SAFETY

Tractor Overturn Protection and Prevention no. 5.018

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Quick Facts...

Tractor turnover, overturn or roll-over accidents account for more than 50 percent of tractor related deaths on the farm.

Most overturn deaths are prevented with seat belts and roll-over protective structures (ROPS).

The Occupational Safety and Health Administration (OSHA) has issued regulations for ROPS.

Many older tractors are not ROPS-equipped, but ROPS can be purchased from the dealer.

Tractor turnover is by far the major cause of tractor-related deaths. In a Johns Hopkins University study of tractor-related deaths between 1975 and 1981, 45 percent, or 1,163 of the 2,566 total deaths, were caused by roll-over accidents. Similarly, a 12-year study of Colorado agriculture-related deaths (1978 to 1990) revealed 50 percent of the tractor-related deaths were due to roll-over.

Most of these deaths could have been prevented if the tractor had been equipped with a roll-over protective structure (ROPS) at a cost of $400 to $600. A ROPS is a cab or frame that protects operators and minimizes the possibility of serious injury in an accidental upset.

Of the 175 tractor turnover accidents reported in Nebraska from January 1966 to January 1972, 78 were fatalities, 93 were injuries and four were noninjuries. Eight of the 175 tractors were equipped with ROPS and resulted in four non-injury and four injury cases.

The National Safety Council (1996) statistics indicate tractor overturns accounted for an average of 51percent of tractor-related fatalities from 1985-1995, with an annual rate of 5.4 deaths/100,000 tractors. The Census of Fatal Occupational injuries (CFOI) surveillance system reported an average 119 deaths with tractor overturns from 1992 to 1995.

See fact sheet 5.016, *General Tractor Safety*, for additional information on safe operation.

ROPS Regulations

The Occupational Safety and Health Administration (OSHA) has issued these regulations for ROPS:

"Agricultural tractors manufactured after October 25, 1976, shall meet the following requirements:

1. A roll-over protective structure (ROPS) shall be provided by the employer for each tractor operated by an employee.
2. Where ROPS are required by this section, the employers shall:
   a. Provide each tractor with a seat belt that meets the requirements of SAE standard J4C;
   b. Ensure that each employee uses the seat belt and tightens the belt sufficiently to confine the employee."

Exempted Uses

- Low profile tractors used in orchards, vineyards or hop yards where the vertical clearance requirements substantially interfere with normal operations and their use is incidental to the work performed.
- Low profile tractors used inside a farm building or greenhouse in which the vertical clearance is sufficient to allow a ROPS equipped

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tractor to operate, and their use is incidental to the work performed.
- Tractors used with mounted equipment that is incompatible with ROPS (e.g., cornpickers, cotton strippers, vegetable pickers and fruit harvesters).

Definitions

Agricultural tractor means a two- or four-wheel drive vehicle, or track vehicle of more than 20 engine horsepower, designed to furnish the power to pull, carry, propel or drive implements that are designed for agriculture. All self-propelled implements are excluded.

Low profile tractor means a wheeled tractor possessing the following characteristics:

- the front wheel spacing is equal to the rear wheel spacing, as measured from the centerline of each right wheel to the centerline of the corresponding left wheel;
- the clearance from the bottom of the tractor chassis to the ground does not exceed 18 inches;
- the highest point of the hood does not exceed 60 inches; and
- the tractor is designed so that the operator straddles the transmission when seated.

Remounting

When ROPS are removed for any reason, remount them to meet the performance requirements specified in the standard.

Labeling

Each ROPS should have a label, permanently affixed to the structure, stating manufacturer's or fabricator's name and address; ROPS model number (if any); tractor makes, models or series numbers that the structure is designed to fit; and whether or not the ROPS model was tested in accordance with the requirements of the standard.

Operating Instructions

Every employee who operates an agricultural tractor should be informed of the operating practices listed below and any other practices dictated by the work environment. Such information must be provided at the time of initial assignment and at least annually thereafter.

- Securely fasten seat belt if the tractor has a ROPS.
- Where possible, avoid operating the tractor near ditches, embankments and holes.
- Reduce speed when turning, crossing slopes, and on rough, slick or muddy surfaces.
- Stay off slopes too steep for safe operation.
- Watch where you are going, especially at row ends, on roads and around trees.
- Do not permit others to ride.
- Hitch only to the drawbar and hitch points recommended by tractor manufacturers.
- Operate the tractor smoothly — no jerky turns, starts or stops.
- When tractor is stopped, set brakes securely and use park lock if available.

Background

In 1984, the National Institute for Farm Safety (NIFS) and the Agricultural Division of the National Safety Council (NSC) transmitted resolutions to the American Society of Agricultural Engineers (ASAE) requesting ROPS be standard equipment on agricultural tractors.

ROPS were designed in the early 1960s to:

- limit most upsets to 90 degrees, and
- protect the operator in upsets beyond 90 degrees.

In 1966, ROPS became available on John Deere farm tractors. The ASAE published their first standards for ROPS design and use in 1967. The 1984 ASAE Standard, ASAE 5383.1 "RollOver Protective Structures (ROPS) for Wheeled Agricultural Tractors," establishes test and performance requirements for ROPS. The new version of ROPS test standard includes ASAE S519, which was adopted as SAE J2194 by SAE in June 1993.

In May 1995, Washington Industrial Safety and Health Act Regional Directive 95-4A, addressing ROPS requirements for pre-1976 agricultural tractors become effective. Another legislative effort that is currently underway is the result of the Tractor Risk Abatement and Control: The policy Conference helf September in 1997 at The University of IOWA.

Be certain the frame or enclosure meets these standards for roll-over protection. Some structures are designed only for weather protection. In 1985, some tractor manufacturers made ROPS standard on all new tractors. Many dealers can install a ROPS on older model tractors, with prices ranging from $350 to $600. Many roll-over injuries are reported with the use of small garden tractors without ROPS. OSHA does not require the use of ROPS with these small tractors, but installation is beneficial to the operator.

The latest ROPS availability reference "A Guide to Agricultural Tractor Rollover Protective Structures" was published by the National Farm Medicine Center in Marshfield of Wisconsin in 1997.

Goals and Preventions

Tractor overturns can be prevented. Tractor operation determines overturns. Stresses caused by vibration, noise, fumes and overwork increase the chances for overturn accidents. Operator enclosures can reduce stresses by filtering air and reducing noise and vibration.

Field slope, tractor speed, turning radius, rear axle torque and center of gravity are interrelated factors that determine tractor turnover potential. Mathematical computer models, designed to simulate tractor turnovers and verified by full-scale tests, have been useful for designing more stable tractors (Denny, 1974). A system to determine tractor turnover potential utilizing the simulation model and sensor field and tractor operating conditions is being developed (Murphy, 1982). Tractor stability index and its monitoring system to monitor tractor rollover was developed (Liu and Ayers, 1998). The ultimate goal is an audible warning system that informs the operator of high turnover potential, or auto-deployable ROPS when a tractor overturn occurs likely.

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