

American National Standard



*Repair of
Laminated Automotive Glass
Standard (ROLAGS®)*



ANSI/NGA R1.1-2007

**American National Standard—
Repair of
Laminated Automotive Glass Standard
(ROLAGS®)**

Secretariat

National Glass Association

Approved June 20, 2007

American National Standards Institute, Inc.

American National Standard

Approval of an American National Standard requires review by ANSI that the requirements for due process, consensus, and other criteria for approval have been met by the standards developer.

Consensus is established when, in the judgement of the ANSI Board of Standards Review, substantial agreement has been reached by directly and materially affected interests. Substantial agreement means much more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered, and that a concerted effort be made towards their resolution.

The use of American National Standards is completely voluntary; their existence does not in any respect preclude anyone, whether he has approved the standards or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standards.

The American National Standards Institute does not develop standards and will in no circumstances give an interpretation of any American National Standard. Moreover, no person shall have the right or authority to issue an interpretation of an American National Standard in the name of the American National Standards Institute. Requests for interpretations should be addressed to the secretariat or sponsor whose name appears on the title page of this standard.

CAUTION NOTICE: This American National Standard may be revised or withdrawn at any time. The procedures of the American National Standards Institute require that action be taken periodically to reaffirm, revise, or withdraw this standard. Purchasers of American National Standards may receive current information on all standards by calling or writing the American National Standards Institute.

Published by

**National Glass Association (NGA)
8200 Greensboro Drive, Ste. 302, McLean, VA 22102**

Copyright © 2007 by National Glass Association (NGA)
All rights reserved.

No part of this publication may be reproduced in any form, in an electronic retrieval system or otherwise, without prior written permission of the publisher.

Printed in the United States of America

Contents

	Page
Foreword	iii
Introduction	iv
1 Scope.....	1
2 Purpose.....	1
3 Normative References	1
4 Glossary of Repair Terminology	1
4.1 Bullseye	1
4.2 Chip.....	2
4.3 Combination Break	2
4.4 Crack.....	2
4.4.1 Short Crack.....	2
4.4.2 Long Crack.....	2
4.4.3 Edge Crack	2
4.4.4 Floater Crack	2
4.4.5 Stress Crack	2
4.5 Damage	2
4.6 Ding.....	2
4.7 Halfmoon.....	2
4.8 Impact Point.....	2
4.9 Laminated Glass	2
4.10 Legs	2
4.11 Lite	2
4.12 Pit.....	2
4.13 Repair	3
4.14 Star Break.....	3
4.15 Stone Break	3
4.16 Surface Pit	3
5 Other Related Terminology.....	3
5.1 Binocular Vision	3
5.2 Cosmetic Blemish	3
5.3 Distributors.....	3
5.4 Driver's Primary Viewing Area (DPVA).....	4
5.5 Manufacturer	4
5.6 Plastic Interlayer	4
5.7 Refraction.....	4

	Page
5.8	Resin..... 4
5.9	Wiper Sweep 4
5.10	Value-Added Features 4
6	Damage Types and Repairable Dimensions 4
7	Repair Limitations 5
8	Process to be Followed by the Repair Technician..... 5
9	Inspection of the Repair Quality by the Technician 6
10	Training of a Repair Technician 6
11	Performance Requirements for Repair of Laminated Auto Glass..... 6
Figures	
1	Bullseye 1
2	Combination Break 2
3	Edge Crack 2
4	Floater Crack 2
5	Star Break..... 3
6	Surface Pit 3
7	Driver’s Primary Viewing Area (DPVA)..... 4
Annex	
A	Bibliography 8

Foreword (This foreword is not part of American National Standard ANSI/NGA R1.1-2007.)

The Repair of Laminated Automotive Glass Standard (ROLAGS®) was jointly created by the National Glass Association and the National Windshield Repair Association working under the auspices of the American National Standards Institute (ANSI) accredited NGA Secretariat for ROLAGS.

ROLAGS represents the windshield repair industry's statement of best practices as compiled under ANSI guidelines by a "balanced" committee of windshield repair system manufacturers, glass manufacturers, windshield repair and replacement retail practitioners, trade associations and other "interested parties".

ROLAGS contains an industry consensus of recommended terminology, definitions, process and procedures. These recommendations reflect the expertise of a Standards Development Committee (SDC) with combined experience of several hundred years and many thousands of practical windshield repairs among its members.

This standard contains one informative annex, which is not considered part of this standard.

Suggestions for improvements of this standard will be welcome. They should be e-mailed to pegs@glass.org.

The following standards contain provisions which, through reference in this text, constitute provisions of this American National Standard. All standards are subject to revision, and parties to agreements based on this American National Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

- Dick Inman, Chair
(Bob's Glass, Longwood, FL)
- Dave Taylor, Vice-Chair
(Cindy Rowe Auto Glass, Harrisburg, PA)
- Deb Levy, Secretary
(Key Communications, Garrisonville, VA)
- Jackie Newman, Project Editor
(Redline, Inc., Austin, TX)

<i>Company Represented</i>	<i>Name of Representative</i>
Auto One Glass and Accessories (Brighton, MI)	Dave Zoldowski
Clearview Windshield (Inwood, IA)	Gerry Zwart
Dee's Windshield Repair (Westminister, CA)	Dee Berge-Morse
Delta Kits (Eugene, OR)	Matt Larson
Diamond Glass Company (Kingston, PA)	Charles Turiello
Glass Doctor (Waco, TX)	Thom Inman
Glass Mechanix (Las Vegas, NV)	Bob Beveridge John Kiland
Glass Medic America (Westerville, OH)	Paul Syfko
Glass Technology (Durango, CO)	Kerry Wanstrath
GlasWeld (Bend, OR)	Mike Boyle
Independent Glass Association (Eden Prairie, MN)	Marc Anderson
Lynx Services LLC (Ft. Myers, FL)	Steve Shaw
Mobil Glas 2000 APS (Genrofte, Denmark)	Fred Sorensen
Novus, Inc. (Savage, MN)	Keith Beveridge
Pilkington North America (Columbus, OH)	William George
Safelite Auto Glass [Belron US] (Columbus, OH)	David Erwin
Safety Auto Glass (San Antonio, TX)	Jay Sampson
Ultra BOND (Grand Junction, CO)	Rich Campfield

Introduction

NOTES:

- 1) The conversion "One inch equals 25 mm" is used throughout this standard.
- 2) *Windshield Repair* and *Repair of Laminated Auto Glass* are used interchangeably throughout this standard.

Windshield Repair is a permanent process that can be used to repair a laminated windshield that has been damaged.

There are two basic causes for damaged laminated auto glass.

Impact: This is the most common and occurs when an object strikes the glass;

Stress or Twist: A crack occurs when a windshield is twisted, either by flexing within the vehicle frame or because of improper mounting.

The concept of repairing laminated windshields first appeared in 1968. The subsequent development of chemicals and tools, specifically designed for repair of laminated auto glass, has enabled windshield repair, if performed by a trained professional, to usually achieve the following on a finite area of the exterior surface:

- Improve the optical clarity of the damaged area
- Restore a smooth surface to prevent interference with the wipers
- Stop the damage from spreading by adding strength to the damaged area
- Retain the original bond, if applicable, by eliminating the need to replace the windshield

American National Standard

Repair of Laminated Automotive Glass Standard (ROLAGS[®])

1. Scope

The Scope of this standard shall be to define:

- Repairable damages;
- The process of windshield repair;
- The performance criteria for repaired laminated glass.

This standard shall also provide best practices for the training of a repair technician.

2. Purpose

It is the intention of the Repair of Laminated Automotive Glass Standards Committee (ROLAGS[®]) that this document:

- Be used to consistently evaluate damages on laminated auto glass in order to aid in the decision to repair or replace the glass;
- Assist the public in understanding what is achieved through windshield repair (repair of laminated auto glass);
- Encourage technicians to strive for the highest quality repair;
- Codify the current best practices of laminated auto glass repair.

3. Normative References

The following standards contain provisions which, through reference in this text, constitute provisions of this American National Standard. All standards are subject to revision, and parties to agreements based on this American National Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

AS/NZS 2366.2: 1999, *Windscreen Repairs, Repair Systems* (Australian/New Zealand Standard)

4. Glossary of Repair Terminology

4.1 Bullseye: Damage that is marked by a separated cone in the outer layer of glass that results in a dark circle with an impact point.



Figure 1 – Bullseye

- 4.2 **Chip:** Non-technical term, commonly used by the public, for damage on a windshield.
- 4.3 **Combination Break:** Damage with multiple characteristics, i.e., star within a bullseye, short or long crack (s) emanating from the damage.



Figure 2 – Combination Break

- 4.4 **Crack:** Single line of separation that may emanate from an impact point.
 - 4.4.1 **Short Crack:** A crack of 6 inches (150 mm) or less.
 - 4.4.2 **Long Crack:** A crack of more than 6 inches (150 mm).
 - 4.4.3 **Edge Crack:** Any crack that that extends to an edge.

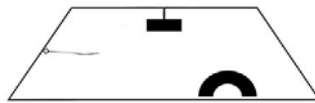


Figure 3 – Edge Crack

- 4.4.4 **Floater Crack:** Any crack that does not extend to an edge.

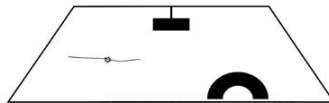


Figure 4 – Floater Crack

- 4.4.5 **Stress Crack:** Any crack that extends from an edge and lacks an impact point.
- 4.5 **Damage:** A break in laminated glass.
- 4.6 **Ding:** Non-technical term, commonly used by the public, for damage on a windshield.
- 4.7 **Half Moon:** Partial bullseye.
- 4.8 **Impact Point:** Location on the glass that was struck by an object and results in damage.
- 4.9 **Laminated glass:** Two or more layers of glass with a non-glass inner layer(s).
- 4.10 **Legs:** Subsurface cracks that emanate from the break.
- 4.11 **Lite:** A single layer of glass.
- 4.12 **Pit:** Impact point from which a small piece of glass is missing.

4.13 Repair: A process that removes air from the break either by vacuum or displacement and fills the break with resin.

4.14 Star Break: Damage that exhibits a series of legs that emanate from the break.

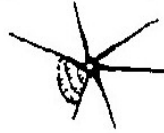


Figure 5 – Star Break

4.15 Stone Break: Non-technical term, commonly used by the public, for damage on a windshield.

4.16 Surface Pit: A nick in the glass associated with normal wear and tear that does not penetrate to the plastic interlayer.

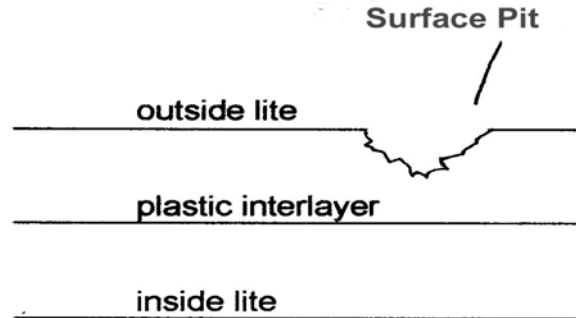


Figure 6 – Surface Pit

5. Other Related Terminology

5.1 Binocular Vision: Vision in which both eyes are used together. Human vision compensates for an obstruction to the vision of one eye with the unimpeded vision of the other eye. If both eyes are obstructed, no compensation is possible and a blind spot occurs. Thus, two windshield repairs, in the same proximity may cause the aforementioned phenomenon. This restriction is limited to the Driver's Primary Viewing Area.

5.2 Cosmetic Blemish: A remnant of damage that is still visible after the repair is completed.

5.3 Distributors: Any firm that purchases, for resale, complete repair kits or parts of kits from manufacturers.

5.4 Driver's Primary Viewing Area (DPVA): An area on the exterior of the windshield:

- 12 inches wide (300 mm wide);
- Centered on the driver's position;
- Extending from the top to the bottom of the wiper sweep.

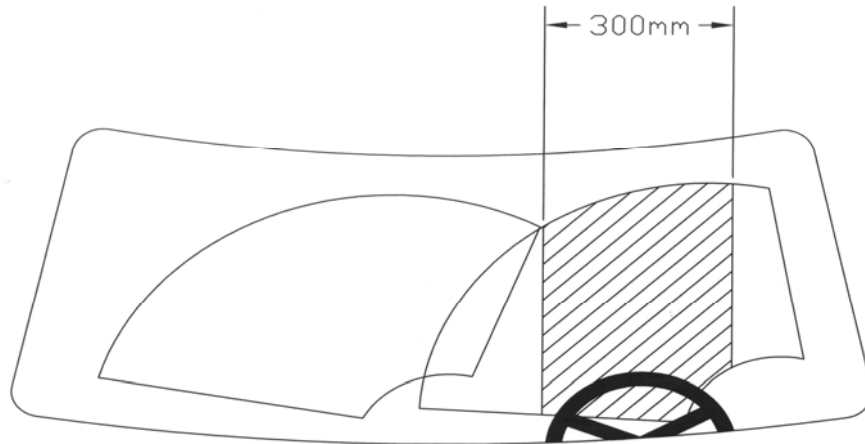


Figure 7 – Driver's Primary Viewing Area (DPVA)

- 5.5 Manufacturer:** Any firm that produces equipment, resins, or other materials used in the repair of laminated auto glass.
- 5.6 Plastic Interlayer:** Layer of plastic that bonds two pieces of glass that may also be referred to as the laminate or PVB (polyvinyl butyral).
- 5.7 Refraction:** The bending of light rays while passing from one medium to another.
- 5.8 Resin:** An organic material that approximates the refractive index of the laminated glass and, when cured, will seal the break or crack.
- 5.9 Wiper Sweep:** An area on the windshield cleaned by a motorized arm with a flexible blade attached.
- 5.10 Value-Added Features:** Items added to the windshield, by the manufacturer, such as certain coatings, rain sensors, heads-up displays (HUD), Night Vision, Global Positioning Systems (GPS) antennas, etc.

6. Damage Types and Repairable Dimensions

For the purposes of this standard, the damages to laminated auto glass are categorized into six basic types, including combinations thereof. The physical descriptions of these basic damage types appear in clause 4 of this standard.

- *Bullseye:* With a diameter no larger than one inch (25 mm);
- *Combination Break:* Diameter of body (excluding legs) not to exceed 2 inches (50 mm);
- *Crack:* No longer than 14 inches (350 mm);
- *Half Moon (Partial Bullseye):* With a diameter no larger than one inch (25 mm);
- *Star Break:* Diameter of the break not to exceed 3 inches (75 mm);
- *Surface Pit:* Damage with a diameter of not less than 1/8 inch (3 mm)

7. Repair Limitations

Both the location and the condition of the damage are important considerations in the decision to repair. Replacement is recommended under any of the following circumstances, i.e., do not repair:

- Damage that penetrates both the inside and outside layer of a laminated glass;
- Damage with three or more long cracks emanating from a single impact point;
- Damage on the inside lite (layer) of laminated glass;
- Damage contaminated with visible impurities that cannot be removed through cleaning;
- Damage or discoloration to the plastic interlayer;
- Damage in an area of the windshield where value-added features may be negatively affected by the damage and/or the repair process;
 - Repair technicians should consult and follow any vehicle manufacturer's recommendations before performing a repair on any value-added feature (see 5.10);
- Damage with a pit size greater than 3/8 inch (9 mm);
- Edge crack(s) that intersect more than one edge;
- Stress cracks;
- In the Driver's Primary Viewing Area (DPVA) if:
 - Diameter of damage is larger than one inch (25 mm);
 - The finished pit will be greater than 3/16 inch (5 mm);
 - The repair will be within 4 inches (100 mm) of another repair (see 5.1);
- If, in the technician's judgment, the repair will affect the proper operation of the vehicle.

8. Process to be Followed by the Repair Technician

NOTE: All steps given in this clause are to be carried out in accordance with the manufacturer's suggested instructions unless the instructions are in conflict with this standard.

- 8.1** In order to ensure the best possible repair, the technician shall do the following:
- (1) Inspect the damage from both inside and outside the glass to determine if the damage is repairable (see clauses 6 and 7);
 - (2) Remove moisture, dirt, foreign matter, loose glass, and contamination from the damaged area;
 - (3) If the temperature of the glass is outside the recommended range, cool or warm the glass accordingly;
 - (4) Access the damage through probing or drilling;
 - (5) Protect the resin from premature curing;
 - (6) Remove the air from the break, either by vacuum or displacement, and fill the void with resin;
 - (7) Properly perform pit filling and resin curing;
 - (8) Finish the repair to be flush with the glass;
 - (9) Inspect the finished repair (see clause 9).

8.2 Crack Repair

- (1) Completely fill the crack with the appropriate resin(s);
- (2) Place a bead of resin on top the crack;
- (3) Properly cure the resin;
- (4) Finish the crack repair to be flush with the glass;
- (5) Inspect the finished crack repair.

9. Inspection of the Repair Quality by the Technician

- The repair shall be inspected visually from the driver's position within the vehicle.
- The repair should be free of significant light scatter, dirt, road contaminants, air pockets, and other optical defects that may affect the proper operation of the vehicle.
- The finished pit should not be larger than 3/8 inch (9 mm) and is limited to 3/16 inch (5 mm) in the Driver's Primary Viewing Area (DPVA) (see 5.4).
- The repair should not interfere with the normal operation of the windshield wipers.

10. Training of a Repair Technician

The technician shall be trained in accordance with this standard, with such training to include:

- Both active (hands-on) and passive coursework;
- Passage of both a written and practical exam;
- Adequate maintenance of records on all participants and their final exam scores.

11. Performance Requirements for Repair of Laminated Auto Glass

Repair of laminated auto glass is a permanent process that removes air from the break either by vacuum or displacement and results in the break being filled with a curable resin that approximates the refractive index, color and clarity of the laminated glass. To accomplish this, it is recommended that a windshield repair system include the following:

- A process to:
 - Inspect the damage and apply repair criteria;
 - Check for moisture and other visible contamination;
 - Ensure that the break is filled.
- Equipment to:
 - Remove moisture and other visible contamination;
 - Access the damage.
 - Remove or displace air and inject the repair resin.
 - Properly perform pit filling and resin curing processes.

- Resin that will:
 - Meet the manufacturer's requirements that are specific to the repair system's equipment such as viscosity, cure rate and ability to be polished;
 - In its cured state, approximate the refractive index, color and clarity of the laminated glass that is being repaired;
 - Minimize light refraction and seal the laminate in a crack;
 - Be recognized as conforming to this standard.

- To be recognized as conforming to this standard, the resin manufacturer shall be able to submit test results from an independent laboratory showing that resins meet AS/NZS 2366.2:1999, which is hereby incorporated as a normative reference with the following changes in:
 - Clause 2, APPLICABILITY, shall not be in force. Rather, the applicable sections of AS/NZS 2366.2:1999 will apply to the repair of laminated auto glass complying with SAE Z26.1-1996 and all applicable Federal Motor Vehicle Safety Standards;
 - Clause 5, PRINCIPAL CHARACTERISTICS OF A WINDSCREEN REPAIR SYSTEM, only characteristics (a) (c), and (d) of subclause 5.2 shall apply. A change in characteristics (c) and (d) of subclause 5.2 shall imply a new system in need of testing;
 - Clause 6, CATEGORIES OF DAMAGE, shall not be in force. Rather, the testing standard shall apply to the corresponding damage categories and size limitations as laid out in clause 6 of this standard;
 - Table I, SCHEDULE OF TESTS AND TYPES OF DAMAGE FOR EACH TEST, shall be amended such that upper size limits in Categories A and B reflect those laid out in ROLAGS. For Category C, "L" shall be equal to the upper limit on repairable crack length as laid out in Section 6 of this standard.

Annex A
(informative)

Bibliography

SAE Z26.1, 1996, *Safety glazing materials for glazing motor vehicles and motor vehicle equipment operating on land highways – Safety standard*

ANSI/AGRSS 002-2002, *Automotive glass replacement safety standard*

AS/NZS 2366.1:1999, *Windscreen repairs, Part 1: Repair procedures*, Standards Australia/Standards New Zealand

BS AU 242:1998, *Automotive windscreen repair - Code of practice*, British Standards Institution (BSI)

BS AU 251:1994, *Specification for performance of automotive laminated windscreen repair systems*, British Standards Institution (BSI)

Recommended practice for the repair of windshields, National Windshield Repair Association, Sept. 2002

Letter from Jacqueline Glassman, Chief Counsel for National Highway Traffic Safety Administration, dated July 7, 2004, to Leo Cyr. (Can be found at <http://isearch.nhtsa.gov/files/Cyr.1.html>.)