Foreword

This standard is a revision of the Standard Administrative Order (SAO) 400:1980 – "Operator's Controls, Location and Method of Operation for Agricultural Tractors and Machines". The revision was initiated by the Agricultural Machinery Testing and Evaluation Center (AMTEC) under the project entitled "Enhancing the Implementation of AFMA Through Improved Agricultural Engineering Standards" which was funded by the Bureau of Agricultural Research (BAR) of the Department of Agriculture (DA).

This revised standard was reviewed by the Technical Committee for Study 1- Development of Standards for Agricultural Production Machinery and was circulated to various private and government agencies/organizations concerned for their comments and reactions. This standard was presented to the Philippine Society of Agricultural Engineers (PSAE) and subjected to a public hearing organized by the National Agriculture and Fisheries Council (NAFC). The comments and reactions received during the presentation and public hearing were taken into consideration in the finalization of this standard.

This standard has been technically revised in accordance with PNS 01:Part 4:1998 - Rules for the Structure and Drafting of Philippine National Standards. The main changes are listed below:

- title of the standard has been modified in conformity to the format of International Standard; and
- modification of some method of operation and sentence construction..

In the formulation of this standard, reference was made to International Organization for Standardization (ISO) 3789-2:1982 – Tractors, machinery for agriculture and forestry, powered lawn and garden equipment – Location and method of operation of operators controls- Part 2: Controls for Agricultural tractors and machinery.

Agricultural Machinery – Location and Method of Operation of Operator's Controls – Control for Agricultural Tractors and Machinery

1 Scope

This standard applies to the following agricultural machines: agricultural tractors, self-propelled and pedestrian-operated machines, implements, and combination thereof primarily used for agricultural operations.

2 Definitions

For the purpose of this standard, the following definitions shall apply:

2.1
agricultural tractor
self-propelled, wheeled, track-laying or semi track-laying machine primarily designed to pull, push, carry and/or operate trailers or provide power to implements and machines used for agricultural, forestry and other related works

2.2
pedestrian-operated machine
machine, having an integral power unit but normally operated by a pedestrian, designed to carry out agricultural operation, and which may also be operated from a seat on an attachment or trailer

2.3
right-hand and left-hand
designations related to the operator when sitting on the operator's station

2.4
self-propelled machine
having one or more integral power units which propel and operate the machine, designed to carry out agricultural operations while on the move

3 Type, Location and Operation of Controls

The type, location and method of operation of the operator's controls are laid down in Table 1 for agricultural tractors and self-propelled machine, and in Table 2 for pedestrian-operated machines.

Table 1 – Type, Location and Operation of Controls for Agricultural Tractors and Self-Propelled Machines

CONTROL	LOCATION	OPERATION
1 ENGINE		
1.1 Starting		The engine may only be started if: 1) the transmission(s) is (are) in the neutral or park position or 2) the traction clutch is disengaged and 3) the operator is in the operator's seat (station).
1.1.1 Ignition switch (if separate from starter switch)	Easily accessible from the operator's seat.	Move control to "on" position.
1.1.2 Starter switch (if separate from ignition switch)	Easily accessible from the operator's seat.	Move control to "start" position.
1.1.3 Starter/ignition switch (spark ignition)	Easily accessible from the operator's seat.	Rotate switch in a clockwise direction to "positive ignition" position. Any auxiliary position provided shall be located between the "off" and "ignition" positions.
1.1.4 Starter switch (compression ignition)	Easily accessible from the operator's seat.	Move control to "start" position. If a rotational switch is provided, rotate clockwise to operate engine starter. If an engine pre-heater circuit is provided, this control shall occur before the "starter" position or maybe activated by rotating the control counter-clockwise.
1.1.5 Recoil type	Recoil starter handle should be so located that it cannot be operated from the front of the machine.	Pull grip.
1.2 Speed		
1.2.1 Foot-operated	Shall be readily accessible to the operator's right foot and preferably to the right of the brake pedal(s).	Push pedal forward and/or downward to increase engine speed.
1.2.2 Hand-operated	Within easy reach and preferably in front of, or to the right side of the operator.	The recommended direction of motion of the control is in a plane generally parallel to the longitudinal axis of the propelling vehicle. The direction of motion shall be away from the operator (generally forward or upward) to increase engine speed.

Table 1 (continued)

CONTROL	LOCATION	OPERATION
1.3 Stop		
1.3.1 Spark ignition	Easily accessible from the operator's seat.	Rotate starter ignition switch counterclockwise to "off" (open circuit) position.
1.3.2 Compression ignition	Easily accessible from the operator's seat. Control or the position "stop" shall be red in color or in contrast with the background and any other control.	Move control to "stop" position. Control shall automatically remain in the "stop" position without the application of sustained manual effort.
2 STEERING		
2.1 Steering wheel	In front of the operator	When a steering wheel control is provided, a clockwise rotation shall effect a right turn, and a counterclockwise rotation shall effect a left turn.
2.2 Two levers	In front of the operator	When two levers are provided for steering to achieve a right turn the right-hand lever shall move rearward; to achieve a left turn the left-hand lever shall move rearward.
2.3 One lever	In front of the operator	When one lever is provided for steering, a lateral motion of the lever to the right shall effect a right turn and a lateral motion to the left shall effect a left turn.
3 BRAKES		
3.1 Service		
3.1.1 Foot-operated	The brake pedal(s) shall be located conveniently to the operator's right foot.	The direction of motion shall be generally forward or downward to engage. Where separate brake pedals are provided on wheeled tractors for the independent right-hand and left-hand brake controls, it shall be possible to obtain combined control such that there is no undue deviation from a straight path of travel.

Table 1 (continued)

CONTROL	LOCATION	OPERATION
3.1.2 Hand-operated	Convenient to the operator.	Pull motion to apply is preferred. Where means are provided for independent right and left hand operations, it shall be possible to obtain combined control such that there is no undue deviation from a straight path of travel.
3.2 Parking		
3.2.1 Hand-operated	Convenient to the operator.	A "pull" motion is preferred. A device shall be provided to retain the brake(s) in the applied position. The device shall not be liable to accidental release.
3.2.2 Foot-operated	Convenient to the operator.	Depress brake pedal and lock-in position.
3.3 Braking of trailers or towed equipment		
3.3.1 Foot-operated	Combined with the pedal(s) of service brake.	The direction of motion shall be generally forward and/or downward to engage.
3.3.2 Hand-operated	Separate right-hand lever	Pull motion to apply.
4 TRANSMISSION		
4.1 Clutch (includes combined transmission and power-take-off)		
4.1.1 Foot-operated	Convenient to the operator's left foot.	Push pedal forward or downward to disengage.
4.1.2 Hand-operated	Within convenient reach of the operator.	Move rearward to disengage. Positive means shall be provided for holding the clutch control in the disengaged position so that it is incapable of being re-engaged unless manually operated. It is recommended that the clutch should be operated only from the operator's seat.

Table 1 (continued)

CONTROL	LOCATION	OPERATION
4.2 Combination ground speed and direction (continuously variable combined control)		
4.2.1 Foot-operated	Convenient to the operator's right foot.	The control shall have the effect of a pedal being pivoted under the operator's foot and shall remain at rest in the neutral position. Forward and/or downward motion of the front of pedal shall cause forward motion and increasing forward speed; downward motion of the rear of the pedal shall cause reverse motion and increasing reverse speed. Where the control can pass directly from forward to reverse through the neutral position, provision shall be made for a secondary motion. A positive "neutral" location shall be provided.
4.2.2 Hand-operated	Accessible to the operator.	Forward motion shall increase speed and reverse motion shall decrease speed. Where the control can pass directly from forward to reverse through the neutral position, provision shall be made for a secondary motion. A positive "neutral" location shall be provided.
4.3 Gear Selection		
4.3.1 In-line operation (hand-operated)	Convenient to the operator.	From neutral position, move control progressively in an upward and/or forward direction to select gears giving increased forward speeds. From neutral position, move control progressively in a rearward and/or downward direction to select reverse gears giving increased reverse speeds. Where the selection control can pass directly from forward to reverse through the neutral position, a separate "neutral" control shall be provided. Provision shall be made for secondary motion when passing through neutral so as to prevent accidental movement of the control.

Table 1 (continued)

CONTROL	LOCATION	OPERATION
4.3.2 Non-in-line operation	Convenient to the operator.	Shifting pattern shall be simple and clearly marked. In particular, the neutral position shall be clearly identified and easy to select.
4.4 Direction control (forward-reverse non-variable speed hand-operated)	Convenient to the operator.	Move control generally forward for forward vehicle motion and move generally rearward for rearward vehicle motion. If a neutral position is provided, provision shall be made to prevent accidental movement of the control from neutral.
4.5 Master implement header or gathering unit clutch (self-propelled machines)		
4.5.1 Hand-operated	Convenient to the operator.	Movement shall be generally rearward and/or downward to disengage. Positive means shall be provided for holding the clutch control in the disengaged position so that it is incapable of being re-engaged unless manually operated. The clutch shall be operated only from the operator's seat.
4.5.2 Foot-operated	Preferably convenient to the operator's left foot.	Push pedal forward or downward to disengage.
5 DIFFERENTIAL LOCK	Preferably convenient to the operator's right foot or hand.	Move forward or downward to disengage. There shall be a clear indication when differential lock is engaged.
6 POWER TAKE-OFF (PTO)		
6.1 Clutch		
6.1.1 Foot-operated	Convenient to the operator's left foot.	Push pedal forward and/or downward to disengage. In the case of a combined traction-drive/PTO clutch, the PTO shall be disengaged on the second stage.
6.1.2 Hand-operated	Convenient to the operator.	Move control downward and/or rearward to disengage. Control should be operated only with the operator in the operator's station.

Table 1 (continued)

CONTROL	LOCATION	OPERATION
6.2 Power-Take-Off (PTO) shaft disengagement		
6.2.1 Lever	Convenient to the operator.	The disengaged position shall be clearly marked, and visible from the operator's seat. Controls shall be operable only with the operator in the operator's station.
7 IMPLEMENTS AND AUXILIARIES (Hydraulics and Remote controls)		
7.1 Lift mechanism		It shall be possible to lock the control lever(s) or mechanism in position during road transport and servicing, or adjusting of implements in the raised position, unless other means are provided.
7.1.1 Hand-operated	Convenient to the operator's right hand.	Move lever upward and/or rearward to raise; downward and/or forward to lower.
7.1.2 Foot-operated	Convenient to the operator's right foot.	Downward movement of the forward part of the pedal to lower and downward movement to the rear part to raise.
7.2 Service selector(s)		Clearly marked to identify function in each position.
7.2.1 Hydraulic	Optional, but readily visible from the operator's normal position	
7.2.2 Electric	Optional	

Table 2 - Type, Location and Operation of Controls for Pedestrian-operated Machines

CONTROL	LOCATION	OPERATION
1 ENGINE		
1.1 Starting		The engine may only be started if: 1) The traction transmission is in neutral or "park" position, or 2) The traction clutch is disengaged.
1.1.1 Starter/ignition switch	Situated so that it can only be operated from the normal operating position.	Rotate switch in a clockwise direction to "positive ignition" position.
1.1.2 Starter switch (compression ignition)	Situated so that it can only be operated from the normal operating position.	Move control to "start" position. If a rotational switch is provided, rotate clockwise to operate engine starter. This "start" position shall always be the final position. If an engine pre-heater circuit is provided, this shall occur immediately before the starter position.
1.1.3 Recoil type	Recoil starter handle should be so located that it cannot be operated from the front of the machine.	Pull grip.
1.1.4 Inertia type	Should not be operated from the front of the machine	Wind handle and release control. It shall be impossible to release the inertia mechanism unless: 1) The traction transmission is in the neutral or park position, or 2) The traction clutch is disengaged.
1.2 Speed		
1.2.1 Hand accelerator		
1.2.1.1 Throttle lever	Accessible to the operator's right-hand side when at normal operating position	Push the lever forward to increase engine speed and pull lever to the rear to decrease engine speed. The engine can be stopped by moving the lever to its extreme rearward position
1.2.1.2 Turning handle	Accessible to the operator's right-hand side	Turn counter-clockwise to accelerate

Table 2 (Continued)

CONTROL	LOCATION	OPERATION
1.3 Stop		
1.3.1 Spark ignition	Control to be forward and within easy reach of the operator in the operator's position. Control shall be red in color or in contrast with the background and any other control.	Rotate starter ignition switch counter-clockwise to "off" (open circuit) position. With pull switch, pull out; with stop button, press button.
1.3.2 Compression ignition		Move control to "stop".
2 STEERING		
2.1 Right hand steering clutch lever	Right-hand side	Gripping the lever toward the handle will disengage the right hand clutch and stop the right hand driving wheel, causing the tractor to turn to the right. Releasing the lever will re-engage the right hand wheel.
2.2 Left hand steering clutch lever	Left-hand side	Gripping the lever toward the handle will disengage the left-hand clutch and stop the left-hand driving wheel, causing the tractor to turn toward the left. Releasing the lever will re-engage the left-hand wheel.
3 TRACTION DRIVE		
3.1 Clutch		
3.1.1 Hand-operated (main transmission excluding 3.1.2)	Preferably convenient to the operator's left hand.	Move rearward or upward to disengage. Positive means shall be provided for holding the clutch control in the disengaged position so that it is incapable of being re-engaged unless manually operated.
3.1.2 Hand-operated (main transmission of the type requiring sustained manual effort)	Preferably convenient to the operator's left hand.	To engage clutch, move control forward or downward.

Table 2 (Continued)

CONTROL	LOCATION	OPERATION
3.2 Gear selection	As near to the center line of the machine as possible and within easy reach of the operator and clearly visible to the operator while in operator's zone.	Shifting pattern should be simple and clearly marked. In particular, the neutral position shall be clearly identified and easy to select. When a reverse gear is fitted, it should only engage as a result of the operator applying sustained manual pressure to a control.
3.3 Idler clutch lever	Between left and right handle	To start forward motion of the tractor, the lever is pulled upward-forward; to stop the tractor, pull the lever rearward-downward. An over-center linkage should hold the lever in the forward engaged position.
4 AUXILIARY CLUTCH ELEMENT	Convenient to the operator's left hand but mounted to the right of the main transmission clutch control.	Move rearward to disengage. Positive means should be provided for holding the control in the disengaged position so that it is incapable of being re-engaged unless manually operated.
5 ELEMENT ADJUSTMENT		
5.1 Screw-operated	Optional	Clockwise rotation should move components affected upwards, rearwards or to the right
5.2 Lever-operated	Optional	For moving components in any plane, the lever should move in the same general direction as the components.
5.3 Stand control lever	Handle bar	Push the lever forward to extend the front stand to support tractor when parked. Pull lever rearward to retract stand before putting the tractor into motion. An over-center spring holds the stand in the retracted position when the tractor is parked and left unattended. A locking pin should be installed to lock the stand in extended position. The locking pin should always be installed when attaching implements to the tractor and servicing or repairing machine.