Powered Mobile Equipment Rollover Prevention & Compliance Game Plan

Every year, dozens of tractor, skidder, forklift and other powered mobile equipment (PME) operators are crushed to death in rollover incidents. Underlining the tragedy is how many of these fatalities could and should have been prevented had the PME been properly fitted with rollover protective structures (ROPS), a protective frame that attaches to the equipment which, with the use of seat belt, keeps the operator in a protective zone during a rollover incident. In addition to avoidable deaths, failing to install ROPS on PME can lead to major penalties under OHS laws.

Example: A 19-year-old Northwest Territories worker was killed when the heavy equipment he was operating rolled over. The employer was initially charged with 9 *Safety Act* offences but got off with a fine of just $100,000 after agreeing to plead guilty to one count—failure to ensure the work was adequately supervised. The relative leniency was due, in part, to the fact that this was the company's first offence and that the victim's failure to wear the required seat belt was a contributing cause of the incident [*Allen Services & Contracting Ltd.*, Govt News Release, February 22, 2018].

Here's a look at OHS ROPS requirements and the 9 things employers must do to comply with them and protect workers

against PME rollover hazards.

Step 1. Perform a Rollover Risk Assessment

The first step is to have a competent person carry out a rollover hazard assessment to assess the risks of PME experiencing a rollover while it's being operated by an on-board operator. BC OHS regulations list the factors a rollover hazard assessment should address, including:

- The stability of the PME to be used for the operation, taking into account its design, configuration and any attachments or towed components;
- Rear torque—if the rear wheels of PME can't turn, e.g., because they're stuck in mud or ice, torque from the drive system may cause the front end of the equipment to lift off the ground and flip backwards;
- The condition of the suspension system and tires;
- Whether the area in which the PME will be operated contains significant rollover hazards, such as grades exceeding 10% (6°), operating areas with open edges, open ramps, load docks, ditches, uneven or irregular surfaces or other similar hazards that have the potential to cause a rollover; and
- The nature and weight of the load to be moved—heavy and unbalanced loads increase the risk of rollover;
- The width of the track—the narrower the width between the tires, the more likely it is that PME will rollover onto its side;
- The presence of wind, rain, snow, ice or other weather conditions that may increase rollover risk; and
- The nature of the activities to be performed using the PME.

Step 2. Determine Which PME Must Be Fitted with ROPS

Ensure that PME is fitted with a ROPS before requiring or allowing workers to use it if either: (i) Your risk assessment identifies the equipment as posing a high risk of rollover; or (ii) the OHS laws of your province list the particular type of PME as being automatically required to be fitted with a ROPS. The latter kinds of PME for which ROPS is mandatory (unless an exception applies) typically include:

- Crawler tractors, loaders and skidders;
- Wheel tractors, dozers, loaders and skidders;
- Agricultural and industrial tractors;
- Motor graders;
- Back hoes;
- Forklifts and industrial lift trucks;
- Self-propelled wheel scrapers;
- Compactors and rollers;
- Self-propelled rock drills moved by onboard operators;
- Wheeled trenchers; and
- Pipe layers and side boom tractors.

Caveat: The rules differ so it’s important to check the specific requirements of your own province. Thus, for example, in some jurisdictions listed PME need only be fitted with a ROPS if:

- It weighs 700 kilograms (1,500 pounds) or more: Alberta, Manitoba, Newfoundland, Yukon;
- It has an engine rated at 15 kilowatts or more: Northwest Territories, Nunavut, Quebec, Saskatchewan;
- It weighs 700 kg or more **and** has an engine rated at 15 kW or more: Ontario.

Compliance Strategy: ROPS can be costly. So, you may be tempted to try cheaper alternatives, such as safe work

procedures, to protect workers from rollovers. But safe work procedures aren't an acceptable substitute for a required ROPS.

Example: A road roller flipped while going down a steep hill. The worker operating it was thrown and seriously injured. The Alberta OHS investigator issued 9 orders to the company, one of which required it to install a ROPS on the road roller. The company appealed 6 of the orders, arguing that forcing it to install a ROPS was a denial of its right under the *OHS Act* to first institute safe work procedures to resolve the problem. The court rejected the company's argument, noting that the company's procedures had been shown to be unsafe given its history of road roller rollovers and lack of training [*Border Paving Ltd. v. Alberta (Occupational Health and Safety Council*), [2006] ABQB 893 (CanLII)].

Step 3. Ensure ROPS Meets Required Standard

In most jurisdictions, employers and suppliers must ensure that required ROPS is certified by the manufacturer or a professional engineer as meeting the requirements of a particular non-government standard. The most referred to standard is a stated version of CSA Standard B352, *Rollover Protective Structures for Agricultural, Construction, Earthmoving, Forestry, Industrial and Mining Machines*, which is made up of 3 Parts:

- CSA B352.0, *Part 1: General Requirements*;
- CSA B352.1, *Part 2: Testing Requirements for ROPS on Agricultural Tractors*; and
- CSA B352.2, *Part 3: Testing Requirements for ROPS on Construction, Earthmoving, Forestry, Industrial, and Mining Machines*.

Instead of CSA B352, ROPS may comply with another

nongovernment standard applicable to the ROPS used for that particular type of PME, which commonly includes a version of Society of Automotive Engineers Standard (SAE) J1042, *Operator Protection for General Purpose Industrial Machines*, SAE J1194, *Rollover Protective Structures (ROPS) for Wheeled Agricultural Tractors*, and/or ISO Standard 3471, *Earth Moving Machinery – Roll Over Protective Structures – Laboratory Tests and Performance Requirements*.

Instead of a nongovernment standard, some jurisdictions set out general criteria that apply to:

- Older ROPS that was manufactured after a specific date (New Brunswick, Nova Scotia, Quebec, Yukon);
- ROPS that was custom-built rather than commercially manufactured (Manitoba); or
- All ROPS (Ontario).

Thus, in Ontario, all ROPS must:

- Be designed, constructed and maintained so that when the machine to which it's fastened is travelling at a 16 km per hour engages a 30° slope and rolls 360° about its longitudinal axis on a hard clay surface: (i) the ROPS will withstand the impact forces, (ii) upon impact, no part of the ROPS will enter the space of the machine that's normally occupied by its operator, and (iii) the ROPS will support the machine in an upside-down attitude without any part of the ROPS entering the space of the machine that's normally occupied by its operator;
- Be securely fastened to the frame of the machine; and
- Be capable of withstanding all forces to which it's likely to be subjected.

Step 4: Ensure ROPS Has Proper Seat

Belts

Seat belts are essential because they keep workers from being thrown out of the ROPS and crushed in the event of a rollover. Every jurisdiction requires PME fitted with ROPS to have seatbelts. Six provinces and territories (Alberta, BC, New Brunswick, Nova Scotia, Prince Edward Island and Yukon) require seat belts to meet SAE J386 or another SAE standard.

Table 1. Required Standards for ROPS Seat Belts

Jurisdiction	**Requirements for ROPS Seat Belts**
Federal	No standard specified
Alberta	SAE J386 (2006) or SAE J2292 (2006)
British Columbia	SAE J386 (August 2012), SAE J2292 (2016), ISO 6683 (2005), ISO 3776, Tractors, or UNIECE ECE Regulation No. 16, Safety-belts
Manitoba	No standard specified
New Brunswick	SAE J386 NOV 97, SAE J117 JAN 1970, or SAE J800 APR 86
Newfoundland	No standard specified
Nova Scotia	SAE J386 or SAE J800
Ontario	No standard specified
Prince Edward Island	An applicable SAE standard (which one(s) not specified)
Quebec	No standard specified
Saskatchewan	No standard specified
Northwest Territories	No standard specified
Nunavut	No standard specified

Jurisdiction	Requirements for ROPS Seat Belts
Yukon	SAE J386, November 1997 or similar standard acceptable to the board

Source: Bongarde Media

Compliance Strategy: If wearing seatbelts is impracticable because of the type of work the PME is being used for or how the equipment is operated, such as an operation or machine in which the operator must stand to drive the equipment, you generally must provide another type of restraining device designed to keep workers from being thrown out of the ROPS, such as a shoulder strap, bar, gate or screen. You must also maintain seatbelts and other restraining devices in good condition.

Step 5. Ensure Workers Use Required Seat Belts & Restraining Devices

Not all rollover requirements are engineering-based. Employers must also implement safe work practices. First and foremost is requiring operators of PME to use their seat belts. This requirement also applies to passengers riding in such equipment. After all, having seatbelts accomplishes nothing unless workers actually wear them. The Northwest Territories employer and young worker who was killed in a rollover in the while not wearing his seat belt in the Allen Services case described above learned this lesson the hard way.

Step 6. Ensure ROPS Windows & Windshields Meet Required Standards

Ensure that windows, windshields and “glazing” on a ROPS is made of safety glass, glass that meets the requirements of a specified voluntary standard (which in Alberta and New Brunswick is ANSI Standard ANSI/SAE Z26.1 (1996), *Safety*

Glazing Material for Glazing Motor Vehicles and Motor Vehicle Equipment Operating on Land Highways – Safety Standard) or a rigid plastic or transparent material that gives at least equivalent protection against shattering. And if the glazing gets damaged or compromised in any way, including damage that obstructs the operator's view, you must immediately replace it. In addition to ROPS requirements, a windshield on PME should have windshield wipers of sufficient size and capacity to clean matter that obstructs the operator's view.

Step 7. Ensure that ROPS Is Properly Marked

ROPS must be permanently and legibly marked with information relevant to the structure's safety, including:

- The name and address of the manufacturer or engineer who certified the ROPS;
- The model number or other means of identifying the machine for which the ROPS was designed;
- The serial number or other unique identifier:
- The maximum weight of the machine for which the ROPS was designed; and
- The CSA or other standard to which the ROPS conforms.

A modified ROPS may need to contain additional information, such as the modifications made, the date of recertification and name and address of the manufacturer or engineer that recertified it.

Step 8. Ensure that ROPS Is Properly Repaired & Modified

Employers must ensure that any modifications, alterations or repairs made to a ROPS that affect its structural integrity meet the requirements of the OHS regulations and that the ROPS

manufacturer, installing agency or a professional engineer certifies that the modifications, alterations or repairs meet those requirements. In some provinces, employers must also keep the certification records available at the workplace and make them available to government OHS inspectors upon request.

Step 9. Provide Safety Training to Workers at Risk of Rollovers

Educate and train workers on rollover hazards and how to protect against them. At a minimum, training should cover:

- What rollovers are;
- The risk factors that cause them to happen;
- The function of the ROPS and how it protects the PME operator and passengers;
- The importance of using seat belts and restraining devices when operating or riding on PME fitted with a ROPS;
- The safe work procedures in place to ensure safe PME operation and prevent rollover; and
- The PPE and protective equipment workers exposed to rollover hazards should use.

Verify that workers actually understand and can apply their training on the job by:

- Quizzing workers on the material after you deliver the lesson;
- Making workers demonstrate how to follow the procedures and use the equipment covered during the training; and
- Observing workers while operating or riding on PME for which a ROPS is required to ensure they’re actually following their training.