

G16.3, 16.19, 16.20 (and 4.3(2)) Welding repair of forks on lift trucks

Issued August 1999; Editorial Revision April 2005; Retired April 30, 2015

Refer to guideline [G4.3\(2\) Welding repair of forks and fork extensions on lift trucks](#).

G16.3 (and 4.3(3)) Tag out procedure for identifying unsafe mobile equipment

Issued August 1, 1999; Editorial Revision April 2005

Section 16.3 (Operation and maintenance) of the *OHS Regulation* ("*Regulation*") sets out various requirements related to maintenance records, servicing and use of mobile equipment. Effective October 29, 2003 section 16.3(2) of the *Regulation* was rescinded. That subsection had required that mobile equipment determined to be unsafe for use be identified in a manner that would ensure it was not inadvertently returned to service. The operative requirement on this issue is now section 4.3(3) (Safe machinery and equipment).

Section 4.3(3) of the *Regulation* states:

A tool, machine or piece of equipment determined to be unsafe for use must be identified in a manner which will ensure it is not inadvertently returned to service until it is made safe for use.

An example of a procedure that will satisfy the requirements of section 4.3(3) for mobile equipment determined to be unsafe for use is as follows:

- Each machine operator and maintenance worker will be issued or have ready access to "Do not operate" and "Caution" tags. Each type of tag will be coloured differently.
- If a worker believes a piece of equipment is unsafe for use, the worker fastens a "Do not operate" tag on the controls of the machine and reports the problem to the supervisor. If the machine has a defect but could still operate safely if the operator is aware of the defect, a "Caution tag" may be used.
- The operator or worker applying a "Do not operate" tag or a "Caution tag" will sign and date the tag, and briefly describe on the tag the concern with the machine, and record this information in the equipment maintenance records.

An example of a procedure for protection of workers doing maintenance or repair on mobile equipment is as follows:

- If a "Do not operate" tag was installed by a worker, as part of a procedure such as in the example described above for complying with section 4.3(3) it will not be removed or altered until all necessary repair work is complete.
- The equipment will be positioned and secured in the manner specified by the equipment manufacturer for the particular maintenance procedure to be performed. The manufacturer's manual may specify actions such as chocking wheel, disconnecting the battery, bleeding air reservoirs and blocking of machine components.
- Prior to starting maintenance and/or repair work, each worker involved in the maintenance will install their personal "Do not operate" tags at all locations from which the equipment can be started. Each tag placed by a maintenance worker will be signed and dated by the installer.
- Each maintenance worker will remove his or her personal tag(s) when that worker has completed his or her work.
- The "Do not operate" tag that was originally installed to identify the unsafe concern will be removed by the maintenance worker making the decision the necessary maintenance work has been completed and it is safe for the machine to go back into service.

G16.3 (and 4.3(4)) Fuel tank filler and vent outlet locations

Issued August 1999; Editorial Revision April 12, 2005; Editorial Revision January 1, 2007

Regulatory excerpt

Section 4.3(4) of the *OHS Regulation* ("*Regulation*") states:

Unless otherwise specified by this Regulation, any modification of a tool, machine or piece of equipment must be carried out in accordance with

- (a) the manufacturer's instructions, if available,
- (b) safe work practices, and
- (c) the requirements of this Regulation.

Purpose of guideline

This guideline describes the requirements that apply to the modification of mobile equipment and considerations related to fuel tank filler and vent outlet locations.

Modification of mobile equipment

Section [16.3 \(Operation and maintenance\)](#) of the *Regulation* sets out various requirements related to maintenance records, servicing and use of mobile equipment. Effective October 29, 2003 section 16.3(4) of the *Regulation*, which required that the modification of mobile equipment be carried out in accordance with the manufacturer's instructions or in their absence with good engineering practice, was rescinded. The operative requirement is now outlined in section 4.3(4).

Tank filler and vent outlet locations

A vehicle fuel tank fill point or tank vent opening should not be included within the enclosed cab of the vehicle. This condition could arise when a winter cab enclosure is improperly installed on a vehicle, in which case section 4.3(4) would apply.

If a fuel tank fill point or a vent outlet is within a worker-occupied enclosure on a vehicle, an extension of the filler and/or vent line to a safe location outside the cab should be installed. The connection between the extension and the original opening should be liquid and vapour tight to prevent fuel leakage or vapour release into the enclosure.

If the feasibility of doing the foregoing modification appears doubtful, the particular case should be discussed with WorkSafeBC's Engineering Section.

G16.4(1)(c) Operating equipment with air brakes

Issued August 16, 2000

Section 16.4(1)(c) of the *OHS Regulation* ("*Regulation*") states:

A person must not operate mobile equipment unless the person...

(c) if operating equipment with air brakes, has a valid air brake certificate or a driver's license with an air brake endorsement, or evidence of successful completion of a course of instruction on air brake systems by an organization acceptable to the Board...

The Insurance Corporation of BC, in the administration of the *Motor Vehicle Act*, uses the following criteria to determine if the operator (driver) of a motor vehicle on a public road requires an air brake endorsement. If the vehicle brake system can be operated to stop the vehicle when there is no air supply, an air brake endorsement is not required. WorkSafeBC accepts the same criteria in determining if section 16.4(1)(c) applies to equipment operated under the jurisdiction of WorkSafeBC.

In simple terms, there are two types of vehicle air brake systems, which can be generally described as "air assisted" brake systems and "air actuated" brake systems.

In an air assisted brake system, the air portion of the brake system is a booster system only, similar to the vacuum assist system in most automobiles (commonly referred to on the automobile "option list" as power brakes). In these systems the brake pedal is directly connected to a master brake cylinder with a mechanical linkage. The master cylinder is part of a hydraulic system that uses liquid (brake fluid) pressure to actuate hydraulic cylinders that are part of the drum or disc brake assembly. The brake assembly works by applying a friction material against a brake drum or rotor (disc) to cause the braking action to slow or stop the machine. If the air supply is lost, the brakes can still be applied to bring the vehicle to a stop by pushing on the brake pedal, although considerably more than the normal force by the foot on the brake pedal will be needed as the air assist is no longer there. If a vehicle has a brake system of this type, the *Motor Vehicle Act* does not require the driver to have an air brake endorsement on the driver's license. The requirements of section 16.4(1)(c) of the *Regulation* also do not apply, however the other requirements of section 16.4(1) must be met.

In an air actuated brake system, there is no direct mechanical linkage between the "brake pedal" and the rest of the brake system. The "brake pedal" is commonly referred to as a brake treadle valve in these systems. Operating the brake treadle valve changes the air pressure in the brake system, causing the brakes to be applied. The system may use air or pneumatic pressure to directly activate the brakes, or may be an "air over hydraulic" system, where air pressure acts on a master cylinder located close to the brakes, with the master cylinder delivering hydraulic pressure to apply the brakes. In these systems, if the vehicle's air supply is lost, the brakes cannot be operated. If the air system pressure is low, the brakes may actuate when the brake treadle valve is operated, but with a reduced effectiveness. If a vehicle has a brake system of this type and is being operated on a public road, the *Motor Vehicle Act* requires the driver to have an air brake endorsement on the driver's license. The requirements of section 16.4(1)(c) of the *Regulation* must be met if such a vehicle is being operated in an occupational application under WorkSafeBC's jurisdiction.

The determination on the applicability of section 16.4(1)(c) to a person operating mobile equipment requires an understanding and assessment of the brake system on the vehicle. The employer has the obligation to do this before placing the equipment into service. The employer should consult with the equipment manufacturer or qualified service personnel as necessary to determine the applicability of section 16.4(1)(c).

An understanding of the brake system is also necessary to ensure persons authorized to operate the equipment have appropriate air brake certificates or endorsements and adequate instruction and training relevant to the brake system on the equipment. For example, an air brake endorsement on a driver's license to operate a truck or bus on a public road does not mean the person is necessarily knowledgeable on the air brake system of equipment such as a lift truck or front-end loader. Most air brake courses leading to an air brake certificate or air brake endorsement focus on the standard air brake systems found on large trucks and buses. A "course of instruction" relevant to the air brake systems found on other types of equipment, particularly industrial and "off highway" heavy equipment, may be difficult to find. In such cases, an "organization acceptable to WorkSafeBC" for providing training could be a qualified representative of the equipment manufacturer or other qualified person familiar with the equipment's brake system and able to provide an appropriate course of instruction and training specific to the equipment the worker will operate. "Evidence of successful completion" of such a course could be training records signed by the trainer and attesting to the worker's successful completion of the required instruction and training. If a person will be operating equipment with air brakes on a public road, the requirements of the *Motor Vehicle Act* must be met.

G16.7(j)-1 Lift truck operator training

Regulatory excerpt

Section 16.7(j) of the *OHS Regulation* ("*Regulation*") states:

The design, fabrication, use, inspection and maintenance of mobile equipment must meet the requirements of the following applicable standard:

...

(j) Lift Truck Operator training: *CSA Standard B335-94, Industrial Lift Truck Operator Training*.

Purpose of guideline

The purpose of this guideline is to explain the training requirements for lift truck operators.

Background

Section 16.7(j) requires lift truck operators be trained in accordance with *CSA Standard B335-94, Industrial Lift Truck Operator Training*. (Note: For a copy of *CSA Standard B335-94*, contact CSA at 604-244-6652, or your local library.)

The version of the *CSA Standard B335-94* adopted at the time the *Regulation* came into effect includes the amendments contained in "General Instruction #2," published by the Canadian Standards Association (CSA) in November 1996. One significant amendment is the addition to the CSA standard of Clause 7, "Training and Refresher Courses," that sets requirements for refresher and upgrading courses for lift truck operators.

CSA Standard B335-94 defines a "trainee" as "the person being trained as a lift truck operator." For the purposes of this guideline and application of section 16.7(j) of the *Regulation*, WorkSafeBC considers a trainee to be a person who is taking training to become a lift truck operator. A lift truck operator is *not* considered a "trainee" when taking refresher or upgrading courses and related training.

A trainee must satisfy medical and fitness criteria before starting training. These requirements are outlined in detail in the CSA standard and are summarized later in this guideline.

Completion of training and testing

The employer is responsible for ensuring a trainee completes training and testing that meets the performance criteria specified in section 16.7(j) before the person is assigned tasks as a lift truck operator. If an employee claims to have past training and/or experience as a lift truck operator, the employer is responsible for checking references and assessing the new employee's ability to meet the performance criteria specified in section 16.7(j) before assigning the person to be a lift truck operator.

Lift truck operators do not need a certificate to confirm satisfactory performance and completion of the training mandated by section 16.7(j). The employer has several options for achieving compliance. Completing an external training course that effectively covers the specified standard, including the testing requirements, is one option to satisfy the *Regulation*. Another option is for the employer to provide in-house training and testing, to confirm the operator's knowledge and abilities meet the specified standard. Regardless of how the employer determines a person has achieved the training standard, the employer still has an obligation to provide sufficient supervision and control in the workplace to ensure lift truck operators meet the standard on an ongoing basis.

The CSA standard stipulates a lift truck operator must take a refresher course at least every two years, or if there is an accident or incident attributable to operator error. The employer is responsible for assessing each lift truck operator's performance on an ongoing basis. Clause 7.1.2 of *CSA Standard B335-94*, regarding ongoing training and refresher courses, states: "Training courses shall be tailored to the individual's needs as demonstrated by an evaluation and assessment. . ." Refresher courses and retraining only need to cover the aspects of lift truck operation that the operator is considered to be deficient in relative to the performance criteria specified in section 16.7(j). If two years after the last refresher or upgrading course an operator is not considered by the employer to have any deficiencies relative to the performance criteria, the refresher course could simply be a general job safety review with the operator. Training is also required any time new equipment is to be used, performance issues become evident, or there are significant changes in the operator's job.

The employer should keep sufficient records of lift truck operator training, testing, and assessment to document compliance with 16.7(j).

Driver's licence requirements

A lift truck operator using a lift truck exclusively on the employer's private property does not need to have a valid driver's licence. However, if the lift truck is operated on a public roadway, the provisions of the *Motor Vehicle Act* apply, and the operator needs a valid driver's licence of the appropriate class, including any required endorsements such as for air brakes, if applicable.

Propane handler's certificate

A lift truck operator (or any other person) required to dispense (transfer) propane from one container to another during refueling of a lift truck must have a "propane handler's certificate." *CSA Standard B149.2 Propane Storage and Handling Code* is adopted under the *Gas Safety Regulation* as a requirement in B.C. Clause 4.2.1 of the CSA standard states: "Propane shall only be transferred from one container to another by a person who is the holder of a certificate recognized by the authority having jurisdiction." The authority having jurisdiction in British Columbia is the BC Safety Authority's (operating as Technical Safety BC — "TSBC") Safety Manager. The Safety Manager recognizes programs that are qualified to issue certificates. Propane suppliers are usually connected to a propane industry program recognized to provide training and certification acceptable to the Safety Manager. A source for information on obtaining a certificate is the Propane Training Institute at 1-877-784-4636, or online at <http://www.propane.ca>. A person dispensing propane should have their certificate available at the location where the activity is

being done. This is normally achieved by having the certificate posted at or near the dispensing station. If there is a concern regarding the validity of a certificate, consult the local Gas Safety inspection office.

If the lift truck refueling process only involves changing propane cylinders, a propane handler's certificate is not required, but the operator or other person doing the task should have appropriate training to perform this function. Also, if a lift truck operator is required to refuel the lift truck with a product other than propane, or to change batteries or connect to a battery charger, the operator's training should cover these tasks.

Detailed training program requirements

Medical and Physical Fitness

A trainee must meet the medical and physical fitness requirement specified in *CSA Standard B335-94* before starting training. This requirement does not apply to existing lift truck operators who are successfully doing this work without difficulty and are taking refresher or upgrading courses. If, however, a lift truck operator appears to have difficulty operating the lift truck in a satisfactory manner, the employer has the right and obligation to investigate. This investigation may include requiring evidence of compliance with the medical and physical fitness criteria.

The medical and physical fitness criteria specified in the CSA standard requires

- Vision of not less than 20/40 in the better eye and good judgment of space including height and distance. If corrective eyewear is required to comply with the above, the operator must use it while operating a lift truck
- Ability to distinguish colour, if colour differentiation is required on the assigned job
- Ability to hear warning signals. If the operator requires a hearing aid to comply with the above, it must be worn while operating a lift truck
- Full movement of trunk, neck, and upper and lower limbs, and the strength, endurance, agility, and coordination to meet the demands of the job

Compliance with the above medical and physical fitness requirements may be determined by a doctor, a nurse, or another responsible party who by training has the ability to make such a determination. A trainee or operator cannot make his or her own determination on the above criteria.

Overview of Training Program Content

A training program will include classroom/theory elements, practical (hands-on) training, and testing. The following summarizes the *CSA Standard B335-94* criteria.

Classroom/Theory Portion

Background

- Relevant legislation and fundamental safety guidelines, rules, and safety codes applicable to the job
- Basic principles of lift truck operation, including a focus on lift types, reach, and stability
- Main components of lift trucks
- Manufacturer's operating manual for the equipment to be used

Basic Principles of Operation

- Start-of-shift checks
- Shutdown and parking procedures
- Safe practices for starting, stopping, and turning
- Lift truck stability factors including items such as speed, cornering, load security, centre of gravity, and grade
- Capacity plate and its location
- Safe procedures for operating on ramps and grades
- Forward and reverse driving
- Correct use of lift trucks
- Driving hazards such as slippery surfaces, restricted visibility, and exhaust emissions
- Lift truck safety including generic safety procedures in accordance with the manufacturer's operating manual
- Lifting, lowering, or supporting people

Load Handling

- General safe methods and procedures for pickup, conveyance, and depositing
- Selection of loads and assessing mass distribution for capacity, security, and integrity
- Preparation for load pickup and placement
- Assessing the safety of load-supporting structures
- Loading trucks, trailers, and railway cars
- Inclines or ramps
- Safety equipment and devices
- Hazards in the operating environment

Operational Maintenance

- Maintenance to be performed by the operator
- Refueling a permanently mounted propane fuel tank
- Changing a removable propane cylinder

- Propane cylinder inspection
- Charging batteries on electric trucks
- Refueling with other fuels
- Reporting unsafe operating conditions of vehicles

Operational (Hands-on) Training

The classroom/theory elements covered are to be followed with practical demonstration and supervised practice.

Testing

A trainee or operator may demonstrate proficiency in classroom/theory areas by way of a written or oral test. A trainee or operator must demonstrate proficiency through an operational test showing skill and understanding of the safe operation of the lift truck(s).

G16.7(j)-2 Lift truck operator training - Alternative standards

Issued November 21, 2006

Regulatory excerpt

Section 16.7(j) of the *OHS Regulation ("Regulation")* states:

The design, fabrication, use, inspection and maintenance of mobile equipment must meet the requirements of the following applicable standard:

...

(j) Lift Truck Operator training: *CSA Standard B335-94, Industrial Lift Truck Operator Training*.

Section 4.4(2)(a) of the *Regulation* states:

(2) When this *Regulation* requires a person to comply with

(a) a publication, code or standard of the Board or another agency, the person may, as an alternative, comply with another publication, code or standard acceptable to the Board...

Purpose of guideline

Section 16.7(j) of the *Regulation* requires that lift truck operators be trained in accordance with *CSA Standard B335-94, Industrial Lift Truck Operator Training ("Standard")*. Parts 4–7 of the Standard describe the required elements of lift truck training and retraining.

The purpose of this guideline is to specify two alternatives to the *Standard* that are acceptable to WorkSafeBC, and to summarize the applicable requirements of the alternative standards.

Alternative acceptable standards

CSA Standard B335-04, Safety Standard for Lift Trucks

WorkSafeBC accepts the training (including retraining and upgrading) part of this standard - Part 6 - as an alternative to the *Standard*. The other parts of this standard are not applicable to operator training, and therefore are not considered part of this alternative standard.

CSA Standard B335-04 describes similar training topics to the *Standard* and provides more detail for some training elements such as load pick-up and stacking. The standard is an expanded one compared to its earlier version. In addition to training requirements, it now includes general lift truck safety information and safe operating procedures, as well as design and construction specifications. The standard includes several sample pre-operation inspection check-lists for operators of electric and internal combustion lift trucks.

CSA Standard B335-04 also provides for retraining and upgrading. Retraining must occur at intervals not exceeding 3 years. The upgrade training course includes all relevant information, as applicable, with the content, delivery method, and individual learning needs of the operator determining the course length. Knowledge verification and practical evaluation is to be performed in the same manner as for initial training.

Refresher courses and retraining only need cover the aspects of lift truck operation that the operator is considered to be deficient in relative to the performance criteria specified in *CSA Standard B335-04* section 16.7(j). If three years after the last refresher or upgrading course an operator is not considered by the employer to have any deficiencies relative to the performance criteria, the refresher course could simply be a general job safety review with the operator. Upgrade training is also required when new or modified equipment is to be used, skill or performance deficiencies have been identified, or there are significant changes in the operator's job.

CSA Standard B335-04 also stipulates that operators undergo practical skills evaluation in accordance with the standard every 18 months, and that the results of this evaluation are documented. The practical skills evaluation must be conducted on the specific work tasks and using the classification of lift truck to which the operator is assigned.

Note: For a copy of CSA Standards contact CSA at 604-244-6652 or <https://community.csagroup.org/login.jspa>, or contact your local library.

ASME B56.1-2004 Safety Standard for Low Lift and High Lift Trucks

WorkSafeBC accepts the training part of this standard (but not the retraining or upgrading portions) - set out in paragraph 4.19 and the references therein - as an alternative to the training portions of the *Standard*.

For retraining and upgrading, the provisions in the above noted CSA Standards are to be used. (i.e. CSA B335-94 or CSA B335-04)

Note: In 2005 the copyright of this ASME standard was obtained by ITSDF (Industrial Truck Standards Development Foundation) in Washington, DC. The standard number was changed to ANSI/ITSDF B56.1-2005 (Reaffirmation of ASME B56.1-2004). This standard can be downloaded from the ITSDF website at: <http://www.itsdf.org/pB56.asp>. The ITSDF home page is: <http://www.itsdf.org/>

G16.13 Braking requirements – Mobile equipment – Alternate standard

Issued June 14, 2013

Regulatory excerpt

Section 16.13 of the *OHS Regulation* ("Regulation") states, in part:

(1) Mobile equipment must have braking systems meeting the requirements of the following applicable standard:

(c) *Society of Automotive Engineers (SAE) Standard J1178 ISO11169 DEC94, Machinery for Forestry - Wheeled Special Machines - Vocabulary, Performance Test Methods, and Criteria for Brake Systems;*

(3) Mobile equipment used as an off-road transport vehicle on a slope greater than 20% must have a braking system meeting the performance requirements of *Society of Automotive Engineers (SAE) Standard J1178 ISO11169 DEC94, Machinery for Forestry - Wheeled Special Machines - Vocabulary, Performance Test Methods, and Criteria for Brake Systems.*

Purpose of guideline

The purpose of this guideline is to specify, for the purposes of section 16.13(1)(c) of the *Regulation*, an alternate standard acceptable to WorkSafeBC for a braking system. The guideline also specifies, for the purposes of section 16.13(3), an alternate standard for braking performance requirements. The Society of Automotive Engineers (SAE) has withdrawn the standard referenced in the *Regulation*.

Acceptable standard under section 16.13(1)

The *ISO 11169:1993 Machinery for Forestry - Wheeled Special Machines - Vocabulary, Performance Test Methods, and Criteria for Brake Systems (ISO 11169:1993)* is an acceptable standard to meet the requirement of the *Regulation* 16.13(1)(c), as an alternate to the *SAE Standard J1178 ISO11169 DEC94, Machinery for Forestry - Wheeled Special Machines - Vocabulary, Performance Test Methods, and Criteria for Brake Systems.*

Acceptable standard under section 16.13(3)

The *ISO 11169:1993* is an acceptable standard to meet the requirement of the *Regulation* 16.13(3) for braking system performance requirements, as an alternate to the *SAE Standard J1178/ISO11169 DEC94, Machinery for Forestry - Wheeled Special Machines - Vocabulary, Performance Test Methods, and Criteria for Brake Systems.*

Note: The only significant change between the *SAE J1178* and the *ISO 11169:1993* is the maximum required test force for the foot pedal (foot control). The *ISO 11169:1993* requires the operator to exert less force (600 N instead of 700 N) to apply the brakes.

G16.13(3) Braking requirements - Mobile equipment

Issued April 1, 2013

Regulatory excerpt

Section 16.13(3) of the *OHS Regulation* ("Regulation") states:

(3) Mobile equipment used as an off-road transport vehicle on a slope greater than 20% must have a braking system meeting the performance requirements of *Society of Automotive Engineers (SAE) Standard J1178 ISO11169 DEC94, Machinery for Forestry - Wheeled Special Machines - Vocabulary, Performance Test Methods, and Criteria for Brake Systems.*

Purpose of guideline

This guideline describes performance requirements from the referenced SAE standard and the types of off-road mobile equipment this regulation section applies to.

Performance requirements

Society of Automotive Engineers (SAE) Standard J1178 ISO11169 DEC94, Machinery for Forestry - Wheeled Special Machines - Vocabulary, Performance Test Methods, and Criteria for Brake Systems (the *Standard*) applies to self-propelled rubber-tired special forestry machines such as skidders, forwarders, and various feller-buncher machines.

The use of this standard in *Regulation* section 16.13(3) is to describe the performance requirements of the standard. The standard includes the following six performance tests:

- Brake system control
- Service brake system recovery capacity
- Secondary brake system capacity

- Warning device for stored energy system
- Holding performance
- Stopping performance

While the requirement refers to a standard for wheeled equipment, it is a performance requirement and applies even if the equipment is tracked.

Transport vehicles

This section applies to mobile equipment that may be wheeled or tracked, and is used in an off-road setting to transport people and/or equipment. Examples of this type of equipment include the Foremost Nodwell Series (2-track), Chieftain Series (4-track), Husky 6,8 (tracked), Delta (all-wheel drive), Terra-Bus personnel transporter, Prinoth Go- Tract vehicles, and NOV Rolligon vehicles.

G16.17 Alternate means of escape - Purpose-built window breaking device

Issued August 18, 2014

Regulatory excerpt

Section 16.17 of the *OHS Regulation* ("Regulation") states:

- (1) Mobile equipment with a single cab entrance door, manufactured after January 1, 2000, must have an alternate means of escape that is clearly marked both inside and outside the cab and which
 - (a) is not located on the same surface as the cab entrance door,
 - (b) is usable regardless of the position of movable components or accessories of the machine,
 - (c) does not pose additional hazards to the operator,
 - (d) can be opened from both the inside and outside without the use of tools when the equipment is in use,
 - (e) requires a force of not more than 135 N (30 lbs) to open, and
 - (f) provides a clear opening of at least 65 cm (26 in) in diameter if circular, 60 cm (24 in) on each side if square, and 47 cm by 65 cm (19 in by 26 in) if rectangular, or the dimensions of which comply with *ISO Standard 2867-1994, Earth-Moving Machinery - Access Systems*.
- (2) Mobile equipment with a single cab entrance door, manufactured before January 1, 2000, must meet the requirements for an alternate means of escape required at the date of manufacture, unless otherwise directed by the Board.

Purpose of guideline

This guideline describes when a purpose-built window breaking device may meet the requirements of section 16.17 of the *Regulation*.

Background

Section 16.17 of the *Regulation* requires an alternate means of escape for mobile equipment with a single cab entrance door. The intent of this requirement is to allow a secondary means of escape if the primary means is obstructed, e.g., due to fire, overturn, submersion, or other mishap.

In most circumstances an openable window can be built into a cab design, or a second door or hatch can be installed in the cab. This is what is anticipated by section 16.17(1) of the *Regulation*.

There may be circumstances where it is not practicable to install or retrofit the cab of mobile equipment with openable windows or to install a second door or hatch, such as follows:

- Cab structural strength would be significantly altered by installing an alternate means of escape, or
- A redesigned alternate means of escape would affect the machine capacity or range of motion

In these circumstances, it may be acceptable to install a purpose-built device to break a window in an emergency so that a person can escape from a cab. For example, this could be a commercially available device that permanently attaches directly to the window and can be used by the operator to break the glass by punching the device. Although the device does not open the window directly, it does open an egress point by breaking the window.

Use of a tool

The *Regulation* states that the alternate means of escape must be openable without the use of a tool. Therefore, it is not acceptable to rely on a hammer or other loose commercial glass breaking devices in the cab for the purpose of breaking a window. Even if the device is tethered to the window, it is still not an acceptable means because there is a significant chance of the device being removed or otherwise being unavailable in an emergency.

However, if a device can be permanently installed on a window so that it cannot be removed in any normal way (i.e., becomes integral with the glass), and can be readily used to break the window, then it would not be considered a tool and could be acceptable under the *Regulation*.

Mobile equipment manufactured after January 1, 2000

For mobile equipment manufactured after January 1, 2000, all the requirements of section 16.17(1) apply.

As an alternate means of escape, an openable hatch or window has some important advantages in terms of reliability. For example, a hatch can be tested and drills can be run regularly to check that the operator can open it in an emergency situation, whereas the purpose-built device cannot readily be tested to ensure the operator can use it to break a window in an emergency. Factors that may affect the utility and reliability of the purpose-built device include the following:

- The device will only be effective with certain types of window glass, e.g., tempered glass versus non-tempered or laminated glass. Not all window glass is tempered glass, and even when it is, it is not always labelled as such. An employer may need to contact the mobile equipment, device, and/or glass supplier to determine whether the glass is of a type that will be broken by the device.
- The device will only be effective for certain thicknesses of glass. An employer will need assurance that the device will work when required in an emergency.
- Tempered glass breaks into fragments rather than sharp shards. While the fragments do not represent the same high hazard as sharp angular shards, there is still a danger of fragments lodging in the skin or eye, and workers need to be made aware to take precautions when breaking the glass.
- When a tempered glass window breaks, it may stay relatively in place in the frame and will then need to be pushed in order to remove it from the frame.
- All equipment operators must be trained in how to properly use the device in an emergency, and refresher training may be required periodically.
- The device needs to be part of a regular inspection regime to ensure it remains in place and undamaged. There is no practical way to test the functioning of the device on a periodic basis. The device may have an expiry date and this will need to be part of the inspection.
- A window film (e.g., advertising, anti-vandalism) or double glazing may affect performance of the device.

A purpose-built device is acceptable if the following considerations are met:

- The requirements of *Regulation* sections 16.17(1)(a)–(f) are met.
- Manufacturer's instructions are followed (both the mobile equipment and the device manufacturer).
- It is not practicable to install an openable escape hatch, door, or window as the alternate means of escape.
- The window is of a type and condition that will break as necessary by use of the device according to the manufacturer's instructions. The window material and the thickness are important in this consideration.
- The window can be safely broken from the inside (by the equipment operator) and the outside (by rescuers).
- The window and attached device do not create an additional hazard. Tempered glass will break into fragments. Workers need to be made aware that the fragments could become embedded in the eye or skin and precautions need to be taken. If the window is of a type that will break into sharp shards that are likely to cause injury to a worker, then this method would not be acceptable.
- The installed device does not obscure the operator's view or otherwise hinder equipment operation.
- The device is installed in a location on the window so that it is likely to be readily accessible when necessary in case of mishap.
- The device is part of the pre-use inspection of the mobile equipment. The presence and condition of the devices must be verified.
- Instructions on how to use the device are clearly visible for the devices inside and outside the window.
- The device is permanently affixed at the window.
- A qualified person has inspected the installed device and provided written confirmation to the employer that the device is installed in accordance with the considerations listed here. This information is provided to the joint occupational health and safety committee or worker representative, as applicable, and is made available to a WorkSafeBC prevention officer upon request.

Mobile equipment manufactured prior to January 1, 2000

As per section 16.17(2) of the *Regulation*, mobile equipment manufactured prior to January 1, 2000 and having a single cab entrance door must be equipped with an alternate means of escape should the primary means be blocked.

The prescriptive requirements of sections 16.17(1)(a)–(f) do not apply to this mobile equipment. Employers should provide openable hatches or windows as an alternate means of escape wherever practicable - however, a purpose-built device such as described in this guideline is also acceptable as an alternate means of providing escape, provided that the manufacturer's instructions are followed.

G16.18 Acceptable standards for operating controls

Issued August 1999; Revised November 18, 2009

Regulatory excerpt

Section 16.18(1) of the *OHS Regulation* ("*Regulation*") states:

Operating controls for mobile equipment must meet the requirements of a standard acceptable to the Board for the type of equipment.

Purpose of guideline

The purpose of this guideline is to specify an acceptable standard for operating controls for mobile equipment.

Acceptable standard for operating controls

For many pieces of mobile equipment, WorkSafeBC has specified, under another section of the *Regulation* or in an OHS Guideline, an applicable standard that must be met. In particular, section [16.7](#) of the *Regulation* specifies applicable standards for certain mobile equipment. Where these

standards cover operating controls, they are considered to be acceptable standards under section 16.18(1) of the *Regulation*.

In the event that WorkSafeBC has not identified an acceptable standard for a piece of mobile equipment, or the identified standard does not cover operating controls, the manufacturer's instructions are considered to be an acceptable standard under section 16.18(1) of the *Regulation*.

In the event that the manufacturer's instructions do not cover operating controls, *SAE J297 Operator Controls on Industrial Equipment* is an acceptable standard under section 16.18(1) of the *Regulation*.

G16.19 Load handling attachments – Forklifts

Issued September 21, 2012; Editorial Revision consequential to February 1, 2013 Regulatory Amendment

Regulatory excerpt

Section 16.19 of the *OHS Regulation* ("*Regulation*") states:

- (1) Buckets, forks, booms, hoists and other load handling attachments must only be installed on mobile equipment as specified by the equipment manufacturer or when certified by a professional engineer for use on the equipment.
- (2) The installation specified by the equipment manufacturer or certified by the professional engineer under subsection (1) for hoists or load handling attachments must
 - (a) include instructions for safe use of the equipment with the load handling attachment, and
 - (b) provide for the evaluation of the stability of the equipment, including the effect of load swing.

Section 4.3(2) of the *Regulation* states:

- (2) Unless otherwise specified by this Regulation, the installation, inspection, testing, repair and maintenance of a tool, machine or piece of equipment must be carried out
 - (a) in accordance with the manufacturer's instructions and any standard the tool, machine or piece of equipment is required to meet, or
 - (b) as specified by a professional engineer.

Section 4.8 of the *Regulation* states:

- (1) Unless provided elsewhere in this Regulation, the rated capacity or rated load of a machine or piece of equipment is that specified by the manufacturer of the machine or piece of equipment based on its design.
- (2) The rated capacity or rated load must be certified by a professional engineer if
 - (a) the manufacturer's specification or other acceptable warranty cannot be produced,
 - (b) the equipment or machine has been modified in a manner which will change its rated capacity or rated load,
 - (c) wear, corrosion, damage or signs of fatigue are found which may reduce the rated capacity or rated load,
 - (d) the equipment or machine is used in a manner or for a purpose other than that for which it was originally designed, if the use will change the safe working load, or
 - (e) in the opinion of the Board, the provision of such certification is deemed necessary.

Sections 16.7(d) and (e) of the *Regulation* state:

The design, fabrication, use, inspection and maintenance of mobile equipment must meet the requirements of the following applicable standard:

- (d) Powered Industrial Trucks (low lift and high lift): *ANSI/ITSDF B56.1-2009, Safety Standard for Low Lift and High Lift Trucks*;
- (e) Rough Terrain Forklifts: *ANSI/ITSDF B56.6-2011, Safety Standard for Rough Terrain Forklift Trucks*;

Purpose of guideline

This guideline provides information regarding the *Regulation* requirements pertaining to installation, written instructions regarding safe use and stability, and determination of rated capacity when a forklift (also known as a lift truck) is fitted with a load handling attachment.

Installation requirements

There are a number of load handling attachments available for low lift, high lift, and rough terrain forklifts; including fork extensions, telescoping booms, and attachable hoisting devices (hooks, clamps, side shifters, etc.). These load handling attachments are available both from the forklift

manufacturer and from third-party manufacturers. *Regulation* sections 4.3(2) and 16.19(1) require that installation of these attachments be carried out

- In accordance with instructions from the manufacturers of both the load handling attachment and the forklift, and the requirements of the relevant forklift standard
- By a professional engineer

Safe use and stability instructions

The potential for instability of the forklift when a load handling attachment is installed and when a load is applied to the attachment is a key hazard to be considered in the development of written safe use instructions required under *Regulation* section 16.19(2).

Instructions for safe use of the forklift with the load handling attachment should address the following factors:

- Changes to the stability of the forklift caused by the following:
 - any extension of the load past the normal point for the load rating of the forklift
 - the swing of any suspended load
- Any altered load capacity caused by the use of the load handling attachment
- Any altered handling characteristics of the forklift or forklift capabilities such as maximum fork elevation for a specific forklift
- Whether the specifications and instructions of either the forklift manufacturer or the load attachment manufacturer are affected when the forklift and attachment are combined
- The relevant specifications and instructions from the appropriate standard (refer to sections 16.7(d) and (e)). These standards include requirements for the use of load handling attachments

Nameplates

If a forklift is equipped with a load handling attachment, clause 4.2.3 of *ANSI/ITSDF B56.1-2009* requires the forklift be marked to identify the attachment, show the weight of the combination of the truck and attachment, and show the capacity of the truck with the attachment at maximum elevation with the load laterally centred.

Rated capacity

Load handling attachments that (1) allow the load to swing, (2) significantly elevate the normal centre of gravity of the load, or (3) reposition the allowable centre of gravity of the load past the normal load rating position (as specified by the forklift manufacturer) can, in addition to affecting stability of the forklift, create significant changes in the load capacity of the forklift.

The forklift manufacturer may have anticipated the effects of the use of load handling attachments and specified the rated capacity for this use. Where the forklift manufacturer has not provided for this use in the design and specifications of the equipment and not specified the appropriate rated capacity, or if the manufacturer's (or authorized agent's) specifications are not available, *Regulation* sections 4.8(2)(a) and (b) require that the modified rated capacity or rated load be certified by a professional engineer.

G16.43(3) Pedestrian and equipment traffic

Issued August 1999; Revised August 1, 2013

Regulatory excerpt

Section 16.43(3) of the *OHS Regulation* ("*Regulation*") states:

In areas where lift truck use is separated from pedestrian traffic, a lift truck may travel forward with an elevated load if such operation will improve the operator's view of the path of travel, provided that operating conditions are maintained to ensure vehicle stability and the specifications of the equipment manufacturer are not compromised.

Purpose of guideline

The purpose of this guideline is to provide information on low lift and high lift truck stability.

Lift truck stability

A lift truck works on the principle of the truck and its load balanced over a fulcrum, where the weight of the lift truck counterbalances the load on its forks (similar to the seesaw principle). The fulcrum, located in the centreline of the front axle of the truck, is the pivot point of the seesaw.

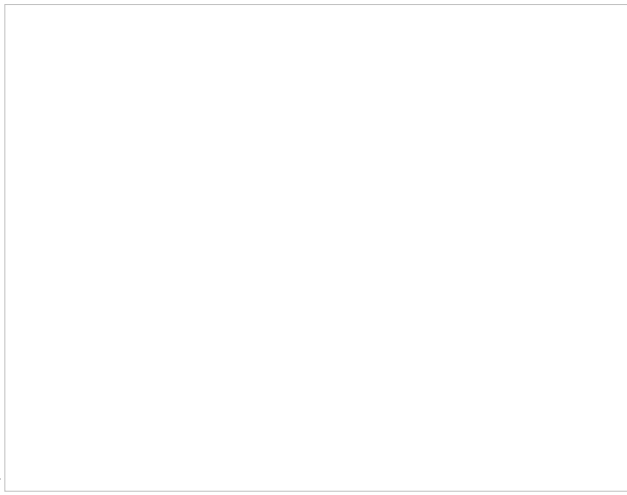


Figure 1: Counterbalance lift truck for illustration purposes only

When a lift truck's load exceeds its capacity rating (either weight and/or load centre), unstable conditions are introduced which may cause the truck to tip over.

- The capacity rating of a lift truck is identified on its data plate (affixed to the truck by the manufacturer) and displays the maximum load (expressed in pounds or kilograms) it can safely raise, lower, and move. The capacity rating consists of two components: weight and load centre. The weight is the weight of the load. The load centre is the horizontal distance between the face of the forks and the centre of gravity or CG of the load (expressed in inches or millimeters), and the vertical distance of the travelling surface to the load centre. The CG is the point on an object where its weight is evenly dispersed and all its parts are in balance.
 - A front end attachment (e.g., fork extension, paper roll clamp) on a lift truck has its own rated capacity causing the truck's load capacity rating to change.

As a load centre distance increases the "load moment" increases. The load moment, or moment, is the product of the load's weight multiplied by the distance of the CG of the load to the fulcrum (pivot point). It is the moment which determines how much overturning force is being applied to the lift truck. For example, if a forklift's stated capacity is 3,000 pounds at a 24 inch load centre, the load moment cannot safely exceed 72,000 inch-pounds (24 inches x 3,000 lb = 72,000 inch-pounds). If the load centre distance for the actual load is greater than 24 inches, the only way to keep the load moment from exceeding 72,000 inch-pounds, which could result in the forklift tipping over laterally, is to reduce the load.

Stability triangle

A lift truck's steer axle is attached to the truck by a pivot pin in its rear axle's centre. When this point is connected to the centre of the two front wheels with imaginary lines it forms a triangle called the stability triangle. A lift truck and load each have their own CG. When a load is placed on a lift truck, the CG of the truck shifts, and a combined centre of gravity (CCG) is created. If the CCG is located outside the stability triangle, unstable conditions are introduced causing the truck to tip over either laterally on its side or tip longitudinally forward. Tip direction is determined by where the CCG is outside the stability triangle.

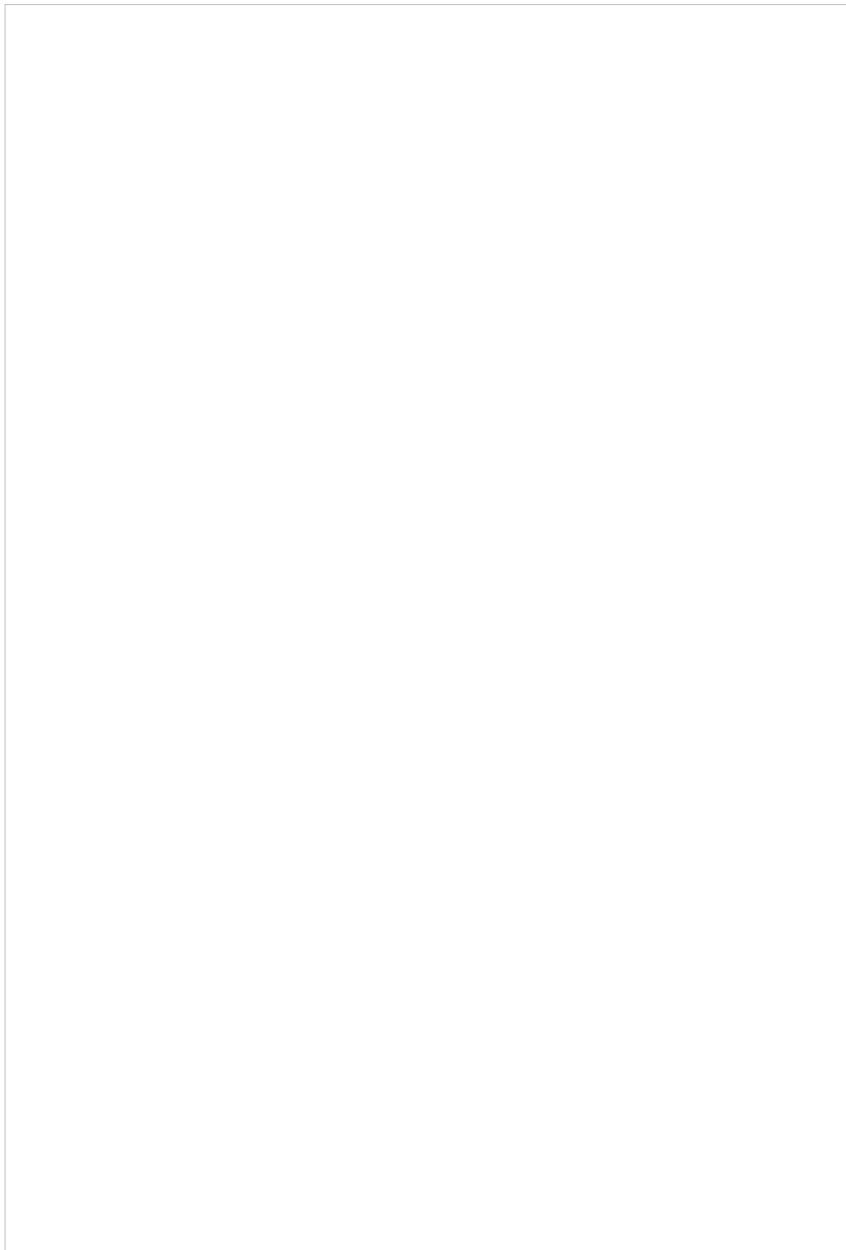


Figure 2: Stability triangle

Measures to ensure stability

The following measures are not an exhaustive list and do not replace lift truck safety standards

- Ensure the lift truck is in good operating condition (e.g., the tires are inflated in accordance with the truck's manufacturer standards, and brakes are in optimal working condition).
- Ensure the load is positioned against the mast, centered across the forks, and its weight evenly distributed.
- Avoid tilting forks forward unless picking up or setting down a load.
- Exercise caution when handling loads that are close to the truck's stated capacity rating.
- When elevating a load, reduce the load capacity, and carry it at its lowest possible position.
- Maintain a clear path of travel and be aware of blind spots.
- Travel at a slow speed, and exercise extra caution when turning.
- Loads should only be elevated for as long as required to clear the obstruction. The higher the load is elevated the less stable the lift truck becomes.
- Be aware of the impact of dynamic forces (e.g., braking suddenly, accelerating rapidly, turning sharply, or operating on uneven surfaces) as the load moment created by these motions may cause the lift truck to tip over.

Stability references

Additional stability references can be found under the following standards:

- *CAN/CSA-B335-04* Safety standard for lift trucks
- *ANSI/ITSDF B56.1* Safety Standard for Low Lift and High Lift Trucks

G16.44(2) Acceptable standard for load restraint

Issued February 11, 2009

Regulatory excerpt

Section 16.44(2) of the *OHS Regulation ("Regulation")* states:

To protect the crew of a vehicle transporting a load which might shift on rapid deceleration of the vehicle, a means of load restraint must be provided which

- (a) will prevent significant load shift relative to the carrier under emergency stopping conditions, and
- (b) meets a standard acceptable to the Board.

Purpose of guideline

The purpose of this guideline is to specify an acceptable standard for load restraint under section 16.44(2).

Acceptable standard for securing loads

Under section 16.44(2)(b), the means of load restraint used to protect the crew of a vehicle transporting a load which might shift on rapid deceleration of the vehicle must meet a standard acceptable to WorkSafeBC. The British Columbia *Motor Vehicle Act Regulations* require loads to be secured in accordance with the [National Safety Code Standard 10, Cargo Securement \(Standard 10\)](#). Section 2(1) of Standard 10 specifies that the standard applies to certain vehicle weights and on public highways. Section 35.02(3) of the *Motor Vehicle Act Regulations* specifies that "Despite section 2 (1) of the Standard, the Standard applies to all vehicles transporting cargo on a highway, regardless of the vehicles' gross vehicle weight." For the purposes of section 16.44(2)(b) of the *Regulation*, Standard 10 is an acceptable standard for all vehicle weights and on all roads, regardless of the restrictions of section 2(1) of the standard.

Logging trucks

[Part 26](#) of the *Regulation* sets out specific requirements for transporting and securing logs on logging trucks. A logging truck which has secured logs in compliance with these *Regulation* requirements will be considered to have secured logs in accordance with a standard acceptable to WorkSafeBC under section 16.44(2)(b) of the *Regulation*. These trucks do not need to comply with Standard 10 for the purposes of securing logs.

G16.31(4) Rider restriction

Issued August 1999

Section 16.31(4) of the *Occupational Health and Safety Regulation* states:

A worker other than the operator may only ride on mobile equipment with a ROPS for the purpose of training or maintenance, and only then if the equipment is operated in an area with no significant hazard of rollover&quit;

Section [16.31\(2\)](#) sets out certain requirements if a worker must ride on non-ROPS equipped mobile equipment to carry out a job task. These requirements are not specifically mandated by subsection (4) for workers riding on ROPS equipment, however, these or similar requirements should be met so that the rider can be transported safely. Subsection [4.3\(1\)](#) applies.

G16.33 Use of seatbelts on forklifts

Issued June 18, 2008; Revised consequential to February 1, 2013 Regulatory Amendment

Regulatory excerpt

Section 4.3(1)(b)(i) of the *OHS Regulation ("Regulation")* states:

- (1) The employer must ensure that each tool, machine and piece of equipment in the workplace is
 - (b) selected, used and operated in accordance with
 - (i) the manufacturer's instructions, if available,

Sections 16.7(d) and 16.7(e) of the *Regulation* state:

The design, fabrication, use, inspection and maintenance of mobile equipment must meet the requirements of the following applicable standard:

- (d) Powered Industrial Trucks (low lift and high lift): ANSI Standard ANSI/ITSDF B56.1-2009, *Safety Standard for Low Lift and High Lift Trucks*;
- (e) Rough Terrain Forklifts: ANSI Standard ANSI/ITSDF B56.6-2011, *Safety Standard for Rough Terrain Forklift Trucks*;

Section 16.32(1) of the *Regulation* states:

Mobile equipment with ROPS and side boom tractors must have seat belts which meet the requirements of *Society of Automotive Engineers (SAE) Standard J386 JUN93, Operator Restraint System for Off-Road Work Machines*.

Section 16.33(1) and (2)(c) of the *Regulation* state:

- (1) If mobile equipment has seat belts required by any law in British Columbia, the operator and passengers must use the belts whenever the equipment is in motion, or engaged in an operation which could cause the equipment to become unstable.
- (2) The use of a seat belt is not required for
- (c) ROPS equipped mobile equipment if the mobile equipment operates in a specific location where there is no significant hazard of rollover, and the surface in the area of operation is maintained free of ground irregularities which might cause a rollover.

Purpose of guideline

The purpose of this guideline is to describe the requirements in the *Regulation* for the use of seat belts or other operator restraints on forklifts.

When a seat belt or other operator restraint is required on a forklift

The requirement to use a seat belt while operating a forklift depends on the type of forklift, including whether or not the forklift is equipped with a Rollover Protective Structure (ROPS), the year the forklift was manufactured, the requirements of the applicable standard referenced in the *Regulation*, and the manufacturer's instructions. The table below summarizes the requirements to use a seat belt.

In the case of powered industrial trucks, *ANSI Standard ANSI/ITSDF B56.1-2009* refers to an operator restraint device, system, or enclosure. An operator restraint device, system, or enclosure is intended to assist the operator in reducing the risk of entrapment of the head and/or torso between the truck and the ground in the event of a tip over. The restraint device or system may include a seat belt, though a seat belt is not necessarily a part of such device or system. In the table below, the requirement, where applicable, to have a restraint device, system, or enclosure is included for additional information.

Type of Forklift	Seat belt or operator restraint requirements	Regulation section
Any forklift, built in any year, where the manufacturer's instructions specify that a seat belt should be used.	The use of the seat belt is required by the <i>Regulation</i> .	Section 4.3(1)(b)(i) of the <i>Regulation</i> .
ROPS equipped forklifts built in any year. Note: Most forklifts have falling object protective structures, but not ROPS. Rough terrain forklifts often have ROPS.	This equipment is required by the <i>Regulation</i> to be equipped with a seat belt. The seat belt must be used unless the equipment operates in a specific location where there is no significant hazard of rollover, and the surface in the area of operation is maintained free of ground irregularities which might cause a rollover.	Section 16.32(1) and 16.33(1) of the <i>Regulation</i> .
Powered industrial trucks without ROPS built in 1993 or later		
Type 1: Counter-balanced, centre control, high-lift trucks with sit-down, non-elevating operator position	Under the required standard, this equipment is required to be equipped with a restraint device, system, or enclosure. The restraint device or system must be used.	Section 16.7(d) of the <i>Regulation</i> . See also section 7.39 and 5.3.19 of <i>ANSI Standard ANSI/ITSDF B56.1-2009</i> .
Type 2: All other powered industrial trucks	Under the required standard, a seat belt or other restraint device or system must be used when provided.	Section 16.7(d) of the <i>Regulation</i> . See also section 5.3.19 of <i>ANSI Standard ANSI/ITSDF B56.1-2009</i> .
Rough terrain forklift without ROPS built in 1992 or later	Under the required standard, seat belts must be provided that meet or exceed the requirements of ANSI/SAE J386. The operator must fasten the seat belt, if provided, before starting to operate the rough terrain forklift.	Section 16.7(e) of the <i>Regulation</i> . See also section 8.26 and 6.2.1(a) of <i>ANSI Standard ANSI/ITSDF B56.6-2011</i> .

G16.21 Protective structures for hydraulic excavators pioneering on steep side hills

Issued August 1999; Editorial Revision April 2005

The standards referenced in section [16.21](#) mean that the minimum operator protection expected on a hydraulic excavator exposed to the hazard of intruding or flying objects, such as loose debris, snags, tree trunks, or limbs, which are conditions normally encountered in pioneering steep side hill logging grades and right-of-way construction, is as follows

[WCB G602](#) - cab structure designed to resist a force of at least 11,500 pounds (simulating a 2000 pound blunt log impacting the cab at approximately 4 miles per hour), and an alternate exit meeting the requirements of section [16.17](#) of the *OHS Regulation*.

[WCB G603](#) - window guards (mild steel bars or rods with a maximum opening of 64 square inches) on the front, sides (where permitted by boom clearance), and back of the cab where there is a hazard of intruding or flying objects.

[WCB G608](#) - heavy duty roof structure (designed to absorb 8500 foot - pounds of energy). (SAE J1043 - Minimum Performance Criteria for Falling Object Protective Structures for Industrial Equipment or equivalent standard is an accepted option under G608.)

Section [4.4\(2\)\(b\)](#) of the *Regulation* permits the reliance on other practices, procedures, or rules which are acceptable to the Board.

An adequate substitute for WCB Standard G603 window guards is polycarbonate (sold under the trade names of Lexan or Tuffac) where it is at least 1/2 inch thick and adequately supported from behind along the perimeter with at least a one inch overlap and by members in one direction not more than 10 inches apart.

Where boom clearance does not permit a side window guard meeting WCB Standard G603, a window guard meeting [WCB Standard G604, Standard for Light-Duty Screen Guards for Off-Highway Equipment](#) may be used. An adequate substitute for WCB Standard G604 is polycarbonate where it is at least 1/4 inch thick and supported from behind with at least a one inch overlap along the perimeter. Section 16.11(4) of the *Regulation* requires each polycarbonate window on mobile equipment manufactured after February 1, 2002, or otherwise installed on mobile equipment after that date, to be marked to show the thickness and grade of the material.

Do not drill holes in polycarbonate windows to mount the window on the machine, or for the installation of accessories such as windshield wipers. Consult with the WorkSafeBC's Engineering Section for further assistance on window guards made using polycarbonate.

G16.21(2)-1 Operator protective structure standards for agricultural tractors

Issued January 1, 2005

Section [16.21\(2\)](#) of the *OHS Regulation* ("*Regulation*") lists a number of standards for operator protective structures on mobile equipment that are acceptable to WorkSafeBC.

Section [4.4\(2\)](#) of the *Regulation* permits WorkSafeBC to accept alternative standards.

WorkSafeBC accepts the following additional standard for operator protective structures on agricultural tractors: *SAE Standard J1167, December 1986, Overhead Protection for Agricultural Tractors - Test Procedures and Performance Requirements*.

G16.21(2)-2 Protective structures - Acceptable alternate standards

Issued October 26, 2011

Regulatory excerpt

Section 16.21(2) of the *OHS Regulation* ("*Regulation*") states:

The means of protection must meet the requirements of the following applicable standard:

- (a) [WCB Standard -- G601, Standard for Log Loader and Log Yarder Backstops](#);
- (b) [WCB Standard -- G602, Standard for Log Loader and Log Yarder Raised Cabs](#);
- (c) [WCB Standard -- G603, Standard for Log Loader and Log Yarder Window Guards](#);
- (d) [WCB Standard -- G604, Standard for Light-Duty Screen Guards for Off-Highway Equipment](#);
- (e) [WCB Standard -- G605, Standard for Mobile Equipment Half-Doors](#);
- (f) [WCB Standard -- G607, Standard for Medium Duty Screen Guards -- Front End Log Loader](#);
- (g) [WCB Standard -- G608, Standard for Mobile Equipment Roof Structures -- Heavy Duty](#);
- (h) [WCB Standard -- G609, Standard for Mobile Equipment Roof Structures -- Light Duty](#);
- (i) *Society of Automotive Engineers (SAE) Recommended Practice J231 JAN81, Minimum Performance Criteria for Falling Object Protective Structure (FOPS)*;
- (j) *Society of Automotive Engineers (SAE) Standard J1043 SEP87, Performance Criteria for Falling Object Protective Structure (FOPS) for Industrial Machines*;
- (k) *ISO Standard 3449:1992, Earth-Moving Machinery -- Falling-Object Protective Structures -- Laboratory Tests and Performance Requirements*;
- (l) *Society of Automotive Engineers (SAE) Recommended Practice J1084 APR80, Operator Protective Structure Performance Criteria for Certain Forestry Equipment*;
- (m) *Society of Automotive Engineers (SAE) Recommended Practice J1356 FEB88, Performance Criteria for Falling Object Guards for Excavators*.

Purpose of guideline

This guideline describes acceptable alternate standards to WorkSafeBC G600 series of standards for protective structures on mobile equipment.

Scope of standards

The scopes of the ISO and SAE standards differ from the G600 standards. WorkSafeBC has considered the performance requirements of the listed alternate standards, regardless of the scope of the standard. For example, although *SAE J1356* is written to apply to earthmoving excavators, it is accepted as an alternative to G603 guards on forestry machines.

Acceptable alternate standards

The standards listed below are acceptable alternate standards for the G600 standards, to the extent outlined in the Table below.

- *ISO 12117-2:2008, Earth-moving machinery -- Laboratory tests and performance requirements for protective structures of excavators -- Part 2: Roll-over protective structures (ROPS) for excavators of over 6 t*
- *ISO 3471:1994, Earth-moving machinery -- Roll-over protective structures -- Laboratory tests and performance requirements*
- *ISO 3471:2008, Earth-moving machinery -- Roll-over protective structures -- Laboratory tests and performance requirements*
- *ISO 8082:2003, Self-propelled machinery for forestry -- Roll-over protective structures -- Laboratory tests and performance requirements*
- *ISO 8082-1:2009, Self-propelled machinery for forestry -- Laboratory tests and performance requirements for roll-over protective structures -- Part 1: General machines*
- *ISO 8082-2:2011, Self-propelled machinery for forestry -- Laboratory tests and performance requirements for roll-over protective structures -- Part 2: Machines having a rotating platform with a cab and boom on the platform*
- *SAE J2267 APR2007 Minimum performance criteria for operator front protective structure (OFPS) for certain equipment*
- *SAE J1356 FEB88 OPS, Performance criteria for falling object guards for excavators* (reaffirmed in 2008)*
- *ISO 8084:2003, Machinery for forestry -- Operator protective structures -- Laboratory tests and performance requirements*
- *SAE J1084 APR80, Operator protective structure performance criteria for certain forestry equipment**
- *ISO 3449:2005, Earth-moving machinery -- Falling-object protective structures -- Laboratory tests and performance requirements*
- *ISO 8083:2006, Machinery for forestry -- Falling-object protective structures (FOPS) -- Laboratory tests and performance requirements*
- *ISO 10262:1998, Earth-moving machinery -- Hydraulic excavators -- Laboratory tests and performance requirements for operator protective guards*
- *SAE J231 JAN81, Minimum performance criteria for falling object protective structure (FOPS)**
- *SAE J1043 SEP87, Performance criteria for falling object protective structure (FOPS) for industrial machines**
- *ISO 3449:1992, Earth-moving machinery -- Falling-object protective structures -- Laboratory tests and performance requirements.**

*These standards are cited in *Regulation 16.21(2)* as applicable standards but are also included here for the sake of completeness.

The above ISO and SAE standards are acceptable alternate standards to the G600 standards, in the manner described in the Table. Any one of the listed alternate standards is an acceptable alternative standard. For example, for G603, compliance with either SAE J2267 APR2007 or the operator protective structure requirements of SAE J1356 FEB88 is acceptable.

Compliance can be achieved by complying with either the applicable G600 standards or the applicable alternative standards referenced in this guideline. The G600 standards are prescriptive. The alternative standards in this guideline are more flexible but require destructive testing.

WCB Standard	Acceptable alternative standards
G601 (Note 1)	None identified
G602 (Note 2)	One of the following ISO standards, combined with G602 sections 4.2 <i>Cab skin</i> , 4.5 <i>Visibility requirements</i> , 4.8 <i>Alternate exit</i> - see also Note 3 , 4.10 <i>Sound isolation & absorption</i> , and <i>Regulation</i> section 16.11 <i>Window standards</i> (Note 4): ISO 12117-2:2008, except for clause 6.1.5 and any references to it (Note 5,6) ISO 3471:1994 ISO 3471:2008 ISO 8082:2003 ISO 8082-1:2009 ISO 8082-2:2011
G603 (Note 7)	SAE J2267 APR2007 SAE J1356 FEB88 performance requirements for OPS (Note 8,9)
G604 (Note 10)	ISO 8084:2003 SAE J1084 APR80 (Note 9)
G605 (Note)	None identified

11)	
G606 (Note 12)	None identified
G607 (Note 13)	None identified
G608 (Note 14)	ISO 3449:2005 Level II performance requirements ISO 8083:2006 11,600 J level (Note 15) ISO 3449:1992 Level II performance requirements ISO 10262:1998 Level II performance requirements for FOPS (Note 8) SAE J1356 FEB88 FOPS (Note 8) SAE J231 JAN81 (Note 9)
G609 (Note 16)	ISO 3449:2005 Level I performance requirements ISO 10262:1998 Level I performance requirements for FOPS (Note 8) ISO 3449:1992 Level I performance requirements SAE J1043 SEP87 (Note 9)

- Note 1 [G601](#) covers yarders and cable log loaders which are no longer in production. There are no identified acceptable alternate standards.
- Note 2 [G602](#) deals with the strength of the cab frame, for which the identified ISO standards are acceptable alternate standards. The protection offered by ISO 3471 is greater than the protection offered by ISO 12117-2.
- Note 3 *Regulation* section [16.17](#) applies for equipment manufactured after the year 2000.
- Note 4 The requirements of *Regulation* section [16.11](#) *Window standards*, supersede the requirements of G602 section 4.9.
- Note 5 ISO 12117-2:2008 clause 6.1.5 allows testing to be stopped before the required force or energy levels are reached. WorkSafeBC does not accept this practice.
- Note 6 The scope of ISO 12117-2 includes equipment with mass from 6,000 kg to 50,000 kg. However, the standard states that this does not preclude the possibility of applying the procedures described in ISO 12117-2 to excavators having larger or smaller masses.
- Note 7 [G603](#) covers window guards for protection from large objects. Where G603 calls for guarding on particular windows, the requirements of SAE J2267 or SAE J1356 only apply for those windows.
- Note 8 SAE J1356 and ISO 10262 address both Operator Protective Structures (window guards) and Falling Object Protective Structures.
- Note 9 This standard (and version) is also identified in *Regulation* section [16.21](#) *Protective Structures* as an applicable standard.
- Note 10 [G604](#) allows SAE J1084 as a method of compliance. SAE J1084 is technically equivalent to ISO 8084. Both call for a 4,000 lb force to be applied to the window in 5 places. Where G604 calls for guarding on particular windows, the requirements of SAE J1084 or ISO 8084 only apply for those windows.
- Note 11 [G605](#) covers half-doors on skidders. No new skidders are produced with half-doors. There are no identified accepted alternate standards for half-doors; however ISO 8084 and SAE J1084 cover full doors.
- Note 12 [G606](#) covers boom boat cab protection. No new boom boats are being produced and there is no identified acceptable alternate standard. G606 is referenced in *Regulation* section [26.86](#) and is included here for information purposes.
- Note 13 [G607](#) covers log loaders operating in less hazardous situations than those anticipated by G603. Where a G607 guard is required a G603 guard can be substituted.
- Note 14 [G608](#) allows SAE J231 as a method of compliance. SAE J231 is technically equivalent to ISO 8083 (11,600 J level), ISO 3449 Level II, ISO 10262 Level II FOPS and SAE J1356 FOPS. All call for a 500 lb. object to be dropped with 8,500 ft-lbs energy.
- Note 15 ISO 8083 has a 5,800 J performance requirement and an 11,600 J performance requirement. The acceptable alternate standard is for the 11,600 J performance requirement.

G16.22 Rollover protective structures (ROPS)

Issued February 27, 2001; Preliminary Revision February 25, 2013

Regulatory excerpt

Section 16.22 of the *OHS Regulation ("Regulation")* states in part that:

(1) The following types of mobile equipment, weighing 700 kg (1 500 lbs) or more, must have rollover protective structures (ROPS):

...

(2) The Board may require a ROPS to be installed on any mobile equipment if the design of the equipment or circumstances of use indicate the need.

(3) Mobile equipment listed in subsection (1) may be used without a ROPS if

(a) the equipment operates in a specific location where there is no significant hazard of rollover, and

(b) the surface in the area of operation is maintained free of ground irregularities which might cause a rollover.

Section 16.1 of the *Regulation* states in part that:

"no significant hazard of rollover" means an area in which there are no grades exceeding 10%, no operating areas with open edges, no open ramps, loading docks, ditches or other similar hazards which might cause a rollover;

"specific location" means a yard, plant or other clearly defined and limited area in which mobile equipment is operated, but does not include an entire municipality, district, transient forestry operation or construction site.

Purpose of guideline

The purpose of this guideline is to explain when ROPS are not required and the alternative to ROPS where compliance with the ROPS requirements is not practicable.

ROPS exemption

Equipment listed in section 16.22(1) of the *Regulation* must normally have ROPS. If the equipment is operated in a location meeting the requirements of section 16.22(3)(a) and the surface meets the requirements of section 16.22(3)(b) then the equipment does not require a ROPS unless WorkSafeBC has required a ROPS be installed because the design of the equipment or circumstances of use indicated the need (refer also to *Regulation* [section 16.21\(2\)](#)).

An example of a specific location where section 16.22(3) could apply is a forestry mill yard. If a forestry mill yard met the requirements of sections 16.22(3)(a) and (b) then ROPS would not normally be required on equipment operating in the yard.

Section 16.22(3) only applies to ROPS. It does not apply to other protective structures such as falling object protective structures (FOPS). [Section 4.12](#) of the *Regulation* prohibits the removal of safeguards unless permitted by the *Regulation*. This includes protective structures such as FOPS.

Situations where ROPS are not practicable

If compliance with the section 16.22(1) requirement for ROPS is not practicable, alternative proposals designed to provide equal or greater protection to workers may be submitted in a variance request. Refer to OHS Guideline [G-D9-164](#) for more information on the variance process.

If the criteria in 16.22(3) are met then a variance application does not need to be submitted to use the equipment without ROPS.

G16.22(2) Use of ROPS on agricultural tractors when operated on steep slopes or narrow roadways

Issued January 1, 2005; Retired consequential to February 1, 2012 Regulatory Amendment

G16.23 ROPS standards - acceptable alternate standards

Issued January 1, 2005; Revised March 9, 2012

Regulatory excerpt

Section 16.23 of the *OHS Regulation ("Regulation")* states:

A ROPS must meet the requirements of one of the following applicable standards:

(a) *CSA Standard B352.0-95, Rollover Protective Structures (ROPS) for Agricultural, Construction, Earthmoving, Forestry,*

Industrial, and Mining Machines--Part 1: General Requirements, and

(i) *CSA Standard B352.1-95, Rollover Protective Structures (ROPS) for Agricultural, Construction, Earthmoving, Forestry, Industrial, and Mining Machines--Part 2: Testing Requirements for ROPS on Agricultural Tractors, or*

(ii) *CSA Standard B352.2-95, Rollover Protective Structures (ROPS) for Agricultural, Construction, Earthmoving, Forestry, Industrial, and Mining Machines--Part 3: Testing Requirements for ROPS on Construction, Earthmoving, Forestry, Industrial, and Mining Machines;*

(b) *Society of Automotive Engineers (SAE) Standard J1040 MAY94, Performance Criteria for Rollover Protective Structures (ROPS) for Construction, Earthmoving, Forestry, and Mining Machines;*

(c) *ISO Standard 3471: 1994, Earth-moving Machinery—Rollover Protective Structures—Laboratory Tests and Performance Requirements.*

Section 4.4(2) of the *Regulation* states, in part, that:

(2) When this Regulation requires a person to comply with

(a) a publication, code or standard of the Board or another agency, the person may, as an alternative, comply with another publication, code or standard acceptable to the Board..

Purpose of guideline

Section 16.23 of the *Regulation* requires rollover protective structures ("ROPS") to meet one of the applicable standards listed in this section. Section 4.4(2)(a) of the *Regulation* permits WorkSafeBC to accept alternative standards. For the standards cited in section 16.23 for agricultural, construction, earthmoving, forestry, industrial, and mining machines, this guideline lists alternative standards acceptable to WorkSafeBC.

Acceptable alternate standards for agricultural tractors

Where ROPS are required on agricultural tractors, WorkSafeBC accepts the following alternative standards in addition to those in section 16.23(a):

- *Canadian Standards Association Standard B352-M1980, Rollover Protective Structures (ROPS) for Agricultural, Construction, Earthmoving, Forestry, Industrial, and Mining Machines*
- *SAE Standard J2194, December 1987, Rollover Protective Structures (ROPS) for Wheeled Agricultural Tractors*
- *SAE Standard J2194, April 2009, Rollover Protective Structures (ROPS) for Wheeled Agricultural Tractors*
- *SAE Standard J1194, May 1989, Rollover Protective Structures (ROPS) for Wheeled Agricultural Tractors*
- *SAE Standard J1194, April 2009, Rollover Protective Structures (ROPS) for Wheeled Agricultural Tractors*
- *SAE Standard S383, March 1977, Rollover Protective Structures (ROPS) for Wheeled Agricultural Tractors*

Other acceptable alternate standards

WorkSafeBC accepts the following alternate ROPS standards for the standards required by sections 16.23(a)(ii), 16.23(b), and 16.23(c).

- *ISO 3471:2008, Earth-moving machinery -- Roll-over protective structures -- Laboratory tests and performance requirements*
- *ISO 8082:2003, Self-propelled machinery for forestry -- Laboratory tests and performance requirements for roll-over protective structures*
- *ISO 8082-1:2009, Self-propelled machinery for forestry -- Laboratory tests and performance requirements for roll-over protective structures -- Part 1: General machines*
- *ISO 8082-2:2011, Self-propelled machinery for forestry -- Laboratory tests and performance requirements for roll-over protective structures -- Part 2: Machines having a rotating platform with a cab and boom on the platform*

One-of-a-kind machines

Clause 6 of *CSA Standard B352-M80, Rollover Protective Structures (ROPS) for Agricultural, Construction, Earthmoving, Forestry, Industrial, and Mining Machines* is a standard acceptable to WorkSafeBC under section 4.4(2) for the design of a ROPS for a one-of-a-kind machine.

G16.24 ROPS certification - Damaged sweep arms

Issued August 1999; Preliminary Revision February 25, 2013

Regulatory excerpt

Section 16.24 of the *OHS Regulation* ("Regulation") states:

(1) A ROPS must be certified by the ROPS manufacturer or a professional engineer as meeting a standard specified in section 16.23.

(2) Any addition, modification, welding or cutting on a ROPS must be done in accordance with the instructions of and be recertified by the ROPS manufacturer or a professional engineer.

Purpose of guideline

The purpose of this guideline is to explain when sweep arms on skidders need to be replaced or recertified.

Sweep arms

The sweep arms on a rubber-tired skidder are intended to deflect material away from in front of the canopy. Sweep arms occasionally get damaged (bent or deformed) through contact with large trees or logs.

Prevention Policy [R16.24-1](#) requires that where the sweep arm is an integral part of the ROPS on a skidder, the ROPS must be replaced or recertified when structural damage to the sweep arm is observed. Where the sweep arm is not an integral part of the ROPS, damage to the sweep arm alone does not invalidate the ROPS certification.

To determine if the sweep arms are an integral part of the ROPS the skidder manufacturer can be contacted. The manufacturer may be able to provide information on the repair or replacement of the sweep arms and ROPS.

G16.28 Guarding moving parts on mobile equipment

Issued August 1999; Revised December 21, 2009

Regulatory excerpt

Section 16.28 of the *OHS Regulation ("Regulation")* states:

Exposed moving parts on mobile equipment which are a hazard to the operator or to other workers must be guarded according to a standard acceptable to the Board, and if a part must be exposed for proper function it must be guarded as much as is practicable consistent with the intended function of the component.

Purpose of guideline This guideline provides information for guarding moving parts of mobile equipment to an acceptable standard under section 16.28 of the *Regulation*.

Application Section 16.28 is intended to apply to moving parts such as engine cooling fans and accessory drive belts, and hazards from any specialized equipment installed. It also applies to power train components such as drive shafts, tracks, sprockets, and like components beneath the vehicle where necessary to prevent the operator contacting them while in the operator's position.

Section 16.28 applies to straddle lumber carriers that have vertical chain drives on the outer sides of the wheel suspensions. These chains and sprockets are usually provided with guards by the manufacturer, but are frequently found unguarded when in use. Effective guarding of these chains and sprockets is required.

Acceptable standard for safeguarding moving parts Where exposed moving parts pose a hazard to the operator or other workers, section 16.28 requires that they be guarded according to a standard acceptable to WorkSafeBC.

In order to determine appropriate guarding for exposed parts, an employer should undertake a risk assessment. WorkSafeBC considers guarding developed as a result of a risk assessment and risk reduction process consistent with the principles of Part 5 of *CSA Z432 - 2004 Safeguarding of machinery* to meet a standard acceptable to WorkSafeBC.

Performing a risk assessment for safeguarding moving parts The aim of the risk assessment is to evaluate the potential for injury posed by the exposed moving part in order to identify, apply, and monitor appropriate risk reduction methods. In applying the principles of risk assessment contained in *CSA Z432*, attention should be paid to the hierarchy of safeguarding controls. Where practicable, means which eliminate the hazard of exposed moving parts should be considered first.

The WorkSafeBC publication [Safeguarding Machinery and Equipment](#) (Chapter 2) includes relevant information pertaining to the risk assessment for safeguarding purposes, as well as a Machine Risk Assessment Survey (Appendix 1 of the publication) that may be a useful reference when performing a risk assessment for safeguarding moving parts of mobile equipment. This publication can be downloaded from the WorkSafeBC website.

In some instances, applying the risk assessment approach laid out in the standard will lead to adopting administrative procedures instead of a physical guard. This is acceptable where, for example, a guard is not practicable or would interfere with the function of the moving part.

Effective risk reduction performed under section 16.28 will also include compliance with other sections of the *Regulation*. In particular, [section 4.3](#) of the *Regulation* outlines requirements for safe machinery and equipment. This includes the requirement to ensure that equipment be capable of safely performing the functions for which it is used. [Part 12](#) of the *Regulation* outlines general requirements for guarding of equipment.

G16.50 All terrain vehicles - Modifications

Issued August 1999; Editorial Revision January 31, 2013

Regulatory excerpt

Section 16.50 of the *OHS Regulation ("Regulation")* states:

A modification to an ATV which may affect its structural integrity or stability must be certified by a professional engineer.

Purpose of guideline

The purpose of this guideline is to explain the intent of section 16.50 of the *Regulation* and to give examples of modifications to all-terrain vehicles (ATVs) that require certification by a professional engineer.

Modifications to ATVs

Some modifications affecting structural integrity that fall within the intent of this section include the following:

- Modifications to the frame, suspension, or steering
- Critical components replaced with lower quality items
- Poor repair practices, for example, bad welding or welding non-weldable parts
- Increasing horsepower or torque

Some modifications affecting stability that fall within the intent of this section include the following:

- Changing the centre of gravity
- Changing the suspension
- Changing the load distribution and size
- Changing the wheelbase
- Changing the horsepower or gearing
- Installing tanks for carrying liquids without adequate internal baffles in the tanks

GENERAL REQUIREMENTS

G16.3, 16.19, 16.20 (and 4.3(2)) [Welding repair of forks on lift trucks](#) [Retired]

G16.3 (and 4.3(3)) [Tag out procedure for identifying unsafe mobile equipment](#)

G16.3 (and 4.3(4)) [Fuel tank filler and vent outlet locations](#)

G16.4(1)(c) [Operating equipment with air brakes](#)

G16.7(j)-1 [Lift truck operator training](#)

G16.7(j)-2 [Lift truck operator training - Alternative standards](#)

G16.13 [Braking requirements - Mobile equipment - Alternate standard](#)

G16.13(3) [Braking requirements - Mobile equipment](#)

G16.17 [Alternate means of escape - Purpose-built window breaking device](#)

G16.18 [Acceptable standards for operating controls](#)

G16.19 [Load handling attachments - Forklifts](#)

GUARDS

G16.21 [Protective structures for hydraulic excavators pioneering on steep side hills](#)

G16.21(2)-1 [Operator protective structure standards for agricultural tractors](#)

G16.21(2)-2 [Protective structures - Acceptable alternate standards](#)

G16.22 [Rollover protective structures \(ROPS\)](#)

G16.22(2) [Use of ROPS on agricultural tractors when operated on steep slopes or narrow roadways](#) [Retired]

G16.23 [ROPS standards - acceptable alternate standards](#)

G16.24 [ROPS certification - damaged sweep arms](#)

G16.28 [Guarding moving parts](#)

SEAT REQUIREMENTS AND RIDER RESTRICTIONS

G16.31(4) [Rider restriction](#)

SEAT BELTS

G16.33 [Use of seat belts on forklifts](#)

OPERATING REQUIREMENTS

G16.43(3) [Pedestrian and equipment traffic](#)

G16.44(2) [Acceptable standard for load restraint](#)

ALL-TERRAIN VEHICLES

G16.50 [All terrain vehicles - Modifications](#)