

Detailed Load Estimation and Cable Sizing Report for Small Building

1. Project Overview

- Building Type: Small residential building (G+1)
- Electrical Supply: 3-phase, 415 V, 50 Hz
- Power Factor: 0.95
- Estimated Feeder Cable Length: 30 meters
- Standards Followed: IS 732, IS 694, IS 3043

2. Connected Load Inventory

Lighting:

- LED lights (various rooms): 0.30 kW
- Ceiling fans: 0.42 kW

Living Room:

- TV: 0.20 kW
- 1.5 TR AC: 5.275 kW

Kitchen:

- Refrigerator: 0.25 kW
- Microwave: 1.2 kW
- Mixer/Grinder: 0.5 kW

Bedrooms:

- Lights + Fans: 0.3 kW
- Two 1.5 TR AC units: 10.55 kW

Utility Areas:

- Washing Machine: 0.8 kW

- Geyser: 2.0 kW

General sockets:

- Approx. 2.4 kW

TOTAL CONNECTED LOAD: 24.35 kW

3. Diversity Factor Application

Not all appliances operate simultaneously → diversity is applied.

- Lighting & Fans: 100%
- AC Units: 90%
- Refrigerator: 50%
- Geyser: 50%
- Washing Machine: 30%
- Kitchen sockets: 30%
- General sockets: 40%
- Pump: 50%

DEMAND LOAD AFTER DIVERSITY ≈ 18.04 kW

4. Current Calculation

3-Phase Current Formula:

$$I = P / (\sqrt{3} \times V \times PF)$$

Substituting:

$$I = 18,000 \text{ W} / (1.732 \times 415 \times 0.95)$$

$$I \approx 26.4 \text{ A per phase}$$

Final Recommendation:

- 40 A TPN MCB as main incomer

5. Main Feeder Cable Sizing

Options evaluated:

- 4 mm² Cu → Acceptable but smaller margin
- 6 mm² Cu → Recommended for:
 - Lower voltage drop
 - AC/pump starting currents
 - Better future expansion margin

Voltage Drop Check (4 mm² example):

- $\Delta V \approx 1.52\%$ (within limits)
- 6 mm² further reduces voltage drop

ENAB RECOMMENDED FEEDER CABLE:

- 3-core (or 4-core) 6 mm² Copper PVC

6. Internal Circuit Cable Sizing and MCB Selection

Lighting Circuits:

- Cable: 1.5 mm² Cu
- MCB: 6-10 A

Power Socket Circuits:

- Cable: 2.5 mm² Cu
- MCB: 16-20 A

Kitchen Heavy Load Circuit:

- Cable: 4 mm² Cu
- MCB: 20-25 A

AC Units (1.5 TR):

- MCB: 25-32 A

Geyser:

- Cable: 4-6 mm² Cu
- MCB: 16-20 A

Water Pump:

- Cable: 2.5-4 mm² Cu
- MCB: 16 A

Main Incoming Circuit:

- Cable: 6 mm² Cu
- Protection: 40 A TPN MCB + 30 mA RCB

7. Earthing System Details

- Follow IS 3043 earthing guidelines
- Target earth resistance: 1-2 ohms
- Use 2 or more earth electrodes if soil is poor
- Earth wire sizes:
 - Lighting/Socket circuits: 1.5-2.5 mm² Cu
 - AC, Geyser, Pump: 4 mm² Cu
 - Main Earthing Conductor: 6 mm² Cu or GI strip as applicable
- Ensure bonding of water pipes, metallic parts

8. Distribution Board Layout (Simplified)

Main DB:

- 40 A TPN Main MCB
- 30 mA RCB for outgoing circuits

- L1 Phase: Lighting, Pump, Bedroom 1 AC
- L2 Phase: Sockets, Geyser, Bedroom 2 AC
- L3 Phase: Kitchen circuits, Living AC

This ensures phase balance.

9. Energy Efficiency Recommendations

- Use star-rated inverter ACs
- Install LED lights throughout
- Add roof insulation to reduce AC load
- Use solar PV system (3-5 kW recommended)
- Use 5-star appliances
- Install timers for geyser
- Use energy-efficient water pump motor
- Practice load shifting (run washing machine during daytime)

10. Final Summary

- Total Connected Load: $\approx 24.35 \text{ kW}$
- Demand Load: $\approx 18.04 \text{ kW}$
- Calculated Current: 26.4 A
- Main Cable Size: $6 \text{ mm}^2 \text{ Cu}$ recommended
- Lighting cables: 1.5 mm^2
- Socket circuits: 2.5 mm^2
- Heavy loads: $4-6 \text{ mm}^2$
- Main MCB: 40 A TPN
- Safety: RCD mandatory, proper earthing essential

This design provides safe operation, future load margin, and good voltage stability.