

Appendix 87  
February 15, 1990  
Revised

## AUTOMATIC RESIDENTIAL GARAGE DOOR OPERATORS

### I. INTRODUCTION

#### A. Background Information

Most entrapment incidents involved children between 2 and 4 years-of-age whose chest depths range between 3.9 and 5.6 inches. It appears that the garage doors are contacting the child at more than 2 inches from the ground and not reversing. Two related events may be responsible for entrapment: 1) the closing door contacting the child's chest may not meet sufficient resistance to trigger the reversal mechanism and thus continues to close; or 2) improperly installed or adjusted bottom limit switches, or floor settlement may increase the two-inch space so that the automatic reverse mechanism disengages at a higher point.

The voluntary standard for automatic garage door operators is maintained by Underwriters Laboratories (UL). The standard, entitled "UL 325, Standard for Safety for Door Drapery Gates, Louvre and Window Operators and Systems was first published on April 1, 1973. It was revised in April 1975 and revised again, effective April 1982 to address the hazard of child entrapment.

After April 1975, the voluntary standard required that the garage door reverse if a downward moving door contacted an object for more than two seconds except during the last two inches of downward travel. The two-inch exception was allowed to prevent false reversals due to small obstructions at the base of the door opening, such as stones or ice, and to allow for movement of the pavement due to frost heave. However, entrapment incidents continued to occur even with automatic garage door operators having the automatic reverse feature.

The revisions to the standard, effective April 1, 1982, eliminated the exception allowing de-activation of the automatic reverse mechanism during the last two inches of downward motion. The conformance test procedure was also changed. A fully installed door system must be tested instead of only the operator, as previously allowed. Door reversal must occur within two seconds of contacting a two inch test object whose top inch is resilient and whose bottom inch is rigid. In addition, the April 1982 revision required that the door reopen if the bottom limit switch is not activated within 30 seconds after the control is pressed to start the closing cycle. The Commission staff will monitor and evaluate their latest revision. Investigation of automatic garage door operator injuries are needed to support this effort.

B. Product Class Description

1. Definitions and General Description

Residential garage door operators consist of electrically-powered drive mechanisms, mounted on the ceiling of garages, which are activated by wall switches and in some cases, remote portable battery-powered transmitter switches. Some of these mechanisms employ momentary contact buttons that must be pushed and released to operate the door. Some units, particularly those manufactured prior to the 1982 revision of the standard, required constant contact pressure on the buttons. On those with a momentary contact button, a second push on the switch, when the door is operating in the down cycle, may either reverse or stop the door, depending on the design. On the up cycle, a second push may stop, reverse, or have no effect on the door motion. (The new UL standard specifies that a push on the button during the up cycle should not reverse the motion of the door.) For doors that stop with a second push, the third push will either reverse the motion or resume the motion in the original direction.

The automatic reverse mechanism reverses the direction of the closing garage door when the door becomes blocked. The sensing mechanism detects increases in resistance to the moving door. When the resistance exceeds a threshold, which is adjustable, the mechanism reverses the drive motor.

The force adjustment regulated the force with which the door descends. The force adjustment should be set as low as possible and yet still adequately close the door. Then, when the door meets a blockage, the door will reverse. If the force adjustment is set to high, the blockage may go unnoticed.

The bottom line switch determines when the drive motor cuts off. This, in turn, determines the reference point at which the automatic reverse mechanism disengages. The bottom limit switch should be set so that the motor cuts off when the door is contacting the ground. If the bottom limit switch is adjusted improperly, or if the ground settles, the motor may cut off before the door reaches the ground. This additional space, when added to the automatic reverse disengagement height, may allow room for a child to become entrapped under a closing door.

The manual disconnect feature is a means to manually detach the door operator from the door, so that the door may be raised or lowered manually. It usually consists of a pull rope.

## II. INSTRUCTIONS FOR COLLECTION SPECIFIC INFORMATION

### A. Synopsis

A description of the sequence of events, the type of door and operator mechanism, and the conditions existing at the time of the accident are necessary to determine the major hazard patterns and the risk of injury associated with residential garage door operators.

### B. Description of Victim Contact With the Product (Victim/Product/Environment Interface)

Determine the accident sequence and the exact position where the door contacted the victim (chest, back, neck, etc.) and the dimensions of the body part(s) affected. Be sure to note whether child was facing into or out of the garage, and whether child's front was facing up or down. In addition, note where under the door the child was found (left side, middle, right side), and provide sketches and dimensions.

### C. Instructions for Collecting Specific Information

#### 1. Information Collection

Determine the manufacturer and age of the unit and by whom it was installed (mechanic, homeowner, etc.). It is particularly important to determine if the opener was installed before or after April 1, 1982.

Describe the location (note dimensions) and principles of operation of the garage door operator components (see attached diagram) including the following:

- o Wall switch
- o Bottom limit switch
- o Radio transmitter remote control
- o Automatic reverse mechanism

- o Types of sensing mechanism and switches
- o Force adjustment mechanism
- o Obtain in detail the operating history of the garage door.
- o Determine how recently the reverse mechanism was checked/observed to be functioning correctly.
- o Describe any previous problems with door operation. Use pictures and sketches if appropriate.
- o Describe any maintenance, adjustments, and/or repair. Determine who made them (mechanism, installer, owner, etc.), when made, and operation of door after changes.
- o Obtain copies of any investigations of the incident prepared by the police, coroner, manufacturer, installer, law firm, insurance company or engineering firm.

Visually examine the garage door system including the door hardware and door opener hardware. Look for signs of loose or broken attachments, bending or buckling, binding, or similar signs of damage, misalignment or other problem. Report presence or absence of such problem. If damages or other problems are noted, do not perform the operational observations discussed below.

Inspect the door opener mechanism, owners manual or other available material for the UL label. Report presence or absence of the label. Photograph label and transcribe information on the label.

Inspect the door opener and manual for information on the manufacturer, make, model, serial number and similar data. Photograph and transcribe this identifying information.

Inspect the doorway for any signs of settlement, heaving or similar displacement from original condition. Inquire about homeowner's knowledge of any such displacement, when it occurred and of any corrective action was taken. Particularly ask if any adjustments were made to the door opener, to the location of the connecting arm bracket on the door, or to the door.

2. Operational Observations

(a) Determine whether or not the owner has used and/or adjusted the garage door opener since the accident and whether or not the owners or their legal representatives would object to routine operation of the system to permit on-site observations.

(b) Ask the owner to perform the following operational checks:

(1) Close the garage door and reopen it using the wall-mounted switch. Note whether or not the motor shuts off at both the fully closed and open positions. At the closed position describe any space left under the door at the right, left and center of the door as you face the door from inside the garage.

(2) Repeat above operations using the remote operator, if available.

(3) Close the door using the wall-mounted switch. Operate the manual disconnect mechanism. Note whether or not the trolley disconnects from the rail. Attempt to manually open the door to the full open position. Close the door using the wall mounted switch. Note whether or not the trolley re-engages automatically, if not, consult owner's manual for instructions on properly re-engaging the trolley.

(4) Wait 5 minutes then check operation of the automatic reverse mechanism to see if reversal occurs when the door is closed on a 1 1/2 inch by 3 inch by 12 inch wood block placed on the ground in line with the operator on the 1 1/2 inch side, the 3 inch side, and the 12 inch side. Do not leave the door in contact with the wood block for longer than 4 seconds. Report results. Wait 5 minutes between each check.

If reversal occurs at 1 1/2 inches or 3 inches, do not check further. Do not make any additional observations. Do not attempt to make any adjustments on the door. If the door fails to reverse and the owner or the manual indicate the door is equipped with this feature, suggest that the owner have the unit examined by an authorized dealer.

D. Description of Victim

- o Indicate the victim's age, sex, height, weight, body measurements, clothing, competence reducing factors (e.g., impaired vision, physical handicaps, medication, alcohol use, etc.) and knowledge of product.
- o Note the victim's activity prior to the incident (if a child, whether the victim was playing with other children, unsupervised by an adult, etc.).
- o Stipulate who was operating the garage door, if it was not the victim.
- o Indicate type of clothing worn by victim.

E. Description of Environment

Characterize weather conditions at the time of the accident, including lighting and ground conditions.

**III. INSTRUCTIONS FOR PHOTOGRAPHING AND/OR DIAGRAMMING ACCIDENT SCENE AND FACTORS RELATED TO THE ACCIDENT SEQUENCE**

Photograph accident scene showing operator mechanism, switches and controls, and presence of safety labeling.

**IV. INSTRUCTIONS FOR OBTAINING SAMPLES AND DOCUMENTS RELATED TO THE INVESTIGATION**

Garage door dimension measurements, clearance dimension measurements, location of the victim and test results of observing the operation of the door and manual disconnect mechanism are to be appended to the investigation report.

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Obtain copies of the operating and installation instructions and repair history (if any) that are available and append them to the investigation report.

Investigators may wish to provide the homeowner with a copy of the attached safety precautions.

### SAFETY PRECAUTIONS

The following safety precautions are recommended by the Commission in order to minimize chances of a mishap or tragedy involving automatic garage doors. 1/

1. Aside from prohibiting all "beat the garage door" games, parents should warn children of risks of intentionally or accidentally activating the automatic doors.

2. Many garage door openers have an automatic reverse mechanism which stops or reverses the garage door upon impact with an object. This mechanism can usually be adjusted for sensitivity. Consult the owner's manual or dealer for instructions.

3. Lubricate the garage door mechanism periodically to reduce friction in accordance with the owner's manual. The easier the door rolls on its track, the easier it is to adjust to control for maximum sensitivity.

4. Homeowners should be aware of what to do in case of entrapment. Devices which contain automatic reverse mechanisms usually either stop or reverse the door when the control is pressed again. In addition, most garage door openers have a manual disconnect feature which enables the opener to be disconnected so that the door may be raised or lowered manually.

5. Remove the pull ropes on the door which were intended to manually raise and lower the door, as these ropes are no longer of value. Removing the ropes eliminates another hazard for your children.

6. Relocating all operating switches out of the easy reach of children will make it difficult for youngsters to play with the devices.

7. Lock all cars contain the radio controls which activate the garage doors.

1/ These were previously cited in the CPSC memo, August/Sept. 1980, and in letters in Action Line Reporters.



GARAGE DOOR OPENER

1. Wall Mounted Switch
2. Garage Door Opener
3. Drive Mechanism
4. Door Track
5. Manual Door Disconnect
6. Header Attachment
7. Door Arm
8. Garage Door

