



Investigation into the safety related aspects of coast control on pedestrian operated industrial trucks

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Investigation into the safety related aspects of coast control on pedestrian operated industrial trucks

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This report lists the truck types currently using coast control, the types of loads they commonly carry and where they are used. It also identifies current recommended and actual operating procedures, floor conditions, safeguards employed (e.g. rules, interlocks), coast distances and accident data.

It compares the findings with the Essential Health and Safety Requirements (EHSR's) of the Safety of Machinery Directive (98/37/EC).

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Executive Summary

A number of sites were visited, principally in the USA, to study Coast Control in operation. Coast Control is used to enhance the pick rate in high throughput warehouses where there is a pick rate of around 250 items per hour per operator.

Coast Control is a means whereby powered pallet trucks, either end controlled or centre controlled types, can roll to a stop when the steering tiller is released instead of the brakes being automatically applied. The brakes can be applied in the upright tiller position by moving the tiller against a spring-loaded stop. In the USA all the trucks seen had mechanical brakes with a linkage between them and the steering tiller.

In the USA, coast control is considered to provide a safe means of pedestrian order picking when the instructions in ASME (American Society of Mechanical Engineers) B56.1 and those in the truck manufacturer's instructions are followed. However the current truck designs in the USA do not prevent exposure to some risks which is contrary to the requirements of the Machinery Directive 98/37/EC. The risks identified are the ability to ride on the truck at high speed with Coast Control engaged and the possibility to step off the front of a truck when Coast Control is engaged.

There is a system similar to Coast Control currently available in Europe whereby when the travel control is released the truck brakes are applied after a short time delay. The time delay is long enough that in the picking operation the truck stops just before the brake is applied. This minimises the risk of load shedding. When the operator rides the truck the brakes are applied immediately the control tiller is released eliminating the risks mentioned above.

1. Types of industrial trucks fitted with Coast Control

The truck types are defined in ISO 5053:1987 clause 3.1.3.2.1 as follows.

3.1.3.2.1 pallet truck: pedestrian or rider-controlled non-stacking lift truck fitted with fork arms.

This standard is now very outdated (is currently undergoing revision) and other terms to describe the types of truck that have Coast Control fitted have come into popular use. These are “pedestrian controlled pallet transporter” and “low level order picker”. In the USA they are also referred to as end controlled and centre controlled trucks. The first, figure 1, may be fitted with a stand-on platform for faster travel over longer distances but is still classed as a pedestrian controlled truck. The platform is fitted at the control end of the truck and the usual European design can be folded away when not required. The second, figure 2, has a stand-on control position within the wheelbase of the truck between the fork back rest and power pack. In the USA the end controlled trucks either do not have provision for the operator to stand on the truck or there is a fixed platform on the truck, figure 3. In all cases the truck lift height is only sufficient to lift the load, usually a pallet, clear of the ground (nominally 250mm) for transportation purposes. The fork length varies to suit either a single pallet or two pallets.



Figure 1 (End controlled)



Figure 2 (Centre controlled)



Figure 3: Pedestrian/stand-on pallet transporter (USA Style – fixed end platform)

2. Description of Coast Control and its mechanics

Coast Control is a system whereby when the speed/direction control is released, typically a rotatable device, e.g. twistgrip or butterfly, the power to the drive motor is cut off but the

brakes are not automatically applied. Thus the truck coasts to a stop and no parking brake is applied.

Coast control is a manually selected function and is engaged by the truck operator with no need to involve tools or specialist engineers. It works by the operator engaging a spring loaded mechanical stop device at the base of the control tiller. This prevents the control tiller (tongue) fully returning to the upright rest position at which point, normally, the brakes would be automatically applied.

The detail of the method of preventing the full return of the tiller to the upright, braked, position varies from manufacturer to manufacturer but is not critical to this report. With the mechanical stop engaged, the operator can override the stop and push/pull the control tiller (tongue) into the upright braking position against the action of the spring if and when braking is required.

Service braking or emergency braking by fully lowering the control tiller (tongue) is unaffected.

On purely pedestrian controlled trucks, as opposed to pedestrian/stand-on trucks, the travel speed of the truck with or without Coast Control engaged is limited to approximately 6 km/h (3.5 mph). The operator walks alongside the truck when using Coast Control with the tiller (tongue) in its almost vertical position. See section 5.

On pedestrian/stand-on trucks, see figure 3, typically there is a three-position keyswitch, see figure 4. Position 0 is off, position 1 allows selection of high (i.e. ride-on) speed, (sometimes called rabbit or hare speed) and position 2 limits the truck speed to walking speed, (sometimes called turtle or tortoise speed). In order to obtain high speed after selecting position 1, the operator must press and hold an additional button located on the grab rail (positioned behind and above the motor housing and in front of the battery compartment) see figure 5.

Coast Control is independent of speed selection. When the operator is riding on the truck with coast control engaged, high or low speed can be used but there will be no automatic braking should the operator fall off or dismount at speed. Whilst on the truck, with Coast Control engaged, the operator can pull/push the tiller fully up or down into the braking positions so normal service braking functions are maintained but the parking brake will not be applied automatically when the operator dismounts.

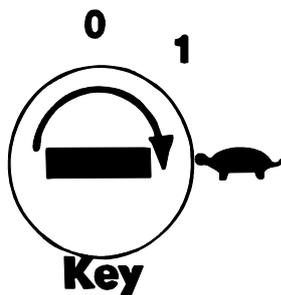


Figure 4: Showing 3 position switch on pedestrian/stand-on trucks



Figure 5: Showing grab rail and rabbit speed selector buttons on pedestrian/stand-on trucks

On low level order pickers, centre controlled trucks, the truck will only travel at high speed when the footswitch on the floor of the operator's compartment is pressed. Thus when

Coast Control is selected and the operator is off the truck it can only travel at low speed. However even with Coast Control selected, when the operator is on the truck, high speed is available but there will be no automatic braking should the operator fall off or dismount from the truck while it is moving. Whilst on the truck, with Coast Control selected, the operator can pull/push the tiller fully up or down into the braking positions.

The truck designs specifically permit ergonomic operation from alongside the truck giving easy access to the necessary controls, e.g. speed and audible warning. In some cases the normal controls can be used and in others there are speed controls built into the side of the tiller (tongue) guard. One manufacturer's truck has a button and trigger grip built into either side of the head of the tiller. When using this control the truck will only travel at a low single speed and only in the direction where the forks are trailing.

3 Types of brakes fitted to trucks with Coast Control

In the USA all the trucks studied had mechanically operated internally expanding drum brakes. These brakes are released by a mechanical linkage connected to the tiller and are spring applied when the tiller is in the fully up or fully down positions. This type of brake is gradually reducing in use in the USA and is tending to follow the European practice of electrically operated brakes. This latter type of brake is off when electrical power is supplied to it but automatically engages under spring pressure when the power supply is cut off.

4 Operating conditions

4.1 Aisle width

The picking aisle width is approximately 3.5 metres allowing two or more trucks to operate in the aisle. See figure 6. It is also wide enough to enable reach trucks to load full pallets into the upper racks and to lower pallets down to ground level for the picking operation to be carried out. Often there is a one way system so that the trucks are all travelling in the same direction.



Figure 6: View of low level order picking aisle

4.2 Loads carried

In all cases seen the load carrier was a pallet carried on the forks of the truck. The loads were mainly packages with sizes ranging from about 0.5 m x 0.5 m x 0.5 m down to individual items such as a large cling film or a packet of felt tip pens. The operator has to exercise considerable skill in placing the loads on the pallet in order to build up the load with a profile that is within the pallet plan dimensions and delicate loads are not damaged by less delicate ones. During the pick the load is unconstrained but when the order is complete the operator manually wraps it with cling film before taking it to the dispatch area. A large roll of cling film is carried on the truck. Roll cages were not favoured because when empty they take up more storage area at the delivery point than a stack of pallets.

4.3 Picking height

Order picking is done predominately from pallets at ground level. In some cases the second level racking is low enough to enable some lighter loads to be picked from it. This is relatively rare.

4.4 Floor surfaces and gradients

Warehouses varying in size from 18 000 to 120 000 m² were visited. The floors were smooth without noticeable joints between the slabs. Also housekeeping was good with no debris on the floor. A few sites did have gradients but none in the area where Coast Control needed to be used. The operators were instructed not to use Coast Control if they had a need to go on the gradient.

4.5 Operating speeds

In the actual picking area whilst going between the pallet locations the speed is low. Estimated speed would be 4 km/h maximum, not even a fast walking speed. However when there is a relatively long distance between the pallet locations the operator usually rides the truck and uses the hold to run high speed facility. In this case the operator initially slows the truck down by plug braking, dismounts the truck and lets it coast into position. See section 4.6. There is no definition of “relatively long distance but imagine it as anything greater than about 10 m. This approximates to more than two pallet bays up to the distance between the end of the pick to the dispatch bay or where the picking list is issued. This can be 50 m or more.

4.6 Coasting distances

In the actual picking operation there is no benefit in allowing the truck to coast more than a specific amount. If this is exceeded then the operator has to walk an extra distance back to the truck with or without the picked load. In practice the operator judges when to release the speed/direction control such that the truck stops at a point where the operator is mid-way between the speed/direction controller and the place on the pallet where the load is to be placed. Typically this distance is 1 to 1.2 m. Thus the operator only walks 1½ times the distance between the speed/direction control and the load placing position rather than 2 times if Coast Control was not used. Over a working day this accumulates to a considerable reduction in walking distance and time.

4.7 Operator training and other factors

The need for fast order picking is essentially a large company requirement. In all places visited training was given to good standards, usually following the USA OSHA guidance, and the operators were licensed.

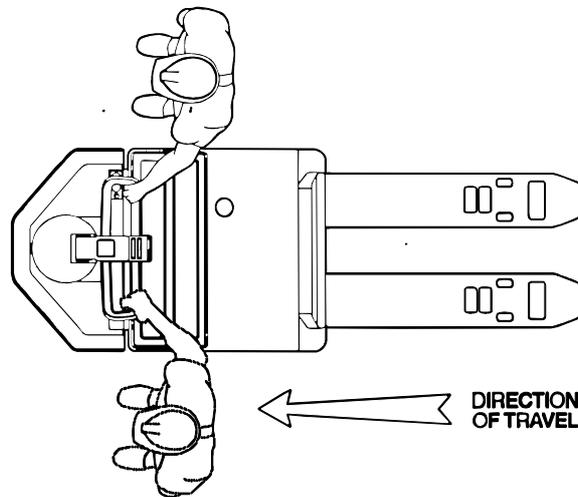
The pay structure is typically a basic wage with bonuses for speed of pick, accuracy of the pick and avoidance of product, warehouse and truck damage. In the extreme the operator could lose his job for not keeping up to the required standard. This is an incentive for working accurately and safely.

The job of picking is very physical and most of the operators seen were young 20 – 30. Some companies even arranged muscle warming exercises before the start of the shift to minimise injuries due to body movements. Some offered body belts if the operator wished to use one.

5 Manufacturer's instructions on the use of Coast Control

The manufacturer's instruction very largely follows the guidance given in ASME B56.1, see sections 12.1 and 12.2. There are specific instructions given on how to select Coast Control on the subject truck. The instructions also duplicate the warning labels put on the truck itself. See section 6.

The diagram and text below is broadly typical of instructions on the safe use of Coast Control.



“When items are located close to each other, you can pick items faster by using the coast controls. The coast selector is located at the base of the steering arm and allows the operator to move the truck forward while positioned at the side of the truck. When walking alongside the truck, it is important that the operator is in the proper position. The operator must be off to the left or right side and travelling in the forward (power unit first) direction. Use the left or right hand to rotate the control handle twist grip. Be sure the coast selector is in the correct operating position. Refer to coast selector in the operating controls section of this booklet.”

6 Examples of warning labels related to the use of Coast Control

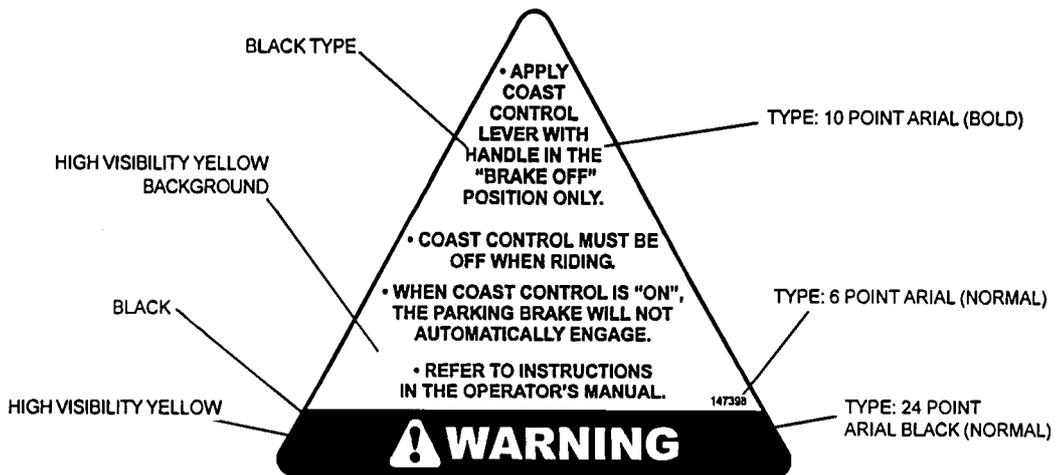
The examples below are typical of the warnings fitted to trucks with Coast Control.



Use the (optional) order picking control only when you are in the pedestrian position and the turtle speed is engaged. Use these controls only in an open area to move the truck along the pick face. Don't use these controls to initiate steering motions. Don't use these controls where they can hit an obstacle.



WARNING: When coast control is set the brake is not automatically applied when the control handle is released



7 Summary of user interviews

Coast Control is only a benefit in high throughput warehousing operations where there is a need to quickly pick a load for an individual destination. In large operations management is usually more aware of its responsibilities and has the necessary infrastructure to apply them.

Those people interviewed expressed the following points:

- Commitment to operator training
- Risks are reduced by monitoring of operator's performance
- Coast Control increases productivity
- Coast Control reduces the risk of load damage
- Coast Control reduces operator fatigue

8 Sales information related to Coast Control

The manufacturers include very little sales information concerning Coast Control in their brochures. Probably this is because Coast Control is not a feature unique to a particular manufacturer. Thus most manufacturers state they have it and sometimes illustrate their approach to the type of controls they provide for it. Statements such as the following appear in sales literature.

- Optional coasting capabilities help boost productivity in low-level order-picking operations.
- Coast control with outboard control knobs (optional). (NB: This feature is illustrated in the sales brochure).
- Coast control option. A jog button integrated into the controls lets operators move the truck from one pick to the next – at the touch of a button.
- Coast control with an integrated jog button glides the truck to the next pick.

Approximately 25% of the 20 000 trucks supplied per annum in the USA that could have Coast Control fitted actually do have it fitted.

9 Benefits of coast control

From discussions with users and operators the following benefits apply to trucks using coast control.

- Faster load picking with up to a 15% reduction in time.
- Reduced wear and tear on brakes.
- Reduced risk of load shedding, as the truck does not come to a sudden stop. See section 4.2
- Reduced risk of repetitive strain injury, RSI, because the operator does not have to pull the tiller down into the unbraked position every time the truck needs to be moved. In fact no vertical movement of the tiller is necessary to move the truck when Coast Control is selected. Note that there can be at least 100 truck movements per hour in a high throughput operation.
- Reduced walking distances for the operator, particularly with the load being picked.
- An alert, non-fatigued truck operator is a safer truck operator.

- Historically, and possibly still now, some truck operators blocked the control tiller (tongue) from returning to the semi-upright automatic braking position thus eliminating any possibility of brake application for whatever reason, service or emergency braking using the upright position of the tiller. In effect, they create their own coasting facility. The word “control” is deliberately omitted. A truck fitted with a factory designed and installed Coast Control system together with proper user instructions and warning labels is inherently safer than blocking the tiller.

10 Accident statistics

Not one of the seven sites visited reported any accidents related to the use of Coast Control

11 Risk assessment

Some potential risks associated with trucks fitted with Coast Control have been identified. These are listed below together with comments.

- The ability to travel at high speed, rabbit speed, with Coast Control engaged thus eliminating automatic braking should the operator loose contact with or dismount from the truck while travelling.

Comment

In the USA operator training and information in the operator manual is intended to overcome this risk (i.e. trucks should not be operated at high speed with coast control engaged). In Europe, operating trucks at high speed with the coast control engaged is likely to be classed as a foreseeable misuse and under these circumstances would need to be safeguarded against under European law. It would appear reasonably practicable to fit an operator presence sensor to recognise when the operator is on the truck and automatically disengage Coast Control should the operator fall off or dismount from the truck while it is travelling at speed. It is also necessary to provide a means for the walking operator to stop the truck and apply the parking brake in the case of an emergency. Particularly with electrically operated brakes it is not too difficult to do.

- On pedestrian/stand-on trucks the riding operator can step off the front of the truck at any travel speed and if Coast Control is engaged it could hit him should he not step to one side of the truck for one reason or another.

Comment

In the USA operator training and information in the operator manual is intended to overcome this risk. In Europe, stepping off a truck into its path of movement is likely to be classed as foreseeable misuse and under these circumstances would need to be safeguarded against under European law. It would appear reasonably practicable to fit an operator presence sensor to recognise when the operator is on the truck and automatically disengage Coast Control should the operator fall or dismount from the truck while it is travelling. It is also necessary to provide a means for the walking operator to stop the truck and apply the parking brake in the case of an emergency. Particularly with electrically operated brakes this is not too difficult to do.

- The truck could be used on a gradient with Coast Control engaged.

Comment

In the order picking areas, where Coast Control is a benefit, gradients do not occur. Occasionally they exist somewhere on the site but the need for the truck to travel on them is minimal. Coast Control must only be supplied as an option for a truck and never as a standard feature. There is a small residual risk of a used truck with Coast Control being sold on to a user who does not need the feature and could have gradients on site. In the EC this risk is covered by article 3.1 of UWED that requires the employer to: “In selecting the work equipment which he proposes to use, the employer shall pay attention to the specific working conditions and characteristics and to the hazards which exist in the undertaking and/or establishment, in particular at the workplace, for the safety and health of the workers, and/or any additional hazards posed by the work equipment in question.”

12 Existing national guidance/standards related to Coast Control

- 12.1 ASME (American Society of Mechanical Engineers) state in the user section of ASME B56.1 the following:

“5.3.21 When operating a low lift order picker truck with a coasting system feature engaged, the operator shall take the following precautions.

- (a) The coasting system shall be used only on a level surface free of debris.
- (b) The coasting system shall not be used to permit the truck to coast into a cross aisle.
- (c) The coasting system shall not be used in pedestrian walkways.
- (d) Care shall be taken to walk along the side of the truck and not into the path of the coasting truck.

Comment

This is in the User Section of B56.1 but it puts an obligation upon the operator to observe the rules. None of this guidance can be controlled by the truck design.

- 12.2 ASME (American Society of Mechanical Engineers) state in the manufacturer’s section of ASME B56.1 the following:

“7.21.5 The brake shall be applied, and current to the drive motor cut off, whenever the steering tongue is in an approximately vertical position, and the same conditions shall exist whenever the steering tongue is in approximately a horizontal position, or the brake shall be applied, and the current to the drive motor cut off, by release of the device normally used to control travel motion of the truck.

EXCEPTION: Low lift order picker trucks may be provided with a coasting system which cuts off current to the drive motor but does not apply the brake when the travel control device is released. Means to apply the brake, and activate the vehicle’s warning device shall be readily operable while walking alongside of the truck. Speed with this system shall not exceed normal walking speed [approximately 3.5 mph (5.6 km/h)] while the operator is walking the truck. Additionally, a label or symbol shall be affixed to the truck, indicating the truck is equipped with a coasting system.”

Comment

The body of the text only refers to low level order pickers whereas it should also include pedestrian controlled and pedestrian/stand-on pallet transporters.

This requirement does not prevent the truck being operated from an “on-board” position with coast control selected and higher speeds being available without the safety benefit of braking being automatically applied should the operator fall off the truck. See section 2 of this report.

12.3 The State of California by the Barclays California Code of Regulations, Article 25 clause 3650 (p) adopted the following:

“(p) After April 1, 1979, motorized hand and hand/rider trucks shall be designed so that the brakes are applied and the power to drive motor shut off when the operator releases his grip on the control tongue, or the device used to control travel.

EXCEPTION: Vehicles designed for use in order picking operations are exempt from the braking requirements, provided the speed of the vehicle does not exceed 3.5 mph while the operator is walking the vehicle.”

Comment

This requirement does not prevent the truck being operated from an “on-board” position with coast control selected and higher speeds being available without the benefit of braking being automatically applied should the operator fall off the truck. See section 2 of this report.

13 Draft international guidance/standards related to Coast Control

ISO 3691-1 Industrial trucks – Safety requirements and verification – Part 1: Self-propelled industrial trucks other than driverless trucks and variable reach trucks is in the process of being completely updated.

At 26 January 2001 the current draft of ISO 3691-1 is ISO/TC110/SC2/WG2 – N258 dated 26-01-2001. Clause 5.4.2.8 states:

“5.4.2.8 Additional operation of pedestrian controlled truck while along side of the truck

Low lift order picker trucks may be provided with a coasting system which cuts off the current to the drive motor without applying the brake when the travel control is released. Means to apply the brake, and activate the vehicle’s warning device shall be readily accessible to the operator while walking alongside the truck. Speed with this system shall not exceed 6 km/h (walking speed) while the operator is walking the truck. Coasting shall only be possible with fork arms trailing.”

Comment

The body of the text only refers to low level order pickers whereas it should also include pedestrian controlled and pedestrian/stand-on pallet transporters.

It does not specify that Coast Control shall not operate when the operator is on the truck.

It does not specify that Coast Control shall not operate at the same time as high speed, rabbit speed, is available.

It does not specify that the parking brake should be applied when the truck comes to a halt.

14 Discussion of Coast Control in relation to the EHSRs (Essential Health and Safety Requirements) of the Safety of Machinery Directive 98/37/EC

The following clauses of the Safety of Machinery Directive relate either totally or in part to the design and use of Coast Control on pedestrian controlled industrial trucks. The Safety of Machinery Directive text (98/37/EC) is in *Italics*. Comments addressing the requirements are this typeface after the heading “**Comment**”.

1.2 Controls

1.2.1 Safety and reliability of control systems

Control systems must be designed and constructed so that they are safe and reliable, in a way that will prevent a dangerous situation arising. Above all they must be designed and constructed in such a way that:

- *they can withstand the rigours of normal use and external factors,*
- *errors in logic do not lead to dangerous situations.*

Comment

Current practice relies on the operator to ensure that coast control is used only where appropriate and to use it in accordance with truck manufacturer’s instructions.

1.2.2 Control devices

Control devices must be:

- *positioned so that their operation cannot cause additional risk,*

Comment

With Coast Control selected on pedestrian/stand-on trucks the location of the controls gives a risk of the operator stepping off the front of the truck and subsequently being hit by the coasting truck.

1.2.4 Stopping device

Normal stopping

Each machine must be fitted with a control whereby the machine can be brought safely to a complete stop.

Each workstation must be fitted with a control to stop some or all of the moving parts of the machinery, depending on the type of hazard, so that the machinery is rendered safe. The machinery's stop control must have priority over the start controls.

Once the machinery or its dangerous parts have stopped, the energy supply to the actuators concerned must be cut off.

Comment

Trucks with or without Coast Control comply. NOTE: When coast control is selected and the truck has coasted to a halt it can be subsequently moved under power to the next picking point by using the speed/direction control. On trucks without coast control or if coast control is not selected the tiller must be moved downwards in order to permit truck movement.

1.7 Indicators

1.7.0 Information devices

The information needed to control machinery must be unambiguous and easily understood. It must not be excessive to the extent of overloading the operator.

Where the health and safety of exposed persons may be endangered by a fault in the operation of unsupervised machinery, the machinery must be equipped to give an appropriate acoustic or light signal as a warning.

Comment

Trucks with or without Coast Control comply.

1.7.4 Instructions

(a) All machinery must be accompanied by instructions including at least the following:

- *a repeat of the information with which the machinery is marked, except the serial number (see 1.7.3) together with any appropriate additional information to facilitate maintenance (e.g. addresses of the importer, repairers, etc.),*
- *foreseen use of the machinery within the meaning of 1.1.2(c),*
- *workstation(s) likely to be occupied by operators,*
- *instructions for safe:*
 - *putting into service,*
 - *use,*
 - *handling, giving the mass of the machinery and its various parts where they are regularly to be transported separately,*
 - *assembly, dismantling,*
 - *adjustment,*
 - *maintenance (servicing and repair),*
 - *where necessary, training instructions,*
 - *where necessary, the essential characteristics of tools which may be fitted to the machinery.*

Where necessary, the instructions should draw attention to ways in which the machinery should not be used.

Comment

The current requirements in the USA are different to those in the EC and trucks with or without Coast Control comply with the USA requirements. All the necessary information is given for avoidance of problems due to the stringent product liability laws in the USA. Further information would be required to ensure that coast control can be used safely in accordance with EC requirements.

3.3 Controls

3.3.1 Control devices

The driver must be able to actuate all control devices required to operate the machinery from the driving position, except for functions which can be safely activated only by using control devices located away from the driving position. This refers in particular to working positions other than the driving position, for which operators other than the driver are responsible or for which the driver has to leave his driving position in order to carry out the manoeuvre in safety.

Comment

The layout of the controls on the trucks allows the operator to activate them from a safe position but he is not forced to do so.

Where their operation can lead to hazards, notably dangerous movements, the machinery's controls, except for those with preset positions, must return to the neutral position as soon as they are released by the operator.

Comment

With Coast Control engaged powered travel is cut off when the operator releases the controls. Neutral does not mean a braked position.

3.3.2 Starting/moving

Self-propelled machinery with a ride-on driver must be so equipped as to deter unauthorised persons from starting the engine.

Travel movements of self-propelled machinery with a ride-on driver must be possible only if the driver is at the controls.

Comment

There is a key switch on these types of truck and with or without Coast Control powered travel is not available without the operator positively actuating a control.

3.3.3 Travelling function

Without prejudice to the provisions of road traffic regulations, self-propelled machinery and its trailers must meet the requirements for slowing down, stopping, braking and immobilisation so as to ensure safety under all the operating, loading, speed, ground and gradient conditions allowed for by the manufacturer and corresponding to conditions encountered in normal use.

Comment

Even with Coast Control engaged these requirements are met when the truck is used in the conditions allowed for by the manufacturer and described as normal use in the operating instructions and operator training. Immobilisation is provided by the keyswitch.

The driver must be able to slow down and stop self-propelled machinery by means of a main device. Where safety so requires in the event of a failure of the main device, or in the absence of the energy supply to actuate the main device, an emergency device with fully independent and easily accessible controls must be provided for slowing down and stopping.

Comment

Even with Coast Control engaged the operator is able to slow down and stop the truck by a main device, the brake. In the event of brake failure plug braking, reverse power, is available to stop the truck.

Where safety so requires, a parking device must be provided to render stationary machinery immobile. This device may be combined with one of the devices referred to in the second paragraph, provided that it is purely mechanical

Comment

With Coast Control disengaged a parking brake is provided using the main braking device. This does require that the operator de-select Coast Control. However, with coast control engaged no such parking brake is provided to make the truck immobile when it is parked.

3.3.4 Movement of pedestrian-controlled machinery

Movement of pedestrian-controlled self-propelled machinery must be possible only through sustained action on the relevant control by the driver. In particular, it must not be possible for movement to occur while the engine is being started.

The control systems for pedestrian-controlled machinery must be designed to minimise the hazards arising from inadvertent movement of the machine towards the driver. In particular:

Comment

The essence of Coast Control is that the truck can coast to a halt without sustained action from the driver. This movement is not powered but the momentum of a laden truck, 1½ tonne or more, could cause injury should the operator inadvertently get between it and a solid surface. The trucks are intended to be used only on level floors where there is no risk of the truck moving spontaneously.

(a) crushing;

Comment

Due to incorrect operation of a pedestrian/stand-on truck with Coast Control engaged there is a risk of the operator stepping off the front of the truck and getting hit and/or crushed.

(b) injury from rotating tools.

Also, the speed of normal travel of the machine must be compatible with the pace of a driver on foot.

Comment

Trucks with or without Coast Control comply when the operator is walking with the truck.

3.4.1. Uncontrolled movements

When a part of a machine has been stopped, any drift away from the stopping position, for whatever reason other than action at the controls, must be such that it is not a hazard to exposed persons.

Comment

When the truck has stopped with Coast Control engaged whilst there is no brake applied no uncontrolled movement is foreseeable in the specified environmental conditions of use, e.g. level floors and a relatively high rolling resistance.

3.6 Indications

3.6.1 Signs and warnings

Machinery must have means of signalling and/or instruction plates concerning use, adjustment and maintenance, wherever necessary, to ensure the health and safety of exposed persons. They must be chosen, designed and constructed in such a way as to be clearly visible and indelible.

Comment

Trucks with or without Coast Control are covered by existing product standards.

15 Current European approaches towards Coast Control (May 2001)

In deference to the perceived requirements of the Safety of Machinery Directive, 98/37/EC, some manufacturers offer variations of a system similar to Coast Control. This has only been seen on low level order pickers of the centre control type. In both cases described below the trucks are fitted with electrically operated fail-safe brakes.

One type has a button and trigger grip built into each side of the head of the tiller. This control is only operative if the steered wheel is within $\pm 10^\circ$ of the straight-ahead position. When actuated the brake is released and the truck can accelerate to a slow single speed of approximately 5 km/h in the direction of forks trailing. When the control is released the truck coasts to a stop. In the picking operation witnessed the truck only coasted about 750 mm before it stopped. The truck forks only accommodated a single pallet so this distance is appropriate for picking. The brakes operate using a time delay and in the picking situation did not come on until the truck had stopped anyway. In a test the truck was allowed to get up to its full speed, 5 km/h, before the control was released. The brakes applied in approximately 1 000 mm just before the truck had stopped resulting in small jolt - probably not even enough to disturb a loose load. The normal butterfly controls on the tiller only work when the deadmans switch on the floor is pressed. Then the truck can travel at high speed. When the deadmans pedal is released the power is cut off to the motor, the brakes are automatically applied and the truck stops. The tiller movement does not move up and down as on a pedestrian or pedestrian/stand-on truck. Its angle is adjustable in the vertical plane to suit different operators.

A second type has a wheel to control the steering through a totally electronic system. It also has a button on each side of the operator's backrest. When actuated the brake is released, the steering automatically moves to and locks in the straight ahead position and only then does the truck accelerate to a slow single speed of approximately 2 km/h in the direction of forks trailing. When the control is released the brake is gradually applied and the truck stops smoothly after about 200 mm. Because this control is immediately in front of the load on the forks, rather than at the front of the truck, extended coast distance is not necessary. The normal butterfly controls on the tiller only work when the deadmans pedal on the floor is pressed. Then the truck can travel at high speed. When the deadmans pedal is released the power is cut off to the motor, the brakes are automatically applied and the truck stops. The tiller does not move up and down as on a pedestrian or pedestrian/stand-on truck but its angle is adjustable in the vertical plane to suit different operators. Note that on this truck it does not even move to effect steering.

16 Conclusions

If used as intended, in the conditions intended, trucks using coast control appear safe and lead to increased productivity. However there are some risks that may be practical to design out, particularly on trucks fitted with electrically powered automatic brakes as is the usual European practice.

- Automatic braking does not occur should the operator loose contact with or dismount from the truck while travelling with Coast Control selected. See clauses 2 and 11.
- On pedestrian/stand-on trucks, (end controlled, see figures 1 and 3), the riding operator can step off the front of the truck at any travel speed and if Coast Control is engaged it could hit him should he not step to one side of the truck for one reason or another. See clauses 11 and 14.
- The truck could be used on a gradient with Coast Control selected. See clause 11.



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