If any hydraulic control or system exhibits erratic performance or responds abnormally, have the machine checked for air in the system.

Air in these circuits may cause incorrect movements with consequent accident hazard. Refer to the Operation and Maintenance Instruction Manual about corrective action to be taken.

OPERATING

Do not run the engine of this machine in closed buildings without proper ventilation capable to remove harmful exhaust gases which concentrate in the air.

Keep the operator's compartment free of foreign objects, especially if not firmly secured. Never use the machine to transport objects, unless proper securing points are provided.

Do not carry riders on the machine. Study and familiarise with escape routes alternative to normal exit routes. For your personal safety, do not climb on or off the machine while it is in motion.

Make sure that bystanders are clear of the machine operating range before starting the engine and operating the attachment. Sound the horn.

Obey all hand signals, safety indications and signs.

When backing, always look to where the machine is to be moved.

Be alert of the position of bystanders. Should someone enter the work area, stop the machine. Maintain a safe distance from other machines or obstacles to ensure required visibility conditions.

Always give way to loaded machines.

Maintain a clear vision of the surroundings of the travel or work area at all times. Keep cab windows clean and repaired.

When pulling loads or towing through a cable or chain, do not start suddenly at full throttle. Take-up slack carefully. Avoid kinking or twisting chains or cables.

Carefully inspect the towing items for flaws or problems before proceeding. Do not pull through a kinked chain or cable as the high anomalous stresses existing in this condition may induce failures in the kinked portion.

Always wear heavy gloves when handling chains or cables.

Chains and cables should be securely anchored using suitable hooks. Anchor points should be strong enough to withstand the expected load.

Keep anyone clear of anchor points and cables or chains.

Do not pull or tow unless the operator's compartments of the machines involved are properly protected against possible backlash in case of cable or chain failure or detachment.

Be alert of soft ground conditions close to newly constructed walls. The fill material and machine weight may cause the wall to collapse under the machine.

In darkness, check area of operation carefully before moving in with the machine. Use all lights provided. Do not move into low visibility areas.

If the engine tends to slow down and stall for whatever reason under load or at idle, immediately report this problem to the maintenance managers for proper action.

Do not operate the machine until this condition is corrected. Regularly check all exhaust system components, as exhaust fumes are toxic for the operator.

Operators must know the performance of the machine they are driving. When working on slopes or near sudden level drops in the terrain, pay attention not to lose adherence and avoid loose soft ground since overturn or loss of machine control could result.

If noise level is high and exceeds 90 dB (A) over 8 hours at the operator's ear, wear approved ear protection in compliance with local regulations.

Do not operate the machine if you are extremely tired or feel ill. Be especially careful towards the end of the working shift.

Where removable counterweights are provided, do not operate the machine if they have been removed.

When operating the machine, keep in mind height limits of overhead doors, arches, overhead cables and lines as well as width limits of corridors, roads and narrow passages.

Also, get to know load limits of the ground and paving type of the ramps you are to work on.

Beware of fog, smoke or dust that obscure visibility.

Always inspect the working area to identify potential risks such as: inclines, overhangs, trees, demolition rubble, fires, ravines, steep slopes, rough terrain, ditches, crowns, ridge trenches,diggings in traffic areas, crowded parking lots, crowded service areas, fenced zones. In such conditions, proceed with extreme care.

Whenever possible, avoid crossing over obstacles such as very rough terrain, rocks, logs, steps, ditches, railroad tracks.

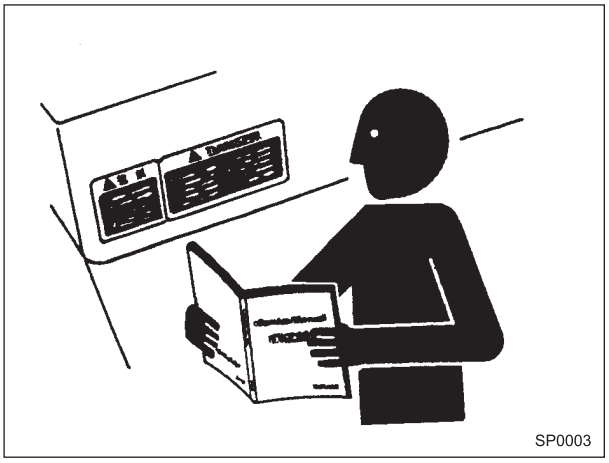
When obstructions must be crossed, do so with extreme care and at a square angle, if possible. Slow down.

Ease up to the break-over point, pass the balance point slowly and ease down the other side also using the attachment, if necessary.

To overcome deep trenches or sinking ground, place the machine perpendicular to the obstacle, drastically reduce ground speed and start crossing using also

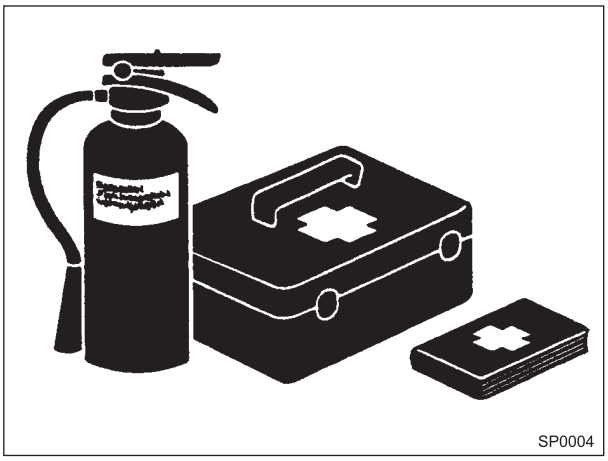
FOLLOW SAFETY PRECAUTIONS

- Carefully read and observe all safety signs on the machine and read all safety precautions in this Manual.
- Safety signs should be installed, maintained, and replaced when necessary.
  - If a safety sign or this Manual are damaged or missing, obtain a replacement from your Dealer in the same way you order a spare part (be sure to detail machine model and serial number upon ordering).
- Learn how to operate the machine and its controls correctly and safely.
- Allow only trained, qualified, authorised personnel to operate the machine.
- Keep the machine in proper working conditions.
  - Unauthorised changes to the machine may impair function and/or safety and affect machine life.
- Safety messages in this Chapter "**SAFETY PRECAUTIONS**", are intended to illustrate basic safety procedures of the machine. However, it is impossible for these safety messages to cover every hazardous situation you may encounter. If you have any doubts, consult your direct supervisor prior to operating or servicing the machine.


SP0003

PREPARE FOR EMERGENCIES

- Be prepared if a fire starts or an accident occurs.
  - Keep the first-aid kit and fire extinguisher on hand.
  - Thoroughly read and understand the label attached to the fire extinguisher to use it properly.
  - Establish emergency priority procedures to cope with fires and accidents.
  - Keep emergency numbers for doctors, ambulance service, hospitals and fire department posted near the telephone.


SP0004

AVOID INJURY FROM BACK-OVER AND SWING ACCIDENTS

- If any person is present near the machine when backing or swinging the upperstructure, the machine may hit or run over that person, resulting in serious injury or death.

- To avoid back-over and swing accidents:
  - Always look around **BEFORE YOU BACK UP AND SWING THE MACHINE. BE SURE THAT ALL BYSTANDERS ARE CLEAR**.

  - **ALWAYS BE ALERT FOR BYSTANDERS MOVING INTO THE WORK AREA. USE THE HORN OR OTHER SIGNAL TO WARN BYSTANDERS BEFORE MOVING MACHINE**.

  - **USE A SIGNAL PERSON WHEN BACKING UP IF YOUR VIEW IS OBSTRUCTED. ALWAYS KEEP THE SIGNAL PERSON IN VIEW**.

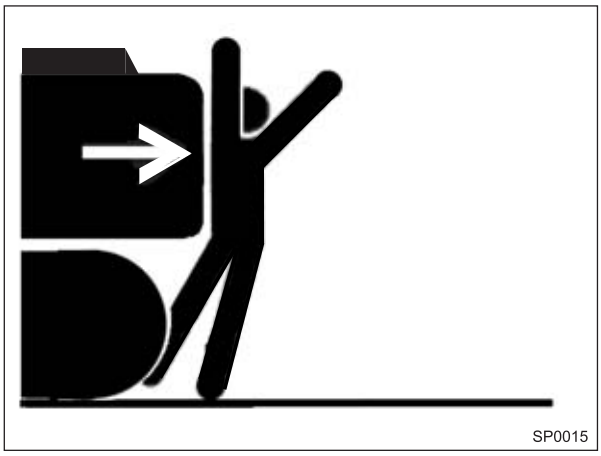
  - Use hand signals, which conform to your local regulations, when work conditions require a signal person.

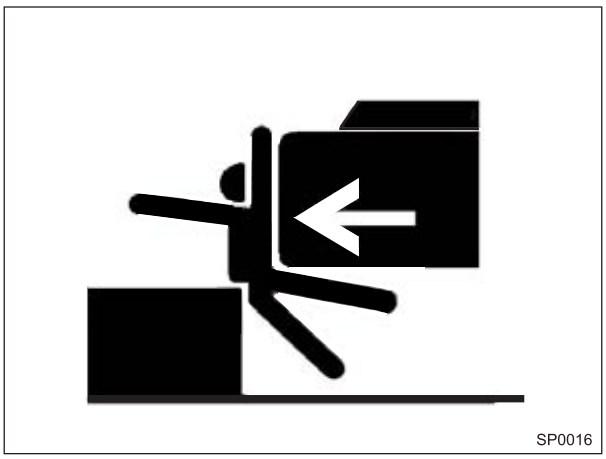
  - No machine motions shall be made unless signals are clearly understood by both signalman and operator.

  - Learn the meanings of all flags, signs, and markings used on the job and confirm with the person in charge of signalling.

  - Always make sure that rear mirrors are clean and correctly adjusted.

  - Dust, heavy rain, fog, etc., can reduce visibility. As visibility decreases, reduce speed and use proper lighting.

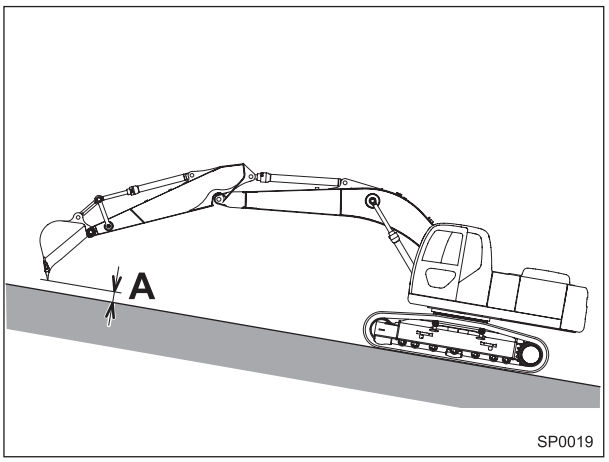

SP0015


SP0016

DRIVE MACHINE SAFELY

- Before moving the machine, confirm which way to move travel pedals/levers for the corresponding direction you wish to go.

  - Pushing down on the front of the travel pedals or pushing the levers forward moves the machine towards the idlers.

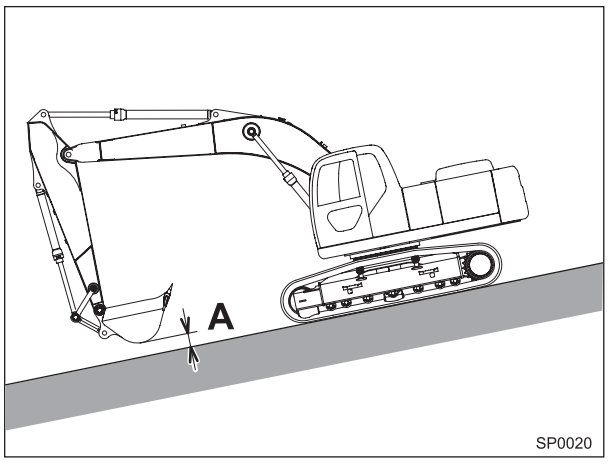


- Traveling on a grade may cause the machine to slip or to overturn, possibly resulting in serious injury or death.

  - When traveling up or down a grade, keep the bucket in the direction of travel, approximately 20 to 30 cm (**A**) above the ground.

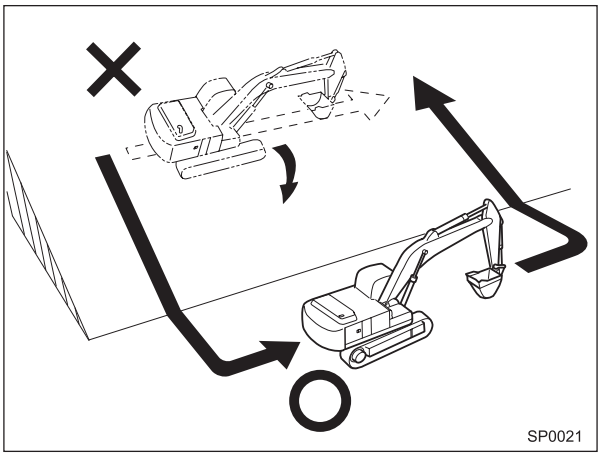
  - If machine starts to skid or becomes unstable, lower the bucket immediately.

  - Traveling across the face of a slope may cause the machine to skid or to overturn. When travelling (ascending/descending) on a slope, be sure to point the tracks uphill/downhill.



  - Turning on an incline may cause the machine to tip over. If turning on an incline is absolutely unavoidable, do so at a place where the slope is gentle and the surface is firm.

  - Do not travel on slopes with an angle exceeding 30°. Do not travel across hill on slopes exceeding an angle of 15°.



SAFE MAINTENANCE

- To avoid accidents:
  - Understand maintenance procedure before starting the work.
  - Keep the working area clean and dry.
  - Do not spray water or steam inside the cab.
  - Do not lubricate or service the machine when it is in motion.
  - Keep hands, feet and clothes far from moving parts.

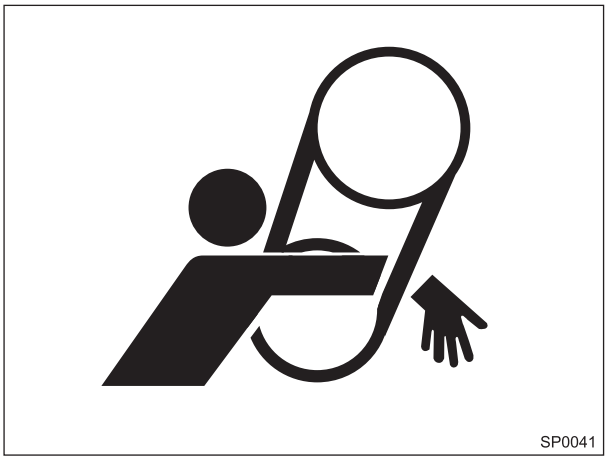
Prior to service in the machine:

1. Park the machine on the level ground.
2. Lower the bucket to the ground.
3. Move the safety lever (pilot-control shut-off lever) to the **LOCK** position.
4. Switch off the Auto-Idle.
5. Let the engine idle with no load for at least five minutes until it has cooled down.
6. Move the key-start switch to the **OFF** position to stop the engine.
7. Remove the ignition key from the start switch.
8. Apply the "Maintenance in progress" tag (see **SAFETY PLATE** in this Chapter). This tag can be applied o the left-hand control lever, safety lever or cab door.
9. Let the engine cool down.

- Do not leave the machine unattended if servicing requires the engine running.
- If the machine is to be raised, place boom and arm at an angle 90 to 110°. Lock machine components which should be raised for maintenance or repair using suitable supporting means.
- Never work under a machine kept raised by the boom.
- Inspect certain component regularly, repair or replace as necessary. Refer to the Chapter **MAINTENANCE** in this Manual.
- Keep all components in good condition and properly install. Immediately repair any fault.
- Immediately repair any damage.Replace worn or failed components. Remove grease, oil, debris build-ups.
- Disconnect the negative cable (-) from the battery before carry out any work on he electrical sysem or arc-welding on he machine.


SP0039


SP0040


SP0041

PREVENT BURNS

Hot spraying fluids:

- After operation, engine coolant is hot and under pressure. Hot water or steam is contained in the engine, radiator and heater lines. Skin contact with escaping hot water or steam can cause severe burns.

  - To prevent possible injury from hot spraying water. Do not remove the radiator cap until the engine is cool. When opening, turn the cap slowly to the stop. Allow all pressure to be released before removing the cap.

  - The hydraulic oil tank is pressurized. Again, be sure to release all pressure before removing the cap.


SP0048

Hot fluids and surfaces:

- Engine oil, reduction gear oil and hydraulic oil also become hot during operation. The engine, hoses, lines and other parts become hot as well.

  - Wait for the oil and components to cool down before starting any maintenance or inspection work.


SP0049

STORE ATTACHMENTS SAFELY

- Stored attachments such as buckets, hydraulic breakers and blades can fall and cause serious injury or death.
  - Securely store attachments and implements to prevent falling.
  - Keep bystanders away from storage areas.

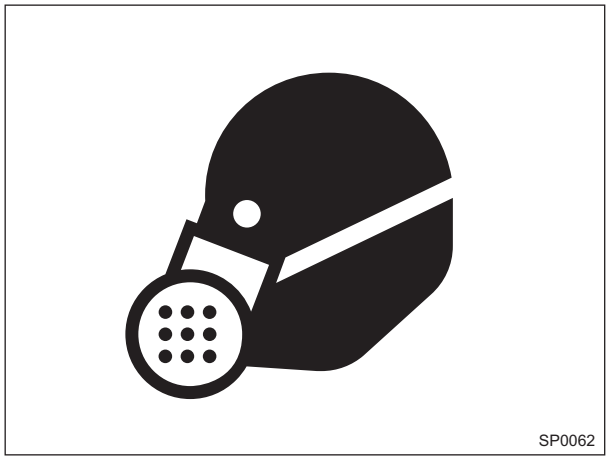

SP0054

EVACUATING IN CASE OF FIRE

- If a fire breaks out, evacuate the machine in the following way:
  - Stop the engine by turning the key-start switch to the **OFF** position if there is time.
  - Use a fire extinguisher if there is time.
  - Exit the machine.

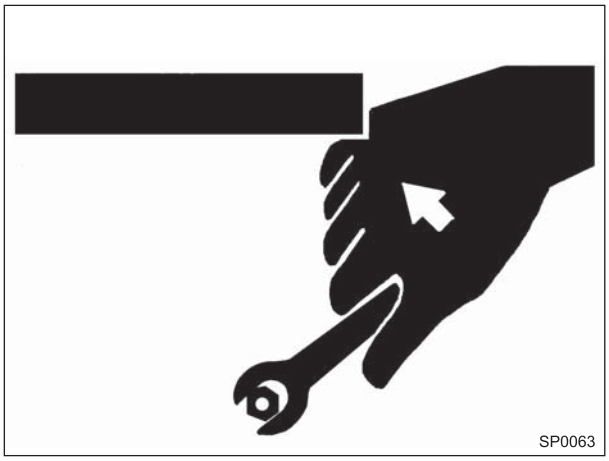
BEWARE OF EXHAUST FUMES

- Prevent asphyxiation. Engine exhaust fumes can cause sickness or death.
  - If you must operate in a building, be sure there is adequate ventilation. Either use an exhaust pipe extension to remove the exhaust fumes or open doors and windows to bring enough outside air into the area.



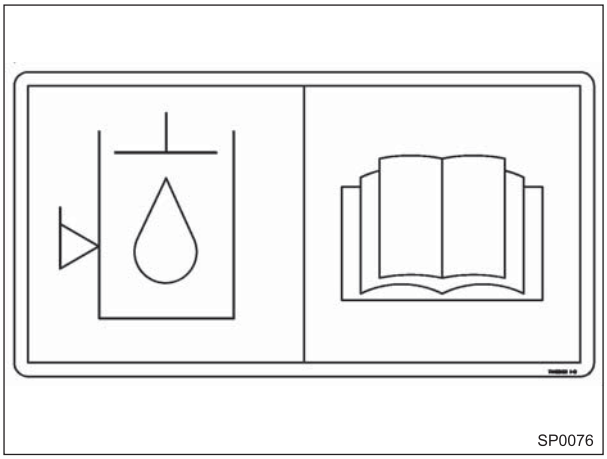
USE APPROPRIATE TOOLS

- Use tools appropriate for the job to be performed.
  - Inappropriate tools, parts and procedures might generate dangerous conditions.
  - Use tools of correct size to tighten or loosening securing elements, in order to avoid injuries caused by a wrench getting out of control.
  - Do not use U.S. Standard or British Standard tools on metric fasteners and vice versa.
- Use only genuine spare parts (please refer to the Spare Parts Catalogue).



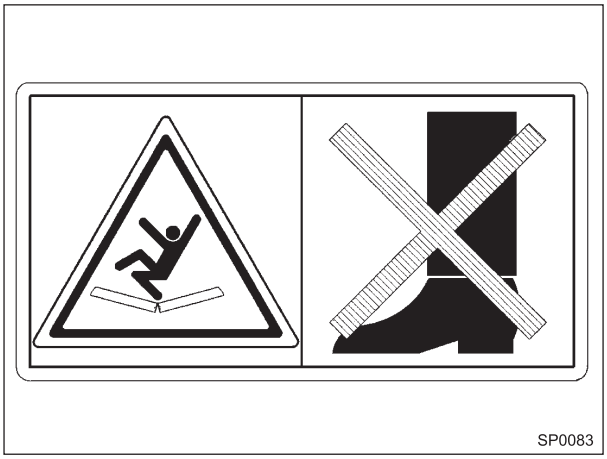
10 - Hydraulic oil pressurised tank warning plate

It indicates that the hydraulic oil is pressurised. Consult the Operation and Maintenance Instruction Manual. Prior to intervening on the hydraulic oil tank, bleed the pressure by actuating the appropriate bleeding button located on the cap. The hydraulic oil, at operating temperature, can cause burns in case of contact with the skin.
Background: yellow
Border and icons: black

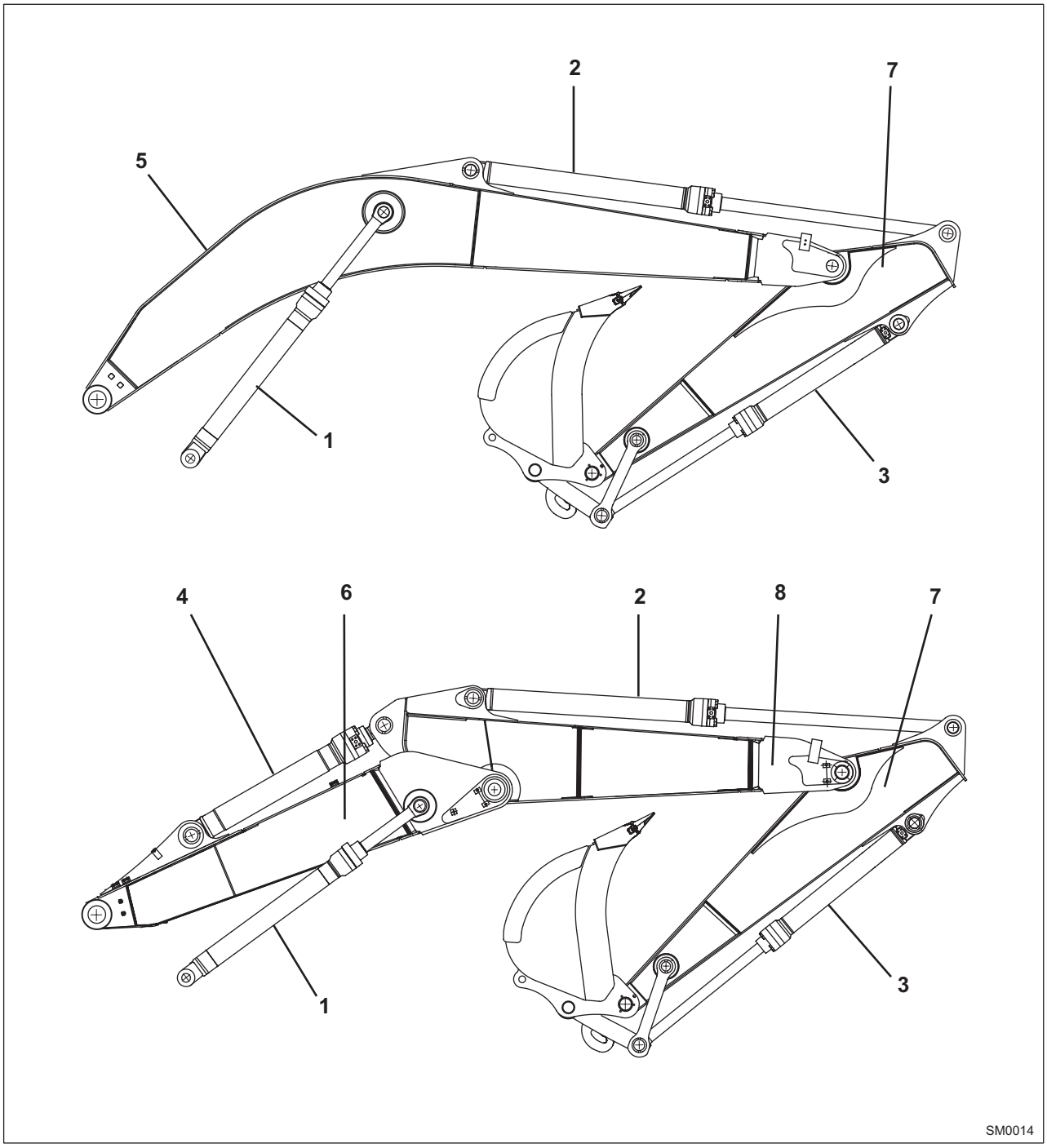


11 - No-stepping warning plate

It instructs not to step on the zone where this decal is attached.
Background: yellow
Cross: red
Border and icons: black



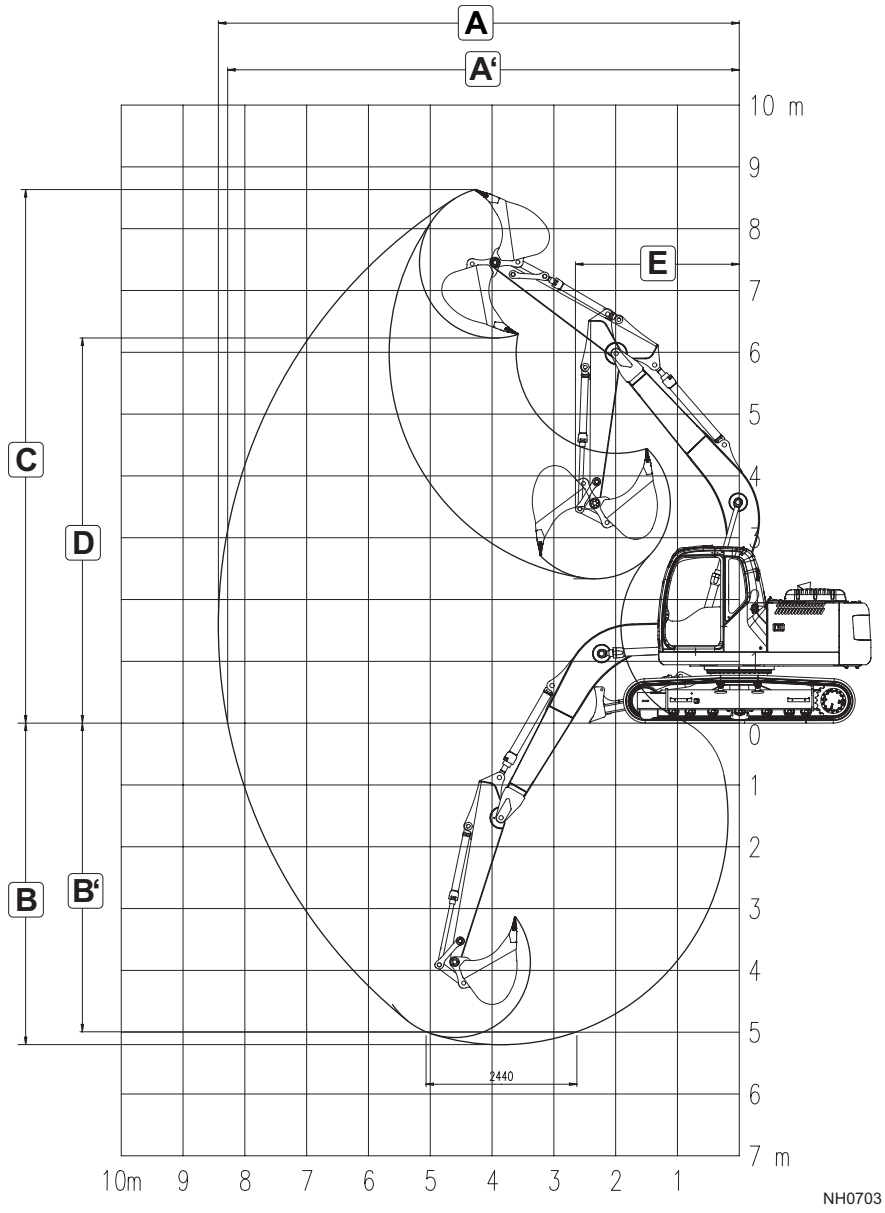
Main Components – Front Attachment



1 - Boom cylinder
2 - Arm cylinder
3 - Bucket Cylinder
4 - Positioning Cylinder (Triple Articulation Version)
5 - Monoblock Boom
6 - Boom (Triple Articulation Version)
7 - Arm
8 - Positioner (Triple Articulation Version)

DIGGING DATA

(Monoblock Version with undercarriage equipped with blade)

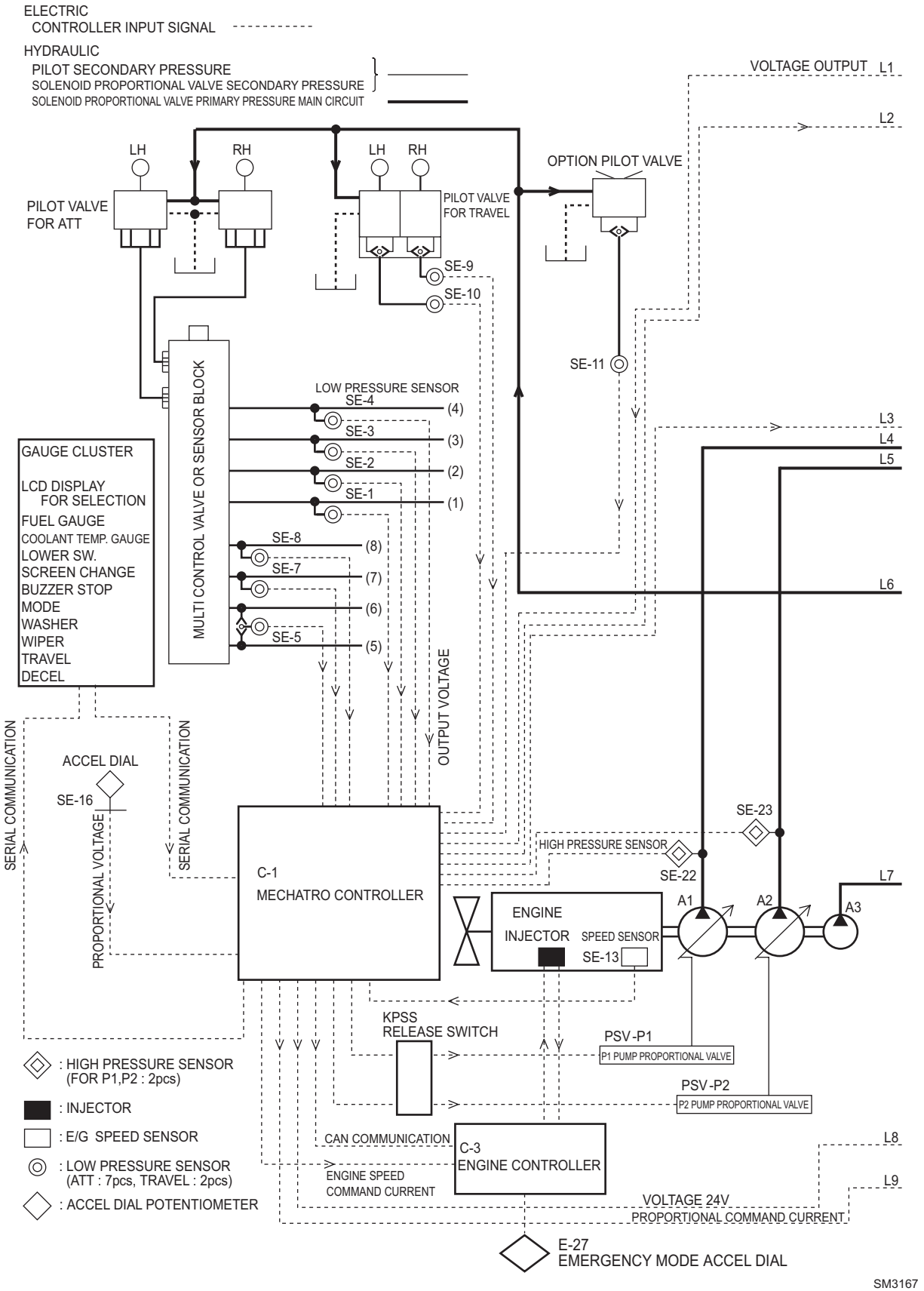


Unit: mm (in)

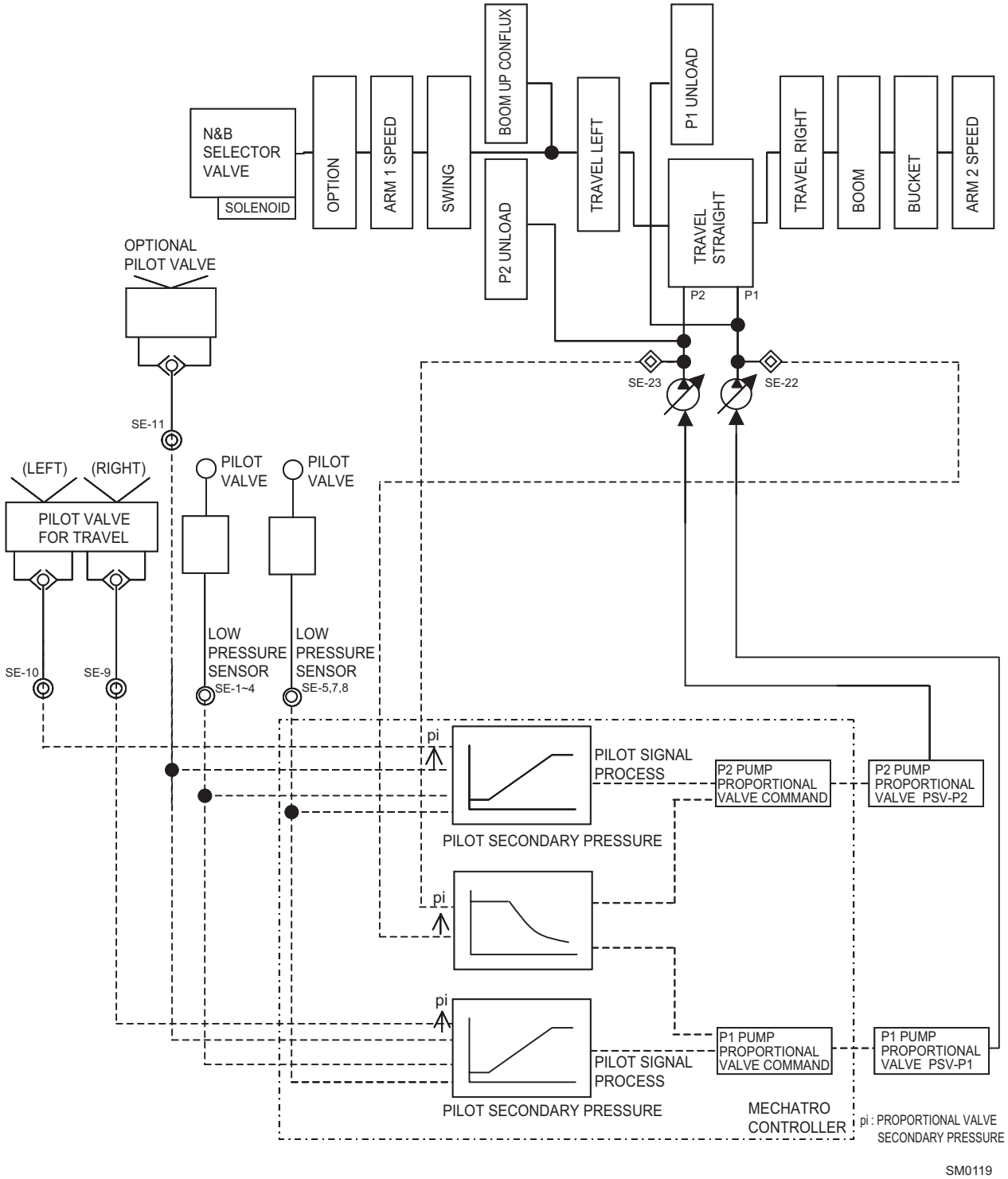
Arm	2100 (82.68)	2450 (96.46)	2950 (116.14)
A	8097 (318.78)	8428 (331.81)	8914 (350.94)
A'	7940 (312.60)	8278 (325.90)	8774 (345.43)
B	4853 (191.06)	5201 (204.76)	5701 (224.45)
B'	4613 (181.61)	4994 (196.61)	5522 (217.40)
C	8411 (331.14)	8633 (339.88)	8977 (353.42)
D	6009 (236.57)	6232 (245.35)	6575 (258.86)
E	2600 (102.36)	2651 (104.37)	2918 (114.88)

2 SUMMARY OF MECHATRO CONTROL SYSTEM

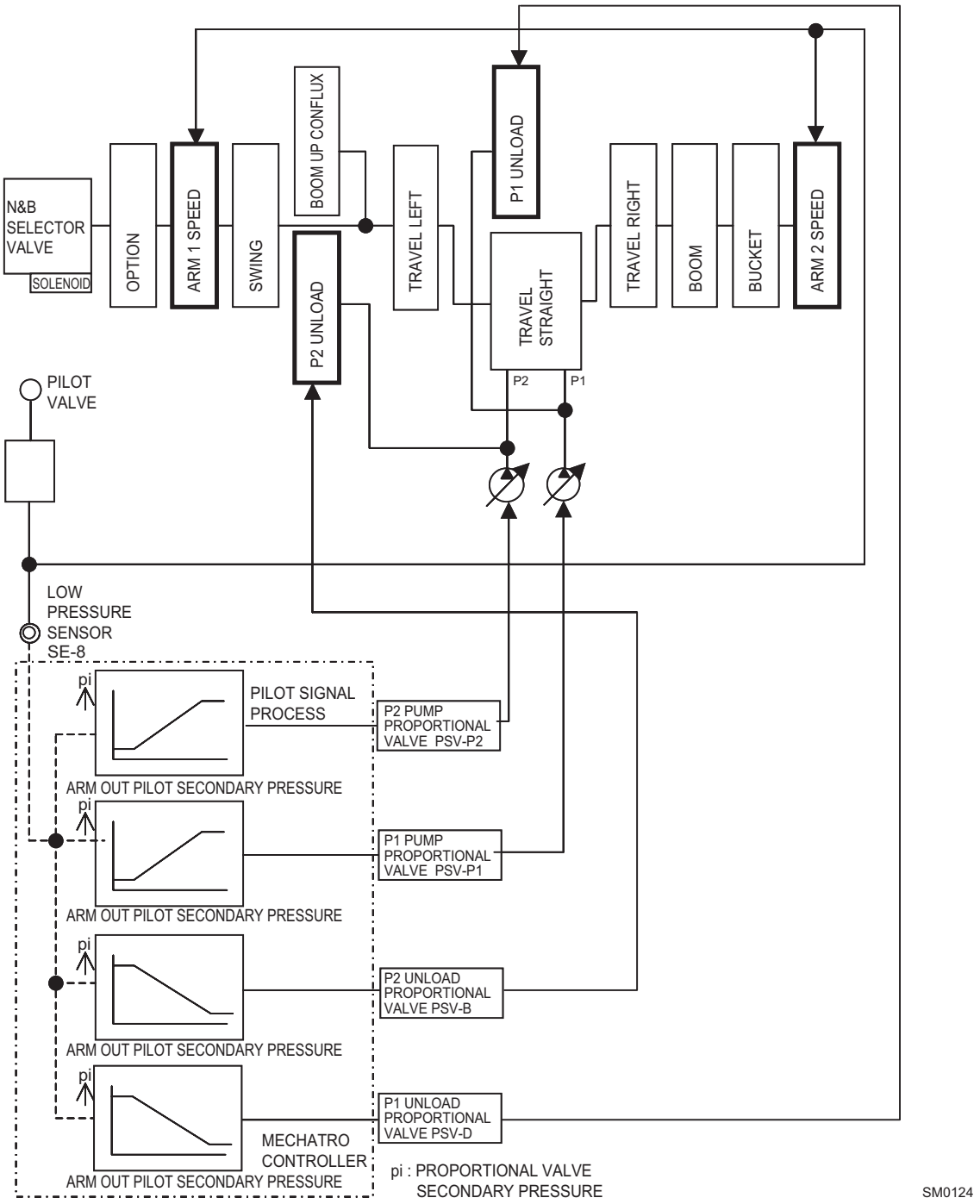
2.1 MECHATRO CONTROL SYSTEM IN GENERAL



2.3 POSITIVE CONTROL & P-Q CONTROL

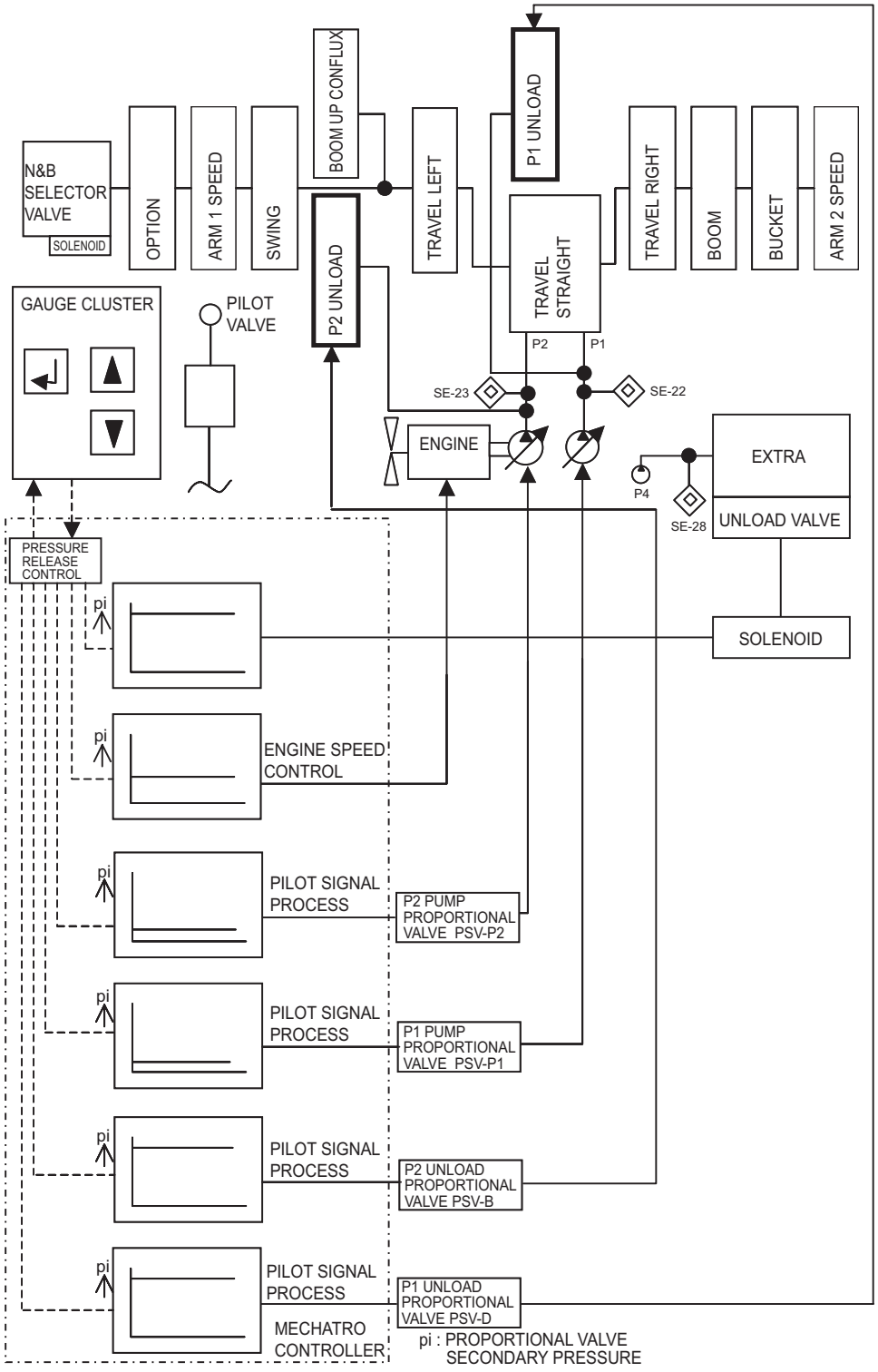


2.7 ARM-OUT CONFLUX CONTROL



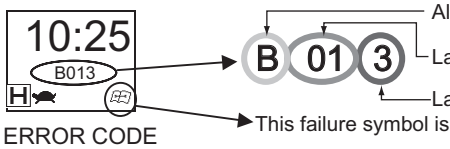
1. On starting arm-out operation, arm-out operating pilot pressure switches arm 1 spool and arm 2 spool and is input to low pressure sensor.
2. The output voltage of low pressure sensor is input to mechatro controller and the mechatro controller processes pilot signal and outputs command according to the input voltage to P1 and P2 proportional valves and P1 and P2 unload proportional valves.
3. Each proportional valve outputs pilot secondary pressure according to the command output by mechatro controller and changes P1 and P2 pump delivery rate and switches P1 and P2 unload pressure control valves.
4. With original hydraulic pressure command, arm 1 spool and arm 2 spool are switched and also with the command output by mechatro controller, P1 and P2 pumps and P1 and P2 unload valves are switched, and consequently the delivery oil on P2 pump side confluxes delivery oil on P1 pump side during arm-out operation.

2.11 PRESSURE RELEASE CONTROL (INCLUDE EXTRA PRESSURE RELEASE)



SM3171

3. Self diagnosis display items
   As-displayed clock (Usually main screen). When error occurred, specifies failed section and the failure type with the aid of error code.



ALPHABET

	A	B	C	D	E	F	G	H	I	K	R
	Controller memory	Low pressure sensor	High pressure sensor	Proportional valve for	Proportional valve for	Solenoid valve	Speed sensor	Potentiometer etc.	Communication	Battery relay	Relay output

2nd AND 3rd DIGIT

01		Boom up	P1 pump	P1 unload	P1 pump	ATT boost		Throttle		Battery relay	Wiper ark prevention
02	Torque adjust data	Boom down	P2 pump	P2 unload	P2 pump	Swing parking brake		Boom angle			Wiper ark forward
03	Unload adjust data	Arm out	Boom head	Travel straight	Relief adjust 1	Travel 1,2 speed		Arm angle			Wiper ark reverse
04		Arm in			Relief adjust 2	Option selector					Washer motor
05		Bucket digging									
06		Bucket dump		Arm 2 spool for arm in							
07		Swing									
09		Travel right						Fuel sensor			
10		Travel left									
11		Selector position							CAN communication		
13											
14											
15											
16		P1 side option									AIS relay 2
17		P2 side option									Engine stop relay
18											Safety lock lever relay
21	Adjustment data sector 1										Safety relay
22	Adjustment data sector 2										
23	Hourmeter sector 1										
24	Hourmeter sector 2										
25	Proportional valve adjust										
31									Cluster communication		

LAST DIGIT

0		Larger than normal range	Larger than normal range								
1	-					Transistor OFF failure/			CAN error		
2	-	Wrong output	Wrong output	Transistor ON failure	Transistor ON failure		Over run				
3	-	Disconnection	Disconnection	Disconnection	Disconnection	Transistor ON failure /	Disconnection	Disconnection	Time is over		
4	-	Power source short circuit	Power source short circuit					Power source short circuit		Contact point is melted and adhered	Power source short circuit
5	Wrong value										