



U.S. Department
of Transportation
Federal Highway
Administration

1200 New Jersey Ave., SE
Washington, D.C. 20590

December 18, 2015

In Reply Refer To:
HSST/CC57D

Mr. Bret Eckert P.E.
Engineering Applications Manager
Trinity Highway Products
3617 Cincinnati Avenue
Rocklin, CA 95677

Dear Mr. Eckert:

This letter is in response to your August 1, 2014 request for the Federal Highway Administration (FHWA) to review a roadside safety device, hardware, or system for eligibility for reimbursement under the Federal-aid highway program. This FHWA letter of eligibility is assigned FHWA control number CC-57D and is valid until a subsequent letter is issued by FHWA that expressly references this device.

Decision

The following devices are eligible, with details provided in the form which is attached as an integral part of this letter:

- QuadGuard Elite System Modification

Scope of this Letter

To be found eligible for Federal-aid funding, modified roadside safety devices should meet the crash test and evaluation criteria contained in the National Cooperative Highway Research Program (NCHRP) Report 350. However, the FHWA, the Department of Transportation, and the United States Government do not regulate the manufacture of roadside safety devices. Eligibility for reimbursement under the Federal-aid highway program does not establish approval, certification or endorsement of the device for any particular purpose or use.

This letter is not a determination by the FHWA, the Department of Transportation, or the United States Government that a vehicle crash involving the device will result in any particular outcome, nor is it a guarantee of the in-service performance of this device. Proper manufacturing, installation, and maintenance are required in order for this device to function as tested.

This finding of eligibility is limited to the crashworthiness of the system and does not cover other structural features, nor conformity with the Manual on Uniform Traffic Control Devices.

Eligibility for Reimbursement

FHWA previously issued an eligibility letter for the roadside safety system described in your pending request. Your pending request now identifies a modification to that roadside safety system.

The original roadside safety device information is:

Name of system: QuadGuard Elite

Type of system: Crash Cushion

Date of original request: September 8, 1998

Date of original FHWA eligibility letter: December 30, 1998

FHWA Control number: CC-57

The modification(s) to the QuadGuard covered by this letter are:

1. Modified the bolt type used to attach the nose belt support legs to the nose belt from elevator head style to hex head style.
2. Modified the diaphragm chain protective coating from purchasing the chain in black, uncoated condition and hot dipped galvanizing after cutting to length to purchasing galvanized chain. The chain remains the same size and grade with identical properties.
3. Modified the wire rope clamp used for the cylinder retention cables by changing the clamp rod diameter from 7/16" to 1/2". The wire rope clamp retains its size for 1/2" cable and provides increased clamping force with the larger rod diameter and correspondingly sized nuts.
4. Improved the fit between the diaphragm components by lengthening the diaphragm side plate from 20 7/8" to 21". This modification provides for a improved fit between the QuadBeam panel and cylinder edge guard.
5. Modified the part number of the bolt used to attach the nose belt to the nose cylinder. There is no change to the size or type of bolt.
6. Improved the assembly of the Hit Indicator post by increasing the hole diameters and providing fastener clearance in the post tubing from 1/2" to 9/16" and 1/4" to 5/16", respectively.
7. Improved the diaphragm lower reinforcements horizontal fillet weld by increasing total weld length on each surface from 17" to 18".

8. Improved the hinge pivot attachment on the wide system diaphragm hinge plates by adding 1/8" fillet welds to the outside surfaces of the hinge pair.
9. Modified the QuadGuard Elite Backup Assembly by eliminating the backup cable support bracket and corresponding fasteners from the backup assembly. The rear cylinder cable will continue to be wrapped around the lower portion of the diaphragm/tension strut backup. This method of wrapping the cable around the lower diaphragm has been the standard method of retaining the cylinders in all other bays in the QuadGuard Elite.
10. Modified the QuadGuard Product and Assembly Manuals to the current Trinity Highway format.
11. Improved the method of ensuring consistent preloading of the fender panel rear tension springs from compressing 1/16" to 1/8", to tightening the nut on mushroom washer bolt until it reaches end of threads. This method eliminates nut loosening and maintains consistent fender panel end gap. The protective coating on the fender panel springs was improved from power coated to mechanically galvanized. The spring rate will be unchanged yielding superior corrosion protection.

FHWA concurs with the recommendation of the accredited crash testing laboratory as stated within the attached form.

Full Description of the Eligible Device

The device and supporting documentation, including reports of the crash tests or other testing done, videos of any crash testing, and/or drawings of the device, are described in the attached form.

Notice

If a manufacturer makes any modification to any of their roadside safety hardware that has an existing eligibility letter from FHWA, the manufacturer must notify FHWA of such modification with a request for continued eligibility for reimbursement. The notice of all modifications to a device must be accompanied by:

- Significant modifications – For these modifications, crash test results must be submitted with accompanying documentation and videos.
- Non-signification modifications – For these modifications, a statement from the crash test laboratory on the potential effect of the modification on the ability of the device to meet the relevant crash test criteria.

FHWA's determination of continued eligibility for the modified hardware will be based on whether the modified hardware will continue to meet the relevant crash test criteria.

You are expected to supply potential users with sufficient information on design, installation and maintenance requirements to ensure proper performance.

You are expected to certify to potential users that the hardware furnished has the same chemistry, mechanical properties, and geometry as that submitted for review, and that it will meet the test and evaluation criteria of the NCHRP Report 350.

Issuance of this letter does not convey property rights of any sort or any exclusive privilege. This letter is based on the premise that information and reports submitted by you are accurate and correct. We reserve the right to modify or revoke this letter if: (1) there are any inaccuracies in the information submitted in support of your request for this letter, (2) the qualification testing was flawed, (3) in-service performance or other information reveals safety problems, (4) the system is significantly different from the version that was crash tested, or (5) any other information indicates that the letter was issued in error or otherwise does not reflect full and complete information about the crashworthiness of the system.

Standard Provisions

- To prevent misunderstanding by others, this letter of eligibility designated as FHWA control number CC-57D shall not be reproduced except in full. This letter and the test documentation upon which it is based are public information. All such letters and documentation may be reviewed upon request.

- This letter shall not be construed as authorization or consent by the FHWA to use, manufacture, or sell any patented system for which the applicant is not the patent holder.

- If the subject device is a patented product it may be considered to be proprietary. If proprietary systems are specified by a highway agency for use on Federal-aid projects:
(a) they must be supplied through competitive bidding with equally suitable unpatented items; (b) the highway agency must certify that they are essential for synchronization with the 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.

Sincerely yours,

A handwritten signature in blue ink that reads "Michael S. Griffith". The signature is written in a cursive style with a large initial "M" and a distinct "S" and "G".

Michael S. Griffith
Director, Office of Safety Technologies
Office of Safety

Enclosures

Request for Federal Aid Reimbursement Eligibility of Highway Safety Hardware

Submitter	Date of Request:	December 16, 2015	<input type="radio"/> New <input checked="" type="radio"/> Resubmission
	Name:	Bret R. Eckert, P.E.	
	Company:	Trinity Highway Products, LLC	
	Address:	3617 Cincinnati Ave., Rocklin, CA 95765	
	Country:	USA	
	To:	Michael S. Griffith, Director FHWA, Office of Safety Technologies	

I request the following devices be considered eligible for reimbursement under the Federal-aid highway program.

System Type	Submission Type	Device Name / Variant	Testing Criterion	Test Level
'CC': Crash Cushions, Attenuators, & Terminals	<input checked="" type="radio"/> Physical Crash Testing <input type="radio"/> Engineering Analysis	QuadGuard® Elite	NCHRP Report 350	TL3

By submitting this request for review and evaluation by the Federal Highway Administration, I certify that the product(s) was (were) tested in conformity with the NCHRP Report 350 (Report 350) and that the evaluation results meet the appropriate evaluation criteria in the Report 350.

Identification of the individual or organization responsible for the product:

Contact Name:	Jim Thonn	Same as Submitter <input type="checkbox"/>
Company Name:	Trinity Highway Products, LLC	Same as Submitter <input checked="" type="checkbox"/>
Address:	70 West Madison Street, Suite 2350, Chicago, IL 60602	Same as Submitter <input type="checkbox"/>
Country:	USA	Same as Submitter <input checked="" type="checkbox"/>

Enter below all disclosures of financial interests as required by the FHWA 'Federal-Aid Reimbursement Eligibility Process for Safety Hardware Devices' document.

The QuadGuard® Elite technology is the commercial embodiment of intellectual property that is protected by patents that are owned by Trinity Highway Products, LLC (THP). THP does not pay royalties for sales of the QuadGuard® Elite system. The QuadGuard® Elite system was designed and developed by engineers at Energy Absorption Systems Inc. (EAS). The patent holders of record for the QuadGuard® Elite system are Michael H. Oberth and John V. Machado and both, Mr. Oberth as well as Mr. Machado, were employed by EAS. The associated United States Patent Office patent application numbers (5,797,592 & 5,733,062) are assigned to Energy Absorption Systems, Inc. / Trinity Industries, Inc.

EAS sponsored certain crash tests of the QuadGuard® Elite system; such tests were conducted by E-Tech Testing Services, an independent, wholly-owned subsidiary of THP. E-Tech Testing Services is an International Standards Organization ("ISO") 17025 accredited laboratory with American Association for Laboratory Accreditation (A2LA) Mechanical Testing certificate 989.01. Full-scale crash testing on the QuadGuard® system was performed in accordance with testing criteria, as set forth by the National Cooperative Highway Research Program ("NCHRP") in the NCHRP Report 350 (1993).

PRODUCT DESCRIPTION

<input type="radio"/> New Hardware or Significant Modification	<input checked="" type="radio"/> Modification to Existing Hardware	Non-Significant
<p>The QuadGuard® Elite system is a redirective, non-gating type crash cushion. The systems consists of energy absorbing cylinders surrounded by a framework of steel Quad-Beam guardrail that can telescope rearward during head-on impacts. The systems have a center monorail that will resist lateral movement during side angle impacts and a back up structure that will resist rearward movement during head-on impacts. The QuadGuard® Elite systems are approved for use per FHWA acceptance letter series CC-57 (dated Dec. 30, 1998 thru Nov. 14, 2008). The design changes presented in this submission consist of the following inconsequential and positive component modifications.</p>		
<p>1) Modified the bolt type used to attach the nose belt support legs to the nose belt from elevator head style to hex head style. A fender washer is used under the bolt head so this is considered an inconsequential modification on the QuadGuard® Elite system.</p>		
<p>2) Modified the diaphragm chain protective coating from purchasing the chain in black, uncoated condition and hot dipped galvanizing after cutting to length to purchasing galvanized chain. The chain remains the same size and grade with identical properties. This is an inconsequential modification on the QuadGuard® Elite system.</p>		
<p>3) Modified the wire rope clamp used for the cylinder retention cables by changing the clamp rod diameter from 7/16" to 1/2". The wire rope clamp retains is size for 1/2" cable and provides increased clamping force with the larger rod diameter and correspondingly sized nuts. This is a positive modification on the QuadGuard® Elite system.</p>		
<p>4) Improved the fit between the diaphragm components by lengthening the diaphragm side plate from 20 7/8" to 21". This modification provides for a improved fit between the QuadBeam panel and cylinder edge guard. This is a positive modification on the QuadGuard® Elite system.</p>		
<p>5) Modified the part number of the bolt used to attach the nose belt to the nose cylinder. There is no change to the size or type of bolt. This modification is an inconsequential modification on the QuadGuard® Elite system.</p>		
<p>6) Improved the assembly of the Hit Indicator post by increasing the hole diameters and providing fastener clearance in the post tubing from 1/2" to 9/16" and 1/4" to 5/16", respectively. This is an inconsequential modification on the QuadGuard® Elite system.</p>		
<p>7) Improved the diaphragm lower reinforcements horizontal fillet weld by increasing total weld length on each surface from 17" to 18". This is a positive modification on the QuadGuard® family systems.</p>		
<p>8) Improved the hinge pivot attachment on the wide system diaphragm hinge plates by adding 1/8" fillet welds to the outside surfaces of the hinge pair. This is a positive modification on the QuadGuard® family systems.</p>		
<p>9) Modified the QuadGuard® Elite Backup Assembly by eliminating the backup cable support bracket and corresponding fasteners from the backup assembly. The rear cylinder cable will continue to be wrapped around the lower portion of the diaphragm/tension strut backup. This method of wrapping the cable around the lower diaphragm has been the standard method of retaining the cylinders in all other bays in the QuadGuard® Elite. This is an inconsequential modification on the QuadGuard® Elite system.</p>		
<p>10) Modified the QuadGuard® Product and Assembly Manuals to the current Trinity Highway format. These are inconsequential modifications on the QuadGuard® Elite system.</p>		
<p>11) Improved the method of ensuring consistent preloading of the fender panel rear tension springs from compressing 1/16" to 1/8", to tightening the nut on mushroom washer bolt until it reaches end of threads. This method eliminates nut loosening and maintains consistent fender panel end gap. The protective coating on the fender panel springs was improved from power coated to mechanically galvanized. The spring rate will be unchanged yielding superior corrosion protection. These are positive modifications on the QuadGuard® Elite system.</p>		
<p>These component modifications for the QuadGuard® Elite system are considered Non-Significant. All revisions have been justified through engineering analysis and judgement and have been determined to be non-significant and will have no bearing on the as-tested performance of the system.</p>		

CRASH TESTING

A brief description of each crash test and its result:

Required Test Number	Narrative Description	Evaluation Results
3-30 (820C)	Test 3-30 was waived for the QuadGuard Elite in FHWA Eligibility letter CC-57 based on tests 3-31 on the narrowest unit and test 3-32 on the widest unit appeared most critical. The non-significant modifications described in the Product Description will have no bearing on the as-tested performance of the QuadGuard® Elite system.	Non-Critical, not conducted
S3-30 (700C)	Not Applicable. Test S3-30 is an optional test and not required for QuadGuard® Elite system eligibility.	
3-31 (2000P)	Test No. 01-7611-002, Test Date October 9, 1998, Test Report "NCHRP Report 350 Crash Test Results for the QuadGuard Elite System, Final Report, Project No. 01-7611, November 1998. The non-significant modifications described in the Product Description will have no bearing on the as-tested performance of the QuadGuard® Elite system.	PASS
3-32 (820C)	Test No. 01-7611-001, Test Date September 29, 1998, Test Report "NCHRP Report 350 Crash Test Results for the QuadGuard Elite System, Final Report, Project No. 01-7611, November 1998. The non-significant modifications described in the Product Description will have no bearing on the as-tested performance of the QuadGuard® Elite system.	PASS
S3-32 (700C)	Not Applicable. Test S3-32 is an optional test and not required for QuadGuard® Elite system eligibility.	
3-33 (2000P)	Test 3-33 was waived for the QuadGuard Elite in FHWA Eligibility letter CC-57 based on tests 3-31 on the narrowest unit and test 3-32 on the widest unit appeared most critical. The non-significant modifications described in the Product Description will have no bearing on the as-tested performance of the QuadGuard® Elite system.	Non-Critical, not conducted
3-34 (820C)	Not Applicable. Test 3-34 is for redirective, gating devices and not applicable for QuadGuard® Elite system eligibility.	
S3-34 (700C)	Not Applicable. Test S3-34 is an optional test and not required for QuadGuard® Elite system eligibility.	
3-35 (2000P)	Not Applicable. Test 3-35 is for redirective, gating devices and not applicable for QuadGuard® Elite system eligibility.	
3-36 (820C)	Test 3-36 was waived for the QuadGuard Elite in FHWA Eligibility letter CC-57 based on tests 3-31 on the narrowest unit and test 3-32 on the widest unit appeared most critical. The non-significant modifications described in the Product Description will have no bearing on the as-tested performance of the QuadGuard® Elite system.	Non-Critical, not conducted
S3-36 (700C)	Not Applicable. Test S3-36 is an optional test and not required for QuadGuard® Elite system eligibility.	
3-37 (2000P)	Test 3-37 was waived for the QuadGuard Elite in FHWA Eligibility letter CC-57 based on tests 3-31 on the narrowest unit and test 3-32 on the widest unit appeared most critical. The non-significant modifications described in the Product Description will have no bearing on the as-tested performance of the QuadGuard® Elite system.	Non-Critical, not conducted

Required Test Number	Narrative Description	Evaluation Results
3-38 (2000P)	Test 3-38 was waived for the QuadGuard Elite in FHWA Eligibility letter CC-57 based on tests 3-31 on the narrowest unit and test 3-32 on the widest unit appeared most critical. The non-significant modifications described in the Product Description will have no bearing on the as-tested performance of the QuadGuard® Elite system.	Non-Critical, not conducted
3-39 (2000P)	Test 3-39 was waived for the QuadGuard Elite in FHWA Eligibility letter CC-57 based on tests 3-31 on the narrowest unit and test 3-32 on the widest unit appeared most critical. The non-significant modifications described in the Product Description will have no bearing on the as-tested performance of the QuadGuard® Elite system.	Non-Critical, not conducted
3-40 (2000P)	Not Applicable. Test 3-40 is for nonredirective, gating devices and not applicable for QuadGuard® Elite system eligibility.	
S3-40 (700C)	Not Applicable. Test S3-40 is optional test for nonredirective, gating devices and not applicable for QuadGuard® system eligibility.	
3-41 (2000P)	Not Applicable. Test 3-41 is for nonredirective, gating devices and not applicable for QuadGuard® Elite system eligibility.	
3-42 (820C)	Not Applicable. Test 3-42 is for nonredirective, gating devices and not applicable for QuadGuard® Elite system eligibility.	
S3-42 (700C)	Not Applicable. Test S3-42 is optional test for nonredirective, gating devices and not applicable for QuadGuard® Elite system eligibility.	
3-43 (2000P)	Not Applicable. Test 3-43 is for nonredirective, gating devices and not applicable for QuadGuard® Elite system eligibility.	
3-44 (2000P)	Not Applicable. Test 3-44 is for nonredirective, gating devices and not applicable for QuadGuard® Elite system eligibility.	

Full Scale Crash Testing was done in compliance with NCHRP Report 350 by the following accredited crash test Laboratory. By signature below, the Laboratory agrees in support of this submission that all critical and relevant crash tests for the device listed above were conducted. (cite the laboratory's accreditation status as noted in the crash test reports.):

Testing Laboratory's signature concurs that these modifications are considered Non-Significant.		
Laboratory Name:	E-Tech Testing Services, Inc.	
Laboratory Signature:	Paul Kruse	<small>Digitally signed by Paul Kruse DN: cn=Paul Kruse, o=E-TECH Testing Services, ou=Plant 1574, email=paul.kruse@trin.net, c=US Date: 2015.12.17 10:39:04 -0500</small>
Address:	3617B Cincinnati Ave., Rocklin, CA 95765	Same as Submitter <input type="checkbox"/>
Country:	USA	Same as Submitter <input type="checkbox"/>
Accreditation Certificate Number and Dates of current Accreditation period :	A2LA Certificate# 989.01, November 30, 2017	

Submitter Signature*: **bret.eckert@trin.net**

Digitally signed by
bret.eckert@trin.net
DN: cn=bret.eckert@trin.net
Date: 2015.12.17 10:36:49 -0500

Submit Form

ATTACHMENTS

Attach to this form:

- 1) Additional disclosures of related financial interest as indicated above.
- 2) A copy of the full test report, video, and a Test Data Summary Sheet for each test conducted in support of this request.
- 3) A drawing or drawings of the device(s) that conform to the Task Force-13 Drawing Specifications [[Hardware Guide Drawing Standards](#)]. For proprietary products, a single isometric line drawing is usually acceptable to illustrate the product, with detailed specifications, intended use, and contact information provided on the reverse. Additional drawings (not in TF-13 format) showing details that are relevant to understanding the dimensions and performance of the device should also be submitted to facilitate our review.

FHWA Official Business Only:

Eligibility Letter		AASHTO TF13	
Number	Date	Designator	Key Words

From: [John LaFrance](#)
To: [Lorraine_Hill@A2LA.com](#)
Subject: RE: CASS 53 Post Sleeve Clamp
Date: Thursday, December 03, 2015 1:50:44 PM

It's available at A2LA's website.



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Currently Accredited Organizations

Organizations meeting your criteria who have not yet been renewed through our process can be viewed [here](#).

"Comm Code" Definitions:

C1 - Available for Commercial Services	Type A - third party (commercially available)
C2 - Conditionally Available for Commercial Services	Type B - first and second party (not commercially available)
C3 - Not Normally Available for Commercial Services	Type C - first and second party, and also offering commercially available inspections

Your query returned 1 records

Certificate#	Organization	Contact	City, State	Country	Phone	Comm Code	Field	Standard	Expiration
969 01	E-TECH Testing Services	Paul Kruse	Rocklin, CA	United States	916 644 9102	C1	Mechanical	ISO/IEC 17025:2005	11/30/2017



3617 Cincinnati Ave, Rocklin, CA 95765
(916) 645-8181 Fax No (916) 645-3495

October 30, 2015

Mr. William P. Longstreet
Highway Engineer, Safety Design Team
Office of Safety Technologies, Rm E71-107
Federal Highway Administration
U.S. Department of Transportation
1200 New Jersey Avenue, SE
Washington, DC 20590

Re: QuadGuard[®] Elite Disclosure of Financial Interest, FHWA Review for Eligibility Letter

Mr. Longstreet,

On behalf of Trinity Highway Products, LLC ("THP"), I am responding to your email requesting details of any financial interest that the crash test laboratory has in the QuadGuard[®] Elite system, manufactured by THP.

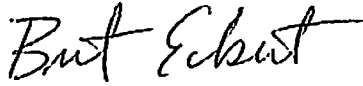
As noted in THP's request for eligibility for reimbursement under the Federal-aid highway program for this product, the QuadGuard[®] Elite system was previously deemed eligible by the FHWA, pursuant to HNG-14/CC-57, HMHS/CC-57A, HSSD/CC-57B, & HSSD/CC-57C.

The QuadGuard[®] Elite technology is the commercial embodiment of intellectual property that is protected by patents that are owned by THP. THP does not pay royalties for sales of the QuadGuard[®] Elite system. The QuadGuard[®] Elite system was designed and developed by engineers at Energy Absorption Systems Inc. (EAS). The patent holders of record for the QuadGuard[®] Elite system are Michael H. Oberth and John V. Machado and both, Mr. Oberth as well as Mr. Machado, were employed by EAS. The associated United States Patent Office patent application numbers (5,797,592 & 5,733,062) are assigned to Energy Absorption Systems, Inc. / Trinity Industries, Inc.

EAS sponsored certain crash tests of the QuadGuard[®] Elite system; such tests were conducted by E-Tech Testing Services, an independent, wholly-owned subsidiary of THP. E-Tech Testing Services is an International Standards Organization ("ISO") 17025 accredited laboratory with American Association for Laboratory Accreditation (A2LA) Mechanical Testing certificate 989.01. Full-scale crash testing on the QuadGuard[®] system was performed in accordance with testing criteria, as set forth by the National Cooperative Highway Research Program ("NCHRP") in the NCHRP Report 350 (1993).

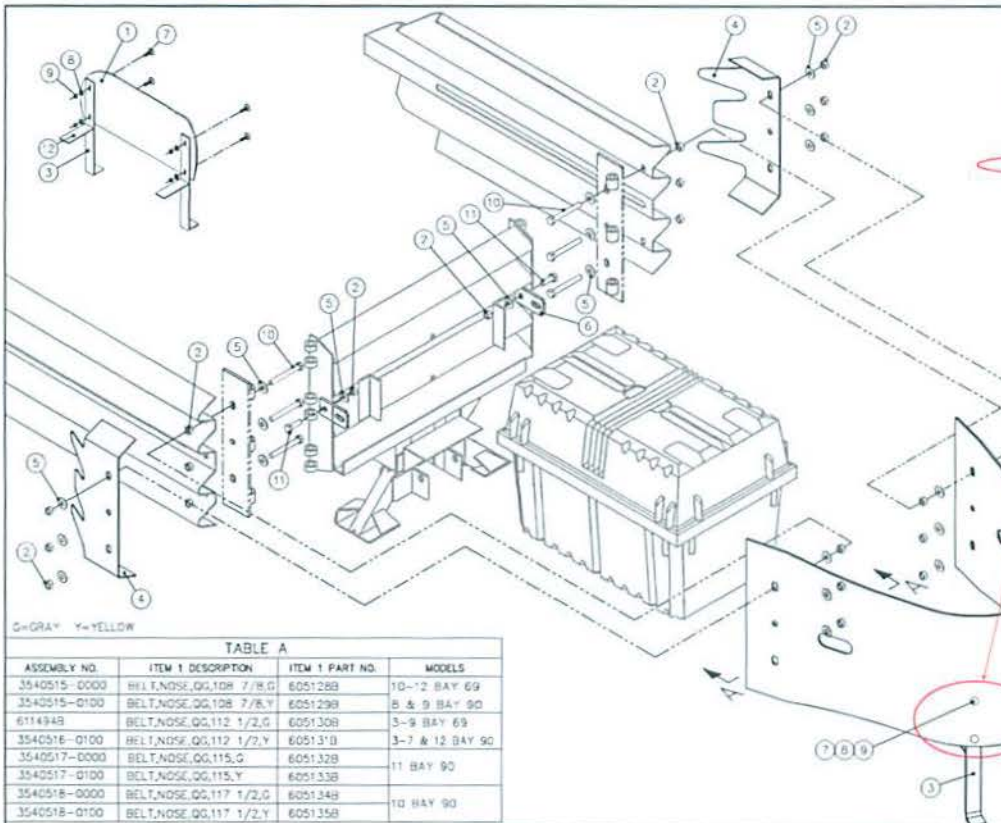
Please advise if further information is required by the FHWA. We look forward to continuing to work with the FHWA in regards to the QuadGuard® Elite and other Roadside Safety Hardware.

Sincerely,

A handwritten signature in cursive script that reads "Bret Eckert".

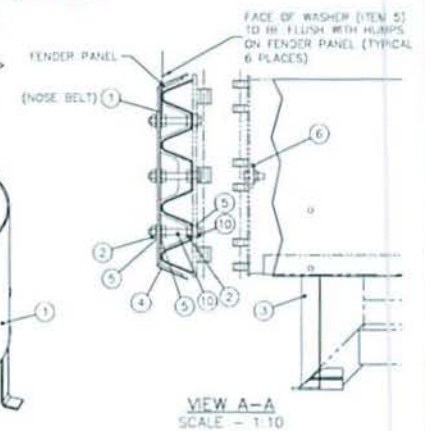
Bret Eckert, P.E.
Engineering Applications Manager
Trinity Highway

Office 916-644-9131
bret.eckert@trin.net



PARTS LIST			
ITEM	STOCK NO.	DESCRIPTION	QTY
1	SEE TABLE A	BELT, NOSE, QG	1.00
2	003354G	NUT, HK, 5/8, G	20.0
3	611194B	LEG, SUPPORT, 30 DEG BEND, FLEX BELT, ADJUSTABLE, QG	2.00
4	606330G	CLAMP, BELT, LMC	2.00
5	003300G	WASHER, FLAT, 5/8X1 3/4, G	20.0
6	605135G	BRACKET, FULL, OUT, QG	2.00
7	113584G	BOLT, H, 3/8X1 1/2, CS, G	4.00
8	118236G	WASHER, FLAT, 3/8X1, G	4.00
9	115960G	NUT, HK, 3/8, G	4.00
10	113667G	BOLT, H, 5/8X5, CS, C.A., L THREAD	6.00
11	113618G	BOLT, H, 5/8X2 1/4, CS, G	2.00
12	606071B	CARTRIDGE SUPPORT LEG, BRACKET, ADJUSTABLE	2.00

Change 1: Bolts changed from elevator heads to hex heads.



G=GRAY Y=YELLOW

TABLE A

ASSEMBLY NO.	ITEM 1 DESCRIPTION	ITEM 1 PART NO.	MODELS
3540515-0000	BELT, NOSE, QG, 108 7/8, G	605128B	10-12 BAY 69
3540515-0100	BELT, NOSE, QG, 108 7/8, Y	605129B	8 & 9 BAY 90
611494B	BELT, NOSE, QG, 112 1/2, G	605130B	3-9 BAY 69
3540516-0100	BELT, NOSE, QG, 112 1/2, Y	605131B	3-7 & 12 BAY 90
3540517-0000	BELT, NOSE, QG, 115, G	605132B	11 BAY 90
3540517-0100	BELT, NOSE, QG, 115, Y	605133B	
3540518-0000	BELT, NOSE, QG, 117 1/2, G	605134B	10 BAY 90
3540518-0100	BELT, NOSE, QG, 117 1/2, Y	605135B	

REFERENCES

REV.	BY	DATE
1	R. Cummins	06/02/08
2	S. Troger	06/02/08
3	M. Looney	06/02/08

ASSEMBLY NO. SEE TABLE A

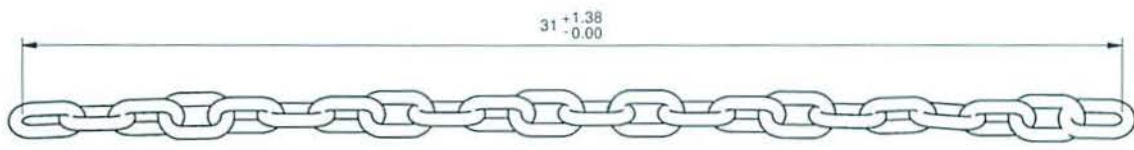
ENERGY ABSORPTION SYSTEMS, INC.
ENGINEERING AND RESEARCH DEPARTMENT

QUADGUARD® SYSTEM
NOSE ASSY, ADJUSTABLE QG,
OR Y, 69/90

Revisions	Date	Rev.	By	Chk	App
ECO 3474; ITEM 7 WAS 2700131-0000	10/16/08	A	DDW/JME	RCB	

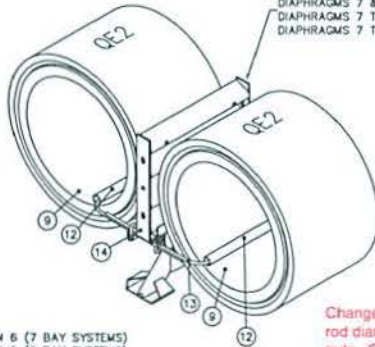
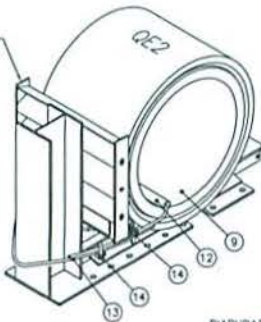
NEXT ASSEMBLY:	MATERIAL:	TOL ANGULAR: ±1' TOL LINEAR: ±2 UNLESS OTHERWISE NOTED	PARTS LIST		
ITEM	STOCK NO.	DESCRIPTION	QTY.		
1	210164G	CHAIN,3/8,GRADE 40/43,G	260		

Change 2: Chain was black then galvanized. Now is galvanized then cut to length.



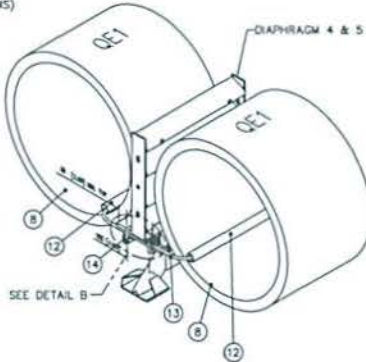
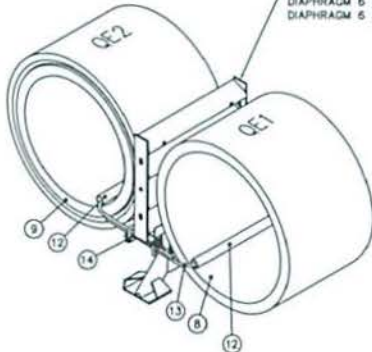
							PART NO. 606164G		0.41 lb.mass		
							 ENERGY ABSORPTION SYSTEMS ENGINEERING AND RESEARCH DEPARTMENT				
Revision	ECO	Date	Rev	By	Chk.	App.	DESIGNED: RBB	DATE: 11/12/1998	CHAIN,3/8,GRADE 40/43,31,G		
WAS 2517212-0000, REMOVED ITEM 88, ITEM 1 WAS 2504969-0000 & DESCRIPTION WAS CHAIN 3/8 GRADE 40,31,G							CHECKED: KM	DATE: 3/2/1999			
	3480	12/12/12	A	WWL	JME	BRE	APPROVED: D. June	DATE: 3/5/1999			
							UNLESS OTHERWISE NOTED, ALL DIMENSIONS ARE IN INCHES DIMENSIONS ACCORDING TO ASME Y14.5M-1994 UNLESS OTHERWISE SPECIFIED		 PARTIAL 606164	SHEET 1 of 1	REV A

BACKUP

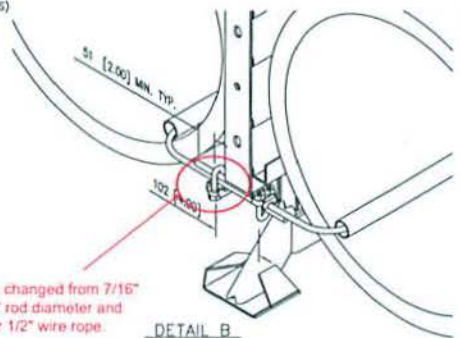


DIAPHRAGM 7 (7 BAY SYSTEMS)
 DIAPHRAGMS 7 & 8 (8 BAY SYSTEMS)
 DIAPHRAGMS 7 THRU 11 (11 BAY SYSTEMS)
 DIAPHRAGMS 7 THRU 14 (14 BAY SYSTEMS)

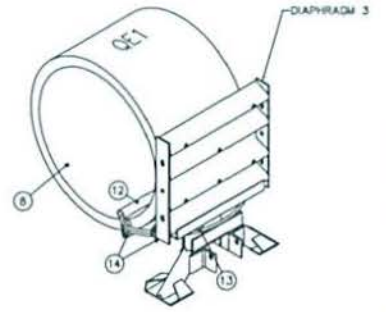
DIAPHRAGM 6 (7 BAY SYSTEMS)
 DIAPHRAGM 6 (8 BAY SYSTEMS)
 DIAPHRAGM 6 (11 BAY SYSTEMS)
 DIAPHRAGM 6 (14 BAY SYSTEMS)



Change 3: Wire Rope Clamp changed from 7/16" rod diameter and nuts to 1/2" rod diameter and nuts. Clamp size remains for 1/2" wire rope.



DETAIL B



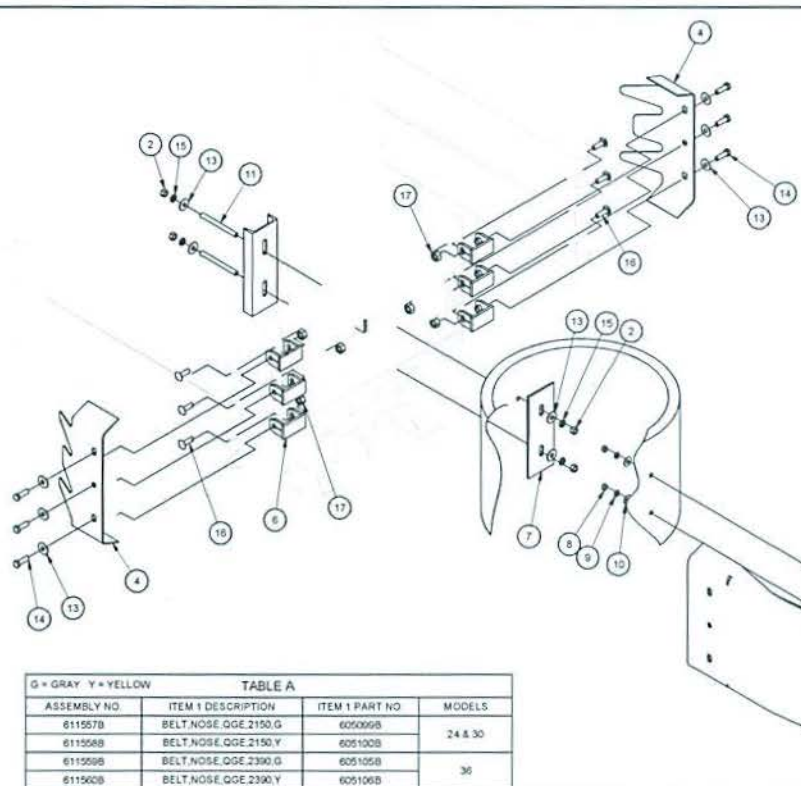
- NOTES:
1. REMOVE ALL SLACK IN CABLE (ITEM 13) PRIOR TO TIGHTENING THE CABLE CLAMPS (ITEM 14).
 2. TORQUE THE CABLE CLAMPS (ITEM 14) TO 50 FT-LBS. DRAW DOWN BOTH NUTS EVENLY.

Revisions	Date	Rev.	By	Chd.	App.
SEE SHEET 1	2/16/00	H	STT	/	/
SEE SHEET 1	10/17/01	I	NWL	/	/
REMOVED CABLE SUPPORT BRACKET (ECO 3737)	11/13/03	J	NWL	MC	ARV

REFERENCES

Author	Date
D. Staus	11/13/98
REVISOR	
RBG	11/13/98
DESIGNER	
KRM	12/8/98
APPROVER	
RBG	12/9/98
CAD FILE:	
605040 SH02.dwg	
NEXT ASSEMBLY:	

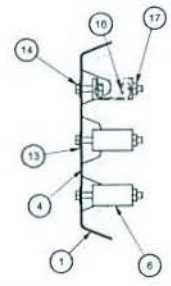
PARTS LIST			
ITEM	STOCK NO.	DESCRIPTION	REV/D
ENERGY ABSORPTION SYSTEMS, INC. ENGINEERING AND RESEARCH DEPARTMENT			
QUADGUARD® ELITE™ SYSTEM			
BAY ASSY, QGE, 24,30,36,48			
1/20	605040	REV 2 of 2	REV J



PARTS LIST			
ITEM	STOCK NO	DESCRIPTION	QTY
1	605098	BELT NOSE 84 5/8 QGE 24&30 G	1
2	1158700	NUT HX 5/8 G	4
3	606688	CYLINDER NOSE HDPE 28X20	1
4	6063308	CLAMP NOSE BELT QG	2
5	6054468	BRACKET CHAIN MOUNT VERT TAB G	1
6	614668	STOP TAB WRAP WELDMENT	6
7	6122538	PLATE NOSE CYLINDER	1
8	115839	NUT HX 1/2 G	2
9	118082	WASHER LOCK 1/2 G	2
10	118009	WASHER FLAT 1/2X1 3/8 G	4
11	1168100	ROD THREADED 5/8X7 05 G	2
12	003295G	BOLT HX 1/2X3 05 G	2
13	003300	WASHER FLAT 5/8 X 1 3/4 G	10
14	118070	BOLT HX 5/8X2 05 G	6
15	1181000	WASHER LOCK 5/8 G	4
16	118614	BOLT HX 5/8X2 05 G	6
17	003340	NUT HX 5/8 G RAIL	6

G = GRAY Y = YELLOW

ASSEMBLY NO.	ITEM 1 DESCRIPTION	ITEM 1 PART NO	MODELS
611557B	BELT NOSE QGE 2150 G	605098	24 & 30
611508B	BELT NOSE QGE 2150 Y	605100B	
611508B	BELT NOSE QGE 2390 G	605105B	36
611508B	BELT NOSE QGE 2390 Y	605106B	



SECTION A-A
SCALE 1 / 10

ASSEMBLY NO. (SEE TABLE)

Revision	Date	Rev	By	Chk	App
003 3371 ITEM 13 WAS 2150/361 0000 14 WAS 118082	5/22/12	D	DDV/JME	AJC	
003 3371 ITEM 13 WAS 2150/361 0000 14 WAS 118082	8/13/12	E	WW/JME	AVB	
003 3371 ITEM 13 WAS 2150/361 0000 14 WAS 118082	1/22/13	F	WW/JME	PAS	

DESIGN	S. Choits	DATE	11/30/1008
APP'D		DATE	
DESIGN	KRM	DATE	3/2/1999
APP'D	RBB	DATE	3/16/1999
611557.dwg			

ENERGY ABSORPTION SYSTEMS
FURNISHING THE BEST AND MOST AFFORDABLE PROTECTIVE EQUIPMENT

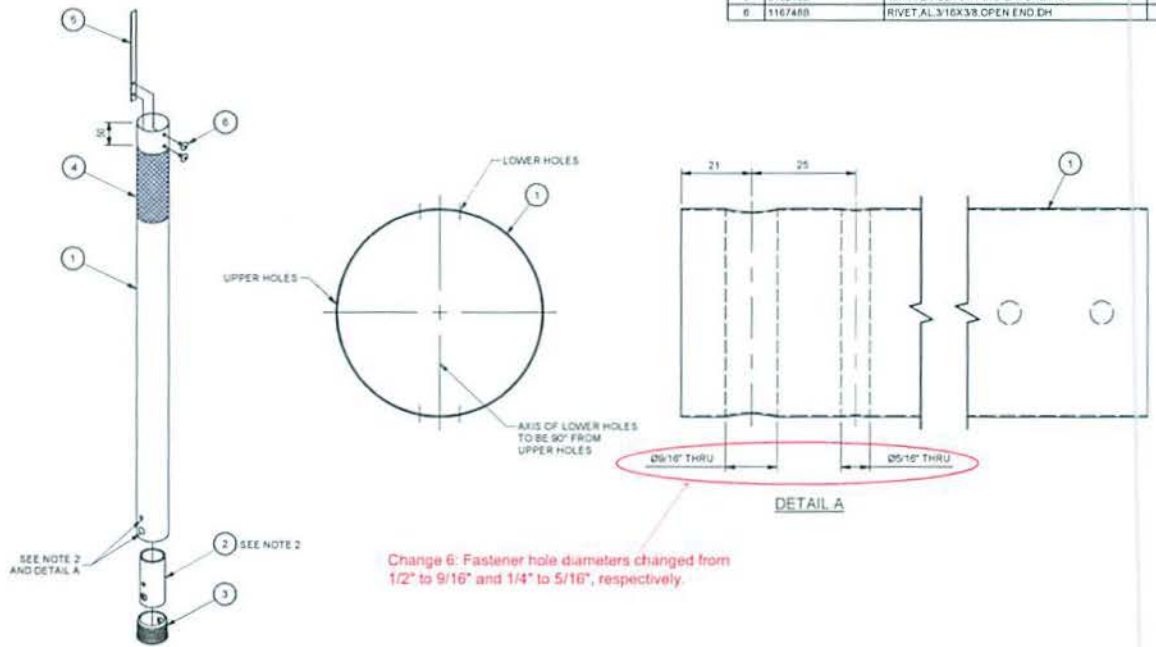
QUADGUARD® ELITE™ SYSTEM
NOSE ASSY, QGE, 24, 30 & 36 G OR Y

1-13	611557	1 of 1	F
------	--------	--------	---

REFER TO:
SEE MATERIAL SPECIFICATION
DO NOT SCALE DRAWING

TOLERANCES PER
EAS-SF-001, UNLESS
OTHERWISE SPECIFIED

PARTS LIST			
ITEM	STOCK NO.	DESCRIPTION	QTY.
1	6104110	TUBE HIT INDICATOR, NO ORANGE	1
2	6104170	TUBE INNER 4"	1
3	6144480	SLEEVE 1-PC	1
4	2108100	TAPE REFLECT HI-INT OD 6 SILVER	1
5	6162160	TRIGGER CLIP HIT INDICATOR LMC	7.20
6	1167400	RIVET AL 3-16X3R OPEN END DH	2



Change 6: Fastener hole diameters changed from 1/2" to 9/16" and 1/4" to 5/16", respectively.

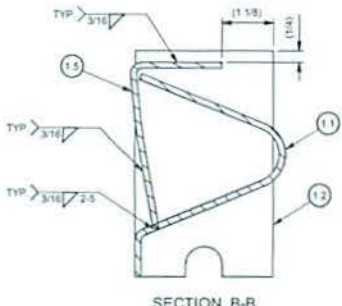
- NOTES
1 DIMENSIONS ARE MILLIMETERS UNLESS OTHERWISE NOTED
2 INSERT ITEM 2 FULLY INTO BOTTOM OF ITEM 3, THEN INSERT ITEM 3 FULLY INTO ITEM 1
3 DRILL HOLES THROUGH ITEM 1, 2 & 3 AFTER ITEMS 2 AND 3 ARE INSERTED IN PLACE. SEE DETAIL A.
4 HOLE DIAMETERS TO BE $\pm 1(1.32)$

Revision	ECO	Date	Rev	By	Chk	App
ITEM 1 WAS 6104110—G. ADDED NOTES AND DETAIL A	---	2/18/99	A	LVLC	KM	RB
ADD TAPS FOR SCREWS TO BE USED FOR BONDING & MOUNTING TO INDICATOR (REF. ECO 2001)	---	1-4-11	A	VWV	J	J
HOLE DIA'S WERE .30" DIA AND .20" DIA ON DETAIL A	3510	04/09/13	B	RJV	KRM	PAS

ASSEMBLY NO. 612480B	
T. Dusee	6/19/1996
RDB	9/11/1996
KRM	9/11/1996
RDB	9/11/1996
ENERGY ABSORPTION DIVISION <small>ENGINEERING AND RESEARCH DEPARTMENT</small> QUADGUARD® LMC SYSTEM POST ASSEMBLY HIT INDICATOR, LMC	
612480	1 of 1

TOL ANGULAR .05°
 TOL FRACTIONAL .005
 TOL DECIMAL .005
 TOL DECIMAL .005
 TOL DECIMAL .005
 TOL DECIMAL .005
 DO NOT SCALE DRAWING

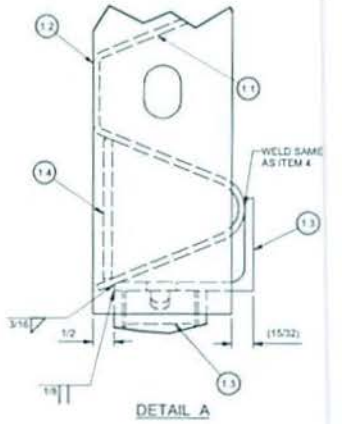
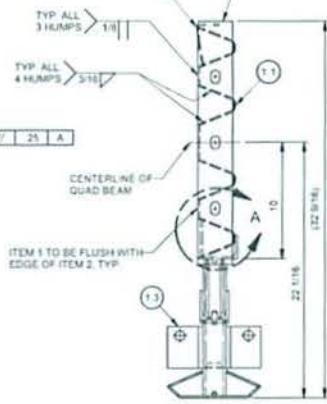
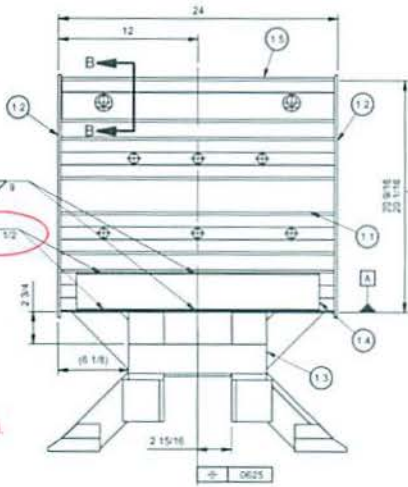
PARTS LIST			
ITEM	STOCK NO	DESCRIPTION	QTY
1	607820B	DIAPHRAGM QB 24 QGE	1
1.1	6129920B	QUAD BEAM DIAPHRAGM 23 1/2	1
1.2	609479B	FLT ST 14X3X21 W/HOLES	2
1.3	607212B	DIAPHRAGM LEG WELDMENT 24 QG	1
1.4	606761B	FTB ST 3/16X3X20 7/8	1
1.5	610010B	GUARD EDGE QG ELITE 24	1



SECTION B-B

TYP. ITEM 4 TO ITEM 1 CENTERED
 TYP. ITEM 4 TO ITEM 1 FROM EACH END

Change 7: Outer weld was 2-3.



DETAIL A

NOTES:
 1. FINISH AND GENERAL WORKMANSHIP PER EAS-SF-002, UNLESS OTHERWISE SPECIFIED
 2. GALVANIZE PER ASTM A-123

Revision	ECO	Date	Rev	By	Chk	App
ADD HOLES TO 1.1 QGE DESCRIPTION	3139	12/30/11	D	DPH	JME	MJB
MADE DIMS ON SECTION B-B REFERENCE	3536	1/8/13	E	WWL	JME	RCB
REMOVED WELDS IN FRONT VIEW	3696	6/26/13	F	DDW	JME	RCB

PART NO. 607820G
 PART NO. 607820B

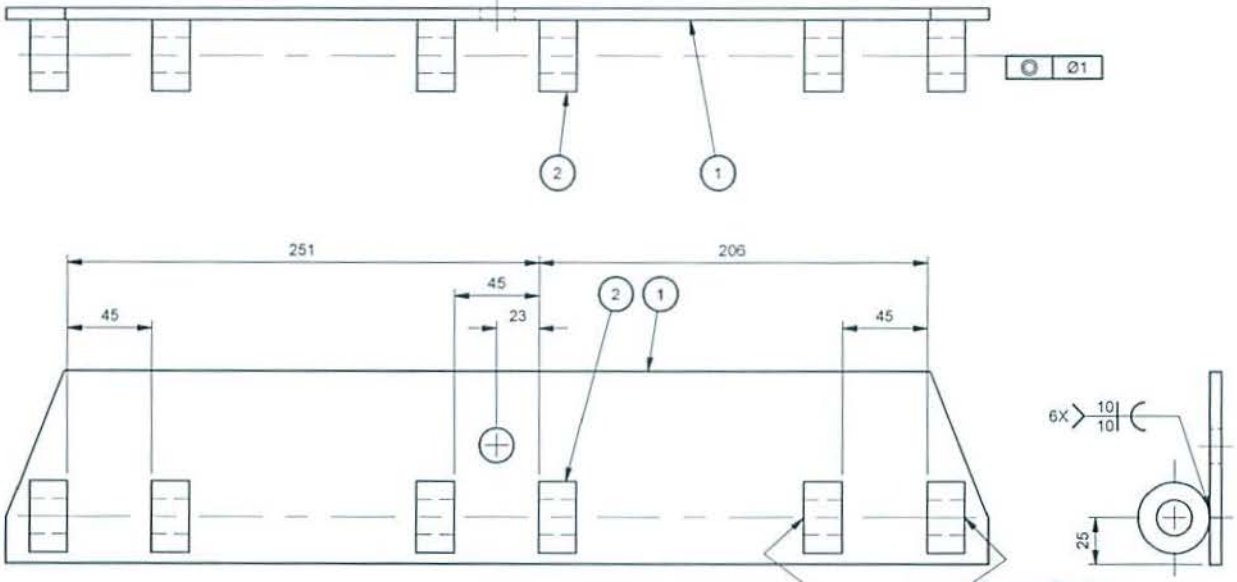
ME 73/8/2002

ENERGY ABSORPTION SYSTEMS
 ENGINEERING AND RESEARCH DEPARTMENT

DIAPHRAGM, QB, 24, QGE

607820 1 of 1 F

MATERIAL SEE PARTS LIST	TOLERANCES PER EAS-SF-001, UNLESS OTHERWISE SPECIFIED.	PARTS LIST			
		ITEM	STOCK NO.	DESCRIPTION	QTY.
DO NOT SCALE DRAWING		1	609528B	FLT ST 1/4X4X20 9/16, W/HO	1
		2	616287B	TUB ST OD 1 1/2X.375WALLX3/4	6



Change 8: Added additional filled welds on outside of hinge pivots.

1/8" 3X DO NOT EXCEED 3/16" WELD HEIGHT

NOTES:
1. FINISH AND GENERAL WORKMANSHIP PER EAS-SF-002, UNLESS OTHERWISE SPECIFIED

PART NO 610170B 7.34 lbmass

DESIGNED D. MILLER	DATE 4/17/1998
CHECKED KRM	DATE 4/22/1998
APPROVED RBB	DATE 4/23/1998

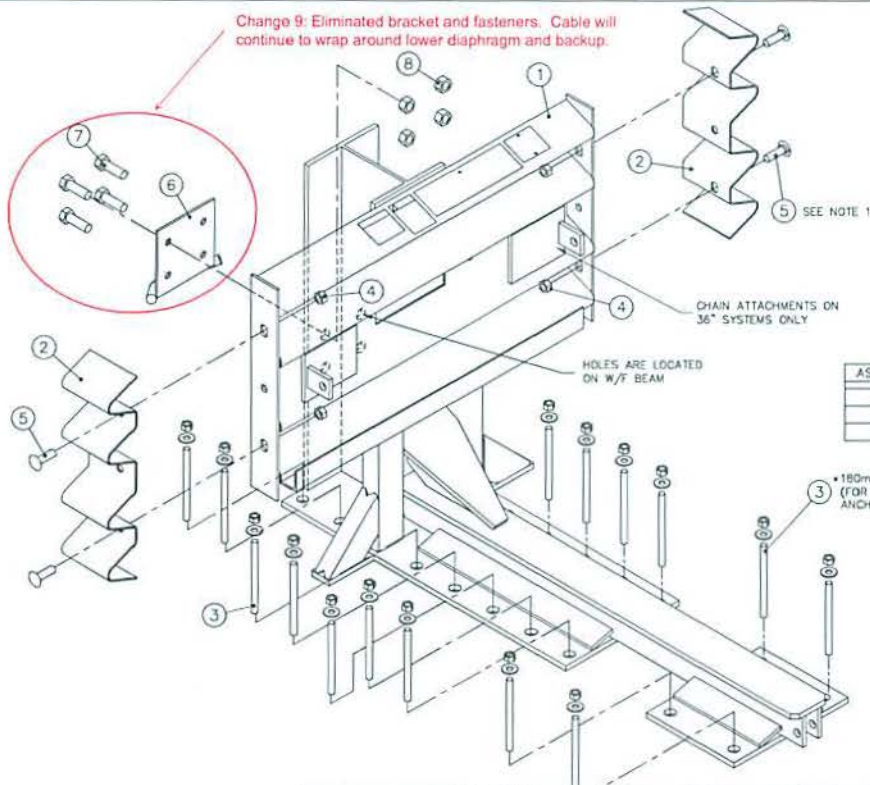
ENERGY ABSORPTION SYSTEMS
ENGINEERING AND RESEARCH DEPARTMENT

Revision	ECO	Date	Rev	By	Chk.	App
PART NO. WAS 2760434-0000	-	2/23/11	-	DK	/	/
ADDED 1/8 WELD SYMBOL	3720	10/4/13	A	WWL	JME	RCB

HINGE PLATE, DIAPHRAGM, QG

UNLESS OTHERWISE NOTED ALL DIMENSIONS ARE IN MILLIMETERS DIMENSIONS ACCORDING TO ASME Y14.9M-1994 UNLESS OTHERWISE SPECIFIED.		610170	1 of 1	A
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Change 9: Eliminated bracket and fasteners. Cable will continue to wrap around lower diaphragm and backup.



PARTS LIST			
ITEM	STOCK NO.	DESCRIPTION	QTY
1	SEE TABLE	BACKUP,TS,___,OG ELITE,W/DECALS	1.00
2	611898G	PANEL,SIDE,OG,G	2.00
3	603673B	ANCHOR,MP-3,PT-KIT,3/4X7,VT	3.00
4	003340G	NUT,HX,5/8,G,RAIL	4.00
5	003400C	BOLT,RAIL,5/8X2,G	4.00
6	605418G	BRACKET,CABLE SUPPORT,BACKUP	1.00
7	113552G	BOLT,HX,3/4X2,G2,G	4.00
B	115953G	NUT,HX,3/4,G	4.00

* FOR TEMPORARY INSTALLATION, SEE NOTE BELOW AND DWG. 35-40-24.

TABLE			
ASSEMBLY NO.	ITEM	PART NUMBER	DESCRIPTION
604603B		604744B	BACKUP,TS,24,OG ELITE,W/DECALS
604604B	1	604751B	BACKUP,TS,30,OG ELITE,W/DECALS
604605B		604764B	BACKUP,TS,36,OG ELITE,W/DECALS

3 ϕ 180mm [7"] OR 460mm [18"]
(FOR TEMPORARY INSTALLATION)
ANCHORING STUDS

- NOTES:
1. WHEN TRANSITIONING QUADGUARD SYSTEM TO EXISTING BARRIER REFER TO THE TRANSITION ASSEMBLY DRAWINGS FOR PROPER USE OF SIDE PANEL PART NO. 2760141-0000.
 2. DIMENSIONS ARE IN MILLIMETERS [INCHES] UNLESS OTHERWISE NOTED.

ASSEMBLY NO. SEE TABLE

 ENERGY ABSORPTION SYSTEMS, INC.
ENGINEERING AND RESEARCH DEPARTMENT

QUADGUARD[®] ELITE™ SYSTEM

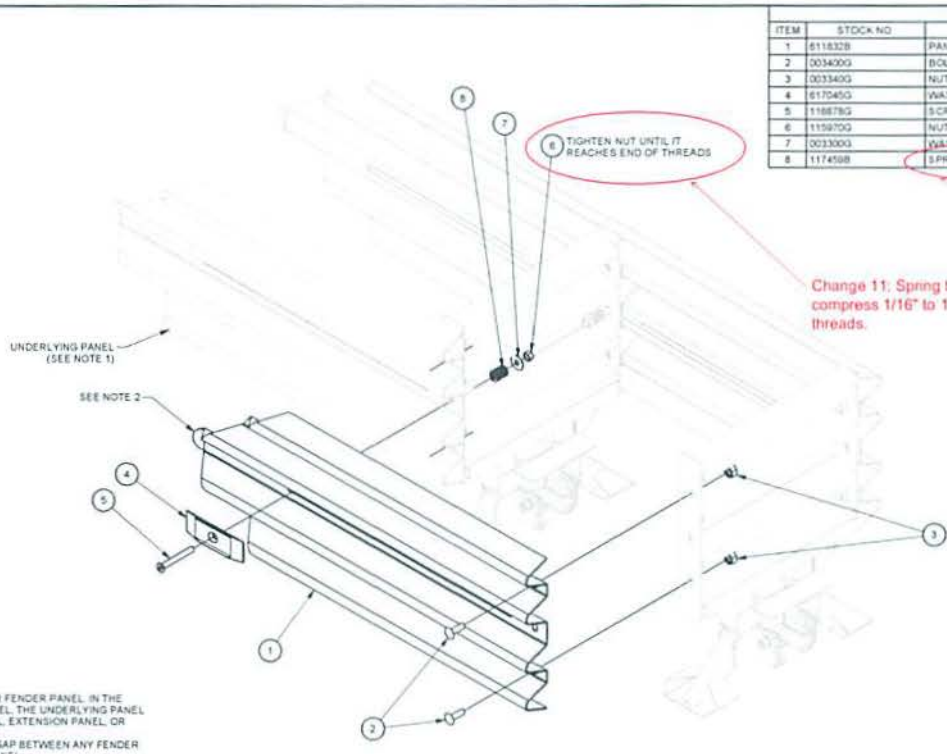
BACKUP ASSY, TS,
OGE, 24, 30, 36

SCALE: N.T.S. QTY: 604603 SHEET: 1 of 1 REV: A

REFERENCES

DESIGNED BY	S. VAN OGLE	DATE	11/11/98
DESIGNED BY	R. Baski	DATE	11/11/98
DESIGNED BY	KRM	DATE	3/19/99
DESIGNED BY	RBB	DATE	3/23/99
QTY FILED	604603.dwg		
NEXT ASSEMBLY			

Revisions	Date	Rev.	By	Chk.	App.
11/1/11	A	WM	JME	ST	



PARTS LIST			
ITEM	STOCK NO	DESCRIPTION	QTY
1	611832B	PANEL FENDER QG	1
2	003400G	BOLT RAIL 5/8X2 G	2
3	003340G	NUT HL 5/8 G RAIL	2
4	617040G	WASHER MUSHROOM FORGED QG G	1
5	118878G	SCREW FL 5/8X5 G8 G HEX SOCKET	1
6	115970G	NUT HL 5/8 G	1
7	003300G	WASHER PLAT 5/8X5 G	1
8	117458B	SPRING DIE 1 1/4 CDX916X1 1/2 B	1

Change 11: Spring coating was improved from powder coated to mechanically galvanized.

Change 11: Spring tightening was improved from compress 1/16" to 1/8" to tighten to ends of threads.

UNDERLYING PANEL (SEE NOTE 1)

SEE NOTE 2

- NOTES
- 1 UNDERLYING PANEL IS ANOTHER FENDER PANEL. IN THE CASE OF THE LAST FENDER PANEL, THE UNDERLYING PANEL COULD BE A BACKUP SIDE PANEL, EXTENSION PANEL, OR TRANSITION PANEL.
 - 2 THERE IS TO BE A 30 [787] MAX. GAP BETWEEN ANY FENDER PANEL AND THE UNDERLYING PANEL.

ASSEMBLY NO 608236B

Revision	Date	Rev	By	Chk	App
0000	4/22/04	1	DK	JME	AC
0001	5/4/11	-	DK	/	/
0002	12/26/13	J	STT	AJC	PLK

J. Espinoza	5/21/1996
JVM/MHO	2/29/1996
S. Trageser	5/4/2011
J. Machado	5/21/1996

ENERGY ABSORPTION SYSTEMS
FENDER PANEL ASSY PARTS LIST FOR ASSEMBLY

FENDER PANEL ASSY, QG

608236 1 of 1 J