SCDF Fire Safety Rules for Cat Ladders: Roof Access, Solar PV and the Fire Code 2023

A practical guide for owners, QPs, and solar installers in Singapore on when a cat ladder is mandatory, when it is acceptable in lieu of a staircase, and what the SCDF Fire Code (2023) and the Fire Safety Act actually require — particularly for rooftop solar PV installations.

Why this matters now

Singapore is racing toward its **solar deployment target of at least 2 GWp by 2030** (EMA — Singapore Solar Plan) under the Green Plan 2030. Almost every commercial roof, JTC industrial roof, HDB block-top, and even private warehouse over the next five years will host solar PV modules. Yet a surprising number of project teams discover, **late in the design phase**, that the building's existing rooftop access — typically a single cat ladder — does not satisfy the **SCDF Fire Code 2023 Clause 10.2** for roof-mounted solar PV.

The cost consequence is meaningful: a retrofitted external exit staircase on an existing warehouse can cost **S$ 60,000–150,000**, while a new compliant cat ladder costs **S$ 2,000–8,000**. Knowing exactly when a cat ladder satisfies SCDF — and when it doesn't — is therefore a financial as much as a safety question.

This blog walks through:

1. The legal framework: Fire Safety Act → Fire Code 2023 → cat-ladder rules
2. **Clause 2.2.11** — when a cat ladder is allowed as the second exit
3. **Clause 10.2** — the solar PV-specific access rules
4. **Clause 9.1.1d** — additional rules for PG I (residential) buildings with PV
5. The **2015 Fire Code amendment** that changed everything for solar
6. SCDF storey-shelter cat-ladder rules (Cl. 2.11.2 — a narrow, specific case for the SS rescue-hatch ladder only, NOT for roof access)
7. A practical decision tree for solar PV installers

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1. The legal framework

The chain of authority for any cat-ladder requirement in Singapore is:

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Fire Safety Act (Cap. 109A)
        ↓
Fire Safety (Building Fire Safety) Regulations 2023
        ↓
Fire Code 2023 (Code of Practice for Fire Precautions in Buildings)
        ↓
Specific Clauses — Chapter 2 (Means of Escape) and Chapter 10 (Special Installations)
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The **Fire Safety Act** empowers the SCDF Commissioner to issue the Fire Code, which has the force of regulation. Cat-ladder requirements live in two main places:

- **Chapter 2 — Means of Escape** — Clause 2.2.11 (number of exit staircases / cat ladders per storey)
- **Chapter 10 — Requirements for Special Installations** — Clause 10.2 (Solar PV)

Both are enforceable as part of the building plan submission to the **Commissioner of Civil Defence**, and non-compliance is grounds for refusal of Fire Safety Certificate (FSC) and Temporary Fire Permit (TFP).

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2. The default rule: every storey needs ≥ 2 exits — but rooftops can use a cat ladder

Per **Fire Code 2023 Clause 2.2.11**:

> "There shall be at least two independent exit staircases or other exits from every storey of a building, unless otherwise permitted under other subsequent provisions of the Code."

This is the baseline. But the same clause carves out two important exceptions for **non-habitable roofs** (i.e. roof spaces not normally occupied):

Exception (a) — One staircase + one-way travel within limit:

> "For non-habitable roof that is able to comply with one-way travel distance, at least one exit staircase shall be provided. The travel distances for roof areas which are open-to-sky shall be based on the requirements for sprinkler-protected buildings."

Exception (b) — One staircase + one cat/ship ladder (when one-way travel can't be met):

> "For non-habitable roof that is unable to comply with one-way travel distance to the exit staircase, an additional cat/ship ladder adequately separated in accordance with Cl.2.3.12 and leading to the circulation area of the floor below shall be provided. All access hatches, if provided, shall be readily accessible from the roof. Access hatch opening shall have a minimum clear width of 1m in diameter." (paraphrased summary of Cl. 2.2.11 — verify verbatim text against the SCDF Fire Code 2023 Cl. 2.2.11. "1 m in diameter" should be read as "1 m minimum clear opening in any direction" for rectangular hatches.)

What this means in practice:

Roof situation	Minimum access	Cat ladder OK as 2nd exit?
Non-habitable roof, small footprint, ≤ 30 m one-way travel	1 staircase	Not required
Non-habitable roof, large, exceeds one-way travel	1 staircase + **1 cat/ship ladder**	**YES**
Habitable roof (rooftop garden, function space)	**2 staircases**	NO — 2 staircases mandatory
Inside a Storey Shelter, to the rescue hatch	**Cat ladder mandatory (Cl. 2.11.2)**	YES — and is the only access permitted; SS/aluminium only

Cl. 2.3.12 (referenced above) requires the two exits to be **adequately separated** — typically diagonally opposite ends of the roof, at distance ≥ ½ × the diagonal of the area served.

Access hatch dimensions are explicit: **≥ 1 m clear opening**. SCDF tightened this from the previous 700 mm to allow firefighters with breathing apparatus and equipment to pass through.

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3. The solar PV-specific rule — Clause 10.2

This is the clause every solar developer must know. Clause 10.2 of the Fire Code 2023 governs **roof-mounted PV installations** (SCDF Cl. 10.2).

10.2(b) Means of Access

> "For access to PV installations on the roof (excluding non-PV areas), at least one exit staircase shall be provided. Where the area is large and one-way travel distance to the exit cannot be met, an additional cat ladder or ship ladder adequately separated from the exit staircase, in accordance with Cl.2.2.11 and leading to the circulation area of the floor below shall be provided..."

In plain language:

Building configuration	Required access
Single-storey building, roof height ≤ 12 m	**Portable sturdy ladder OR cat/ship ladder** (no staircase needed)
Inaccessible pitched roof up to 24 m from grade	**Portable sturdy ladder OR cat/ship ladder**
Single-storey + fire engine access road serving roof ≤ 12 m	**No PV access ladder required** (firefighters use turntable from below)
Inaccessible pitched roof 12–24 m + fire engine accessway	**No PV access ladder required**
External / open-sided overhead bridge / linkway, clear width ≤ 6 m, height ≤ 12 m, no commercial activity	**Exempted** entirely
Multi-storey building, large flat roof	**1 exit staircase + 1 cat ladder** if travel distance fails one-way limit
Existing buildings (PV plans submitted ≤ 16 June 2016)	**Cat/ship ladder only** (grandfathered)

10.2(c) PV Array Geometry — interacts with cat ladder placement

Clause 10.2 also caps the PV array footprint:

Item	Limit
Maximum PV array dimension	**60 × 40 m** (PG II–VIII); **40 × 40 m sub-array** for high hazard
Clearance around access hatch / staircase exit door	**3 m** all around
Perimeter aisle, no parapet ≥ 900 mm	**≥ 2.5 m clear**
Distance from any PV module to nearest access aisle	**≤ 20 m**

The cat ladder, where used, **lands inside that 3 m clear zone** — not in the middle of the PV field. It must be unobstructed for firefighter access during a panel fire.

10.2(d) Detection & Suppression Triggers

Clause 10.2(d) lists conditions under which the building must be upgraded with **automatic fire alarm system (SS 645) and** PV modules elevated **≥ 200 mm above the finished roof level** — typically:

- PV installation on roof of **PG VIII building > 8 m** (vehicle access level to roof)
- PV installation on **high-hazard occupancies**

If you are adding solar to a warehouse roof at ~10 m height, this clause is the one that drives the most CAPEX — full alarm + cat-ladder access + firefighter exit signage.

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4. Why the rules tightened in 2015

Before March 2015, most rooftop solar installs in Singapore used a single existing cat ladder for access. After a series of overseas rooftop PV fires — and the realisation that **a single narrow cat ladder cannot**

accommodate firefighters carrying hose reels and breathing apparatus — SCDF issued a circular requiring **two exit staircases** for new solar PV roofs in most cases (Straits Times, March 2015).

The rationale, in SCDF's own words at the time:

> "Currently, rooftop access of many buildings is via cat ladders, which are usually narrow and cannot accommodate the transport of equipment... existing ladders to rooftops are for maintenance works." — Asst Commissioner Christopher Tan, SCDF Director of Fire Safety & Shelter

The 2015 circular was later codified into the **Fire Code 2018** and **2023** as Clause 10.2. The current rule is therefore a **post-2015 policy** that **grandfathers** older buildings (plans before 16 June 2016) but applies in full to any **new submission or PV addition**.

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5. Storey-shelter cat ladders — a narrow, specific case (NOT the same as roof-access cat ladders)

This section applies ONLY to a very specific cat ladder: the one inside a **Civil Defence Storey Shelter (SS)** that provides access **through the rescue hatch opening** in the SS ceiling slab. It does **not** apply to roof-access cat ladders, plant-deck cat ladders, water-tank cat ladders, or solar PV cat ladders — even when these are on the same project. The legal authority is different (Civil Defence Shelter Act, not the Fire Code), and the design rules are different.

A Storey Shelter is the protected chamber within an HDB flat or commercial premises designed to withstand blast and fragmentation. When the building is damaged and the main door is blocked, occupants escape **upward** through a rescue hatch in the SS ceiling into the unit above — **and the cat ladder is the only way they can reach that hatch**. That is the use case Clause 2.11.2 is regulating.

Clause 2.11.2 of the **SCDF Technical Requirements for Storey Shelters 2021** states verbatim (SCDF Cl. 2.11):

> "Cat-ladder shall be provided for access through rescue hatch opening. The cat-ladder shall be made of either stainless steel or aluminium or equivalent. The mounting connections of cat-ladder to the SS wall shall be designed to withstand shock loads of at least 12.5g in all directions, where g is the gravitational acceleration, details and dimensions as shown in FIGURE 2.11.2."

Note what this clause does — and does not — cover:

Aspect	What Cl. 2.11.2 actually says
Where the cat ladder is	**Inside the Storey Shelter**, fixed to the **SS wall** (the RC wall of the shelter chamber)
What it accesses	**The rescue hatch opening** in the SS ceiling slab — **not** the building roof
Material	**Stainless steel or aluminium or equivalent** (mild steel not permitted **for this specific ladder**)
Mounting connection	Designed for **shock load ≥ 12.5 g in all directions** — to keep the ladder anchored after a blast event when the SS wall has been shocked
Rescue hatch opening (Cl. 2.11.1)	**700 × 700 mm** clear minimum

What this clause does not regulate:

- Roof-access cat ladders on the same building
- Solar PV cat ladders
- Maintenance ladders to plant rooms, AHU decks, water tanks
- Cat ladders inside non-shelter staircases or service shafts

For those, the governing standards are **EN ISO 14122-4** for geometry/loading and **EN 1992-4** for anchorage — **not** SCDF Cl. 2.11.2. The 1.5 kN side-load and 1.5 kN per-anchor design action of EN 14122-4 are very different from — and far less onerous than — the 12.5 g shock load of the storey-shelter regime, and applying the 12.5 g to a roof-access ladder would be over-design.

Why 12.5 g for storey shelters specifically? The shelter is designed to remain habitable after a blast. The cat ladder must remain anchored even when the host RC wall has just absorbed an impulsive load — i.e. immediately after the blast it must still carry the occupants up to the hatch. 12.5 g (≈ 122.6 m/s²) is the impulsive design acceleration prescribed for that scenario. The anchor must be designed by calculation under EN 1992-4 for the actual 12.5 g shock load, geometry, and edge conditions — the standard mapping is to ETA Option 1 chemical anchors with declared **seismic performance** (e.g. Hilti HIT-RE 500 V4, Fischer FIS EM Plus + A4 stainless rod, hef ≥ 110 mm). Note: ETA "seismic C1/C2" categories under EOTA TR 049 are defined by EN 1998-1 design-spectrum performance — not by a fixed g-value — so they are a conservative proxy for the SCDF shock requirement, not a direct equivalent. **All this applies only to the SS-wall ladder, not to roof-access ladders elsewhere on the same project**.

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6. Decision tree — do I need a cat ladder for my solar PV install?

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Q1: Are you adding PV modules to a roof?
        │
        ├── No  →  Apply normal Cl. 2.2.11 rules
        │
        └── Yes →  Q2

Q2: Is the building a single-storey with roof height ≤ 12 m?
        │
        ├── Yes →  Q3: Is there a fire-engine access road serving the roof?
        │              ├── Yes  → No ladder required (Cl. 10.2(b)(2)(a))
        │              └── No   → Portable sturdy or cat/ship ladder OK
        │
        └── No  →  Q4

Q4: Is it an inaccessible pitched roof up to 24 m from grade?
        │
        ├── Yes →  Q5: Is there a fire-engine accessway serving 12–24 m height?
        │              ├── Yes → No ladder required
        │              └── No  → Portable sturdy or cat/ship ladder OK
        │
        └── No  →  Q6

Q6: Is the roof footprint such that one-way travel distance
    to the single exit staircase exceeds the Cl. 2.2 limit?
        │
        ├── No  →  1 exit staircase only — no cat ladder required
        │
        └── Yes →  1 staircase + 1 additional cat/ship ladder
                   (separation per Cl. 2.3.12, hatch ≥ 1 m clear)

Q7: Does the building fall under PG I (residential)?
        │
        └── Yes →  Apply Cl. 9.1.1d additional requirements
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Q8: Is the building > 8 m to roof, PG VIII or high-hazard?
        |
        └── Yes →  Add SS 645 alarm system + 200 mm PV elevation
                   per Cl. 10.2(d)
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7. What a compliant submission looks like

For a typical **JTC industrial warehouse roof at 10 m height with 2,500 m² of PV modules**, the SCDF Fire Safety submission should include:

Document	Content
Cover plan	Building footprint, roof access points, fire engine accessway, PV array boundaries
Roof plan	All exit staircases, cat ladders, hatches, marked with travel distances
Cat ladder GA + sections	Front + side elevation, dimensions, materials, bracket details
PE-endorsed structural calc	Loads per EC0 / EC1, anchor design per EN 1992-4
PV array layout	Sub-array sizes ≤ 60 × 40 m, 3 m clearance around hatches/exits, ≤ 20 m to access aisle
Fire engine accessway plan	Position, length, hardstand specs
Alarm system specs	If Cl. 10.2(d) triggered — SS 645 compliant, with rooftop detectors
Site simplified plan	A1-size at hatch / exit, height 1.5–2 m above floor (Cl. 10.2 §3.4.3)
Maintenance access plan	Workplace Safety & Health Act compliance — fall-arrest anchor points, edge protection

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8. Common mistakes that delay solar PV approvals

After many years of solar PV submissions in Singapore, the **top eight reasons** for SCDF feedback are:

1. **Travel distance not calculated** — the QP simply assumes one-way travel is OK without showing the math
2. **Cat ladder hatch < 1 m clear** — old installations had 700 mm hatches; SCDF now requires 1 m
3. **PV modules within 3 m of the exit door / hatch** — Cl. 10.2 requires 3 m clearance
4. **Cat ladder lands in the middle of the PV array** instead of at the building edge
5. **No simplified site plan at the hatch** — required to show layout + circuit diagram
6. **Two exits not "adequately separated"** — usually too close together; should be diagonally opposite
7. **PG I residential building treated as PG II** — different rule set applies (Cl. 9.1.1d)
8. **Existing pre-2016 building incorrectly assumed grandfathered** — only valid if PV plan was submitted before 16 June 2016

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9. Owner / installer checklist

☐	Item	Reference
☐	Confirm Purpose Group of building (PG I–VIII)	Fire Code Cl. 1.4
☐	Confirm habitable height (vehicle access level → highest occupied floor)	Cl. 1.4
☐	Map roof type: non-habitable flat / pitched / habitable	Cl. 2.2.11
☐	Calculate roof one-way travel distance to nearest exit	Cl. 2.2
☐	Determine access requirement: 0 / 1 portable / 1 cat / 1 staircase + 1 cat / 2 staircases	Cl. 10.2(b)
☐	If cat ladder required: design to EN ISO 14122-4 with PE endorsement	Building Control Act §5A
☐	Hatch ≥ 1 m clear	Cl. 10.2(b)
☐	Cat ladder lands inside 3 m clear zone	Cl. 10.2(c)
☐	Sub-array ≤ 60 × 40 m (or ≤ 40 × 40 m for high hazard)	Cl. 10.2(c)
☐	Perimeter aisle ≥ 2.5 m if no parapet ≥ 900 mm	Cl. 10.2(c)
☐	All PV ≤ 20 m from nearest access aisle	Cl. 10.2(c)
☐	If Cl. 10.2(d) triggered: SS 645 alarm + 200 mm PV elevation	Cl. 10.2(d)
☐	Simplified site plan + circuit diagram displayed at access	Cl. 10.2 §3.4.3
☐	Workplace Safety & Health risk assessment for installation works	WSH Act
☐	If — and only if — the cat ladder is the **SS rescue-hatch ladder** (inside a Storey Shelter): SS or aluminium + 12.5 g shock anchorage	SCDF SS Cl. 2.11.2
☐	LEW endorsement of PV electrical scheme	Singapore Solar PV Handbook

10. Bottom line

For most Singapore buildings adding rooftop solar PV:

- **Single-storey ≤ 12 m, with fire engine road**: **no ladder required** — fire trucks reach the roof directly.
- **Single-storey ≤ 12 m, no fire engine road**: **portable sturdy ladder OR cat ladder** is sufficient.
- **Multi-storey large flat roof**: typically **1 exit staircase + 1 cat ladder** (the cat-ladder-as-second-exit rule under Cl. 2.2.11 + Cl. 10.2(b)).
- **Pre-2016 plan-stamped buildings**: grandfathered with **cat ladder only**, no staircase upgrade required.
- **Inside a Storey Shelter, accessing the rescue hatch**: **cat ladder mandatory**, SS or aluminium, 12.5 g shock-load anchorage on the SS wall — and **only** for that ladder. Roof-access and solar-PV cat ladders on the same building are not subject to Cl. 2.11.2.

The cat ladder is **back in fashion** for rooftop solar precisely because Clauses 2.2.11 and 10.2 explicitly permit it as the second exit on non-habitable roofs. The design of those roof-access ladders must satisfy **EN ISO 14122-4** for geometry and **EN 1992-4** for anchorage. The **12.5 g shock requirement** of the SCDF storey-shelter regime is a **separate, narrower rule** that only applies to the cat ladder inside a Storey Shelter providing access through the SS rescue hatch — it should **not** be applied to roof-access or solar PV cat ladders.

The cost difference between a compliant cat-ladder install (~ S$ 5,000) and a retrofitted exit staircase (~ S$ 100,000+) is usually decisive for the project economics. Specifying the right cat ladder, **at the right place on the roof**, with **the right SCDF clause cited on the drawing**, is what gets the FSC issued without comments.

References cited inline. Authority hierarchy: Fire Safety Act (Cap. 109A) → Fire Code 2023 → Clauses 2.2.11, 9.1.1d, 10.2 → SCDF Submission Requirements for Solar PV Systems on Roof. Companion to the 18 m cat-ladder design blog and the EN10025 Steel Grades workbook.