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What Is IG-55?

NFPA 2001 · ISO 14520-14

- An **inert gas** agent: a blend of **50 % nitrogen + 50 % argon** (each $\pm 5\%$), both taken from the air we breathe
- Stored as a **compressed gas** (not a liquid) in high-pressure cylinders, so cylinder pressure shows the contents
- Used as a **total-flooding** agent: it fills the whole enclosure to a design concentration and **lowers the oxygen** below what a fire needs
- Leaves **no residue**, conducts no electricity and forms no breakdown products in the fire

BLEND
N₂ / Ar
50 / 50 % by volume

ENVIRONMENT
0 ODP
no global-warming impact

DENSITY 21 °C
1.41
kg/m³ $\approx 1.17\times$ air

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Where We Use It

Data & server rooms racks, UPS, raised floors	Telecom & control switch rooms, SCADA, BMS	Electrical LV / MV switch rooms, battery rooms*
Archives & museums vaults, heritage, records	Process & machinery enclosed equipment, turbines*	Occupied or not sensitive, irreplaceable assets

*Only where the listing and a hazard review support it. Not for reactive metals, metal hydrides or chemicals that carry their own oxygen.

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Advantages

- Safe for people at normal design levels (see Part 2)
- **Zero ODP**, negligible GWP, no long-term phase-out risk
- Clean: **no residue**, no water or powder damage
- Electrically **non-conductive**
- Gas, not a fog: **visibility** stays good for escape
- Long pipe runs and **multi-zone** banks via selector valves

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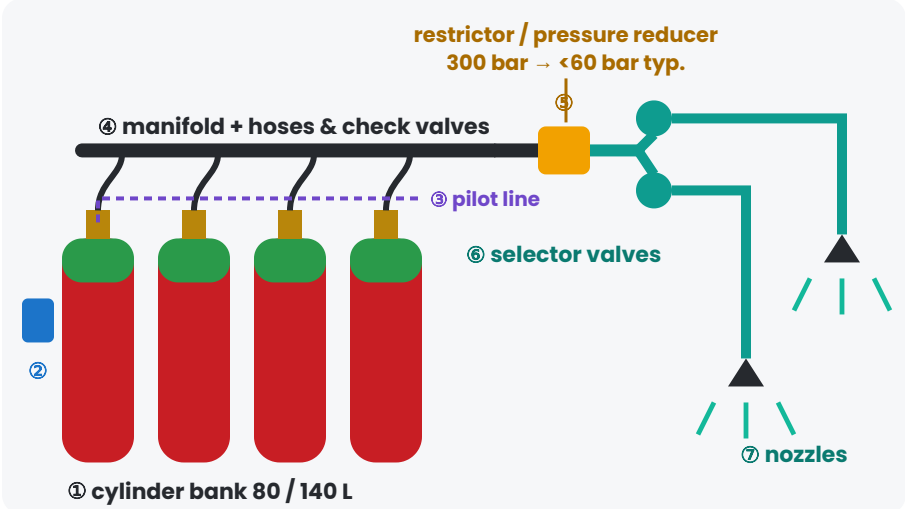
Limitations

- **Many cylinders**: more floor space and floor load than chemical agents
- **High pressure** (200 / 300 bar) needs trained handling
- Needs **over-pressure vents** and a tight room (Part 7)
- Lowers O₂: strict **exposure limits** and alarms
- Discharge takes **60–120 s**, slower than chemical agents
- Deep-seated fires need longer hold and review

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Typical Components

#	Item	Typical data
①	Cylinders	Seamless steel, typically 80 L or 140 L , filled to 200 or 300 bar at 15 °C
②	Valves & actuators	Brass cylinder valves; manual, pneumatic or electromagnetic (solenoid) actuation on the master
③	Pilot line	Gas from the master opens the slave cylinders pneumatically
④	Hoses & manifold	Flexible discharge hoses with check valves into a common manifold with gauge & safety relief
⑤	Pressure reduction	Restrictor / regulator: typically below 60 bar after the manifold, so lighter downstream pipe
⑥	Selector valves	One bank can serve several zones ; the valve directs gas to the zone in alarm
⑦	Nozzles & control	Brass nozzles with drilled orifices; releasing panel, detection, pressure switch, signs



Our generic schematic. Use a **listed / approved** system (e.g. VdS, UL, FM, LPCB) and follow its design manual; VdS 2380 covers non-liquefied inert gas systems.



IG-55 Inert Gas Suppression System

Part 2: Principle & Safety

Design & Installation Learning Series · working principle, design concentrations and people safety

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- 1 Intro
- 2 Principle
- 3 Quantity
- 4 Cylinders
- 5 Piping
- 6 Detection
- 7 Room
- 8 Install
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1 o2 How IG-55 Puts a Fire Out

- **Oxygen dilution:** the gas mixes with room air and cuts O₂ from **20.9 %** to about **12–13 %** at Class A design levels, below what flaming combustion needs
- The added gas also soaks up some heat, but the action is **physical**, not chemical: nothing decomposes, so no acid by-products
- Room air is **pushed out** through vents as the gas comes in (Part 7); the mix must then be **held** for the hold time
- People can still breathe at these levels for a **short, limited** time: enough to get out

OXYGEN LEFT AFTER DISCHARGE

$$O_2 = 20.95 \times (100 - C) / 100$$

C = IG-55 concentration, % by volume. Example: C = 42.7 % → O₂ = 12.0 %

Air
21 % O₂

+ IG-55
N₂ + Ar

Fire out
~12 % O₂

2 f(x) Design Concentration = Extinguishing × Safety Factor

NFPA 2001 · ISO 14520-14

Hazard	Basis	Min. extinguishing	Safety factor	Min. design (MDC)
Class A surface	NFPA 2001	31.6 %	× 1.2	37.9 %
Class C electrical	NFPA 2001	31.6 % (A)	× 1.35	42.7 %
Class B n-heptane	NFPA 2001	35.0 %	× 1.3	45.5 %
Surface Class A	ISO 14520-14	31.0 % (ABS)	× 1.3	40.3 %
Class B heptane	ISO 14520-14	36.5 % (cup)	× 1.3	47.5 %

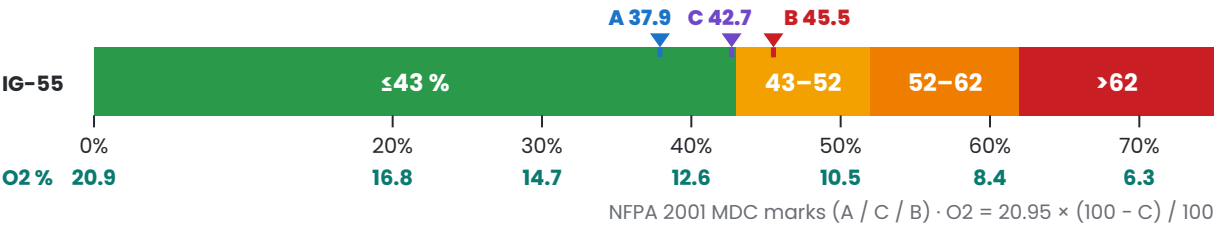
NFPA values at 21 °C, ISO at 20 °C. Listed system data can differ: the listed design manual and the AHJ decide. Other fuels need their own test values.

WHICH ONE DO WE USE?

- Pick the standard the project is designed to, then the **worst hazard** in the room
- Server / electrical rooms: **Class C** under NFPA 2001
- Mixed fuels: use the **highest** MDC
- Our worked example (Parts 3–7): **42.7 %**

3 People Safety: Concentration, Oxygen & Exposure Time

NFPA 2001 inert gas limits



NFPA 2001 MDC marks (A / C / B) · O₂ = 20.95 × (100 - C) / 100

NOAEL

43 %
≈ 12 % O₂

LOAEL

52 %
≈ 10 % O₂

NOAEL / LOAEL as published for IG-55 (ISO 14520-14 / EN 15004 data). NFPA 2001 uses the same 43 / 52 % steps as oxygen-based limits.

Design concentration	O ₂ (sea-level equivalent)	Space	Max. exposure
Below 43 %	above 12 %	Normally occupied permitted	5 min
43 – 52 %	12 – 10 %	Normally occupied permitted	3 min
52 – 62 %	10 – 8 %	Normally unoccupied only	< 30 s if exposed
Above 62 %	8 % or less	Unoccupied, no exposure	none

4 Safety Measures We Always Build In

- **Pre-discharge alarm + time delay:** required for inert gas systems
- Means to **limit exposure** (exits, drills, egress check) within the times above
- **Warning signs**, lock-off / manual mode for maintenance, training
- Check gas **migration** to adjacent spaces; ventilate before re-entry
- At altitude, the O₂ limits apply as **sea-level equivalent** (Part 3)

⚠ CHECK THE ACTUAL CONCENTRATION

Cylinders come in whole numbers, so the room gets **more** than the minimum. Check the **actual** concentration at the **warmest** room temperature against the table. Our room: MDC 42.7 % becomes **45.5–46.7 %** (Part 4), the **3-minute** band.



IG-55 Inert Gas Suppression System

Part 3: Agent Quantity

Design & Installation Learning Series · NFPA 2001 equation, specific volume, temperature, altitude

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1 f(x) The Inert-Gas Flooding Equation NFPA 2001 total flooding quantity

AGENT VOLUME PER M³ OF PROTECTED VOLUME

$$X = 2.303 \times (V_s / S) \times \log_{10}[100 / (100 - C)]$$

X = m³ of IG-55 (at 21 °C, 1.013 bar) per m³ of hazard · C = design concentration, % · S = specific volume at the **minimum** room temperature, m³/kg · V_s = specific volume at 21 °C = 0.7106 m³/kg. Tip: 2.303 × log₁₀ is simply ln.

SPECIFIC VOLUME OF IG-55 (SI)

$$S = 0.6598 + 0.00242 \times T$$

T in °C, S in m³/kg (NFPA 2001 constants k₁, k₂)

TOTAL QUANTITY

$$Q = V \times X \times ACF \cdot \text{kg} = Q / V_s$$

V = net volume, m³ · ACF = altitude correction factor

2 Flooding Factor X (m³/m³): Our Results From the Equation

Min. temp.	S, m ³ /kg	C = 37.9 %	C = 40.3 %	C = 42.7 %	C = 45.5 %	C = 47.5 %
0 °C	0.6598	0.513	0.556	0.600	0.654	0.694
10 °C	0.6840	0.495	0.536	0.579	0.631	0.670
20 °C	0.7082	0.478	0.518	0.559	0.609	0.647
30 °C	0.7324	0.462	0.501	0.540	0.589	0.625
40 °C	0.7566	0.448	0.485	0.523	0.570	0.605

37.9 / 42.7 / 45.5 % = NFPA 2001 Class A / C / B; 40.3 / 47.5 % = ISO 14520-14 Surface A / B. Highlighted = our example. Calculated by us with the NFPA equation; the design itself comes from the listed software.

3 Step by Step: Our Server Room

Step	What we do	Result
1	Volume: 10 × 8 m × (3.0 room + 0.5 floor void + 0.6 ceiling void)	V = 328 m³
2	Hazard Class C (electrical), NFPA 2001	C = 42.7 %
3	Min. room temperature 20 °C: S = 0.6598 + 0.00242 × 20	S = 0.7082
4	X = (0.7106 / 0.7082) × ln(100 / 57.3)	X = 0.5589
5	Q = 328 × 0.5589 × 1.00 (sea level)	Q = 183.3 m³
6	Mass = 183.3 / 0.7106	258.0 kg IG-55

Voids that share the enclosure are included. Racks are not deducted; only permanent solid structure may be. Part 4 turns this into cylinders.

4 Temperature Effect

USE THE COLDEST ROOM TEMPERATURE

Colder room = denser gas = **more** agent for the same %. Our room:

10 °C → **267.1 kg**

20 °C → **258.0 kg** ◀ design

30 °C → **249.4 kg**

Then check the **maximum** concentration at the **warmest** temperature (Part 4).

5 Altitude: Atmospheric Correction Factor NFPA 2001 Table 7.3.3.3

Altitude, m	0	300	610	915	1,220	1,830	2,440	3,050
Factor	1.00	0.96	0.93	0.89	0.86	0.78	0.72	0.66

Equivalent altitude, selected rows. Below sea level the factor is above 1.00.

OUR ROOM AT 915 M?

258.0 kg × 0.89 = **229.6 kg**. Adjust the quantity where ambient pressure differs from sea level by more than about 11 % (≈ 1,000 m).



IG-55 Inert Gas Suppression System

Part 4: Cylinders & Manifold

Design & Installation Learning Series · cylinder selection, real-concentration check, manifold layout

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1 Our Design Data (from Part 3)

NET VOLUME

328 m³

room + floor + ceiling void

DESIGN CONC.

42.7 %

NFPA 2001 Class C

ROOM TEMP.

20–30 °C

min. for quantity, max. for check

AGENT NEEDED

258.0 kg

= 183.3 m³ at 21 °C

ALTITUDE

ACF 1.00

sea level

2 Cylinder Options: Count, Supplied Agent & Real Concentration

Cylinder	Fill, kg*	≈ m ³ at 15 °C*	Need / fill	Qty	Supplied, kg	Excess	Actual C at 20 / 30 °C	Exposure band
80 L / 200 bar	22.9	15.9	258.0 / 22.9 = 11.26	12	274.8	+6.5 %	44.7 / 45.9 %	3 min
80 L / 300 bar	32.1	22.3	258.0 / 32.1 = 8.04	9	288.9	+12.0 %	46.4 / 47.5 %	3 min
140 L / 200 bar	40.0	27.8	258.0 / 40.0 = 6.45	7	280.0	+8.5 %	45.4 / 46.5 %	3 min
140 L / 300 bar	56.3	39.1	258.0 / 56.3 = 4.58	5	281.5	+9.1 %	45.5 / 46.7 %	3 min

*Assumption: typical published IG-55 minimum fill quantities at 15 °C (80 L: 22.9 / 32.1 kg; 140 L: 40.0 / 56.3 kg at 200 / 300 bar). Fills differ between listed systems: always use the manufacturer's fill table. We count in kg because the mass does not change with temperature. Actual C from the same NFPA equation, solved for C.

3 Our Choice & the Safety Check

- 5 × 140 L / 300 bar = 281.5 kg: fewest cylinders, smallest rack and floor area
- Actual concentration **45.5 %** at 20 °C → O₂ **11.4 %**; **46.7 %** at 30 °C → O₂ **11.2 %**
- Above 43 % but below 52 %: still allowed in a normally occupied room, with means to limit exposure to **3 minutes**
- Even the exact 258.0 kg gives **43.8 %** at 30 °C, so the warm-room check matters for every option

NUMBER OF CYLINDERS

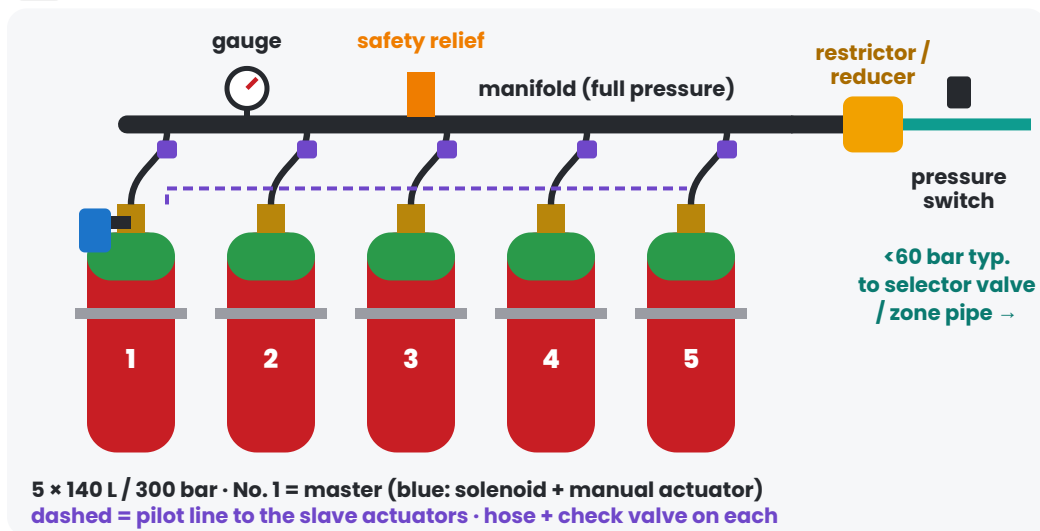
$$N = \lceil m_{\text{req}} / m_{\text{fill}} \rceil$$

258.0 / 56.3 = 4.58 → **5**. Round up, then re-check the actual concentration.

RACK WEIGHT (TYPICAL)

140 L / 300 bar ≈ **264 kg** each when full → 5 × = **1.32 t**. Ask the structural engineer to confirm the floor.

4 Manifold Layout



5 Layout Rules

- Bank **outside** the protected room, near it, in a dry, secure, accessible place
- Temperature within the **listed range**; no direct sun or heat
- Each cylinder **strapped** to a rack; space to weigh, gauge-read and swap
- Check valve** on every hose, so one cylinder can be removed safely
- Multi-zone bank: size it for the **largest zone**; selector valve per zone
- Reserve / connected spare where the spec or AHJ asks



IG-55 Inert Gas Suppression System

Part 5: Piping & Discharge

Design & Installation Learning Series · piping, restrictor, discharge time, nozzles and hydraulic software

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5 Piping

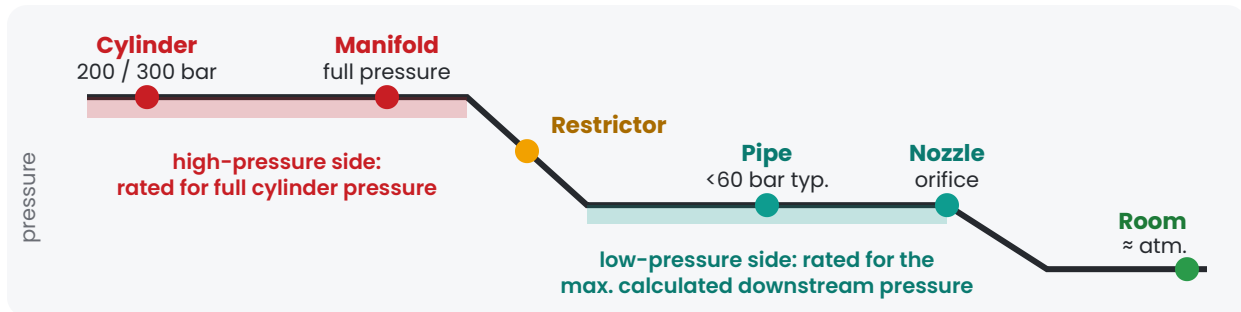
6 Detection

7 Room

8 Install

9 Maintain

1 Pressure Path: Cylinder to Room



- Up to the restrictor everything sees **cylinder pressure**
- The restrictor drops it to a lower, steadier pressure (typically **below 60 bar**)
- Nozzle orifices meter the gas into each space

2 Discharge Time NFPA 2001

Hazard	95 % of agent for MDC within
Class B (flammable liquids)	60 s
Class A surface · Class C	120 s

Or as the AHJ requires. Timed at 21 °C on the agent needed for the minimum design concentration. ISO 14520-1 / EN 15004 use 60 s, with 120 s for Class A in current editions; many listed systems are designed to 60 s.

MINIMUM AVERAGE FLOW, OUR ROOM
 $0.95 \times 258.0 \text{ kg} / 60 \text{ s} = 4.08 \text{ kg/s}$ · $/ 120 \text{ s} = 2.04 \text{ kg/s}$

3 The Restrictor (Orifice)

- A drilled **orifice plate** or regulator at the manifold outlet
- Flattens the flow: no huge peak at the start, so **smaller pipe** and a **smaller vent**
- Bore size comes from the **hydraulic calculation**; it is stamped and recorded
- Never swap, re-drill or omit it on site
- Downstream pipe, fittings and selector valves are rated for the calculated pressure

4 Nozzles & Agent Split (Our Room)

Space	Volume	Share	Agent	Nozzles*	Per nozzle
Room	240 m³	73.2 %	206.0 kg	4	51.5 kg
Floor void	40 m³	12.2 %	34.3 kg	2	17.2 kg
Ceiling void	48 m³	14.6 %	41.2 kg	2	20.6 kg
Total	328 m³	100 %	281.5 kg	8	

*Illustrative: agent split by volume. The real nozzle count, coverage and orifices come from the listing and software.

5 Nozzle Rules

- 360° / 180° types; keep to the listed **coverage area** and **height**
- Every void gets its **own** nozzles
- Keep clear of obstructions; secure light ceiling tiles and loose items
- Check the orifice code against the calculation before fitting

6 Hydraulic Calculation: Listed Software Only VdS / UL / FM listed

WHY NOT BY HAND?

Inert gas flow is **compressible** and the pressure falls as the cylinders empty. Approved software steps through the discharge in small quasi-steady time steps, conserving **mass, energy and momentum** in every pipe section. Our hand numbers above are only a check.

WHAT IT GIVES US

Pipe sizes · restrictor and nozzle orifices · nozzle pressures · discharge time · concentration per space · peak flow for vent sizing. Stay inside its limits (pipe length, splits, elevation).



IG-55 Inert Gas Suppression System

Part 6: Detection & Release

Design & Installation Learning Series · cross-zoning, cause & effect, abort, manual release, alarms

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1 The Release Sequence

1 · Zone A

first detector: stage-1 alarm, staff check

2 · Zone B

second zone confirms the fire

3 · Pre-discharge

sounder + beacon, HVAC and dampers shut, people leave

4 · Time delay

countdown, often about 30 s (project spec)

5 · Release

solenoid opens the master, pilot gas opens the slaves

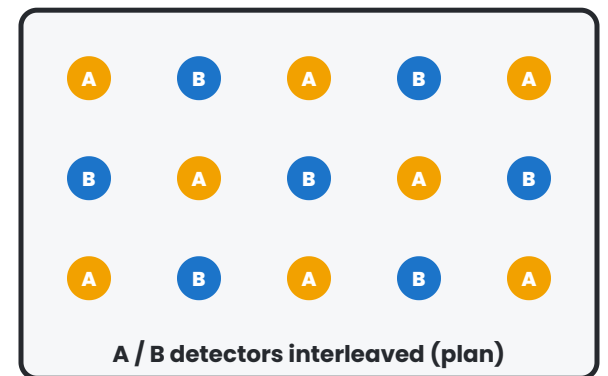
6 · Confirm

pressure switch lights 'gas released', no entry

2 Cross-Zoned Detection

common practice

- Two **independent** detection zones, with detectors **interleaved** over the whole area and in each void
- Auto release needs **both** zones: one faulty or dusty head cannot dump the system
- Point smoke detectors or aspirating (ASD) with two alarm levels; spacing per NFPA 72 / local code, reduced for high airflow
- Cross-zoning is good practice and often specified, not a fixed NFPA 2001 rule: follow the spec / AHJ



3 Cause & Effect Matrix (our example)

Cause ↓ / Effect →	Stage-1 alarm	FACP / BMS signal	Pre-discharge sounder + beacon	HVAC & dampers off	Delay timer	Release solenoid	'Gas released' lamp
Detector, Zone A only	●	●	—	—	—	—	—
Detector, Zone B only	●	●	—	—	—	—	—
Zone A + Zone B (confirmed)	●	●	●	●	●	● after delay	—
Manual release (dual action)	●	●	●	●	●	● after delay*	—
Abort held (deadman)	—	●	● stays on	—	● held	—	—
Manual / lock-off mode	—	●	—	—	—	blocked	—
Discharge pressure switch	—	●	—	—	—	—	●
Fault (open / short circuit)	—	fault	—	—	—	—	—

● active ● release / discharge ● held. *Whether manual release keeps the delay is a project decision. The real matrix comes from the spec and the listed panel, and is tested point by point at commissioning (Part 8).

4 Abort & Manual Release

- Abort** (if fitted): inside the room near the exit, **deadman** type (works only while held), gives a distinct signal
- Manual release**: dual action, at each exit, clearly labelled; it is **not** stopped by the abort
- Mechanical release at the **cylinder bank** as back-up
- Auto / manual** switch or lock-off for maintenance, status shown at the door

5 Alarms & Signs

- Different tones for **stage 1** and **pre-discharge**; beacons for noisy rooms
- At every entrance: **'Inert gas protected area'** sign and a **'Gas released, do not enter'** lamp
- Inside: evacuate on alarm; instructions posted at the panel
- Signs to NFPA 2001 / ISO 7010 / local rules



IG-55 Inert Gas Suppression System

Part 7: Room Integrity & Venting

Design & Installation Learning Series · hold time, door-fan integrity test and over-pressure vent sizing

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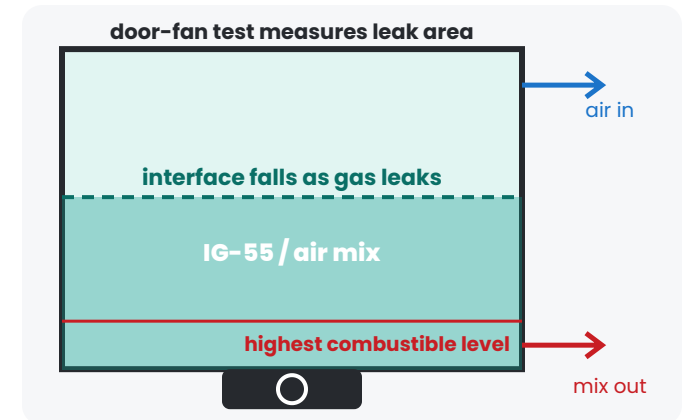
7 Room

8 Install

9 Maintain

1 Why the Room Must Be Tight NFPA 2001

- The gas must **stay** long enough for the fire to die and the room to cool: the **hold time**
- NFPA 2001: at least **85 %** of the minimum design concentration at the **highest combustibile level** for **10 minutes**, or longer if responders need it
- IG-55 is a little heavier than air ($\approx 1.17\times$), so low-level leaks let the mix out and high-level leaks let air in
- Unsealed cable holes, open dampers and gaps under doors are the usual culprits



2 Enclosure Integrity (Door-Fan) Test NFPA 2001 (2025) Annex D

- Set up**
fan in the door frame, room as in normal use, dampers shut
- Measure**
pressurise and depressurise at several pressures, record flow
- Leak area**
work out the equivalent leakage area (ELA)
- Predict**
retention time with the agent and room data
- Pass / fix**
 ≥ 10 min passes; if not, find leaks, seal, re-test

Annex D = enclosure integrity procedure in the 2025 edition. A full discharge test is not needed to prove retention. We re-inspect the room every 12 months (Part 9).

3 Over-Pressure Venting: the Idea

- We add about **0.56 m³** of gas per m³ of room in 1–2 minutes. The same volume of air/gas mix must **leave**, or the walls feel the pressure
- IG-55 gives only a **positive** pressure (no negative swing like some chemical agents)
- The **room strength** comes from the client / structural engineer. UK guidance quotes about **500 Pa** for blockwork and **250 Pa** for lightweight partitions
- Vent to outside (or a large space), fire-rated like the wall, opening only on pressure; natural leakage (ELA) may count, with judgement

FREE VENT AREA (CONCEPT)

$$A = M \times S / \sqrt{(P \times S_H)}$$

A m² · M = gas flow, kg/s · S = IG-55 specific volume · P = allowed pressure, Pa · $S_H = [C \cdot S + (100 - C) \cdot S_{air}] / 100$, $S_{air} = 0.7738 + 0.00283 \cdot T$

OUR ROOM (20 °C, 60 S, CONSTANT FLOW)

$M = 281.5 / 60 = 4.69$ kg/s · $C = 45.5 \%$ · $S_H = 0.7748$
500 Pa: $A = 0.169$ m² · 250 Pa: $A = 0.239$ m²

Formula form from UK industry (FIA) venting guidance. Constant flow is our simplification: the real **peak** flow from the listed software is used, and an unregulated discharge peaks much higher. Venting through another room needs about $\sqrt{2} \times$ the area per vent.

4 Room Checklist Before We Commission

- Seal all **cable, pipe and duct** penetrations with fire-rated sealant
- Doors **self-closing**, with seals and drop seals
- HVAC **dampers** close on stage 2; fresh-air and extract units stop
- Floor and ceiling voids sealed at the room edge
- Pressure vent fitted, free to open, flow direction right
- Post-discharge **extract** to a safe outside point



IG-55 Inert Gas Suppression System

Part 8: Install & Commission

Design & Installation Learning Series · site checklist, tests, commissioning and handover documents

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1 Installation Checklist

CYLINDERS & MANIFOLD

- Rack anchored, cylinders strapped, labels outward
- Outlet safety caps **on** until each cylinder is connected
- Hoses, check valves and pilot line fitted the right way round
- Actuators fitted **last**, after all tests
- Restrictor bore matches the calculation

PIPE & NOZZLES

- Material, schedule and fittings as the calculation
- Route matches the isometric; any change = **re-calculate**
- Rigid supports near nozzles and changes of direction (thrust)
- Pipe blown clean before nozzles go in
- Nozzle orifice code checked at each location

ELECTRICAL & ROOM

- Zone A / B detectors interleaved, voids covered
- Manual release, abort, signs at every door
- Releasing panel, standby batteries, monitored circuits
- Room sealed, vent fitted, dampers wired
- System left in **manual / isolated** until handover

2 Testing & Commissioning NFPA 2001 acceptance tests

Test	What passes	Note
Pipe, open-ended sections	Pneumatic, 40 psi (2.8 bar) for 10 min; drop ≤ 20 %	before nozzles / lagging
Pipe, closed sections	Hydrostatic, 1.5 × max. working pressure for 2 min, no leaks	e.g. manifold to selector valve
Flow ('puff') test	Nitrogen / inert gas through the pipe: flow at every nozzle, no blockage	clear and re-test if blocked
Enclosure integrity	Door-fan test, predicted hold time ≥ 10 min	Part 7
Detection & control	Every detector, call point, abort, mode switch: C&E point by point	actuators off the valves
Release circuit	Solenoid / actuator fires on signal (tested off the cylinder)	then re-fit, seal, log
Interfaces	HVAC & dampers shut, vents open, pressure switch, BMS / FACP signals	with the other trades
Cylinders	Pressure and temperature of each logged against the fill chart	>5 % low = reject

Pipe test values as given in NFPA 2001 (2025) acceptance testing; check the edition and spec your project uses. A full gas discharge test is **not** required by NFPA 2001: only where the spec or AHJ asks.

3 Final Steps on Handover Day

- 1 Re-fit actuators, remove test links
- 2 Panel to AUTO, all status normal
- 3 Walk-through with the owner and staff
- 4 Sign acceptance report, AHJ approval

4 Handover Documents

As-built drawings

layout, isometrics, nozzle & orifice schedule

Hydraulic calc

final listed-software report

Cause & effect

matrix + panel configuration

Integrity report

door-fan results, hold time

Test certificates

pipe, puff, functional, interfaces

Cylinder records

fill / serial, P-T chart, test dates

O&M manual

datasheets, approvals, spares

Training & sign-off

operator training, acceptance report, AHJ



IG-55 Inert Gas Suppression System

Part 9: Inspection & Maintenance

Design & Installation Learning Series · NFPA 2001 schedule, gauge readings, common faults and safety

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1 Inspection & Maintenance Schedule NFPA 2001 (2025) Chapter 11

When	Who	What we check
Monthly	Owner	Visual: system looks operable, panel normal, gauges in range, no damage; manual release, abort and signs clear; room unchanged
Semi-annual	Competent person	Check pressure of every container (temperature-adjusted); loss > 5 % = refill or replace. Vents free to open
Annual	Qualified service	Full inspection & function test (no discharge); gauges compared with a calibrated device; hoses examined; enclosure inspected
5-yearly	Qualified service	All hoses tested; containers in continuous service: full external visual inspection
Periodic	Approved facility	Cylinder re-test / requalification per the pressure-vessel rules in force (e.g. PESO in India, DOT, TPED)

The enclosure check can be replaced by a documented administrative control programme for barrier integrity. In India, also see IS 15496 (inspection & maintenance) and IS 15506 (IG-55). Tag and log every visit.

2 Read the Gauge With the Temperature

Cylinder temp.	0 °C	15 °C	30 °C	40 °C
Full (300 bar @ 15 °C)	284 bar	300 bar	316 bar	326 bar
5 % loss limit	270 bar	285 bar	300 bar	310 bar

Our ideal-gas estimate ($p \propto \text{absolute } T$). A full cylinder in a cold room at 0 °C reads about 284 bar, below the 285 bar limit at 15 °C, yet nothing is lost. Use the manufacturer's P-T chart.

RULE OF THUMB

Roughly **1 bar per °C** at 300 bar. Note the cylinder temperature with every reading, and compare like with like.

3 Common Faults & Fixes

Symptom	Likely cause	What we do
Cylinder pressure low	Valve / gauge leak, or a cold reading	Correct for temperature first; still >5 % low = refill or replace
False stage-1 alarms	Dust, high airflow, wrong detector	Clean / relocate; never bypass a zone
Hold time now fails	New cable holes, ceiling or door changes	Seal, then repeat the door-fan test
Panel in fault	Open circuit, battery, actuator off	Fix and re-test the circuit; log it
Left in manual / isolated	Not reset after work	Mode status lamp at the door, checked monthly
Vent or damper stuck	Paint, debris, no power	Free and function-test every 6 months

4 Safety While Servicing

- Panel to **manual / isolated** and actuators **off** the cylinder valves before any test
- Outlet caps on any disconnected cylinder; never roll, drag or drop; never lift by the cap
- Never loosen a fitting under pressure
- After a discharge: ventilate, check O₂, then enter; refill only at an authorised station

5 Impairments & Records NFPA 2001 Ch. 12

- System out of service or discharged: tell the **AHJ** and the owner, and again when restored
- Impairment tag at the panel; extra fire watch if needed
- Keep a log: dates, pressures, temperatures, faults, who did it
- Review the room and the design after any change of use