BARRIER SYSTEMS INC

TECHNICAL
BRIEF

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Product Specification

Universal TAU-II®
Redirective, Non-Gating, Crash Cushion

I. General

The Universal TAU-II® system is a Redirective, Non-Gating Crash Cushion in accordance with the definitions in the National Cooperative Highway Research Program Report 350 (NCHRP 350). The system configurations that have been evaluated for various impact velocities and hazard widths are shown in the Universal TAU-II System Configuration Chart (Figure 1).

II. Performance

The Universal TAU-II® system is designed to absorb the impact energy of an errant vehicle in accordance with NCHRP 350 guidelines for Redirective, Non-Gating Crash Cushions. The system is designed for locations where both head-on and angled impacts are likely to occur and where it is desirable to have the majority of post impact trajectories on the impact side of the system. The design provides for a high degree of flexibility in applying the system to a wide range of hazard widths (up to 2.6 meters (8.5 feet)) in 150mm (6 inch) increments and a large variety of non-proprietary transitions to other highway barriers. The systems also provide a very low life-cycle cost by demonstrating an average repair cost of less than 20% for the whole NCHRP 350, Test Level 3 test matrix. When installed in accordance with the manufacturer's instructions, any of the configurations shown in the Configuration Chart (Figure 1) under the 100 km/h (62.1 mph) column is capable of safely redirecting or stopping a 2000 kg (4400 lb) pick-up truck and an 820 kg (1800 lb) car impacting the system at 100 km/hr (62.1 mph).

A. When properly installed according to the manufacturer's recommendations, the systems shall be able to meet the recommended structural adequacy, occupant risk, and vehicle trajectory criteria set forth in the in NCHRP 350 for Test Level 3 (100 km/hr) Redirective, Non-Gating Crash Cushions with an average material cost for refurbishment of less than 20% of the installed cost. The NCHRP 350, Test Level 3 Test Matrix includes the following conditions:

    1. A 2000 kg vehicle at -20 degrees (reverse direction) impact to the midpoint of the system (Test 3-39).

2. A 2000 kg vehicle at 20 degrees impacting at the Critical Impact Point of the system. The critical impact point was determined to be the front of the backstop along the centerline of the system (Test 3-38).

3. A 2000 kg vehicle at 20 degrees impacting the side, near the front of the system (Test 3-37).

4. An 820 kg vehicle at 20 degrees impacting the side, near the front of the system (Test 3-36).

5. A 2000 kg vehicle at 15 degrees impacting the front of the system (Test 3-33).

6. An 820 kg vehicle at 15 degrees impacting the front of the system (Test 3-32).

7. A 2000 kg vehicle at 0 degrees and centered on the front of the system (Test 3-31).

8. An 820 kg vehicle at 0 degrees and an offset of ¼ the width of the vehicle from the centerline of the system (Test 3-30).

B. The impact velocity of a hypothetical front seat passenger against the vehicle interior as calculated from the longitudinal vehicle acceleration and 600 mm [23 5/8 in] forward displacement, and the lateral vehicle acceleration and 300 mm [12 in] lateral vehicle displacement, shall be less than 12 m/s (39.3 ft/s). The highest 10 ms average vehicle acceleration in the longitudinal and lateral directions subsequent to the instant of hypothetical occupant impact shall be less than 20 g's in the NCHRP 350 testing matrix of the Universal TAU-II system.

   Detached debris shall not show potential for penetrating the vehicle occupant compartment or present a hazard to other traffic, pedestrians, or workers in a work zone. The vehicle shall remain upright during and after the collision, although moderate roll, pitch, and yaw may occur. Vehicle deformations shall not cause intrusion into the occupant compartment in excess of 150 mm (6 inches).

III. Description of System

A. The Universal TAU-II crash cushion is made up of independent collapsible bays that are guided and supported by high strength galvanized steel cables. The system's energy capacity is provided by an array of Energy Absorbing Cartridges. The Universal TAU-II systems are available in various length and width configurations and with capacities as shown in the Universal TAU-II System Configuration Chart (Figure 1). All of these configurations can be assembled from the basic parts as shown in the Universal TAU-II Parts List (Figure 2). The systems shall be made up of the following components and shall be fabricated from materials conforming to the following specifications:

1. The foundation system for the Universal TAU-II consists of two cables, a Back Support and Front Cable Anchors as shown in Figure 2 or Figure 3. The Front Cable Anchor weighs approximately 35 kg (75 lb). The types of Cable Anchors and Back Supports can be selected from those shown in Figures 2 and 3 based on the requirements of the specific site.

    a. All steel structural components of these assemblies shall be fabricated from mild steel in conformance with ASTM A-36 specifications. These components are hot dipped galvanized per ASTM A-123.

    b. Fasteners shall be Class 5.8 (Grade 2) or greater and galvanized in accordance with ASTM 153. Washers shall be hardened and galvanized.

    c. The steel cables shall be at least 25 mm (1 in) diameter and galvanized in accordance with ASTM A-603.

2. Front and Middle Supports and the various sizes of Bulkheads (XL, XXL and XXXL) (Figure 2) separate each independent collapsible bay. Cable Guides bolt to the Middle Supports and Bulkheads, capturing the cables and connecting the bays to the foundation system.

    a. All Front and Middle Supports, Bulkheads and cable guides shall be fabricated from mild steel in conformance with ASTM A-36 specifications. These components are hot dipped galvanized per ASTM A-123.

    b. All fasteners shall be Class 5.8 (Grade 2) or greater and galvanized in accordance with ASTM 153. Washers shall be hardened and galvanized.

3. Each Bay is enclosed on the sides with Sliding Panels. Sliding Bolts fasten the panels to the Front and Middle Supports and Bulkheads. End Panels are attached to the Back Support and the last bays's Sliding Panels through Pipe Panel Mounts and provide transition mounting points. The Pipe Panel Mounts are bolted to the back support.

    a. Steel panels are to be fabricated from steel that conforms to the requirements of AASHTO M180 Class B.

    b. Sliding Bolts are to be cast from ASTM 1045 HT steel and galvanized per ASTM A-123.

c. Steel Pipe Panel Mounts shall be fabricated from mild steel in conformance to ASTM A513, Type 5 specifications.

d. Fasteners shall be Class 5.8 (Grade 2) or greater and galvanized in accordance with ASTM 153. Washers shall be hardened and galvanized.

4. Flexible Front Support Legs and a Nose Piece mount to the Front Support. The Front Support Legs and Nose Piece are bolted in place. The Nose Piece provides a location to attach suitable delineation in conformance with local specifications (to be supplied by others).

a. The front support legs shall be fabricated from either synthetic or natural rubber or polyurethane.

b. The Nose Piece shall be fabricated from polyurethane.

c. All fasteners shall be Class 5.8 (Grade 2) or greater and galvanized in accordance with ASTM 153. Washers shall be hardened and galvanized.

5. Two types of Energy Absorbing Cartridges (Figures 4 and 5) provide the primary energy absorbing capacity for the system. The cartridges appear as cylindrical plastic containers measuring approximately 775 mm (30 ½ in) in length and approximately 635 mm (25 in) in diameter. Each cartridge weighs approximately 16 kg (35 lb).

a. All plastic parts shall be molded from specially formulated High Density Cross-linked Polyethylene.

B. The Universal TAU-II systems are available in various capacities, each requiring a specific configuration of Energy Absorbing Cartridges (Types A and B). The capacities and configurations are shown in the Universal TAU-II System Configuration Chart (Figure 1).

C. The Universal TAU-II system shall require attachment to a foundation. Anchoring of the system will require attachment in accordance with the manufacturer's drawings and instructions. Anchor capacity will require 12000 kg (25000 lb) pull out and 8500 kg (19000 lb) shear strength.

D. The TAU-II system shall be assembled, installed, and refurbished in accordance with the manufacturer's instructions.

IV. Application of Safety Appurtenances

Highway safety appurtenances should be applied to hazardous sites in accordance with the guidelines and recommendations in the American Association of State Highway

Transportation Officials (AASHTO), “Roadside Design Guide”, and other Federal Highway Administration and State Department of Transportation requirements. Placement of the TAU-II system must comply with these specifications and guidelines as well as those of the manufacturer.

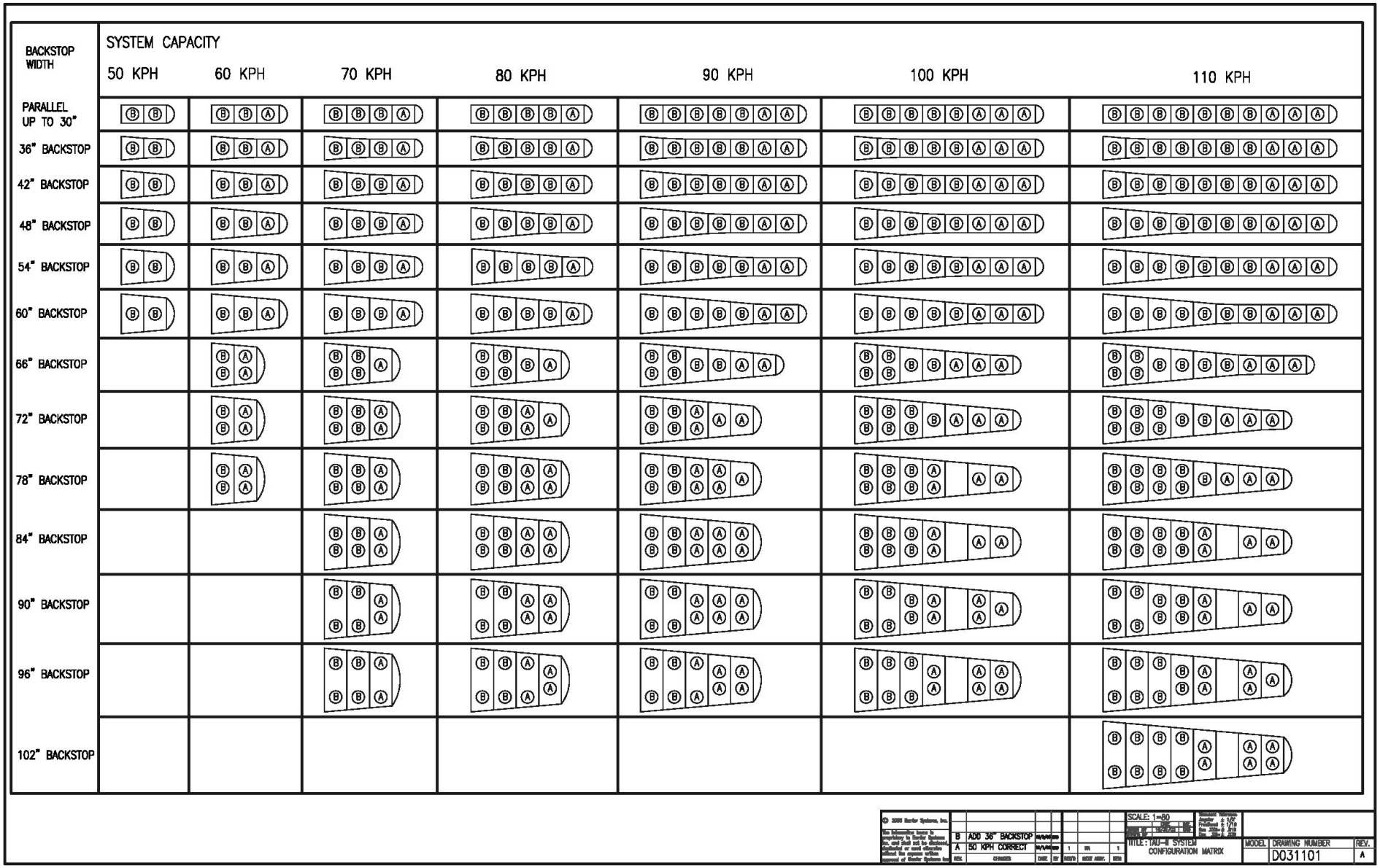
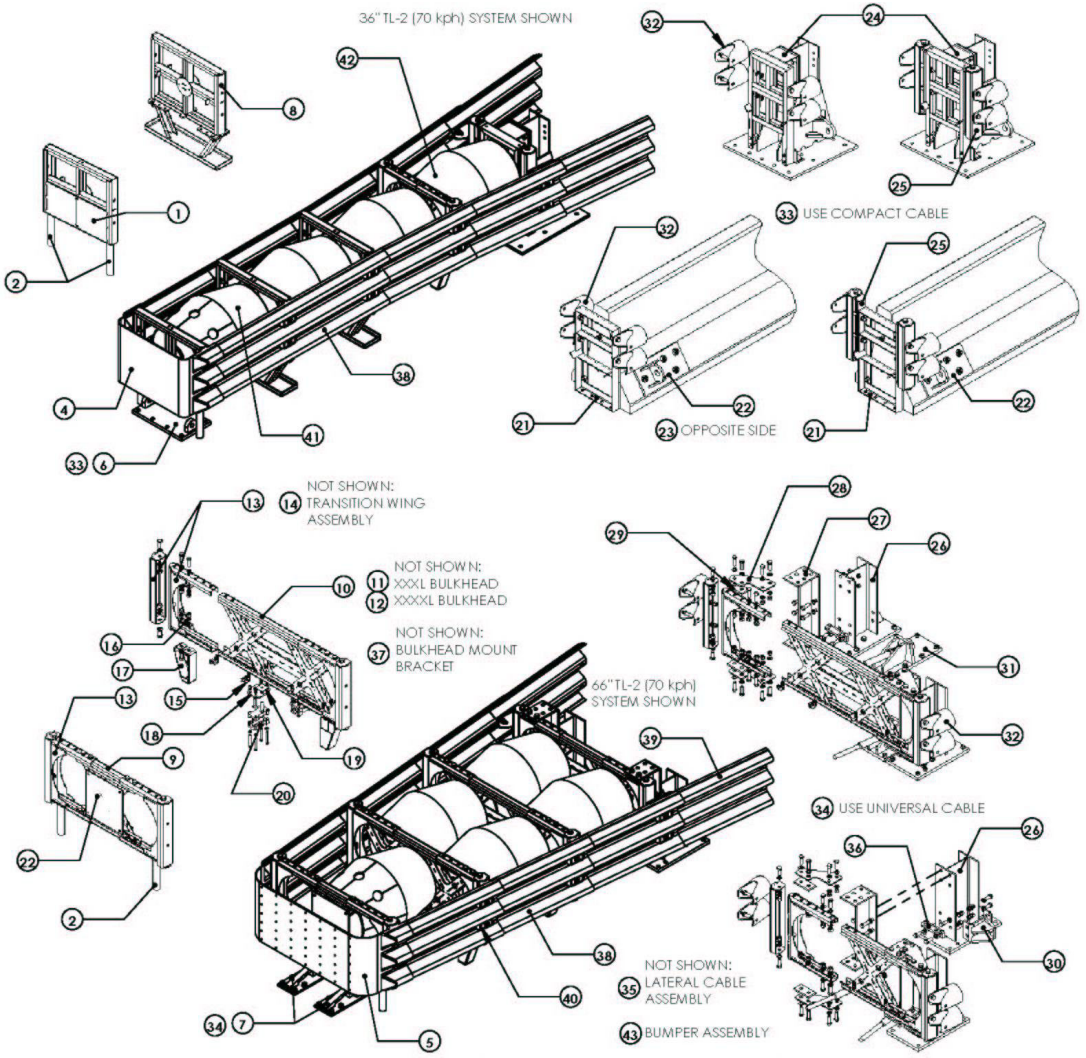

BACKSTOP WIDTH
SYSTEM CAPACITY
50 KPH
60 KPH
70 KPH
80 KPH
90 KPH
100 KPH
110 KPH
PARALLEL UP TO 30"
36" BACKSTOP
42" BACKSTOP
48" BACKSTOP
54" BACKSTOP
60" BACKSTOP
66" BACKSTOP
72" BACKSTOP
78" BACKSTOP
84" BACKSTOP
90" BACKSTOP
96" BACKSTOP
102" BACKSTOP
B ADD 36" BACKSTOP
A 50 KPH CORRECT
SCALE: 1=80
TITLE: TAU-II SYSTEM CONFIGURATION MATRIX
MODEL
DRAWING NUMBER
D031101
REV.
A

Figure 1



ITEM	PART DESCRIPTION	PART #
1	FRONT SUPPORT	B010528
2	FRONT SUPPORT LEG KIT	K001005
3	FRONT COLLISION PLATE	B030801
4	NOSE PIECE, NARROW	B010711
5	NOSE PIECE WIDE	B030902
6	FRONT CABLE ANCHOR, COMPACT	B010248
7	FRONT CABLE ANCHOR, UNIVERSAL	B010935
8	MIDDLE SUPPORT ASSEMBLY	B010530
9	XL BULKHEAD	B030521
10	XXL BULKHEAD	B030528
11	XXXL BULKHEAD	B030529
12	XXXXL BULKHEAD	B030532
13	WING ASSEMBLY	B030509
14	TRANSITION WING ASSEMBLY	B030910
15	EAC LOCATING TAB	B031112
16	BACKING PLATE	B030543
17	LEG	B030425
18	CABLE GUIDE MOUNT	B030411
19	LEVEL SPACER	B030551
20	CABLE GUIDE ASSEMBLY KIT	K001004
21	PCB BACKSTOP	B011007
22	REAR CABLE ANCHOR "R" (PCB)	B010929
23	REAR CABLE ANCHOR "L" (PCB)	B011041
24	COMPACT BACKSTOP	B010537
25	36" ADAPTER (PCB & COMPACT)	B031201
26	WIDE FLANGE BACKSTOP	B030668
27	BACKSTOP BLOCKOUT (WF)	B030713
28	WING BRACE (WF)	B030821
29	WING BRACE SPACER (WF)	B030823
30	REAR CABLE ANCHOR, WF	B031020
31	REAR CABLE ANCHOR, IND (WF)	B030938
32	PIPE PANEL MOUNT	B010651
33	CABLE, COMPACT	TBD
34	CABLE, UNIVERSAL	TBD
35	LATERAL CABLE ASSEMBLY	B031034
36	LATERAL SUPPORT MOUNT (WF)	B031011
37	BULKHEAD MOUNT BRACKET	B031010
38	SLIDING PANEL	B010202
39	END PANEL	B010659
40	SLIDING BOLT ASSEMBLY	K001003
41	ENERGY ABSORBING CARTRIDE, TYPE	B010802
42	ENERGY ABSORBING CARTRIDE, TYPE	B010722
43	BUMPER ASSEMBLY	B031035

REV.	CHANGES	DATE	BY	REQ'D	NEXT ASSY.	ITEM
				1	NA	1

SCALE: 1:1

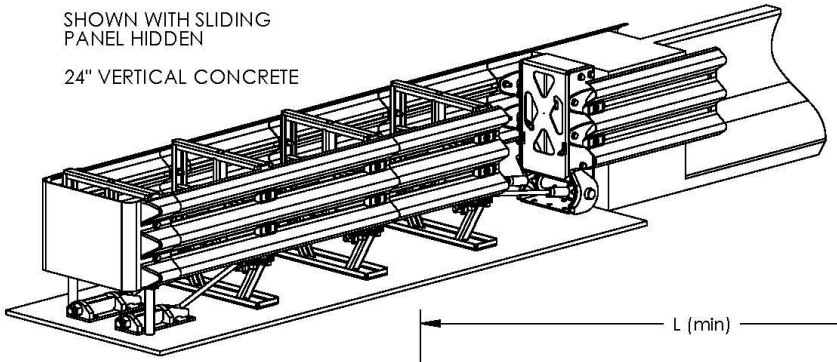
	DATE	INIT.
DRAWN BY	04/22/04	GAD
APPR'D BY		JSM

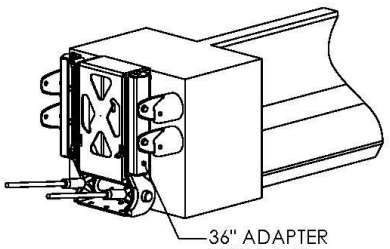
Standard Tolerance
Angular +/- 1/2 Deg.
Fractional +/- 1/16
Dec. . XXX= +/- .010
Dec. . XX= +/- .030

TITLE : UNIVERSAL TAU-II PARTS LIST

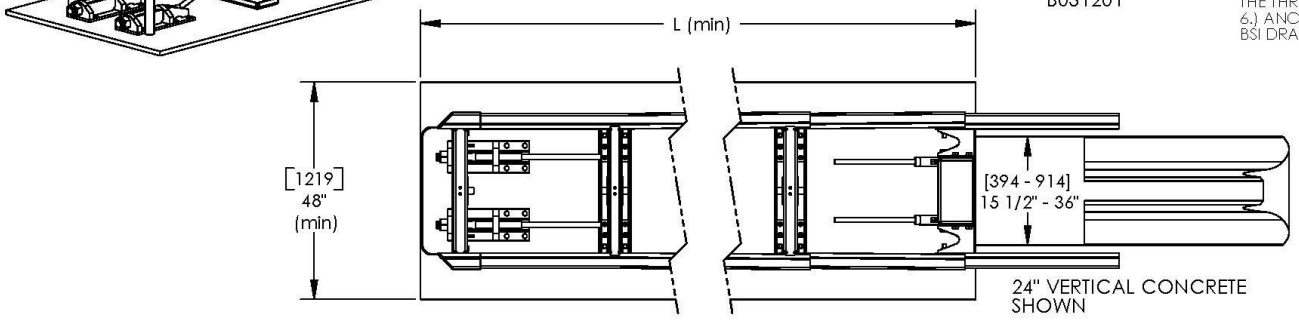
MODEL	DRAWING NUMBER	REV.
	A040416	

Fiaure 2

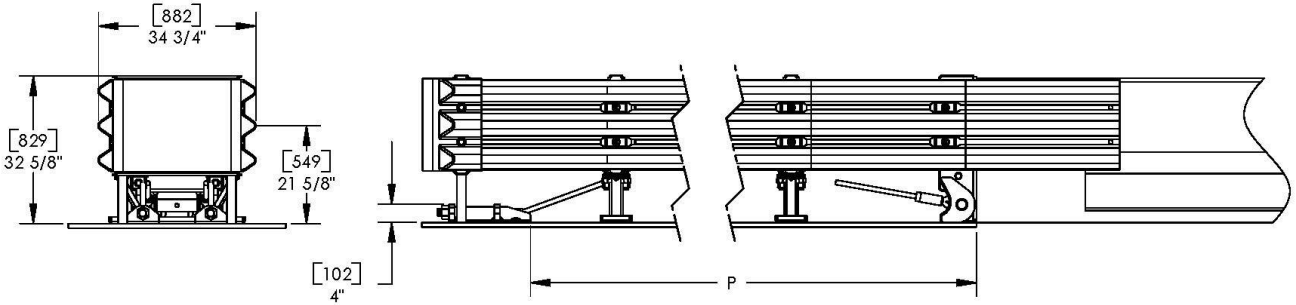




NOTES:
1.) FLUSH MOUNT BACKSTOP SYSTEMS ARE INTENDED FOR APPLICATIONS WHERE THE HAZARD WIDTH EXCEEDS THE LIMITATIONS OF THE PCB BACKSTOP. FLUSH MOUNT SYSTEMS ARE ALSO APPLICABLE IN LOCATIONS WITH LIMITED FOUNDATION SIZE.
2.) THE FLUSH MOUNT BACKSTOP MAY BE ATTACHED TO REINFORCED SAFETY SHAPE OR VERTICAL CONCRETE STRUCTURES UP TO 36" [914] WIDE. STRUCTURES OVER 24"[610] WIDE REQUIRE 36" ADAPTER B031201. EDGES OF VERTICLE CONCRETE MAY REQUIRE CHAMFER ACCORDING TO LOCAL STANDARDS.
3.) VERTICAL SLOTS ON THE BACKSTOP ALLOW REMOVAL/ REPLACEMENT OF THE BACKSTOP. ANCHORS MUST BE PLACED AT THE TOP OF SAID SLOTS TO BE EFFECTIVE.
4.) FLUSH MOUNT BACKSTOP SYSTEMS USE THE SAME CABLE USED IN ALL PARALLEL SYSTEMS. THE CABLE IS INSTALLED WITH THE THREADED TENSIONING END FORWARD. THE LOOPED END IS PINNED IN PLACE AT THE BACKSTOP.
5.) THE FRONT CABLE ANCHOR USES AN INSERTED KEY TO KEEP THE THREADED STUD FROM ROTATING DURING TENSIONING.
6.) ANCHOR ACCORDING TO BSI SPECIFICATIONS. REFERENCE BSI DRAWING A040113.



FOUNDATION PAD LENGTH DIMENSION "L" (MINIMUM)			
BAY No.	CAPACITY (kph)	L (ft-in)	L (mm)
2	50	6' - 11 1/2"	2121
3	60	9' - 9 1/2"	2985
4	70	12' - 7 1/2"	3848
5	80	15' - 5 1/2"	4712
6	85	18' - 4"	5588
7	90	21' - 2"	6452
8	100	24' - 0"	7315
9	105	26' - 10"	8179
10	110	29' - 8 1/2"	9055
11	115	32' - 6 1/2"	9919
12	120	35' - 4 1/2"	10782



FRONT ANCHOR PLACEMENT DIMENSION "P"			
BAY No.	CAPACITY (kph)	P (ft-in)	P (mm)
2	50	4' - 11 1/2"	1511
3	60	7' - 9 1/2"	2375
4	70	10' - 7 1/2"	3239
5	80	13' - 5 1/2"	4102
6	85	16' - 4"	4978
7	90	19' - 2"	5842
8	100	22' - 0"	6706
9	105	24' - 10"	7569
10	110	27' - 8 1/2"	8446
11	115	30' - 6 1/2"	9309
12	120	33' - 4 1/2"	10173

NOTE:
THICKNESS OF WELD TO BE EQUAL TO THE THINNER OF 2 PIECES BEING JOINED. WELD TO BE ALL AROUND UNLESS OTHERWISE SPECIFIED

REV.	CHANGES	DATE	BY	REQ'D	NEXT ASSY.	ITEM
				1	TBD	1

SCALE: 1:24

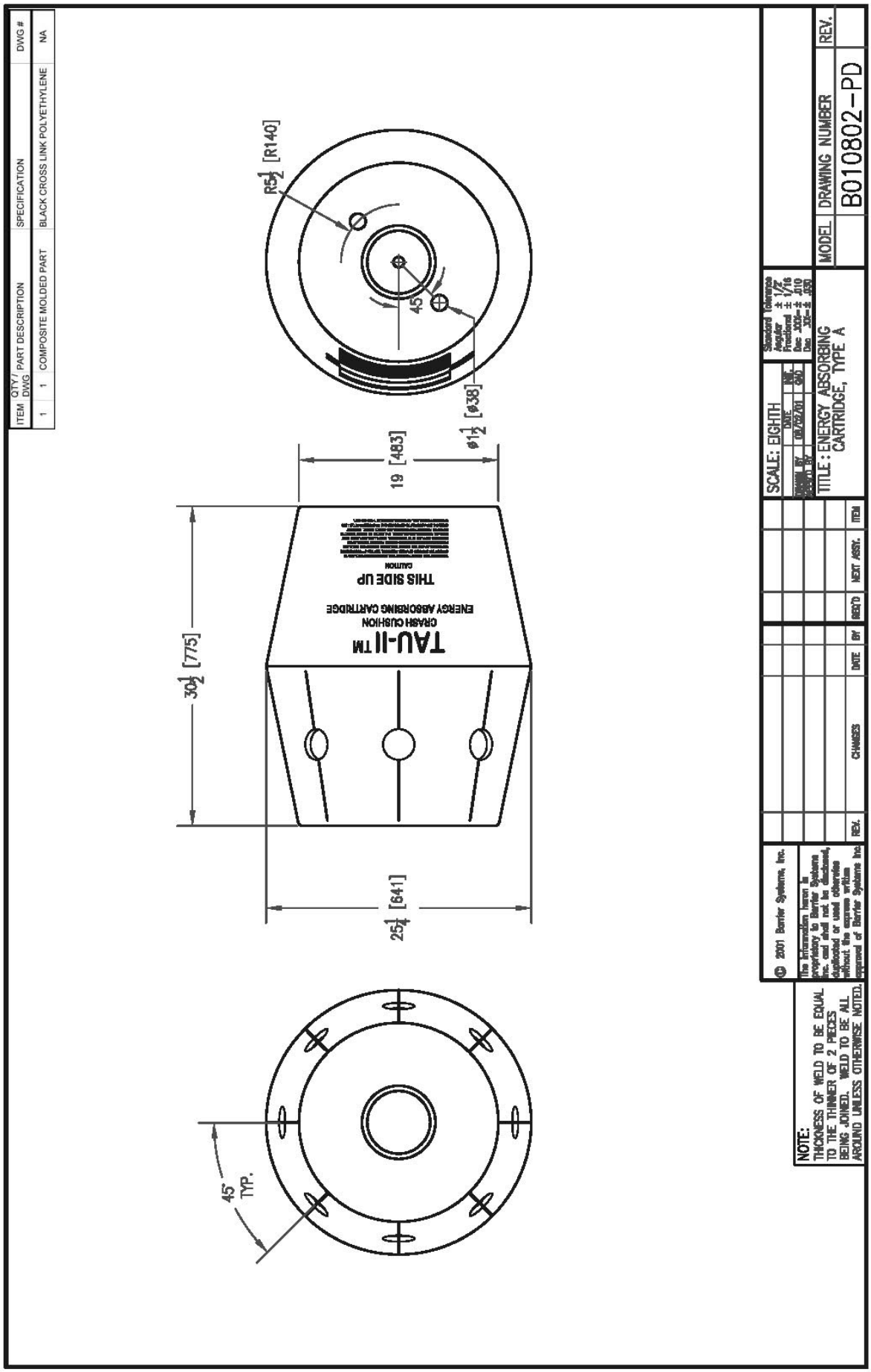
	DATE	INT.
DRAWN BY	4/21/04	GAD
		GAD

Standard Tolerance
Angular +/- 1/2 Deg.
Fractional +/- 1/16
Dec. XXX= +/- .010
Dec. XX= +/- .030

TITLE: APPLICATION, FLUSH MOUNT BACKSTOP

MODEL	DRAWING NUMBER	REV
	B040239	

Figure 3


ITEM QTY/ DWG
PART DESCRIPTION
SPECIFICATION
DWG #
1 1 COMPOSITE MOLDED PART
BLACK CROSS LINK POLYETHYLENE
NA
R5½ [R140]
45°
ø1½ [ø38]
19 [483]
30½ [775]
25¼ [641]
TAU-II™
CRASH CUSHION
ENERGY ABSORBING CARTRIDGE
THIS SIDE UP
CAUTION
45° TYP.
NOTE:
THICKNESS OF WELD TO BE EQUAL TO THE THINNER OF 2 PIECES BEING JOINED. WELD TO BE ALL AROUND UNLESS OTHERWISE NOTED.
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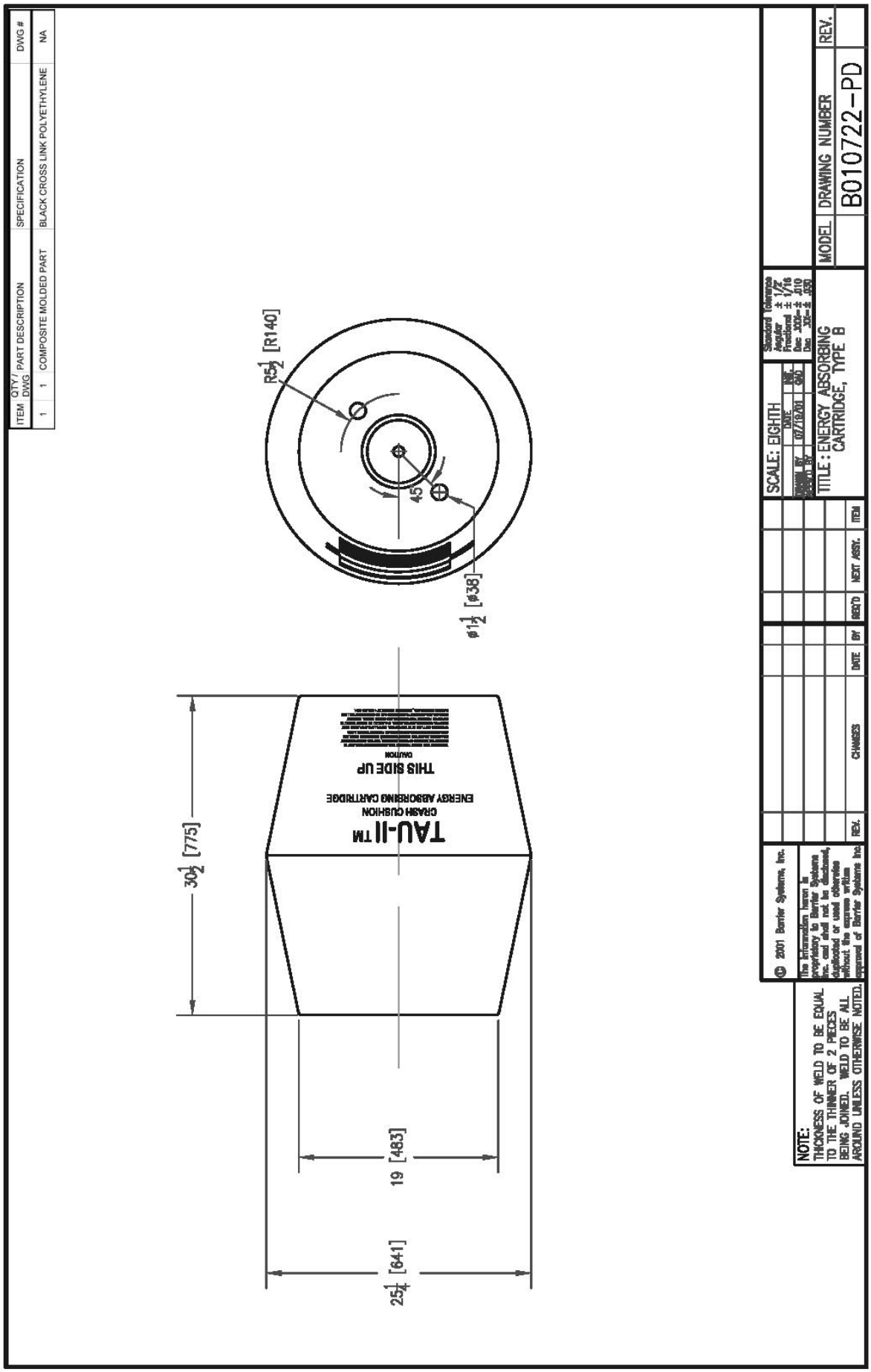
REV.
CHANGES
DATE
BY
BSD'D
NEXT ASSY.
ITEM
SCALE: EIGHTH
DATE
08/29/01
CHK'D
APP'D
Standard Tolerance
Angular ± 1/2°
Fractional ± 1/16
Dec .XX= ± .010
Dec .XXX= ± .005
TITLE: ENERGY ABSORBING CARTRIDGE, TYPE A
MODEL
DRAWING NUMBER
B010802-PD
REV.

Figure 4


ITEM
QTY / DWG
PART DESCRIPTION
SPECIFICATION
DWG #
1
1
COMPOSITE MOLDED PART
BLACK CROSS LINK POLYETHYLENE
NA
R5½ [R140]
45°
ø1½ [ø38]
30½ [775]
TAU-II™
CRASH CUSHION
ENERGY ABSORBING CARTRIDGE
THIS SIDE UP
CAUTION
19 [483]
25¼ [641]
NOTE:
THICKNESS OF WELD TO BE EQUAL TO THE THINNER OF 2 PIECES BEING JOINED. WELD TO BE ALL AROUND UNLESS OTHERWISE NOTED.
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REV.
CHANGES
DATE
BY
APPD
NEXT ASSY.
ITEM
SCALE: EIGHTH
DRAWN BY
DATE
07/19/01
CHK'D
APP'D
Standard Tolerance
Angular ± 1/2°
Fractional ± 1/16
Dec .XXX= ± .010
Dec .XX= ± .030
TITLE: ENERGY ABSORBING CARTRIDGE, TYPE B
MODEL
DRAWING NUMBER
B010722-PD
REV.

Figure 5