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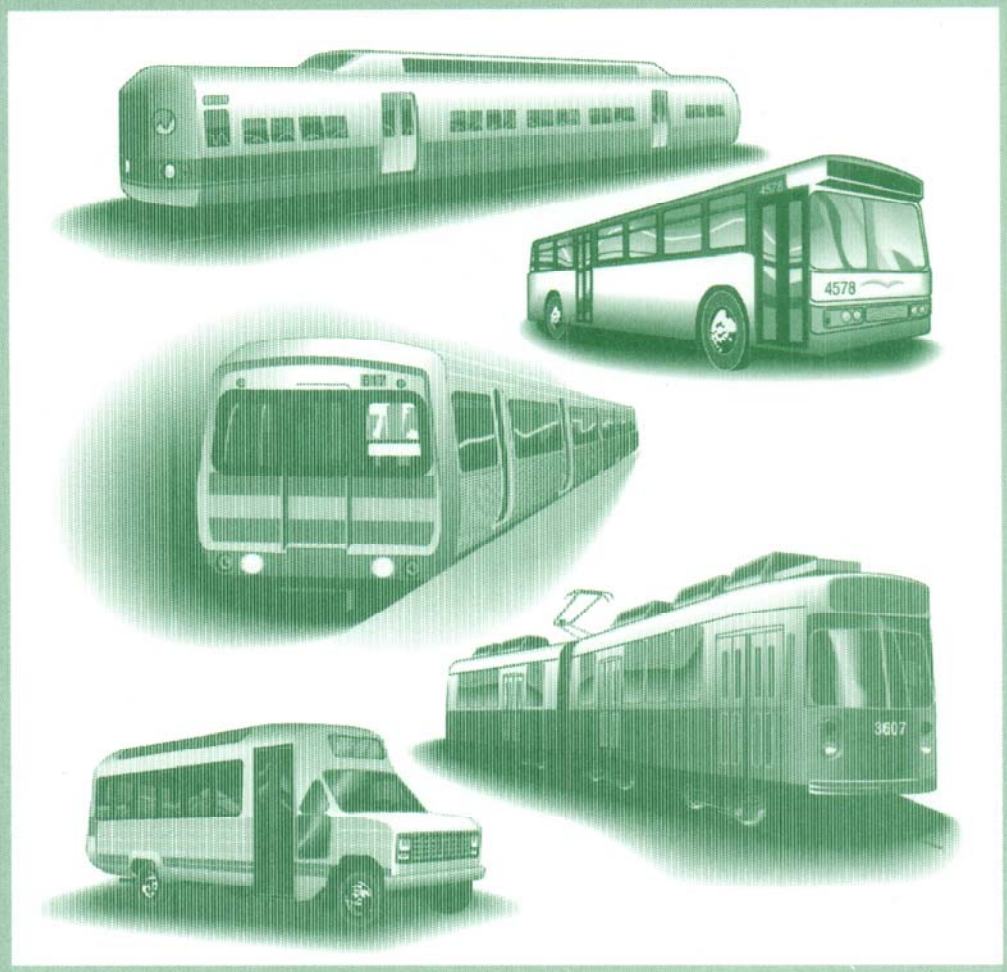
Standardization of Availability Location, and Use of Safety Equipment on Urban Transit Buses

U.S. Department of Transportation
Research and Special Programs Administration
John A. Volpe National Transportation Systems Center
Cambridge, MA 02142

Final Report
May 1996



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13. ABSTRACT (Maximum 200 words)

This document represents the conclusion of a project undertaken to identify guidelines which will correct the problems encountered by rescue forces while attempting to gain entry to, shut down, and evacuate urban transit buses involved in an emergency or accident. This Final Report presents (1) the availability, location, and use of eleven key safety components on six urban transit bus models; (2) the process used in the development of standardization guidelines; and (3) proposed guidelines for the potential standardization of eight key safety components on urban transit buses.

This project, funded by the Federal Transit Administration (FTA) through a grant to the Cambria County Transit Authority (CCTA), and by the Volpe National Transportation Systems Center, was based on previous work by the KETRON Division of The Bionetics Corporation. The FTA had previously funded, through CCTA in response to a specific accident, the development of emergency and accident procedures training materials for several popular urban transit bus models. A wide disparity among bus models with regard to key safety components was discovered. Under a new contract with CCTA, KETRON documented aspects of eleven components on six popular urban transit bus models. An inter-industry Guidelines Development Committee, representing vehicle manufacturers, engine suppliers, the American Public Transit Association (APTA), FTA, the Volpe National Transportation Systems Center, maintenance managers, transit authorities, emergency response forces, bus window suppliers, and other vendors, met periodically to discuss how to best standardize the safety components on urban transit buses. The guidelines developed herein are the result of original research and development efforts by KETRON in concert with input from the Guidelines Committee and Members of the APTA Bus Safety Committee.

The last section presents guidelines which detail potential specifications for standardization of the availability, location, identification, use, and function of eight safety components, including: 1) master run switch; 2) driver's side window; 3) emergency engine shutdown switch in engine compartment; 4) front side door release control; 5) rear side door release control; 6) electrical (batteries) switch; 7) roof-mounted emergency ingress and escape hatches; and 8) passenger side windows. The guidelines also present a new Universal Access Symbol to identify key entry points and emergency devices to rescue forces.

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METRIC/ENGLISH CONVERSION FACTORS

ENGLISH TO METRIC

LENGTH (APPROXIMATE)

1 inch (in)	=	2.5 centimeters (cm)
1 foot (ft)	=	30 centimeters (cm)
1 yard (yd)	=	0.9 meter (m)
1 mile (mi)	=	1.6 kilometers (km)

AREA (APPROXIMATE)

1 square inch (sq in, in^2)	=	6.5 square centimeters (cm^2)
1 square foot (sq ft, ft^2)	=	0.09 square meter (m^2)
1 square yard (sq yd, yd^2)	=	0.8 square meter (m^2)
1 square mile (sq mi, mi^2)	=	2.6 square kilometers (km^2)
1 acre = 0.4 hectare (ha)	=	4,000 square meters (m^2)

MASS – WEIGHT (APPROXIMATE)

1 ounce (oz)	=	28 grams (gm)
1 pound (lb)	=	45 kilogram (kg)

1 short ton = 2,000 pounds (lb) = 0.9 tonne (t)

VOLUME (APPROXIMATE)

1 teaspoon (tsp)	=	5 milliliters (ml)
1 tablespoon (tbsp)	=	15 milliliters (ml)
1 fluid ounce (fl oz)	=	30 milliliters (ml)
1 cup (c)	=	0.24 liter (l)
1 pint (pt)	=	0.47 liter (l)
1 quart (qt)	=	0.96 liter (l)
1 gallon (gal)	=	3.8 liters (l)
1 cubic foot (cu ft, ft3)	=	0.03 cubic meter (m^3)
1 cubic yard (cu yd, yd3)	=	0.76 cubic meter (m^3)

TEMPERATURE (EXACT)

[(x- 32) (5/9)] °F = y °C

METRIC TO ENGLISH

LENGTH (APPROXIMATE)

1 millimeter (mm)	=	0.04 inch (in)
1 centimeter (cm)	=	0.4 inch (in)
1 meter (m)	=	3.3 feet (ft)
1 meter (m)	=	1.1 yards (yd)
1 kilometer (km)	=	0.6 mile (mi)

AREA (APPROXIMATE)

1 square centimeter (cm^2)	=	0.16 square inch (sq in, in^2)
1 square meter (m^2)	=	1.2 square yards (sq yd, yd^2)
1 square kilometer (km^2)	=	0.4 square mile (sq mi, mi^2)
10,000 square meters (m^2)	=	1 hectare (ha) = 2.5 acres

MASS - WEIGHT (APPROXIMATE)

1 gram (gm)	=	0.036 ounce (oz)
1 kilogram (kg)	=	2.2 pounds (lb)

1 tonne (t) = 1,000 kilograms (kg) = 1.1 short tons

VOLUME (APPROXIMATE)

1 milliliter (ml)	=	0.03 fluid ounce (fl oz)
1 liter (l)	=	2.1 pints (pt)
1 liter (l)	=	1.06 Quarts (qt)
1 liter (l)	=	0.26 gallon (gal)
1 cubic meter (m^3)	=	36 cubic feet (cu ft, ft^3)
1 cubic meter (m^3)	=	1.3 cubic yards (cu yd, yd^3)

TEMPERATURE (EXACT)

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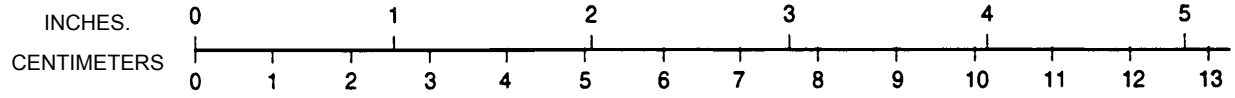

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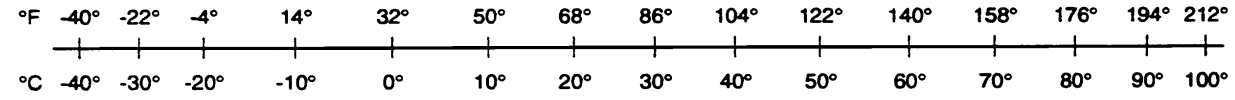

For more exact and or other conversion factors, see NIST Miscellaneous Publication 286, Units of Weights and Measures. Price $2.50. SD Catalog No. C13 10286.

Updated 9/29/95

PREFACE

The FTA has identified a critical need to cause the safety equipment on Urban Transit Buses to be standardized so that in the event of an accident or emergency situation, rescue forces will be able to efficiently gain access to the interior, to shut down appropriate systems, and to evacuate passengers after providing immediate life support. This report provides the guidelines for the potential standardization of eight key safety components.

The author of this report is John N. Balog, Vice President, Transportation Research, Planning and Operations, KETRON Division of the Bionetics Corporation.

The KETRON Division of The Bionetics Corporation would like to extend its full appreciation to the Cambria County Transit Authority (CCTA), the Federal Transit Administration (FTA), the Volpe National Transportation Systems Center (VNTSC), and those individuals who were instrumental in initiating this project and for bringing it to its currently successful status: Franz K. Gimmler, Former Deputy Associate Administrator for Safety, FTA; Judy Z. Meade, FTA; Ronald Kangas, Emergency Preparedness Engineer, FTA; Carole Ferguson, FTA; William T. Hathaway, VNTSC; Mary Anderson, FTA; William J. Gasior, General Manager, CCTA; Harold Jenkins, Former General Manager, CCTA; and Michael Quinn, Former Planner, CCTA.

KETRON would also like to thank the following individuals and organizations for their valuable contributions to the guidelines and their generous and informed participation through two **Guidelines Development Committees:** Mary Anderson, FTA; Chief Jonathan Best, National Association of Emergency Medical Technicians; Peter Bigwood, Ontario Bus Industries; Captain Ben E. Blankenship, National Association of Emergency Medical Technicians; James G. Bolton, Flxible Corporation; Carlton K. Brown, Vapor • Mark IV Industries; Stephen C. Cunningham, Culver City Municipal Bus Lines; Captain Joseph Deal, Philadelphia Fire Department; Daniel A. DiSantis, Southeastern Pennsylvania Transportation Authority; Richard G. Duser, Lehigh & Northampton Transportation Authority; Commander Craig Edwards, Pittsburgh Police Department; Eric A. Garzon, Greyhound Canada, Inc.; Douglas E. Greenwood, CCTA; William Hathaway, VNTSC, U.S. Department of Transportation; Craig O. Henrikson, Detroit Diesel Corporation; James Higgins, Philadelphia Fire Department; Rich Himes, Ikarus USA, Inc.; Harold Jenkins, Formerly with CCTA; Ronald C. Lamparter, Transpec, Inc.; Paul Lennon, American Public Transit Association; John C. Martin, Port Authority of Allegheny County; James McDowell, Transportation Manufacturing Corporation; Lt. David D. Smith, Philadelphia Fire Department; Darrell Sykes, Neoplan USA Corporation; Professor James C. Wambold, Altoona Bus Testing Facility; and David West, Transportation Manufacturing Corp.

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For their enthusiasm in spreading the word and coordinating meetings, KETRON acknowledges with great appreciation: Stephen C. Cunningham, APTA Bus Safety Committee Chairman; Dennis Costello, Fomer APTA Bus Safety Committee Chairman; Paul J. Lennon, American Public Transit Association; and Jerome T. Fair, American Public Transit Association.

To the following APTA Safety Committee Members who took the time to review Draft Guidelines and to provide comments, an appreciative thank you: Oliver Bellard, Metropolitan Transit Authority; Frank A. Cecere, Los Angeles County Metropolitan Transportation Authority; Stephen C. Cunningham, Culver City Municipal Bus Lines; Homer Clemmons, MARTA; Joseph Dorsey, Regional Transit Authority; Peter G. Drake, South Coast Area Transit; Rufus Francis, Los Angeles County Metropolitan Transportation Authority; Jim Gigantino, New Jersey Transit, Inc.; Fred Griffith, Southeastern Pennsylvania Transportation Authority; Theodore V. Janysek, VIA Metropolitan Transit; Dave Kirby, Central Contra Costa Transit Authority; Kenneth Kohagen, City of Yakima; Elias Mosqueda, SamTrans; Andres E. Morales, VIA Metropolitan Transit; Adrian Moy, Tri-Met; Howard Perry, Birmingham Transit Authority; Homer G. Phillips, Gary Public Transportation Corporation; Sharon Porter, Central Contra Costa Transit Authority; Bill Rueschaw, PACE; Donald L. Toney, City of Yakima; and Guy Wright, San Francisco Municipal Railway;

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1. INTRODUCTION

Urban bus transit is extremely safe in the United States. However, this achieved level of success causes significant problems for emergency preparedness forces including fire services, police, ambulance, etc., when they arrive on the scene of an accident or emergency. They have had extremely limited experience dealing with urban transit buses and the various kinds of safety equipment and devices on board. Compounding the problem is widespread inconsistency among the various safety components across the studied bus models.

Under a grant from the Federal Transit Administration to the Cambria County Transit Authority (CCTA), and with the financial help of the Volpe National Transportation Systems Center, the KETRON Division of The Bionetics Corporation documented the availability, location, and use of eleven key safety components on six representative urban transit buses. Based on this documentation and with the significant help of the **American Public Transit Association (APTA) Safety Committee**, the **Guidelines Development Committee**, the **Window Subcommittee**, and various suppliers, KETRON has developed guidelines for the potential standardization of eight key safety components. This final report documents the safety components on urban transit buses, describes the guidelines development process, and presents the resulting proposed guidelines in full.

1.1 BACKGROUND

In the early 1980s, the Cambria County Transit Authority experienced a severe accident involving one of its buses. The bus, out of control, was wedged, at speed, between a utility pole and a store front. The forces of impact caused its transmission to slip into reverse while the throttle was fully open. The bus literally tore itself in half and set itself on fire. Arriving emergency forces did not know how to gain access to the interior of the bus or how to turn off the engine.

This accident experience served as the basis for an Urban Mass Transportation Administration grant to develop a set of emergency and accident procedures materials for use as training documents[1] for emergency preparedness forces responding to accidents involving public transit buses. The comprehensive courses were developed

[1] Balog, John N. *Introduction to Urban Transit Bus Accident Experience: Emergency & Accident Procedures Training,* slides and manual, 13 pages, June, 1988; *Emergency & Accident Procedures Training Manual for the Flxible Corporation Urban Transit Bus,* video tape, slides, and manual, 110 pages, March, 1988; *Emergency & Accident Procedures Training Manual for the General Motors Corporation RTS Urban Transit Bus,* slides, videotape, and manual, 130 pages, March, 1988; *Emergency & Accident Procedures Training Manual for the Neoplan USA Corporation Urban Transit Bus,* slides, videotape, and manual, 120 pages, March, 1988; and *Instructor's Manual: Emergency & Accident Procedures Training for: the Neoplan, GMC/RTS, and Flxible Corporation Urban Transit Bus,* 14 pages, January 1989. The KETRON Division of The Bionetics Corporation, 350 Technology Drive, Malvern, PA 19355.

by KETRON, while under contract with CCTA, and have since been distributed and used to train emergency preparedness forces associated with many transit systems.

During the development of that Emergency and Accident Procedures Program, CCTA and KETRON had to carefully identify all relevant safety components and their correct operation for each of the three advanced design bus models encompassed within the program: the Neoplan USA, the General Motors RTS, and the Grumman Flxible. One problem which became quite apparent was the lack of standardization of the type, location, and operation of each of the safety components. This lack of standardization causes potentially significant problems for emergency forces arriving on the scene of an accident.

KETRON also conducted a number of simulated emergencies and accidents involving urban transit buses in a number of states including Pennsylvania, Connecticut, Massachusetts, and West Virginia. It was clear from the simulation exercises that emergency response personnel are very interested in learning how to gain entry, how to shut down engines, and other rescue information regarding buses. Without specific knowledge their approach tends to be quick-actioned, which often results in significant damage to the coach. Once presented information on the safety components and their operation, they generally perform well in gaining entry and disengaging systems without any damage. This experience testified to the need for transit authorities and others providing transit services to interact on a regular basis with the emergency preparedness forces in their service area so that knowledge can be shared and safety effectiveness can be maximized.

It is clear that standardization of safety equipment needs to be adopted by urban transit bus manufacturers and authorities as a goal so that emergency response personnel will be more effective in performing their life saving duties. Consequently, this project, sponsored by CCTA and funded by the Federal Transit Administration (FTA) and the Volpe National Transportation Systems Center, was undertaken to assist the industry in reaching this laudable goal.

1.2 CANDIDATE SAFETY ITEMS FOR STANDARDIZATION

In correspondence with CCTA and representatives of FTA, KETRON initially identified eleven safety items as strong potential candidates for standardization, based on priorities in evacuation and rescue and previous experience. The following eleven items were originally selected for standardization with respect to location, use, and function:

- Master Run Switch;
- Emergency Stop Switch;
- Engine Compartment Stop Switch;
- Engine Stop Solenoid Plunger;
- Roof Escape (Ingress) Hatch(es);

- Driver's Window;
- Driver's Area Master Door Switch;
- Front Door Release Control;
- Rear Door Release Control;
- Electrical (Battery) Switch(es); and
- Passenger Side Windows.

Each is indicated generically in *Figure 1-1* and described in the following section, which documents various aspects of each component on six urban transit bus models.

Section 3 of this document describes the Development Process for Standard Emergency Safety Components which was undertaken after the aspects of current equipment had been documented.

The result of this process is an Application Approach which includes specific guidelines describing each component as they should be standardized. These guidelines are presented in Section 4.

A list of the study set of urban transit bus models investigated as background, a list of resources for interested researchers, and a bibliography are presented in Appendices A, B, and C, respectively.

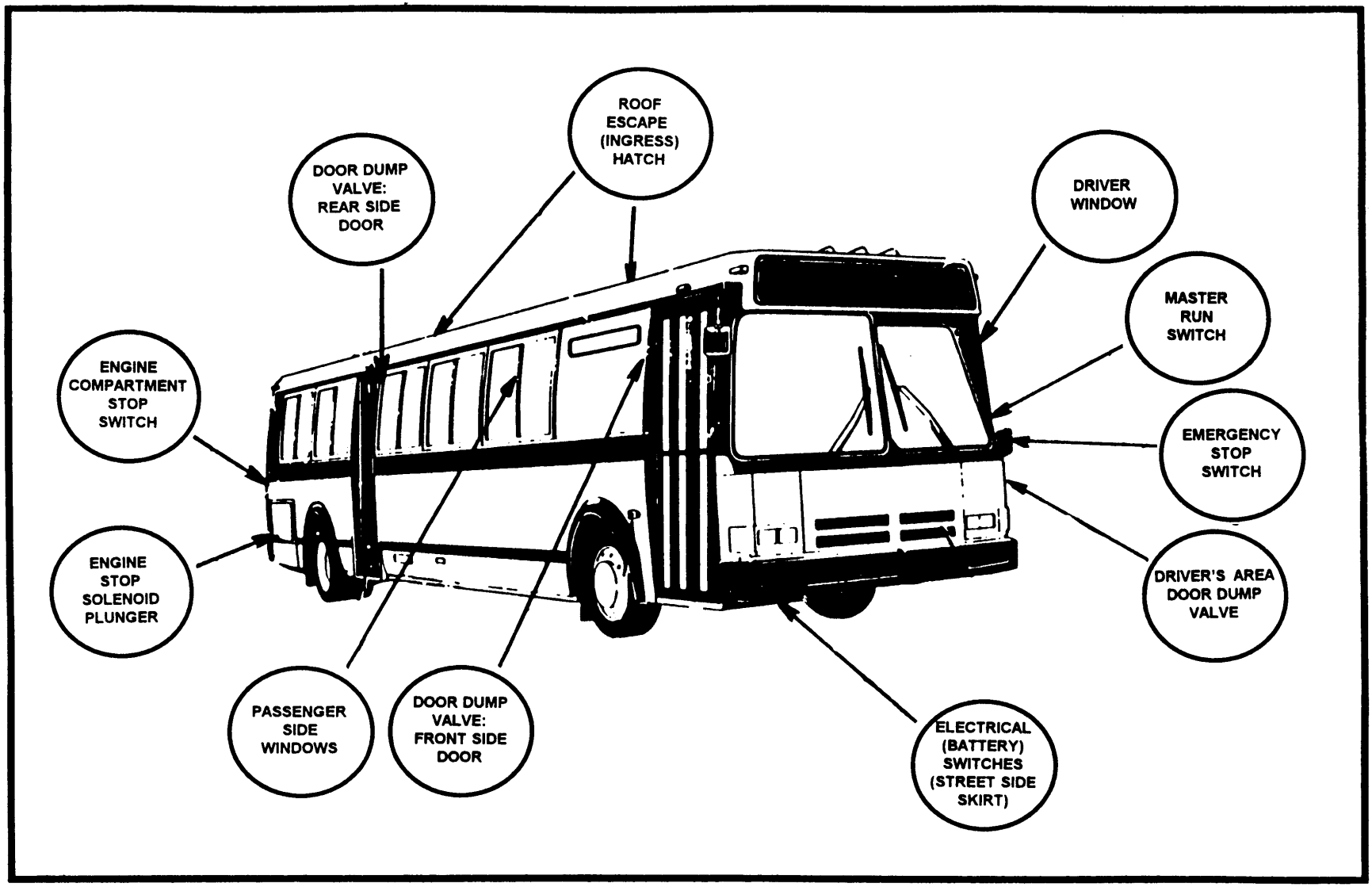

FIGURE 1-1. SAFETY DEVICES TARGETED FOR STANDARDIZATION

2. DOCUMENTATION OF AVAILABILITY, LOCATION, AND USE OF SAFETY ITEMS

One of the key realizations of the original study for CCTA was that there tended to be a lack of standardization for the location and function of the various safety devices among the three most common models of urban transit buses — the Flxible Corporation, General Motors Corporation (Transportation Manufacturing Corporation) RTS, and Neoplan USA Corporation. In the Summer of 1991 this was broadened by the study of Ikarus USA articulated, Gillig, and Bus Industries of America Orion urban transit bus models. Safety components were also found to vary among these vehicles. The vehicles of these six manufacturers comprised over 80% of the urban transit buses operating in the United States at the time of this review.

In July of 1991, each of the eleven candidate safety components on models by each of these manufacturers were documented.[2] This information is partially represented in the following pages and includes brief discussions of each of the safety components. Following the discussion of each component, tables summarize, for each of the six models: the location; accessibility of the device from outside the coach; the use of the device; its function; and any vehicle-specific safety problem(s). Photographs of all of the actual devices are included following each table, in alphabetical order by bus model manufacturer: Flxible, GMC/TMC, Gillig, Ikarus, Neoplan, and Orion.

This study is based on the vehicle models available for inspection and additional information provided at the time of compilation; vehicles actually vary, of course, among models, model years, and transit agencies. A list of the actual vehicles used for documentation is included in Appendix A. Each safety component is considered as it relates to emergency response handling and evacuation, in light of a (potentially) incapacitated driver. The discussions, tables, and photographs presented here served as the basis of discussion at the first meeting of the Guidelines Development Committee in August, 1991.

2.1 MASTER RUN SWITCH

A summary of the Master Run Switch data for the six bus models studied is shown in *Table 2-1.* The Master Run Switch and its location in each of the six bus models are shown in *Photographs 2-1* through *2-6*.

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[2] Balog, J.N., Gribbon, R.B., and Schwarz, A.N., *KETRON Technical Discussion: Availability. Location, and Use of Safety Items for Standardization on Urban Transit Buses.* KETRON, August 13, 1991, 124 pages.

On five of the six coach models, the Master Run Switch is located in the operator's compartment on the side wall control panel directly to the rear of the door control handle. As the exception, the Master Run Switch in the Gillig Phantom is located immediately forward of the door control handle, as can be seen in *Photograph 2-3.* Although proximity to the door control handle varies slightly among vehicles, the Master Run Switch is consistently the largest knob on the driver's left side control panel. In each case it is accessible to emergency preparedness forces from outside of the coach. In each case its use is consistent: reaching through the signal window and rotating the switch counterclockwise to the engine stop or off position. For each bus, this shuts down the engine (as long as the device and its related circuits have not been damaged by the accident or emergency).

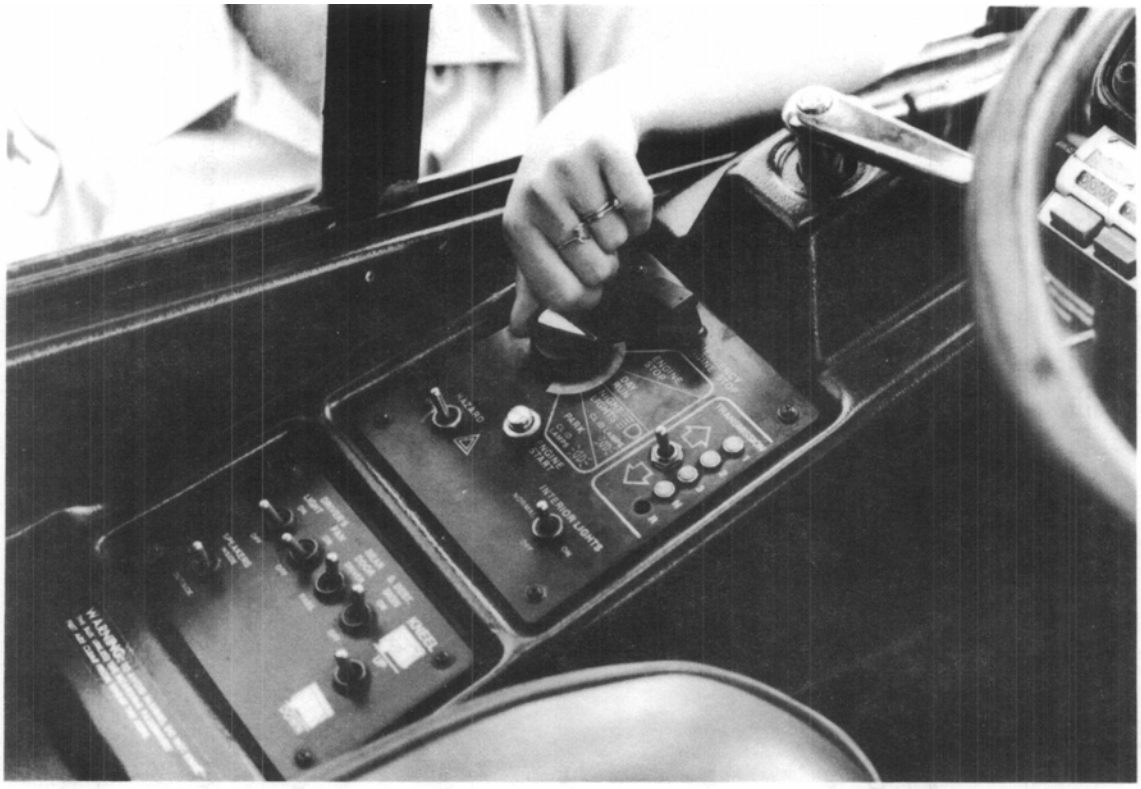
Despite some general consistencies, there are specific inherent safety problems associated with each of the buses for this device. Use of the Master Run Switch can be limited on any vehicle by locking driver's side windows. At many transit systems this switch remains easily accessible from outside only because locking mechanisms have been removed. Furthermore, some vehicles may not shut down if the transmission is in gear. In general, once the engine is shut down, there is a lack of consistency with respect to what electrical functions have actually been terminated and prevented. Indeed, the variety of electrical functions still available is dramatically different among the six buses. On a Neoplan model, for example, only the hazard warning system might still operate, while in the Ikarus the hazards, horn, interior lights, and stop request signs are still operable.

In addition, there is a particular concern which could seriously impact the performance and safety of emergency preparedness forces and passengers. If one or both of the side doors are open when someone shuts down the engine with the Master Run Switch, the side doors may then close in some cases. This is a particularly serious problem if someone is standing in or moving through the doorwell area or someone is on a stretcher or backboard being carried out through the doors. At a minimum this will hinder any evacuation efforts underway, and could potentially instigate passenger panic.

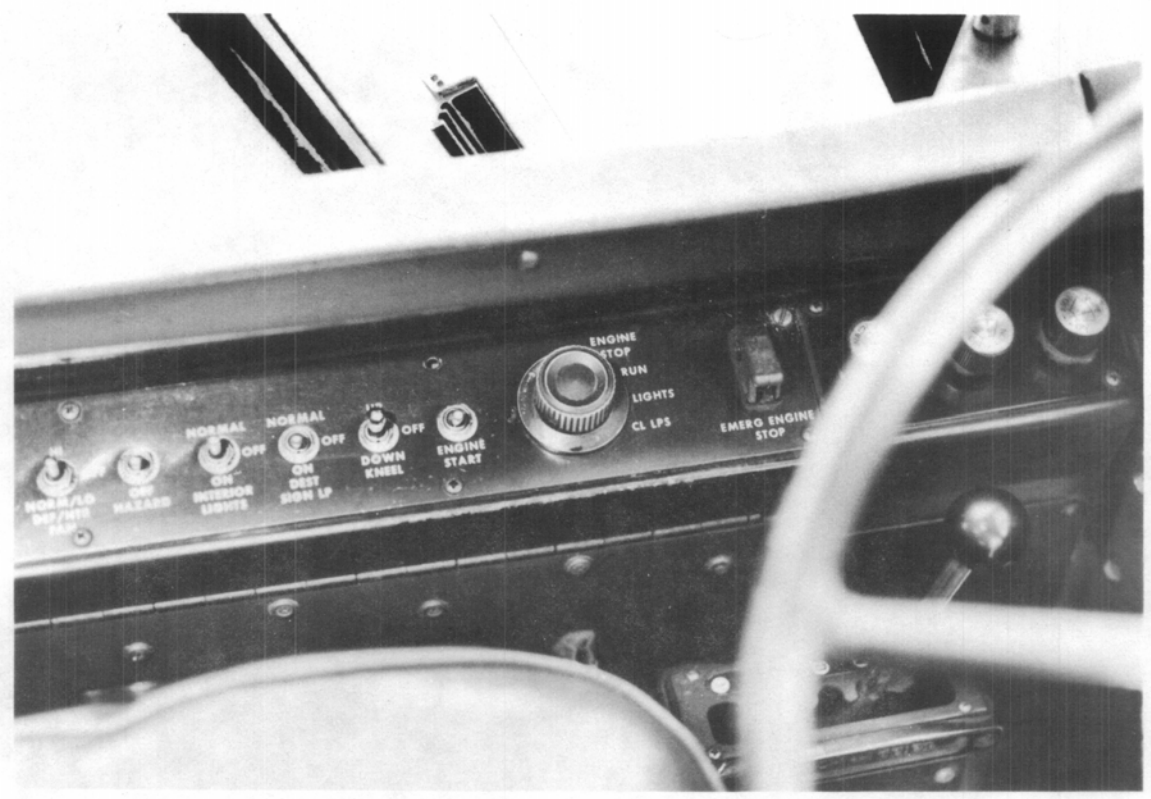
TABLE 2-1. SAFETY DEVICE: MASTER RUN SWITCH

URBAN TRANSIT BUS MODEL*	LOCATION	ACCESSIBLE FROM OUTSIDE OF COACH	EMERGENCY USE	FUNCTION	VEHICLE SPECIFIC SAFETY PROBLEM
FIxible	Directly to rear of door control handle	Yes	Reach in through sliding driver signal window and rotate counterclockwise to Engine Stop position	Shuts down engine	Only some electrical functions still operate
GMC (TMC) RTS	To rear of door control handle, near front of panel and directly adjacent to driver's signal window	Yes	Reach in through sliding half of driver signal window and rotate counterclockwise to Engine Stop position	Shuts down engine	Only some electrical functions still operate; if doors previously opened, they may close
Gillig Phantom	Directly forward of door control handle	Yes	Reach in through driver window and rotate counter-clockwise to Off position	Shuts down engine	May not shut down engine if transmission is in gear; only some electrical functions still operate, rear doors will lock
Ikarus USA Articulated	Directly to rear of door control handle	Yes	Reach in through forward/ sliding half of driver window and rotate counter-clockwise to Off position	Shuts down engine	Indicator is not obvious, making it difficult to tell position of switch; only some electrical functions still operate; if rear doors previously opened, they may close
Neoplan USA	Directly to rear of door control handle	Yes	Reach in through driver window and rotate counter-clockwise to Stop position	Shuts down engine	Only hazard warning system will operate; if doors previously opened, they may close
Orion	Directly to rear of door control handle	Yes	Reach in through sliding half of driver window and rotate counterclockwise to Engine Stop position	Shuts down engine	Only some electrical functions still operate; located below the window so difficult to see from outside

Specific bus models tested are detailed in Appendix A.

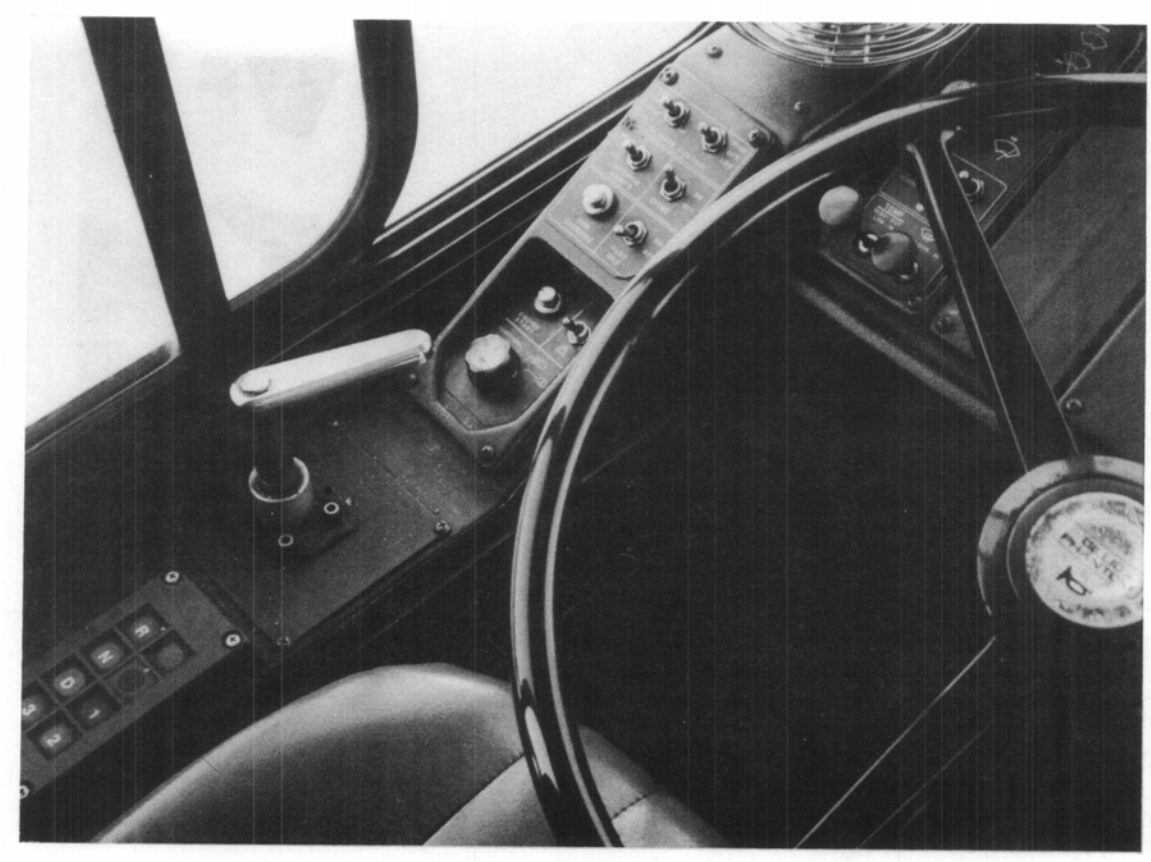


PHOTOGRAPH 2-1
FLXIBLE MODEL:
USING THE MASTER RUN SWITCH TO SHUT DOWN THE ENGINE



PHOTOGRAPH 2-2

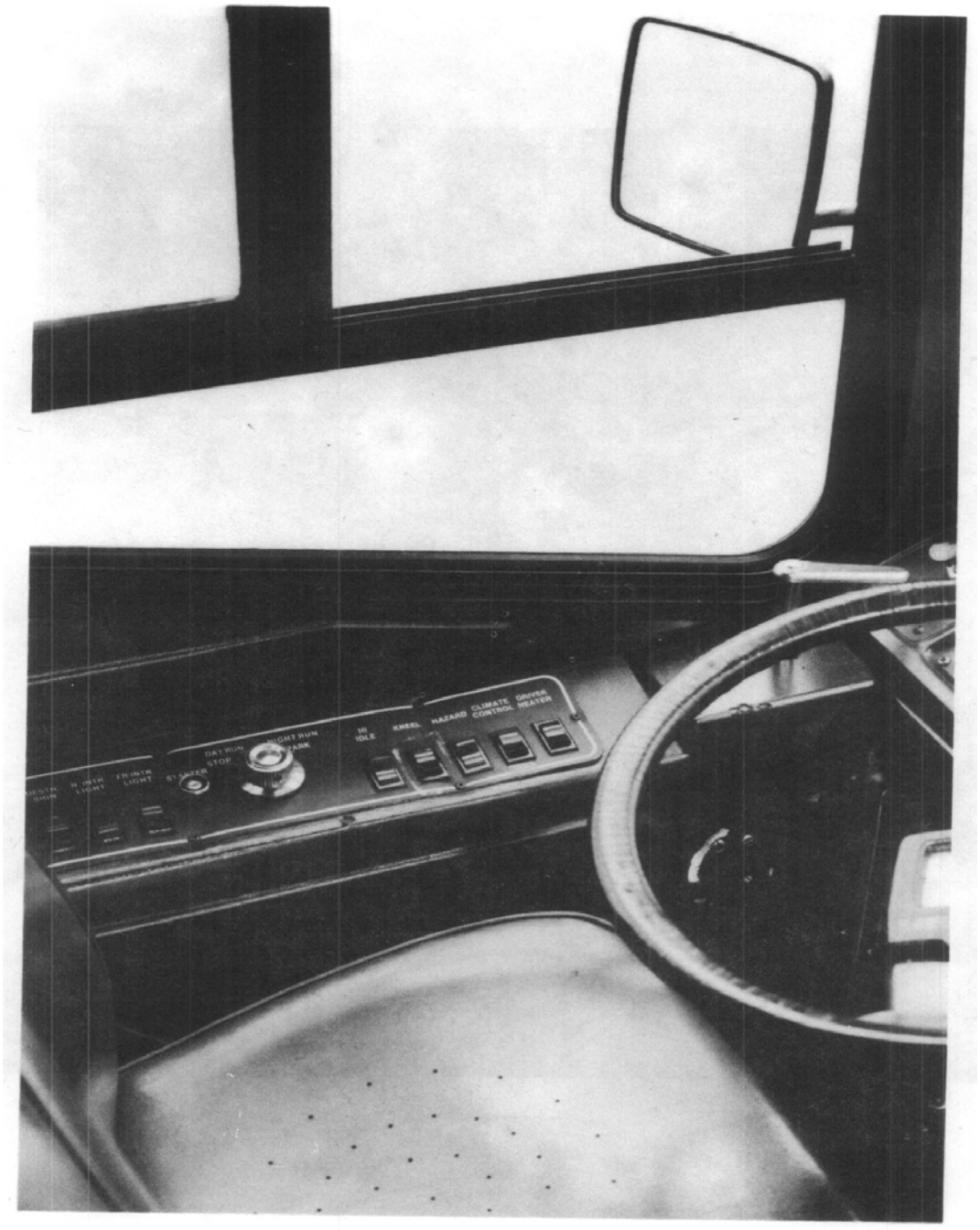
GMC RTS MODEL:
LOCATION OF MASTER RUN SWITCH ON LEFT SIDEWALL INSTRUMENT PANEL



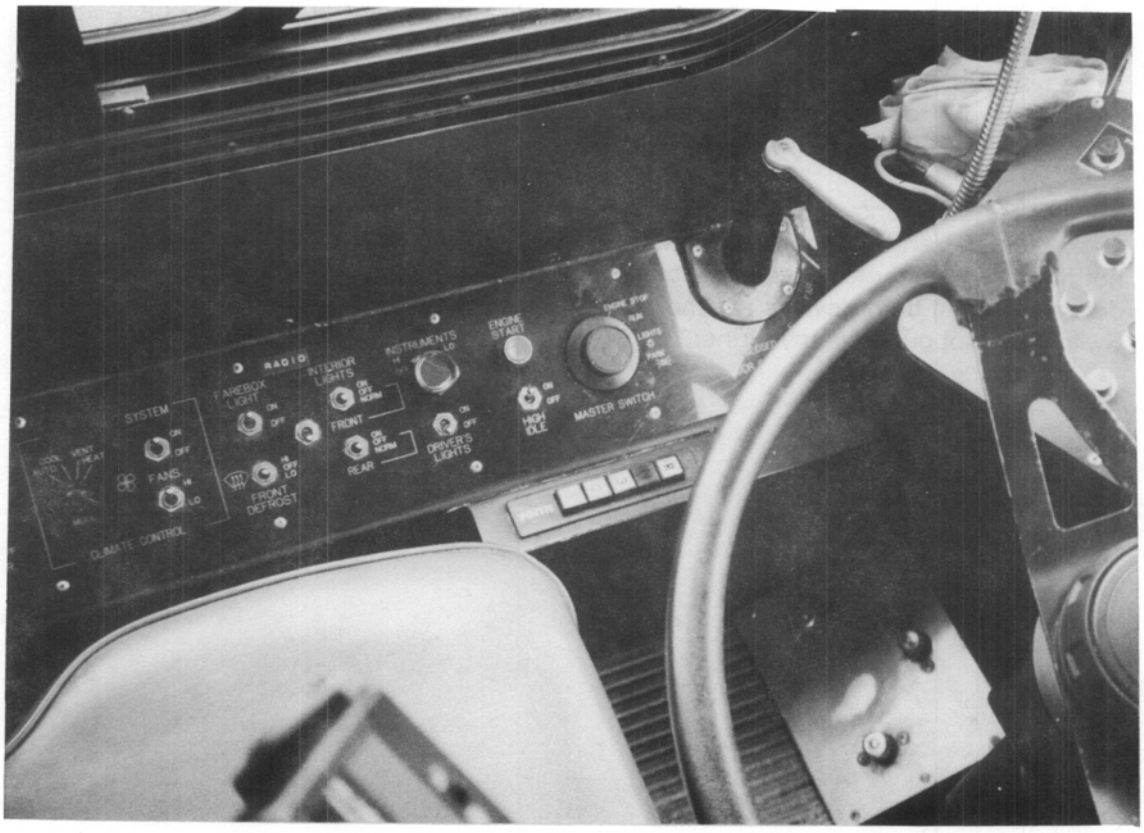
PHOTOGRAPH 2-3

GILLIG PHANTOM MODEL:
LOCATION OF MASTER RUN SWITCH ON LEFT SIDEWALL INSTRUMENT PANEL

PHOTOGRAPH 2-4
IKARUS USA ARTICULATED MODEL:
LOCATION OF MASTER RUN SWITCH ON LEFT SIDEWALL INSTRUMENT PANEL



PHOTOGRAPH 2-5
NEOPLAN USA MODEL:
LOCATION OF MASTER RUN SWITCH ON LEFT SIDEWALL INSTRUMENT PANEL



PHOTOGRAPH 2-6
ORION MODEL:
LOCATION OF MASTER RUN SWITCH ON LEFT SIDEWALL INSTRUMENT PANEL

2.2 EMERGENCY STOP SWITCH

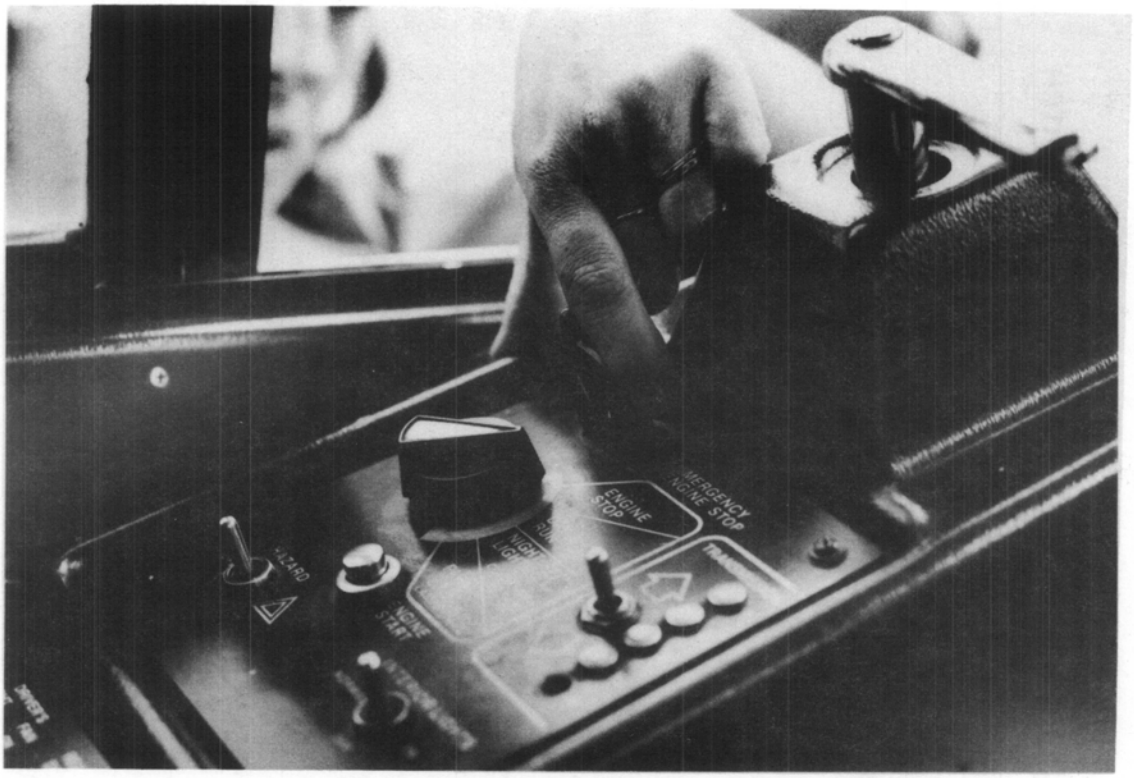
With respect to the driver's area Emergency Stop Switch, the Flxible, the GMC RTS, and Orion model coaches had similar devices which operate in a similar manner. They had no inherent safety problem other than the fact that most firemen wear gloves along with their normal bunker coats, helmets, pants, and boots, and such gloves are quite bulky and may cause difficulties in lifting the guard and pulling the Emergency Stop Switch lever (or pushing the switch rearward in the Orion model) until the engine stops. This information is summarized for each of the six buses in *Table 2-2,* followed by photographs for each of the three coaches equipped (*Photographs 2-7, 2-8, 2-9*) with a driver's area Emergency Stop Switch.

The Emergency Stop Switch generally works by releasing the cam on the air choke valve. Vehicles equipped with an electronic engine control system generally do not have this safety feature. In August, 1991 the Guidelines Development Committee determined that both devices are therefore essentially obsolete. The Emergency Stop Switch was not pursued any further

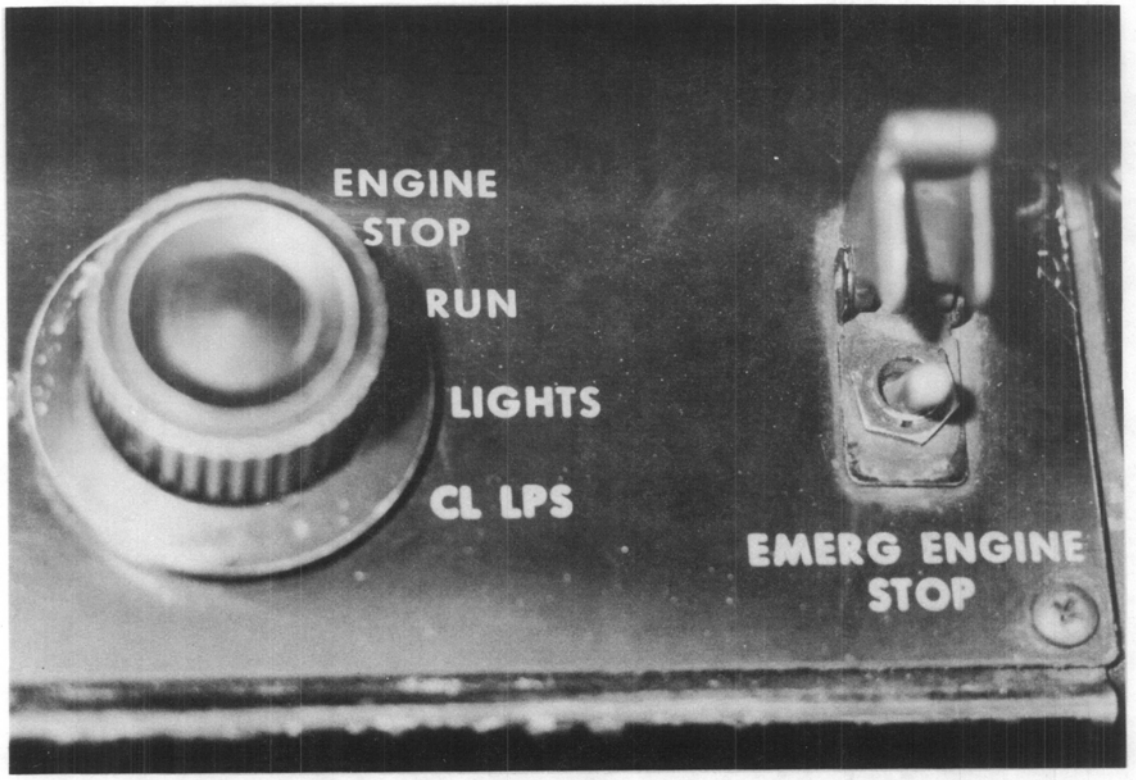
TABLE 2-2. SAFETY DEVICE: EMERGENCY STOP SWITCH

URBAN TRANSIT BUS MODEL*	LOCATION	ACCESSIBLE FROM OUTSIDE OF COACH	EMERGENCY USE	FUNCTION	VEHICLE SPECIFIC SAFETY PROBLEM
FIxible	Immediately forward of master run switch	Yes	Reach in through signal window, raise guard, pull lever toward you and hold until engine stops	Shuts down engine by releasing cam on air choke valve	Not available on all models; Switch must be held in position
GMC (TMC) RTS	Immediately forward of master run switch	Yes	Reach in through sliding half of driver signal window, lift protective cover, pull lever toward you and hold until engine stops	Shuts down engine by releasing cam on air choke valve	Switch must be held in position
Gillig Phantom	None	NA	NA	NA	No alternate means to shut down engine from driver's compartment
Ikarus USA Articulated	None	NA	NA	NA	No alternate means to shut down engine from driver's compartment
Neoplan USA	None	NA	NA	NA	No alternate means to shut down engine from driver's compartment
Orion	Rearward of master run switch near rear of driver's side control panel	Yes	Reach in through sliding half of driver window, raise protective cover, push switch rearward	Shuts down engine by releasing cam on air choke valve	Not available on all models; location may vary slightly among models; difficult to see and reach if rear half of driver window does not open; located next to identical looking switch (Emergency Brake Override switch which overrides rear door brake interlock and does not shut down engine)

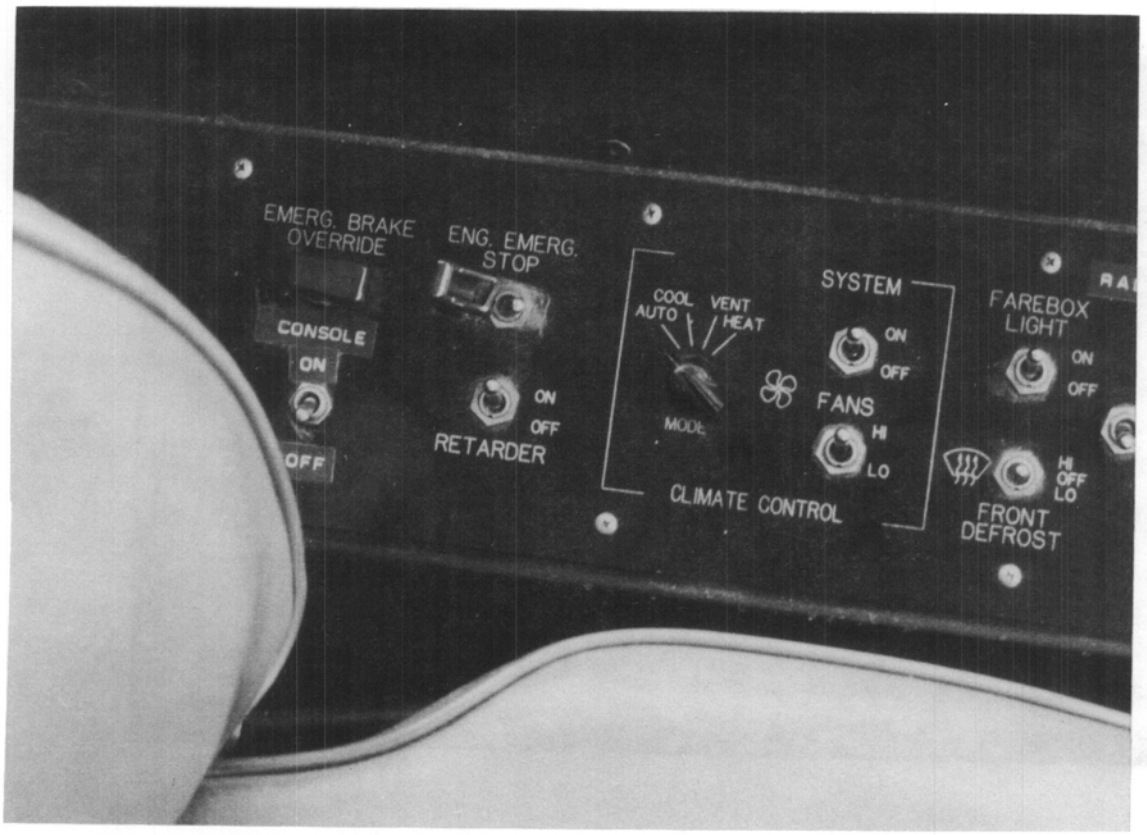
*: Specific bus models tested are detailed in Appendix A.



PHOTOGRAPH 2-7
FLXIBLE MODEL:
USING THE EMERGENCY ENGINE STOP SWITCH
IN THE OPERATOR'S COMPARTMENT



PHOTOGRAPH 2-8
GMC RTS MODEL:
FIRST STEP IN USE OF EMERGENCY ENGINE STOP SWITCH
IN THE OPERATOR'S COMPARTMENT



PHOTOGRAPH 2-9
ORION MODEL:
EMERGENCY STOP SWITCH ON OPERATOR'S LEFT SIDEWALL
INSTRUMENT PANEL

2.3 ENGINE COMPARTMENT STOP SWITCH

Each of the six coaches contains a Stop Switch located in the Engine Compartment. The summary information for the Engine Compartment Stop Switch for the six bus models is shown in *Table 2-3,* and each is shown in *Photographs 2-10* through *2-15.*

Normally used for maintenance, there is a great deal of inconsistency with regard to location, orientation, and use of the switch. In one, the switch box is located in the upper left corner of the engine compartment, in three others, it is located in the upper right corner, in another it is on the right side, and in another it is located in the upper right of center. Two switch panels often face to the right (Flxible and Neoplan) and four face the user (GMC RTS, Gillig, Ikarus, and Orion). In three cases the middle switch on the switch box is used to shut down the engine and in two others it is the right-most switch. Three require a rescuer to push the switch down to a horizontal position while two require the rescuer to push the switch up to a horizontal position. Furthermore, the labeling for this device is often confusing and inconsistent among vehicles. The Engine Compartment Stop Switch on the Gillig was found to be completely non-functional as an emergency item, as the Ignition/Off switch will only shut down the engine if it was started from the engine compartment controls — a condition which is unlikely at a post-accident scene.

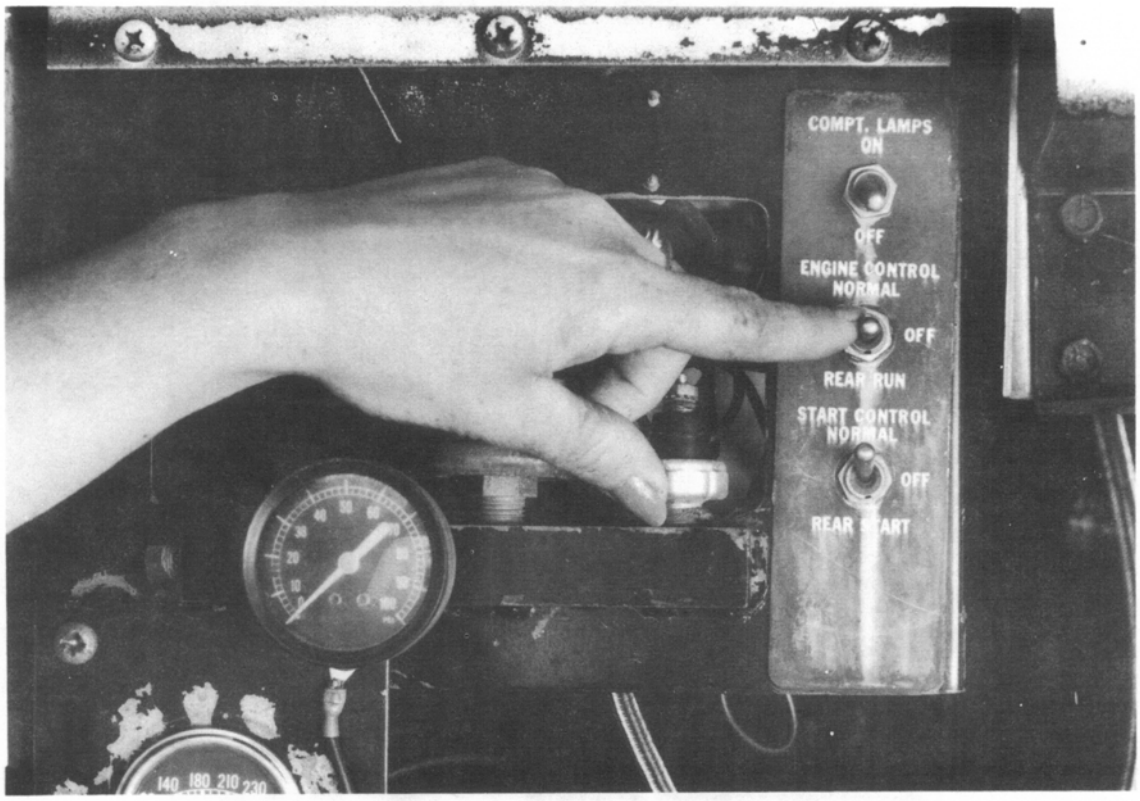
With some Flxible coaches the box faces to the right which causes a rescuer to get rather close to the engine in order to see the location of the lever switch and to activate it. This is also the case with Neoplan models, however, the Neoplan Engine Compartment Stop Switch is located in a box very close to and facing the right wall of the coach. This position makes it extremely difficult to find the location of the switch and to activate it. In addition, on the Neoplan model, there is an exposure potential to the various belts, pulleys, and hot surfaces that is not existent with the other coaches.

TABLE 2-3. SAFETY DEVICE: ENGINE COMPARTMENT STOP SWITCH

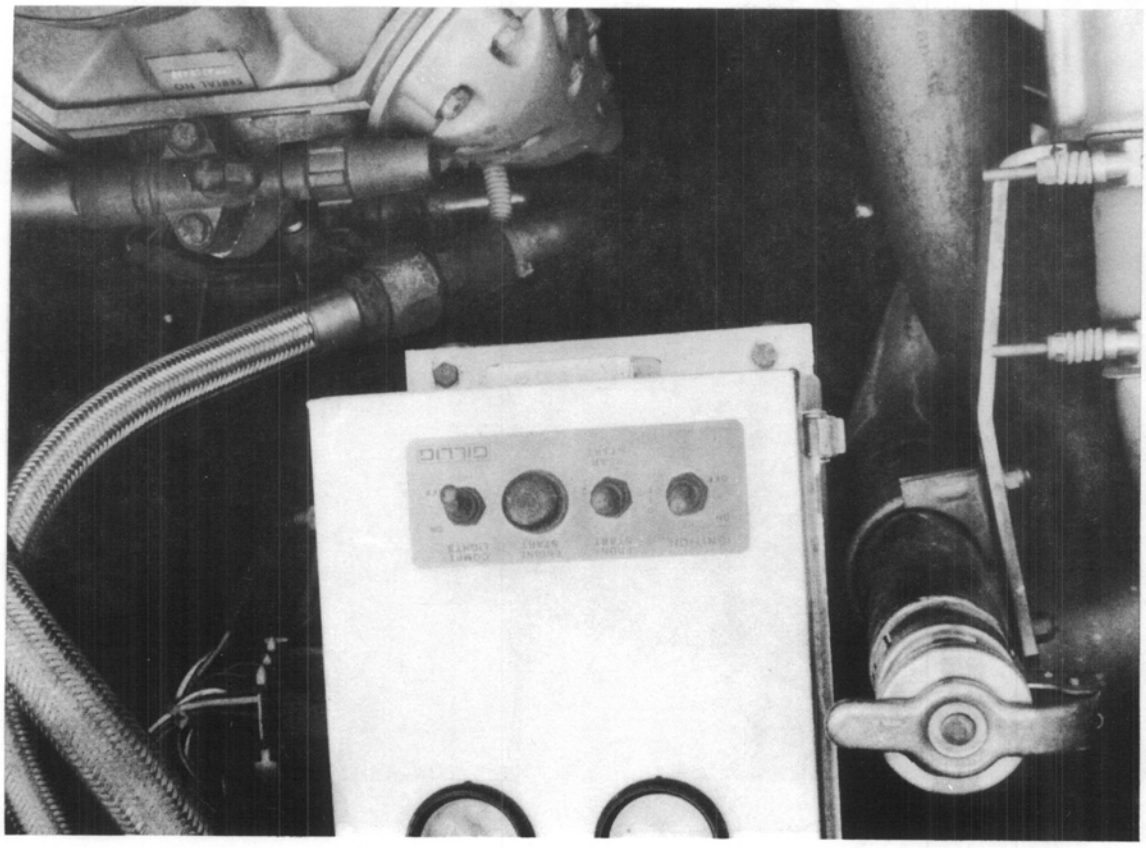
URBAN TRANSIT BUS MODEL*	LOCATION	ACCESSIBLE FROM OUTSIDE OF COACH	EMERGENCY USE	FUNCTION	VEHICLE SPECIFIC SAFETY PROBLEM
Flxible	Left upper corner of engine compartment faces to right; or upper center of engine compartment, faces user	Yes	Lift engine access door, move middle switch down to horizontal position	Shuts down engine	If faces to right, individual must get close to engine, hard to see
GMC (TMC) RTS	Upper right of center of engine compartment, faces user	Yes	Lift engine access door, move middle switch down to horizontal position	Shuts down engine	None
Gillig Phantom	Right upper corner of engine compartment, faces user	Yes	Not useful	Not functional	Engine cannot be shut down from engine compartment if started by driver
Ikarus USA Articulated	Right side of engine compartment, faces user	Yes	Lift engine access door, move rightmost switch up to stop position and hold	Shuts down engine	Engine Stop switch may be confused with Engine Run Off switch, must be held in position until engine stops; switch appears to be in Engine Stop position when in Run due to position of switch label
Neoplan USA	Right upper corner or upper center of engine compartment, faces to right	Yes	Lift engine access door, move middle switch up to horizontal position	Shuts down engine	Faces to right, individual must get close to engine, very hard to see between engine control box and right wall, exposure to belts and pulleys
Orion	Right upper corner of engine compartment, faces user	Yes	Lift engine access door, move lower right switch down to horizontal position	Shuts down engine	None

*: Specific bus models tested are detailed in Appendix A.

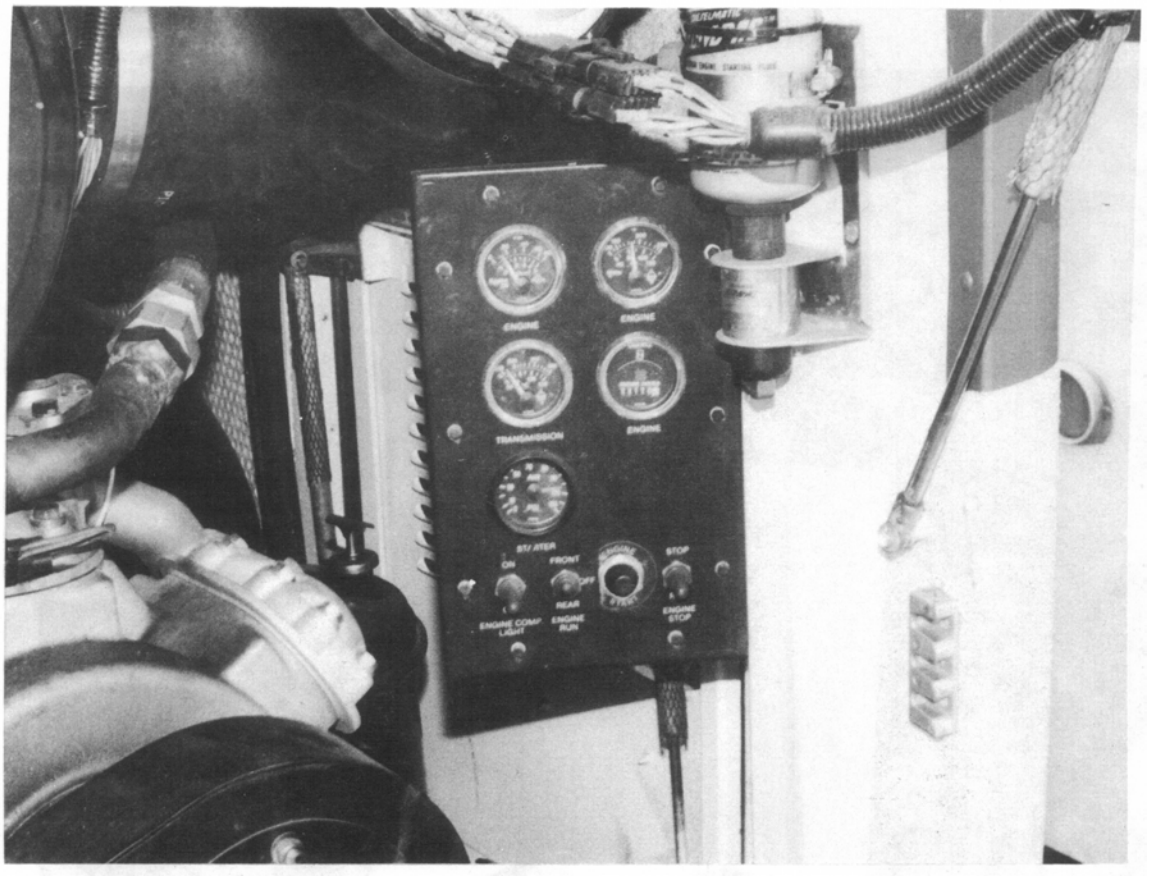
PHOTOGRAPH 2-10
FLXIBLE MODEL:
ENGINE COMPARTMENT CONTROL BOX CONTAINING ENGINE STOP SWITCH



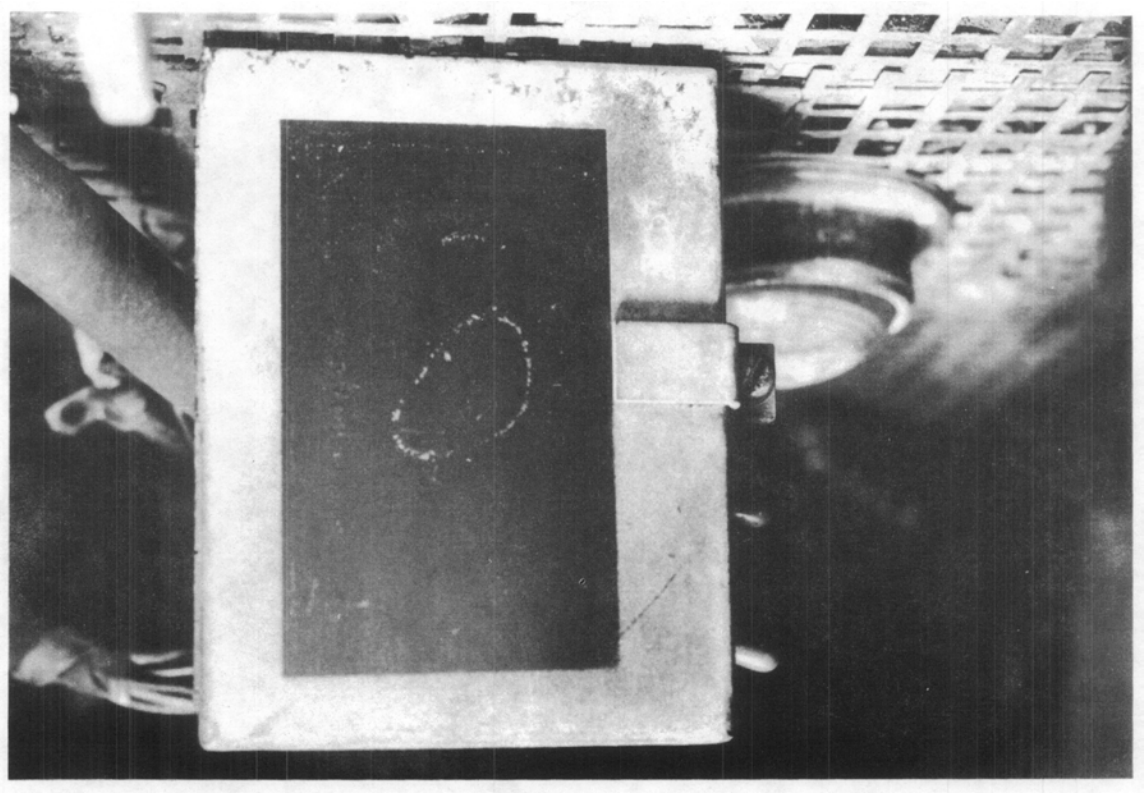
PHOTOGRAPH 2-11
GMC RTS MODEL:
CLOSE-UP OF CONTROL BOX IN ENGINE COMPARTMENT
CONTAINING ENGINE STOP SWITCH



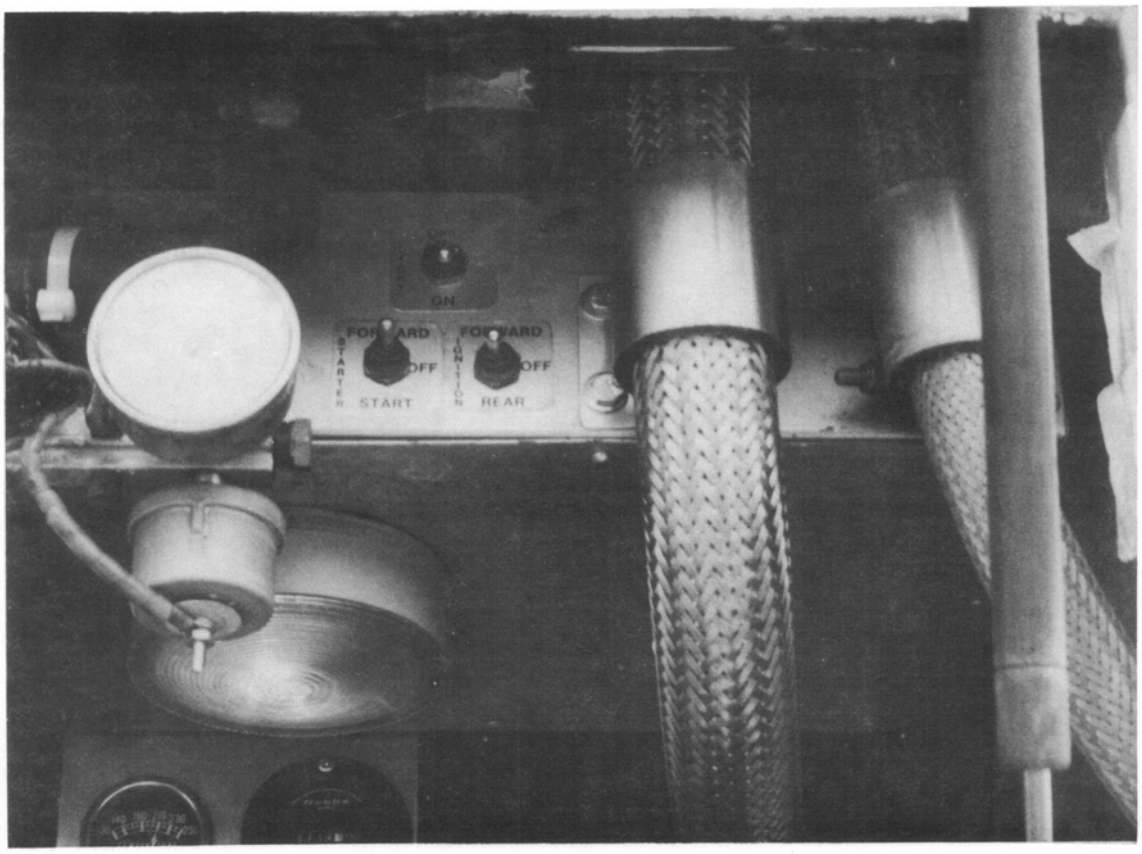
PHOTOGRAPH 2-12
GILLIG PHANTOM MODEL:
ENGINE COMPARTMENT CONTROL BOX CONTAINING
ENGINE REAR RUN SWITCHES



PHOTOGRAPH 2-13
IKARUS USA ARTICULATED MODEL:
ENGINE COMPARTMENT CONTROL BOX
CONTAINING ENGINE STOP SWITCH



PHOTOGRAPH 2-14
NEOPLAN USA MODEL:
CLOSE-UP OF CONTROL BOX IN ENGINE COMPARTMENT
CONTAINING ENGINE STOP SWITCH



PHOTOGRAPH 2-15
ORION MODEL:
ENGINE COMPARTMENT CONTROL BOX
CONTAINING ENGINE STOP SWITCH

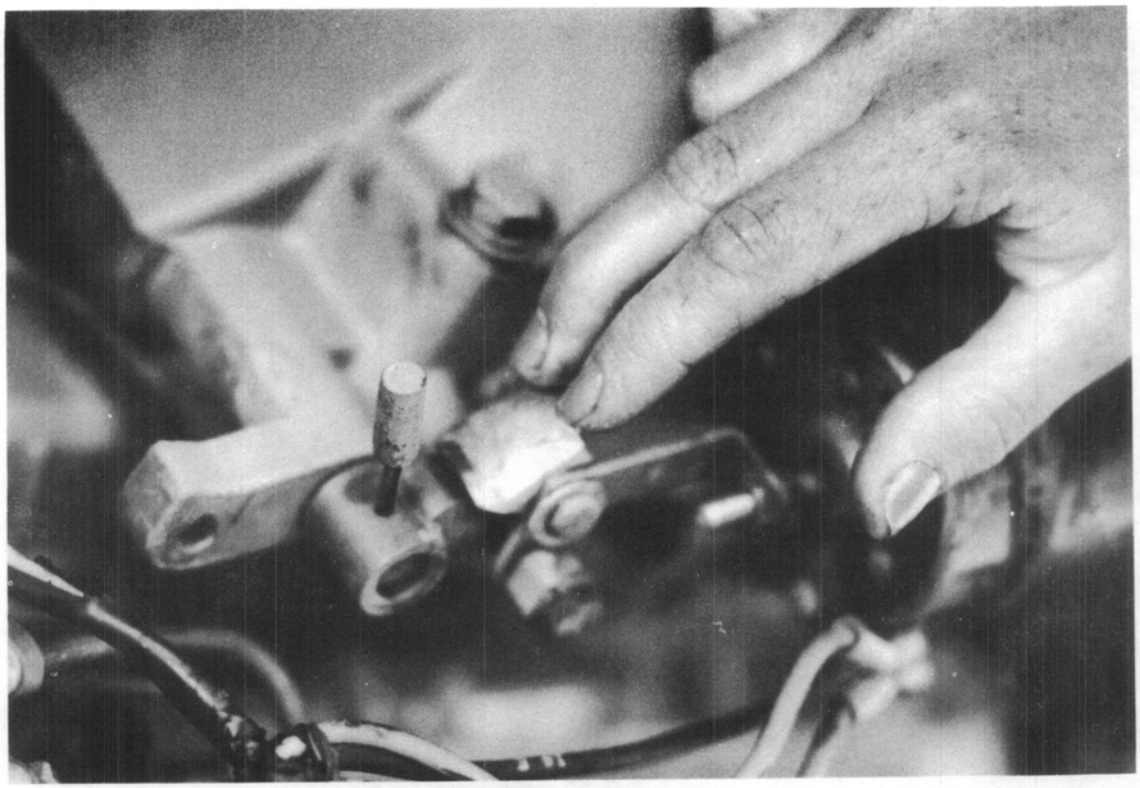
2.4 ENGINE STOP SOLENOID PLUNGER

Four of the bus models were equipped with an emergency Engine Stop Solenoid Plunger, located on the engine itself, which shuts down the engine by depriving the engine of air. In the case of the Flxible, GMC RTS, and Orion model coaches, it is accessible to rescuers. In contrast, with the Neoplan, it is virtually inaccessible. Indeed, with the Neoplan, it is advisable to not even show rescuers the location of the device in training since reaching to activate the device exposes them to moving belts, pulleys, hot surfaces, and other extreme hazards even if the rescuer tries to use a probe device. Except on the Orion, there is no label or color indicator, or any other device which would help a rescuer to find the solenoid. Summary information for the Engine Stop Solenoid Plunger for each bus model is shown in *Table 2-4,* followed by photographs of each of the four vehicles equipped with this device *(Photographs 2-16* to *2-19).* As most electronically controlled engines do not need this device, it was later determined to be obsolete and inappropriate for standardization. The Engine Stop Solenoid Plunger was not pursued any further.

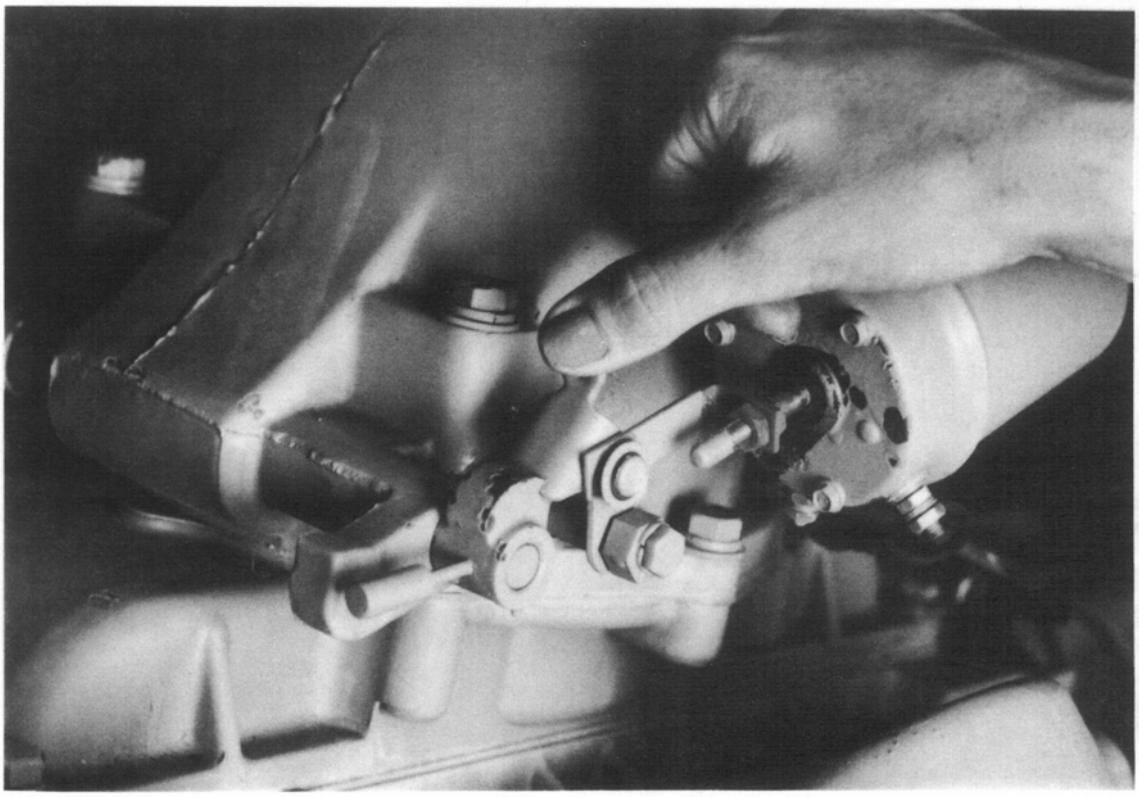
TABLE 2-4. SAFETY DEVICE: EMERGENCY STOP SOLENOID PLUNGER

URBAN TRANSIT BUS MODEL*	LOCATION	ACCESSIBLE FROM OUTSIDE OF COACH	EMERGENCY USE	FUNCTION	VEHICLE SPECIFIC SAFETY PROBLEM
FIxible	Center of engine compartment on engine	Yes	Lift engine access door, push down and right on choke cam tab	Shuts down engine by depriving engine of air	No label or color indicator, individual must get close to engine; not available on all engines
GMC (TMC) RTS	Center of engine compartment on engine	Yes	Lift engine access door, push down and right on choke cam tab	Shuts down engine by depriving engine of air	No label or color indicator, individual must get close to engine
Gillig Phantom	None	NA	NA	NA	No mechanical means to shut down computer-controlled engine
Ikarus USA Articulated	None	NA	NA	NA	No mechanical means to shut down engine
Neoplan USA	At top and rear of engine, if so equipped	Yes, but with great difficulty and danger	Lift engine access door, use long probe to push down on choke cam tab	Shuts down engine by depriving engine of air	Exposes individual to belts and pulleys, hot surfaces; impossible to use hand; very difficult to use probe, user must get close to engine
Orion	Center of engine compartment on engine	Yes	Lift engine access door, push down and right on choke cam tab	Shuts down engine by depriving engine of air	No label, individual must reach around hot surfaces

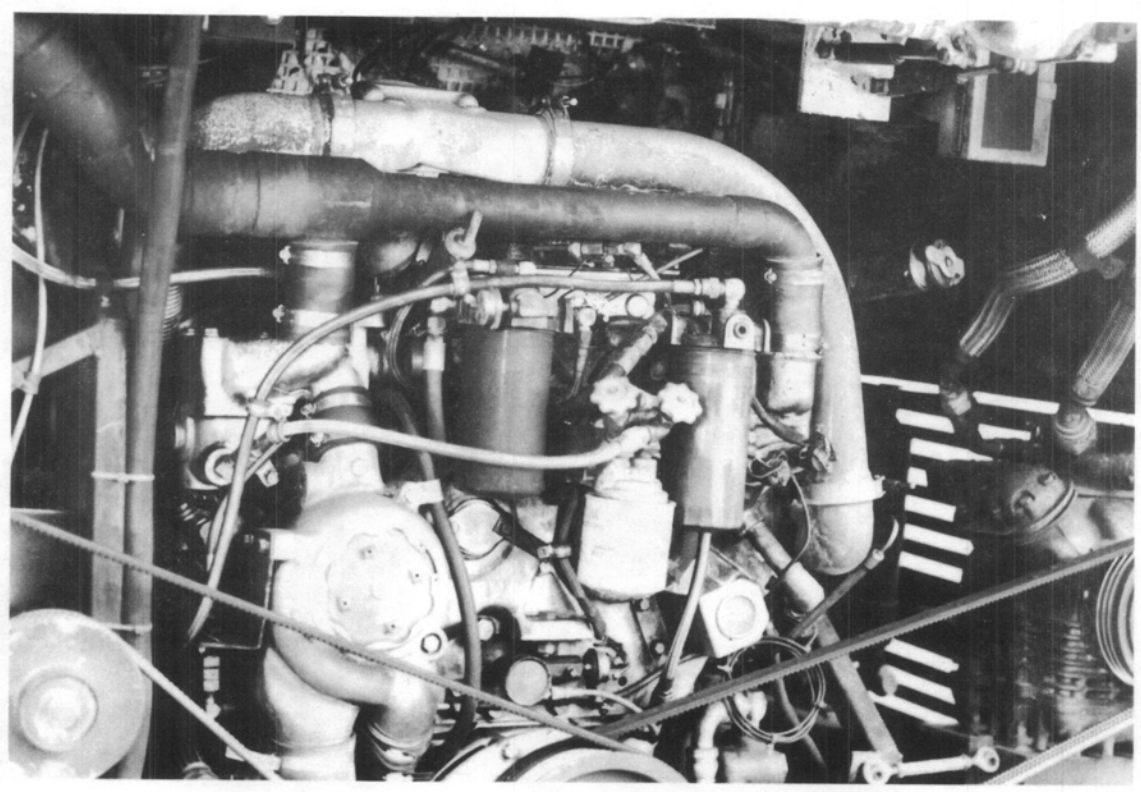
*: Specific bus models tested are detailed in Appendix A.



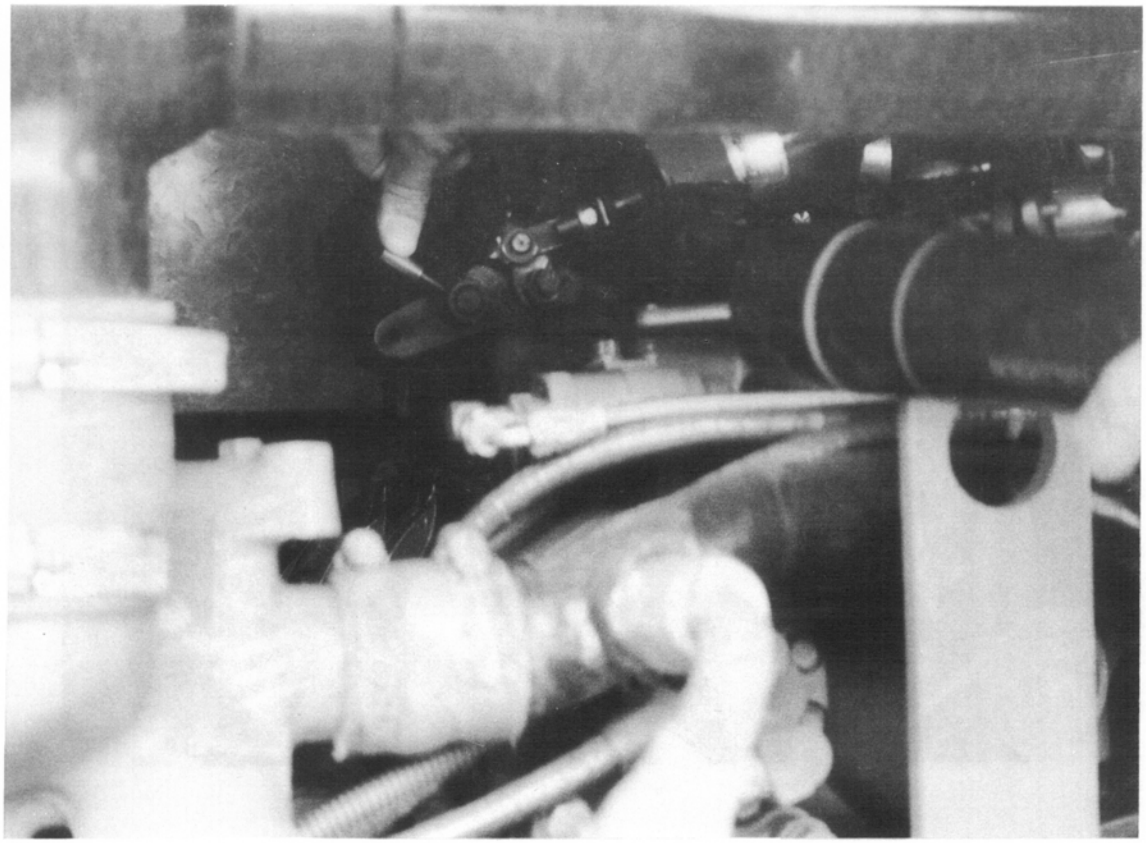
PHOTOGRAPH 2-16
FLXIBLE MODEL:
CLOSE-UP OF EMERGENCY STOP SOLENOID PLUNGER
IN ENGINE COMPARTMENT IN STOP POSITION



PHOTOGRAPH 2-17
GMC RTS MODEL:
CLOSE-UP OF EMERGENCY STOP SOLENOID PLUNGER
IN ENGINE COMPARTMENT IN RUN POSITION



PHOTOGRAPH 2-18
NEOPLAN USA MODEL:
ENGINE COMPARTMENT: NOTE LIMITATIONS OF ACCESS TO EMERGENCY STOP SOLENOID PLUNGER



PHOTOGRAPH 2-19
ORION MODEL:
EMERGENCY STOP SOLENOID PLUNGER IN ENGINE COMPARTMENT
IN RESET POSITION

2.5 ROOF ESCAPE (INGRESS) HATCH

A summary of information concerning the Roof Escape (Ingress) Hatch is shown in *Table 2-5.*

In each of the six coach models the Transpec roof escape (ingress) hatch is installed. In many cases, there may only be one hatch present, as seen in *Photograph 2-20.* In some cases, the GMC RTS model for example *(Photographs 2-21, 2-22*), a separate non-Transpec hatch may also be present. Many of these additional hatches are typically very difficult if not impossible to open from outside the coach. On other models the second hatch may only provide a ventilator function.

In order for rescuers to use the Transpec hatch as an emergency ingress point, they must be taught how to pull the hatch up to its full ventilation position along with how to reach under the hatch and how to release it by pulling the black tab to the side and pushing upwards on the white handle surrounding the black tab *(Photograph 2-23).* The whole procedure can often, with practice, be done in less than a minute and without any damage to the hatch or the coach. The Transpec hatches are felt to be reasonably inexpensive compared to the value of their function. Other model hatches have an entirely different release mechanism. Without labeling, practice, or knowledge of the hatch release mechanisms, opening the hatch from outside can be a difficult and time-consuming task.

One of the problems experienced in working with a variety of coaches is that the placement of the hatch's release mechanism (for example, oriented to the rear of the coach) is not consistent. It is not uncommon for vehicles to have the release mechanism on the street side (as seen in *Photograph 2-24),* the curb side, or on the forward side of the hatch itself. A trained fireman may be able to lift the hatch to the full ventilation position and often release it in less than a minute, as long as the latch is consistently located. However, if it is not where the rescuer expects it to be, valuable time could be lost while the rescuer struggles (with bulky gloves on) with the device, without being able to see to the latch mechanism. It was apparent that, in each vehicle, the orientation of the hatch should be consistent and oriented as indicated by the manufacturer.

Views of the standard Transpec roof escape (ingress) hatches are shown in *Photographs 2-25* and *2-26*. Transpec has more recently introduced a significantly different release mechanism for the vent emergency exit. This new version is somewhat simpler to use; however, this slight variation significantly increases the knowledge required of emergency response personnel. New models also have an optional exterior release. The new release mechanism enables one to imagine the potential complications of multiple manufacturers with various models.

TABLE 2-5. SAFETY DEVICE: ROOF ESCAPE (INGRESS) HATCH: TRANSPEC

URBAN TRANSIT BUS MODEL*	LOCATION	ACCESSIBLE FROM OUTSIDE OF COACH	EMERGENCY USE**	FUNCTION	VEHICLE SPECIFIC SAFETY PROBLEM
Flxible	In roof near rear of coach, may have second near front	Yes	Pull hatch upward to full ventilation position, release black tab by pulling to side of hatch, push upwards on white handle surrounding black tab, or break supports	To gain entry to interior, to remove passengers	Not always installed in correct orientation, may only be one hatch, method of use will vary on newer Transpec models
GMC (TMC) RTS	In roof near rear of coach, may have second near front or a second non-Transpec hatch	Transpec Yes Other Hatch often No	Pull hatch upward to full ventilation position, release black tab by pulling to side of hatch, push upwards on white handle surrounding black tab; or break supports	To gain entry to interior, to remove passengers	Not always installed in correct orientation, may only be one hatch, second hatch may not open from outside, method of use will vary on newer Transpec models
Gillig Phantom	In roof near rear of coach, second near front	Yes	Pull hatch upward to full ventilation position, release black tab by pulling to side of hatch, push upwards on white handle surrounding black tab; or break supports	To gain entry to interior, to remove passengers	Not always installed in correct orientation, method of use will vary on newer Transpec models
Ikarus USA Articulated	In roof near rear of coach, second near front; also in center on articulated models	Yes	Pull hatch upward to full ventilation position, release black tab by pulling to side of hatch, push upwards on white handle surrounding black tab; or break supports	To gain entry to interior, to remove passengers	May not be installed in correct orientation; method of use will vary on newer Transpec models

TABLE 2-5. SAFETY DEVICE: ROOF ESCAPE (INGRESS) HATCH: TRANSPEC (CONTINUED)

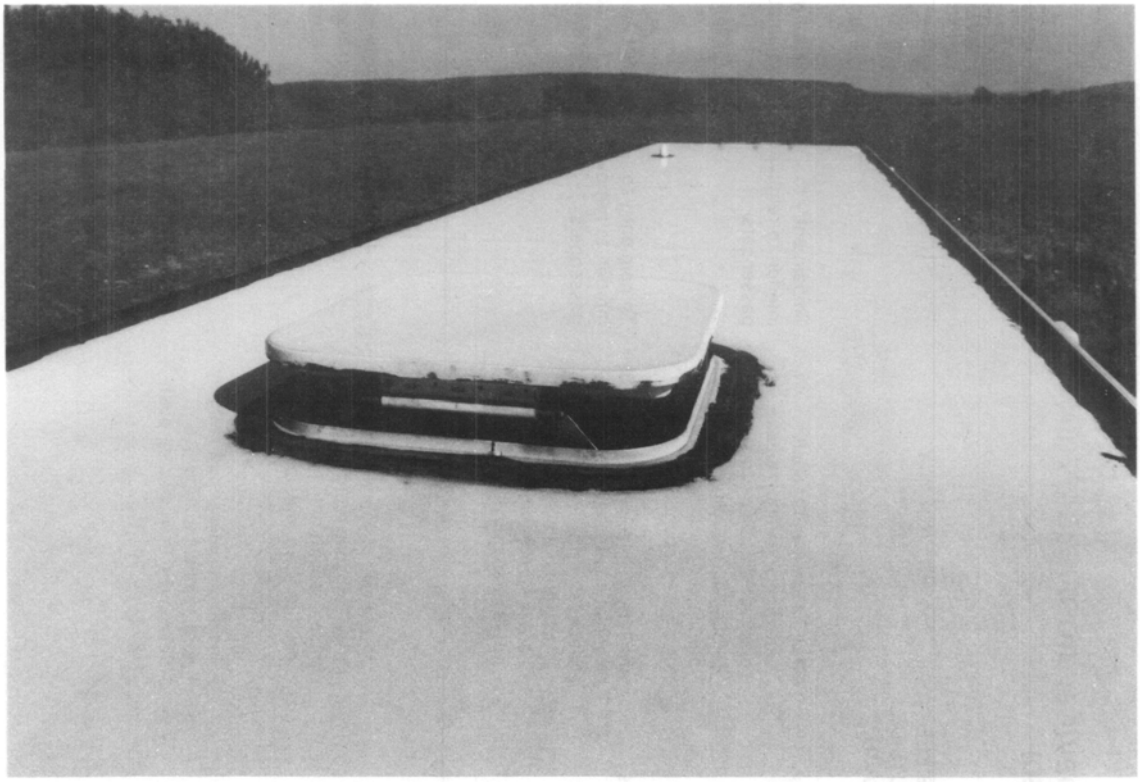
URBAN TRANSIT BUS MODEL*	LOCATION	ACCESSIBLE FROM OUTSIDE OF COACH	EMERGENCY USE**	FUNCTION	VEHICLE SPECIFIC SAFETY PROBLEM
Neoplan USA	In roof near rear of coach, may have second near front	**Yes**	Pull hatch upward to full ventilation position, release black tab by pulling to side of hatch, push upwards on white handle surrounding black tab; or break supports	To gain entry to interior, to remove passengers	Not always installed in correct orientation, may only be one hatch, method of use will vary on newer Transpec models
Orion	In roof near rear of coach (rearward of rear door), second near front (just rearward of standee line)	**Yes**	Pull hatch upward to full ventilation position, release black tab by pulling to side of hatch, push upwards on white handle surrounding black tab; or break supports	To gain entry to interior, to remove passengers	Not always installed in correct orientation, method of use will vary on newer Transpec models

NOTES:

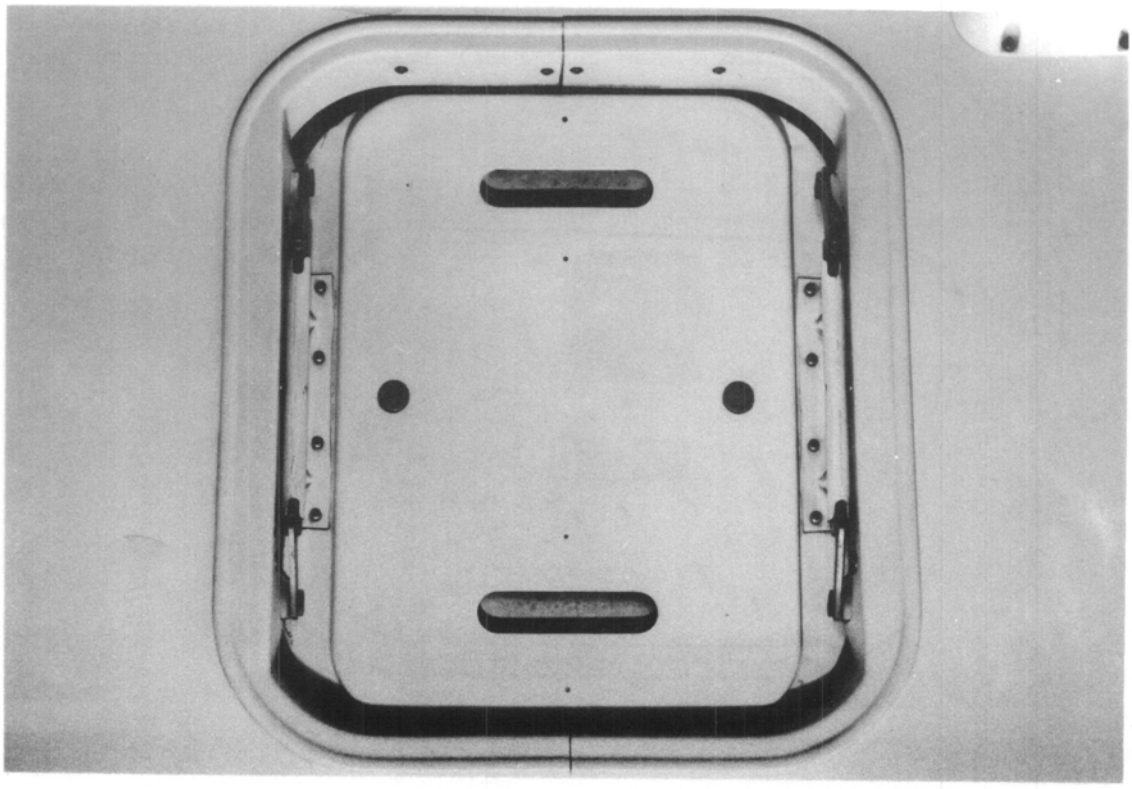
* Specific bus models tested are detailed in Appendix A.

** Method of use will vary on new Transpec models, pull hatch upward to full ventilation position, from outside turn red knob counterclockwise to unlock, pull knob up; or reach inside and release red knob by turning counterclockwise (clockwise from inside), push red knob up

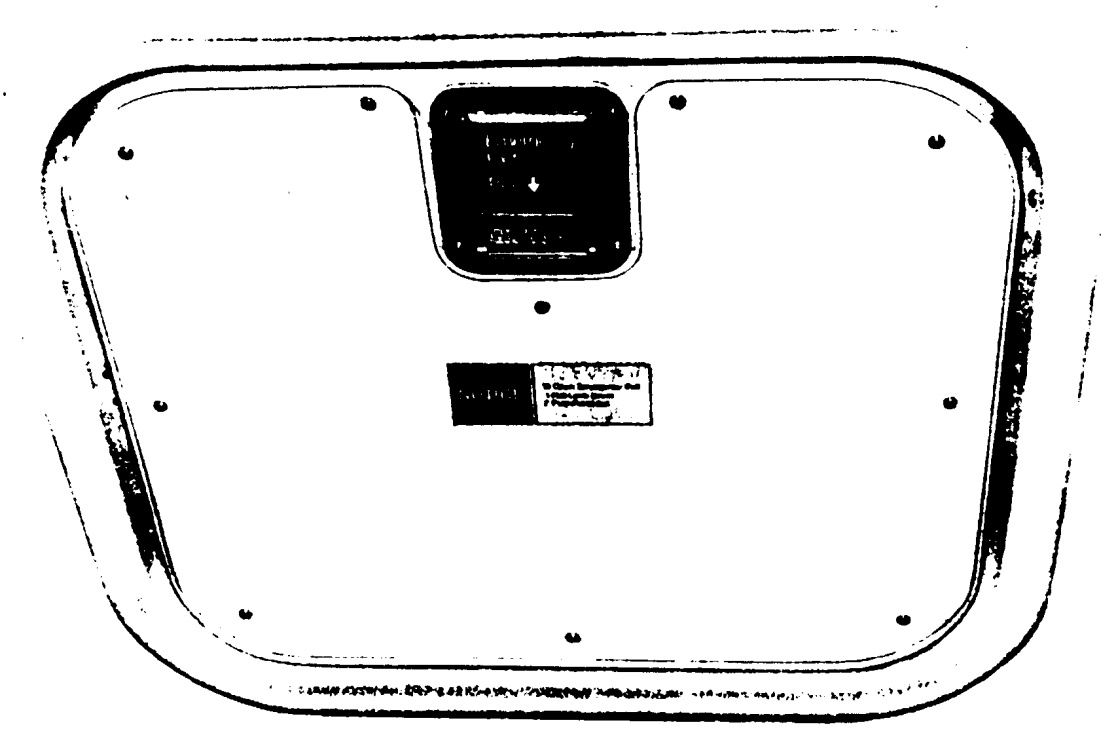
On newer Transpec models outside release is optional, instructions may wear off



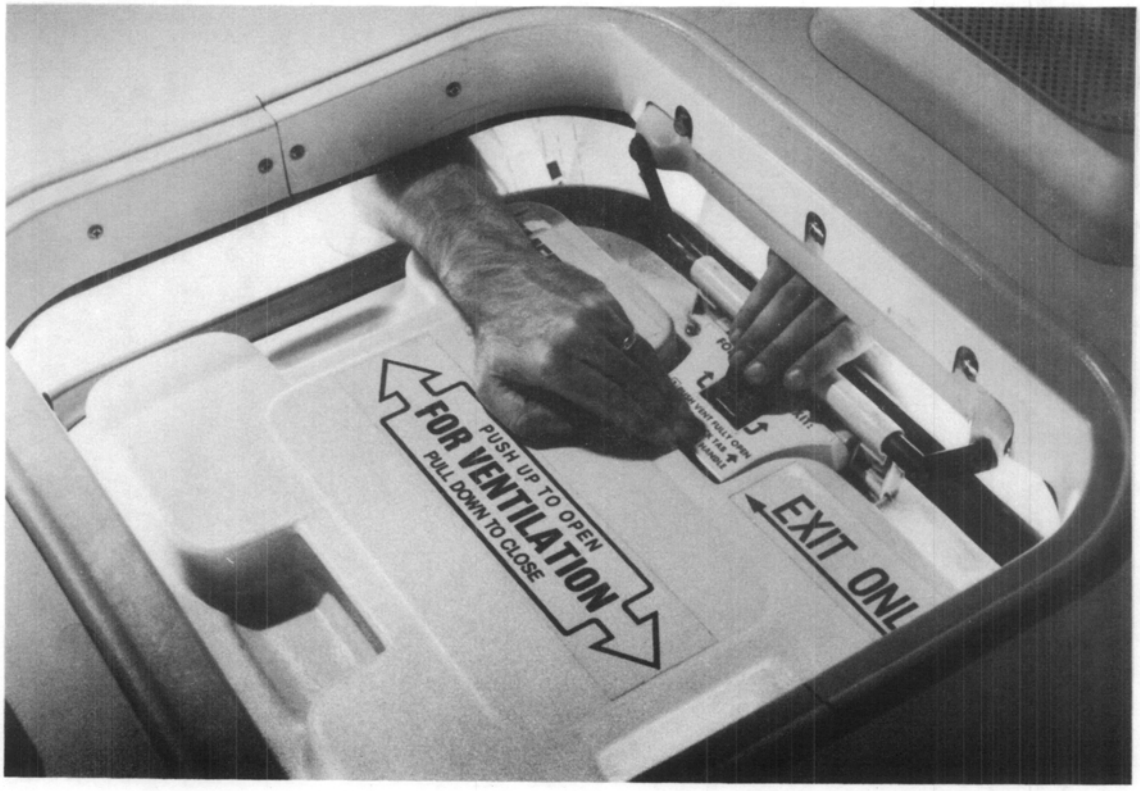
PHOTOGRAPH 2-20
FLXIBLE MODEL:
EXTERIOR VIEW OF SINGLE ROOF ESCAPE (INGRESS) HATCH



PHOTOGRAPH 2-21
GMC RTS MODEL:
INTERIOR VIEW OF ALTERNATIVE VENTILATION HATCH
IN CLOSED POSITION

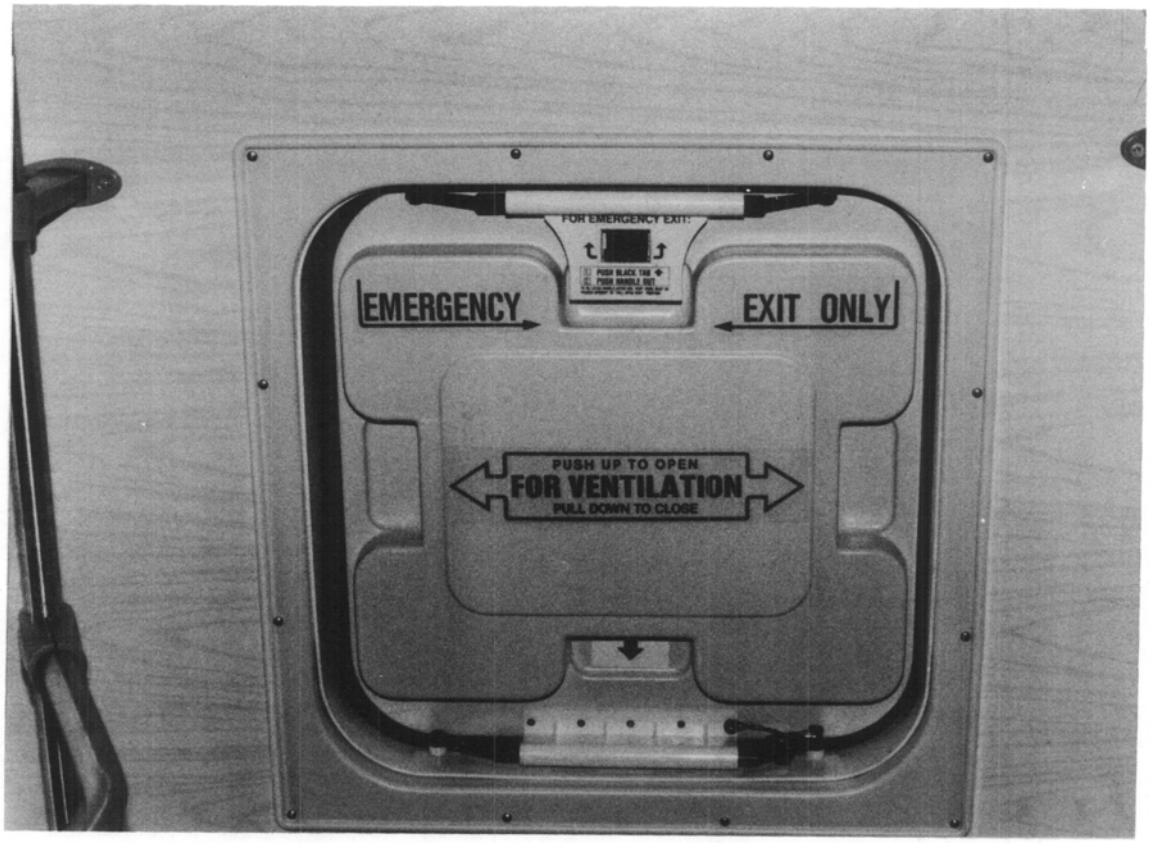


PHOTOGRAPH 2-22
GMC RTS MODEL:
INTERIOR VIEW OF ALTERNATIVE ROOF ESCAPE HATCH
IN CLOSED POSITION

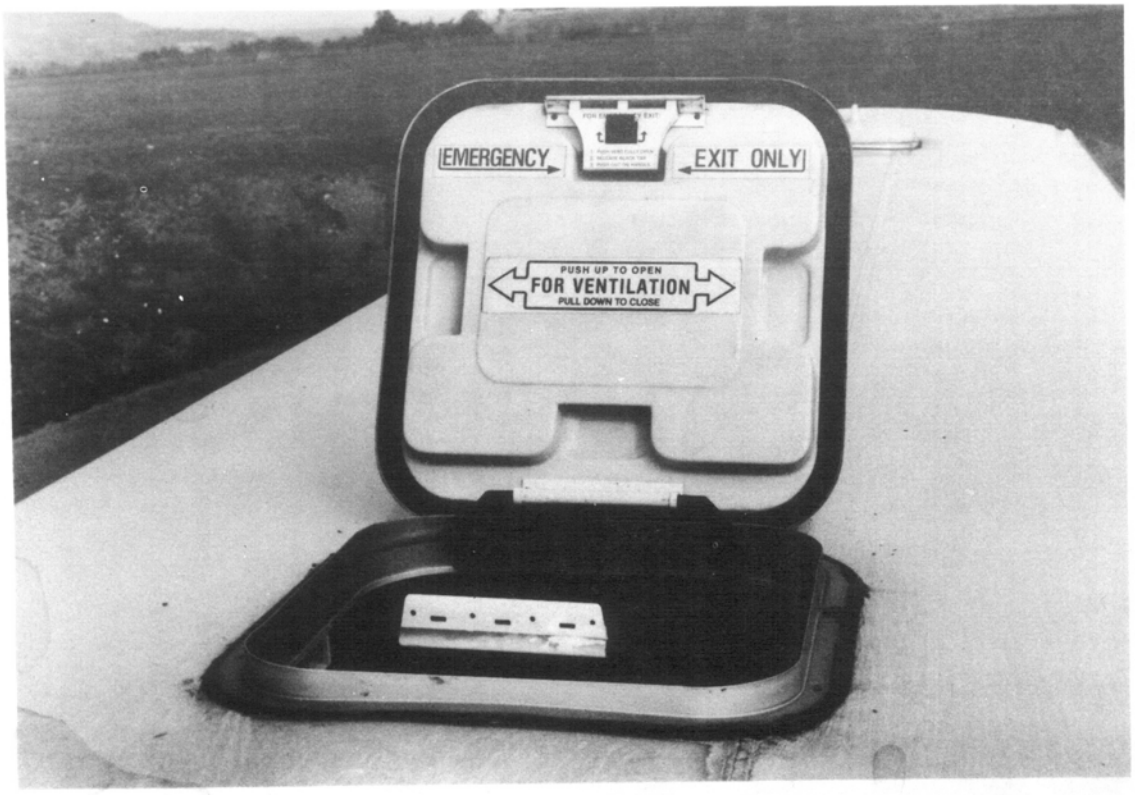


PHOTOGRAPH 2-23
GMC RTS MODEL:
RELEASE OF TRANSPEC ROOF ESCAPE (INGRESS) HATCH FROM OUTSIDE

PHOTOGRAPH 2-24
GMC RTS MODEL:
INTERIOR VIEW OF ROOF ESCAPE (INGRESS) HATCH
WITH STREET SIDE ORIENTATION



PHOTOGRAPH 2-25
IKARUS USA ARTICULATED MODEL:
INTERIOR VIEW OF TRANSPEC ROOF ESCAPE (INGRESS) HATCH



PHOTOGRAPH 2-26
NEOPLAN USA MODEL:
FULLY OPENED TRANSPEC ROOF ESCAPE (INGRESS) HATCH

2.6 DRIVER WINDOW AS INGRESS

Since the door control handle, the Master Run Switch, the Emergency Stop Switch, and in some cases the Driver's Area Door Dump Valve or Switch are all located in the operator's area, it is important that the driver's side window be useful as an ingress point.

In the case of the GMC RTS model, the full side window does not open and there is no way for a rescuer to move through this window, if necessary, to gain access to the interior of the bus. The driver's window on the Flxible and Orion models does open easily, allowing significant access to all the controls and the ability for the rescuer to climb in. The window, however, does not stay open by itself during such maneuvers and attempts. Either another rescuer has to hold the window open or a pike pole or other device must be used as a support.

One half of the Gillig Phantom, Ikarus, and Neoplan models driver's windows slide open and because the design is a sliding window, they do not require a rescuer to prop them open. However, the window openings are actually rather small. In simulation exercises with a Neoplan coach and fire service personnel in full regalia, rescuers have been able to put their right leg and the right part of their body through the window without significant difficulty. However, in some cases as they tried to move their helmets and heads through the window, its width was insufficient to allow the rescuer's helmet to clear. This makes it very difficult for the rescuer since he/she is trying very hard not to step on, or otherwise disturb the operator who would, in such a case, most likely be incapacitated as a result of the accident. While balancing themselves with one foot on the dashboard or side control panel and the other outside the window, a rescuer has to remove his/her helmet in order to get through the window.

Although some Guidelines Development Committee members and some APTA Safety Committee members believed it was clear that the driver's side window needs to be openable and large enough to facilitate entry by rescuers, the concensus of the Guidelines Development Committee was to not require the driver side window to be available as an ingress location for emergency personnel. An information summary of the driver window as an ingress location for the six coaches is shown in *Table 2-6. Photographs 2-27* through *2-32* show the driver's windows for each coach model.

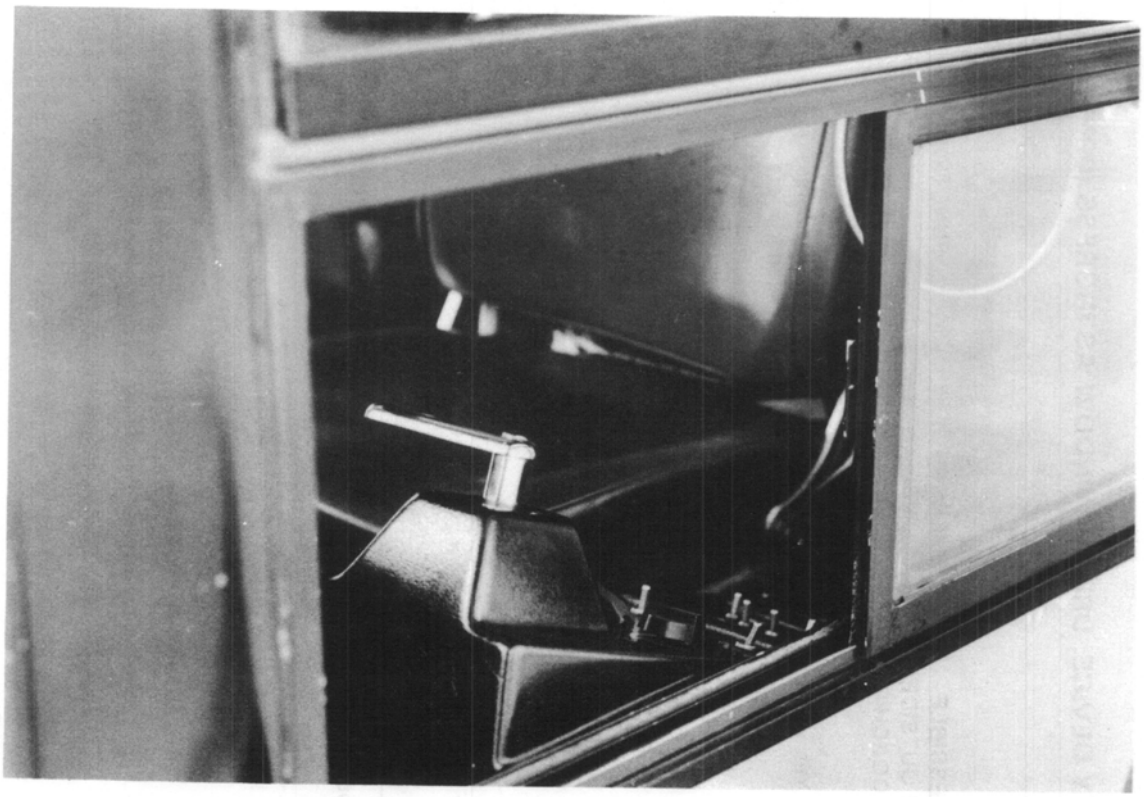
TABLE 2-6. SAFETY DEVICE: DRIVER WINDOW AS INGRESS

URBAN TRANSIT BUS MODEL*	LOCATION	ACCESSIBLE FROM OUTSIDE OF COACH	EMERGENCY USE	FUNCTION	VEHICLE SPECIFIC SAFETY PROBLEM
Flxible	Adjacent to driver, above split side window, hinged at top	Yes	Insert hand in open half of sliding window, push up on release latch in middle of lower sill, lift window outward from bottom	Allows ingress to interior	Window will not stay open by itself, requires manual intervention; split side window may be locked
GMC (TMC) RTS	Adjacent to driver	NA	Not useful	Not functional	Window is too small to use as ingress point
Gillig Phantom	Adjacent to driver	Yes	Slide front half of window rearward, or rear half of window forward	Allows limited ingress to interior	Insufficient size to easily climb through, impossible for larger person, or person with large helmet; may be locked
Ikarus USA Articulated	Adjacent to driver, forward half	Yes	Slide front half of window rearward	Allows limited ingress to interior	Insufficient in size to easily climb through, may be impossible for large person, or person with large helmet
Neoplan USA	Adjacent to driver, front half of upper portion	Yes	Slide front half of window rearward	Allows limited ingress to interior	Insufficient in size to easily climb through, impossible for large person, or person with large helmet

TABLE 2-6. SAFETY DEVICE: DRIVER WINDOW AS INGRESS (CONTINUED)

URBAN TRANSIT BUS MODEL*	LOCATION	ACCESSIBLE FROM OUTSIDE OF COACH	EMERGENCY USE	FUNCTION	VEHICLE SPECIFIC SAFETY PROBLEM
Orion	Adjacent to driver, hooked to the frame at top	Yes	Slide front half of window rearward, move red handle down to horizontal position, lift window outward from bottom	Allows ingress to interior	Window will not stay open by itself, requires manual intervention. Window is hooked to the frame at top and can be unhooked by raising the window slightly above honzon-tal position — windows can fall if rescuers assume they are hinged, significant injuries could result Windows require lubri-cation and cycling to remain openable, drains must be appropriate to prevent cold weather freezing of window assembly and/or corrosion

*: Specific bus models tested are detailed in Appendix A.

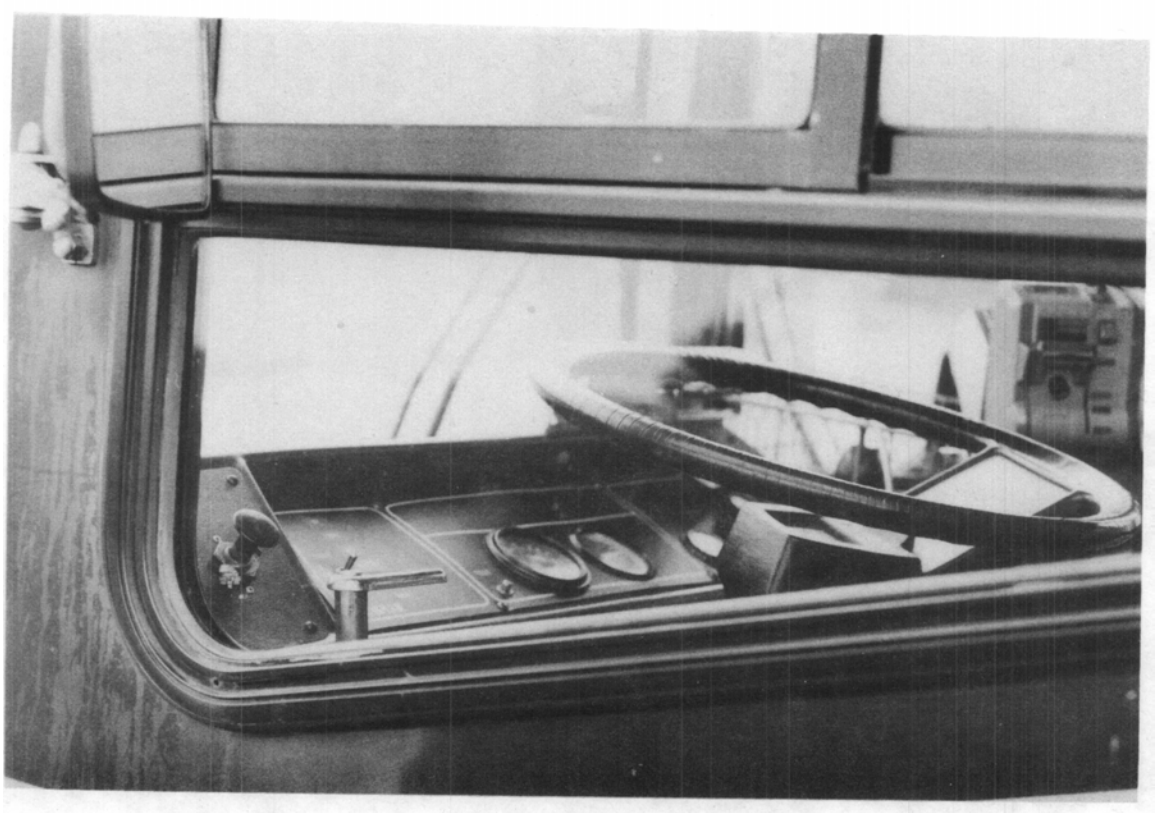


PHOTOGRAPH 2-27
FLXIBLE MODEL:
CLOSE-UP OF DRIVER'S SIGNAL WINDOW AS VIEWED FROM FRONT CORNER OF BUS — ACCESS TO EMERGENCY WINDOW RELEASE LATCH

PHOTOGRAPH 2-28
GMC RTS MODEL:
CLOSE-UP OF DRIVER'S WINDOW —
LACK OF INGRESS POINT

PHOTOGRAPH 2-29
GILLIG PHANTOM MODEL:
FORWARD SLIDING DRIVER'S WINDOW PARTIALLY OPENED
LIMITED INGRESS

PHOTOGRAPH 2-30
IKARUS USA ARTICULATED MODEL:
DRIVER'S SIDE WINDOW — LIMITED INGRESS



PHOTOGRAPH 2-31
NEOPLAN USA MODEL:
DRIVER'S SIDE AND SIGNALWINDOWS - LIMITED INGRESS

PHOTOGRAPH 2-32
ORION MODEL:
DRIVER'S WINDOWS AS INGRESS

2.7 DOOR DUMP VALVE OR RELEASE (DRIVER'S AREA)

In the event rescuers cannot use the door control handle for whatever reason, the door dump valve or release in the driver's area is a critical safety device which can allow easy access through the right side door(s). Summary information on the Door Dump Valve or Release in the Driver's Area for the six bus models studied is shown in *Table 2-7.*

The Flxible coach's door dump valve is located on the side wall below the driver's seat and cannot be reached by a rescuer through the driver's signal window *(Photograph 2-33).* In contrast, the Door Dump Valve on the GMC RTS model coach is located immediately inside the driver's signal window, seen and reached with ease *(Photograph 2-34).* On the Ikarus coach, the valve is located just inside the driver's window immediately rearward of the Master Run Switch, also easily seen and reached. The driver's area door dump valve on the Gillig Phantom model is inset on the driver's side wall, slightly below and forward of the level of the seat *(Photograph 2-35).* While it can be reached and operated from outside the driver's window, it cannot be seen, and can be difficult to find, especially when compared to the Ikarus switch *(Photograph 2-36).* Similarly, the Neoplan model's door dump valve is located halfway between the bottom of the window and the floor on the driver's side wall *(Photograph 2-37).* It too is not visually available to rescuers standing at the signal window, but may only be reached with considerable difficulty by a rescuer with a long arm due to the height of the driver's window. The Orion coach's door dump valve is located on the front wall below the front windshield about 2 feet from the floor. It is accessible from either the driver's area or the front door stepwell but is not accessible from outside the coach; it is generally partially hidden by the farebox and stanchions *(Photograph 2-38).*

On many coaches, if the side door is already open and a rescuer dumps the door valve or activates the switch, the door may close causing injury to a rescuer or an injured passenger who is moving or being moved through the door opening.

The six devices are operated in different manners. The valve on the Flxible model requires the individual to turn it counterclockwise. The GMC coach's door dump valve is pulled to release the door. The Gillig either has a valve that is turned or, like the Ikarus, a lever that is moved forward. The Neoplan and Orion model valves must be turned clockwise. Bus models with electronically controlled doors have similar controls which perform these same functions without the valve and without actually dumping air.

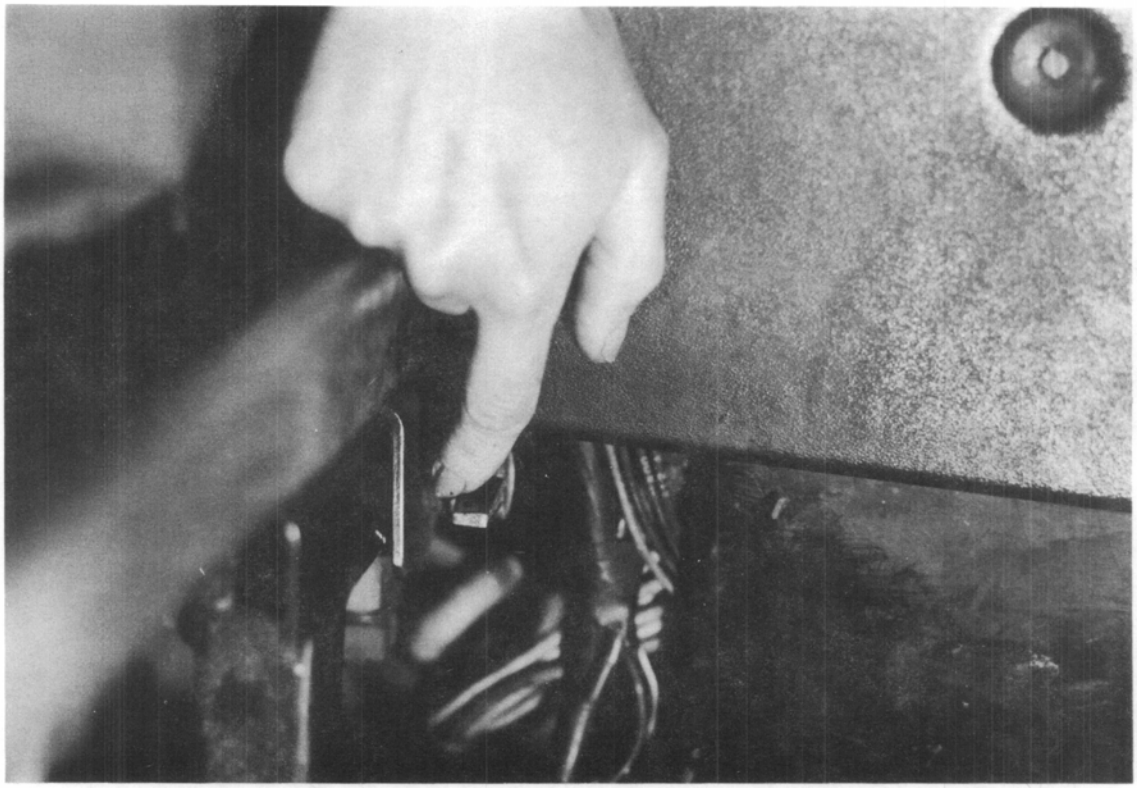
The Driver's Area Door Dump Valve or Release demonstrates a useful safety device inconsistently located and inconsistently operated to achieve the goal of releasing the door.

The concensus of the Guidelines Development Committee was that this device is redundant to others in this location and should not be standardized or promoted as a safety component.

TABLE 2-7. SAFETY DEVICE: DOOR DUMP VALVE (DRIVER'S AREA)

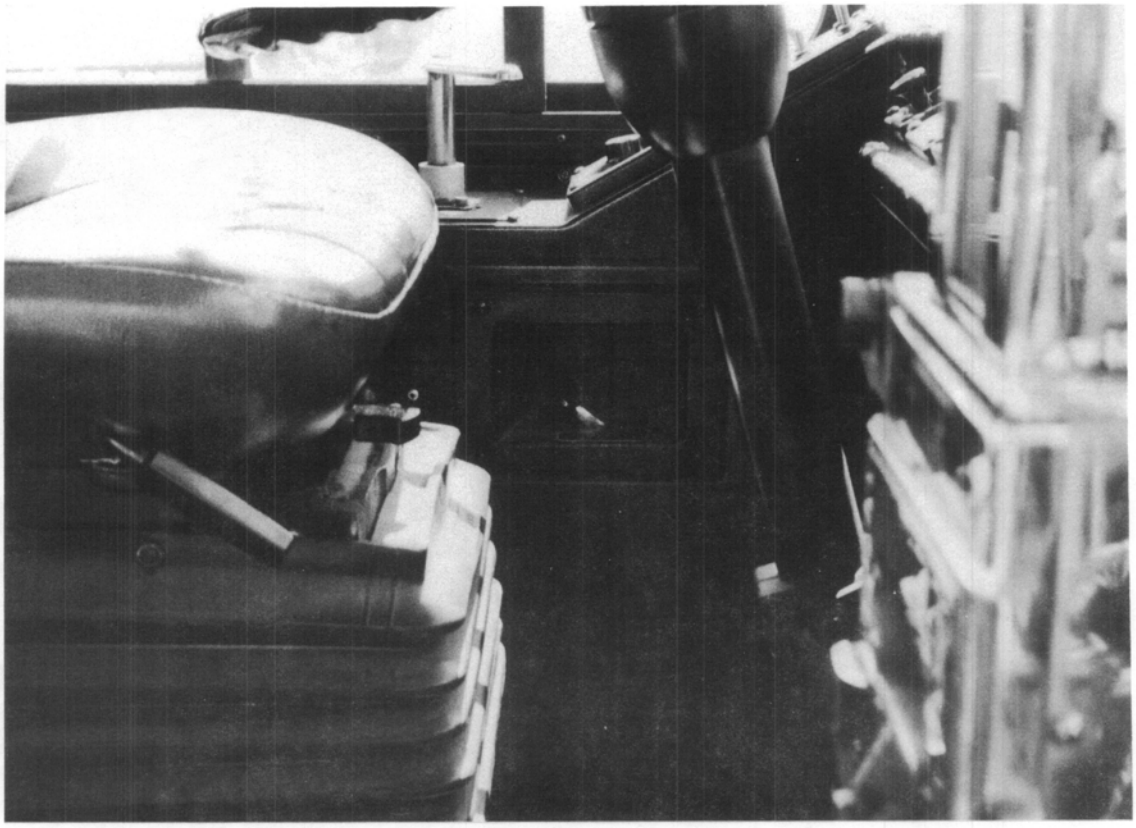
URBAN TRANSIT BUS MODEL*	LOCATION	ACCESSIBLE FROM OUTSIDE OF COACH	EMERGENCY USE	FUNCTION	VEHICLE SPECIFIC SAFETY PROBLEM
Flxible	On left side wall below driver's seat	No	Rotate lever counterclockwise	Releases front door only	If door is open, and valve is used, may cause door to close; cannot be reached from outside; no label or instructions
GMC (TMC) RTS	On left side wall panel between driver's side window and panel	Yes	Pull knob	Releases front door only	If door is open and valve is used, may cause door to close; no label or instructions
Gillig Phantom	Inset on left side wall below driver's side control panel	Yes	Move lever forward or turn valve to Off position	Releases front door only	Method of use not consistent in all models; not visible from exterior, if door is open and valve is used, may cause doors to close, may not be labeled
Ikarus USA Articulated	On driver's left control panel, directly rearward of master run switch	Yes	Move lever forward to Off position	Releases front door only	If door is open and valve is used, may cause door to close, not sufficiently labeled
Neoplan USA	Forward of and below driver's side window, midway to floor	Only with considerable difficulty	Rotate lever or knob clockwise	Opens both front and rear doors	If doors are open and valve is used, may cause doors to close, very difficult to reach from outside; may not be labeled
Orion	To right of driver compartment on front wall of vehicle, approximately 2' above vehicle floor	No	Turn knob clockwise from vertical to horizontal position	Opens both front and rear doors	Cannot be reached from outside; hidden from view; if doors are open and valve is used, may cause doors to close

* Specific bus models tested are detailed in Appendix A.

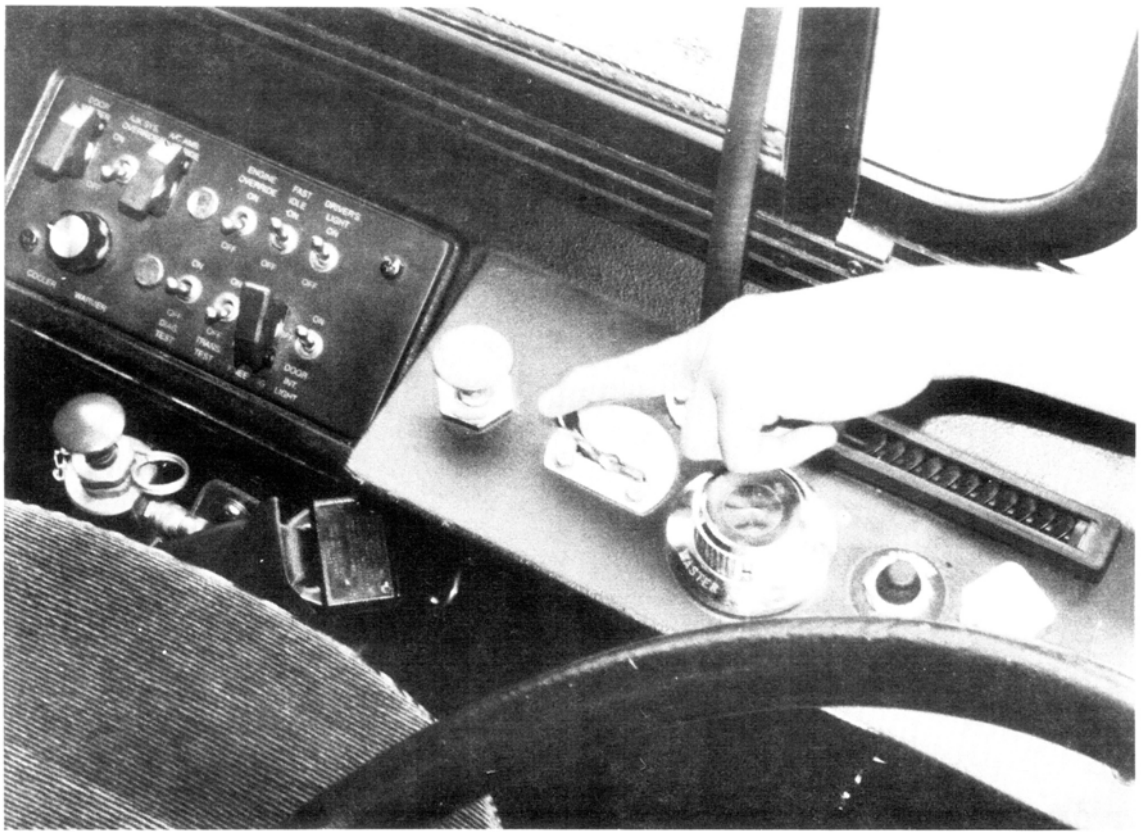


PHOTOGRAPH 2-33
FLXIBLE MODEL:
CLOSE-UP OF DRIVER'S AREA DOOR DUMP VALVE

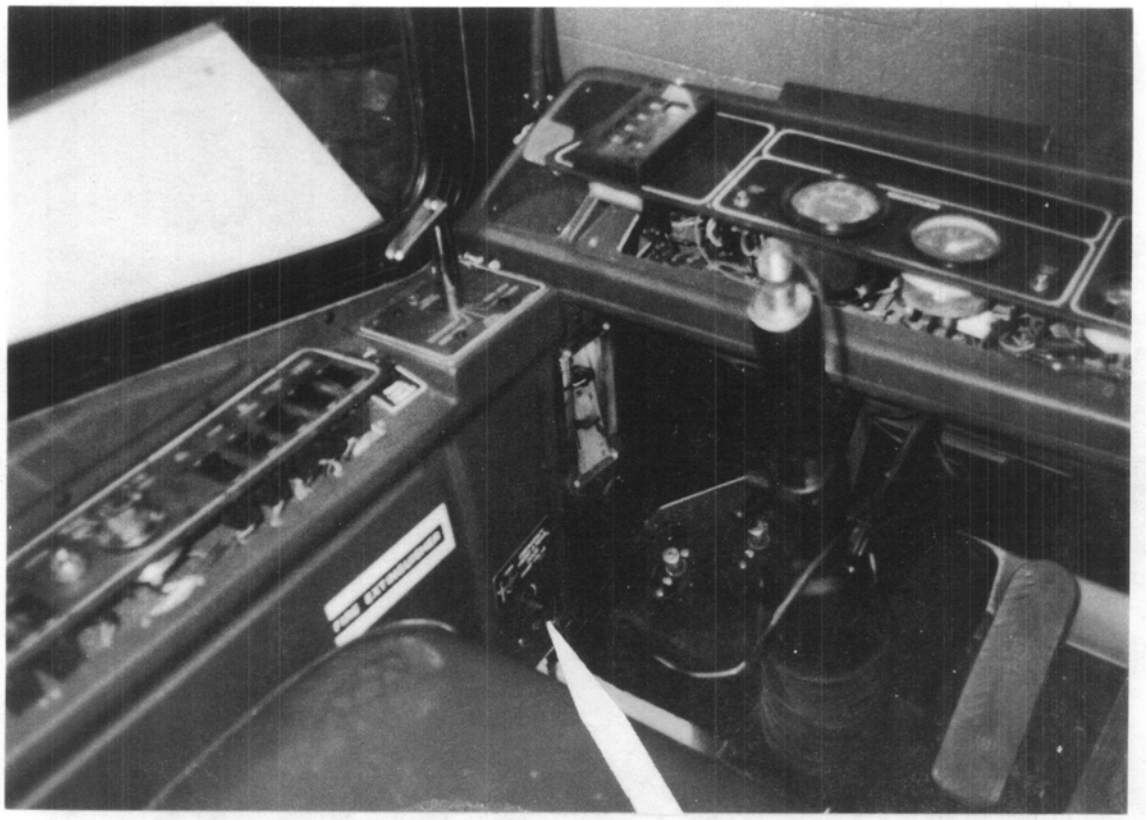
PHOTOGRAPH 2-34
GMC RTS MODEL:
USE OF DOOR DUMP VALVE AT OPERATOR'S SIGNAL WINDOW



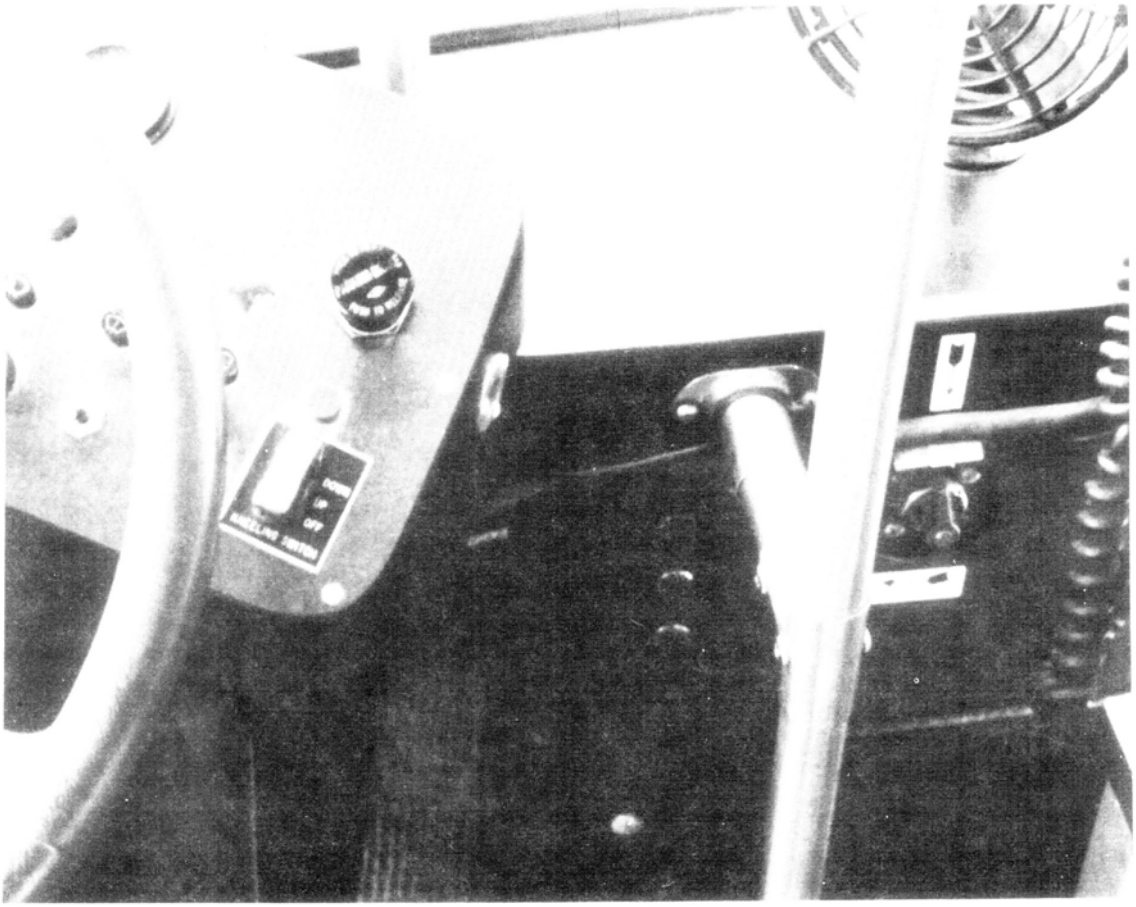
PHOTOGRAPH 2-35
GILLIG PHANTOM MODEL:
LOCATION OF DRIVER'S AREA DOOR DUMP VALVE (IN ON /CLOSED POSITION)



PHOTOGRAPH 2-36
IKARUS USA ARTICULATED MODEL:
USE OF DRIVER'S AREA DOOR DUMP VALVE (IN ON /CLOSED POSITION)



PHOTOGRAPH 2-37
NEOPLAN USA MODEL:
LOCATION OF DRIVER'S AREA DOOR DUMP VALVE
BELOW DOOR CONTROL HANDLE



PHOTOGRAPH 2-38
ORION MODEL:
LOCATION OF DRIVER'S AREA DOOR DUMP VALVE
(IN ON /CLOSED POSITION) TO RIGHT OF STANCHION

2.8 DOOR DUMP VALVE OR RELEASE (FRONT SIDE DOOR)

Once inside a vehicle, after moving through the escape hatch, or front windshield, a rescuer may (try to) open the Front Side Door using the Door Dump Valve or Release mounted on the wall. To gain access to the device, the Flxible, GMC RTS, Ikarus, and Neoplan models all require the user to break a glass or clear plastic plate. The Gillig model, if equipped with a passenger side front door release, requires the user to unlatch the access panel door, raise and hold the door, and correctly identify the unmarked handle without benefit of instructions. On some Neoplan models the valve handle is located in an enclosed but lidded plastic box. The Orion model does not have a passenger side Front Door Dump Valve, but rather requires the rescuer to use the Master Door Dump Valve located on the front wall behind the farebox.

Operation of the devices varies greatly. The Flxible model requires the rescuer to pull a red handle downward while the GMC RTS model requires the rescuer to pull the valve lever toward him/her and down. The Gillig, Ikarus, and some Neoplan models (if such a device is available, and not all Neoplan coaches have them near the front door) require the rescuer to rotate the lever clockwise. Other Neoplan models require the rescuer to rotate a handle counterclockwise.

These inconsistencies can cause confusion to rescuers, particularly if a smoke condition exists or the vehicle is, for example, turned over on its left side. In five buses, the device opens only the front door. This is a reasonable expectation and should probably be maintained. However, if a rescuer already has the front side door open and wants to open the rear door and activates the right front side door dump valve or release, the front door may close on anyone in the doorwell area.

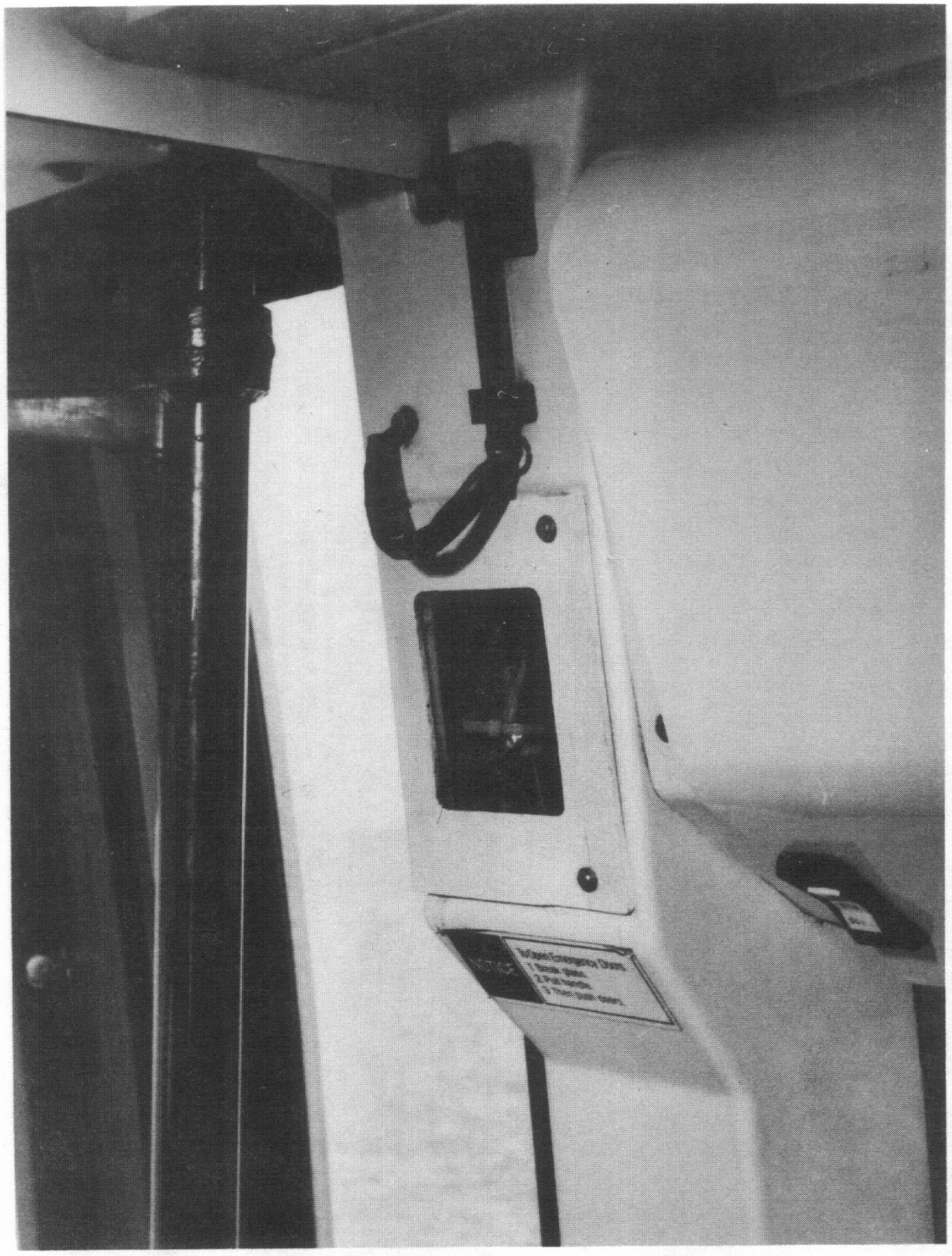
Summary information on the Front Side Door Dump Valve or Release is shown in *Table 2-8,* and pictures of each device are shown in *Photographs 2-39* through *2-43*.

TABLE 2-8. SAFETY DEVICE: DOOR DUMP VALVE (FRONT SIDE DOOR)

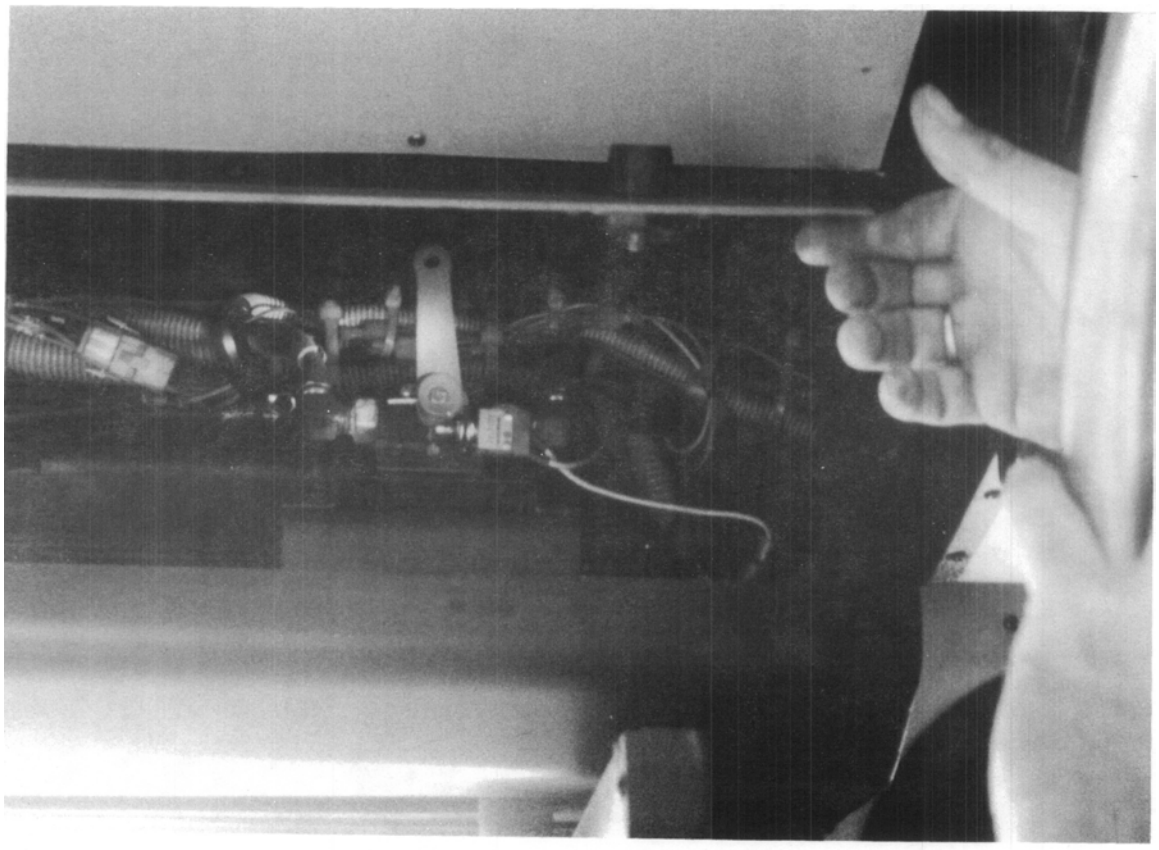
URBAN TRANSIT BUS MODEL*	LOCATION	ACCESSIBLE FROM OUTSIDE OF COACH	EMERGENCY USE	FUNCTION	VEHICLE SPECIFIC SAFETY PROBLEM
Flxible	On right side wall to upper right of front door in glass-fronted metal box	No	Break glass, pull red handle down	Releases front door only	If door is open, and valve is used, may cause door to close
GMC (TMC) RTS	On right side wall to upper right of front door in glass-fronted metal compartment	No	Break glass, pull valve lever toward you and down	Releases front door only	If door is open, and valve is used, may cause door to close
Gillig Phantom	Above front door to right, behind horizontal access panel	No	Turn access panel door knobs counterclockwise, lift panel door, rotate lever clockwise to vertical position	Releases front door only	Not available on all coaches, may not be marked, no instructions, not accessible if access panel cannot be opened; if door is open and valve is used, may cause door to close
Ikarus USA Articulated	Above front door to left, behind clear plastic window in horizontal access panel	No	Break plastic, or turn access panel door knobs counterclockwise and raise access panel; rotate red lever rearward (clockwise)	Releases front door only	If door is open, and valve is used, may cause door to close, lever not easily seen through plastic window; no instructions once cover is broken
Neoplan USA	Not available on all coaches; above front door on right side in glass-fronted metal box; or on front wall above right front windshield in enclosed but lidded plastic box	No	Break glass, rotate lever clockwise; or lift cover and rotate handle counterclock-wise	If equipped, opens front door only	Not available on all coaches; if door is open and valve is used, may cause door to close
Orion	None	NA	NA	NA	NA

* Specific bus models tested are detailed in Appendix A

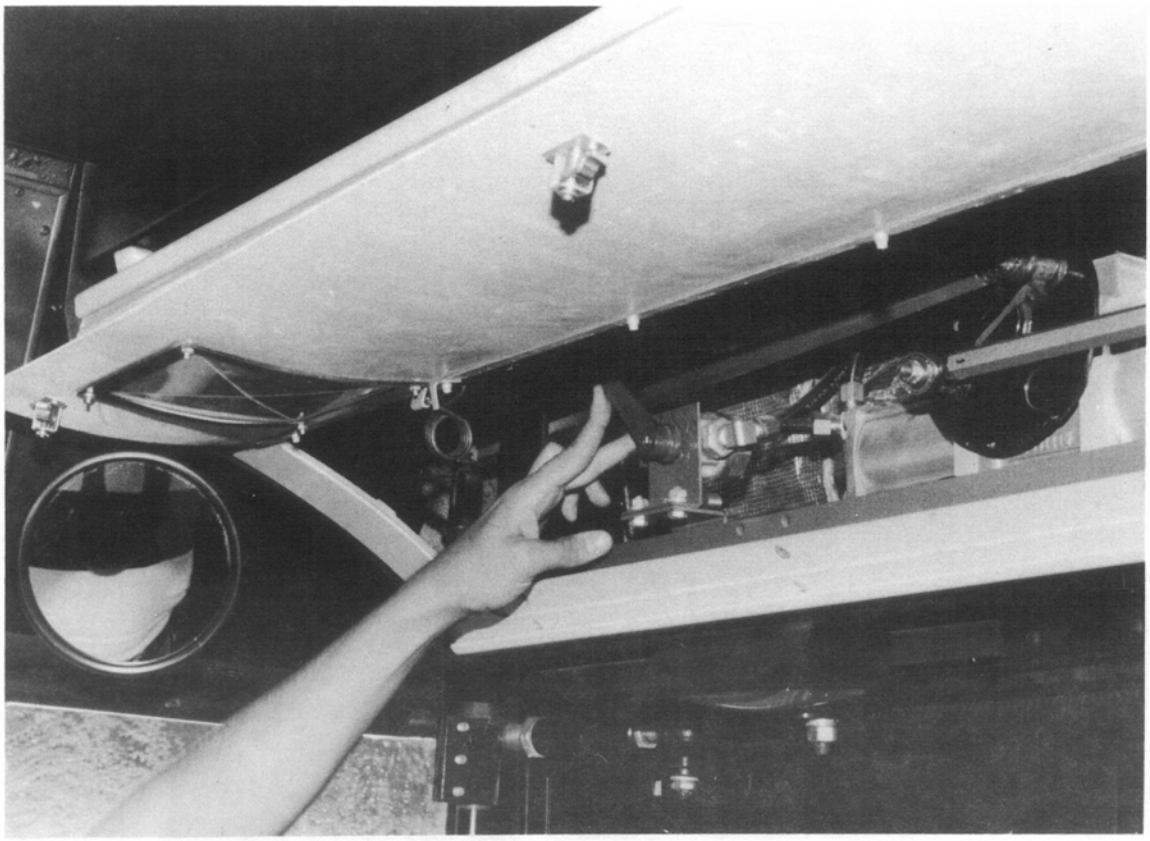
PHOTOGRAPH 2-39
FLXIBLE MODEL:
FRONT DOOR DUMP HANDLE LOCATED TO UPPER RIGHT OF THE FRONT DOOR



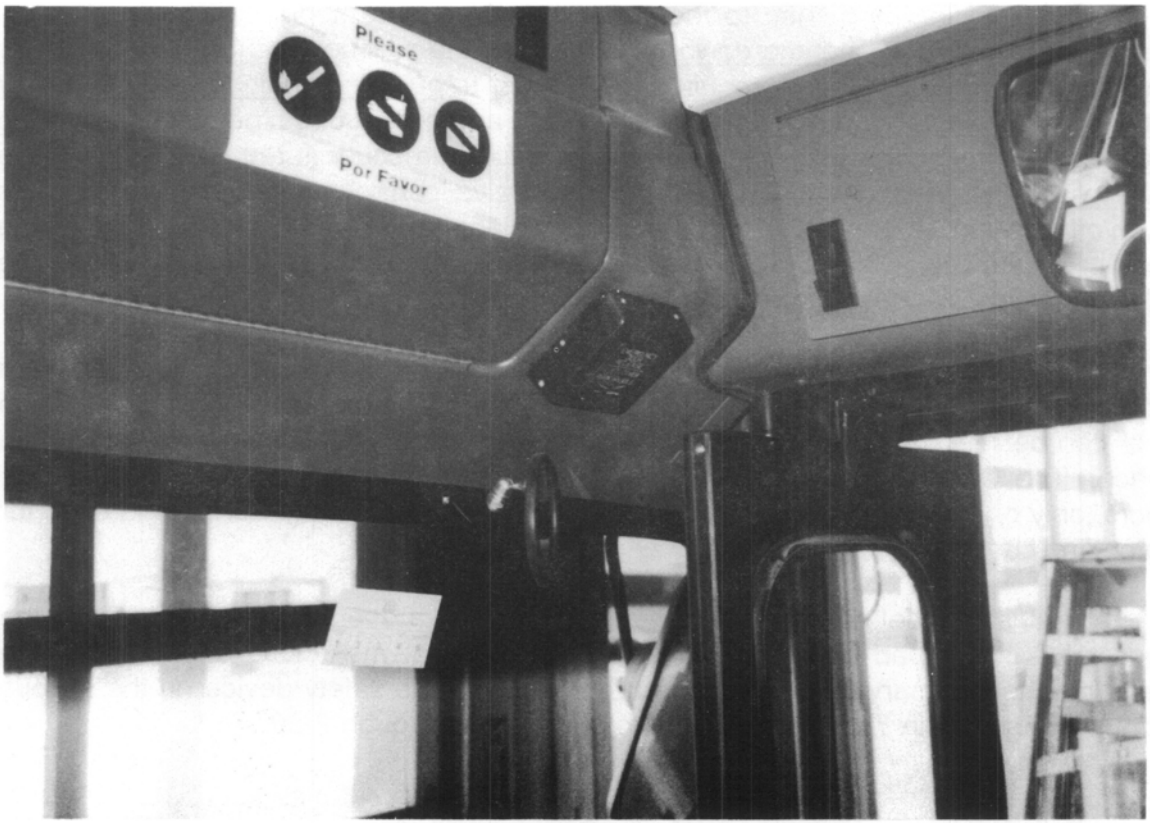
PHOTOGRAPH 2-40
GMC RTS MODEL:
FRONT DOOR DUMP LEVEL LOCATED TO UPPER RIGHT OF FRONT DOOR



PHOTOGRAPH 2-41
GILLIG PHANTOM MODEL:
FRONT DOOR DUMP VALVE LEVER LOCATED ABOVE TO RIGHT OF FRONT DOOR BEHIND ACCESS PANEL



PHOTOGRAPH 2-42
IKARUS USA ARTICULATED MODEL:
USE OF FRONT DOOR DUMP LEVER LOCATED ABOVE DOORS BEHIND CLEAR PLASTIC COVER



PHOTOGRAPH 2-43
NEOPLAN USA MODEL:
LOCATION OF FRONT DOOR DUMP CONTROL BOX ON FRONT WALL

2.9 DOOR DUMP VALVE OR RELEASE (REAR SIDE DOOR)

The Rear Side Door Dump Valve or Release was found on all six coaches. Five of them required the rescuer to first break a glass or clear plastic cover while a sixth, on some models, requires the rescuer to simply lift a front cover.

Once access is gained to the valve, however, one model coach requires the rescuer to pull the red handle down, one requires the rescuer to pull the valve lever toward him/her and down, one requires the rescuer to pull the handle toward him/her *or* rotate the valve lever to a horizontal position, and another requires the rescuer to rotate the lever counterclockwise, while in yet two others the rescuer is required to rotate the lever clockwise. The Rear Side Door Dump Valve control or Release, in its doors open/off position, is oriented down, horizontal, diagonal, or vertical depending on the coach. On the Gillig Phantom and Neoplan model coaches, the location and use of the release mechanism depends on the type of rear doors.

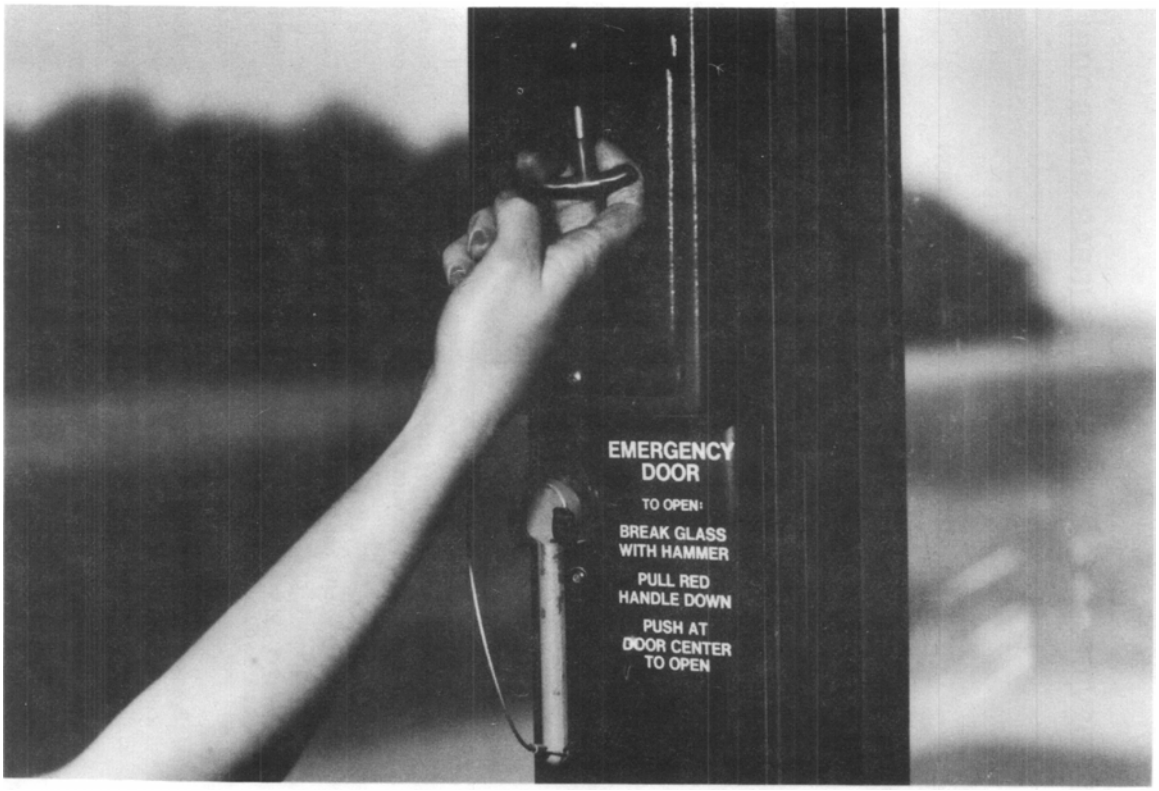
In the case of the Neoplan model, some coaches have a valve only in this rear side door position and not near the front door; consequently only the right rear side door can be released using a door dump valve mounted on the right side wall of the coach. The Orion model actually has two door switches located above the rear side doors, only one of which is the door dump valve. This could cause confusion even for trained rescuers.

In all six model coaches, if for whatever reason a door is already open and the door valve is dumped or the switch activated, the door may close and could cause injuries. The summary of information and pictures of this safety device on the six bus models are shown in *Table 2-9* and *Photographs 2-44* through *2-50*.

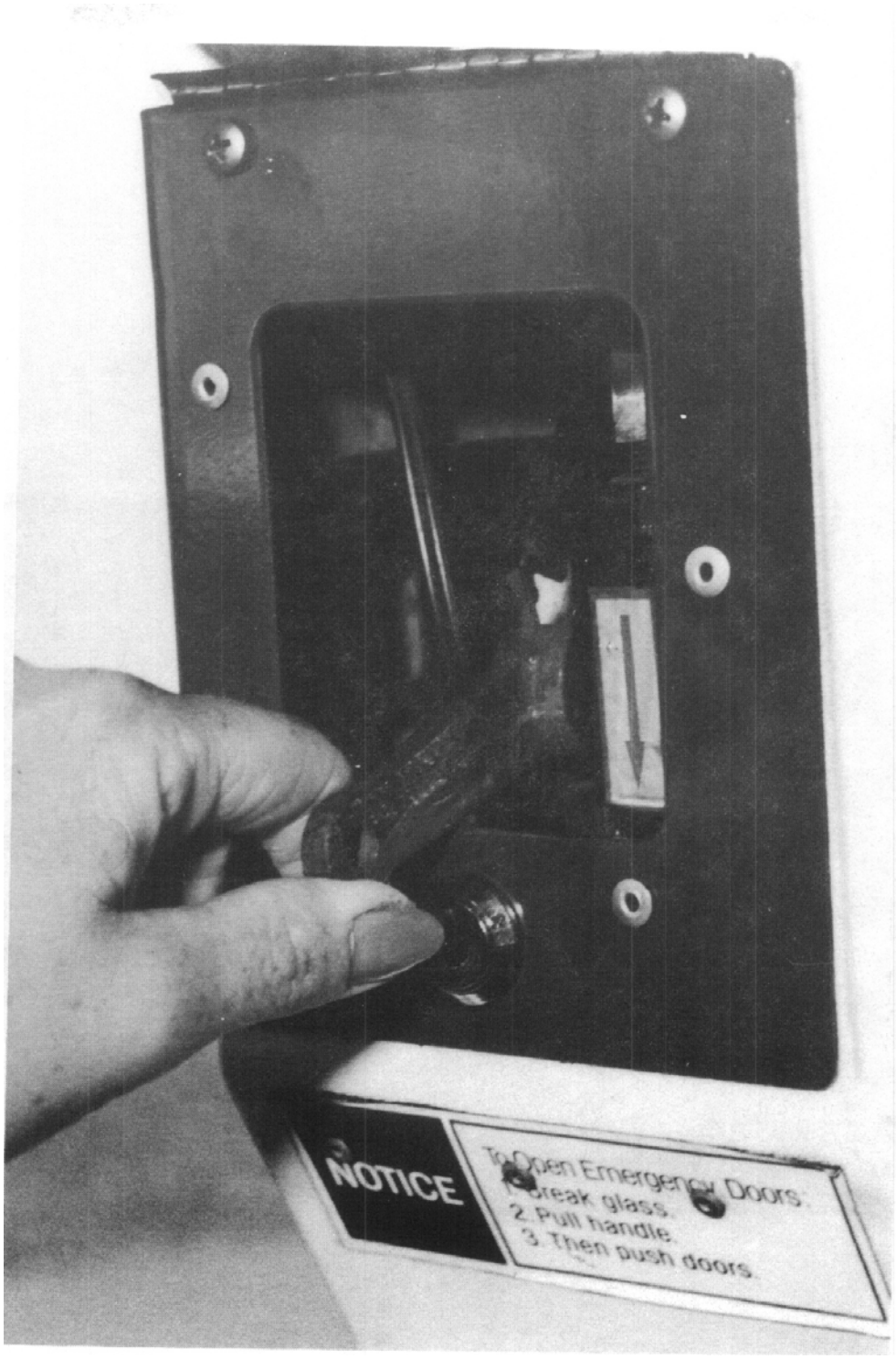
TABLE 2-9. SAFETY DEVICE: DOOR DUMP VALVE (REAR SIDE DOOR)

URBAN TRANSIT BUS MODEL*	LOCATION	ACCESSIBLE FROM OUTSIDE OF COACH	EMERGENCY USE	FUNCTION	VEHICLE SPECIFIC SAFETY PROBLEM
Flxible	On right side wall to left top of rear door in glass-fronted metal box	No	Break glass, pull red handle down	Releases rear door only	If door is open, and valve is used, may cause door to close
GMC (TMC) RTS	On right side wall to left top of rear door in glass-fronted metal box	No	Break glass, pull valve lever toward you and down	Releases rear door only	If door is open, and valve is used, may cause door to close
Gillig Phantom	Above rear door behind plastic window, to left in horizontal compartment	No	Break plastic with hammer or hand; or turn both knobs counterclockwise and pull access door down. Rotate valve handle to horizontal position, or pull handle toward you, push door down and out	Releases or opens rear door only	Release mechanism different for different door types; if door is open and valve is used, may cause door to close
Ikarus USA Articulated	Above rear door behind clear plastic window, in center left of horizontal compartment	No	Break plastic or turn both knobs counterclockwise and raise access door. Rotate red lever rearward (clockwise)	Releases rear doors; activates brake interlock if power is available	If door is open, and valve is used, may cause door to close; no instructions once cover is broken
Neoplan USA	Behind an enclosed but lidded box at left top of rear door; or above rear door	No	Lift cover, rotate handle counterclockwise; or lift access panel, rotate red lever; or break glass, pull handle toward you and down	Opens rear door only	Does not open front door on coaches without front side door dump valve release mechanism different for different door types; if door is open and valve is used, may cause door to close
Orion	Above rear door behind glass window, in center of horizontal compartment	No	Break glass or turn both knobs counterclockwise and pull access door down. Turn red handle clockwise from horizontal to vertical position	Releases rear door only	A door master switch is located on the left of the compartment, but does not release door, which rescuers may assume; if door is open and valve is used, may cause door to close

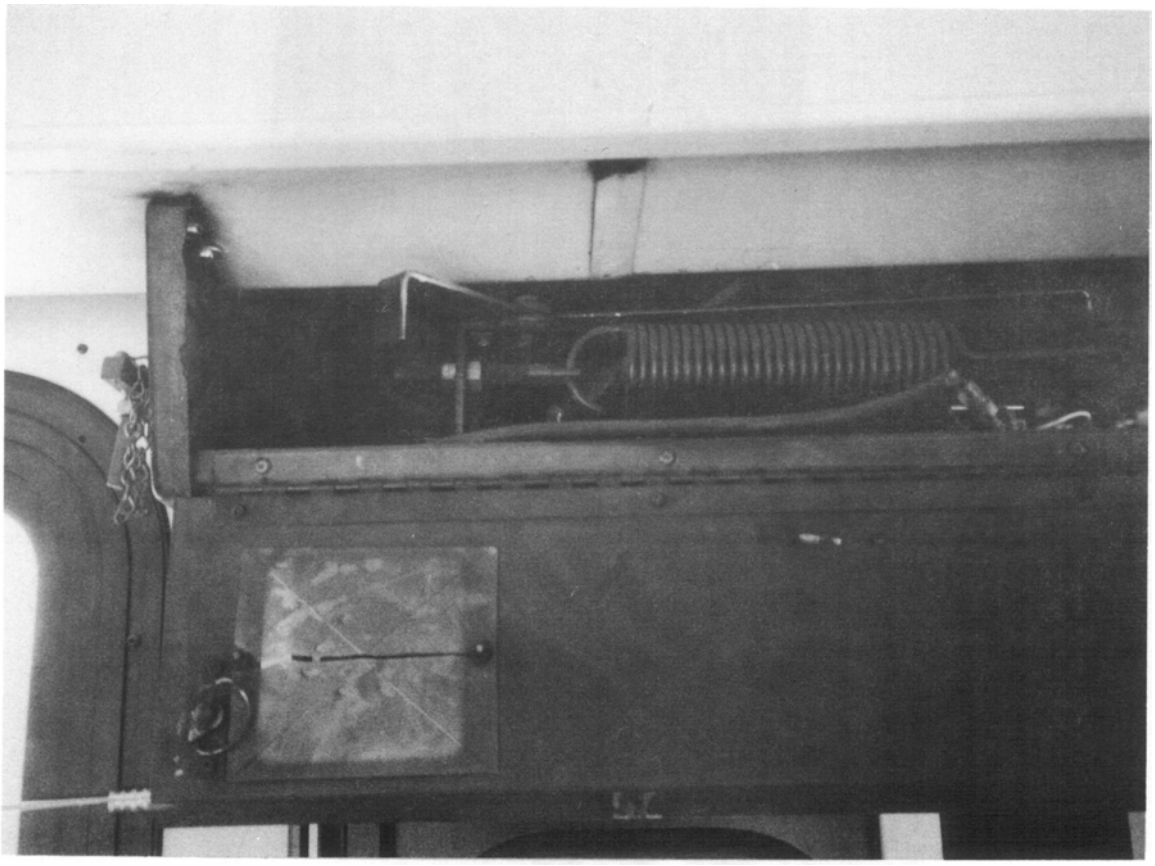
**: Specific bus models tested are detailed in Appendix A.



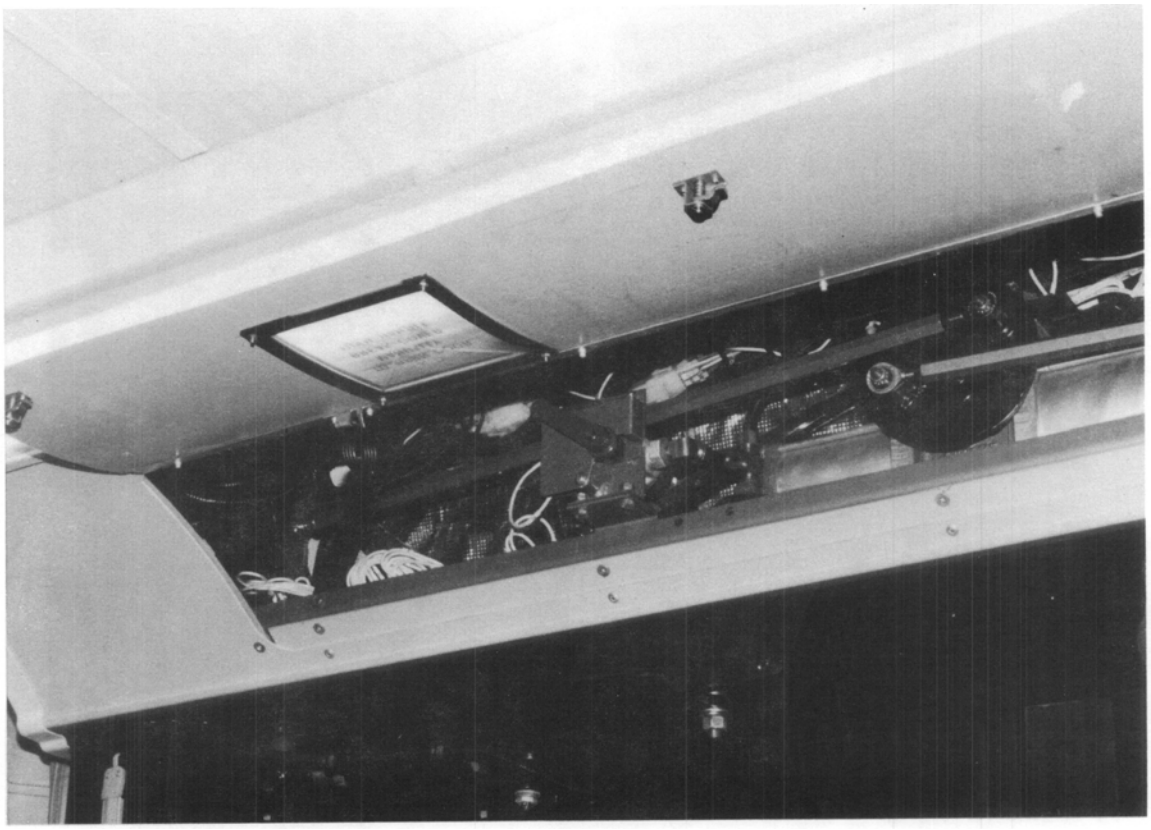
PHOTOGRAPH 2-44
FLXIBLE MODEL:
USING THE EMERGENCY REAR DOOR DUMP VALVE



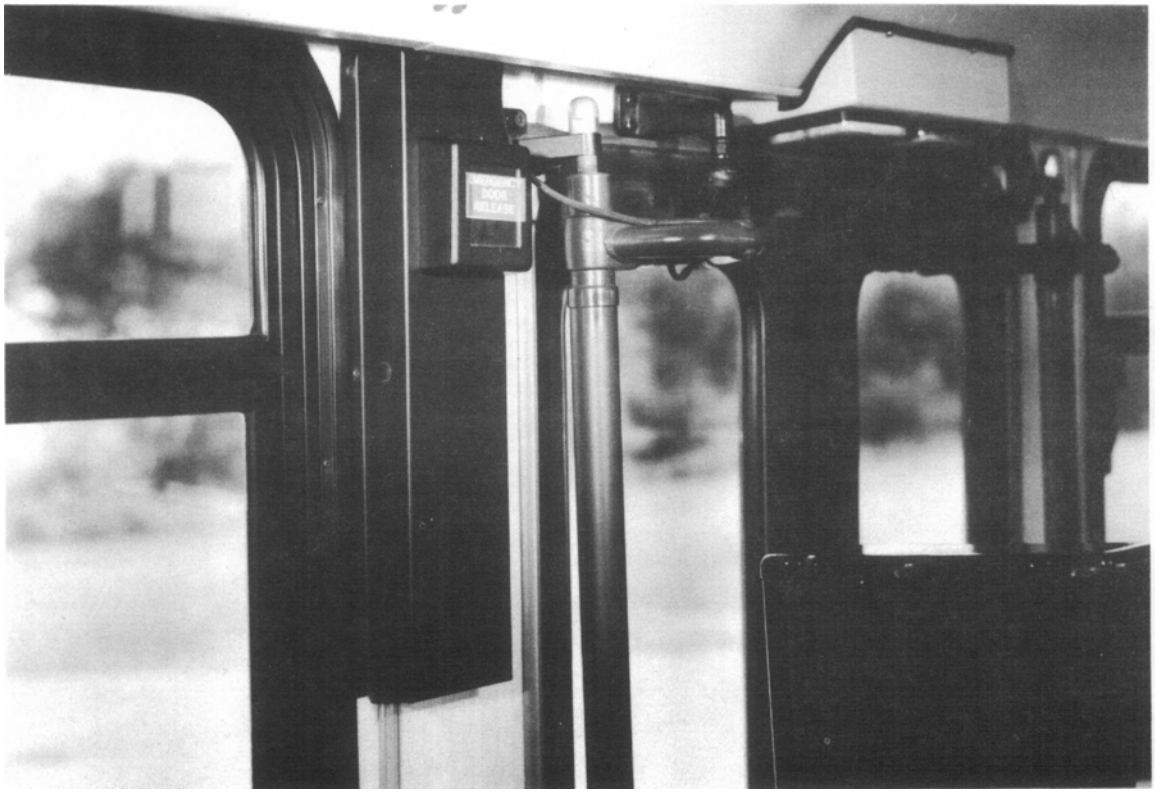
PHOTOGRAPH 2-45
GMC RTS MODEL:
USING THE EMERGENCY REAR DOOR DUMP VALVE



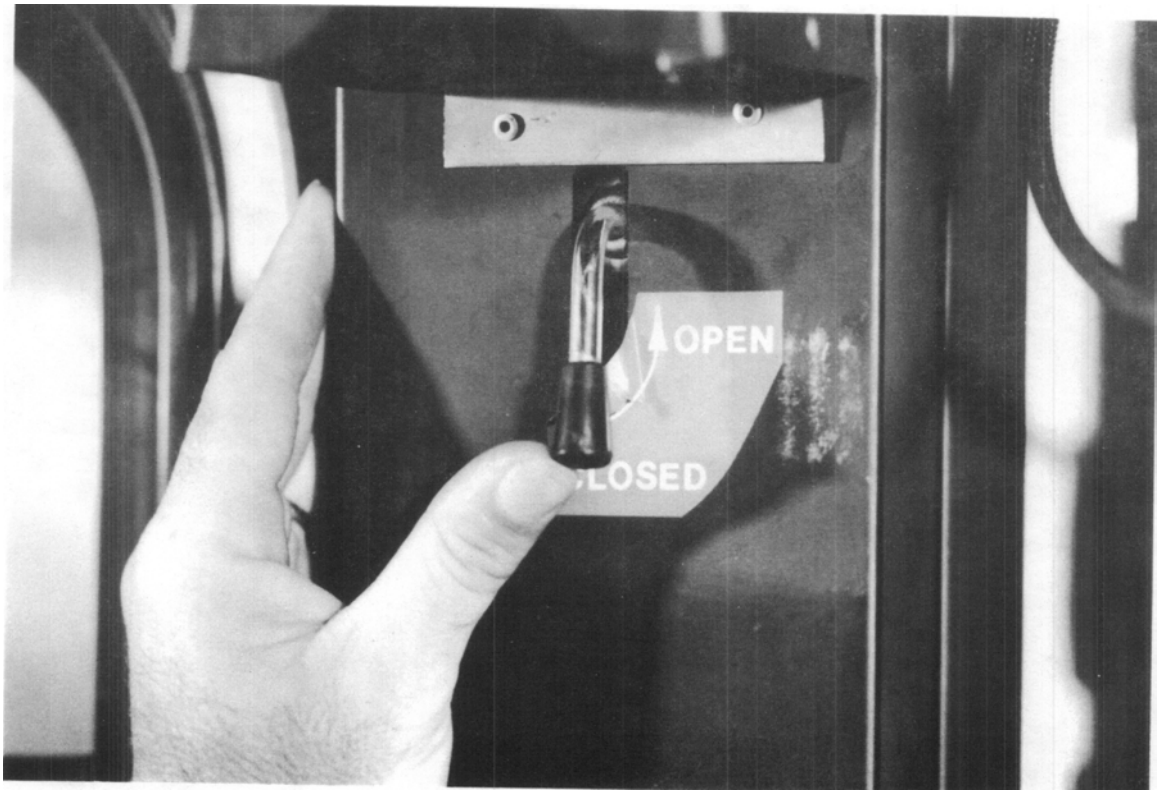
PHOTOGRAPH 2-46
GILLIG PHANTOM MODEL:
EMERGENCY REAR DOOR RELEASE HANDLE IN COMPARTMENT OVER REAR DOORS SHOWN WITH PLASTIC WINDOW AND HAMMER



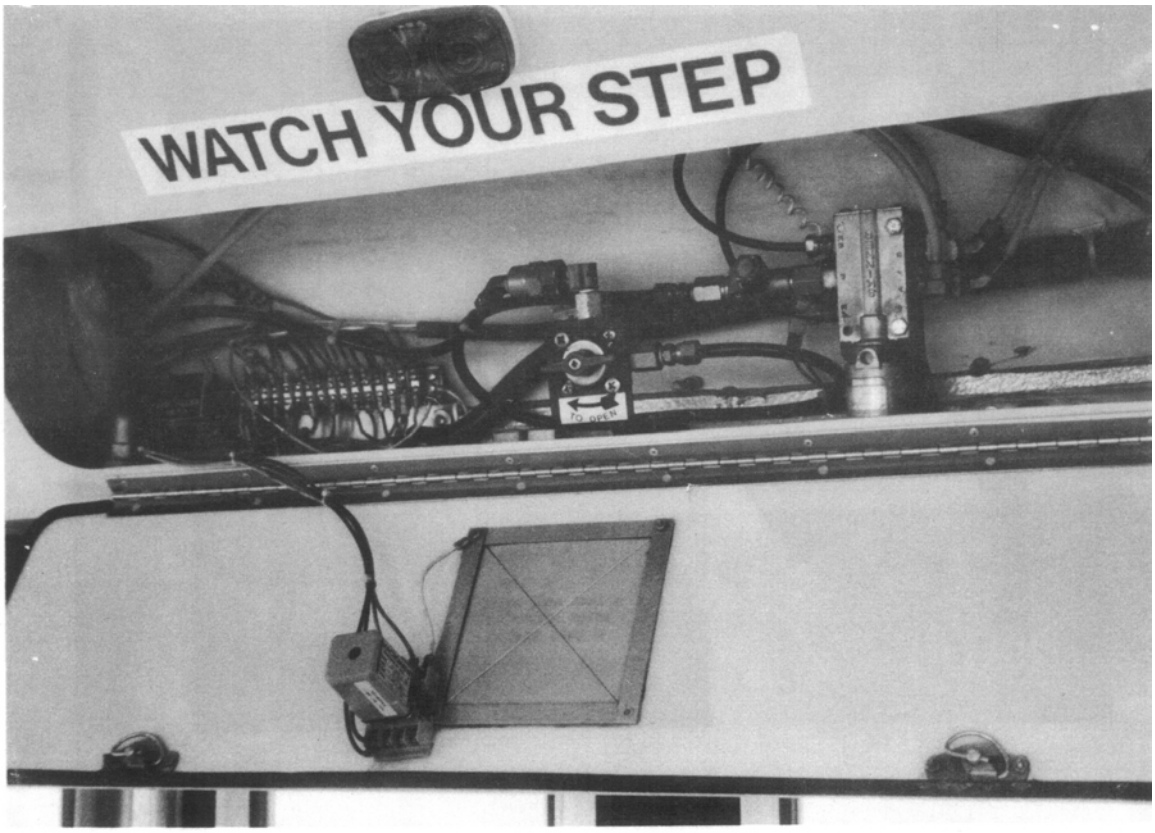
PHOTOGRAPH 2-47
IKARUS USA ARTICULATED MODEL:
LOCATION OF REAR DOOR DUMP VALVE OVER REAR DOORS



PHOTOGRAPH 2-48
NEOPLAN USA MODEL:
REAR DOOR BOX CONTAINING EMERGENCY DUMP VALVE



PHOTOGRAPH 2-49
NEOPLAN USA MODEL:
EMERGENCY REAR DOOR DUMP VALVE



PHOTOGRAPH 2-50
ORION MODEL:
EMERGENCY REAR DOOR DUMP VALVE

2.10 ELECTRICAL (BATTERY SWITCHES)

After a serious accident it is wise for a rescuer to try to minimize the chance of electrical fire initiation or propagation. Each of the six coaches studied has a bank of batteries located on the street side of the coach behind a service door. In each case, there are one or more switches available to kill the electrical power. Rescuers currently have to be taught that killing the electrical power will not necessarily cause the diesel engine to stop running. The engine must be shut down separately or electrical power will still be available to most circuits.

Table 2-10 shows summary information on the Electrical (Battery) Switches for the six bus models. Photographs of the disconnect switches are shown in *Photographs 2-51* through *2-57*.

The Flxible model bus has a small side door with a grommeted hole which allows the rescuer to open the door, reach in and rotate a single switch or knob counterclockwise to the stop position *(Photograph 2-51).* On the other models, the service door covering the battery bank has to be unlocked with a door control handle, a "T" handle (supplied with the GMC RTS coach) or a large screwdriver; or released by disengaging rubber handle straps by pulling them toward oneself and then downward; or opened by simply grasping handles and pulling the service door outward and upward.

Once the service doors are opened, in the case of the Gillig coach (*Photograph 2-54*), there is a single switch lever on the front sidewall of the battery compartment (except in 30' models where the switch is located in the engine compartment on the curb side). In the cases of the GMC RTS, Ikarus, Neoplan, and Orion models there are two switches, one for the 24-volt system and one for the 12-volt system. On the Ikarus coach both switches are stacked vertically on a plate in the center of the battery compartment (*Photograph 2-55*). The GMC RTS coach has the 24-volt disconnect switch attached to the right side wall in the lower position (*Photograph 2-52*) and the 12-volt disconnect switch attached to the right side wall right above it (*Photograph 2-53*). On the Neoplan coach the switches are attached to the front side wall of the battery compartment. The 24-volt disconnect switch is in the lower position and the 12-volt disconnect switch is either in the upper position (*Photograph 2-56*) *or* hidden behind the 24-volt switch levers. On some Neoplans there is a single switch on the right rear side wall of the battery box. On the Orion model the two switches are side by side, attached to the top left corner of the battery compartment (*Photograph 2-57*).

The single switch on the Gillig model is moved downward to kill the battery power. To kill the electricity from the 24-volt switch on the GMC RTS model the rescuer has to move the switch downward to the off position. In contrast, on the Neoplan coach, a rescuer has to move the switch up to the off position. In both cases, the 12-volt switch is rotated counterclockwise to the off position. On the Ikarus and Orion models, both 12- and 24-volt switches must be rotated counterclockwise to the off position.

Some inherent problems obviously relate to the inconsistency of the location and use of the devices, and the fact that on buses with two switches a rescuer might only trip one of them. Certain switch levers tend to become stiff or even stuck with age and weathering. Four models were supplied with a rotating switch by the Cole Hersey Company; the handles of these switches are easy to use but rescuers can mistakenly assume the handles are the on/off position indicators, which would reverse the apparent positions of the switch (causing Off to appear as On, etc.). On all models, if a side door has been previously opened, activation of the electrical disconnect switch may cause the doors to close on anyone in the doorwell area.

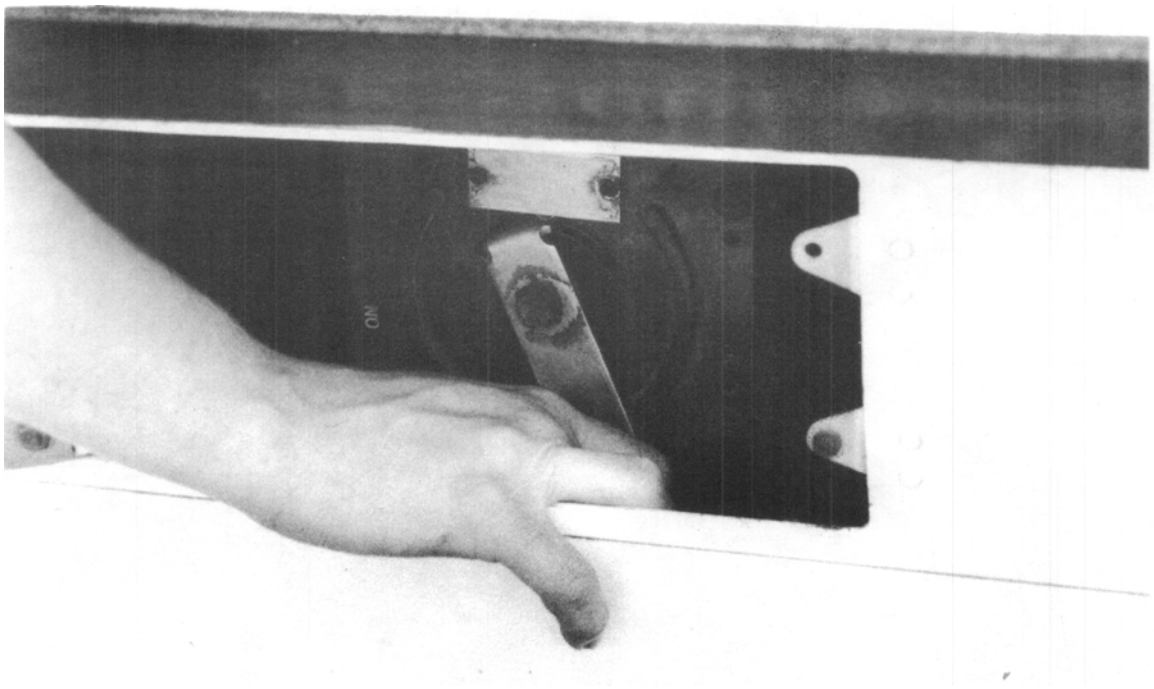
TABLE 2-10. SAFETY DEVICE: ELECTRICAL (BATTERY) SWITCHES

URBAN TRANSIT BUS MODEL*	LOCATION	ACCESSIBLE FROM OUTSIDE OF COACH	EMERGENCY USE	FUNCTION	VEHICLE SPECIFIC SAFETY PROBLEM
FIxible	On street side behind service panel directly in front of rear wheels	Yes	Place fingers in grommeted hole in door and pull outward, rotate switch handle or knob counter-clockwise to stop position; or disengage rubber handle straps by pulling toward you and then downward, raise access door, use door prop rod on each end, rotate switch handle or knob counter-clockwise to stop position	Try to minimize electrical fire initiation or propagation	Electrical power may still be available to some circuits, doors may close if open and switches are turned
GMC (TMC) RTS	On street side behind service door directly in front of rear wheels; 24-volt disconnect switch attached to right side wall in lower position; 12-volt disconnect switch attached to right side wall in upper position	Yes	Unlock service door with "T" handle wrench or large screw-driver by rotating, or disengage rubber handle straps by pulling toward you and then downward; raise access door and use left side door prop to lock door; move 24-volt switch downward to off position; rotate 12-volt switch counterclockwise to off position	Try to minimize electrical fire initiation or propagation	Electrical power may still be available to some circuits, doors may close if open and switches are thrown/turned; rescuers may only trip one switch
Gillig Phantom	On street side behind service panel located at midpoint of coach to immediate right of center post, on 35' and 40' models only; on 30' model located in engine compartment at curb side	Yes	Disengage rubber handle straps by pulling toward you and then downward, raise access door, move large switch downward	Try to minimize electrical fire initiation or propagation	Electrical power may still be available to some circuits, doors may close if open and switch is thrown

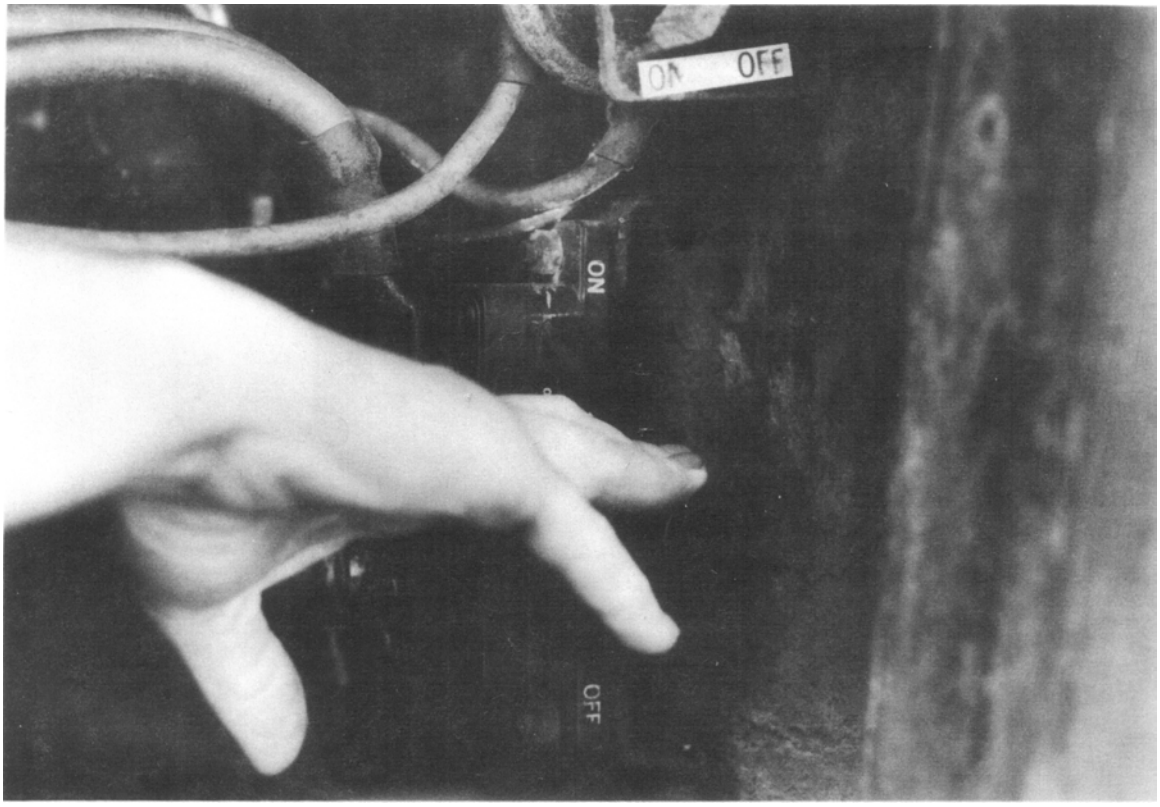
TABLE 2-10. SAFETY DEVICE: ELECTRICAL (BATTERY) SWITCHES (CONTINUED)

URBAN TRANSIT BUS MODEL*	LOCATION	ACCESSIBLE FROM OUTSIDE OF COACH	EMERGENCY USE	FUNCTION	VEHICLE SPECIFIC SAFETY PROBLEM
Ikarus USA Articulated	On street side behind service panel directly forward of rearmost wheels; center of compartment	Yes	Grasp handles with fingers and pull outward and upward raising access door; rotate both switch handles counterclockwise to off position	Try to minimize electrical fire initiation or propagation	Electrical power may still be available to some circuits; doors may close if open and switches are turned; interior, door, and hazard lights may be extinguished; rescuers may mistake switch handle for indicator
Neoplan USA	On street side behind second service door to rear of front wheel; 24-volt disconnect switch attached to front side wall of battery compartment in lower position; 12-volt disconnect switch on some models above 24-volt switch on front sidewall; some models have a single switch on right rear sidewall of battery box	Yes	Unlock service door with door control handle by rotating counterclockwise or disengage rubber handle straps by pulling toward you and then downward; raise access door until door props lock; move 24-volt switch up to off position; rotate 12-volt switch counterclockwise to off position; for single switch coaches move master switch down to off position	Try to minimize electrical fire initiation or propagation	Electrical power may still be available to some circuits, doors may close if open and switches are turned; rescuers may only trip one switch; rescuers may mistake switch handle for indicator
Orion	On street side in most forward of three compartments located forward of rear wheels. Two switches in upper left corner of compartment facing outward	Yes	Unlock service door by disengaging rubber handle straps by pulling down. Raise access door, remains open itself. Rotate both switch handles counterclockwise to off position	Try to minimize electrical fire initiation or propagation	Electrical power may still be available to some circuits; position of indicator switches is unclear, doors may close if open and switches are turned, rescuers may mistake switch handle for indicator

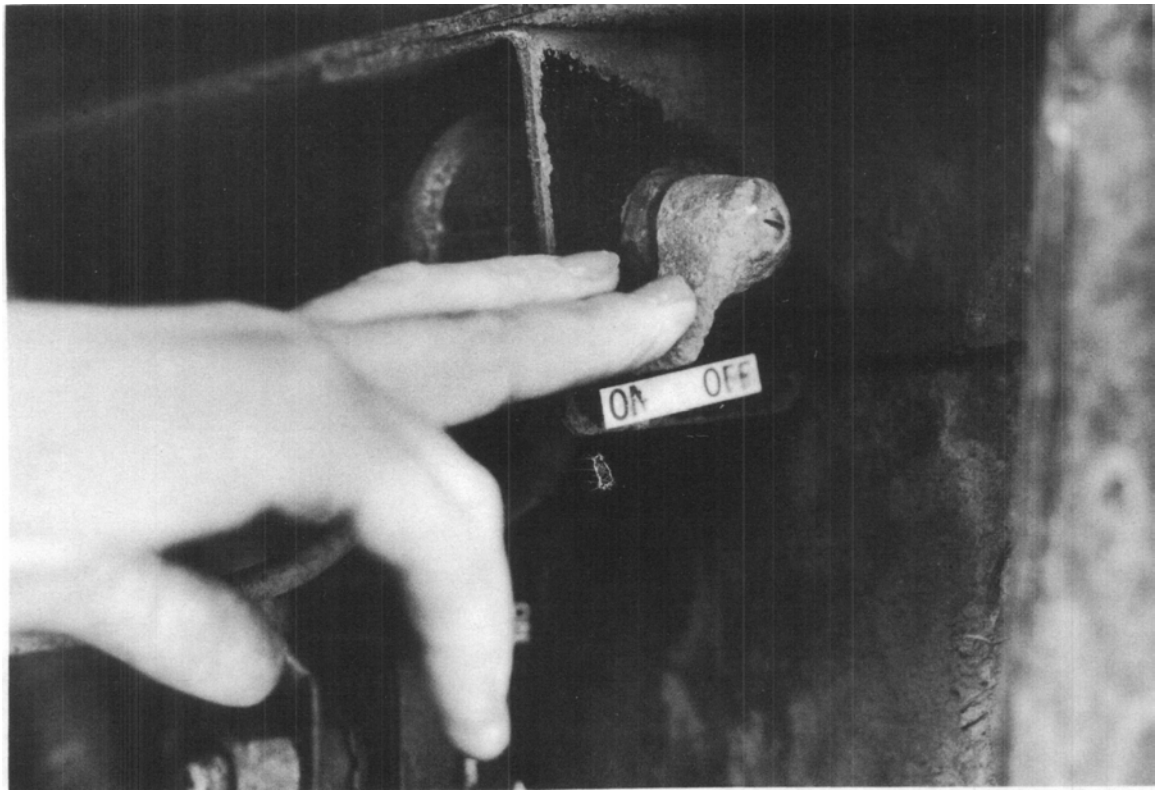
* Specific bus models tested are detailed in Appendix A.



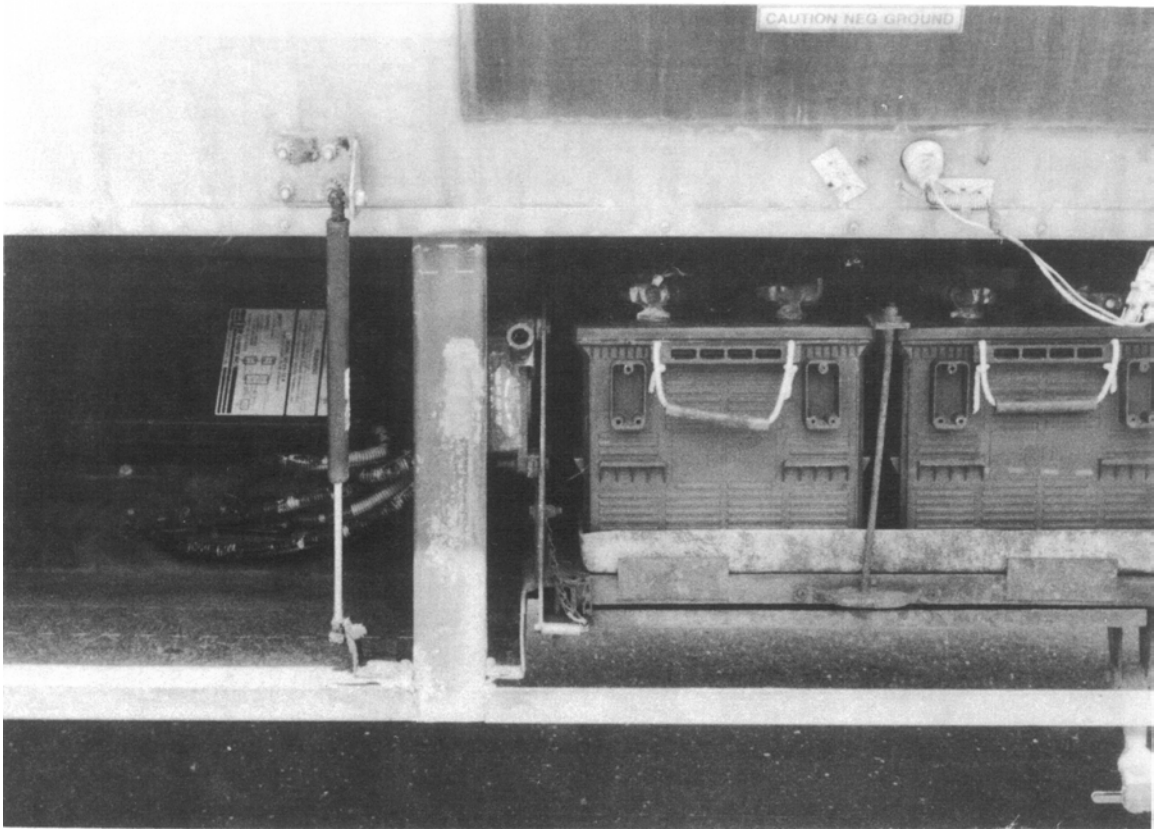
PHOTOGRAPH 2-51
FLXIBLE MODEL:
ELECTRICAL (BATTERY) MASTER SWITCH



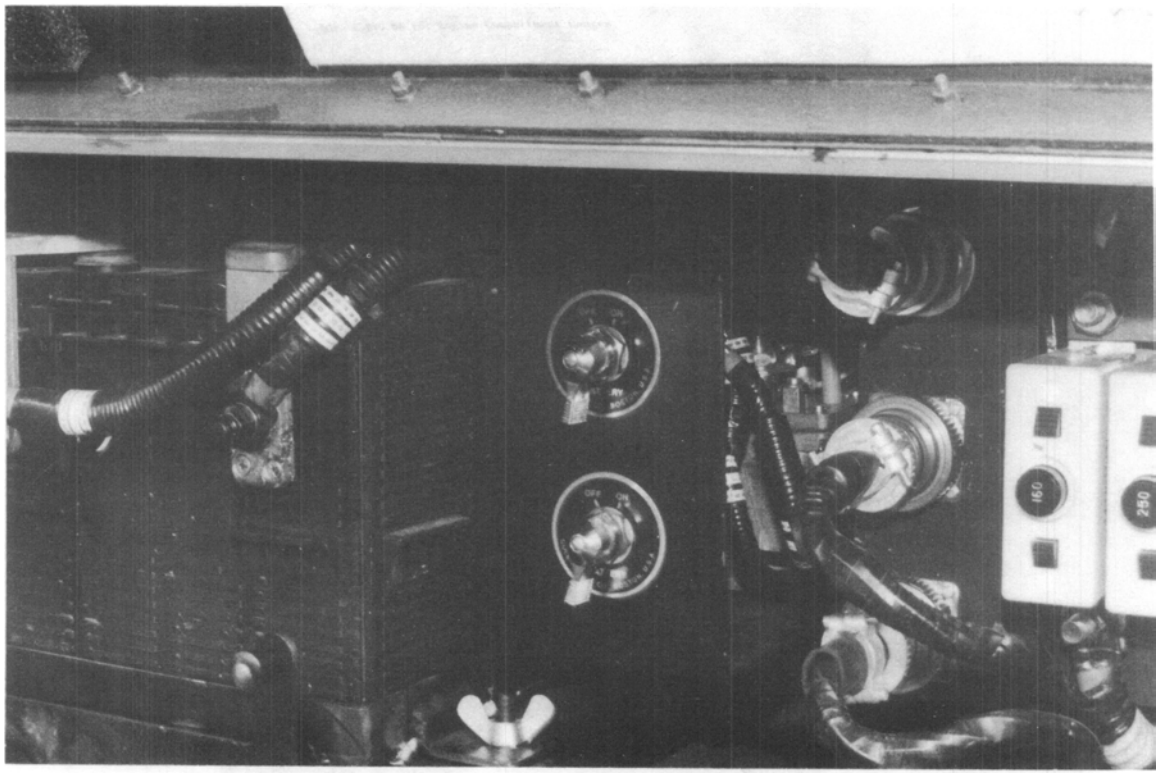
PHOTOGRAPH 2-52
GMC RTS MODEL:
USE OF 24-VOLT ELECTRICAL (BATTERY) SWITCH



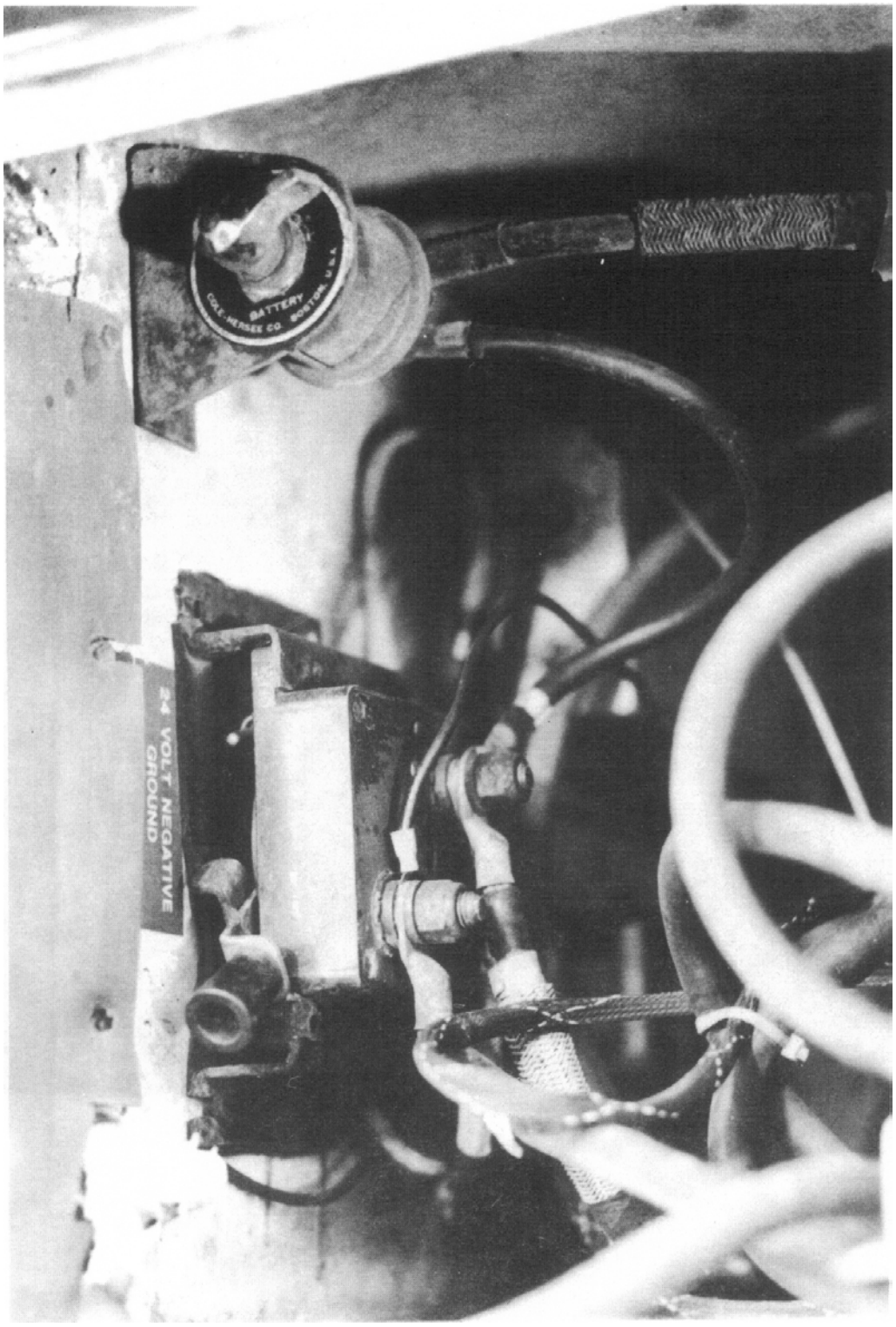
PHOTOGRAPH 2-53
GMC RTS MODEL:
USE OF 12-VOLT ELECTRICAL (BATTERY) SWITCH



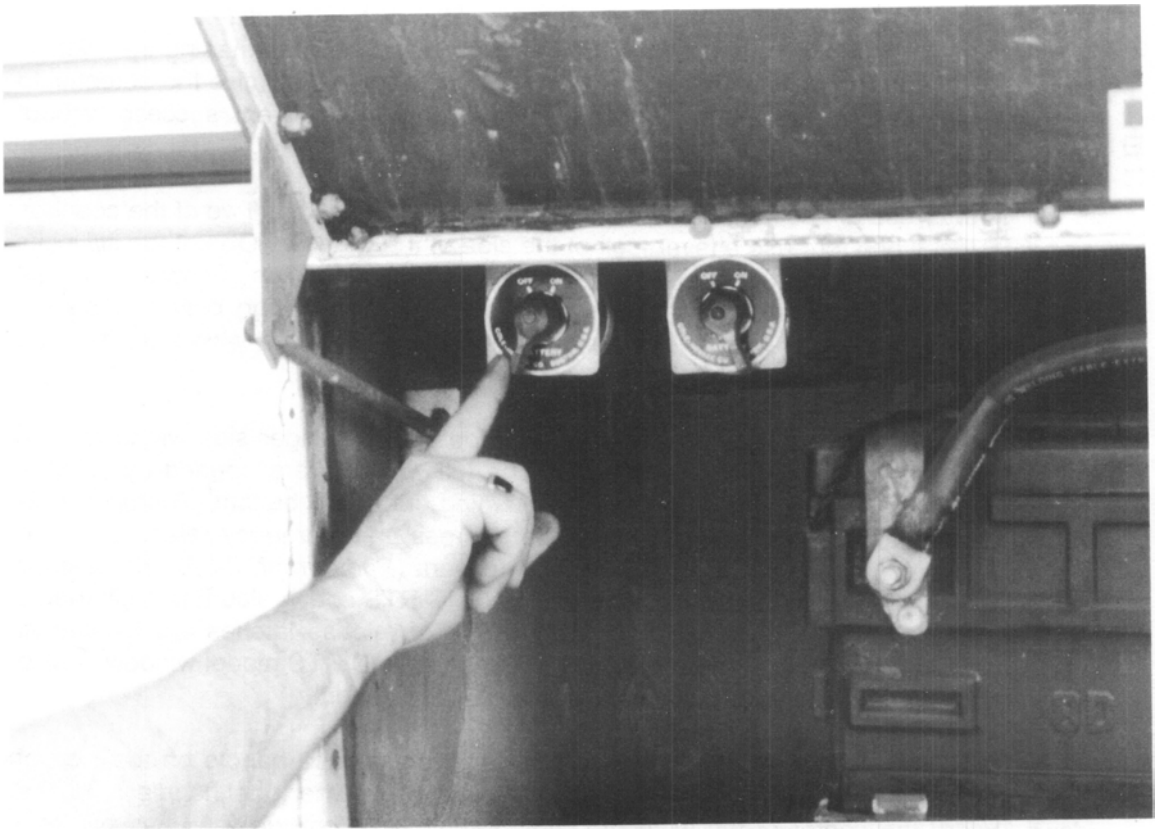
PHOTOGRAPH 2-54
GILLIG PHANTOM MODEL:
LOCATION OF ELECTRICAL (BATTERY) MASTER SWITCH ON FRONT WALL OF BATTERY COMPARTMENT



PHOTOGRAPH 2-55
IKARUS USA ARTICULATED MODEL:
ELECTRICAL (BATTERY) SWITCHES LOCATED IN CENTER
OF BATTERY COMPARTMENT



PHOTOGRAPH 2-56
NEOPLAN USA MODEL:
12-VOLT AND 24-VOLT ELECTRICAL (BATTERY) SWITCHES



PHOTOGRAPH 2-57
ORION MODEL:
LOCATION OF ELECTRICAL (BATTERY) SWITCHES

2.11 PASSENGER SIDE WINDOWS

In the event of an emergency or accident which causes both of the right side doors to be unavailable for ingress or egress, it is particularly important for rescuers to be able to use the windows. In all six coaches, it is extremely difficult to open the windows from outside the vehicle without breaking the glazing or damaging the window assembly. Rescuers can be taught where to place pry bars to maximize the potential to pop the latches but these methods can achieve only inconsistent success without damaging the bus.

Interior use of passenger side windows is somewhat easier. Two of the coaches use sill latches and four use a lever lock at the side of the window. One of the *sill* locks requires a user to place *both* of his/her hands in a particular position in order to release the lock. In contrast, the *lever* release can be achieved by using only one hand. Further, the side lever release is not blocked on those windows where aisle-facing seats are placed.

The Flxible model is equipped with two types of passenger side windows — a full window or sliding passenger windows. The full windows are opened by lifting a handle which runs the length of the sill and pushing out at the bottom (*Photograph 2-58*). The sliding windows require the user to depress an emergency release latch in the sill while sliding the rear half of the window forward (*Photograph 2-59*). Sometimes these sliding windows are difficult to open. The GMC RTS coach also has a sill that is lifted to open the emergency windows but the pair of release latches are located at particular points along the sill (*Photograph 2-60*). The GMC RTS model window is also hinged at the top and opened by pushing outward at the bottom.

The Gillig, Ikarus, and Orion models have a red release handle on the side of the window which releases the window latches in the sill when the handle is pulled down toward the center of the window (*Photographs 2-61* through *2-67*). While this handle is held down the window can be pushed outward at the bottom. Because the release handles are on the side and the locks are actually in the bottom sill, a mechanical arrangement of cable and springs allows the handle to release the latches (*Photograph 2-63*) only if they are lubricated, regularly cycled and maintained to prevent rusting and breakage. There is some variation as to whether the handle is located on the forward or rear side of the glazing and how many windows are so equipped. The Orion model coach has only one emergency exit passenger window.

Once the windows are opened it is very difficult to keep them in place without the use of a pike pole or other device. With the Flxible and GMC RTS model coaches, the windows can be held with such a device. However, the Ikarus, Neoplan, and Orion model coaches' window design (*Photograph 2-65*) will cause it to drop from the coach if it is raised above a horizontal position. Some could argue that this type of window is a better design since it can be removed and does not have to be held open. Removing these windows (without damaging them) is very difficult. The Neoplan model, for

example, requires a rescuer on each side of the window on a ladder and a fair amount of rocking back and forth of the window to cause the window to be released. The weight of typical passenger side windows makes this a dangerous undertaking. It seems reasonable that a window design with hinges at the top and with an automatic prop to hold it open would be a better design.

The design and function of the rear side door also has an impact on the usability of the windows adjacent to it. On the Neoplan model, if the windows are pulled up above the door, the door can be opened and the bifolds can be used to hold the windows open (*Photograph 2-66*). However, if the door is already opened then neither adjacent window can be opened. On the GMC RTS coach, opening the rear side door also prevents opening the adjacent side windows, however, the design is such that the windows cannot be held open by letting them rest on the bifold doors.

Summary information on passenger side windows is shown in *Table 2-11.*

TABLE 2-11. SAFETY DEVICE: PASSENGER SIDE WINDOWS

URBAN TRANSIT BUS MODEL*	LOCATION	ACCESSIBLE FROM OUTSIDE OF COACH	EMERGENCY USE	FUNCTION	VEHICLE SPECIFIC SAFETY PROBLEM
Flxible	Along both sides of coach	1. Split/sliding window - accessible if unlocked; split windows very diffi-cult to pry open from outside without breaking at least rear half of window	1. Slide split window open or break glazing full width of rear half; reach into coach, depress emergency release latch located near the center of window sill and slide the rear glazing and frame forward	Allow emergency forces to gain access to interior, allow ambulatory passengers to escape, allow emergency forces to remove injured passengers on stretchers and backboards	Windows cannot be opened easily from outside; glazing breakage very probable with potential injury to passengers, windows require lubrication and cycling to remain openable, drains must be appropriate to prevent cold weather freezing of window assembly and/or corrosion; windows will not automatically stay open, sliding windows are difficult to open in warm weather
		2. Solid windows very difficult to pry open from outside without breaking	2. Insert pry bar midway up side of glazing, try to pop sill lock and raise window; or break glazing, reach into coach and release locking device by lifting the sill channel upward and manually pulling the entire window assembly outward		
GMC (TMC) RTS	Along both sides of coach	Solid windows and split windows very difficult to pry open from outside without breaking	Insert pry bar midway up side of glazing, and try to pop sill lock, or slide split windows open or break glazing, then reach into coach and release locking device by pulling the panel using both hands positioned at black latches up and toward the center of the coach and manually pull entire window assembly outward	Allow emergency forces to gain access to interior, allow ambulatory passengers to escape, allow emergency forces to remove injured passengers on stretchers and backboards	Windows cannot be opened from outside; glazing breakage very probable with potential injury to passengers; windows require lubrication and cycling to remain openable; drains must be appropriate to prevent cold weather freezing of window assembly and/or corrosion; windows will not automatically stay open; windows adjacent to side doors cannot be used (blocked) if side doors are open

TABLE 2-11. SAFETY DEVICE: PASSENGER SIDE WINDOWS (CONTINUED)

URBAN TRANSIT BUS MODEL*	LOCATION	ACCESSIBLE FROM OUTSIDE OF COACH	EMERGENCY USE	FUNCTION	VEHICLE SPECIFIC SAFETY PROBLEM
Gillig Phantom	Along both sides of coach	Yes — if window is unlocked; may be difficult to pry open without breaking	Insert pry bar midway up side of glazing and try to pop sill locks; or slide window open or break glazing, then reach into coach and release locking device by pulling red emergency open handle downward and manually pulling window assembly outward	Allow emergency forces to gain access to interior, allow ambulatory passengers to escape, allow emergency forces to remove injured passengers on stretchers and backboards	Windows cannot be opened easily from outside, glazing breakage very probable with age with potential injury to passengers; windows require lubrication and cycling to remain openable; drains must be appropriate to prevent cold weather freezing of window assembly and/or corrosion, windows will not automatically stay open
Ikarus USA Articulated	Large windows along both sides of coach	Lower windows very difficult to pry open from outside without breaking	Insert pry bar midway up side of glazing and try to pop sill locks; or break glazing, reach into coach and release locking device by pull-ing red emergency handle down-ward and manually pulling window assembly outward	Allow emergency forces to gain access to interior, allow ambulatory passengers to escape, allow emergency forces to remove injured passengers on stretchers and backboards	Windows cannot be opened easily from outside; glazing breakage very probable with potential injury to passengers; windows require lubrication and cycling to remain openable; drains must be appropriate to prevent cold weather freezing of window assembly and/or corrosion; windows will not automatically stay open; lower/larger windows are hooked to their frame at top and may come unhooked if forced above horizontal position, windows can fall if rescuers assume they are hinged, significant injuries could result

TABLE 2-11. SAFETY DEVICE: PASSENGER SIDE WINDOWS (CONTINUED)

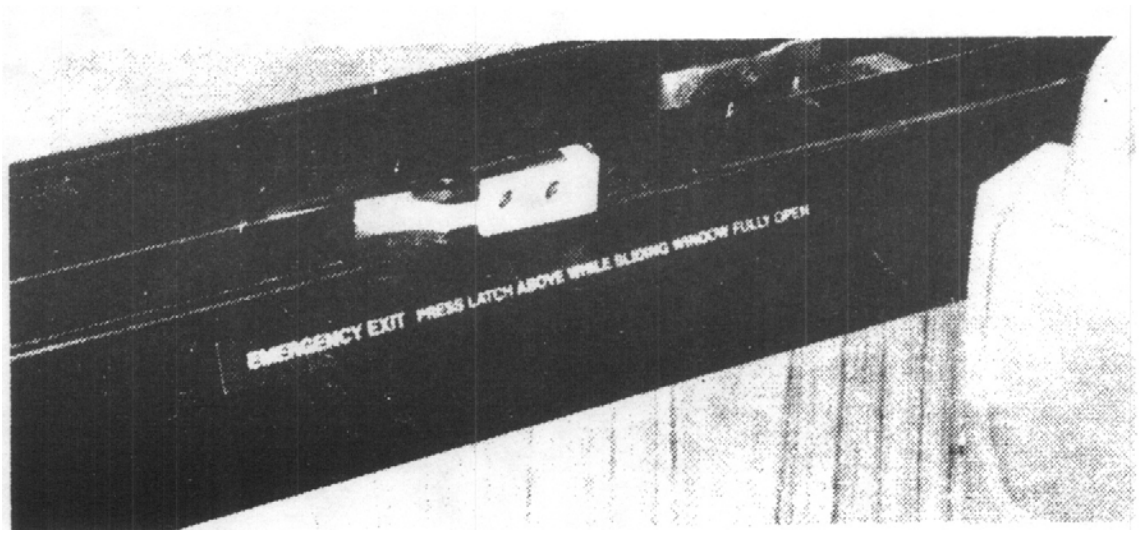
URBAN TRANSIT BUS MODEL*	LOCATION	ACCESSIBLE FROM OUTSIDE OF COACH	EMERGENCY USE	FUNCTION	VEHICLE SPECIFIC SAFETY PROBLEM
Neoplan USA	Along both sides of coach except for first window behind front door and first window behind opera-tor's position	Very difficult to pry open from outside without breaking	Insert pry bar between window and frame midway up side of glazing and try to pop lock; or break glazing, then reach into coach and release locking device by pulling red emergency open handle downward and manually pulling window assembly outward	Allow emergency forces to gain access to interior, allow ambulatory passengers to escape, allow emergency forces to remove injured passengers on stretchers and backboards	Windows cannot be opened easily from outside; glazing breakage very probable with potential injury to passengers, windows require lubrication and cycling to remain openable, drains must be appropriate to prevent cold weather freezing of window assembly and/or corrosion; windows will not automatically stay open; windows adjacent to side doors cannot be used (blocked) if side doors are open; rear side doors can be used to hold open previously opened adjacent windows but actions causing doors to close could result in windows falling on rescuers or passengers, windows are hooked to their frame at top and can be unhooked by raising the window slightly above horizontal position — windows can fall if rescuers assume they are hinged, significant injuries could result

TABLE 2-11. SAFETY DEVICE: PASSENGER SIDE WINDOWS (CONTINUED)

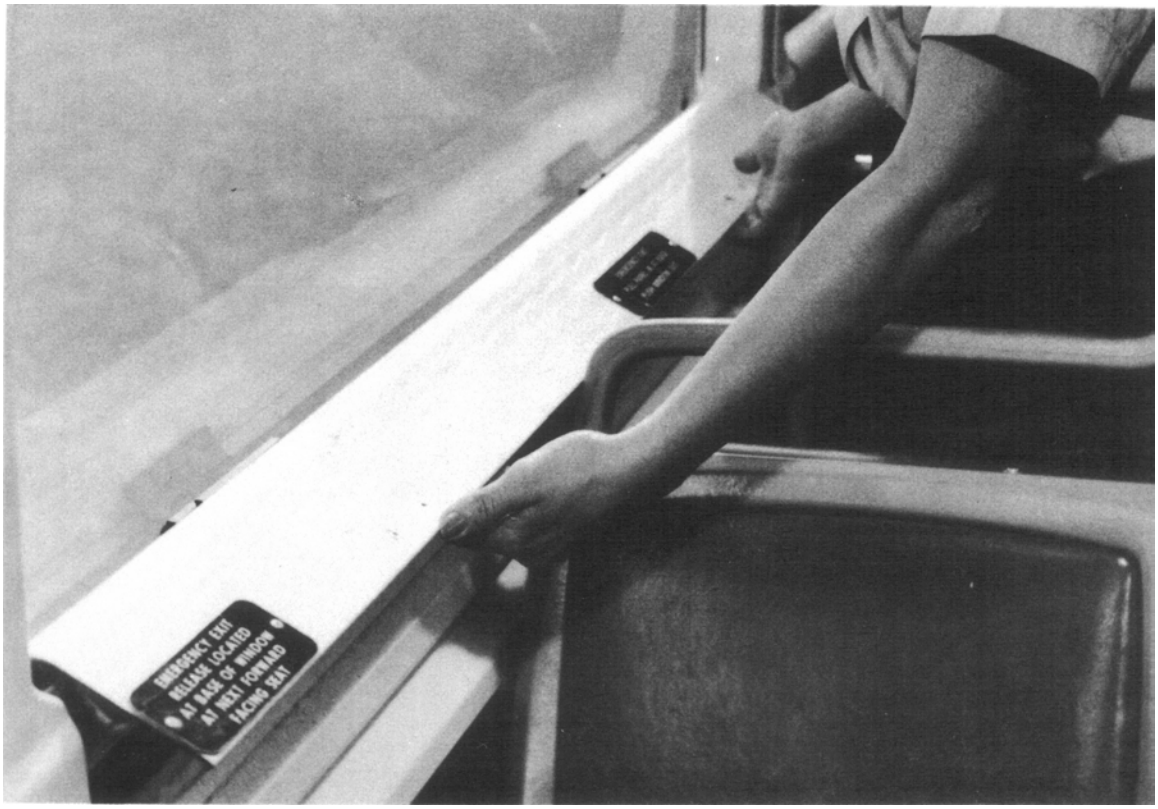
URBAN TRANSIT BUS MODEL*	LOCATION	ACCESSIBLE FROM OUTSIDE OF COACH	EMERGENCY USE	FUNCTION	VEHICLE SPECIFIC SAFETY PROBLEM
Orion	Fourth window from front on left side of coach	Window very difficult to pry open from outside without breaking. Block inserted in top of frame & held with screw prevents fully sliding window open, which would be wide enough for entry through any passenger window	Insert pry bar midway up side of glazing and try to pop sill locks; or break glazing, then reach into coach and release locking device by pulling red emergency open handle downward and manually pulling window assembly outward	Allow emergency forces to gain access to interior, allow ambulatory passengers to escape, allow emergency forces to remove injured passengers on stretchers and backboards	Window cannot be opened easily from outside, glazing breakage very probable with potential injury to passengers; windows require lubrication and cycling to remain openable; drains must be appropriate to prevent cold weather freezing of window assembly and/or corro-sion; window will not automati-cally stay open; window is hooked to its frame at top and can be unhooked by raising the window slightly above hori-zontal position — windows can fall if rescuers assume they are hinged, significant injuries could result, only one window on left side of coach is emergency access, no windows on right open

* Specific bus models tested are detailed in Appendix A

PHOTOGRAPH 2-58
FLXIBLE MODEL:
EMERGENCY RELEASE FOR FULL PASSENGER SIDE WINDOW (INTERIOR)



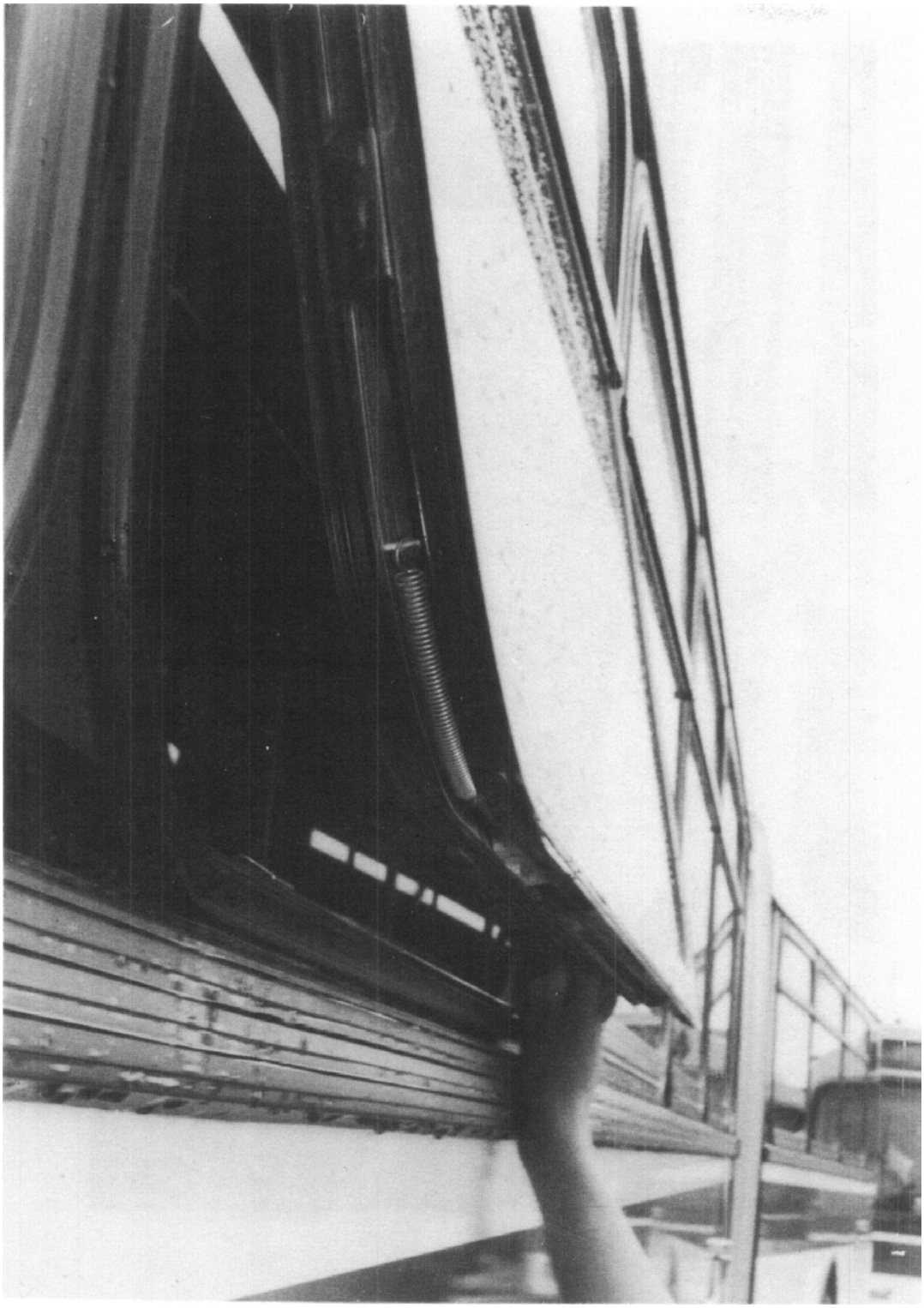
PHOTOGRAPH 2-59
FLXIBLE MODEL:
EMERGENCY RELEASE FOR SLIDING PASSENGER SIDE WINDOW (INTERIOR)



PHOTOGRAPH 2-60
GMC RTS MODEL:
USE OF EMERGENCY PASSENGER SIDE WINDOW

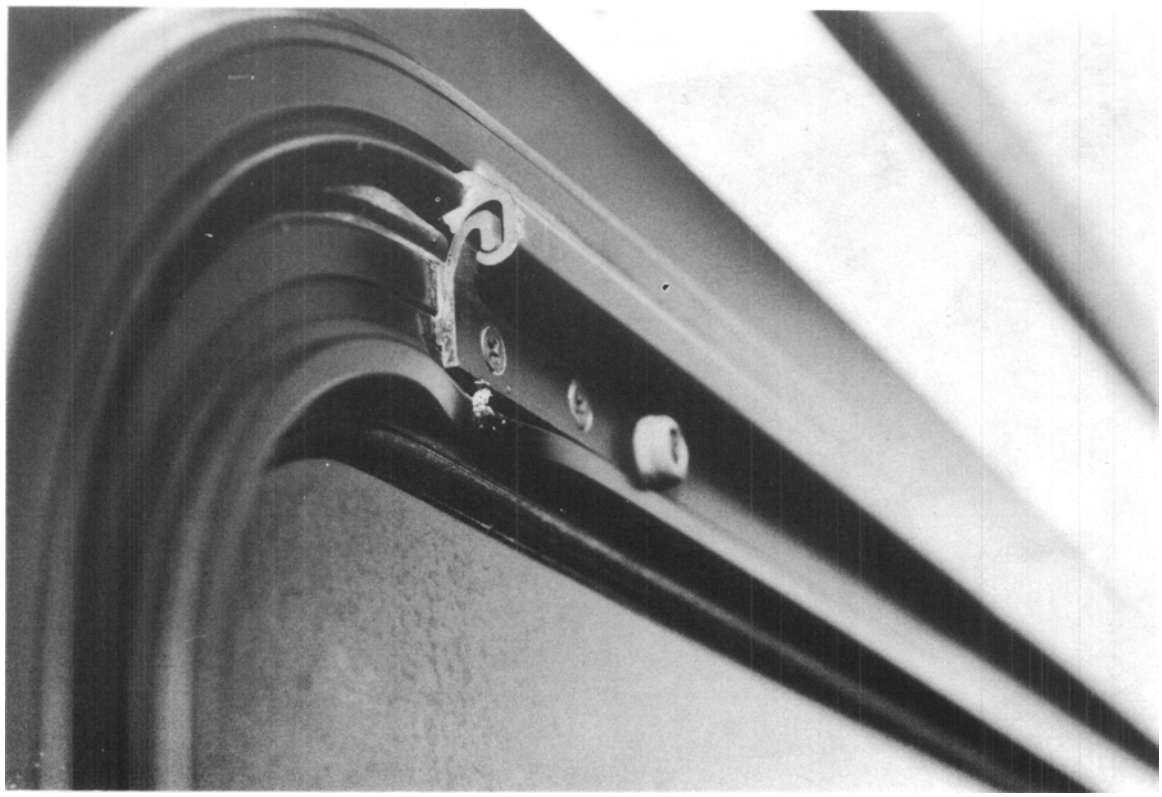
PHOTOGRAPH 2-61
GILLIG PHANTOM MODEL:
USE OF EMERGENCY RELEASE FOR EMERGENCY PASSENGER SIDE WINDOW

PHOTOGRAPH 2-62
IKARUS USA ARTICULATED MODEL:
USE OF EMERGENCY RELEASE FOR EMERGENCY PASSENGER SIDE WINDOW

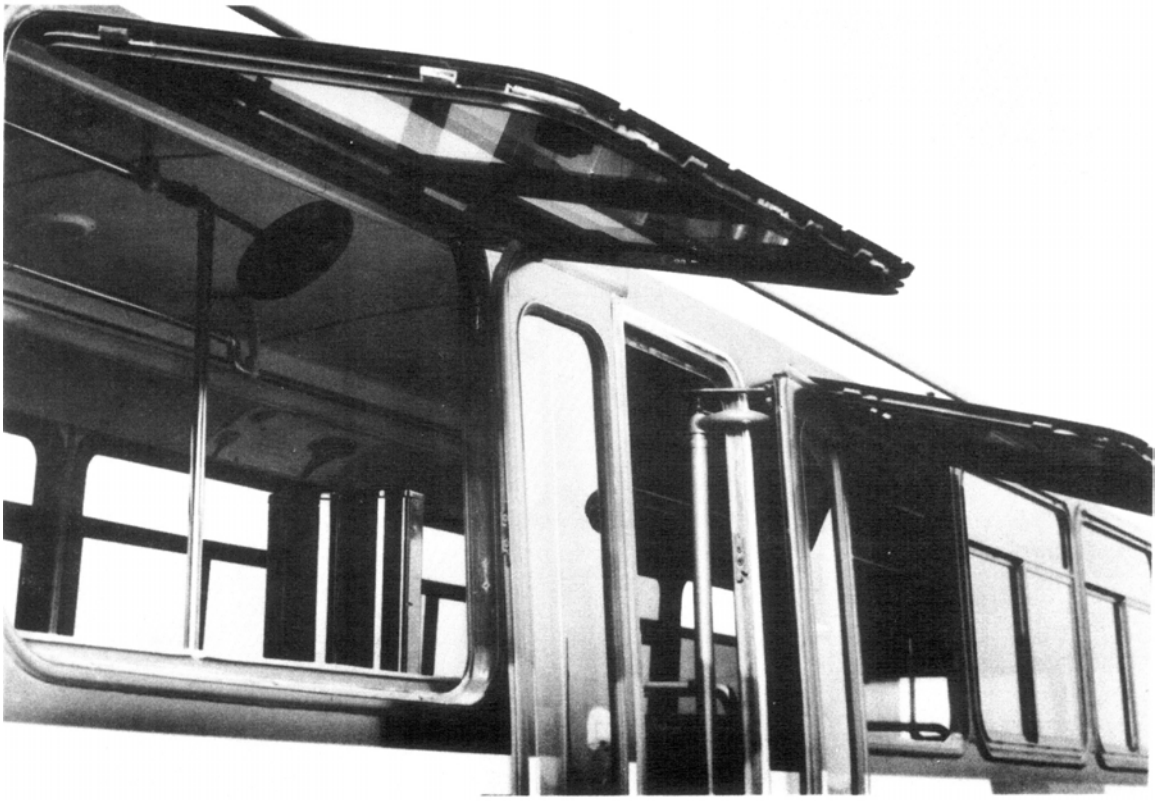


PHOTOGRAPH 2-63
IKARUS USA ARTICULATED MODEL:
EXTERIOR VIEW OF EMERGENCY PASSENGER SIDE WINDOW AND RELEASE RETURN MECHANISM

PHOTOGRAPH 2-64
NEOPLAN USA MODEL:
USE OF EMERGENCY PASSENGER SIDE WINDOW



PHOTOGRAPH 2-65
NEOPLAN USA MODEL:
HOOK ASSEMBLY ON PASSENGER SIDE WINDOW AND FRAME



PHOTOGRAPH 2-66
NEOPLAN USA MODEL:
USE OF REAR DOOR TO HOLD OPEN PASSENGER SIDE WINDOWS

PHOTOGRAPH 2-67
ORION MODEL:
SINGLE EMERGENCY PASSENGER SIDE WINDOW

3. STANDARD EMERGENCY SAFETY COMPONENTS: DEVELOPMENT PROCESS

3.1 THE GUIDELINES DEVELOPMENT COMMITTEE

In the Summer of 1991, the availability, location, and use of the original 11 key safety components were documented in the *KETRON Technical Discussion.* At the same time, the Cambria County Transit Authority and KETRON organized an inter-industry **Guidelines Development Committee** to assist in assessing the currently available components. By contributing expertise and experience the Committee developed suggestions on how the key safety components might be standardized. By design, the comprehensive Committee represented vehicle manufacturers, engine suppliers, maintenance managers, transit authorities, emergency response forces, parts suppliers, advocates, and government. Major representation on the Committee is shown in *Figure 3-1.*

Vehicle manufacturers were represented by Flxible Corporation, Greyhound Canada, Ikarus USA, Neoplan USA, Ontario Bus Industries, and Transportation Manufacturing Corporation. The Detroit Diesel Corporation represented engine suppliers. The American Public Transit Association (APTA) represented advocates. Maintenance management professionals were included from CCTA, the Port Authority of Allegheny County (PAT), and the Southeastern Pennsylvania Transportation Authority (SEPTA). End-users included the Altoona Bus Testing Facility, CCTA, the National Association of Emergency Medical Technicians, the Philadelphia Fire Department, and the Pittsburgh Police Department. Representation from the government included members from the Federal Transit Administration (FTA) and the John A. Volpe National Transportation Systems Center.

A Window Subcommittee was later formed which included representation from Beclawat, Commercial Plastics & Supply, Ellcon-National, Excel Industries, G.E. Plastics, Hehr International, J.T. Nelson, R.E. Jackson, and Storm-Tite.

The specific membership of the Original Guidelines Development Committee is summarized in *Table 3-1.* In addition, Gillig Corporation, New Flyer Industries, Cummins Engine Corporation, various transit authorities, assorted suppliers, and a number of other significant organizations were made aware of the project and were involved indirectly. These associate members and interested parties are shown in *Table 3-2.* Many other companies were contacted during research phases.

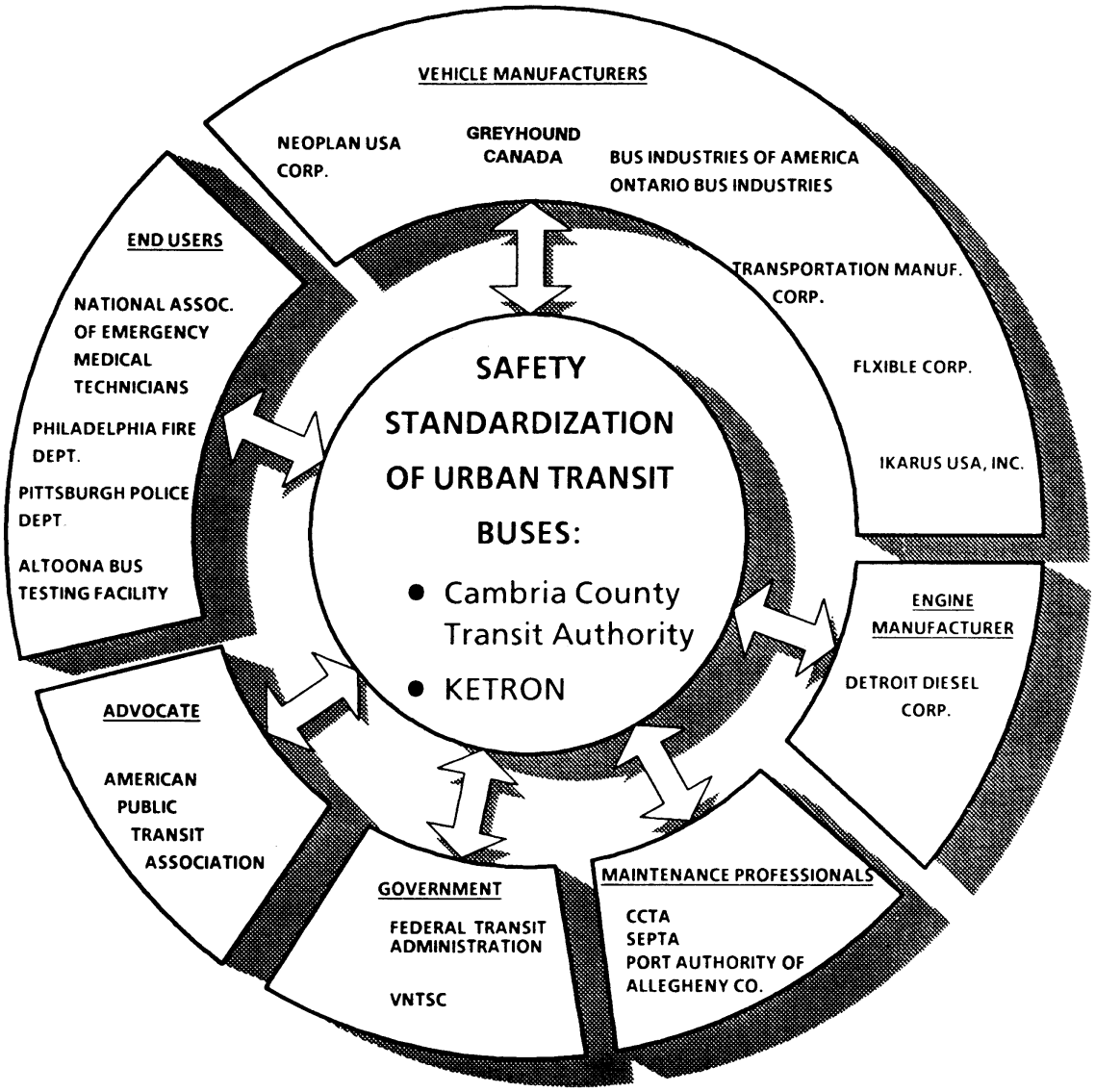


FIGURE 3-1. GUIDELINES DEVELOPMENT COMMITTEE

TABLE 3-1. ORIGINAL GUIDELINES DEVELOPMENT COMMITTEE MEMBERS

BUS MANUFACTURERS	
●	●
●	●
●	●
ENGINE SUPPLIERS	
●	
ADVOCATES	
●	● Corporation
MAINTENANCE MANAGEMENT PROFESSIONALS	
●	● Authority
●	
END-USERS	
●	●
●	●
● Technicians	
GOVERNMENT	
●	●
WINDOW SUBCOMMITTEE	
● Manufacturing, Inc.	●
	●
●	●
●	●
●	●

TABLE 3-2. ASSOCIATE MEMBERS AND INTERESTED PARTIES

ASSOCIATE MEMBERS AND INTERESTED PARTIES	
•	• Transportation Authority
•	•
•	•
•	•
•	•
•	•
•	•
	•

3.2 PROCESS

On August 21 and 22, 1991, the inter-industry Guidelines Development Committee met at APTA headquarters to introduce the project to the APTA Bus Safety Committee and to discuss the eleven safety components with the goal of standardizing their location, accessibility, labeling, use, and function. The text, tables, and photographs represented in the previous section served as the basis of discussion at those meetings, along with two slideshow presentations.[3]

Participation at the August meetings was enthusiastic. The Guidelines Development Committee immediately recognized a number of areas where components were well designed and fairly close to being standardized. The Committee discerned that other components required specific improvements before they could be standardized. The consultant, KETRON, was charged with the tasks of solidifying the Committee's recommendations for standardization and improvement, further researching possibilities for necessary design improvements, and drafting guidelines for each of the components to be standardized.

Based on the results of the August meeting, KETRON began, in September, the task of researching options and writing the recommended detailed guidelines. By December, over a hundred organizations and sources had been consulted for detailed information on components.

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[3] Balog, J. N, and Gribbon, R. B *Presentation Bus Safety Standardization.* KETRON, August 21, 1991, and Balog, J.N., Gribbon, R. B., and Schwarz, A. N. *Bus Safety Standardization Guidelines Development Committee Meeting* slideshow. KETRON, August 21-22, 1991.

On January 7, 1992, several emergency response members of the Guidelines Development Committee that were unable to participate in the August meeting met with KETRON professionals in Malvern, Pennsylvania. The then current guidelines for each component were supplemented with the very practical concerns of rescue forces on the scene of an accident. This meeting was essential to ensure an adequate level of input from the emergency response industry.

The Guidelines Development Committee had determined in August that developing an acceptable, significantly improved, standard for emergency windows was probably beyond the scope of this effort, yet current concerns needed to be addressed. Consequently a Window Subcommittee was formed. This group, made up of the major transit window and frame manufacturers, met on January 9th in KETRON's Philadelphia, Pennsylvania office, to discuss possible improvements for emergency window standards. A number of possibilities were discussed and the most necessary and feasible were incorporated into the guidelines. The Subcommittee also concluded that significant additional research and development was required.

During January and February, 1992, KETRON finished draft guidelines synthesized from the results of all three meetings and information from additional research. On March 26, 1992 a meeting was conducted with members of the Guidelines Development Committee and Window Subcommittee in Philadelphia to discuss the draft guidelines.

KETRON then revised the guidelines by addressing the comments made by Committee members. These finalized guidelines were presented on May 18th at the 1992 APTA Bus Safety and Technology Conference in Charlotte, NC,[4] which several members of the Guidelines Development Committee attended. On September 11, 1992 KETRON and representatives from the Committee met with FTA in Washington, DC to discuss the project itself. It was concluded that the project had made significant advances toward improved and standardized urban transit bus safety equipment. KETRON was pleased to have candid and cooperative input from all members of the Guidelines Development Committee, Window Subcommittee, and the participating industries; their assistance directly contributed to urban transit bus safety.

One of the conclusions from this meeting was that the research work should continue. In the fall of 1993, contractual arrangements were put in place between CCTA and KETRON and between VNTSC and KETRON.

In the subsequent activities a new Guidelines Development Committee was created. All original Members along with additional relevant professionals were invited to participate using the letter shown in Exhibit 3-1, dated May 23, 1994. It was also decided that the current Members of the APTA Bus Safety Committee should be invited to review the Guidelines. On May 19, 1994, a letter was sent to APTA Bus Safety

[4] Balog J.N. and Gribbon R. *B., Minimizing Your Risks and Reducing Accident Cost: Proposed FTA Guidelines for Bus Safety Equipment Standardization,* KETRON/APTA Information Center, May 18, 1992.

Committee members inviting them to review the Guidelines (Exhibit 3-3), followed by a second letter dated August 1, 1994. (Exhibit 3-4).

Twenty-one Members responded using KETRON's Evaluation Form. The results were tabulated.[5] In summary, for all 10 safety components at least 12 of 21 APTA Safety Committee respondents agreed with the specific Guidelines as written. For the driver's side window, 18 members agreed with the Guidelines as written. For the master door release control and roof-mounted emergency ingress and escape hatches, 17 agreed. For the master run switch 16 agreed. The Guidelines for the front side door release control and the passenger side windows had 14 agrees. For the electrical (batteries) switch 13 agreed. Lastly, for the emergency engine stop switch, the rear side door release control, and the universal emergency shut-down switch, 12 agreed.

In several cases, those who disagreed with the specific Guidelines offered comments which were considered by KETRON and discussed by the Guidelines Development Committee during a meeting on October 12, 1994 in Philadelphia. The Committee generated some changes to the Guidelines and decided to delete some safety components from further consideration. Use of the driver's side window for ingress and egress was considered redundant to other locations on the buses. The master door release control in or near the operator's area was also considered to be redundant in location. Lastly, the universal emergency shut down switch conceptually identified by the original Guidelines Development Committee was deleted from further consideration. With the depression of one mushroom switch, its functionality was to shut down the engine, remove electrical power supplied by the batteries, release (but not open the doors), and place the transmission in park. Although considered to be an excellent idea, it would require the reversing of some of the current design logic on the buses. In addition, development of a detailed set of Guidelines was considered beyond the monetary and technical scope of the current contract.

KETRON consequently revised the remaining eight Guidelines[6] to reflect the direction of the Guidelines Development Committee and distributed them to the APTA Safety Committee members for evaluation on November 11, 1994 (Exhibit 3.5). Fourteen members responded. At least 8 of the 14 respondents agreed with all of the then current Guidelines as written. For the Roof-mounted Emergency Ingress and Escape Hatches, 11 Members agreed with the Guidelines as written. For the Master Run Switch and the Electrical (Batteries) Switch, 10 agreed. For the Emergency Engine Shutdown Switch in the Engine Compartment, 9 agreed. Lastly, 8 agreed on the Driver's Side Window, the Front Side Door Release Control, the Rear Side Door Release Control, and the Passenger Side Windows.

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[5] Balog, John N., "Bus Safety Standardization Program: APTA Safety Committee Evaluation Summary of Guidelines," KETRON Division of the Bionetics Corporation, Malvern, PA, BSP-JNB-94-234, August 30, 1994.

[6] Balog, John N., "Proposed Guidelines for Bus Safety Equipment Standardization," KETRON Division of the Bionetics Corporation, Malvern, PA, BSP-JNB-94-255, November 11, 1994.

A combination of 28 APTA Safety Committee Members reviewed and responded with evaluations of the first and second set of draft guidelines.

One basic philosophical issue developed during this iterative process which makes it difficult to standardize the Guidelines. One of the major tenets of this research effort was to develop Guidelines which when adopted, will maximize accessibility of emergency response forces to all safety components without the need to seriously damage or destroy any parts of urban transit buses. Some APTA safety professionals believe that this approach will lead to vandalism and as such, suggests that key lock approaches are more appropriate.

This issue, along with the evaluations of the APTA Safety Committee Members, was addressed on December 14, 1994 in Philadelphia at a meeting of the Guidelines Development Committee membership. The Committee used two documents in its deliberations: the APTA Bus Safety Committee Comments[7] and the revised proposed guidelines[8]. The Guidelines presented in Section 4 of this Final Report clearly reflect the understanding, comments, discussions, and evaluations of the Guidelines Development Committee, the APTA Safety Committee, and KETRON professionals.

3.3 THE GUIDELINES

In the development of guidelines, a number of important concerns had to be integrated in order to form comprehensive requirements. The following paragraphs describe these concerns.

The guidelines for urban transit bus components were developed with one overriding concern: **safety**. Of similar importance was the component's ease of use by untrained emergency response personnel. A number of additional goals were nearly equally important. The Guidelines were ultimately written with the following priorities.

- Components should provide for the maximum safety of passengers, drivers, and emergency personnel in the event of an accident or emergency.

- Components should be easily usable by emergency response personnel wearing full gear, including heavily padded gloves, bunker coats, helmets, and possibly air tanks.

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[7] Balog, John N., "Bus Safety Standardization Program: APTA Safety Committee Evaluation Summary of Revised Guidelines," KETRON Division of the Bionetics Corporation, Malvern, PA, BSP-JNB-94-356, Decembers, 1994.

[8] Balog, John N., "Proposed Guidelines for Bus Safety Equipment Standardization," KETRON Division of the Bionetics Corporation, Malvern. PA. BSP-JNB-94-255, November 11, 1994.

- Components should be easy to find and obvious in use so as to be easily used by any individual, especially those without training.

- The guidelines for components should be precise and unrefutable as to intent.

- Costs, the potential for damage to the vehicle or the components themselves, and the potential for injury to the user, should be minimized.

- Existing standards and widely recognized commonalities should be used to the maximum extent feasible.

- Improvements and innovation in the industry should be encouraged.

- The potential for misuse and/or vandalism should be minimized.

Identifying Features

In recognition of the first four priorities, significant space is devoted to describing the identifying features of each component. In general, emergency controls are described so as to be clearly distinguishable from normal controls. Each is a clearly distinguishable shape, standardly located, and red, with red on white emergency instructions. Also, a newly designed universal access symbol was developed by KETRON to identify each component which is accessible from the outside for arriving emergency forces. One significant problem discovered early in the project during field inspections was that good identification and instruction labeling was often found in a deteriorated condition. Consequently, guidelines for the durability of markings are also included.

Accessibility

Significant efforts were made to make each component operable from outside the vehicle by emergency personnel, and from inside as appropriate. This was essential to the goals of the project.

Use

In descriptions of the actual use of each component, existing reasonable methods generally prevailed, with standardization of the main thrust. Where a clear standard did not exist, the usage most often employed (if reasonable) was selected as standard. The use of up for on and down for off, and similar generally accepted

standards were incorporated as much as possible. In addition, consideration was given to the need to be able to operate the devices with typical rescue equipment worn.

Existing Versus Improved Components

Many of the paragraphs herein describe, in detail, the aspects of existing, common reasonable components so that standardization may be achieved and maintained. In other cases, however, wholly acceptable standards did not exist for the component or certain aspects of the component. In these cases, an improved standard was developed based on the priorities described above, discussions on feasibility with vehicle manufacturers, and research with component suppliers.

3.4 APPLICATION OF GUIDELINES

An issue that did not become apparent until the Committee had met a second time was that the specificity and degree of improvement of the Guidelines suggested for implementation would be influenced by how they were to be applied. Very few details could be included if the standards were to be suggested for retrofitting all U.S. vehicles. Conversely, significant and detailed improvements in safety components to meet all the needs of evacuation and emergency response would require significant research and development efforts which are beyond the scope of this project.

It was determined that significant standardization through retrofits was financially prohibitive and, even if possible, could leave the industry with standard yet less than perfect equipment. *The aim of these guidelines is to standardize urban transit buses to be acquired.* Fleet managers may, however, carefully select specific guidelines to apply to existing vehicles to increase overall safety in emergency situations.

It was also necessary to determine whether guidelines should be immediately implementable or would be a standard that involved significant improvements to existing designs and components. Ultimately this was determined by the needs of each component. The safety problems associated with emergency windows require significant amounts of research and development. The Master Run Switch concept, on the other hand, has few safety problems and is nearly standard with regard to some aspects; in order to both provide a usable device for emergency rescue forces and standardize the component, outside accessibility and a change in its size was required. Concepts that would require significant research and development but would contribute only slight improvements to the industry were generally omitted.

3.5 COMPONENTS ADDRESSED

At the project start, eleven components were targeted for standardization. Two of these, discussed below, were determined to be obsolete by the first Guidelines Development Committee, and guidelines for a standard were not pursued for these components. It was also determined by the first Guidelines Development Committee that a new component which combined the features of others should be added. This new component, the Universal Emergency Shut Down Switch, is also discussed below.

Engine Stop Solenoid Plunger

Four of the bus models studied were equipped with an emergency Engine Stop Solenoid Plunger. This feature, located on the engine itself, was designed for emergency use to stop runaway diesel engines by releasing the cam on the air choke valve and depriving the engine of air. The feature had some inherent safety problems, but most newer, electronically controlled engines do not need this device, as any interruption of power supply should shut down the engine. The plunger was determined to be obsolete and inappropriate for standardization.

Emergency Stop Switch

This switch, located in the driver's compartment, remotely activates the Engine Stop Solenoid Plunger on the engine, releasing the cam on the air choke valve and shutting down the engine. As electronically controlled engines make the Engine Stop Solenoid Plunger essentially obsolete, this remote device was also considered to be inappropriate for standardization and was not pursued any further.

Universal Emergency Shut-Down Switch

At the first meeting of the Guidelines Development Committee and at the introduction of the project to the APTA Bus Safety Committee at APTA headquarters on August 21st and 22nd (1992), there was significant discussion in favor of a single device that would accomplish the necessary functions relating to all emergency safety components. Functions associated with shutting the bus down seemed to be especially suited to this potential purpose. Releasing the doors would also be an important feature, but evacuation emergency features such as windows and roof hatches would perhaps be more difficult to control remotely. Although a number of locations were discussed, it seemed that the shut-down switch should be located with other engine controls in the engine compartment, but should be unique from other engine controls so as to not interfere with the normal maintenance functions. It was determined that the consultant (KETRON) should investigate the possibility of such a device, but that it could not replace standard emergency equipment. Standards for the other emergency components would need to be developed first and as well. The remaining discussion at that time focused on each of the individual components.

The auxiliary meeting of the Guidelines Development Committee in January, 1992, involving the emergency response forces as end-users, revisited this feature. It was seen that a standard and universal device for shutting down the vehicle could clearly enhance the effectiveness of responding emergency forces, reduce the risk to passengers and rescuers after an accident, and decrease the amount of training necessary to provide the emergency response forces the level of proficiency in transit bus components otherwise necessary. KETRON continued to work primarily on the individual components, while incorporating their features into a universal shut-down switch.

In March 1992 the Committee discussed the universal shut-down switch itself and suggested that the most appropriate location for the switch would be in the battery compartment. The details of this discussion were incorporated into the final guidelines approach suggested for a Universal Emergency Shut-Down Switch. The Guidelines were further discussed during meetings of the second Guidelines Development Committee and evaluated by the members of the APTA Safety Committee.

Other Deletions

As mentioned earlier, the Second Guidelines Development Committee decided that the driver's side window for ingress and egress was redundant to other locations on the bus, and that the master door release control in or near the operator's area was redundant in location.

Other Key Emergency Safety Components

The remaining eight components originally studied were felt to be highly appropriate for standardization. KETRON, the Guidelines Development Committee and the APTA Safety Committee devoted significant energies in developing guidelines which may be used for improved, standard components.

The following section presents the detailed suggested guidelines for the standardization of eight key safety components on urban transit buses.

EXHIBIT 3-1. INVITATION TO PARTICIPATE ON GUIDELINES DEVELOPMENT COMMITTEE

BSP-JNB-94-«1»
May 23, 1994
MAILED

« 2»« 3»
« 4»

RE: STANDARDIZATION GUIDELINES DEVELOPMENT COMMITTEE

Dear Mr.« 3»:

In recent years the KETRON Division of the Bionetics Corporation has provided consulting services to the Cambria County Transit Authority utilizing funding from the Federal Transit Administration and the VOLPE National Transportation Systems Center. The focus of the most recent activities evolve around the development of guidelines for standardization of urban transit bus safety equipment. As a result of previous research and analysis work, it has been determined that it is difficult for emergency preparedness forces arriving on the scene of an urban transit bus accident or emergency to fully understand and utilize the safety components in an efficient and cost effective manner. This is primarily a result of the lack of consistency on how the components operate in addition to a lack of certain functional capabilities. The effect of this inconsistency and unavailability of safety components is intensified because the urban transit bus industry is demonstrably very safe. Since there are relatively few urban transit bus accidents and emergencies in contrast to other highway type vehicles, such as automobiles, to which emergency preparedness forces have to respond, emergency preparedness forces have little opportunity to familiarize themselves with the safety components and characteristics of urban transit buses.

In order to remedy this difficulty, KETRON previously worked with a Guidelines Development Committee made up of individuals representing bus manufacturers, engine suppliers, advocate organizations, maintenance manager professionals, and end-users (including emergency preparedness forces), government officials, window vendors, and numerous other interested parties. The result was a document of draft guidelines entitled, "Standardization of Safety Components on Urban Transit Buses." This document was designed based on the consensus of opinion generated by the active members of the original Guidelines Development Committee. The Federal Transit Administration and the VOLPE National Transportation Systems Center is interested in further pursuing the development and evaluation of the guidelines as a basis to determine what if any steps should be taken.

« 2»« 3»
May 23, 1994
Page 2

As such, we are reconstituting and expanding the Guidelines Development Committee membership. I invite you to become a member of the committee and to participate actively in two meetings expected to occur in Philadelphia to discuss the guidelines. If you would like to become a member of the new Guidelines Development Committee, please fill out Attachment A and return it to me as soon as possible, but no later than June 15, 1994. In the near future, I will provide all active members of the committee a copy of the current version of the guidelines. A meeting date will also be established and made apparent. I encourage you to become a member of the committee and to participate actively. Your views and comments are considered to be extremely important with respect to the approach being taken with the guidelines. If you have any questions regarding the project, feel free to call me or to submit written correspondence.

Thank you very much for taking the time to assist us in this very important process. I look forward to your response.

Sincerely,

KETRON Division of
The Bionetics Corporation

John N. Balog
Vice President,
Transportation Research, Planning
and Operations

JNB/jas

cc: Anne N. Schwarz
Mark Hood
John A. Morrison

Attachment A

EXHIBIT 3-1. INVITATION TO PARTICIPATE ON GUIDELINES DEVELOPMENT COMMITTEE (continued)

BSP-JNB-94-123

ATTACHMENT A

ACCEPTANCE OF MEMBERSHIP ON NEW GUIDELINES DEVELOPMENT COMMITTEE FOR STANDARDIZATION OF SAFETY COMPONENTS ON URBAN TRANSIT BUSES

Attn: John N. Balog
Vice President
Transportation Research, Planning, and Operations
KETRON, Division of The Bionetics Corporation
350 Technology Drive
Malvern, PA 19355-1370

I understand that it is the intent of the Cambria County Transit Authority and KETRON to further pursue the development of guidelines for the standardization of the type, location, and operation of safety devices on urban transit buses. To these ends, a new Guidelines Development Committee is being established.

In recognition of the importance of such an undertaking, and in the interest of safety and cooperation, I accept a position on the Guidelines Development Committee as a representative of _____(company). I agree to attend two meetings to contribute to the development of standardization, and am providing you with the following contact information below.

Name

Title _____

Company _____

Address _____

_____

Phone _____

FAX _____

_____

Signature Date

CONSULTANT STUDY FUNDED BY FTA & VOLPE TSC

EXHIBIT 3-1. INVITATION TO PARTICIPATE ON GUIDELINES DEVELOPMENT COMMITTEE (continued)

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075

Mr. Darrell Sykes
Manager, Customer Serv. Div.
Neoplan USA Corporation
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Transportation Manufacturing Corp.
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St. Eustache
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Bus Component Suppliers
VAPOR Divison
Mark IV Transportation Products Corp.
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EXHIBIT 3-1. INVITATION TO PARTICIPATE ON GUIDELINES DEVELOPMENT COMMITTEE (continued)

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079

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080

Mr. Peter Bigwood
Vice President, Engineering
Ontario Bus Industries
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Mr. Harold Zuschlag
Executive Vice President
Product Integration
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Roswell, NM 88201-5670

EXHIBIT 3-1. INVITATION TO PARTICIPATE ON GUIDELINES DEVELOPMENT COMMITTEE (continued)

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Oriskany, NY 13424-0449

083

Mr. Craig O. Henriksen
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084

Mr. Paul J. Lennon
Bus Safety/Bus Operations
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Mr. Dennis Costello
Asst. General Manager-Transportation
APTA Bus Safety Committee
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P.O. Box 731
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EXHIBIT 3-1. INVITATION TO PARTICIPATE ON GUIDELINES DEVELOPMENT COMMITTEE (continued)

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087

Mr. Daniel A. DiSantis
Maintenance Superintendent
Southeastern Pennsylvania Transporatation Authority
Germantown Facility
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088

Mr. John C. Martin
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EXHIBIT 3-1. INVITATION TO PARTICIPATE ON GUIDELINES DEVELOPMENT COMMITTEE (continued)

090

Mr. Jonathan Best, Chief
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091

Mr. Joseph Deal, Captain
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Philadelphia Fire Department
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Mr. Ben E. Blankenship, Captain
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North Little Rock, AR 72114

EXHIBIT 3-1. INVITATION TO PARTICIPATE ON GUIDELINES DEVELOPMENT COMMITTEE (continued)

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Transportation Systems Center
Office of Systems Assessment
Safety & Security Division, DTS-65
U.S. Department of Transportation
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Cambridge, MA 02142

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Product Manager - Transit Systems
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EXHIBIT 3-1. INVITATION TO PARTICIPATE ON GUIDELINES DEVELOPMENT COMMITTEE (continued)

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115

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116

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North South Road
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119

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President Letter-Rite, Inc.
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120

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121

Mr. Jack Soppelsa
President
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122

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Downs View, Ontario
CANADA M3M 1J8

EXHIBIT 3-2. INVITATION TO APTA BUS SAFETY COMMITTEE MEMBERSHIP

BSP-JNB-94-«1»
May 19, 1994

« 2»« 3»« 4»
« 5»

RE: GUIDELINES FOR BUS SAFETY EQUIPMENT STANDARDIZATION

Dear Mr.« 3»:

In recent years, the KETRON Division of the Bionetics Corporation has provided consulting resources to the Cambria County Transit Authority. The focus of the most recent activity evolves around the development of Guidelines for Standardization of Urban Transit Bus Safety Equipment. The current project is based on the fact that it is difficult for emergency preparedness forces arriving on the scene of an urban transit bus accident or emergency to fully understand and utilize the safety components in an efficient and cost-effective manner. This results from a lack of consistency on how the components operate and a lack of certain functional capabilities. The effect of this inconsistency and unavailability of safety components is intensified because the urban transit bus industry is demonstrably very safe. Since there are relatively few urban transit bus accidents and emergencies in contrast to other highway type vehicles, such as, automobiles, to which emergency preparedness forces have to respond, emergency preparedness forces have little opportunity to familiarize themselves with the safety components and characteristics of urban transit buses.

In order to remedy this difficulty, KETRON established a Guidelines Development Committee made up of individuals representing bus manufacturers, engine suppliers, advocate organizations, maintenance management professionals, end-users (including emergency preparedness forces), government officials, window vendors, and numerous other interested parties.

An interim meeting was conducted on August 21 and 22, 1991 at APTA Headquarters to introduce the project to the APTA Bus Safety Committee. Additional meetings were conducted with the Guidelines Development Committee to discuss the proposed guidelines and to revise them to reflect the consensus of the various participating professionals.

EXHIBIT 3-2. INVITATION TO APTA BUS SAFETY COMMITTEE MEMBERSHIP (continued)

« 2»« 3»
May 19, 1994
Page 2

As a current member of APTA's Bus Safety Committee, KETRON is interested in learning of your views and reactions to the current guidelines. Consequently, please find enclosed a summary copy of the guidelines. Please review them as soon as possible and fill out the attached Evaluation Form and return to me no later than June 20, 1994. Your comments will be utilized to determine what, if any, modifications should be made to the guidelines prior to convening a follow-up meeting with the Guidelines Development Committee in Philadelphia. Your views and comments are considered to be extremely important with respect to the approach being taken with the guidelines. The results of the guidelines development process will be provided to the Federal Transit Administration for their consideration. It is our understanding that FTA is interested in the consensus of opinion developed and presented by the APTA Safety Committee.

If you would like to become a member of the Guidelines Development Committee, you are certainly welcome and need only to advise me of your interest.

If you have any questions regarding the project, or the current version of the guidelines, feel free to call me or to submit additional written correspondence. Thank you very much for taking the time to assist us in this process. As a member of the APTA Bus Safety Committee, your expertise and opinions are valued. I will keep you informed of the results of the study.

Sincerely,

KETRON Division of
The Bionetics Corporation

John N. Balog
Vice President
Transportation Research, Planning and Operations

JNB/ns

cc: Paul Lennon, APTA
Dennis Costello, Chairman

BSP-JNB-94-070

EXHIBIT 3-2. INVITATION TO APTA BUS SAFETY COMMITTEE MEMBERSHIP (continued)

May 19, 1994

- EVALUATION FORM -

COMMENTS ON BUS SAFETY STANDARDIZATION GUIDELINES

COMMENTOR: _____

TITLE: _____

ORGANIZATION: _____

ADDRESS: _____

_____

TELEPHONE: (__) _____

FAX: (__) _____

Safety Components	Agree With As Written	Disagree With As Written	Suggested Revisions
1. Master Run Switch			
2. Driver's Side Window			
3. Emergency Engine Stop Switch in Engine Compartment			
4. Master Door Release Control			

EXHIBIT 3-2. INVITATION TO APTA BUS SAFETY COMMITTEE MEMBERSHIP (continued)

5. Front Side Door Release Control			
6. Rear Side Door Release Control			
7. Electrical (Batteries) Switch			
8. Roof-Mounted Emergency Ingress and Escape Hatches			
9. Passenger Side Windows			
10. Universal Emergency Shut Down Switch			

PLEASE FORWARD YOUR RESPONSE TO:

John N. Balog, Vice President
Transportation Research, Planning & Operations
KETRON Division of
The Bionetics Corporation
350 Technology Drive
Malvern, PA 19355-137

EXHIBIT 3-2. INVITATION TO APTA BUS SAFETY COMMITTEE MEMBERSHIP (continued)

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126

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Chief Safety Officer and Administrator -
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127

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128

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Montgomery County Transit Services
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EXHIBIT 3-2. INVITATION TO APTA BUS SAFETY COMMITTEE MEMBERSHIP (continued)

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131

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132

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EXHIBIT 3-2. INVITATION TO APTA BUS SAFETY COMMITTEE MEMBERSHIP (continued)

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134

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135

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136

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EXHIBIT 3-2. INVITATION TO APTA BUS SAFETY COMMITTEE MEMBERSHIP (continued)

137

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138

Mr. John Shoemaker
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139

Ms. Sandra Surretsky
Performance Analyst
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140

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EXHIBIT 3-2. INVITATION TO APTA BUS SAFETY COMMITTEE MEMBERSHIP (continued)

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142

Mr. Adrian Gaines
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143

Mr. James W. Holland, General Manager
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144

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EXHIBIT 3-2. INVITATION TO APTA BUS SAFETY COMMITTEE MEMBERSHIP (continued)

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146

Mr. James F. O'Neil, Jr.
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147

Mr. Bill Rueschaw
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148

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Greater Richmond Transit Company
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EXHIBIT 3-2. INVITATION TO APTA BUS SAFETY COMMITTEE MEMBERSHIP (continued)

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150

Mr. Anthony Borcic, Manager
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Mr. Lee O. Camardella
Safety /Training Manager
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Benefit Area Corporation
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EXHIBIT 3-2. INVITATION TO APTA BUS SAFETY COMMITTEE MEMBERSHIP (continued)

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153

Mr. Richard J. Daley, Jr.
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154

Mr. Joseph Dorsey
Assistant Director of Transportation
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155

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Metropolitan Transit Authority
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1201 Louisiana
P.O. Box 61429
Houston, TX 77208-1429

EXHIBIT 3-2. INVITATION TO APTA BUS SAFETY COMMITTEE MEMBERSHIP (continued)

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157

Mr. John Seccia
Director, Special Projects
and Administration
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Office of the Chief Transit Officer
25 Jamaica Avenue
Brooklyn, NY 11207

158

Mr. Larry Stover
Manager of Transportation
Jacksonville Transportation Authority
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Jacksonville, FL 32203

159

Mr. David Sutton
Superintendent of Operations
City of Detroit Department of
Transportation
1301 East Warren Avenue
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EXHIBIT 3-2. INVITATION TO APTA BUS SAFETY COMMITTEE MEMBERSHIP (continued)

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161

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EXHIBIT 3-3. SECOND INVITATION TO PARTICIPATE ON GUIDELINES DEVELOPMENT COMMITTEE

BSP-JNB-94-«1»
August 1, 1994
MAILED

« 2»« 3»« 4»
« 5»

RE: PREVIOUS LETTER DATED MAY 19, 1994 CONCERNING GUIDELINES FOR BUS SAFETY EQUIPMENT STANDARDIZATION

Dear Mr.«3»:

As a current member of APTA Bus Safety Committee, I previously sent you a copy on May 19, 1994 of a Letter, Evaluation Form, and a Summary copy of the Guidelines. At that time, I requested that you review the Guidelines and send the Evaluation Form in, as soon as possible.

Since Ketron remains very interested in your views and reactions to the current Guidelines, I again requested that you fill out the Evaluation Form and return it to me, as soon as possible and, certainly, no later than August 21, 1994. Your comments are important to us since they will be utilized to determine what, if any modifications, should be made to the Guidelines prior to convening a follow-up meeting with the Guidelines Development Committee in Philadelphia. Your views and comments are considered to be extremely important with respect to the approach being taken with the Guidelines. The results of the Guidelines Development process will be forwarded to the Federal Transit Administration for their consideration. It is our understanding that the FTA is interested in the consensus of opinion developed and presented by the APTA Safety Bus Committee.

If you would like to become a member of the Guidelines Development Committee, you are certainly welcome and need only to advise me of your interest.

EXHIBIT 3-2. INVITATION TO APTA BUS SAFETY COMMITTEE MEMBERSHIP (continued)

« 2»« 3»
August 1, 1994
Page 2

If you have any questions regarding the project, or the current version of the Guidelines, feel free to call me or to submit additional written correspondence. Thank you very much for taking the time to assist us in this process. As a member of the APTA Bus Safety Committee, your expertise and opinions are valued. I will keep you informed of the results of this study.

Sincerely,

KETRON Division
of The Bionetics Corporation

John N. Balog
Vice President
Transportation Research,
Planning and Operations

JNB/ns

cc: Paul J. Lennon, APTA
Dennis Costello, Chairman
APTA Bus Safety Committee

Enc.

EXHIBIT 3-4. PROPOSED GUIDELINES FOR BUS SAFETY EQUIPMENT STANDARDIZATION, NOVEMBER 11, 1994

BSP-JNB-94-255
Revised November 11, 1994

PROPOSED GUIDELINES FOR BUS SAFETY EQUIPMENT STANDARDIZATION

AUTHORED BY:

- **JOHN N. BALOG, VICE PRESIDENT, TRANSPORTATION RESEARCH, PLANNING, AND OPERATIONS**

SUBMITTED BY:

KETRON DIVISION OF
THE BIONETICS CORPORATION
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ABSTRACT

This document presents proposed Guidelines for the standardization of eight safety components on urban transit buses. These Guidelines were developed to correct problems encountered by rescue forces while attempting to gain entry to, shut down, and evacuate urban transit buses that have been involved in an emergency or accident.

This project, funded by the Federal Transit Administration (FTA) through grants to the Cambria County Transit Authority (CCTA), and the Volpe National Transportation Systems Center was based on previous work by KETRON. In response to a specific accident, the FTA had previously funded, through CCTA, the development of emergency and accident procedures training for several popular urban transit bus models. A wide disparity with regard to key safety components was discovered among the bus models. In 1991, under a new contract with CCTA, the KETRON Division of The Bionetics Corporation documented aspects of eleven safety components on six popular urban transit bus models. In August 1991, an inter-industry Guidelines Development Committee, representing vehicle manufacturers, engine suppliers, the American Public Transit Association (APTA), maintenance managers, transit authorities, emergency response forces, the FTA, bus window suppliers, other vendors, and KETRON, met to discuss how to best standardize the safety components on urban transit buses. The Guidelines generated in 1992 were the result of original research and development efforts by KETRON in concert with input from the Committee. KETRON's contract was then amended in 1993 to solicit comments from members of the American Public Transportation Association (APTA) Safety Committee and to again provide opportunities for comment to the urban transit bus industry.

These current Draft Guidelines reflect input from the Safety Committee and the industry and detail standard requirements for the availability, location, identification, use, and function of eight components, including: 1) master run switch; 2) driver's side window; 3) emergency engine stop switch in engine compartment, 4) front side door release control; 5) rear side door release control; 6) electrical (batteries) switch; 7) roof-mounted emergency ingress and escape hatches; and 8) passenger side windows. The Guidelines also present a Universal Access Symbol to identify, to rescue forces, key entry points and emergency devices.

ACKNOWLEDGEMENTS

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Volpe National Transportation Systems Center;

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Culver City Municipal Bus Lines,
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Former APTA Bus Safety Committee Chairman;

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American Public Transit Association; and

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Benjamin Gribbon
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INTRODUCTION

Urban bus transit is extremely safe in the United States. However, this achieved level of success causes significant problems for emergency preparedness forces including fire services, police, ambulance, etc., when they arrive on the scene of an accident or emergency. They have had extremely limited experience dealing with urban transit buses and the various kinds of safety equipment and devices on board. Compounding the problem is widespread inconsistencies among the availability, location, identification, use and function of the safety components associated with the various bus models.

Under a grant from the Federal Transit Administration to the Cambria County Transit Authority (CCTA), and with the financial help of the Volpe National Transportation Systems Center, the KETRON Division of The Bionetics Corporation, with the significant help of the **American Public Transit Association (APTA) Safety Committee**, the **Guidelines Development Committees**, the **Window Subcommittee**, and various suppliers, has developed these draft guidelines for the standardization of key safety components. This document presents these draft guidelines in full.

BACKGROUND

In 1981, the Cambria County Transit Authority (CCTA) experienced a severe accident involving one of its buses. The bus, out of control, was wedged, at speed, between a utility pole and a store front. The forces of impact caused its transmission to slip into reverse while the throttle was fully open. The bus literally tore itself in half and set itself on fire. Arriving emergency forces did not know how to gain access to the interior of the bus or how to turn off the engine.

This accident experience served as the basis for an Urban Mass Transportation Administration grant to develop a set of emergency and accident procedures materials for use as training documents for emergency preparedness forces responding to accidents involving public transit buses. This comprehensive and beneficial course, developed by KETRON while under contract with CCTA, has since been distributed and

used to train emergency preparedness forces associated with many transit systems across the nation.[9]

During the development of the Emergency and Accident Procedures Program, KETRON and CCTA had to carefully identify all relevant safety components and their correct operation for each of the three advanced design bus models encompassed within the program: the Neoplan USA, the General Motors RTS, and the Grumman Flxible. One problem which became quite apparent was the lack of standardization of the type, location, and operation of each of the safety components. This lack of standardization causes potentially significant problems for emergency forces arriving on the scene of an accident.

KETRON has conducted a significant number of simulated emergencies and accidents involving urban transit buses in a number of states including Pennsylvania, Connecticut, Massachusetts, and West Virginia. It was clear from these simulation exercises that emergency response personnel are very interested in learning how to gain entry, how to shut down engines, and other rescue information regarding buses. Without specific knowledge their approach tends to be quick-actioned, which often results in significant damage to the coach. Once presented information on the safety components, they generally perform well in gaining entry and disengaging systems without any significant damage. This experience testified to the need for transit authorities and others providing transit services to interact on a regular basis with the emergency preparedness forces in their service area so that maximization of knowledge can be shared.

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[9] Introduction to Urban Transit Bus Accident Experience: Emergency & Accident Procedures Training (includes slides); Emergency & Accident Procedures Training Manual for the Flxible Corporation Urban Transit Bus (includes video tape and slides); Emergency & Accident Procedures Training Manual for the General Motors Corporation RTS Urban Transit Bus (includes video tape and slides); Emergency & Accident Procedures Training Manual for the Neoplan USA Corporation Urban Transit Bus (includes video tape and slides); and Instructor's Manual: Emergency & Accident Procedures Training for the Neoplan. GMC/RTS, and Flxible Corporation Urban Transit Bus, authored by the Project Manager, Mr. John N. Balog, can be obtained from The KETRON Division of The Bionetics Corporation, 350 Technology Drive, Malvern, PA 19355, (610/648-9000).

Standardization of safety equipment needs to be adopted by urban transit bus manufacturers as a goal so that emergency response personnel will be more effective in performing their life saving duties. Consequently, this expanded project, sponsored by CCTA and funded by the Federal Transit Administration and the Volpe National Transportation Systems Center, was undertaken to assist the industry in achieving this laudable goal.

DOCUMENTATION OF AVAILABILITY, LOCATION, AND USE OF KEY SAFETY ITEMS

One of the key realizations of the original study for CCTA was that there tended to be a lack of standardization for the location and function of the various safety devices among three of the most common urban transit buses _ the Flxible Corporation, General Motors Corporation RTS (Transportation Manufacturing Corporation), and Neoplan USA Corporation. This sample was broadened by KETRON's study of Ikarus USA articulated, Gillig, and Bus Industries of America Orion urban transit buses. Safety components were also found to vary in these vehicles. These six vehicle types studied comprise over 80% of the urban transit buses operating in the United States:

- Flxible Corporation
- Ikarus USA
- Neoplan USA Corporation
- Orion
- GMC/RTS
- Gillig

In July of 1991, safety components for each of these vehicles were documented in the *KETRON Technical Discussion: Availability, Location, and Use of Safety Items for Standardization on Urban Transit Buses.* This document, which includes discussion, tables, and photographs, served as the basis of discussion at the August, 1991 meeting of the **Guidelines Development Committee.**

GUIDELINES DEVELOPMENT PROCESS

On August 21 and 22, 1991, the inter-industry **Guidelines Development Committee** met at APTA headquarters to introduce the project to the APTA Bus Safety Committee and to discuss eleven key safety components with the goal of standardizing their location, accessibility, labeling, use, and function.

Based on the results of the August meeting, KETRON began, in September, the task of researching additional options and writing the recommended detailed Guidelines. By December over a hundred organizations and sources had been consulted for detailed information on components.

On January 7, 1992, several emergency response members of the **Guidelines Development Committee** that were unable to participate in the August meeting met with KETRON professionals in Malvern, Pennsylvania. The then current Guidelines for each component were supplemented with the very practical concerns of rescue forces on the scene of an accident. This meeting was essential to ensure an adequate level of input from the emergency response industry.

The **Guidelines Development Committee** had determined in August that developing an acceptable standard for emergency windows is difficult since it requires additional research and development funding; yet current concerns needed to be addressed. Consequently a **Window Subcommittee** was formed. This group, made up of the major transit window and frame manufacturers, met on January 12, 1992 in Philadelphia, Pennsylvania, to discuss possible improvements for an emergency window standard.

During January and February, 1992, KETRON put the finishing touches on draft guidelines synthesized from the results of all three meetings and information from additional research. On March 26, 1992 KETRON conducted a meeting with members of the **Guidelines Development Committee** and the **Window Subcommittee** to discuss the draft Guidelines.

KETRON then revised the Guidelines by addressing the comments made by Committee members. The Guidelines at that time represented the culmination of these efforts and were presented at the APTA 1992 Bus Operations and Technology Conference in Charlotte, North Carolina.

More recently, additional limited funding has been made available to KETRON from CCTA and Volpe to further interact with the APTA Bus Safety Committee and the Guidelines Development Committee. Members of the APTA Bus Safety Committee were asked to review and comment on Draft Guidelines sent to them on May 18, 1994. A widely disseminated invitation to join the new Guidelines Development Committee was sent by KETRON on May 23, 1994. A summary of the comments made by 21 APTA Bus Safety Committee respondents was generated on August 31, 1994 and distributed to the members of the current Guidelines Development Committee during a meeting in Philadelphia on October 12, 1994.

The Draft Guidelines reported here reflect input from the APTA Safety Committee membership and members of the current Guidelines Development Committee.

THE GUIDELINES

In the development of the current Guidelines, a number of important concerns had to be integrated in order to form comprehensive requirements. The following paragraphs describe these concerns.

These guidelines for urban transit buses were developed with one overriding concern: **safety**. Of similar importance was the component's ease of use by untrained emergency response personnel. A number of additional goals were nearly equally important. The guidelines were ultimately established with the following hierarchy of priorities.

1. Components should provide for the maximum safety of passengers, drivers, and emergency personnel in the event of an accident or emergency.

2. Components should be easily usable by emergency response personnel wearing full gear, including heavily padded gloves, bunker coats, helmets, and possibly air tanks.
3. Components should be easy to find and obvious in use so as to be easily used by any individual, especially those without training.
4. The guidelines for components should be precise and unrefutable as to intent.
5. Costs, and the potential for damage to the vehicle or the components themselves, should be minimized.
6. Existing standards and widely recognized commonalties should be used to the maximum extent feasible.
7. Improvements and innovation in the industry should be encouraged.
8. The potential for misuse and/or vandalism should be minimized.

In recognition of the first four priorities, significant space is devoted to describing the identifying features of each component. In general, emergency controls are described so as to be clearly distinguishable from normal controls. Each is a clearly distinguishable shape and standardly located, and is red, with red on white emergency instructions. Also, a newly designed universal access symbol was developed to identify each component which is accessible from the outside for arriving emergency forces. One significant problem discovered early in the project during field inspections was that good identification and instruction labeling was often found in a deteriorated condition. Consequently, guidelines for the durability of markings are also included.

Significant efforts were made to make each component operable from outside the vehicle by emergency personnel, and from inside as appropriate. This was essential to the goals of the project.

In descriptions of the actual use of each component, existing methods generally prevailed, with standardization the main thrust. Where no clear standard existed, the usage most often employed was selected as standard. The use of up for on and down for off, and similar standards were incorporated as much as possible.

Many of the paragraphs herein describe, in detail, the aspects of existing, common components so that standardization may be achieved and maintained. In other cases, however, no wholly acceptable standard existed for the component or certain

aspects of the component. In these cases, a standard was developed based on the priorities described above, discussions on feasibility with vehicle manufacturers, and research with components suppliers.

SAFETY ITEMS FOR STANDARDIZATION

Initially KETRON identified, with CCTA and representatives of FTA, eleven safety items as strong potential candidates for standardization. The original **Guidelines Development Committee** as a whole determined two candidate safety items, the Emergency Stop Switch in the operator's compartment and the Engine Stop Solenoid Plunger, to be obsolete. More recently, the current **Guidelines Development Committee** recommended deletion from the Standardization Guidelines, the Master Door Release Control because of its redundant function. It also recommended the Universal Emergency Shutdown Switch be set aside for now because of the technical issues that need to be resolved and which are beyond the fiscal limitations of the current program. In the future such a device would be located at the batteries compartment and it would, when switched off, shut down the engine, disconnect power from the batteries, release the passenger doors, and engage the parking brake. The remaining eight items continue to be studied to develop standards with respect to location, use, and function:

- Master Run Switch;
- Driver's Side Window;
- Emergency Engine Shutdown Switch in Engine Compartment;
- Front Side Door Release Control;
- Rear Side Door Release Control;
- Electrical (Batteries) Switch;
- Roof-Mounted Emergency Ingress and Escape Hatch; and
- Passenger Side Windows.

Each component is indicated in Figure I-1, and one section of this document is devoted to each.

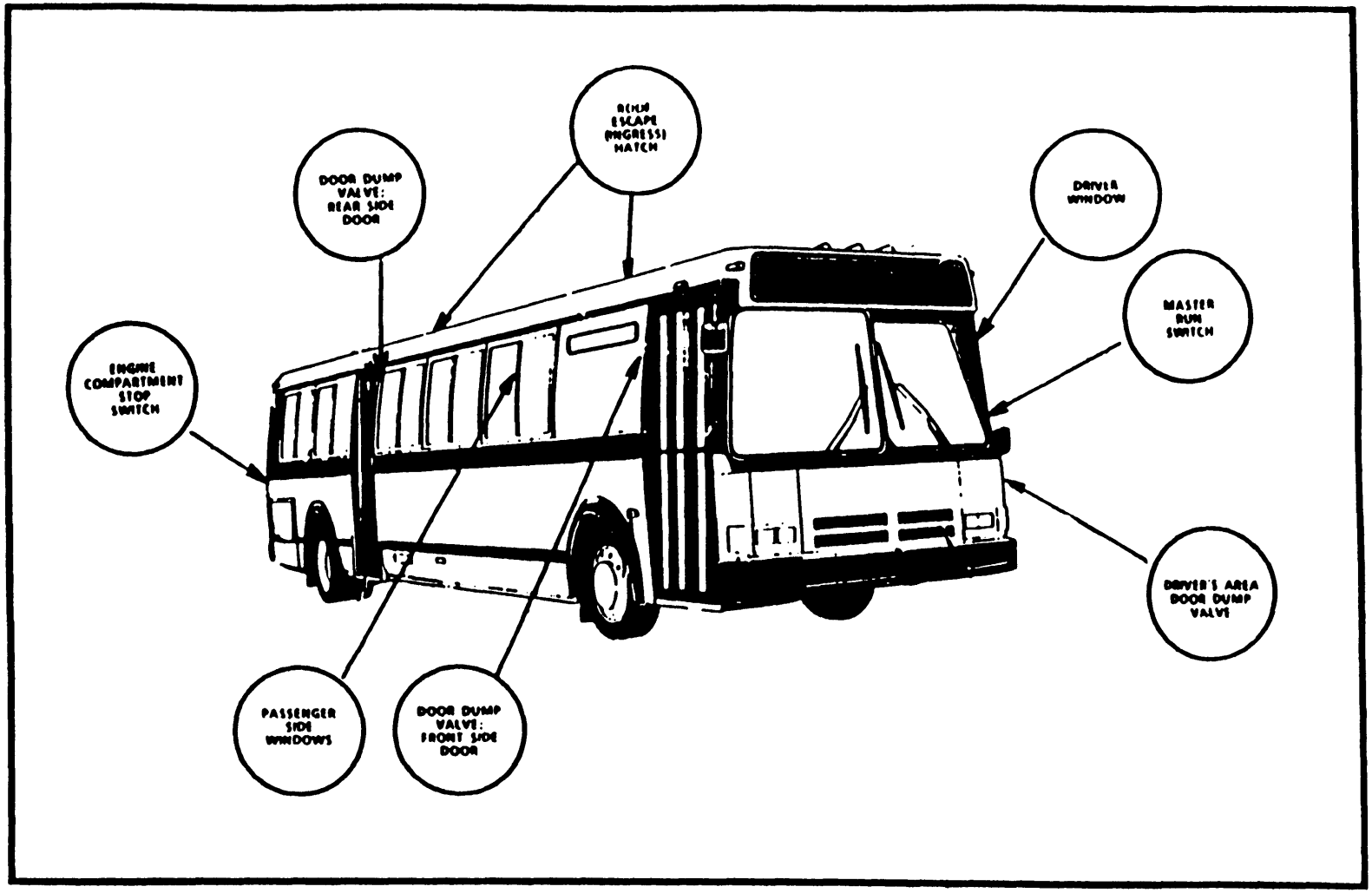

FIGURE I-1. SAFETY DEVICES TARGETED FOR STANDARDIZATION

* FIxible Advanced Design Bus used as surrogate for a generic bus

Appendix A and Appendix B conclude this document with a list of some important resources and a bibliography, for readers seeking additional information.

APPLICATION OF GUIDELINES

An issue that did not become apparent until the original Committee had met a second time was that the specificity and degree of improvement of the Guidelines suggested for implementation would be influenced by how they were to be applied. Very few details could be included if the standards were to be suggested for retrofitting all U.S. vehicles. Conversely, significant and detailed improvements in safety components to meet all the needs of evacuation and emergency response would require significant research and development efforts which are beyond the scope of this project.

It was determined that significant standardization through retrofits was financially prohibitive and, even if possible, could leave the industry with standard yet less than perfect equipment. *The aim of these guidelines is to standardize urban transit buses to be acquired.* Fleet managers may, however, carefully select specific guidelines to apply to existing vehicles to increase overall safety in emergency situations.

It was also necessary to determine whether guidelines should be immediately implementable or would be a standard that involved significant improvements to existing designs and components. Ultimately this was determined by the needs of each component. The safety problems associated with emergency windows require significant amounts of research and development. The Master Run Switch concept, on the other hand, has few safety problems and is nearly standard with regard to some aspects; in order to both provide a usable device for emergency rescue forces and standardize the component, outside accessibility and a change in its size was required. Concepts that would require significant research and development but would contribute only slight improvements to the industry were generally omitted.

With regard to all safety components, KETRON was pleased to have candid and cooperative input from all the members of both the original and current **Guidelines Development Committees**, the **Window Subcommittees**, and members of the **American Public Transit Association Safety Committee**. Their assistance will directly contribute to urban transit bus safety.

SECTION 1

STANDARDIZATION GUIDELINES FOR THE MASTER RUN SWITCH

SECTION 1

STANDARDIZATION GUIDELINES FOR THE MASTER RUN SWITCH

1. Each bus shall be equipped with a Master Run Switch.

2. The Master Run Switch shall be equipped with a fluted cylindrical knob that is at least 3" in diameter at its highest surface. The height of the fluted cylindrical knob shall be at least 1⅛". See *Figure 1-1.*

3. The Master Run Switch Knob (MRSK) shall be located on the driver's left side control panel to the immediate rear of *and not more than 6" from* the standard and distinctive door control handle. There shall not be any other switch or device between the door control handle and the MRSK. The door control handle shall be closer to the windshield than the MRSK.

4. The MRSK and its mounting surface shall not be recessed. The top surface of the MRSK shall be at least 1⅛" above the surface of the control panel.

5. The MRSK, at its top surface, shall be the largest circular knob on the control panel and be bigger in diameter than any other knob on the control panel.

6. The MRSK shall be easily reachable by any driver who is safety belted in the operator's seat.

7. The MRSK shall be colored red and be capable of exhibiting negligible color change in any operating environment including, but not limited to, daily interior bus washings for at least 12 years.

8. The MRSK shall be easily reachable, by a person 5'6" tall standing outside and adjacent to the bus with feet flat on the ground, through the driver's left side window.

9. The MRSK shall be easily operated from outside the bus by a rescue individual wearing heavily padded gloves on his/her hands and shall have at least 3" of clear area around the outer edge of its circumference.

10. A driver's left side window complying with Section 2 of these Guidelines shall allow access to the MRSK by sliding easily rearward without latching along the track at any point, to create an opening no smaller than 8" high and 10" wide and large enough for the MRSK to be easily operated as described in this section. This window shall be non-locking and openable from outside the bus without breakage.

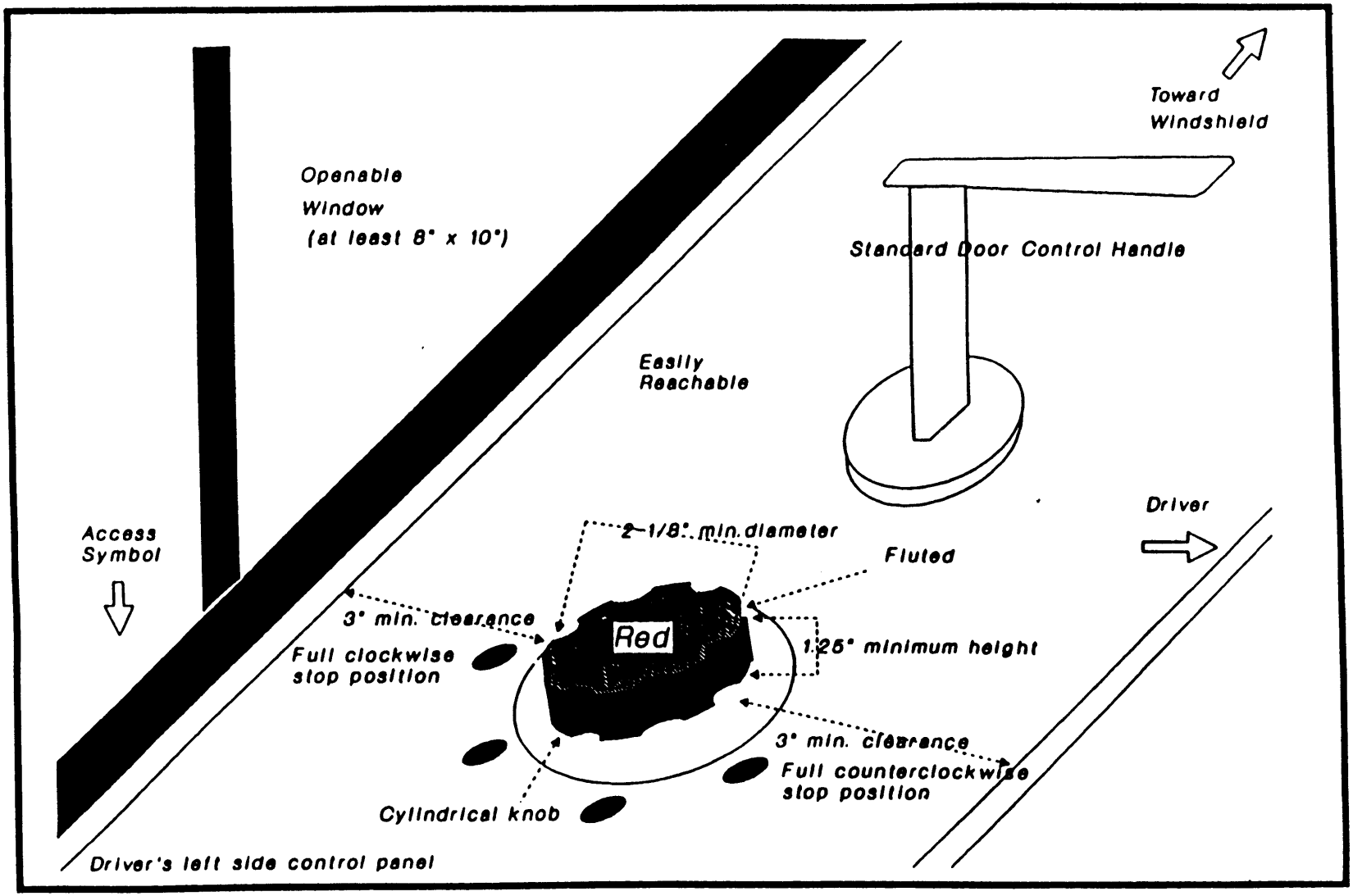

FIGURE 1-1. MASTER RUN SWITCH

STANDARDIZATION GUIDELINES FOR THE MASTER RUN SWITCH (CONTINUED)

11. The universal access symbol shown and described in Figure 1-2 indicating the location of the MRSK shall be placed on the outside surface of the bus directly adjacent to the MRSK.

12. The access symbol shall be 4" in diameter, reflective, permanently attached to the bus surface, and capable of exhibiting negligible color change, legend fading, blistering or edge curl in any operating environment including, but not limited to, daily mechanical bus washings for at least 3 years. The access symbol shall not be covered or obscured in any way by paint, logo, trim, advertising, or any other materials.

13. At the end of 3 years the symbol label shall be reasonably easy to remove and replace. Replacement labels shall be readily available as spare parts from the Original Equipment Manufacturer.

14. The MRSK shall be capable of fully shutting down the engine by turning with one hand (with and without a heavily padded glove) clockwise to its stop position. It shall also be capable of fully shutting down the engine by turning with one hand (with and without a heavily padded glove) counterclockwise to its stop position. The number of non-stop positions and their functionality shall be dictated by local preference.

15. The MRSK shall not be capable of turning past either stop position (both full clockwise and full counterclockwise).

16. The MRSK, in a stop position, shall have the effect of shutting down the engine, regardless of when and with what controls the bus was originally started, and regardless of the status of the transmission selector. The MRSK shall not prevent the effective functioning of other engine shut down devices. The engine shall not start with the MRSK in either the full clockwise or full counterclockwise positions.

17. When the bus engine is shut down by use of the Emergency Engine Stop Switch in the engine compartment, or any other device, the MRSK or any other device shall not be capable of restarting the bus engine until the engine shut down switch is reset.

18. Additional local requirements for such equipment as a key switch which prevents starting the engine without a key are allowed but shall not supersede the function of any of the above guidelines.

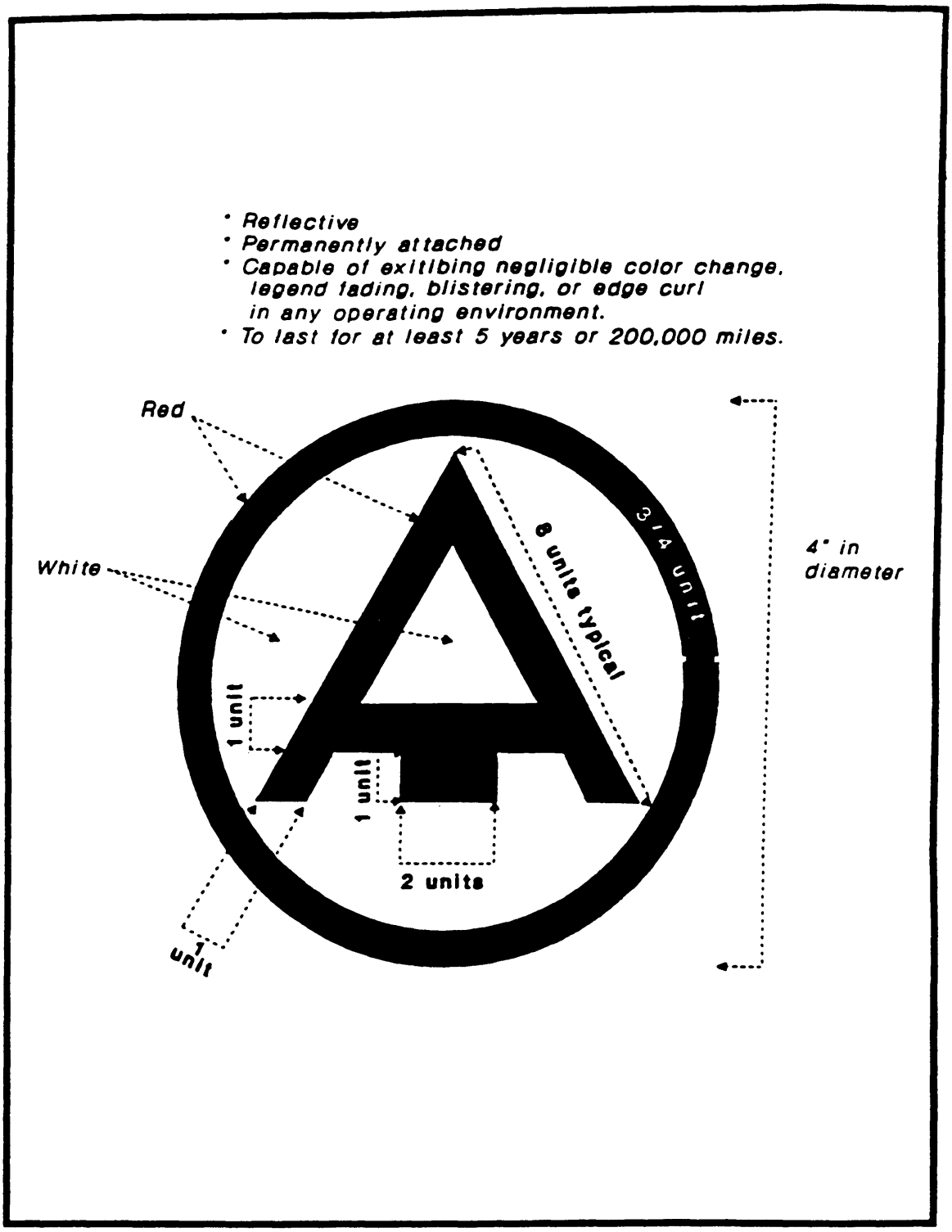

FIGURE 1-2. UNIVERSAL ACCESS SYMBOL

SECTION 2

STANDARDIZATION GUIDELINES FOR THE DRIVER'S SIDE WINDOW(S)

SECTION 2

STANDARDIZATION GUIDELINES FOR THE DRIVER'S SIDE WINDOW(S)

1. A non-locking window (NLW) to the driver's immediate left shall enable the door control handle, Master Run Switch Knob, Master Door Release Control, and driver's left side window emergency egress release mechanism to be easily seen and be easily reached and operated by a person 5'6" tall standing with feet flat on the ground, outside and adjacent to the bus.

2. The NLW shall allow outside access to driver's controls by sliding easily rearward without latching along the track at any point, to create an opening no smaller than 8" high and 10" wide and at least large enough to easily operate the door control handle, Master Run Switch Knob, Master Door Release Control, and emergency egress release mechanism from outside the bus. The NLW shall be easily opened from outside the bus without breakage.

3. The access symbol shown and described in Figure 2-1 shall be placed on the outside surface of the bus directly adjacent to and pointing to the exact location at which the NLW opens.

4. The access symbol shall be 4" in diameter, reflective, permanently attached to the bus surface, and capable of exhibiting negligible color change, legend fading, blistering or edge curl in any operating environment including, but not limited to, daily mechanical bus washing for at least 3 years. The access symbol shall not be covered or obscured in any way by paint, logo, trim, advertising, or any other materials.

5. At the end of 3 years the symbol label shall be reasonably easy to remove and replace. Replacement labels shall be readily available as spare parts from the Original Equipment Manufacturer.

6. A driver's window to the driver's immediate left side shall be provided.

7. The NLW shall be permanently attached, along at least one edge, to the body of the bus to prevent falling while being used in an emergency.

8. The NLW, when closed, shall prevent the entrance of rain water.

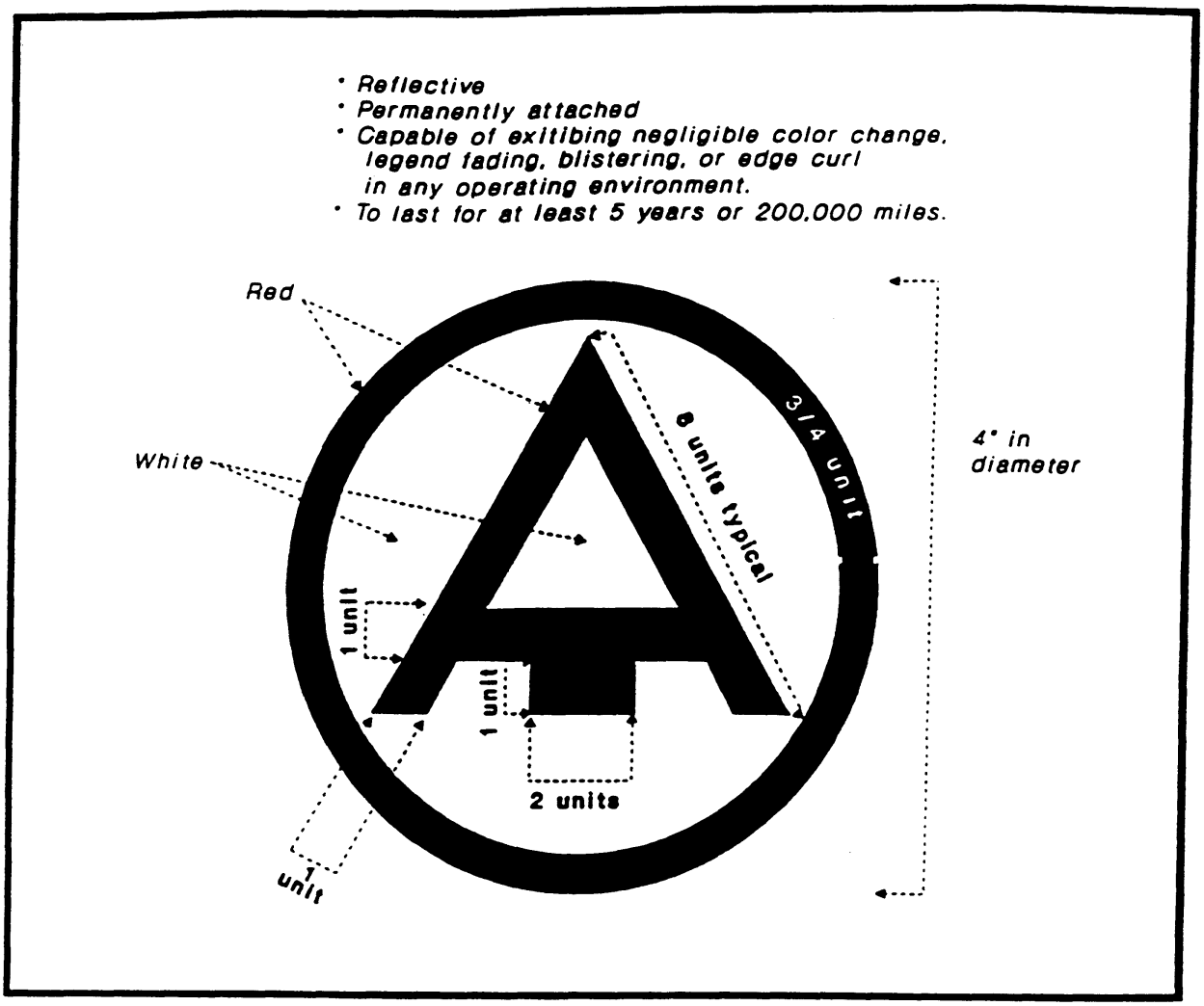

FIGURE 2-1. UNIVERSAL ACCESS SYMBOL

STANDARDIZATION GUIDELINES FOR THE DRIVER'S SIDE WINDOW(S) (CONTINUED)

9. The NLW shall fully satisfy and/or exceed all applicable Federal Motor Vehicle Safety Standards including FMVSS 205 and conform to all federal, state, and local regulations.

10. The NLW shall in all other respects conform to FMVSS 217 (Bus Window Retention and Release), except as superseded by these Guidelines.

11. The NLW shall be similar in design and operation to Passenger Windows wherever possible.

12. As a result of local preference, the NLW may be equipped with a keylock, opened only from the outside, as long as local standard operating procedures and operator training require the lock to be in its open position whenever the bus is in service. This local preference option shall not supersede the function of any of the above guidelines.

SECTION 3

STANDARDIZATION GUIDELINES FOR THE EMERGENCY ENGINE SHUTDOWN SWITCH IN ENGINE COMPARTMENT

SECTION 3

STANDARDIZATION GUIDELINES FOR THE EMERGENCY ENGINE SHUTDOWN SWITCH IN ENGINE COMPARTMENT

1. Each bus shall be equipped with an Emergency Engine Shutdown (EESD) Switch located in the engine compartment.

2. The EESD Switch shall be located facing the engine compartment door on the same control box and on the same plane as other engine compartment control switches, but at least 4" from other engine compartment control switches and no more than 6" from them.

3. The control box shall be located in the upper right quadrant of the engine compartment as viewed by a user facing the engine compartment door from outside the bus. The control box surface exhibiting the EESD Switch shall be located no more than 12" from the engine compartment door.

4. The control box shall be mounted to a structural member of the bus rather than to the engine, and such that the possibility of damage to the switch by vibration is prevented.

5. The control box surface, upon which the EESD Switch shall be mounted, shall be bright white and capable of exhibiting negligible color change in any operating environment including, but not limited to, revenue service, steam cleaning, and chemical exposures for at least 12 years.

6. An access door with an opening no smaller than 8" high and 10" wide shall be placed in the engine compartment door so that when the access door is open, the EESD Switch and use instructions can be easily seen and the EESD Switch easily operated by a rescue individual with heavily padded gloves on his/her hands while standing with both feet on the ground looking directly through the access door opening. *See Figure 3-1.*

7. Under no circumstances shall the access door be covered, blocked, or camouflaged by advertising or any other devices or materials.

8. The access door shall be non-locking, hinged on one side, and easily opened in a single motion by an individual with heavily padded gloves on his/her hands.

9. A rectangular metal guide/tunnel, of the same dimension as the access door opening, shall be permanently attached to the inside of the engine compartment door at the same location as the access door opening and shall extend 6" into the engine compartment.

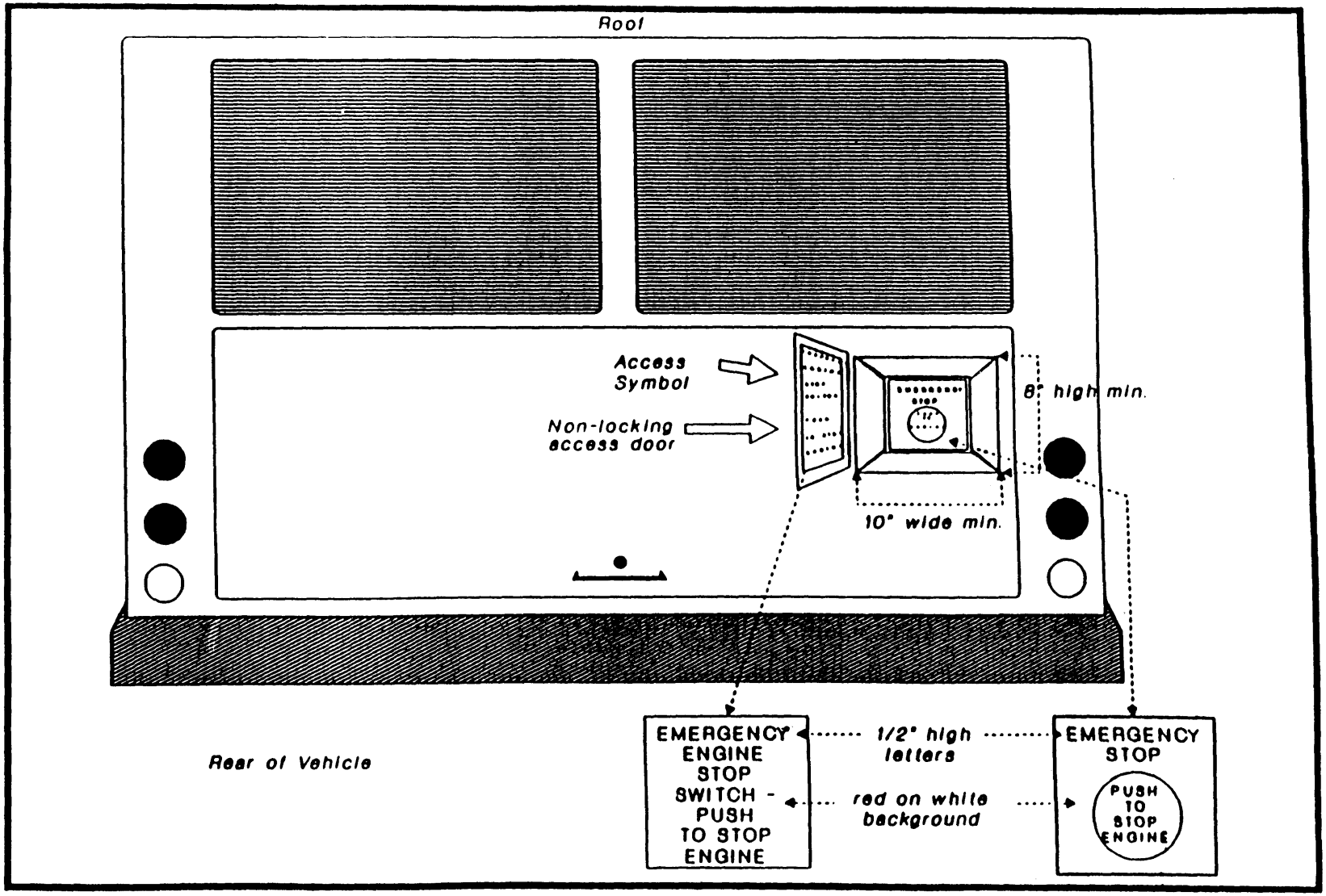

FIGURE 3-1. LOCATION AND CHARACTERISTICS OF THE EMERGENCY ENGINE SHUTDOWN SWITCH AS VIEWED WITH THE ENGINE COMPARTMENT DOOR IN THE CLOSED POSITION

10. The universal access symbol shown and described in *Figure* 3-2, indicating the location of the EESD Switch, shall be 4" in diameter, reflective, permanently attached to the outside surface of the access door, and capable of exhibiting negligible color change, legend fading, blistering or edge curl in any operating environment including, but not limited to, daily mechanical bus washing for at least 3 years. Such symbol shall not be covered or obscured in any way by paint, logo, trim, advertising, or any other material.

11. At the end of 3 years the symbol label shall be reasonably easy to remove and replace. Replacement labels shall be readily available as spare parts from the Original Equipment Manufacturer.

12. On the inside surface of the access door shall be placed the legend "EMERGENCY ENGINE STOP SWITCH, PUSH TO STOP ENGINE" in red ½" tall legible capital Helvetica bold letters on a bright white background equal in size to the inside dimension of the access door. The legend and background shall be reflective and capable of exhibiting negligible color change in any operating environment including, but not limited to, revenue service, steam cleaning, and chemical exposures for at least 12 years. *See Figure 3-3.*

13. The EESD Switch shall be an internally illuminated, maintained, non-spark producing, explosion-preventing, push/pull mushroom button switch with a red lens at least 3" in diameter. On the lens in white capital Helvetica bold letters shall be the legend "PUSH TO STOP ENGINE" in the largest legible type. The EESD Switch lens and legend shall be capable of exhibiting negligible color change in any operating environment including, but not limited to, revenue service, steam cleaning, and chemical exposures for at least 12 years. See *Figures 3-4 and 3-5.*

14. The EESD Switch, when pushed in to its off position, shall cause the engine to fully shut down regardless of the setting of any other switch or device on the bus. With the EESD Switch in the off (depressed) position, the engine shall not, under any circumstances, be able to be restarted, regardless of all other devices, functions, and settings. All other engine start and stop controls and devices shall function normally only after the EESD Switch is pulled out fully to its on position.

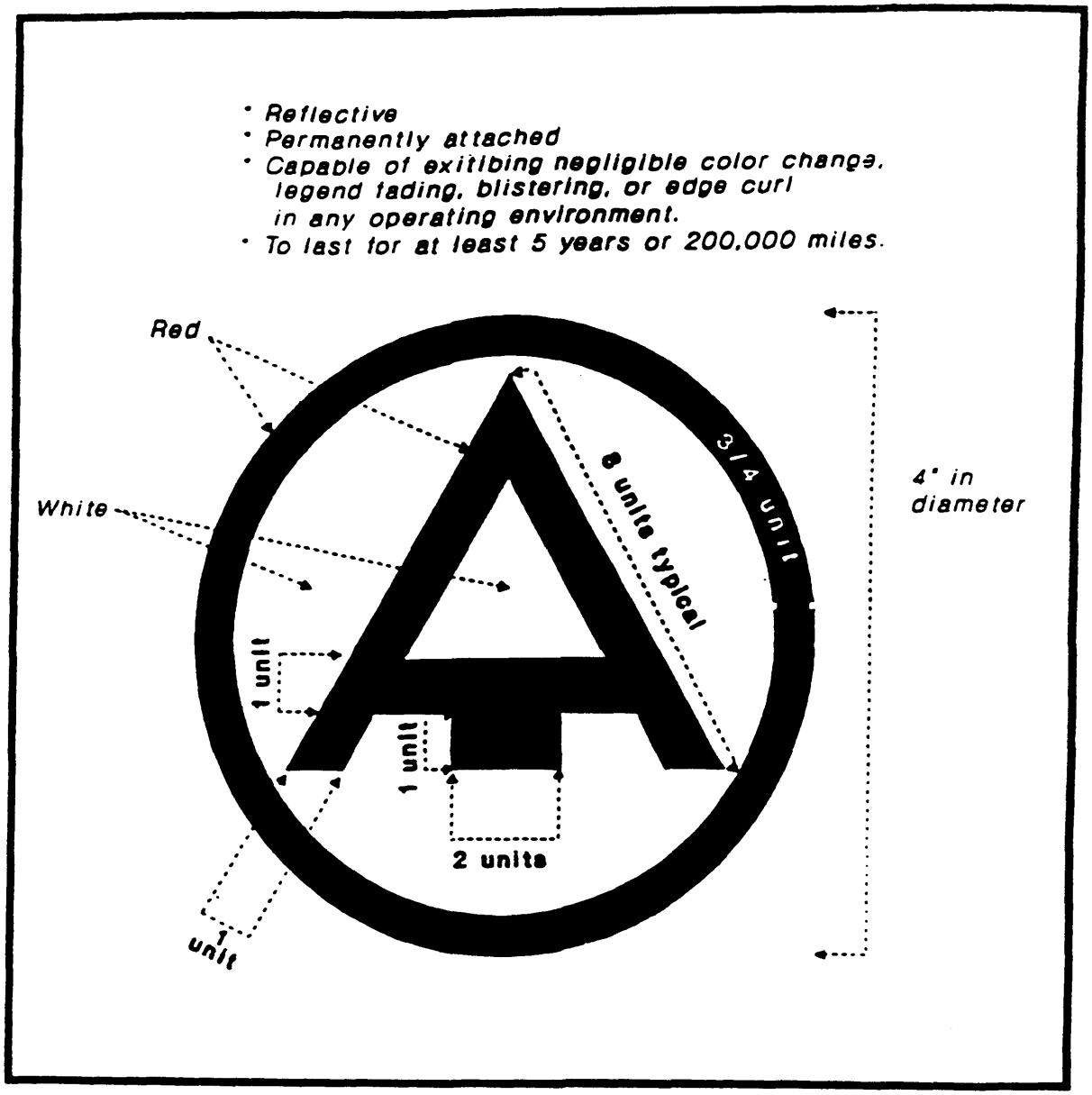

FIGURE 3-2. UNIVERSAL ACCESS SYMBOL

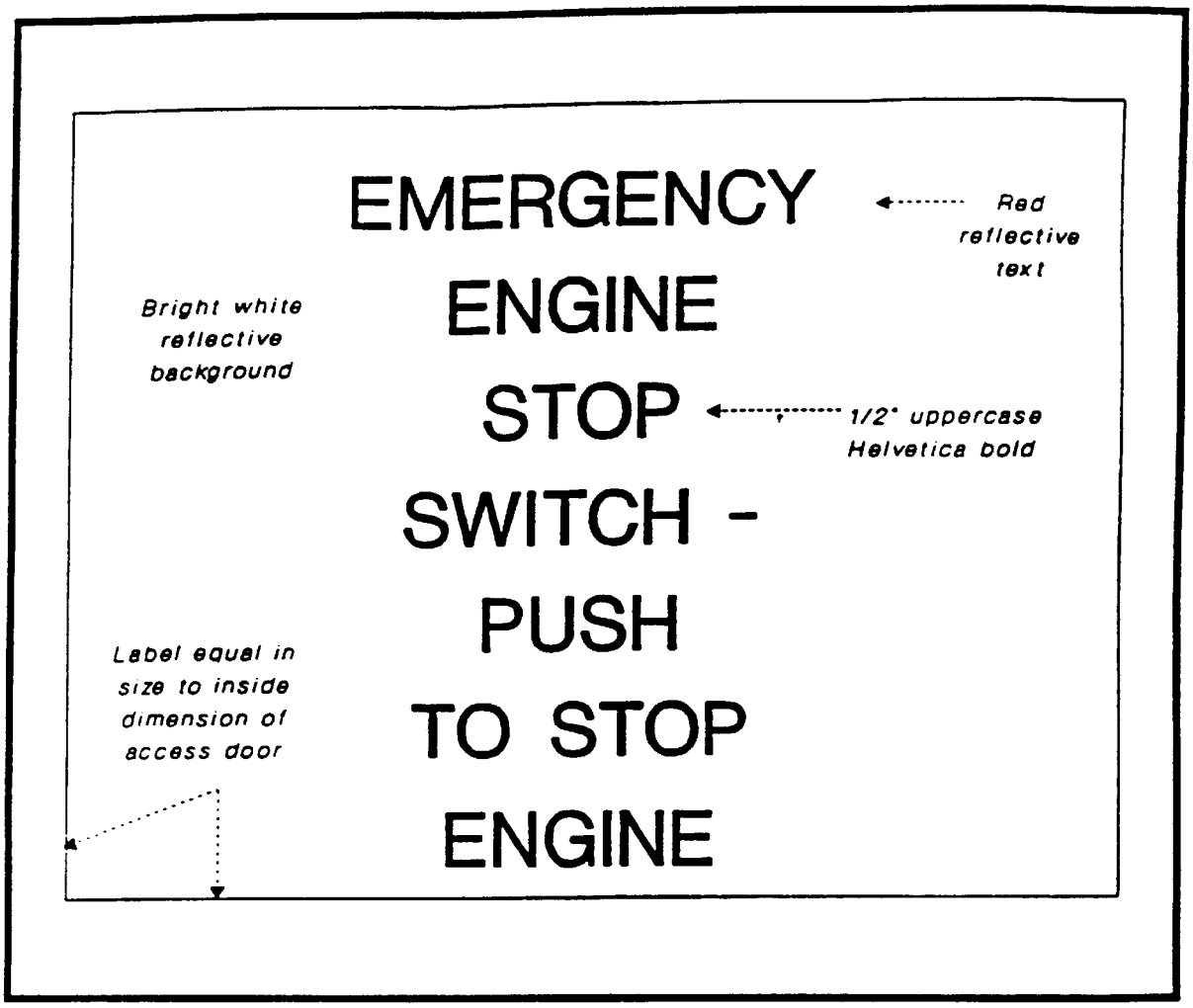

FIGURE 3-3. LEGEND ON INSIDE SURFACE OF ACCESS DOOR TO EMERGENCY ENGINE SHUTDOWN SWITCH IN ENGINE COMPARTMENT

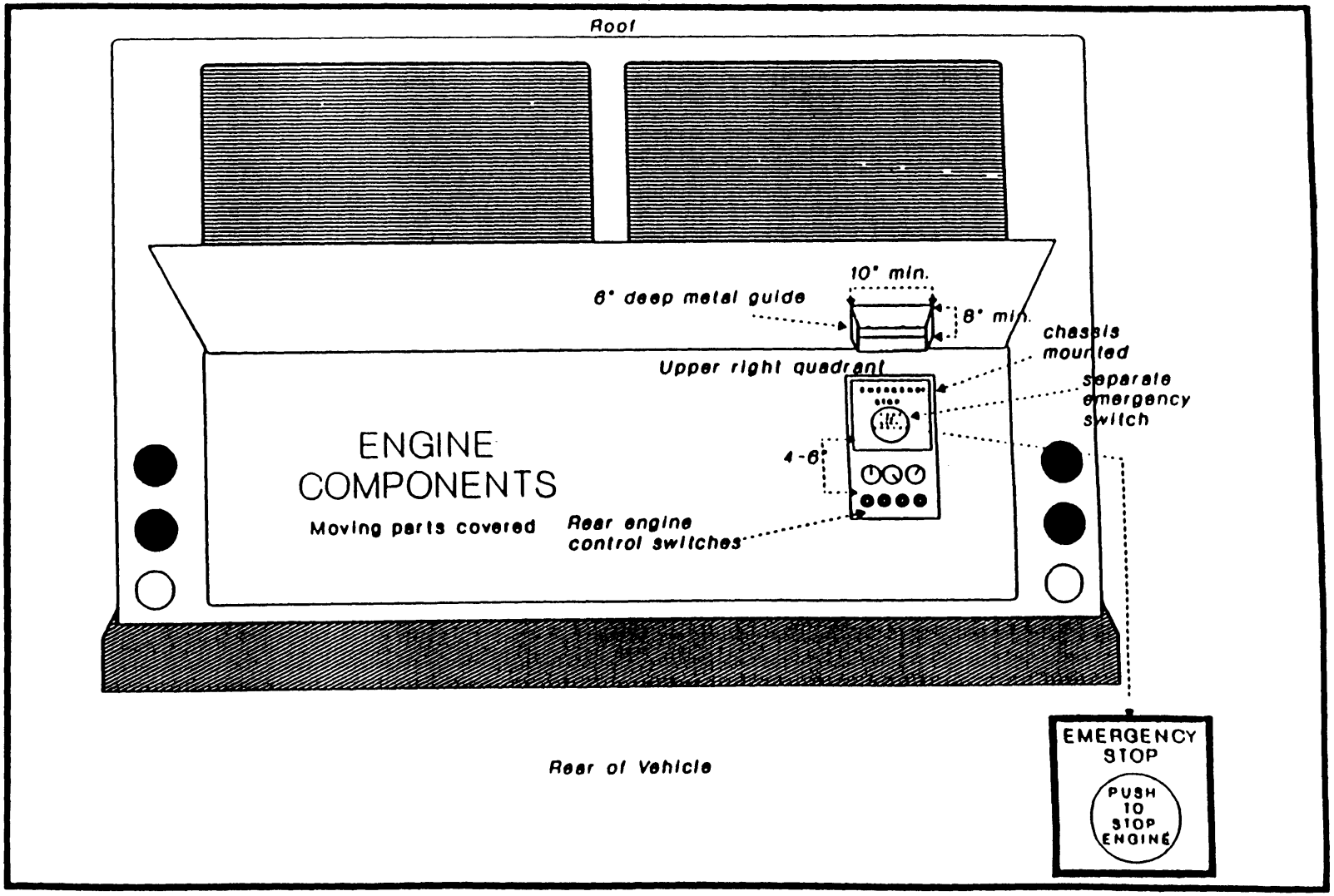

FIGURE 3-4. LOCATION AND CHARACTERISTICS OF THE EMERGENCY ENGINE SHUTDOWN SWITCH AS VIEWED WITH THE ENGINE COMPARTMENT DOOR IN THE OPEN POSITION

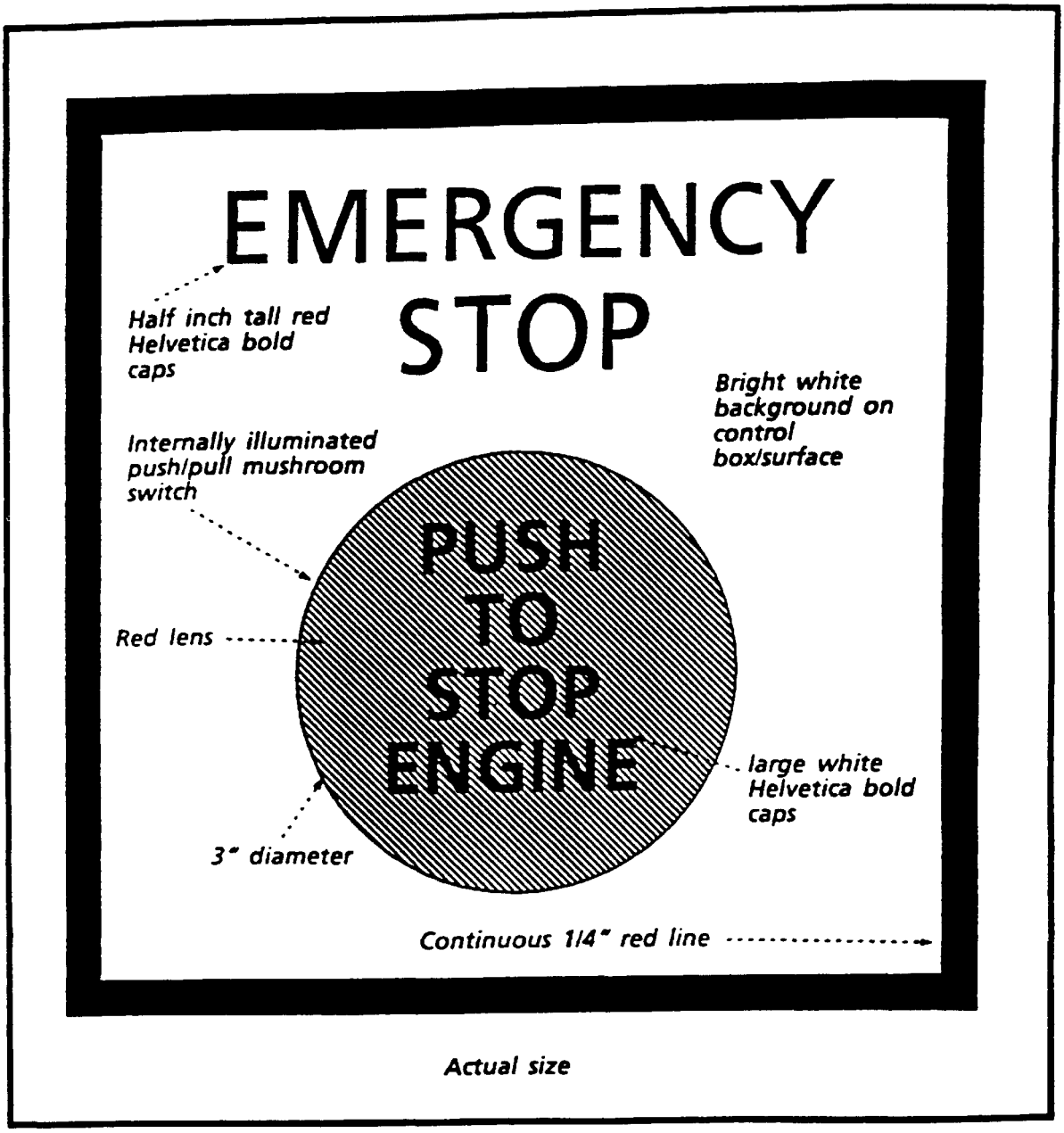

FIGURE 3-5. EMERGENCY ENGINE SHUTDOWN SWITCH AND LABELING

STANDARDIZATION GUIDELINES FOR THE EMERGENCY ENGINE SHUTDOWN SWITCH IN ENGINE COMPARTMENT (CONTINUED)

15. Directly above the EESD Switch on the white surface of the control box shall be the legend "EMERGENCY STOP" in ½" tall clearly legible red capital Helvetica bold letters. The legend shall be reflective and permanently attached to the control box surface and capable of exhibiting negligible color change, legend fading, blistering, or edge curl in any operating environment including, but not limited to, revenue service, steam cleaning, and chemical exposures for at least 12 years.

16. A single and continuous quarter-inch-wide red line shall surround in a rectangular shape the "EMERGENCY STOP" label and the EESD Switch to clearly distinguish it from non-emergency operating switches, instructions, and indicators. This line shall be permanently attached to the white surface of the control box and capable of exhibiting negligible color change, legend fading, blistering, or edge curl in any operating environment including, but not limited to, revenue service, steam cleaning, and chemical exposures, for at least 12 years.

17. The EESD Switch shall be internally illuminated and the interior illumination shall be activated when the engine is running and shall be extinguished otherwise. The illumination shall be bright enough in all light conditions and environments to immediately attract rescuers' attention upon opening the access door, and to clearly enunciate the message "PUSH TO STOP ENGINE" on the EESD Switch lens.

18. The EESD Switch shall be sealed to prevent intrusion of dirt, grease, moisture, or any other agent which could degrade or prevent full functionality during revenue service, after an accident, or in an emergency.

19. The EESD Switch shall be separate in use from all other rear/maintenance engine controls and is not intended to be used in normal maintenance operation. The EESD Switch shall not be combined with any non-emergency engine compartment switches, including, but not limited to, light, control, run, ignition, start, or normal stop switches.

20. All moving engine parts within 18" of the control box switch panel shall be adequately and completely covered to totally avoid any and all potential for injuries to users of the EESD Switch.

21. Helvetica bold text may be substituted with only the following sans-serif fonts in uppercase so as to be plainly legible in emergency situations: Megaron Bold, Megaron Bold Condensed, Triumvirate Bold Condensed, Eurostile, Eurostile Bold, Universal (filled), and Universal (filled) Bold.

SECTION 4

STANDARDIZATION GUIDELINES FOR THE FRONT DOOR RELEASE CONTROL

SECTION 4

STANDARDIZATION GUIDELINES FOR THE FRONT DOOR RELEASE CONTROL

1. Bus shall be equipped with one interior and one exterior emergency front door release control located at the front door.

2. The interior control mechanism shall be positioned adjacent to and rearward of the front door such that it can be easily reached by any person.

3. The exterior control mechanism shall be located adjacent to and rearward of the front door at a height of at least 8 feet above the ground, and shall be recessed so as to prevent damage and accidental operation by tree branches, signs, or other items along any and all service routes.

4. Access by a person to the interior control shall be easily achievable by any person through a simple one-step operation that can be accomplished safely using only one heavily padded gloved or ungloved hand. Such access may be:

   a) a cover that is lifted or slid to reveal the control; or

   b) a cover panel grooved for easy breakage, which when broken will reveal the control.

5. The exterior control shall be easily reached and operated with a fireman's standard pike pole by a rescuer 5'6" tall standing with feet flat on the ground outside and adjacent to the bus.

6. The access symbol shown and described in Figure 4-1 indicating the location of the control shall be placed on the outside surface of the bus directly adjacent and pointing to the control.

7. The access symbol shall be 4" in diameter, reflective, permanently attached to the bus surface, and capable of exhibiting negligible color change, legend fading, blistering or edge curl in any operating environment including, but not limited to, daily mechanical bus washing for at least 3 years. The access symbol shall not be covered or obscured in any way by paint, logo, trim, advertising, or any other materials.

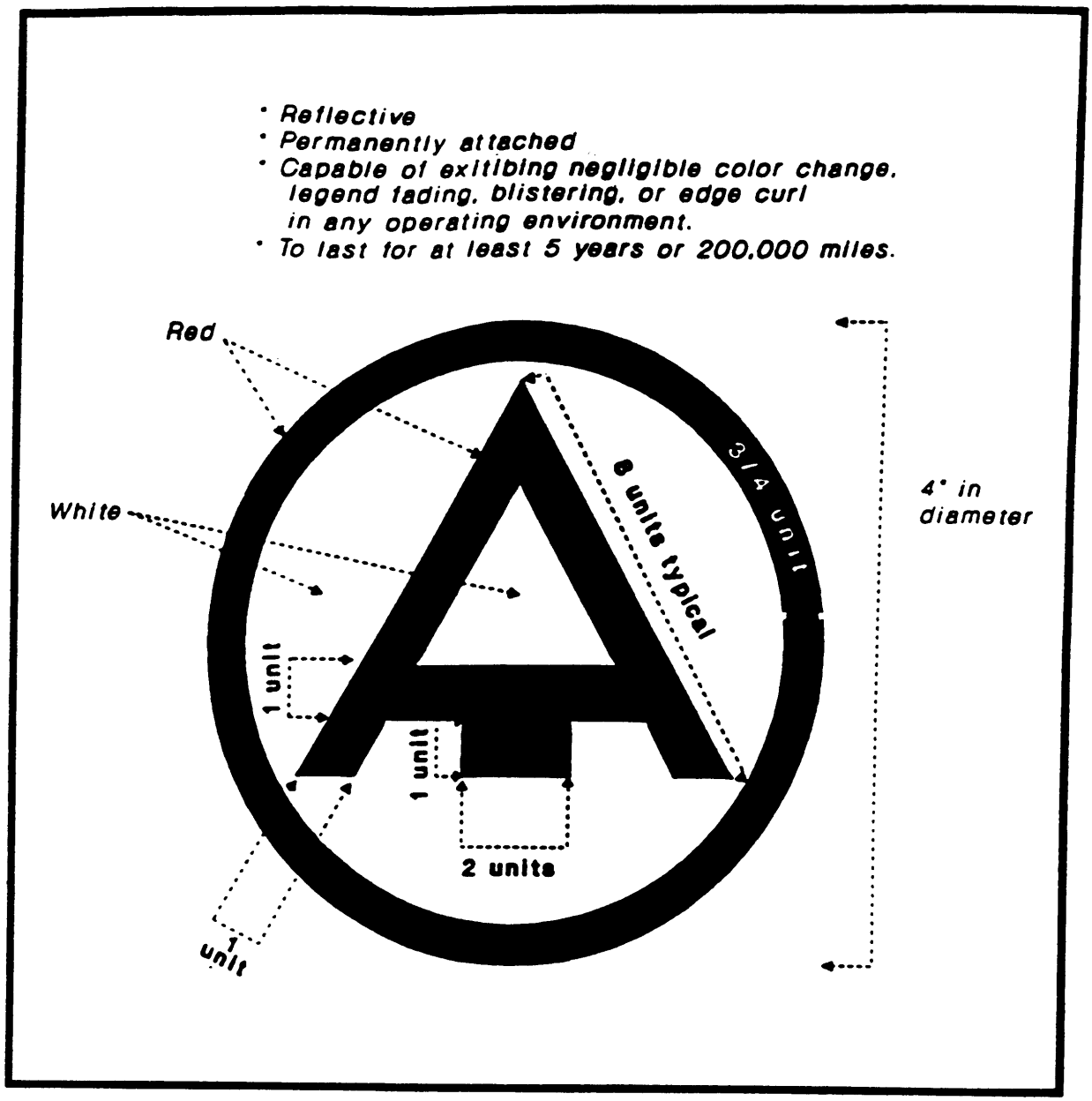

FIGURE 4-1. UNIVERSAL ACCESS SYMBOL

STANDARDIZATION GUIDELINES FOR THE FRONT DOOR RELEASE CONTROL (CONTINUED)

8. At the end of 3 years the symbol label shall be reasonably easy to remove and replace. Replacement labels shall be readily available as spare parts from the Original Equipment Manufacturer.

9. User instructions for access to the interior control shall be obvious, simple, concise, and effective. The letters shall be uppercase Helvetica bold, in red on a bright white background. Such instructions shall be located on or immediately adjacent to the actual access component.

10. The access opening to the interior control shall be of a size and shape such that the control shall be immediately visible and obvious to the user once access is gained.

11. The interior control shall be easily reached and operated with one hand by any person traveling without an escort, irrespective of age, disability, or any other characteristic who may or may not be wearing heavily padded gloves on his/her hands.

12. The exterior control shall be ring-shaped, at least 1½" in radius, and shall be easily operated by a rescuer 5'6" tall standing with feet flat on the ground outside and adjacent to the bus, by pulling with any hook attached to a standard fireman's pike pole.

13. The use of the controls shall be each accomplished through a simple one-step operation.

14. The exterior and interior front door release controls shall be: equipped with a zero speed detection device to prevent the doors from being released or opened unless the bus is stopped; and equipped with a brake interlock system to prevent the doors from being released or opened unless the bus is stopped.

15. Both interior and exterior controls shall be red, permanently attached, and capable of exhibiting negligible color change in any operating environment for 12 years.

16. Instructions for use of the interior control shall be in red on white using red uppercase Helvetica bold letters and shall be obvious, simple, and clearly understandable once access to the control has been gained. Such instructions shall remain legible after access to the control has been gained.

17. The instructions for use shall be permanently attached and capable of exhibiting negligible color change, legend fading, blistering, or edge curl in any operating environment for 12 years.

STANDARDIZATION GUIDELINES FOR THE FRONT DOOR RELEASE CONTROL (CONTINUED)

18. Each door release control, when used in an emergency, shall have the effect of releasing or unlocking the front door so that it can be easily pushed open or closed, regardless of the status of any other valves, switches, or controls. Resetting this control shall have the effect of restoring normal operation to this door subject to other valves, switches, or controls.

19. The control shall operate as a two-position switch.

20. Helvetica bold text may be substituted with only the following sans-serif fonts in uppercase so as to be plainly legible in emergency situations: Megaron Bold, Megaron Bold Condensed, Triumvirate Bold Condensed, Eurostile, Eurostile Bold, Universal (filled), and Universal (filled) Bold.

21. Front side door release controls shall be the same in operation as the door release controls located at and for the rear side door.

SECTION 5

STANDARDIZATION GUIDELINES FOR THE REAR DOOR RELEASE CONTROL

SECTION 5

STANDARDIZATION GUIDELINES FOR THE REAR DOOR RELEASE CONTROL

1. Bus shall be equipped with one interior and one exterior emergency rear door release control located at the rear door.

2. The interior control mechanism shall be positioned adjacent to and forward of the rear door such that it can be easily reached by any person traveling without an escort, irrespective of age, disability, or any other characteristic.

3. The exterior control mechanism shall be located adjacent to and forward of the rear door at a height of at least 8 feet above the ground, and shall be recessed so as to prevent damage and accidental operation by tree branches, signs, or other items along any and all service routes.

4. Access by a person to the interior control shall be easily achievable by any person, through a simple one-step operation that can be accomplished safely using only one heavily padded gloved or ungloved hand. Such access may be:

   a) a cover that is lifted or slid to reveal the control; or

   b) a cover panel grooved for easy breakage, which when broken will reveal the control.

5. The exterior control shall be easily reached and operated with a fireman's standard pike pole by a rescuer 5'6" tall standing with feet flat on the ground outside and adjacent to the bus.

6. The access symbol shown and described in Figure 5-1 indicating the location of the control shall be placed on the outside surface of the bus directly adjacent and pointing to the control.

7. The access symbol shall be 4" in diameter, reflective, permanently attached to the bus surface, and capable of exhibiting negligible color change, legend fading, blistering or edge curl in any operating environment including, but not limited to, daily mechanical bus washing for at least 3 years. The access symbol shall not be covered or obscured in any way by paint, logo, trim, advertising, or any other materials.

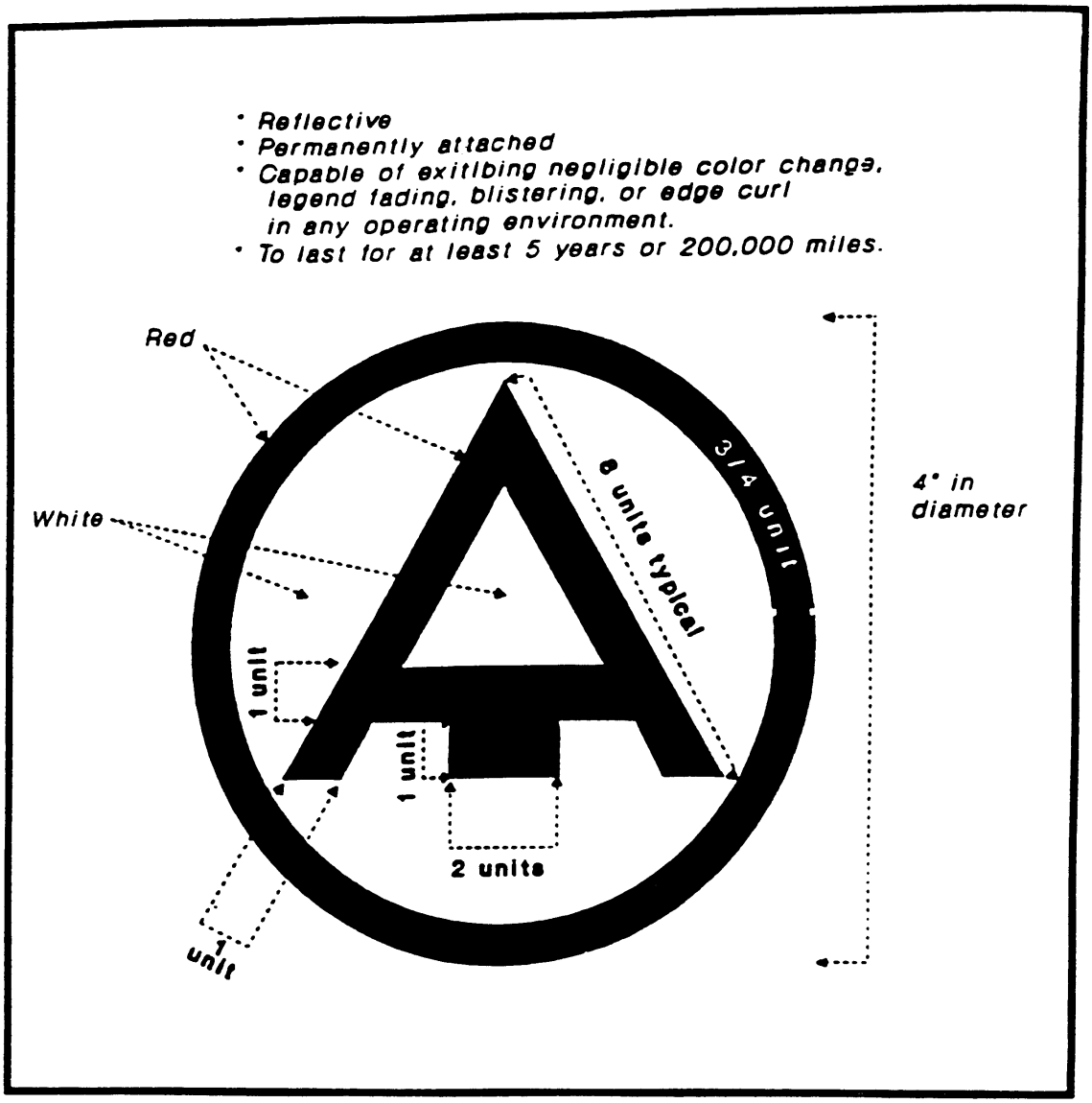

FIGURE 5-1. UNIVERSAL ACCESS SYMBOL

STANDARDIZATION GUIDELINES FOR THE REAR DOOR RELEASE CONTROL (CONTINUED)

8. At the end of 3 years the symbol label shall be reasonably easy to remove and replace. Replacement labels shall be readily available as spare parts from the Original Equipment Manufacturer.

9. User instructions for access to the interior control shall be obvious, simple, concise, and effective. The letters shall be uppercase Helvetica bold, in red on a bright white background. Such instructions shall be located on or immediately adjacent to the actual access component.

10. The access opening to the interior control shall be of a size and shape such that the control shall be immediately visible and obvious to the user once access is gained.

11. The interior control shall be easily reached and operated with one hand by any person traveling without an escort, irrespective of age, disability, or any other characteristic who may or may not be wearing heavily padded gloves on his/her hands.

12. The exterior control shall be ring-shaped, at least 1½" in radius, and shall be easily operated by a rescuer 5'6" tall standing with feet flat on the ground outside and adjacent to the bus, by pulling with any hook attached to a standard fireman's pike pole.

13. The use of the controls shall be each accomplished through a simple one-step operation.

14. The exterior and interior front door release controls shall be: equipped with a zero speed detection device to prevent the doors from being released or opened unless the bus is stopped; and equipped with a brake interlock system to prevent the doors from being released or opened unless the bus is stopped.

15. Both interior and exterior controls shall be red, permanently attached, and capable of exhibiting negligible color change in any operating environment for 12 years.

16. Instructions for use of the interior control shall be red on white using red uppercase Helvetica bold letters and shall be obvious, simple, and clearly understandable once access to the control has been gained. Such instructions shall remain legible after access to the control has been gained.

17. The instructions for use shall be permanently attached and capable of exhibiting negligible color change, legend fading, blistering, or edge curl in any operating environment for 12 years.

STANDARDIZATION GUIDELINES FOR THE REAR DOOR RELEASE CONTROL (CONTINUED)

18. Each door release control, when used in an emergency, shall have the effect of releasing or unlocking the rear door so that it can be easily pushed open or closed, regardless of the status of any other valves, switches, or controls. Resetting this control shall have the effect of restoring normal operation to this door subject to other valves, switches, or controls.

19. The controls shall operate as a two-position switch.

20. Helvetica bold text may be substituted with only the following sans-serif fonts in uppercase so as to be plainly legible in emergency situations: Megaron Bold, Megaron Bold Condensed, Triumvirate Bold Condensed, Eurostile, Eurostile Bold, Universal (filled), and Universal (filled) Bold.

21. Rear side door release controls shall be the same in operation as the door release controls located at and for the front side door.

SECTION 6

STANDARDIZATION GUIDELINES FOR THE ELECTRICAL (BATTERIES) SWITCH

SECTION 6

STANDARDIZATION GUIDELINES FOR THE ELECTRICAL (BATTERIES) SWITCH

1. The batteries compartment shall be located on the street side of the bus.

2. The bus shall be equipped with a batteries shut-off switch.

3. The batteries shut-off switch shall be a non-spark-producing, explosion-preventing knife type switch. The switch shall be encased and the entire assembly permanently attached to the forward structural wall of the battery compartment, such that the strength of the wall will reduce the possibility of damage to the switch in all weather environments and in accident situations.

4. The switch assembly shall be mounted so that the switch handle moves in a vertical plane.

5. The switch handle knob shall be spherical in shape and at least 1½" in diameter. The knob shall be red in color and capable of exhibiting negligible color change in any operating environment including, but not limited to, revenue service, steam cleaning, and chemical exposure for at least 12 years. The switch handle knob shall have at least 3" of clear area around the outer edge of its circumference along the entire corridor of travel for the switch handle knob.

6. The switch shall be a two-position maintained switch configured so that full up is the on position and full down is the off position. The switch handle shall not move from its normal run position to the off position during operation of the bus as a result of vibration or any other cause. Moving the switch fully down to the off position shall prevent all electrical flow from all batteries to both the 24- and 12-volt electrical systems, except to the hazard warning lights.

7. An instruction label shall be permanently posted adjacent to the knife switch on a plane parallel to the centerline of the bus. The legend "ON" in at least ½" tall legible red capital, Helvetica bold letters shall appear on the instruction label at the fully on (up) position of the spherical handle of the knife switch. The legend "OFF" in at least ½" tall legible red capital, Helvetica bold letters shall appear on the instruction label at the fully off (down) position of the spherical handle of the knife switch. A double-headed arrow 3/16" in width shall be shown vertically, equal in length, next to and parallel to the corridor of travel for the knife switch. The instruction label shall be rectangular and bright white in color. The instruction label shall provide at least a ¼" white border around the ON-OFF legends and be capable of exhibiting negligible color change in any operating environment

including, but not limited to, revenue service, steam cleaning, and chemical exposures for at least 12 years. *See Figure 6-1.*

8. An access door with an opening no smaller than 8" wide by 10" tall shall be placed in the battery compartment door so that when the access door is opened the switch handle knob and use instructions can be easily seen and the knife type switch can be easily used by a rescue individual with heavily padded gloves on his/her hands.

9. The access door shall be non-locking, hinged on one side, and easily opened in a single motion by an individual with heavily padded gloves on his/her hands.

10. On the inside surface of the access door shall be placed the legend EMERGENCY BATTERY DISCONNECT SWITCH, MOVE RED KNOB DOWN TO OFF in ½" tall legible red capital, Helvetica bold letters on a bright white background equal in size to the inside dimension of the access door. The legend shall be capable of exhibiting negligible color change, legend fading, blistering, or edge curl in any operating environment including, but not limited to, revenue service, steam cleaning, and chemical exposures for at least 12 years. *See Figure* 6-2.

11. The universal access symbol shown in Figure 6-3 shall be 4" in diameter, reflective, and permanently attached to the outside surface of the access door, and capable of exhibiting negligible color change, legend fading, blistering, or edge curl in any environment including, but not limited to, daily mechanical washing for at least 3 years. The access symbol shall not be covered or obscured in any way by paint, logo, trim, advertising, or any other material.

12. At the end of 3 years the symbol label shall be reasonably easy to remove and replace. Replacement labels shall be readily available as spare parts from the Original Equipment Manufacturer.

13. Helvetica bold text may be substituted with only the following sans-serif fonts in uppercase so as to be plainly legible in emergency situations: Megaron Bold, Megaron Bold Condensed, Triumvirate Bold Condensed, Eurostile, Eurostile Bold, Universal (filled), and Universal (filled) Bold.

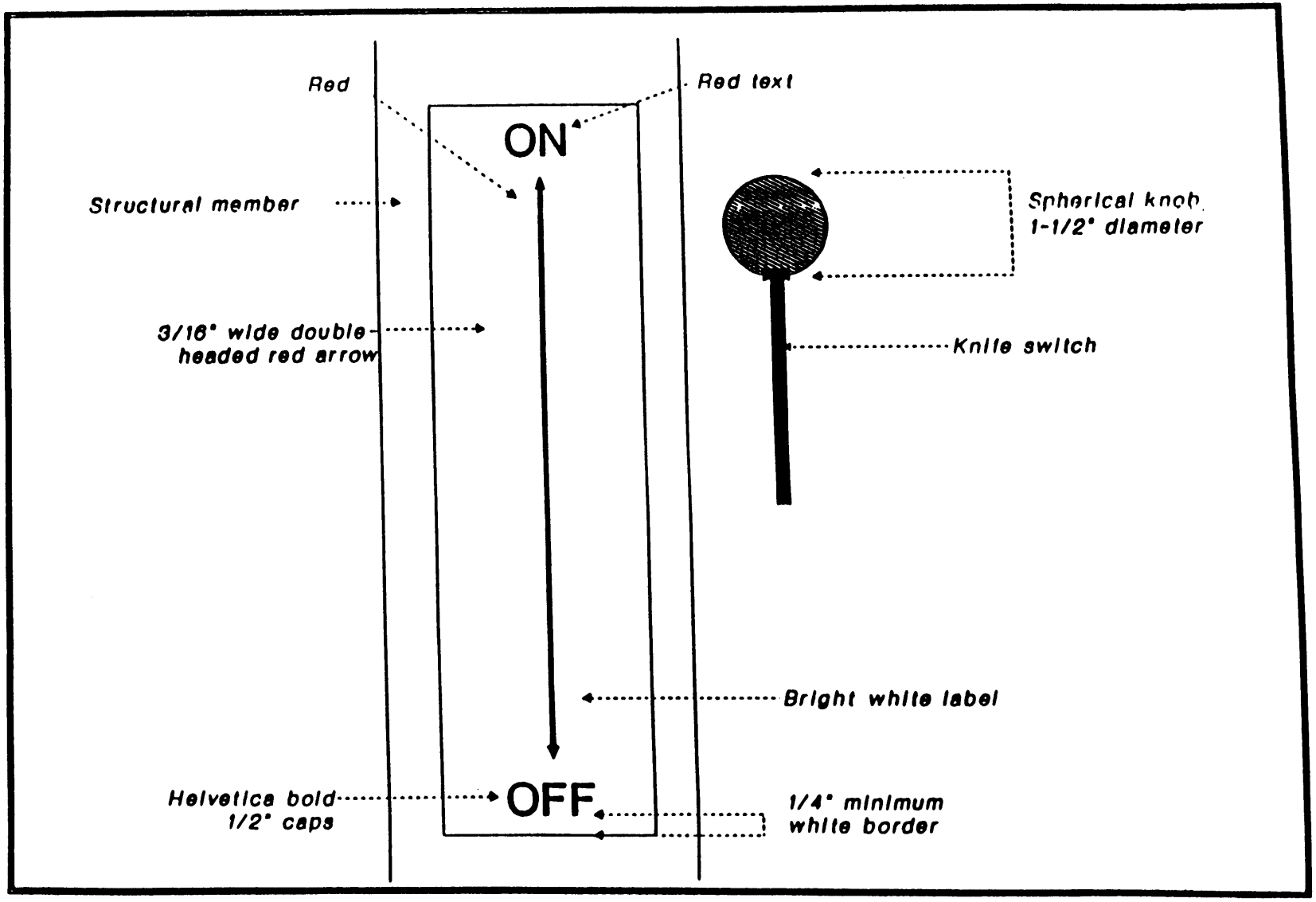

FIGURE 6-1. BATTERIES SWITCH AND LEGEND

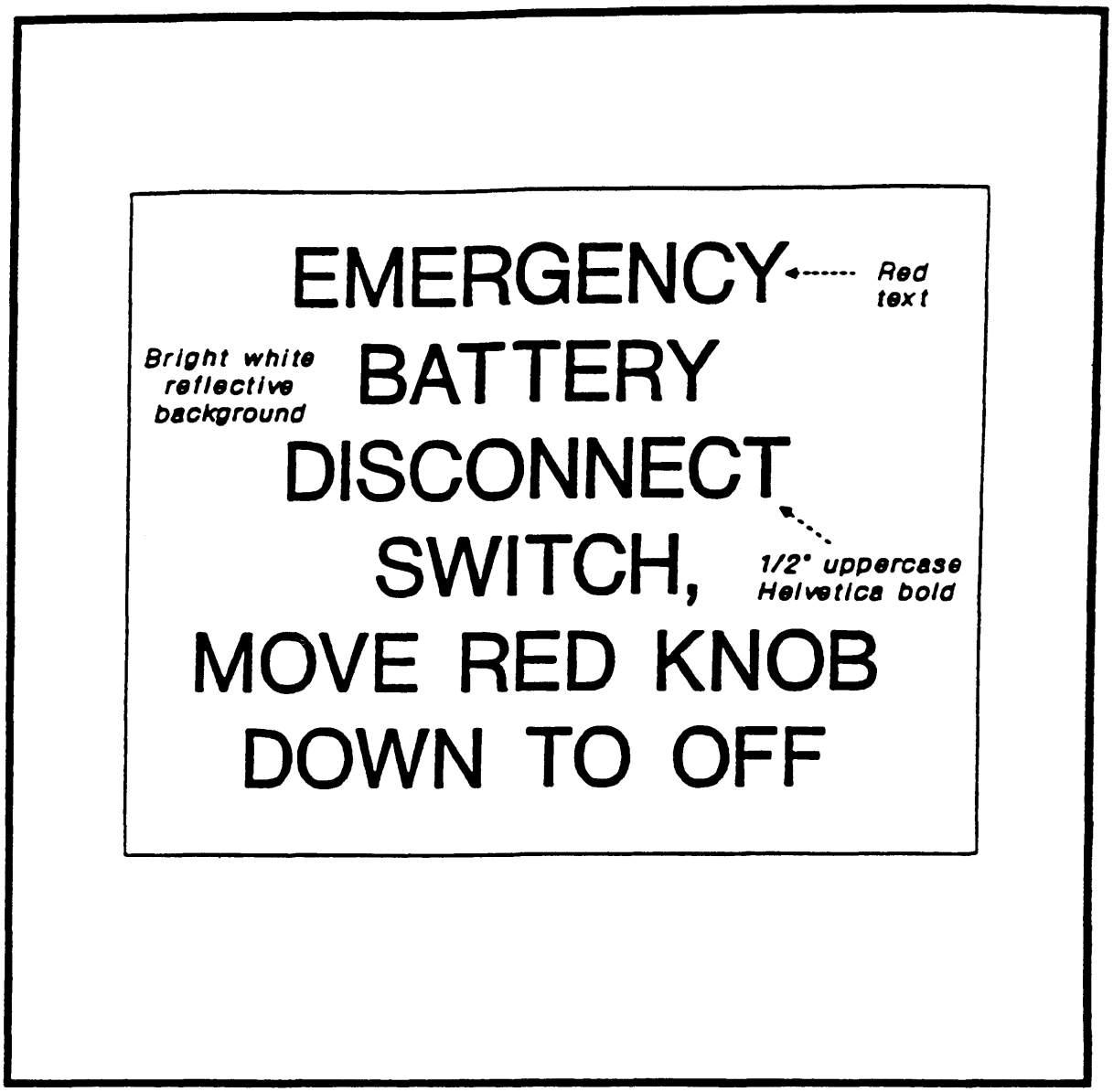

FIGURE 6-2. LEGEND ON INSIDE SURFACE OF BATTERIES SWITCH ACCESS DOOR

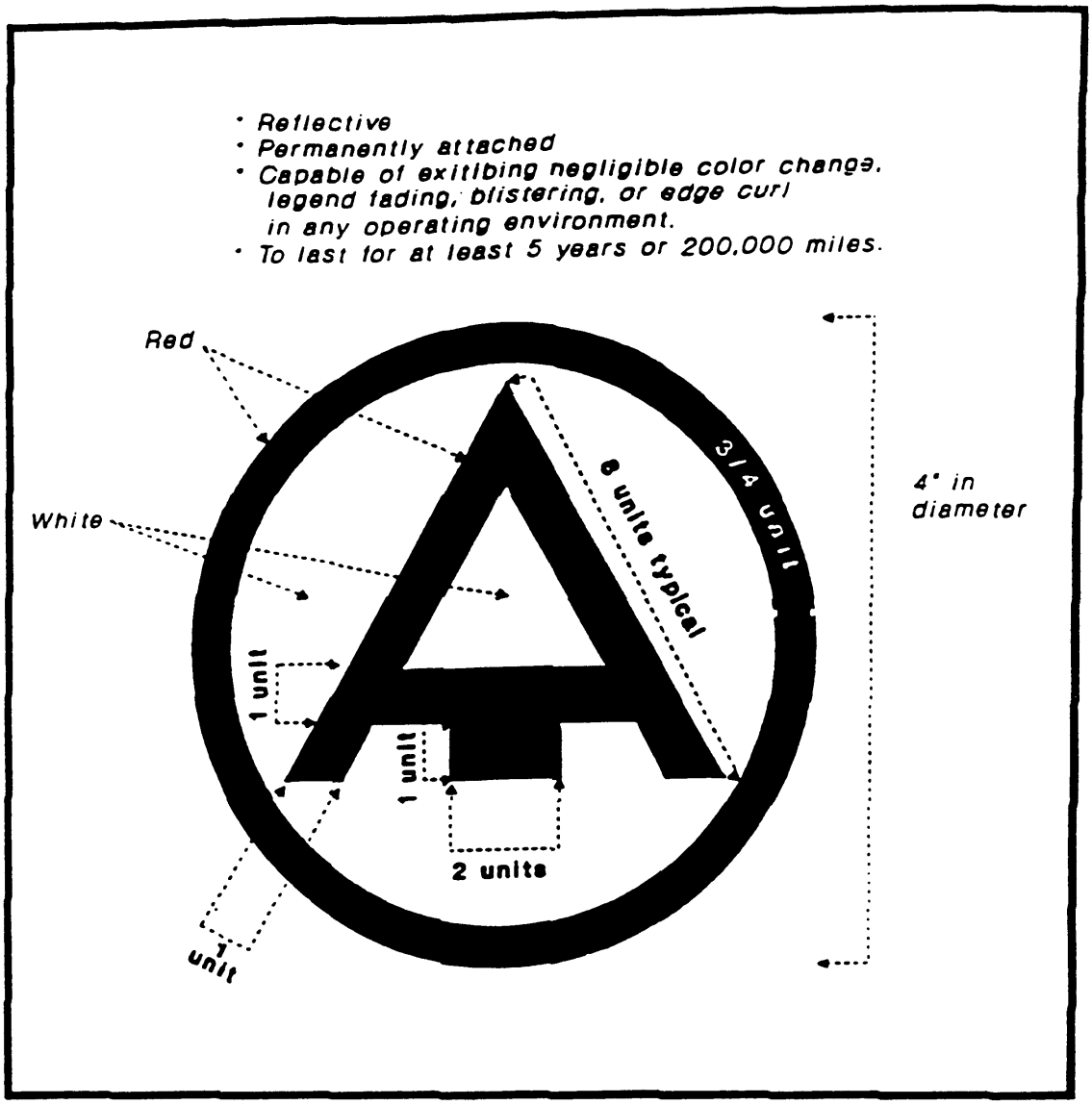

FIGURE 6-3. UNIVERSAL ACCESS SYMBOL

SECTION 7

STANDARDIZATION GUIDELINES FOR ROOF-MOUNTED EMERGENCY INGRESS AND ESCAPE HATCHES

SECTION 7

STANDARDIZATION GUIDELINES FOR ROOF-MOUNTED EMERGENCY INGRESS AND ESCAPE HATCHES

1a. For non-articulated buses:

Bus shall have a minimum of two Transpec (or approved equal) roof-mounted combination ventilation, emergency ingress and escape hatches.

1b. For articulated buses:

Bus shall have a minimum of three Transpec (or approved equal) roof-mounted combination ventilation, emergency ingress and escape hatches.

1c. Transit buses having roof-mounted alternative (non-gas, non-diesel) fuels, or designed with their primary chassis in their roof in order to achieve low floors, shall be exempted from requirements 1a and 1b.

1d. A transit bus providing an emergency exit window, located in the rear wall of the bus, that complies with all the requirements of Section 9 shall have a minimum of one Transpec (or approved equal) roof-mounted combination ventilation, emergency ingress and escape hatch.

2. Hatches shall be placed to provide maximum accessibility to passengers and emergency personnel. The forward hatch shall be placed as close as possible to directly over the forward axle. For articulated buses only, the middle hatch shall be as close as possible to midway between the forward and rearward hatches. The rearward hatch shall be placed as close as possible to directly over the rearward axle. All hatches shall be as close as possible to the centerline of the bus.

3. Each hatch shall be easily and fully releasable and openable from the outside by a rescuer, with heavily padded gloves on his/her hands, while on the roof of the bus, without the need for tools or any other equipment, by: 1) grasping and turning the release knob ¼ turn counterclockwise to its unlocked position; and 2) pulling the release knob vertically upward to the hatch's full open position. These shall be the only steps necessary in order to open a hatch from the outside.

4. Each hatch shall have a release knob mounted on the outside horizontal plane of the hatch near its most rearward edge. Each hatch shall be releasable from the roof structure along the hatch's most rearward edge. The release knob shall be a round knob at least 1½" in diameter. The handle shall be protected from damage and accidental use by tree branches or other low overhead items along any and

all service routes. The underside of the knob shall be flat, horizontal, parallel to the roof of the bus, and serrated so as to be easily grasped and turned by a rescue individual with or without heavily padded gloves on his/her hands. There shall be at least 1⅛" of clearance between the surface from which the knob protrudes and the underside of the knob. The forward 180° of the knob shall have at least ⅞" of clearance around its outside circumference. The rearward 180° of the outside circumference of the knob shall have unlimited clearance.

5. The knob shall be red in color with the legend TURN & PULL in the largest possible legible capital white Megaron bold letters and with a filled-in white circle indicating the handle position with regard to the lock and the unlock positions. The knob shall be capable of exhibiting negligible color change in any operating environment including, but not limited to, daily mechanical bus washing for at least 12 years. The legend and circle shall be capable of exhibiting negligible color change, legend fading, blistering, or edge curl, in any operating environment including but not limited to, daily mechanical bus washing for at least 3 years.

6. The legend EMERGENCY ACCESS in at least 2" tall legible capital red Megaron bold condensed letters on a bright white rectangular background shall be placed on the hatch just forward of the release handle and its use instructions on the outside flat surface of the hatch, along a line perpendicular to the centerline of the bus. The legend shall be oriented to and readable by a rescuer standing on the roof rearward of the hatch and facing the front of the bus. The legend shall be reflective and capable of exhibiting negligible color change in any operating environment including, but not limited to, daily mechanical bus washing for at least 3 years.

7. Operating instructions for the hatch to facilitate emergency access to the interior of the bus shall be as follows.

   The legend:

   FOR EMERGENCY ACCESS:
   1. TURN KNOB
   2. PULL KNOB

   shall be at least ⅜" tall legible capital red Megaron bold letters on a bright white rectangular background and placed immediately between the release handle and the large legend EMERGENCY ACCESS on the flat horizontal surface of the hatch. Along a 90° arc, approximately 3¼" equidistant from the center of the release handle shall be a dashed red line terminating at each end with a red arrow head pointing to a fully filled in red circle denoting the positions of unlock and lock; the red legend along the arc shall be on a bright white background.

The legends LOCK and UNLOCK shall be at least ⅜" tall capital legible red letters on a bright white background. The legend along the arc and the LOCK and UNLOCK shall be on the same bright white background label. The legend along the arc shall be recognizable to a rescuer while standing on the roof adjacent to the hatch. The legend shall be capable of exhibiting negligible color change in any operating environment including, but not limited to, daily mechanical bus washing for at least 3 years.

8. Each hatch shall have a release handle mounted on the inside horizontal plane of the hatch near its most rearward edge. Each hatch shall be releasable from the roof structure along its most rearward edge. The release handle shall be shaped like a wingnut or short T handle at least 2" in length with a flange extending ⅛" around the perimeter so as to make the knob easier to grip. The handle shall be red in color. On the flat top of the handle on a horizontal plane parallel to and facing the floor of the bus shall appear the legend PUSH in the largest possible white Megaron bold letters and a filled-in white circle indicating the handle position with regard to the lock or unlock position. The handle, legend, and circle shall be capable of exhibiting negligible color change in any operating environment for at least 12 years. The handle shall be easily operated and shall have at least 2" of clear area around the outer edges of its circumference.

9. Each hatch shall be easily and fully releasable and openable from inside the bus to facilitate emergency exit of those inside by: 1) rotating the release handle 90° clockwise from the LOCK to the UNLOCK position; and 2) pushing the release handle to disengage the rearward edge of the hatch from its supporting structure.

10. Operating instructions for the hatch to facilitate emergency exit from the interior of the bus shall be as follows:

    The legend:

    1. TURN KNOB
    2. PUSH KNOB

    shall be in at least ⅜" tall legible red capital Megaron bold letters on a bright white background and placed adjacent to the release handle on the flat horizontal surface of the hatch. Along a 90° arc approximately 2½" equidistant from the center of the release handle shall be a dashed red line terminating at each end with a red arrow head pointing to a fully filled-in red circle denoting the positions of UNLOCK and LOCK; the legends UNLOCK and LOCK shall be at least ⅜" tall legible red capital Megaron bold letters on a bright white background. The legend along the arc and the UNLOCK and LOCK words shall be on the same bright white background label. The legend along the arc shall be recognizable to a person while standing on the floor of the bus looking up at the hatch. The legend

shall be capable of exhibiting negligible color change in any operating environment for at least 12 years.

11. On the inside of the hatch the legend EMERGENCY EXIT in at least 1" tall legible red capital Megaron bold condensed letters on a bright white rectangular background shall be placed adjacent to the hatch release knob and its use instructions on the flat surface of the hatch along a line perpendicular to the centerline of the bus. The legend shall be readable by occupants positioned with their backs against the floor of the bus directly opposite the hatch. The legend shall be capable of exhibiting negligible color change, legend fading, blistering, or edge curl in any operating environment for at least 12 years.

12. The longitudinal and latitudinal center lines of each hatch opening shall be at least 23" $\times$ 23" in dimension and the opening area, clear of obstructions, shall be at least 450 square inches.

13. Each hatch shall be capable of remaining open unassisted.

14. The access symbol shown and described in Figure 8-1 shall be placed on the outside of the bus and used to indicate the position and existence of each hatch. The symbol shall be placed at a position on each side of the bus as close as possible to the hatch at the highest location while still visible to someone standing on the ground adjacent to the bus. Both the rear and front of the bus shall each have one access symbol similarly placed. The street and curb sides of the bus shall each have one symbol for each hatch.

15. The access symbol shall be 4" in diameter, reflective and permanently attached to the bus and capable of exhibiting negligible color change, legend fading, blistering or edge curl in any operating environment including, but not limited to, daily mechanical bus washing for a period of at least 3 years.

16. At the end of 3 years the symbol label shall be reasonably easy to remove and replace. Replacement labels shall be readily available as spare parts from the Original Equipment Manufacturer.

17. Under no circumstances shall the structural integrity or crashworthiness of the bus be reduced in any way as a result of the placement of hatches in the roof.

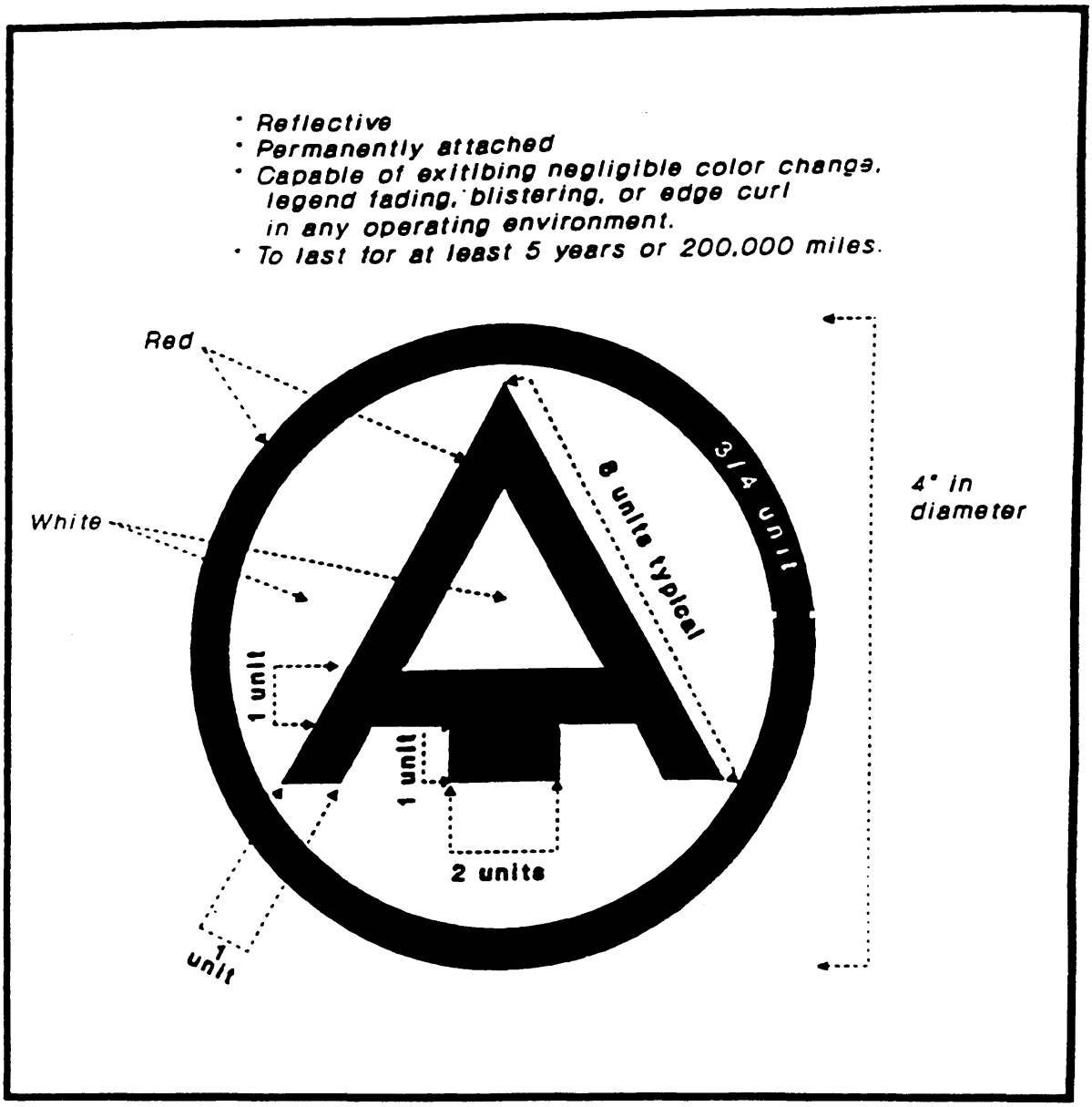

FIGURE 7-1. UNIVERSAL ACCESS SYMBOL

18. Megaron bold fonts may be substituted with only the following sans-serif fonts in upper case so as to be plainly legible in emergency situations: Helvetica Bold, Megaron Bold Condensed, Triumvirate Bold Condensed, Eurostile, Eurostile Bold, and Universal.

19. All instructions for non-emergency functions on each hatch *shall not* be printed in red or on a red background.

20. *Except as superseded by these guidelines* each hatch shall fully satisfy all applicable requirements of Federal Motor Vehicle Safety Standard 217 (Bus Window Retention and Release).

SECTION 8

STANDARDIZATION GUIDELINES FOR PASSENGER WINDOWS

SECTION 8

STANDARDIZATION GUIDELINES FOR PASSENGER WINDOWS

1. At least 80% of all passenger side windows shall be emergency exit windows. This requirement cannot be waived or lessened by the provision of roof exits and/or doors.

2. Each emergency exit window (EEW) shall be releasable by a passenger or other individual from inside the bus by operating one mechanism. The use of this mechanism shall not be hampered by seatbacks, stanchions, railings, or any other component.

3. The release mechanism on each EEW shall be in conformance with Federal Motor Vehicle Safety Standard 217.

4. After the release mechanism has been operated, the EEW shall be manually openable by a single occupant to a Full Emergency Egress Position that provides a clear opening wide enough to facilitate the entrance of emergency response personnel wearing helmets, bunker coats, gloves, and possibly airpacks, and facilitate the safe removal of passengers on backboards or stretchers, and having a minimum opening width parallel to the bus floor of at least 22" and a minimum clear opening height perpendicular to the bus floor of at least 22".

5. Top-hinged push out EEWs shall be capable of being extended to a Full Emergency Egress Position which allows the window glazing and frame to be held horizontal and parallel to the floor of the bus.

6. Each EEW shall have a built-in mechanical means of being automatically secured open when opened to any and all points beyond at least 65% of the travel to the Full Emergency Egress Position. The device used to secure open the emergency window shall be automatic or shall be easily engaged by any user inside or outside the bus using only one hand.

7. The securement device shall not *cause* latched or unlatched windows to open further prior to the attainment of 66% of travel to the Full Emergency Egress Position, regardless of the motion of the bus.

8. Each EEW, when secured open, shall require deliberate action by an individual in order to close the window, and shall allow the individual full control of the window while closing, such that the potential for the window to accidentally close or injure a rescuer or passenger is totally eliminated.

9. EEWs shall be clearly identifiable to trained emergency response personnel as rescue points, while discouraging unauthorized access. The universal access symbol shown and described in Figure 8-1 shall identify each EEW, located at each exterior access point and release mechanism which is reachable from outside.

10. The access symbol shall be red on a white background, 4" in diameter, reflective, permanently attached to the outside bus surface, and capable of exhibiting negligible color change, legend fading, blistering or edge curl in any operating environment including, but not limited to, daily mechanical bus washing for at least 3 years. Such symbol shall not be covered or obscured in any way by paint, logo, trim, advertising, or any other materials.

11. At the end of 3 years the symbol shall be reasonably easy to remove and replace. Replacement symbols shall be readily available as spare parts from the Original Equipment Manufacturer.

12. The access symbol, if located on the glazing, shall be 1½" in diameter, white with the glazing as background, permanently attached, reflective, easily visible to rescuers outside the vehicle, and capable of exhibiting negligible color change, fading, disintegration, or deterioration in any operating environment including, but not limited to, daily mechanical bus washing for at least 3 years. At the end of 3 years the symbol shall be reasonably easy to remove and replace. Replacement symbols shall be readily available as spare parts from the Original Equipment Manufacturer.

13. The legend EMERGENCY EXIT and concise operating instructions for use of emergency windows shall be obviously posted on the interior in red on white or white on red adjacent to each interior release mechanism, oriented so as to be plainly legible to passengers. It shall also be in conformance with the requirements in Federal Motor Vehicle Safety Standard 217.

14. All EEWs shall be permanently attached, along one edge, to the body of the bus to prevent falling while being used in an emergency.

15. Drains shall be appropriate in design to prevent cold weather freezing of EEW assembly and/or corrosion; EEWs shall remain easily openable without maintenance more frequent that once every two months.

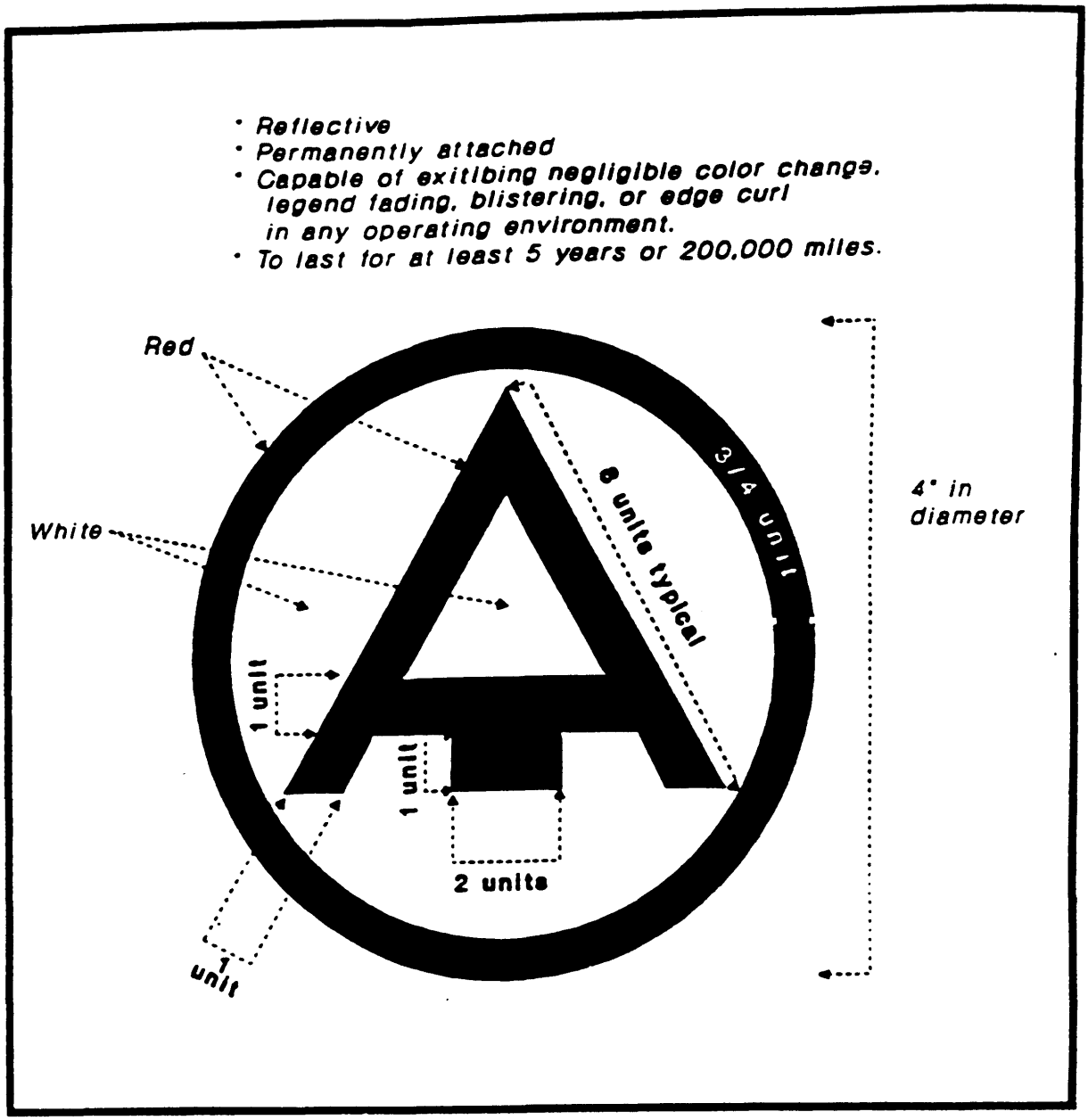

FIGURE 8-1. UNIVERSAL ACCESS SYMBOL

16. All windows and glazing shall satisfy all applicable Federal Motor Vehicle Safety Standards including FMVSS 205 and conform to all federal, state, and local regulations.

17. Except as superseded by these Guidelines, passenger side windows must conform to FMVSS 217 (Bus Window Retention and Release).

18. Helvetica bold text may be substituted with only the following sans-serif fonts in uppercase so as to be plainly legible in emergency situations: Megaron Bold, Megaron Bold Condensed, Triumvirate Bold Condensed, Eurostile, Eurostile Bold, Universal (filled), and Universal (filled) Bold.

APPENDIX A

RESOURCES

APPENDIX A
RESOURCES

FIRE AND RESCUE ORGANIZATIONS

Fire and Rescue Training Institute University of Missouri-Columbia

International Association of Fire Fighters

International Association of Fire Chiefs

International Society of Fire Service Instructors

International Fire Services Training Association (IFSTA)

Joint Council of National Fire Organizations

Lancaster County Fireman's Association

Maryland Fire & Rescue Institute

Montgomery County (PA) Fire Academy

National Association of Fire Equipment Distributors (NAFED)

National Fire Protection Association (NFPA)

National Association for Search & Rescue

National Fire Academy

Pennsylvania Fire Academy

Philadelphia Fire Fighters Union Local 22

SAFETY & TRANSPORTATION ORGANIZATIONS

National Safety Council

National Transportation Safety Board

Transportation Research Board (TRB)

Transportation Safety Institute

STANDARDS ORGANIZATIONS

American National Standards Institute (ANSI)

American Society of Automotive Engineers (SAE)

American Society of Mechanical Engineers

Canadian Standards Institute

National Electrical Manufacturers Association (NEMA)

National Institute of Standards and Technology

National Standards Association

National Technical Information Service

OTHER ORGANIZATIONS

International Association of Chiefs of Police, Inc.

APPENDIX B

BIBLIOGRAPHY

APPENDIX B

BIBLIOGRAPHY

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Balog, J.N. *Emergency & Accident Procedures Training Manual For: The Neoplan USA Corporation Urban Transit Bus (includes slides and video tape):* KETRON, Inc., Malvern, PA; March, 1988.

Balog, J.N. *Emergency & Accident Procedures Training Manual For: The General Motors Corporation RTS Urban Transit Bus (includes slides and video tape);* KETRON, Inc., Malvern, PA; March, 1988.

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Balog, J.N. and Gribbon, R.B. *Bus Safety Standardization (Presentation);* KETRON, Inc., Malvern, PA; August 21, 1992.

Balog, J.N.; Gribbon, R.B.; Schwarz, A.N.: Chia, D.; and Ketola, H.N. *KETRON Technical Discussion: Availability, Location, and Use of Safety Items for Standardization on Urban Transit Buses;* KETRON, Malvern, PA; August 7, 1991.

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Baseline Advanced Design Transit Coach Specifications, with Addendums; APTA, Washington, DC; April 4, 1977.

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4. STANDARD EMERGENCY SAFETY COMPONENTS: AN APPLICATION APPROACH

This section presents an application approach recommended by KETRON as a result of its work with the Guidelines Development Committees and the APTA Safety Committee for the standardization of urban transit bus safety equipment. The approach takes the form of guidelines based on the research and discussions held throughout the project. In this section, guidelines are presented for the Master Run Switch; Emergency Engine Stop Switch in the engine compartment; Driver's Side Window; Front and Rear Door Release Controls; Electrical (Batteries) Switch; Emergency Escape/Ingress Hatch; and Passenger Windows.

Although the intent of these Guidelines is to maximize accessibility to the various safety components by emergency preparedness forces, some transit officials are concerned with the potential for vandalism or security problems if such devices are not locked. Consequently, it is left to local determination as to whether or not the components should be behind locked doors. If this choice is made, the transit authorities must standardize the locks with non-reproducible (normal channels) keys, provide an ample supply of keys to all emergency preparedness forces and provide regular training on their use.

Each of these Guidelines has been addressed with stand alone requirements. As such, if all are adopted as authored, a large number of universal access symbols would be placed on the skin of each bus. Each transit authority should decide when one symbol would provide communication to emergency preparedness forces for more than one safety component.

4.1 MASTER RUN SWITCH

1. Each bus shall be equipped with a Master Run Switch.

2. The Master Run Switch shall be equipped with a fluted cylindrical knob that is at least 3" in diameter at its highest surface. The height of the fluted cylindrical knob shall be at least 1⅛". *See Figure 4-1.*

3. The Master Run Switch Knob (MRSK) shall be located on the driver's left side control panel to the immediate rear of *and not more than 6" from* the standard and distinctive door control handle. There shall not be any other switch or device between the door control handle and the MRSK. The door control handle shall be closer to the windshield than the MRSK.

4. The MRSK and its mounting surface shall not be recessed. The top surface of the MRSK shall be at least 1⅛" above the surface of the control panel.

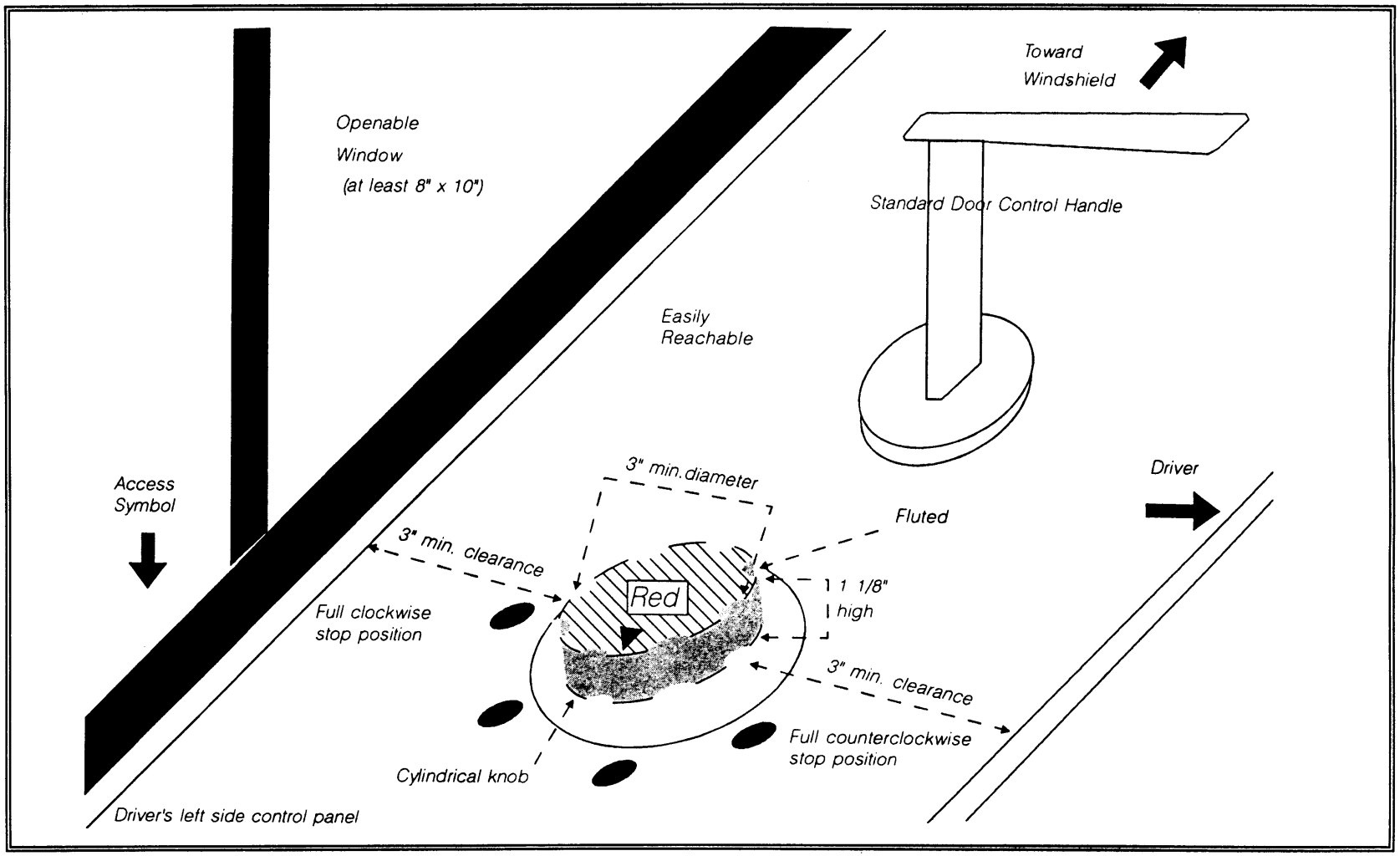

FIGURE 4-1. MASTER RUN SWITCH

5. The MRSK, at its top surface, shall be the largest circular knob on the control panel and be bigger in diameter than any other knob on the control panel.

6. The MRSK shall be easily reachable by any driver who is safety belted in the operator's seat.

7. The MRSK shall be colored red and be capable of exhibiting negligible color change in any operating environment including, but not limited to, daily interior bus washings for at least 12 years.

8. The MRSK shall be easily reachable by a person 5'6" tall standing outside and adjacent to the bus with feet flat on the ground, through the driver's left side window.

9. The MRSK shall be easily operated from outside the bus by a rescue individual wearing heavily padded gloves on his/her hands and shall have at least 3" of clear area around the outer edge of its circumference.

10. A driver's left side window complying with Section 4.2 of these Guidelines shall allow access to the MRSK by sliding easily rearward without latching along the track at any point, to create an opening no smaller than 8" high and 10" wide and large enough for the MRSK to be easily operated as described in this section. This window shall be non-locking and openable from outside the bus without breakage.

11. The universal access symbol shown and described in *Figure 4-2* indicating the location of the MRSK shall be placed on the outside surface of the bus directly adjacent to the MRSK.

12. The access symbol shall be 4" in diameter, reflective, permanently attached to the bus surface, and capable of exhibiting negligible color change, legend fading, blistering, or edge curl in any operating environment including, but not limited to, daily mechanical bus washings for at least 3 years. The access symbol shall not be covered or obscured in any way by paint, logo, trim, advertising, or any other materials.

13. At the end of 3 years the symbol label shall be reasonably easy to be removed and replaced. Replacement labels shall be readily available as spare parts from the Original Equipment Manufacturer.

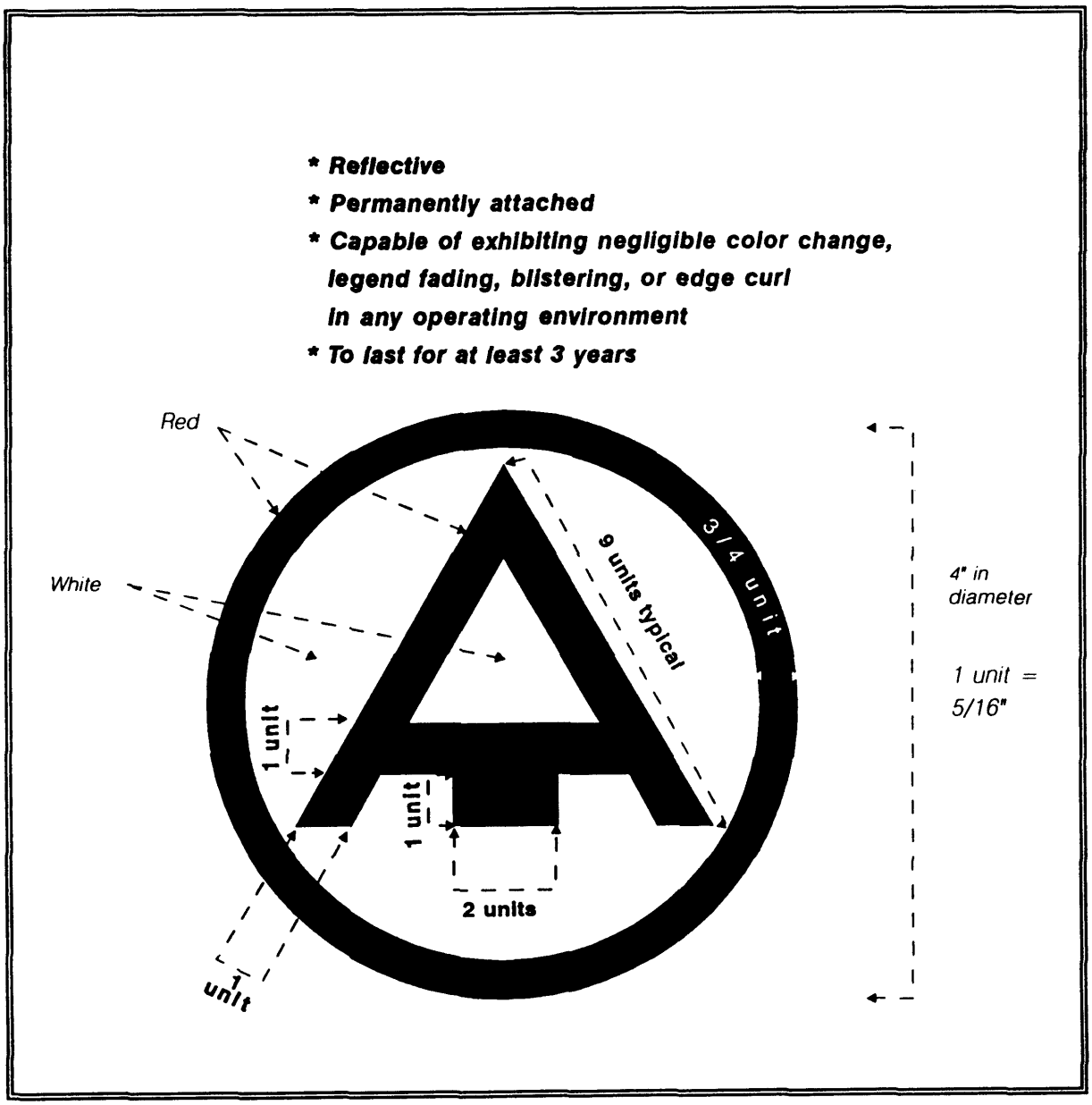

FIGURE 4-2. UNIVERSAL ACCESS SYMBOL

14. The MRSK shall be capable of fully shutting down the engine by turning with one hand (with or without a heavily padded glove) clockwise to its stop position. It shall also be capable of fully shutting down the engine by turning with one hand (with or without a heavily padded glove) counterclockwise to its stop position. The number of non-stop positions and their functionality shall be dictated by local preference.

15. The MRSK shall not be capable of turning past either stop position (both full clockwise and full counterclockwise).

16. The MRSK, in a stop position, shall have the effect of shutting down the engine, regardless of when and with what controls the bus was originally started, and regardless of the status of the transmission selector. The MRSK shall not prevent the effective functioning of other engine shut down devices. The engine shall not start with the MRSK in either the full clockwise or full counterclockwise positions.

17. When the bus engine is shut down by use of the Emergency Engine Stop Switch in the engine compartment, or any other device, the MRSK or any other device shall not be capable of restarting the bus engine until the engine shut down switch is reset.

18. Additional local requirements for such equipment as a key switch which prevents starting the engine without a key are allowed but shall not supersede the function of any of the above Guidelines.

4.2 DRIVER'S SIDE WINDOW(S)

1. A non-locking window (NLW) to the driver's immediate left shall enable the door control handle, and Master Run Switch Knob to be easily seen and be easily reached and operated by a person 5'6" tall standing with feet flat on the ground, outside and adjacent to the bus.

2. The NLW shall allow outside access to driver's controls by sliding easily rearward without latching along the track at any point, to create an opening no smaller than 8" high and 10" wide and at least large enough to easily operate the door control handle, Master Run Switch Knob, Master Door Release Control, and emergency egress release mechanism from outside the bus. The NLW shall be easily openable from outside the bus without breakage.

3. The access symbol shown and described in *Figure 4-2* shall be placed on the outside surface of the bus directly adjacent to and pointing to the exact location at which the NLW opens

4. The access symbol shall be 4" in diameter, reflective, permanently attached to the bus surface, and capable of exhibiting negligible color change, legend fading, blistering, or edge curl in any operating environment including, but not limited to, daily mechanical bus washings for at least 3 years. The access symbol shall not be covered or obscured in any way by paint, logo, trim, advertising, or any other materials.

5. At the end of 3 years the symbol label shall be reasonably easy to remove and replace. Replacement labels shall be readily available as spare parts from the Original Equipment Manufacturer.

6. A driver's window to the driver's immediate left side shall be provided.

7. The NLW shall be permanently attached, along at least one edge, to the body of the bus to prevent falling while being used in an emergency.

8. The NLW, when closed, shall prevent the entrance of rain water.

9. The NLW shall fully satisfy and/or exceed all applicable Federal Motor Vehicle Safety Standards including FMVSS 205 and conform to all federal, state, and local regulations.

10. The NLW shall in all other respects conform to FMVSS 217 (Bus Window Retention and Release), *except as superseded by these Guidelines.*

11. The NLW shall be similar in design and operation to Passenger Windows wherever possible.

4.3 EMERGENCY ENGINE SHUTDOWN SWITCH IN ENGINE COMPARTMENT

1. Each bus shall be equipped with an Emergency Engine Shutdown (EESD) Switch located in the engine compartment.

2. The EESD Switch shall be located facing the engine compartment door on the same control box and on the same plane as other engine control switches, but at least 4" from other engine control switches and no more than 6" from them.

3. The control box shall be located in the upper right quadrant of the engine compartment as viewed by a user facing the engine compartment door from outside the bus. The control box surface exhibiting the EESD Switch shall be located no more than 12" from the engine compartment door.

4. The control box shall be mounted to a structural member of the bus rather than to the engine, and such that the possibility of damage to the switch by vibration is prevented.

5. The control box surface, upon which the EESD Switch shall be mounted, shall be bright white and capable of exhibiting negligible color change in any operating environment including, but not limited to, revenue service, steam cleanings, and chemical exposures for at least 12 years.

6. An access door with an opening no smaller than 8" high and 10" wide shall be placed in the engine compartment door so that when the access door is open, the EESD Switch and use instructions can be easily seen and the EESD Switch easily operated by a rescue individual with heavily padded gloves on his/her hands while standing with both feet on the ground looking directly through the access door opening. See *Figure 4-3.*

7. Under no circumstances shall access doors be covered, blocked, or camouflaged by advertising or any other devices or materials.

8. The access door shall be non-locking, hinged on one side, and easily opened in a single motion by an individual with heavily padded gloves on his/her hands.

9. A rectangular metal guide/tunnel, of the same dimension as the access door opening, shall be permanently attached to the inside of the engine compartment door at the same location as the access door opening and shall extend 6" into the engine compartment.

10. The universal access symbol shown and described in *Figure 4-2,* indicating the location of the EESD Switch, shall be 4" in diameter, reflective, permanently attached to the outside surface of the access door, and capable of exhibiting negligible color change, legend fading, blistering, or edge curl in any operating environment including, but not limited to, daily mechanical bus washings for at least 3 years. Such symbol shall not be covered or obscured in any way by paint, logo, trim, advertising, or any other material.

11. At the end of 3 years the symbol label shall be reasonably easy to remove and replace. Replacement labels shall be readily available as spare parts from the Original Equipment Manufacturer.

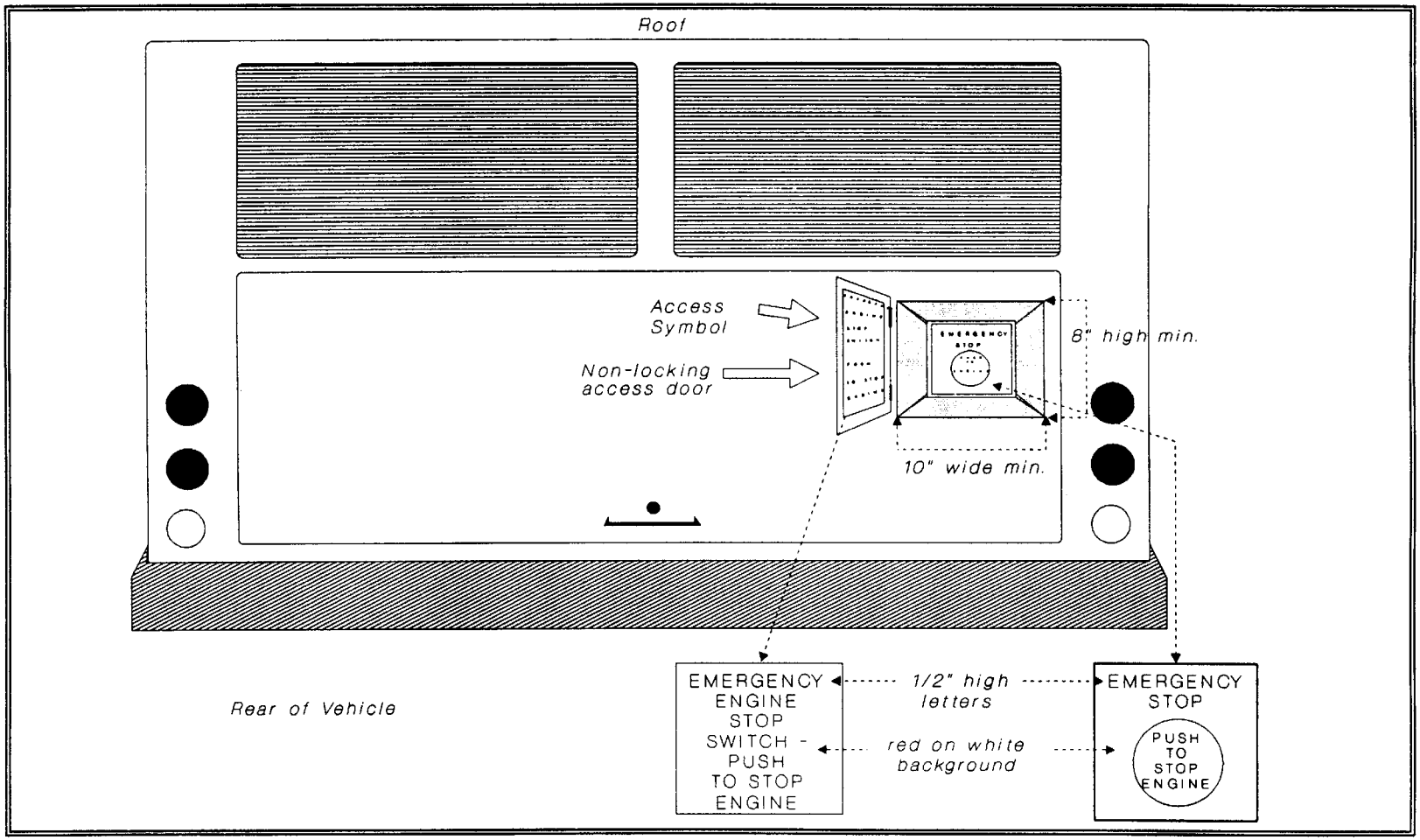

FIGURE 4-3. LOCATION AND CHARACTERSITICS OF THE EMERGENCY ENGINE STOP SWITCH AS VIEWED WITH THE ENGINE COMPARTMENT DOOR IN THE CLOSED POSITION

12. On the inside surface of the access door shall be placed the legend "EMERGENCY ENGINE STOP SWITCH, PUSH TO STOP ENGINE" in red ½" tall legible capital Helvetica bold letters on a bright white background equal in size to the inside dimension of the access door. The legend and background shall be reflective and capable of exhibiting negligible color change in any operating environment including, but not limited to, revenue service, steam cleanings, and chemical exposures for at least 12 years. See *Figure 4-4.*

13. The EESD Switch shall be an internally illuminated, maintained, non-spark producing, explosion-proof, push/pull mushroom button switch with a red lens at least 3" in diameter. On the lens in white capital Helvetica bold letters shall be the legend "PUSH TO STOP ENGINE" in the largest legible type. The EESD Switch lens and legend shall be capable of exhibiting negligible color change in any operating environment including, but not limited to, revenue service, steam cleanings, and chemical exposures for at least 12 years. See *Figures 4-5 and 4-6.*

14. The EESD Switch, when pushed in to its off position, shall cause the engine to fully shut down regardless of the setting of any other switch or device on the bus. With the EESD Switch in the off (depressed) position, the engine shall not, under any circumstances, be able to be restarted, regardless of all other devices, functions, and settings. All other engine start and stop controls and devices shall function normally only after the EESD Switch is pulled out fully to its on position.

15. Directly above the EESD Switch on the white surface of the control box shall be the legend "EMERGENCY STOP" in ½" tall clearly legible red capital Helvetica bold letters. The legend shall be reflective and permanently attached to the control box surface and capable of exhibiting negligible color change, legend fading, blistering, or edge curl in any operating environment including, but not limited to, revenue service, steam cleanings, and chemical exposures for at least 12 years.

16. A single and continuous quarter-inch-wide red line shall surround in a rectangular shape the "EMERGENCY STOP" label and the EESD Switch to clearly distinguish it from non-emergency operating switches, instructions, and indicators. This line shall be permanently attached to the white surface of the control box and capable of exhibiting negligible color change, legend fading, blistering, or edge curl in any operating environment including, but not limited to, revenue service, steam cleanings, and chemical exposures, for at least 12 years.

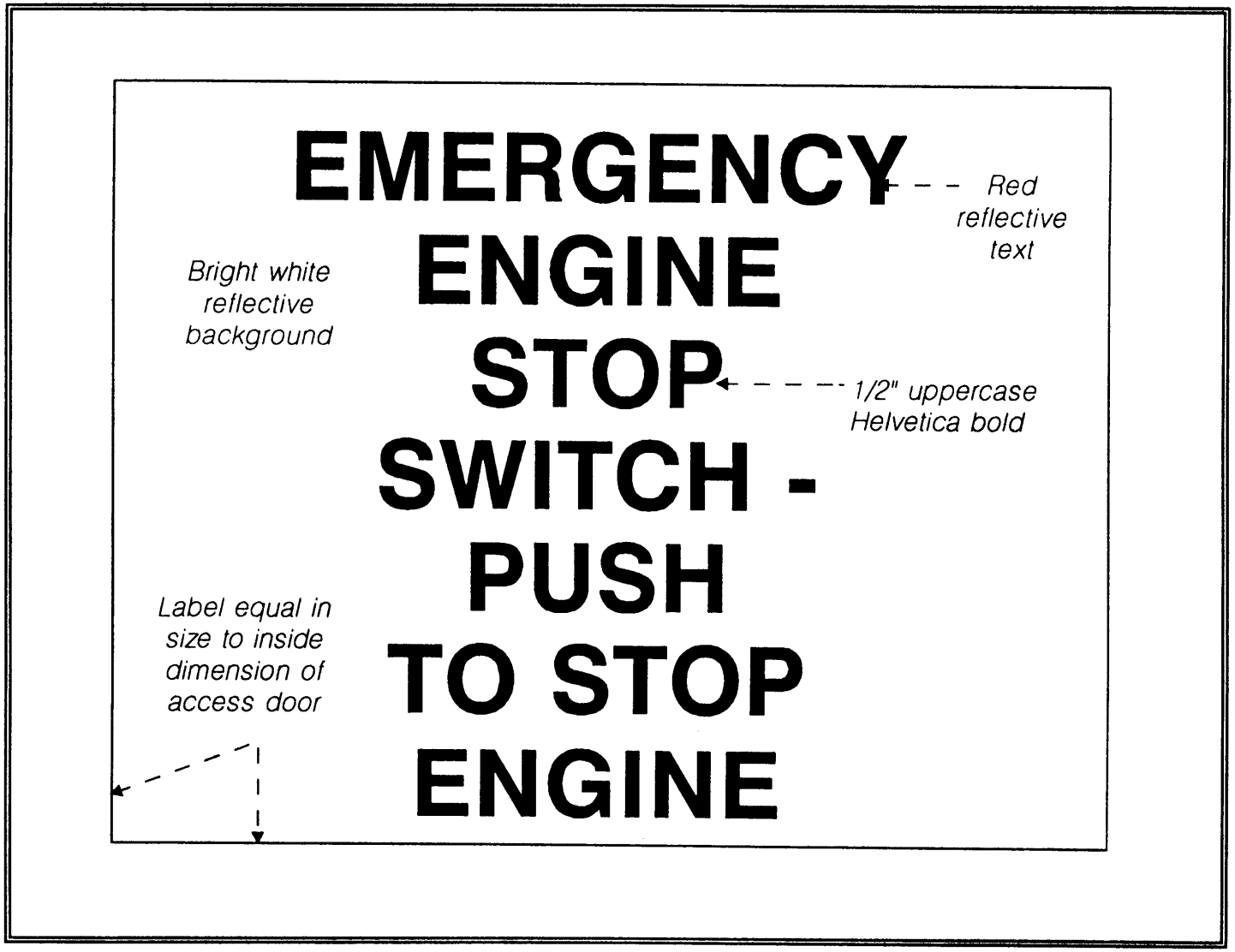

FIGURE 4-4. LEGEND ON INSIDE SURFACE OF ACCESS DOOR TO EMERGENCY ENGINE STOP SWITCH IN ENGINE COMPARTMENT

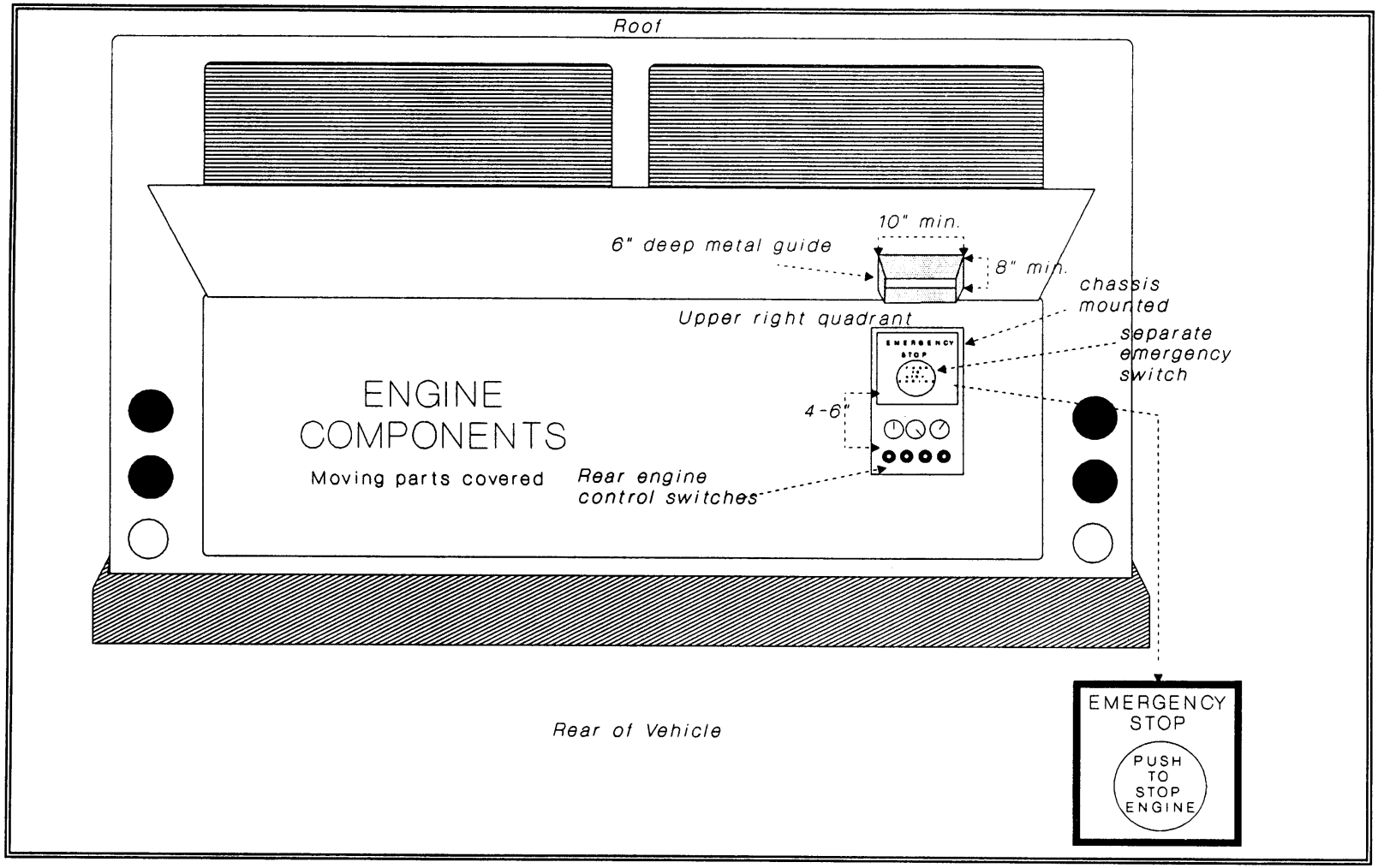

FIGURE 4-5. LOCATION AND CHARACTERISTICS OF THE EMERGENCY ENGINE STOP SWITCH AS VIEWED WITH THE ENGINE COMPARTMENT DOOR IN THE OPEN POSITION

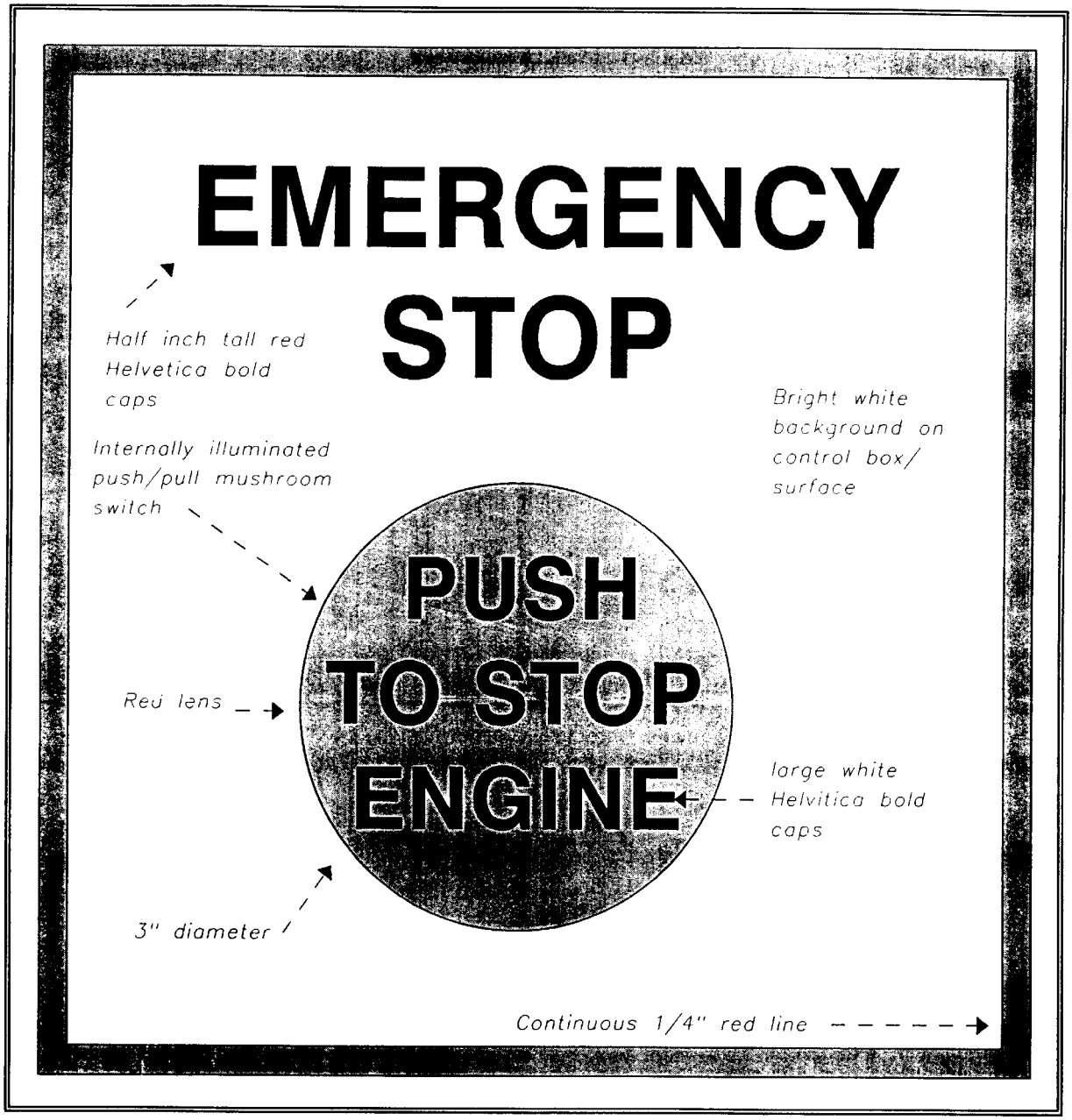

FIGURE 4-6. EMERGENCY ENGINE STOP SWITCH AND LABELING

17. The EESD Switch shall be internally illuminated and the interior illumination shall be activated when the engine is running and shall be extinguished otherwise. The illumination shall be bright enough in all light conditions and environments to immediately attract rescuers' attention upon opening the access door, and to clearly enunciate the message "PUSH TO STOP ENGINE" on the EESD Switch lens.

18. The EESD Switch shall be sealed to prevent intrusion of dirt, grease, moisture, or any other agent which could degrade or prevent full functionality during revenue service, after an accident, or in an emergency.

19. The EESD Switch shall be separate in use from all other rear/maintenance engine controls and is not intended to be used in normal maintenance operation. The EESD Switch shall not be combined with any non-emergency engine compartment switches including, but not limited to, light, control, run, ignition, start, or normal stop switches.

20. All moving engine parts within 18" of the control box switch panel shall be adequately and completely covered to totally avoid any and all potential for injuries to users of the EESD Switch.

21. Helvetica bold text may be substituted with only the following sans-serif fonts in uppercase so as to be plainly legible in emergency situations: Megaron Bold, Megaron Bold Condensed, Triumvirate Bold Condensed, Eurostile, Eurostile Bold, Universal (filled), and Universal (filled) Bold.

4.4 FRONT DOOR RELEASE CONTROL

1. Buses shall be equipped with one interior and one exterior emergency front door release control located at the front door.

2. The interior control mechanism shall be positioned adjacent to and rearward of the front door such that it can be easily reached by any person.

3. The exterior control mechanism shall be located adjacent to and rearward of the front door at a height of at least 8 feet above the ground. The mechanism shall be covered so as to prevent damage and accidental operation by tree branches, signs, or other items along any and all service routes. The cover shall be flush with the outer skin of the bus.

4. Access by a person to the interior control shall be easily achievable by any person through a simple one-step operation that can be accomplished safely using only one heavily padded gloved or ungloved hand. Such access may be:

a) a cover that is lifted or slid to reveal the control; or

b) a cover panel grooved for easy breakage, which when broken will reveal the control.

5. The exterior control shall be easily reached and operated with a fireman's standard pike pole by a rescuer 5'6" tall standing with feet flat on the ground outside and adjacent to the bus.

6. The access symbol shown and described in *Figure 4-2* indicating the location of the control shall be placed on the outside surface of the bus directly adjacent and pointing to the control.

7. The access symbol shall be 4" in diameter, reflective, permanently attached to the bus surface, and capable of exhibiting negligible color change, legend fading, blistering, or edge curl in any operating environment including, but not limited to, daily mechanical bus washings for at least 3 years. The access symbol shall not be covered or obscured in any way by paint, logo, trim, advertising, or any other materials.

8. At the end of 3 years the symbol label shall be reasonably easy to remove and replace. Replacement labels shall be readily available as spare parts from the Original Equipment Manufacturer.

9. User instructions for access to the interior control shall be obvious, simple, concise, and effective. The letters shall be uppercase Helvetica bold, in red on a bright white background. Such instructions shall be located on or immediately adjacent to the actual access component.

10. The access opening to the interior control shall be of a size and shape such that the control shall be immediately visible and obvious to the user once access is gained.

11. The interior control shall be easily reached and operated with one hand by any person who may or may not be wearing heavily padded gloves on his/her hands.

12. The exterior control shall be ring-shaped, at least 1½" in radius, and shall be easily operated by a rescuer 5'6" tall standing with feet flat on the ground outside and adjacent to the bus, by pulling with any hook attached to a standard fireman's pike pole.

13. The use of the controls shall be accomplished each through a simple one-step operation.

14. The exterior and interior front door release controls shall be equipped with a zero speed detection device to prevent the doors from being released or opened unless the bus is stopped; and equipped with a brake interlock system to prevent the doors from being released or opened unless the bus is stopped.

15. Both interior and exterior controls shall be red, permanently attached, and capable of exhibiting negligible color change in any operating environment for 12 years.

16. Instructions for use of the interior control shall be in red on white using red uppercase Helvetica bold letters and shall be obvious, simple, and clearly understandable once access to the control has been gained. Such instructions shall remain legible after access to the control has been gained.

17. The instructions for use shall be permanently attached and capable of exhibiting negligible color change, legend fading, blistering, or edge curl in any operating environment for 12 years.

18. Each door release control, when used in an emergency, shall have the effect of releasing or unlocking the front door so that it can be easily pushed open or closed, regardless of the status of any other valves, switches, or controls. Resetting this control shall have the effect of restoring normal operation to this door subject to other valves, switches, or controls.

19. The control shall operate as a two-position switch.

20. Helvetica Bold text may be substituted with only the following sans-serif fonts in uppercase so as to be plainly legible in emergency situations: Megaron Bold, Megaron Bold Condensed, Triumvirate Bold Condensed, Eurostile, Eurostile Bold, Universal (filled), and Universal (filled) Bold.

21. Front side door release controls shall be the same in operation as the door release controls located at and for the rear side door.

4.5 REAR DOOR RELEASE CONTROL

1. Buses shall be equipped with one interior and one exterior emergency rear door release control located at the rear door.

2. The interior control mechanism shall be positioned adjacent to and forward of the rear door such that it can be easily reached by any person.

3. The exterior control mechanism shall be located adjacent to and forward of the rear door at a height of at least 8 feet above the ground. The mechanism shall be covered so as to prevent damage and accidental operation by tree branches, signs, or other items along any and all service routes. The cover shall be flush with the outer skin of the bus.

4. Access by a person to the interior control shall be easily achievable by any person through a simple one-step operation that can be accomplished safely using only one heavily padded gloved or ungloved hand. Such access may be:

   a) a cover that is lifted or slid to reveal the control; or

   b) a cover panel grooved for easy breakage, which when broken will reveal the control.

5. The exterior control shall be easily reached and operated with a fireman's standard pike pole by a rescuer 5'6" tall standing with feet flat on the ground outside and adjacent to the bus.

6. The access symbol shown and described in *Figure 4-2* indicating the location of the control shall be placed on the outside surface of the bus directly adjacent and pointing to the control.

7. The access symbol shall be 4" in diameter, reflective, permanently attached to the bus surface, and capable of exhibiting negligible color change, legend fading, blistering, or edge curl in any operating environment including, but not limited to, daily mechanical bus washings for at least 3 years. The access symbol shall not be covered or obscured in any way by paint, logo, trim, advertising, or any other materials.

8. At the end of 3 years the symbol label shall be reasonably easy to remove and replace. Replacement labels shall be readily available as spare parts from the Original Equipment Manufacturer.

9. User instructions for access to the interior control shall be obvious, simple, concise, and effective. The letters shall be uppercase Helvetica bold, in red on a bright white background. Such instructions shall be located on or immediately adjacent to the actual access component.

10. The access opening to the interior control shall be of a size and shape such that the control shall be immediately visible and obvious to the user once access is gained.

11. The interior control shall be easily reached and operated with one hand by any person who may or may not be wearing heavily padded gloves on his/her hands.

12. The exterior control shall be ring-shaped, at least 1½" in radius, and shall be easily operated by a rescuer 5'6" tall standing with feet flat on the ground outside and adjacent to the bus, by pulling with any hook attached to a standard fireman's pike pole.

13. The use of the controls shall be each accomplished through a simple one-step operation.

14. The exterior and interior rear door release controls shall be: equipped with a zero speed detection device to prevent the doors from being released or opened unless the bus is stopped; and equipped with a brake interlock system to prevent the doors from being released or opened unless the bus is stopped.

15. Both interior and exterior controls shall be red, permanently attached, and capable of exhibiting negligible color change in any operating environment for 12 years.

16. Instructions for the use of the interior control shall be red on white using red uppercase Helvetica bold letters and shall be obvious, simple, and clearly understandable once access to the control has been gained. Such instructions shall remain legible after access to the control has been gained.

17. The instructions for use shall be permanently attached and capable of exhibiting negligible color change, legend fading, blistering, or edge curl in any operating environment for 12 years.

18. Each door release control, when used in an emergency, shall have the effect of releasing or unlocking the rear door so that it can be easily pushed open or closed, regardless of the status of any other valves, switches, or controls. Resetting this control shall have the effect of restoring normal operation to this door subject to other valves, switches, or controls.

19. The control shall operate as a two-position switch.

20. Helvetica bold text may be substituted with only the following sans-serif fonts in uppercase so as to be plainly legible in emergency situations: Megaron Bold. Megaron Bold Condensed, Triumvirate Bold Condensed, Eurostile, Eurostile Bold, Universal (filled), and Universal (filled) Bold.

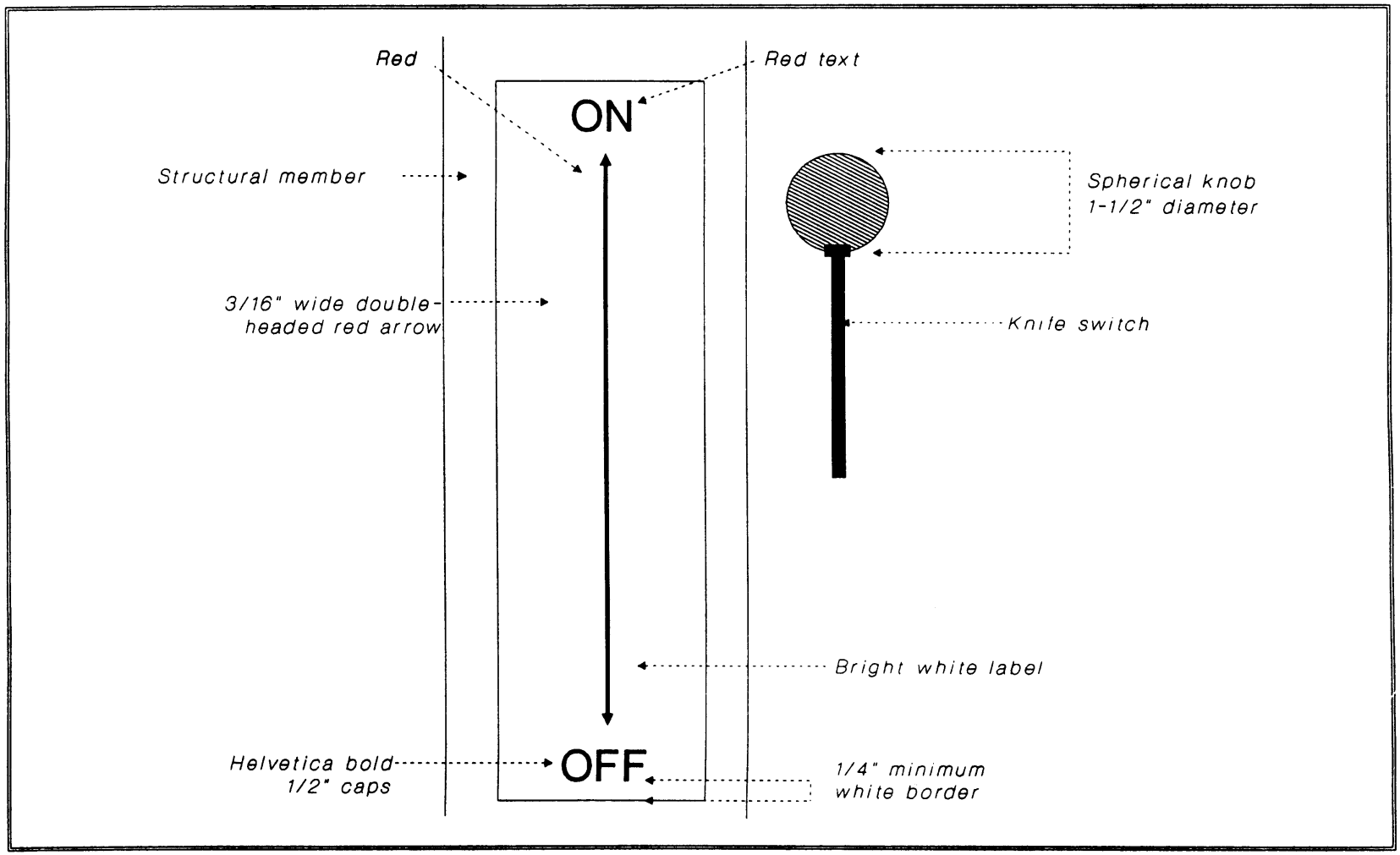

FIGURE 4-7. BATTERIES SWITCH AND LEGEND

21. Rear side door release controls shall be the same in operation as the door release controls located at and for the front side door.

4.6 ELECTRICAL (BATTERIES) SWITCH

1. The batteries compartment shall be located on the street side of the bus.

2. The bus shall be equipped with a batteries shut-off switch.

3. The batteries shut-off switch shall be a non-spark producing, explosion-proof knife-type switch. The switch shall be encased and the entire assembly permanently attached to the forward structural wall of the battery compartment, such that the strength of the wall will reduce the possibility of damage to the switch in all weather environments and in accident situations.

4. The switch assembly shall be mounted so that the switch handle moves in a vertical plane.

5. The switch handle knob shall be spherical in shape and at least 1½" in diameter. The knob shall be red in color and capable of exhibiting negligible color change in any operating environment including, but not limited to, revenue service, steam cleanings, and chemical exposure for at least 12 years. The switch handle knob shall have at least 3" of clear area around the outer edge of its circumference along the entire corridor of travel for the switch handle knob.

6. The switch shall be a two-position maintained switch configured so that full up is the on position and full down is the off position. The switch handle shall not move from its normal run position to the off position during operation of the bus as a result of vibration or any other cause. Moving the switch fully down to the off position shall prevent all electrical flow from all batteries to both the 24-volt and 12-volt electrical systems, except to the hazard warning lights.

7. An instruction label shall be permanently posted adjacent to the knife switch on a plane parallel to the centerline of the bus. The legend "ON" in at least ½" tall legible red capital, Helvetica bold letters shall appear on the instruction label at the fully on (up) position of the spherical handle of the knife switch. The legend "OFF" in at least ½" tall legible red capital, Helvetica bold letters shall appear on the instruction label at the fully off (down) position of the spherical handle of the knife switch. A double-headed arrow 3/16" in width shall be shown vertically, equal in length, next to and parallel to the corridor of travel for the knife switch. The instruction label shall be rectangular and bright white in color. The instruction label shall provide at least a ¼" white border around the ON-OFF legends and be capable of exhibiting negligible color change in any operating environment

including, but not limited to, revenue service, steam cleanings, and chemical exposures for at least 12 years. See *Figure 4-7.*

8. An access door with an opening no smaller than 8" wide by 10" tall shall be placed in the battery compartment door so that when the access door is opened the switch handle knob and use instructions can be easily seen and the knife-type switch can be easily used by a rescue individual with heavily padded gloves on his/her hands.

9. The access door shall be non-locking, hinged on one side, and easily opened in a single motion by an individual with heavily padded gloves on his/her hands.

10. On the inside surface of the access door shall be placed the legend EMERGENCY BATTERY DISCONNECT SWITCH, MOVE RED KNOB DOWN TO OFF in ½" tall legible red capital, Helvetica bold letters on a bright white background equal in size to the inside dimension of the access door. The legend shall be capable of exhibiting negligible color change, legend fading, blistering, or edge curl in any operating environment including, but not limited to, revenue service, steam cleanings, and chemical exposures for at least 12 years. See *Figure 4-8.*

11. The universal access symbol shown in *Figure 4-2* shall be 4" in diameter, reflective, and permanently attached to the outside surface of the access door, and capable of exhibiting negligible color change, legend fading, blistering, or edge curl in any environment including, but not limited to, daily mechanical washing for at least 3 years. The access symbol shall not be covered or obscured in any way by paint, logo, trim, advertising, or any other material.

12. At the end of 3 years the symbol label shall be reasonably easy to remove and replace. Replacement labels shall be readily available as spare parts from the Original Equipment Manufacturer.

13. Helvetica bold text may be substituted with only the following sans-serif fonts in uppercase so as to be plainly legible in emergency situations: Megaron Bold, Megaron Bold Condensed, Triumvirate Bold Condensed, Eurostile, Eurostile Bold, Universal (filled), and Universal (filled) Bold.

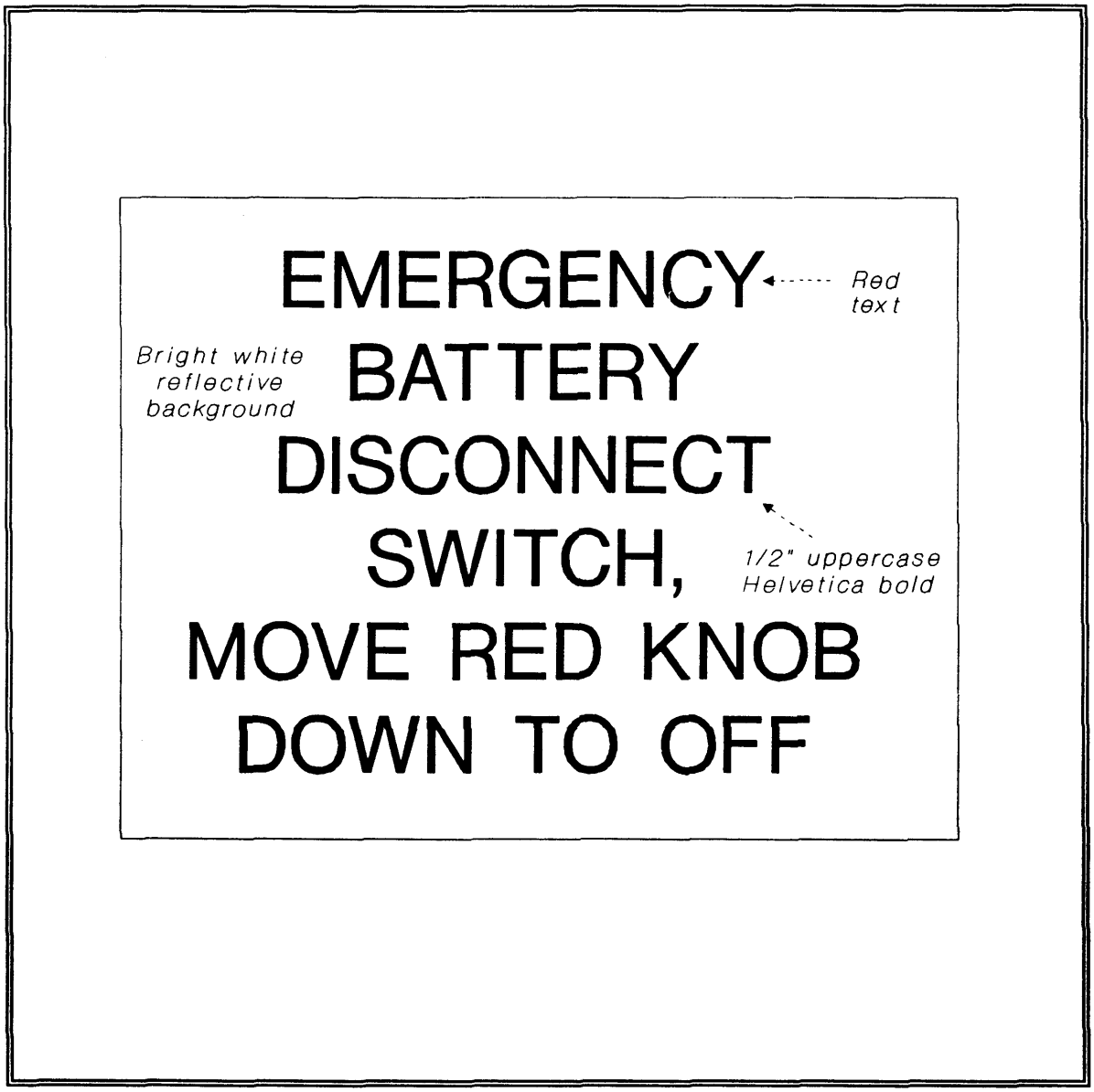

FIGURE 4-8. LEGEND ON INSIDE SURFACE OF BATTERIES SWITCH ACCESS DOOR

4.7 ROOF-MOUNTED EMERGENCY INGRESS AND ESCAPE HATCHES

1a. For non-articulated buses:

The buses shall have a minimum of two Transpec (or approved equal) roof-mounted combination ventilation, emergency ingress and escape hatches.

1b. For articulated buses:

The buses shall have a minimum of three Transpec (or approved equal) roof-mounted combination ventilation, emergency ingress and escape hatches.

1c. Transit buses having roof-mounted alternative (non-gas, non-diesel) fuels, or designed with their primary chassis in their roof in order to achieve low floors, shall be exempted from requirements 1a and 1b.

1d. A transit bus providing an emergency exit window, located in the rear wall of the bus, that complies with all the requirements of Section 4.8 shall have a minimum of one Transpec (or approved equal) roof-mounted combination ventilation, emergency ingress and escape hatch.

2. Hatches shall be placed to provide maximum accessibility to passengers and emergency personnel. The forward hatch shall be placed as close as possible to directly over the forward axle. For articulated buses only, the middle hatch shall be as close as possible to midway between the forward and rearward hatches. The rearward hatch shall be placed as close as possible to directly over the rearward axle. All hatches shall be as close as possible to the centerline of the bus.

3. Each hatch shall be easily and fully releasable and openable from the outside by a rescuer, with heavily padded gloves on his/her hands, while on the roof of the bus, without the need for tools or any other equipment, by: 1) grasping and turning the release knob % turn counterclockwise to its unlocked position; and 2) pulling the release knob vertically upward to the hatch's full open position. These shall be the only steps necessary in order to open a hatch from the outside.

4. Each hatch shall have a release knob mounted on the outside horizontal plane of the hatch near its most rearward edge. Each hatch shall be releasable from the roof structure along the hatch's most rearward edge. The release knob shall be a round knob at least 1¾" in diameter. The handle shall be protected from damage and accidental use by tree branches or other low overhead items along any and all service routes. The underside of the knob shall be flat, horizontal, parallel to the roof of the bus, and serrated so as to be easily grasped and turned by a rescue individual with or without heavily padded gloves on his/her hands. There

shall be at least 1⅛" of clearance between the surface from which the knob protrudes and the underside of the knob. The forward 180° of the knob shall have at least ⅞" of clearance around its outside circumference. The rearward 180° of the outside circumference of the knob shall have unlimited clearance.

5. The knob shall be red in color with the legend TURN & PULL in the largest possible legible capital white Megaron bold letters with a filled-in white circle indicating the handle position with regard to the lock and the unlock positions. The knob shall be capable of exhibiting negligible color change in any operating environment including, but not limited to, daily mechanical bus washing for at least 12 years. The legend and circle shall be capable of exhibiting negligible color change, legend fading, blistering, or edge curl, in any operating environment including, but not limited to, daily mechanical bus washing for at least 3 years.

6. The legend EMERGENCY ACCESS in at least 2" tall legible capital red Megaron bold condensed letters on a bright white rectangular background shall be placed on the hatch just forward of the release handle and its use instructions on the outside flat surface of the hatch, along a line perpendicular to the centerline of the bus. The legend shall be oriented to and readable by a rescuer standing on the roof rearward of the hatch and facing the front of the bus. The legend shall be reflective and capable of exhibiting negligible color change in any operating environment including, but not limited to, daily mechanical bus washing for at least 3 years.

7. Operating instructions for the hatch to facilitate emergency access to the interior of the bus shall be as follows.

   The legend:

   FOR EMERGENCY ACCESS:
   1. TURN KNOB
   2. PULL KNOB

   shall be at least ⅜" tall legible capital red Megaron bold letters on a bright white rectangular background and placed immediately between the release handle and the large legend EMERGENCY ACCESS on the flat horizontal surface of the hatch. Along a 90° arc, approximately 3¼" equidistant from the center of the release handle shall be a dashed red line terminating at each end with a red arrow head pointing to a fully filled in red circle denoting the positions of unlock and lock; the red legend along the arc shall be on a bright white background.

   The legends LOCK and UNLOCK shall be at least ⅜" tall capital legible red letters on a bright white background. The legend along the arc and the LOCK and UNLOCK shall be on the same bright white background label. The legend

along the arc shall be recognizable to a rescuer while standing on the roof adjacent to the hatch. The legend shall be capable of exhibiting negligible color change in any operating environment including, but not limited to, daily mechanical bus washing for at least 3 years.

8. Each hatch shall have a release handle mounted on the inside horizontal plane of the hatch near its most rearward edge. Each hatch shall be releasable from the roof structure along its most rearward edge. The release handle shall be shaped like a wingnut or short T-handle at least 2" in length with a flange extending ⅛" around the perimeter so as to make the knob easier to grip. The handle shall be red in color. On the flat top of the handle on a horizontal plane parallel to and facing the floor of the bus shall appear the legend PUSH in the largest possible white Megaron bold letters and a filled-in white circle indicating the handle position with regard to the lock or unlock position. The handle, legend, and circle shall be capable of exhibiting negligible color change in any operating environment for at least 12 years. The handle shall be easily operated and shall have at least 2" of clear area around the outer edges of its circumference.

9. Each hatch shall be easily and fully releasable and openable from inside the bus to facilitate emergency exit of those inside by: 1) rotating the release handle 90° clockwise from the LOCK to the UNLOCK position; and 2) pushing the release handle to disengage the rearward edge of the hatch from its supporting structure.

10. Operating instructions for the hatch to facilitate emergency exit from the interior of the bus shall be as follows:

    The legend:

    1. TURN KNOB
    2. PUSH KNOB

    shall be in at least ⅜" tall legible red capital Megaron bold letters on a bright white background and placed adjacent to the release handle on the flat horizontal surface of the hatch. Along a 90° arc approximately 2½" equidistant from the center of the release handle shall be a dashed red line terminating at each end with a red arrow head pointing to a fully filled in red circle denoting the positions of UNLOCK and LOCK; the legends UNLOCK and LOCK shall be at least ⅜" tall legible red capital Megaron bold letters on a bright white background. The legend along the arc and the UNLOCK and LOCK words shall be on the same bright white background label. The legend along the arc shall be recognizable to a person while standing on the floor of the bus looking up at the hatch. The legend shall be capable of exhibiting negligible color change in any operating environment for at least 12 years.

11. On the inside of the hatch the legend EMERGENCY EXIT in at least 1" tall legible red capital Megaron bold condensed letters on a bright white rectangular background shall be placed adjacent to the hatch release knob and its use instructions on the flat surface of the hatch along a line perpendicular to the centerline of the bus. The legend shall be readable by occupants positioned with their backs against the floor of the bus directly opposite the hatch. The legend shall be capable of exhibiting negligible color change, legend fading, blistering, or edge curl in any operating environment for at least 12 years.

12. The longitudinal and latitudinal center lines of each hatch opening shall be at least 23" $\times$ 23" in dimension and the opening area, clear of obstructions, shall be at least 450 square inches.

13. Each hatch shall be capable of remaining open unassisted.

14. The access symbol shown and described in *Figure 4-2* shall be placed on the outside of the bus and used to indicate the position and existence of each hatch. The symbol shall be placed at a position on each side of the bus as close as possible to the hatch at the highest location while still visible to someone standing on the ground adjacent to the bus. Both the rear and front of the bus shall each have one access symbol similarly placed. The street and curb sides of the bus shall each have one symbol for each hatch.

15. The access symbol shall be 4" in diameter, reflective and permanently attached to the bus and capable of exhibiting negligible color change, legend fading, blistering, or edge curl in any operating environment including, but not limited to, daily mechanical bus washing for a period of at least 3 years.

16. At the end of 3 years the symbol label shall be reasonably easy to remove and replace. Replacement labels shall be readily available as spare parts from the Original Equipment Manufacturer.

17. Under no circumstances shall the structural integrity or crashworthiness of the bus be reduced in any way as a result of the placement of hatches in the roof.

18. Megaron bold fonts may be substituted with only the following sans-serif fonts in upper case so as to be plainly legible in emergency situations: Helvetica Bold, Megaron Bold Condensed, Triumvirate Bold Condensed, Eurostile, Eurostile Bold, and Universal.

19. All instructions for non-emergency functions on each hatch *shall not* be printed in red or on a red background.

20. *Except as superseded by these Guidelines* each hatch shall fully satisfy all applicable requirements of Federal Motor Vehicle Safety Standard 217 (Bus Window Retention and Release).

4.8 PASSENGER SIDE WINDOWS

1. At least 80% of all passenger side windows shall be emergency exit windows. This requirement cannot be waived or lessened by the provision of roof exits and/or doors.

2. Each emergency exit window (EEW) shall be releasable by a passenger or other individual from inside the bus by operating one mechanism. The use of this mechanism shall not be hampered by seatbacks, stanchions, railings, or any other component.

3. The release mechanism on each EEW shall be in conformance with Federal Motor Vehicle Safety Standard 217.

4. After the release mechanism has been operated, the EEW shall be manually openable by a single occupant to a Full Emergency Egress Position that provides a clear opening wide enough to facilitate the entrance of emergency response personnel wearing helmets, bunker coats, gloves, and possibly airpacks, and facilitate the safe removal of passengers on backboards or stretchers, and having a minimum opening width parallel to the bus floor of at least 22" and a minimum clear opening height perpendicular to the bus floor of at least 22".

5. Top-hinged push out EEWs shall be capable of being extended to a Full Emergency Egress Position which allows the window glazing and frame to be held horizontal and parallel to the floor of the bus.

6. Each EEW shall have a built-in mechanical means of being automatically secured open when opened to any and all points beyond at least 65% of the travel to the Full Emergency Egress Position. The device used to secure open the emergency window shall be automatic or shall be easily engaged by any user inside or outside the bus using only one hand.

7. The securement device shall not *cause* latched or unlatched windows to open further prior to the attainment of 66% of travel to the Full Emergency Egress Position, regardless of the motion of the bus.

8. Each EEW, when secured open, shall require deliberate action by an individual in order to close the window, and shall allow the individual full control of the window

while closing, such that the potential for the window to accidentally close or injure a rescuer or passenger is totally eliminated.

9. EEWs shall be clearly identifiable to trained emergency response personnel as rescue points, while discouraging unauthorized access. The universal access symbol shown and described in *Figure 4-2* shall identify each EEW, located at each exterior access point and release mechanism which is reachable from outside.

10. The access symbol shall be red on a white background, 4" in diameter, reflective, permanently attached to the outside bus surface, and capable of exhibiting negligible color change, legend fading, blistering, or edge curl in any operating environment including, but not limited to, daily mechanical bus washings for at least 3 years. Such symbol shall not be covered or obscured in any way by paint, logo, trim, advertising, or any other materials.

11. At the end of 3 years the symbol shall be reasonably easy to remove and replace. Replacement symbols shall be readily available as spare parts from the Original Equipment Manufacturer.

12. The access symbol, if located on the glazing, shall be 1½" in diameter, white with the glazing as background, permanently attached, reflective, easily visible to rescuers outside the vehicle, and capable of exhibiting negligible color change, fading, disintegration, or deterioration in any operating environment including, but not limited to, daily mechanical bus washings for at least 3 years. At the end of 3 years the symbol shall be reasonably easy to remove and replace. Replacement symbols shall be readily available as spare parts from the Original Equipment Manufacturer.

13. The legend EMERGENCY EXIT and concise operating instructions for use of emergency windows shall be obviously posted on the interior in red on white or white on red adjacent to each interior release mechanism, oriented so as to be plainly legible to passengers. It shall also be in conformance with the requirements in Federal Motor Vehicle Safety Standard 217.

14. All EEWs shall be permanently attached, along one edge, to the body of the bus to prevent falling while being used in an emergency.

15. Drains shall be appropriate in design to prevent cold weather freezing of EEW assembly and/or corrosion; EEWs shall remain easily openable without maintenance more frequent than once very two months.

16. All windows and glazing shall satisfy all applicable Federal Motor Vehicle Safety Standards including FMVSS 205 and conform to all federal, state, and local regulations.

17. *Except as superseded by these Guidelines,* passenger side windows must conform to FMVSS 217 (Bus Window Retention and Release).

18. Helvetica bold text may be substituted with only the following sans-serif fonts in uppercase so as to be plainly legible in emergency situations: Megaron Bold, Megaron Bold Condensed, Triumvirate Bold Condensed, Eurostile, Eurostile Bold, Universal (filled), and Universal (filled) Bold.

APPENDIX A. STUDY SET OF URBAN TRANSIT BUS MODELS

Grumman
Flxible 870
Cambria County Transit Authority
Johnstown, PA
Inspected Spring, 1988
Vehicle #208
Mfr. Date: 1981

General Motors Corporation
RTS II
Cambria County Transit Authority
Johnstown, PA
Inspected Spring, 1988
Vehicle #104
Mfr. Date: 1980

Gillig Corporation
Phantom
County of Lackawanna Transit System Authority
Scranton, PA
Inspected July 17, 1991
Vehicle #558
Mfr. Date: 1987 (D-Deck 1)

Ikarus USA, Inc.
Articulated 60' Urban Transit Bus
Port Authority of Allegheny County
Pittsburgh, PA Inspected July 23, 1991
Vehicle #3220
Mfr. Date: 1991

Neoplan USA Corporation
AN-40-A
Cambria County Transit Authority
Johnstown, PA
Inspected Spring, 1988
Vehicle #309
Mfr. Date: 1983

Bus Industries of America, Inc.
Orion
Lehigh & Northampton Transportation Authority
Allentown, PA
Inspected July 18, 1991
Vehicle #8950;
Mfr. Date: September 1989

APPENDIX B. RESOURCES

FIRE AND RESCUE ORGANIZATIONS

Federal Emergency Mgmt. Association Fire and Rescue Training Institute University of Missouri-Columbia

International Association of Fire Fighters

International Association of Fire Chiefs

International Society of Fire Service Instructors

International Fire Services Training Association (IFSTA)

Joint Council of National Fire Organizations

Lancaster County Fireman's Association

Maryland Fire & Rescue Institute

Montgomery County (PA) Fire Academy

National Association of Fire Equipment Distributors (NAFED)

National Fire Protection Association (NFPA)

National Association for Search & Rescue

National Fire Academy

Pennsylvania Dire Academy

Philadelphia Fire Fighters Union Local 22

SAFETY & TRANSPORTATION ORGANIZATIONS

National Safety Council

National Transportation Safety Board

Transportation Research Board (TRB)

Transportation Safety Institute

STANDARDS ORGANIZATIONS

American National Standards Institute (ANSI)

American Society of Automotive Engineers (SAE)

American Society of Mechanical Engineers

Canadian Standards Institute

National Electrical Manufacturers Association (NEMA)

National Institute of Standards and Technology

National Standards Association

National Technical Information Service

OTHER EMERGENCY RESPONSE ORGANIZATIONS

International Association of Chiefs of Police, Inc.

APPENDIX C. REFERENCES

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Balog, J.N. *Emergency & Accident Procedures Training Manual For The General Motors Corporation RTS Urban Transit Bus (includes slides and video tape);* KETRON, Malvern, PA; March, 1988.

Balog, J.N. *Emergency & Accident Procedures Training Manual For The Neoplan USA Corporation Urban Transit Bus (includes slides and video tape);* KETRON, Malvern, PA; March, 1988.

Balog, J.N. *Introduction to Urban Transit Bus Accident Experience: Emergency & Accident Procedures Training (includes slides);* KETRON, Malvern, PA; June, 1988.

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Balog, J.N. and Gribbon, R.B. *Bus Safety Standardization Guidelines Development Committee Meeting (Presentation);* KETRON, Malvern, PA; August 21-22, 1991.

Balog, J.N. and Gribbon, R.B. *Minimizing Your Risks and Reducing Accident Cost: Proposed FTA Guidelines for Bus Safety Equipment Standardization;* KETRON/APTA Information Center; May 18, 1992.

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Balog, John N., "Bus Safety Standardization program: APTA Safety Committee Evaluation Summary of Guidelines," KETRON Division of the Bionetics Corporation, Malvern, PA, BSP-JNB-94-234, August 30, 1994.

Balog, John N., "Proposed Guidelines for Bus Safety Equipment Standardization," KETRON Division of the Bionetics Corporation, Malvern, PA, BSP-JNB-94-255, November 11, 1994.

Balog, John N., "Bus Safety Standardization Program: APTA Safety Committee Evaluation Summary of Revised Guidelines," KETRON Division of the Bionetics Corporation, Malvern, PA, BSP-JNB-94-356, December 6, 1994.