

MEETING COLLISION STANDARDS

HEAD ON

A Compilation of Crashworthiness Testing and Examination
of Key Issues Facing Collision Parts Performance Today



DIAMOND STANDARD BRAND
CLASS AAA SAFETY PARTS



DIAMOND STANDARD is a series of copyrighted protocols based on one principle. "The original equipment manufacturer's part (OEM) that came on the vehicle from the factory is the standard for safety and damageability." Our job as a supplier of quality safety parts is to replicate the part's safety and damageability characteristics and offer a consumer friendly, cost effective alternative to OEM.

DIAMOND STANDARD COMPANIES, Reflexion Automotive and Production Bumper Stampings, have invested extensively in dynamic, destructive and quasi-static third party testing of OEM, DIAMOND STANDARD, and parts made from NON-OEM material. MGA Research of Burlington, Wisconsin, was chosen as the third party test facility due to their 32 year history of providing companies such as General Motors, Ford, Chrysler, Hyundai, Toyota, etc., with dynamic IIHS protocol and crash evaluation testing. To our knowledge, DIAMOND STANDARD BRAND is the only alternative or aftermarket manufacturing group publishing testing results.

DIAMOND STANDARD has utilized several prominent experts from the crash industry for purposes of designing and validating third party testing results by MGA Research.



James R. Hackney – Former Director of Crashworthiness at NHTSA. Co-author of the paper "New Car Assessment-Five Star Crash Rating-Vehicle Safety Performance Characteristics". Jim was critical in designing Diamond Standard testing protocols and evaluating results just as he was instrumental in a majority of the safety devices now standard on vehicles throughout the world.



George Neat - Former Chief, Vehicle Crashworthiness Division of the Volpe National Transportation Systems Center and former NHTSA expert.



Rudy H. Arendt – Recognized globally as an expert on the design and implementation of automotive safety testing protocols.



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Cover Photo: Thanks to The Insurance Institute For Highway Safety, Arlington, VA

A Matter of Safety

New passenger vehicles must be designed to meet minimum crashworthiness and crash avoidance requirements as specified by the DOT, National Highway Traffic Safety Administration. These requirements are defined in Federal Motor Vehicle Safety Standards (FMVSS) that are contained in the code of Federal Regulations (CFR) 49.

Crashworthiness standards are generally applicable to new vehicle SYSTEM performance, examples being FMVSS 208 related to protection that a new vehicle must provide to occupants in frontal impact crashes, and FMVSS 214 related to protection in side impact crashes. Further, there is an OEM requirement that establishes requirements for the impact resistance of vehicles in low speed front and rear collisions contained in CFR 49, Part 581 – Bumper Standard.

OEM Bumper System Components defined as bumper fascia, foam energy absorbers and steel reinforcements comply with FMVSS established under the NHTSA in CFR 49, Part 581. The Bumper Systems are designed to provide load paths and distribute crash energy in a manner that contributes to the safety performance of the vehicle, minimize damage in lower speed events, keep crash energy from being transferred into the passenger compartment and in the case of frontal systems assist the proper performance of air bag deployment systems.

Given the precision engineered nature and complexity of material in original Bumper System components, particularly high density foam absorbers made of HPP high density polyethylene foam compressed to provide energy absorption and roll formed reinforcements using HSS, UHSS or AHSS steel to provide maximum crash energy resistance, repair of damaged parts is discouraged and new part replacement is recommended as a policy of Diamond Standard. A repaired part becomes suspect in its ability to function as originally intended in subsequent events. The Diamond Standard Policy is replacement of Bumper System high density foam absorbers and steel reinforcements with either OE replacement service parts or Diamond Standard Alternative Safety Parts, validated to provide equivalent functional performance to OE in crashworthiness testing to properly restore the collision management system and component function to predamaged condition. In selecting replacement parts be cognizant parts manufactured utilizing substandard non-OE materials which do not match the material properties of the original part have been shown in comparative testing to fail the Federal Standards of crashworthiness. This policy is supported by the opinions and increased damage and safety risk posed by use of substandard parts offered below.



July 1, 2008 Article entitled "Bumper Times Have Changed," written by Bruce Burrow, AAM, who is ASE Master Certified and instructor for the Automotive Management Institute.

"For the most part, bumpers now consist of a plastic bumper cover over a SYSTEM designed for absorbing and directing collision energy. All of this makes repairing bumpers much more involved and requiring far more attention to detail when estimating damage involving them. High Strength Steel (HSS) reinforcements and plastic absorbers need to be replaced when damaged. Your shop MUST make sure each bumper system will perform as designed should there be another collision."



September 11, 2008 Statement regarding crashworthiness performance of reinforcements, made by George W. Neat, former Chief, Vehicle Crashworthiness, Volpe National Transportation System Center.

"OEM bumper and/or rebar systems may be designed to provide load paths and to distribute crash loads in a manner that contributes to the safety performance of vehicles and, for front systems, the proper performance of air bag deployment systems. It's important that aftermarket bumpers and/or rebars essentially replicate these conditions. The Aftermarket manufacturers must be diligent in their design/manufacturing practices to assure that safety performance is maintained".

State Regulations Impacting Aftermarket Parts Quality

Diamond Standard Brand is committed to provide the insurer, shop and consumer with true Alternative safety parts to OEM, which meet all federal and state regulations requiring manufacturer identification on the part and the part be like kind quality to the OEM part for fit, form, functional performance and safety.



The NAIC has provided its model rules governing Aftermarket Parts quality model regulations dated 2000 to the individual States, which is considered outdated since its publish but provides wording designed to permit the continued use by insurers of non-OEM parts with acceptable safeguards to insure that such parts are not inferior to the parts that existed on their vehicles prior to the accident. Currently, safety parts are not included in the model rule or state regulations.

To date, only 20 States have adopted the wording or intent of the NAIC model rule speaking to equivalency of part to the OEM part as detailed below. Given the OEM material and safety system performance changes over time, a broad review of the model law and State regulations is needed to make the regulations more stringent including safety parts and defining performance and material that is used to assure proper function of a safety part's performance.

State Aftermarket Regulations Requiring LKQ, Equivalency, Performance Restoration To Predamaged Condition	
State	Regulation
Arkansas	Equivalency of fit, quality, performance, warranty
California	Equivalency to the OE parts in kind, quality, safety, fit and performance
Florida	Equivalency in kind and quality in terms of fit, appearance and performance
Hawaii	Utilize a kind and quality part equal to or better than OE, certified to govt standards
Illinois	Equivalency in kind and quality to OE part for fit, quality and performance
Iowa	Certified to be at least equivalent in kind and quality to OE fit, quality and performance
Kentucky	Equivalency in kind and quality to replaced part in fit, quality and performance
Minnesota	Replace damaged part with LKQ
Missouri	Equivalency in LKQ for fit, quality and performance of OE
Montana	Cannot use part if inferior in quality or fit and/or safety, not restoring precollision condition
Nebraska	Equivalency in LKQ for fit, quality and performance of OE
New Hampshire	Equivalency in LKQ for fit, quality and performance of OE
New Jersey	Equivalency in LKQ for fit, quality and performance of OE and certified by indep lab
New York	If not certified, warrant part equals or exceeds OE in fit, quality, performance and warranty
North Carolina	Equivalency in fit, quality, performance and warranty to OE
Oregon	Certified by indep test facility to be equivalent to part replaced
Pennsylvania	Same or equivalent to OE
Rhode Island	Equivalent in kind and quality to OE fit, quality, performance
Virginia	Equivalent in LKQ for fit, quality and performance to the original parts replaced
Wyoming	Equivalent in LKQ for fit and performance to the original parts
20 states require like kind and quality or equivalency to OEM	
3 States requiring certification part is equivalent	
Remaining States without such equivalency regulations focus on disclosure and part identification	
Missing in all state regulations is the requirement meeting OEM material or its material properties	
This leaves the door wide open to material substitution and as a result substandard performing parts	
There is an immediate need to review all state regulations regarding strengthening the regulations	

(LKQ = Like, Kind, Quality)

Diamond Standard Brand is currently reviewing the NAIC model law and has been requested to provide recommendations to NAIC on areas by which to strengthen the regulations on Aftermarket Safety Part Quality. To assist the industry in terms of knowing the current regulations nationally and by state for Aftermarket part quality, a "State Regulations" feature has been added to our website www.diamondstandardparts.com.

Alternative Parts Assurance By Precision Engineering

Precision Engineering = Alternative Parts

Summary

Reflexion Automotive or Production Bumper Stampings produced Diamond Standard Brand SAFETY Parts can be equivalent to OEM by rigidly following our blueprint of quality discipline:

1. Use like material that matches OEM on mechanical properties.
2. Use material that has the same thickness.
3. The part must be the same shape as OEM.

In a marketplace dominated by OEM there is a need for a unified part quality standard and equivalent part choice for safety parts. The Diamond Standard Brand of Alternative Parts has established the standard, on the simple but profound concept that the part which came on your vehicle initially is the part benchmark and standard of performance by which Diamond Standard Parts are measured. This standard can be replicated by precision engineering to answer the need for guaranteed parts that meet OEM parts in the area of fit, form, function, and safety.

Diamond Standard Brand Alternative Parts are backed by an OEM ready manufacturing group certified ISO 9001:2000 and TS 16949:2002, committed to OEM quality management systems and processes that sets forth the requirement of the parts and process. Our processes and core competencies from precision engineering to final manufacturing and crash testing enable us to represent Diamond Standard Brand Safety Parts as true Alternative parts.



Importance of Material Matching / Part Formation to the Standard

Last decade, OEM began replacing Low Strength Carbon Steel with High Strength Steel (HSS) in manufacturing bumpers and reinforcements as part of the vehicles bumper safety system which achieved lighter weight to meet CAFÉ standards while increasing strength and integrity of the parts in resisting impact and stress. This trend to stronger materials has continued with the use of Ultra and Advanced Strength steels today. In addition the OEM steel reinforcements are one piece rolled formed which provide for repeatable dimensional stability and tolerance throughout the entire length of the part providing a strength advantage over competing processes of forming. Some Aftermarket manufacturers of safety parts substitute 2 separate non-HSS steel plates overlapped and welded together. This inferior formation leads to parts which are significantly less resistance to crash energy and can lead to increased vehicle damage and safety issues. Diamond Standard Brand reinforcements match the OEM material and are rolled formed.

As can be seen in the reinforcement beam photos below, the OEM beam is made of a single piece of High Strength Steel which is rolled formed and seamed on the rear of the beam in the center of the channel for maximum integrity and strength. Diamond Standard Alternative reinforcement beams are formed in the same manner and incorporate OEM High Strength Steel. The Aftermarket reinforcement beam is made from two pieces of non-OEM carbon steel which is not High Strength Steel overlapped and spot welded on top and on the bottom of the beam. This formation structure and use of non High Strength Steel yields parts in testing which fail to resist crash energy as set forth in federal standards, the original OEM part or the Diamond Standard Alternative part.



OEM energy absorbers are made of ARPRO EPP Polypropylene as are Diamond Standard absorbers for their high performance, engineered closed cell plastic foam components in automotive bumper systems to absorb energy and help reduce vehicle damage in event of impact. This material is sourced from Japan. In addition to its excellent energy absorption, light weight, EPP Polypropylene offers a very high strength to weight ratio, shape resilience, load bearing structural support, is non-flammable and recyclable at the end of a vehicle's service. Some Aftermarket manufacturers use non-OEM polystyrene for energy absorbers. This does not provide the ability to absorb energy, is flammable, and is not recyclable which adds to environmental issues.

NSF-Diamond Standard Safety Parts Certification



NSF-Diamond Standard Safety Parts Certification

Diamond Standard has entered into a contractual agreement with NSF International, a North American third-party accreditation company to oversee a series of Copyrighted part protocols which replicate OEM part performance in safety part quality and performance. These protocols/standards are based on the OE Manufactured part that came on the vehicle from the factory; the part benchmark and standard to which Diamond Standard Brand parts must be held for safety and damageability. NSF's Automotive Parts Certification program will certify Diamond Standard Safety parts to the protocols. The ultimate test of determining Diamond Standard Safety parts' replicate OEM parts in safety part quality and performance has been and will continue to be determined by dynamic and destructive comparative testing vs. OEM service parts and validation of those test results by crashworthiness experts.

NSF's certification of Diamond Standard Safety Parts covers the following categories: steel bumpers, high strength steel and aluminum reinforcements, high density foam energy absorbers, bumper brackets and full assembly stepbumpers. The copyrighted protocols and certification allows Diamond Standard to be the first to bring certified and validated collision Safety parts on these categories to the industry.

The NSF Role in Diamond Standard Safety Parts Certification and Validation

1. Development and approval of the safety part protocols from OEM parts
2. Approval of the Diamond Standard Manufacturer's Quality Control System
3. Approval of the individual parts meeting the protocols
4. On-going monitoring of certified parts through periodic audits of DS facilities
5. In-market random testing of each part type from each approved Diamond Standard manufacturing facility
6. Complaint tracking and Corrective Action Reporting oversight
7. Monitoring of dynamic and destructive testing results validation

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About NSF International: NSF International, The Public Health and Safety Company, a not-for profit, non-governmental organization, is the world leader in standards development, product certification, laboratory testing, third party auditing, market place education, and risk-management for public health and safety. For 65 years, NSF has been committed to public health, safety, and protection of the environment. NSF develops national standards, provides learning opportunities through its Center for Public Health Education, develops and conducts testing in it's ISO 17025 accredited laboratories, and provides third-party conformity assessment services.

NSF was founded in 1944 and is headquartered in Ann Arbor, MI USA. The NSF Mark is recognized for its value in the local, state and federal levels. NSF has over 650 employees worldwide servicing over 12,000 clients in 100 countries and certifies over 200,000 different products.

NSF-ISR, a wholly owned Corporation, is a world leader in automotive registration and third-party auditing. NSF ranks within the top third in North America third-party registrations (ISO/TS) with clients including Johnson Controls, Goodyear, Honeywell and Federal Mogul. In addition to third-party registration work, NSF-ISR has been a leader in working with the automotive alternative collision parts industry, assisting LKQ in its AQR program development and administration.

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Front Bumper - Light Duty Truck Alternative Part Protocol



Front Bumper – Multi Purpose Vehicle Protocol AP-001

1 Scope

- 1.1 This protocol defines the material and performance testing requirements for multi purpose vehicle bumpers (also known as “metal facebars”) used for replacement applications. See Appendix A – “Front Bumper Test/Performance Matrix”.
- 1.2 This protocol applies to multi purpose front bumpers that are made from high strength steel, and are either plated with decorative nickel-chrome, or are coated with electrocoat or powder coat primer.
- 1.3 Brackets used in the front bumper assembly are covered under the “Vehicle Bumper Brackets Protocol”.
- 1.4 A part shall meet or exceed all requirements as outlined in this protocol.

2 Definitions

- 2.1 Original Equipment Manufacturer: Automobile companies that manufacture the vehicles; abbreviated “OE” in this protocol.
- 2.2 Test Part: A replacement part made by a manufacturer other than the original equipment manufacturer.
- 2.3 Approved Testing Labs
 - 2.3.1 Accredited lab: A laboratory that has been certified to ISO 17025 by an ILAC approved accreditation body.
 - 2.3.2 Compliant lab: A laboratory that has been audited by NSF to verify that it is ISO 17025 compliant.
- 2.4 ASTM: American Society for Testing and Materials

3 Reference Standards:

- 3.1 ASTM A370 Standard Test Methods and Definitions for Mechanical Testing of Steel Products
- ASTM B368 Standard Test Method for Copper-Accelerated Acetic Acid-Salt Spray (Fog) Testing (CASS Test)
 - 3.2 ASTM B456 Standard Specification for Electrodeposited Coating of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium
 - 3.3 ASTM B571 Standard Practice for Qualitative Adhesion Testing of Metallic Coatings
- 3.4 ASTM D3359 Standard Test Methods for Measuring Adhesion by Tape Test
- 3.5 ASTM D7091 Standard Practice for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Non-Ferrous Metals
- 3.6 ISO/IEC 17025 General requirements for the competence of testing and calibration laboratories

4 Equipment

- 4.1 Calipers or micrometers.
- 4.2 Ultrasonic thickness tester.
- 4.3 Instron load frame or equivalent.
- 4.4 Prior to use within these tests, all measuring devices and equipment are required to be calibrated to traceable standard such as NIST or equivalent SI. Equipment or traceable standards must be certified by an ISO/IEC17025:05 accredited source.

5 Test Samples

- 5.1 OE samples should be purchased by the Approved Testing Lab(s) for the purpose of testing. The manufacturer of the bumper will supply the test parts to the lab.

Tests	OE	Test Part
Material Testing	1	1
Surface Coating		1
Vehicle Test Fit	1	2
Performance Validation	2	2

- 5.2 The OE parts must have the OE part number and associated manufacturer’s purchase order number to the OE dealer permanently marked or labeled on the inside of the part. The purchase order number will be listed on the lab report.
- 5.3 The manufacturer’s test parts must have a lot number and manufacturer’s name or logo permanently marked or labeled on the inside of the part and the parts must be made using production tooling. This lot number shall be listed on the lab report.

6 Testing for Part Qualification

- 6.1 The samples will be tested for part thickness, tensile and yield strength, surface coating, vehicle test fit for appearance and functionality, and quasi static pole test performance validation.
- 6.2 The OE test results will become the nominal OE test requirement values unless a specific test value is listed in this protocol.
- 6.3 All tests outlined in this standard (except Vehicle Test Fits) will be performed by an ISO17025 accredited testing lab.
- 6.4 Accredited labs performing tests prescribed in this standard must have those tests listed in the laboratory scope of their ISO17025 certification. (This does not apply to labs performing Vehicle Fit Validations)
- 6.5 All Vehicle Test Fit labs will audited by NSF International for ISO17025 compliance.

Specimen first page for the Front Bumper – Multi Purpose Vehicle Protocol. For the complete Front Bumper Protocol or the Protocol for all Diamond Standard parts categories contact Geoff Crane: geoff@diamondstandardparts.com .



Front Bumper Comparative Testing

New passenger vehicles must be designed to meet minimum crashworthiness and crash avoidance requirements as specified by the Department of Transportation, National Highway Traffic Safety Administration, defined in Federal Motor Vehicle Safety Standards (FMVSS) that are contained in the Code of Federal Regulations (CFR) 49.

Crashworthiness standards are generally applicable to new vehicle system performance with FMVSS 208 related to the protection that a new vehicle must provide to occupants in frontal impact crashes and impact resistance in low speed events under CFR, Part 581. Therefore, OEM steel bumpers, being part of a vehicle's collision management system, are designed to provide load paths to distribute crash loads in a manner that contributes to safety performance of vehicles and, on front systems, the proper performance of air bag deployment.

To provide information regarding the damageability and safety performance of Alternative steel bumpers, a destructive comparative testing of OEM and Diamond Standard Alternative bumper for a 2006 Chevy Silverado was conducted by MGA Design Research according to IIHS low speed crash testing protocol into a fixed barrier at 10.0 KM/h. The Diamond Standard front steel bumper performed at a level of crashworthiness meeting OEM and resulted in a repair cost parts savings of \$324.47 in a low speed collision.



IIHS LOW SPEED CRASH TEST INTO FIXED BARRIER @ 10.0 KM/H

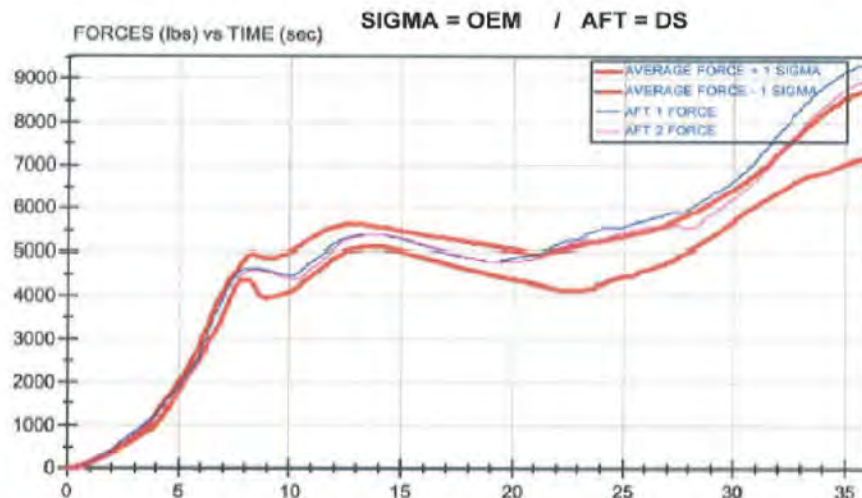


OEM BUMPER & COMPONENTS



DIAMOND STANDARD BUMPER & OEM COMPONENTS

In addition, the Diamond Standard Alternative front steel bumper was tested vs. OEM in quasi-static testing to determine the level of crashworthiness, damageability, and load carry capability by comparing force and energy performance criterion. As seen in the chart below the Diamond Standard Alternative bumper performed at a level at least equal to OEM.



HSS Steel Reinforcement Comparative Testing

OEM High Strength Steel reinforcements are part of vehicle's collision management system considered structural parts and designed to provide resistance to impact energy. To provide comparative information on energy resistance through the deceleration and velocity change of OEM, Diamond Standard Alternative and Aftermarket rebar testing was conducted on 2007 Toyota Camry front rebar. The rebars were attached to rigid steel mounts to the face of an IIHS side impact cart and impacted a fixed barrier at 6MPH. OEM and Diamond Standard rebars are made of a single piece of High Strength Steel and rolled formed for maximum strength. Some Aftermarket Manufacturers substitute lower cost NON-OEM carbon steel and welded 2-plate construction.

Using the OEM part as the standard, the Diamond Standard Brand part performed equal to or better than OEM while the aftermarket part failed in providing the OEM or Diamond Standard level of energy resistance. This is disturbing and will result in greater damageability to a vehicle in a slow speed collision possibly involving the grille and hood.



OEM BEFORE



DIAMOND STANDARD BEFORE



NON-OEM MATERIAL BEFORE



OEM AFTER



DIAMOND STANDARD AFTER



NON-OEM MATERIAL AFTER

"Diamond Standard appreciates the assistance of the IIHS officers as a sounding board of Diamond Standard comparative crashworthiness testing"....Mike O'Neal, President of Diamond Standard, LLC. Mike is pictured below in a recent meeting with IIHS officers Adrian Lund, President, Steve Oesch, Sr. Vice President of Insurer and Government Relations, and Joe Nolan, Sr. Vice President of VRC Operations at the IIHS testing center.



High Density Foam Energy Absorber

Comparative Testing

OEM High Density Foam Absorbers are part of a vehicle's collision management system and designed to absorb and distribute crash energy and be non-flammable. To provide comparative information on energy absorption/resistance and flammability a series of tests were conducted including quasi-static load cell tests, dynamic impact tests, and flammability testing according to FMVSS 302 protocol. OEM and Diamond Standard energy absorbers are made from High Density EPP polypropylene foam sourced from the Japan for maximum density and strength. Some Aftermarket absorber manufacturers use low cost, non-OEM polystyrene material. Using the OEM part as the standard, Diamond Standard Alternative foam energy absorbers performed equally to OEM in strength, ability to absorb energy, and are non-flammable. The Aftermarket absorber failed to meet the federal standard and OEM performance, creating less crash energy absorption which potentially will put more pressure on structural rebar and lead to greater damageability. The Aftermarket absorbers are flammable creating a potential fire hazard given their proximity to a heat source and their bulk nature.

LOW IMPACT TEST
8 lb SLEDGE HAMMER
47" FROM ABSORBER CENTER
90 DEGREE ANGLE



OEM POLYPROPYLENE MATERIAL



OEM POLYPROPYLENE MATERIAL



NON-OEM POLYSTYRENE MATERIAL

BURN TEST
BUTANE LIGHTER
1" FROM ABSORBER
5 SEC. IGNITION TIME
2 MIN. BURN TIME



5 SECOND IGNITION



1 MINUTE ELAPSED TIME



2 MINUTES ELAPSED TIME



- * Top Quality OEM High Density Foam Material
- * Dual High Density Foam Where Applicable
- * Non-Flammable Material
- * MGA Tested
- * 3rd Party Validation



Full Assembly Stepbumper V-5 Testing

Step Bumpers and full assembly systems are part of a vehicle's collision safety system and designed to resist and distribute crash energy. Testing applicable to step bumpers is the Vehicle Equipment Safety Commission (VESC) Regulation V-5 utilized across Diamond Standard Alternative full assembly step bumper systems to determine each hitch shall be capable of withstanding the forces applied, without causing permanent deformation of the ball platform. The final position of the ball must not depart more than the allowable 5 degrees from its original, nominally vertical position.



Bumpers are rigidly mounted to a test fixture. The hitch rating for Class 3 is 5000lbs GTWR with a tongue rating of 500lbs. All test loads, as in this example of a 2005 Chevrolet/GMC Fleetside Rear Bumper, were applied above the minimum test loads for the Class rating to the center of the ball at a rate less than 150lbs per second, and held for a minimum of 5 seconds. The angle of the ball from vertical, relative to its original axis, was measured before and after each of five load applications and in cumulative total movement. Test A applies equal load forces vertically and horizontally simultaneously. Tests B&C measure the impact of attempting to pull off the ball with increased horizontal load factors while maintaining downward pressures. Tests D&E simulate and measure a sideways position of the trailer. The ball axis movement of Diamond Standard's Alternative step bumper showed a net movement of less than 3 degrees, which is less than the VESC V-5 test standard of 5 degrees allowable movement.

MINIMUM TEST LOADS FOR CLASS RATING

WEIGHT CARRYING	TEST	DESCRIPTION	HORIZONTAL LOAD (LBS)
	A	DOWNWARD VERTICAL FORCE WITH COMPRESSIVE LONGITUDAL FORCE	PASS
	B	TENSILE LONGITUDAL FORCE WITH DOWNWARD VERTICAL FORCE	PASS
	C	COMPRESSION LONGITUDAL FORCE WITH DOWNWARD VERTICAL FORCE	PASS
	D	LEFT TRANSVERSE FORCE	PASS
	E	RIGHT TRANSVERSE FORCE	PASS

The final position of the ball axis following testing should not depart more than 5 degrees. The test results are shown in the table below

TEST DATA FOR 1999-2005 CHEVROLET/GMC FLEETSIDE REAR BUMPER

WEIGHT CARRYING		MAXIMUM LOAD	MAXIMUM LOAD	BALL AXIS MOVEMENT
	MGA TEST	PEAK HORIZONTAL LOAD (LBS)	PEAK VERTICAL LOAD (LBS)	SET (DEG)
	A	2909	2931	2.4
B	2767	803	0.2	
C	2759	810	0.1	
D	1623		0	
E	1617		0	

Aftermarket Safety Parts Impact on Damageability & Total Losses

GM released in December 2004 a Bumper System Test Analysis conducted to the IIHS low speed crash test protocol to a rear bumper of a 2001 Chevrolet Cavalier comparing the level of crashworthiness and damageability of the bumper system using a GM fascia, energy absorber and reinforcement beam vs. a bumper system which used Aftermarket parts. The conclusion reached was there are significant geometric and construction differences in the tested bumper components which affected performance and resulted in significantly greater vehicle damage with the Aftermarket System costing \$1,500 more to repair. We agree with GM your vehicle came with precision crafted collision management systems in place that need to be fully restored to predamaged condition following a crash event. Diamond Standard Brand Safety Parts, being a true alternative to OEM, conducted in March 2005, an IIHS low speed crash test, through MGA Research Corporation of a 2001 Chevrolet Cavalier comparing the crashworthiness and damageability of the bumper system using the GM fascia as a constant and comparing the energy absorber and reinforcement beam for Diamond Standard Alternative parts vs. OEM. OEM being the standard, Diamond Standard Alternative bumper system performed equally to OEM and resulted in a \$126.94 lower cost of repair.

The test protocol, post damage visuals and cost details are provided below.

	TEST 1	TEST 2	TEST 3
TEST VEHICLE	2001 CHEVROLET CAVALIER	2001 CHEVROLET CAVALIER	2001 CHEVROLET CAVALIER
TEST SPEED (MPH)	5.2	5.0	5.2
BUMPER COVER	OEM	OEM	AFTERMARKET
REAR ABSORBER	OEM	DIAMOND STANDARD ALTERNATIVE	AFTERMARKET
REAR REBAR	OEM	DIAMOND STANDARD ALTERNATIVE	AFTERMARKET



OEM



DIAMOND STANDARD

2005 Damage Repair Cost Estimates for 2001 Chevrolet Cavalier

OEM - \$816.61

DIAMOND STANDARD - \$689.67

AFTERMARKET - \$2,316.61

As can be seen in the post damage visuals above OEM and Diamond Standard Alternative outfitted vehicles showed no obvious visual signs of having impacted the static pole at 5MPH in the Diamond Standard Brand IIHS test. The GM Bumper System Analysis documented that Aftermarket's bumper system failed to provide the same level of crashworthiness protection in the low speed test resulting in damage to the trunk lid and increasing the cost of repair by \$1,500 vs. the OEM bumper system. Diamond Standard provided an additional savings of \$126.94.

Given the aging vehicle population, increased costs of repair and parts, the same Chevrolet Cavalier outfitted with Substandard. Parts involved in a similar low speed crash would be totaled vs. repairable with either OEM or Diamond Standard Alternative Parts.

Diamond Standard Group Accreditation



The Complete Diamond Standard Parts Database on Industry Leading Estimate Platforms



Diamond Standard Parts Distributed Throughout North America By:



An LKQ Company.

Increasing Total Losses



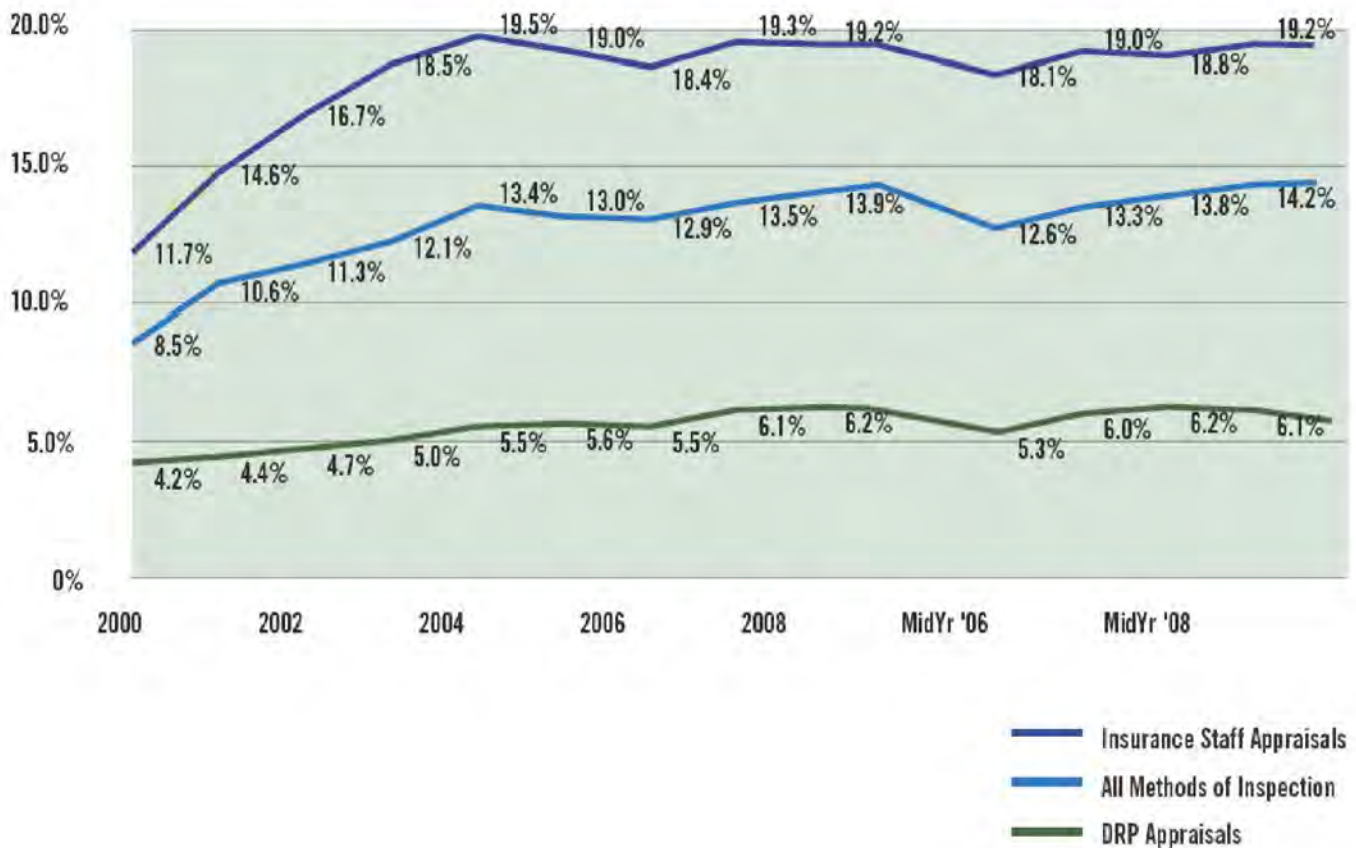
Fall 2009 Update on Factors Driving Auto Collision Repair and Total Losses

The claims environment today and for the foreseeable future is the perfect storm. The increasing level of total losses due to devalued older vehicles combined with labor and new specialized materials have raised cost of repair. Unemployment has steadily risen and currently 10%. The result is the insurer is facing an increase in the pure loss ratio of incurred losses to premium earned. The Property Casualty Insurance industry continues to see growth and profit besieged in 2009 and pressure to reduce/maintain premiums for cash-strapped consumers.

Total Loss Frequency Rises Further

As the age of the fleet on the road ages, the frequency at which a vehicle is considered a total loss increases. From mid-year 2006 to mid-year 2009, the percent of vehicle appraisals flagged as total loss has increased to 14.2% from 12.6% with the average age of vehicles deemed total loss being 9.0 years.

Figure 20: Percent of CCC Vehicle Appraisals Flagged as Total Loss



Managing Vehicle Repair Costs with Alternative Parts

Declining OE Part Usage

After experiencing 2 – 3% annual increases in avg. repair cost each year, repair costs stayed essentially flat between 2007 and 2008 with even a slight further drop of 2 – 3% during the first half of 2009. This was attributable to fewer non-driveable repairs, use of fewer parts per appraisal and fewer labor hours. The aging of the repaired vehicle and controlling repair costs put pressure on use of Alternative parts at the expense of OE replacement parts with OE share of usage dropping significantly to 65% in 2009.

8

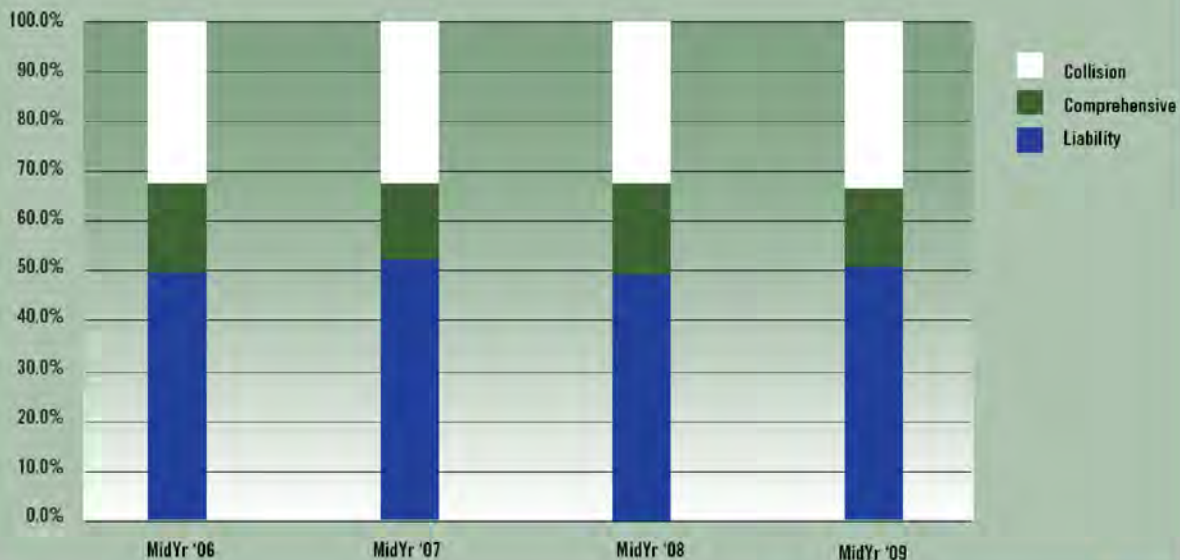
Figure 19: CCC National Industry Repairable Appraisals - OEM % of Part Amt by Calendar Year and Vehicle Age

Vehicle Age	2006	2007	2008	2009 ytd	Change '06 vs '09
Current Yr & Newer	92.2%	92.4%	92.2%	92.4%	0.2%
1 Year Old	82.8%	82.8%	82.8%	83.5%	0.7%
2 Years Old	75.2%	73.5%	74.1%	73.4%	-1.8%
3 Years Old	70.4%	69.5%	68.1%	67.3%	-3.0%
4 Years Old	66.8%	65.8%	65.9%	62.7%	-4.1%
5 Years Old	63.8%	62.3%	62.4%	60.9%	-2.8%
6 Years Old	60.2%	59.4%	58.7%	57.4%	-2.8%
7 Years & Older	53.7%	52.7%	52.1%	50.1%	-3.6%
All Ages	69.9%	68.8%	68.1%	65.0%	-5.0%

Liability Trend / Premium Pressures A Concern

The share of collision is up about .5%, liability losses are up almost a full percentage point. While the loss ratio for private passenger auto collision losses dropped each quarter from the same quarter prior year since the beginning of the recession (Q4 2007), the opposite is true for property damage liability. This mirrors the trend noted in the Jan 29 edition of Auto Insurance Report, where data shows an increase in the pure loss ratio of incurred losses to premium earned from 59.5% in 2005 to 65.6% in 2008. Further noted is the significant trend in worsening loss ratios for liability which is 59% of personal auto premium. Higher loss ratios in a market climate of declining premiums means lower profitability to the industry.

Figure 11: Volume Share of CCC National Industry Appraisal Volume by Loss Category (2006-2009)



Safety Parts Certification

CollisionWeek

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Source: CollisionWeek

Diamond Standard Announces Safety Parts Certification Program

In response to the alerts raised by recent presentations at NACE in November 2009, and the Collision Industry Conference in January 2010, Diamond Standard announced that it has accelerated the time frame for its planned launch of a full certification program for safety parts. The company is itself a US based manufacturer of high strength steel reinforcements, front steel bumpers, high density foam energy absorbers, full assembly step bumper systems and bumper brackets.

The Diamond Standard program will enlist one or more worldwide recognized certification firms capable of ANSI standard writing and certification auditing along with continuous part quality monitoring.

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Photos of the '06 Nissan Altima front bumper reinforcement bar and energy absorber system crashworthiness test video presented at the CIC Meeting. The tests compared OEM vs. Diamond Standard vs. Aftermarket.

Tests were conducted at MGA Research Corporation. The FMVSS 214 test using IIHS protocols subjected the parts to a collision with a fixed barrier at just under 10 MPH. The results show similar performance for OEM and Diamond Standard. The aftermarket system suffered considerably more damage.

The Diamond Standard program will enlist one or more worldwide recognized certification firms capable of ANSI standard writing and certification auditing along with continuous part quality monitoring.

Mike O'Neal, President of Diamond Standard and Reflexxion Automotive, points out, "The presentation at CIC and industry alerts by Diamond Standard for five years show a problem exists with safety parts from manufacturers who substitute both non-OEM material and parts manufacturing process to provide 'replacement' parts."

O'Neal believes the responsibility for part quality rests with the company that makes the aftermarket part. "It's on the manufacturers, period," O'Neal said. "They provide zero backup test and material data to large and small distributors who rely on them to provide a comparable part."

Diamond Standard has advocated the position that performance testing is the only way to measure whether or not a part is functional equivalent of the OEM original part. The company prides itself on manufacturing parts designed to replicate the safety and damageability characteristics of the OEM part, and has dynamically and destructively tested its own parts with independent test results validated by former crashworthiness experts from the National Highway Traffic Safety Administration (NHTSA). One of whom, Jim Hackney, co-authored "New Car Assessment-Five Star Crash Rating-Vehicle Safety Performance Characteristics."

Diamond Standard Safety parts are currently available through Keystone and the company said a special master data base for Diamond Standard parts has been filed with CCC Information Services and distribution to other estimating systems such as Audatex is imminent.

BREAKING NEWS: At the date of this printing, a contract has been signed with NSF International of Ann Arbor, Michigan.

Industry Summary/Conclusion

Industry Summary

The U.S. Property & Casualty Insurance Industry is facing a “perfect storm” evidenced by the pure loss ratio of incurred losses to premiums earned. The continued growth in total loss claims, the inability and certainly the pressure in the near term to maintain or lower premiums suggests a continuation of the ratio trend.

The downturn in the economy regarded as the steepest decline since the Great Depression, the crisis in the home ownership and financial system continued credit crunch and rising unemployment places mounting pressures on insurers.

Further, the approximate and growing base of total losses of 5 million vehicles is creating additional job loss pressures in the weak U.S. job market for body shops and parts suppliers.



Conclusion

Extensive testing results validate that Diamond Standard Brand Safety Parts are a safe and cost effective alternative to OEM parts. Aftermarket parts utilizing non-OEM materials tested were not equivalent to the OEM or Diamond Standard parts in function or performance.

Inferiority of some substandard safety parts in design and materials creates many problems:

- Increased collision damage and total losses impacting low and middle income individuals and small business.
- The possibility of air bag deployment delays and fire hazards risking occupant safety.
- Higher insurance premium pressure to offset increased damage and repair costs.
- Job loss @ body shop, parts suppliers, and the OEM's as well.
- Environmental issues involved with vehicle disposal.

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