

1.0 **GENERAL BUILDING, CONSTRUCTION, AND PERFORMANCE:**

- 1.1 One (1) factory built, self-contained, relocatable, modular Haz-Safe Building, wide x long x high (including 4" high roof top crane lifting lugs), with overall building footprint of ft.<sup>2</sup>. The interior shall be one whole room, wide x long x high, with a total of ft.<sup>2</sup> of usable floor space. Interior dimensions shall have priority over exterior dimensions. Placement of the module(s) by user's crane at site and user facility's hand wiring of the electrical power supply system to the building's prewired entrance panel(s), interconnection of user supplied operation mechanicals (cabling, plumbing, etc.) at building's prepared penetrations shall complete field installation. (The interior ceiling height is less than or exceeds the OSHA regulation per 29CFR 1910.37(l), Headroom "...shall be so designed and maintained as to provide adequate headroom, but in NO case shall the ceiling be less than 7 feet 6 inches...." Also see Structural Loads, paragraph 1.2.2 and Interior Lighting, paragraph 3.2.1.)

Storage Capacity shall be for up to:

(  ) fifty-five (55) gallon drums or (  ) 4' square pallets stored back-to-front and side-to-side completely filling all available floor space. Total room storage capacity is (  ) gallons in "packed-in" mode.

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(  ) fifty-five (55) gallon drums or (  ) 4' square pallets stored with (  ) wide aisle for inspection and material handling of hand trucks, lifters, forklifts and crane hoists maneuvering capability. Total room storage capacity is (  ) gallons less floor space allowed for aisles.

- 1.2 **PROTECTED CRADLE AND CROWN CONSTRUCTION:** (True heavy gauge steel construction has to do with the quantity and quality (see paragraph 1.4) of the steel used. For example, 1/4" thick steel has, by weight, 186% more steel than 10 gauge which has 281% more steel than 18 gauge! An all-steel building is classified as non-combustible and is acceptable, in most applications, for enclosures of corrosive or toxic chemicals without making the building fire rated. When located more than 75' away from other facilities, roads or property lines, fire rating is not necessary for flammable and combustible chemicals. Should the building require heating or cooling systems, then the walls and ceiling/roof would have to be insulated. The exposed insulation material should be covered for mechanical protection. This can be efficiently achieved with gypsum wall board which incidentally will fire rate the building.)

- 1.2.1 Heavy Duty Building shall have a continuously welded steel skeleton of 1/4" thick wall tubular (square or rectangular) members starting at the cradle (base) with 4" wide x 6" high tubes all around the perimeter. The lifting crown shall have 4" x 4" tubes all around the top of the building. Vertical wall members shall be 2" x 4" tubes in all corners, and on 24" centers shall be 2" x 2" tubes filling in the front, back, and end walls. (Thin common steel, up to 10 gauge thick, for studs, joists or purlins shall not be acceptable as wall or roof members.) There shall be 2" x 4" tubes (non combustible buildings only) or 2-1/2" x 4" or 6" high recessed structural steel channel inside the lifting crown framework (fire rated or insulated buildings) on 24" centers spanning the width of the roof. The

exterior skin of the building shall be 10 gauge temper pass carbon plate steel applied in 48" wide sheets on the walls and roof, spot welded in place every 12" from the inside of the building and seam welded (continuous) at plate junctures and structure periphery on the outside for a "sealed up" rugged structure. Building shall be ideally suited for heavy duty industrial usage to resist damage during lifting operations or vehicular impact resistance such as forklift impact and punctures as may occur from the forklift forks and from forklift loads with protrusions and "sprightly sprockets" attached to industrial equipment that could ding or even penetrate a light, thinly constructed building. (Lightweight or thin steel skins, plywood, or rubber membranes shall not be used, and no mechanical fasteners, vertical battens, such as exposed screws, fasteners, or rivets, shall be used to attach or penetrate the exterior skin. See Paragraph 5.5.1, Warranty.)

1.2.2 Structural Loads as described by Factory Mutual (FM) approval standard for Flammable and Combustible Liquid Storage Buildings, Class Number 6049, as defined by N.F.P.A. 30 shall be:

⇒ 100 lbs. ft.<sup>2</sup> (488 kg/m<sup>2</sup>) internal blast resistance. (The basic construction in paragraph 1.2.1 has a 120 lbs. ft.<sup>2</sup> blast rating. Higher ratings shall be easily achieved by either reducing space between vertical members and/or increasing tubular members wall thickness or size and/or adding the resistance values of insulation and wall board applied on the interior [see note at bottom of paragraph 2.3.1]. This is important when using upgraded stiffer N.F.P.A. 68 standard, paragraph 5.3 equations for enclosure strength and relief venting. Equivalent Factory Mutual Property Loss Prevention Data Sheet 1-44, Damage Limiting Construction, paragraph 1.0 Scope states, "Recommended combinations of vent area and design pressures for pressure-resistant construction are addressed for gas/air deflagrations. The criteria varies depending on the degree of hazard of the fuel(s) involved.")

⇒ 90 mph (144 km/h) wind load, to a velocity pressure of 21 lbs. ft.<sup>2</sup>

⇒ 40 lbs. ft.<sup>2</sup> (195 kg/m<sup>2</sup>) roof snow load, plus the weight of the roof construction and any roof installed components.

⇒ 250 lbs. ft.<sup>2</sup> (1220 kg/m<sup>2</sup>) floor support system under dry conditions.

⇒ Zone 4 Seismic Condition.

NOTE: Haz-Safe blast resistance calculations are based on only the structural strength of the tubular frame and exterior steel plate as described in paragraph 1.2.1. This means, when adding on one or both sides of the tubular frame, steel furring strips, layer(s) of gypsum and the porcelain enamel steel finish (as described in paragraph 2.3.1, 2.3.2, and 2.3.3), the blast capabilities are considerably increased. Most other steel buildings use the resistance of all parts of the wall and roof construction to barely meet the 100 lbs. per sq. ft. requirements. Also, other building manufacturers' published literature do not show floor to ceiling heights above 7'4" and therefore do not have Factory Mutual approval above 7'4"! In order to meet the above blast ratings, walls higher than 7'4" need to be redesigned and resubmitted to Factory Mutual. In general, to raise the wall, every 6" increase in height would require

approximately up to 20% more steel by weight the entire length of each vertical wall member not just for the incremental increase. Keep in mind FM approval is limited to published heights. Haz-Safe buildings are pre-approved to 16' high!

- 1.2.3 Optional Modular Building System shall be applied to the building(s) with manufacturing done in two (2) modular end units, each or one ( ) wide x ( ) long and the other ( ) wide x ( ) long, bolted together at the factory and shipped to client's location (or shipped separately and bolted together at client's location for large multi-module building). There shall be a large 1/2" thick tubular rafter ( " high x " wide) at the crown of the open wall of each end unit to meet all load specifications as described in paragraph 1.2.2 and to provide a clear span the length of the building (up to 30'. Buildings [longer than 30'] shall have a single floor-to-ceiling column or post in the middle of the building). The patented roof and floor joints between modules shall be covered with a 12 gauge steel cap. (The floor cap prevents spills from getting into the environment.) The floor cap shall be secured (a) by having a "hat" with a brim shape, (b) with the brim of the "hat" being bolted to steel angles that are welded to the inside wall of the two sumps, and (c) with the elevated flooring (see paragraph 1.7) sitting down on the top of the brim. The flooring shall be flush with the top of the modular joint cap. The roof cap shall extend above the roof seven (7) inches covering the crane lifting lugs which become flanges for bolting the roof together. The finished building shall have the appearance of a non-modular whole building.

Expansion Mid Units shall be available to be delivered complete so that at any time in the future, the initial building can be unbolted and split to accept a new mid module. Mid modules shall be available in any width increment (up to 14' wide interior) to increase the storage capacity of the above building. The engineered drawings shall be designed assuming the above modules shall be separated in the future in order to accept a mid module of the same size so that the future building shall be 33% larger or up to 1500 square feet.

During the initial installation or installation of a future mid unit, the modules are separated and brought together by crane, aligning two (2), three (3), etc. 4" square aligning tubes welded under each module's floor. Each of these tubes shall become a sealed enclosure to house a 1" diameter threaded rod. There shall be a two directional (side to side or up and down) aligning sleeve partially inserted into the tubes at the joint between each modular unit as they are being brought together by onsite crane to approximately 6" of each other. The 1" rods are fed into the aligning tubes of the first module past the sleeve at the mid joint and through the tubes of the second module. The sleeve shall be designed to maintain all loads as described in paragraph 1.2.2, and shall maintain loads and joint connection in a Zone 4 earthquake environment. 1" dia. nuts on 1/2" thick x 4" x 4" caps at each end of the tubes are used to crank the modules together the last inch or two. Each rod and tube combination shall have a minimum 17,000 lbs. compression capability. The exterior wall joint shall be weather caulked and the interior ceiling and wall

joints shall be covered with porcelain enameled steel-finished fire rated gypsum as described in paragraph 2.3. (Modular pre-fab hazmat buildings as described here are protected by U.S. Patent Numbers 5,191,742, 5,285,617, and 5,396,742.)

- 1.3 Vendor Qualifications: Only manufacturers regularly engaged in the design and construction of Factory Mutual (FM) approved hazmat buildings and conforming to the following trade and industrial standards and codes shall be considered. Building shall exceed requirements of EPA, OSHA (29 CFR1910.106), RCRA (40 CFR 264.1101), NFPA (17, 68, 70, and 91), UBC, UFC, BOCA National Building Code/1993 and Subtitle 4, SBFP, NEMA, NEC, and NESC, as well as ASTM, AISI, and AWS - and is approved by Factory Mutual with UL listed components and fire wall construction.

For use of local building and fire authorities approving process, manufacturer shall submit: (1) a copy of Factory Mutual approval (upon request), (2) three sets of custom engineered drawings (average [15] 'D' sized pages and available on one CD), and (3) optional drawings stamped by a registered ( ) ( ) structural engineer as a part of submittals.

User has responsibility of communicating with the authority having jurisdiction and/or the insurance underwriter for concurrence with the approach and design of building and all accessories and components.

- 1.4 All Metal Materials - N.C. (Non-Combustible) Unitized Superstructure shall be ASTM-A Grade 500-B4 tubular steel stock and ASTM-A 36 channels - and (12 or 10) gauge temper pass carbon plate steel shall be ASTM-A 567. All structural steel members, doors, frames, and exposed metal components not having factory prefinished coatings shall be painted with one (1) prime coat and two (2) finish coats of Sherwin Williams industrial enamel HS coating (high solids, low VOC, alkyd gloss top coat). Sump walls and floor shall be painted with one (1) prime coat and two (2) coats of Sherwin Williams industrial macropoxy HS high solids. All surfaces shall be prepared per paint manufacturer's specification prior to application of prime coat. Optional: All vertical wall and roof perimeter tubular members shall be completely covered with continuously welded 10 gauge temper pass carbon (ASTM 526G) steel plate with G-90 galvanized coating. All structural members under the sump floor shall be hot dipped galvanized after being cut to size. The exterior surface shall be painted with two (2) coats of industrial and marine high solids macropoxy. (See Paragraph 5.5.2, Warranty.) Optional: Paint color selection and accents shall be selected by user from paint manufacturer's color chart, and custom corporate color match and logos are available. Interior walls and ceiling finishes are described in Paragraph 2.3.3.

- 1.5 A Minimum of Four (4) Crane Lifting Lugs shall be strategically located and continuously welded where vertical wall and roof members intersect the 4" x 4" tube at the roof edge along the long walls of the building. Each lug shall have a minimum lifting capacity of 16,000 lbs., eliminating rigging with full width spreader bars over the roof or slings under the floor of the building. There shall be four (4) L-shaped tie-down brackets at the

base for wind and seismic bracing, and two (2) forklifting 1/4" thick x 4" x 10" tubes under the floor to permit lifting the building from the front and rear which prevents forks from damaging or penetrating 10 gauge sump floor (user is required to provide distance dimension between forklift tubes) - or - no forklifting tubes under the floor of the building (modular buildings and buildings over 10' wide and/or 18' long and/or 10' high should not be lifted with a forklift).

1.5.1 Optional : A minimum of four (4) sunken/hidden-type crane lifting lugs shall be recessed parallel with and down into the above 4" x 4" tube (requires increasing width to 6"). Each lug shall have a pivoting clevis or shackle (up position for lifting and down for storage within the tube). Outdoor buildings shall have a neoprene gasket covered with a stainless steel plate bolted over the clevis opening.

1.5.2 Optional Four (4) Universal-type Crane Lifting Lugs shall be welded perpendicular onto the above 4" x 4" tube where vertical wall and roof members intersect, and two (2) universal-type lugs shall be welded perpendicular onto where vertical wall and under-the-floor members intersect the 4" x 6" base tube on one (1) side of the building. Universal-type lugs shall be capable of lifting both from above the roof and the one side of the building to allow riggers to lift and lay over the building on its other side for shipping purposes and to reset building on its base at user's site.

## 1.6 Floor:

1.6.1 Sump shall be an integral spill containment function located under an elevated floor and constructed of 1/4" thick tubular steel, 6" high x 4" wide, surrounding its perimeter and providing a 6" high double sump wall, and a 10 gauge steel plate subfloor shall be laid on 4" high steel C-channels spaced on 24" centers, all continuously welded together and hydrotested before painting. Optional: Modular building and a multi-room building shall require a sump in each module and in each room. Floor is designed to be set on a flat concrete foundation provided by others. (The installer of the foundation shall finish and measure the surface so a gap at any point between concrete surface, as tested with an unleveled freestanding 10' long straightedge, resting on any two high spots anywhere on the surface, does not exceed 1/8". Verification to be provided to Precision prior to the shipment of Haz-Safe modules.) The sump shall have ( )% capacity of the total number of 55 gallon drums that could be packed into building for a total of ( ) gallons (typical requirements E.P.A. 10% and FM 25%). The 6" high sump plus 4" underneath the building totals 10" of clearance over the door threshold. (The rise or step spacing allowed by OSHA in 29 CFR 1010.24 "Fixed Industrial Stairs" is between 6-1/2" and 9-1/2" high which means a 10" high threshold is just slightly an unsafe height for a step into or out of the building! Buildings with higher thresholds are even more dangerous and are not acceptable.) Optional there shall be a 4" high sump with ( )% at ( ) gallons which shall have an ideal 8" high clearance over the top of the door threshold. (This also helps shorten ramp lengths. See para. 4.8). The four inch height under the sump floor shall

allow for a 1-1/2" diameter sump spill drain pipe (BOCA: 418.3.2.5) and for visual inspection from outside underneath the floor. Optional under the floor heights are available to increase drain pipe diameters. In addition to the above sump capacity, the building shall have an option to contain 110% plus a 20 or 30 minute discharge of the automatic water sprinkler system (BOCA: 418.3.2.5). This shall require (a) the above 4" or 6" sump height shall be increased to a total of (") high, which shall provide a total of ( ) gallons capacity or (b) the sump shall have one (two, etc.) (") diameter pipe penetration(s) through the sump wall for a sprinkler water drain connection into a separate reservoir or tank provided by the user. (The drainpipe(s) shall be sized to prevent sprinkler water from overflowing the door thresholds.)

Optional sump wall shall be 1, 2, or 4 HRRF fire rated with the gypsum covered with 10 gauge plate continuously welded to the sump floor and the top of the perimeter sump tube.

- 1.6.2 Spark Resistant Elevated Flooring shall be provided over the sump floor so when there is a spill, containers, machinery, test equipment, etc. shall not be sitting-in, forklift's wheels not passing through, and workers are not stepping in chemical liquids. The elevated floor section (sized in removable sections) shall be mechanically fastened to stainless steel floor supports to prevent uneven joints to trip over. The grating shall be of dissimilar metal than the floor supports so as to provide a spark resistant floor construction (painted or galvanized carbon steel on top of stainless steel floor supports). The support steel shall be continuously welded to the sump wall and floor to prevent spilled chemicals from getting under crevices, etc., and causing corrosion and hidden contamination. (Elevated flooring and supports that are dropped, laid, or snapped into place and plywood materials shall not be considered acceptable.) The elevated floor shall be designed for 250 lb. ft.<sup>2</sup> live load.

Elevated floor shall be 1" high with 1" wide x 4" long openings painted, or optional galvanized steel grating. Other options available:

⇒ 1" high with 1/4" wide x 4" long openings galvanized steel grating shall be installed in the aisle areas allowing a relatively "smooth" surface for wheeled material handling vehicles to maneuver. The aisle shall be over either the "V" connection (para. 2.2.2) or the sloped trench (para 2.3.3) of the optional double sloped floors. The fasteners holding the grating to the elevated supports shall be counter sunk into the grating.

⇒ 1/4" thick painted or galvanized, diamond or checker or smooth steel plate in maximum 16 ft.<sup>2</sup> sections shall be installed along the outside walls and over the upper portions of the optional

sloped sump floors for placement of 55 gal. drums, pallets and tote tanks. Fasteners holding the plate to the floor supports shall be countersunk into the plate. The plate shall be installed so that there shall be a 1" gap between the plate and the perimeter of the sump wall to allow a spilled chemical to drain into the sump. The top surface of the smooth plate shall be either gray epoxy painted or coated with a 100% solids 2 component epoxy non-slip floor and deck coating. Coefficient of friction per ASTM F603 shall be Dry 1.0 and Wet 1.00. (Extending plate more than 4' toward the interior option could cause extending the dry chem type fire suppression system piping, sensors and discharge heads to be installed under the plate.)

⇒ 1" high fiberglass grating, T-beam fire rated protruded type.

⇒ Any combination of the above.

1.6.3 Optional Floor Level Pallet Rack shall be provided over the sump floor, constructed of painted 2" x 4" tube steel laid flat that are continuously welded to the sump walls at the door threshold height. The rack shall be designed for 250 lbs. ft.<sup>2</sup> live load.

1.6.4 Optional Second and Third Level Pallet Rack shall be constructed of continuously welded 1/4" thick tubular steel with the front edge of the horizontal rack being 1/4" thick x 4" x 4" beam (forklift damage protection) and utilizing 2" x 4" tubes laid flat, providing a platform for the pallets. The upper level rack shall have its own 6" deep sump which shall be constructed as described in the above sump paragraph. There shall be a minimum of 4" clearance from the top of a 40" high pallet load sitting on the floor level rack to the bottom of the second level rack and from the top of a 40" high pallet load sitting on the second level rack to the bottom of the third level rack and from the top of a 40" high pallet load sitting on the third level rack to the top of the door opening. The racks shall be a minimum of 4' deep with a 4" high angle backstop at the rear. The second and third level racks shall be "free standing" with most of the load bearing passed directly to the overhead door frames of the building. The rack shall be designed for 250 lbs. ft.<sup>2</sup> live load.

1.7 Interior Shall Be Ergonomically Worker-Safe for handling hazardous material containers near walls with all vents, conduits, ductwork, plumbing, fire suppression and alarm system components, explosion relief panels, and heaters wall mounted above 42" off the elevated floor, recessed into the wall, or mounted in weatherproof housing on the exterior.

- 1.8 Water Runoff shall be provided for all exterior (not in-plant) buildings with a minimum of one (1) inch sloped roof and a drip edge over all standard doors (not including overhead roll up) and explosion relief panels. The drip edge shall be two (2) inches wide and angled down from wall of building.
- 2.0 HAZ-SAFE COMPONENTS:
- 2.1 Optional Sump Drain (BOCA 418.3.2.5 Requirement) shall consist of a rectangular drain pit of 1/4" thick steel with 4" high walls which are sunk down from the sump floor plate to foundation level, and an optional 1" diameter polypropylene pipe mechanically fastened to the pit wall. The pipe shall have a hand operated valve and a cap screwed on the end. Optional: There shall be two drains per each room because of the joint between modules creating more sumps.
- 2.2 Sloped Drainage Systems - John LeBlanc, project engineer of Factory Mutual Research Corporation's Standards Division, explains: "When we evaluate fire protection for solids, our goal is to contain the fire to its point of origin. We can't do that with liquids. When a liquid is pouring across the floor, you can't stop the flow. The heat release rate of a fire is controlled by the surface area available to burn. As the surface area grows, so does the heat release rate...A well-arranged drainage system on the floor is the best protection you can buy. Ideally, it should be like a trench drainage system designed to remove fuel from the building."

NOTE: When considering gas detection (paragraph 3.8) versus liquid sump detection, keep in mind there has to be a fume coming off a liquid spill. There is also a continuously running ventilation system (paragraph 3.3) changing the air over six (6) air changes an hour, which certainly dilutes fumes in early stages of a liquid spill. In order to have enough of a fume to be an explosive threat, there first has to be a lot of leaked liquid chemical spread out over a large surface area on a flat sump floor. It will take time for the spill to reach a height of an inch or more, causing a liquid detector to alarm if there is an optional sump sensor alarm in a drain pit. An optional single sloped sump floor will gather (reducing its surface area) the liquid spill along the long sump wall, and it will inch upward on the sloped floor. It will also take time for enough evaporation to take place to cause a gas sensor to sound an alarm. If the sloped floor leads to a sloped trench at the end of which is an alarm drain pit, then a very small amount of liquid would be required to reach the end of the trench to trip an alarm. This should be the first line of defense for protection against explosions which would be much faster than any number of gas sensors. When a posi-ventilation system is incorporated (as described in paragraph 3.3.2) so that the fumes are removed immediately from over the top of the sloped trench, the explosion threat from fumes shall be almost eliminated. This will reduce the number of gas sensors to one or eliminate the need for them completely.

2.2.1 Optional Single Sloped Sump Floor (NFPA 30:4-4.2.6, .7, and .8) shall facilitate the natural gravity movement of (a) air under the floor grate (cold air is heavy and falls) and heavier-than-air fumes, gases and vapors, as well as liquid chemical spills and cleaning water and agents to move toward the low portion of the sloped floor, and (b) with a spill detector shall accomplish an early warning of a liquid spill and the early warning against a liquid chemical fire or fume explosion. The floor shall be sloped a minimum of one (1) inch from one long wall to the other. Somewhere along the wall, at the low edge of the sloped floor, there shall be an optional sump drain or alarm pit (BOCA 418.3.2.6) as described in Paragraph 2.1. Installed in the outside wall of the pit shall be an optional liquid detector (see Paragraph 3.7). System shall pass a test at the factory whereby gallons (it may take 2-3 gallons depending on size of sump) of water is deliberately poured at the upper part of the sloped floor the farthest distance from the alarm pit so that enough water shall reach and fall into the alarm pit and trigger an alarm (less than pint). (Protected by U.S. patent number 6, 305, 131.)

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2.2.2 Optional Double Sloped Floor shall have sloped floors starting at each long wall and meeting at a "V" in the center of the building or under an aisle. This shall facilitate the movement of air, fumes and liquids, as described above in paragraph 2.2.1, and be under the optional Posi-ventilation System, as described in paragraph 3.3.2. (Protected by U. S. patent number 6,305,131.)

- OR -

2.2.3 Optional Single or Double Sloped Sump Floor With Sloped Trench (NFPA 30:4-4.2.7 and .8) shall facilitate the movement of air, fumes and liquids, as described in paragraph 2.2.1 above, and provide quick and easy drainage and with an optional drain/alarm pit and spill detector shall accomplish the speediest warning of a liquid spill which is the earliest warning against a liquid chemical fire or fume explosion (sloped trench not available with optional sump liner per paragraph 2.2.3). The floor shall be sloped a minimum of one (1) inch from (a) the long wall of the building toward the other long wall or from (b) each long wall toward the center of the building to a 4" wide x 1" (minimum) deep steel trench which shall also be angled with a minimum two (2) inch drop. This option shall add 2" to the threshold height (and overall building height) for a new threshold height of 12", assuming a 6" high sump as described in paragraph 1.6.1, and shall require a step to be elevated to the base of the building under the personnel doors. At the bottom end of the trench shall be an optional alarm or drain pit as described in Paragraph 3.6. Installed at the low end of the trench or in optional alarm pit shall be an optional liquid spill detector (see Paragraph 3.6). System shall pass a test at

the factory whereby a gallon of water is poured at either upper part of the sloped floor at the opposite end corner of the building from the alarm pit so that enough water shall reach the alarm pit to raise the float (less than a pint) and trigger an alarm. (Protected by U.S. patent number 6,305,131.)

The trench shall be located under the center of an aisle between storage containers, etc. This shall (a) provide easiest visual verification of a spill, (b) direct the spill out from under shelving, work surfaces, testing devices, pumps, and containers sitting on the elevated flooring - and prevent liquid flames from getting under these items, and (c) expose flames from burning liquids to automatic or hand held fire suppression materials.

2.3 Interior Fire Ratings, Insulation, & Finishes:

(Fire ratings are based on N.F.P.A. 30, part I, 4-4.2.1, 4-4.2.2, and 4-6.4.2 fire resistant construction for flammable combustible liquids, and the following chart is a simplification of Factory Mutual's interpretation. Any deviations should be approved by user's Local Authority Having Jurisdiction.) For example, the distance may increase if the floor area exceeds 500 ft.<sup>2</sup>. Also, the AHJ must approve separation distances under 50 ft. from one hazmat building to another or from hazmat building to user's on-site other facilities, parking lots, sidewalks, property line(s), roads, etc., taking into account quantity, type of materials, building construction, fire suppression systems, and explosion relief venting.)

HAZMAT BUILDING DISTANCE FROM ANY WALL OR PROPERTY LINE	<u>HOURLY FIRE RATING</u>		
	WALLS	CEILING	OPENINGS
10' or less	4	3	3
10' to 50'	2	1	1-1/2
50' to 75'	1	1	1-1/2

75' or more	None or Noncombustible
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2.3.1 Walls: The interior surface of the exterior 10 gauge wall plate and within the 23" wide space between each 2" x 2" vertical tubular wall member (120 lbs. blast rate) shall be filled with 2" thick Thermax glass fiber reinforced polyisocyanurate foam insulation board which is manufactured foamed-in-place between sheets of aluminum foil (R-14.4). Galvanized 7/8" deep steel furring channels shall be mechanically fastened over the Thermax onto the 2" edge (protects against an internal fire threat) or on both sides (optional, protects bi-directionally against external and internal fire threats) of each 2" x 2" vertical member so that gypsum board can be screwed to the furring, providing a thermal break between the inner and outer wall surfaces. Optional, the 23" wide x 7/8" deep horizontal space between channels shall be filled in with 3/4" thick Thermax insulation board (R-5.4), bringing total insulation value to R-19.8. The gypsum shall be 1/2" thick X-type (1 HRFR) or 3/4" thick (2.8 lbs. ft.<sup>2</sup>) Ultracode Core (2 HRFR) or optional two (2) layers of 3/4" thick Ultracode Core (4 HRFR) (5.6 lbs. total ft.<sup>2</sup>). (There is a 62% increase in strength from 1/2" thick gypsum panel to 3/4" thick gypsum panel per the Hard Body Test as described in paragraph 2.3.3.) Ultracode core panel edges shall be tapered providing for less fastener blowouts and extra resistance to cracks caused by thermal and hygrometric changes. Total wall thickness shall be (3-1/2", 3-3/4", or optional 4-1/2").

NOTE: When utilizing the above paragraph's optional 3/4" thick (R-5.4) horizontally applied foam board, the wall becomes a "solid sandwich" of 10 gauge outer steel plate against a total of 2-3/4" of foam board against 3/4" of gypsum bonded to 22 gauge steel plate inside. The assembled wall material can add another 39 lbs. ft.<sup>2</sup> of blast resistance to the 120 lb. ft.<sup>2</sup> rated building construction as described in paragraph 1.2.2, for a total blast rating of 159 lbs. ft.<sup>2</sup>! This stronger wall is important when upgrading from blast resistant standards of N.F.P.A. 30 to N.F.P.A. 68 or the equivalent Factory Mutual Property Loss Prevention Data Sheet 1-44, Damage Limiting Construction.

Choose:

2.3.1.1 Separation Walls: Each partition shall be either galvanized chain link or a stainless steel trellis construction within a 2" x 2" x 1/4" thick tubular steel wall frame that shall be wall to wall and up from the top of the sump divider wall to the ceiling. The stainless

trellis shall be constructed of 1/8" 7 x 7 style cable in a 1' sq. design and each "crossover" shall be held in place with stainless steel net clips.

- OR -

- 2.3.1.2 Separation Walls: Each partition shall be load bearing ( ) hour fire rated construction, and shall meet 110 psf blast requirements from either side. There shall be a 2" x 2" x 1/4" thick tubular steel vertical member every 2' on center and welded to the floor/sump wall tube and the ceiling rafter. On one side of the vertical tubes shall be welded continuously 10 gauge plate steel for a water and air tight seal at floor, walls, and roof (NFPA 30:4-4.2.1). On both sides of the above wall, a ( ) thick layer of ( ) gypsum shall be screwed to the wall. Permanently bonded to the gypsum shall be a sheet of cold rolled steel which has been finished with a baked-on porcelain enamel.
- 2.3.2 Ceiling: The 23" wide space between each 4" deep C-channel in the roof shall be filled with 2", 2-1/2", or 4" thick Thermax (R-15, R-22, or R-30) insulation board. Galvanized 7/8" deep steel furring channels shall be mechanically fastened over the Thermax insulation on the bottom edge of the C-channels so that gypsum board can be screwed to the furring (also provides a thermal break between the inner ceiling steel sheet or gypsum and outer roof steel plate). The gypsum shall be 1/2" thick X-type (1 HRFR) or optional 1/2" thick X-type and 3/4" Ultracode Core (3 HRFR).
- 2.3.3 Ceramic Steel Interior Finish: Porcelain enamel steel sheet shall be seen on all exterior walls (white) and ceiling to provide a highly reflective surface for light distribution and extra fire resistance quality through the reflection of a fire's radiant heat rays. The steel sheets shall have been chemically coated, rinsed and ceramic frit coated on both sides before passing through a furnace at 1,450 degrees Fahrenheit (softening the steel, thereby allowing the ground coat to fuse or become a part of the steel). Two (2) coats of powdered ceramic frit shall have been sprayed onto the top surface of the steel before re-entering the furnace (each coat), creating a hardened, extremely rugged, non-chalking, corrosion resistant, maintenance-free porcelain enamel finished surface exceeding PEI T-21 (ASTM C-282) Class A acid resistance standard. Combination 3/4" Thick Ultracode Core Gypsum Bonded to 22 Gauge Sheet shall exceed 250 lbs. sq. ft. strength test. (Wall stiffness is measured by U.S. Gypsum Hard Body Test simulating a sledge hammer slamming into a 2' square panel.) Wear characteristics shall be greater than 1000 cycles (per ASTM D4060 using Taber Abrason Model 140 PT, S/N 62338, type H22 wheels) with no wear seen through substrate. The steel clad gypsum panels

shall be secured to the walls and ceiling with exposed drywall screws every 12" in one direction and 24" in the other, per UL Design Standards fastening pattern. All screws holding fire rated gypsum in place shall be exposed to permit visual inspection as well as allow for removal and replacement in order to inspect within the wall. Screw heads, spaced across panel surface, shall be covered with color matched snap-on plastic caps. Cracks in seams, joints, and corners shall be filled in with fire rated caulk.

2.3.4 Custom Extruded Aluminum Trim Detail shall be mechanically applied on all joints and corners to overlap the surfaces of the above porcelain enamel steel finished gypsum at the butt joints, providing protection over saw cut or curled edges. There shall be precision molded 3" wide "flat" bar and a bi-directional corner bar with 1-1/2" sides and a 2-1/4" high base/openings bar, each with concave back surface(s) and a 96° angle (inside corners) on the corner bar, allowing only the outer edge of the bars to contact the surfaces of adjoining panels, providing a tight hairline fit once screwed into place. Optional: Prior to fastening the trim bar, there shall be a heavy bead of silicone (or optional fire rated) caulk applied to fill in the space between the "flat" and corner bars and panel surfaces, eliminating the unlikely chance of crevices where contaminants can collect or moisture getting in due to frequent hose washdowns of the walls and ceiling.

2.3.5 Optional Floor: Under the 10 gauge plate floor shall be 2" of Thermax insulation (R-15) which shall slide in on top of a 14 gauge galvanized steel plate fully welded to angles welded approximately 2-1/4" down from the 10 gauge sump floor plate. Each 2' wide insulation panel shall be removable from under the floor (for inspections and in case of an improbable leak and repair requires welding). There shall be a 1/4" thick aluminum cover plate bolted onto the building to cover the ends of the foam insulation. Floor insulation required with A/C or cooling system equipped buildings to prevent premature moisture condensation and rust under sump floor pan.

2.3.6 Non-Combustible Interior shall be non-fire rated painted steel showing each 1/4" thick tubular steel member of the building's frame as well as the back side of the 10 gauge plate welded to the outside of the framing which is described in paragraph 1.2.

2.4 Doors:

NOTE: An open door (swing or overhead) will interfere with the planned air flow of the mechanical ventilation system as described in paragraphs 2.5 and 3.3. The intake air will come into the opening in the open doorway and not through the air intake vent opening. This will cause large dead air pockets where dangerous heavier-than-air fumes will build up. Optional sloped trench and posi-ventilation would eliminate this hazard. (See paragraphs 2.2 and 3.3.2.)

2.4.1 One (two, three, etc.) ( ) ( ) Wide x ( ) High Standard Fire (Only) Door(s) and Frame(s) shall be spot welded (to prevent deflection, warping, or jamming of the steel door in the frame) within the wall's 2" x 4" quarter-inch thick tubular steel jamb. (Personnel door is the only way to provide for emergency exit with panic bar option should a worker be trapped in building equipped with only roll-up doors that have the chain operator installed outside the building.) Door manufacturer's frame shall be 16 gauge steel. Door leaf shall have 16 gauge steel top, bottom, and side channels with 18 gauge steel skin front and back. Door shall be assembled and dressed smooth with invisible seamless finish. The door and frame shall be U.L. approved and "B", "C" labeled 1-1/2 or "A" labeled 3 hour fire rated and Class A rated for 1 million open/close cycles per ANSI A151.1. Each door shall be equipped with U.L. listed keyed cylindrical lockset, three (3) 4.5" high x .134" thick steel ball bearing hinges (Hinges exposed on exterior of building can be removed allowing intruders entry. See paragraph 2.4.2 below for hingeless door with greater security.), (optional low profile panic hardware (on single door, or on active leaf of double door), manual top and bottom surface bolts on inactive leaf of double door (for three point locking), optional closer(s) with 165 degrees Fahrenheit fusible link hold open device, (NFPA 30 para. 4.4.2.2, "...Such doors shall be permitted to be arranged to stay open during material handling operations if the doors are designed to close automatically..."), optional automatic gravity operated coordinating device on double leaf doors to assure 3/4" astragal on active leaf closes over top of "inactive" leaf in order to seal building(s) or room(s), and optional automatic flush bolts at the top and bottom of inactive leaf of double door. The "hollow" door interior shall be filled with one inch cell, 99 lb. test resin impregnated honeycomb. (Optional "hollow" interior shall have polyurethane foamed in place after door is assembled with final expansion, curing, and chemical bonding to all interior galvanized steel surfaces while door is compressed between platens. Insulated door shall have an R factor of 15.)

- OR -

2.4.2 Optional One (Two, Three, etc.) ( ) ( ) Wide x ( ) High Standard VLR (Blast) and Fire Door(s) shall be "frameless" mounted within the wall's 1/4" thick tubular steel door jamb using a continuous semi-concealed hinge eliminating any projecting common hinge knuckles. The body of the door shall be 1-3/4" thick

stressed steel structure without point loading. Door(s) shall have 18 gauge steel skins bonded to the core and welded to top, bottom and side channels and internal 16 gauge steel horizontal stiffeners on 12" centers. Continuous locking channel and hinge shall provide a tested 180 lbs. ft.<sup>2</sup> VLR blast rating. The lever shall be compatible with any standard cam mortise cylinder. Door(s) shall be 1-1/2 (B, C labels) and 3 (A-label) hour fire rated and cycle tested to over 1 million cycles as tested by Warnock Hersey to be in compliance with U.L. 10C; N.F.P.A. 352; ASTM E 152 and UBC standard 7-2, parts I and II. Optional low profile panic hardware, closer(s) with 165° F fusible link door hold open device (N.F.P.A. para 4.4.2.2, "...Such doors shall be permitted to be arranged to stay open during material handling operations if the doors are designed to close automatically...") sides and head, gasketing (passed TAS 202 air infiltration tests with actual 0.01 CFM/ft.<sup>2</sup> with allowable 0.50 CFM/ft.<sup>2</sup>), Pemko 185AP threshold, sweeps, glazing: wire glass (1-1/2 hr.), ceramic (3 HR) fire rated electrically operated doors and locking functions. The continuous locking channel and hinge shall eliminate the need for vertical rods, top and bottom manual or automatic flush bolts, door coordinators, astragals and floor and upper frame strikes. The hollow core shall have an insulation value of R-4.76.

- OR -

2.4.3 Optional One (Two, Three, etc.) ( ) ( ) Wide x ( ) High Custom Blast Door(s) and Frame(s) shall be spot welded and mechanically fastened with a minimum of (6) 5/8" and (8) 3/8" screws alternately spaced and driven into a 2" x 4" x 1/4" tubular steel jamb and header. The door(s) shall be designed with minimum 14 gauge frames and skins to withstand ( ) lbs. per sq. ft. total static loading with 100% rebound and be operatable after the blast. (Factory Mutual Property Loss Prevention Data Sheet 1-44, Damage Limiting Construction, paragraph 2.3, 2b states, "All doors should be capable of resisting the same overpressures as the wall.") Door and frame shall be U.L. approved and labeled 1-1/2 or 3 hour fire rated and Class A rated for over 1 million open/close cycles per ANSI A151.1. All doors shall be equipped with (3) 5" x 4-1/2" stainless steel hinges, exterior 165 degrees Fahrenheit fusible link released hold-open/closing device, and interior surface mounted panic hardware. Single door(s) shall have double aught series mortise keyed lock(s). Double door(s) shall have top and automatic latches with concealed vertical control rods. There shall be a keyed lock and a 3/4" astragal (to seal the space between the "active" and "inactive" leafs) on the "active" door and an automatic coordinating device on the header to assure the active door always closes over the inactive door. All doors shall be R-7 insulated and weatherstripped.

2.4.4 One (Two, Three, etc.) ( ) Overhead Roll Up Door(s), 9' or 13'4" wide x ( ) high, shall be provided to accommodate the handling of two (2) or three (3) 48" wide pallets being forklifted into the building with 4" to spare on each side of the door jambs and between the pallets, and 6" above 36" high drums on 4" high pallets to the above rack or door header. Doors shall be installed in

accordance with NFPA 80 Standard for Fire Doors, 1995 edition. Guides shall be attached to the jambs with bolts every 18" per FM approval procedure. Door(s) shall be three (3) hour fire rated and manually chain operated. Automatic closure activated by melting link shall have a speed governor controlling the door to close at an average speed of not less than 6 inches per second and not more than 24 inches per second. (NFPA 30 para. 4.4.2.2, "...Such doors shall be permitted to be arranged to stay open during material handling operations if the doors are designed to close automatically...")

Door(s) shall be mounted between 1/4" tubular jambs (to prevent deflection, warping, or jamming of the door while building is being shipped or being bumped into by a forklift). The door(s) shall hang 3" out from the building wall and either (a) 3" down from the door threshold, or (b) touch the slope of the ramp, allowing wind blown rain that gets through joints in the curtain slats or moisture from condensation on the door's curtain to drain out from the building and not into the sump. The hood shall be concealed within the building's wall structure as it extends six (6) inches out and six (6) inches into the building with 165 degree fusible link attached to the interior ceiling (NFPA 30: 4-4.2.2). This installation method shall have the curl part of every slat of the door curtain face toward the inside of the building, allowing the arched smooth surface of the slats to face the weather side. The overhead door's mechanical components, manual chain, optional motor, etc. shall all be inside the building, protected from vandalism, wind blown debris, rain, snow, and ice. (A worker trapped in the building could manually use the chain to get out of the building should motor operation fail.) The back of the door's hood (now facing out from the building) shall be constructed to resist accidental forklift mast and load damage by welding a combination 6" x 6" x 3/8" and 1" x 1" x 1/8" steel angles at the top of the rough wall opening and a 2" x 2" x 3/16 angle at the bottom, all welded in place before bolting on a 10 gauge steel face plate. (This application of overhead roll up doors in a hazmat building is protected by U.S. Patent No. 5,301,479.) Optional door(s) shall have an explosion-proof, electric, drip-proof motor, removable without affecting auxiliary hand chain operator or setting off limit switches. All electric components wired to a terminal block in control panel. Up, down, and stop push-button station shall be in NEMA 1 enclosure.

Optional Door(s) shall be installed on the exterior surface of the 1/4" thick tubular frame rough opening with the exposed 24 gauge steel hood and all mechanical components suspended out (exposed to forklift hazards, weather damage and vandalism) from the exterior wall approximately 24" and 18" above the roof. (This conventional installation method allows for up to 20" reduced interior ceiling height.) Should a worker become trapped inside building and the chain operator is outside the building, there isn't a means for exit. Optional motor operation shall be the same as above except with non-classified electrical components.

Optional Thermal Strip Curtain shall be installed on the inside of the overhead rollup door opening to create a trapped air space for insulation purposes. (The strip curtain reduces the amount of condensation on the steel slats of the door. When the overhead door is opened or left open, the curtain shall, in the summer, prevent cold refrigerated air from leaving the building and resist humidity from entering, and in the winter shall prevent liquid materials [stored too close to the uninsulated steel slats] from freezing.) The strip curtain shall be installed up against the ceiling (not under the hood of the door) and shall be along the length and sides of the hood. The curtain sides shall touch the wall of the building. In addition, the curtain shall extend to the floor of the building, which under the bottom edge of the curtain shall be 1/4" thick painted steel plate that shall be flushed with the rest of the elevated floor, as described in paragraph 1.6.2. This installed method shall provide a trapped pocket of air between the curtain and the overhead door.

2.4.5 One (Two, Three, etc.) ( ) ( ) Wide x ( ) High Cooler Door(s) and Frame(s) shall be mechanically fastened within 2" x 4" x 1/4" thick tubular steel jamb that is continuously welded to the tubular skeleton of the building to prevent deflection, warping, or jamming for the life of the building. The (each) door shall have 5" foamed-in-place insulation (R-37). The door hardware shall have three (3) heavy duty ball bearing steel hinges, one (1) three-point compression latch with inside safety release handle, outside pull handle, and locking capability. Optional: the door frame and sill shall enclose a 115 V heater cable with continuously "on" operation without the need for thermostat control. Door and frame shall be clad in 20 gauge G-90 galvanized coated steel inside and out. Optional thermal strip curtain shall be installed on the inside of the cooler door opening to create a trapped air space for insulation purposes. (When the cooler door is opened or left open, the curtain shall prevent cold refrigerated air from leaving the building and resist humidity from entering.) Optional drop-down shutter shall be installed on the inside of the door opening so that opening has 3 HR fire rating (similar in operation to shutter description in Paragraph 2.6.3).

2.5 One (1) Low Level Gravity or Air Intake Vent shall be provided to minimize accumulation of heavier than air hazardous vapors. The vent shall be framed with tubular steel and recess mounted on exterior wall at 12" above the floor grating (N.F.P.A. 30, para. 4-4.2.11 and BOCA para. 418.3.2.8). Unit shall be minimum of 22" square (N.F.P.A. 395, para. 2-2.7.1) with a fixed outside louver designed to keep rain out. The vent shall have a UL approved 1-1/2 hour or 3 hour fire rated damper with folding blades held open by a 165 degree fusible link and a 1/4" bird screen. In mechanical ventilation (See paragraph 3.3 to attain minimum required 6.5 air changes calculated and confirmed by testing), the vent opening shall be at floor level with an optional 10 gauge steel duct chase or blast hood installed over the air intake opening down to an opening in the elevated flooring (not used with posi-vent system). This shall cause the outside fresh air to sweep across the bottom of the sump and reduce the need for optional pre-heating (see paragraphs 3.11 and 3.12) of cold or pre-conditioning of hot, humid air coming into the building. Optional the vent openings shall have a 10 gauge steel blast/rain hood (in lieu of rain louver) installed over the air intake vent opening on the outside of the building (resists blast driven objects from flying out of room).

2.6 Optional Explosion Relief Vent Systems: Background - (A) There is a dichotomy between fire and blast requirements wherein blast relief vent(s) or panel(s) cannot be fire rated as described in N.F.P.A. 68 and FM 1-44 because of lightweight construction constraints. Fire rated drop-down shutters are available as in paragraph 3.6.2.2. (B) Different calculations for total sq. ft. of open vent or panel area required are in N.F.P.A. 30 as defined by FM Class Number 6049, NFPA 68 and FM 1-44. (C) Blast relief vent(s) or panel(s) may be substituted with mechanical ventilation as recommended in these codes: (1) N.F.P.A. 69 Explosion Prevention Systems 1992 Edition, Chapter 3, (2) BOCA National Building Code/1999 Paragraph 418.3.1.4, "Explosion Relief: Means for explosion relief shall be provided as specified in Sections 417.5.1, **OR** spaces shall be equipped with equivalent mechanical ventilation..." , and (3) 2000 International FireCode, paragraph 911.1 which states, "...Such areas shall be provided with explosion venting, explosion prevention systems or barricades...". Please refer to this specification paragraph number 3.3.3 describing low level dual fan posi-ventilation system (paragraph 3.3.1 and 3.3.2) and sloped sump floors (paragraph 2.2) are prevention systems or a substitute for explosion relief panels and blast shafts.

2.6.1 One (Two, Three, etc.) ( ) 8' Wide x 4' High and One (Two, Three, etc.) 4' Square Explosion Relief Wall Panel(s) shall be mechanically installed up close to the ceiling within a 1/4" thick tubular steel jamb to prevent deflection, or warping during shipping and placement of building which may cause panels to malfunction. (Roof top panels shall not be acceptable due to potential build-up of ice, snow, dirt and debris. In addition, the hottest temperature from an internal fire shall be at the ceiling, causing ceiling panels to be destroyed before wall panels. Number of panels in this spec shall exceed 1 sq. ft. of open clear opening for every 50 cu. ft. of internal building volume (including volume within sump) as classified in Factory Mutual Standard 6049, which is based on N.F.P.A. 30. Larger ft.<sup>2</sup> required utilizing N.F.P.A. 68 formula or Factory Mutual Property Loss Prevention Data Sheets 1-44.) The panel(s) shall pivot from the bottom, utilizing a .625" diameter hinge and open 60 degrees at the end of safety cable tethered to the top of panel frame. (Escaping explosion gases shall exit up and outwardly - and not down.) There shall be a shock absorbing device cushioning panel at full open and a flip-out arm to hold open panel to allow return air in during implosion phase. Panel shall be resettable and operable after testing, explosion or being pulled open by high winds. The panel shall have a patented magnetic release approved by Factory Mutual for adjustable settings from 15 - 30 lbs./sq. ft. and be preset at factory for 20 lbs.

Explosion relief panel's head, sill, jamb, and mullion frame members shall be one-piece extruded aluminum with interior compression gaskets to minimize air leakage and rain water entrainment when closed. Within the frame shall be 2" foam insulation (R-9) sandwiched between aluminum sheets. This lightweight construction shall not exceed a total of 33 ft.<sup>2</sup> and 2.5 lbs./ft.<sup>2</sup> for quick release over inertia per NFPA 68 "Standards for Venting Deflagrations." Each panel shall be labeled with the Factory Mutual (FM) mark and, upon request, actual dynamic test reports by Factory Mutual per Data Sheet 1-44, "Damage Limiting Construction" shall be submitted.

Room	Ft. <sup>2</sup> Required Opening	# Relief Panels	Ft. <sup>2</sup> Clear Opening	Upward Type Blast Shafts
		( ) 8' W x 4' H		( ) 8'7" W x 9' H x 5'6" D ( ) 8'7" W x 5' H x 5'6" D
		( ) 8' W x 4' H ( ) 4' W x 4' H		( ) 8'7" W x 5' H x 5'6" D

2.6.2. Blast Shaft(s) (BOCA 417.5.1, 2 and 3) shall be provided to direct the effects of an explosion away from the Haz-Safe building to a harmless open air location. Code calls for venting or shaft construction to be of the same internal blast pressure requirements as the Haz-Safe building walls and ceiling (see paragraph 1.2.2). (Applications depend on whether Haz-Safe building is inside of users existing facility ("inplant") or outside as an "attached" or a "stand alone" building within 50' or next to users facility.)

2.6.2.1 Inplant Horizontal Blast Shaft(s) shall be constructed of 1/4" thick tubular steel frame clad with 10 gauge steel plate. Shaft shall be bolted over the relief panel opening and shall extend through a hole (cut by others in the users facility's existing wall). The bottom portion of the shaft shall be sloped a minimum of one inch to allow rain and snow to drain outside and not into the Haz-Safe building.

2.6.2.2 Upward Type Blast Shaft(s) shall be constructed of 1/4" thick tubular steel frame clad with 10 gauge steel plate. The back of the shaft shall have a 45° angle up from the base of the building to approximately 2'6" from the wall of the building and then proceed at a sharper angle to a maximum 7' depth from the wall

of the building. Shaft shall be bolted onto (1) the outside opening of the above horizontal blast shaft (the relief panel(s) shall be installed within the outermost end of the horizontal shaft and not within the relief opening of the Haz-Safe building), or (2) on the outside wall of the Haz-Safe building over the relief panel opening(s). The upward type shaft shall have three sides and be opened at the top and bottom to permit snow, rain and debris to pass down through. During an explosion, the open bottom of the shaft shall be filled in when the bottom hinged relief panel is forced open. The blast effects shall be directed upward and out the open top of the shaft. (Upward type blast shafts have U.S. Patent #6,223,473B1.)

2.6.3 Intruder Security Grill shall be recessed flush with interior wall and mechanically fastened within the 1/4" thick tubular frame surrounding the explosion relief panel. The grill shall have its own welded angular steel frame with 9 gauge expanded steel (with 1-1/2 inch holes) welded within. Purpose of the grill is to (1) protect against material handling damage to "soft" skin of relief panel(s) and prevent workers from tripping and falling into horizontal blast shaft(s) installed below 42" off floor, (2) prevent objects from exiting building and becoming lethal projectiles during an explosion per BOCA 417.5.1.3, and (3) resist intruder entry.

2.6.4 3 HRFR Overhead Drop-down Shutter shall be installed on the leading edge of the 1/4" thick tubular frame surrounding the above non-fire rated explosion relief panels so when it closes, it shall seal and protect the relief panel opening from an internal fire threat. Shutter shall be 3 HRFR, normally in open position, and manually reset after test or actual operation. The hood shall extend 9-1/2 inches above the top of the relief panel with 165 degrees Fahrenheit fusible link release attached to the ceiling. Automatic closing shall have a controlling governor to slow the rate of descent.

### 3.0 EXPLOSION PROOF ELECTRICAL SYSTEM:

3.1 All electrical systems shall be UL listed and designed for Class I, Division I, Group D atmosphere, per Article 500 of NFPA-70. The electrical system shall be complete, including all necessary explosion proof and non-sparking equipment, rigid galvanized steel conduits and elbows, cast iron devices with threaded hubs, J-boxes, and seal-offs. All interior and exterior electrical components (A/C units, heaters, fans, dampers, sensors, alarm devices, etc.) shall be mounted on the same end wall of the building as the entrance box unless otherwise stated in this specification. Electricals shall be inspected at factory by a third party electrical inspection agency and be so labeled as having passed inspection before being shipped.

Exterior wiring shall comply to general purpose weatherproof requirements utilizing NEMA 3R Power Distribution Load Center with 100 amp. main and twelve (12) circuit breakers and twelve (12) spare breaker spaces installed not closer than 3' to a door. There shall be a NEMA 4 common alarm and control cabinet mounted on end wall of building.

Interior wiring shall have: (1) all-threaded joint having 5 full threads with 3/4" per foot taper, (2) seal-offs where required at exterior wall penetrations, devices, appliances and components, (3) no fittings between seal-offs and exterior wall, and (4) only THHN conductors rated at 75°C minimum used with all conduits supported every 6' and fastened within 3' of a junction box.

Static Electricity Grounding System shall consist of all interior walls having an aluminum (optional copper) grounding/bonding bus bar angle 42" off floor, and an appropriate number of 8' long x 1/2" thick copper clad steel bar(s) shall be supplied for user - to be driven into the ground and connected to the building's exterior grounding lug.

Optional Lightning Protection System shall be installed on the exterior of the building to comply with UL96A and NFPA No. 780. (Metallic structures are inherently self-protecting if they are "electrically continuous, tightly sealed to prevent seepage of liquids, vapors, or gases, and are of adequate thickness ... sheet steel less than 3/16" or 18.75 gauge ... shall not be relied upon ...".) The Underwriters' Laboratories Label "C" shall be delivered to the architect/engineer/owner. System shall consist of all necessary air terminals and groundings as designed to blend into the appearance of the building.

### 3.2 Interior Lighting:

3.2.1 One (Two, etc.) ( ) Incandescent Fixtures with 200 watt lamps shall be installed on the ceiling with control switch (inside or outside) within one (1) foot of the main entrance door. Fixture shall have an epoxy finished aluminum base sealed with a heavy duty glass globe covered with a protective metal guard. (The explosion proof light fixture and its metal guard when properly installed on a ceiling extends a minimum of 14" down from the ceiling. The OSHA regulation per 29 CFR 1910.37(i), "Headroom... nor any projection from the ceiling be less than 6 feet 8 inches from the floor." When you add 6'8" and 14", the total is a minimum required ceiling height of 7'10"! Buildings with less ceiling height

shall require ceiling fixtures to be installed close to walls and/or corners to reduce chances of a person's head banging into the fixtures.)

3.2.2 Optional ( ) Ceiling Height shall be added so Incandescent Light Fixture(s) can be installed near the center of the ceiling (fire suppression discharge nozzles and sensors have center ceiling position priority) to bring floor-to-ceiling height to eight (8) feet.

3.2.3 One (Two, etc.) ( ) Fluorescent Fixtures shall be "full float" short mounted at each end with relamp of each individual lamp by removal of cast end cap, held captive by stainless safety cable. Fixtures shall be near center ceiling, positioned to give fire suppression components center ceiling priority. Ballast shall be thermally protected for temperatures down to 0 degrees Fahrenheit, and the 100 watt lamps shall be good for minus 20 degrees Fahrenheit starting. Lighting shall be controlled with a switch within 1' of a door. Fixture shall extend down from ceiling not more than 10 inches.

3.2.4 Outdoor Lighting: A photoelectric controller shall operate (one, two, etc.) 250 watt high pressure sodium flood light fixture(s). The fixture(s) shall be installed on one, both, or end(s) of the building and/or next to, over, or between overhead roll up door(s).

3.3 Ventilation Systems: (For failsafe system, see paragraph's 3.3.3 Dual Ventilation and 3.15 Standby Generator)

3.3.1 Low Level Ventilation System Explosion Proof Exhaust Fan (#1) shall provide six (6) air changes per hour. Each exhaust fan shall have a direct drive aluminum non-overheating centrifugal wheel in (A) spun aluminum exterior housing or (B) a square steel housing with formed collars for duct connection for user to provide ductwork from inplant Haz-Safe building through facility to outside. (Fans with propeller blades are not acceptable.) The motor shall be sealed from contaminants in the building's (room's) exhausted air stream and cooled through a separate outside fresh air tube. All electrical connections and motor shall be accessible through a removable cover. The fan shall draw fresh air into the building through the air intake vent (as described in paragraph 2.5), across the top of the elevated flooring to the (A) building's (room's) or (B) optional separation wall's vent opening and across the next room's elevated flooring to the building's other end wall's exhaust air opening. This opening shall be within one (1) foot of the grated floor line (N.F.P.A.-30, part 3, para. 2-2.7.1) and constructed with a 1-1/2 or 3 HRFR fusible link U.L. approved fire

damper. (Optional fire suppression released solenoid link.) (Fans mounted inside or at the ceiling shall not be acceptable.) The opening through the wall shall lead to a 12 gauge duct which shall be welded up the outside wall to within six (6) inches of the roof line. The ductwork shall comply with UL 181 or comparable NRTL Standard and SMACNA 90. At the top of the duct, the fan(s) shall be installed. (Optional 1995 N.F.P.A. 91 paragraph 2.4.5.1 says, "...flammable or combustible materials, discharge shall terminate above the roof with direction away from combustible construction that is within 25 ft..." The duct shall continue up the outside wall and over the corner of the roof so that the fan shall be mounted on the roof. This shall require the fan to be shipped packaged and stored within the building for user to install at site. User shall also be responsible for providing a chimney or stack for discharging fumes at a to-be-determined higher height.) (Fan(s) shall be easily serviced outside building, saving removing stored containers, shelving, etc., out of way to service fan inside.)

Optional: There shall be a steel duct chase installed over the air exhaust vent opening down to an opening in the elevated flooring. This will draw air across the bottom of the sump from the similarly equipped air intake vent (paragraph 2.5).

3.3.2 Single or Dual 10" Wide x 4" Deep Posi-ventilation Duct(s) shall be welded as an integral part of the elevated floor system's support steel (para. 1.6.2) and over either the "V" connection of the optional double sloped floor (para. 2.2.2) or the sloped trench (para. 2.2.3) and shall transition up out of the elevated flooring to the air exhaust vent opening (para. 3.3.1). The purpose of the posi-ventilation system is to remove heavier-than-air fumes coming down the sloped floors and off spilled chemical liquids gathering in the "V" of the sloped floors or the sloped trench and eliminate compromising the designed air flow pattern when door(s) are open. Optional: Each room's dual sump floors shall each have a tubular duct. The bottom of the tubular duct chase shall have an appropriate number of exhaust holes on 24" centers along its length. After the tube is cut to length and the holes are drilled, the tube shall be hot dipped galvanized. The holes shall have an average 2" diameter with smaller holes nearest the exhaust fan end of the posi-vent tube and larger holes at the end farthest from the exhaust fan end. (Posi-Ventilation System is U.S. patent pending.)

3.3.3 Optional Dual Ventilation and Control Systems: Fan #1 shall run continuously (BOCA F-2317.2.1 - 3 and 4) and shall have an optional explosion-proof air pressure sensor/switch installed in its exhaust air stream (N.F.P.A.-30, part 1, para. 4-4.2.11). If air pressure falls off or fails in Fan #1, automatically an optional Fan #2 shall be switched on as well as an audible (bell) and visual (blue) "trouble" alarm strobe on the roof for Fan #1 and a remote trouble alarm contact for user's trouble alarm system to connect to. A control box on the exterior of the building shall have: 1) a blue fan malfunction pilot light, 2) a

common alarm silence push-button to stop alarm bell ringing, and 3) a common reset push-button to put out the strobe, pilot light and shut off Fan #2. Dual fan system shall require a back draft damper to prevent either fan from becoming the building's air intake vent. (Fan #2 is provided to: 1) reduce or eliminate need for explosion relief panels, and 2) assure local authority having jurisdiction (AHJ) there should be no reason to believe fumes could accumulate and create a condition to harm workers or a chance for a spark to trigger an explosion.)

Fan #2 shall have an optional on/off switch installed inside the building(s) or room(s) with a built-in (up to 30 minutes) timer. (The purpose of the on/off switch is to (a) test fan #2 to check operation and (b) almost double air changes during mixing, dispensing, and testing of hazardous materials and during spill cleanup emergencies. The purpose of the timer is to (a) make sure fan #2 is not forgotten to be turned off and (b) limit stress on the A/C and heating systems during extreme outside temperatures when both fans are running at the same time.) When the optional posi-vent duct system (as described in para. 3.3.2) is utilized, there shall be no on/off switch for the second fan. Instead, the two separate fans shall be interconnected by a lead lag controller to alternate primary and secondary fans on an adjustable time line basis.

There shall be an optional pilot light indicator for each fan mounted on the outside wall of the building, labeled "Ventilation Fan #1 On" or "Ventilation Fan #2 On."

- 3.4 Optional Fume Extractor Arm System shall consist of an explosion proof exhaust fan (#3, if option for above dual low level exhaust system is specified. Otherwise, this fan is (#2), a rated vent opening, an internal duct and (one, two, etc.) telescopic extractor arm(s) with fume scoping hood. The exhaust fan (#3) shall be similar to the fans described in paragraph 3.3 and mounted on the exterior wall or on the roof over a vent opening that is protected with its own 1-1/2 or 3 HRFR gravity (wall type) or spring loaded (ceiling/roof type) damper and a separate back draft damper. A stainless steel plate shall cover the vent opening that shall have attached a minimum 6" dia. duct installed over to a 10 gauge steel duct chase that is mechanically fastened to the ceiling. Attached to the bottom of the duct chase shall be a 6" dia. telescopic extractor arm. The combined dimension of the chase and the upper mobile elbow of the extractor arm in the horizontal position shall not be closer than 7' to the elevated floor of the building. The hood of the extractor arm shall be capable of being placed over and to within 10" of the top of a set of 55 gal. drums on a 4" high pallet setting on the floor. The arm shall consist of an upper 360° swivel elbow (ceiling mounted) or 180° (wall mount), a 6" dia. wire reinforced PVC hose and a four-way friction joint at the hood. The extractor's mechanical support shall consist of an internal telescopic zinc coated outer tube and second and third aluminum extruded internal tubes and an arm spring. The hood shall be made of spun aluminum with an internal mouth opening of 12" and the outer opening of 15". The lip of the hood is rolled to function as a hand grab to permit easy mobility.

There shall be a separate on/off switch to operate the fan and a thirty-minute timer to shut it off.

3.5 Optional Break Glass Shutdown Switch (BOCA F-2317.2.1-4) shall be installed on the outside wall of the building for emergency shutdown of electrical components operating inside the building such as exhaust fans, fan driven A/C and heating systems, etc. Switch shall be labeled "Emergency Shutoff Ventilation Fans and Electrical Systems."

3.6 Optional Upper Level Ventilation System for removal of lighter-than-air hazardous vapors or hot air accumulation at ceiling shall have air vents (similar to vents described in 2.5) to be installed through the walls at ceiling height. One vent is for upper air intake on each room's exterior wall, and the other is installed on opposite room's end wall in front of the #2 exhaust fan (as described in paragraph 3.3) at top of exterior duct. A motorized louver shall be installed over each room's intake and exhaust vent end wall openings to be controlled by a single thermostat (in room with exhaust vent end wall) which shall operate when the room gets too hot and/or a gas sensor on the ceiling (see paragraph 3.8) alarms and removes lighter-than-air fumes. There shall be a galvanized duct extending across the ceiling from the exhaust vent opening on the end wall nearest the fans to the vent opening in the separation walls. Each room shall have a manually adjustable exhaust louver on the duct. (The upper ventilation system shall exhaust 70%, and the lower ventilation system shall exhaust 30% of the air and with both fans running at the same time, the air changes in the building shall be increased up to 75%.)

3.7 Optional Liquid Detection System, as indicated in BOCA: 418.3.2.6, shall consist of a classified detector installed down as close to the flat sump floor (as possible) at the low edge of the sloped sump floor or from the outside of the building into the side wall of the optional alarm pit(s) as described in para. 2.2. When approximately 1-1/2" of liquid rises from the bottom of the pit, an alarm shall be initiated, turning on a common audible bell and visual (amber) alarm strobe on the roof (optional BOCA 418.3.2.6 requires a strobe at every point of entry and a "warning" sign on every door) and operating a set of contacts for remote signaling of a spill alarm to user's central facility annunciator. In addition, the spill alarm shall automatically turn on the optional fan #2, almost doubling the room('s) air changes per hour. A control box on the exterior of the building shall have: 1) an amber pilot light for each float detector, 2) a common alarm silence push-button to stop alarm bell ringing, and 3) a reset push-button to put out strobe, pilot light and shut off Fan #2.

3.7.1 Float Type Liquid Detector shall have a stainless steel leakproof housing having within it a lever mechanism with a polypropylene float bulb (stainless is an option) extending out from one end of the housing. At the other end of the lever is a magnet which moves next to a stainless steel inner wall of the

housing. On the other side of the wall is a magnetized DPDT switch. Detector shall be U.L. listed, Class I, Groups A, B, C, and D, and Class II, Groups E, R, and G, rated at 5 amps, 125/250 VAC.

- OR -

- 3.7.2 Tuning Fork Type Liquid Detector shall have a 316 stainless steel frequency shift tuning fork driven by a piezoelectric crystal housed in an aluminum housing (stainless is optional) with all electronics and a DTDP relay. The electronics shall be continuously self-checking so as to send a separate "trouble" alarm during malfunction. Liquid detection shall not be hampered by debris falling into and collecting in the alarm/drain pit as described in paragraph 2.2, vibrations, or shall be unaffected by liquids of varying density, viscosity, capacitance, conductivity, and wide temperature shifts. Detector shall be F.M. approved, Class I, Division I, Groups A, B, C, and D, universal rated 8/16 milliamps and 19 to 253 VAC or 19 to 55 VAC.
- 3.8 Optional Gas Detection System shall consist of a single MSA Model #A-Ultima XE33E1S00000003C gas monitor for Class I, Div. 1, Group B, C, and D to be mounted in optional posi-ventilation duct tube, as described in paragraph 3.3.2, and/or a gas sensor mounted on the ceiling and connected to the upper ventilation system (see paragraph 3.6). In a NEMA 4X box on the exterior shall be a Model A-5100-N-1-01-0-0 two channel capacity RMR unit with three relays for each channel, common trouble relay and common horn, horn relay with a 3 digit digital display and three LED's for set point status indication, MSA Calibration Kit #A-CAL-40F-10028034-000-10028028, a span gas and zero gas cylinder. The gas detection system shall be tested on the factory floor. The on-site tests and calibration are the responsibility of the user who can contact and contract locally with MSA's nearby dealer/distributor.
- 3.9 Optional: One (Two, Three, etc.) ( ) Ruffneck Ceiling Suspended Fan-Forced Unit Heater(s) with thermostat shall produce ( ) KW's of heat to maintain room at ( ) and be sized to handle six air changes per hour per paragraph 3.3. (Stratified hot air at ceiling is forced down to the floor in order to reduce heat loss and to be sure stored product on floor will not freeze.) (Convection heaters are not acceptable.) Unit shall be listed for Class I, Div. I, Groups C and D. Circuit breaker size shall be ( ) amps for 480 volts and 3-phase. The cabinet assembly shall be fabricated from 14 gauge steel with a baked epoxy powder coating over a 5-stage pretreatment including iron phosphate, for protection from corrosive atmospheres. Louvers shall be individually adjustable and made of anodized extruded aluminum.
- 3.10 Optional: One (1) Convection Heater With Thermostat shall be mounted 6" off the wall and in front of air intake vent (as described in para. 2.5) to preheat or temper sub-freezing incoming cold air. (This air could freeze the liquid materials stored in the air circulation path from the air intake vent across to the exhaust vent.) Heater shall be rated for 3.6 KW's. Heater cabinet shall be 36" long x 20" high x 8-1/2" deep and

mounted 42" off the floor. It shall be designed for Class 1, Division 1, Group D atmospheres, in accordance with the National Electric Code.

- OR -

3.11 Optional Intake Air Vent Preheater shall be one (1) 5 KW Chromalox heat exchanger (taken out of U.L. listed CXH unit heater as described in para. 3.8) mounted in a custom engineered steel housing to be bolted over the top of the exterior of the air intake vent (para. 2.5). The rain louver and bird screen of the vent opening shall be moved out in front of the preheater housing. The exchanger shall be controlled by a thermostat preset at 50°F and be prewired and tested with a control center, including a magnetic contactor, transformer, and terminal block in a NEMA 7 and 9 housing. There shall be a high limit manual reset thermal cutout. The heat is transferred from a copper sheathed immersion heater within steel tubes with aluminum fins. Within the vent housing shall be an air pressure/sensor to shut off the heater when uniform air flow rate across the heat exchanger drops below a minimum of 700 CFM. The 165 degree F. fusible link release of the drop down fire damper in the vent opening shall be replaced with a solenoid release that is connected to the discharge of the fire suppression system.

3.12 Air Conditioner Units:

Optional One (Two, Three, etc.) ( ) Explosion Proof Air Conditioner (off-the-shelf residential A/C units, modified by removing U. L. label, all wiring and controls from the front portion of unit and reinstalling on outside wall of building) shall be installed through the exterior wall of building (room(s), etc.). There shall be a thermostat housed in an explosion-proof enclosure installed 60" off the floor. The wall opening shall be framed in 1/4" thick tubular steel. Unit shall be rated for ( ) BTU's, and sized to maintain ( ) degrees Fahrenheit with six air changes per hour per paragraph 3.3. Circuit breaker size shall be ( ) amps for ( ) volts and ( ) phase. Inside portion of the unit, with no electricals, meets Class 1, Group C & D, Division 1 (outside portion of unit shall be Division 2). (Based on the use of Table 705.3 in the 1996 BOCA Code, the air conditioner opening does not have to be fire rated).

3.13 Optional Refrigeration System for building shall be capable of maintaining degrees Fahrenheit. System shall be split type: Unit cooler shall be a BTU evaporator/air handler, conforming to NEC Class I, Division I requirements. Unit shall be suspended from the ceiling above the door of the building. A non-classified condensing unit with all weather housing shall be mounted on a cantilevered platform welded to the outside at the end of the building.

3.14 Optional: ( ) Receptacles with mechanical interlock and circuit breaker in cast aluminum, explosion proof housing shall be provided. Unit shall be supplied with appropriate plugs for user to connect to end of flexible power cable of user's testing equipment.

- 3.15 Optional One (1) Air Cooled Gas Engine Electric Generator shall be installed on a 5' wide x 3' deep cantilevered platform constructed of tubular steel and galvanized steel grating that is welded to one end of the building or modular unit. The generator shall be 120/240 VAC, single phase with a 6 kW output for automatic standby power for the building's ventilation and alarm systems. The natural gas (supplied and connected by others) shall be OHV1 design with "Spiny-Lok" cast iron cylinder walls, electronic ignition. The electric generator shall be of revolving field design with skewed stator, displaced phase excitation, automatic voltage regulation and U.L. 2200 listed. There shall be a U.L. listed fully automatic transfer switch for up to 100 amps. The unit shall be 24" deep x 48" long x 28" high painted steel weather protective enclosure with an enclosed critical grade muffler.

4.0 SAFETY SPECIALTIES AND OPTIONS:

- 4.1 Optional Dry Chemical Fire Suppression System: Ansul pre-engineered, stored pressure type, shall be UL listed and FM approved for detection and suppression of a fire. System shall include all chemical tank(s) for agent storage to protect against A, B, and C type fire hazards size for total flooding, manual pull stations, automatic detection by means of U. L. rated mechanical 212 Deg. F. fusible links designed to separate at specific temperature and release tension on the detection cable which will cause the mechanical controls on the tank to release the agent through a distribution piping network on the ceiling (sizes, length, and fittings all predetermined) ending at nozzle(s) designed and tested for specific areas of coverage. Wiring, and local remote and shutdown contacts shall be as required per N.F.P.A. 70. Chemical tanks, control head, and appropriate devices shall be housed in NEMA 4 weatherproof steel enclosure on exterior wall. All electrical devices within NEMA box shall be Class I, Div. I explosion proof housings to insure any flammable or combustible vapors coming into the box from the open detection and discharge piping cannot contribute to an explosion. There shall be an audible horn and visual fire (red) alarm strobe on the roof and a set of alarm contacts for user's fire alarm system to be connected to. Activation of a fire alarm shall shut down all exhaust fans, HVAC systems, and lighting.
- 4.2 Optional Underhung Water Sprinkler Piping Assembly shall be installed on the ceiling of the building with appropriate number of U.L. listed 212 Deg. F. fusible link heads (one [1] per each 100 ft.<sup>2</sup>) and a stubbed through-the-wall pipe with a minimum 1/4" NPT exterior coupling or 2-1/2" connection for local fire department to connect to in response to an alarm. Optional: There shall be a water flow sensor for local and remote alarm and shut down contacts. There shall be an audible and visual fire (red) alarm strobe on the roof and a set of alarm contacts for user's fire alarm system to be connected to.

- 4.3 Optional: Steel Storage Shelves shall be designed to be bolted to the ceiling and/or walls, and shall not have floor supports so as to not interfere with the removal of the floor during spill cleanup. ( ) total linear feet of shelving in ( ) tiers located on the ( ) long walls and ( ) short wall. The shelving shall be of no less than 14 gauge galvanized steel, not less than 18" or 24" deep, and with a 1" lip (front and exposed sides), and to have a load rating of not less than 150 lbs. per sq. ft. The top edge of the lip shall be protected with a pressed-in-place steel reinforced rubber grommet. Each shelf shall be height adjustable to within 2' of the grated floor and up to 6' above the floor.
- 4.4 Optional: One (1) ( )Wide x 6'8" Long Class A Steel Ramp per CFR 29, OSHA 1910.37, table E-1, minimum width of the door(s), and length a minimum of eight (8) inches long for every one (1) inch of door threshold height. (10" threshold equals 6'8" long and Option #1: 8" high threshold equals shorter 5'4" long ramp. See paragraph 1.7) Ramp shall have 3/16" thick checker or diamond plate surface welded to steel supports. Ramp shall have a notched back plate that sits down onto 1/2" thick steel brackets that are welded on building wall under door threshold. There shall be a 1' wide section of the ramp that is hinged to allow the leading edge to be no higher than 3/16" to allow for easy passage of hand-trucks onto the ramp. Ramp shall be painted gray. Option #2: Shall have yellow safety handrails bolted to it. Option #3: Upper portion of ramp shall have grated flooring to reduce dirt being tracked into building. Option #4: Recessed flush into ramp flooring shall be two (2) 11" wide x 4-1/2" high swing-out forklift handles in order for a single ramp to be forklifted from door to door.
- 4.5 Optional: One (two, etc.) Emergency Shower/Eye Wash Station(s) shall be attached to the interior or exterior wall of the building, consisting of shower head and eye wash assembly joined with 1-1/4" diameter galvanized steel pipe covered with yellow polyurethane. The 10" diameter yellow plastic shower head shall be controlled by a chrome plated brass 1" IPS stay-open ball valve operated by a stainless steel triangular handled pull rod. A 10" dia. stainless steel eye wash bowl and spray heads shall be controlled by a chrome plated 1/2" IPS stay-open valve activated by either a push flag handle or stainless steel foot treadle.

## 5.0 **PREPARATION AND EXECUTION:**

- 5.1 Final Factory Inspection of building shall be performed in accordance with Factory Mutual whereby quality control inspection and test forms shall be filled in, signed off, and made available for user upon demand. Provisions shall be arranged with a national manufacturer for user to contact and contract with an authorized local dealership to provide for inspection, hook-up and arming of the dry chemical suppression system, testing of operation of the overhead roll up doors, and the availability in the future for local testing and maintenance service.

- 5.2 NFPA 704 Sign Rating Decal, DOT Flip Chart Placards, and a Metal Plate with Factory Mutual (FM) approved mark, model number, storage capacity, fire rating, and location limits shall be provided on door of building (each room, etc.). There shall be a 6" high red stripe (denoting a fire rated building) and a green stripe (denoting a non-combustible building) between the top of a standard door and the roof. In the stripe shall be appropriate white-colored Factory Mutual and hour fire rating decals.
- 5.3 Documentation/Quality Assurance shall be provided in the form of (a) As-Built Drawings (one [1] set) after building has been accepted by user. Three (3) sets of Operation, Maintenance and Component Data Manuals shall be provided. User shall be permitted inspection visits at manufacturing plant in Sarver, PA at any time during on-going fabrication prior to, during, and after completion at reasonable times to be mutually determined. Manufacturer shall fix or replace any part of the building, components, or systems found to be unacceptable during the shop tests/inspections.
- 5.4 Building shall have all corners, sharp edges, and protrusions covered with foam padding and covered with heat shrunk, non-smear type plastic wrap strapped with nylon ties prior to shipping.
- 5.5 Purchaser Responsibilities include 1: building permits, 2: off-loading crane or forklift, 3: foundations such as concrete pads or pylons, shims, fasteners, or anchor bolts for securing building to foundation, 4: removal of shrink wrap, packing materials, tape, and temporary "open wall" fill-in materials required for shipping, etc., 5: arming and testing fire suppression systems or overhead door testing and adjustments, 6: installation of electricity grounding rods, electrical power connections, including but not limited to, wiring, conduit, supports, transformers, disconnect switch, remote wiring, 7: re-installation devices for safe shipping practice, 8: utility connections of electrical or water plumbing, and 9: paint touchups.
- 5.6 Modular Building: Delivery and installation of ( ) modular units shall consist of one of two options: (1) Haz-Safe supervising modules being lifted from their trailers and onto user foundation and technical support for purchaser installation crews, **OR** (2) Haz-Safe providing labor to anchor building to user's foundation, join modules together and seal with silicone caulk all exterior joints at roof and walls, fire caulk all interior joints on wall and ceiling, re-apply custom trim moldings as required, replace sump floor cap and install roof cap, and to reconnect all electrical, fire suppression, and alarm systems where they were separated at the modular joint connections, to reinstall all outside electrical and fire suppression components that were removed for shipping purposes, and (3) providing for final check and testing of refrigeration, alarms and suppression systems, and paint touchups.

5.7 Warranty by the manufacturer for materials, labor, and workmanship on the buildings shall be as follows:

5.7.1 Ten (10) years on all welded steel including, but not limited to, quarter (1/4) inch thick tube steel skeleton and ten (10) gauge steel exterior skin. (User has responsibility to repaint painted steel surfaces a minimum of every two years, or longer depending upon surface conditions.)

5.7.2 Two (2) years on all painted steel surfaces.

5.7.3 Fifteen (15) years on all interior baked-on porcelain enamel steel surfaces.

5.7.4 Warranty for all accessories and components shall be as per each individual manufacturer.

5.7.5 User/customer has all responsibility and liability for all loss or damage arising from application, use, and any accidents occurring in, on, or near building. User agrees to indemnify, hold safe and harmless, and defend Haz-Safe Division of Precision, LLC, its officers, and employees from any and all liens, charges, claims, demands, losses, and costs, including but not limited to legal fees and other court costs, causes of action or suits of any kind or nature whatsoever from any causes whatsoever, whether known or unknown, foreseen or unforeseen, arising by reason of Precision's products after installation.

5.8 Manufacturer Proof of Performance shall require upon request evidence of experience, knowledge, and warranty capability in manufacturing of heavy duty steel buildings as described herein that are still in service after ten (10) years and installation of interiors utilizing porcelain enameled steel clad gypsum for over fifteen (15) years. Proof of same shall be provided with a published list with a minimum of ten (10) satisfied customers including up-to-date contact person and phone number for each, and shall be prepared to show complete "in-house" (using company paid employees) control of every manufacturing function such as ... purchasing of raw materials and components, inventory, production, engineering, labor, and state-of-the-art CAD and production facilities. Subcontracting or brokering of work shall not be acceptable.