

CONTROLLED ENVIRONMENTS



EQUIPMENT HOUSES

CLEANROOMS

application specific engineered building systems

PLC SHELTERS

CONTROL ROOMS

ASEPTIC MANUFACTURING AREAS

NOISE CONTROL ENCLOSURES

QUALITY ASSURANCE TEST & INSPECTION

TEMPERATURE & HUMIDITY CONTROL

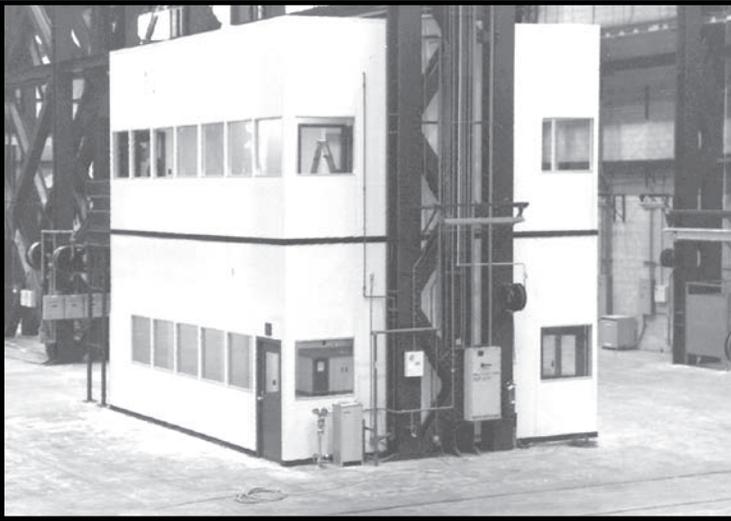
REMOTE INTERACTIVE MONITORING & CONTROL



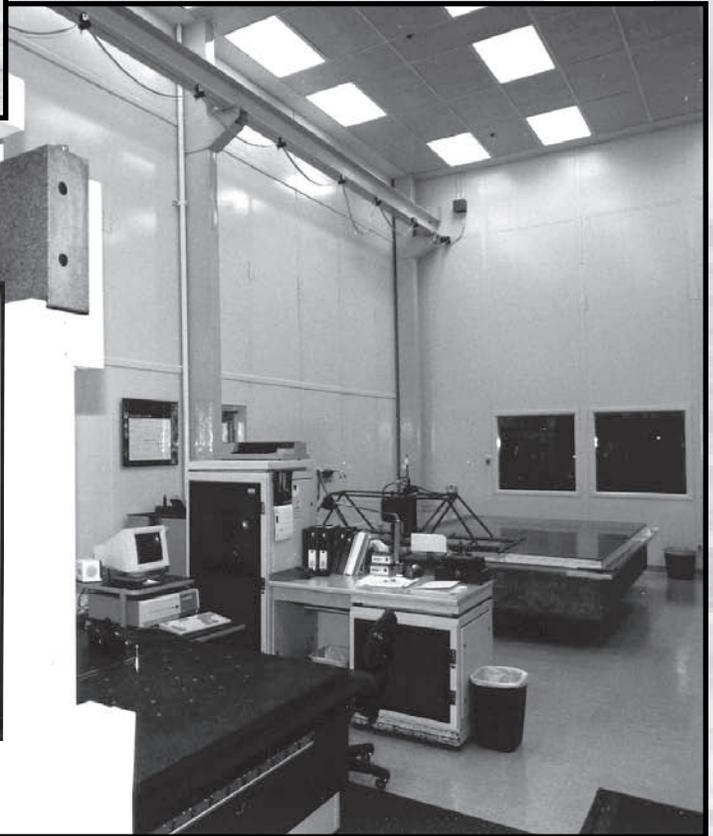
PRECISION PRODUCTION ENVIRONMENTS

BUILDINGS ■ ROOMS ■ ENCLOSURES

CREATING THE BETTER



Left: Multipurpose complex within metal working production area provides quiet space and conditioned air needed for conference and media rooms, engineering suites, as well as an employee cafeteria.



Above: Metrology Laboratory: Temperature and humidity precisely controlled to permit traceability to the National Bureau of Standards.



Training rooms located adjacent to an automobile assembly area provide acoustical privacy. Operable acoustical walls quickly divide larger areas into smaller meeting rooms.



PHOENIX-E structures provide protection for employees and sensitive equipment from unacceptable conditions such as dust, humidity, temperatures, noise and hazardous elements:

- Hazardous (H) Occupancies
- Industrial Cleanrooms
- Production Environments
- Noise Control Systems
- Control Rooms
- PLC Enclosures
- Product Diagnostic Rooms
- QC Test Chambers
- Laboratories
- Test Cells
- Temperature - Humidity Control

Permit Series controlled environments are provided for critical manufacturing equipment, controls, personnel or processes in harsh or hostile conditions.

Functional Building systems are engineered for personnel occupancy in areas where toxic materials, fire or explosion hazards may exist due to gases, vapors, flammable liquids or combustible particulate.

Enviro-Con enclosure systems establish environments to precise tolerances needed to maintain standards of quality in manufacture, assembly, and process.

Temperature, humidity and airborne contamination are regulated for such applications as cleanrooms, clean zones, laboratories, precision production, photometric testing, and sanitizing operations.



Cleanroom ventilation is incorporated as part of the PHOENIX-E modular panel construction.

PHOENIX-E BUILDING

PHOENIX-E BUILDING SYSTEMS

have included structures for:

- Power generation
- Petrochemical
- Primary metals
- Manufacturing
- Food
- Electronics
- Technology

Special-building systems

developed as standard products can match a variety of specialized applications: **Permit Series** interior and exterior buildings and the **Enviro-Con** enclosure systems are each available in a variety of constructions and materials.

OPTIONS

Noise control panel systems
Raised floors
Relocatable structural skids
Elevated structures
Removable panels
Rigid frame or self-framing designs

WALL CONSTRUCTION AND FINISHES

Aluminum
Galvanized steel
Stainless steel
Prefinished steel
Powder Coatings
Plastic Laminate
Fiberglass (FRP)
Melamine

MECHANICAL & LIGHTING

HEPA & ULPA air filtration
Purging equipment
PLC Controlled Environments
Recording & monitoring devices
Interactive control systems
Plumbing kits for gas and liquids
Uninterruptable and emergency power
Clean power
Explosion-proof electrical systems



Left: Administration of aircraft support maintenance within the hanger is conducted in buildings complete with explosion proof electrical, fresh air ventilation, and noise control.



Incoming materials inspection facility. Equipment is tested and calibrated as required prior to being released for use on board aircraft.



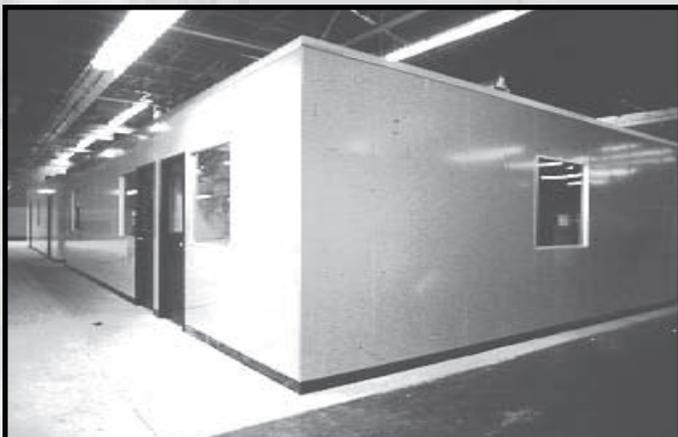
Multiple cleanroom classifications are established within the same building envelope utilizing clear vinyl softwall panels.



Electronic instrumentation is tested at a constant 131° F prior to acceptance and shipment to the customer.



Test enclosure for hazardous machinery device evaluation. Controls and monitors to regulate the test environment as well as both wet and dry fire suppression are installed.



Insulated steel faced panels with baked enamel finish are assembled without the use of exposed joining hardware to provide a clean contemporary surface.

PROJECT ADMINISTRATION

Occupancy schedules from project start-up to completion are shortened. Last minute changes in building layout, necessary power or communication utilities, and occupancy configurations are readily accommodated.

Turn-key responsibility for the design and construction of related work, obtaining building permits, coordination with other trades, and interface with the customer representatives is regularly provided by **PHOENIX-E**. When requested, fast track schedules, where engineering and fabrication is concurrent, are established as part of the construction management process.

Clean construction means less disturbance to existing manufacturing occupancy activities. Occupancy and system start-up is quick and reliable with less construction contamination needing to be removed.

Future requirements efficiently accommodated by the component systems which speed and substantially reduce the expense of alterations. Power and telecommunications, for instance, can be quickly relocated or placed generally without significant alterations to the building itself.

TRACEABLE AND THIRD-PARTY CERTIFIABLE

Temperature and humidity limits are precisely controlled as necessary for critical processes, production, or testing.

When needed, conditions are controlled to permit traceability to the National Bureau of Standards.

Cleanliness levels are engineered into the room and enclosure mechanical package to comply with ISO and Federal Specification 209 regulations. (Classifications are shown in Table 1 and Table 2 on page 7.)

CONTROLS AND DATA COLLECTION TO COMPLY WITH ISO REQUIREMENTS

To precisely control and document performance of the interior environments, measurement and monitoring systems are integrated into the mechanical equipment design.

Additional to standard data collection tools such as graphic recorders, PLC and computer technology readily permit optional computer based (PC) graphical user interface and remote monitoring and adjustment of the mechanical systems.

Indoor Air Quality Design

Adequate ventilation for health as well as comfort are typically specified by local building codes. As a guide for planning purposes, the following alternate procedures may be used to estimate the amount of outside or makeup air needed.

The quantities of air required can be based on (1) established recommended air changes based upon type of occupancy, (2) the number of occupants or (3) the anticipated gain within the space from equipment as well as occupants.

Outdoor air requirements may be reduced if appropriate filtration equipment or methods are employed.

Method 1. Air change method.

	Typical air changes required per minute:
Assembly Halls	3-10
Boiler Rooms	2-4
Engine Rooms	1-1.5
Garages	2-10
Generating Rooms	2-5
Machine Shops	3-5
Transformer Rooms	1-5
Turbine Rooms	2-6
Warehouses	2-10

$$\text{CFM} = \text{Room Volume} / \text{Air Change Frequency}$$

Method 2. Occupant load method:

	CFM per person	Persons/ 1000 ft ²
Auditoriums	15	150
Conference Rooms	20	50
Laboratories	20	30
Office Space	20	7

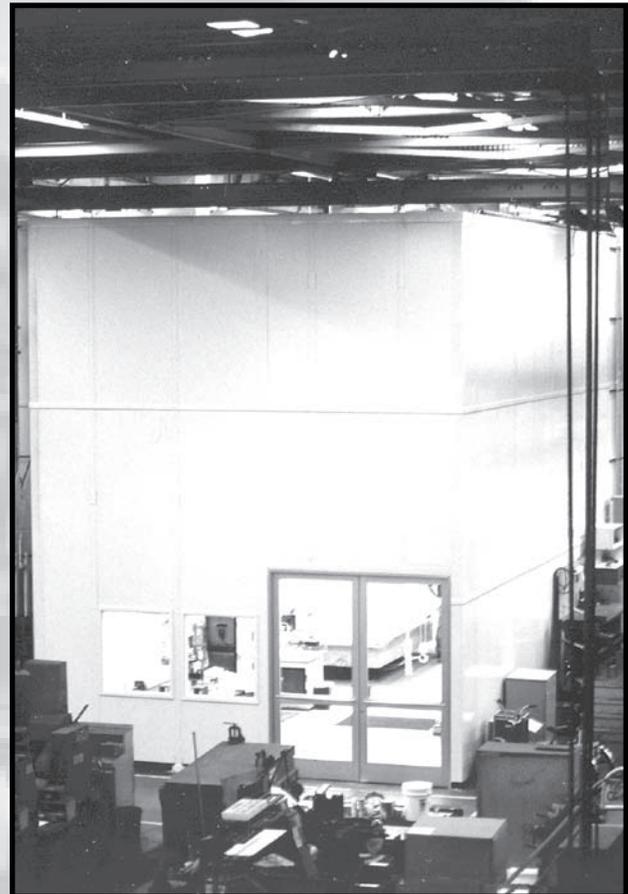
$$\text{CFM} = \text{Number of persons} \times \text{Outdoor Air Requirement}$$

Method 3. Heat gain from occupants in conditioned space:

	Sensible Heat (BTUH)	Latent Heat (BTUH)
Offices	215-220	185-230
Factories	240-510	510-940

When outside air is cooler, appropriate ventilation also provides methods for "free" cooling. In addition to occupants, include heat gains from equipment in conditioned space:

$$\text{CFM} = \text{Heat Removal (BTUH)} / (1.10 \times \text{temperature difference})$$



Temperature gradient within 20'-0" cleanroom is maintained at $\pm 1^\circ \text{F}$ over one meter.



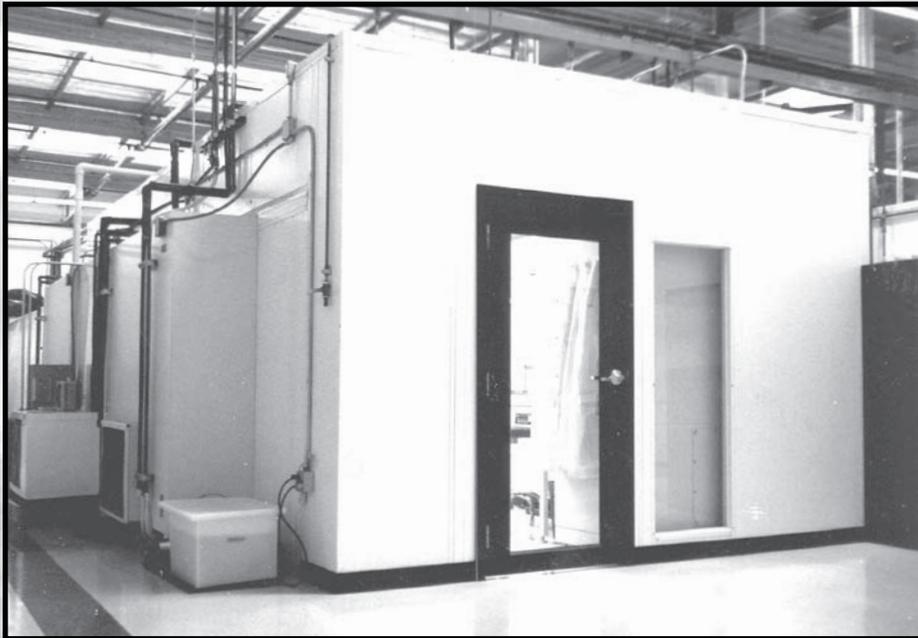
Above: Full inspection and measurement is efficiently accomplished under aseptic conditions.



Above: Particulate infiltration is controlled by the use of an air-shower.

ENVIRONMENT CRITERIA

USER CRITERIA GUIDELINES FOR ESTABLISHING CONTROLLED ENVIRONMENTS



Series of prefabricated cleanroom suites are used for the inspection of CD master copies prior to distribution.

In determining the scope of work required to meet the operating requirements for a critical environment including equipment required and room characteristics, the following minimum criteria and checklist are relevant to a variety of applications:

- Equipment and processes to be employed.
- Material classification and characteristics.
- Room specifications: humidity and temperature tolerances.
- Cleanliness demanded by the activities.
- Fire, corrosive or toxic hazards present.
- Electrical power / devices necessary.
- Telephone, and other communication equipment / wiring.
- Number of personnel using the new facility.
- Ambient temperature / humidity within the existing building.
- Waste heat from such equipment as ovens and motors.
- Existing available air conditioning equipment.
- Room wall, ceiling and floor finishes.
- Types of fire suppression systems permissible or compatible.
- Available utilities such as power, water, drainage.

FIGURE 1: ISO/TC209 14644-1 Airborne Particulate Cleanliness Classes

ISO Class	Concentration Limits (particles/m ³)					
	0.1µm	0.2µm	0.3µm	0.5µm	1µm	5µm
ISO Class 1	10	2				
ISO Class 2	100	24	10	4		
ISO Class 3	1,000	237	102	35	8	
ISO Class 4	10,000	2,370	1,020	352	83	
ISO Class 5	100,000	23,700	10,200	3,520	832	29
ISO Class 6	1,000,000	237,000	102,000	35,200	8,320	293
ISO Class 7				352,000	83,200	2,930
ISO Class 8				3,520,000	832,000	29,300
ISO Class 9				35,200,000	8,320,000	293,000

FIGURE 2: Federal Standard 209 E Airborne Particulate Cleanliness Classes

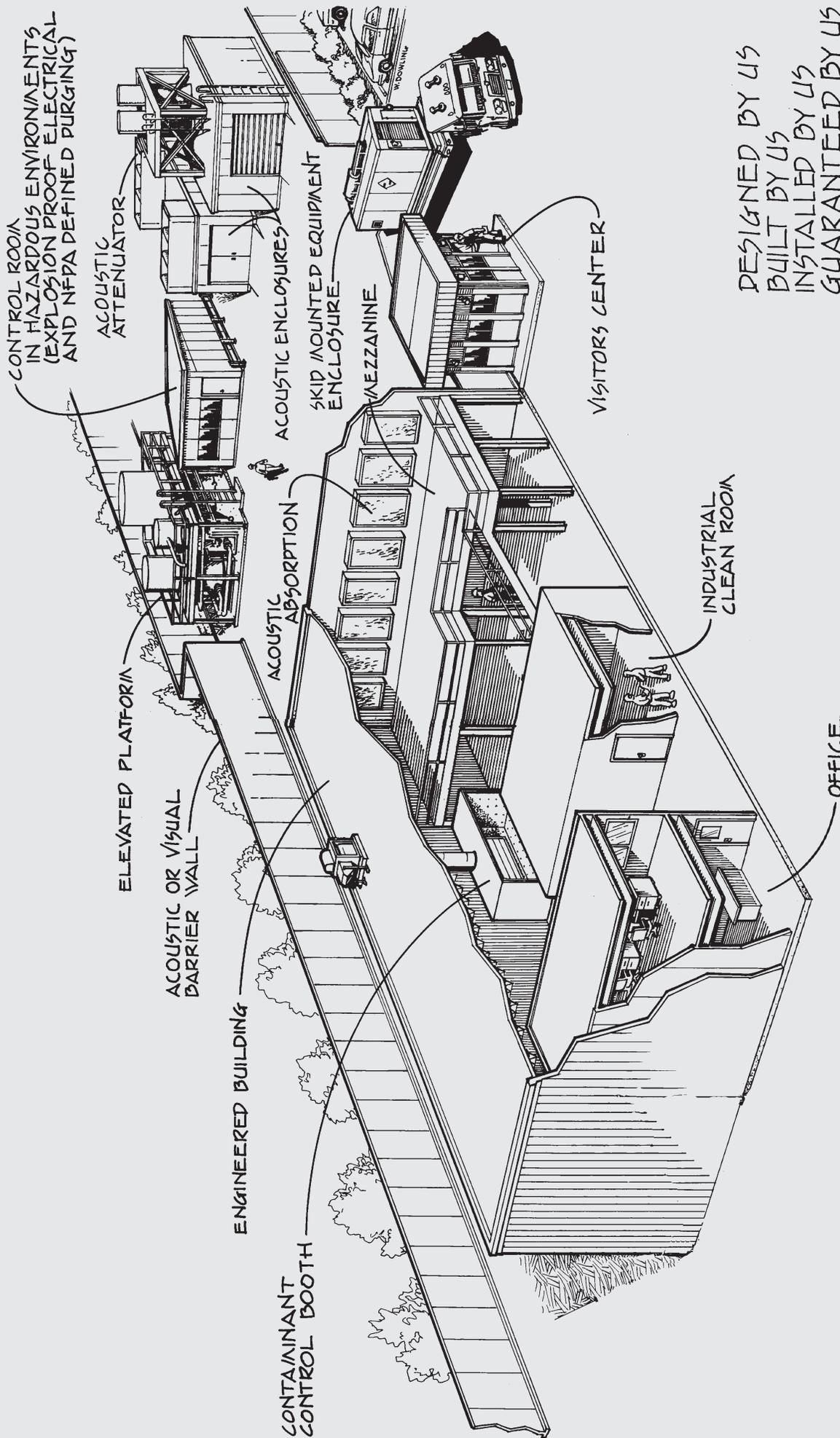
SI	Class Name	Class Limits									
		0.1 µm		0.2µm		0.3µm		0.5µm		5µm	
		Volume Units	Volume Units								
	English	m ³	ft ³								
M1		350	9.91	75.7	2.14	30.9	0.875	10.0	0.283		
M1.5	1	1,240	35.0	265	7.50	106	3.00	35.3	1.00		
M2		3,500	99.1	757	21.4	309	8.75	100	2.83		
M2.5	10	12,400	350	2,650	75.0	1,060	30.0	353	10.0		
M3		35,000	991	7,570	214	3,090	87.5	1,000	28.3		
M3.5	100			26,500	750	10,600	300	3,530	100		
M4				75,700	2,140	30,900	875	10,000	283		
M4.5	1,000							35,300	1,000	247	7.00
M5								100,000	2,830	618	17.5
M5.5	10,000							353,000	10,000	2,470	70.0
M6								1,000,000	28,300	6,180	175
M6.5	100,000							3,530,000	100,000	24,700	700
M7								10,000,000	283,000	61,800	1,750

Creating the better workplace...

ACOUSTIC ABSORPTION
ACOUSTIC CERAMIC PANELS
ACOUSTIC DOORS AND WINDOWS
ACOUSTIC TEST CHAMBERS
AIRCRAFT MAINTENANCE DOCKS
AIRCRAFT RUN UP SUPPRESSORS
BLOWDOWN SILENCERS
BLOWER NOISE CONTROL
BREAK ROOM
CLEAN ROOMS
COGENERATION NOISE CONTROL
COMMUNITY NOISE CONTROL
COMPRESSOR ENCLOSURES
COMPUTER ROOMS
CONFERENCE ROOMS
CONTROL ROOMS
COOLING TOWER NOISE CONTROL
CURTAIN SYSTEMS
DUCT SILENCERS
DYNAMOMETER TEST ROOMS
ELEVATED OFFICES
EQUIPMENT ENCLOSURES
EQUIPMENT PLATFORMS
EXPLOSION PROOF ELECTRICAL
FD FAN SILENCERS
FLOATING FLOORS

FREESTANDING BARRIERS
GENERATOR ENCLOSURES
GRINDING STATIONS
HAZARDOUS MATERIALS STORAGE
HIGHWAY NOISE BARRIERS
INDOOR SHOOTING RANGES
JET ENGINE TEST CELLS
LABORATORIES
LASER TEST ROOMS
LIGHT TIGHT ROOMS
MAINTENANCE
MANUFACTURING MEZZANINES
MUSIC PRACTICE ROOMS
NFPA X, Y, AND Z PURGING
NO_x EMISSION CONTROLS
OPERABLE WALLS
PARTICULATE CONTROL
PERSONNEL TRAINING ROOMS
PHOTOMETRIC FACILITIES
PLASMA SPRAY ENCLOSURES
PLC CONTROL ROOMS
PLENUMS
PORTABLE BUILDINGS
PORTABLE NOISE SHELTERS

PRINTING PRESS NOISE CONTROL
PUMP ENCLOSURES
RAILWAY NOISE CONTROL
RECEIVING FACILITIES
REFINERY NOISE CONTROL
RF SHIELDED BUILDINGS
SANITARY CEILINGS AND WALLS
SELF FRAMING BUILDINGS
SEMI CLEAN ROOMS
SHOP AREAS
SILENCERS
SOFTWALL BARRIERS AND ENCLOSURES
STACK STUFFERS
STORAGE MEZZANINES
SUPERVISORIAL OFFICES
TEMPEST FACILITIES
TEST CELLS
TEST LABORATORIES
THERMAL PANEL SYSTEMS
TRANSFORMER ENCLOSURES
TUMBLER ENCLOSURES
TURBINE GENERATOR ENCLOSURES
TURBINE PUMP ENCLOSURES
VIBRATION ISOLATION



DESIGNED BY US
 BUILT BY US
 INSTALLED BY US
 GUARANTEED BY US

CONTROL ROOMS • PLC SHELTERS EQUIPMENT & PROCESS HOUSES NFPA PURGED FACILITIES VISITOR RECEPTION CENTERS NOISE CONTROL ROOMS & ENCLOSURES

Building Design

PHOENIX-E buildings are engineered to be rugged, durable and to withstand harsh or demanding industrial environments.

Roofs and sidewalls are made of heavy industrial gauge interlocking steel panels with a protective coating having a life expectancy of up to 20 years. Components have been computer designed to meet and, in most cases, exceed the most rigorous building codes.

Such buildings have ready application as microwave shelters, PLC shelters, control rooms, equipment enclosures, and process or quality control stations.

PHOENIX-E buildings are designed for easy field erection or can be factory assembled and shipped ready for use.

Thermal Efficient

PHOENIX-E's wide variety of roof, ceiling, and wall insulating systems, ranging from inexpensive faced fiberglass to high performance bonded foam systems, allow you to have a building system that meets your insulating need without exceeding your budget.

Explosion Proof

When specified, **PHOENIX-E** can provide building systems for interior or exterior use which meet the stringent NFPA safety requirements for explosive, flammable, or toxic environments.

Group H-Occupancies

PHOENIX-E buildings are engineered and fabricated to minimize the hazards of the workplace as prescribed by the local building codes.

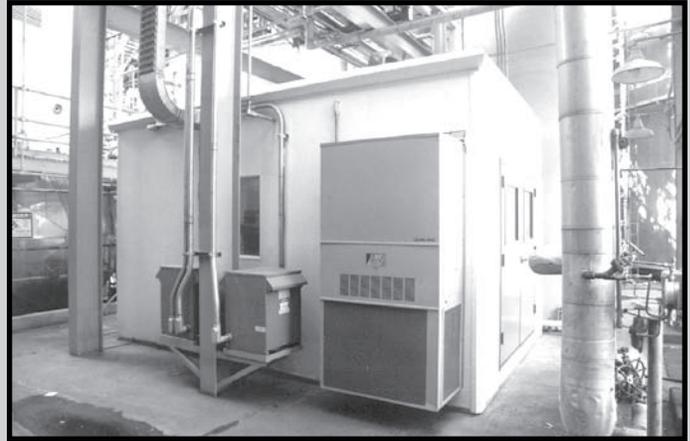
Bullet Resistance

PHOENIX-E can provide, as an option, economical wall systems that have been independently tested and rated. These bullet resistant systems allow easy field assembly of light weight wall components that can be installed without power equipment.

Portable and Expandable

The interlocking, all bolted, panel system utilized for both the roof and walls may easily be modified in the future. When the building must be portable, **PHOENIX-E** will provide the building pre-assembled on a steel skid with floor system. These buildings are easily moved with a forklift; lifting eyes for use with overhead crane can also be provided when necessary.

Portable buildings are generally wired with the basic electrical services by **PHOENIX-E**.



Temperature controlled, sound attenuating panel construction protects computer systems used in the manufacture of electric power.



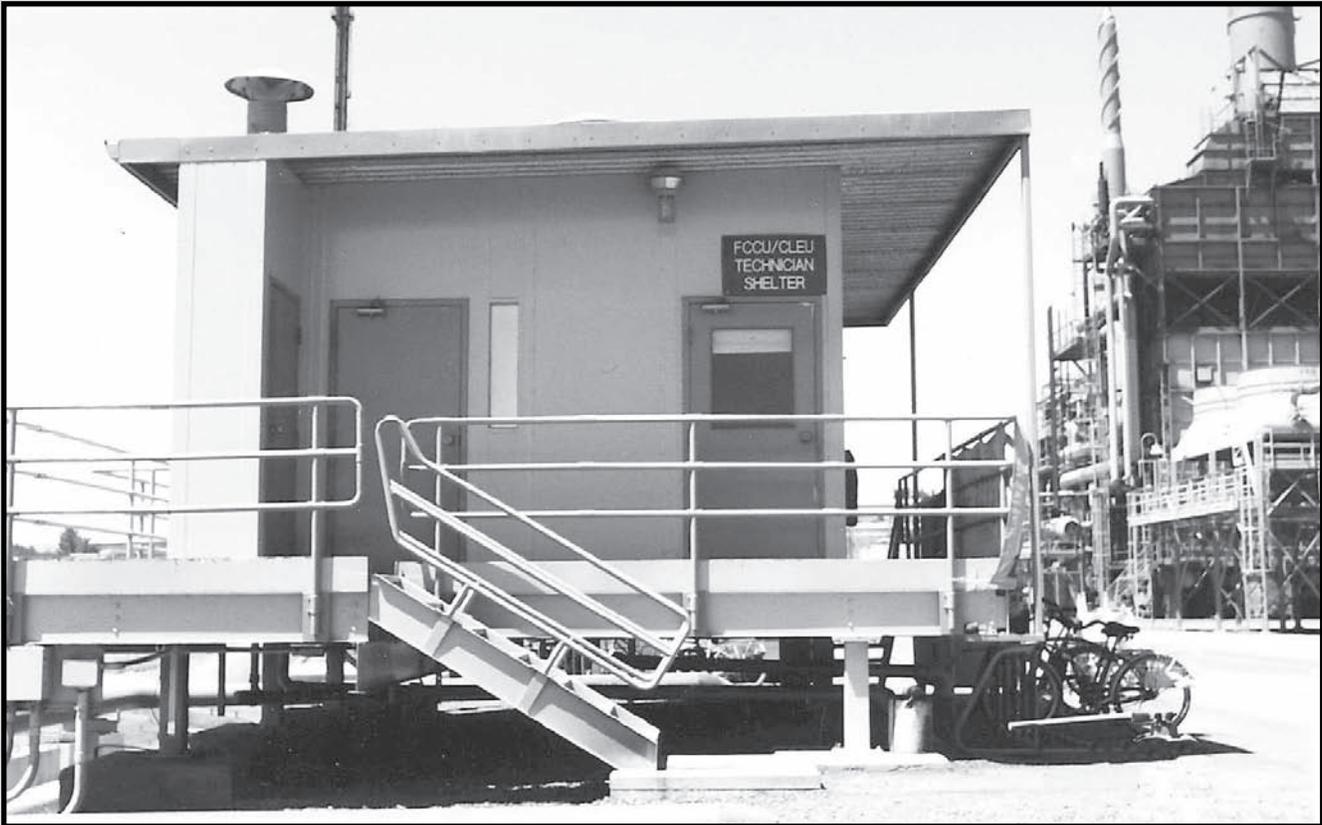
Personnel and equipment within the control rooms are isolated from high temperatures, dirt and noise. The building is self-contained, complete with emergency power systems, housing the computerized operating system at this automated cement batch plant.



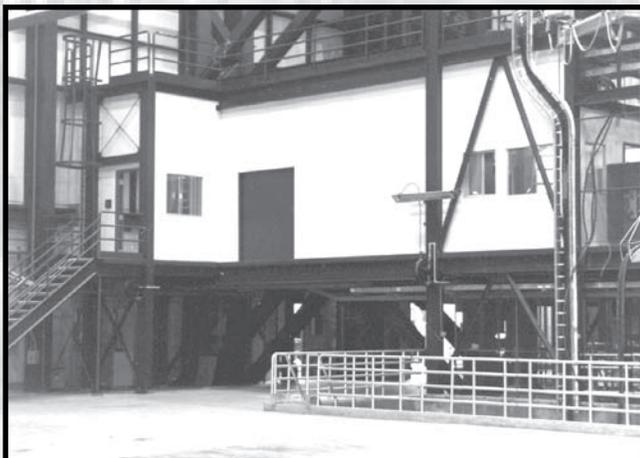
Aircraft maintenance is monitored on hanger floor. Self-contained quality assurance pods are forkliftable and positioned adjacent to tasks.

BUILDING SYSTEMS

Visitor reception center shields attendant and provides a quiet and conditioned space for monitoring security activities.



Elevated to eliminate hazards from heavier-than-air gases, the **Permit Series** Functional Building is located at the refinery production process. It contains a quality control chemical laboratory, lavatory and kitchen area. Air conditioning is provided through a pressurized system which simultaneously filters hazardous chemical vapors and purges the interior space.



Engineering, maintenance, and small equipment calibration are accomplished adjacent to heavy equipment repair operations.

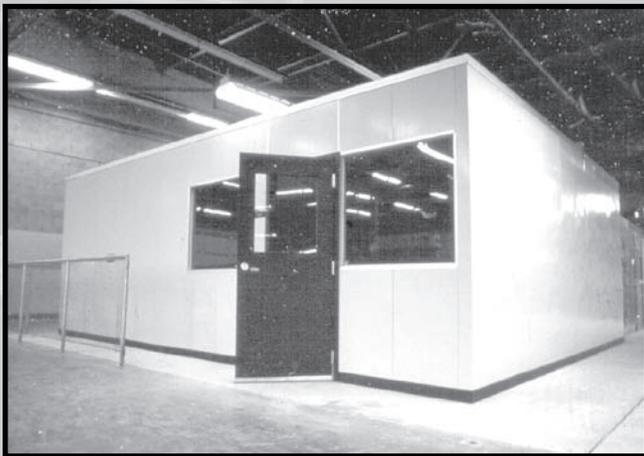


Prefabricated security shelters incorporate electronic surveillance and communication equipment.

PERMIT SERIES

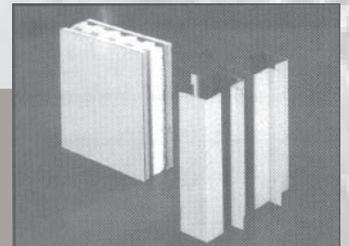


Self-contained, sound proof buildings: Conference rooms, offices, and quality control laboratories are installed immediate to the production areas. Cleanable, all steel exteriors maintain appearance under severe industrial environments.



STEEL SERIES

The main stud section is fabricated of 16 gauge steel and provides primary support.



Removable stud covers provide easy access to wiring or other concealed utilities without compromising the studs structural integrity. The stud support system is flush with the panel providing a contemporary and smooth appearance.

Wall section is steel faced on both sides for exceptional durability. Vinyl faced interior finishes are also available as standard.

ENVIRONMENTS



SPECIFICATION: PERMIT SERIES

WALL PANELS

Noncombustible 3-1/4" thick panel consisting of a 2" polystyrene core laminated on both sides with (select):

- 1/2" Gypsum Board
- Steel
- Aluminum
- Fire Rated FRP Assembly

Panels to be finished on both sides with (select):

- Polyester Baked-enamel
- Field Applied Enamel
- Epoxy Coating
- Vinyl Laminate
- Plastic Laminate
- Anodize

STRUCTURAL JOINERS

Panel system studs and connecting hardware to be fabricated of galvanized 16 gauge steel or extruded aluminum to match the building panel system or application.

Studs shall provide concealed chase with removable cover plates to permit the installation of electrical service vertically and accept standard device hardware.

DOORS

Standard doors and frame shall be 36"x80" insulated (R-12), 20 gauge steel with sweep, prehung in an 18 gauge weather stripped steel frame. Door shall be equipped with 1-1/2" pair of chrome plated hinges and stainless steel levered lockset (option: heavy-duty door closure).

When specified, doors will be provided with a 24"x30" window glazed with 1/4" tempered safety glass.

WINDOWS

Windows shall be fixed, non-operable type with heavy duty frame. Glass to be 1/4" tempered safety and shall be mounted with resilient glazing stops.

Where shown on the drawings, lockable vertical and horizontal sliding windows will be provided. Glass to be 1/8" thick tempered safety.

CEILING

Standard ceiling shall consist of a prefinished metal grid and lay-in acoustical, noncombustible white mineral board with R-19 insulation (R-31 insulation optional).

ROOF DECK

Roof deck is 22 gauge ribbed steel, minimum 1-1/2" deep and cut to length. Deck shall be supported by structural framing channels or beams as required.

STRUCTURAL

Standard buildings to be engineered and constructed in accordance with the Uniform Building Code for lateral, seismic,

specified collateral, and live loads.

When specified, calculations and sealed drawings prepared by a licensed structural or civil engineer will be furnished after final approval of the submittal drawings.

Elevated or multistory structures will utilize a unitized structural frame assembly in conjunction with the Permit Series self-framing panel system to provide a structure in compliance with the UBC.

Compliance with other applicable building codes will be as specified at time of proposal.

SKID/LIFTING ATTACHMENTS

A structural skid can be provided with forklift pockets and/or lifting rings when specified.

SLAB REQUIREMENTS

The building and structural system shall be installed on a concrete pad. The slab thickness shall be as dictated by the local building codes.

As a minimum requirement, buildings should be assembled on a concrete slab not less than 4" thick and 2" wider than the building on all four sides. Larger buildings and elevated or long-span platform structures will generally require thicker foundations. (Unless otherwise specified, the customer is responsible for the foundation on which the building or structure will sit.)

EXTERIOR ROOF

Exterior roof shall consist of an interlocking metal formed roof system or a composite consisting of single-ply membrane roof (minimum 60 mil) bonded to tongue and groove plywood decking. Perimeter to be steel gutters or fascia trim. Mansard or vertical facades shall, when specified, be provided as shown on the drawings.

BASE TRACK

Track shall be roll-formed steel channel to be field attached to structural angle clips. Angle will complete the structural frame and provide a rigid connection for the wiring studs. Interior of track will be finished with standard vinyl base.

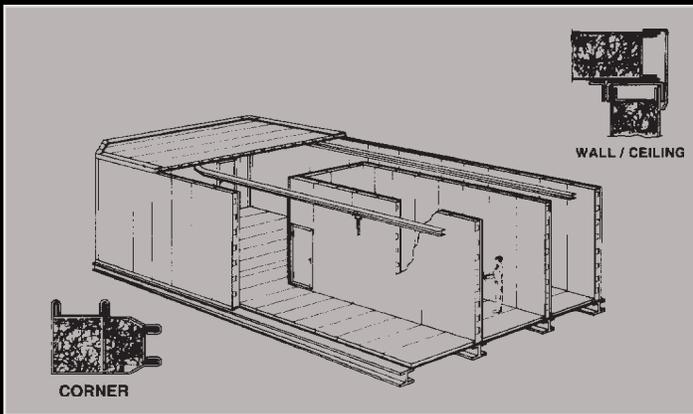


ENCLOSURES FOR PRODUCTION

ENVIRO-CON CONTROLLED ENVIRONMENTS

PHOENIX-E controlled environments provide precise humidity and temperature control necessary for critical production or processing. Conditions are controlled to permit traceability to the National Bureau of Standards. Cleanliness levels are engineered into the enclosure systems as packaged or module equipment to meet the current ISO and Federal Specification 209 regulations.

The versatility of the **PHOENIX-E** thermal panel systems make them ideal for use as rooms and enclosures for applications requiring low heat transfer.



Durable metal clad composite panels are factory fabricated and finished. These are packed with a high density mineral fiber for maximum thermal insulation and noise absorption. A unique slot in the framing members provides for minimum heat transfer to the enclosure exterior. A complete line of trim and accessories is available.

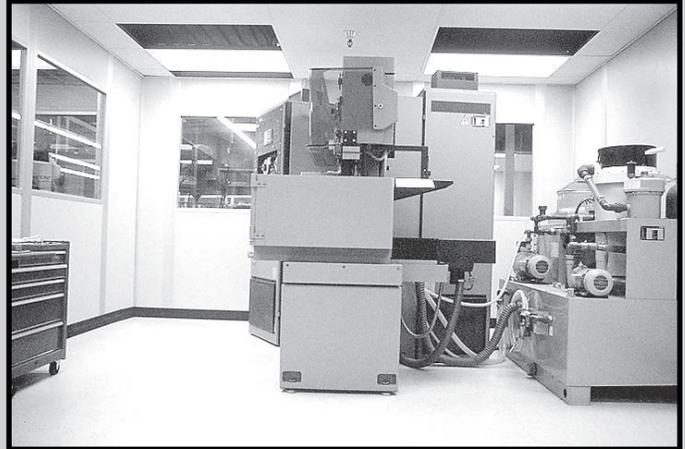
No environmental panel system is more economical to install.

Interlocking tongue and groove connections provide a flush, contemporary design. This panel to panel connection also substantially reduces the time required for installation. Conventional "T", "H" and "batten strip" systems are available for special applications.

PHOENIX-E design allows longer spans to reduce labor and structural costs. (Panels over 30 feet long have been manufactured and installed).

Self-supporting panels eliminate the need for structural steel in all but the largest enclosures.

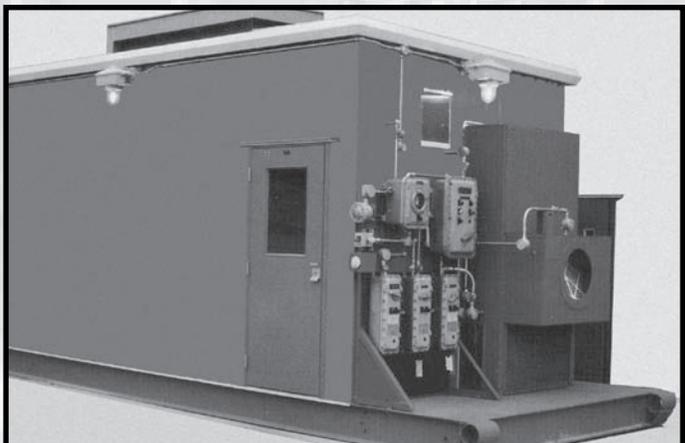
The class A rating for flame spread, fuel contribution and smoke development meets the requirements of NFPA 90.



NC Equipment Enclosure well illuminated and dust free, automated equipment enclosure is generously provided with viewing windows to display this technology as well as continually monitor it's unattended operation.



Quiet conference area for manufacturer of titanium prosthetics.



Skid based building structures enclose standby or emergency power generators, compressors, and communication equipment.

SPECIFICATION

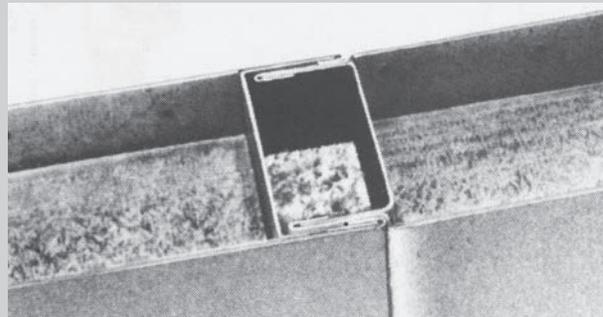
ENVIRO-CON THERMAL PANELS

GENERAL

Furnish and install thermal/acoustical double wall panels as shown on the plans. Panels shall have all specified acoustical, thermal and structural properties as manufactured by **PHOENIX-E STRUCTURES**.

CONSTRUCTION

Panels shall be 4" minimum nominal thickness and shall be fabricated of minimum 20 gauge steel. Sheets are formed with 180° returned edges to provide for secure clamping of the side channels spotwelded to the inner and outer sheets. Panels shall be packed with high density thermal/acoustical insulating material. An interlocking tongue and groove design shall be used to join all the panels.



DOORS shall be fabricated using construction compatible to the panels and be filled with thermal / acoustical insulating materials. The frame shall be fabricated of a minimum of 16 gauge steel. The door assembly will be factory hung to assure alignment of the hardware, leaf and seals. Thermal and acoustical seals shall be utilized as required.

DOUBLE LEAF DOORS shall be of similar construction as the single leaf doors. The assembly shall be shipped KD and prepared for field installation.

DOOR HARDWARE will be in accordance with hardware specifications.

WINDOWS shall be a minimum 1/4" tempered dual pane glass. Laminated, wire, or acoustical windows shall be provided where noted on the drawings.

PERFORMANCE

a. Thermal—Entire panel system shall have "U" factor of (*). Individual panels shall be a "U" factor of (*). Panel manufacturer shall submit design data to verify compliance with the specification.

b. Acoustical—The panels shall provide noise reduction of STC (*). Panels shall have been tested by a recognized independent testing laboratory.

c. Structural—The Enviro-Con enclosure shall be self supporting. Where required, additional structural support shall be provided by the panel manufacturer.

d. Fire Safety—The structure shall meet the specified building codes for Seismic Zone and basic wind speed.

* Specified by customer

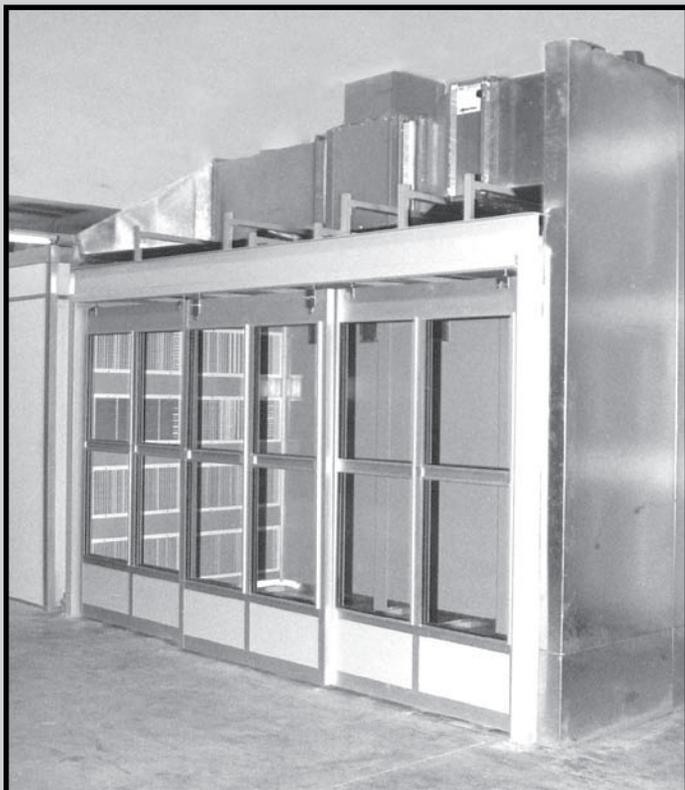
(ASTM Test E 119):

Flame spread.....	15
Fuel Contribution	0
Smoke Development	0

Note flame spread ratings may vary with alternate panel construction.

INSTALLATION

When specified **PHOENIX-E** shall furnish complete, coordinated erection drawings and calculations to include, but not limited to, those pertaining to the structural steel, acoustical structure, electrical and mechanical ,



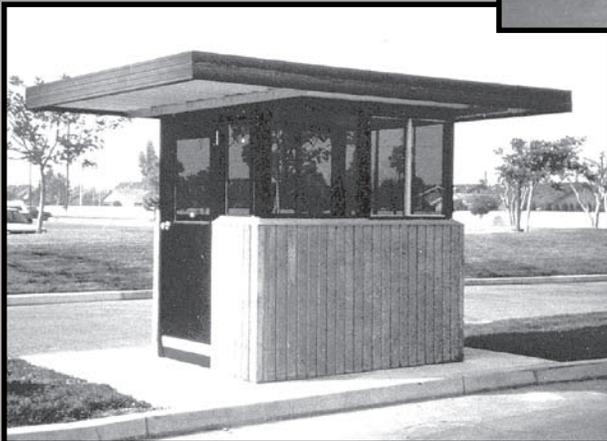
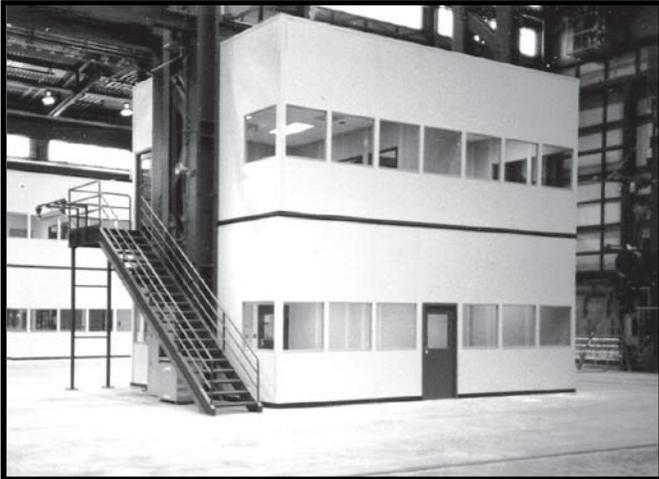
Self-contained mechanical equipment furnishes constant temperature and air flow for testing of communication equipment.



Mezzanine structure optimizes the use of available floor space permitting the installation of offices and laborato-

PHOENIX-E SPECIAL CONSTRUCTIONS

Matching customer requirements with special building system features include elevated platform and mezzanine structures, material transport systems, guard monitoring stations, attendant and visitor reception shelters.




phoenix-E

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