U.S. Department of Justice
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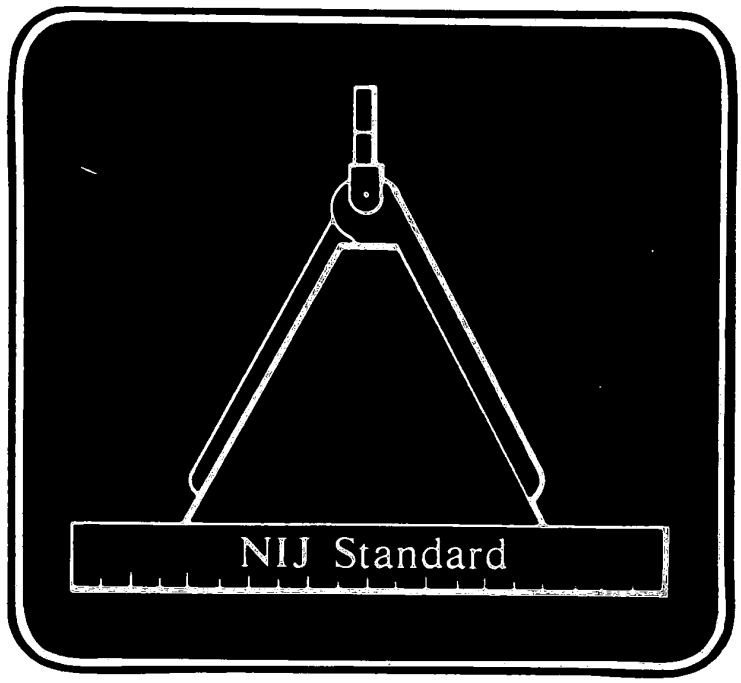
Technology Assessment Program

NIJ Standard-0316.00

Physical Security of Window Units



A Program of the National Institute of Justice

Technology Assessment Program

NIJ Standard for Physical Security of Window Units

A Voluntary National Standard Promulgated by the National Institute of Justice.

AUGUST 1980

U.S. DEPARTMENT OF JUSTICE
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Harry M. Bratt, Acting Director

ACKNOWLEDGMENTS

This standard was formulated by the Law Enforcement Standards Laboratory (LESL) of the National Bureau of Standards under the direction of Jacob J. Diamond and Lawrence K. Eliason, successive Chiefs of LESL. Technical research was performed at the NBS Center for Building Technology by John S. Stroik and Thomas W. Reichard.

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NIJ STANDARD FOR THE PHYSICAL SECURITY OF WINDOW UNITS

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FOREWORD

Following a Congressional mandate* to develop new and improved techniques, systems, and equipment to strengthen law enforcement and criminal justice, the National Institute of Law Enforcement and Criminal Justice, now the National Institute of Justice (NIJ), established the Law Enforcement Standards Laboratory (LESL) at the National Bureau of Standards. LESL's function is to conduct research that will assist law enforcement and criminal justice agencies in the selection and procurement of quality equipment.

In response to priorities established by NIJ, LESL is: (1) Subjecting existing equipment to laboratory testing and evaluation and (2) conducting research leading to the development of several series of documents, including national voluntary equipment standards, user guides, and technical reports.

This document, NIJ-STD-0316.00, Physical Security of Window Units, is a law enforcement equipment standard developed by LESL and approved and issued by NIJ. Additional standards as well as other documents are being issued under the LESL program in the areas of protective equipment, communications equipment, security systems, weapons, emergency equipment, investigative aids, vehicles and clothing.

This equipment standard is a technical document consisting of performance and other requirements together with a description of test methods. Equipment which can meet these requirements is of superior quality and is suited to the needs of law enforcement agencies. Purchasers can use the test method described in this standard to determine firsthand whether a particular equipment item meets the requirements of the standard, or they may have the tests conducted on their behalf by a qualified testing laboratory. Law enforcement personnel may also reference this standard in purchase documents and require that any equipment offered for purchase meet its requirements and that this compliance be either guaranteed by the vendor or attested to by an independent testing laboratory.

The necessarily technical nature of this NIJ standard, and its special focus as a procurement aid, make it of limited use to those who seek general guidance concerning the physical security of window units. The User Guide Series is designed to fill that need. We plan to issue guides to various items of law enforcement equipment as soon as possible, within the constraints of available funding and the overall NIJ program.

The user guides being issued are highly readable and tutorial in nature in contrast to the standards, which are highly technical and intended for laboratory use by technical personnel. The guides provide, in non-technical language, information for purchasing agents and other interested persons concerning the capabilities of equipment currently available. They may then select equipment appropriate to the performance required by their agency.

NIJ standards are subjected to continuing review.** Technical comments and recommended revisions are invited from all interested parties. Suggestions should be addressed to the Program Manager for Standards, National Institute of Justice, U.S. Department of Justice, Washington, DC 20531.

Lester D. Shubin
Program Manager for Standards
National Institute of Justice

*Section 402(b) of the Omnibus Crime Control and Safe Streets Act of 1968, as amended.

**Prior to citing this standard, or any other NIJ equipment standard, in a contract document the user should verify that the most recent edition is used. Write to: Chief, Law Enforcement Standards Laboratory, National Bureau of Standards, Washington, DC 20234.

NIJ STANDARD FOR THE PHYSICAL SECURITY OF WINDOW UNITS

1. PURPOSE AND SCOPE

The purpose of this document is to establish performance requirements and methods of test for the resistance to forced entry of window units intended for use in residences and some small businesses. This standard addresses the capability of window units to frustrate the "opportunity" crimes committed by unskilled and semi-skilled burglars. The skilled or rarely used methods of gaining entry through window units are not addressed.

This standard is compatible with the NIJ standards for the physical security of single-swing entry doors and sliding glass door units [1,2]*.

2. CLASSIFICATION

For the purposes of this standard, window units are classified into four classes by their relative resistance to forced entry, and into six types by their mode of operation.

2.1 Security Level

2.1.1 Class I

Window units that provide a minimum level of physical security.

2.1.2 Class II

Window units that provide a moderate level of physical security.

2.1.3 Class III

Window units that provide a medium level of physical security.

2.1.4 Class IV

Window units that provide a relatively high level of physical security.

2.2 Mode of Operation (see fig. 1)

2.2.1 Type A (Sliding)

Window units that incorporate one or more sashes that open by sliding in the plane of the unit, either vertically or horizontally.

2.2.2 Type B (Outswinging)

Window units that incorporate one or more sashes that are hinged at or near two adjacent corners and open toward the exterior. The glazing may be either completely framed or partially framed.

*Numbers in brackets refer to the references on page 11.

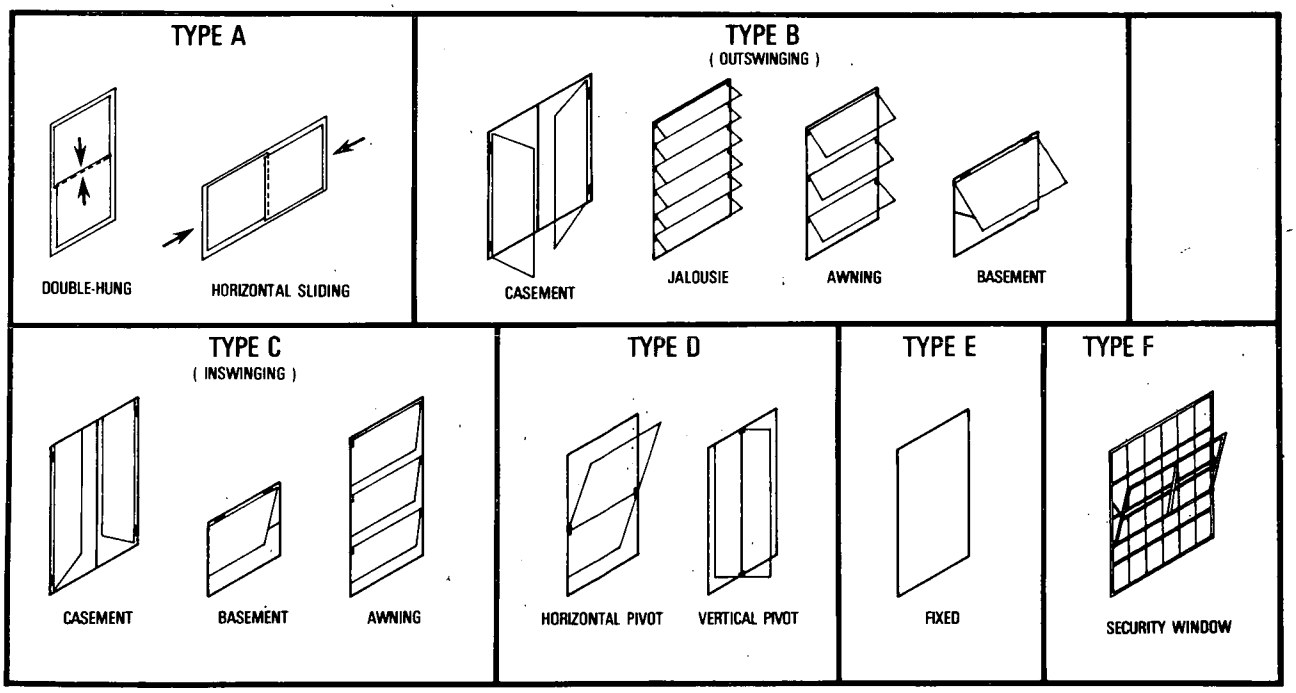


FIGURE 1. Window unit types.

2.2.3 Type C (Inswinging)

Window units that incorporate one or more sashes that are hinged at or near two adjacent corners and open toward the interior.

2.2.4 Type D (Pivoted)

Window units that incorporate one or more sashes that are hinged or pivoted, either horizontally or vertically, near the centers of two opposites sides such that part of the sash opens toward the interior and part opens toward the exterior.

2.2.5 Type E (Fixed)

Window units that are designed not to open; the glazing material may be installed in a sash, or may be installed directly into the window frame.

2.2.6 Type F (Security)

Window units that have metal bars fastened to the exterior of the window frame for the purpose of preventing entry. Such windows may incorporate movable sashes and means of unfastening the metal bars for emergency egress.

3. DEFINITIONS (See fig. 2)

3.1 Glazing

The transparent or translucent material forming that part of the window unit that allows light to be transmitted.

3.2 Jamb

A vertical member of a window frame that is attached to the surrounding wall.

3.3 Locking Device

A part of a window unit that is intended, when engaged, to prevent operation of the movable sash. Usually it is the sash lock, but in its absence the sash operator may be used as the locking device.

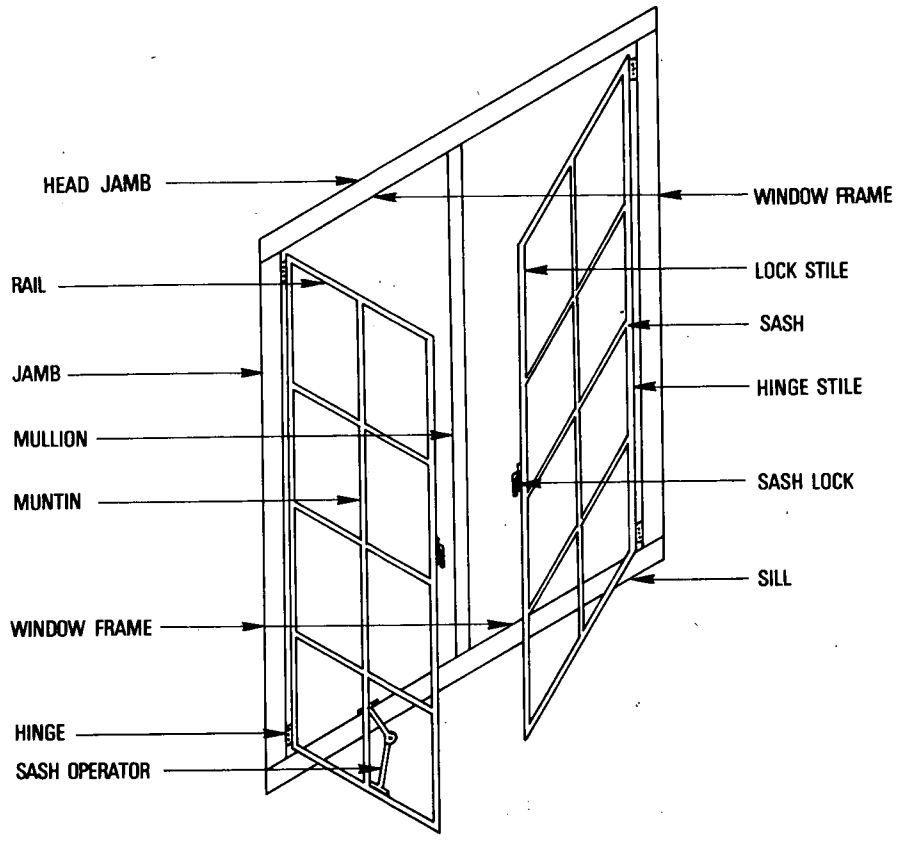


FIGURE 2. Typical window unit components.

3.4 Loiding

A method of manipulating a locking device from the exterior by means of a thin, flat object or a thin stiff wire that is inserted between two window components so as to force the locking device into its unlocked position. Also known as KNIFING.

3.5 Mullion

An intermediate window frame member that meets with and provides support for a pair of adjacent sashes or windows at their edges. A mullion can be either vertical or horizontal.

3.6 Muntin

An intermediate member of a sash that extends either horizontally between the stiles or vertically between the rails to support individual panes of glazing material when the sash contains two or more panes.

3.7 Rail

A horizontal framing member of a sash. A meeting rail is one that either mates and overlaps with a rail of another sash (type A windows), or that closes against a mullion or framing member that is opposite the hinge rail (type B and C windows). Horizontal pivoted windows (type D) have both top and bottom meeting rails. A hinge rail is one that contains either a hinge or a pivot (type B, C and D windows).

3.8 Sash

An assembly consisting of glazing material and the stiles, rails and sometimes muntins that surround and support it.

3.9 Sash Lock

A mechanical device used to secure a movable sash to the window frame or to a companion sash in such a manner as to prevent operation of the movable sash.

3.10 Sash Operator

A mechanical device used to move or adjust the position of a movable sash. The sash operator, on some units, may also act as a locking device in lieu of, or in addition to, a sash lock.

3.11 Sill

The lowest horizontal member of a window frame.

3.12 Stile

A vertical framing member of a sash. A meeting stile is one that either mates and overlaps with a stile of another sash (type A windows), or that closes against a mullion or framing member which is opposite the hinge stile (type B and C windows). Vertical pivoted windows (type D) have two meeting stiles. A hinge stile is one that contains either a hinge or a pivot (type B, C and D windows).

3.13 Window Frame

That part of a window unit which surrounds and supports the sashes and is attached to the surrounding wall. It consists of two side jambs, a head and a sill, and may include one or more mullions.

3.14 Window Unit

A unit intended for installation in a prepared wall opening for the prime purpose of admitting light while preventing the penetration of undesirable elements. A window unit normally includes one or more sashes, a sash lock, a window frame, and miscellaneous hardware.

4. REQUIREMENTS

The window unit requirements given below are summarized in table 1.

4.1 General Requirements

4.1.1 Classification

A window unit meets the requirements for a specific security classification if the test sample passes all of the required tests for that class.

4.1.2 Composite Window Units

When composite window units, which include two or more units of one window type or combinations of two or more window unit types, are evaluated for conformance with this standard, each separate unit of the composite window unit shall be tested as though it were an individual window unit.

4.1.3 Failure Criteria

A window unit shall fail a test if, at any time during or after the test, entry can be made through the unit from the exterior because the window has been opened enough, by lifting, pushing, pulling or manipulating a component such as a lock or sash, or because the test has caused enough damage to the window unit to create an unobstructed opening within which a rectangle 14 by 40 cm (5 1/2 by 15 3/4 in) or larger can be inscribed.

TABLE 1. *Window unit requirements*

Test	Test method paragraph	Measured parameter	Minimum requirement			
			Class I	Class II	Class III	Class IV
Loiding force	5.9	Force to move locking device	45 N (10 lbf)	45 N (10 lbf)	45 N (10 lbf)	45 N (10 lbf)
Locking device stability	5.10.1 (Type A)	Resistance to unlocking motion	50 cycles by hand	50 cycles by hand	50 cycles by hand	50 cycles by hand
	5.10.2 (Type B, C, D and F)		50 cycles at 222 N (50 lbf)	50 cycles at 222 N (50 lbf)	50 cycles at 222 N (50 lbf)	50 cycles at 222 N (50 lbf)
Locking device strength	5.11.1 (Type A)	Resistance to static load	222 N (50 lbf)	667 N (150 lbf)	1335 N (300 lbf)	3335 N (750 lbf)
	5.11.2 (Type B, C, D, and F)	-	—	667 N (150 lbf)	1335 N (300 lbf)	3335 N (750 lbf)
Window strength	5.12.1 (Type A)	Resistance to static load	Primary 222 N (50 lbf)	Primary 445 N (100 lbf)	Primary 445 N (100 lbf)	Primary 445 N (100 lbf)
			Secondary 222 N (50 lbf)	Secondary 667 N (150 lbf)	Secondary 1335 N (300 lbf)	Secondary 3335 N (750 lbf)
	5.12.2 (Type B, C, D, E and F)		222 N (50 lbf)	667 N (150 lbf)	1335 N (300 lbf)	3335 N (750 lbf)
Impact strength	5.13.1 Glazing	Resistant to impact	—	One impact of 50J (37 ft-lbf)	One impact of 100J (74 ft-lbf)	Ten impacts of 100J (74 ft-lbf)
	5.13.2 Sash frame	Resistant to impact	—	One impact of 50J (37 ft-lbf)	One impact of 100J (74 ft-lbf)	Ten impacts of 100J (74 ft-lbf)
	5.13.3 Security bars	Resistant to impact	—	—	—	Ten impacts of 100J (74 ft-lbf)

4.2 Resistance to Disassembly

Window units shall contain no screws, bolts, hinge pins or other fasteners that are accessible from the exterior side, and whose removal in accordance with paragraph 5.6 would permit entry after partial or complete disassembly of the unit.

4.3 Resistance to Loiding

Window units, except type E units and type F units whose security bars meet the unobstructed opening criterion defined in paragraph 4.1.3 when tested in accordance with paragraph 5.7, shall be tested in accordance with paragraph 5.8 to determine whether or not it is possible to exert pressure on a sash locking device, or (if there is none) on a sash operator, in a direction that would tend to unlock or open the sash.

If pressure can be exerted on a sash locking device or sash operator, when the window unit is tested in accordance with paragraph 5.8, the force required to operate the sash lock, or (if there is none) the sash operator, and/or to gain entry shall be not less than 45 N (10 lbf) when it is tested in accordance with paragraph 5.9.

4.4 Locking Device Stability

When type A window units are tested in accordance with paragraph 5.10.1, the unit shall prevent entry after being subjected to fifty cycles of lateral and vertical movement, after which the window unit shall continue to meet the requirements of paragraph 4.3.

When type B, C, D and F window units are tested in accordance with paragraph 5.10.2, the unit shall prevent entry after being subjected to fifty loading cycles of 222 N (50 lbf), after which the window unit shall continue to meet the requirements of paragraph 4.3.

This requirement shall not apply to type E units, nor to type F units having security bars that meet the unobstructed opening criterion defined in paragraph 4.1.3 when tested in accordance with paragraph 5.7.

4.5 Locking Device Strength

When type A window units are tested in accordance with paragraph 5.11.1, the unit shall prevent entry after the locking device has been subjected to a static load of 222 N (50 lbf) for class I, 667 N (150 lbf) for class II, 1335 N (300 lbf) for class III, and 3335 N (750 lbf) for class IV units, after which the window unit shall continue to meet the requirements of paragraph 4.3.

When type B, C, D, and F window units are tested in accordance with paragraph 5.11.2, the unit shall prevent entry after each operable sash has been subjected to a static load of 667 N (150 lbf) for class II, 1335 N (300 lbf) for class III, and 3335 N (750 lbf) for class IV units, after which the window unit shall continue to meet the requirements of paragraph 4.3.

This requirement shall not apply to type E window units, nor to type F units having security bars that meet the unobstructed opening criterion defined in paragraph 4.1.3 when tested in accordance with paragraph 5.7.

4.6 Window Strength

When type A vertical sliding window units are tested in accordance with paragraph 5.12.1, the unit shall prevent entry after the meeting rail of each sash has been subjected to primary and secondary static tensile loads of 222 N (50 lbf) and 222 N (50 lbf), respectively, for class I, 445 N (100 lbf) and 667 N (150 lbf) for class II, 445 N (100 lbf) and 1335 N (300 lbf) for class III, and 445 N (100 lbf) and 3335 N (750 lbf) for class IV units, after which the unit shall continue to meet the requirements of paragraph 4.3.

The requirements for type A horizontal sliding windows shall be the same as those given above except that the primary static tensile loads to which they are to be subjected shall be those given above plus the weight of the sash.

When type B, C, D and F window units, and type E units in which the glazing material is installed in a sash frame, are tested in accordance with paragraph 5.12.2, the unit shall prevent entry after each sash has been subjected to a static tensile load of 445 N (100 lbf) for class I, 667 N (150 lbf) for class II, 1335 N (300 lbf) for class III, and 3335 N (750 lbf) for class IV units, after which the unit shall continue to meet the requirements of paragraph 4.3.

This requirement shall not apply to type F window units having security bars that meet the unobstructed opening criterion defined in paragraph 4.1.3 when tested in accordance with paragraph 5.7.

4.7 Glazing Impact Strength (Classes II, III, and IV only)

When window units are tested in accordance with paragraph 5.13.1, the unit shall prevent entry after the glazing has been subjected to one impact of 50 joules (J) [37 foot pounds-force (ft-lbf)] for class II, one impact of 100 J (74 ft-lbf) for class III, and ten impacts of 100 J (74 ft-lbf) for class IV units, after which the unit shall continue to meet the requirements of paragraph 4.3.

This requirement shall not apply to type F window units having security bars that meet the requirements of paragraph 4.9 when tested in accordance with paragraph 5.13.3.

4.8 Sash Frame Impact Strength (Classes II, III and IV only)

When type A, B, C, D and F window units, and type E units in which the glazing material is installed in a sash, are tested in accordance with paragraph 5.13.2, the unit shall prevent entry after each required test location has been subjected to one impact of 50 J (37 ft-lbf) for class II, one impact of 100 J (74 ft-lbf) for class III, and ten impacts of 100 J (74 ft-lbf) for class IV units, after which the unit shall continue to meet the requirements of paragraph 4.3.

This requirement shall not apply to type F window units having security bars that meet the requirements of paragraph 4.9 when tested in accordance with paragraph 5.13.3.

4.9 Security Bar Impact Strength (Type F, Class IV only)

When a type F window unit is tested in accordance with paragraph 5.13.3, the unit shall prevent entry after each security bar has been subjected to ten impacts of 100 J (74 ft-lbf). A unit having an unobstructed opening larger than that defined in paragraph 4.1.3 when tested in accordance with paragraph 5.7 shall be considered to not meet this requirement and need not be tested in accordance with paragraph 5.13.3.

5. TEST METHODS

5.1 Test Sample

The test sample shall consist of a single window unit, plus additional window units or components as required to replace those that are destroyed during the testing. Installation instructions, and templates where necessary, for all hardware items that are to be installed in the field shall be included with each window unit.

5.2 Test Equipment (See appendix A)

5.2.1 Low-Range Tensile Loading Device

The low-range tensile loading and force measuring device shall have a capacity of no less than 45 newtons (N) [10 pounds-force (lbf)] with a combined calibration and reading error no greater than 4.5 N (1.0 lbf).

5.2.2 Medium-Range Tensile Loading Device

The medium-range tensile loading and force measuring device shall have a capacity of no less than 667 N (150 lbf) with a combined calibration and reading error no greater than 9.0 N (2.0 lbf).

5.2.3 High Range Tensile Loading Device

The high-range tensile loading and force measuring device shall have a capacity of no less than 3335 N (750 lbf) with a combined calibration and reading error no greater than 67 N (15 lbf).

5.2.4 Loiding Tools

Two loiding tools are required: a knife or spatula with a thin blade [approximately 0.8 mm (1/32 in) thick] and a stiff steel wire with an approximate diameter of 1.6 mm (1/16 in).

5.2.5 Impactor

The impactor shall be a pendulum system made of steel and capable of delivering horizontal impacts of up to 100 joules (J) [74 foot-pounds force (ft-lbf)]. The striking end of the impactor shall have a removable hemispherical nose approximately 32 mm (1 1/4 in) in diameter.

5.3 Test Fixtures

5.3.1 Test Wall

The width of the test wall shall be not less than 142 cm (56 in), but shall extend at least 30 cm (12 in) from each side of the window unit. Except for window units intended for floor-to-ceiling installation, the height of the test wall shall be at least 244 cm (96 in) and shall extend at least 30 cm (12 in) above the top of the window unit; floor-to-ceiling window units shall be installed in a test wall with a height equal to that recommended by the manufacturer. In the absence of manufacturer-specified wall construction, the window unit shall be installed into a test wall constructed in accordance with figure 3. If desired, the wall section may be constructed to duplicate exactly the wall construction specified by the manufacturer, or distributor, for a specific window unit.

5.3.2 Wall Support Fixture

The wall support fixture shall include framing members and shall provide rigid transverse restraint along all four edges of the wall section. The restraint provided by this fixture shall simulate the rigidity normally provided to a wall in a building by the ceiling, floor and intersecting walls. Figure 4 shows a suitable wall support fixture.

5.4 Sample Preparation

Construct a test wall section as shown in figure 3 and described in paragraph 5.3.1 and rigidly support it with a wall support fixture as shown in figure 4 and described in paragraph 5.3.2. Install the fully glazed window unit into the test wall in accordance with the manufacturer's instructions. Tape glass-glazing so as to prevent sharp fragments

CONSTRUCTION NOTES

1. ALL STUDS AND PLATES ARE 2×4's. HEADERS AS APPROPRIATE FOR OPENING.
2. NAIL SOLE PLATE AND LOWER MEMBER OF TOP PLATE TO EACH STUD WITH 2 - 16d END NAILS.
3. NAIL UPPER OF TOP PLATE TO THE LOWER MEMBER WITH 16d NAILS, ONE NAIL NEAR EACH STUD AND 2 NEAR EACH END.
4. NAIL THE DOUBLE STUDS TOGETHER WITH 16d NAILS NOT MORE THAN 61cm (24in) ON CENTERS.
5. NAIL THE HEADER TO EACH FULL LENGTH STUD WITH 4 - 16d END NAILS.
6. ON THE DESIGNATED EXTERIOR NAIL ½ INCH PLYWOOD SHEATHING TO PLATES AND STUDS WITH 6d NAILS 15cm (6in) ON CENTERS AROUND THE PERIMETERS AND 30cm (12in) ON CENTERS ALONG INTERMEDIATE SUPPORTS.
7. ON THE DESIGNATED INTERIOR NAIL ½ INCH GYPSUM DRYWALL TO ALL SUPPORTS WITH THREADED DRYWALL NAILS 20cm (8in) ON CENTERS.

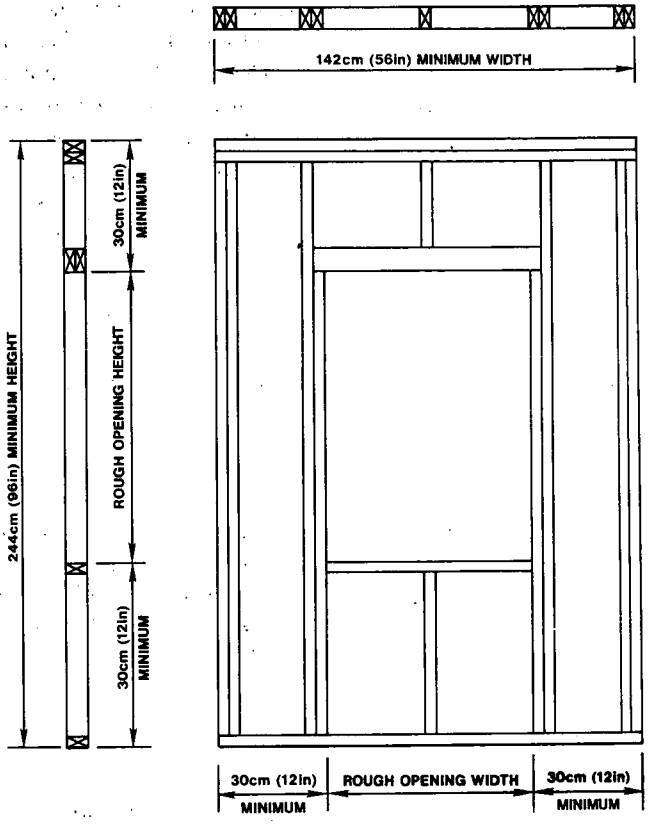
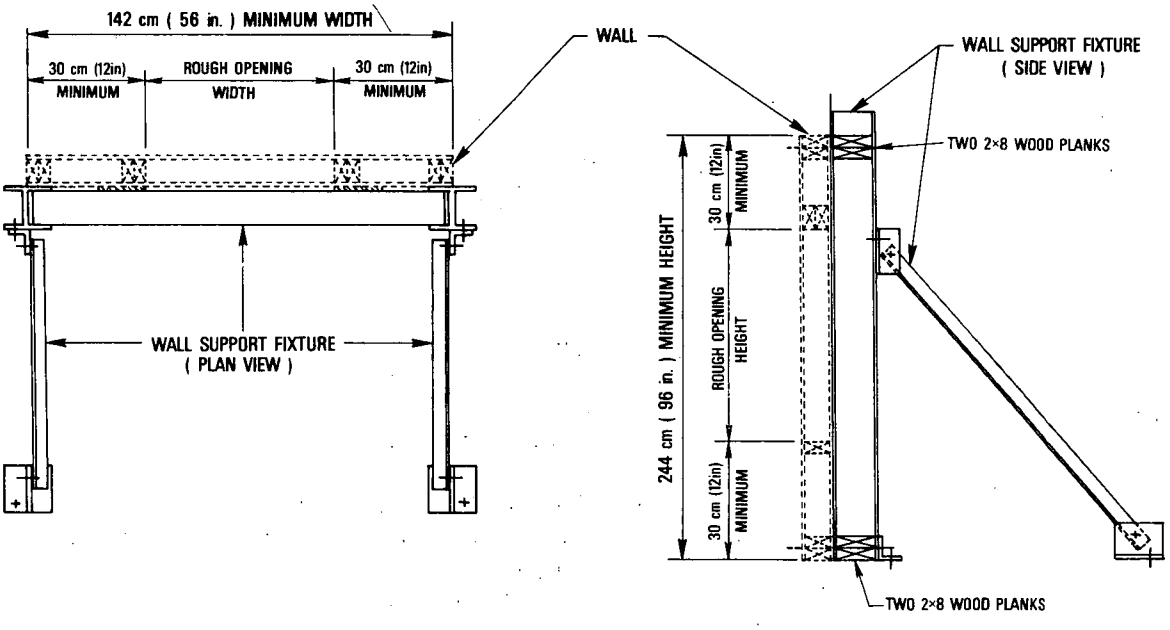


FIGURE 3. Test wall.



1. VERTICAL MEMBERS - EQUIVALENT TO, OR BETTER IN BENDING THAN, W8 × 10 STEEL BEAM.
2. HORIZONTAL MEMBERS - EQUIVALENT TO, OR BETTER IN BENDING THAN, TWO 2×8 WOOD PLANKS.
3. DIAGONAL MEMBERS - EQUIVALENT TO, OR BETTER THAN, 2 X 2 X 1/4 STEEL ANGLE.

FIGURE 4. Wall support fixture.

from falling or flying out if the glass is broken during testing. One-inch wide masking tape installed around the perimeter of the glass within two inches of the edge, plus diagonals, has been found to be sufficient.

Perform all tests with the sashes closed and locked unless otherwise required. Replace any component that is broken or damaged during a test with an identical component prior to any subsequent test.

Certain of the test procedures require that tensile loading devices be attached to the window units at specified locations. This may be accomplished by any convenient means, such as attaching a small bracket at the required location by means of screws or bolts. In some cases, such as when testing a jalousie window, it may be necessary to fashion a loading attachment from a piece of thin wire inserted through a small hole drilled through the stile of the individual pane.

5.5 Test Sequence

Perform the tests for each window unit in the same order as the tests are presented below, as appropriate for the item under test. Note that all test forces are static tensile forces unless specifically stated otherwise.

5.6 Disassembly Test

Remove all screws, bolts, hinge pins, rigid snap-in glazing beads, and other fastening and assembly devices (other than putty) that can be removed from the exterior side of the window unit by means of commonly available tools such as knives, Allen wrenches and conventional and Phillips screw drivers with blades no longer than 15 cm (6 in). After removal of the fastening and assembly devices determine whether it is possible to gain entry after partial or complete disassembly of the window unit.

Do not replace any of the fasteners before proceeding with the tests that follow. If a broken or damaged component must be replaced, remove the fasteners in accordance with this paragraph before proceeding with the testing.

5.7 Unobstructed Opening Test (Type F only)

Construct a 14 by 40 by 40 cm (5 1/2 by 15 3/4 by 15 3/4 in) test object out of any rigid material such as wood, plastic, etc. Determine whether it is possible to pass this test object through any of the openings between the security bars.

5.8 Loiding Test

By actual trial, determine whether it is possible to insert each of the two loiding tools (par. 5.2.4) from the exterior side of the window unit and to manipulate it so as to exert pressure on a locking device, or (if there is none) on a sash operator, in a direction that would tend to unlock the locking device or move the sash operator in its opening direction.

5.9 Loiding Force Test

Attach the low-range tensile loading device to the midpoint of the handle that operates the locking device, or (if there is none) to the sash operator, directly or by means of a small wire and exert a force of 45 N (10 lbf) upon the handle in the direction that would tend to unlock or open the sash.

If the handle that operates the locking device is an integral part of or rigidly attached to the latch, test the locking device as described above. If the handle is not integral with the latch and utilizes spring action or another mechanism to reduce the force required to operate the locking device, attach the tensile loading device to the latch rather than the handle. If the latch is enclosed by a cover when in a locked position, drill a hole or mill a notch in the cover, if necessary, to allow the attachment of the tensile loading device to the latch.

Observe whether the locking device (or sash operator) moves to the unlocked (or open) position.

5.10 Locking Device Stability Test

5.10.1 Type A Windows

Apply, by hand, sufficient force to move the outermost operable sash to the limit of its travel alternately in all four directions in the plane of the sash so as to produce in the sash an essentially rotary motion in the direction that

would tend to unlock the locking device. Rotate the sash fifty cycles in this manner or until entry can be made, whichever comes first.

5.10.2 Type B, C, D, and F Windows

Alternately apply and release a tensile load of 222 N (50 lbf) to the meeting stile (or rail) of each operable sash in the direction that would tend to open the window. When testing a partially framed sash (e.g., a jalousie window) apply the load near the bottom of the stile closest to the sash operator. Repeat the loading cycle fifty times or until entry can be made, whichever comes first.

5.11 Locking Device Strength Test

5.11.1 Type A Window Units

Apply the required load to the meeting rail (or stile) of the outermost operable sash at a point within 10 cm (4 in) of the center, in the direction that would tend to open the window.

5.11.2 Type B, C, D and F Window Units

Apply the required load to the meeting rail (or stile) of each operable sash at a point within 10 cm (4 in) of the center, in the direction that would tend to open the window.

5.12 Window Strength Test

5.12.1 Type A Window Units

If the window is of the horizontal sliding type, weigh each individual sash. Reassemble the window unit if necessary and, for each sash in succession, simultaneously apply the two required tensile loads to a point on the meeting stile (for a horizontal sliding unit) that is within 10 cm (4 in) of the lower end of the stile, or on the meeting rail (for a double-hung unit) and within that distance of either end of the rail.

Apply the primary tensile load in the direction that is parallel to the glazing, perpendicular to the opening direction of the sash, and away from the adjacent frame; apply the secondary tensile load in the direction that is perpendicular to the sash and would tend to pull it away from its mating sash.

5.12.2 Type B, C, D, E and F Window Units

For each sash in succession, apply the required tensile load at a point on the meeting rail (or stile) within 10 cm (4 in) of either end, in the direction that would tend to open the window. For type D units, repeat the test by applying the load to the equivalent point on the diagonal corner, again in the direction that would tend to open the window. For type E units, apply the load to the equivalent point on a lower corner, pulling to the outside, and then to the equivalent point on the diagonal corner, pulling to the inside.

5.13 Impact Strength Tests

5.13.1 Glazing Test

Position the impactor (par. 5.2.5) in front of the exterior side of the sash so that, at rest, its major axis is perpendicular to the glazing and its striking end just touches the surface of the glazing. Deliver the required impacts to the glazing of each sash at a point within 10 cm (4 in) of the stile and rail at one corner of the pane. If the sash has more than a single glazing pane, impact the glazing pane that is closest to the locking device, or (if there is none) the sash operator, within 10 cm (4 in) of the vertical and horizontal sash members that form the corner that is closest to the locking device or sash operator.

Pull the impactor back, raising it to the height necessary to produce the required impact, and release it. Repeat the test if necessary to deliver the required number of impacts.

5.13.2 Sash Frame Test

For a type A window unit, position the impactor as described in paragraph 5.13.1, but with its striking end just touching the surface of the sash frame of the innermost sash at a point within 10 cm (4 in) of the corner formed by the meeting rail (or stile) and either joining stile (or rail). If the width of the exposed portion of the rail (or stile) is

less than the diameter of the impactor, attach a block of wood or other rigid material to the rail (or stile) at the impact point such that the surface of the attached block extends in front of the plane of the outermost sash frame member; position the impactor so that, at rest, the striking end just touches the surface of this block. Impact type B, C, D, E, and F window units within 10 cm (4 in) of either corner formed by the meeting rail (or stile) and a joining stile (or rail).

Pull the impactor back, raising it to the height necessary to produce the required impact, and release it. Repeat the test if necessary to deliver the required number of impacts.

If any sash in the window unit contains one or more muntins, also subject to the required impacts either a) the intersection of a vertical and horizontal muntin or, if there is no such intersection, b) any muntin within 5 cm (2 in) of its intersection with a rail or stile.

5.13.3 Security Bar Test (Type F only)

Position the impactor so that, at rest, its striking end (with the hemispherical nose removed) just touches the surface of a vertical bar at a point 10 cm (4 in) from its end support and its major axis is in line with the center of the bar and makes an angle of 30 degrees with the plane of the test wall.

Pull the impactor back, raising it to height necessary to produce the required impact, and release it. Repeat the test until nine more impacts have been delivered or the bar breaks away from its end support, whichever comes first. If failure has not occurred, repeat the test for the remaining bars or until failure occurs.

If the window unit has horizontal security bars, install the window unit into the test wall at a 90 degree angle to its normal installation, so that the bars are vertical, before conducting (or continuing) this test.

REFERENCES

1. NILECJ-STD-0306.00, Standard for the Physical Security of Door Assemblies and Components, Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, Stock No. 027-000-00402-4 (May 1976).
2. NIJ-STD-0318.00, Standard for the Physical Security of Sliding Glass Door Units (In press).

APPENDIX A—TEST EQUIPMENT

Test equipment suitable for use in evaluating the physical security of window units is described below. However, any equipment that meets the requirements of paragraph 5.2 would be acceptable.

1. Low-Range Tensile Loading Device

The low-range tensile loading and force measuring device used was a surveyor's spring balance system as shown in figure A-1. A large handle was attached to the case for convenience in use. The spring balance had a load capacity of 135 newtons (N) [30 pounds-force (lbf)].

2. Medium-Range Tensile Loading Device

The medium-range tensile loading and force measuring device consisted of a spring balance with a capacity of 667 N (150 lbf), a cable and a turnbuckle for applying tension. A typical arrangement for using this device is shown in figure A-2.

3. High-Range Tensile Loading Device

The high-range tensile loading and force measuring device consisted of a calibrated universal strain-gauge type of load cell with a capacity of 4450 N (1000 lbf) attached to a cable-turnbuckle arrangement. Figure A-2 indicates the method of using this equipment. The force imposed on the test specimen was measured with a conventional strain-gauge readout instrument wired to the load cell.

4. Impactor

A sketch of the impactor system is shown in figure A-3. The pendulum ram had a diameter of 5.6 cm (2 3/16 in), a length of 83.8 cm (33 in) and a weight of 16 kg (35.3 lb). The impact nose was made from a 1/4 inch carriage bolt. The height-of-drop for the pendulum ram to produce an impact of 100 joules (74 ft-lbf) was 63.7 cm (2.10 ft). The height-of-drop to produce an impact of 50 joules (37 ft-lbf) was 31.9 cm (1.05 ft).

In use, it was convenient to suspend the pendulum system from the forks of a fork-lift truck. This enabled rapid horizontal and vertical adjustment of the impact point of the impactor.

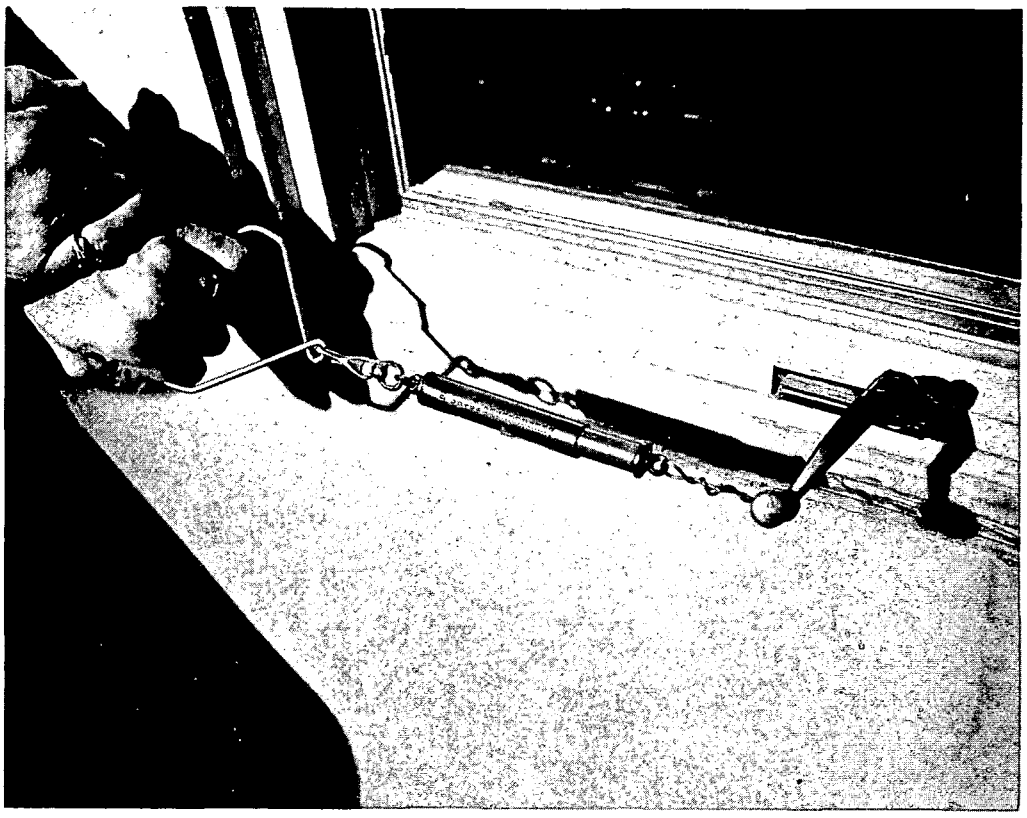


FIGURE A-1. Low-range tensile loading device.

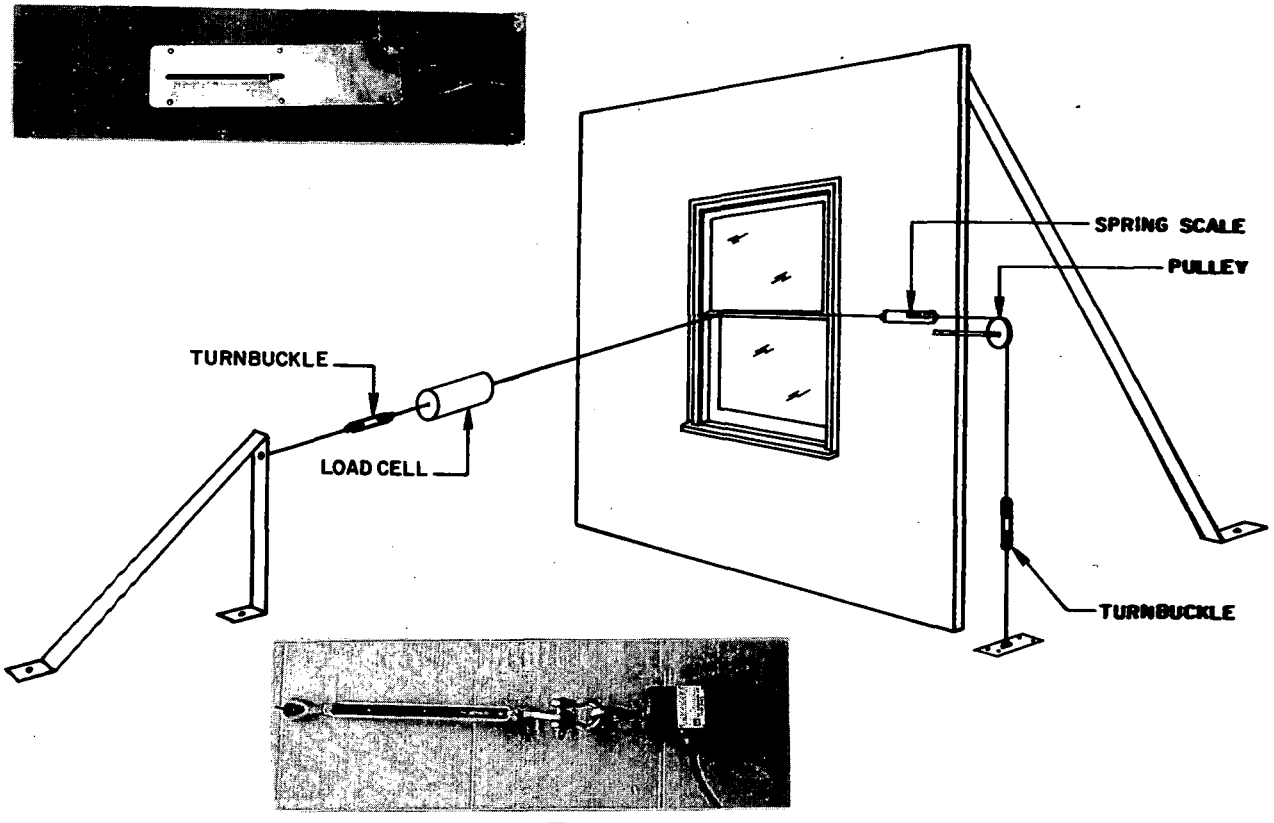


FIGURE A-2. Equipment arrangement for static load resistance test.

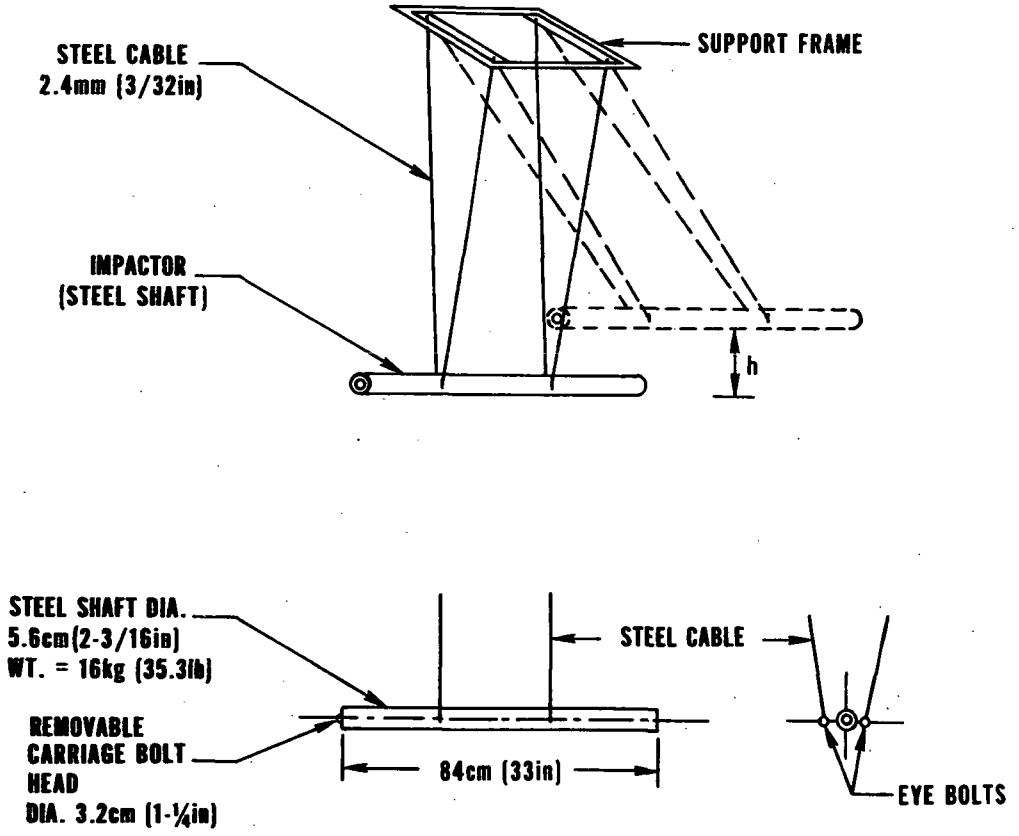


FIGURE A-3. Impactor.

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