

CLIMATE-CONTROLLED CHAMBERS

Professional Technical Datasheet Package — April 2026
ESSENTIA INDUSTRIAL PROJECTS LLC / ESSE COSTRUZIONI srl

TEMPERATURE

-10 to +60 degC

HUMIDITY RH

10% – 98%

CO2 CONTROL

Ambient – 3,000 ppm

PHOTOPERIOD

0 – 24 h LED

Plant Research

Microgreens

Pharmaceutical

Defense/Military

Containerized

General Product Sheet — Chamber Family

Essentia / Esse Costruzioni climate-controlled chambers are fully custom-built systems designed for precise control of temperature, relative humidity, CO2, airflow, and photoperiod. The core platform is shared across all application sectors; configurations are tailored to the customer's process requirements.

KEY SPECS — Standard Range

Parameter	Range / Value	Parameter	Range / Value
Temperature	41 to 113 degF (5 to 45 degC, ext....	LED Spectrum	Full-spectrum PAR + UV + IR
Relative Humidity	30-90% RH (ext. 10-98%)	Control System	PLC + HMI touchscreen
CO2 Control	Ambient - 3,000 ppm	Monitoring	Remote access + data logging
Photoperiod	0-24 h multistep programmable	Construction	Insulated panels + SS interior
PAR Intensity	50-800 umol m-2 s-1	Formats	Compact / Walk-in / ISO Container

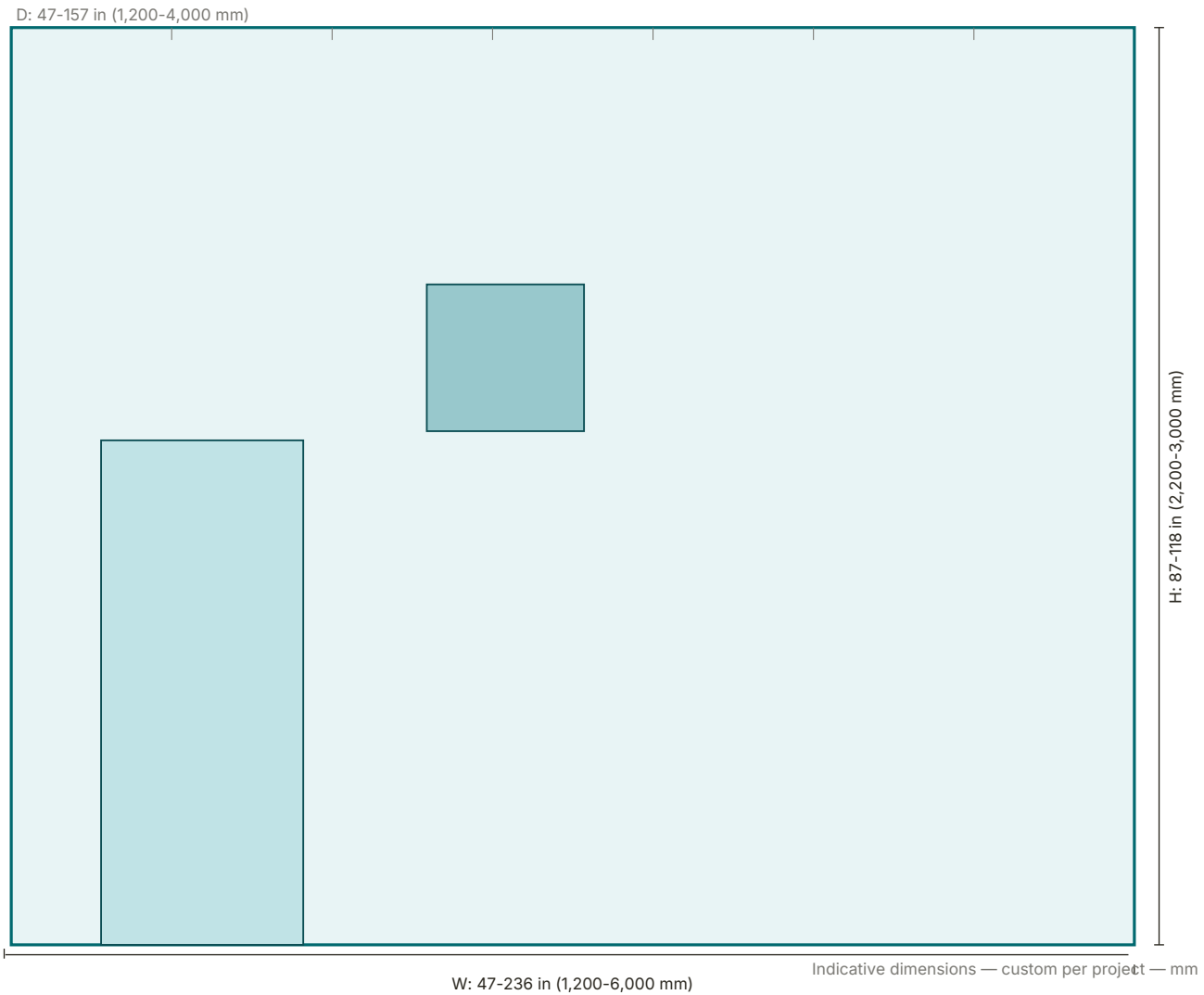
MAIN APPLICATIONS

Sector	Typical Customer
Plant Research	Universities, agronomy institutes, USDA,...
Microgreens	Urban farms, restaurants, retailers
Pharmaceutical	Pharma/biotech labs, CROs, API manuf...
Defense & Field	Armed forces, NATO, DoD contractors
Containerized	Cross-sector deployable format

COMMERCIAL OPPORTUNITIES

Target	Opportunity
Universities & R.Centers	NSF/USDA/CREA multi-year chamber p...
Agrotech Startups	Pilot plants, rapid proof-of-concept
Pharma Industry	ICH Q1A stability, GMP cleanrooms
Armed Forces / NATO	Container ECU CBRN, DoD/GSA procur...
Fine Dining & Retail	In-house microgreens, zero logistics

INDICATIVE DIMENSIONAL DIAGRAM — Standard Walk-in Chamber



SECTOR 1 — PLANT SCIENCE & AGRONOMIC RESEARCH

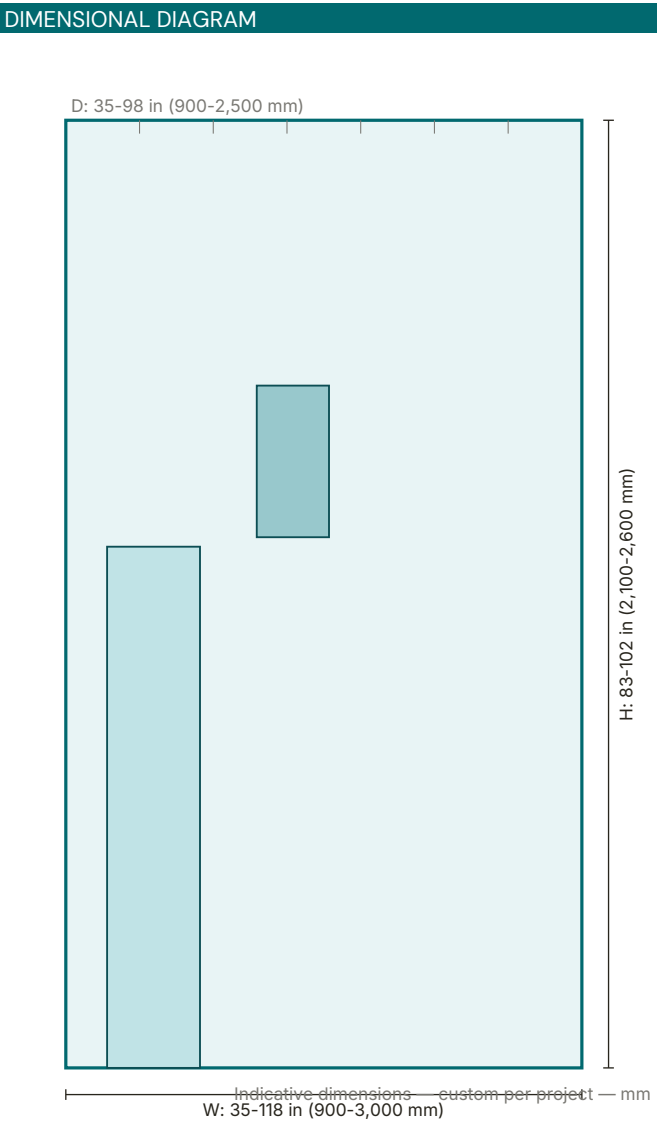
Plant Growth & Research Chamber

Climate chamber designed for universities, research centers, seed companies, and plant science programs requiring absolute environmental reproducibility. Supports plant physiology, accelerated breeding, biotic and abiotic stress studies, functional genomics, and in-vitro protocols. Reference customers: Cornell, University of Minnesota (145 CFANS chambers), USDA ARS.

KEY SPECS		
Parameter	Value / Range	Notes
Temperature	41-122 degF (5-50 degC)	Precision +/-0.5 degF (+/-0.3 degC)
Rel. Humidity	10%-98% RH	Precision +/-2% RH
CO2	Ambient - 3,000 ppm	Closed-loop control on request
Photoperiod	0-24 h multistep	Season & latitude simulation
LED Spectrum	PAR + UV-A/B + Far-red	Interchangeable modules
PAR Intensity	50-800 umol m-2 s-1	Uniform canopy distribution
Airflow	0.2-0.8 m/s (0.6-2.6 fps)	Laminar/turbulent/mixed

MAIN APPLICATIONS
- Breeding & varietal selection: accelerated reproductive cycles - Climate stress simulation: drought, salinity, heat waves, elevated CO2 - Tissue culture, micropropagation, CRISPR genomics under sterile conditions - Entomology research: plant-pathogen-insect interaction studies - NASA/aerospace programs: feasibility of extraterrestrial crop cultivation - Multi-year NSF/USDA ARS grant-funded chamber programs

COMMERCIAL OPPORTUNITIES	
Target / Customer	Commercial Opportunity
Land-Grant Universities	NSF/USDA ARS contracts; references Cornell, U. of Minnesota
CREA / CNR (Italy)	PNRR and ministerial programs; large walk-in chambers
Seed Companies	R&D on stress-resistant varieties; multi-zone controlled testing
Biotech & Plant Labs	In-vitro culture, CRISPR; compact sterile chambers with HEPA



SECTOR 2 — MICROGREENS & INDOOR FOOD PRODUCTION

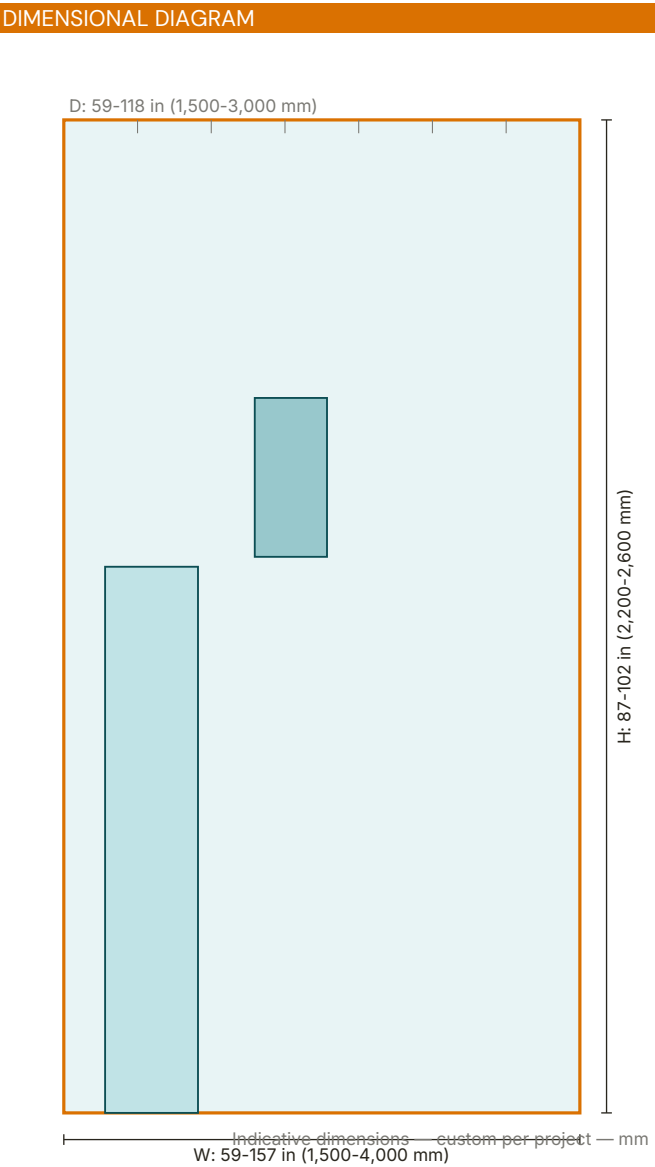
Microgreens Production & Indoor Farming Chamber

Chamber optimized for commercial production and R&D of microgreens, herbs, sprouts, and leafy greens. The global microgreens market is projected to reach USD 3.34 billion by 2031 (CAGR 19.74% vertical farming segment — Mordor Intelligence). Essentia's solution scales from a single restaurant module to full walk-in multi-rack urban farming operations.

KEY SPECS		
Parameter	Value / Range	Notes
Temperature	70-81 degF (21-27 degC)	Optimal growth speed at 79 degF
Humidity RH	40%-60% RH	>70% RH = mold risk
CO2	Ambient (~400 ppm)	Not critical for production only
LED Full-sp.	16 h light / 8 h dark	Spectrum tuned for chlorophyll
Ventilation	Vertical circulation <0.3 m/s	No direct airflow on crops
HVAC sizing	+10% - +20% oversized	Stability at full biological load
Air Filtration	G4-F7, opt. HEPA	Reduction of microbial load

MAIN APPLICATIONS
• Compact restaurant modules (11-54 sq ft): harvest hours before service • Multi-rack indoor urban farms: scalable production for grocery and delivery • Biofortified microgreens: enhanced vitamin C, carotenoids, antioxidants (CEA) • Integrated hydroponics: NFT, aeroponics, DWC with automated fertigation • R&D on new species and light recipes for food science and Michelin-star chefs • Container farms for zero-mile distribution and reduced food-miles logistics

COMMERCIAL OPPORTUNITIES	
Target / Customer	Commercial Opportunity
Fine Dining & Chefs	Compact in-house chamber; harvest-to-plate; zero supply chain
Urban Farms	Walk-in multi-rack; fertigation; grocery & box delivery
Grocery & Retailers	Proximity production: fresh, traceable, no extended cold chain
Public Grant Programs	CDFA (USA), PSR/PNRR (Italy): sustainable vertical farming



SECTOR 3 — PHARMACEUTICAL & BIOTECH

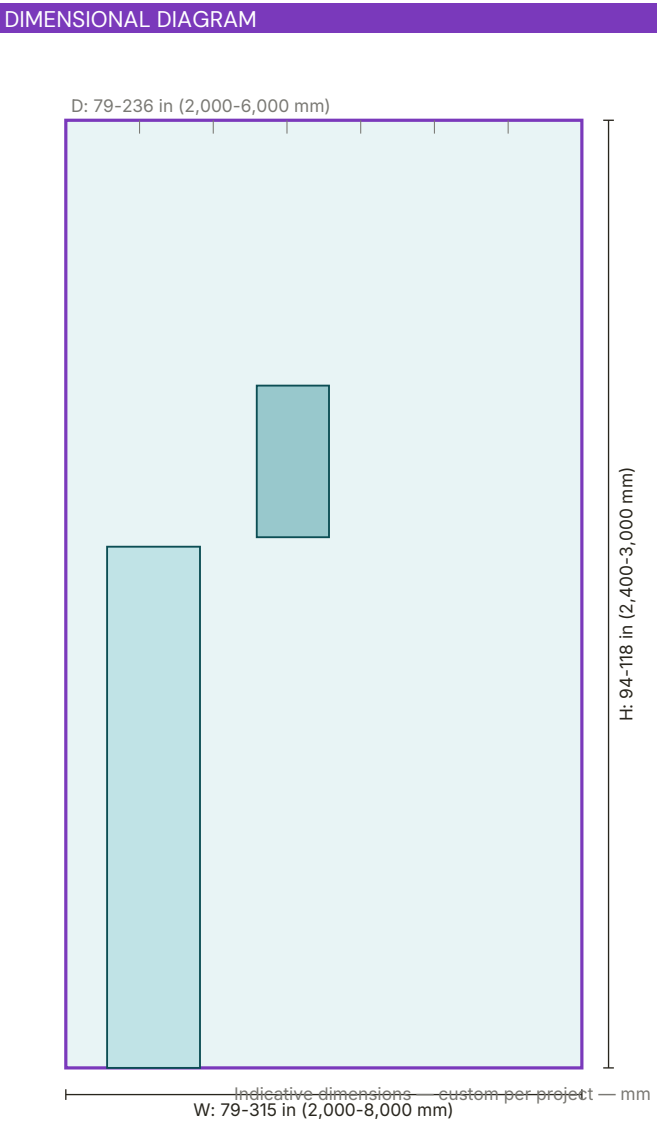
Pharmaceutical Stability & GMP Chamber

Chamber for ICH Q1A(R2) stability testing, API storage, GMP production environments, and medicinal plant cultivation. Every drug approved by FDA, EMA, or PMDA must pass stability tests conducted under precisely documented and validated conditions (IQ/OQ/PQ). Tolerances: +/-3.6 degF (+/-2 degC) temperature, +/-5% RH humidity. FDA 21 CFR Part 11 compliant.

KEY SPECS		
Parameter	Value / Range	Notes
Long-term (Zone I-II)	77 degF +/-4 / 60% RH +/-5%	12-60 months; FDA/EMA
Intermediate	86 degF +/-4 / 65% RH +/-5%	6-12 months
Accelerated	104 degF +/-4 / 75% RH +/-5%	6 months — stress test
Refrigerated	41 degF +/-5 degF	APIs & biologics storage
Frozen	-4 degF +/-9 degF	Long-term biologics storage
Photo-stability	ICH Q1B UV/vis controlled	Photolytic degradation study
GMP Cleanroom	64-72 degF / 40-60% RH	HEPA, positive pressure ISO 7/8

- MAIN APPLICATIONS
- API and finished drug stability testing: mandatory for FDA/EMA approval
 - GMP production rooms: HEPA-filtered HVAC, positive pressure, ISO 7/8 classification
 - Sample and raw material storage: -4 degF to +77 degF (Eur. Pharm. / USP)
 - Medicinal plant cultivation under GMP: therapeutic cannabis, Hypericum
 - Photo-stability UV/vis testing: photolytic degradation of photosensitive drugs
 - IQ/OQ/PQ validation with NIST-calibrated sensors; 21 CFR Part 11 audit trail

COMMERCIAL OPPORTUNITIES	
Target / Customer	Commercial Opportunity
CROs & Analytical Labs	ICH stability chambers turnkey; IQ/OQ/PQ validation included
Pharma Manufacturers	GMP stability rooms; 21 CFR Part 11; LIMS/ERP integration
Biotech & Cannabis	GMP environments for medicinal cultivation and bioprocesses
Hospitals & Clinics	Biologics, vaccines, blood products storage; -4 to +41 degF



SECTOR 4 — DEFENSE & MILITARY

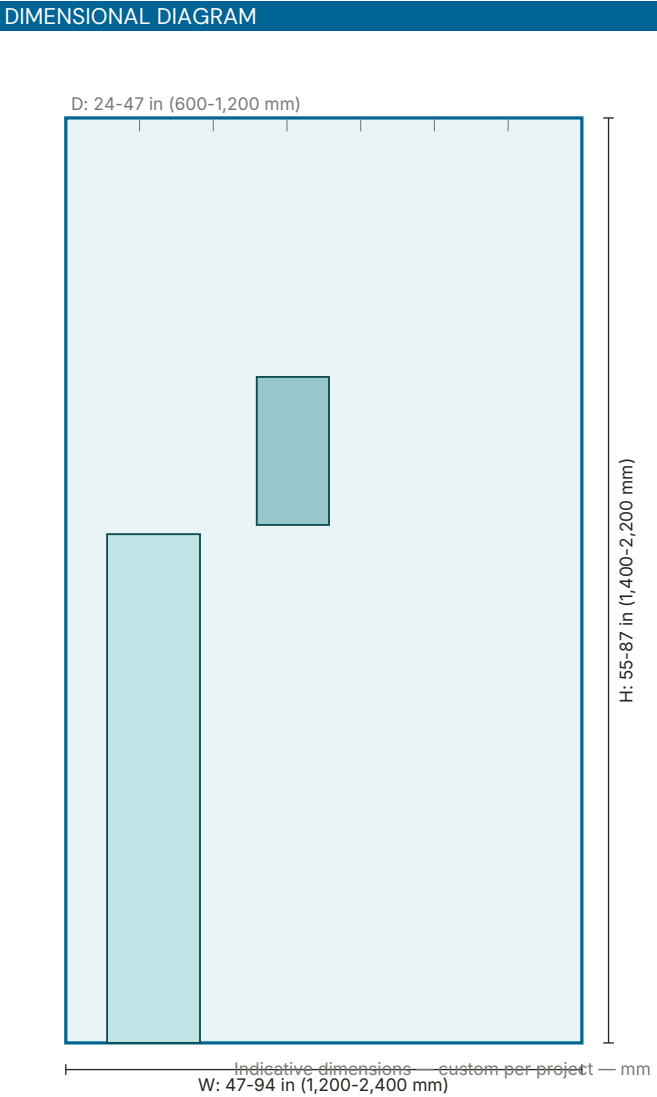
Defense & Military Climate Chamber / ECU

The military market breaks into two segments: equipment qualification testing (MIL-STD-810) in fixed laboratory chambers, and field environmental control (ECU — Environmental Control Unit) for shelters, containers, and deployed structures. Essentia addresses both with technical documentation suitable for DoD/GSA procurement and Italian/NATO Defense.

KEY SPECS		
Parameter	Value / Range	Notes
Operating Temp.	-40 to +140 degF (-40/+60 degC)	Arctic/desert range available
Test Chamber Temp.	-94 to +185 degF (-70/+85 degC)	MIL-STD-810 methods 501-503
Rel. Humidity	10%-98% RH	Method 507.5 - tropical/naval
Thermal Shock	DeltaT >=90 degF in <5 min	Avionics, missiles, field electronics
Salt Fog (opt.)	5% NaCl at 95 degF +/-4	Method 509 - naval systems
CBRN Filtration	NBC filtration available	Contaminated environments
Power Supply	Single/three phase; genset-ready	NATO generator interface

- MAIN APPLICATIONS
- MIL-STD-810 qualification testing: high/low temp., thermal shock, humidity
 - Field ECUs: heating/cooling for shelters, tents, tactical command posts
 - Cold storage for medicines and vaccines: humanitarian missions, field hospitals
 - Li-ion battery testing for military vehicles and drones (growing segment)
 - Mobile BSL-2/3 laboratories: CBRN response, field biosafety
 - NATO interoperability: weight/footprint certified for air, sea, and land transport

COMMERCIAL OPPORTUNITIES	
Target / Customer	Commercial Opportunity
Italian Defense / NATO	Procurement contracts; STANAG-compliant climate labs
US DoD / GSA Schedule	CAGE code + GSA; ECUs and test chambers for Air & Missile Defense
Tier-1 Defense Contractors	OEM supply to Leonardo, MBDA, Raytheon, L3Harris
Humanitarian / PKO Missions	Container cold storage vaccines, BSL kits; CBRN readiness



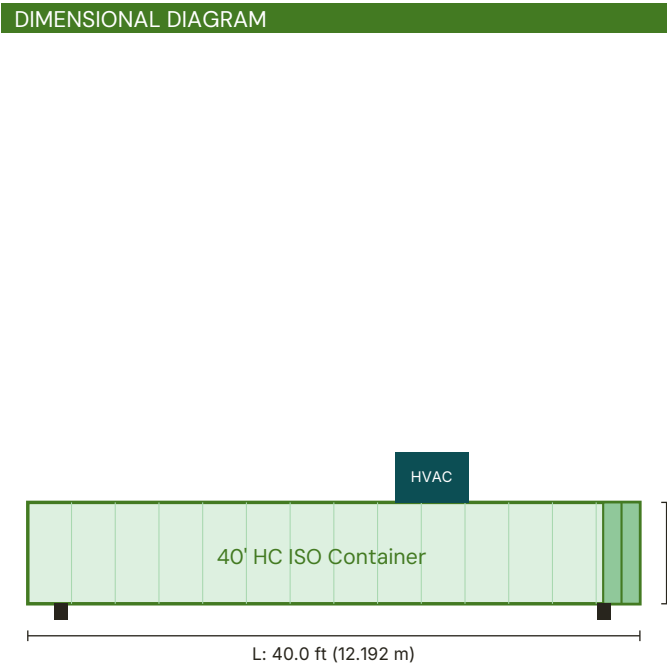
SECTOR 5 — CONTAINERIZED & DEPLOYABLE SOLUTIONS

Containerized Climate Lab & Deployable Growing Unit

Climate chamber integrated into a 20 ft or 40 ft HC ISO container: mobility, rapid deployment (24-48 hours), and operational self-sufficiency. The containerized solution is a cross-sector delivery format: the same core HVAC platform adapts to research, microgreens, pharma, and defense — transportable by ship, rail, or truck with no special permits required.

KEY SPECS			MAIN APPLICATIONS		
Parameter	Value / Range	Notes	• Mobile ag R&D: containerized pilot growing units for USDA, universities, seed cos. • Container urban farms: microgreens and greens for zero-mile restaurant/grocery supply • Mobile pharma labs: field stability testing, deployable cold chain anywhere • Military CBRN ECUs: climate-controlled shelters, field hospitals, vaccine cold storage • Traveling demo units: trade shows, customer sites, and project developers • Modular scalability: multiple containers side-by-side or stacked as production grows		
Base Structure	20 ft or 40 ft HC ISO	Structural reinforcement + insulation			
Insulation	Up to R25-R28 PIR/PUR	Class A2 fire rating			
Interior Temp.	14-113 degF (-10 to +45 degC)	Extended range on request			
Humidity RH	30%-95% RH	Active humidification/dehumidification			
Utilities	Panel + HVAC + opt. water	Generator interface available			
Off-grid	Diesel gen., solar, batteries	Energy self-sufficiency option			
Deployment	Operational in 24-48 hrs	Plug & play electrical hookup			

COMMERCIAL OPPORTUNITIES	
Target / Customer	Commercial Opportunity
USDA ARS & Universities	Traveling R&D containers; comparative trials in remote fields
Restaurants & Urban Farms	Container microgreens turnkey; 0-mile, traceable, on-demand
Pharma & Biotech	Mobile BSL labs; cold chain in areas without infrastructure
Defense & Humanitarian	CBRN ECUs; vaccine cold storage; prefab field hospitals



40' HC: 40.0 x 8.0 x 9.5 ft (12.192 x 2.438 x 2.896 m) | 20': 20.0 x 8.0 x 8.6 ft