BUILDING REPORTS UNIVERSITY

Fire & Life Safety Inspection

BENCHMARK REPORT 2016

The most trusted name in compliance reporting.

Friends & Colleagues,

First and foremost, I would like to convey my sincere appreciation to BuildingReports' network of more than 800 fire and life safety service members for their continued dedication to ensuring the safety of people and property. Without their expertise and diligence, this report would not be possible.

That being said, I am pleased to present the *2016 BuildingReports Fire & Life Safety Benchmark Report!* This report provides data and analysis of over 3 million fire alarm and signaling, fire sprinkler, fire suppression, life safety, and security inspections conducted from 2000 through 2016.

In the 2015 report, we highlighted the following findings:

- **Damaged Goods**: In the 2015 report, the failure cause categories "Damaged or Defective" were separated. A more granular look at the data revealed that – in most cases – the majority of devices were Defective. Many of the Damaged devices for Sprinkler had been painted.

- **Extinguishing the Risk with Best Practices**: It is probably not surprising that fire extinguishers are one of the most susceptible fire and life safety devices, requiring regular service and being at-risk for human tampering. To offset this risk, adhere to the NFPA 10 requirements for monthly visual inspections.

- **Back to School**: With the 2014 report, we included a supplement on healthcare occupancy types, and in the 2015 report, we put a microscope to educational facilities:
  - Overall, preschools and day care centers not only have far fewer incidents, but based on inspection data, they also have fewer device failures in each of the device categories.
  - Both K-12 and higher education have more devices on average than preschool/day care occupancy types. The sole exception to this difference is fire suppression.

- **Sign of the Times**: Fire alarm and signaling signage was the most common device type failure at 33.83%, while sprinkler system air compressors took the most time to inspect at just under 27 minutes on average.

In this 2016 report, we will continue to benchmark key inspection indicators and take a deeper dive into industrial occupancy types. Thank you for your interest and we hope you find it useful.

Warmest regards,

Jason Kronz
President & CTO, BuildingReports

Did You Know…

…that all primary fire codes also now allow for electronic reporting?

BuildingReports' easy to use scan and reporting tools, combined with an online database of safety equipment and national and local safety regulations, takes the pain out of manual paper inspection reporting for service companies.

Using a simple, point-and-scan process, inspectors can easily scan safety equipment, complete a building system inspection in less time than paper-based inspection and in real-time deliver an online, comprehensive inspection report to the building owner that can be securely accessed at any point.

BuildingReports leverages innovative technology and on-demand reporting tools to dramatically improve the building safety inspection process, leading to lower inspection cost and significantly reduced compliance risk. Service companies rely on BuildingReports' easy-to-use mobile scanning tools, online report database, and management tools to properly inspect and maintain the safety devices in buildings they serve.

With BuildingReports' 24/7 access to secure online inspection reports, building owners and AHJs can verify that an inspection was conducted properly and that safety equipment is working as expected. Building owners can also determine if actions are required to comply with safety standards, thereby reducing risk.

800+
Inspection Partners

550,000+
Buildings Inspected

3.5+ MILLION
Inspection Reports

250+ MILLION
Devices Inspected

9+ BILLION SQUARE FEET
of Floorspace Inspected

Table of Contents

Compiled from the largest database of fire and life safety equipment inspection data in the world, this report examines fire and life safety device inspections – including failure rates and reasons – for facilities across 10 distinct building occupancy types. The devices represented fall into five separate categories, including Fire Signaling and Detection, Fire Suppression, Fire Sprinkler, Life Safety, and Security systems. The data on the following pages has been collected by BuildingReports' extensive Member Services network of over 800 inspection companies, as well as the Building Owner and Facility Management community who execute their own inspections internally.

With over 3.5 million inspections in the database encompassing over 250 million inspected devices at the time of publication, the third edition of the report examines:

- What differences between occupancy types and the application of codes and standards does the data from varying industries illustrate?

- What is the benchmark for each industry in terms of the time, number of devices inspected, and the rate at which different device types fail?

- What devices fail, why do they fail, and what can we learn from the data?

- By their nature, industrial facilities such as manufacturing plants and oil refineries offer environmental health and safety professionals numerous safety challenges. What can we learn from the inspection data that may help service companies and facility management avoid potential workplace injury, death, and damage to valuable equipment and property?

In this edition of the report, we continue to analyze inspection data for 10 building occupancy classifications:

- Assembly
- Business
- Detention
- Educational
- Healthcare
- Industrial
- Mercantile
- Mixed
- Residential
- Storage

In 2014, we closely examined healthcare facilities, which yielded interesting results in terms of the highest average inspection times and lowest overall device failure rates. In 2015, we spotlighted educational occupancy types in a special supplement across three distinct categories:

- Day Care & Preschool
- K-12
- Higher Education (colleges, universities, technical and trade schools, etc.)

Both prior reports are available at www.buildingreports.com in the Resources section. This year, our special supplement takes a deeper look at industrial facility types. Skip to page 18 to read the special report on industrial facilities.

Occupancy Type Performance by Device Category

Device Failure Rate & Time Overview

Fire Alarm — Healthcare (1.6%, +0.25% year-over-year from 2015, or from here forward abbreviated as YOY) and Mixed Use (1.96%, -0.01% YOY) facilities lead with the lowest Fire Alarm device failure rates by industry. Conversely, while Mercantile (4.27%, -0.07% YOY) and Industrial (3.41%, -0.03% YOY) facilities experienced the highest device failure rates, both recorded minor improvements over 2015. Overall, Fire Alarm devices experienced an improvement in device failures, bringing the mean down to 2.28% — nearly a 0.10% improvement over 2015.

Safety —In 2016, Safety devices once again ranked highest in terms of the mean failure rate at 6.99%. However, this demonstrated an improvement for a second straight year after averaging 7.15% for 2015 and 7.82% for 2014. Residential (11.01%, -0.11% YOY) and Assembly (9.85%, -0.45% YOY) ranked highest in device inspection failures, which — as in 2015 — were also the largest failure rates of any device type in any category. Healthcare (3.62%, -0.34% YOY) and Storage (4.95%, +0.77% YOY) again ranked lowest in Safety device failures. For the second straight year, Life Safety devices in Storage occupancies failed at a higher percentage than the previous year, along with Detention (8.49%, +0.31% YOY) and Mercantile (8.56%, +0.16% YOY) occupancy types that also reported YOY increases.

Security — In 2016, two occupancy types reported failure rates under 1%. Mercantile (0.62%, no change YOY) and Detention (0.99%, -0.02% YOY) facilities reported the lowest Security device failure rates for the third consecutive year. Also, Assembly (6.16%, +0.44% YOY) reported the highest Security device failures in 2016, while Healthcare (4.59%, +0.71% YOY, and up 2.29% total over the past two years) increased significantly over the inaugural 2014 report.

Sprinkler — Residential failure rates fell modestly for a second straight year (7.54%, -0.14% YOY), but remained highest in the percentage of failed Sprinkler devices. Business (6.37%, -0.03% YOY) and Mixed Use (5.86%, -0.11% YOY) occupancy types followed with the second and third highest failure rates, respectively. Healthcare (2.59%) and Industrial (5.22%) both remained relatively static with only a 0.01% change YOY. Mercantile had the largest change reporting a 5.22% failure rate (+0.48% YOY).

Suppression — Mercantile (0.64%, +0.16% YOY) followed by Healthcare (1.75%, -0.16%) experienced the lowest failure rates in 2016. Healthcare replaced Detention as the second lowest failure rate in both previous reports after Detention reported a 0.85% increase to 1.82% from 0.97% in 2015. Conversely, Education (3.69%, -0.12% YOY) and Residential (3.89%, -0.42% YOY) yielded the highest Suppression device failure rates. As a category, Suppression again had the lowest average device failure rate of any category. While only 2.56% of devices failed on average, it was the second straight increase for the category as a whole at +0.04%.

Key Takeaways — As a whole, the average overall failure rate for all devices inspected fell from 3.63% in 2015 to 3.58% in 2016. In fact, every device category reported a decrease YOY from 2015, with the exception of Suppression which rose 0.04%. As we saw in both previous reports, Healthcare occupancy types reported the fewest device failures overall as well as in the Fire Alarm, Sprinkler, and Safety categories. However, Healthcare varied furthest above the mean in Security at 4.59% versus the 2.87% average for the category – a variance of 1.72%. Healthcare varied the most below the mean in Security with a variance of -3.37%.

The widest variance from the mean for any occupancy type versus the category mean is the failure rate for Safety devices in Residential buildings. Safety continues to report the highest overall failure rate of any category even though it fell below the 7% mean for the first time in 2016. As mentioned above, Suppression devices continue to report the lowest device failure rates by category. When overall figures are compared by occupancy type, as they did in 2015, Healthcare is the lowest at 1.60% overall while Mercantile has the highest overall failure rate at 5.24%.

For more granular data by industry, see Appendix A.

The Highs and Lows: Device Failure by Facility Type

= Category Mean
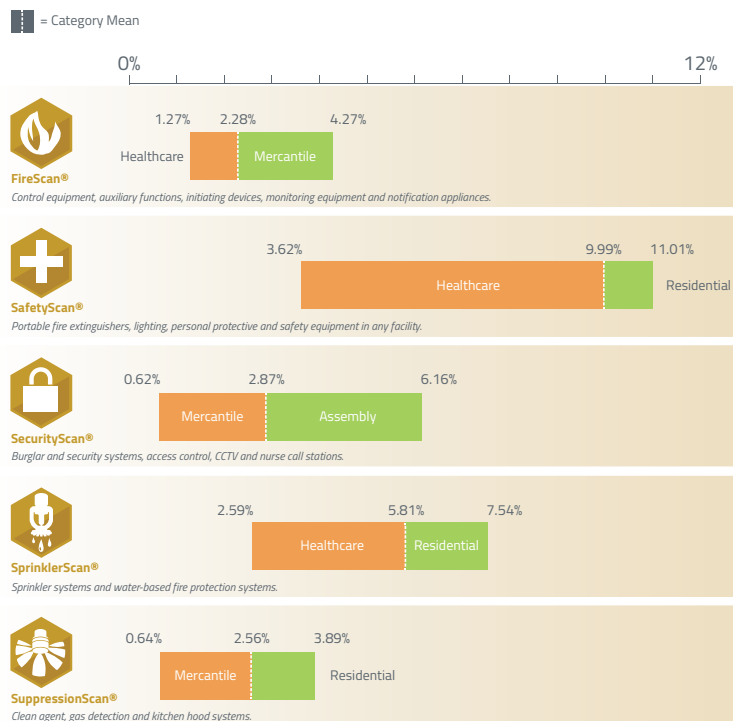
Average Building Inspection Time by Occupancy Type for All Device Types

Occupancy Type	Minutes
Healthcare	233.04
Detention	153.22
Assembly	130.40
Education	119.04
MEAN	112.41
Residential	105.31
Mixed	93.24
Industrial	91.14
Business	90.96
Mercantile	59.12
Storage	51.72
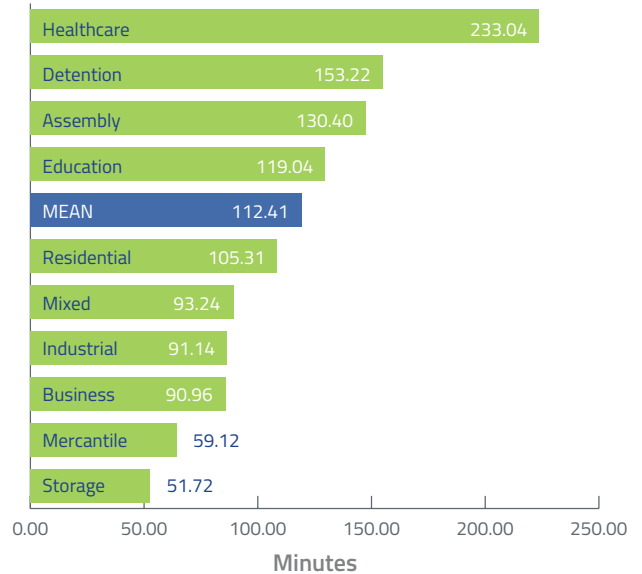
Average Inspection Time per Device by Occupancy Type for All Device Types

Occupancy Type	Minutes
Assembly	2.14
Business	2.01
Mixed	2.01
Mercantile	2.00
Industrial	1.96
Detention	1.94
Healthcare	1.93
MEAN	1.91
Education	1.84
Storage	1.82
Residential	1.67

Minutes

Average Device Failure Rate
by Occupancy Type for All Device Types

Occupancy Type	Rate
Mercantile	5.24%
Residential	4.58%
Assembly	4.48%
Industrial	4.47%
Business	4.35%
Storage	4.09%
MEAN	3.70%
Mixed	3.66%
Detention	3.37%
Education	3.11%
Healthcare	1.60%

0.00% 1.00% 2.00% 3.00% 4.00% 5.00% 6.00%
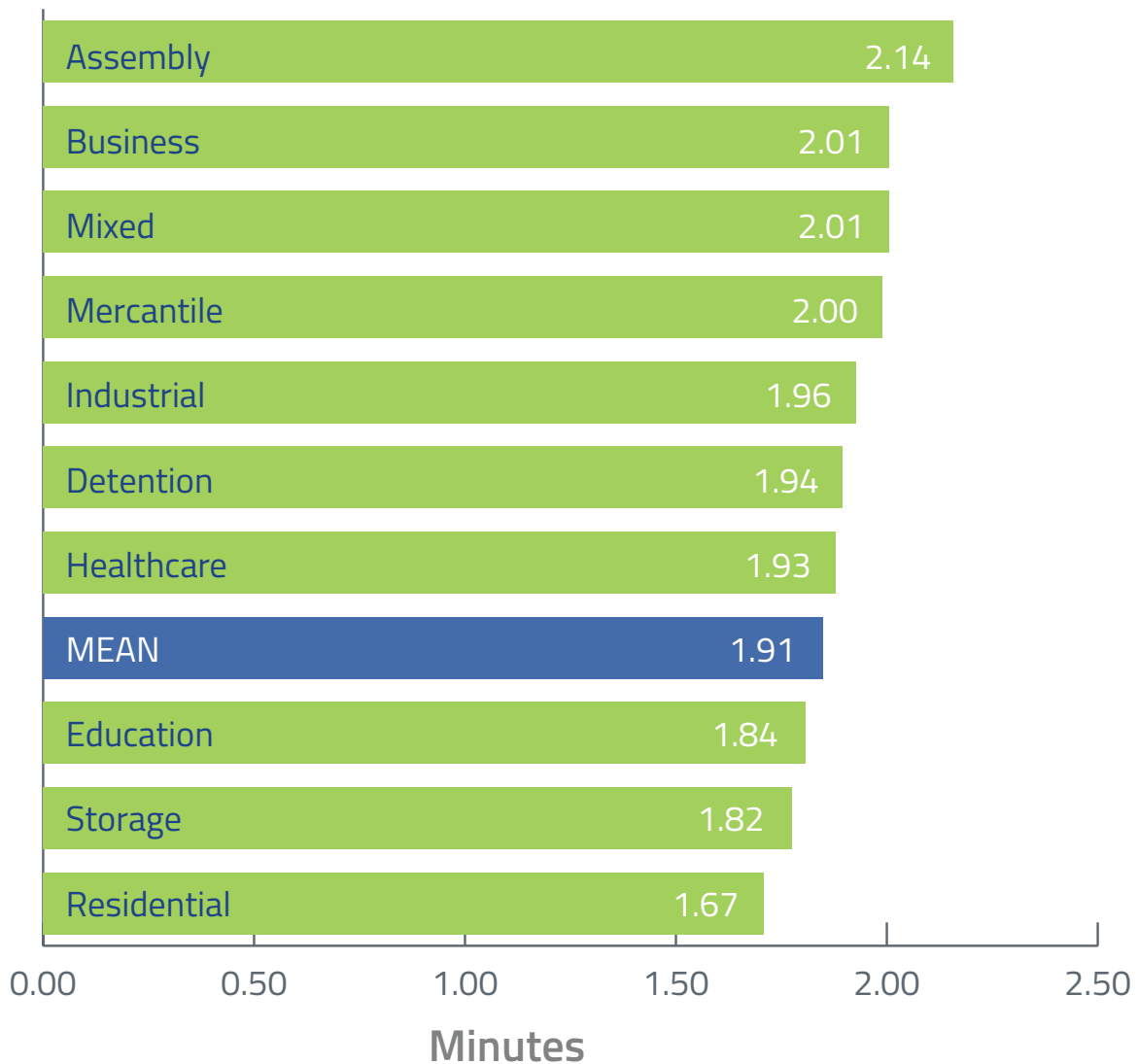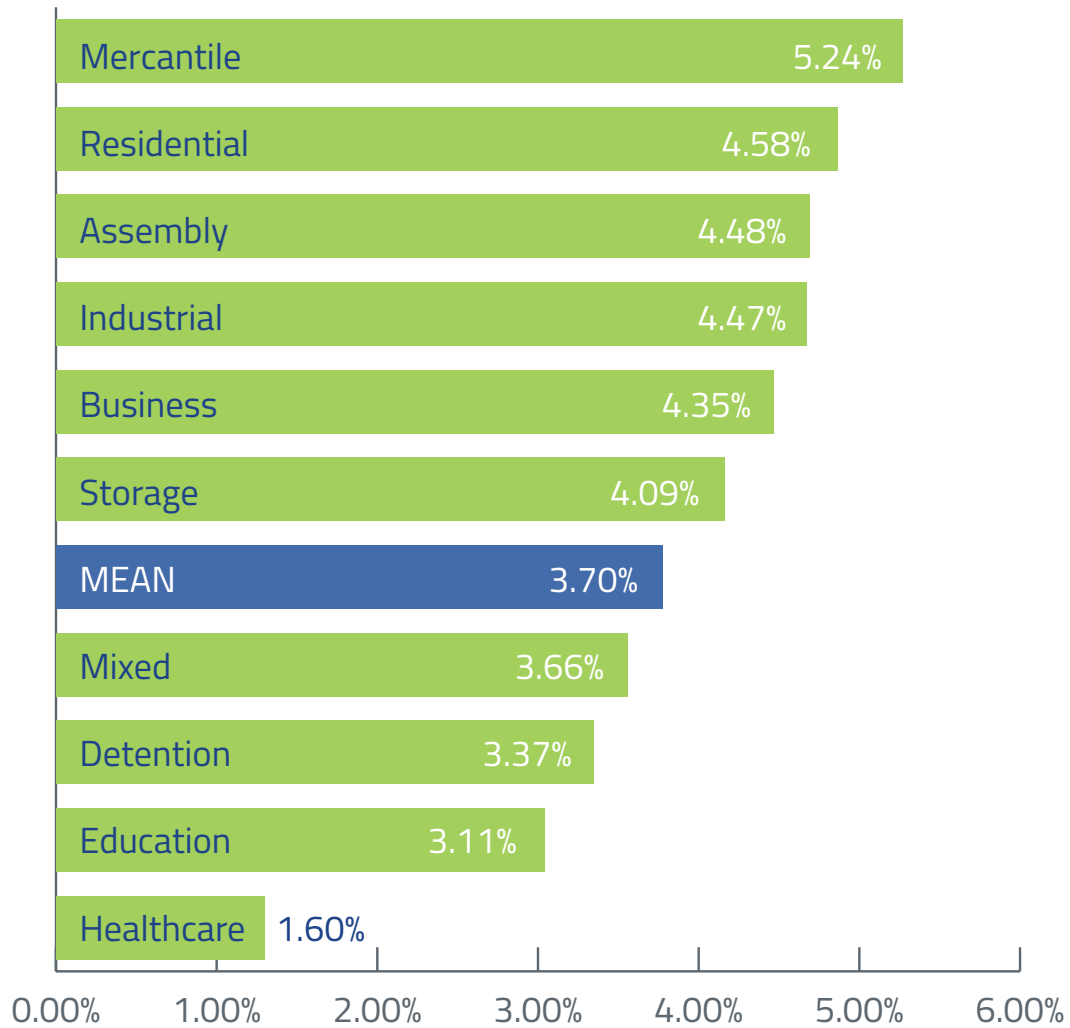
Summaries by Device Type for All Occupancy Types

For the purposes of painting a broader picture, we've included the top line averages across all occupancy types for better industry-wide perspective. Deeper analysis is applied to the more granular data in following sections.

Average Failure Rate/Device Type

Device Type	Failure Rate
SafetyScan	6.97%
SprinklerScan	5.77%
MEAN	3.70%
SecurityScan	2.87%
SuppressionScan	2.58%
FireScan	2.29%

Failure Rate axis: 0.00% — 2.00% — 4.00% — 6.00% — 8.00%

Average Inspection Time/Device Type

Device Type	Minutes
SafetyScan	2.14
FireScan	1.91
MEAN	1.91
SprinklerScan	1.81
SuppressionScan	1.57
SecurityScan	1.15

Minutes axis: 0.00 — 0.50 — 1.00 — 1.50 — 2.00 — 2.50

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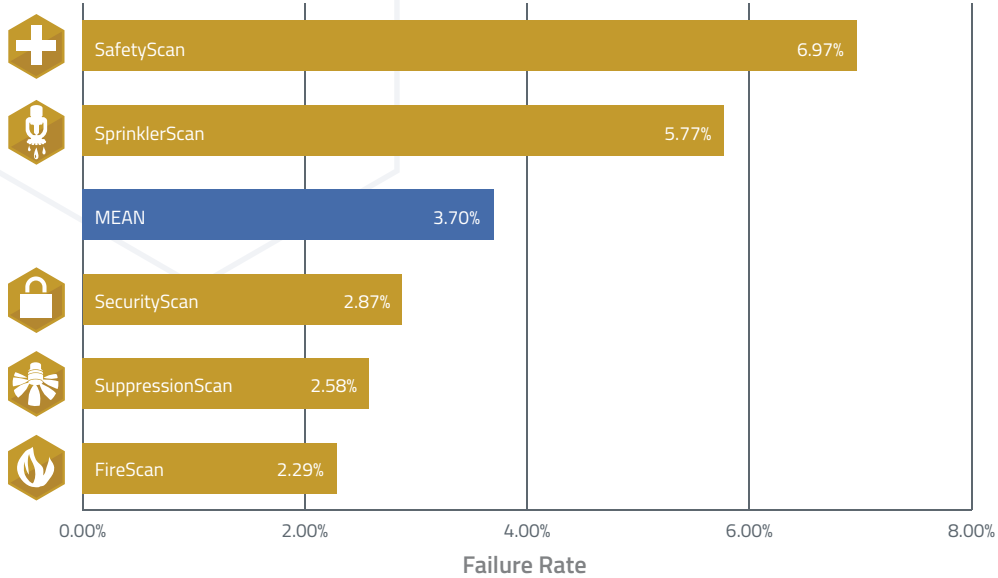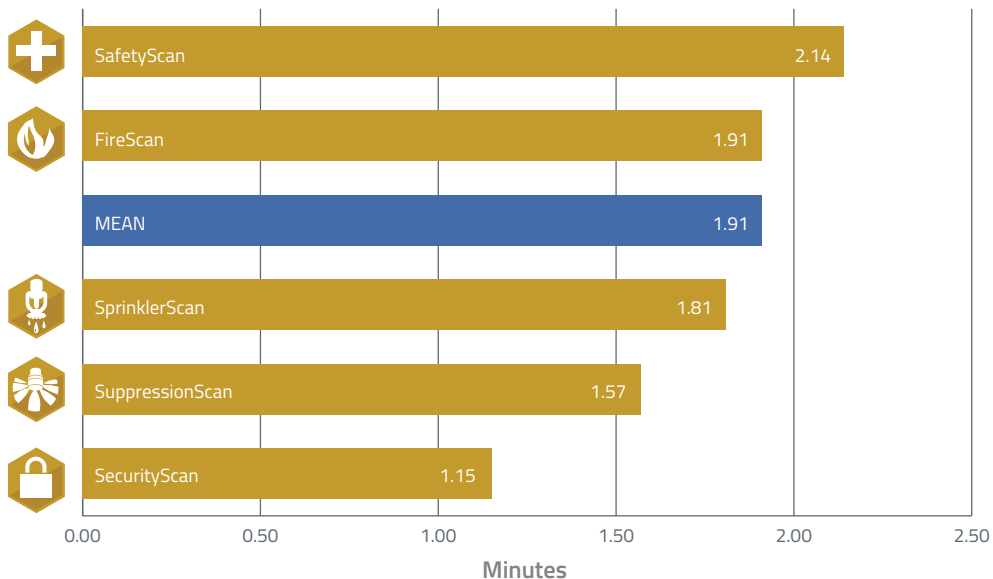
Average Total Number of Devices/Building

Category	Devices
FireScan	95.55
MEAN	57.22
SecurityScan	42.99
SafetyScan	36.73
SprinklerScan	30.09
SuppressionScan	22.48

Devices

Average Total Inspection Time/Building

Category	Minutes
FireScan	182.86
MEAN	109.70
SafetyScan	78.72
SprinklerScan	54.48
SecurityScan	49.26
SuppressionScan	35.27

Minutes
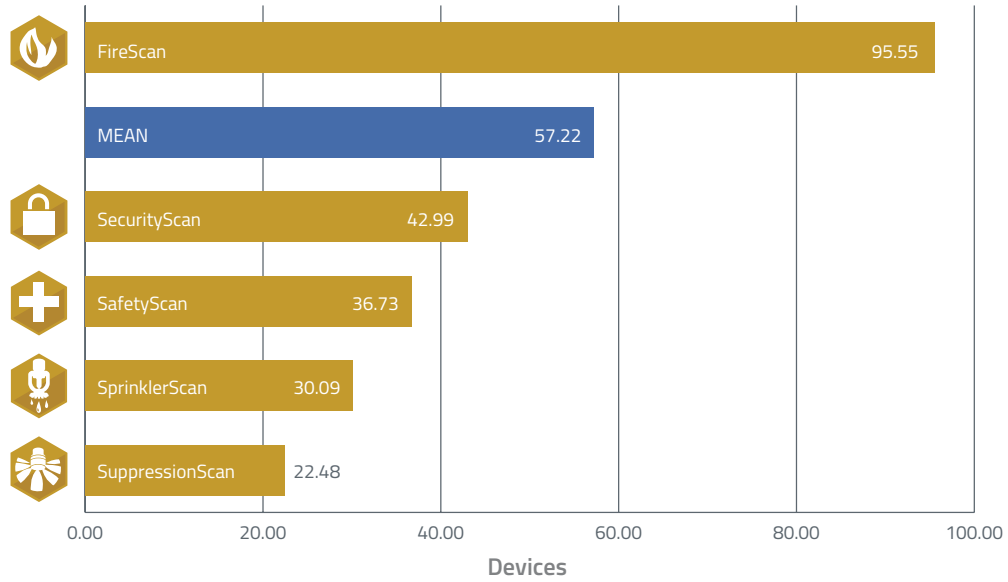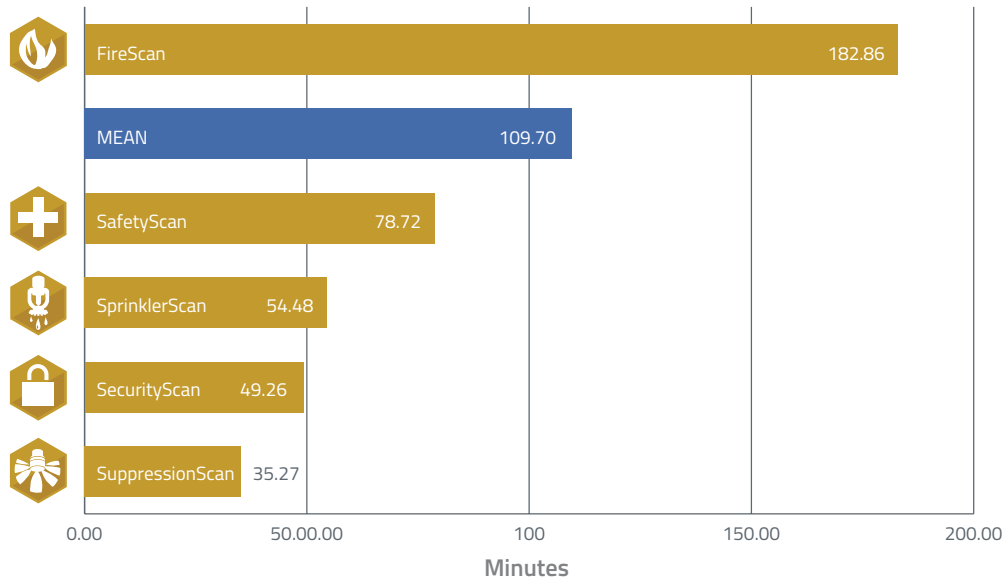
Inspection Times vs. Average % of Device Failures by Category

FireScan

FireScan Average Total Inspection Time by Occupancy Type

Occupancy Type	Minutes
Healthcare	366.09
Assembly	203.36
Detention	197.75
MEAN	186.04
Education	172.04
Mixed	171.10
Business	155.97
Residential	128.51
Mercantile	128.20
Industrial	102.61
Storage	55.26

Minutes: 0.00 – 50.00 – 100.00 – 150.00 – 200.00 – 250.00 – 300.00 – 350.00 – 400.00

FireScan Average Inspection Time/Device

Occupancy Type	Minutes
Assembly	2.10
Business	2.02
Detention	1.98
Education	1.83
Healthcare	1.93
Industrial	2.22
Mercantile	2.18
Mixed	1.96
Residential	1.56
Storage	1.95
MEAN	1.91

FireScan Average Failure Rate by Occupancy Type

Bar chart values: Assembly 4.48%, Business 4.35%, Detention 3.37%, Education 3.11%, Healthcare 1.60%, Industrial 4.47%, Mercantile 5.24%, Mixed 3.66%, Residential 4.58%, Storage 4.09%, MEAN 3.58%

Takeaways:

- Consistent with previous years, inspection times per device ranged from 1.83 minutes/device (Educational) to 2.22 minutes/device (Industrial), with the exception of Residential at approximately 1.50 minutes/device.

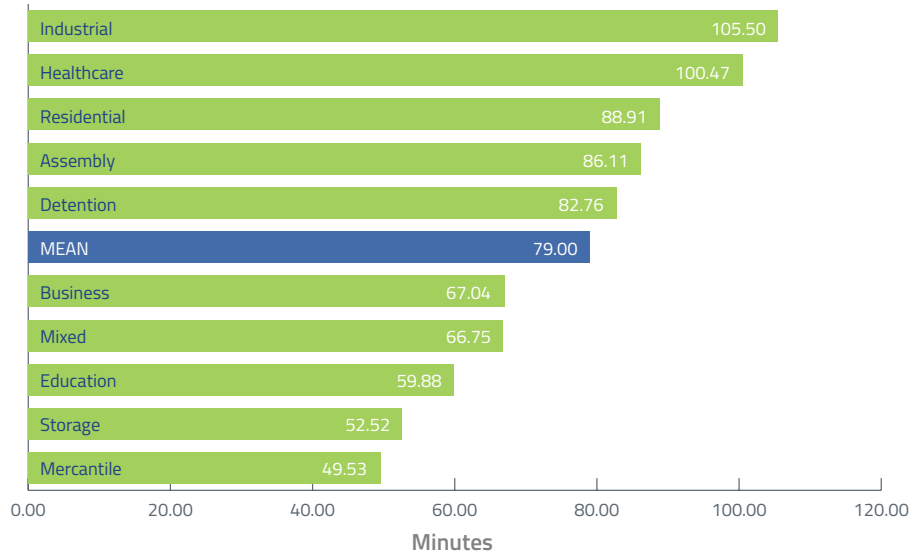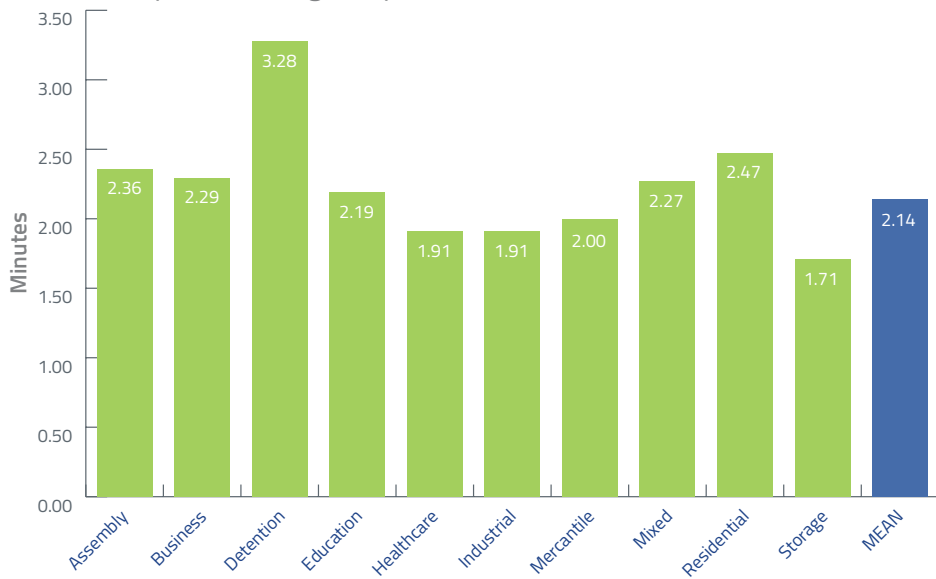- While Industrial (2.22 minutes/device) and Mercantile (2.18 minutes/device) occupancy types had the longest inspection times per device, they still ranked second and third respectively in shortest total inspection time per building. Industrial occupancy types took on average 2:08:12 to inspect, and Industrial occupancy types took 1:42:37 to inspect.

- Not surprisingly, Storage facilities — with their comparatively low device count overall — took less than an hour to inspect on average, even with an average per-device inspection time just above the mean at 1.95 minutes.

- Far and away, Healthcare occupancy types took the longest time to inspect at more than six hours and 10 minutes, but easily reported the best failure rate at only 1.27% — more than a full percentage point less than the mean.

- Once again, Mercantile was the only occupancy type to report a higher than 4% failure rate for Fire Alarm and Signaling devices. Closer analysis of the data reveals that 11 device types experienced double-digit failure rates, with five of them over 20% and one of those — Aspirating Detectors — reporting a 33.98% failure rate. Aspirating detectors are typically only used in clean room environments, such as data centers, due to their sensitivity. Our experts were skeptical of why these devices would be deployed in Mercantile facilities. However, Aspirating Detectors may be used in facilities where large volumes of highly flammable materials or goods may be stored or sold. In light of this, we hypothesize that airborne particulates such as dust in Mercantile facility types where early detection is critical are responsible for the exceptionally high failure rate.

SafetyScan

SafetyScan Average Total Inspection Time by Occupancy Type

Occupancy Type	Minutes
Industrial	105.50
Healthcare	100.47
Residential	88.91
Assembly	86.11
Detention	82.76
MEAN	79.00
Business	67.04
Mixed	66.75
Education	59.88
Storage	52.52
Mercantile	49.53

Minutes

SafetyScan Average Inspection Time/Device

Occupancy Type	Minutes
Assembly	2.36
Business	2.29
Detention	3.28
Education	2.19
Healthcare	1.91
Industrial	1.91
Mercantile	2.00
Mixed	2.27
Residential	2.47
Storage	1.71
MEAN	2.14

Minutes

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SafetyScan Average Failure Rate by Occupancy Type

Bar chart values:
- Assembly: 9.85%
- Business: 8.53%
- Detention: 8.49%
- Education: 8.34%
- Healthcare: 3.62%
- Industrial: 4.98%
- Mercantile: 8.56%
- Mixed: 6.18%
- Residential: 11.01%
- Storage: 4.95%
- MEAN: 6.99%

Takeaways:

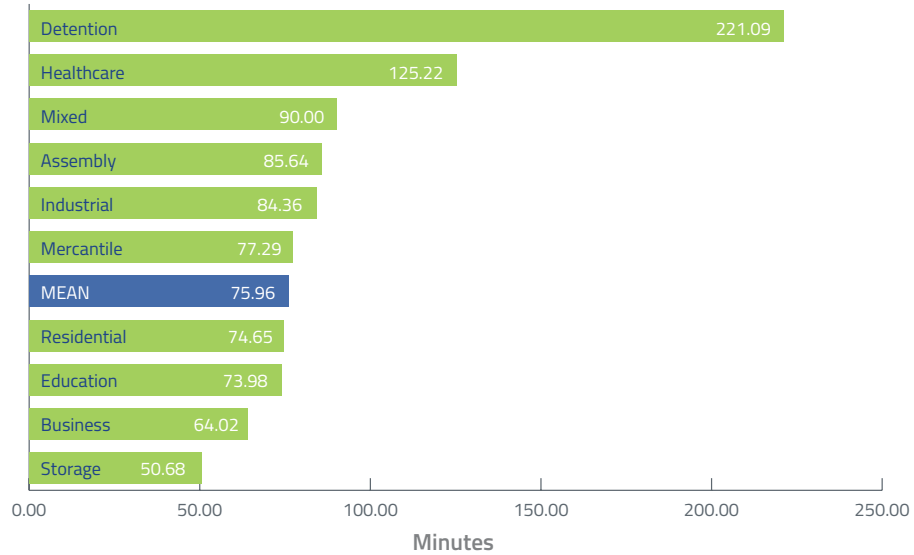- Unlike FireScan where the average total inspection time from lowest to highest increased by 563%, SafetyScan inspections only reported a variance from lowest to highest of 113%. Due to the special and sometimes hazardous nature of Industrial occupancy types, it is not surprising that they take longer on average to inspect (1:45:30) than Healthcare facilities, which rank second at just under 1:40:30.

- Mixed Use (6.18%, -0.50% YOY), Industrial (4.98%, -0.01% YOY), Storage (4.95%, +0.77% YOY), and Healthcare (3.62%, -0.34% YOY) all fell below the mean (6.99%, -0.09% YOY) for average failure rate in 2016. This was also true for 2015, and continues the trend for Healthcare occupancy types demonstrating the lowest failure rate for Life Safety devices.

- Contrary to 2015 when Assembly (10.30%) and Residential (11.12%) occupancy types reported an average failure rate of over 10%, only Residential (11.01%) was above that mark in 2016 while still showing improvement. Assembly dropped just under it with a 9.85% failure rate in 2016.

- The following Life Safety device types all failed in double digits for 2016:
  - Standby Power Supply (21.44%)   – Standby Generator (11.90%)
  - Fire Hose (15.60%)   – Ladder (11.33%)
  - Battery (15.08%)   – Emergency Light (10.54%)
  - Shower Station (12.95%)

- At over three minutes and 15 seconds per device, Detention occupancy types once again had the highest average inspection time per device. As discussed in previous editions of this report, there is no discernable spike in certain device types that accounts for this finding, so this result is likely due to the secure nature of Detention facilities, which impedes inspector progress.
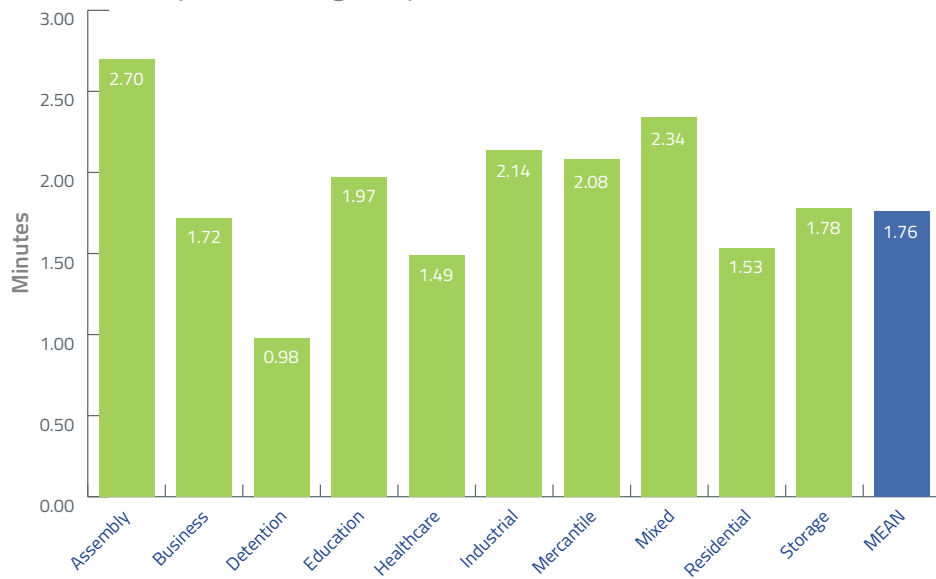
SecurityScan

SecurityScan Average Total Inspection Time by Occupancy Type

Occupancy Type	Minutes
Detention	221.09
Healthcare	125.22
Mixed	90.00
Assembly	85.64
Industrial	84.36
Mercantile	77.29
MEAN	75.96
Residential	74.65
Education	73.98
Business	64.02
Storage	50.68

SecurityScan Average Inspection Time/Device

Occupancy Type	Minutes
Assembly	2.70
Business	1.72
Detention	0.98
Education	1.97
Healthcare	1.49
Industrial	2.14
Mercantile	2.08
Mixed	2.34
Residential	1.53
Storage	1.78
MEAN	1.76

SecurityScan Average Failure Rate by Occupancy Type

Bar chart showing failure rates by occupancy type:
- Assembly: 6.16%
- Business: 2.21%
- Detention: 0.99%
- Education: 5.04%
- Healthcare: 4.59%
- Industrial: 2.53%
- Mercantile: 0.62%
- Mixed: 3.69%
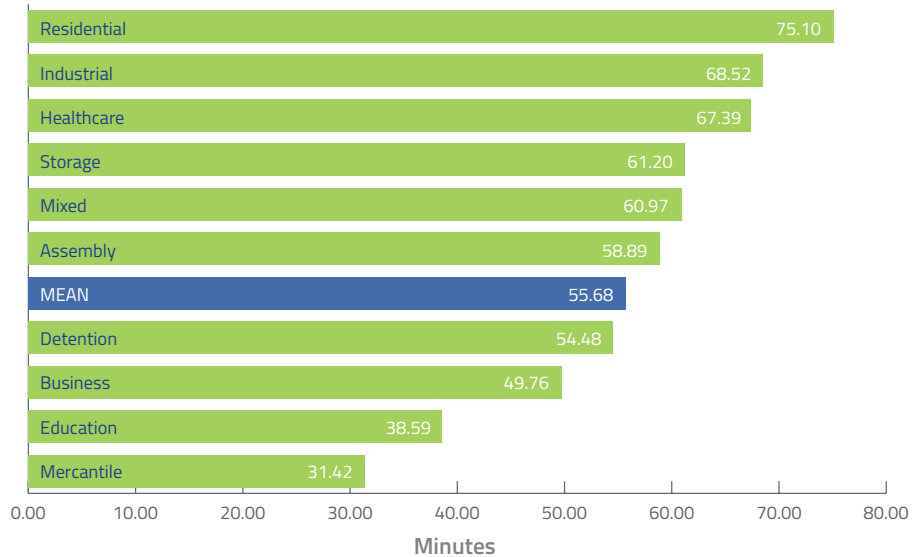- Residential: 2.94%
- Storage: 2.65%
- MEAN: 2.87%

Takeaways:

- Security inspections in Detention occupancy types take over three hours and 40 minutes on average, nearly 100 minutes longer than the two-hour and 5-minute average inspection time for Healthcare occupancy types. While that may not be surprising, the fact that it takes less than a minute (0.98) to inspect each device versus the mean of approximately one minute and 45 seconds might seem to make that conclusion counterintuitive. However, Detention occupancy type have the most devices per facility with an average of 226.58 devices. Healthcare which came in second averages 84.05 security devices per facility.

- Detention occupancy types only experienced a 0.99% failure rate. As impressive as that may be, Mercantile facility types only experience a 0.62% failure rate – the lowest of any occupancy type for any device type. It is also worth noting that the second-lowest failure rate across all device types is Suppression in Mercantile occupancy types at 0.64%.

- While Assembly, Educational, and Healthcare occupancy types all topped 5% average device failure rate in the 2015 report, the Healthcare failure rate fell 0.71% to 4.59% in 2016. Educational remained above the 5% mark, but still fell a modest -0.07% to 5.04% in 2016. Despite that good news, Assembly occupancy types (+0.44% to 6.16%) experienced a reverse trend.

- Across all Occupancy types, the following experienced double-digit failure rates:
  - Auxiliary Station (35.72%)
  - Vehicle Sensor (13.70%)
  - Radio (28.29%)
  - Exit (12.99%)
  - Standalone Lockset (25.86%)
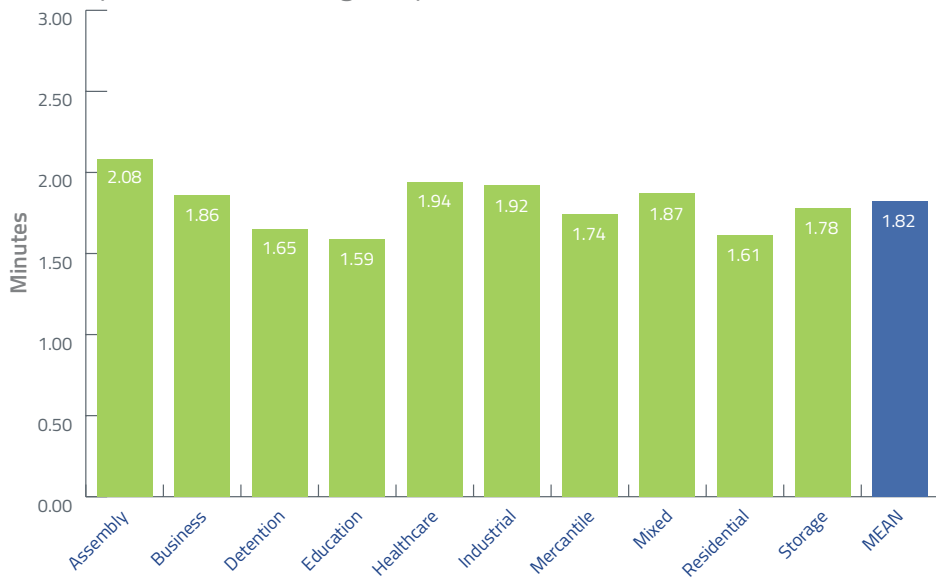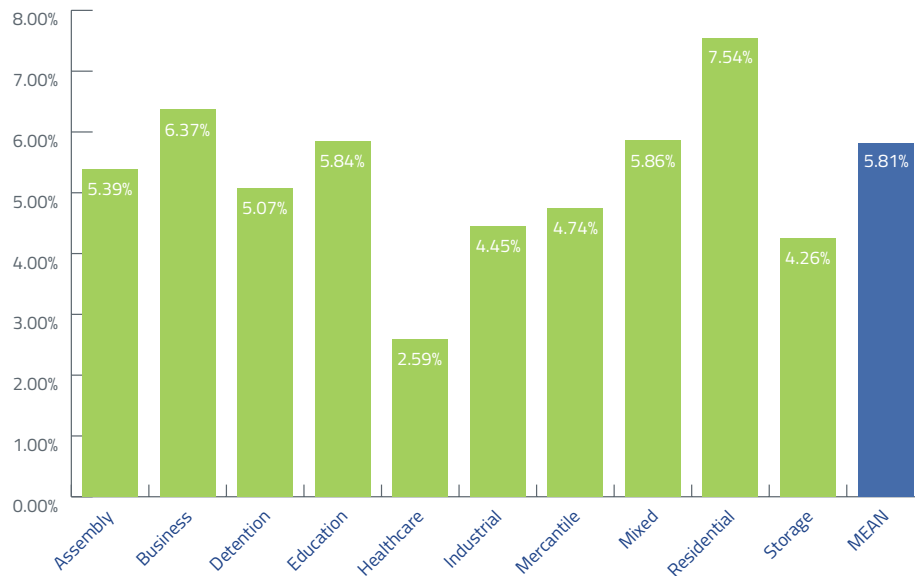 - Batteries (11.97%)
  - Vest (16.67%)

SprinklerScan

SprinklerScan Average Total Inspection Time by Occupancy Type

Occupancy Type	Minutes
Residential	75.10
Industrial	68.52
Healthcare	67.39
Storage	61.20
Mixed	60.97
Assembly	58.89
MEAN	55.68
Detention	54.48
Business	49.76
Education	38.59
Mercantile	31.42

Minutes

SprinklerScan Average Inspection Time/Device

Occupancy Type	Minutes
Assembly	2.08
Business	1.86
Detention	1.65
Education	1.59
Healthcare	1.94
Industrial	1.92
Mercantile	1.74
Mixed	1.87
Residential	1.61
Storage	1.78
MEAN	1.82

SprinklerScan Average Failure Rate by Occupancy Type

Bar chart values:
- Assembly: 5.39%
- Business: 6.37%
- Detention: 5.07%
- Education: 5.84%
- Healthcare: 2.59%
- Industrial: 4.45%
- Mercantile: 4.74%
- Mixed: 5.86%
- Residential: 7.54%
- Storage: 4.26%
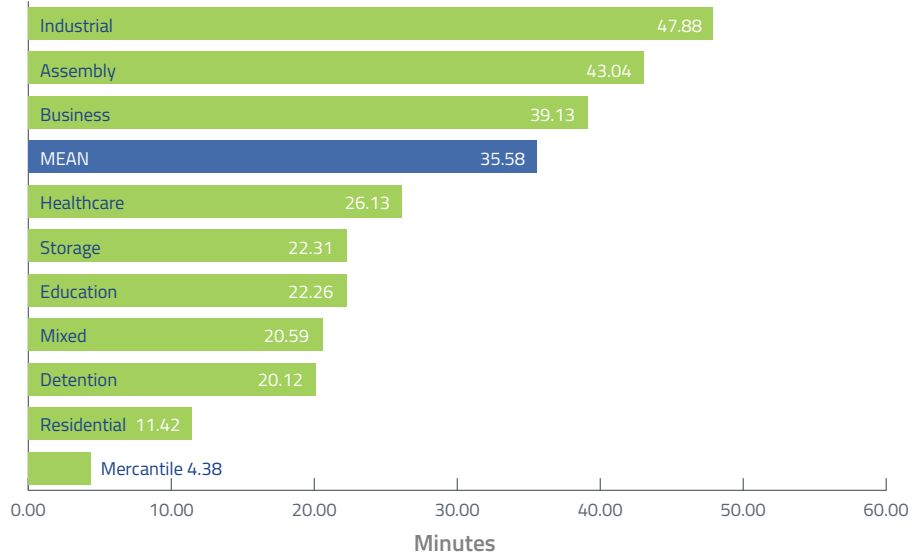- MEAN: 5.81%

Takeaways:

- Before evaluating the statistics regarding water-based fire sprinkler systems, it is important to note that the barcode scanning and reporting software used to inspect these devices is not based on scanning each and every sprinkler head in the facility. While each sprinkler head should be inspected according to code, a single barcode is used to represent all of the heads of a given type (i.e., Extended Coverage or Standard Response) within each facility for logistical reasons. Please bear this in mind when reviewing the results.

- Residential continues to report the highest average inspection time per facility at 1:15:06, whereas Mercantile sprinkler systems report just over half an hour at 31:25. However, the average sprinkler device inspection time for Residential was the second lowest at only 1.61 minutes per device.

- Overall, the mean total average inspection time remained nearly static (+0.09 minutes YOY), while Business, Detention, and Mercantile increased YOY. The biggest gain was reported in Detention occupancy types at almost three minutes longer per facility, and the biggest decrease occurred in Residential with a nearly three-minute decrease per facility.

- Healthcare once again demonstrated the lowest sprinkler device failure rate of 2.59%, consistent with the 2015 report. While Residential showed an improvement with a decrease of 0.14% YOY, it still reported the highest rate with 7.54% of devices failing, with the next closest being Business occupancy types at 6.37%. Only three occupancy types exceeded the mean for failure rate: Residential (7.54%), Business (6.37%), and Mixed (5.86%).

- Valves, Main Drains, and Jockey Pumps experienced the lowest failure rates, and Gauges, Antifreeze Systems, and Check Valves reported the highest. However, unlike 2015, none of the failure rates exceeded 20%*.

Sprinkler heads reported higher than 20%, but these figures were omitted due to the previous disclosure regarding how the data for heads is collected.
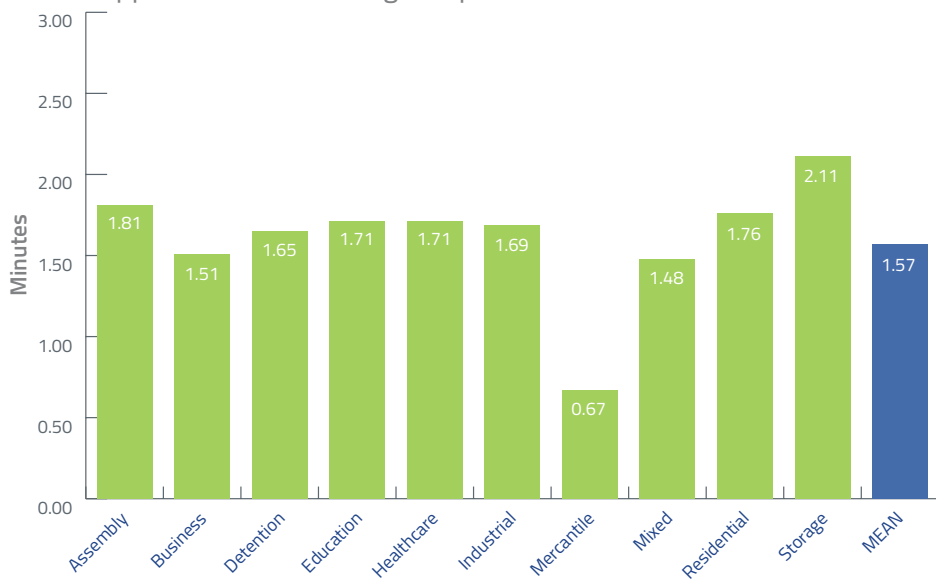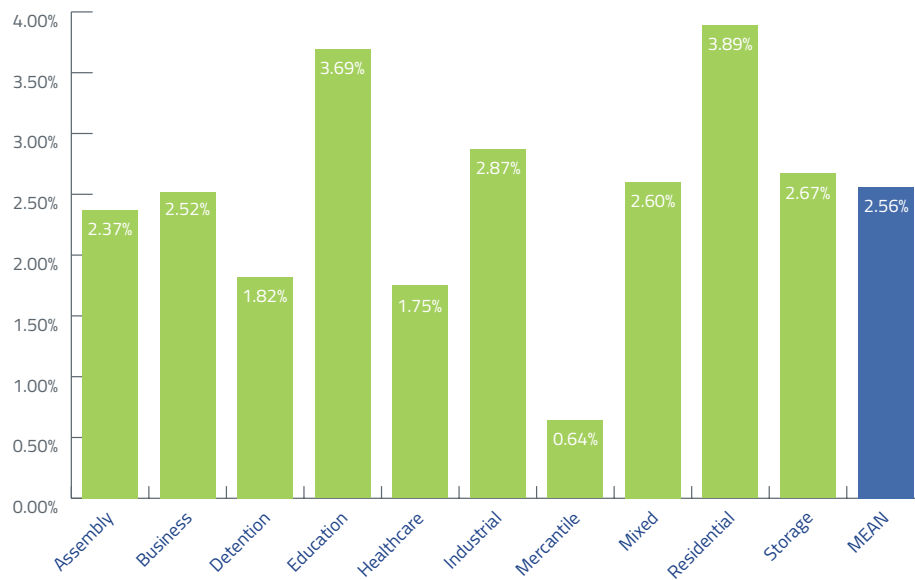
SuppressionScan

SuppressionScan Average Total Inspection Time by Occupancy Type

Occupancy Type	Minutes
Industrial	47.88
Assembly	43.04
Business	39.13
MEAN	35.58
Healthcare	26.13
Storage	22.31
Education	22.26
Mixed	20.59
Detention	20.12
Residential	11.42
Mercantile	4.38

Minutes

SuppressionScan Average Inspection Time/Device

Occupancy Type	Minutes
Assembly	1.81
Business	1.51
Detention	1.65
Education	1.71
Healthcare	1.71
Industrial	1.69
Mercantile	0.67
Mixed	1.48
Residential	1.76
Storage	2.11
MEAN	1.57

SuppressionScan Average Failure Rate by Occupancy Type

Takeaways:

- The average total inspection time for Suppression systems by Occupancy type is consistent with the prevalence of those systems in those occupancy types. As to be expected, Industrial occupancy types reported the longest average total inspection time at over 47 minutes. We cover the unique challenges for Industrial facility types in the special supplement included, but at a high level, this is likely due to the fact that Industrial occupancy types must address unique hazards and multiple code requirements.

- Assembly (43.04 minutes) and Business (39.13 minutes) occupancy types also reported times higher than the mean (35.58 minutes). The inspection length for Assembly in some cases may be attributed to the size of the facility, and due to the fact that restaurants, banquet halls, and similar facilities must maintain kitchen systems. Business occupancy types include facilities such as data centers and laboratories that require more complex Suppression systems than the average building.

- At less than five minutes per facility, Mercantile is not surprising either since there are relatively few Mercantile facilities that would require a Suppression system.

- One of the largest areas of concern were the high failure rates in both Residential (3.89%, -0.42% YOY) and Educational (3.69%, +0.27% YOY) occupancy types due to the risks posed to families and children.

- In 2015, Detention occupancy types experienced a failure rate of less than 1%, but for 2016 the failure rate climbed to 1.82% (+0.9% YOY) – almost double that of the previous year. Storage occupancy types had the second largest change YOY, increasing from 1.94% in 2015 to 2.67% in 2016.

- Post Indicator Valves were the easily the most problematic devices with a 37% failure rate. Foam Systems (19.18%), Carbon Dioxide Systems (17.58%), Hoses (13.23%), and Dampers (11.35%) all reported double-digit failure rates as well.

Spotlight on Industrial Occupancy Types

If you have followed this report over the past couple years, you have already seen Healthcare (2014) and Educational (2015) occupancy types highlighted. Both types of facilities have their own unique challenges and level of compliance scrutiny, as evidenced by the data.

In the 2016 edition of the *Fire & Life Safety Inspection Benchmark Report*, we take a deeper dive into the statistics for Industrial occupancy types. For the purposes of this report, the Industrial occupancy type refers to both hazardous and non-hazardous facilities that, in whole or in part, serve the purpose of manufacturing, fabricating, assembling/disassembling, processing, refining, recycling, and similar industrial processes.

Unlike the Educational occupancy type data that was segmented by school type using keywords (preschool/ day care, primary schools, and higher education/trade), parsing the Industrial occupancy type data is much more challenging. Without a high degree of confidence in identifying the functional process of a facility, we did not feel comfortable providing that degree of analysis.

For industry stakeholder consideration, the following supplement to the report reflects how Industrial occupancy types vary uniquely from other occupancy types and the underlying factors.

Three-Year Trends for Industrial Facilities

Average Total Inspection Time/Building (Minutes) - Industrial Facility

FireScan   SafetyScan   SecurityScan   SprinklerScan   SuppressionScan
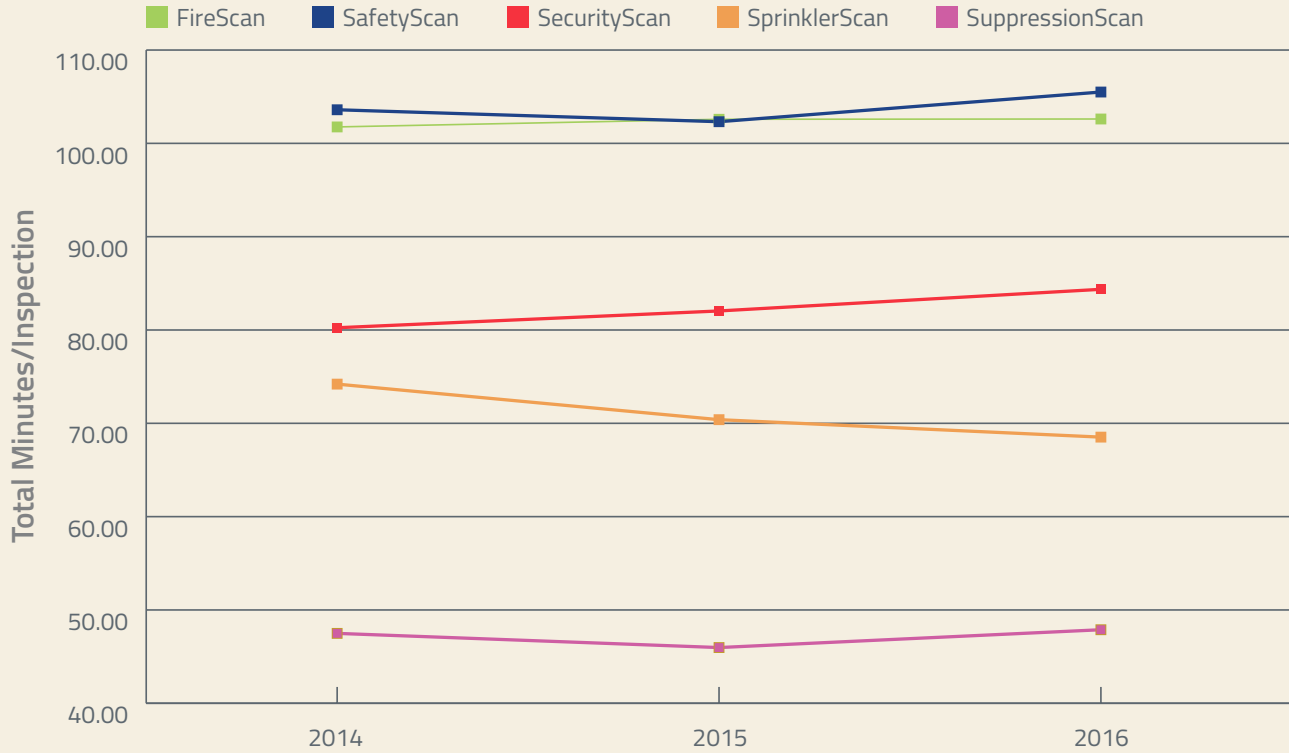
	2014	2015	2016
FireScan	101.76	102.58	102.61
SafetyScan	103.60	102.32	105.50
SecurityScan	80.24	82.04	84.36
SprinklerScan	74.20	70.39	68.52
SuppressionScan	47.49	45.97	47.88

While the variance is not dramatic, all total inspection times increased from 2015-2016 in Industrial occupancy types with the exception of Sprinkler systems, which are down nearly six minutes since 2014.

Average Inspection Time/Device (Minutes) - Industrial Facility
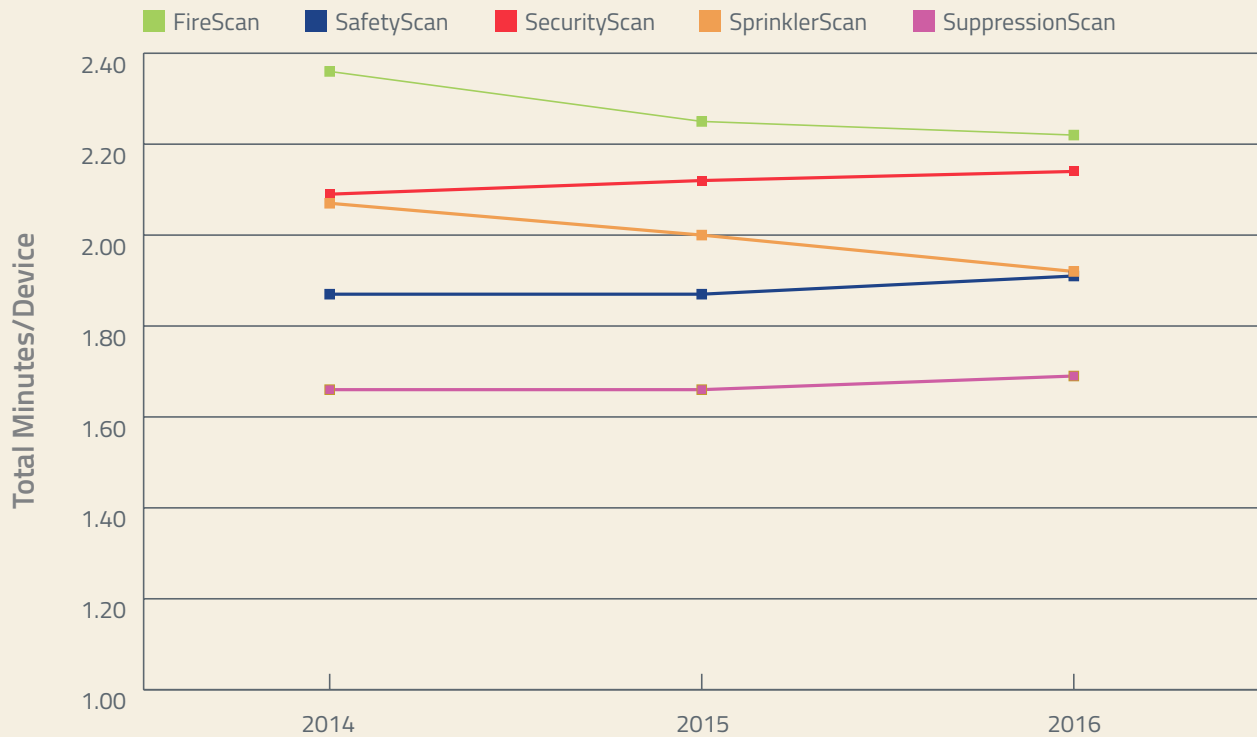
	2014	2015	2016
FireScan	2.36	2.25	2.22
SafetyScan	1.87	1.87	1.91
SecurityScan	2.09	2.12	2.14
SprinklerScan	2.07	2.00	1.92
SuppressionScan	1.66	1.66	1.69

Fire Alarm & Signaling and Fire Sprinkler have steadily decreased in device inspection times, while Security and Life Safety have increased.

Average Device Failure Rate - Industrial Facility

■ FireScan ■ SafetyScan ■ SecurityScan ■ SprinklerScan ■ SuppressionScan
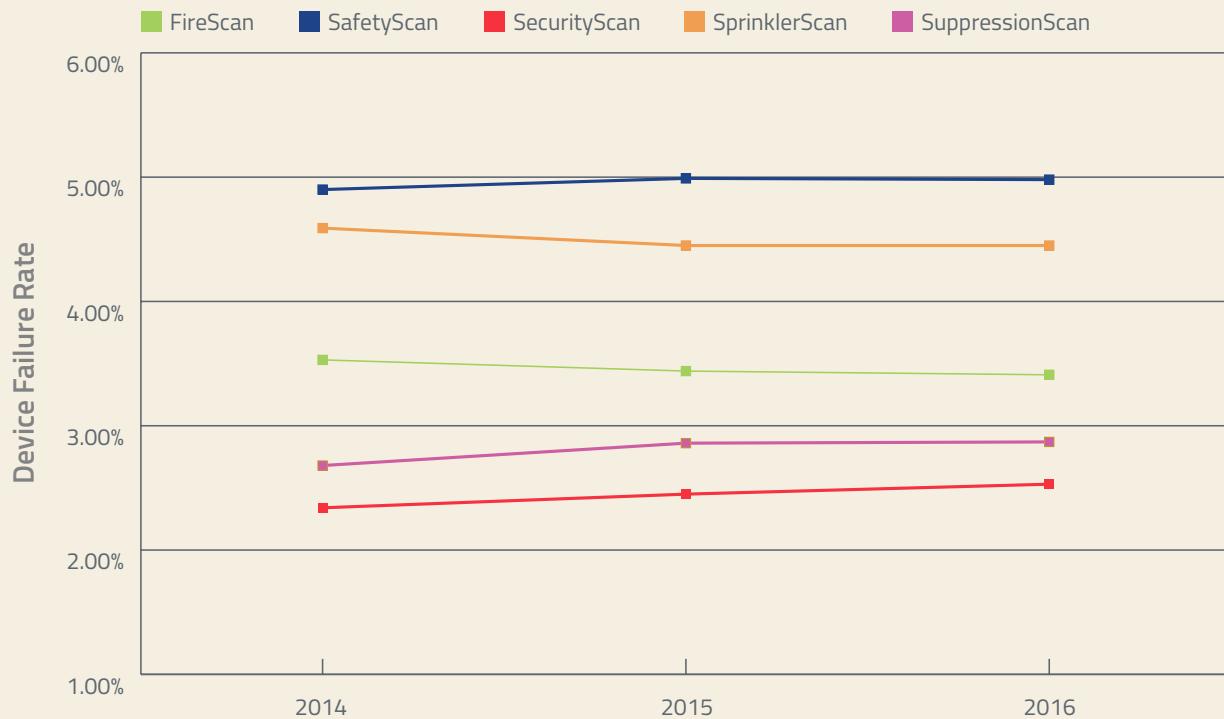
	2014	2015	2016
FireScan	3.53%	3.44%	3.41%
SafetyScan	4.90%	4.99%	4.98%
SecurityScan	2.34%	2.45%	2.53%
SprinklerScan	4.59%	4.45%	4.45%
SuppressionScan	2.68%	2.86%	2.87%

While device failure rates have remained relatively static or slightly declined, both Suppression and Security have seen slight increases of approximately 0.2% for the period.

Industrial Facility Level-of-Effort and Maintenance Cost Correlation

Total Inspection Time vs. Device Failure Rate - Industrial Facility
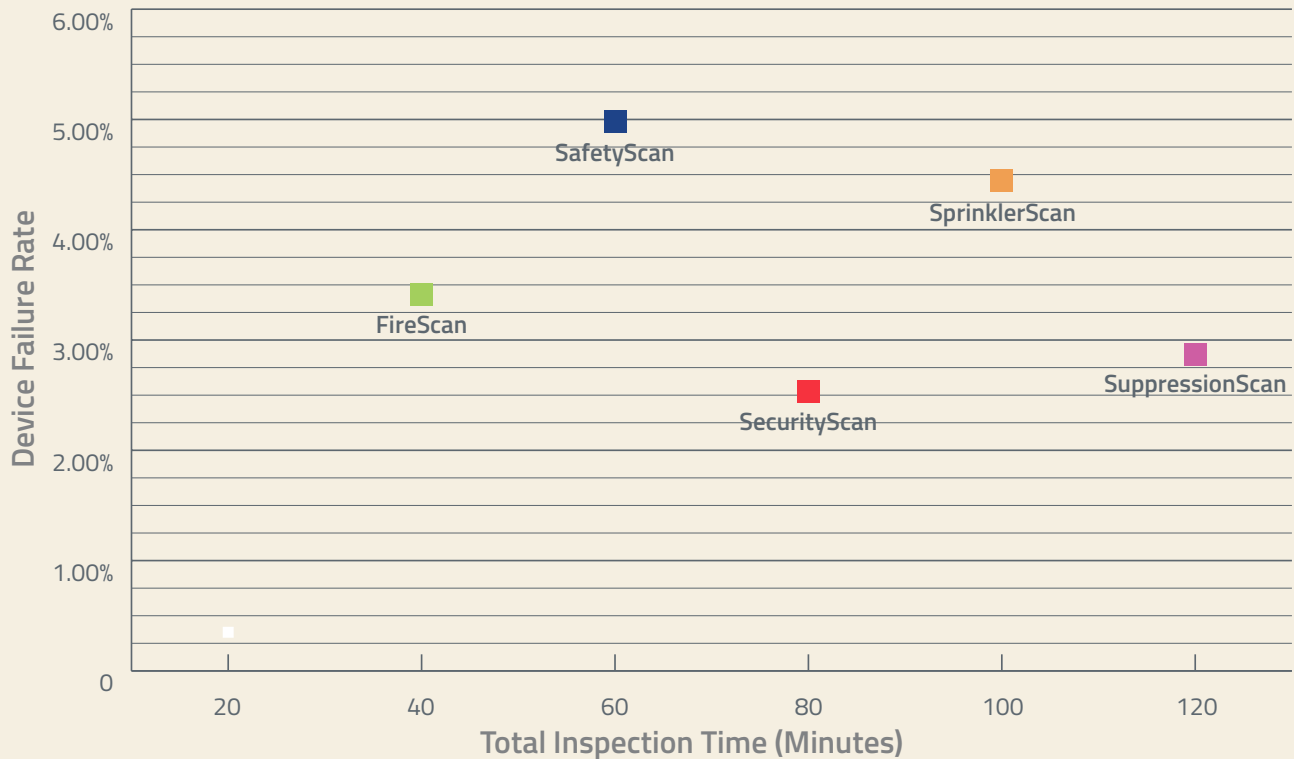
The chart above shows the correlation between cost of repairing and replacing devices combined with the average total inspection time for Industrial occupancy types. Life Safety (SafetyScan) devices represent one extreme with a device failure rate of 4.9% and average total inspection time of 1:45:30. On the opposite end of the spectrum, Fire Suppression (SuppressionScan) devices take on average 47:53 to inspect with a reported failure rate 2.87%. Security devices slightly edge Suppression with a lower failure rate of 2.53%, but take nearly 1:24:22 to inspect – longer than both Suppression and Sprinkler. In general, device types with the highest average inspection time per device take longer overall to inspect with the exception of Life Safety. This is due to Industrial occupancy types having nearly 70 devices per building on average.

Industrial Device Failures

For the purposes of this section, we excluded devices that did not have a statistically viable scan count as well as sprinkler heads since one scan represents all the heads within a facility, which can skew their data. The following list represents the devices with the highest failure rates:

Device Type	Device	Failure Rate
SuppressionScan	Post Indicator Valve	37.00%
FireScan	Generator Trouble	26.80%
FireScan	Generator Running	25.73%
SuppressionScan	Carbon Dioxide System	22.71%
SuppressionScan	Foam System	22.59%
SuppressionScan	Gas Detector	21.13%
SecurityScan	Telephone Entry	19.46%
SprinklerScan	Antifreeze System	17.62%
SafetyScan	Range Suppression	17.49%
SecurityScan	Visual Notification	17.17%

Of the top 10 devices most likely to fail, four are related to Suppression system inspections despite Suppression systems reporting the second lowest device failure rate of all device categories for Industrial occupancy types. Another key finding is that generators seem to pose the most issues with regard to Fire Alarm & Signaling systems in Industrial facilities. These findings indicate that the more frequent checks by an assigned employee may be warranted to mitigate risk between official inspections.

Suppression system Post Indicator Valves reported the highest failure rate, with all device failures being attributed to device damage or wear. Post Indicator Valves in Sprinkler systems fail for a much wider array of reasons, though a very significant number were damaged or worn. Two SafetyScan devices, Scaffolding (0.06%) and Fire Blanket (0.19%), ranked lowest in average failure rate.

Key Takeaways for Industrial Occupancy Types

Mitigating risk and protecting people and property from fire and life safety risks in industrial facilities can be particularly challenging, especially in facilities classified as hazardous. Costly losses resulting from operational downtime in Industrial occupancy types is also a primary concern that costs companies tens to hundreds of thousands of dollars. In fact, a 2006 survey of industrial manufacturing executives conducted by Advanced Technology Services, Inc. estimated the average per-minute downtime cost at $22,000. This is in addition to the property damage and liability risk in the event of an incident, especially in high-risk or hazardous facilities.

- **Foam, Foam on the Range**: Because of the types of equipment, processes, and the prevalence of chemicals and flammable materials/liquids in industrial occupancy types, these facilities often require more advanced and specialized Fire Suppression systems.
  - The average Industrial facility has 35.83 Suppression devices – nearly 25% more per building than the average for all other occupancy types.
  - Remove the other two high-end outliers – Assembly and Business occupancy types – from the mix and the variance increases to 60% more devices on average.
  - However, Suppression systems in Industrial occupancy types are also the fastest on average to inspect out of the five device types. On the contrary, these facilities also have the longest total average Suppression inspection time for all occupancy types.

- Even with the large number and complexity of Suppression devices, Industrial occupancy types are normally easier to physically inspect. For example, they typically do not have subfloor areas or operations scheduling complications that create hurdles like those found in data centers.

- **Safety First**: Safety devices ranked first in two categories: highest Total Inspection Time and highest Device Failure Rate. As with Suppression, the nature of Industrial facilities and stringent codes regarding employee safety naturally require an increased presence of those devices within the occupancy type.
    - At 69.58 devices on average, Industrial occupancy types are second only to Healthcare (71.25) in the number of Life Safety devices per facility. The next closest are Assembly facilities at 45.72 per building.
    - One of the more concerning trends is the 16.64% failure rate reported for Shower Stations. These stations are critical in the event of an incident, particularly one in which an occupant comes into contact with hazardous substances that must be washed off immediately. Environmental health and safety professionals may need to consider periodic testing between inspections to ensure that these systems are in working order. Other potentially troublesome devices in terms of failure rate include:
        - Exit Light (14.15%)
        - Fall Protection (12.29%)
        - Ladder (11.97%)
    - Fall Protection devices also prove challenging from an inspection standpoint, averaging over four minutes per device to inspect — more than double the average device inspection time of 1.91 minutes per Life Safety Device in Industrial facilities.

- **Extinguish Inefficiencies & Budget Questions**: According to the data, Cartridge and Fire Extinguishers account for more than 73% of the Life Safety devices inspected in Industrial occupancy types.
    - Because of the frequency of maintenance requirements and the fact that visual inspections are required monthly, these devices represent a disproportionate amount of time and attention.
    - Understanding failure rates, installation dates, inventory figures, device location, and maintenance frequency can help facility management and environmental health and safety professionals to more efficiently manage and improve budgeting for these types of devices.

- **See the Light**: In the event of a power outage, particularly one caused by a large workplace incident or natural disaster, Industrial facilities demonstrate several areas for concern:
    - Failure rates for back-up generator components tied to Fire Alarm and Signaling systems rank as the second and third most likely to fail, which could put the facility at a higher risk of warning occupants in the event of a fire during an outage. In fact, more than one in four of these devices fail during inspection:
        - Generator Trouble (26.80%)
        - Generator Running (25.73%)
    - Exit Signs, Exit Lights, and Emergency Lighting are another area of potential issues. Combined, they comprise just under 10% of all Life Safety Devices in Industrial occupancy types and report at a 7.39% failure rate. These devices are critical in ensuring occupants are able to safely exit the facility, whether vision is inhibited by smoke or power failure.
    - Given these three devices take less than one minute 50 seconds to inspect and record the data, a visual spot check during monthly Extinguisher inspections is a low-effort exercise that would reduce risk.

In this section, we have compiled granular device-level data collected using the five BuildingReports' ScanSeries® applications to examine the reasons various device types failed inspection. See Appendix B for a full listing of devices by category and below for general examples:

- **FireScan®** - control equipment, auxiliary functions, initiating devices, monitoring equipment, and notification appliances

- **SafetyScan®** - portable fire extinguishers, lighting, personal protective, and safety equipment in any facility

- **SecurityScan®** - burglar and security systems, access control, CCTV, and nurse call stations

- **SprinklerScan®** - sprinkler systems and water-based fire protection systems

- **SuppressionScan®** - clean agent, gas detection, and kitchen hood systems

Before analyzing the data, a few key points should be considered:
- Devices with fewer than 100 failures were excluded from the device-level analysis.

- Within each data set, there are dozens – and in some cases, hundreds – of specific reasons why a device may have failed. In order to make the information consumable for this report, each data point was assigned a category that effectively encompasses a variety of specific causes.

- We felt it important to expand the number of categories for failure causes in the 2015 report above and beyond the categories presented in the 2014 report. The new categories introduced in 2015 and found in this edition are:
  - Damaged
  - Defective
  - Device or Component Missing
  - Disconnected
  - Expired or Decommissioned
  - Inaccessible or Blocked
  - Incompatible Device
  - Incorrect Description
  - Location Discrepancy
  - Other/Not Specified
  - Requires Maintenance

FireScan Failure Reasons

Requires Maintenance 3.06%

Asbestos Abatement 0.03%

Damaged 3.57%

Other/Not Specified 22.25%

Defective 45.45%

Location Discrepancy 0.66%

Incorrect Description 1.5%

Incompatible 0.15%

Inaccessible or Blocked 8.38%

Expired or Decommissioned 12.66%

Disconnected 1.16%

Device or Component Missing 1.14%
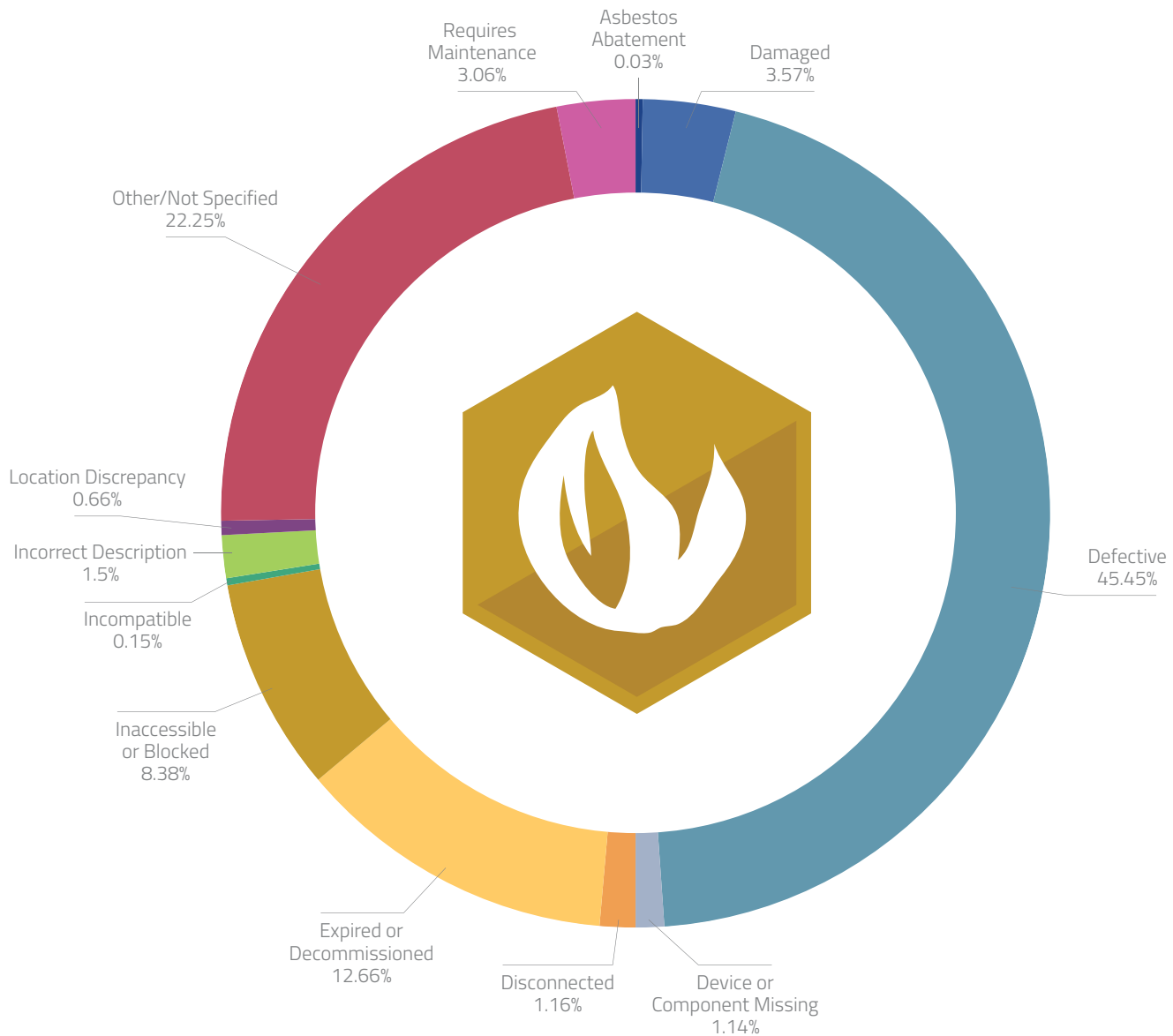
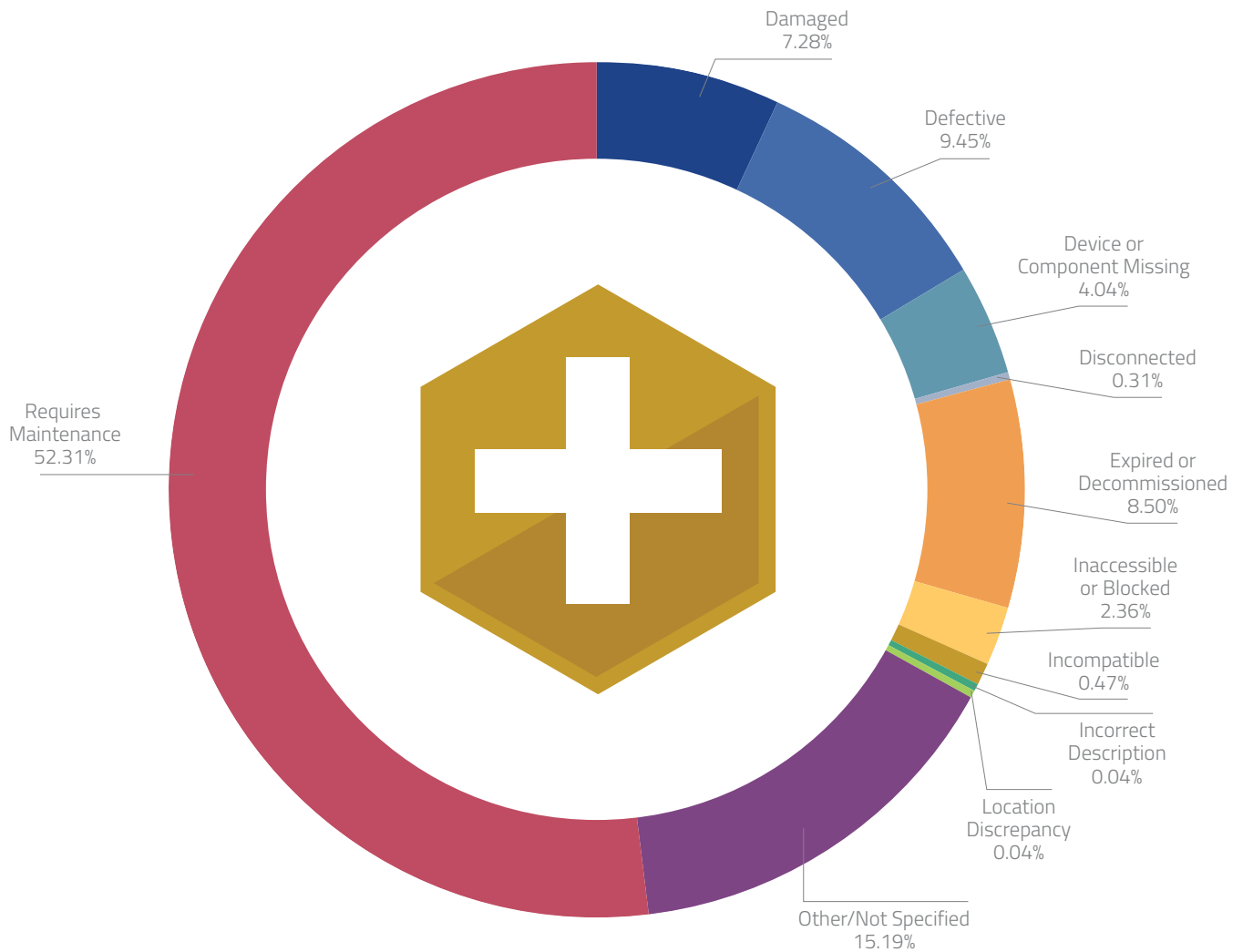**Takeaways:**

- **Expired or Decommissioned**: Since 2015, the percentage of devices failing for reasons under this category dropped slightly from 15.42% to 15.10%. As in previous years, the majority of devices that failed in this area were Batteries, Heat Detectors, Smoke Detectors, and Duct Detectors. In particular, a very large number of expired Batteries helped contribute to the overall figure.

- **Inaccessible or Blocked**: The percentage of devices that failed for this reason increased YOY, from 9.88% for 2015 to 9.99% for 2016. An item for concern in the 2015 report, the data suggests that facility management and service companies could be doing better at ensuring devices are accessible for inspection and that other objects do not physically block them.

- **Damaged**: At 4.26% (+0.10% YOY), reports of damaged devices have also increased slightly. Painted devices, battery corrosion, and physical damage were the most prevalent reasons cited. A smaller percentage of devices had water damage.

- **Defective**: This category represents the most significant increase, from 53.49% in 2015 to 54.18% in 2016. Batteries made up the largest percentage of devices found to be Defective, with a large number displaying signs of corrosion. More frequent visual inspections could help identify early signs of corrosion so the matter can be proactively addressed before other equipment becomes compromised.

- **Location and Description Discrepancies**: The data shows both of these areas have shown improvement since 2015. Devices failed due to a Location Discrepancy decreased from 1.64% in 2015 to a mere 0.79% failure rate in 2016, while reported instances of Incorrect Descriptions fell from 2.61% to 1.78% in 2016. This not only demonstrates that at least some of the prior instances have most likely been corrected, but that new occurrences have also declined.

- **Other/Not Specified**: Devices that included special notes from the inspector – in a text field for more descriptive explanations – experienced a slight decrease to 7.31% in 2016 (-0.24% YOY).

- **Asbestos Abatement**: Unique to FireScan, this failure category is not found in any of the other device types. The 0.03% rate is very low, but it demonstrates how infrequently the removal of asbestos from a facility prohibits inspectors from accessing them.

SafetyScan Failure Reasons

Damaged
7.28%

Defective
9.45%

Device or
Component Missing
4.04%

Disconnected
0.31%

Expired or
Decommissioned
8.50%

Inaccessible
or Blocked
2.36%

Incompatible
0.47%

Incorrect
Description
0.04%

Location
Discrepancy
0.04%

Other/Not Specified
15.19%

Requires
Maintenance
52.31%

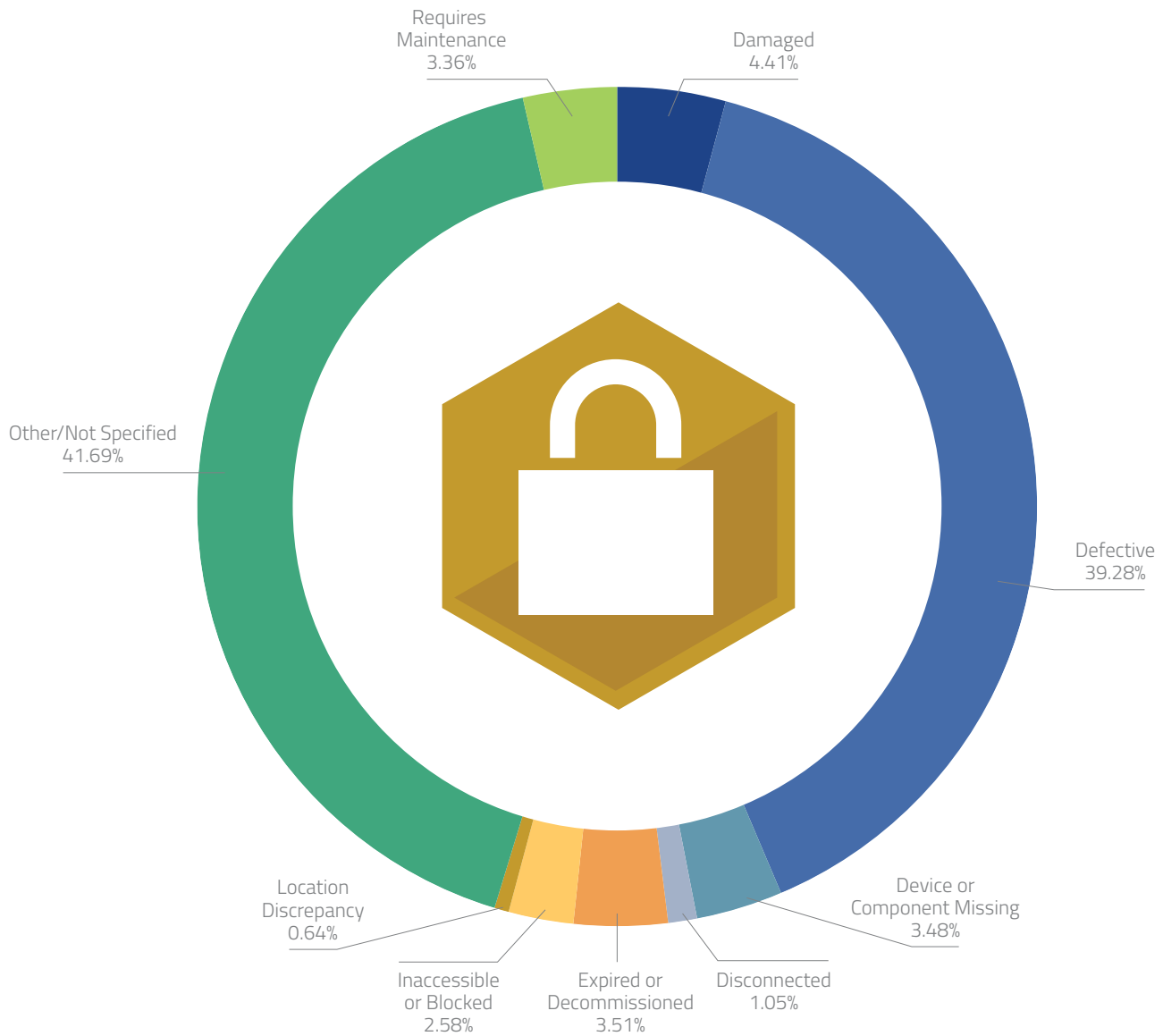**Takeaways:**

- **Requires Maintenance**: In contrast to other categories, Safety devices failed inspection 61.29% of the time due to required maintenance. The figure is up just over a percentage point from 60.19% in 2015. This is not surprising considering the hydro testing, extinguisher charging, and six-year maintenance requirements for Fire Hose, Fire Extinguisher, and Breathing Aid devices that make up the category. As in 2015, a lesser number of devices required re-racking, relocating, new tags, or new batteries/bulbs.

- **Other/Not Specified**: Once again, fewer than one percent of devices included a special note from the inspector in 2016. The figure only increased by 0.03% YOY to 0.63%. Over 85% of the devices failed in this category were Fire Extinguishers, which should not be a surprise for those in the industry. This underscores the importance of tracking expiration dates for extinguishers.

- **Defective**: Compared to other device categories with higher rates, Life Safety devices were found to be defective 11.07% of the time. SprinklerScan reported the second lowest Defective rate at 16.31%, while SecurityScan reported the highest at 61.72%

- **Expired or Decommissioned**: At 9.96% for 2016 (-0.98% YOY), the number of devices failing for this category fell below double digits.

- **Device or Component Missing**: In the 2015 report, we highlighted the industry concern of "device switching," or people basically swapping their own used or expired Life Safety devices for working devices in a facility. The good news is that the reported rate for missing components – often due to tampering by occupants – or devices dropped from 5.24% in 2015 to 4.73% in 2016. A recommended best practice to offset risks associated with human tampering and device degradation over time is to conduct a monthly visual inspection by a qualified employee.

- **Inaccessible or Blocked**: According to Kellie Guthrie, Safety & Loss Expert for the United States' largest private insurance provider The Gowrie Group, "blocked extinguishers are found in most workplaces" (Risk Report: Portable Fire Extinguishers, The Gowrie Group, 2014). While the failure rate increased from 2.4% in 2014 to 2.77% in 2015, the 2016 data shows that incidents of the devices being blocked remained consistent at 2.77%. Not only does this continue to pose a potential safety risk, but OSHA financial penalties for each violation could cost offenders $7,000 for each device (regulation 29 CFR 1910.157).

- **Location Discrepancy, Incorrect Description, Incompatible, and Disconnected**: Appearing more frequently with other device categories on average, these failure reasons are relatively negligible for Safety devices.

SecurityScan Failure Reasons
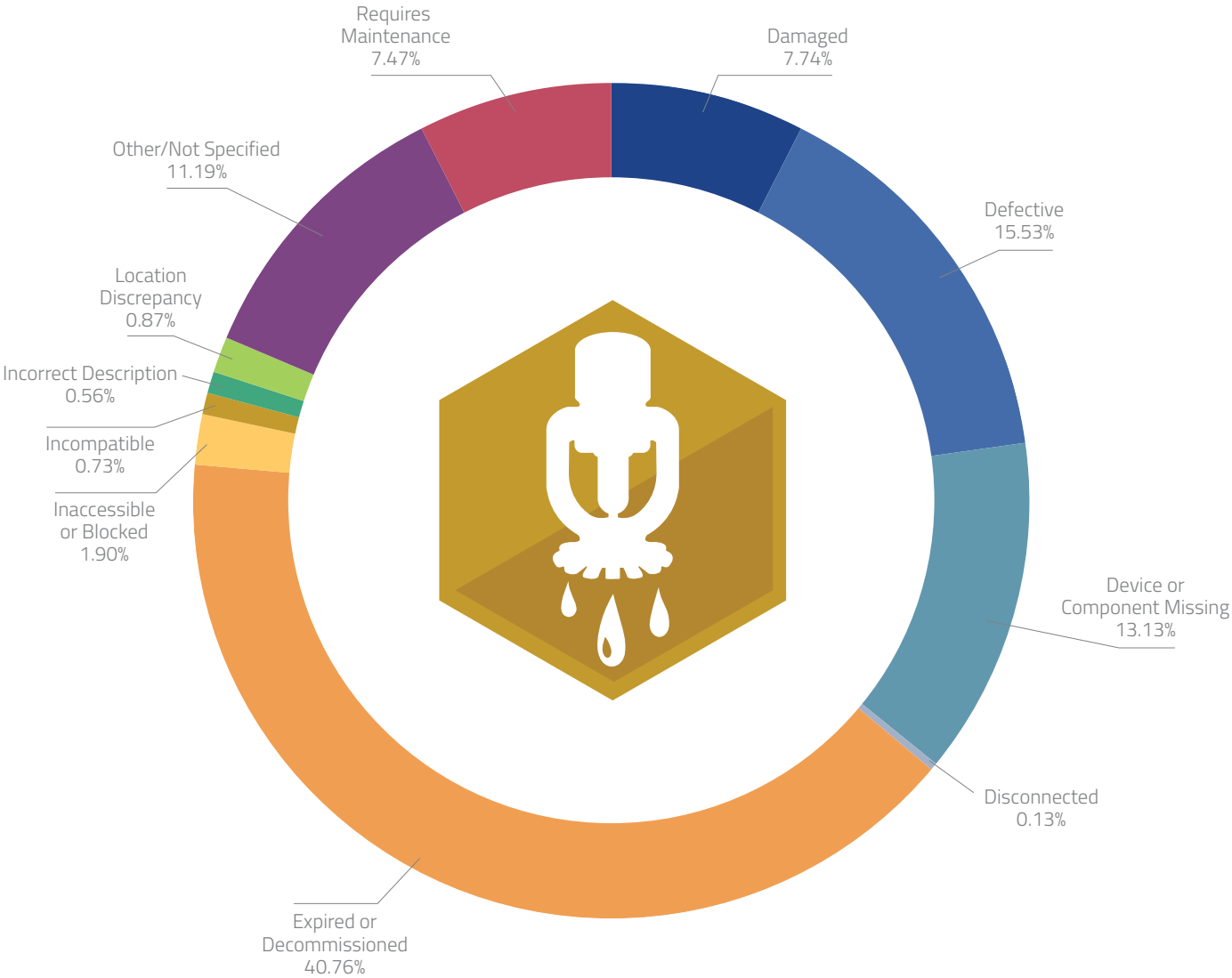

Requires
Maintenance
3.36%

Damaged
4.41%

Other/Not Specified
41.69%

Defective
39.28%

Location
Discrepancy
0.64%

Inaccessible
or Blocked
2.58%

Expired or
Decommissioned
3.51%

Disconnected
1.05%

Device or
Component Missing
3.48%

Takeaways:

- **Defective**: At 61.72%, Security devices are the most likely to be failed due to being Defective out of the five device categories presented. This included a broad range of device types from more complex electronic devices to simple battery failures.

- **Damaged**: At 7.86% in 2015, the 2016 data decreased by almost a percentage point to 6.92%. Gate Operators, Turnstiles, and Batteries were the most likely to fail due to being physically compromised (the last most likely due to corrosion).

- **Expired or Decommissioned**: After a more than 1% increase from 2014 to 2015, this category also saw a decline in 2016 to 5.51% (-2.35% YOY). This likely indicates that many devices were to set to expire last year and had been addressed by the time of their 2016 inspection. Only four device types were subject to this failure: Batteries, Storage, Power Supplies, and Video Monitors.

- **Disconnected**: Bed Exits, Cameras, Controllers, and Door Contacts were all simply not connected, while Power Supplies were missing batteries. The good news is that disconnected devices can easily be connected once the issue is determined, and only 1.64% fit this category. However, the bad news is that it still represents nearly twice the number for 2015. Most concerning was the fact that batteries are being removed from devices and not replaced for whatever reason.

- **Requires Maintenance**: As in previous years, the majority of the devices required either minor adjustments to Camera position or remounting, with some instances of Monitors being wired improperly to the Cameras. This category remained relatively steady at 5.27% in 2016 compared to 5.22% in 2015.

- **Device or Component Missing**: With 5.47% of the total, occupants likely tampered with the majority of the components missing from devices. It was more rare for the entire device to be reported missing.

- **Other/Not Specified**: Down from 10.02% in 2015 to 8.39% in 2016, this category includes devices that failed including a "Special Note". Some of the other verbatim notes such as "Red LED on Encoder", "New Device", and "Forced Issues" were not descriptive enough to be categorized elsewhere.

- **Asbestos Abatement, Incompatible Device, and Incorrect Description**: No device failures were reported for these reasons in the Security device category.

SprinklerScan Failure Reasons

Requires Maintenance
7.47%

Damaged
7.74%

Other/Not Specified
11.19%

Defective
15.53%

Location Discrepancy
0.87%

Incorrect Description
0.56%

Incompatible
0.73%

Inaccessible or Blocked
1.90%

Device or Component Missing
13.13%

Disconnected
0.13%

Expired or Decommissioned
40.76%

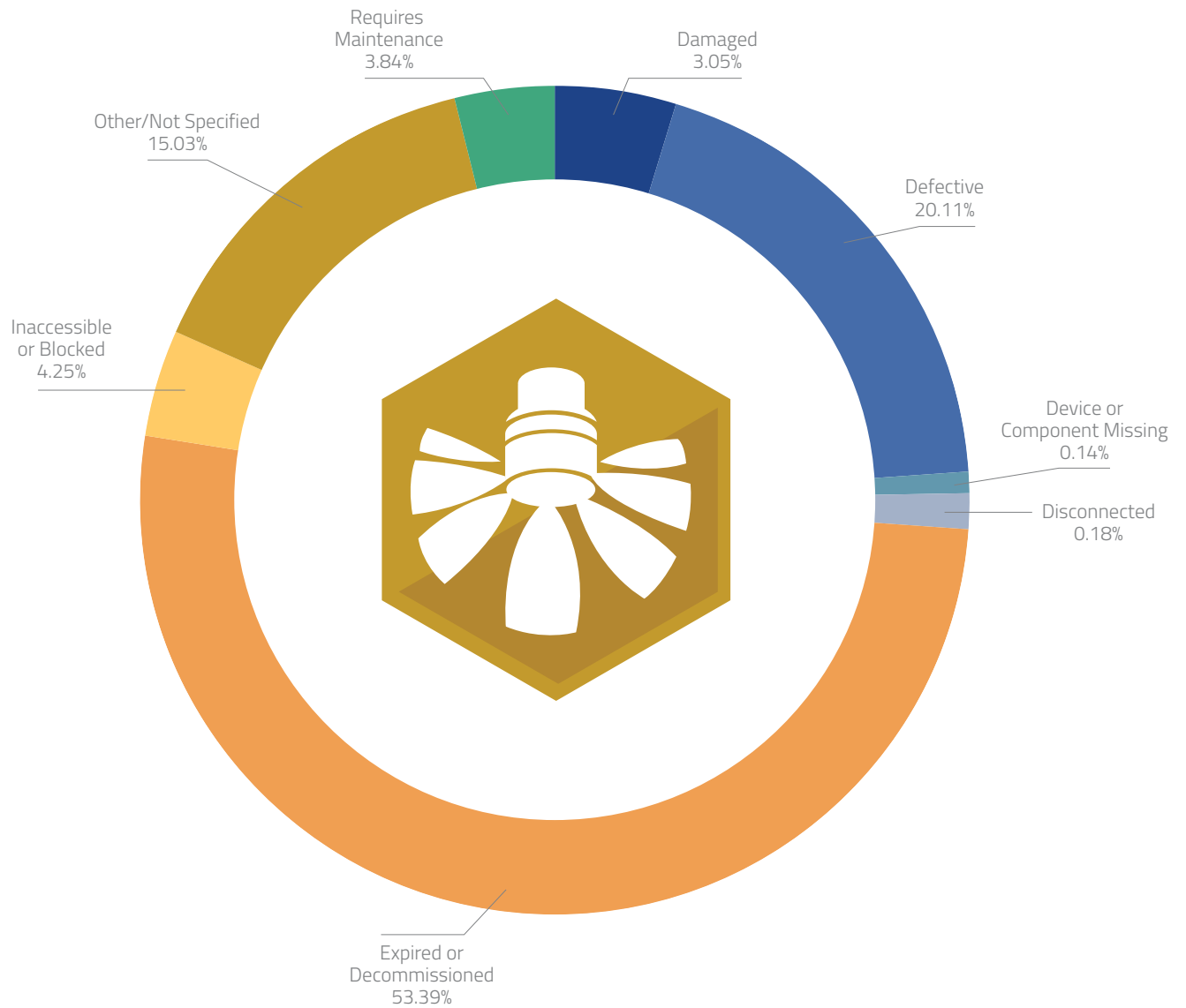**Takeaways:**

- **Expired or Decommissioned**: Second only to Suppression, which reported a 59.81% failure rate for this device category, Water-based Sprinkler System devices failed 42.82% of the time. Overwhelmingly, Gauges made up the largest percentage of devices in this category, followed Check Valves and then Piping. The mark is a slight decline from the 2015 report (42.85%, -0.03% YOY).

- **Defective**: With a solid decline of nearly two percentage points from 18.30% in 2015 to 16.31% in 2016, the Defective devices remained fairly consistent in terms of breakdown of devices and specific, verbatim failure reasons cited.

- **Damaged**: The number remains relatively unchanged for Damaged devices (+0.08% YOY). In 2015, approximately 45% of devices failed as Damaged and were attributed to being Damaged or Worn, whereas the remaining devices – about 55% – were specifically attributed to being Painted or having Corrosion/Rust. The 2016 numbers remain relatively similar, which is likely not a surprise to those who see this in the field on a day-to-day basis. Unfortunately there is not much that can be done above and beyond the manufacturing process and materials with regard to corrosion or rust impacting wet sprinkler systems. However, the preventable costs of having to replace sprinkler heads due to painters or tenants can be frustrating for building owners and facility management. As more jurisdictions push for residential fire sprinkler requirements, it is clear that better education is required for painting and renovations in facilities with these systems.

- **Device or Component Missing**: With the third highest failure rate for the device category, devices that were failed due to being completely missing or having at least one component missing were reported 13.79% of the time. This is relatively unchanged from 2015 (13.78%, +0.01% YOY), but per the 2014 analysis, the original National Board of Underwriters Standard 13 (or NFPA 13) signage requirements have undoubtedly made an impact on sprinkler devices failing inspection. Missing Signage accounted for the largest cited reason for failure, with these devices accounting for 28.10% combined of the total Device or Component Missing category (although Fire Department Connection refers to the caps on the device, a common component that frequently goes missing):

  – Control Valve (16.03%)   – Drain (5.54%)   – Fire Department Connection (3.88%)

- **Requires Maintenance**: As to be expected, 7.84% of devices failed due to requiring the mandated five-year maintenance, which is an increase of less than half a percentage point from the previous year (7.47%, +0.37% YOY).

- **Inaccessible or Blocked**: From 2014 to 2015, devices that failed due to being Inaccessible or Blocked rose from 0.31% to 1.82%, an increase of 587% YOY. This trend stabilized somewhat in 2016 with a comparatively modest increase from 1.82% to 1.99%. However, there is still plenty of room for improvement to return to the 2014 levels if that year was not an anomaly. Future reports should determine whether or not 2014 was simply an outlier.

- **Location/Description Discrepancies, Disconnected, and Incompatible Devices**: While the percentages appear small in comparison, they still represent a large total number of devices since the database currently contains data on over 250 million individual devices. However, the good news is that they remain minor issues in the grand scheme of things for Sprinkler systems compared to some other device types.

SuppressionScan Failure Reasons

Requires Maintenance
3.84%

Damaged
3.05%

Other/Not Specified
15.03%

Defective
20.11%

Inaccessible
or Blocked
4.25%

Device or
Component Missing
0.14%

Disconnected
0.18%

Expired or
Decommissioned
53.39%

Takeaways:

- **Asbestos Abatement, Incompatible Device, and Location/Description Discrepancies**: None of these failure reasons have been applicable for Suppression Systems (Asbestos Abatement has only been reported for FireScan devices), so this chart is somewhat simpler than most. However, it is worth noting that these are not issues for devices in this category.

- **Device or Component Missing and Disconnected**: While rare, there are still incidents of devices failing for either of these reasons. Signage is the only device to be reported as Missing (0.16%), and Agent Tanks were the only devices to be reported as Disconnected (0.21%).

- **Expired or Decommissioned**: As in 2014 and 2015, numerous Suppression devices failed because they were expired. However, the failure rate for this category declined from a three-year high in 2015 to a reported 59.81% failure rate for 2016 (-2.23% YOY). In fact, the reported failures increased from 56.68% in 2014 to 62.04% in 2015. Hoses, Batteries, Discharge Devices, Agent Tanks, and CO2 Tanks make up the majority of devices failing due to Expiration. A small number of Smoke Detectors failed due to being Decommissioned.

- **Defective**: As the second most (22.53%) reported failure category for Suppression, Defective devices ranged fairly evenly across numerous types of devices, but Batteries and Smoke Detectors were the most reports. Batteries accounted for 46.63% of the Defective devices while Smoke Detectors accounted for the second most with 12.80%, but Batteries and Smoke Detectors were the most reported.

- **Inaccessible or Blocked**: Down from 4.86% in 2015, 4.76% of Suppression devices failed for this reason in 2016. Of those, 21.39% were Operating Devices that were physically obstructed and the remainder were devices where the inspector was either denied access (locked, occupied, or secure areas) or physically unable to complete the inspection (out of reach, how it was constructed, etc.). NFPA 2001 (Clean Agent Standard) states as follows:

    – "Operating devices shall include agent-releasing devices or valves, discharge controls, and shutdown equipment necessary for successful performance of the system."

- **Damaged**: At 3.41%, Suppression devices are the least likely to fail due to sustaining physical damage (FireScan devices rank second lowest). Most were failed due to be "Damaged/Worn", but other reasons cited included being Painted or tanks that had been Discharged.

- **Requires Maintenance**: As in previous years, devices in this category were primarily CO2 Tanks and Agent Tanks, as to be expected due to the periodic requirements. A few other device types required adjustments or remounting, but not a significant number. However, the 4.31% failure rate was a significant increase compared to the 3.22% that failed the previous year.

- **Other/Not Specified**: At 4.82%, the number of devices with more detailed explanations remained consistent (-0.06% YOY).

Individual Device Performance

In the 2015 report, we looked deeper at which devices failed most and least often as well as the time it takes to inspect specific devices. In each category, we took the top and bottom 10 device types from each end of the spectrum to review.

FireScan Failure Rate Highs and Lows

Device Type	Lowest Failure Rate by Device Type
Fan Running	0.65%
Chime/Strobe	0.82%
Masterbox	0.84%
Water Mist System	0.88%
Strobe	0.89%
Multi-Criteria Detector	0.95%
Speaker	1.24%
Smoke Detector	1.36%
Pull Station	1.41%
Speaker/Strobe	1.42%

Device Type	Highest Failure Rate by Device Type
Signage	17.69%
Battery	11.86%
Roll Down Door	9.43%
Phone Jacks	7.99%
Emergency Light	6.86%
Generator Trouble	6.78%
Gas Detector	6.68%
Beam Detector	6.17%
Smoke Alarm	6.08%
Printer	6.06%

FireScan Inspection Time Highs and Lows

Device Type	Lowest Average Inspection Time per Device (Minutes)
Fan Running	0.47
Exit Light	0.93
Emergency Light	0.94
Strobe	1.12
Speaker/Strobe	1.15
Water Mist System	1.24
Horn/Strobe	1.25
Speaker	1.27
Horn	1.30
Releasing Device	1.32

Device Type	Highest Average Inspection Time per Device (Minutes)
Printer	5.83
Gas Detector	3.97
Emergency Power Off	3.78
Kitchen Hood	3.67
Low Temperature	3.66
Low Fuel	3.60
Roll Down Door	3.59
Generator Auto	3.53
Disconnect	3.50
Duct Detector	3.41

SafetyScan Failure Rate Highs and Lows

Device Type	Lowest Failure Rate by Device Type
Scaffolding	0.06%
Storage Container	0.55%
Fire Blanket	0.56%
Personal	1.00%
Toggle Switch	1.16%
Hearing Protection	1.18%
Transfer Switch	1.42%
Special System	1.50%
Defibrillator	1.74%
Fire Hose Cabinet	1.99%

Device Type	Highest Failure Rate by Device Type
Standby Power Supply	21.44%
Fire Hose	15.60%
Battery	15.08%
Shower Station	12.95%
Standby Generator	11.90%
Ladder	11.33%
Emergency Light	10.54%
Wheeled Unit	9.93%
Fall Protection	8.78%
Exit Light	8.19%

SafetyScan Inspection Time Highs and Lows

Device Type	Lowest Average Inspection Time per Device (Minutes)
Emergency Power System	0.56
Fire Hose Cabinet	1.00
Extinguisher Cabinet	1.03
Special System	1.19
Battery	1.21
Exit Light	1.24
Exit Sign	1.24
Fire Door	1.32
Fire Blanket	1.49
Canister	1.52

Device Type	Highest Average Inspection Time per Device (Minutes)
Fire Damper	5.09
Range Suppression	4.83
Breathing Apparatus	4.23
Personal Gas Monitor	4.06
Breathing Cylinder	4.02
Toggle Switch	3.75
Ladder	3.59
Fall Protection	3.57
Cartridge Extinguisher	3.43
Standby Power Supply	3.34

SecurityScan Failure Rate Highs and Lows

Device Type	Lowest Failure Rate by Device Type
Breathing Apparatus	0.52%
Central Station Receiver	0.53%
Receiver	0.60%
Badger	0.70%
Air Monitor	0.78%
Restraint Device	0.80%
Reader	0.84%
Clothing	1.11%
Electric Strike	1.13%
Defibrillator	1.28%

Device Type	Highest Failure Rate by Device Type
Radio	28.29%
Auxiliary Station	26.82%
Standalone Lockset	25.86%
Vehicle Sensor	13.70%
Exit	12.99%
Batteries	11.97%
Fence	9.98%
Gate Operator	8.77%
Seismic Sensor	8.74%
Storage	8.34%

SecurityScan Inspection Time Highs and Lows

Device Type	Lowest Average Inspection Time per Device (Minutes)
Controller	0.86
Standalone Lockset	0.88
Patient Monitor	0.90
Video Console	0.93
Electric Lock	0.97
Bath Station	1.13
Bed Exit	1.17
Staff Assist Station	1.17
Code Blue	1.18
Magnetic Lock	1.20

Device Type	Highest Average Inspection Time per Device (Minutes)
Fall Protection	5.84
PTZ Unit	4.71
Fence	4.22
Breathing Apparatus	3.86
Camera	3.81
Air Monitor	3.71
Vehicle Sensor	3.68
Defibrillator	3.55
Biometric Device	3.44
Exit	3.24

SprinklerScan Failure Rate Highs and Lows

Device Type	Lowest Failure Rate by Device Type
Valve	1.10%
Main Drain	1.12%
Jockey Pump	1.19%
Fire Pump Phase Reversal	1.27%
Electrical Driver	1.29%
Jockey Controller	1.54%
Spray Nozzle	1.72%
Pump Test	1.87%
Tamper Switch	2.05%
Excess Pressure Pump	2.06%

Device Type	Highest Failure Rate by Device Type
Antifreeze System	18.66%
Check Valve	14.66%
Gauge	13.90%
Piping	12.96%
Emergency Light	12.11%
Signage	12.03%
Fire Pump Gauge	11.92%
Standpipe	9.60%
Backflow Prevention	9.35%
Fire Hose	9.24%

SprinklerScan Inspection Time Highs and Lows

Device Type	Lowest Average Inspection Time per Device (Minutes)
Emergency Light	0.93
Fire Pump Gauge	1.06
Gauge	1.12
Check Valve	1.28
Alarm Valve	1.32
Fire Pump Running	1.35
Tamper Switch	1.38
Level Alarm	1.43
Control Valve	1.43
Fire Pump Power	1.45

Device Type	Highest Average Inspection Time per Device (Minutes)
Manifold	8.98
Communicator	6.11
Impairment	5.77
Gear Controlled Nozzle	5.20
Fire Hydrant	4.97
Backflow Prevention	4.63
Monitor	4.47
Hose Nozzle	4.40
Antifreeze System	4.13
Fire Dept. Connection	4.09

SuppressionScan Failure Rate Highs and Lows

Device Type	Lowest Failure Rate by Device Type
Speaker	0.12%
Maintenance Bypass Switch	0.45%
Tamper Switch	0.46%
Abort Station	0.49%
Smoke Detector	0.53%
Speaker/Strobe	0.61%
Spark Detector	0.73%
Bell	0.73%
Waterflow Switch	0.76%
Foam Distribution Device	0.76%

Device Type	Highest Failure Rate by Device Type
Foam System	19.18%
Carbon Dioxide System	17.58%
Hose	13.23%
Damper	11.35%
Fire Barrier	9.65%
Discharge Device	9.51%
Foam Tank	9.21%
Battery	8.86%
Gauge	8.65%
Emergency Light	8.64%

SuppressionScan Inspection Time Highs and Lows

Device Type	Lowest Average Inspection Time per Device (Minutes)
Monitoring Device	0.90
Speaker	0.93
Spark Detector	1.06
Hose	1.07
Supervisory Device	1.10
Module	1.10
Smoke Detector	1.11
Relay	1.14
End Of Line	1.16
Heat Detector	1.17

Device Type	Highest Average Inspection Time per Device (Minutes)
Foam System	5.57
Logbook	4.28
Fire Barrier	3.91
Pneumatic Time Delay	3.28
Temperature Alarm	3.27
Beam Detector	3.20
Chemical System	3.14
Gas Detector	3.12
Chime	3.02
Air Compressor	2.90

Addressable vs. Conventional Systems

In 2014, we reached several conclusions regarding Addressable versus Conventional systems:

- Only 13.14% of the total devices inspected in the sample were Conventional, but they accounted for 17.68% of total device failures.

- While devices attached to Conventional Systems failed at a 3.05% rate, devices on an Addressable system only failed at a 2.33% rate.

- The net takeaway supported the hypothesis that devices on Addressable Systems typically performed better than Conventional.

13.14%

17.68%

3.05%

2.33%

= Total Devices Inspected

= Total Devices Failures

= Conventional

= Addressable
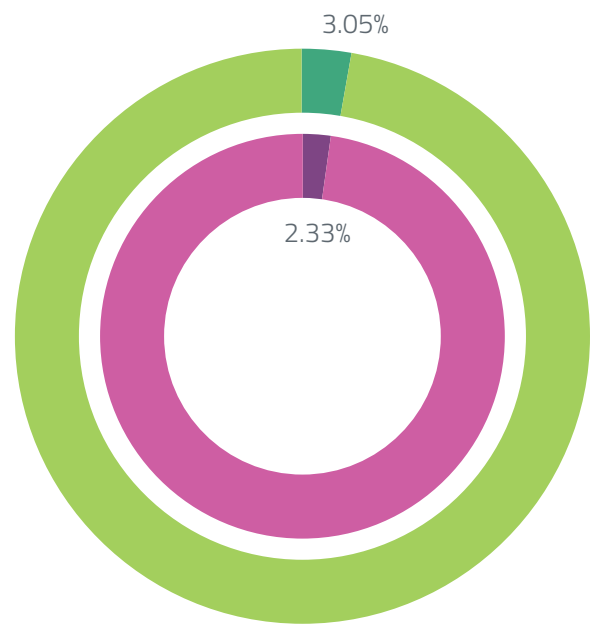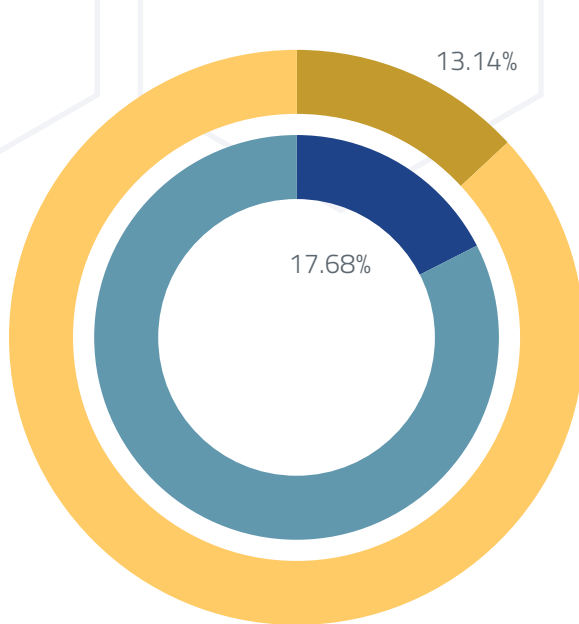
Since data at this level fluctuates very mildly year-to-year, it has not been reported for 2016. However, we will reexamine the data in the fifth edition of the report for the calendar year 2019 to be published in 2020. *(To read deeper analysis in this area, please refer to the 2014 report.)*

One Foot in Front of the Other

We introduced a new top-line stat this year based on data from a recent report published by the Rocky Mountain Institute – the estimated total square footage of buildings covered by this report. Based on the distribution of the percentage of buildings that fall within square footage ranges and the number of commercial buildings in the BuildingReports database, we can extrapolate that 12.06% of U.S. buildings and 9,052,723,470 square feet are represented in the analysis. These additional metrics further establish the statistical validity of the data presented and will be updated in future editions.

Time Really Is Money

Healthcare facilities are easily the most expensive to inspect and maintain, with quarterly accredited agency inspection requirements for some devices and an average inspection time – for all device types – of 3:53:40 per building. Fire Alarm and Signaling in Healthcare occupancy types are particularly time-intensive at 6:10:15 on average to inspect. Detention (2:33:22 minutes/building) and Assembly (2:10:40 minutes/building) – the latter also featuring the highest per-device inspection time – are also time-intensive. Keep in mind that the times represented are from the first device scanned until the data entry is completed for the last device scanned. Time for driving to and from the site, pre- and post-inspection meetings, and any required maintenance to correct device failures should also be factored in when bidding on new projects or when reviewing bids from new service companies. For service companies that do not utilize automated web-based reporting solutions, there may also be additional hours spent in the office producing paper reports.

Extinguishing the Risk with Best Practices

Revisiting a finding from the 2015 Benchmark Report, it is probably not surprising that fire extinguishers are one of the most susceptible fire and life safety devices requiring regular service and being at-risk for human tampering. In addition, the Gowrie report cited in the 2015 report also alludes to the fact that fire extinguishers are incorrectly blocked in many businesses. To offset these risks, NFPA 10 requires monthly visual inspections that include:

- Confirming that the extinguisher is visible, unobstructed, and in its designated location.
- Verifying that the locking pin is intact and that the tamper seal is unbroken.
- Examining the extinguisher for obvious physical damage, corrosion, leakage, or a clogged nozzle.
- Confirming that the pressure gauge or indicator is in the operable range or position, and lifting the extinguisher to check if it is still full.
- Ensuring that the operating instructions on the nameplate are legible and facing outward.
- Checking the last professional service date on the tag, if applicable (a licensed fire extinguisher maintenance contractor must have inspected the extinguisher within the past 12 months).*
- Initialing and dating the back of the tag, if applicable.*

*According to NFPA 10, tags may not be required if a barcoding system such as BuildingReports' ScanSeries is used.

Industrial-Strength Compliance

Fire and life safety compliance can be challenging in Industrial occupancy types due to the inherent dangers associated with many of their functions and processes. Not only are the safety of the occupants and assets of utmost concern, but downtime in the wake of an incident was estimated in 2006 to cost companies $22,000 per minute on average. Given inflation over the past decade, that figure is likely higher today. Our special supplement on Industrial occupancy types uncovered a few takeaways for professionals in charge of environmental health and safety in those facilities, and the companies who service them:

- **Foam, Foam on the Range**: The average Industrial facility has 35.83 Suppression devices, or nearly seven more per building than the average for all other occupancy types. Remove the other two high-end outliers – Assembly and Business occupancy types – from the mix and the variance increases to 13.44 more devices on average. However, Suppression systems in Industrial occupancy types are also the fastest on average to inspect, and are most likely simpler to inspect because they do not have the subfloor areas or operations scheduling complications.

- **Safety First**: Safety devices ranked first in two categories for Industrial occupancy types: highest Total Inspection Time and highest Device Failure Rate. Industrial facilities have stringent codes regarding employee safety due to their function, and require an increased presence of those devices within the occupancy type. At 69.58 devices on average, Industrial occupancy types are second only to Healthcare (71.25) in the number of Life Safety devices per facility. However, the 16.64% failure rate reported for Shower Stations, which are critical in the event of an incident, is cause for concern. Other potentially troublesome devices in terms of failure rate include:

    – Exit Light (14.15%)
    – Fall Protection (12.29%)
    – Ladder (11.97%)

- **Extinguish Inefficiencies and Budget Questions**: According to the data, Cartridge and Fire Extinguishers account for more than 73% of the Life Safety devices inspected in Industrial occupancy types. Because of the frequency of maintenance requirements, and the fact that visual inspections are required monthly, these devices require a disproportionate amount of time and attention. Understanding failure rates, installation dates, inventory figures, device location, and maintenance frequency can help facility management and environmental health and safety professionals to more efficiently manage and improve budgeting for these types of devices.

- **See the Light**: In the event of a power outage, particularly one caused by a large workplace incident or natural disaster, Industrial facilities have several concerning attributes. Failure rates for back-up generator components tied to Fire Alarm and Signaling systems rank as the second and third most likely to fail, which could put the facility at a higher risk of warning occupants in the event of a fire during an outage. Exit Signs, Exit Lights, and Emergency Lighting comprise just under 10% of all Life Safety Devices in Industrial occupancy types and report at a 7.39% failure rate. Given these three devices take less than on minute 50 seconds to inspect and record the data, a visual spot check during monthly Extinguisher inspections is a low-effort exercise that would reduce risk.

Most Likely Not to Succeed

SuppressionScan and SecurityScan both had the same number of devices ranked in the top 10 device failure rates:

1. Post Indicator Valve - 37.00% (SuppressionScan)
2. Auxiliary Station - 35.72% (SecurityScan)
3. Radio - 28.29% (SecurityScan)
4. Standalone Lockset - 25.86% (SecurityScan)
5. Standby Power Supply - 21.44% (SafetyScan)
6. Gauges - 19.49% (SprinklerScan)
7. Foam System - 19.18% (SuppressionScan)
8. Antifreeze System - 18.66% (SprinklerScan)
9. Signage - 17.69% (FireScan)
10. Carbon Dioxide System - 17.58% (SuppressionScan)

It's a Matter of Time

Out of the top 10 devices in terms of average inspection time per device, five were devices in Sprinkler systems, including the number one device overall.

1. Manifold - 8.98 (SprinklerScan)
2. Deluge Valve - 8.89 (SuppressionScan)
3. Communicator - 6.11 (SprinklerScan)
4. Fall Protection - 5.84 (SecurityScan)
5. Printer - 5.83 (FireScan)
6. Impairment - 5.77 (SprinklerScan)
7. Foam System - 5.57 (SuppressionScan)
8. Gear Controlled Nozzle - 5.20 (SprinklerScan)
9. Fire Damper - 5.09 (SafetyScan)
10. Fire Hydrant - 4.97 (SprinklerScan)

Appendix A

Inspection App	Occupancy Type	Total Inspection Time	Inspection Time/ Device	Failure Rate
FireScan	Assembly	203.36	2.36	3.18%
FireScan	Business	155.97	2.29	2.80%
FireScan	Detention	197.75	3.28	3.13%
FireScan	Educational	172.04	2.19	2.36%
FireScan	Health	366.09	1.91	1.27%
FireScan	Industrial	102.61	1.91	3.41%
FireScan	Mercantile	128.20	2.00	4.27%
FireScan	Mixed	171.10	2.27	1.96%
FireScan	Residential	128.51	2.47	2.72%
FireScan	Storage	55.26	1.71	2.98%
SafetyScan	Assembly	86.11	2.70	9.85%
SafetyScan	Business	67.04	1.72	8.53%
SafetyScan	Detention	82.76	0.98	8.49%
SafetyScan	Educational	59.88	1.97	8.34%
SafetyScan	Health	100.47	1.49	3.62%
SafetyScan	Industrial	105.50	2.14	4.98%
SafetyScan	Mercantile	49.53	2.08	8.56%
SafetyScan	Mixed	66.75	2.34	6.18%
SafetyScan	Residential	88.91	1.53	11.01%
SafetyScan	Storage	52.52	1.78	4.95%
SecurityScan	Assembly	85.64	2.70	6.16%
SecurityScan	Business	64.02	1.72	2.21%

Inspection App	Occupancy Type	Total Inspection Time	Inspection Time/ Device	Failure Rate
SecurityScan	Detention	221.09	0.98	0.99%
SecurityScan	Educational	73.98	1.97	5.04%
SecurityScan	Health	125.22	1.49	4.59%
SecurityScan	Industrial	84.36	2.14	2.53%
SecurityScan	Mercantile	77.29	2.08	0.62%
SecurityScan	Mixed	90.00	2.34	3.69%
SecurityScan	Residential	74.65	1.53	2.94%
SecurityScan	Storage	50.68	1.78	2.65%
SprinklerScan	Assembly	58.89	2.08	5.39%
SprinklerScan	Business	49.76	1.86	6.37%
SprinklerScan	Detention	54.48	1.65	5.07%
SprinklerScan	Educational	38.59	1.59	5.84%
SprinklerScan	Health	67.39	1.94	2.59%
SprinklerScan	Industrial	68.52	1.92	4.45%
SprinklerScan	Mercantile	31.42	1.74	4.74%
SprinklerScan	Mixed	60.97	1.87	5.86%
SprinklerScan	Residential	75.10	1.61	7.54%
SprinklerScan	Storage	61.20	1.78	4.26%
SuppressionScan	Assembly	43.04	1.81	2.37%
SuppressionScan	Business	39.13	1.51	2.52%
SuppressionScan	Detention	20.12	1.65	1.82%
SuppressionScan	Educational	22.26	1.71	3.69%
SuppressionScan	Health	26.13	1.71	1.75%
SuppressionScan	Industrial	47.88	1.69	2.87%
SuppressionScan	Mercantile	4.38	0.67	0.64%
SuppressionScan	Mixed	20.59	1.48	2.60%
SuppressionScan	Residential	11.42	1.76	3.89%
SuppressionScan	Storage	22.31	2.11	2.67%

Appendix B

FireScan Devices Include: Air Pressure Switch, Alarm Device, Annunciator, Aspirating Detector, Batteries, Beam Detector, Bell, Building Automation, Carbon Dioxide System, Chemical System, Chime, Chime/ Strobe, Clean Agent System, CO Detector, Communication Line, Communicator, Control Panel, Damper, Damper Control, Disconnect, Door Smoke Detector, Duct Detector. Elevator Recall, End of Line, Emergency Light, Emergency Power Off , Exit Light, Expander Panel, Fan Running, Fan Shutdown, Fan Start, Fault Isolation Module, Fire Barrier, Fire Pump Auto, Fire, Pump Power, Fire Pump Running, Fire Pump Trouble, Flame Detector, Foam System, Gas Detector, Gas Shutdown, Generator Auto, Generator Running, Generator Trouble, Handset, Heat Detector, Horn, Horn/Strobe, Initiating Device, Kitchen Hood System, Lighting Control, Locking Device, Low Fuel, Low Temperature, Low Water, Monitor Device, Monitoring, No Entry Sign, Phone Jack, Phone Station, Power Loss, Power Supply, Preaction Signal, Preaction System, Printer, Programmable Relay, Pull Station, Releasing Device, Roll Down Door, Smoke Detector, Sound Shutdown, Sound Test, Speaker, Speaker/Strobe, Special Control, Stairwell Exit, Supervisory Device, Supervisory Valve, Tamper Switch, Voice Evacuation, Water Mist System, Water Pressure Switch, Water Flow Switch

SafetyScan Devices Include: Access Hatch, Batteries, Breathing Apparatus, Breathing Cylinder, Cabinets, Canister, Cylinder, Cartridge, Cartridge Extinguisher, Clothing, Cooking Equipment, Defibrillator, Exit Sign, Emergency Light, Emergency Power System, Eye Wash Station, Eye Protection, Extinguisher Cabinet, Fire Blanket, Fire Damper, Fire Door, Fire Hose, Fire Hose Cabinet, Fire Extinguishers, Fire Protection, First Aid, Hearing Protection, Lockout, Personal Protection, Personal Gas Monitor, Respirators, Range Hood, Range Suppression, Shower Station, Special System, Spill Control, Standby Power Supply, Storage Container, Stretcher, Tagout, Toggle Panel, Toggle Switch, Transfer Switch, Vehicle, Wheeled Unit

SecurityScan Devices Include: Access Sensor, Air Monitor, Annunciator, Audible, Auxiliary Station, Badger, Barrier, Batteries, Bath Station, Bed Exit, Biometric, Biohazard, Breathing Apparatus, Breathalyzer, Button, Camera, Central Station Receiver, Client, Clothing, Code Blue, Communicator, Console, Controller, Control Panel, Defibrillator, Detector, Door, Door Contact, Dome Light, Duty Station, DVR, Electric Lock, Electric Strike, Emergency Call, Enclosure, Entrance, Exit, Exit Device, Fall Protection, First Aid, Footwear, Gate, Gas Mask, Gate Operators, Intercom, Interface, IV Pump, Keypad, Keyswitch, Magnetic Lock, Mantrap, Media, Monitor, Motion Sensor, Multiplexer, Nurse Console, Parking, Patient Monitor, Power Supply, Pressure Mat, Printer, PTZ Unit, Radio, Reader, Receiver, Router, Request to Exit, Restraint Device, Respirator, Shower Station, Seismic Sensor, Sensor, Staff Station, Staff Assist Station, Standalone Lockset, Storage, Switch, Switcher, Telephone, Telephone Entry, Transmitter, Turnstile, VCR, Video Console, Video Monitor, Vehicle, Vehicle Sensor, Vest, Visual, Weapon, Window Contact

SprinklerScan Devices Include: Alarm Valve, Air Compressor, Air Maintenance Device, Antifreeze System, Back Flow Prevention, Batteries, Check Valve, Controller, Control Valve, Deluge Valve, Dry Pipe Valve, Drain, Diesel Driver, Dry Sprinkler, Electrical Driver, Excess Pressure Pump, Extended Coverage, Fire Department Connection, Fire Hydrant, Fire Pump Off, Fire Pump Phase Reversal, Fire Pump Power, Fire Pump Running, Fire Pump Trouble, Fire Pump Gauge, Fire Hose, Gauge, Gear Controlled Nozzle, Generators, Hose Connection, Hose Nozzle, Hose Storage, Heating System, Hydraulic Driver, Inspector's Test, Isolation Valve, Jockey Controller, Jockey Pump, Level Alarm, Monitor Nozzle, Natural Gas Driver, Piping, Pressure Switch, Pressure Regulating Valve, Post Indicator Valve, Preaction Valve, Proportioner, Pump, Quick Opening Device, Residential Sprinkler, Spray Nozzle, Sprinkler Nozzle, Special Sprinkler, Sprinkler Box, Sprinkler Box Spares, Standard Nozzle, Standard Response, Steam Driver, Storage Sprinkler, Tamper Switch, Temperature Alarm, Water Flow Switch, Water Motor Gong, Water Storage Tank, Wrenches

SuppressionScan Devices Include: Abort Station, Actuator, Agent Tank, Annunciator, As-Builts, Aspirating Detector, Batteries, Beacon, Beam Detector, Bell, Carbon Dioxide System, Chemical System, Chime, Chime/Strobe, Clean Agent System, CO Detector, CO2 Tank, Communicator, Computer, Control Panel, Deluge System, Detector, Discharge Device, Disconnect, Duct Detector, Dump Switch, Emergency Light, Emergency Power Off, End of Line, Expander Panel, Explosion Protection, Fan Shutdown, Fan Start, Fault Isolation Module, Fire Barrier, Flame Detector, Foam System, Fusible Link, Gas Detection System, Gas Detector, Generator, Halon System, Heat Detector, Horn, Horn/Strobes, Hose, Interlock, Kitchen System, Leak Detector, Level Alarm, Lockout, Logbook, Low Fuel, Low Water, Main Reserve Switch, Manual Station, Messaging, Module, Moisture Detector, Moisture/Leak System, Monitoring Device, Operating Device, Piping, Power Supply, Preaction System, Pressure Detector, Pressure Switch, Pressurization, Printer, Pull Station, Relay, Releasing Device, Signage, Signal, Siren, Smoke Detector, Speaker, Speaker/Strobe, Special Control, Strobe, Supervisory Device, Tamper Switch, Temperature Alarm, Valve, Video Detector, Water Mist System, Water Flow Switch

About BuildingReports

Building safety compliance is critical to service companies, building owners, and fire and safety officials who are charged with safeguarding occupants. BuildingReports' award-winning mobile and online inspection reporting tools enable inspectors to gather data on fire and life safety devices quickly to ensure that they are working properly and meet code requirements or to identify actions needed to meet compliance through easily verifiable inspection reports. With millions of inspection reports to date, hundreds of thousands of buildings represented and over 800 inspection companies in its network, BuildingReports has earned its reputation as the trusted name in compliance reporting. For more information, contact **sales@buildingreports.com** or visit **www.buildingreports.com**.

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For over a decade BuildingReports has been pleased to sponsor Inspector's Boot Camp, a leading training resource for the Fire and Life Safety industry. Inspector's Boot Camp is now part of the new BuildingReports University. BuildingReports University is committed to providing the best available classroom and hands-on lab training, webinars, educational resources, research like this report, and BuildingReports solutions training. With a half century of combined training experience, and decades of experience inspecting and managing field service teams in the industry, our team of subject matter experts are uniquely equipped to help your team stand head-and-shoulders above the competition.

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