HPW-TP-0511.00
(December 2002)

H.P. WHITE LABORATORY, INC.

TEST PROCEDURE

BALLISTIC RESISTANCE AND FORCED ENTRY RESISTANCE OF FLIGHT DECK DOORWAY ASSEMBLIES OF PASSENGER AIRCRAFT

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ABSTRACT

This test procedure establishes minimum standards of ballistic resistance and forced entry resistance of doorway assemblies used in passenger aircraft to control access to the flight deck.

1.0 INTRODUCTION

1.1 Background

1.1.1 The hazards of public air transportation have, until recently, been from unintended mechanical failures, operator errors, and severe meteorological conditions.

1.1.2 Increasing criminal and terrorist activities, intended to seize control of aircraft, have prompted members of the airline industry to request H.P. White Laboratory, Inc. to develop a test procedure with which to evaluate physical barriers intended to resist unauthorized access to the flight deck space of passenger aircraft.

1.2 Discussion

1.2.1 Operational control of an aircraft may be exercised either directly or indirectly.

1.2.2 Indirect control of an aircraft may be characterized as threats to cabin personnel, or passengers, to coerce flight deck personnel to alter the destination of the aircraft, i.e. hijacking. The prevention of indirect control of an aircraft is outside of the scope of this test procedure.

1.2.3 Direct control of an aircraft requires access to the flight deck, and disabling flight deck personnel. Denial of this access is best accomplished by the use of physical barriers.

1.2.4 Separation of the passenger cabin and flight deck is effected through the use of a permanent bulkhead, or bulkheads. Access to the flight deck is provided by a lockable doorway, or doorways. Elimination of such doorways will effectively eliminate cabin-to-flight deck movement. However, this is not regarded by many members of the airline community as a viable option.

1.2.5 As such, this test procedure is intended to ensure that bulkhead doorway prototypes satisfy a minimum standard of ballistic resistance and forced entry resistance.

1.2.6 Forced entries are best characterized by the nature of the assembly to be breached, the tool complement available, the number of perpetrators, the experience of the perpetrators, the vigor of the perpetrators, and the elapsed time available.

1.2.7 This test procedure assumes that existing security procedures intended to deny the boarding of forced entry tools may be circumvented.

1.2.8 This test procedure recognizes that implements normally on-board passenger aircraft may be improvised to force an entry to the flight deck.

1.2.9 This test procedure includes the use of concealable firearms and explosives, which may be undetected by passenger screening personnel, or cached on-board by an airline, or airport, employee accomplice.

1.2.10 This test procedure assumes the number of individuals actively engaged in a forced entry of the flight deck will be limited to two, due to space limitations imposed by rather narrow corridors on most aircraft. However, these individuals may have accomplices to assist in their replacement as they fatigue.

1.2.11 The time available to force an entry will, in the extreme, be limited to the time necessary to safely land an aircraft. It is assumed a domestic flight can be safely landed at an airport within thirty minutes of an altercation. It is further assumed an international flight can be safely landed at an airport within one-hundred twenty minutes of an altercation. As such, the manufacturer shall declare whether the bulkhead doorway prototype submitted for testing is intended for use on domestic flights, requiring a thirty minute forced entry resistance test, or international flights, requiring a one-hundred twenty minute forced entry resistance test.

1.2.12 This test procedure is intended to evaluate bulkhead doorway prototypes on their own merit, independent of the existence of other security measures, such as armed security personnel in the passenger cabin, chemical incapacitating devices, etc.

2.0 GLOSSARY OF TERMS

2.1 General

The definitions of this section shall apply to all portions of testing conducted in accordance with this standard.

2.1.1 **BALLISTIC FAILURE** – penetration of the witness panel (see below) by a bullet, bullet fragments, spall from the test prototype, or any combination of these items, as a result of a fair impact, OR any fair impact which unlocks the door assembly, or otherwise results in access to the flight deck, shall constitute failure of the test prototype to satisfy the ballistic resistance requirements of this test procedure.

2.1.2 **FAIR BULLET IMPACT** – any bullet impact which (1) is of the specified bullet type, (2) is within the specified velocity tolerance, (3) strikes the test sample at the intended angle of obliquity, and (4) is no closer than 1.0 inch from a prior impact (as measured from the tangents of the impact holes), except that –

- any otherwise fair impact which impacts at a velocity greater than that permitted by the fair velocity tolerance, but which does not penetrate the test sample, shall be considered a fair impact.

- any otherwise fair impact which impacts at a velocity less than that permitted by the fair velocity tolerance, but which does penetrate the test sample, shall be considered a fair impact.

2.1.3 **OBLIQUITY** – the angle between the flight path of the bullet and a line perpendicular to the surface of the target at the point of impact.

2.1.4 **BULLET PENETRATION** – any fair shot which results in a perforation of the witness panel by a fragment of the bullet, or the test sample, or both, to the extent that the light from at least a 60 watt lamp may be seen, OR which creates a hole in the sample through which the muzzle of a gun may pass (5/8” diameter rigid shape), shall be considered a ballistic penetration.

2.1.5 **WITNESS PANEL** – a 0.020 inch (nominal) thick, alloy 2024T3 aluminum panel positioned 6 inches behind, and parallel to, the test sample. This panel is used to determine whether or not a bullet has penetrated the test prototype.

2.1.6 **BULLET YAW** – the angle between the longitudinal centerline of the bullet and the flight path of the bullet. Yaw, if in question, can be determined with the use of yaw cards. Yaw shall not exceed 3 degrees.

2.1.7 **DISCLOSURE DRAWINGS** – drawings which completely detail the configuration, construction, operation, and installation of the door assembly.

2.1.8 **FORCED ENTRY FAILURE** – passage of a rigid, 8 x 8 x 5 inch rectangular shape through (1) the plane of the bulkhead door, (2) any space created between the bulkhead door and the door frame, or (3) any space created between the door frame and the bulkhead panels.

2.1.9 **MANTRAP** – the space between tandem door bulkheads which, when both doors of the bulkheads are locked, entrap that space. The locking of such doors is normally fitted with an interlock mechanism to prevent both doors from being simultaneously in the unlocked and open position.

2.1.10 **TEST SAMPLE** – one full-size, operational bulkhead doorway prototype, as it is intended to be installed on an aircraft, to include the door, door frame, surrounding bulkhead panels, mounting hardware, locking mechanism, hinging, air-pressure equalization features, and, if applicable, see-through features, speak-through features, and pass-through features.

The bulkhead doorway prototype shall be manufactured, and installed for testing in a manner identical to that intended to be employed in a passenger aircraft. The dimensions of the full-size operational bulkhead doorway prototype shall not exceed the dimensions of the test fixture specified in this test procedure (see enclosed drawing for details). While the dimensions of the door assembly may be varied as desired – thus requiring an attendant variance in the dimensions of the surrounding bulkhead panels – there shall in no case be less than 24 inches of bulkhead material to each side of, and above, the framed door assembly.

Any change in design deemed by the manufacturer to be necessary to pass the requirements of this test procedure - but not accounted for in the disclosure drawings - shall be required in the actual installation of the bulkhead doorway on a passenger aircraft. Such changes include, but are necessarily limited to, the use of additional material, bracing, reinforcement, etc. This requirement shall apply whether the installation is for a new aircraft, or a retrofit.

3.0 REQUIREMENTS

3.1 Test Sampling

3.1.1 The test sampling shall be a full-size, operational bulkhead doorway prototype, as it is intended to be installed on an aircraft, to include the door, door frame, surrounding bulkhead panels, mounting hardware, locking mechanism, hinging, air-pressure equalization features, and, if applicable, see-through features, speak-through features, and pass-through features.

3.1.2 The submission of bulkhead doorway prototypes shall include a set of disclosure drawings, which completely describe the construction, intended mounting, and operation of the prototype. The disclosure drawings shall be in 8-1/2 x 11 inch format.

3.1.3 Submission of bulkhead doorway prototypes and disclosure drawings should be at least ten working days in advance of the scheduled test date to confirm compliance of the prototype with the disclosure drawings.

3.1.4 The manufacturer shall declare whether the bulkhead doorway prototype is to be tested to the *domestic* or *international* forced entry provisions of this test procedure.

3.1.5 A bulkhead doorway prototype found to satisfy the ballistic resistance requirements of Section 3.3 of this test procedure, as well as either the *domestic* flight, or *international* flight, forced entry resistance requirements of Section 3.4 of this test procedure, shall be rated as a *domestic* flight bulkhead doorway, or an *international* flight bulkhead doorway, respectively. Any bulkhead doorway prototype rated as an *international* flight bulkhead doorway shall be deemed as satisfying the rating for *domestic* flight bulkhead doorway, as well.

3.2 Sample Fixturing

3.2.1 Bulkhead doorway prototypes shall be installed in the test fixture in accordance with the instructions provided by the manufacturer.

3.2.2 Installation shall be identical to that intended to be employed in a passenger aircraft.

3.2.3 Prior to the initiation of testing, the door assembly shall be shown to be fully-operable, including the locking mechanism(s).

3.2.4 Prior to initiation of testing, the force necessary to open, and close, the door shall be recorded. The resulting value is for information only, and shall not be used to fail a sample.

3.2.5 Fixturing of prototypes shall include overhead and side restrictions to simulate the restriction of movement caused by the corridor of an aircraft.

3.3 Ballistic Resistance Testing

3.3.1 Bulkhead doorway prototypes shall first be tested for ballistic resistance, after which the *same* test sample shall undergo forced entry resistance testing.

3.3.2 Ballistic resistance testing shall be the same for all prototypes, whether such prototypes are intended for domestic flight, or international flight, forced entry resistance testing.

3.3.3 Ballistic resistance testing of a prototype shall be conducted using caliber .44 Magnum, 240 grain, JHP ammunition only. Impact locations shall conform with the provisions of Table I of this test procedure. The base material of the bulkhead panels, and of the door, shall be subjected to five impacts. The specified impact pattern shall be one impact on each corner, and one impact in the center, of an eight inch square.

3.3.4 All dissimilar features of a bulkhead doorway prototype shall be tested with at least one impact. Such features shall include framing, seams, hinges, lockset assembly, latching assembly, see-through features, pass-through features, etc.

3.3.5 The number of impacts necessary to comply with 3.3.4 will vary with each prototype submission. However, the test director may direct as many impacts as necessary, limited only by the fair impact requirement of Section 2.1.2 of this test procedure.

3.3.6 All impacts shall be at obliquities of zero degrees, except impacts on convoluted features, such as through-passages, speak-through devices, etc., which, in the opinion of the test director, are more readily-penetrated by impacts at obliquities other than zero degrees.

3.3.7 The muzzle of the test barrel shall be positioned 16.5 feet from the impact surface of the prototype to produce zero degree obliquity impacts, except as noted in Section 3.3.6 of this test procedure.

3.3.8 Velocity screens shall be positioned at 6.5 and 9.5 feet which, in conjunction with elapsed time counters (chronographs), shall be used to determine bullet velocities 8.0 feet forward of the muzzle of the test barrel.

3.3.9 Any fair impact, as defined by Section 2.1.2 of this test procedure, which penetrates the prototype, as defined by Sections 2.1.1, 2.1.4, and 2.1.5 of this test procedure, shall constitute failure of the ballistic resistance requirements of this test procedure, regardless of the number of non-penetrating impacts.

3.3.10 Any prototype failing to satisfy the ballistic resistance requirements of Section 3.3 of this test procedure shall NOT be eligible for forced entry resistance testing.

3.4 Forced Entry Testing

3.4.1 Forced entry resistance testing will not be performed until a prototype has first satisfied the ballistic resistance requirements of Section 3.3 of this test procedure.

3.4.2 Forced entry resistance testing shall not be performed by any facility failing to demonstrate at least twenty years of experience in forced entry resistance testing.

3.4.3 Forced entry resistance testing of a prototype shall be conducted subsequent to ballistic resistance testing, and shall be performed on the *same* prototype tested for ballistic resistance.

3.4.4 Prototypes intended to satisfy *domestic* flight requirements shall successfully resist thirty minutes of forced entry resistance testing. Prototypes intended to satisfy *international* flight requirements shall successfully resist one-hundred twenty minutes of forced entry resistance testing.

3.4.5 During forced entry resistance testing, the test director shall direct the efforts of the test technicians to those areas of the prototype the test director deems to be most vulnerable. The test director is obligated to exploit those features of the prototype he believes will most readily permit an entry to be forced. The test director shall ensure testing is performed using only those tools specified in Section 3.4.8 of this test procedure. The test director shall direct the use of these tools, as well as the bodies of the test technicians, in any manner, or combination, he deems appropriate. The test director is not necessarily obliged to ensure the use of all of the tools specified in Section 3.4.8 of this test procedure.

3.4.6 The duration of forced entry resistance testing shall include only that time during which the prototype is actively being testing. If, at any time, testing is suspended, e.g. for reasons of safety, tool replacement, etc., the duration of suspension shall not be charged to the time permitted to force an entry.

3.4.7 Test personnel shall consist of one test director and four technicians. The test director shall be in overall control of the test, shall direct the efforts of the technicians, and shall ensure that testing is conducted in conformance with the provisions of this test procedure. The technicians shall be males between the ages of 17 and 40, shall each weigh between 160 and 250 pounds, shall be athletically inclined, and shall have no physical infirmities precluding them from performing this testing in a vigorous manner. These age and weight restrictions may be waived, if the test director deems an otherwise qualified individual to be fit for this testing based upon athletic conditioning, experience, or both.

3.4.8 The following tool complement shall be made available to the test technicians:

3.4.8.1 Manipulative Tools
- Screwdriver, slotted – 8 inch length (nominal), one
- Screwdriver, Phillips – 8 inch length (nominal), one
- Punch – 1/8 inch diameter, 5 inch length (nominal), one
- Pliers, pump – 12 inch length (nominal), one

3.4.8.2 Impacting Tools
- Hammer, sledge – 4 pound, 12 inch length (nominal), one
- Hammer, ball peen – 32 ounce, 16 inch length (nominal), one

3.4.8.3 Cutting Tools
- Chisel, cold – 7/8 inch edge, 8 inch length (nominal), one
- Saw, compass – 8-12 teeth per inch, 15 inch length (nominal), one
- Hatchet – hand-held, 12 inch length (nominal)

3.4.8.4 Prying/Wedging Tools
- Crowbar – 24 inch length (nominal)
- Wedge – forged-steel, 2-1/2 inch edge (nominal), 9 inch length (nominal)

3.4.8.5 Explosive Tools
- Linear shaped charge – ¼ inch, 125 grains RDX per foot (0.1 pounds of RDX total). This is an optional item, and shall NOT be employed, unless specified by the client.

3.4.9 Should a tool, or implement, be broken during testing, testing time shall be suspended until the tool is either replaced or repaired. While hijackers will not have the opportunity to replace or repair their tools during an actual incident, it should not be assumed their tools will break. Therefore, to permit the worse-case scenario, any tool broken during testing will be replaced or repaired.

3.4.10 Forced entry resistance testing of a bulkhead doorway prototype shall be terminated –

3.4.10.1 when an entry is forced, defined by the passage of a rigid, 8 x 8 x 5 inch rectangular shape through (1) the plane of the bulkhead door, (2) any space created between the bulkhead door and the door frame, or (3) any space created between the door frame and the bulkhead panels, or

3.4.10.2 after thirty minutes of forced entry resistance testing without entry being forced (domestic flight requirements), or

3.4.10.3 after one hundred twenty minutes of forced entry resistance testing without entry being forced (international flight requirements).

3.5 Reporting

3.5.1 A detailed test report shall be completed within ten working days of completion of all testing. The test report shall include:

3.5.1.1 a complete description of the test sample, to include the disclosure drawings provided by the manufacturer prior to testing.

3.5.1.2 the test date, location, and names of all witnesses to the test.

3.5.1.3 a description of the testing, as well as the results of the testing.

3.5.1.4 still photographs of the test sample prior to testing, subsequent to ballistic resistance testing, and subsequent to forced entry resistance testing. Still photographs of all ballistic penetration and forced entries shall be included as well.

3.5.1.5 detailed ballistic resistance and forced entry resistance data records.

3.5.1.6 A videotape (VHS format) of all forced entry resistance testing.

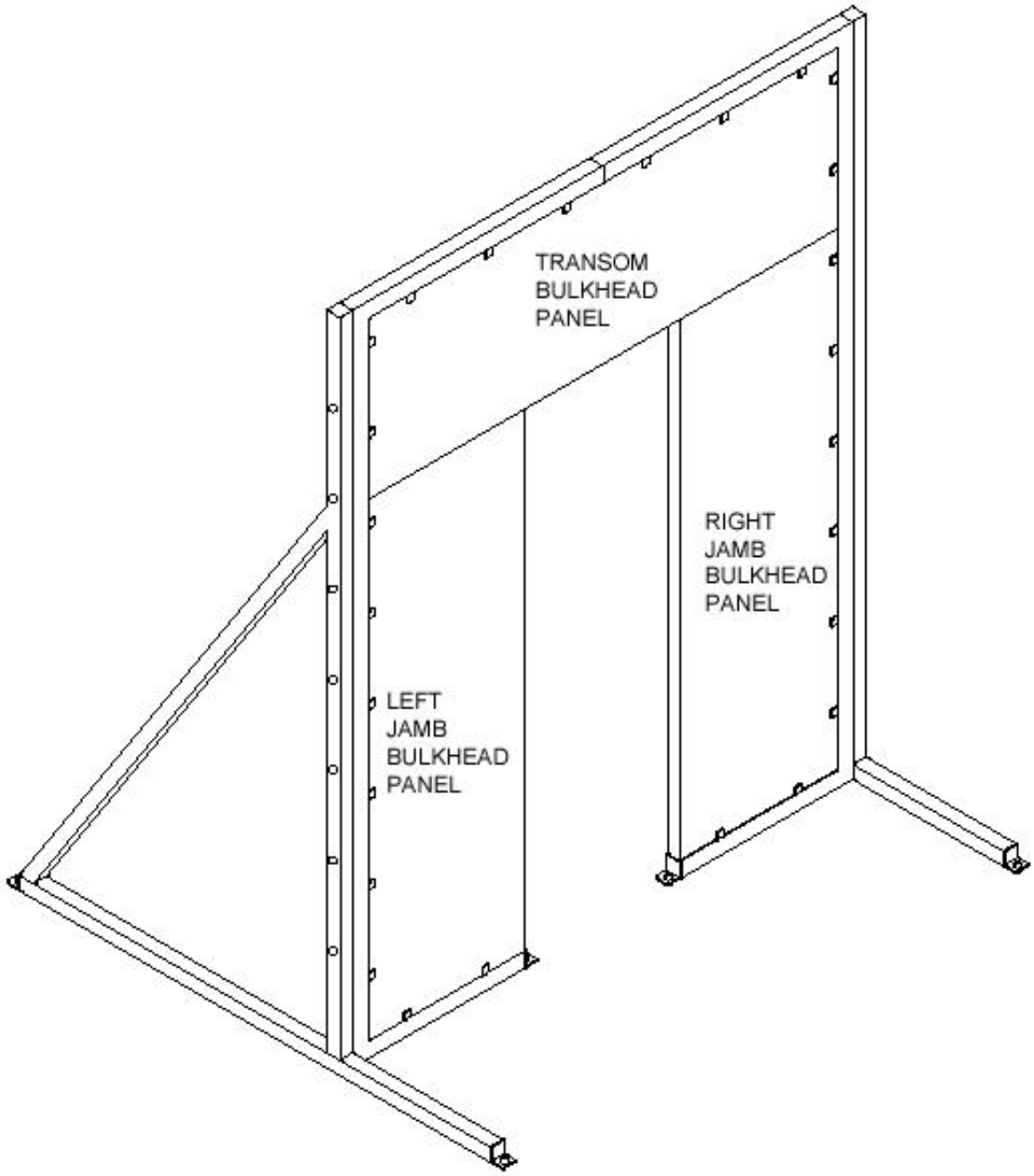
TABLE I. BALLISTIC RESISTANCE REQUIREMENTS (a)

Impact Location	Shots, Minimum(b)
Base Material of Door	5(c)
Door Frame	1
Door-Frame Seam	1
Hinge	1
Lockset	1
Handle	1
Other Features	1 each

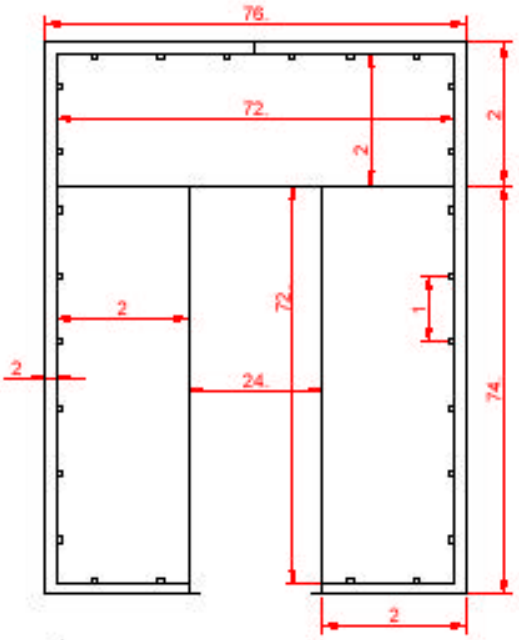
(a) Bullet: .44 Magnum, 240 gr., JHP; Velocity: 1400-1450 fps.
(b) Additional impacts may be required at discretion of test director, limited only by impact spacing requirements of Section 2.1.2 of this test procedure.
(c) One impact on each corner, and one impact in the center, of an eight inch square.

TABLE II. FORCED ENTRY RESISTANCE REQUIREMENTS

Forced Entry Resistance Rating	Time Duration	Tool Complement
Domestic Flight	30 minutes	(See Section 3.4)
International Flight	120 minutes	(See Section 3.4))



TEST FIXTURE LESS DOOR



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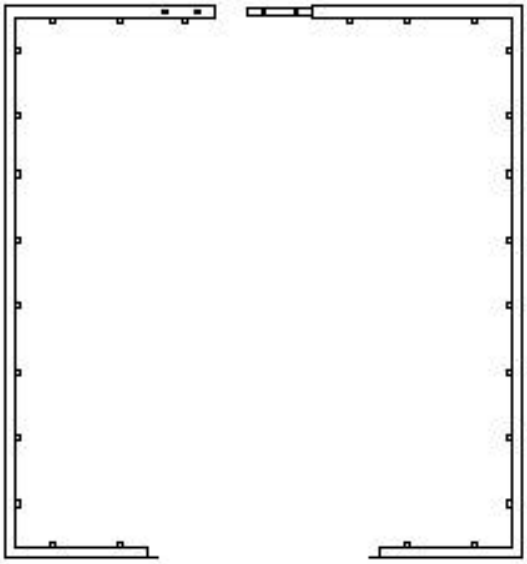

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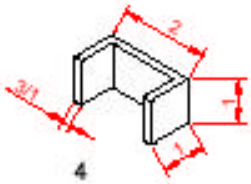

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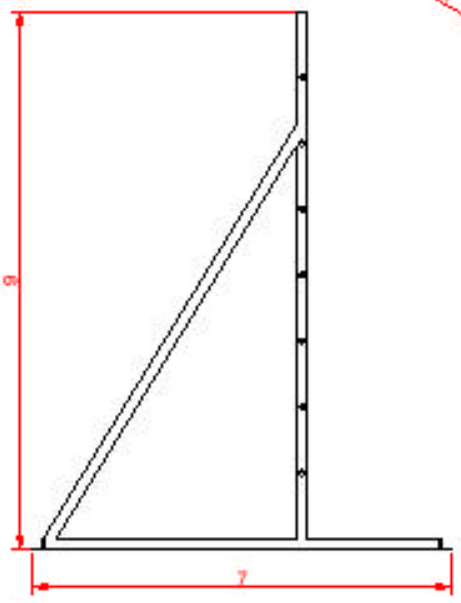

2

3

NOTES:
A ALL DIMENSIONS ARE IN INCHES
B TUBE STEEL TO BE 2X2
C FOOT ANCHOR ELBOWS 1/4" THICK
TO ACCOMODATE 1/2" ANCHORS