



# **SURFACE VEHICLE RECOMMENDED PRACTICE**

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## Three-Point Hitch (Type A) Backhoe Personnel Protection

## RATIONALE

This document is being revised including the following:

- Removal of various referenced Standards that have been cancelled or where the reference was not valid.
- Addition of various referenced Standards replacing others that have been cancelled.
- Correcting of “revision numbers” of certain referenced Standards to show the most current version.
- Addition of titles for certain referenced Standards where titles were previously omitted.
- Addition of reference to ASAE standard for agricultural tractors.
- Correction of typographical errors.
- Use of more commonly used terms or requirements.

## 1. SCOPE

This SAE Recommended Practice applies to three-point hitch (Type A) backhoes as defined in SAE J326 when mounted on either an agricultural tractor as defined in ANSI/ASAE S390 or other off-road self-propelled work machine as defined in SAE J1116. This criterion is intended for the manufacturer of the backhoe, whether or not the backhoe is manufactured or marketed by the same company that manufactures or markets the propelling machine.

## 1.1 Purpose

This SAE Recommended Practice establishes minimum performance criteria for operator and bystander protection from machinery hazards for three-point hitch (Type A) general purpose backhoes which are within the scope of this document.

## 2. REFERENCES

## 2.1 Applicable Publications

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

### 2.1.1 SAE Publications

Available from SAE ~~at~~ 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA). [www.sae.org](http://www.sae.org).

SAE J49 Specifications Definitions - Hydraulic Backhoes

SAE J115 Safety Signs

SAE J185 Access Systems for Off-Road Machines

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SAE J326 Nomenclature - Hydraulic Backhoes

SAE J517 Hydraulic Hose

SAE J899 Operator's Seat Dimensions for Off-Road Self-Propelled Work Machines

SAE J920 Technical Publications for Off-Road Work Machines

SAE J1116 Categories of Off-Road Self-Propelled Work Machines

#### 2.1.2 ISO Publications

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

ISO 3411:2007 Earth-moving machinery - Human physical dimensions of operators and minimum operator space envelope

ISO 3457 Earth-moving machinery - Guards - Definitions and requirements

ISO 5353 Earth-moving machinery, and tractors and machinery for agriculture and forestry - Seat index point

#### 2.1.3 ASABE Publications

Available from the American Society of Agricultural and Biological Engineers, 2950 Niles Road, St. Joseph, MI 49085-9659, Tel: 269-428-6324, [www.asabe.org](http://www.asabe.org).

ASAE S203.14 Front and Rear Power Take-Off for Agricultural Tractors

ASAE S217.12 Three-Point Free-Link Hitch Attachment of Implements to Agricultural Wheel Tractors

ASAE S277.2 Mounting Brackets and Socket for Warning Lamp and Slow-Moving Vehicle (SMV) Identification Emblem.

ASAE S278.7 Agricultural wheeled tractors and implements - Three-point hitch couplers - Part 1: U-frame coupler

ASAE S390 Definitions and Classifications of Agricultural Field Equipment

### 3. DEFINITIONS

#### 3.1 Backhoe Components

See SAE J326.

#### 3.2 Functional Component

A working mechanism of an attachment or implement designed to perform a specific task such as the bucket of a backhoe.

#### 3.3 Inadvertent Contact

Contact between a person and machinery hazard, or other type of hazard, resulting from the person's unplanned action during normal operation or servicing.

### 3.4 Label

A durable label used as a safety sign or for instruction or identification and that shall meet or exceed the requirements of 4.3 of this document.

### 3.5 Machinery Hazard

A source of potential injury created by machinery parts which can cause serious injury upon contact or by entanglement of personal apparel. This includes, but is not limited to, pinch points of power driven gears, run-on points of belts and chains, and projections on rotating parts.

### 3.6 Normal Operating Position

The position specified by the manufacturer in which the operator is able to control the backhoe operations. The operator is sitting on the backhoe seat with hands on the backhoe control levers and feet on areas provided for foot placement.

### 3.7 Power Take Off (PTO)

An external shaft on the rear of a propelling machine to provide rotational power to implements. (ASAE S203.14)

### 3.8 Propelling Machine

An agricultural tractor or other off-road self-propelled work machine.

### 3.9 Shield (Or Guard)

A protective device, alone or combined with other parts of the machine, designed and fitted to minimize the possibility of contact with a machinery hazard.

## 4. GENERAL REQUIREMENTS

### 4.1 Guarding and Shielding

4.1.1 Guarding and shielding shall be provided to protect against inadvertent contact with machinery hazards during normal mounting, starting, operating, or dismounting of the equipment.

4.1.2 The following are some potential hazard areas:

1. Possible pinch points between moving components and the operator.

2. Implement or pump input drive line assembly.

4.1.3 Shields shall remain functional under the forces that could be applied by a 120 kg (260 lb) individual leaning on, falling against or stepping on them. This applies only to those forces that could be expected in normal machine operation and maintenance.

4.1.4 Equipment with access doors and shields which can be opened or removed while components continue to rotate more than 7 s after the power is disengaged, shall have:

a. Visible or audible indication of rotation and,

b. A suitable safety sign per SAE J115

4.1.5 Access doors, guards, and shields, which need to be opened for normal servicing, shall be easily opened and closed, but shall not be readily detached from the machine.

4.1.6 Safety signs per 4.3.2 shall be affixed to the backhoe in a prominent location stating that the backhoe shall not be operated without removable shield(s) in place.

## 4.2 Controls

### 4.2.1 Control Functional Requirements

On machines designed after the publication of this document, the boom control shall have four positions as follows:

Position A	Moving towards the operator from neutral shall raise the boom.
Position B	Neutral shall hold the boom's vertical position blocking both ports of the boom cylinder valve.
Position C	Moving the control away from the operator shall cause the boom to lower.
Position D	Moving the control further away from the operator beyond Position "C" shall enter a "float" position, or some other means shall be provided so that pressure is relieved from the end of the boom cylinder which forces the boom down. The valve control shall return automatically from Position "D" to neutral when released.

### 4.2.2 Control Identification

The controls furnished with the backhoe, and their direction of motion for stopping, starting, speed control and all operating functions shall be identified by a label per 4.3.3.

## 4.3 Labels and Safety Signs

### 4.3.1 Machine Identification

The backhoe shall be provided with identification per 4.3.4 or 4.3.5 giving model number, serial number and the name and address of either the U.S. or Canadian source of replacement parts and services.

### 4.3.2 Safety Signs

Safety signs shall conform to all requirements of SAE J115.

### 4.3.3 Labels

Labels shall meet the durability requirements of SAE J115.

#### 4.3.3.1 Cast Labels

Embossed, indented, cast or molded metal labels shall be considered sufficient to meet the requirements of this section.

### 4.3.4 Metal Plates

Metal plates over 0.48 mm (0.019 in) thick with embossed or etched lettering and fastened with rivets or equivalent fastening means shall be considered sufficient to meet the requirements of this section.

## 4.4 Operation, Service and Maintenance Instructions

### 4.4.1 General Requirements

Specific written instructions shall be provided with the equipment explaining proper operation of the machine plus proper operational, service and maintenance procedures to avoid potential hazards. (See also SAE J920.)

The operators manual shall also advise that: "In addition to the design and configuration of equipment, hazard control and accident prevention are dependent upon the awareness, concern, prudence, and proper training of personnel involved in the operation, transport, maintenance, and storage of equipment."

#### 4.4.1.1 Written hazard avoidance instructions shall identify the need for personal protective equipment such as, but not limited to, protection for eyes, ears, feet, hands and head.

4.4.1.2 The operator's manual shall contain instructions so that a person has adequate information to prepare the backhoe for operation, adjust, start, operate, transport, stop, park and unhitch the backhoe.

4.4.1.3 The operator's manual shall include backhoe specifications per SAE J49.

#### 4.4.2 Hydraulic Warnings

The operator's, service and maintenance manuals shall contain:

- A warning that hydraulic fluid escaping under pressure can have sufficient force to penetrate skin and do serious damage, and that if fluid is injected into the skin, it can result in gangrene if the fluid is not surgically removed within a few hours by a doctor familiar with this form of injury.
- A warning to keep body and hands away from pin holes or nozzles which eject hydraulic fluid under high pressure and to use paper or cardboard, not hands, to search for leaks.
- A warning to make sure all hydraulic fluid connections are tight and all hydraulic hoses and lines are in good condition before operating.
- Instructions on how to relieve all pressure in the hydraulic system before disconnecting lines or servicing system.

### 5. MACHINE REQUIREMENTS

#### 5.1 Hydraulic Components

5.1.1 Hydraulic hose assemblies furnished with the backhoe, subjected to pressures above 1725 kPa (250 psi) shall meet the requirements of SAE J517.

5.1.2 Pressurized hoses, hydraulic lines and other hydraulic components furnished with the backhoe shall be guarded per the requirements in ISO 3457

#### 5.2 Access System

5.2.1 Hand holds and steps shall be provided for mounting and dismounting per SAE J185.

#### 5.3 Stored Energy Devices

Any stored energy device such as, but not limited to, spring loaded mechanisms and pressurized fluid systems such as hydraulic accumulators which can be disconnected, disassembled or freed in such a way as to release energy or material in a hazardous manner, shall have an appropriate safety sign on or near the device. The sign shall include instructions for de-energizing and proper disassembly or include a reference to instructions provided in the operator's manual.

#### 5.4 Attachment Means

Three-point hitch backhoes shall be attached to the propelling machine by one of the following means:

- Use of only the two lower hitch points of the three-point hitch coupler of the propelling machine as defined in ASAE S217.12 or ISO 730. The backhoe shall not be capable of accepting the standard ASABE or ISO upper link.
- Alternatively, if a three-point hitch upper link is required for the mounting the backhoe in addition to the two lower hitch points, the upper link shall be furnished with the backhoe as standard equipment and shall be used in the structural integrity test (Section 6). The upper hitch point on the backhoe shall be so designed that a three-point upper link as provided in ASAE S217.12 or ISO 730 cannot be used.

5.4.1 A means (limiter device) shall be provided with the backhoe to prevent upward movement of the backhoe relative to the tractor which could be hazardous to the operator, and shall meet the requirements of the tests in Section 6.

#### 5.4.2 Crushing Hazard

A DANGER safety sign per 4.3.2 including a pictorial depicting the hazard of an operator being thrust upward into any overhead structure such as a ROPS or cab shall be provided in a prominent location advising of the proper use and adjustment of the limiter device and proper hook-up procedures. It shall also advise that use of backhoes is prohibited on machines where the minimum operator space envelope around the normal operating position is inadequate as defined by ISO 3411. However, since this document is for mobile machine operation and the backhoe use is stationary, the 1050 mm (41 in) minimum head clearance is reduced to 915 mm (36 in) minimum from the seat index point

5.4.3 Information shall be provided on a label on the backhoe and in the operator's manual specifying the recommended hitch category and minimum tractor lift force capacity necessary to lift and support the backhoe in operation and transport.

5.4.4 A safety sign per 4.3.2 shall be provided on the backhoe and a warning in the operator's manual to warn against its use on a three-point "Quick Attaching Coupler". (ASAE S278.7)

5.4.5 A safety sign shall be provided on the backhoe and instructions in the operator's manual advising that front end weight shall be added as needed to provide a minimum of 20% of the total gross weight on the front wheels of the propelling machine with the backhoe in transport position. The operator's manual shall instruct the operator to drive carefully, especially on turns and slopes while transporting.

5.4.6 Instructions shall be provided in the manual that prohibit installing the backhoe with required counterweights on a propelling machine which would exceed the ROPS certification label maximum machine mass.

#### 5.5 Transport Requirements

5.5.1 A means shall be provided to prevent the boom from swinging freely or the bucket from contacting the ground during transport, in the event of any hydraulic component failure. The locking means shall be adequate to resist maximum available hydraulic force without failure.

5.5.2 An SMV identification emblem attaching means per ASAE S277.2 shall be provided on the rear of the backhoe.

#### 5.6 Hydraulic/PTO Compatibility

5.6.1 If the backhoe hydraulic system is operated by the propelling machine power take-off, instructions shall be provided in the operator's manual and on a label per 4.3.3 advising of the maximum allowable PTO speed for this system.

5.6.2 If the backhoe utilizes the propelling machine hydraulic system, a label shall be provided on the backhoe and information in the operator's manual advising of the maximum permissible flow rates and pressure that may be used. Also, the type of hydraulic system that can be accepted or specific system requirement shall be specified.

#### 5.7 Operating Warnings

Information shall be provided on one or more safety signs (See section 4.3.2) on the backhoe and in the operator's manual advising of operating limitations and hazards. Examples of such information include:

- Check the operating area to be dug for any possible overhead or underground lines such as electric, gas, oil, water, etc., and extreme caution must be exercised in these areas where present. Consult local utilities before digging.
- Operate backhoe controls ONLY from the normal operating position.