



FAMA BUYER'S GUIDE

TC057

Occupant Protection

Prepared by the FAMA Chassis Subcommittee

This guide does not endorse any manufacturer or product





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Introduction

NFPA1901 Standard for Automotive Fire Apparatus requires an approved seat belt to accommodate crew members with and without heavy clothing for each crew riding position. The standard also defines seat belt web length as defined by the type of seat belt system, and webbing color for vehicles having a Gross Vehicle Weight Rating greater than 19,500 pounds.

Seat belts are only effective if they are worn. The standard also calls for signage to warn of the importance of seat belt usage and which seats can be occupied while the vehicle is in motion. In addition, an audible warning system is required to alert all occupants of seat belt usage status and a visual warning system for the operator when the parking brake is released or the transmission is not in park.

Overview

There are two different types of safety restraints. First and foremost is the primary restraint which is your seat belt. They come in many different shapes and sizes with many different parts and pieces. On the surface some may say that a "seat belt is a seat belt", but that statement is so untrue. In the following text hopefully you will see all the different varieties of primary restraint systems.

The second type of restraint used is the Supplemental Restraint System which is commonly referred to as airbags. Airbags come in many shapes and sizes according to what purpose they will serve for the occupant. Some airbag's have been designed for rollover and others for frontal impact. In the following text we will give you a better understanding of the supplemental restraint systems (airbag) and how they interact with the primary restraint system to keep occupants safe if an accident were to occur.

In addition, crew cabs for vehicles over 26,000 GVW must pass rigorous safety testing according to ECE29.

Primary Restraint Systems

A seat belt, also known as a safety belt, is considered a Primary Restraint System due to the vital role it plays in occupant safety. The different types of Primary Restraint Systems available in the marketplace are:

NON-RETRACTABLE LAP BELT – The non-retractable seat belt is similar to what is found on passenger airplanes. It consists simply of web, a buckle, and an adjustor.

RETRACTABLE LAP BELT – Decades ago, retractable lap belts were found in cars. Their primary function was to prevent ejection of the occupant.



SINGLE RETRACTOR 3-POINT LAP-SHOULDER BELT – This restraint is found in cars, trucks, and some off-highway vehicles. The 3-point belt not only prevents ejection; it also reduces injuries.

DUAL RETRACTOR 3-POINT LAP-SHOULDER BELT – This restraint is designed to keep the belt out of the door and off the Nader pin, or striker stud that secures the door. The dual retractor system has both the shoulder and lap retractors which offers more web in the system compared to single retractor 3-point seat belts.



4-POINT SEAT BELT HARNESS – This 4-point retractor restraint system includes a central buckle, which provides occupants greater mobility. It is used primarily in the ambulance and EMS applications.

Some seat belt systems use an extension to place the seat belt in an easier to reach position with minimal movement while seated.



Seat Belts: ABTS versus non-ABTS

Seatbelts can be cab mounted or contained within the seat itself, coined with the phrase "All Belts to Seat" or ABTS. Seating considerations for driver, officer, and crew can vary greatly depending on variables such as terrain, accessibility to PPE, and space need for quick ingress and egress from the vehicle. Seatbelts can come in a variety of configurations.

A 2-point seatbelt is considered a Type 1 harness belt and is for pelvic restraint only. A 3-point seatbelt or Type 2 harness contains a lap belt as well as a torso belt that travels over the shoulder and across the occupant's torso. A 3-point, Type 2 seatbelt is most standard. A Type 2 seat belt can have either a single retractor or dual retractors, but is required to meet NFPA standards for all forward-facing seats (14.1.3.5).

Some manufacturers offer the added safety of ABTS dual-retractor seat belts which provide faster, stronger retraction, preventing snags on equipment and damage to the belts from apparatus doors. These dual-retractor systems also provide more total webbing payout to accommodate larger occupants and/or bulky occupant-worn gear. Also available are options which customize the height of the seat belt to fit various sized fire fighters.

Supplemental Restraint Systems

Optional Supplemental Restraint Systems (SRS), also known as airbags, are designed to supplement the Primary Restraint System (seat belt) and improve occupant protection in certain types of collisions. These include frontal and rollover accidents.

ROLLOVER PROTECTION – For large vehicles, such as fire apparatus or heavy commercial trucks, these systems react when they detect an unrecoverable rollover. Within a fraction of a second, the following occurs:

- Seat belt pre-tensioner tightens to keep the occupant securely in the seat.





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- Suspension seat is pulled to its lowest position to increase survivable space.
- Side airbag deploys to cushion head and neck.

FRONTAL PROTECTION – In a frontal collision, the crash sensor detects the crash within a fraction of a second and provides the driver and officer with airbag protection through these steps:

- Seat belts tighten around the occupant to position him/her securely in the seat.
- Suspension seat is pulled to its lowest position to increase survivable space.
- System inflates a steering wheel airbag to protect the head and neck of the driver, while the officer's legs are protected with a knee bolster airbag.



Cab Safety Testing



NFPA 1901 states that all crew cabs on fire apparatus with a GVWR over 26,000 pounds must protect occupants. Most Occupant Protection Systems are dynamically tested to meet or exceed safety requirements at the Center for Advanced Product Evaluation (CAPE).