

# DIN EN 12845:2020-11 (E)

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

---

<b>Contents</b>		<b>Page</b>
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	<b>Ⓐ</b> Periodic system inspection.....	131
	<b>Annex A (normative) Classification of typical hazards.....</b>	<b>132</b>
	<b>Annex B (normative) Methodology for categorizing stored goods.....</b>	<b>135</b>
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
	<b>Annex C (normative) Alphabetical listing of stored products and categories.....</b>	<b>140</b>
	<b>Annex D (normative) Zoning of sprinkler installations .....</b>	<b>144</b>
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
<b>Annex H</b>	<b>(normative) Sprinkler systems monitoring.....</b>	<b>161</b>
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
<b>Annex I</b>	<b>(normative) Transmission of alarms .....</b>	<b>163</b>
I.1	Functions to be monitored .....	163
I.2	Alarm levels .....	164
<b>Annex J</b>	<b>(informative) Precautions and procedures when a system is not fully operational.....</b>	<b>165</b>
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
<b>Annex K</b>	<b>(informative) Twenty-five year inspection.....</b>	<b>167</b>

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

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)	<b>Ⓐ</b> Periodic system inspection.....	214
Bibliography	.....	215