

JUN 20 1997

Refer to: HNG-14

Mr. Clifford M. Dent
 President
 Dent Breakaway Ind., Inc.
 10 A Town Plaza
 Suite 130
 Durango, Colorado 81301

Dear Mr. Dent:

This is in response to your December 17, 1996, letter to Mr. Nicholas Artimovich requesting that the Federal Highway Administration (FHWA) accept your company's breakaway couplings for use in various support systems on the National Highway System (NHS). The couplings are ASTM A325 fasteners with special dimensional requirements (A325 breakaway couplings). Transmitted with your letter were three December 1996 reports of pendulum testing conducted by the Southwest Research Institute on single-post supports, a video of the tests, drawings of the hardware, and other documentation. Additional information and drawings were sent on March 19 in response to our request.

Requirements for breakaway supports are those in the American Association of State Highway and Transportation Officials' (AASHTO) Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals. We also recognize the testing and evaluation guidelines in the National Cooperative Highway Research Program (NCHRP) Report 350 Recommended Procedures for the Safety Performance Evaluation of Highway Features.

The three pendulum tests are summarized in the table below. A brief description of the test articles follows the table.

Test Number	LP-1	SP-1	CB-1
Support Type	Steel Luminaire Support	Perf. Square Sign Post	Motorist Aid Callbox
Support Size	305 mm Diameter	64 mm Square	127 mm Diameter
Wall Thickness	7 Gage	12 Gage	Schedule 40

CONCURREN-

RTG SYMB
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Test Number	LP-1	SP-1	CB-1
Coupling Designation	A-LP	A Modified*	A
Thread Diameter	25.4 mm	12.7 mm	12.7 mm
Diameter @ Neck Between Cones	7.1 mm	7.1 mm	7.1 mm
Radius of Groove Between Cones	1.6 mm	1.6 mm	1.6 mm
Radius of Cone Bases	50.8 mm	25.4 mm	25.4 mm
Height of Flats @ Cone Bases	1.6 mm	1.6 mm	1.6 mm
Distance Between Cone Bases	38.1 mm	9.5 mm	12.7 mm
Bolt Circle Diameter	381 mm	(single bolt)	220 mm
Test Article Mass	461 kg	20 kg	88.5 kg
Soil Type **	n/a	n/a	n/a
Height	19.81 m	3.7 m	3.28 m ***
Impact Speed	9.8 m/s	9.8 m/s	9.8 m/s
Pendulum Mass	816 kg	816 kg	816 kg
Velocity Change	3.1 m/s	0.5 m/s	2.0 m/s
Est. Velocity Change @ 100 km/h ****	4.8 m/s	0.6 m/s	2.8 m/s
Stub Height	19 mm	89 mm	12 mm

*The Type A coupling (nominally 114.3 mm) was modified for this application. Length of the coupling was 51 mm.

**All supports were mounted to the rigid test frame, simulating concrete foundations in strong soil.

***Height of the callbox was 1 meter above grade.

****High Speed extrapolation based on the procedure in FHWA Notice N 5040.20.

Test Article Descriptions:

LP-1: The Type A-LP A325 breakaway coupling was a 1-inch (25.4-mm) diameter galvanized device (see Enclosure 1) used to attach the luminaire pole base plate to a foundation plate in the test fixture (see Enclosure 2) The pole base plate was a conventional non-breakaway four-bolt design.

SP-1: The test article consisted of 3700-mm long by 64-mm perforated square steel tubing (12-gage wall, grade 50 steel.) The tube was bolted to a ground to pole adapter bracket (see Enclosures 3 A and 3B) using two 3/8-inch (9.5-mm) diameter carriage bolts. The bracket was bolted (using 3/8-inch carriage bolts) to a section of 76.2-mm square steel tube that was welded to the test fixture. One 1/2-inch (12.7-mm) diameter galvanized A325 breakaway coupling (see Enclosure 4) was used in the ground to pole adapter bracket.

CB-1: The test article consisted of a 3280-mm long by 127-mm diameter round steel pole mounted to a 257-mm diameter plate with a motorist aid call box and a 900-mm aluminum sign panel attached to the pole. No antenna was attached to the pole. Four 1-inch (12.7-mm) diameter galvanized A325 breakaway couplings (see Enclosure 5) were used to attach the pole to a foundation plate in the test fixture.

Because the results of the pendulum testing and the high-speed extrapolations met the stub height and change-in-velocity criteria recognized by the FHWA, your company's A325 breakaway couplings with 0.280-inch (7.11-mm) necked down breakaway cross sections will be acceptable for use on the NHS, in the range of conditions tested, when proposed by a State. The following limitations and conditions also apply:

For sign supports:

- Maximum mass per foot of sign post shall not exceed 45 kg/m (30 pounds per foot.)
- Maximum mass of sign installation is 275 kg (600 pounds).

For luminaire supports:

- Luminaires may be up to 18.5-m high with a maximum mass of 450 kg (with a one percent tolerance.)

For all installations:

- Maximum bolt circle diameter is 381 mm (15 inches).
- Maximum diameter at the grooved section is 7.11 mm.
- No more than one support is permitted in a 2.1-meter path.
- All supports shall be mounted to a structural concrete foundation that will not move in the soil if the support is struck by a vehicle.

You requested acceptance of a larger bolt circle diameter and higher and heavier luminaire poles than we have found acceptable. We have limited our acceptance of the bolt circle diameter to the dimension that was tested because we believe increasing bolt circle diameters will increase the difficulty of actuation when breakaway couplings are used. We have limited the maximum mass and height because pendulum testing of luminaire supports does not reveal the consequences of a support falling on the roof of an impacting vehicle. Based on test observations and engineering judgement, the FHWA has set upper limits on the support masses and heights it will find acceptable even where analysis or testing appear to indicate acceptability of greater mass or height supports.

You also requested that the bracket tested for square tubes in test SP-1 be accepted whether the size of the post fits inside or outside the upper portion of the bracket. This variation is acceptable as long as the posts are at least as stiff as the tested 12-gage 64-mm square perforated tube. The section modulus of the tested tube ($10,520 \text{ mm}^3$) may be used when comparing other post sections. Posts with lesser section properties should not be used unless verified by crash testing.

Your drawings also included bracket designs for use with round tubes (see Enclosures 6 A and 6B) and a u-channel post and we infer that you desire our action on these as well. The round tube post will be acceptable, subject to the same restriction on the stiffness of the sign post as mentioned above. However, our acceptance does not extend to u-channel posts as their open section gives them a greater tendency to bend than square or round tubes. Please note that only the bracket design with the 3/8-inch (9.5-mm) gap, for use with the Type A (modified) couplings is acceptable. The use of larger couplings with these brackets is not acceptable unless crash tested with successful results.

We should point out that we expect the couplings to be undersized for use with a structure the size of the luminaires supports used in the testing. We would suggest that your design guidance be based on static and fatigue testing which, we understand, is currently being conducted.

Our acceptance is limited to the breakaway characteristics of the tested supports when used with your company's couplings and does not cover their structural features. Presumably, you will supply potential users with sufficient information on design and installation requirements to ensure proper performance. We anticipate that the States will require certification from Dent Breakaway Industries that the hardware furnished has essentially the same mechanical properties and geometry as that used in the crash testing, and that it will meet the FHWA change in velocity requirements.

The Dent Breakaway Coupling is a proprietary product. To be used in Federal-aid projects, except exempt, non-NHS projects, proprietary products: (a) must be supplied through competitive bidding with equally suitable unpatented items; (b) the highway agency must certify that they are essential for synchronization with existing highway facilities or that no equally suitable alternative exists; or (c) they must be used for research or for a distinctive type of construction on relatively short sections of road for experimental purposes. Our regulations concerning proprietary products are contained in Title 23, Code of Federal Regulations, Section 635.411, a copy of which is Enclosure 7.

Sincerely yours,

DAVID A. PRICE



Dwight A. Horne, Chief
Federal-Aid and Design Division

7 Enclosures

Federal Highway Administration

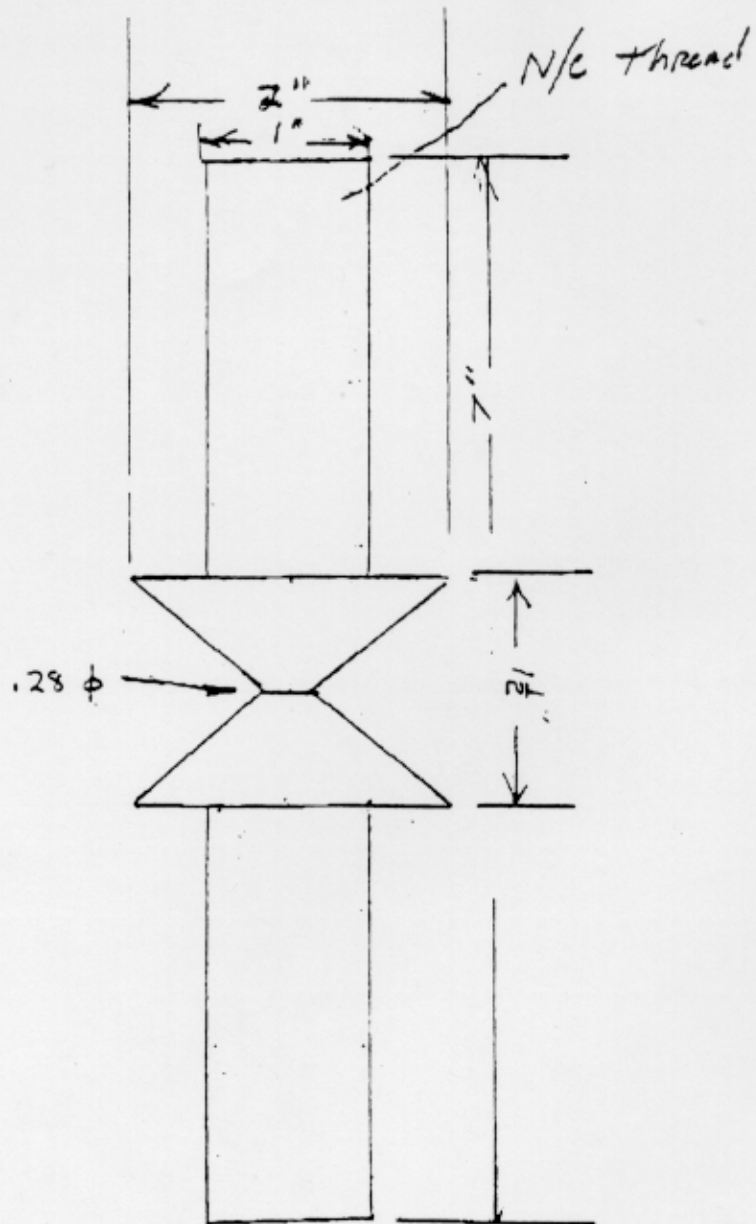
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copies to:

HNG-1 HNG-10 HNG-14 Reader 3128 File 3128

RA'S HFL-1 HHS-10 HRS-20 HNG-20

Geometric and Safety Design Group Acceptance Letter SS-60B rev



1" DIAMETER BOLT

Figure 2. Type A-LP Break Away Connector

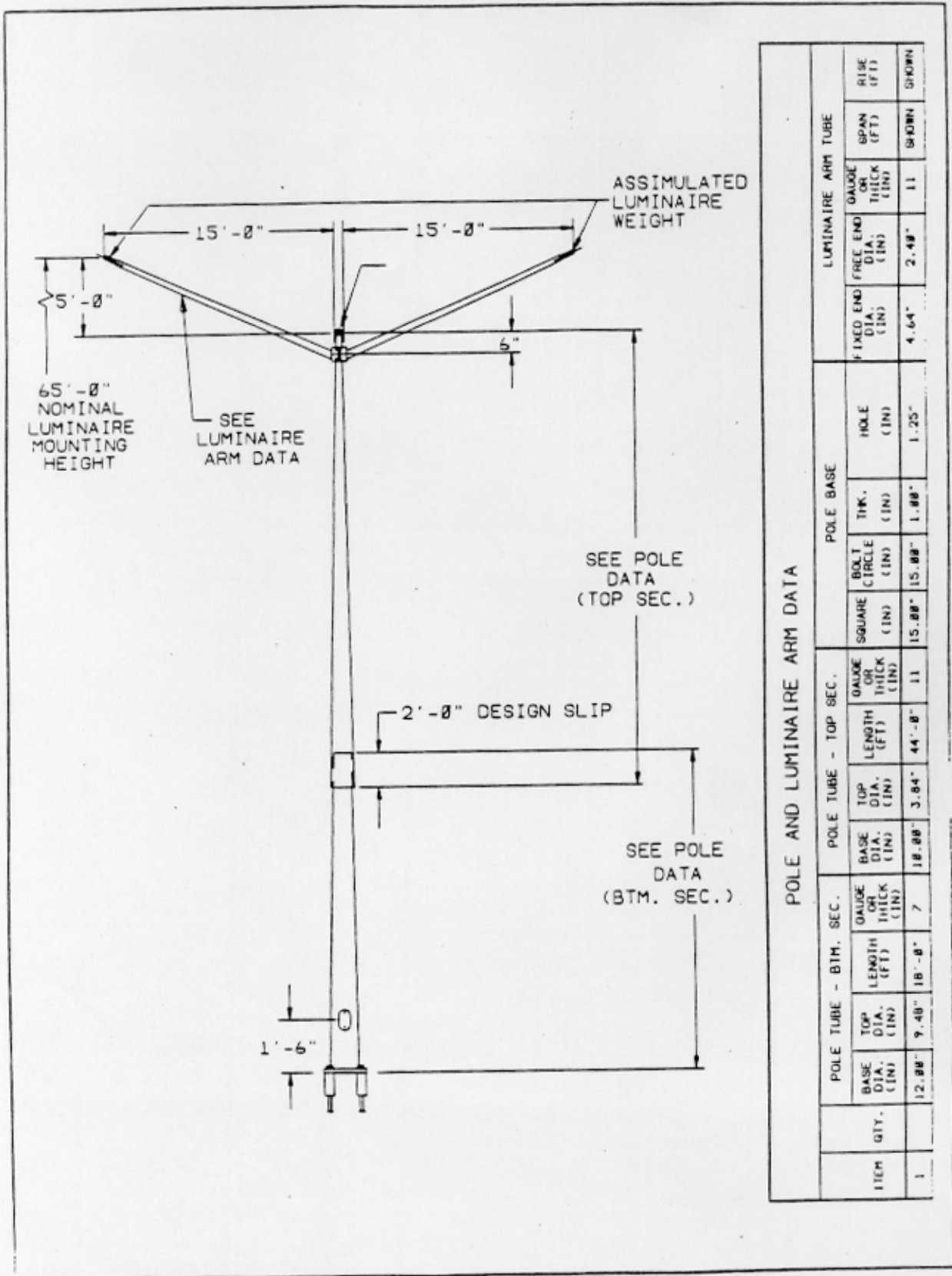


Figure 2. (Continued) Type A-LP Break Away Connector

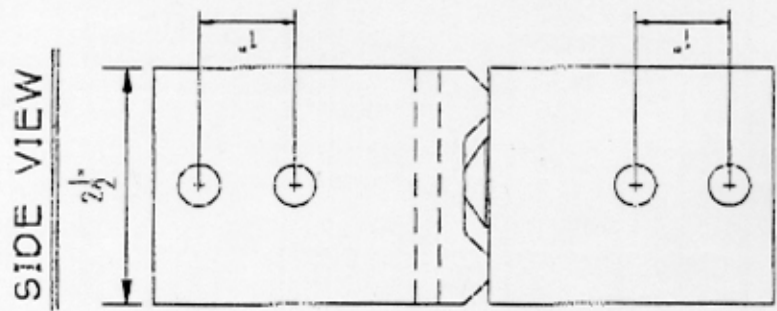
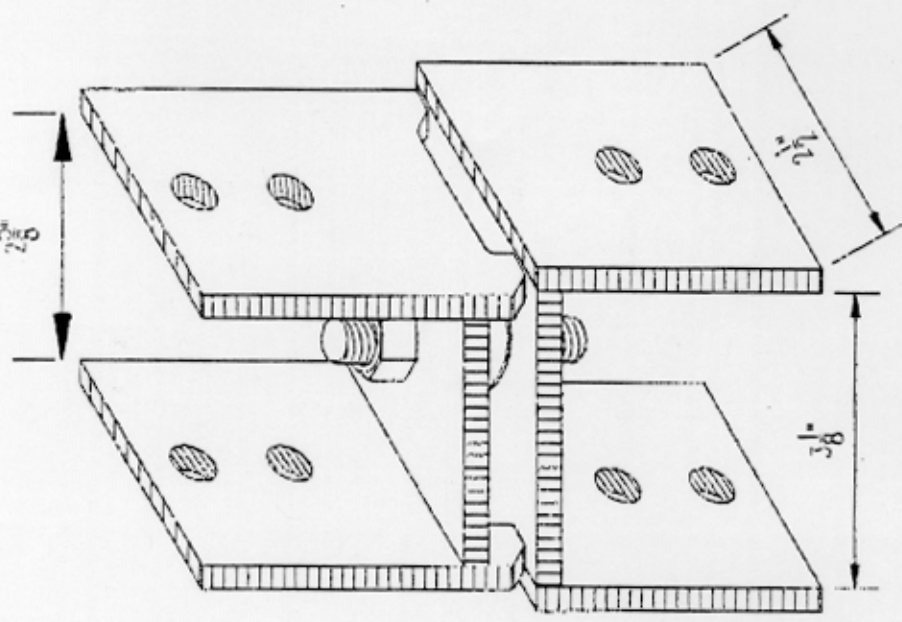
ADAPTOR BRACKET FOR TYPE 'A' OR 'B' BREAKAWAY CONNECTOR FOR SMALL SIGN SUPPORT

ADAPTOR BRACKET FOR TYPE 'A' OR 'B' BREAKAWAY CONNECTOR FOR SMALL SIGN SUPPORT
 GRAPHICS BY: WILDAD DESIGN
 P.O. BOX 27 MANCOS, CO 81328 970-533-9016

Prepared for: CLIFFORD DENT
 P.O. BOX 1119
 KENAI, ALASKA 99611

3-26-04

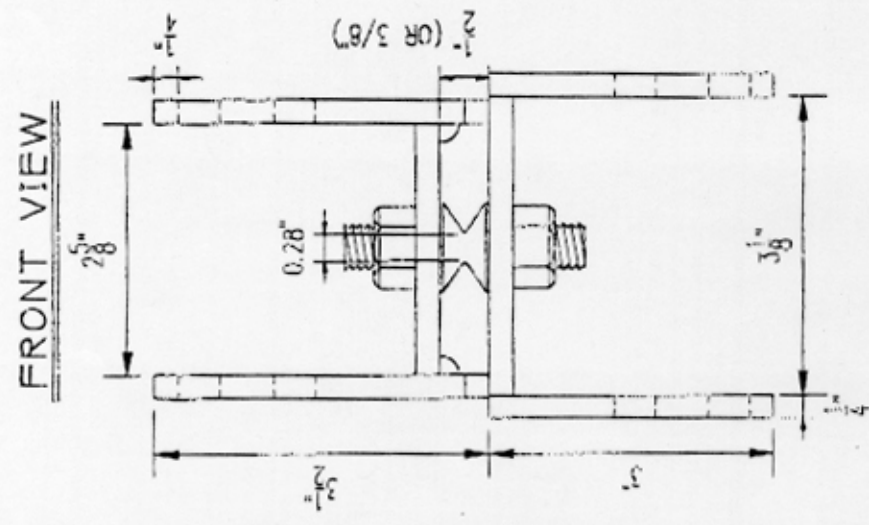
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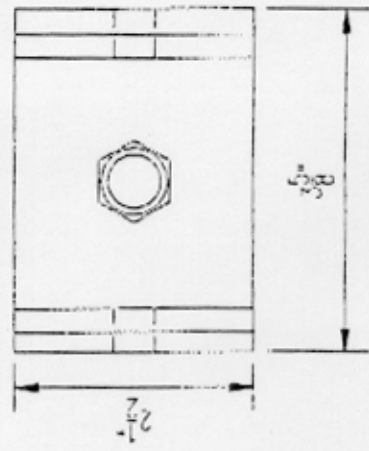
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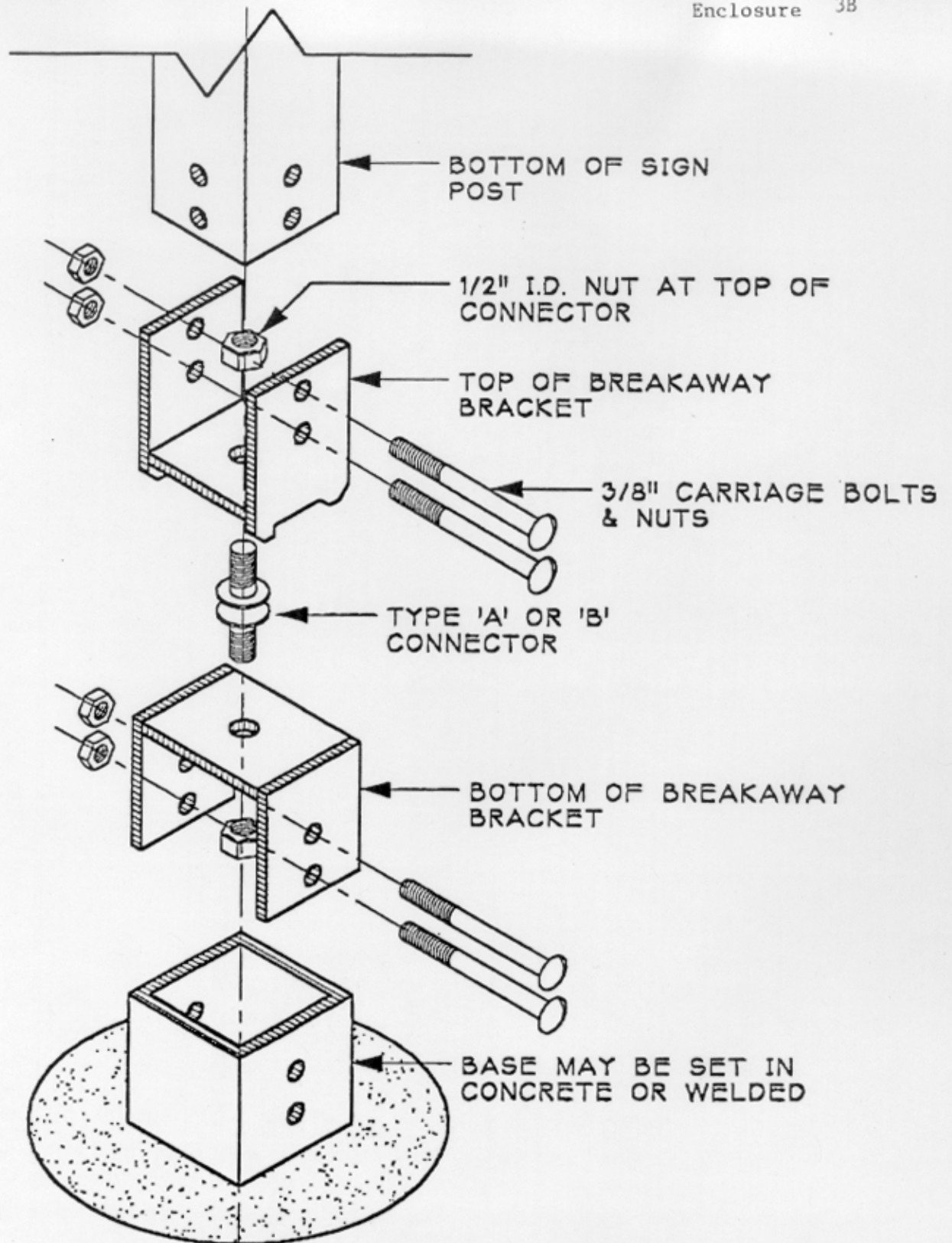
NOTES:

1. CONNECTOR SHALL BE MADE OF THE SAME STRENGTH OR STRONGER MATERIAL THAN THE POST AND BASE ATTACH TO.
2. MATERIAL CAN BE 12 GAUGE TO 1/4" THICKNESS DEPENDING ON MATERIALS IT IS ATTACHED TO.
3. CONNECTOR CAN BE 3 OR 4 SIDED OR ROUND OR ANY SHAPE NEEDED TO MATCH THE EXISTING MATERIAL.
4. BRACKET SHALL BE HOT-DIPPED GALVANIZED AFTER CONSTRUCTION.
5. ALL BOLTS AND CONNECTOR TO MEET A.S.T.M. 325 SPEC. WITH NATIONAL COURSE THREADS.



TOP VIEW





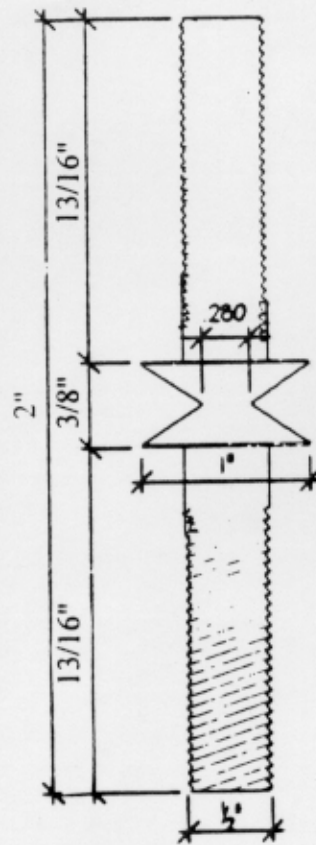
EXPLODED VIEW

NOT TO SCALE

Prepared for: CLIFFORD DENT
 P.O. BOX 1119
 KENAI, ALASKA 99611

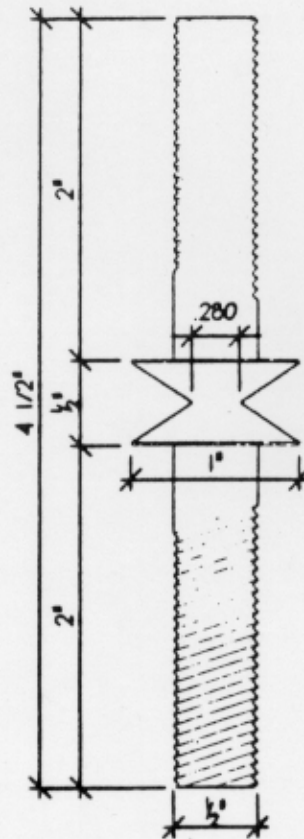
ADAPTOR BRACKET FOR TYPE 'A' OR 'B'
 BREAKAWAY CONNECTOR FOR SMALL SIGN SUPPORT
 GRAPHICS BY: WILDCAD DESIGN
 P.O. BOX 27 MANCOS, CO 81328 970-533-9015

**U.S. Patent No. 4,923,319
BREAKAWAY CONNECTOR
1989 Clifford B. Dent**



TYPE A BREAK AWAY CONNECTOR

**U.S. Patent No. 4,923,319
BREAKAWAY CONNECTOR
1989 Clifford R. Dent**



TYPE A BREAK AWAY CONNECTOR

Full Scale

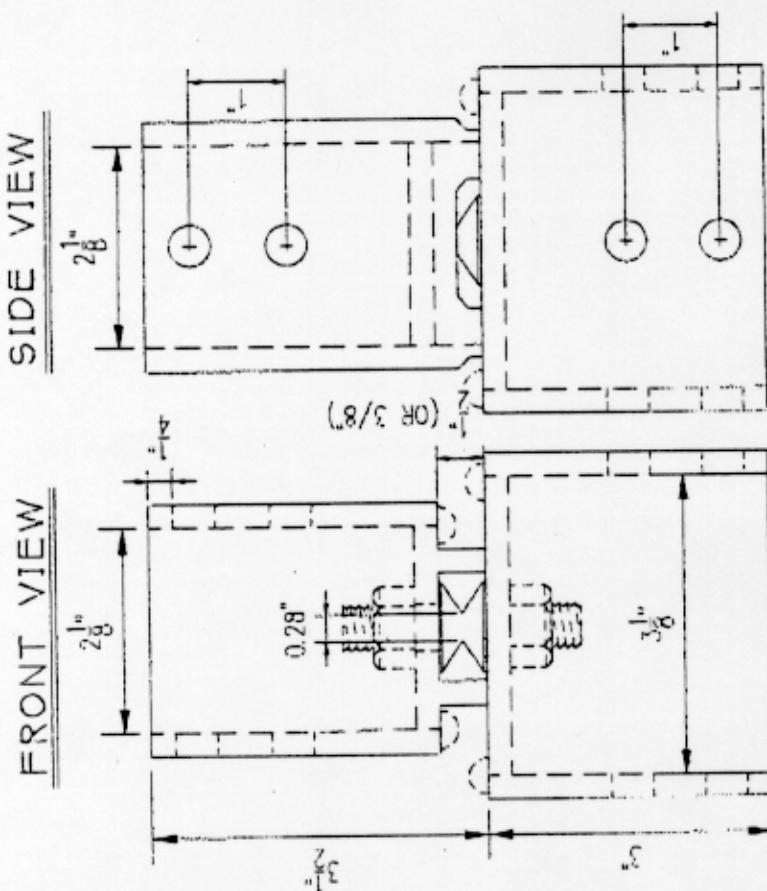
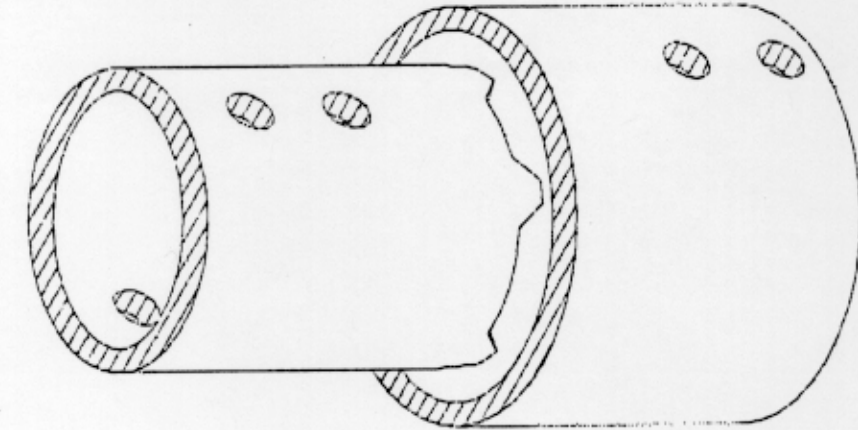
Figure 2. Manufacturer's Drawing of Test Article

ADAPTOR BRACKET FOR TYPE 'A' OR 'B'
BREAKAWAY CONNECTOR FOR SMALL SIGN SUPPORT
GRAPHICS BY: WILDGAD DESIGN
P.O. BOX 27 MANCOS CO 81328 970-638-9016

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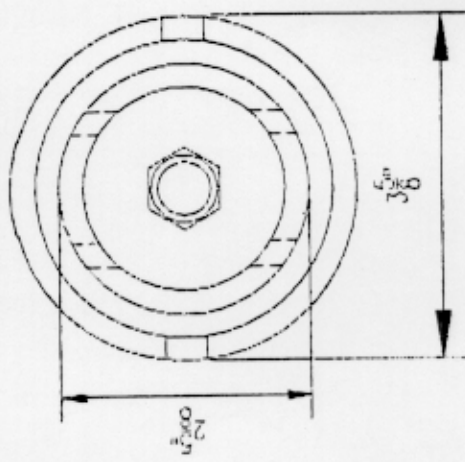
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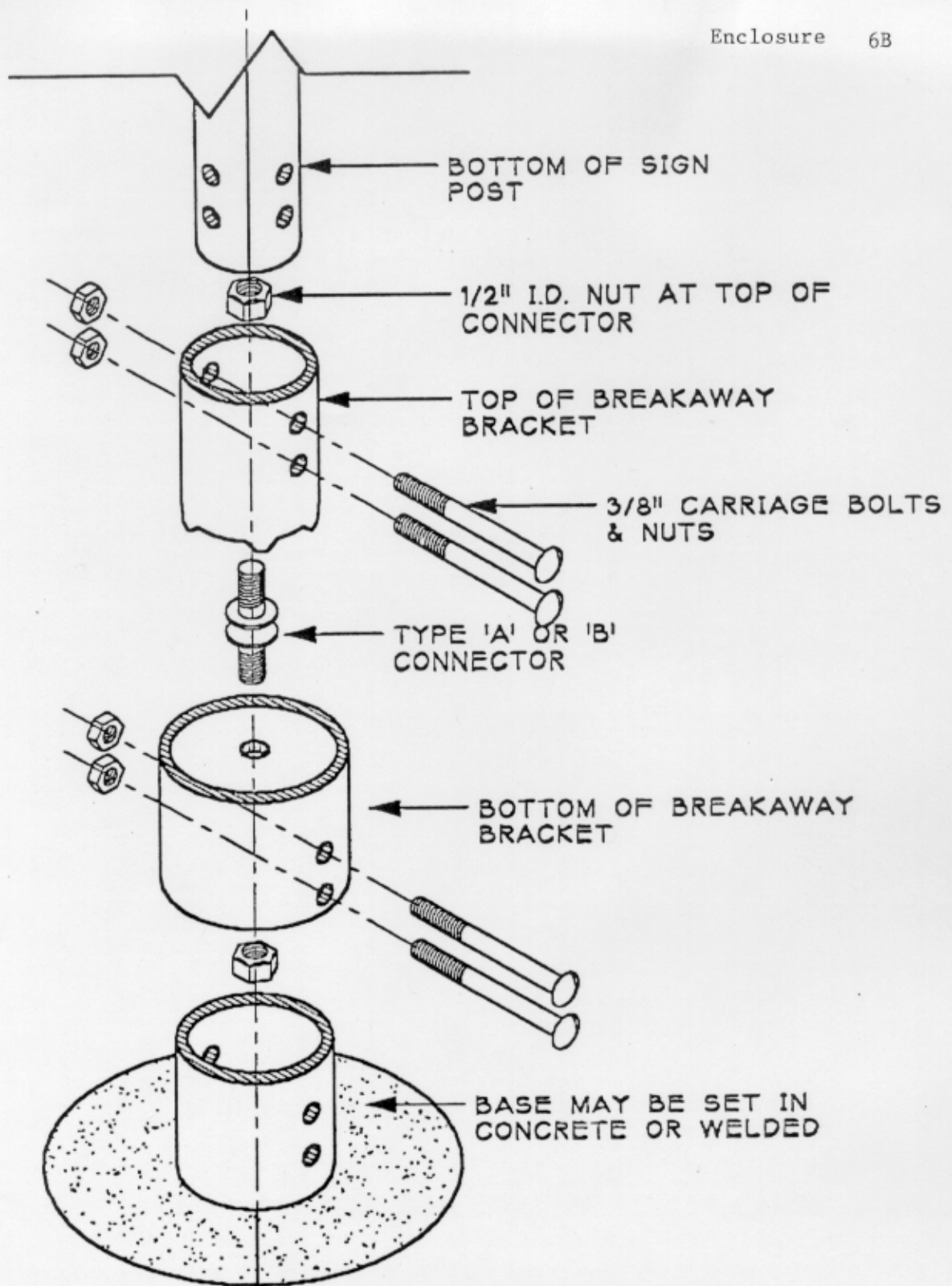


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EXPLODED VIEW

NOT TO SCALE

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BREAKAWAY CONNECTOR FOR SMALL SIGN SUPPORT
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