'W by 10'L) that is sized (high enough) to accommodate spillage of the largest tank and 20 minutes of sprinkler flow *landing within the diked area* than normally there is not a need to contain a larger design area of 2,000 square feet. The only water we are interested in capturing is what will land within the 100 square foot dike. ***Note that depending on the design, chemicals, codes, and other engineering or code requirements, there may be requirements to contain leakage of process piping outside of the dike. For our purposes we are focusing on the tank and not process piping. Design engineers such as the project fire protection engineer should be identifying specific requirements of where secondary containment is required to be provided.***

- Thus, if we want to provide secondary containment for the dike indicated above we need to know the density of discharge (assume 0.2gpm/sqft), the area of the dike (100 sqft), and the volume of the largest single tank (300 gallons). With this information we establish:

  (0.2 gpm/sqft) x (100 sqft area) x (20 minutes) + (300 gallon tank) = 700 gallons
  [this example did not include spacing overage which might be added into the question such as 20%]

- Let's assume that there is no dike and the tanks are located out in a large storage area. Assuming the sprinkler density is 0.2/2,000 and there are no reductions in area we would now have:

  (0.2 gpm/sqft) x (2,000 sqft area) x (20 min) + (300 gal tank) = 8,300 gallons
  [this example did not include spacing overage which might be added into the question such as 20%. Including 20% for sprinkler spacing overage would result in 9,900 gallons of containment.]

As you can see, providing a room or dike around the chemicals will significantly reduce the amount of water that must be contained from sprinkler discharge. It is also easier to contain the water in a dike rather than trying to contain water on the floor of a warehouse or providing a large pit. It is important for the sprinkler contractor/designer to understand the impacts of secondary containment so that questions can be asked early in a project and proper solutions identified.