

## SAFETY



**WARNING:** This symbol means **WARNING ! BE VIGILANT ! YOUR SAFETY IS AT RISK**. The message that follows the symbol contains important safety information. Read it carefully. Be sure you understand the possible risks of injury or even death.

To avoid all risks, always follow the safety notes contained in this section and throughout this manual.

Put the warning tag shown below on the key for the keyswitch when servicing or repairing the machine. One warning tag is supplied with each machine. Additional tags, Part Number 321-4614, are available from your service parts supplier.



PDG0328



**WARNING:** Read the Operator's Manual carefully and make sure you understand how to operate the controls correctly.



**WARNING:** Never operate the machine and attachment controls unless you are seated in the operator's seat. If you are not in the operator's seat, you run the risk of serious injury.



**WARNING:** The machine is built to carry the operator only. Do not allow passengers to ride on the machine.



**WARNING :** Prior to starting up the engine read the safety messages contained in the operator's manual carefully. Read all safety stickers on the machine. Have people move back from the machine. Learn how to use the controls before starting up the machine. It is your responsibility to follow the manufacturer's instructions on how to operate and maintain the machine. It is your responsibility to follow applicable rules and regulations. Service and Operator's Manuals are available from your J.I. Case Dealer.



**WARNING:** If you wear loose clothing or if you omit to use safety equipment for your work, you risk injury. Always wear clothes that do not risk getting caught in the machine. Other safety equipment may be necessary, in particular : helmets, safety shoes, ear plugs, safety glasses, protection mask, thick gloves and reflecting clothes.

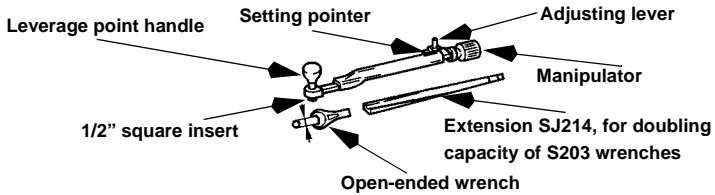
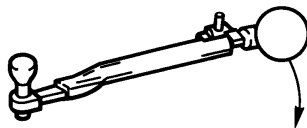
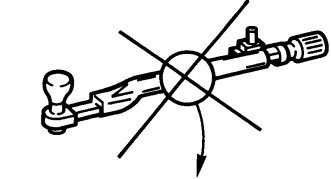
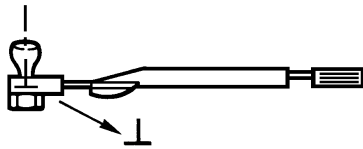
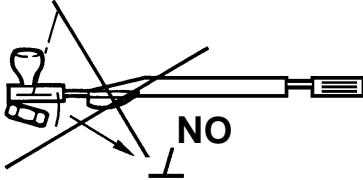
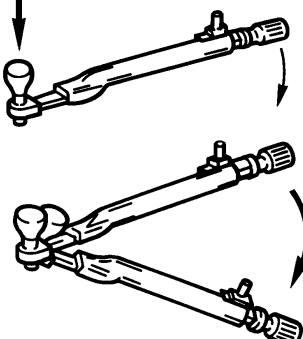
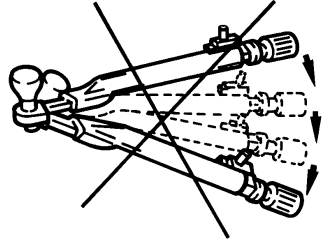
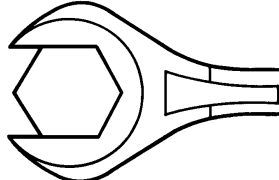
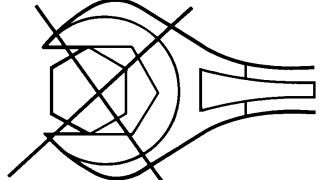


**WARNING:** When working close to the fan with the engine running, avoid wearing loose clothing and operate with extreme caution.



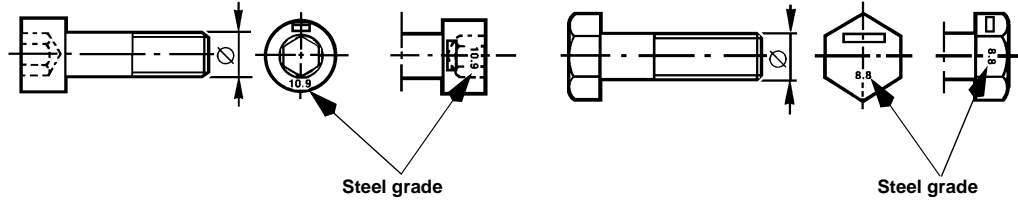
**WARNING:** When checking the hydraulic circuits, follow procedures to the letter. **DO NOT CHANGE** procedures.

# CORRECT USE OF TORQUE WRENCHES

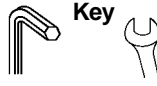




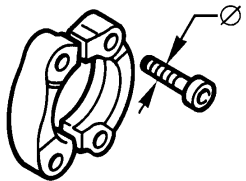
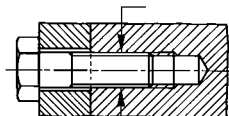
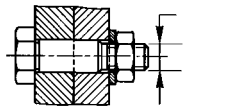
<p><b>TORQUE WRENCHES</b></p>	 <p style="text-align: right;">PDG0315</p>
<p><b>CORRECT USE</b></p> <p>a - Hold the wrench by the handle provided.</p> <p>b - When tightening, always keep the wrench perpendicular to the screw.</p> <p>c - Keep one hand on the leverage point handle on the wrench.</p> <p>d - Tighten progressively in one movement.</p> <p>e - Position a correctly dimensioned socket or open-ended wrench on the flats of the screw head.</p>	<div style="text-align: center;"> <p><b>NO</b></p>   </div> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p><b>HAND</b></p>  </div> <div style="text-align: center;"> <p><b>NO</b></p>  </div> </div> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  </div> <div style="text-align: center;"> <p><b>NO</b></p>  </div> </div> <div style="display: flex; justify-content: space-around; margin-top: 20px;"> <div style="text-align: center;">  </div> <div style="text-align: center;"> <p><b>NO</b></p>  </div> </div> <p style="text-align: right;">PDG0316</p>



# STANDARD SCREW A TORQUE SPECIFICATIONS

## Correct screw identification



PDG0320

	Diameter x thread size Grade 8.8	 Key		Torque			
				Nm		lb.ft	
							
Two-part hydraulic connector (to SAE J518 specifications)    PDG0321	M5 x 0.8 M6 x 1 M8 x 1.5 M10 x 1.5 M12 x 1.75 M14 x 2 M16 x 2 M18 x 2.5 M20 x 2.5 M22 x 2.5 M24 x 3 M27 x 3 M30 x 3.5	4 5 6 8 10 12 14 14 17 17 - - -	8 10 13 17 19 22 24 27 30 32 36 41 46	5.5 9 22.5 45 70 100 170 250 350 500 600 900 1200	5.5 9 22.5 45 80 120 200 300 400 600 700 1000 1400	4.1 6.7 16.6 33.2 51.6 73.8 125.5 184.5 258.3 369 442.8 664.2 885.6	4.1 6.7 16.6 33.2 59 88.6 147.6 221.4 295.2 442.8 516.6 738 1033.2
Components assembled by screws and bolts <b>SCREW</b>      <b>BOLT</b>  PDG0322	<b>Grade 10.9</b> M5 x 0.8 M6 x 1 M8 x 1.5 M10 x 1.5 M12 x 1.75 M14 x 2 M16 x 2 M18 x 2.5 M20 x 2.5 M22 x 2.5 M24 x 3 M27 x 3 M30 x 3.5	4 5 6 8 10 12 14 14 17 17 - - -	8 10 13 17 19 22 24 27 30 32 36 41 46	75 12.5 35 60 100 170 250 350 500 700 900 1200 1700	75 12.5 35 70 120 200 300 400 600 800 1000 1400 1900	5.6 9.3 25.8 44.3 73.8 125.5 184.5 258.3 369 516.6 664.2 885.6 1254.6	5.6 9.3 25.8 51.6 88.6 147.6 221.4 295.2 442.8 442.8 738 1033.6 1402.2

 Zinc bichromate  
 Phosphate

## Electrical system

Circuit voltage circuit ..... 24 volt, negative earth  
 Batteries ..... two low-maintenance 12 volt batteries  
 All electrical system safety functions are grouped in an electrical cabinet with a printed circuit.  
 Instrument panel with printed circuit.  
 Automatic instrument panel lamp testing.  
 Two-stage alarm system.  
 Upperstructure electrical power connection (24 V, 15 Amp.).  
 Battery master switch.

## Upperstructure

### All welded frame

Modular structure.  
 Transverse walkway giving access to the various components.  
 Sound-proofed, lockable cowling meeting all current regulations.  
 Tool box with tool set.

### Swing

Hydraulic motor with reduction gear and automatic static brake.

**788, 788 "Plus", 988 "Plus"**

**988**

Rotational speed..... 7.7 rpm.....8.8 rpm  
 Turntable..... Alternating rollers and internal teeth  
 Centralised bearing surface and tooth lubrication

## Cab

Removable, sound-proofed, on flexible mounting blocks.  
 Up and over windshield.  
 Tinted windshield.  
 Pre-fitted for radio installation.  
 Transparent roof hatch ..... optional equipment  
 Sliding door window ..... standard since November 1999  
 Polycarbonate windows ..... optional equipment  
 Cab safety guards ..... available on request  
 Elevated cab ..... available on request  
 Ant-vandal cab ..... optional equipment

## Operation

De-luxe seat with armrests and multi-position adjustment (vibration level III/ISO 7096).  
 Hydraulically assisted controls.  
 Attachment and swing ..... 2 control levers  
 Travel ..... 2 pedals  
 Speed programmer which also automatically changes speed range on the two-speed version.  
 Single-speed windshield wiper, plus intermittent action, windshield washer, heating, de-frosting, two-speed ventilation, cab light, cigarette lighter, sun shield.  
 Working lights:  
   On upperstructure ..... 2 x 70/75 W  
   On attachment ..... 70 W  
   Front and rear (on cab) ..... optional equipment  
   Rear (on cab) ..... 70 W  
 Air conditioning ..... optional equipment  
 Cab sun-shield ..... optional equipment  
 Cab blower ..... optional equipment

**(988 CK "Plus")**

Boom	Dipper	Track pads			
		0.50 m	0.60 m	0.70 m	0.90 m
Monoblock	1.60 m	17 490	17 715	17 940	18 390
	2.10 m	17 535	17 760	17 985	18 435
	2.70 m	17 655	17 880	18 105	18 560
	3.10 m	17 690	17 915	18 140	18 595
Backhoe offset	1.60 m	17 955	18 180	18 405	18 860
	2.10 m	18 000	18 225	18 450	18 905
Articulated	1.60 m	18 080	18 305	18 530	18 985
	2.10 m	18 130	18 355	18 580	19 030
	2.70 m	18 250	18 475	18 700	19 150
	3.10 m	18 285	18 510	18 735	19 185

**NOTE:** These values are given in kg, with 760 L backhoe bucket.

Boom	Dipper	Track pads			
		0.50 m	0.60 m	0.70 m	0.90 m
Handling	4.50 m	17 025	17 250	17 475	17 925

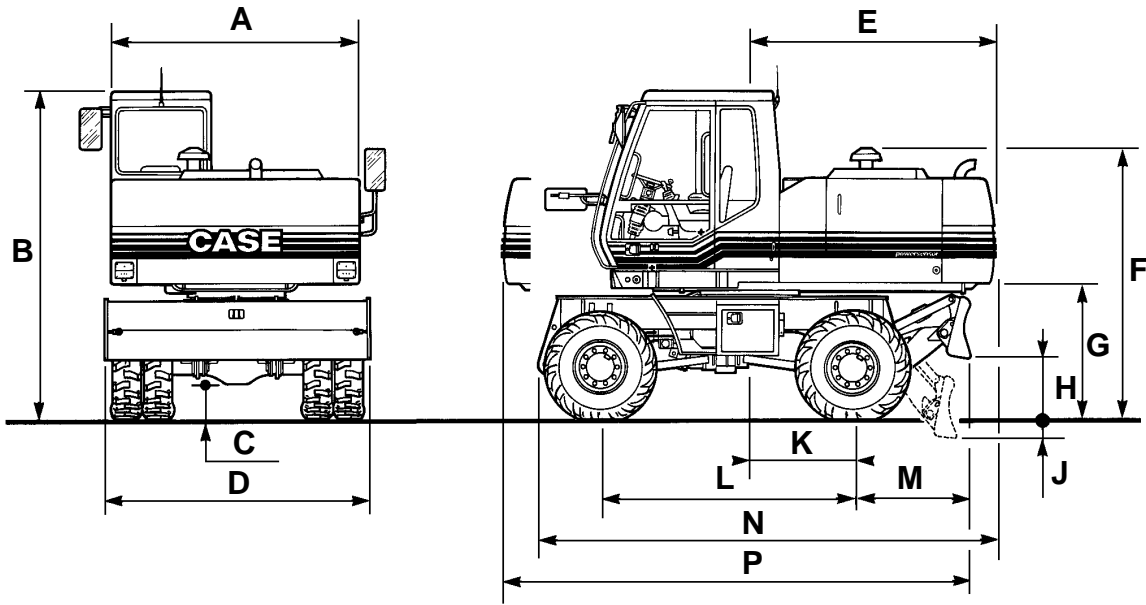
**(988 CKE "Plus")**

Boom	Dipper	Track pads		
		0.50 m	0.60 m	0.70 m
Monoblock 5.20 m	1.50 m	17 460	17 685	17 910
	2.10 m	17 505	17 730	17 955
	2.70 m	17 625	17 850	18 075
	3.10 m	17 690	17 885	18 110
Backhoe offset	1.60 m	17 925	18 150	18 375
	2.10 m	17 975	18 200	18 425
Articulated	1.60 m	18 055	18 280	18 505
	2.10 m	18 100	18 325	18 550
	2.70 m	18 220	18 445	18 670
	3.10 m	18 255	18 480	18 705

**NOTE:** These values are given in kg, with 760 L backhoe bucket.

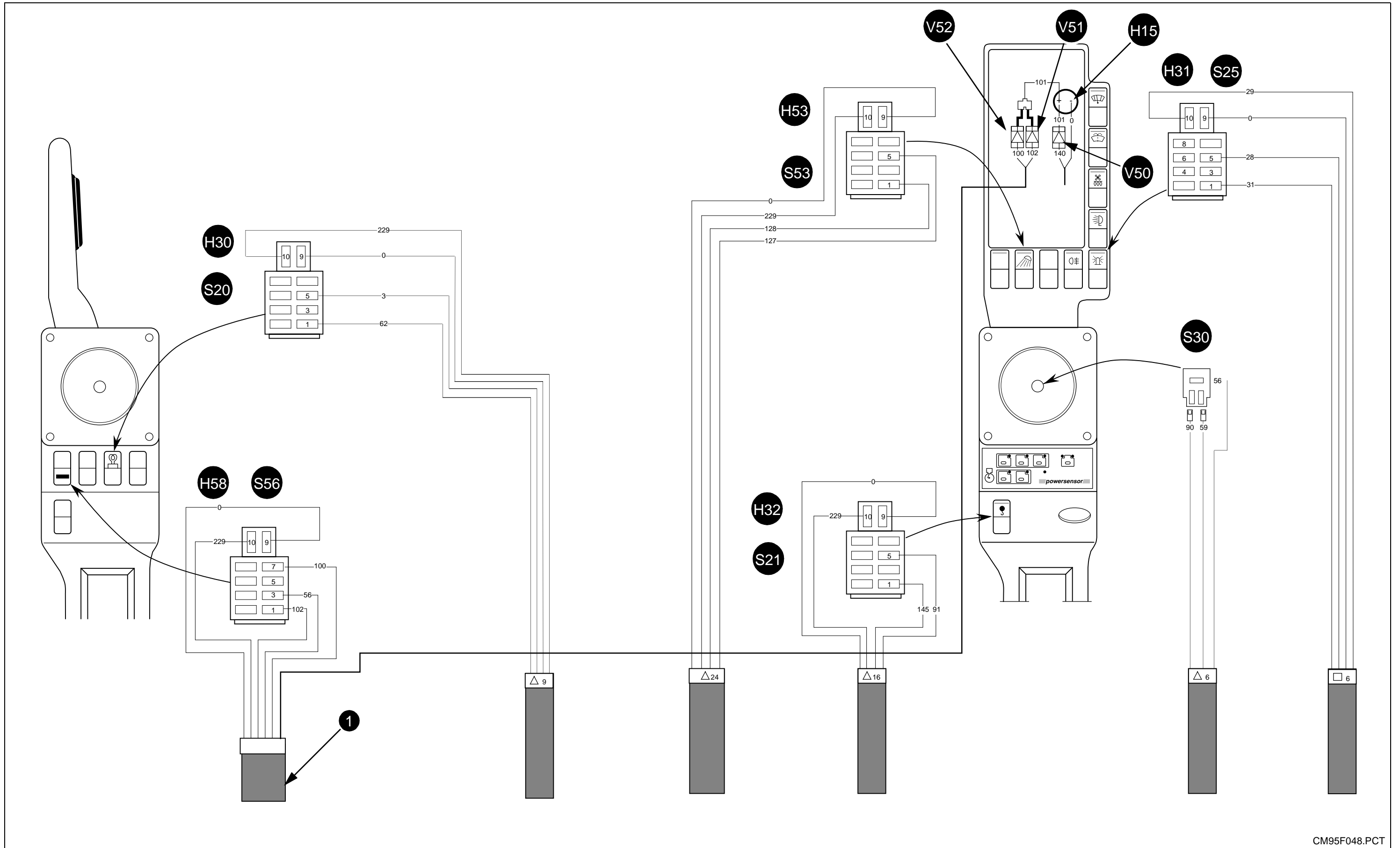
Boom	Dipper	Track pads		
		0.50 m	0.60 m	0.70 m
Handling	4.50 m	16 995	17 220	17 445

**PL Version**



CS95N243

	<b>788</b>	<b>788 "Plus"</b>	<b>988</b>	<b>988 "Plus"</b>
A .....	2.44 m	2.44 m	2.44 m	2.44 m
B .....	3.23 m	3.23 m	3.24 m	3.25 m
C .....	0.34 m	0.34 m	0.33 m	0.33 m
D .....	2.48 m	2.48 m	2.48 m	2.46 m
E (radius) .....	2.05 m	2.08 m	2.40 m	2.45 m
F .....	2.67 m	2.79 m	2.66 m	2.68 m
G .....	1.26 m	1.26 m	1.47 m	1.26 m
H .....	0.59 m	0.59 m	0.59 m	0.49 m
J .....	0.18 m	0.18 m	0.18 m	0.18 m
K .....	0.95 m	0.95 m	1.03 m	1.13 m
L .....	2.30 m	2.30 m	2.50m	2.60 m
M .....	1.15 m	1.15 m	1.15 m	1.23 m
N .....	4.06 m	4.14 m	4.48 m	4.53 m
P .....	4.15 m	4.26 m	4.58 m	4.81 m

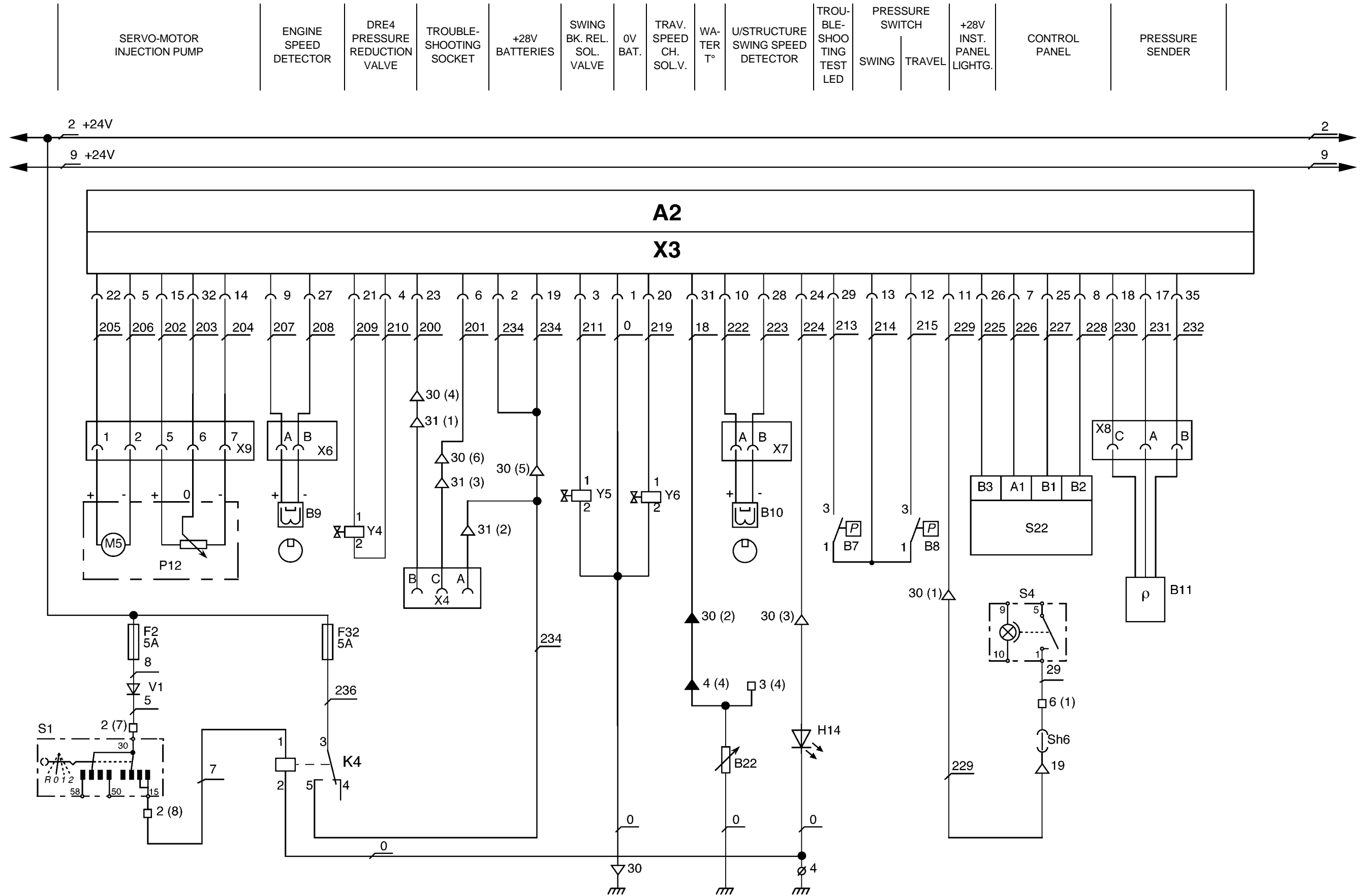


## PRINTED CIRCUIT SCHEMATIC GUIDE

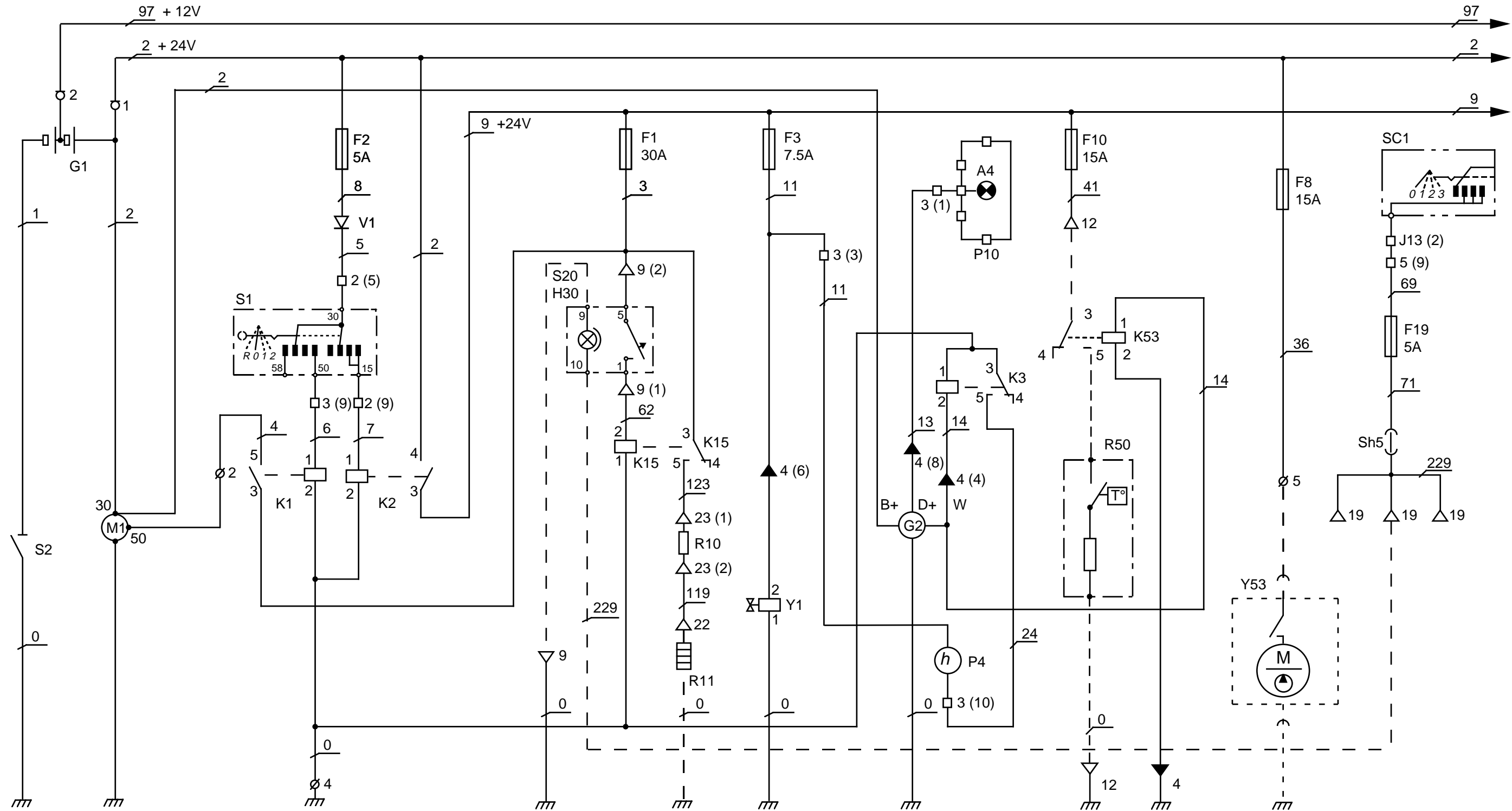
- Q1** (1) 24 V PCB supply
- Q1** (2) 24 V PCB supply
- Ø 4** (1) Printed circuit earth
- Ø 4** (2) Printed circuit earth
- F1** Fuse, 30 A, starter motor solenoid, thermostart
- F2** Fuse, 5 A, starter key switch
- F3** Fuse, 7.5 A, instrument panel, hourmeter
- F4** Fuse, 5 A, cab lighting, horn (control), hood lighting
- F5** Fuse, 10 A, working lights (control), rotary light (std), night lighting for switch on instrument panel and electronics
- F6** Fuse, 15 A, attachment working light, rear cab light, upperstructure working lights
- F7** Fuse, 10 A, horn (power)
- F8** Fuse, 15 A, upperstructure socket, fuel pump
- F9** Fuse, 10 A, windshield washer, windshield wiper (BAT + R)
- F10** Fuse, 10 A, heater
- F11** Fuse, 7.5 A, cigar lighter, cab blower
- F12** Fuse, 10 A, pilot safety, overload indicator
- F13** Fuse, 15 A, air conditioner
- F14** Fuse, 10 A, step-down transformer / radio
- F15** Fuse, 15 A, general lighting
- F16** Not used
- F17** Not used
- F18** Not used
- F19** Not used
- F20** Not used
- F21** Not used
- F22** Not used
- F23** Not used
- F24** Not used
- F25** Not used
- F26** Not used
- F27** Fuse, 5 A, remote controlled or articulated boom, tool quick coupler, air suspension seat, speed threshold detector (788P heavy lift)
- F28** Fuse, 40 A, engine stop/start solenoid (injection)
- F29** Fuse, 10 A, cab front working light
- F30** Fuse, 10 A, windshield wiper (BAT +)
- F31** Fuse, 10 A, fuel heater
- F32** Fuse, 5 A, (BAT +) electronics
- H14** Troubleshooting test LED

- K1** Starter motor relay
- K2** Battery relay
- K3** Hourmeter relay
- K4** Electronic supply relay
- K5** Horn relay
- K6** Working light relay
- K7** Not used
- K9** Pilot safety relay/axle unlocking
- K13** Engine stop solenoid relay
- K15** Thermostart relay
- K20** Windshield wiper intermittent action
- K21** Safety relay piloting pressure switch piloting
- K52** Not used
- K53** Fuel heater relay
- K54** Frequency threshold detector relay (threshold: 1 = 1600 rpm) (788)
- K55** Frequency threshold detector relay (threshold: 2 = 1400 rpm) (788)
- K56** Not used
- K57** Not used
- K58** Not used
- K59** Air conditioning compressor relay
- K60** Air conditioning condenser relay
- K61** Battery relay (heater/air conditioner)
- S3** Shunt relay K7
- S4** Not used
- S5** Not used
- S6** Night lighting (switch)
- S8** Not used
- S9** Not used
- S10** Not used
- S11** Not used
- V1** Starter key switch diode
- V2** Diode less engine running
- V3** Not used
- V5, V6, V7, V8, V9, V10** Not used
- V12, V13, V14, V15, V16, V17, V18, V19, V20** Not used
- V21** Overload indicator lamp diode on instrument panel
- V22** Rotary light diode on instrument panel
- V23** Not used
- V24** K54 relay diode
- V25** K55 relay diode
- V26** Not used
- V27** Not used
- V28** Not used
- V30** Buzzer diode
- V31** Not used
- V52** Quick coupler switch diode


















BATTERY MASTER SWITCH | MASTER SWITCH STARTER MOTOR | STARTER KEY SWITCH STARTER MOTOR RELAY | MAIN RELAY | COLD START ASSISTANCE (OPTIONAL) | ENGINE SHUT DOWN | ALTERNATOR HOURMETER | CHARGE WARNING LAMP | FUEL HEATER (OPTIONAL) | FUEL FILLER PUMP (OPTIONAL) | COMBINATION SWITCH (COMMODO)

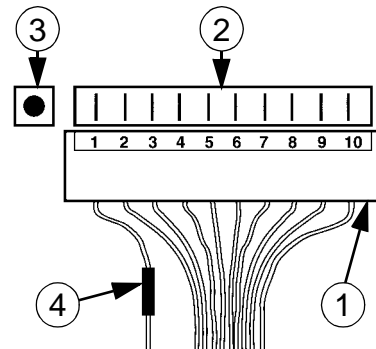


## SCHEMATIC SYMBOLS












- A (n)** Radio/housings
- B (n)** Indicators/pressure switches/loud-speakers/detectors/thermal detector/gauge
- E (n)** Lighting components
- F (n)** Fuses
- G (n)** Electrical supply generators
- H (n)** Warning devices (lighted and audible)
- K (n)** Relays
- M (n)** Motors
- P (n)** Instruments
- R (n)** Resistors/heating elements/heating plugs
- S (n)** Shunt resistors/switches/rotating switches/main switch
- Sh (n)** Shunt
- V (n)** Diodes
- X (n)** Supply line connections
- Y (n)** Solenoid valves, solenoids

**NOTE:** *The (n) shows the component number.  
Example: K2 is relay N°2.*

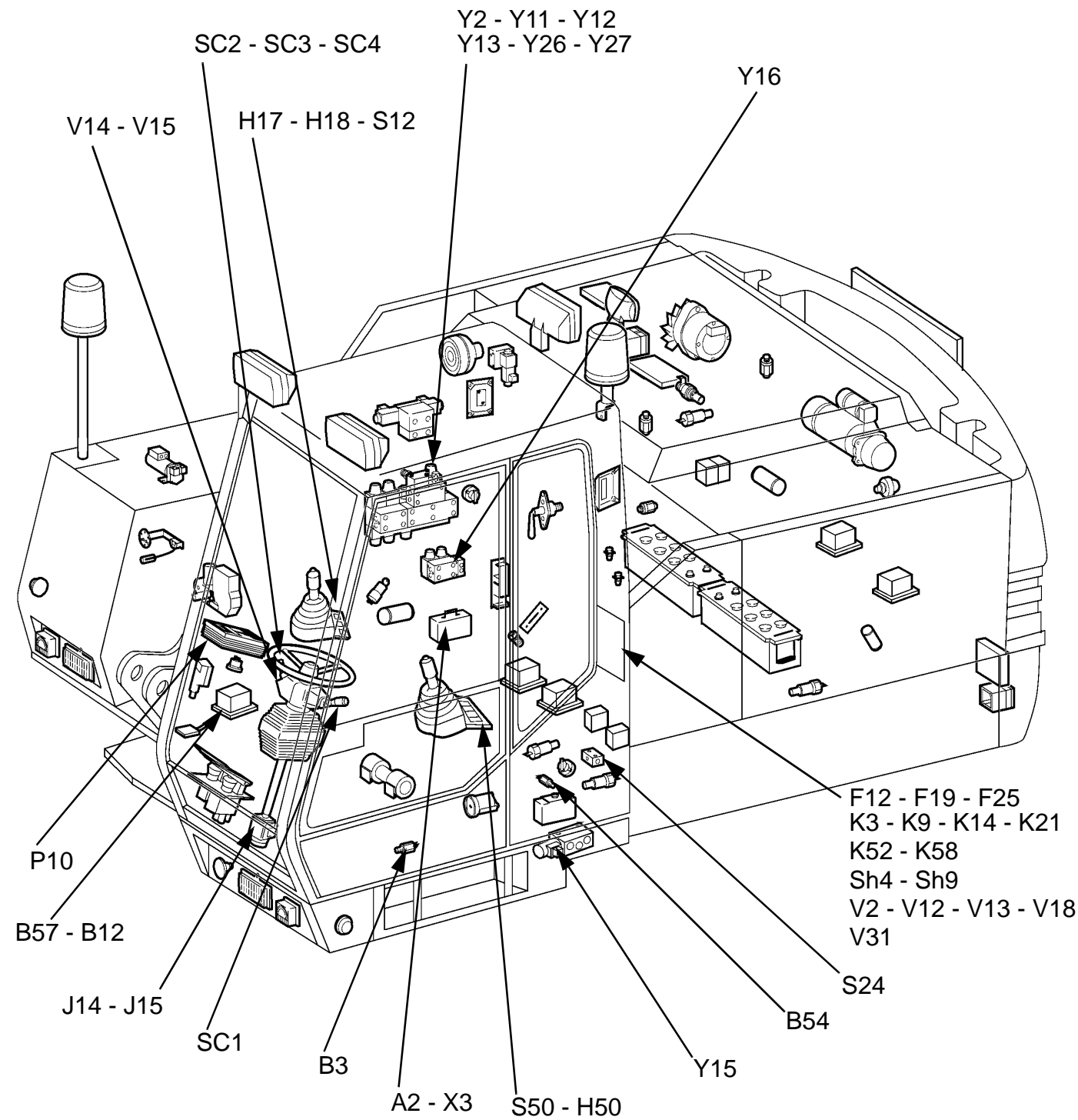
-  (n) Supply on printed circuit
-  (n) Battery terminal
-  (n) Printed circuit connection terminal
-  Printed circuit earth connector
-  A1 Instrument panel connector
-  1 or  1 or  1 Identification of harness
-  1(1) or  1(1) or  1(1) Identification of harness, followed by path identification number
-  (1) or  (1) Printed circuit earth connectors



The installation position for the harness connector (1) on connector (2) of the printed circuit is identified by a red mark (3) followed by the figure 1 on the printed circuit. This identification corresponds to the position of path 1 of the harness connector (1). This position is completed when the path 1 line is shown by a red ring (4) located on line 1 wire, or by red paint marking.

-  Local earth
-  Wire number
- NC** Closed circuit
- NO** Open circuit
-  Intersection of two wires with connection point
-  Intersection of two wires without connection point
-  Link with following plate
-  Link with preceding plate
-  Return to another plate with the same letter
-  Bulbs
-  Test bulb
-  Light emitting diode (LED)
-  Regulator

## ELECTRICAL SCHEMATIC (PLATE 4)



### ELECTRICAL CABINET

- F12** Fuse, 10 A, two-speed electro, axle unlocking, piloting neutralisation (std - Italy), stabilizers, direction of travel control, overload indicator
- F19** Fuse, 5 A, LH front/rear sidelight + night lighting
- F25** Fuse, 7.5 A, parking brake electro, working brake electro (std/D/I)
- K3** Hourmeter + transmission brake pressure switch + two-speed supply relay
- K9** Pilot safety relay/axle unlocking
- K14** Speed change relay (588)
- K21** Safety relay piloting pressure switch piloting
- K52** Speed change relay (except 588)
- K58** Two-speed supply relay
- Sh4** Shunt OK Standard - not Italy
- Sh9** Shunt contact K58 two-speed supply
- V2** Diode less engine running
- V12** 2nd speed indicator lamp diode on 588P
- V13** 1st speed indicator lamp diode on 588P
- V18** Axle unlocking indicator lamp diode on instrument panel
- V31** K58 relay diode

### FLOOR

- A2** Electronic control box (788-988-1188)
- B3** Pilot pressure switch
- B12** Brake pressure switch (588)
- B54** Front axle unlocking pressure switch
- B57** Speed change pressure switch
- H50** Working brake and parking brake switch lighting (optional)
- J14** Steering column connector
- J15** Steering column connector
- SC2** Front axle automatic and manual unlocking switch
- SC3** Front axle locking and unlocking switch (in the axle unlocked position)
- SC4** Stabilizer raising and lowering momentary inverter switch
- S12** Two-speed switch (588)
- S24** Pilot safety switch
- S50** Parking brake and working brake switch (optional)
- V14-V15** Stabilizer solenoid valve diodes (in combination switch (commodo))
- X3** 35-way connector (788-988-1188)

### UPPERSTRUCTURE

- Y2** Pilot safety solenoid valve
- Y11** Gear box solenoid valve (first speed)
- Y12** Gear box solenoid valve (second speed)
- Y13** Front axle unlocking solenoid valve
- Y15** Parking brake solenoid valve
- Y16** Working brake solenoid valve
- Y26** Stabilizer raising solenoid valve
- Y27** Stabilizer lowering solenoid valve

### CAB

- H17** First speed green indicator light (588)
- H18** Second speed blue indicator light (588)
- P10** Instrument panel
- SC1** Direction indicator combination switch (commodo), main beam and dip switch, side lights and headlight flasher switch

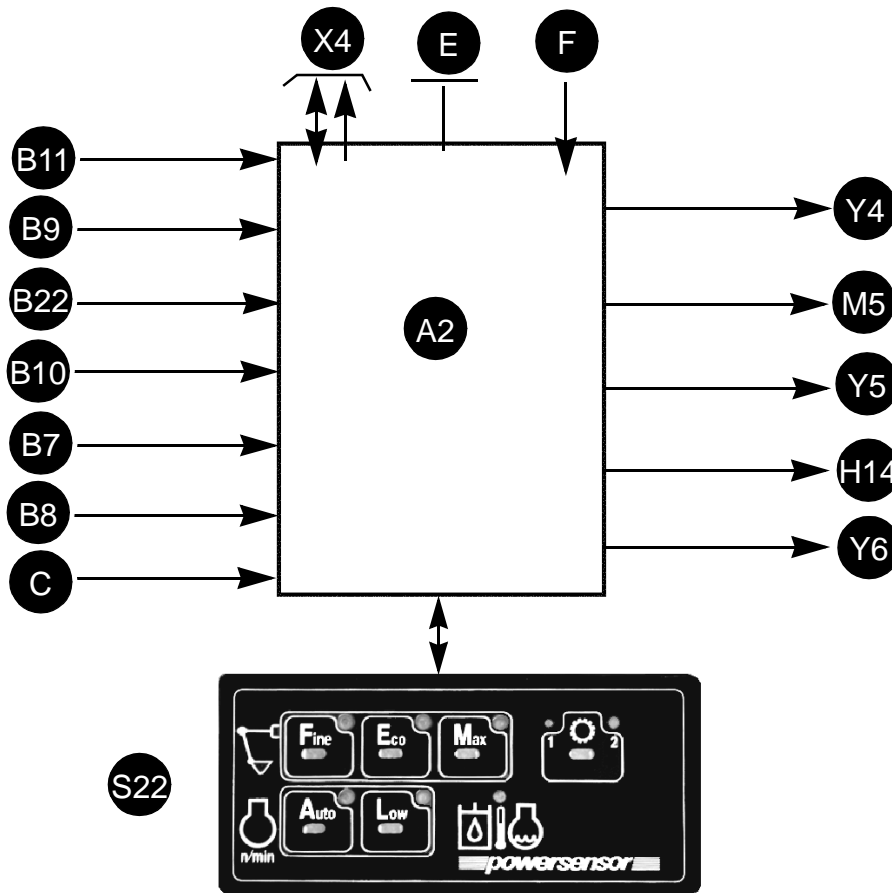
## ELECTRONIC SYSTEM

### General

Some of the machine's functions are managed and checked electronically. The functions concerned are as follows:

- Cold start assistance.
- Electric acceleration.
- Automatic return to idle.
- Engine overheating safety system.
- Engine / hydraulic system power regulation: "Speed sensing".
- Swing braking and brake release.
- Automatic travel sequencing (Two-speed excavators only).
- Electronic system diagnosis.

### Components connected to electronic system

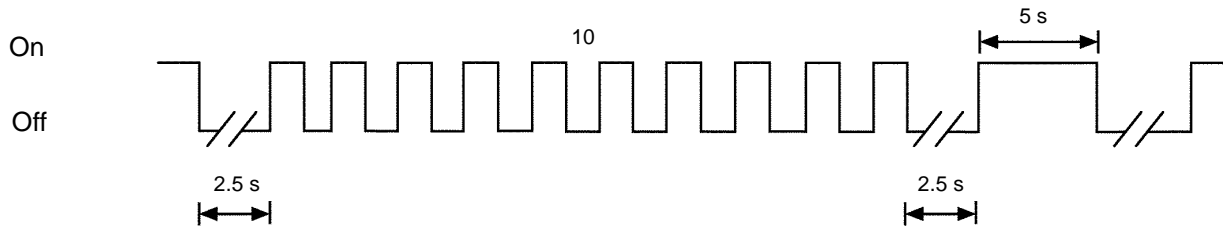


- A2** Electronic control box
- B7** Swing detector pressure switch
- B8** Travel detector pressure switch
- B9** Engine speed detector
- B10** Swing motor speed detector
- B11** Hydraulic pressure detector
- B22** Engine coolant temperature sender
- H14** Correct operation indicator light (LED)

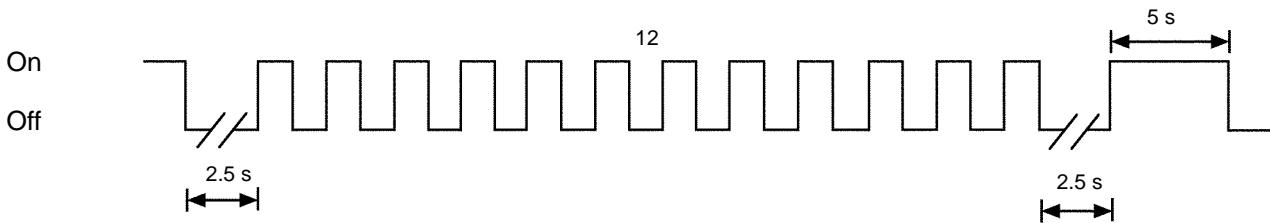
- M5** Injection pump servo-motor
- S22** Control keyboard
- X4** Diagnostic socket
- Y4** Proportional pressure reduction valve DRE4
- Y5** Upperstructure brake release electro-control valve
- Y6** Travel motor displacement change electro-control valve (two-speed excavators only)
- C** Lighting 28 volts
- E** Earth
- F** 28 volt battery

## Defect code 10, 12 and 13: Components associated with the control box

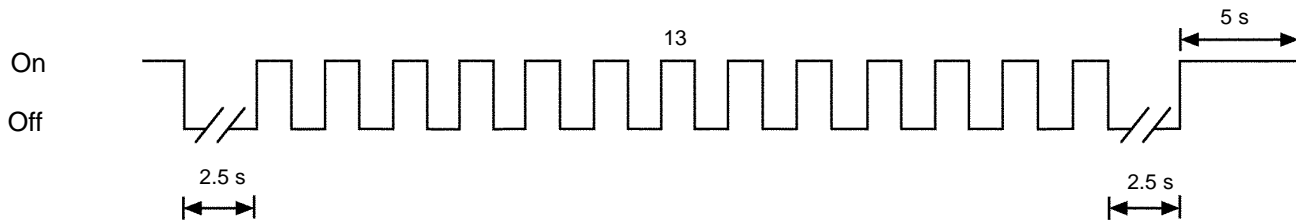
### Illustration of the indicator lamp signal



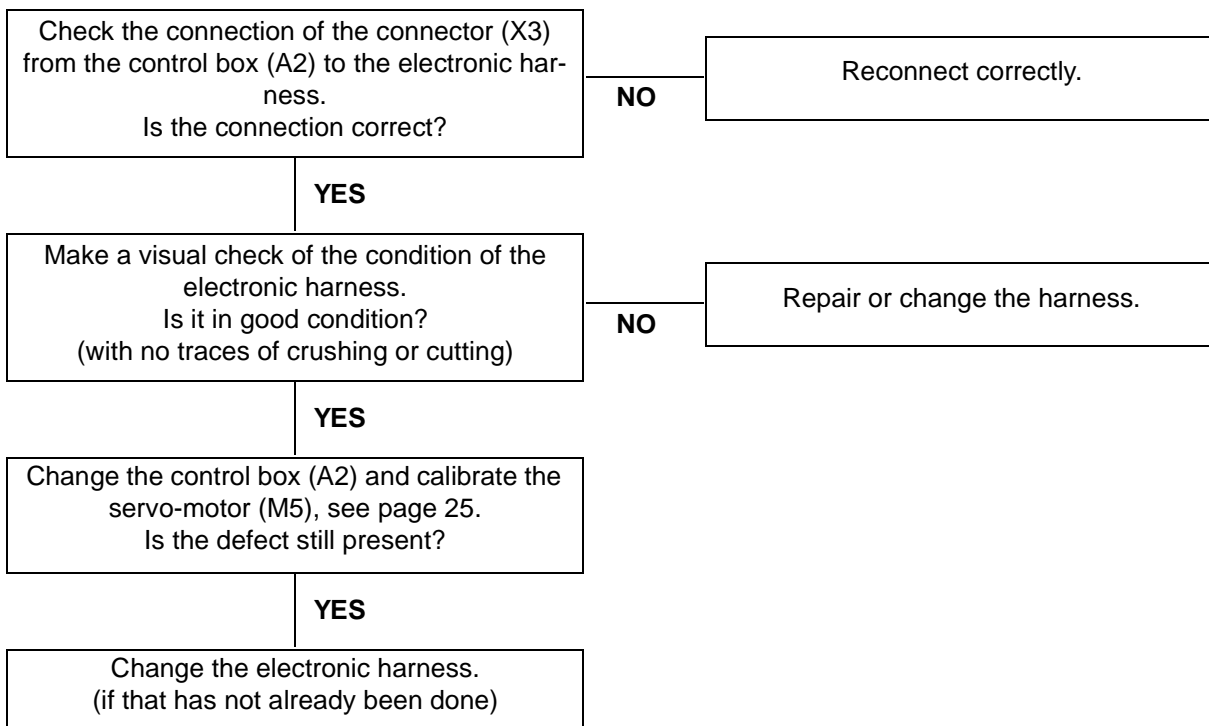
PDH0483



PDH0484



PDH0485



## Defect code 01

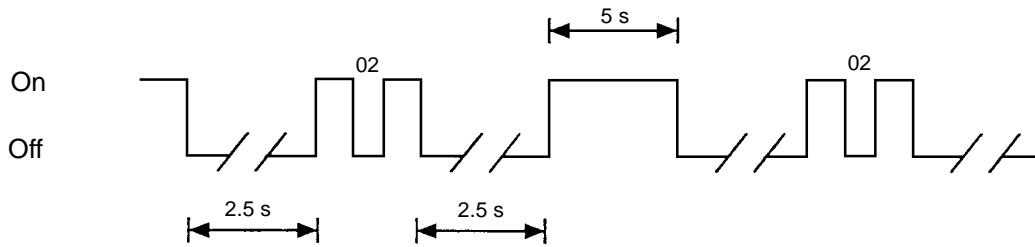
Not used.

## Defect code 02: Components associated with engine electrical acceleration

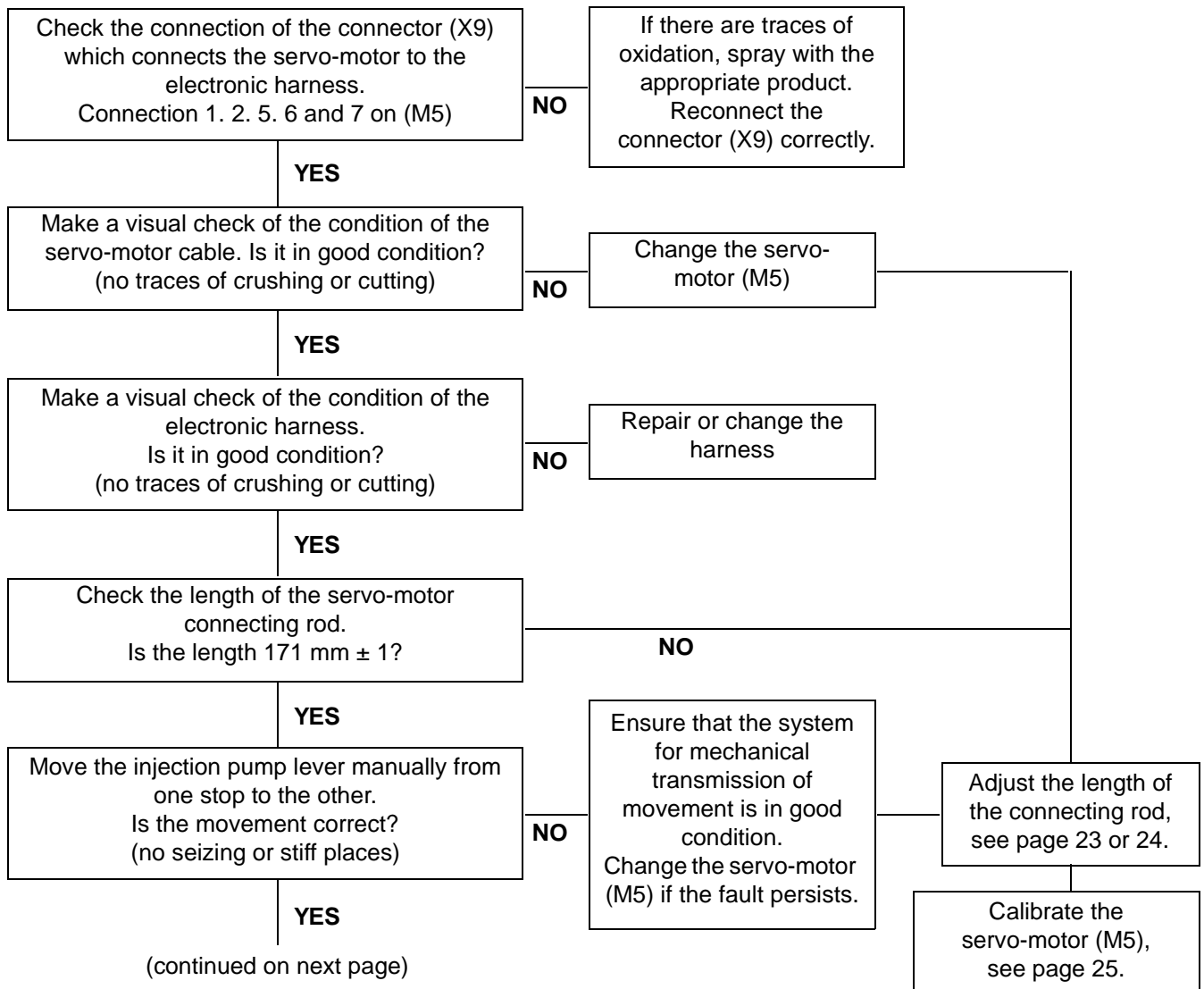
### Problems found:

- Engine returns automatically to idle (lever against the injection pump minimum stop)
- Control keyboard completely off except travel mode on two-speed excavators only
- The code appears regardless of the type of electric motor failure (short-circuit or open circuit)

### Illustration of indicator lamp



PDH0491



(continued on next page)