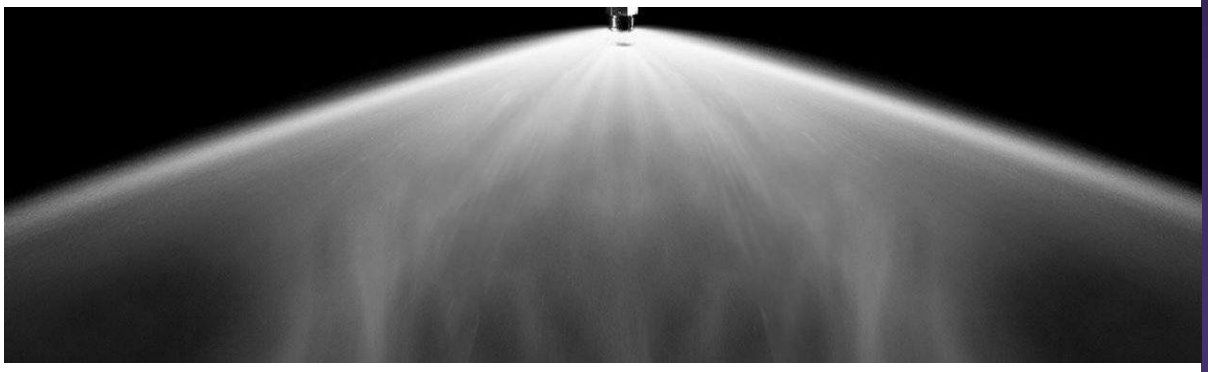
IWMA
International Water Mist Association

# WATER MIST DESIGN GUIDE



## HOW TO DESIGN A WATER MIST SYSTEM IN PRACTICE

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## The design process at a glance – Comparison to sprinkler systems

This guide provides a practical sequence for the design, approval, installation and through-life management of land-based water mist systems. Much of the design process will be familiar to sprinkler designers: define the hazard and protection objective, select a suitable approved system, lay out the nozzles, perform the hydraulic calculations, provide the required water supply, commission the installation and maintain the system throughout its service life.

The fundamental difference is that water mist is a performance-based technology, whereas sprinkler system design is generally more prescriptive. This guide should therefore be read together with the Water Mist Guide, the governing standard, the applicable fire-test protocol/summary and system/type approval, and the manufacturer's current Design, Installation, Operation and Maintenance (DIOM) manual. The DIOM manual should be based on the relevant approval and fire-test evidence and subject to appropriate third-party verification, particularly with regard to the design parameters and limits of application.

For sprinkler systems, the design standard generally defines the required design water application rate and area of operation for a given hazard classification. For water mist systems, key design parameters, including nozzle flow, operating pressure, spacing, installation height, area of nozzle operation and other application limits, are established through fire testing and transferred into the system approval and DIOM manual. The designer therefore follows a largely familiar design process, but applies product-specific parameters within the tested and approved limits.

### The design process in short

The practical process can be summarised in ten points:

1. **Say what the system must achieve.** Define the protected scope and whether the objective is control, suppression, extinguishment, or temperature control.

2. **Describe the real hazard.** Record the fuel, quantity and arrangement, geometry, ceiling height, ventilation and obstructions. Occupancy classification is useful, but it is not enough on its own.

3. **Fix the compliance route.** For land-based work in Europe this is normally EN 14972-1 together with the applicable application-specific part; FM, VdS or another accepted route may govern some projects.

4. **Match the hazard to the fire-test or approval basis.** This establishes the performance limits for the selected system.

5. **Obtain the current DIOM manual.** It should be controlled by the manufacturer, traceable to the applicable third-party approval or certification, and include the fire-test summary and application limits.

6. **Check the project against the tested and approved limits.** Confirm the application, area or volume, height, fuel, ventilation, obstructions and other stated limits of approval / fire test summary. Resolve any exceedance before detailed design.

7. **Set the design basis from the DIOM manual.** Record nozzle spacing and height, working pressure and flow, area of nozzle operation, discharge duration, water quality and other project limits.

8. **Design the layout, water supply and hydraulics.** The process is familiar from sprinkler design, but every nozzle and component must remain within the DIOM and approval limits.

9. **Design detection, operation, interfaces and person safety.** For open-nozzle systems, detection and operation are performance-critical parts of the system.

10. **Review, approve, install, commission and maintain the system.** Record deviations and reassess the design whenever the hazard, building or use changes.

The key rule: Most of the design process is also familiar from sprinkler systems. The important difference is that water mist design values are product- and application-specific and must remain within the tested and approved limits stated in the DIOM manual.

## Water mist design compared with sprinkler design

As most designers are familiar with sprinkler systems, it is useful to highlight the similarities and differences between the sprinkler and water mist design processes. These are summarised in the following table. The overall process is largely the same; the main difference is where the design parameters come from.

For sprinkler systems, the installation standard generally defines the required design application rate and assumed area of operation for the classified hazard, while the product data provide the characteristics of the selected sprinkler.

For water mist systems, EN 14972-1 provides the overall design and installation framework, but the product-specific design parameters are established through application fire testing and transferred into the manufacturer's controlled DIOM manual and related type approval. The key additional task is therefore to verify that the actual project hazard and design remain within the tested and approved application limits.

| Design question | Sprinkler system (e.g. EN 12845) | Water mist system (e.g. EN 14972) |
|---|---|---|
| **Where the design values come from** | Design application rate and assumed area of operation are taken from the installation standard for the hazard class. | Nozzle flow, pressure, spacing, mounting height, area of nozzle operation and duration are taken from the DIOM manual and originate in a full-scale fire test. Table 1 defines minimum area of operation and Table 4 min duration (EN 14972). |
| **The decisive early decision** | Classification of the hazard (e.g. light, ordinary, high hazard and storage categories). | Selection of the applicable fire test protocol from EN 14972-2 series, based on the described hazard. |
| **What the manufacturer supplies** | A data sheet: K-factor and pressure, temperature rating, deflector type, spacing and position rules. | A controlled DIOM manual, traceable to the applicable third-party approval or certification and summarising the fire-test basis and design limits, together with the relevant system and component certificates or listings. |
| **Role of fire testing** | Component listing. System performance is established generically by the standard; components are tested individually. | System performance is established for each specific product by full-scale fire test to a protocol of the series. Components or systems are tested separately. |

| Design question | Sprinkler system (e.g. EN 12845) | Water mist system (e.g. EN 14972) |
|---|---|---|
| **Interchangeability** | Heads of the same type and temperature rating are generally interchangeable between listed manufacturers. | Use only components permitted by the DIOM and approval. Some systems, including certain low-pressure water mist configurations, may allow defined alternative components or interfaces; this is acceptable only where it is expressly covered by the current DIOM manual and approval. |
| **Design freedom** | The designer chooses spacing and layout within the rules of the standard. | The designer uses layout and hydraulic tasks within product-specific tested and approved limits. Exceeding those limits requires a documented and accepted deviation or equivalency route. |
| **Water supply sizing** | Design application rate multiplied by the assumed area of operation, plus any hose allowance; duration by hazard class. | Number of nozzles in the design area multiplied by the nozzle flow at design pressure; duration from the protocol and the DIOM manual. |
| **Hydraulic acceptance criterion** | Calculate the hydraulically most demanding design area and demonstrate the required flow and pressure. | Calculate the hydraulically most demanding design area and demonstrate the required flow and pressure. |
| **Pipework** | Sized by hydraulic calculation; steel or listed plastics. | Sized by hydraulic calculation; stainless steel or listed plastics as per DIOM manual. |
| **Competence** | Recognised design qualification and, where required, scheme certification. | Comparable competence is required, plus product-specific manufacturer training or authorisation where required by the DIOM, approval or scheme. |
| **What invalidates the design later** | A change of hazard class, storage height, ceiling height or obstruction. | A change of hazard class, storage height, ceiling height, obstruction anything exceeding DIOM Manual recorded and approved operating limits. |
| **How compliance is demonstrated** | Calculation against the standard, plus the installation certificate. | A clear evidence chain: hazard → protocol/test summary/approval → controlled DIOM → design and calculation → commissioning and final certificate. |

The figure below shows the common workflow and the different source of design values.

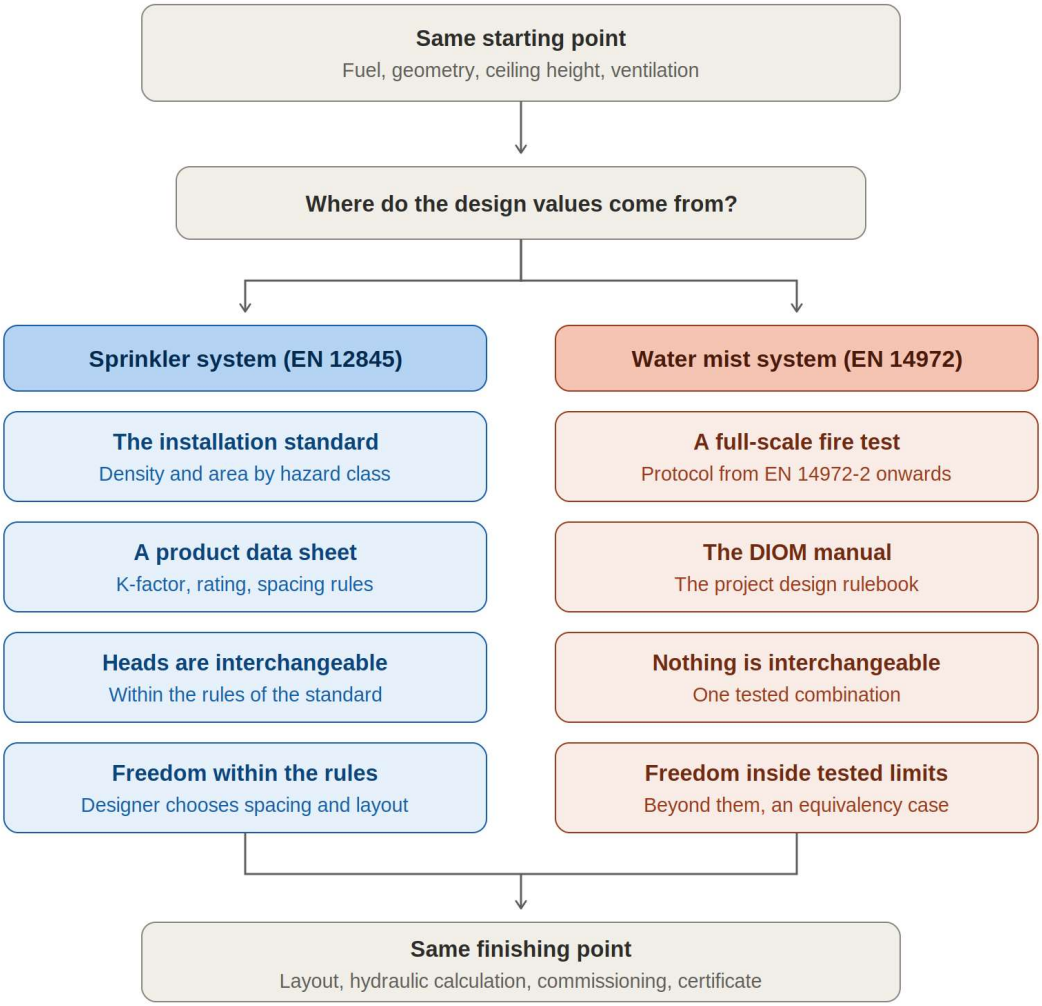



*Figure 1 — A familiar design route with a different source of design values. Both systems start from the hazard and finish with design, hydraulic verification, commissioning and certification (Note! Some low-pressure water mist systems might have interchangeable components outside nozzles).*

**Design notice:** Some fire test protocols require sprinkler equivalency (comparison tests) as a test result, but it does not refer to the design method: it means that, in a defined fire test, the water mist system performed at least as well as a sprinkler reference in terms of fire damage and ceiling gas temperature. It does not mean that sprinkler design application rates or layout rules can automatically be transferred to water mist, or vice versa.

# How to work with this guide - EN 14972 water mist standard series

### Working with EN 14972 Series

For land-based systems in Europe, the EN 14972 series is the normal route. Each document has a distinct role: EN 14972-1 provides the installation framework, the application parts provide the fire-test protocols, and the DIOM manual translates the approved test basis into product-specific design rules.

| Document | What it tells you | Used in this guide defined process |
|---|---|---|
| **EN 14972-1** | How a water mist system is designed, installed, inspected and maintained. It is the installation standard. It does not give design densities or nozzle spacings. | Steps 5 and 11–19 |
| **EN 14972-2 series (application parts)** | The fire test protocol for a defined application: test arrangement, fire load, ventilation, nozzle type, acceptance criteria and the limits for which the results are valid. | Steps 6 and 9 |
| **Annex A of EN 14972-1** | The route for developing a test protocol where no published part covers the hazard. Note! Annex A will be removed from EN14972 to an own document. | Step 7 |
| **EN 17450 series** | Product characteristics and test methods for the critical water mist components, for example nozzles, and strainers and filters. | Step 10 |
| **Manufacturer's DIOM manual** | The product-specific design rules derived from the fire-test and approval basis: spacing, height, pressure, flow, area of nozzle operation, duration, water quality, design, installation, commissioning and maintenance. This is the most important document for the designer. DIOM manuals connected to type approvals are controlled documents by approval bodies. | Steps 8–19, as applicable |
| **Third-party approval / certification and fire-test summary** | Confirms the tested application, conditions, result and approved scope. The DIOM manual should summarise the fire-test basis and limits; the full laboratory report is not normally required for design. | Step 9 |
| **System and component certificates** | The scope within which the tested system may be offered, including models, pressure ratings and application limits. | Step 10 |
| **IWMA Matrix** | An index of the available land-based and marine fire test protocols, kept up to date as parts are published and revised. | Step 6 |
| **IWMA Competence scheme** | Is currently under preparation | |

Two practical points about the series. First, confirm the edition and amendment status of EN 14972-1 and of every application part before use, and record it in the design file; parts are added and revised, and further protocols are in preparation.

Second, the application parts are written either for automatic nozzle systems or for open nozzle systems, and that choice comes with the protocol. The building occupancies are generally automatic nozzle protocols leading to fire control and suppression systems, while many industrial protection applications use open nozzle protocols leading to extinguishing systems that are actuated by a separate detection system.

Design caution: Do not proceed to detailed design without the current DIOM manual. It should be controlled by the manufacturer and traceable to the applicable third-party approval or certification.

### How this guide relates to standards and approvals

This guideuses EN 14972 as the main land-based route. FM, VdS or another accepted approval route may govern insurer-driven or project-specific applications. The practical design workflow remains

similar, but the applicable listing, approval and manufacturer documentation must be followed for the selected route.

An important principle is to use one clearly defined document hierarchy for each protected application. Do not combine parameters or approval conditions from different systems or schemes unless this is expressly permitted by the applicable DIOM manual or approval, or accepted through a documented project-specific justification by the manufacturer and approving parties.

**Scope note:** Marine water mist systems are not covered by this guide. Marine applications follow the applicable IMO fire-test protocols, flag-state requirements and class-society approval process. The IWMA Matrix may still be used to identify the relevant marine documents, but the land-based workflow below should not be treated as a marine design route.

**Roles and responsibilities**

| Role | Principal responsibility |
|---|---|
| Specifier / fire engineer | Defines the fire strategy, protection objective, performance criteria, interfaces and project constraints. |
| Water mist designer | Develops the project-specific layout, water supply, hydraulics, controls and documentation within the DIOM manual limits. |
| System manufacturer | Provides the DIOM manual, fire-test evidence, component evidence, authorised system data and product-specific training. |
| Installer | Installs the system to approved documents, controls workmanship and records deviations and hidden work. |
| AHJ / approving body | Confirms the compliance route, reviews deviations and accepts the design, commissioning evidence and conditions of approval. |
| Insurer | States property-protection requirements and may require an approval, redundancy or inspection regime beyond the minimum code. |
| Commissioning / maintenance provider | Tests the complete system, verifies interfaces, trains users and maintains availability throughout the system life. |
| Owner / operator | Provides operational information, accepts impairment and maintenance responsibilities, and controls later changes to the hazard. |

Where project information changes, the process should return to the earliest affected step. A later approval does not validate an earlier assumption that has become incorrect.

## Overview of the design process

Figure 2 presents an overview of the practical water mist design process, divided into five parts comprising 19 steps and seven decision gates. The process covers the entire project, from defining the fire protection objectives and selecting the appropriate system to design, installation, commissioning and through-life management.

The overall process is largely similar to that used for sprinkler systems. The main differences are found in Part II – Route and Part III – Evidence, where particular attention must be given to selecting the appropriate fire test protocol, verifying the fire test evidence and confirming that the proposed application falls within the limits defined in the manufacturer's DIOM manual and applicable approval. These steps establish the technical basis for the subsequent system design.

The seven decision gates represent the main milestones at which the project basis, compliance route, technical evidence and design are reviewed and accepted before proceeding. The final gates address design approval, commissioning and handover, and continued system availability throughout its service life.

Each of the 19 steps also includes Step completion criteria, identifying the conditions that should be satisfied before that step is considered complete. These are practical verification checks and should not be confused with the seven overall decision gates.

The process is intended as practical guidance and does not introduce additional requirements beyond those established by the applicable standards, approvals and project specifications.

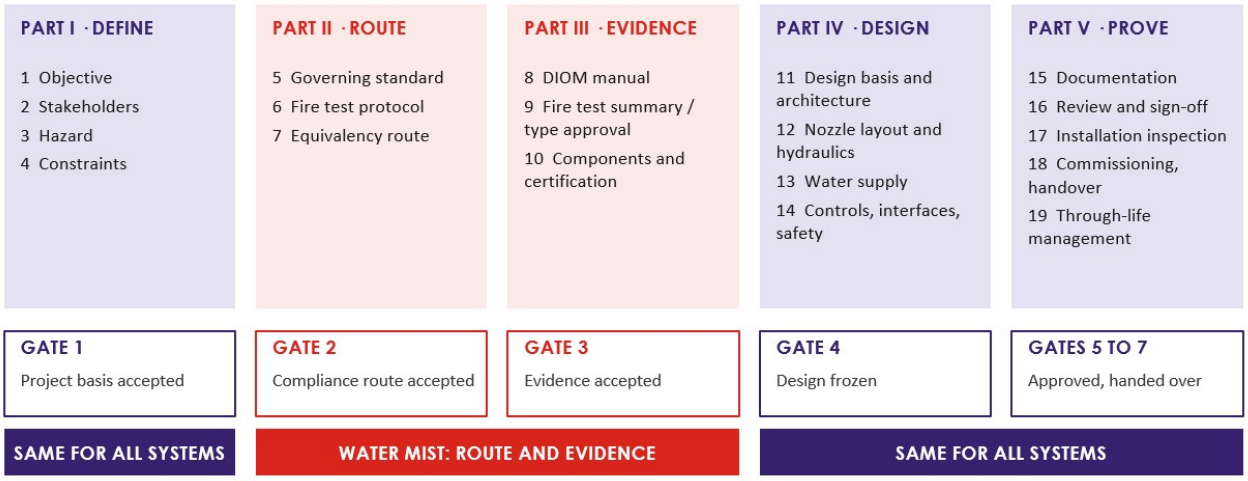



*Figure 2 — Overview of the water mist design process, showing the five parts, 19 steps and seven decision gates*

# Part I — Define the project scope

## A1.1 Step 1: Establish the project basis and the fire protection objective

*Links to Water Mist Guide: §2.7, §4.4*

**Purpose.** Create a controlled project basis that explains why the system is required, what it protects and what successful performance means.

**Why it matters.** The protection objective determines the evidence, design and interfaces that are needed. Define it early so the selected fire-test or approval basis can be checked against the intended performance.

### Actions

- **Define the protected scope.** Identify buildings, rooms, equipment, zones, boundaries and exclusions.
- **Confirm the fire strategy.** Record the code, contractual, insurer and business-continuity drivers for automatic suppression.
- **State the objective.** Select fire control, suppression, extinguishment, temperature control or a defined combination.
- **Set measurable criteria.** Where the project uses performance-based requirements, define the quantities, locations, durations and acceptance limits to be assessed.
- **Record project assumptions.** Include occupancy, operating state, staffing, response arrangements and dependencies on other systems.

**Design notice:** Do not use "equivalent to sprinklers" as the only objective. State what must be achieved and the basis on which equivalency will be judged. Water mist may provide benefits relating to water consumption and consequential water damage. Where these benefits form part of the selection rationale, they should be supported by project-specific evidence and clearly stated performance assumptions.

**Step completion criteria.** The specifier, owner and relevant approver accept the project basis and protection objective before a product or nozzle layout is selected.

## A1.2 Step 2: Identify and consult the stakeholders

*Links to Water Mist Guide: §4.4*

**Purpose.** Identify every party that can impose requirements, provide critical information, approve the design or operate the completed system.

**Why it matters.** As with sprinkler projects, several parties influence the design. Early agreement on the compliance route, evidence and approval responsibilities avoids late redesign.

### Actions

- **Prepare a stakeholder list.** Include the owner, user, fire engineer, architect, MEP disciplines, manufacturer, designer, installer, AHJ, fire authority, insurer and commissioning and maintenance parties.
- **Allocate decisions.** Use a responsibility matrix to show who supplies information, who designs, who reviews and who signs off each gate.
- **Agree communication routes.** Record meeting cadence, document-control platform, response times and the formal route for technical queries and deviations.
- **Consult early.** Present the intended standard, protocol and approval route before detailed design begins, especially where the application is unusual.

**Step completion criteria.** The stakeholder and responsibility matrix is accepted, and no necessary approving or operational party is missing.

## A1.3 Step 3: Characterise the hazard

*Links to Water Mist Guide: §2.6, §4.1*

**Purpose.** Describe the actual fire challenge in sufficient detail to select and verify an applicable fire-test protocol.

**Why it matters.** Water mist systems are validated for defined fire risks rather than broad building classifications alone. Describe the actual fuel, geometry, ventilation and obstructions well enough to compare the project directly with the applicable test and DIOM manual limits.

**Actions**

- **Identify fire classes and fuels.** Record solid, liquid, cooking-oil and electrical involvement, including fuel properties that affect fire development and suppression.
- **Quantify and arrange the fuel.** Record quantities, storage heights, packaging, shielding, separation, equipment geometry and foreseeable changes.
- **Describe the enclosure.** Measure floor area, volume, ceiling height, ceiling form, openings, voids and connections to adjacent areas.
- **Assess ventilation.** Record normal and fire-mode airflows, leakage, extraction, supply, door positions and credible operating conditions.
- **Identify obstructions.** Include beams, ducts, cable trays, racks, machinery, suspended ceilings and objects that can block heat or mist movement.
- **Record environmental and occupancy factors.** Include temperatures, contamination, sensitivity of contents, people present, access and expected fire-brigade intervention.

**Design notice:** An occupancy name alone is not a hazard description. Two rooms with the same occupancy can require different test evidence because of fuel installed or ceiling height. Broad hazard categories, such as OH1 or HC1, may cover several different risks. The actual fire challenge must therefore be described rather than inferred from classification alone.

**Step completion criteria.** The hazard description is complete enough to compare the project with the tested application and to identify the worst credible design condition.

## A1.4 Step 4: Define the constraints and special considerations

*Links to Water Mist Guide: §2.4, §3.2.4*

**Purpose.** Capture site and project conditions that can limit system selection, reliability, constructability or environmental performance.

**Why it matters.** Site constraints can change both the available system options and the reliability of the selected solution. For example, high ventilation rates can challenge system performance, freezing can prevent correct operation, an undersized plant room can prevent maintenance, and an inadequate electrical supply can defeat a pump-based system. These matters should be treated as design inputs, not as installation details to be solved after the system has been selected.

**Actions**

- **Water.** Record available source, pressure, flow, storage space, quality, temperature, treatment, drainage and fire-water run-off constraints.
- **Environment.** Assess freezing, heat, ventilation, aggressive atmospheres, seismic loads, vibration and corrosion.

- **Space and access.** Confirm plant-room area, structural loads, access for cylinders or pumps, maintenance clearances and replacement routes.
- **Power and resilience.** Identify normal and standby supplies, generator capacity, electrical classification and required operating time.
- **Sustainability.** Record water-consumption targets, material and embodied-carbon considerations, run-off containment and any life-cycle assessment requirements.
- **Special hazards.** Identify high voltage, sensitive archives or electronics, food hygiene, clean-room requirements, explosion hazards, noise limits and security constraints.

**Design notice:** This step is equally applicable for sprinkler and water mist systems.

**Step completion criteria.** The constraints register is reviewed by the project disciplines and accepted as an input to system selection.

# Part II — Choose the route to compliance

## A1.5 Step 5: Select the governing design and installation standard

*Links to Water Mist Guide: §2.1, §4*

**Purpose.** Establish the document hierarchy that governs the design and resolve conflicts before detailed engineering begins.

**Why it matters.** The code, installation standard, approval or listing, DIOM and insurer requirements serve different purposes. Record their hierarchy so the design team knows which document controls each decision.

**Actions**

- **Identify mandatory requirements.** Confirm the applicable legislation, building code, fire strategy, client specification and insurer conditions.
- **Select the water mist design standard.** For land-based European work this will commonly be EN 14972-1 together with the relevant application-specific part of the EN 14972 series.
- **Identify related standards.** Record standards for water supplies, backflow protection, detection and alarm, electrical work, pressure equipment, seismic design and other interfaces.
- **Fix editions.** List the exact edition, amendment and national adoption required by the contract or AHJ.
- **Set precedence.** Agree how conflicts between the standard, approval certificate, DIOM manual and project specification will be resolved.

**Route-specific checks**

- EN route: use the adopted edition of EN 14972-1, the applicable application-specific part(s), the manufacturer's DIOM manual and the component evidence required by the EN 17450 series. Record any national annexes and AHJ interpretations.
- FM route: use the current FM Property Loss Prevention Data Sheet 4-2, the applicable hazard-specific FM data sheet, the exact FM Approval Guide listing and the manufacturer's FM Approved design manual or DIOM manual. FM 5560 is the approval standard and does not by itself constitute the complete project design and installation specification.
- VdS route: use VdS 3188 within its stated scope together with the applicable VdS fire-test basis, system certificate, approved application limits and insurer requirements.
- Where more than one route is contractually required, prepare a clause-by-clause compliance matrix and resolve conflicts in writing before design proceeds.

**Design notice:** This step is equally applicable for sprinkler and water mist systems.

**Step completion criteria.** The governing documents and precedence order are accepted by the specifier, designer and approving parties.

## A1.6 Step 6: Select the applicable fire test protocol / summary or type approval

*Links to Water Mist Guide: §4, §4.1*

**Purpose.** Select the fire-test protocol whose application, fire challenge and limits provide the evidence basis for the proposed system. The relevant evidence is normally provided through a fire-test summary, type approval or certification package linked to the manufacturer's DIOM manual.

**Why it matters.** The fire-test or approval basis links the actual hazard to the selected system. Choose it from the fire challenge and protection objective, not from the occupancy title alone.

**Actions**

- **Start from the hazard.** Use the Step 3 description rather than selecting a protocol only from the building name.
- **Check EN 14972 application parts.** Identify the part or combination of parts that corresponds to the protected application.
- **Consider recognised parallel routes.** Where accepted by the AHJ and contract, evidence may come from recognised insurer schemes such as FM or VdS.
- **Use the IWMA Matrix.** Use it as an index to relevant fire-test protocols, then obtain and read the actual protocol and evidence.
- **Define full-building coverage.** Where several hazards exist, map each room or area to a protocol and identify gaps or interfaces between systems.

**Design notice:** Do not assume that passing one protocol/approval validates every hazard in the same building.

**Route-specific checks**

- Select the application-specific EN 14972 fire-test part that most represents the actual hazard and verify all stated limits and acceptance criteria.
- For FM projects, confirm that the proposed application appears within the exact FM Approved system scope and that the relevant FM data sheets permit the protection concept for the facility.
- For VdS projects, verify the applicable VdS 3883 test basis or other accepted protocol and the application limitations stated in the VdS certificate and VdS 3188 annexes.

**Step completion criteria.** The selected fire test evidence is accepted in principle and is available for detailed review.

## A1.7 Step 7: Handle the case where no protocol fits — equivalency and the case-by-case route

*Links to Water Mist Guide: §4*

**Purpose.** Create a transparent and approvable route where no published protocol directly covers the project hazard.

**Why it matters.** New hazards do not always fit an existing protocol. This is where the performance-based nature of water mist is useful: a controlled equivalency assessment, and where needed application-specific full-scale fire testing, can turn a new challenge into validated design evidence. Agree the basis and acceptance route with the AHJ and insurer before relying on it. This route is currently covered by Annex A of EN 14972-1 (Note! CEN/TC 191 WG10 has agreed to remove Annex A and to cover the process in a separate EN document).

**Actions**

- **Describe the gap.** Identify exactly which project characteristic is outside the available protocol: fuel, height, area, ventilation, geometry, obstruction or another parameter.
- **Select a reference basis.** Choose the closest fire-test protocol, approved system or conventional reference system and explain why it is relevant.
- **Demonstrate equal or lower challenge.** Compare heat release, fuel arrangement, ceiling height, ventilation, shielding, system exposure and required outcome.
- **Define compensating measures.** Consider reduced spacing, higher pressure within approval limits, additional nozzles, zoning, detection improvements or restrictions on the hazard only where supported by engineering and the manufacturer.

- **Plan additional evidence.** Where analysis alone is insufficient, as will often be the case, specify representative fire testing or other verification with agreed acceptance criteria.
- **Seek early acceptance.** Obtain written agreement from the AHJ and insurer before relying on the case-by-case route.

**Design notice:** New and emerging hazards may require application-specific full-scale fire testing. This is a normal part of the performance-based water mist approach and allows new challenges to be converted relatively quickly into validated protection solutions.

**Step completion criteria.** The equivalency strategy, evidence plan, acceptance criteria and decision authority are agreed before detailed design proceeds.

# Part III — Verify the evidence

## A1.8 Step 8: Obtain and read the DIOM manual

*Links to Water Mist Guide: §4.2*

**Purpose.** Establish whether the evidence relied upon is current, traceable, independently verified and sufficiently transparent for the proposed application.

**Why it matters.** A DIOM manual is a manufacturer-controlled document. For approved or certified systems, the DIOM manual is included within the scope of the approval and subject to external oversight by the approval body. For non type approved systems, the DIOM manual remains solely under manufacturer control. The designer should therefore understand the basis on which confidence in the design parameters is established, whether through recognised third-party approval and certification, or through a documented and traceable chain of fire-test evidence supporting the DIOM manual.

Actions

- **Confirm the test laboratory** accreditation and scope applicable at the date of testing.
- **Confirm whether the testing was witnessed, reviewed or otherwise incorporated** within the certification or approval process, and identify the basis of any extension of scope, engineering judgement or family grouping.
- **Compare the approval certificate, fire-test summary and DIOM manual** to confirm consistent system identity, nozzle model, operating parameters and application limits.
- **Record any qualification, exclusion, unresolved inconsistency or reliance** on manufacturer interpretation in the design evidence register. Where the available evidence is insufficient to resolve a material question, obtain clarification or additional evidence from the manufacturer and, where applicable, the approval or certification body before design proceeds.

**Design notice:** Water mist designers should normally be trained by the system manufacturer in the correct use of the DIOM manual. This helps ensure that the system is designed in accordance with the approved application limits and product-specific requirements.

**Step completion criteria.** The evidence chain is complete, internally consistent and accepted as sufficiently robust for the proposed application.

## A1.9 Step 9: Check the fire-test basis against your hazard

*Links to Water Mist Guide: §2.1.1, §4*

**Purpose.** Confirm that every risk in the project is covered by a system that has passed the fire test protocol written for that risk.

**Why it matters.** The designer normally does not need to re-evaluate the laboratory test. The task is to confirm, from the protocol, approval and DIOM fire-test summary, that the offered system covers the project hazard and that the project stays within the stated limits.

**Actions**

- **Match each risk to its protocol.** For every protected area, room or object, confirm that the protocol selected at Step 6 is the one written for that hazard.
- **Confirm the system has passed it.** Obtain evidence that the specific system offered was tested to that protocol at an accredited laboratory and passed.
- **Check the application limits.** Confirm that the limits stated in the protocol and in the DIOM manual, typically the application and the area or volume and the ceiling height, cover the project.

- **Check that nothing is left uncovered.** Confirm that no protected area or object has been left without a protocol, and that the interfaces between areas covered by different protocols are resolved.
- **Refer anything outside the limits to Step 7.** Where a risk falls outside the stated application limits, it is an equivalency question and is handled there. Where the project is demonstrably within all relevant limits, no project-specific re-analysis of the laboratory test is normally required. However, inconsistencies, omissions or unclear traceability must be resolved before the evidence is accepted.

**Design notice:** The question at this step is whether the risk is covered, not whether the test method was correct. The protocol states what it covers; the DIOM manual states the limits. Where both are satisfied, the evidence review is complete.

**Step completion criteria.** Every risk in the project is matched to a fire test protocol for which the offered system holds a passed test, or the difference is being handled under Step 7.

## A1.10 Step 10: Verify component testing, approvals and certification scope

*Links to Water Mist Guide: §4.3*

**Purpose.** Confirm that the installed components and complete system configuration are covered by reliable component evidence and the claimed approval or listing.

**Why it matters.** The installed components must remain within the scope of the system approval and DIOM manual. Do not assume component interchangeability; some systems, including certain low-pressure water mist arrangements, may allow defined alternatives or interfaces, but only where the current approval and DIOM explicitly permit them.

**Actions**

- **Check critical components.** Verify applicable testing for nozzles, pumps, valves, strainers, cylinders, controls, detection interfaces and other system-critical items.
- **Review EN 17450 evidence.** Where used, confirm the relevant part of the EN 17450 series and the tested component model and configuration.
- **Read certificate scope.** Check application, system type, pressure range, component list, manufacturing location, limitations and surveillance conditions.
- **Match the offered product.** Compare model numbers, materials, orifice or K-factor, firmware, actuator, seal, hose and fitting types with the certificate and DIOM manual.
- **Check validity and issuer.** Confirm the certificate is current and issued by a competent third party, and that the test laboratory's scope covers the work performed.
- **Control substitutions.** Require technical and approval review before any alternative component is accepted. A small number of systems, including certain low-pressure water mist configurations, may have defined scope for component substitution, but only where this is expressly permitted and documented in the current DIOM manual and approval, never assume interchangeability without that written confirmation.

**Design notice:** Component interchangeability, excluding nozzles, is typically permitted only in certain low-pressure water mist systems and only where explicitly allowed by the DIOM manual and/or applicable approval.

**Step completion criteria.** The product schedule is traceable to the current DIOM manual and the applicable system and component approval or certification scope.

# Part IV — Design the system

## A1.11 Step 11: Set the design basis from the DIOM manual

*Links to Water Mist Guide: §3.1–§3.6, §3.3.1, §4.2*

**Purpose.** Fix the numerical and qualitative design basis from the manufacturer's DIOM manual that governs every later calculation and drawing, confirming the system architecture needed to apply it correctly.

**Why it matters.** The DIOM manual is the design basis: it fixes nozzle pressure, spacing, height, obstruction limits, duration and the other numbers used in every later calculation and drawing. Which DIOM tables and limits apply depends on the system architecture — application type, pressure class, nozzle type and water-supply method — so architecture must be confirmed first, as the opening action below.

**Actions**

- **Application and architecture.** Choose application type (area, local, volume or zoned protection), pressure class, nozzle type (automatic, open or electronically operated), water-supply method (pumped, cylinder or twin-fluid), operation type (wet, dry, deluge, pre-action or electronically controlled) and engineered/pre-engineered design type, all as supported by the evidence.
- **Reliability concept.** Define zoning, isolation, redundancy, standby supply and impairment philosophy.
- **Design parameters (DIOM).** From the DIOM manual, record: area/number of operating nozzles; nozzle spacing, wall distance, mounting height, orientation and ceiling-form limits; minimum/maximum working pressure, nominal flow or K-factor and balance requirement; discharge duration and refill/reserve; thermal element rating and ambient range; and water-quality, filtration, pipework, delay, detection, zoning, ventilation and obstruction rules.
- **Project baseline.** Issue a design-parameter sheet, obtain manufacturer confirmation where interpretation is required, and treat it as the project baseline.
- **Treat exceedance as a deviation.** Where any required parameter cannot be met within the DIOM manual or approval limits, do not adjust it locally: return to Step 7 for the equivalency route and obtain the AHJ's, and where relevant the insurer's, written acceptance on a project-specific basis before proceeding.

**Design notice:** Do not invent a generic water density or substitute a pressure and flow from another nozzle. The tested and DIOM-defined parameters govern.

**Step completion criteria.** The architecture and design-parameter schedule are checked against the current DIOM manual and approved as the project baseline by the manufacturer, designer and project stakeholders.

## A1.12 Step 12: Lay out the nozzles and calculate the hydraulics

*Links to Water Mist Guide: §3.3, §4.1, §3.2.4, §3.6.1*

**Purpose.** Position and orient the nozzles within the DIOM manual limits, then demonstrate by calculation that the pipe network delivers every nozzle in the design area within those limits — the same two-part exercise used for sprinkler design.

**Why it matters.** A hydraulically adequate system can still fail if mist cannot reach the fire as it did in testing, so layout is performance-critical, not just coordination; the hydraulic calculation is the link

between the approved nozzle limit and the network actually installed, and must reproduce the issued routing, elevations, fittings and supply characteristics.

**Actions**

- **Design grid and ceiling geometry.** Establish the design grid from DIOM spacing, wall-distance, mounting-height and area-of-operation requirements; coordinate sloped, stepped, curved and irregular ceilings.
- **Obstructions and special spaces.** Resolve obstructions per DIOM manual rules (beams, ducts, trays, luminaires, racks, partitions, equipment); protect concealed and special spaces separately.
- **Local-application aiming.** Aim local-application nozzles to the tested position, distance and angle, and prevent movement in service.
- **Access and protection.** Allow access for inspection, cleaning and replacement, and protect nozzles from damage or contamination.
- **Coordination drawings.** Coordinate in sections and elevations, not only reflected ceiling plans, and record any deviation from the standard arrangement.
- **Materials and routing.** Select materials and ratings; develop routing that minimises losses while allowing drainage, venting, isolation, flushing, access and support.
- **Calculation rules.** Define calculation rules (fluid properties, pipe roughness, fitting and valve losses, elevation, nozzle data, software version).
- **Design areas.** Identify the hydraulically most (and, where relevant, least) demanding areas, remote branches, elevations and simultaneous zones.
- **Nozzle pressures.** Check minimum pressure at the most remote nozzle and maximum pressure/flow at favourable locations; confirm acceptable balance.
- **Supply interaction.** Plot the calculated demand against the available pump, tank or cylinder performance over the required duration (see Step 13).
- **Verify calculation quality.** Independently check topology, units, boundary conditions and correspondence with drawings.

**Design notice:** Using a larger pipe does not correct every problem. Excessively low or high velocities, trapped air, delivery time, cylinder pressure decay may also happen. The underlying hydraulic logic and design tools are broadly comparable with those used for sprinkler systems.

**Step completion criteria.** The coordinated layout is within tested limits with no unresolved obstructions, and the reviewed calculations demonstrate compliance for all governing scenarios and match the issued drawings and equipment selection.

## A1.13 Step 13: Size the water supply

*Links to Water Mist Guide: §3.4*

**Purpose.** Provide the required flow, pressure and duration at the system connection under the worst credible operating condition, matched against the demand established in Step 12.

**Why it matters.** Water supply design must cover the actual operating scenario for the required duration, including simultaneous zones and credible degraded conditions; if stored volume alone is not enough the supply must deliver the required pressure and flow throughout.

**Actions**

- **Determine demand.** Determine demand from the governing area of operation, simultaneous zones and the Step 12 hydraulic calculation, not a simple nozzle-count estimate.
- **Size stored water.** Size stored water including required duration, unusable volume, pump suction conditions, cylinder residuals and stated design margin, without masking poor design.

- **Verify water quality.** Verify water quality, treatment, filtration and materials compatible with nozzle orifices and the DIOM manual requirements.
- **Select pumps or cylinders.** Select pumps or cylinders: duty point, pressure range, starting arrangement, reserve/standby configuration, propellant gas and pressure-equipment requirements.
- **Provide resilience.** Provide resilience (standby power, fuel duration, redundant units, refill arrangements, single points of failure) as required by the project.
- **Protect the supply.** Protect the supply (backflow protection, isolation, drainage, heating/frost protection, monitoring, ventilation, safe access).
- **Confirm interfaces.** Confirm structural, electrical, controls, drainage, noise and maintenance-clearance interfaces.

**Design notice:** The basic design logic is largely the same as for sprinkler systems. However, water mist systems typically require only a fraction of the water supply needed for an equivalent sprinkler installation.

**Step completion criteria.** The water supply can meet the calculated duty and duration under normal and credible degraded conditions, and its location and services are coordinated.

## A1.14 Step 14: Complete the controls, interfaces and person-safety design

*Links to Water Mist Guide: §3.5, §3.3.3, §4.2, §2.6, §3.2*

**Purpose.** Define how the system detects, operates/activates, reports and fails safely; ensure other building systems support rather than undermine its tested performance; and control the risks the finished installation creates for people.

**Why it matters.** Detection and operation logic, systems integration and person safety are usually developed by different disciplines but must be resolved together before installation: control logic decides when and how many nozzles operate, other systems can help or defeat the tested scenario (ventilation, power/fuel isolation, BMS), and the finished installation contains pressurised water, pumps or cylinders and electrical equipment that must be made safe for occupants and workers.

**Actions**

- **Cause-and-effect matrix.** Prepare a cause-and-effect matrix covering every initiating device, logic state, output, delay, alarm, release, shutdown and reset condition.
- **Detection and zoning.** Select detection type, coverage and voting logic for the fire growth, environment and required release time; align detection zones, release zones, hydraulic sections and compartment boundaries.
- **Manual controls and supervision.** Provide manual release, stop or abort controls only where permitted by the standard, DIOM manual and fire strategy; supervise power, valves, pumps, cylinder pressure, water level, detection circuits and control panels.
- **Fail-safe behaviour.** Define fail-safe behaviour for power loss, detector fault, communication failure, broken pipe, low pressure and incomplete release.
- **System interfaces.** Coordinate with the fire alarm, ventilation and smoke control, power/fuel isolation, building management system, life-safety systems, and water/drainage, so that none of them can defeat an essential fire-mode function, consistent with the test evidence and fire strategy.
- **Integrated testing.** Create an integrated test matrix covering all interfaces, with expected responses, responsible parties and evidence to be recorded.
- **Occupant and mechanical safety.** Assess occupant exposure (visibility, thermal conditions, oxygen displacement in enclosed total-flooding applications, evacuation routes), electrical

safety, mechanical/pressure safety (leaks, hose movement, cylinder handling, stored energy, plant-room access), noise/startle, and slip/drainage/water-damage risk.

- **Entry and re-entry.** Define safe entry and re-entry after discharge (isolation, ventilation, atmosphere checks, re-ignition risk, authorisation).
- **Signage and training.** Provide signage, operating instructions and training for people working in or around the protected space.

**Design notice:** Water mist is generally compatible with occupied spaces, but this does not remove the need to assess the actual enclosure, electrical conditions, discharge method and evacuation strategy.

**Step completion criteria.** The cause-and-effect matrix, interface schedule and person-safety measures are agreed by the fire engineer, manufacturer, controls designer, AHJ and other affected disciplines, with no unresolved conflicts.

# Part V — Prove, install and keep it working

## A1.15 Step 15: Compile the design documentation package

*Links to Water Mist Guide: §4.5*

**Purpose.** Assemble a complete, traceable package that allows an independent reviewer to understand the basis, reproduce the checks and verify the proposed installation.

**Why it matters.** Approval depends on traceability. A reviewer should be able to follow the chain from hazard and objective to protocol, test evidence & approval scope, DIOM manual parameters, calculations, drawings and commissioning criteria.

**Actions**

- **Design report.** Summarise the objective, hazard, standards, protocol, evidence, architecture, key parameters, assumptions and conclusions.
- **Drawings.** Issue coordinated plans, sections, schematics, plant layouts, nozzle details, pipework and zone information.
- **Calculations.** Include hydraulics, water storage, pump or cylinder duty, power, supports and other project-required engineering checks.
- **Evidence.** Provide the current controlled DIOM manual, the applicable third-party approval or certification, and the relevant component evidence. The DIOM manual should identify the fire-test basis and application limits.
- **Schedules.** Include nozzles, pipes, valves, pumps, cylinders, detection, controls and approved component identifiers.
- **Deviations and decisions.** Maintain a register showing the requirement, proposed deviation, technical justification, manufacturer position and approval status.
- **Competence.** Provide evidence that the designer is trained and authorised for the specific system and application.

**Design notice:** Do not assemble the documentation package only at submission time, but build it as the design proceeds.

**Step completion criteria.** The package passes an internal completeness and consistency check before formal submission.

## A1.16 Step 16: Design review, approval and sign-off

*Links to Water Mist Guide: §4.3, §4.4*

**Purpose.** Obtain documented confirmation that the design basis, evidence and project-specific design are acceptable before installation proceeds.

**Why it matters.** Formal review is the point at which assumptions and interfaces are challenged before they become installed defects. The review should confirm not only arithmetic and drawing quality but also the validity of the selected compliance route and evidence. Approval conditions should be treated as design requirements and transferred into procurement, installation, commissioning and maintenance documents.

**Actions**

- **Internal review.** Use a competent checker independent of the original calculations where required by risk, contract or quality system.
- **Manufacturer review.** Confirm product-specific compliance, interpretation of DIOM manual limits and compatibility of the selected components and architecture.

- **AHJ and insurer review.** Submit the agreed package and respond to all comments, conditions and requests for further evidence.
- **Close comments.** Maintain a review log with response, revision, owner and closure status; do not rely on informal acceptance.
- **Control changes.** Freeze the approved revision and define when a later change requires renewed calculation, review or approval.
- **Record conditions.** Transfer approval conditions into drawings, commissioning tests, maintenance requirements and owner responsibilities.

**Design notice:** Informal or verbal approval is not sign-off; record it and carry conditions forward into later stages.

**Step completion criteria.** The approved-for-construction design is signed off by the designated parties and all conditions and open items are clearly controlled.

## A1.17 Step 17: Installation supervision and inspection

*Links to Water Mist Guide: §4.5*

**Purpose.** Ensure that the installed system reproduces the approved design and that workmanship, cleanliness and product traceability preserve performance and reliability.

**Why it matters.** Small installation changes can alter mist distribution, hydraulic performance or component reliability. Nozzle orientation, pipe cleanliness, strainer arrangement, support, joint quality and concealed obstructions are difficult to correct after ceilings close. A planned inspection and test regime should therefore identify hold points and record evidence while the work remains visible.

**Actions**

- **Verify competence and documents.** Confirm the installer's authorisation and that the latest approved drawings and DIOM manual are available on site.
- **Inspect incoming materials.** Check model numbers, certificates, pressure ratings, damage, cleanliness and storage conditions.
- **Control pipework installation.** Inspect routing, supports, joints, slopes, drainage, flushing points, isolation, corrosion protection and pressure-class identification.
- **Inspect nozzles.** Check type, orifice or K-factor, orientation, height, spacing, wall distance, obstruction clearance and protection from contamination or paint.
- **Inspect plant and controls.** Check pumps, tanks, cylinders, valves, detection, panels, power, heating, ventilation and monitoring.
- **Record concealed work.** Inspect and photograph pipework and supports before ceilings, walls or insulation conceal them.
- **Manage deviations.** Stop and resolve non-conforming work through the approved change process before it is hidden or commissioned.

**Design notice:** Inspect and record concealed work before ceilings, cladding or insulation cover it.

**Step completion criteria.** Installation inspections show that the system is complete, traceable and ready for testing, with all deviations resolved or formally accepted.

## A1.18 Step 18: Testing, commissioning and handover

*Links to Water Mist Guide: §4.5*

**Purpose.** Prove that the installed mechanical, electrical and control systems operate together as designed and provide the owner with a complete and usable handover package.

**Why it matters.** Commissioning demonstrates that the approved design has become a functioning installation. It must test the mechanical supply, detection, release, alarms, interfaces and fault supervision as one system. The acceptance criteria should be defined during design, not invented on site, and the final records should show both successful results and any deviations that remain subject to formal acceptance.

**Actions**

- **Clean and prepare.** Flush pipework, clean strainers and filters, fill and vent the system, and verify water quality and antifreeze or additive condition where applicable.
- **Pressure and leak test.** Complete required hydrostatic, pneumatic or other tests safely and issue certificates.
- **Test water supply.** Verify tank or cylinder capacity, pump start and duty point, standby operation, pressure regulation, alarms and refill arrangements.
- **Test discharge and delivery.** Carry out functional or representative discharge tests required by the standard and DIOM manual, verify delivery time, nozzle operation and drainage.
- **Test detection and controls.** Test every initiating device, release path, zone, manual control, interlock, shutdown, alarm, fault and monitored condition.
- **Integrated testing.** Demonstrate the agreed sequence with fire alarm, ventilation, power isolation, BMS and other building systems.
- **Handover.** Issue the final certificate, declared deviations, as-built drawings, calculations, settings, spares, manuals, training and maintenance plan.

**Design notice:** Acceptance criteria are a design output, not something decided on commissioning day.

**Step completion criteria.** The commissioning results meet the acceptance criteria, open defects are closed or formally managed, and the owner accepts the system and responsibilities.

## A1.19 Step 19: Maintenance, availability and through-life management

*Links to Water Mist Guide: §4.6*

**Purpose.** Maintain the system in an available condition and ensure that later changes to the hazard, building or system do not invalidate the design basis.

**Why it matters.** Water mist systems may remain unused for many years and must still operate correctly when needed. Availability depends on inspection, testing, maintenance, impairment control, competent service and management of changes to the protected hazard. A system that was compliant at handover can become unsuitable if ceilings, storage, ventilation, equipment, water supply, control software or occupancy change without revalidation.

**Actions**

- **Establish ITM.** Adopt the DIOM manual and governing-standard inspection, testing and maintenance intervals and assign responsible competent persons.
- **Manage impairments.** Define authorisation, risk assessment, temporary measures, notifications, restoration and records for any isolation or outage.
- **Monitor condition.** Use supervised alarms and remote monitoring where appropriate to identify faults, low pressure, closed valves, low water level or power loss.

- **Provide spares and support.** Maintain critical nozzles, seals, filters, detectors, control parts, cylinder arrangements and access to authorised technical support.
- **Control changes.** Review alterations to occupancy, fire load, storage, partitions, ceilings, ventilation, equipment, process, water supply and power before implementation.
- **Revalidate periodically.** Confirm that approvals, DIOM manual information, hazard assumptions, hydraulic conditions, software settings and competence remain suitable.
- **Keep records and train.** Maintain service history, fault trends, discharge records, changes, training and emergency instructions throughout the system life.

**Design caution:** A compliant system does not stay compliant automatically. Later changes to the hazard or building require revalidation.

**Step completion criteria.** The owner has accepted a documented availability, impairment and change-control plan and has appointed competent service providers.

# Appendices to this document

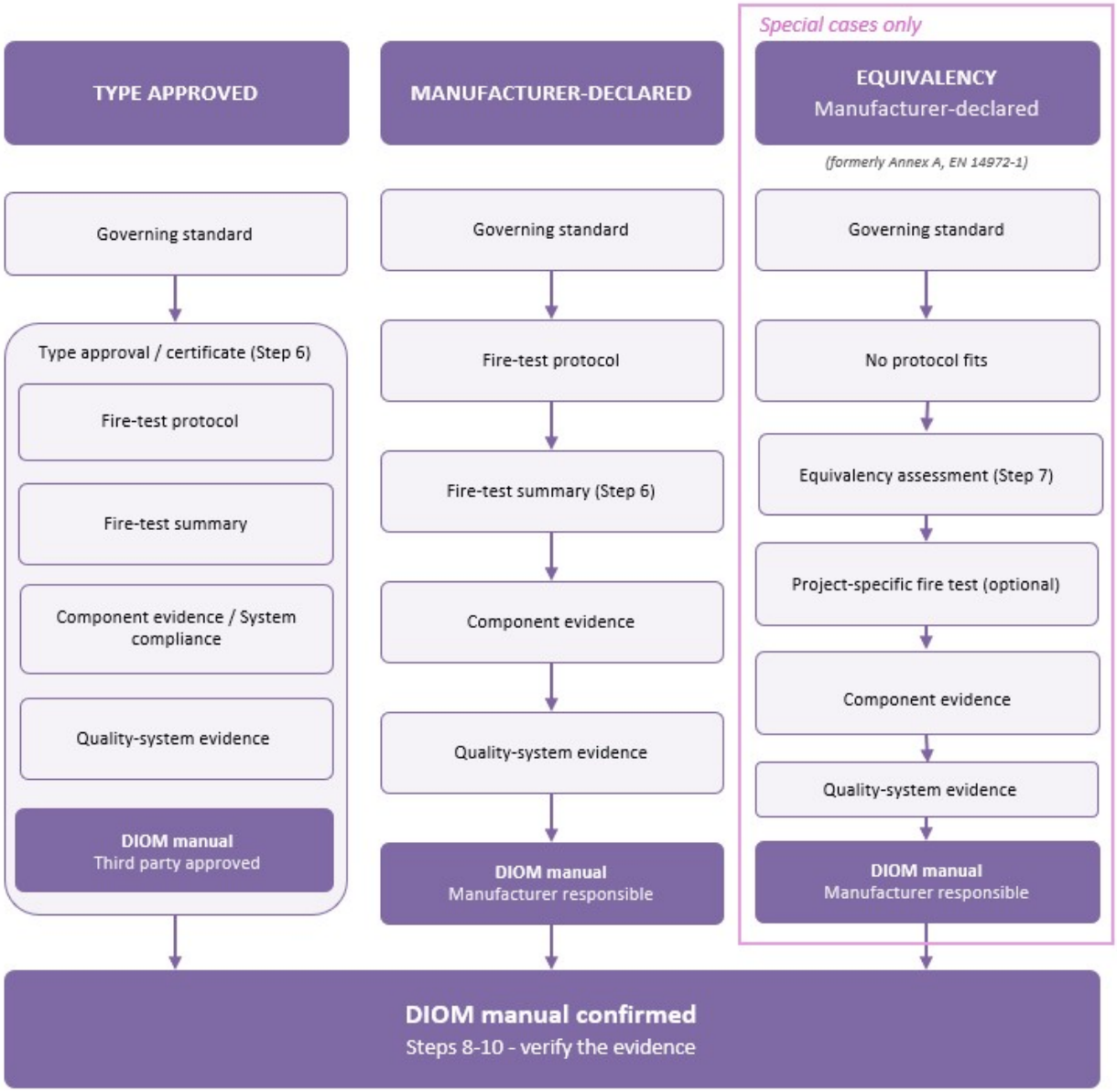
## A1.A Suggested design evidence checklist

The project file should provide evidence covering the following items:

| Evidence item | What the project file should show |
|---|---|
| Protected hazard | The occupancy, fuel package, storage or ceiling height and other parameters that define the tested scenario. |
| Governing standard | The installation standard applied (e.g. EN 14972-1, FM 5560, VdS guidelines) and its edition. |
| Applicable protocol / summary | The specific fire-test protocol or summary (e.g. an EN 14972-2 part) that supports the design. |
| Exact system and nozzle | Manufacturer, system name, and the nozzle model and configuration actually specified. |
| Current approval or certificate | The live approval or listing reference (e.g. a VdS or FM Approval Guide entry) confirming the system remains valid. |
| Controlled DIOM revision | The DIOM manual issue, revision number and date used for the design. |
| Component evidence | Test or approval evidence for pumps, valves, cylinders, pipework and other critical components. |
| Design parameters | Nozzle spacing, height, pressure, flow, area of nozzle operation and duration taken from the DIOM manual. |
| Deviations | Any departure from the DIOM manual or approval, with its justification and the party who approved it. |
| Approval conditions | Conditions attached to the approval or certificate that affect the design or installation. |
| Commissioning acceptance criteria | The pass/fail criteria to be demonstrated at commissioning and handover. |

## A1.B Different routes to the evidence gate

These are the typical routes to a confirmed DIOM manual. A system can be type approved, which needs less evidence because it is already consolidated on the approval certificate; manufacturer declared, which needs more evidence directly, from performance (fire-test summary), component testing and quality assurance; or equivalency based, typically used when the hazard is not covered by existing test protocols or their scopes.




**Notice:**

**General:** The appropriate route should provide sufficient evidence, verification and technical scrutiny to give stakeholders confidence in the proposed solution, considering the nature of the application.

**Type-approved systems:** Independent approval provides verified evidence of system performance and design, allowing stakeholders to rely on the third-party approved DIOM manual and reducing the need for further detailed technical review.

**Manufacturer-declared systems:** These require robust supporting evidence of component and system performance. Stakeholders should verify the evidence and undertake additional technical scrutiny where a third-party verified DIOM manual is not available.

**Equivalency route:** This is project-specific and typically used where existing standards, approvals or protocols do not adequately cover the application. Demonstrating equivalent safety and performance generally requires detailed technical justification or testing and extensive stakeholder review, making this route the exception rather than the norm.

## A1.C Normative and informative references used in this guide

The project shall use the editions required by the applicable law, contract and AHJ. The list below identifies the reference families used in this document and is not a substitute for a project-specific standards register.

**Currency of references.** A project shall identify the current edition and status of every document used. Standards can be revised, approval scopes can change and Approval Guide or certificate entries can be withdrawn; therefore, the final design review shall confirm validity at the date of approval and again before handover.

| Reference | Use in this guide |
|---|---|
| IWMA Water Mist Guide, current version | Informative basis and terminology for this guide. |
| EN 14972-1:2020, Fixed firefighting systems — Water mist systems — Part 1 | Principal European land-based design, installation, inspection and maintenance framework referenced by the Water Mist Guide. |
| EN 14972 series, application-specific fire-test protocols | Select the part applicable to the project hazard and verify its current title, edition and limitations. |
| EN 17450 series, water mist component test protocols | Component evidence for critical water mist system components. |
| FM 5560, Water Mist Systems, and the FM Approval Guide entry | Approval and fire-test route, and verification of the exact FM Approved system, application, components and operating limits. |
| VdS water mist guidelines and approval documents | Approval and design route where specified or accepted. |
| IWMA Matrix of fire-test protocols | Informative index for identifying relevant land-based and marine fire-test documents. |
| Applicable national law, building code, fire strategy and insurer requirements | Mandatory project-specific requirements; list exact editions in Step 5. |
| FM Property Loss Prevention Data Sheet 4-2, Water Mist Systems | FM project guidance for selection, design, installation, water supply, supervision and maintenance; use the current edition and insurer instructions. |
| VdS 3883 series, Fire Test Protocols for Water Mist Systems | Application-specific fire-test basis used with VdS 3188 and the relevant VdS approval certificate. |
| EN 12845, Fixed firefighting systems — Automatic sprinkler systems — Design, installation and maintenance | Related reference only where a project requirement or water-supply interface expressly invokes sprinkler-system provisions; it does not replace water mist evidence. |
| Manufacturer's controlled DIOM / approved design manual and approval documentation | Primary proprietary source for the exact system design limits under EN, FM, VdS or another accepted approval scheme. |

**Marine reference:** IMO circulars and class-society rules are mentioned only to clarify scope. They are not included as a design track in this land-based guide.