

	<b>SURFACE VEHICLE RECOMMENDED PRACTICE</b>	<b>SAE</b> <b>J2752 JUN2010</b>
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Personnel Protection - Compact Tool Carriers		

## RATIONALE

Not applicable.

### 1. SCOPE

This SAE Recommended Practice applies to compact tool carriers sometimes called, but not limited to mini-loaders, mini skid-steer loaders or compact utility loaders. Machines having a seated-operator position are excluded from this standard. However, certain attachments for a compact tool carrier may provide a seated-operator position for the operation of the attachment.

#### 1.1 Purpose

This SAE Recommended Practice is intended to provide personnel protection guidelines for compact tool carriers.

This document is intended as a guide towards standard practice, but may be subject to frequent change to keep pace with experience and technical advances. This document provides performance criteria for newly designed compact tool carriers.

### 2. REFERENCES

#### 2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

##### 2.1.1 ISO Publications

Available from American National Standards Institute, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, [www.ansi.org](http://www.ansi.org).

ISO 2867	Earth-moving machinery – Access systems
ISO 3411	Earth-moving machinery – Human physical dimensions of operators and minimum operator space envelope
ISO 3450	Earth-moving machinery – Braking systems of rubber-tyred machines – Systems and performance requirements and test procedures

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ISO 3457	Earth-moving machinery – Guards – Definitions and requirements
ISO 6405-1	Earth-moving machinery – Symbols for operator controls and other displays – Part 1: Common symbols
ISO 6405-2	Earth-moving machinery – Symbols for operator controls and other displays – Part 2: Specific symbols for machines, equipment and accessories
ISO 6682	Earth-moving machinery – Zones of comfort and reach for controls
ISO 6750	Earth-moving machinery – Operator's manual – Content and format
ISO 9244	Earth-moving machinery – Safety signs and hazard pictorials – General principles
ISO 10265	Earth-moving machinery – Crawler machines – Performance requirements and test procedures for braking systems
ISO 10533	Earth-moving machinery – Lift-arm support devices
ISO 10968	Earth-moving machinery – Operator's controls
ISO 12508	Earth-moving machinery – Operator station and maintenance areas – Bluntness of edges
ISO 15817	Earth-moving machinery – Safety requirements for remote operator control
ISO 17063	Earth-moving machinery – Braking systems of pedestrian-controlled machines – Performance requirements and test procedures

## 2.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this SAE Technical Report.

ISO 6165	Earth-moving machinery – Basic types – Identification and terms and definitions
ISO 14397-1	Earth-moving machinery – Loaders and backhoe loaders – Part 1: Calculation of rated operating capacity and test method for verifying calculated tipping load

## 3. DEFINITIONS

### 3.1 COMPACT TOOL CARRIER

A self-propelled crawler or wheeled machine having an operating mass of less than 1500 kg with a rigid frame, having either a walk-behind operator position or standing operator platform at the rear of the machine and having either front-mounted interchangeable equipment or lift arms with an attachment bracket capable of coupling to interchangeable, front-mounted attachments.

### 3.2 EQUIPMENT

A set of components mounted onto the base machine that allows an attachment to perform the primary design function of the machine, e.g., lift arms.

#### 3.2.1 Interchangeable Equipment

Equipment that can be added to and removed from the base machine to change the primary design function of the machine.

### 3.3 ATTACHMENT

An assembly of components that can be mounted onto the base machine or equipment for a specific use.

#### 3.3.1 Load Carrying Attachment

An attachment that during its normal use would contain or support a payload, e.g., bucket, pallet fork, sweeper bucket, grapple fork, etc.

#### 3.3.2 Non-load Carrying Attachment

An attachment that during its normal use would not contain or support a payload, e.g., auger, blade, trencher, mower, breaker, tiller, snow blower, soil conditioner, etc.

### 3.4 EQUIPMENT AND/OR ATTACHMENT BRACKET

A device to facilitate quick interchange of equipment or attachments.

### 3.5 GUARD

A barrier that is intended to prevent inadvertent contact with a potential hazard during normal operation and servicing.

#### 3.5.1 Guarding by Location

A means of preventing inadvertent contact with a hazardous component or with the operator's control(s) by having the component or control(s) outside the reach of a large operator, as described in ISO 3411, when in the operating position as described by the manufacturer.

### 3.6 NORMAL OPERATION

The reasonable use of the compact tool carrier by a trained person using attachments as approved by the compact tool carrier manufacturer.

### 3.7 MAINTENANCE

A service operation performed in accordance with the operator's manual, service manual or machine sign.

### 3.8 OPERATOR POSITION

The location of the operator designated by the compact tool carrier manufacturer.

### 3.9 OPERATOR PLATFORM

The surface provided for a standing, ride-on operator to operate the compact tool carrier.

### 3.10 GROUND-SUPPORTED OPERATOR PLATFORM

An operator platform with a trail wheel(s) or skid surface that pivots about a horizontal axis to allow the trail wheel(s) or skid surface to follow the contour of the ground.

### 3.11 MAXIMUM REACH

The position of the equipment and attachment that results in the maximum horizontal distance between the load center of gravity and the front tipping line of the compact tool carrier

### 3.12 TIPPING LINE

The line about which the loader tips.

### 3.13 OPERATING MASS

The mass of the base machine, with equipment and empty attachment as specified by the manufacturer, and with the operator (75 kg), full fuel tank and all fluid systems (i.e., hydraulic oil, transmission oil, engine oil, engine coolant) at the level specified by the manufacturer

NOTE: The mass of the operator (75 kg) is only included for ride-on machines.

## 4. OPERATION INSTRUCTIONS

- 4.1 General operator instructions, including those listed in 4.2 through 4.6, and maintenance procedures shall be provided by manuals and/or machine signs attached to the compact tool carrier. A durable, weather-resistant storage location for the manual shall be provided on the equipment. ISO 6750 should be used as a guideline in preparing manuals.
- 4.2 Instructions shall be included for general operation, traveling and changing of equipment and/or attachments.
  - 4.2.1 Instructions shall be included for changing, storing and operating the interchangeable equipment and/or attachments. These instructions can be provided in the compact tool carrier operation instructions or in a separate manual.
  - 4.2.2 Instructions shall be included for the effect of changes of motion and of ground conditions such as slopes.
  - 4.2.3 Instructions shall be included for carrying the load or attachment including restrictions related to terrain and speed of travel.
  - 4.2.4 Instructions shall be included for lifting the load.
  - 4.2.5 Instructions shall be included for the proper use and maintenance, if necessary, of the ride-on operator platform, if equipped.
- 4.3 Instructions shall be provided for loading, including the use of loading ramps, and tying down the compact tool carrier for transporting.
- 4.4 Instructions shall be provided for lifting the compact tool carrier as a complete unit.
- 4.5 Instructions shall be provided for proper use of the interchangeable equipment locking system and/or the attachment bracket locking system (coupler), if required.
- 4.6 Instructions shall be provided prohibiting the use of the compact tool carrier for lifting persons with any equipment or attachment (e.g., work platform).

## 5. OPERATION

- 5.1 The operator's controls shall be in accordance with ISO 10968.
- 5.2 Operator's controls shall be identified. Symbols should be in accordance with ISO 6405, Part 1 and Part 2.
- 5.3 The compact tool carrier shall be fitted with a means to prevent unauthorized operation of the machine (e.g., a key switch or a key code).

- 5.4 It shall be possible to lower the equipment and/or attachment with the engine stopped. The means to lower the equipment and/or attachment can be located away from the primary operating controls but shall not require the operator to reach under the raised equipment or attachment to operate, and shall be described in the operating instructions.
- 5.5 Operator's control(s) for travel of the compact tool carrier shall return to neutral upon release causing the travel of the machine to stop.
- 5.6 Operator's control(s) for travel of the compact tool carrier shall be designed to allow the operator to control with one hand while leaving the other hand available for support.
- 5.7 Machine and equipment or attachment movement from the holding position, other than by actuation of the controls by the operator, due to drift or creep (e.g., by internal leakage through the hydraulic components) or when the power supply stops, shall be limited to the extent that it cannot create a risk to exposed persons.
- 5.8 The travel speed shall be in accordance with the following as determined by the configuration of the compact tool carrier:
- 5.8.1 The travel speed of a compact tool carrier with a walk-behind operator position shall not exceed 6 km/h in the forward direction and 4 km/h in the reverse direction and shall be controllable to align with the speed of the operator on foot.
- 5.8.2 The maximum travel speed of a compact tool carrier with a ride-on platform is to be based on factors such as machine configuration, operator station position, machine weight distribution, control design and normal operation as specified by the manufacturer.
- 5.9 A means shall be provided to prevent unintended movement of the machine, equipment or attachment while starting the compact tool carrier.
- 5.10 A means to prevent unintended movement of the equipment and/or attachment with the engine off shall be provided.
- 5.11 Compact tool carriers intended to operate powered attachments shall comply with 5.11.1, 5.11.2, and 5.11.3.
- 5.11.1 For powered attachment operation, a means shall be provided to automatically remove power to the attachment when the operator leaves the compact tool carrier's operator position. Controls that return to their neutral position when the operator releases the control (return-to-neutral control) meet this requirement. Except for return-to-neutral controls, reactivation of the attachment shall only be possible by two or more separate and distinct actions by the operator.
- 5.11.2 For powered attachments normally used when the compact tool carrier is stationary and the attachment provides an alternative operator position, a means may be provided to allow operation of these attachments with the operator not in the compact tool carrier's operator position. Such means shall require an intentional action by the operator prior to leaving the compact tool carrier's operator position.
- 5.11.3 The travel control system shall be disabled or guarded by location during operation of a powered attachment with a seated operator position (e.g., backhoe attachment). The travel controls being located outside the zones of reach as provided in ISO 6682 satisfies the requirement of guarded by location.
- 5.12 Remote operator-controlled compact tool carriers shall also comply with the requirements as specified in ISO 15817.

## 6. OPERATOR PROTECTION

- 6.1 The operator's working space when in the operator position shall not present any sharp, exposed edges or acute angles/corners. Radius of corners and bluntness of edges shall comply with ISO 12508.
- 6.2 A suitable device (e.g., handhold) allowing the operator to support himself during machine travel shall be provided. If the compact tool carrier is equipped with an operator platform, the device shall not restrict or impede the operator's access to and from the platform. The device and the control(s) for travel shall be located so the operator's hand will be within the width of the frame of the compact tool carrier when the operator grasps the control(s) or device.

NOTE: Since the operator of a compact tool carrier is not seated while operating the machine, a roll-over protective structure (ROPS) is not required.

NOTE: A roll-over protective structure (ROPS) is not required on an attachment having its own operating position due to the compact tool carrier being stationary during operation of the attachment.

## 7. CAPACITY RATING

- 7.1 Compact tool carriers shall use the appropriate capacity rating method for the equipment fitted on the compact tool carrier. For compact tool carriers with interchangeable equipment, each different type of equipment shall be rated using the appropriate capacity rating method for that type of equipment.

NOTE: For example, the rated operating capacity for a compact tool carrier with lift arms and bucket shall be in accordance with ISO 14397-1.

- 7.2 The mass of the operator (75 kg) should only be used during the capacity rating test(s) if the mass of the operator is supported only by the machine.

## 8. TIPPING LIMIT

- 8.1 The compact tool carrier and interchangeable equipment, if equipped, but with no attachment, shall meet the following criteria.

- a. The tipping limit with the rear of the compact tool carrier down slope with the equipment at the maximum lifting height shall be 15 degrees or greater as tested per the tipping limit test in Appendix A.

- 8.2 The compact tool carrier and interchangeable equipment/attachment combinations should meet the following criteria as appropriate:

- 8.2.1 Compact tool carrier with load carrying equipment or attachment that is intended to be loaded or unloaded at the maximum lifting height of the equipment should meet the following criteria:

- a. The lateral, forward and rearward tipping limits with the equipment or attachment loaded to the equipment or attachment's maximum capacity, as determined by the manufacturer, while positioned to maintain the load at the maximum lifting height of the equipment shall be 15 degrees or greater as tested per the tipping limit test in Appendix A.

- b. The forward tipping limit with the equipment or attachment loaded to the equipment or attachment's maximum capacity, as determined by the manufacturer, while positioned to maintain the load at maximum reach shall be 15 degrees or greater as tested per the tipping limit test in Appendix A.

8.2.2 Compact tool carrier with non-load carrying equipment or attachment having a manufacturer's recommended working position at or below maximum reach should meet the following criteria:

a. The lateral and forward tipping limits with the equipment or attachment in the least stable position at maximum reach shall be 15 degrees or greater as tested per the tipping limit test in Appendix A.

8.2.3 Compact tool carrier with equipment or attachment that normally are operated at or below maximum reach but may be raised above maximum reach but less than the maximum lifting height of the equipment for short periods of operation (e.g., auger, sod roller, tree spade, etc.) should meet the following:

a. The lateral, forward and rearward tipping limits with the equipment or attachment positioned in the least stable position and fully loaded, if required, at the manufacturer's recommended maximum working height shall be 15 degrees or greater as tested per the tipping limit test in Appendix A.

8.2.4 Compact tool carrier with equipment or attachment that can only be operated while the compact tool carrier is stationary and the equipment (e.g., lift arms) are down (e.g., backhoe attachment) should meet the following:

8.2.4.1 The lateral, forward and rearward tipping limits with the equipment or attachment in the travel position, as specified by the manufacturer, shall be 15 degrees or greater as tested per the tipping limit test in Appendix A.

8.3 Appropriate instructions and warnings for proper operation regarding lifting height and slope limitations shall be provided with the equipment or attachment for those equipment or attachments tested per 8.2.3, 8.2.4 and any equipment or attachment that does not meet the requirements of 8.2.1 or 8.2.2.

## 9. APPROVAL OF INTERCHANGEABLE EQUIPMENT AND ATTACHMENTS

9.1 Normal operation and maintenance of the interchangeable equipment and/or attachment shall be evaluated to determine if any additional safety features are necessary as part of the process of approving the use of interchangeable equipment and/or attachment on a compact tool carrier.

9.2 In addition to the tipping limit requirements of 8.1, 8.2, and 8.3, technical standards related to the interchangeable equipment and/or attachment should be applied, where applicable, as part of the process of approving the use of interchangeable equipment and/or attachment on a compact tool carrier.

9.3 Compact tool carriers shall not be used as a work platform or to lift personnel.

## 10. GUARDING AND SHIELDING

10.1 Guarding shall be provided to prevent access to areas or exposure to parts where a hazard exists to the operator during normal starting and operation of the compact tool carrier.

10.1.1 Guards shall comply with ISO 3457.

10.1.1.1 The machine structure around the operator's area of the compact tool carrier may be considered to be part of the barrier guard for determining safety distances.

10.2 Fluid systems such as batteries, fuel tanks, oil reservoirs and coolant systems should be constructed, located, or sealed to minimize the possibility of spillage when operating the compact tool carrier in accordance with the general operator instructions.

## 11. OPERATOR PLATFORM

11.1 Operator platforms, if provided, shall have:

- a. A durable, slip-resistant surface.
- b. Handholds, steps or other means to facilitate ingress and egress from the compact tool carrier operator platform that comply with ISO 2867.
- c. A standing area with minimum dimensions of 430 mm in width by 315 mm in depth.

11.2 The upward rotation of a ground-supported operator platform shall be limited to provide clearance for the operator between structural components of the base machine and the pivoting platform. Both small and large operator human physical dimensions according to ISO 3411 shall be considered.

11.3 If the compact tool carrier with a walk-behind operator position has a provision to add an operator platform, the platform shall meet the requirements of 11.1 and 11.2 if applicable.

## 12. BRAKING

12.1 Compact tool carriers with wheels and a ride-on operator platform shall comply with ISO 3450.

12.2 Compact tool carriers with tracks and a ride-on operator platform shall comply with ISO 10265.

12.3 Compact tool carriers with a walk-behind operator position shall meet either the requirements in section 12.1 or 12.2 or shall comply with ISO 17063. The rate of creep without the use of hydraulic power shall not exceed 2 m/min.

## 13. MACHINE SAFETY LABELS

13.1 Machine safety labels applied to the compact tool carrier and its interchangeable equipment and/or attachments shall be in accordance with ISO 9244.

## 14. FLUID FILL

14.1 Service fill openings on all fluid tanks shall have proper identification for fluid type attached adjacent to the fill opening.

14.2 Any fuel or oil that might leak when the tank is being filled shall be directed away or shielded from engine exhaust parts.

## 15. LIFT ARM SUPPORT DEVICE

15.1 The lift arm support device, if required, shall conform to ISO 10533.

15.2 The operator's and service manuals shall provide instructions on the use of the lift arm support device.