

Inert Gas Extinguishing System Two Minute Discharge Study

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Why?

- NFPA 2001 recently changed due to manufacturer and customer demand
 - Decrease room pressure and consequently vent requirements
 - Decrease pipe network size

Test Setup

Enclosure

- 15.08 X 15.08 X 16 feet



Extinguishing System

- Fike ProInert 200 Bar System
- Regulated discharge pressure 42 bar
- 1 Inch nozzle

Agent Concentration

- Oxygen Monitored
 - NOVA 320S-3
- Oxygen % to Agent % Relation
 - $Agent\% = \left(1 - \left(\frac{O_2\%}{20.9}\right)\right)$

IG-100 Tests

IG-100/Class B

- Pan
 - Run per UL 2127 par. 34.3 and FM 5600 par. 4.1.2.2
 - Std. UL/FM 2 ½ sq.ft. Pan
- Can
 - Run per UL 2127 par. 35.5 and FM 5600 par. 4.2.2
 - Std. size can
- Commercial grade heptane

IG-100/Pan

- Used MEC for heptane of 31%
- Extinguished 2:24 from start of pre-burn
- 6 seconds before end of discharge
- 36 seconds before requirement when using end of discharge requirement
- 24 seconds past requirement for 1 minute discharge

IG-100/Can

- Run like NVDT test
- Last can extinguished 1:55 from start of pre-burn
- Last can out 1:05 before end of discharge
- Meets current requirements for 1 minute discharge
- Longer discharge seems to mix better

IG-100/Class A

- Wood Crib
 - Run per UL 2127 34.2.2 and FM 5600 4.1.2.1
- Polymeric
 - Acrylonitrile-butadiene-styrene (ABS), Polymethyl Methacrylate (PMMA), and Polypropylene (PP)
 - Run per UL 2127 34.2.3 and FM 5600 4.1.2.1
 - Pre-burn typically 10-20 longer than called for

IG-100/Wood Crib

- Moisture content 9.8% (low side of range)
- Long heptane pre-burn 5:50 (3:30 in standard)
- Extinguished 4 seconds before end of discharge
- No embers after 10 minutes
- Meets current requirements for 1 minute discharge

IG-100/Polymeric

- ABS, PMMA, PP
- 3 ½ minute pre-burn (90s heptane pre-burn)
- Weight loss measured from 10 to 600s after end of discharge (was 4:40 from start of pre-burn now 5:40)
- Current limit 15g

IG-100/ABS

- Extinguishment times 6:10, 5:50, and 5:58 from start of pre-burn
- Weight losses using 5:40 to 15:40 window: 10, 12, and 12g.
- Weight losses using 4:40 to 14:40 window (as if this were a 1 minute discharge): 28 and 24g (one test not recorded)

IG-100/PMMA

- Extinguishment times 8:46 to 7:58 from start of pre-burn
- Weight losses using 5:40 to 15:40 window: 10g for all
- Weight losses using 4:40 to 14:40 window (as if this were a 1 minute discharge): 28, 34 and 32g

IG-100/PP

- Extinguishment time 5:03 from start of pre-burn
- Weight losses using 5:40 to 15:40 window: +170g
- Very poor burning with dripping
- No further tests run

IG-55

IG-55

- Polymeric worst case only
 - ABS, PMMA
 - 2 trials each (provided there was consistency)
- Run below MEC at 34% (MEC 35%)

IG-55/ABS

- Extinguishment times 5:46 and 5:52 from start of pre-burn
- Weight losses using 5:40 to 15:40 window: 6 and 8g
- Weight losses using 4:40 to 14:40 window (as if this were a 1 minute discharge): 16 and 18g

IG-55/PMMA

- Extinguishment times 8:27 and 8:51 from start of pre-burn
- Weight losses using 5:40 to 15:40 window: 10g each
- Weight losses using 4:40 to 14:40 window (as if this were a 1 minute discharge): 34 and 36g

IG-01

IG-01

- Polymeric worst case only
 - ABS, PMMA
 - 2 trials each (provided there was consistency)
- Run below MEC at 37% (MEC 42%)

IG-01/ABS

- Extinguishment times 6:11 and 5:41 from start of pre-burn
- Weight losses using 5:40 to 15:40 window: 8g each
- Weight losses using 4:40 to 14:40 window (as if this were a 1 minute discharge): 16 and 8g

IG01/PMMA

- Extinguishment times 10:44 and 9:35 from start of pre-burn
- Weight losses using 5:40 to 15:40 window: 14 and 12g each
- Weight losses using 4:40 to 14:40 window (as if this were a 1 minute discharge): 38 and 34g
- Additional agent would reduce weight losses

Discussion

- Some tests meet current requirements as written (wood crib, NVDT)
- Some pass as written if a 2 minute discharge is allowed (pan and polymeric tests)
- Double weight loss for polymeric using 1 minute criteria
- Close to 1% weight loss from total initial weight

Discussion

- Current requirement is 1/2% of total initial weight
- Agent majority enters in first minute
- Fire suppression begins as soon as agent enters room
- Additional 1/2% does not constitute a significant threat to life or property

Recommendations

- Change Class A and B requirements in UL 2127 and FM 5600 to allow 2 minute discharge
- Leave current requirements as measured from end of discharge
- Leave NVDT test at 1 minute discharge as this is more severe