

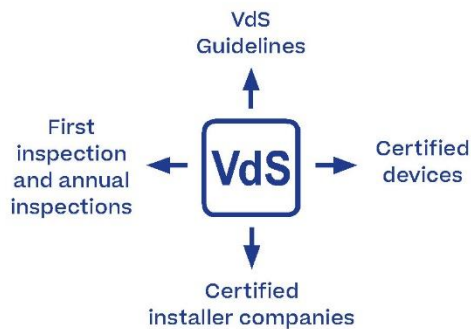
Water mist... an alternative to conventional systems?

Water mist systems have been on the market for over 30 years and there are several guidelines for their application, yet water mist is still treated as a new technology. Should you be afraid of water mist? Can we use it as an alternative to conventional systems such as sprinklers? Kamil Swietnicki of VdS offers some guidance.

VdS has been dealing with certification and acceptance of this type of system for many years. The experience gained can be helpful not only for designers, contractors and manufacturers but also for customers who would like to invest in good and effective fire protection. But how can you tell if an installation is effective? Can safety be measured? Who can possibly do this?

VdS – who are we?

Set up in 1908, VdS Schadenverhütung GmbH is a 100% subsidiary of the German Insurance Association (GDV). With seven offices in Germany and four abroad (Poland, Czech Republic, Netherlands and China), VdS today has over 400 experts who conduct risk assessments, site inspections, and certifications of products, companies and professionals. We also offer training programmes and a comprehensive suite of publications. We believe in an integral concept of protection to achieve reliability and efficiency of fire protection systems!



Why are site inspections so important?

It might seem that a well-designed fire extinguishing system is a good system. But is it? During our daily work we find that even the best-designed system can have some errors. VdS differentiates between different notices of deficiency in its reports. Some of the examples we see are below.

Design deficiencies

- This is the moment when the most inaccuracies are made. Our customers can save a lot of money by identifying mistakes at this stage.

Deficiencies found during on-site inspections

- Sprinklers mounted before installation at the ceiling
- Incorrectly made pipe connections



Building deficiencies

- Sprinkler in ceiling insulation
- Non-executed / damaged installation passages through fire walls
- Incorrectly made electric trace-heating



Technical deficiencies

- Sprinklers painted on site, pump reductions on site
- Incorrect execution of pipe fasteners
- Improper slopes of pipelines in dry sections
- Missing inspections on old installations after 12½ or 25 years



Organizational errors

- Storage areas exceeded
- Storage of flammable materials right next to the building
- Inappropriate storage conditions



Differences between low and high pressure water mist systems and wet pipe and dry pipe systems

The information below shows the most relevant differences.

Pressure losses

	Low pressure	High pressure
Typical nozzle pressure	1 to 10 bar	50 to 80 bar
Typical pressure at the pump	3 to 10 bar	100 to 140 bar
Possible acceptable pressure loss	2 to 10 bar	20 to 80 bar

High-pressure technology requires different components

- Pumps - piston pumps are generally used instead of centrifugal pumps

Low pressure pump systems	High pressure pump systems
Pumps comply with VdS CEA 4001 or VdS 2109	The pump, pump modules or pump set comply with VdS 3188
As a rule, one pump and possibly a pressure tank are used	Pump modules are most used to achieve flow rates
Impellor pumps are used	Piston pumps are used Piston pumps need a safety valve and relief valve
Pump characteristic curve must be selected for the installation	Piston pumps always have the same capacity

- Valves - ball valves and solenoid valves are generally used instead of control and alarm valves
- Pipelines - stainless steel pipes are generally used instead of steel pipes

Cylinder systems (high pressure)

- Cylinder systems have separate cylinders for gas (usually nitrogen or compressed air) and water
- Typical gas/water mixture ratio is 1:3
- The duration is limited and is at least double the extinguishing time determined by fire tests
- Use with or without a pressure control valve

Low and High pressure systems according to standards:

- EN 14972:

Low pressure	Medium pressure	High pressure
Up to 12.5 bar	12.5 bar to 35 bar	over 35 bar

- NFPA 750 and FM 5560

Low pressure	Medium pressure	High pressure
Up to 12.1 bar	12.1 bar to 34.5 bar	over 34.5 bar

- VdS 3188

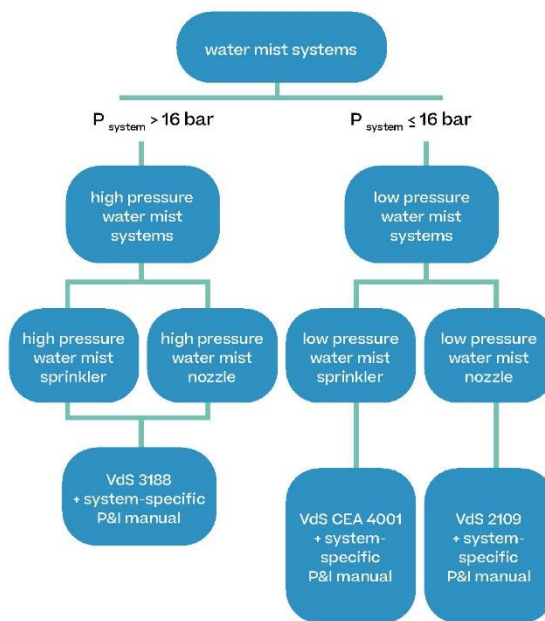
Low pressure	High pressure
Up to 16 bar	over 16 bar

water mist

What installation types can be found in water mist systems?

- Automatic water mist systems
Systems with a thermal release element (e.g. glass bulb) in the water mist nozzle. Complete system providing water mist protection and comprising one or more systems, pipework to the systems and the water supply.
- Water mist extinguishing systems
Systems in which open water mist nozzles are used, which may be divided into different extinguishing zones and are triggered in zones

How to choose a proper guideline for water mist systems according to VdS?



Schematic overview of the application of regulations for water mist systems

Design basics for water mist extinguishing systems

What standards and guidelines are present on the market?

- VdS 3188:2019-10(02): Water Mist Sprinkler Systems and Water Mist Extinguishing Systems (High Pressure Systems) - Planning and Installation
 - VdS 3188 contains the requirements of EN 14972
 - Main part:**
 - Basic requirements
 - Dimensioning and requirements for hydraulic calculations
 - Water supply and electric energy supply
 - Requirements for pressure systems
 - Arrangement of nozzles

- Alarming and monitoring devices
- Maintenance of operational readiness

Annex K:

- Requirements and guidelines for selected fields of application
- Fields of application
- Limits of application
- Further annex:
 - Requirements for design, installation, operation and maintenance (DIOM) manual + technical sheets
- Adding foaming agent
- Dimensioning the network

- VdS 3883 1-8: Fire Test Protocols for different applications

- EN14972-1:2021: Fixed firefighting systems - Water mist systems - Part 1: Design, installation, inspection and maintenance

Includes protection of areas such as:

- Residential areas, rooms in hospitals, etc.
- Underground garages
- Office areas
- Defined commercial and storage areas

Must be used with the system certificate and its manufacturer's DIOM manual

- FM 5560: Approval Standard for Water Mist Systems
 - It is not a guideline for "design and installation"
 - A set of requirements for components and systems
 - Very detailed environmental requirements
 - Detailed fire test protocols (many are VdS approved)
 - Guideline FM 4-2 January 2022 "Water Mist Systems" provides basic information on planning and installation

- NFPA 750:2023: Standard on Water Mist Fire Protection Systems.

- No details for installation dimensioning
- Typically, a reference to the "manufacturer's listing" or AHJ. There are no binding statements or specifics, which can result in a very wide range of interpretations
- Must be used with system certificate and its manufacturer's DIOM manual



Other

- IMO (np. IMO MSC 1165, IMO A. 800)
- APSA D2 CNPP
- British Standard: DD 8489: 2016

What do you need to pay attention to when applying other design principles?

- Mixing of standards should be categorically excluded due to the frequent contradiction of requirements.
- The requirements of a given standard must be fully met.
- Selected standard together with the system certificate and its manufacturer's manual should be used.

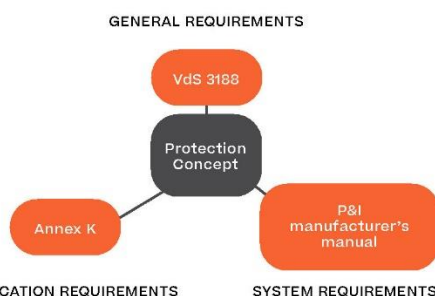
Necessary documents for design?

-  VdS 3188 - Basic requirements for the system, application and basic parameters
- +
-  Nozzle parameters, system assembly details, etc. (DIOM = Design, Installation, Operation and Maintenance Manual)

What are the general requirements according to VdS 3188?

- Hydraulics
 - Area of operation (VdS 3188 point 6.1.1) – for automatic water mist systems:
 - Depends on the type of application (table below)

Examples of protection concepts



Designation	Corresponds to fire hazard class ¹⁾	Wet pipe or pre-action system	Dry pipe system
		Area of operation [m ²]	
Office areas	LH	84	inadmissible
	OH1	72	90
Recreation areas	LH	84	inadmissible
	OH1	72	90
Office and recreation areas with water mist side wall sprinklers	LH	144	inadmissible
	OH1	120	inadmissible
False ceilings in above mentioned areas	LH	84	inadmissible
	OH1	72	90
Parking garages	OH2	144	180
Selected sales, technical and storage areas	OH3	216	inadmissible

1) If further requirements (e.g. high-rise building or convention room) result in a classification in another fire hazard class, which results in a larger area of operation, and if the fire risk corresponds to the field of application defined for the respective water mist system, the larger area of operation shall always be taken as the basis.

Table 6-1: Fields of application and areas of operation for water mist sprinkler systems

Field of application	Restriction (examples)	Other limitations which can be found
Office: <ul style="list-style-type: none"> • single and open offices • restaurants and kitchens • public areas in buildings with low fire load • escape routes or other corridors • museums 	<ul style="list-style-type: none"> • Storage of plastics only possible to a small extent (consultation with VdS necessary). • Kitchen areas (e.g. in restaurants) may only be protected with a water mist sprinkler system for office areas if it has been proven that no water can reach areas where hot grease is to be expected and no oil or grease is sprayed by the automatic water mist nozzles. 	Area limitation ≤ 50m ² , (fire separated 30 min) for <ul style="list-style-type: none"> • Storage rooms (storage of flammable liquids, gases, plastics, etc. not allowed) • Libraries, file rooms, archives • Technical areas • Area of operation of 144 m² • Technical rooms with low fire risk • High-rise buildings and areas classified as recreation areas (OH4) • Extra requirements in Annex D or E • Areas such as cinemas, theatres, concert halls, exhibitions, fairs, etc. not allowed
Recreation areas <ul style="list-style-type: none"> • hotel rooms • rooms in hospitals, care homes, homes for the elderly • apartments • recreation areas 	<ul style="list-style-type: none"> • Other installations, e.g. air conditioning, must be switched off automatically 	
Office and recreation areas with automatic water mist side wall nozzles <ul style="list-style-type: none"> • offices • public areas with low fire load • hotel rooms • rooms in hospitals, nursing homes, homes for the elderly • apartments • recreation areas 	<ul style="list-style-type: none"> • Fast response nozzles shall be used • Automatic water mist side wall nozzles may be used in rooms up to 120 m² (fire separated 30 min) 	<ul style="list-style-type: none"> • Storage rooms - not allowed
False ceilings and false floors	<ul style="list-style-type: none"> • False ceilings and false floors from 0.3 m to 0.8 m 	<ul style="list-style-type: none"> • There shall be no fire load above the nozzles • Conveyor systems not allowed in these areas (e.g. pneumatic conveyor system) • Calculations of the fire load of cable routes according to Annex S, VdS 3188 • Space of the false floors shall be made as a fire-retardant area with a fire resistance of 30 minutes
Parking garages	<ul style="list-style-type: none"> • Non-automatic fully enclosed car parks and underground garages • Only parking areas and driveways for passenger cars with a permissible total weight of 3.5 tonnes may be protected 	<ul style="list-style-type: none"> • Ventilation and its effects should be considered • Dry network only if included in DIOM • Storage in these areas, e.g. tyres is not allowed
Selected sales, storage and technical areas <ul style="list-style-type: none"> • sales areas • storage areas adjacent to sales areas • archives • libraries • technical areas 	<ul style="list-style-type: none"> • The individual areas together may have a maximum area of 500 m² (fire separated 30 min) 	<ul style="list-style-type: none"> • The storage of flammable liquids or gases is not permitted • The storage or sale of furniture or materials with expanded plastics is not permitted

(Annex K.1)

Water mist

Field of application	Restriction (examples)	Other limitations which can be found
Cable ducts	<ul style="list-style-type: none"> The maximum length of one area should not exceed 60 m From 100 m² of the fire compartment, the water mist extinguishing system shall be designed for at least 100 m³ or for three adjacent zones with the greatest water demand, whichever is greater 	<ul style="list-style-type: none"> The longitudinal air velocity shall not exceed 1 m/s The size of a cable ducts is strictly defined
Machine room <ul style="list-style-type: none"> Generators, emergency aggregates Hydraulic aggregates (including associated equipment such as oil pumps, oil tanks, generators, gearboxes, drive shafts and hydraulic aggregates) Pumping devices Test stands Gas or steam turbines 	Combustible liquids: <ul style="list-style-type: none"> Metal containers up to 210 l Total storage quantity < 450 l Flash point > -4°C Rack or similar storage is not allowed Storage of gases (including liquids) is not allowed 	<ul style="list-style-type: none"> Specified permissible openings in the room Fuel (flash point < -4°C) acceptable but limited for test run purposes only A triggering of the water mist extinguishing system shall automatically stop the test Duration = "Run-down time" + DIOM extinguishing time
Paint booths <ul style="list-style-type: none"> paint booths dryers preparation or flash-off area shifting area 	<ul style="list-style-type: none"> In the protected area, the quantity of flammable liquids shall not exceed 100 l, the maximum tank size is 50 l, Flash point > 21°C 	<ul style="list-style-type: none"> Only water mist extinguishing systems may be used in paint booths Protect paint robots with a separate extinguishing system, such as a gas extinguishing system – CO₂
Storage and processing areas for flammable liquids <ul style="list-style-type: none"> paint and lacquer storage room paint mixing room 	Combustible liquids: <ul style="list-style-type: none"> Flash point > -4°C 	<ul style="list-style-type: none"> Storage: Metal IBCs with a capacity of max. 1000 l on metal pallets Rack storage (construction limitations) or directly on the floor For storage quantities > 2,000 l in a room, a manually controlled proportioning of film-forming foam concentrates shall be provided
Kitchen protection equipment <ul style="list-style-type: none"> deep fat fryers tiltable frying pans frying, griddle and grill plates woks associated exhaust hoods with grease separators woks associated exhaust hoods with grease separators 	<ul style="list-style-type: none"> The maximum filling capacity of a deep fat fryer shall not exceed 50 litres of grease or oil with area of 800 x 600 mm 	<ul style="list-style-type: none"> Ventilation and its effects should be considered Dry network only if included in DIOM Storage in these areas, e.g. tyres is not allowed

(Annex K.2)

Effective area (VdS 3188 point 6.1.2) – for water mist extinguishing systems:

- Room protection: the entire cubic capacity
- Dividing a room into several effective areas is not allowed
- All areas of operation within a radius of 7 m, if not separated according to point 4.4 VdS 3188
- Water duration
 - Automatic water mist systems:**
 - Areas LH - 30 min
 - Areas OH - 60 min
 - Water mist extinguishing systems:**
 - Minimum 30 min
 - Different durations are described in the DIOM manual

What examples of the applications or application requirements can be found in VdS 3188?

- Field of applications of water mist systems (Annex K.1)
- Field of applications of water mist extinguishing systems (Annex K.2)

Are you sure that's all?

The information provided is only an introduction to the world of water mist systems. For most customers, this is still a new and unrecognised fire protection system, and therefore there are great concerns about its effectiveness.

Water mist systems have been tested in many ways for many years. It is worth noting that these tests are performed under full scale conditions. The tests conducted by VdS compare the efficiency of these systems with sprinkler systems (in most cases) as a reference. You might wonder why we compare them to sprinkler systems. Well, we know the fire protection performance of sprinkler systems very well, hence they are the basis for comparisons.

Are water mist systems effective? Of course, provided the water mist system is designed and manufactured in accordance with applicable standards. Are they complicated? That depends, but in fact they have limits and are not suitable for all areas. Should you be afraid of them? Absolutely not, if used properly. Ask the experts of VdS for support.