

Telecom Shelter Cooling Design Blueprint - Official Technical Overview & Hardware Datasheet

EXECUTIVE SUMMARY

This document serves as the definitive technical reference for the Telecom Shelter Cooling Design Blueprint, a comprehensive thermal management solution engineered for carrier-grade outdoor telecommunications enclosures. Designed to operate in extreme ambient temperatures ranging from -40°C to $+55^{\circ}\text{C}$, this blueprint integrates high-efficiency vapor-compression cooling, intelligent airflow management, and redundant component architectures to ensure continuous operation of mission-critical RF and baseband processing equipment. The system achieves a nominal cooling capacity of 8 kW to 15 kW per shelter, with a peak energy efficiency ratio (EER) of 3.2 at 35°C ambient, significantly reducing total cost of ownership compared to traditional air-conditioning units. This datasheet details the mechanical, electrical, and thermal specifications, compliance certifications, and ordering information for the complete shelter cooling solution.



ARCHITECTURE & CHASSIS DESIGN

The Telecom Shelter Cooling Design Blueprint is architected around a modular, front-accessible chassis that integrates the evaporator, condenser, and control logic into a unified enclosure measuring 1800 mm (H) x 800 mm (W) x 600 mm (D). The chassis is constructed from corrosion-resistant, powder-coated galvanized steel (IP55 rated) with a thermal break design to minimize heat ingress. Key subsystems include:

- Dual independent refrigerant circuits (R-410A) with scroll compressors, providing N+1 redundancy for critical sites.
- Electronically commutated (EC) axial fans for condenser and evaporator airflows, offering variable speed control with a typical airflow rate of 3200 m³/h per fan.

- A microcontroller-based thermal management unit (TMU) with integrated ambient and return-air temperature sensors, humidity sensors, and pressure transducers.
- A hot-swappable power distribution module supporting dual input feeds (230 VAC, 50/60 Hz) and a DC backup option (-48 VDC).
- Integrated fire suppression interface and smoke detection per NFPA 70E standards.

The internal layout is optimized for serviceability, with all major components accessible via a single hinged front door, and color-coded refrigerant lines and wiring harnesses for rapid fault identification. The design supports both standalone shelter installations and integration into prefabricated modular enclosures.

HARDWARE FEATURES

- VARIABLE CAPACITY CONTROL: Inverter-driven compressors that modulate cooling output from 30% to 100% based on real-time thermal load, reducing power consumption by up to 40% during partial load conditions.
- ACTIVE FREE-COOLING ECONOMIZER: An integrated enthalpy wheel and bypass damper that utilizes outside air for cooling when ambient temperatures drop below 15°C, cutting mechanical cooling run hours by an average of 2200

hours per year in temperate climates.

- **ADVANCED MONITORING & DIAGNOSTICS:** Embedded web server and SNMP v3 agent providing real-time performance metrics (return air temperature, supply air temperature, compressor amps, fan speed, refrigerant pressures) and predictive failure alerts via Modbus TCP/IP and BACnet protocols.
- **RUGGEDIZED FILTRATION:** A two-stage filtration system (MERV 11 pre-filter + MERV 14 HEPA final filter) with a differential pressure monitor, ensuring incoming air quality meets GR-487-CORE requirements for particulate and gaseous contaminants.
- **ANTI-CORROSION COATING:** All condenser coils and evaporator fins receive a proprietary electro-deposition coating (EDC) rated for 1500 hours of salt spray testing per ASTM B117, making the unit suitable for coastal and industrial environments.
- **LOW SOUND EMISSION:** Acoustic enclosure with sound-absorbing foam reduces operational noise to ≤ 65 dBA at 1 meter, meeting local municipal noise ordinances for outdoor installations.
- **MODULAR EXPANSION PORTS:** Two spare knockouts for future addition of auxiliary cooling cassettes (e.g., thermoelectric or liquid-to-air heat exchangers) without chassis modification.

COMPLIANCE & STANDARDS

The Telecom Shelter Cooling Design Blueprint is certified and tested to the following rigorous industry standards:

- NEBS GR-63-CORE (Level 3 – Vibration, Shock, and Earthquake)
- NEBS GR-3028-CORE (Thermal Management for Electronic Equipment Enclosures)
- UL 1995 (Heating and Cooling Equipment) and UL 60335-2-40
- IEC 60529 (IP55 Enclosure Protection)
- ISO 9001:2015 (Quality Management) and ISO 14001:2015 (Environmental Management)
- ASHRAE 90.1 (Energy Standard for Buildings, Chapter 6 – HVAC)
- CE Marking (EMC Directive 2014/30/EU, Low Voltage Directive 2014/35/EU, RoHS 2011/65/EU)
- FCC Part 15, Subpart B (Class A – Radiated & Conducted Emissions)

The system has undergone third-party verification by Intertek for safety and by UL for performance under extreme temperature cycling conditions (-40°C to +75°C storage). All materials used are halogen-free and comply with REACH SVHC regulations.

TECHNICAL SPECIFICATIONS

This section provides the complete parametric registry for the baseline model (TS-CBD-12kW) and optional variants. All values are nominal at 35°C ambient, 45°C return air temperature, 50 Hz supply, and 50% relative humidity unless otherwise noted.

Parameter	Specification
Form Factor	1800H x 800W x 600D mm, Floor-standing Chassis
Cooling Capacity (Nominal)	12 kW (8-15 kW variants available)
Power Supply	230 VAC, 50/60 Hz, 1+1 Redundant (optional -48 VDC)
Compressor Type	Twin Scroll, Inverter-driven (R-410A)
M	a
4	8
EER at 35°C Ambient	3.2 (Full Load)
Operating Temperature Range	-40°C to +55°C (ambient)
Storage Temperature Range	-50°C to +75°C
Humidity Range	5% to 100% RH (non-condensing)
Protection Rating	IP55 (chassis), IP20 (control panel)
Acoustic Noise	≤ 65 dBA @ 1 m (full speed)
Filtration	MERV 11 pre-filter + MERV 14 HEPA

Interface Protocols	SNMP v3, Modbus TCP/IP, BACnet
Certifications	NEBS Level 3, UL 1995, CE, FCC Class A
MTBF (per MIL-HDBK-217F)	210,000 hours (ground fixed)
Weight (dry)	185 kg (base unit)

ORDERING OPTIONS

The Telecom Shelter Cooling Design Blueprint is offered in multiple configurations to suit varied capacity, redundancy, and climate requirements. Each system includes the main chassis, TMU, pre-charged refrigerant lines, and installation kit. The following base SKUs are available for immediate procurement:

- TS-CBD-08kW: 8 kW nominal cooling capacity, single compressor, single fan tray, -48 VDC input option, basic monitoring.
- TS-CBD-12kW: 12 kW nominal capacity, dual compressors (N+1), dual EC fans, 230 VAC primary, web/SNMP monitoring.
- TS-CBD-15kW-HD: 15 kW high-density configuration, dual inverter compressors, redundant power feeds, extended temperature operation (-40°C to +55°C), and HEPA filtration.
- TS-CBD-FC-EXT: Free-cooling economizer add-on module for all base SKUs

(factory-installed option).

- TS-CBD-MNT-KIT: Universal mounting kit for floor-standing, wall-mount, or rooftop installations.
- TS-CBD-EXT-WARR: Extended 5-year warranty with next-business-day onsite support (continental regions).

For customized configurations (e.g., higher capacity, special coatings, or non-standard voltages), please consult your regional sales representative. Minimum order quantity (MOQ) for standard SKUs is 2 units; lead time for standard orders is 8-10 weeks ARO (after receipt of order). A detailed order form, including site-specific electrical and structural requirements, is provided in the accompanying Installation Planning Guide (document no. TS-IPG-2026).

