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SURFACE VEHICLE RECOMMENDED PRACTICE

SAE J1388

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An American National Standard

PERSONNEL PROTECTION - SKID STEER LOADERS

***Foreword*—**This Document has not changed other than to put it into the new SAE Technical Standards Board Format.

***1. Scope*—**This recommended practice is intended to provide personnel protection guidelines for skid steer loaders. This SAE Recommended Practice is intended as a guide towards standard practice, but may be subject to frequent change to keep pace with experience and technical advances, and this should be kept in mind when considering its use. This recommended practice provides performance criteria for newly-manufactured loaders and it is not intended for in-service machines.

2. References

2.1 Applicable Publications—The following publications form a part of the specification to the extent specified herein. Unless otherwise indicated the lastest revision of SAE publications shall apply.

2.1.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J38—Lift Arm Support Device for Loaders
SAE J115—Safety Signs
SAE J153—Operator Precautions
SAE J154—Operator Enclosures Human Factor Design Considerations
SAE J297—Operator Controls on Industrial Equipment
SAE J298—Universal Symbols for Operator Controls on Industrial Equipment
SAE J386—Operator Restraint Systens for Off-Road Work Machines
SAE J674—Safety Glazing Materials - Motor Vehicles
SAE J731—Component Nomenclature - Loader
SAE J732—Specification Definitions—Loaders
SAE J818—Rated Operating Load for Loaders
SAE J898—Control Loactions for Off-Road Machines
SAE J899—Operator's Seat Dimensions for Off-Road Self-Propelled Work Machines
SAE J920—Technical Publications for Off-Road Work Machines
SAE J1040—Performance Criteria for Rollover Protective Structures (ROPS) for Construction, Earthmoving, Forestry, and Mining Machines
SAE J1042—Operator Protection for General Purpose Industrial Machines
SAE J1043—Performance Criteria for FOPS on General Purpose Industrial Machines
SAE J1057—Identification Terminology of Earthmoving Machines

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SAE J1152—Braking Performance—Rubber-Tured Construction Machines
SAE J1164—Labeling of ROPS and FOPS

3. Definitions

3.1 A skid steer loader is a self-propelled machine that is steered by using variation of speed and/or direction of rotation between wheels on opposite sides of the machine on fixed axles. It is designed primarily to do work by attachments or implements fastened to a lift arm or chassis. Normal entry to and exit from the operator compartment is over the front attachment point. The component nomenclature is identified in SAE J731 (October 1977). Specifications are defined in SAE J732 (February 1980). Earth moving machine definition is found in SAE J1057 (June 1981).

3.2 A "guard" or "shield" is a barrier which is intended to prevent inadvertent contact with a potential hazard during operation.

3.3 "Moving machinery part hazard" is a source of potential injury by direct contact or entanglement. This includes, but is not limited to, the projections on rotating parts and the nip points at the acute entry angle of power driven gears, belts, and chains.

3.4 "Nip point" means the pinch point of gears and the run-on point where a belt or chain contacts a sheave, sprocket, or idler.

3.5 "Guarded by location" means a component is guarded during operation, when because of its location, no person can inadvertently come in contact with the potential hazard.

3.6 "Side screens" are barriers which cover the side openings of an operator cab.

3.7 "Normal operation" is the reasonable use of the loader by a trained person using attachments as approved by the loader manufacturer.

3.8 "Field maintenance" is a service performed in accordance with the operator manual, field service manual, or machine sign.

3.9 "Lift arm support device" is a mechanical device used to prevent accidental lowering of the lift arm when the lift arm is required to be held in the elevated position for maintenance, service, or purpose other than loader operation.

4. Operation Instructions—General operator instructions and field maintenance procedures shall be provided by manuals and/or machine signs attached to the loader. Manuals should have SAE J153 (January 1970) and SAE J920 (March 1973) as a guideline.

4.1 Instructions shall be included for loading, traveling, and dumping. Information shall be included regarding the effects of changes of motion and of field conditions such as slope.

4.2 Instructions shall be provided for hauling the loader.

4.3 Instructions shall be given for lifting the loader as a total unit.

4.4 Instructions shall be provided for field maintenance.

5. Operation

5.1 Movement of operator controls shall be in accordance with SAE J297 (April 1980). With the exception of 7.4.1 and 7.6, it is not necessary to have neutral interlocks or steering controls with a secondary motion when passing through neutral.

5.2 Controls should be identified. If symbols are used, they should be in accordance with SAE J298 (May 1973).

5.3 Handholds, steps, or other means to facilitate entry and exit from the loader operation position shall be provided.

5.4 Application of operator seat and controls should be within guidelines established by SAE J898 (April 1980) and SAE J899 (October 1980).

5.5 Load rating shall be in accordance with SAE J818 (June 1977) for wheel loaders. Tipping load is defined by SAE J732 (February 1980).

6. Operator Constraints

6.1 Loaders shall be equipped with Type 1 seat belt systems which meet SAE J386 (April 1980) requirements except that static test force shall be in 4.45 kN (1000 lbf), (Reference 9.5.1.1, SAE J386).

6.2 A means to prevent the lift arm from lowering when the operator is entering or exiting shall be provided.

7. Operator Guards and Shields

7.1 The following shall be shielded or guarded by location.

7.1.1 Nip point of exposed gear, belt, and chain drives.

7.1.2 Outside faces of pulleys, sheaves, sprockets, cooling fans, and gears that rotate when the engine is running with all clutches disengaged.

7.1.3 Rotating parts with projections such as exposed bolts, keys, or set screws.

7.1.4 Revolving shafts, except smooth shaft ends, protruding less than one-half the outside diameter of the shaft.

7.2 Fluid System Guarding

7.2.1 Batteries, fuel tanks, oil reservoirs, and coolant system should be constructed, located, or sealed per guidelines in SAE J1042 (April 1980).

7.3 Guard Design

7.3.1 The guard and its support shall be capable of withstanding the weight of a 120 kg (265 lb) person.

7.3.2 Guards which must be opened for frequent lubrication or inspection, such as required for field maintenance, shall be hinged or otherwise permanently attached and latched.

8. Operator Cab

8.1 Skid steer loaders shall be provided with rollover protective structures (ROPS) with side screens for applications as designated in SAE J1040 (April 1979). Operator cab should follow guidelines provided in SAE J154 (March 1979) except (Reference 3.3) inside cab width should not be less than 600 mm (23.6 in).

8.1.1 The rollover protective structure shall be capable of meeting the requirements of SAE J1040 (April 1979) ROPS and SAE J1043 (April 1980) falling object protective structure (FOPS).

8.1.2 If ROPS or side screens are capable of being removed, a warning sign to reinstall them before operating the loader shall be attached to part of the loader which is not removed. A sign shall also be attached to machine warning against modifying equipment.

8.1.3 Operator cab shall have at least two openings for emergency exit, one of which can be the normal operator entrance.

8.1.4 Glazing material, such as glass or plastic used in cabs, shall be in accordance with SAE J674 (June 1976).

8.1.5 All edges, corners, or other projections that might be contacted by a 95th percentile male operator restrained by a tight seat belt shall comply with SAE J1042 (April 1980).

8.1.6 Labeling of ROPS structure shall comply with SAE J1164 (June 1977).

9. Braking and Parking Requirements

9.1 Loaders shall comply with SAE J1152 (April 1980). Drive systems may be used as a service braking system and brakes need not be directly applied to wheels.

10. Safety Signs

10.1 Safety signs shall be displayed to warn the operator and others during normal operations and servicing of potential hazards.

10.2 Safety signs shall conform to SAE J115 (September 1979).

11. Fire Protection

11.1 Service fill openings on all fluid tanks shall have proper indentification of fluid attached adjacent to the fill opening on a nonremoveable surface.

11.2 Fuel spillage during fill shall drain to avoid contact with hot engine parts and entering operator cab.

12. Lift Arm Support Device

12.1 A lift arm support device, if required, shall conform to load required by SAE J38 (July 1982).

12.2 The operator's manual shall provide instructions on the use of the lift arm support device.

PREPARED BY THE SAE OFF-ROAD MACHINERY TECHNICAL COMMITTEE

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Rationale—

Background

Skid steer loaders were initially developed in the early 1960's for applications requiring an unusually compact, highly maneuverable machine. Development of the concept throughout the years has resulted in a multipurpose machine having numerous market applications. Today, skid steer loaders are a significant machine class in total units sold each year. Skid steer loaders are retailed in significant numbers to each of the following areas: farms agribusiness, general construction, landscaping handling, and other associated uses. The concept has definitely been proven to be useful in the commercial world.

Purpose and Scope

Skid steer loaders have certain design characteristics which depart significantly from other conventional two-wheel or four-wheel drive agricultural, construction and industrial equipment. Skid steer loaders, by virtue of their compactness, short wheel base, independent drive system on each side, entry to the machine and relationship of the operator to machine components are distinct from other equipment. Other standards are based on equipment which does not have the same distinct features of skid steer loaders. The development of other standards for the most part occurred prior to skid steer loader machine development. Existing SAE standards of certain publication date are used in whole or in part whenever possible in SAE J1388. The differences that exist between skid steer loaders and other equipment necessitate a separate standard to satisfy the unique requirements of skid steer loaders without loss of the features that make the skid steer loader valuable to society as a unique machine.

A separate document for skid steer loaders serves to provide a basis for further standardization of related types of attachments necessary to satisfy skid steer loader requirements. A separate document for skid steer loaders also serves as a basis for common understanding within the engineering community and with the public.

There will be an unavoidable time lag between the publication of SAE J1388 guidelines and the manufacture of machines per SAE J1388 guidelines because of time required to evaluate changes, which may involve new design, test, and factory retooling. Therefore, it is intended that these guidelines will only apply to newly manufactured machines after a reasonable time for development and manufacturing implementation following the publication of the guidelines. The guidelines must not interfere with the manufacturer's need to prove by his evaluation procedures that a product change is safe and acceptable to the user.

Machine Definition

A skid steer loader is identified by SAE J731 (October 1977) nomenclature and SAE J732 (February 1980) specification definition as a "front end loader". As described in those documents, it has its own unique configuration. Normal entry to exit from the operator compartment is over the front attachment point. Steering of skid steer loaders is controlled by using variation of speed and/or direction of rotation between wheels on opposite sides of the machine on fixed axles.

Recommended Practice Development

The proposed recommended practice is directed towards those areas which directly affect the operator when maintaining and using the machine. It deals with operator instructions, operation and control of the machine, operator constraints, operator guards and shields, safety instruction, fire hazard protection, and safety devices for maintenance.

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Since a skid steer loader is a mobile machine generally powered by an internal combustion engine, component items or areas such as moving and rotating machine parts have common identity with other existing recommended practices such as SAE J208 (May 1978) or SAE J98 (December 1980). As expected, some of the language and terminology is similar to these other recommended practices.

Certain other standards, which apply to component areas of mobile equipment, such as, SAE J386 (April 1980) Seat Belt; SAE J297 (April 1980) Controls; SAE J298 (May 1973) Symbols; and SAE J1040 (April 1979) ROPS and SAE J1043 (April 1980) FOPS are identified where applicable as outlined in the report. Like other machine types, skid steer loaders as a type, have their own set of requirements that need special consideration. The skid steer loader report provides a composite summary of existing SAE reports and separate distinct needs for a total report covering skid steer loaders. The following sections of this rationale statement deal with specific areas of the report.

The changes are as follows;

3. DEFINITIONS:

The definitions used represent use of existing definitions from other standards and use of unique definitions necessary to describe skid steer loaders and explain certain requirements. Definitions are used to provide uniformity within the document and to avoid unnecessary duplication of description. Existing definitions were used when available and if they were applicable. Where modifications or new definitions were necessary, the objective was to avoid conflicts with similar existing definitions.

3.1 Refer to machine definition section for further identification of unique machine characteristics.

3.2 Definition of a "guard" or "shield" used in the SAE J1388 report is consistent with definitions used in other documents such as SAE J208 (May 1978).

3.3 Definition of moving part hazard used in the report is consistent with the definition provided in SAE J208 (May 1978).

3.4 Definition of "nip point" is consistent with SAE J208 (May 1978).

3.5 Definition of "guarded by location" is consistent with SAE J208 (May 1978).

3.6 Definition of "side screen" is consistent with practice established by manufacturers of skid steer equipment.

3.7 Definition of "normal operation" is consistent with practice established by manufacturers and users of skid steer equipment.

3.8 Definition of "field maintenance" is consistent with service practices established by manufacturers direction through operator manuals, field service manuals, and machine signs.

3.9 Definition of "lift arm support device" is consistent.

4. OPERATOR INSTRUCTIONS:

The intent of the operator instructions section is to provide guidance for developing and applying instruction, procedures, and machine signs using existing standards where available.

4.1, 4.2, 4.3, 4.4

The guidance provided by 4.1, 4.2, 4.3, and 4.4 represent general and unique instructions which shall be part of the information supplied to the user of the skid steer loader.

5. OPERATION:

The intent of this section is to provide a consistent approach to those elements of control and operation of a skid steer loader.

5.1 This section deals with the application of an existing standard, SAE J297 (April 1980) which is referenced as a guide for operator controls with the exception that movement of the operator controls is exempted from a secondary motion and interlock when passing through neutral.

A skid steer loader is generally controlled by two levers or a T-bar which controls the speed and direction of the two independent drivetrains which provide the unique skid steer turning and maneuverability by virtue of rapid bias of one side direction and/or speed versus the other side. This action requires smooth, uniform, noninterrupted motion of levers or T-bar. A secondary motion or interlock would destroy the unique utility of this machine and could create a hazard in some machine uses, since smooth control in turning is vital for machine stability.

5.2, 5.3, 5.4

The intent of 5.2, 5.3, and 5.4 is to provide guidance relative to proper identification of controls and use of control symbols. Also it's pointed out that to facilitate operator entry and exit from operator cab, it may be necessary to provide certain components such as handholds and steps, unless inherently provided for in the structure of the machine. Application of operator seat and controls are recommended to be within the guidelines established by SAE J898 (April 1980) and SAE J899 (October 1980).

5.5 The intent of this section is to identify applicable standards regarding tip load and load rating for skid steer loaders.

6. OPERATOR CONSTRAINTS:

This section deals with requirements of the restraints system provided for the operator when in the operator seat and any provisions for lift arm restraint.

6.1 The seat belt requirements are consistent with current skid steer loader practice and requirements for industrial equipment as defined by SAE J1042 (April 1980).

6.2 The operator is not exposed to motion of the lift arms when entering or exiting the front of the loader when the lift arms are down and the engine is off. Manufacturers have emphasized with instructions and warning this operating procedure of lowering the arms and shutting off the engine when leaving the loader. Manufacturers have considered new systems of devices for added protection of the operator from lift arm motion. It is recognized that proper application of new systems or devices by manufacturers will be the result of evaluation on individual machines such that machine function is not comprised, user acceptance is encouraged, the new system or device and overall safety of the machine is not reduced when applied in all its work areas. Each manufacturer must evaluate whether any proposed system or device is reasonable and safe for that manufacturer's machine.

7. OPERATOR GUARDS AND SHIELDS:

The intent of this section is to provide guidance for all forms of guarding against hazards.

7.1.1, 7.1.2, 7.1.3, 7.1.4

Sections 7.1.1, 7.1.2, 7.1.3, and 7.1.4 are consistent with other existing standards dealing with moving machinery part hazards.

7.2.1 This section specifies that the guidelines developed in SAE J1042 (April 1980) are applicable for performance criteria during rollover.

7.3 This section deals specifically with guard requirements of strength, durability, and continual use.

8. OPERATOR CAB:

8.1 This section specifies the requirements for skid steer loaders to have ROPS protection as designated by SAE J1040 (April 1979) with the addition of side screens. SAE J154 (March 1979) is recommended except for the change in width provision which is specified as a realistic value based on the smallest machines developed by the skid steer industry that have been found to have acceptable usage.

The first skid steer loaders were designed for safe operation with the operator using the seat belt so that he was restrained in a position between the lift arms. With his hands on the steering levers and his feet on the lift pedals there was no exposure of the operator to the lift arm motion.

The first skid steer loaders were designed for indoor applications without need for overhead guards for the operator. As more applications were developed for the loaders, there was a need to have a guard above the operator to protect him from falling objects at construction sites.

When the overhead guard with the necessary supporting upright was added to the loader, it introduced the need for side screens to keep the operator away from the lift arms at the side openings of the overhead guards. Without standards for ROPS, manufacturers offered various operator enclosures for overhead or weather protection. In 1972, OSHA Department of Labor, considered whether it was feasible or practical to require retrofitting ROPS on early machines. At that time it was published in F.R. Vol. 32, No. 66, page 6839, April 5, 1972, paragraph 1926.1000 (a) (2), the promulgation of specific standards for rollover protective structures for compactors and rubber-tired skid steer equipment is reserved pending consideration of standards currently being developed. This published decision still stands.

In 1973 the ROPS standards were modified so that smaller skid steer loaders could comply with SAE J397. In 1975 SAE J1040 provided for specific applications of skid steer loaders.

8.1.1 This section outlines that ROPS standard SAE J1040 (April 1979) and FOPS standard SAE J1043 (April 1980) are applicable.

8.1.2 This section deals with the fact that modification of a loader by removal of the ROPS from the machine or removal of side screens from the operator cab represents misuse of equipment provided for operator protection.

8.1.3 Operator cab shall have two openings provided for emergency exit.

8.1.4 This deals with the use of proper glazing materials as defined by SAE J674 (June 1976).