Buyer's Guide: Central Battery Emergency Lighting Systems

1. Introduction

Emergency lighting is a legal and safety requirement in most commercial, industrial, and public buildings. It ensures that occupants can safely evacuate in the event of a mains power failure.

When choosing an emergency lighting system, one of the key decisions is between:

- A Central Battery System (CBS), and
- A Conventional / Self-Contained Emergency Lighting System (each fitting has its own battery).

This guide will help you understand how central battery systems work, what to consider when specifying one, and how they compare to conventional systems.

2. What Is a Central Battery Emergency Lighting System?

A Central Battery System (CBS) powers multiple emergency luminaires from a single, central power source, usually located in a secure plant room.

Instead of each luminaire having its own integral battery, the central battery supplies low-voltage DC (commonly 24V, 48V, 110V, or 220V DC) or AC power through dedicated cabling to all emergency light fittings.

3. Key Components

- ✓ Central Battery Unit (CBU):
    - Contains batteries (often lead-acid or nickel-cadmium, sometimes lithium).

  - Includes chargers, inverters, and monitoring systems.
- ✓ Distribution Panels:
  - Split the power supply into circuits feeding various areas.
- ✓ Emergency Luminaires:
  - Supplied with constant or switched live feed from the CBU.
- ✓ Monitoring & Control System:
  - Allows remote testing, fault monitoring, and status reporting.

4. Benefits of a Central Battery System

Benefit	Description
Centralized Maintenance	Batteries and control gear are in one accessible place, simplifying testing and replacement.
Longer Battery Life	Central batteries often use industrial-grade cells with longer lifespans (up to 10–15 years).
Improved Environmental Conditions	Batteries are kept in a controlled environment, reducing degradation from heat or cold.
Simplified Luminaire Design	Fittings are smaller and lighter without integrated batteries.
Central Monitoring	Modern systems allow fully automatic testing and remote monitoring, reducing manual inspection costs.
Higher Light Output	Because fittings can be powered by larger, stable supplies, illumination levels can be higher and more consistent.
Suitable for Large or Complex Buildings	Ideal for hospitals, airports, tunnels, and universities where numerous luminaires are required.

5. Drawbacks of a Central Battery System

Drawback	Description
High Initial Cost	Installation and equipment costs are higher, especially for cabling and control.
Complex Installation	Requires dedicated cabling and distribution infrastructure.
Single Point of Failure	If the central unit fails, all connected luminaires may lose power (though redundancy options exist).
Battery Room Requirements	Needs suitable space, ventilation, and fire protection for the battery system.
Voltage Drop Considerations	Cable runs must be carefully designed to minimize voltage drop, particularly for DC systems.

6. Comparison: Central Battery vs. Conventional (Self-Contained) Systems

Feature	Central Battery System	Self-Contained (Stand-Alone) System
Power Source	Centralized battery/inverter	Individual battery in each luminaire
Maintenance	Easier centralized maintenance	Requires access to each luminaire
Initial Cost	Higher	Lower
Running Cost	Lower (fewer batteries to replace)	Higher (frequent battery replacements)
System Complexity	Higher	Simple installation
Reliability	Potential single point of failure	Distributed failure affects only one fitting
Aesthetics	Smaller, sleeker fittings	Bulkier luminaires
Best Suited For	Large buildings, critical infrastructure	Small to medium facilities, simple layouts
Testing & Monitoring	Centralized, automated	Manual or addressable systems needed

7. Best Practices When Choosing and Installing a Central Battery System

1. Perform a Detailed Risk & Load Assessment
   - Identify critical escape routes, occupancy types, and required illumination durations (typically 1 or 3 hours).
2. Select the Right Battery Type
   - Lead-acid (VRLA): Reliable, cost-effective, widely used.
   - Nickel-Cadmium (NiCd): Long life, high discharge capability.
   - Lithium-Ion ($LiFePO_4$): High efficiency, long lifespan, low maintenance (increasingly popular).
3. Plan Redundancy and Reliability
   - Consider dual battery banks or twin inverters for mission-critical sites.
4. Design for Voltage Drop
   - Use appropriate cable sizes and keep runs within limits to maintain consistent luminaire output.
5. Integrate Automatic Testing
   - Modern systems can automatically test and log performance, helping comply with BS 5266, EN 50171, and local codes.
6. Provide Environmental Control
   - Maintain battery room temperature between 20–25°C for optimal performance.
7. Allow for Future Expansion
   - Choose a system with spare capacity and modular expandability.
8. Ensure Compliance
   - Verify that the system meets BS EN 50171, BS EN 1838, and local fire and building codes.

8. When a Central Battery System Makes Sense

You should consider a CBS if:

- The building is large or multi-level with many luminaires.
- Regular maintenance access to all fittings is difficult.
- There is a requirement for centralized control and testing.
- Reliability and longevity are key operational concerns (e.g., hospitals, transport hubs, data centres).

9. When a Conventional System Might Be Better

Choose self-contained fittings if:

- The site is small or has limited numbers of fittings.
- You want a lower initial cost.
- You need a fast installation with minimal cabling.
- You prefer decentralized reliability (each light independent).

10. System Selection Checklist

Question	Why it matters
What is the size of the building (floor area, number of floors, number of luminaires) and the escape routes?	Large or complex buildings favour central battery systems because of scale and maintenance efficiency.
What is the required emergency illumination duration (1 h, 3 h, etc)?	Informs battery sizing, system type, redundancy.
How accessible are the luminaires for maintenance/testing (ceiling height, number of fittings, building occupation)?	If access is difficult, a system with centralised maintenance/testing (like a central battery system) may save cost/time.
What are the ambient environmental conditions of the luminaire locations (temperature, humidity, vibration)?	Self-contained units may suffer if batteries are exposed to extreme ambient conditions. Firesafe+1
What are the wiring and cabling implications (existing wiring, fire-rated cables, distance of runs)?	Central battery systems require dedicated wiring (often fire-rated) from the central unit to each “slave” luminaire. Firesafe+1
What is the required monitoring/testing regime (monthly, annual full duration test, self-test vs manual)?	Systems with automatic/self-test features reduce labour and long-term cost. Spirit Energy+1
What is the budget for initial capex versus lifecycle operating cost (maintenance, battery replacement, labour)?	Selecting purely on lowest initial cost may lead to higher long-term cost. Electrical Review+1
Is there a requirement for redundancy (for critical sites: hospitals, data centres, airports)?	Central battery systems can incorporate large banks and monitoring; but also single point of failure if not properly designed. JLKelectrical+1
Will the system need future expansion or flexibility (new wings, extra floors, refurbishment)?	Choosing modular systems or allowing spare capacity can aid future proofing.
What regulatory / compliance standards apply (in UK: BS 5266-1, BS EN 50171, etc)?	Ensures you select systems that meet legal and safety requirements.

11. Cost Comparison Example

Below is a simplified cost-comparison model to illustrate typical numbers and pay-back scenarios for a conventional self-contained system vs a central battery system.

Scenario

A mid-sized building requiring 100 emergency lighting points (exit signs + bulkheads) and full three-hour emergency duration. These are approximate costs, and a site survey would be required to confirm an exact cost.

Self-Contained System (Conventional)

- ✓ Initial cost for units + installation: Let's assume £150 per point (materials + fitting) → 100 × £150 = £15,000.
- ✓ Wiring complexity minimal (standard radial lighting circuits).
- ✓ Maintenance: monthly functional test + annual full duration discharge, plus battery replacements every 4-5 years. Example: Manual testing labour £100/month (12×) + annual £400 for full duration test.
- ✓ Battery replacements: assume each luminaire battery every 5 years; battery replacement cost say £30 each (labour + parts) → 100 × £30 = £3,000 every 5 years → ~£600/year amortised.
- ✓ So approximate annual maintenance & battery cost ~£1,600/year (labour + battery amortisation).
- ✓ Over a 10-year period: Capex £15,000 + ten years × £1,600 = £31,000 (not adjusted for inflation or discounting).

Central Battery System

- ✓ Initial cost: More complex. Suppose the central battery unit + distribution wiring + fire-rated cable, plus slave luminaires with no integral batteries. Example London figure: higher cost "£150–£250 per point" for CBS. Let's assume £220 per point → 100 × £220 = £22,000 plus some central plant room cost (ventilation, enclosure) say extra £3,000 = £25,000 total initial.

- Wiring: fire-rated cables to each point, more complex design.
- Maintenance: centralised battery bank less frequent replacement (battery life maybe 10 years or more). Manual testing may be simplified or automated, less job time per luminaire. Suppose annual labour cost £500/year. Battery replacement says every 10 years cost £2,000 → amortised £200/year. So annual cost £700/year.
- Over 10 years: Capex £25,000 + ten × £700 = £32,000.

Interpretation

- Up-front cost: central battery system is higher (£25,000 vs £15,000).
- Over 10 years: Self-contained £31,000, Central battery £32,000 — quite close in this model.
- With longer life span, less labour, possibly automated testing, central battery system may become cheaper in lifecycle cost especially if labour rates are high or if system is large.
- If building is larger (say 300 points) the economy of scale shifts more favourably to central battery system (because cost per point reduces, maintenance labour savings grow).

Pay-back Considerations

- If replacing large number of self-contained units (battery and labour) or if labour cost is high for testing/upkeep, the central battery option may pay back in fewer years.
- Also consider disruption cost: replacing many individual batteries or accessing many luminaires (especially high ceilings) costs time/money; central battery system reduces that.
- Consider resale/occupancy value, reliability, and building use-case (critical infrastructure) which may justify higher capex.

Key Take-away

- ✓ For small to medium sized buildings with fewer points, simpler layout, easy access, the self-contained system often offers lower initial cost and is easier to install.
- ✓ For large buildings, complex layouts, high maintenance burden, high labour costs, or where reliability & monitoring are critical — the central battery system may offer better total cost of ownership.
- ✓ Always model total cost of ownership over e.g., 10-15 years, not just first cost.
- ✓ Don't forget non-monetary factors: downtime/disruption from maintenance, site access safety, building reputation/tenant expectations, compliance risk.

12. Summary

Factor	Central Battery System	Conventional Self-Contained
Cost (Initial)	High	Low
Cost (Lifecycle)	Moderate–Low	High
Maintenance	Centralized	Distributed
Reliability	High (with redundancy)	Good
Suitability	Large/complex sites	Small/simple sites
Compliance	BS EN 50171	BS EN 60598-2-22

Final Recommendation

A Central Battery Emergency Lighting System is a long-term, high-reliability investment suitable for large or high-occupancy buildings where centralized control, testing, and maintenance efficiency is essential. For smaller installations, self-contained systems remain a cost-effective and simple alternative.