Frequently Asked Questions

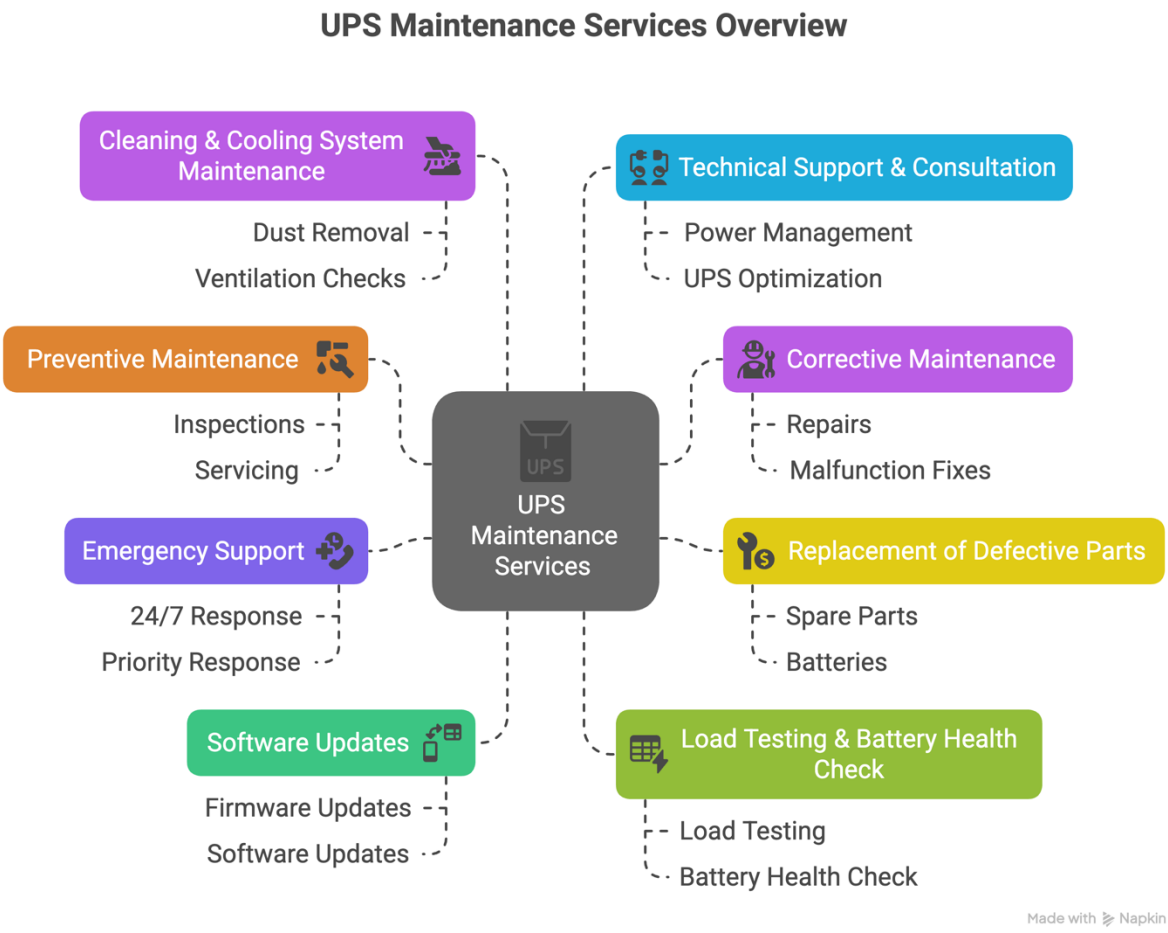
UPS AMC FAQ

2) What is Comprehensive AMC of Online UPS System?

A **Comprehensive Annual Maintenance Contract (AMC)** for an **Online UPS (Uninterruptible Power Supply) System** is a service agreement between the UPS owner and the service provider. This contract ensures the proper maintenance, repair, and servicing of the UPS system to keep it running efficiently and prevent unexpected failures.

2) What Does a Comprehensive AMC of Online UPS System Cover?

Unlike a non-comprehensive AMC, which only includes servicing and excludes parts, a **Comprehensive AMC** typically includes:



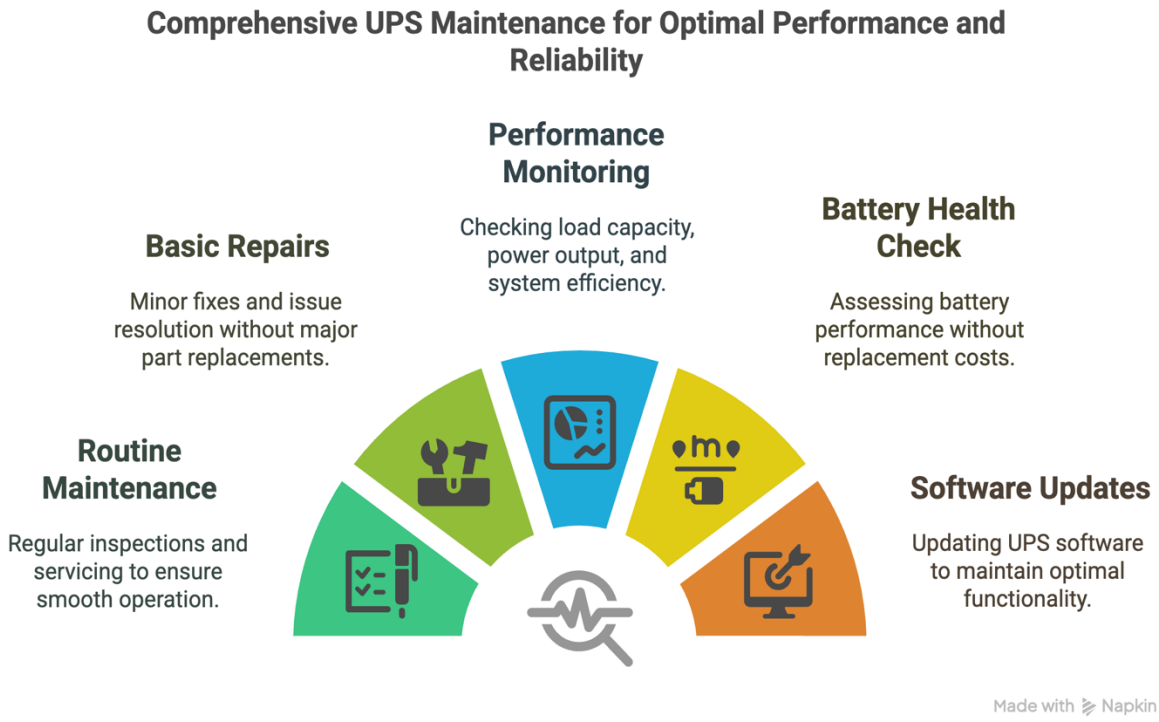
2) What is a Non-Comprehensive AMC of Online UPS System?

A **Non-Comprehensive AMC** for an **Online UPS (Uninterruptible Power Supply) System** is a maintenance contract almost same as comprehensive AMC but it **does not include the cost of spare**

parts or battery replacements. If any component of the UPS system needs to be replaced, the customer must bear the cost separately.

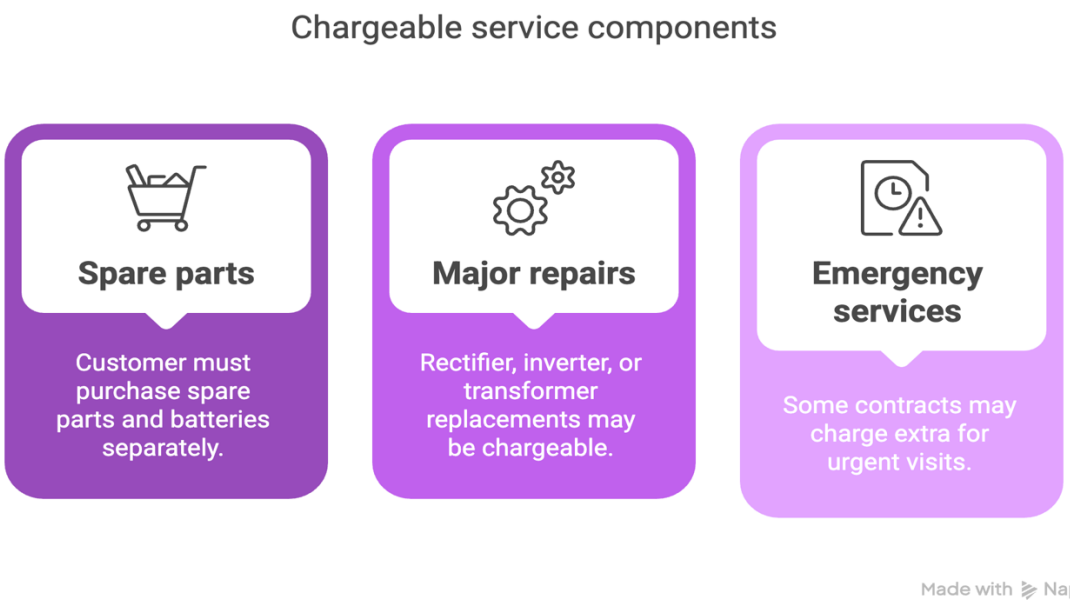
2) What Does a Non-Comprehensive AMC of Online UPS System Cover?

A Non-Comprehensive AMC of Online UPS System Covers the Following Things:



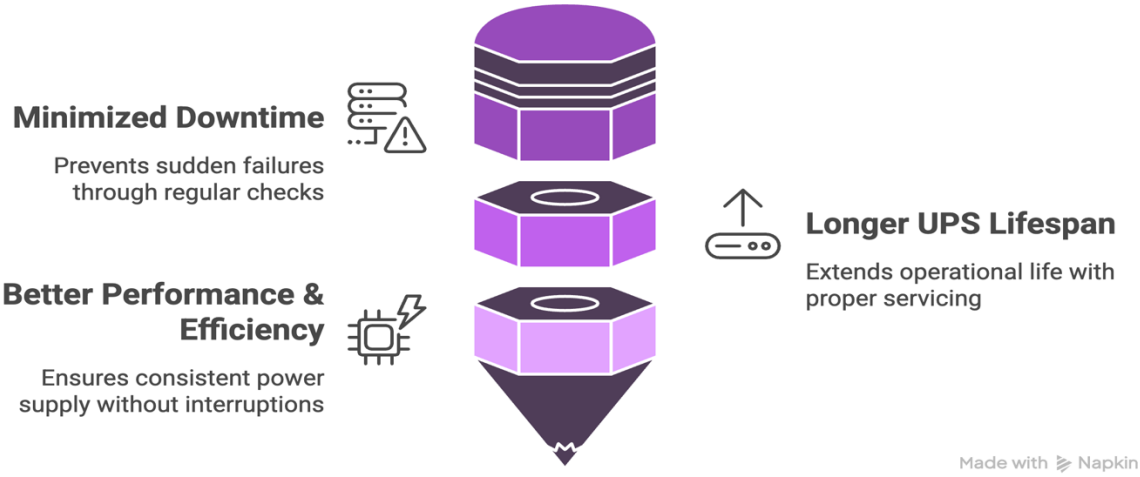
2) What Non-Comprehensive UPS AMC of Online UPS System Does Not Cover?

- A Non-Comprehensive AMC of Online UPS System does not Cover the following things:



2) What are the Benefits of a Comprehensive AMC of Online UPS System?

The Benefit of such AMC is as follows:

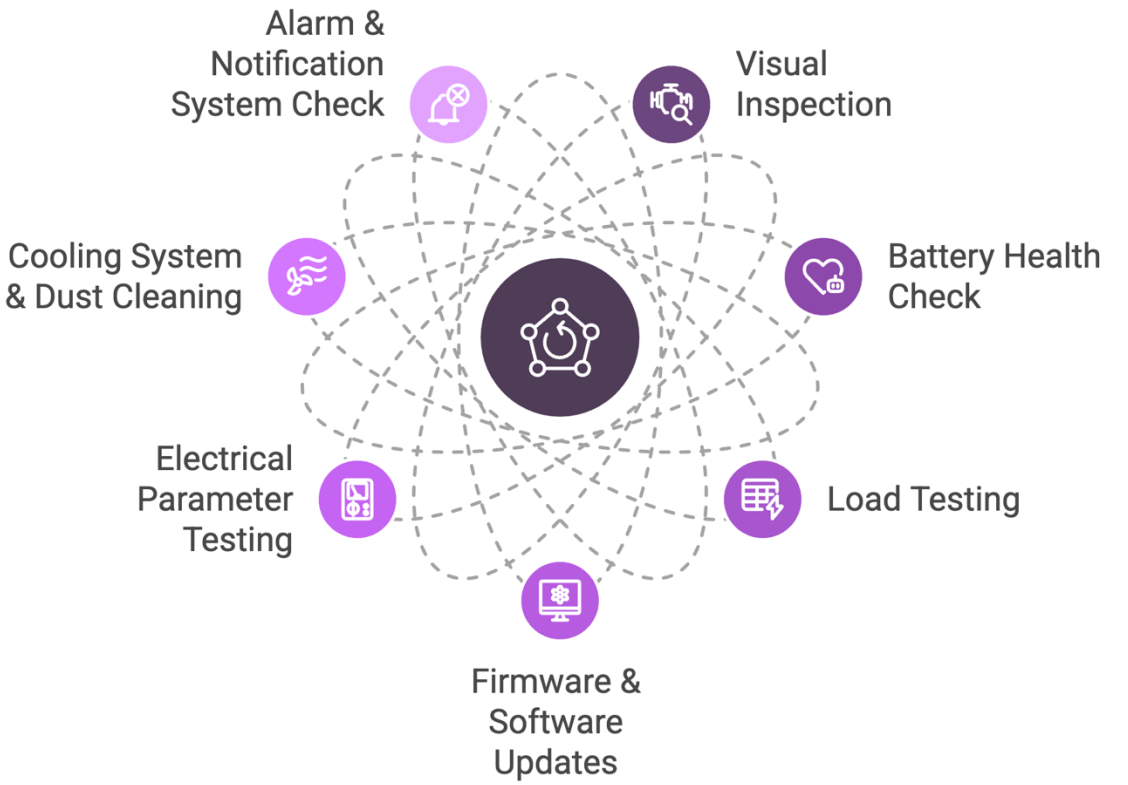


2) When to Choose a Non-Comprehensive AMC of Online UPS System?

- If your UPS system is relatively new and less likely to require major repairs.
- If you prefer to pay for spare parts only when necessary instead of a fixed cost.
- If you already have backup spare parts available separately.

2) What is Preventive Maintenance and what are the Key Activities present in Preventive Maintenance of an Online UPS System?

Preventive maintenance (PM) is a proactive approach to maintaining equipment, such as an Online UPS (Uninterruptible Power Supply) System, to prevent unexpected failures and extend its lifespan. It involves regular inspections, servicing, and minor repairs to ensure the system runs efficiently and reliably.



Detailed Explanation of the Chart is as follows:

1) **Visual Inspection:**
- Checking for loose connections, dust accumulation, or physical damage.
- Ensuring proper ventilation and cooling.

2) **Battery Health Check:**

- Measuring battery voltage and capacity.
- Checking for corrosion or swelling.
- Replacing weak or damaged batteries if necessary.

3) **Load Testing:**
- Simulating a power failure to ensure the UPS functions properly.
- Verifying the system can handle the connected load.

4) **Firmware & Software Updates:**

- Updating the UPS firmware for optimal performance.
- Checking communication between the UPS and monitoring systems.

5) **Electrical Parameter Testing:**

- Checking input/output voltage and frequency.
- Measuring efficiency and power factor.
- Testing for voltage fluctuations or irregularities.

6) **Cooling System & Dust Cleaning:**

- Ensuring the UPS fans and heat sinks are clean and functional.
- Removing dust and debris to prevent overheating.

7) **Alarm & Notification System Check:**

- Testing error alerts and warning signals.
- Ensuring the UPS communicates faults correctly.

UPS FAQ

1) How to analyse what Capacity of UPS System is required?

Choosing the right **UPS system capacity** is crucial to ensure it supports your load **efficiently**, without being oversized (wasting money) or undersized (causing failures). Here's a step-by-step guide to help you **analyse and determine the right UPS capacity** for your needs:

2) List All Equipment to be Connected:

Make a complete list of all the devices you want to connect to the UPS.
Examples:

- **Servers, routers, switches**
- **PCs, monitors**
- **Medical or lab equipment**
- **CCTV and security systems**
- **Industrial controllers or PLCs**

2) Find the Power Consumption of Each Device:

- **Check the power rating (in watts or VA) on the nameplate label or user manual**
- **Use actual wattage, not just the maximum rating (for accuracy)**
- **If power factor (PF) is available, note it down.**

Formula: If a device rating is in amps (A):

Power (in VA) = Voltage (V) × Current (A)

Example: A monitor rated 0.5A at 230V = 115 VA

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2) Calculate Total Load:

Add up the VA or Watt ratings of all equipment.

- **If you have power in Watts, and the UPS rating is in VA, use this:**

VA = Watts ÷ Power Factor (Typical PF = 0.8 for general use)

Example:
Total = 4,000 watts
UPS PF = 0.8
→ 4,000 ÷ 0.8 = 5,000 VA (or 5 kVA) required

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2) Add Safety Margin (Buffer):

Add a 20–25% margin for future growth and safety.

Recommended Capacity = Total Load × 1.25

Example:
5,000 VA × 1.25 = 6,250 VA (or 6.25 KVA)
So choose a 7.5 KVA UPS (rounded up to the nearest standard size)

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2) Decide on Backup Time (Runtime):

How long should the UPS keeps systems running during an outage?

- 5–15 minutes: For safe shutdown (standard)
- 30–60+ minutes: For longer operations (requires bigger battery bank)

UPS capacity ≠ battery runtime
Higher runtime = **more batteries**, not necessarily a larger UPS.

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2) Consider Power Type:

- **Single-phase or 3-phase?** Match to your input/output needs

- **Online UPS** is best for critical applications (zero switchover time)

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2) Account for Load Type:

Some loads (like motors, laser printers, compressors) require **higher starting current**, so size accordingly.

Quick Checklist of the above things Discussed:

Item	Example Value
Total load in Watts	4,000 W
Power Factor	0.8
Total VA needed	5,000 VA
Safety margin (25%)	+1,250 VA
UPS Capacity to choose	**≥ 6.25 kVA**
Backup time needed	15 minutes (or more)
Type of UPS	Online / Line-Interactive

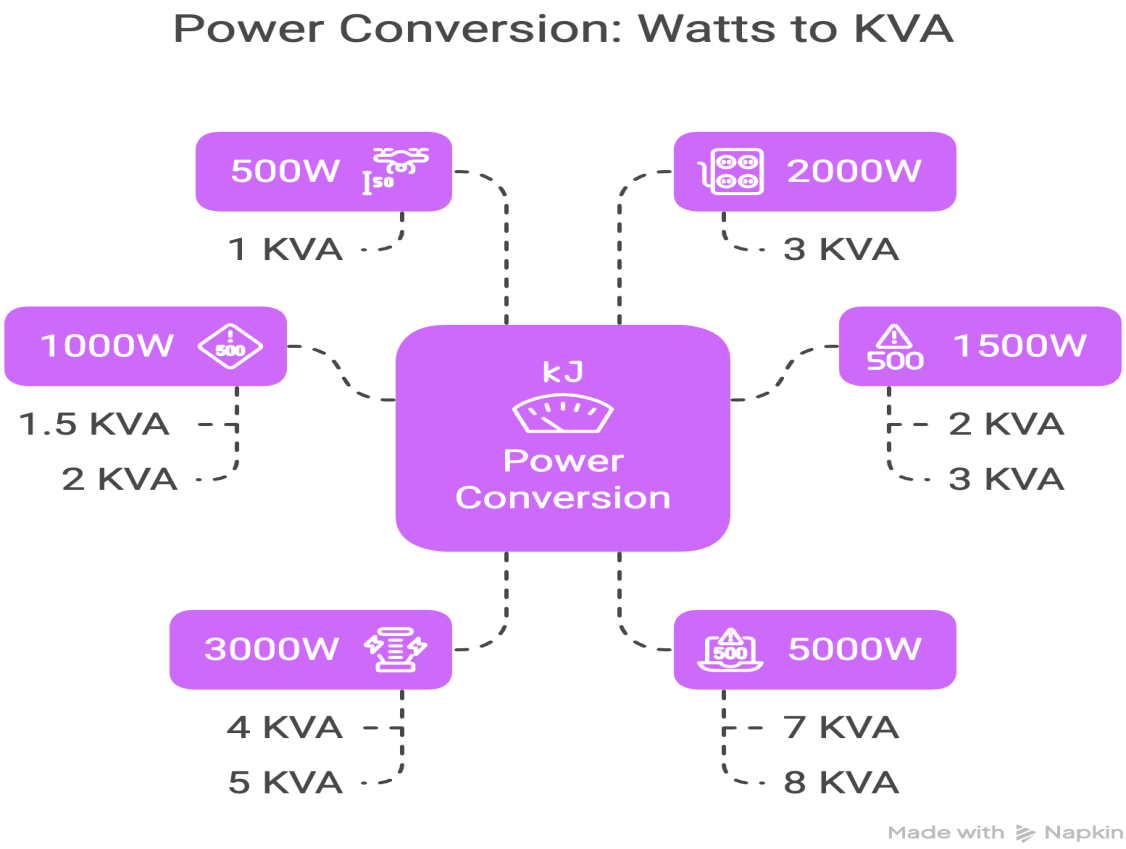
Final Guideline:

If you plan to add more devices later, choose a UPS with at least 20-30 Percent more capacity.

For example, If your need is **2.5 KVA**, go for a **3 KVA** or **4 KVA** UPS to accommodate future growth.

UPS Size Selection chart (Approximate Guide):

Total Load (Watts) recommended UPS (KVA):



Summary of the Illustration is as follows:

500W	**1 KVA**
1000W (1 KW)	**1.5 - 2 KVA**
1500W (1.5 KW)	**2 - 3 KVA**
2000W (2 KW)	**3 KVA**

3000W (3 KW) 4 - 5 KVA

5000W (5 kw) 7 – 8 KVA

2) How to Know What Topology of UPS System to be used?

To determine the **right UPS topology** (Offline, Line-Interactive, or Online), you need to match the level of power protection you require with the type of equipment you're protecting. Here's a decision guide:

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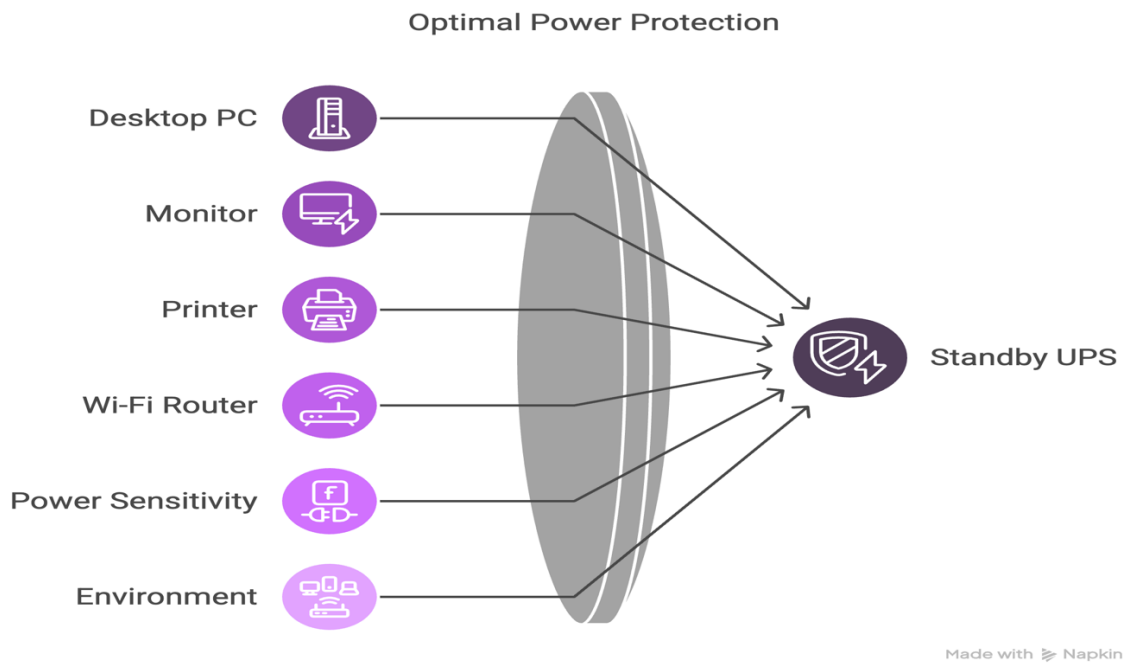
1. **What Kind of Equipment Are You Protecting?**

1. Basic Home or Office Electronics

- Examples: Desktop PC, monitor, printer, Wi-Fi router
- Power sensitivity: Low
- Environment: Stable power grid
- **Recommended topology: Standby UPS is the Right Option.**



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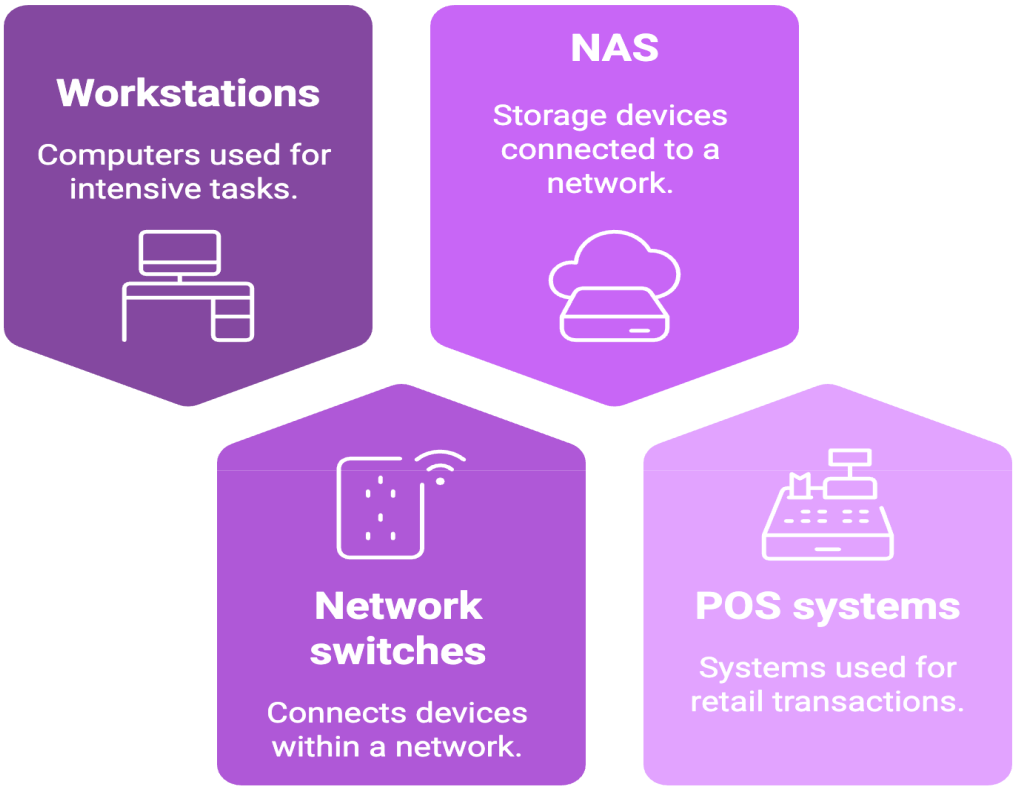
2. Business Equipment / Network Hardware:

- Examples: Workstations, network switches, NAS, POS systems

- Power sensitivity: Medium
- Environment: Some voltage fluctuations
- **Recommended topology: Line-Interactive UPS is the Right Option.**



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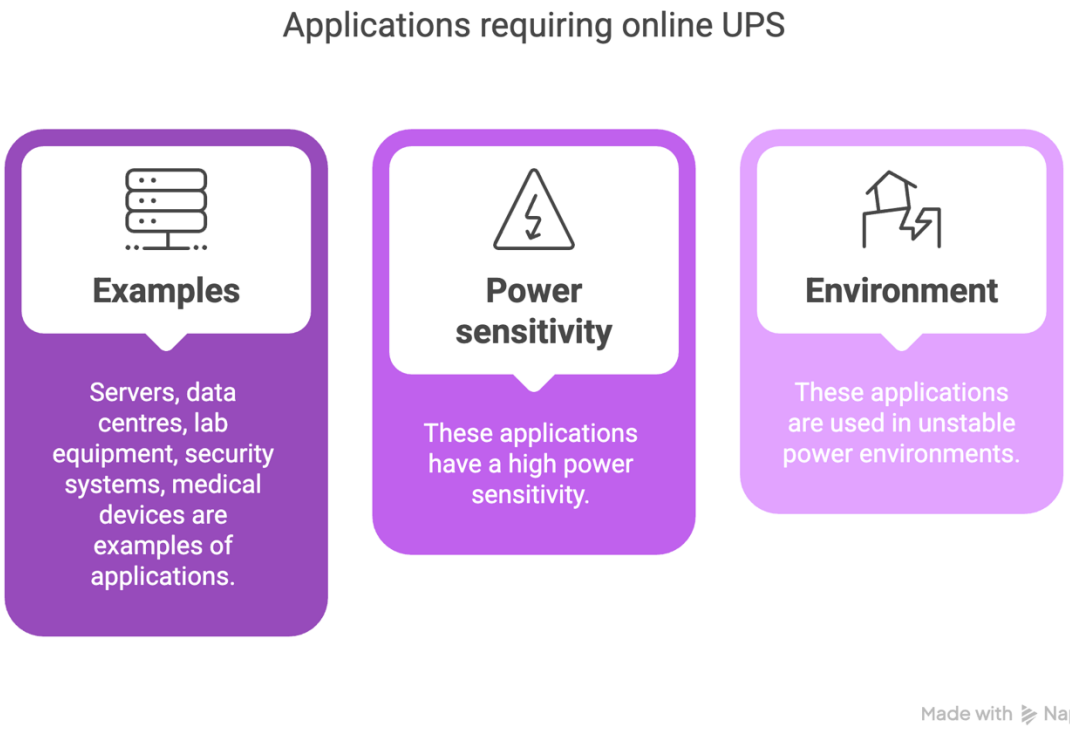
3. Critical Servers / Medical / Industrial Equipment

- Examples: Servers, data centres, lab equipment, security systems, medical devices
- Power sensitivity: High
- Environment: Unstable power or absolutely no downtime tolerated
- **Recommended topology: Online (Double-Conversion) UPS is the Right Option.**



- **Quick Summary Table of the above:**

UPS Topology	Protection Level	Use Case	Switch Time
Offline	Low	Home PCs, basic electronics	2–10 Milli Second
Line-Interactive	Medium	Small business, network gear	2–4 Milli Second
Online (Double Conversion)	High	Servers, critical systems, hospitals	Zero (no switch)

2. What Should be the UPS Phase and UPS DC Buss?

Solid question—choosing the right **UPS phase** (single-phase vs. three-phase) and **DC bus voltage** is key for designing a UPS system that fits your power needs.

Let's break it down simply:

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1. UPS Phase: Single-Phase vs. Three-Phase:

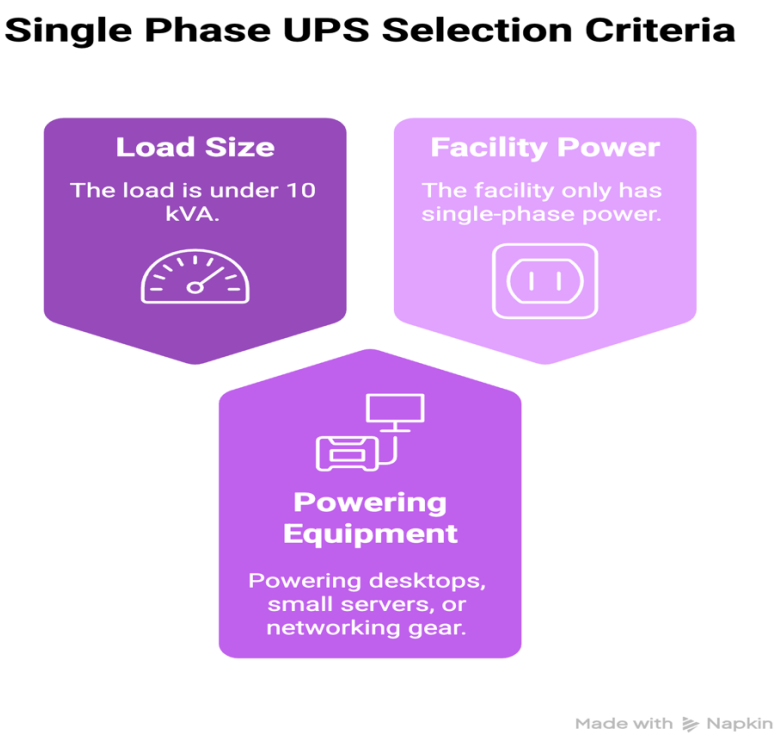
Single-Phase UPS:

- **Use for:** Homes, small offices, network closets, low-to-medium power needs

- Power range: Usually up to 10 KVA
- Input/Output: 230V (or 120V depending on region)

Choose **Single-Phase UPS** if:

- Your load is under 10 kVA
- You're powering desktops, small servers, or networking gear
- Your facility only has single-phase power

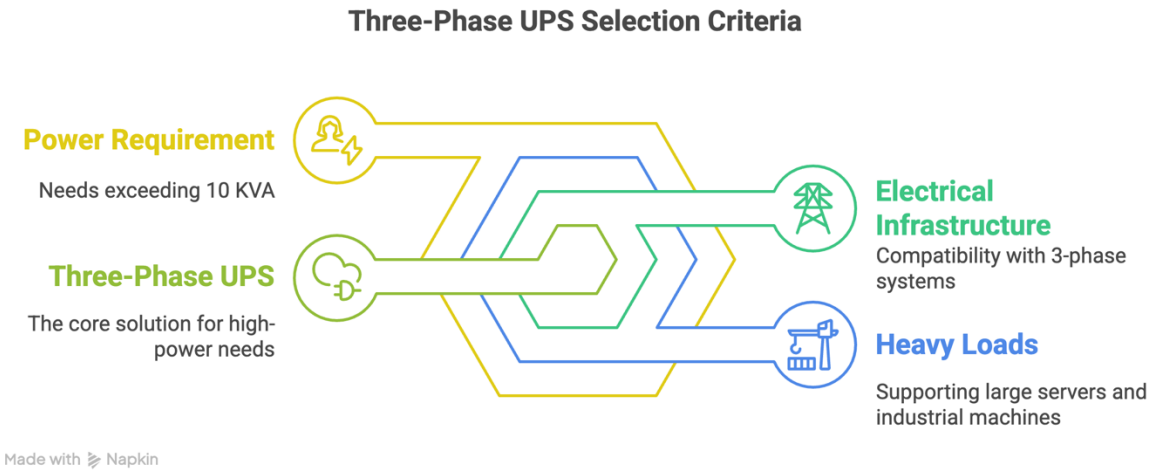


Three-Phase UPS:

- **Use for:** Data centres, industrial setups, large IT environments
- **Power range:** 10 kVA and up (can go into hundreds of kVA)
- **Input/Output:** 440 V 3-phase

Choose **Three-Phase UPS** if:

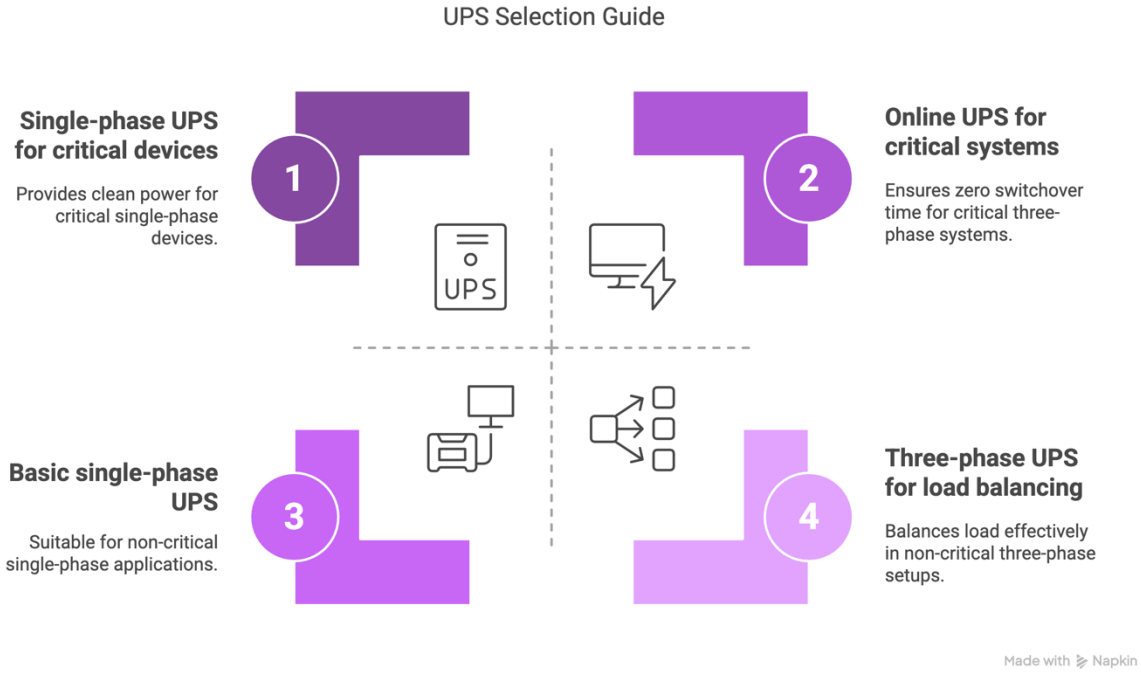
- You need more than 10 KVA
- You're supporting heavy loads like large servers, HVAC systems, industrial machines
- Your facility has a 3-phase electrical infrastructure



SINGLE PHASE VS THREE PHASE (A Simpler Explanation):

Consider Power Type:

- **Single-phase or 3-phase?** Match to your input/output needs (If Load is a 3 Phase device, then Input may be single phase but Output Must be 3 Phase.
- If there is a purpose of Load balancing Input of the UPS Must be 3 Phase.
- **Online UPS** is best for critical applications (zero switchover time and for Clean Power.



Account for Load Type:
Some loads (like motors, laser printers, compressors) require **higher starting current**, so size accordingly. For this type of Load UPS Must be of Industrial type.

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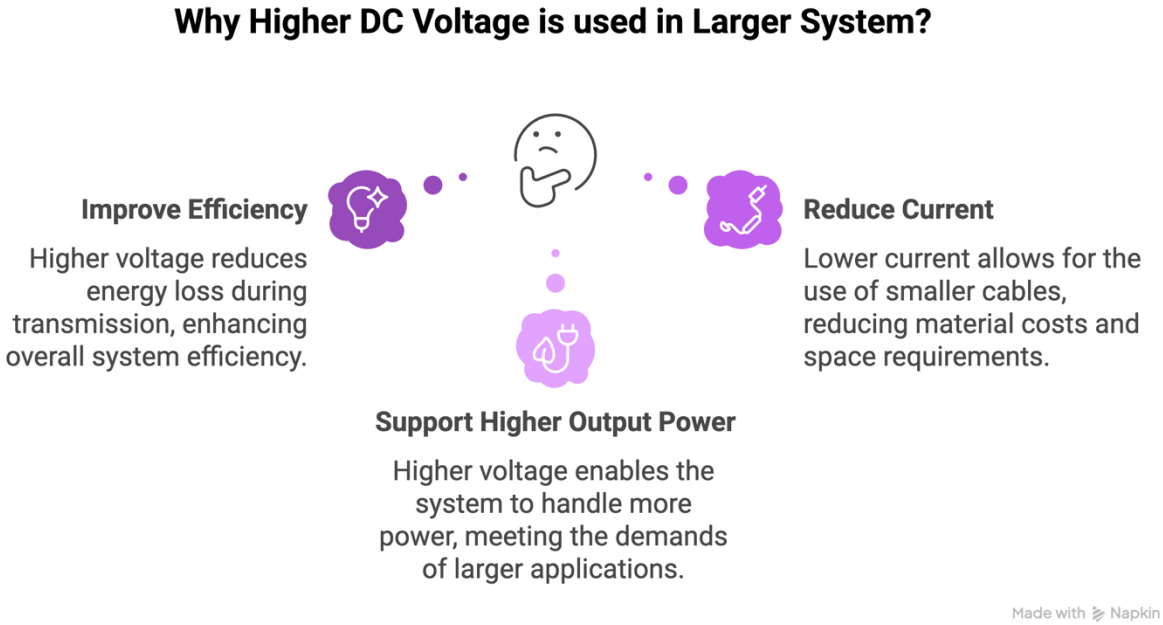
2. UPS DC Bus Voltage:

The **DC bus** is the internal voltage level between the rectifier and inverter inside the UPS. It's not something you directly configure, but you should know what it means when selecting or designing a system.

UPS Size	Typical DC Bus Voltage
Domestic UPS (500/600 VA)	12 V
Very Small UPS (1 kVA)	24 V
Small UPS (2–3 kVA)	72/96 V
Mid-Range UPS (6 – 10 KVA)	192/240 V
Higher KVA (Above 10 KVA)	Above 240 V



To Simplify the Above Information:

Scenario	UPS Phase	DC Bus
Home / Office PC / Small Business	Single-Phase	24V–96V
Medium office / Server Room	Single or 3-Phase	96V–192V
Data Centre / Industrial Setup	Three-Phase	240V–600V+

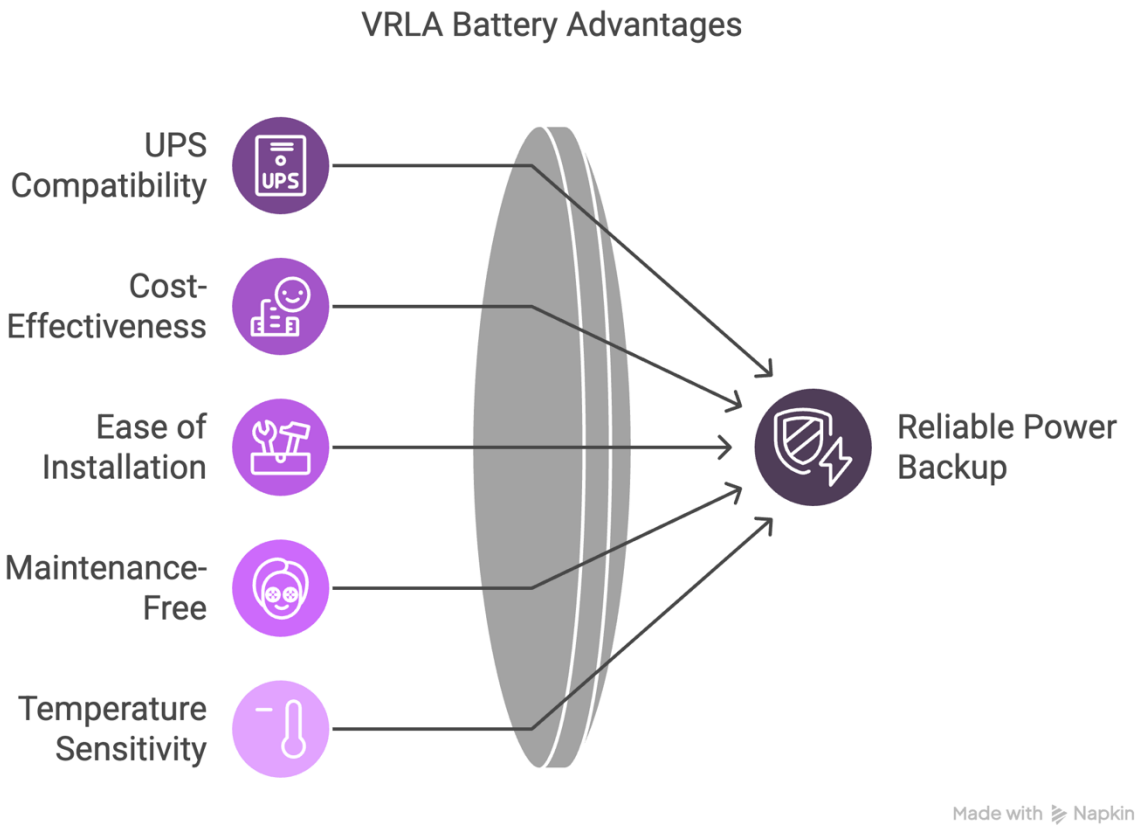
BATTERY FAQ

1) How to Choose Battery Type for UPS System?

VRLA (Valve Regulated Lead Acid) / SMF (Sealed Maintenance-Free):

- **Most common for UPS**
- Affordable, easy to install
- Lifespan: ~3–5 years
- No maintenance required
- Temperature-sensitive

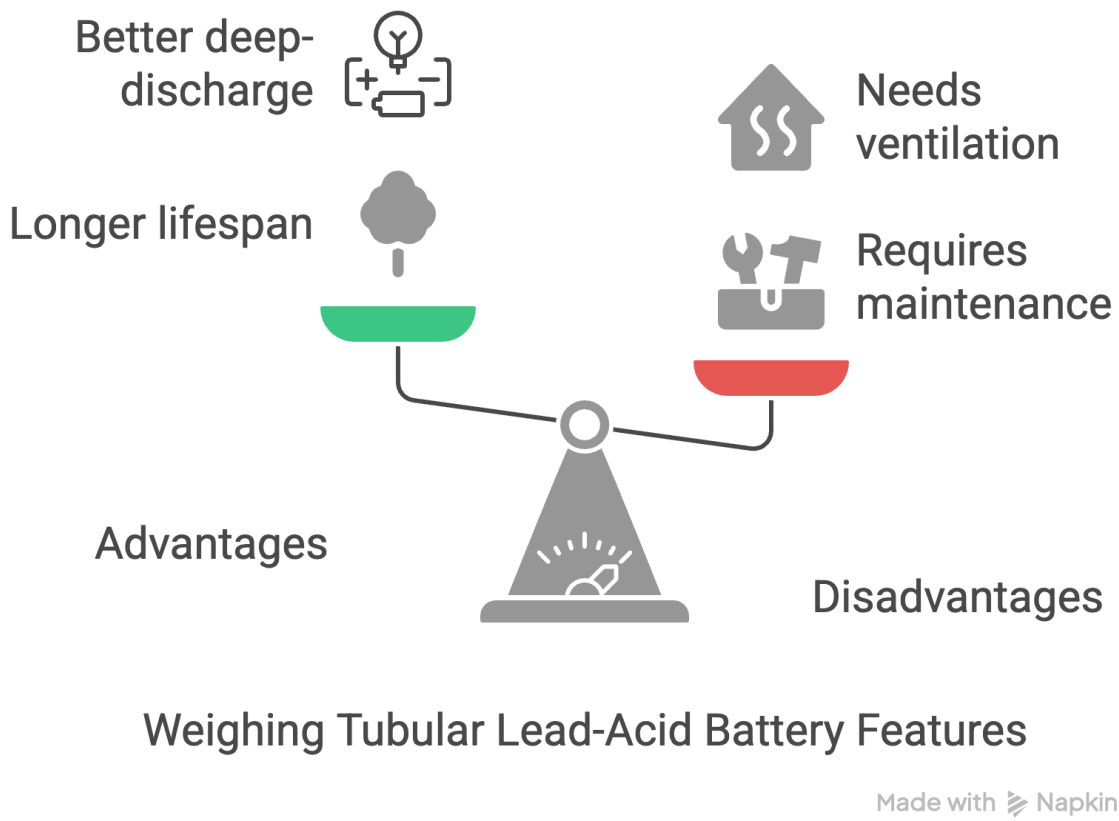
Ideal for: Office, home, small server rooms.



Tubular Lead-Acid Batteries:

- Higher lifespan (5–8 years)
- Better deep-discharge performance
- Requires ventilation and some maintenance

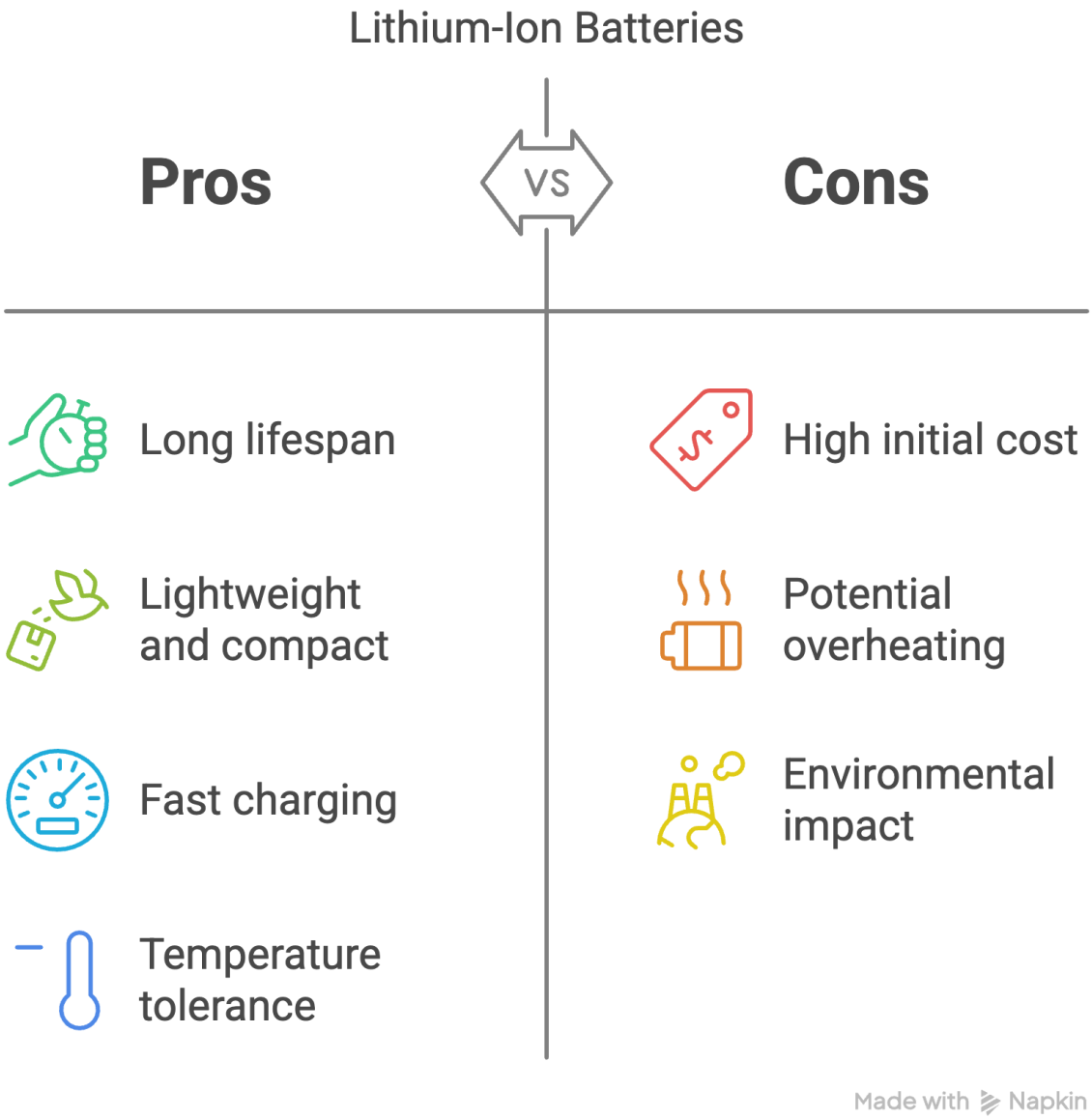
Ideal for: Industrial or semi-commercial use, where space and maintenance are manageable



Lithium-Ion Batteries:

- Long lifespan (10–15 years)
- Lightweight, fast charging, compact
- Expensive, but cost-effective over time
- Excellent temperature tolerance

Ideal for: High-end setups, data centres, long-life systems, limited space.



Quick Battery Type Comparison:

Type	Maintenance	Cost	Use Case
VRLA / SMF	None	Low	Home, office UPS
Tubular Lead-Acid	Yes	Medium	Industrial/Commercial UPS
Lithium-Ion	None	High	Critical systems, data centres

2) How to Decide Battery AH (Amp-Hour)?

The AH rating tells you **how long your batteries can supply power**. To calculate it, you need to know:

- **Load power** (in Watts or VA)
- **Required backup time** (in Hours)
- **Battery Bank voltage**
- **Battery efficiency / inverter efficiency**
- **Load current**

The AH rating tells you **how long your batteries can supply power**. To calculate it, you need to know:

$$\text{DC Current from Battery Bank } (I_{dc}) = \frac{\text{KVA rating x Load Power factor x 1000}}{\text{Battery Bank Voltage x Inverter efficiency}}$$

Ah Capacity Calculation:

Ah = I_{dc} x K-factor x Design margin (1.1) x T- factor x Aging factor (1.25)

Example:
You want to back up a 10 KVA load for 30 Min using a 16 Nos. 12 Volt SMF Battery :

Power Factor : 0.9
Typical K factor @ 30 Min Discharge Rate : 1.3 (Its value depends on Backup time)
Typical Inverter efficiency : 85 %
Design Margin : 1.1
Aging factor (1.25)
Temperature Correction factor is not considered as 1 as it is assumed that batteries are kept at 23 Degree Celsius

$$\text{DC Current from Battery Bank } (I_{dc}) = \frac{10 \times 0.8 \times 1000}{192 \times 0.85} \text{ Amp} = 49 \text{ Amp}$$

Required Ah = 49 x 1.3 x 1.1 x 1 x 1.25 Ah = 87.5 Ah
If we don't consider Design Margin and Aging factor Required Ah = 65 Ah for 30 min backup with full Load

We would Round up to nearest Ah depending on safety margin and availability.

Common Battery Configurations:

System Voltage	No. of 12 V Batteries	Used For
12 V	1	Domestic UPS (500/600 VA)

24 V	2	Very Small UPS (1 kVA)
48 V	4	Typical UPS (2–3 kVA)
72V /96 V	6/8	Small UPS (2–3 kVA)
192 V/230 V	16/20	Mid-Range UPS (6 – 10 KVA)
Above 192 Volt	Above 20	Higher KVA (Above 10 KVA)

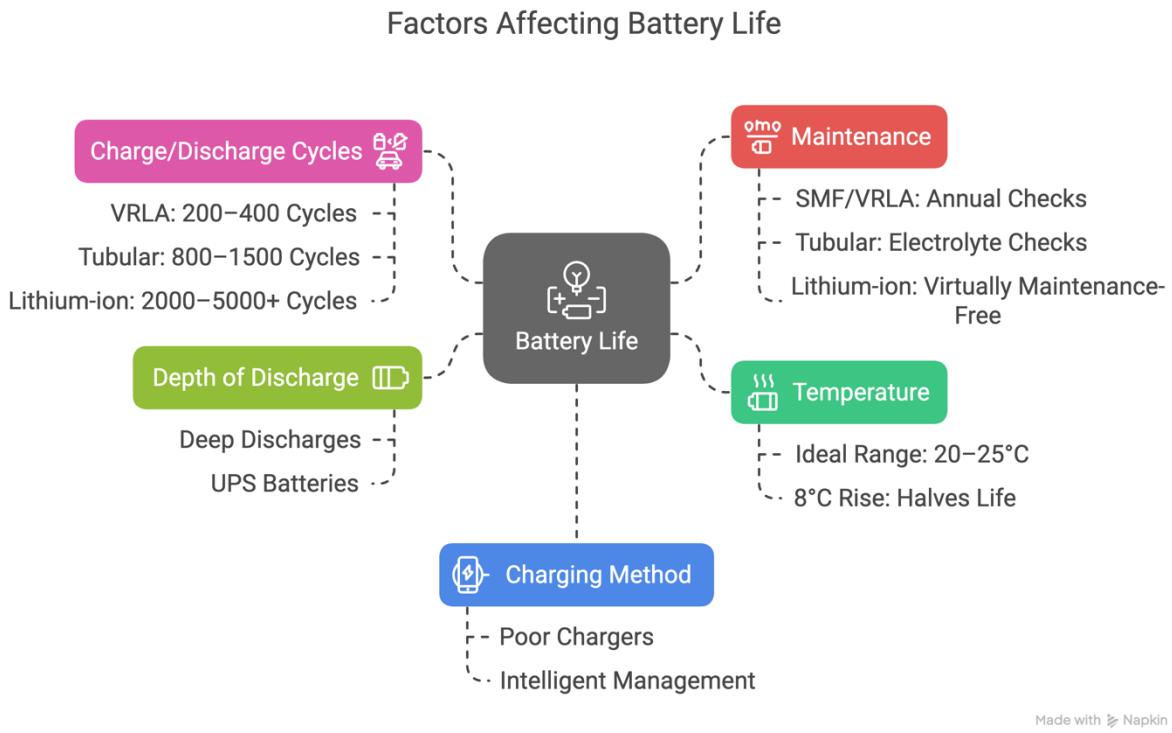
2) What is the Battery Life Expectancy?

The **battery life expectancy** depends on **battery type**, **usage conditions**, **temperature**, and **charging cycles**. Here's a breakdown of what to expect from each type used in UPS systems:

Actually, battery life is defined by cycle ((refers to the number of times a battery can be fully charged and discharged before its capacity degrades significantly, typically to 80% of its initial capacity. This "cycle life" is a key indicator of a battery's lifespan and performance) of use not by year.

Battery Type	Life Expectancy In Years	Cycle Use	Notes
VRLA / SMF (Sealed Lead-Acid)	3–5 years	200 to 400	Most common UPS battery. Life drops sharply with heat or overcharging.
Tubular Lead-Acid	5–8 years	800 to 1500	More rugged, better for long discharges. Needs maintenance (water top-up).
Lithium-Ion	10–15 years	2000 to 5000	Higher cost, but excellent for long-term use. Very low degradation.
Nickel-Cadmium (NiCd)	10–20 years	1000 to 2000	Rare in UPS use, toxic materials, mainly used in harsh environments.

Key Factors That Affect Battery Life:



1. Temperature

- Ideal: **20–25°C (68–77°F)**
- Every **8°C rise** above 25°C **cuts battery life in half**
    - e.g., VRLA rated for 5 years at 25°C may last only 2.5 years at 35°C

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2. Depth of Discharge (DoD)

- Frequent **deep discharges** reduce battery life
- UPS batteries last longer when kept mostly charged and only used during actual outages.

3. Charge/Discharge Cycles

- Each battery type has a **limited number of cycles**
    - VRLA: ~200–400 full cycles
    - Tubular: ~800–1500 cycles
    - Lithium-ion: **2000–5000+ cycles**

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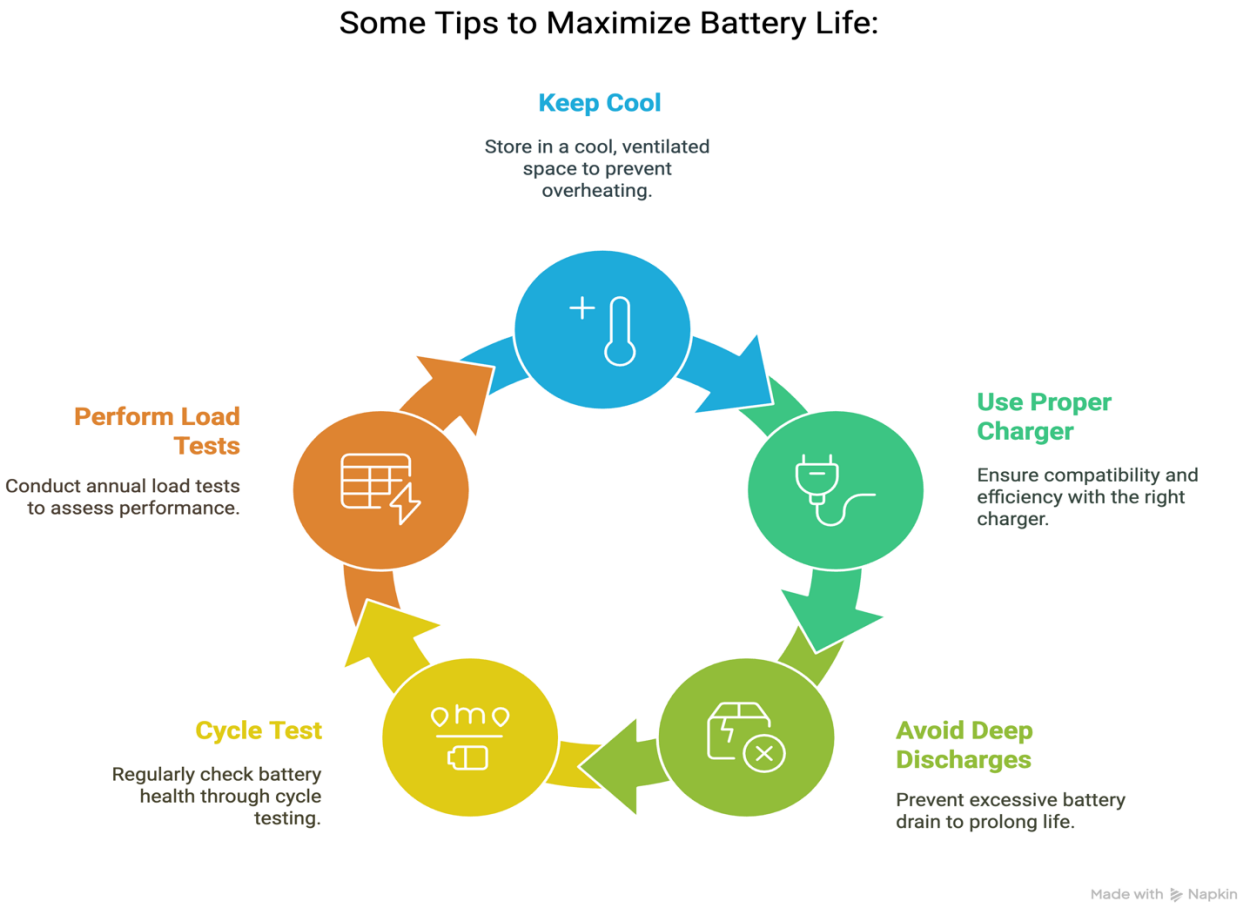
4. Charging Method

- Poor quality chargers or mismatched charge voltages **reduce life**
- Good UPS systems have intelligent battery management for longer life

5. Maintenance

- SMF/VRLA: No maintenance required, but should still be checked annually
- Tubular: Requires electrolyte level checks every few months
- Lithium-ion: Virtually maintenance-free



2) What are the Battery Connecting Tools which are Required?

Here are the essential tools and materials used for connecting batteries in a UPS system:

1. Battery Interlink Cables / Battery Jumpers

- **Purpose:** Connect batteries in series or parallel.
- **Specs:**
  - **Material:** Copper with PVC/XLPE insulation / Nyvin Cable
  - **Gauge:** 10 mm^2 to 50 mm^2 depending on current
  - **Length:** 0.5 to 1 meter typical (custom depending on layout)
  - **Terminal lugs:** Crimped or soldered eyelet terminals (M6, M8 size)

2. Battery Terminal Lugs

- **Purpose:** Secure connection to battery posts.
- **Types:**
  - **Flat copper lugs**
  - **Ring terminals** (M6, M8, or M10 holes)
- **Material:** Tin-plated copper or pure copper

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3. Crimping Tool

- **Purpose:** Attach lugs securely to cables
- **Type:** Manual hydraulic or heavy-duty ratchet crimper
- **Die Sizes:** Match to cable gauge (10mm^2, 25mm^2, etc.)

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4. Battery Torque Wrench / Spanner

- **Purpose:** Tighten battery terminals to manufacturer specs
- **Torque range:** ~5–10 Nm for small batteries, higher for large ones

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5. Battery Cable Markers / Sleeves

- **Purpose:** Identify positive and negative lines
- **Colours:** Red (positive), Black (negative)

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6. DC Breakers / Fuses / Battery Disconnects

- **Purpose:** Safety isolation for battery banks
- **Rated for:** System DC Bus Voltage and expected DC current

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7. Insulated Gloves & Multimeter

- For safety and testing continuity/voltage.

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5) How to Desing the Sizing for Battery Bank and Battery Bank Rack?

Battery Rack Size and Layout

Battery racks organize and support the battery bank. Size depends on:

- **Number of batteries**
- **Battery size**
- **Ventilation/maintenance space**

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1. **Common Approximate Battery Sizes (12V, 26AH to 100AH):**

Battery AH	Dimensions (L × W × H)	Weight
7AH	~ 150 × 65 × 95 mm	~ 2.0–2.5 kg
18AH	~ 180 × 75 × 170 mm	~ 5.0–6.0 kg
26AH	~ 165 × 175 × 125 mm	~ 8.0–9.0 kg
42AH	~ 197 × 165 × 170 mm	~ 13–14.5 kg
65AH	~ 260 × 170 × 180 mm	~ 20–24 kg
100AH	~ 330 × 170 × 220 mm	~ 30–35 kg

2. Battery Rack Types are as Follows:

Rack Type	Capacity	Size (approx.)	Notes
2-tier rack (4x 12V/100AH)	48V string (1 row)	700 × 500 × 500 mm	Small setups
4-tier rack (8x 12V)	96V string	800 × 500 × 1000 mm	Mid-size UPS
2-row parallel rack (16x)	2x 96V or 192V	1200 × 800 × 1200 mm	High runtime
Customized welded rack	24+ batteries	Varies, often modular	Data centres

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