



Australian Government

CPCSFS8002 Analyse, design and evaluate complex special hazard fire systems

Release: 1

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Modification History

Release 1.

This version first released with CPC Construction, Plumbing and Services Training Package Version 1.

Replaces superseded equivalent CPCSFS7002A Analyse, design and evaluate complex special hazard fire systems.

Application

This unit of competency specifies the outcomes required to analyse options for the design of special hazard fire systems, design their components, and evaluate the designs prior to client sign-off.

Special hazard fire systems are not referenced in the National Construction Code. They include gaseous, foam and water spray solutions that offer protection for life safety and to facilities and equipment vital to business operation and success.

The development of a fire systems design project is subject to significant complexities due to the typical requirement to integrate multiple fire detection and suppression systems.

This unit of competency supports senior fire systems designers who design effective and efficient special hazard fire detection and suppression systems.

No licensing, legislative, accreditation, regulatory or certification requirements apply to this unit at the time of endorsement.

Pre-requisite Unit

Nil

Competency Field

Fire system design

Unit Sector

Plumbing and services

Elements and Performance Criteria

Elements describe the essential outcomes.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the range of

conditions.

- | | |
|---|---|
| 1. Select appropriate special hazard fire suppression solutions | 1.1. Research is conducted to determine appropriate fire suppression solutions that address building or facility's risk profile and special hazard standards that have been identified for use. |
| | 1.2. Cost-benefit and efficiency analyses of the range of fire suppression systems are conducted. |
| | 1.3. Recommendations for selection of preferred solutions are reported to appropriate personnel. |
| 2. Select appropriate special hazard fire detection and occupant warning solutions. | 2.1. Research is conducted to determine appropriate fire detection and occupant warning solutions that address building or facility's risk profile, ambient conditions and the selected fire suppression solution. |
| | 2.2. Cost-benefit and efficiency analyses of the range of fire detection and occupant warning systems are conducted. |
| | 2.3. Recommendations for selection of preferred solutions are made to appropriate personnel. |
| 3. Set up special hazard fire systems design drawing. | 3.1. Relevant project drawings and documentation are requested, received, named and filed according to workplace procedures. |
| | 3.2. Drawings are cleaned to leave minimal essential information. |
| | 3.3. Layers showing designs of other services are imported into clean architectural or structural drawings. |
| | 3.4. Details from drawings of floor or building adjacent to the areas under design consideration are added if these affect the design. |
| | 3.5. Detailed design drawing is named, filed and backed up according to workplace procedures. |
| 4. Lay out the special hazard fire | 4.1. Site visit is conducted where possible to confirm dimensions and assess installation risks and constraints. |

- systems design.
- 4.2. **Interactions** between various systems are identified and planned.
 - 4.3. Exact locations of sprinklers and other fittings are determined and notated on the drawing according to relevant codes and standards.
 - 4.4. Most **efficient and workable layout and location of system components** are determined and notated on the drawing.
 - 4.5. Dimensions are calculated, checked and notated on the drawing.
5. Calculate the requirements for the special hazard fire system solutions.
- 5.1. **Calculations** to identify and confirm required capacity of the special hazard fire systems are undertaken.
 - 5.2. **Infrastructure** to support special hazard fire system solution is identified and quantified.
 - 5.3. Shortfalls in water pressure are determined and sizes of pumps and tanks required for water spray systems are calculated.
6. Evaluate and implement special hazard fire system solutions.
- 6.1. Components of special hazard fire system solution are gathered from relevant expert personnel as required.
 - 6.2. Special hazard system design drawings are evaluated for efficiency and effectiveness.
 - 6.3. Design drawings are submitted to relevant personnel within scheduled timeframe.
 - 6.4. Required amendments to design drawings are made or **negotiated** as required.
 - 6.5. Final approved design drawings are processed and distributed according to project and workplace requirements.
 - 6.6. **Fittings and components** are selected and ordered.

Foundation Skills

This section describes core skills that are essential to performance and not explicit in the performance criteria. Employment skills essential to performance are explicit in the performance criteria of this unit of competency.

Skill	Performance feature
Learning skills to:	• attempt complex tasks requiring sophisticated conceptualisation and analysis over an extended period and employ lateral thinking and problem solving strategies • select and use a range of ICT tools for fire systems design, file and project management and research • organise own work, including creating personal systems and checklists for planning, managing and checking work • manage detailed input to concurrent fire systems design projects at different stages of the process and with diverse sets of regulatory requirements.
Numeracy skills to:	• interpret and apply mathematical principles, equations and calculation methods to special hazard fire systems design, including performing calculations for electrical systems • read, measure and interpret dimensions, ratios and scales on drawings.
Oral communication skills to:	• listen to and communicate clearly with colleagues, fitters, suppliers and contractors • lead and participate in project meetings and consultations with a range of service contractors.
Reading skills to:	• access, interpret and apply current relevant legislation, codes and standards to the design and evaluation of complex special hazard fire systems • recognise conflicts and errors on drawings supplied by other service contractors.
Writing skills to:	• write to construction and fire safety specialists using technical vocabulary about such things as notifications of incompleteness, and conflicts and errors in drawings supplied by other service contractors.

Range of Conditions

This section specifies work environments and conditions that may affect performance. Essential operating conditions that may be present (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) are included. Bold italicised wording, if used in the performance criteria, is detailed below.

Fire suppression solutions must include two of the following:

- chemical systems
- detection and warning systems
- special hazard foam systems
- special hazard gaseous agent systems
- water-based deluge or pre-action sprinkler systems.

Risk profile of the building or facility will reflect its use and must include details of:

- users of and visitors to the site and the need to protect them
- value of the equipment, facility or goods stored
- susceptibility of the stored goods to water or other forms of damage resulting from the use of different types of system.

Special hazard standards must include at least one standard from the following list:

- relevant Australian standards, including:
 - AS ISO 14520.1 Gaseous fire-extinguishing systems - Physical properties and system design - General requirements
 - AS4487 Condensed aerosol fire extinguishing systems - Requirements for system design, installation and commissioning and test methods for components
- United States National Fire Protection Association (NFPA) standards, including:
 - NFPA 2001 Clean Agent Fire Extinguishing Systems
 - NFPA 11 Low, Medium and High Expansion Foam Systems
 - NFPA 11A Medium and High Expansion Foam Systems
 - NFPA 13 The Installation of Sprinkler Systems
 - NFPA 16 Deluge Foam-Water Sprinkler and Foam-Water Spray Systems.

Fire detection and occupant warning solutions must include:

- fire alarms
- fire gas detectors
- flame detectors
- heat-sensing detectors
- smoke-sensing detectors.

- File naming*** must include:
- accurate naming and filing of drawings, including formal document control and amendments:
 - history
 - transmittal notices
 - naming conventions for design drawings and drawing registers.
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- Interactions*** between multiple systems on a complex site must be analysed to:
- ensure most effective selection of systems to protect different assets
 - maximise effectiveness of systems
 - maximise efficiency of installation process.
- Efficient and workable layout and location*** must consider:
- access constraints
 - aesthetic requirements
 - conflict with other services
 - efficiencies to facilitate work on site
 - installation problems
 - penetrations
 - reduction of labour costing
 - work health and safety risks.
- System components*** must include:
- brackets
 - discharge nozzles
 - fire panels
 - pipework
 - system valves
 - zone valves.
- Calculations*** that relate to the special hazard fire systems must include:
- foam system calculations.
 - gaseous system calculations
 - hydraulic calculations to assess pressure requirements and confirm pipe sizes
 - water-spray system calculations.
- Infrastructure*** for special hazard fire system solutions must include:
- delivery systems for the suppression agent
 - pipework
 - storage containers
 - tanks.

Negotiated change must include one made due to:

- impact on cost-effectiveness
- impact on installation risks and constraints
- non-compliance with applicable legislation, codes and standards.

Fittings and components must include:

- control valves
- elbows
- hangers
- pipe fabrication methods and constraints
- pumps
- sprinkler heads
- tanks
- tees.

Unit Mapping Information

CPCSFS7002A Analyse, design and evaluate complex special hazard fire systems

Links

Companion Volume implementation guides are found in VETNet -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=7e15fa6a-68b8-4097-b099-030a5569b1ad>

Assessment Requirements for CPCSFS8002 Analyse, design and evaluate complex special hazard fire systems

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Performance Evidence

A person demonstrating competency in this unit must satisfy all of the elements, performance criteria and foundation skills of this unit. The person must analyse, design and evaluate complex special hazard fire systems for two different types of projects.

In particular the person must:

- apply a knowledge of fire and related sciences when designing compliant and effective systems that address the specific conditions of the projects being undertaken
- calculate system capacities and performance
- read and interpret a range of design documents, including concept briefs, design briefs, drawings, plans and specifications from the following specialist fields:
 - architectural
 - electrical
 - fire engineer or estimator
 - hydraulic
 - mechanical
 - structural
- use computer software packages and systems relevant to special hazard fire systems design projects, including:
 - project management software
 - hydraulic calculation software
 - estimating software
 - parametric modelling software
- apply project management strategies to ensure contractual obligations are met
- apply legislation, codes, standards, and regulatory and insurance requirements that may apply to special hazard fire systems design projects, including Australian and United States National Fire Protection Association (NFPA) standards
- research appropriate special hazard fire detection and warning systems
- produce and edit special hazard fire systems design drawings using industry standard software that specify:
 - layouts

- sections
- details
- external references
- freezing layers
- create detailed hand-drawings and sketches to convey information to on-site workers
- design integrated solutions encompassing fire detection, warning and suppression components for special hazard fire systems as they apply to at least two different types of special hazards requiring the application of different technical solutions.

Knowledge Evidence

A person demonstrating competency in this unit must be able to demonstrate knowledge of:

- characteristics and limitations of products and materials used in fire systems and issues relating to material capability
- contractual processes
- financial management, including:
 - budgeting
 - cost-effectiveness
- fire engineering principles, including:
 - engineered solutions
 - fire modelling
 - innovative fire systems
- fire science sufficient to ensure the design of compliant and effective systems that address the specific conditions of the projects being undertaken, including:
 - fire behaviour and dynamics
 - impact of fire on structures and materials
 - products of combustion
 - fire control strategies
 - fire retardants
 - fire detection technologies
 - fire suppression technologies
 - fire containment
- fire systems' technology and components
- fluid mechanics and hydraulics relating to:
 - pipe range
 - pressure
 - pressure vessels
 - pump selection
 - tank selection
 - water supply
- interconnection of fire systems, including:

- cause and effect matrix
- interface with other services
- passive fire safety elements, including:
 - fire modelling
 - identification of passive elements
 - impact of fire systems design on passive elements
 - innovative fire systems
 - specifications required to safeguard integrity of passive fire element performance where penetrations are necessitated by the fire systems design
- principles of basic physics, including an understanding of:
 - Boyle's Law
 - Charles' Law
 - Dalton's Law
 - Henry's Law
- principles of electrical and electronics theory, including:
 - acoustics and speech intelligibility for occupant warning systems
 - basic operation of common electronic and electrical components used in fire detection and warning systems
 - basic operation of communication protocols on addressable systems, peripheral devices (printers) and high-level interfaces to other communication devices used in fire detection and warning systems
 - definition of voltage ratings as defined in communication and electrical safety regulations, including extra low voltage, low voltage and hazardous voltages
 - effects of AC and DC current in series and parallel circuit paths that includes resistive, inductive and capacitive loads
 - layout of electrical wiring systems to meet communication and electrical safety regulations applicable to fire detection and warning systems
 - relationship between voltage drops around a circuit and applied voltage
 - units used to measure current (AC and DC), power, capacitance, inductance and sound attenuation
- principles of organic and inorganic chemistry, including basic chemical substances and reactions
- principles of thermodynamics, including:
 - effects of heat
 - stratification of gases
 - smoke and heat dynamics
- project management strategies
- protection requirements for different buildings, including the existence of special zones, the egress requirements of occupants, and the construction materials used
- purpose and operation of fire systems, including:
 - layout
 - maintenance standards

- performance requirements
- special products and hazards
- system activation and operation
- system operation
- relevant current legislation, codes and standards specific to complex special hazard fire systems, including:
 - building Acts and regulations
 - infrastructure supply regulations
 - Australian and international standards for fire systems
 - National Construction Code (NCC)
 - other fire system standards commonly required by building insurers
- requirements for installation:
 - access requirements
 - work health and safety requirements
- sustainability requirements relevant to the system:
 - energy conservation
 - water conservation
- water supplies, including:
 - booster configurations
 - common water sources
 - conservation requirements
 - in-ground reticulation
- workplace design tools and processes, including the use of software.

Assessment Conditions

Assessment must be conducted in the workplace or a close simulation of the workplace.

Suitable assessment of performance would require:

- equipment:
 - computer with internet and email access
 - software: word processing and spreadsheet functionality; parametric modelling; and proprietary estimating, project management, and hydraulic calculation
- materials:
 - access to current legislation, codes and standards relevant to the jurisdiction and the project being undertaken, including:
 - Australian and international standards for fire systems
 - building Acts and regulations
 - infrastructure supply regulations
 - NCC
 - other fire system standards commonly required by building insurers

- project documentation for two special hazard fire systems design projects, including design briefs, design drawings, specifications, construction schedules, product information and other supporting documents.

Assessor requirements

Assessors must satisfy the assessor requirements in the Standards for Registered Training Organisations (RTOs) current at the time of assessment.

Links

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<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=7e15fa6a-68b8-4097-b099-030a5569b1ad>