

DIN EN 12845:2020-11 (E)

Fixed firefighting systems - Automatic sprinkler systems - Design, installation and maintenance

Contents		Page
European foreword.....		12
Introduction		13
1	Scope.....	15
2	Normative references.....	15
3	Terms and definitions	16
4	Contract planning and documentation.....	24
4.1	General.....	24
4.2	Initial considerations.....	24
4.3	Preliminary or estimating stage	24
4.4	Design stage	25
4.4.1	General.....	25
4.4.2	Summary schedule.....	25
4.4.3	Installation layout drawings	25
4.4.4	Water supply.....	28
5	Extent of sprinkler protection.....	31
5.1	Buildings and areas to be protected.....	31
5.1.1	General.....	31
5.1.2	Permitted exceptions within a building.....	31
5.1.3	Necessary exceptions.....	31
5.2	Storage in the open air	31
5.3	Fire resistant separation	31
5.4	Protection of concealed spaces	32
5.5	Height difference between the highest and lowest sprinklers.....	32
6	Classification of occupancies and fire hazards.....	32
6.1	General.....	32
6.2	Hazard classes	32
6.2.1	General.....	32
6.2.2	Light Hazard - LH	32
6.2.3	Ordinary Hazard - OH.....	32
6.2.4	High Hazard - HH	33
6.3	Storage	34
6.3.1	General.....	34
6.3.2	Storage Configuration.....	34
7	Hydraulic design criteria.....	37
7.1	LH, OH and HHP	37
7.2	High Hazard Storage - HHS.....	38
7.2.1	General.....	38
7.2.2	Ceiling or roof protection only	38
7.2.3	Intermediate level in-rack sprinklers	39
7.3	Pressure and flow requirements for pre-calculated systems.....	41
7.3.1	LH and OH systems	41
7.3.2	HHP and HHS systems without in-rack sprinklers.....	42
8	Water supplies	44

8.1	General	44
8.1.1	Duration	44
8.1.2	Continuity	44
8.1.3	Frost protection.....	44
8.2	Maximum water pressure.....	44
8.3	Connections for other services	45
8.4	Housing of equipment for water supplies	46
8.5	Test facility devices.....	46
8.5.1	General	46
8.5.2	At pump house	47
8.5.3	At control valve sets.....	47
8.6	Water supply test.....	47
8.6.1	General	47
8.6.2	Storage tank and pressure tank supplies	47
8.6.3	Town main, booster pump, elevated private reservoir and gravity tank supplies	48
9	Type of water supply	48
9.1	General	48
9.2	Town mains.....	48
9.3	Storage tanks.....	48
9.3.1	General	48
9.3.2	Water volume.....	49
9.3.3	Refill rates for full capacity tanks.....	50
9.3.4	Reduced capacity tanks	50
9.3.5	Effective capacity of tanks and dimensions of suction chambers	52
9.3.6	Strainers.....	53
9.4	Inexhaustible sources – settling and suction chambers	53
9.5	Pressure tanks	56
9.5.1	General	56
9.5.2	Housing.....	56
9.5.3	Minimum capacity (water).....	56
9.5.4	Air pressure and contents	56
9.5.5	Charging with air and water	57
9.5.6	Control and safety equipment.....	57
9.6	Choice of water supply.....	57
9.6.1	Single water supplies	57
9.6.2	Superior single water supplies	58
9.6.3	Duplicate water supplies	58
9.6.4	Combined water supplies	58
9.7	Isolation of water supply	59
10	Pumps	59
10.1	General	59
10.2	Multiple pump arrangements	59
10.3	Compartments for pumpsets.....	60
10.3.1	General	60
10.3.2	Sprinkler protection.....	60
10.3.3	Temperature	60
10.3.4	Ventilation.....	60
10.4	Maximum temperature of water supply	60
10.5	Valves and accessories.....	60
10.6	Suction conditions.....	61
10.6.1	General	61
10.6.2	Suction pipe	61

10.7	Performance characteristics.....	64
10.7.1	Pre-calculated systems – LH and OH.....	64
10.7.2	Pre-calculated systems – HHP and HHS with no in-rack sprinklers.....	65
10.7.3	Calculated systems.....	66
10.7.4	Pressure and water capacity of boosted town mains.....	67
10.7.5	Pressure switches.....	67
10.8	Electrically driven pumpsets.....	67
10.8.1	General.....	67
10.8.2	Electricity supply.....	67
10.8.3	Main switchboard.....	68
10.8.4	Installation between the main switchboard and the pump controller.....	68
10.8.5	Pump controller.....	69
10.8.6	Monitoring of pump operation.....	69
10.9	Diesel engine driven pumpsets.....	69
10.9.1	General.....	69
10.9.2	Engines.....	69
10.9.3	Cooling system.....	70
10.9.4	Air filtration.....	70
10.9.5	Exhaust system.....	70
10.9.6	Fuel, fuel tank and fuel feed pipes.....	70
10.9.7	Starting mechanism.....	71
10.9.8	Electric starter motor batteries.....	72
10.9.9	Battery chargers.....	72
10.9.10	Siting of batteries and chargers.....	72
10.9.11	Starter alarm indication.....	72
10.9.12	Tools and spare parts.....	73
10.9.13	Engine tests and exercising.....	73
11	Installation type and size.....	74
11.1	Wet pipe installations.....	74
11.1.1	General.....	74
11.1.2	Protection against freezing.....	74
11.1.3	Size of installations.....	74
11.2	Dry pipe installations.....	75
11.2.1	General.....	75
11.2.2	Size of installations.....	75
11.3	Alternate installations.....	75
11.3.1	General.....	75
11.3.2	Size of installations.....	76
11.4	Pre-action installations.....	76
11.4.1	General.....	76
11.4.2	Automatic detection system.....	76
11.4.3	Size of installations.....	77
11.5	Subsidiary dry pipe or alternate extension.....	77
11.5.1	General.....	77
11.5.2	Size of subsidiary extensions.....	77
11.6	Subsidiary water spray extension.....	77
12	Spacing and location of sprinklers.....	77
12.1	General.....	77
12.2	Maximum area of coverage per sprinkler.....	78
12.3	Minimum distance between sprinklers.....	80
12.4	Location of sprinklers in relation to building construction.....	80
12.5	Intermediate sprinklers in HH occupancies.....	86

12.5.1	General	86
12.5.2	Maximum vertical distance between sprinklers at intermediate levels	86
12.5.3	Horizontal position of sprinklers at intermediate levels	86
12.5.4	Numbers of rows of sprinklers at each level	88
12.5.5	HHS intermediate sprinklers in non-shelved racks	88
12.5.6	HHS intermediate sprinklers below solid or slatted shelves in racks (ST5 and ST6)	89
13	Pipe sizing and layout	90
13.1	General	90
13.2	Calculation of pressure losses in pipework	90
13.2.1	Pipe friction loss	90
13.2.2	Static pressure difference	91
13.2.3	Velocity	91
13.2.4	Pressure loss through fittings and valves	91
13.2.5	Accuracy of calculations	92
13.3	Pre-calculated systems	93
13.3.1	General	93
13.3.2	Location of Design Points	93
13.3.3	Light Hazard - LH	94
13.3.4	Ordinary Hazard - OH	96
13.3.5	High hazard - HHP and HHS (except intermediate level sprinklers)	97
13.4	Fully calculated systems	106
13.4.1	Design density	106
13.4.2	Locations of the area of operation	107
13.4.3	Shape of the area of operation	107
13.4.4	Minimum sprinkler discharge pressure	110
13.4.5	Minimum pipe diameters	110
14	Sprinkler design characteristics and uses	111
14.1	General	111
14.2	Sprinkler types and application	111
14.2.1	General	111
14.2.2	Ceiling, flush, recessed and concealed pattern	112
14.2.3	Sidewall pattern	112
14.2.4	Flat spray pattern	112
14.3	Flow from sprinklers	112
14.4	Sprinkler temperature ratings	113
14.5	Sprinkler thermal sensitivity	114
14.5.1	General	114
14.5.2	Interaction with other measures	114
14.6	Sprinkler guards	114
14.7	Sprinkler water shields	114
14.8	Sprinkler rosettes	115
14.9	Corrosion protection of sprinklers	115
15	Valves	115
15.1	Control valve set	115
15.2	Stop valves	115
15.3	Ring main valves	115
15.4	Drain valves	115
15.5	Test valves	116
15.5.1	Alarm and pump start test valves	116
15.5.2	Remote test valves	117
15.6	Flushing connections	117
15.7	Pressure gauges	117

15.7.1	General.....	117
15.7.2	Water supply connections.....	117
15.7.3	Control valve set.....	117
15.7.4	Removal.....	118
16	Alarms and alarm devices.....	118
16.1	Water flow alarms.....	118
16.1.1	General.....	118
16.1.2	Water motor and gong.....	118
16.1.3	Piping to water motor.....	118
16.2	Electrical water flow and pressure switches	118
16.2.1	General.....	118
16.2.2	Water flow alarm switches.....	118
16.2.3	Dry and pre-action systems.....	119
16.3	Fire brigade and remote central station alarm connection.....	119
17	Pipework.....	119
17.1	General.....	119
17.1.1	Underground piping.....	119
17.1.2	Above ground piping.....	119
17.1.3	Welding of steel pipe.....	119
17.1.4	Flexible pipes and joints.....	120
17.1.5	Concealment.....	120
17.1.6	Protection against fire and mechanical damage.....	120
17.1.7	Painting.....	120
17.1.8	Drainage	120
17.1.9	Copper pipe	121
17.2	Pipe supports.....	121
17.2.1	General.....	121
17.2.2	Spacing and location	121
17.2.3	Design.....	122
17.3	Pipework in concealed spaces.....	122
17.3.1	General.....	122
17.3.2	False ceilings above OH occupancies	122
17.3.3	All other cases	123
18	Signs, notices, and information.....	123
18.1	Block plan	123
18.2	Signs and notices	123
18.2.1	Location plate	123
18.2.2	Signs for stop valves.....	123
18.2.3	Control valve set.....	123
18.2.4	Water supply connections to other services.....	124
18.2.5	Suction and booster pumps.....	124
18.2.6	Electric switches and control panels.....	124
18.2.7	Testing and operating devices.....	125
19	Commissioning.....	125
19.1	Commissioning tests	125
19.1.1	Pipework.....	125
19.1.2	Equipment	125
19.1.3	Water supplies	126
19.2	Completion certificate and documents	126
20	Maintenance.....	126
20.1	General.....	126

20.1.1	Introduction.....	126
20.1.2	Programmed work.....	126
20.1.3	Precautions while carrying out work.....	126
20.1.4	Replacement sprinklers.....	126
20.2	User's programme of inspection and checking.....	127
20.2.1	General	127
20.2.2	Weekly routine.....	127
20.2.3	Monthly routine	128
20.3	Service, testing and maintenance schedule	128
20.3.1	General	128
20.3.2	Quarterly routine.....	128
20.3.3	Half-yearly routine.....	129
20.3.4	Yearly routine	130
20.3.5	3 Yearly routine.....	130
20.3.6	10 yearly routine	131
21	A1 Periodic system inspection.....	131
	Annex A (normative) Classification of typical hazards.....	132
	Annex B (normative) Methodology for categorizing stored goods.....	135
B.1	General	135
B.2	Material factor (M).....	135
B.2.1	General	135
B.2.2	Material Factor 1.....	135
B.2.3	Material factor 2.....	136
B.2.4	Material factor 3.....	136
B.2.5	Material factor 4.....	137
B.3	Storage configuration.....	137
B.3.1	Effect of storage configuration.....	137
B.3.2	Exposed plastic container with non-combustible content	138
B.3.3	Exposed plastic surface - unexpanded	138
B.3.4	Exposed plastic surface - expanded.....	138
B.3.5	Open structure.....	138
B.3.6	Solid block materials	139
B.3.7	Granular or powdered materials.....	139
B.3.8	No special configuration	139
	Annex C (normative) Alphabetical listing of stored products and categories.....	140
	Annex D (normative) Zoning of sprinkler installations	144
D.1	General	144
D.2	Zoning of installations	144
D.3	Requirements for zoned installations.....	144
D.3.1	Extent of zones.....	144
D.3.2	Zone subsidiary stop valves.....	144

D.3.3	Flushing Valves	144
D.3.4	Monitoring.....	144
D.3.5	Zone test and drainage facilities.....	145
D.3.6	Installation control valve set	145
D.3.7	Installation monitoring and alarms	145
D.4	Block plan	145
Annex E	(normative) Special requirements for high rise systems.....	147
E.1	General.....	147
E.2	Design criteria.....	147
E.2.1	Hazard group	147
E.2.2	Subdivision of high rise sprinkler systems.....	147
E.2.3	Standing water pressures at non-return and alarm valves	147
E.2.4	Calculation of distribution pipework for pre-calculated systems.....	147
E.2.5	Water pressures	147
E.3	Water supplies	148
E.3.1	Types of water supplies	148
E.3.2	Pressure and flow requirements for pre-calculated installations.....	148
E.3.3	Water supply characteristics for pre-calculated installations	148
E.3.4	Pump performance for pre-calculated installations.....	148
Annex F	(normative) Additional measures to improve system reliability and availability	151
F.1	General.....	151
F.2	Subdivision into zones	151
F.3	Wet pipe installations.....	151
F.4	Sprinkler type and sensitivity	151
F.5	Control valve set.....	151
F.6	Water supplies	151
F.7	Additional measures for theatres	151
F.8	Additional precautions for maintenance	152
Annex G	(normative) Protection of special hazards.....	153
G.1	General.....	153
G.2	Aerosols	153
G.3	Clothes in multiple garment hanging storage.....	153
G.3.1	General.....	153
G.3.2	Categorization	154
G.3.3	Sprinkler protection other than at ceiling.....	154
G.3.4	Sprinklers in operation.....	154

G.3.5	Ceiling sprinklers	154
G.3.6	Automatic shutdown	154
G.3.7	Control valve set.....	155
G.4	Flammable liquid storage.....	155
G.5	Idle pallets.....	157
G.6	Spirit based liquors in wooden barrels	158
G.7	Non-woven synthetic fabric	158
G.7.1	Free standing storage.....	158
G.7.2	Rack storage	159
G.8	Polypropylene or polyethylene storage bins.....	159
G.8.1	General	159
G.8.2	Classification	159
G.8.3	Palletized rack storage (ST4)	159
G.8.4	All other storage.....	159
G.8.5	Foam additive.....	160
Annex H	(normative) Sprinkler systems monitoring	161
H.1	General	161
H.2	Functions to be monitored	161
H.2.1	General	161
H.2.2	Stop valves controlling water flow to sprinklers	161
H.2.3	Other stop valves	161
H.2.4	Liquid levels.....	161
H.2.5	Pressures	161
H.2.6	Electrical power	162
H.2.7	Temperature	162
Annex I	(normative) Transmission of alarms	163
I.1	Functions to be monitored	163
I.2	Alarm levels	164
Annex J	(informative) Precautions and procedures when a system is not fully operational.....	165
J.1	Minimizing the effects.....	165
J.2	Planned shut-down	165
J.3	Unplanned shut-down.....	166
J.4	Action following sprinkler operation.....	166
J.4.1	General	166
J.4.2	Installations protecting cold storage warehouses (air circulation refrigeration)	166
Annex K	(informative) Twenty-five year inspection.....	167

Annex L (informative) Special technology	168
Annex M (informative) Independent certification body	169
Annex N (normative) Control Mode Specific Application Sprinklers: CMSA	170
N.1 Introduction	170
N.1.1 General.....	170
N.1.2 Definitions	170
N.1.3 General.....	170
N.1.4 Sprinkler type and temperature rating	170
N.1.5 Water demand.....	171
N.2 Sprinkler location	171
N.2.1 Sprinkler spacing	171
N.2.2 Range pipe sizes.....	171
N.2.3 Minimum clear space below sprinklers.....	171
N.2.4 Excessive clearance	171
N.2.5 Distance of sprinklers below ceiling.....	171
N.2.6 Location of sprinklers in beam and girder, concrete T and panel construction.....	172
N.2.7 Obstructions to sprinkler distribution.....	172
N.3 Design.....	176
Annex O (informative) Example of P&ID	182
Annex P (normative) ESFR sprinkler protection	183
P.1 Introduction	183
P.2 Scope	183
P.3 Definitions	183
P.3.1 Sprinkler, ESFR pattern	183
P.3.2 Suppression mode	183
P.3.3 Classification of goods	183
P.3.4 Ceiling height.....	184
P.3.5 Laced tyre storage.....	184
P.3.6 Paper categories, based on weight	184
P.4 Contract arrangements	184
P.5 General.....	184
P.6 Occupancies and fire hazards	185
P.7 Racked, shelved and post pallet storage.....	185
P.7.1 Longitudinal and transverse flues	185
P.7.2 Shelving.....	186
P.7.3 In-rack sprinklers for ESFR systems	186

P.7.4	Design requirements.....	186
P.8	Building requirements	205
P.8.1	Roof or ceiling slope	205
P.8.2	Measures required to correct excessive roof or ceiling slope.....	205
P.8.3	Ceiling strength	206
P.8.4	Sky lights.....	206
P.8.5	Powered ventilation	206
P.8.6	Walkways and conveyors	208
P.8.7	Sprinkler protection beneath mezzanines.....	208
P.9	ESFR sprinkler installation design	208
P.9.1	Installation type	208
P.9.2	Sprinkler nominal k-factor	208
P.9.3	Temperature ratings thermal sensitivity and colour codings	208
P.9.4	ESFR sprinkler location relative to obstructions at or near the ceiling or roof.....	209
P.10	Pipe sizing	210
P.10.1	General	210
P.10.2	Minimum pipe sizes	210
P.10.3	Minimum ESFR sprinkler flow pressure	210
P.10.4	The number of sprinklers assumed to be operating	210
P.10.5	Shape of design sprinkler area	211
P.10.6	Sprinklers beneath obstructions	211
P.11	Sprinkler spacing and location	211
P.11.1	ESFR sprinkler area of coverage	211
P.11.2	Obstructions	211
P.11.3	Sprinkler positioning relative to roof and ceilings	212
P.11.4	Sprinkler orientation relative to the floor or pipework	212
P.11.5	Clear space below sprinklers	212
P.11.6	Sprinkler location relative to draught or smoke curtains.....	212
P.11.7	Positioning of ESFR sprinklers relative to draught or smoke curtains.....	212
P.11.8	ESFR sprinkler protection adjacent to areas protected by standard sprinklers.....	212
P.12	Water supplies.....	213
P.12.1	Pump drive and power arrangements	213
P.12.2	Pump selection	213
P.12.3	Duration.....	213
Annex Q (informative)	Ⓐ Periodic system inspection.....	214
Bibliography	215