Designation: F3277 – 19

Standard Specification for Cantilevered Steel Bunks Used in Detention and Correctional Facilities[1]

This standard is issued under the fixed designation F3277; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification provides five test methods suitable for assessing the safety and performance characteristics of cantilevered steel bunks for detention and correctional facilities.

1.2 These test methods address impact from the top of the bunk, the application of a static force from the top, sides, in various directions, and a force applied from the bottom of the bunk.

1.3 The forces applied simulate those that are foreseeable from abuse by up to two individuals.

1.4 The tests are intended to be used to aid in identifying the appropriate level of physical security associated with various configurations of cantilevered bunk design.

1.5 *Units*—The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.7 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

F825 Specification for Drawers, Furniture, Marine, Steel

F1244 Specification for Berths, Marine

F1427 Consumer Safety Specification for Bunk Beds

F1450 Test Methods for Hollow Metal Swinging Door Assemblies for Detention and Correctional Facilities

2.2 *AWS Standards:*[3]

AWS B2.1-1-003-90 Light Gage Welding Specification (Carbon Steel Sheet Metal 10 thru 18 gauge-Gas Metal Arc Welding)

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *bracket, n—as applied to steel bunks*, end piece, welded to wall-mounted bunk pans, for attachment to a wall, either by using mechanical fasteners or by field welding to embeds or metal wall.

3.1.2 *cantilever, n—as applied to steel bunks*, projecting from the wall, with no support from the front of the bunk down to the floor and no support from walls at either end. The bunk to be fastened to the wall utilizing brackets only.

3.1.3 *embed, v—as applied to steel bunks*, steel plate fixed firmly into a concrete or masonry wall.

3.1.4 *pan, n—as applied to steel bunks*, formed or flat steel sheet with reinforced edges used to form the sleeping platform.

3.1.5 *storage shelf, n—as applied to steel bunks*, compartment with, or without ends, that is attached to the underneath side of the bunk pan.

4. Summary of Test Methods

4.1 There are five test methods: top impact, static force, cantilever, uplift, and end force.

4.2 *Top Impact Test*—This test method simulates the effect of two inmates, each weighing 200 lb (90.7 kg), jumping from a height of 18 in. (457.2 mm) onto the bunk pan. In the test, a pair of weighted shot bags are used to simulate the two inmates.

4.3 *Downward Static Force Test*—This test method simulates the effect of several inmates standing or sitting on the

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from American Welding Society (AWS), 8669 NW 36 St., #130, Miami, FL 33166-6672, http://www.aws.org.

bunk. It measures the rigidity and strength of the bunk pan. In the test, a static load is applied to the center of the bunk pan. Deflection of the bunk pan is measured.

4.4 *Cantilever Test*—This test method simulates the effect of several inmates standing or sitting on the bunk and measures the deflection of the bunk pan and end brackets. This test is conducted applying static loads to various areas of the bunk.

4.5 *Uplift Test*—This test method simulates the effect of two inmates standing on the floor or lying on the lower bunk and applying upward pressure on either of the two bunks.

4.6 *End Force Test*—This test method simulates the effect of an inmate pushing against the end of the bunk and measures the lateral deflection.

5. Significance and Use

5.1 The predictable and reliable performance of detention cantilevered steel bunks used for detention and correctional facilities is a major concern. These test methods aid in checking the physical integrity and attachment security of one or more levels of cantilevered steel bunks installed in detention cells, based upon objective tests.

5.2 The primary purpose of these test methods is to approximate both the normal operating conditions found in detention and correctional facilities and the levels of abuse to which detention steel bunks are potentially subject.

5.3 The desired result from the use of these test methods is to provide a measure of reassurance to facility managers and protection for correctional personnel, the public, and inmates themselves.

6. Specimen

6.1 Two identical full-size bunks are to be submitted for testing. One bunk shall be used for impact testing; the other bunk shall be used for the remaining static load tests. The nominal pan size of each bunk shall be 30 in. (762 mm) wide by 76 in. (1930 mm) long. The room edge of the tested pan and end brackets shall cantilever not less than 32 in. (813 mm) from the wall. The back length tested shall be 76 in. (1930 mm). It is acceptable to use test results for a large size to qualify sizes up to 10 % greater in width or length. Test specimens with smaller dimensional variation in width or length shall be acceptable without further testing.

6.2 *Cantilevered*—Two brackets connecting bunk pan to wall, one on each end of the long dimension of the bunk, with no connection of the bracket or pan to the wall at either end of the bunk. The inside edge of pan shall be located 2 ± 0.25 in. (51 mm) off the wall. Edges shall be formed up, down, or trimmed with angle.

6.3 The bunk shall be constructed of steel appropriate to pass this specification.

7. Test Procedure

7.1 *Top Impact Test:*

7.1.1 This test method is intended to evaluate the capability of a complete bottom bunk assembly (including frame, and other options installed by the manufacturer) to resist a large impact force from the top at a critical designated area.

7.1.2 This test method is intended to simulate two inmates jumping on the bunk and to evaluate the resulting damage on the assembly. Following the test, the bunk shall not be removed from its original location nor shall parts of the bunk be allowed to dislodge from it.

7.1.3 *Weight*—To simulate the weight of inmates, a pair of 200 ± 5 lb (90.7 ± 2.2 kg) weighted shot bags shall be used. Each shot bag shall be approximately 12 ± 1 in. (305 ± 25 mm) in diameter, constructed of heavy-duty reinforced canvas covering with a strap and handle rated for the load, and filled with steel shot or slugs.

7.1.4 Fixture the weights to be 36 ± 1 in. (914 ± 25 mm) apart, centered as depicted in Fig. 1, Fig. 2, and Fig. 3, suspended at a height of 18 ± 1 in. (457 ± 25 mm) above the pan surface, and dropped simultaneously onto the center of the bunk pan (see Fig. 2 and Fig. 3).

7.1.5 After dropping the weight, remove the shot bags and measure the amount of deflection at the center of both the outside and the inside lip of the pan.

7.1.6 Measure also the level of deformation of the lip and the damage at the bracket connection at both the pan and embed. Continue process until bunk pan shows no further deflection.

7.2 *Static Force, Cantilever, and Uplift Tests:*

7.2.1 These three test methods are intended to evaluate the capability of a complete bunk assembly (including frame, wall anchoring, and other options installed by the manufacturer) to resist a large static force from three directions (top, side, and bottom) onto three critical designated areas.

7.2.2 These three methods are intended to simulate the effect of having two inmates either standing on the bunk or applying force to the bunk, and to evaluate the resulting damage to the assembly. Following the test, the bunk shall not be removed from its original location nor shall parts of the bunk be allowed to dislodge from it.

7.2.3 *Weight*—A hydraulic ram and pump able to produce loads in excess of 1000 lb (454 kg) shall be used.

7.2.4 *Test Procedure:*

7.2.5 Apply the weight as indicated in 7.2.5.1 – 7.2.5.3, as appropriate.

7.2.5.1 *Static Force Test*—Place the weight at the center of the bunk pan, pushing down onto a steel plate, 24 in. (610 mm) by 24 in. (610 mm) by 0.25 in. (6 mm) in dimension, in such a way as to distribute the force in a uniform manner (see Fig. 4).

7.2.5.2 *Cantilever Test*—Place the weight at one front corner of the bunk pan, pushing down within 2 in. (51 mm) of the bracket and front lip of the pan (see Fig. 5).

7.2.5.3 *Uplift Test*—Place hydraulic ram at the opposite front corner of the bunk pan from that used in the cantilever test, pushing up within 2 in. (51 mm) of the bracket and front lip of the pan (see Fig. 6).

7.2.6 For each one of the three tests, apply a set of loads, starting at 100 lb (45 kg), and increasing by 100 lb steps up to 1000 lb (454 kg). After each application of the load, measure

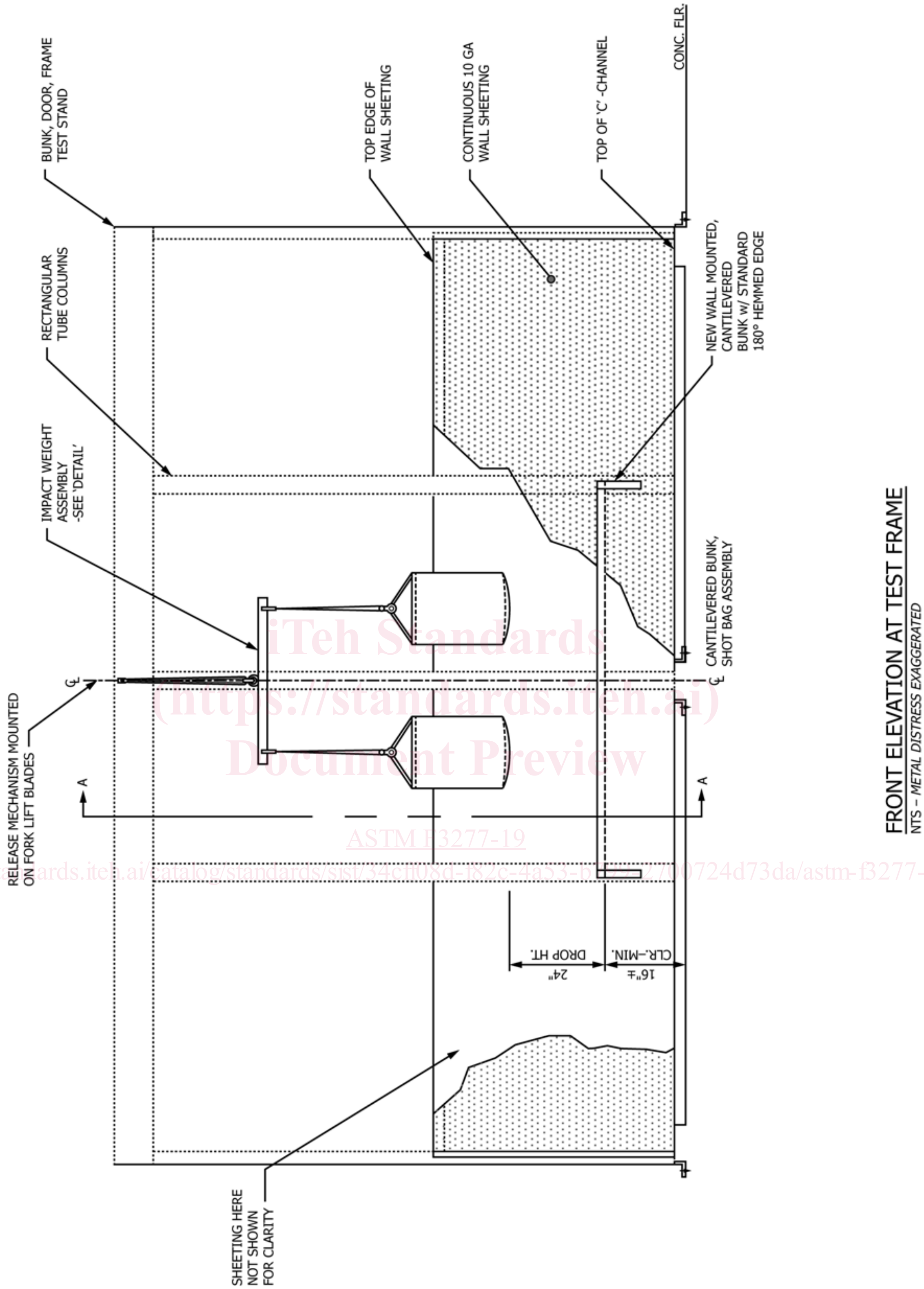
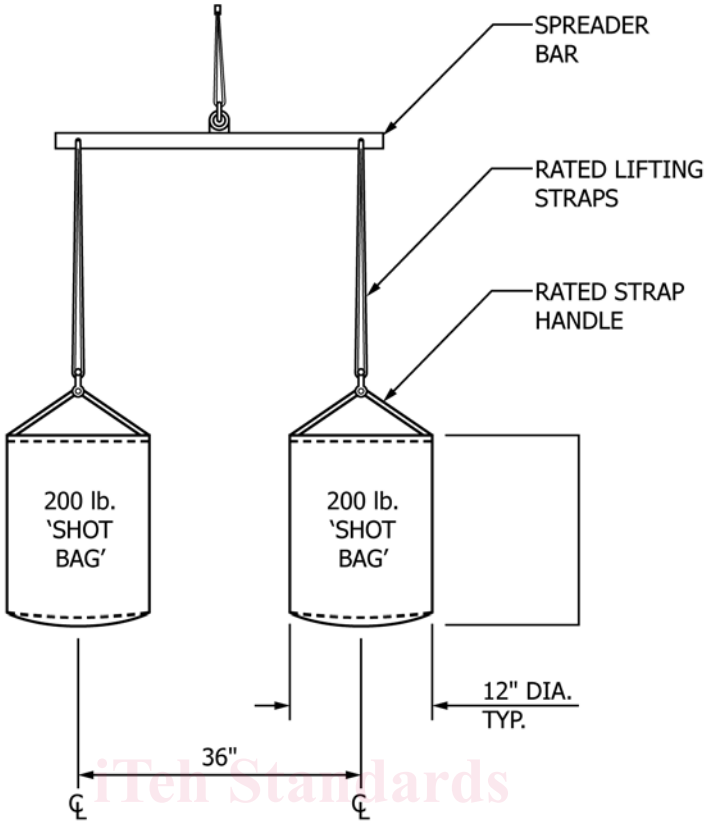


FIG. 1 Top Impact Test

the level of deflection and check for deformation of the lip and for damage at the bracket connection at both the pan and embed.

7.2.7 Measure the deflection following each application of a weight, as indicated in 7.2.7.1 – 7.2.7.3, as appropriate.



IMPACT TEST WEIGHTS
CANVAS BAGS FILLED w/ STEEL SHOT OR SLUGS
– DROPPED SIMULTANEOUSLY, w/ ATTEMPT
TO SIMULATE THE EFFECT OF 'PEOPLE'
JUMPING ON BUNK.

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FIG. 2 Top Impact Test

7.2.7.1 *Static Force Test*—Measure the deflection at both the front and back lips on the centerline of the bunk pan.

7.2.7.2 *Cantilever Static Load Test*—Measure the deflection downwards at the front outside corner of the bunk.

7.2.7.3 *Cantilever Uplift Test*—Measure the deflection upwards at the front outside corner of the bunk pan.

7.2.8 Generate a graph of force versus deflection for each of the three tests.

7.2.9 After measuring the deflection for each load, release the final load and record the rebound or the residual deflection, for each of the three tests.

7.2.10 Report details of bunk construction, description of mounting, and weights used, together with all observations made.

7.3 *End Force Test:*

7.3.1 This test method is intended to evaluate the capability of a complete bunk assembly (including frame, and other options installed by the manufacturer) to resist an end force applied to the bunk at a critical designated area.

7.3.2 The test method is intended to closely simulate the effect of having one inmate push the end of the bunk with the feet, while braced against a wall, and to evaluate the resulting damage to the assembly. Following the test, the bunk shall not be removed from its original location nor shall parts be allowed to come off it.

7.3.3 *Weight*—A cylinder able to produce loads in excess of 1000 lb (454 kg) shall be used.

7.3.4 *Test Procedure:*

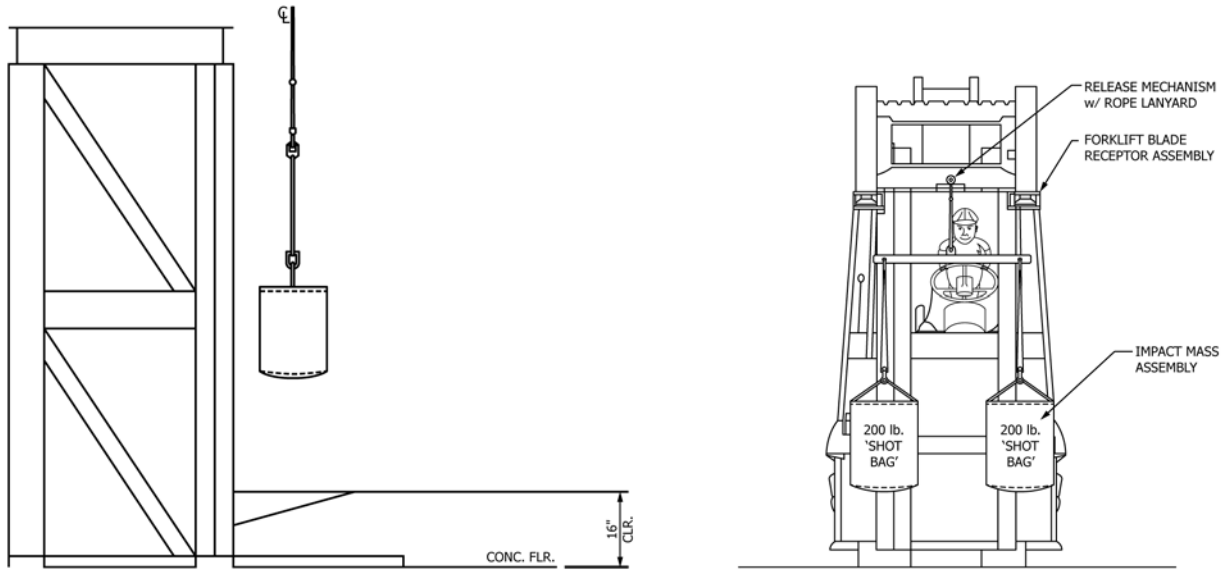


FIG. 3 Top Impact Test

7.3.5 Place the weight at one front corner of the bunk pan end, pushing sideways within 2 in. (51 mm) of the front edge of the bracket or the front lip of the pan (see Fig. 7).

7.3.6 For the test, apply a set of loads, starting at 100 lb (45 kg), and increasing by 100 lb steps up to 1000 lb (454 kg). After each application of a load, measure the level of deflection and check for deformation of the lip and for damage at the bracket connection at both the pan and embed.

7.3.7 Measure the deflection following each application of a weight, at both the left hand and the right-hand bunk edges, in the direction of the load.

7.3.8 Generate graphs of force versus deflection.

7.3.9 After measuring the deflection for each load, release the final load and record the rebound or the final deflection.

7.3.10 Report details of bunk construction and weights used, together with all observations made.

7.3.11 The complete bunk assembly shall be tested without mattresses or bedding. The rigidity and strength of the hinges (if present) can affect the results of the test. A bunk assembly tested without hinges or drawers cannot be retested with those items.

8. Acceptance Criteria

8.1 For each test, the bunk bed shall be deemed unsatisfactory if one of the following occurs.

8.1.1 Loose or damaged parts as a result of testing.

8.1.2 Any of the moving parts cease to function as intended.

8.1.3 Bunk parts do not remain securely joined together, or display buckling, permanent deflection or distortions, which exceed 0.25 in. (6 mm) for all tests with the exception of the top impact test, cracking of welds, or loosening of assembly (non-anchored) fasteners to the degree that the bunk can be disassembled by hand without tools.

8.1.4 The permanent deflection or deformation for the top impact tests in 4.2 shall be reported only with no stated pass/fail criteria.

9. Report

9.1 Report the following descriptive information:

9.1.1 Model or product identification and name and address of laboratory,

9.1.2 Date the laboratory completed tests,

9.1.3 Name and address of bunk assembly manufacturer,

9.1.4 Identifying markings on all components of the test assembly,

9.1.5 Diagrams, details, and photographs of test assembly(s),

9.1.6 Specification and details of test sample components, and

9.1.7 Calibration records of all measuring equipment.

9.2 Report the following test results:

9.2.1 All the information required by the appropriate test method (see 7.1.6, 7.2.10, and 7.3.10) including all test data and observations.

10. Certification

10.1 The manufacturer shall be permitted to produce certification that the assembly was manufactured and tested. Such certification shall be accompanied by a complete test report.

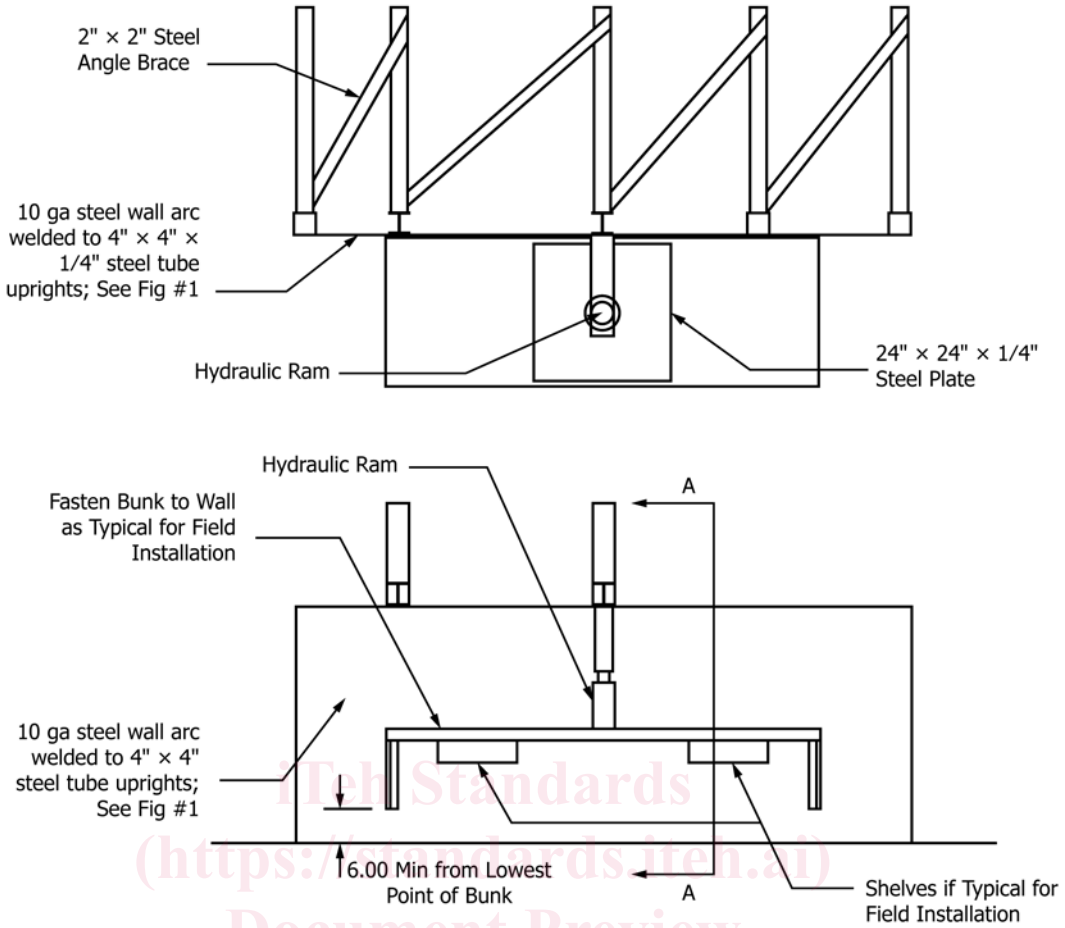
10.2 The manufacturer shall be permitted to contract with an independent testing laboratory to provide the manufacturer with a report certifying construction of the assemblies.

11. Precision and Bias

11.1 *Precision*—The precision of these test methods has not been determined. No activity has been planned to develop information to assess the precision of these test methods.

11.2 *Bias:*

11.2.1 The true value of performance of bunks can only be defined in terms of a test method. Within this limitation, this test method has no known bias and can be accepted as a reference method.



Section A - A Bunk Static Load Test Side View

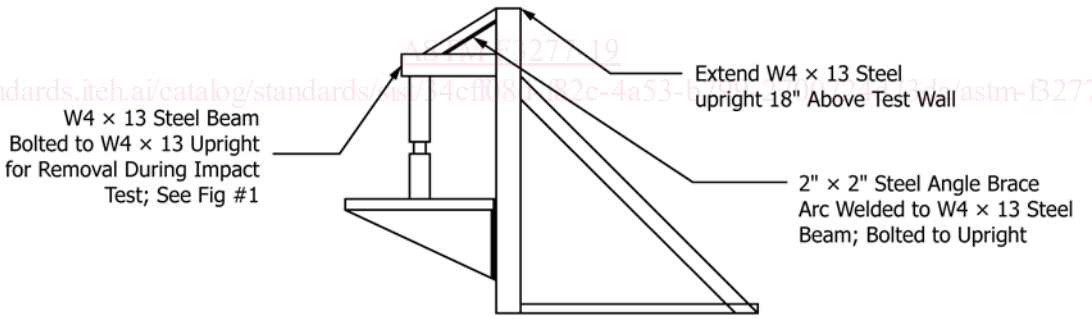


FIG. 4 Static Force Test

12. Keywords

12.1 bunk; cantilever; correctional facility; detention facility; physical security; security level; static force; top impact; uplift; wall mounted bunk