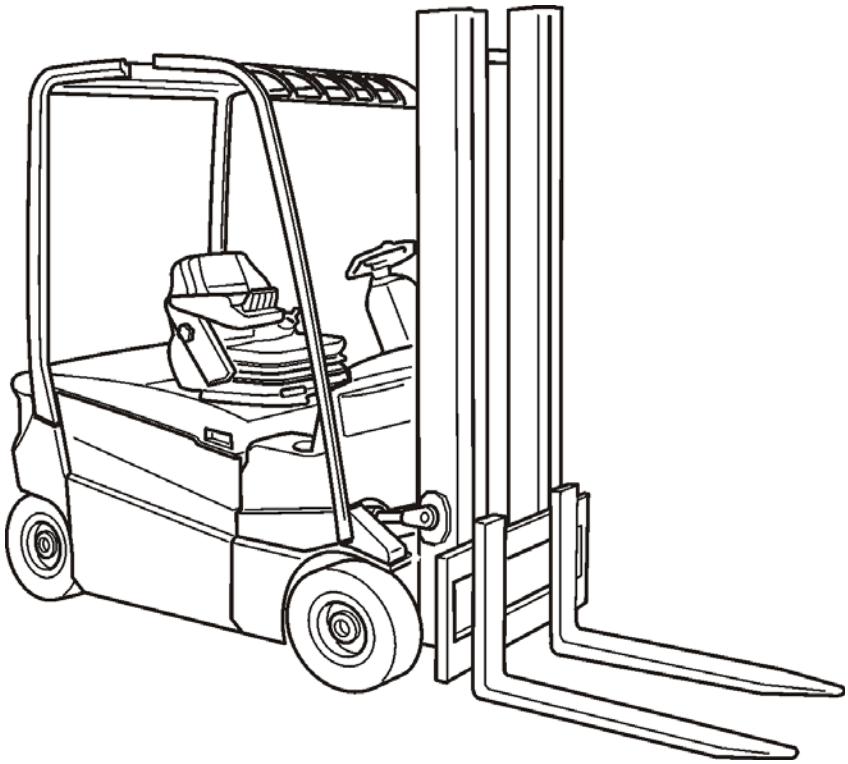
REPAIR MANUAL

C3E150	C4E150
C3E160	C4E160
C3E160L	C4E160L
C3E180	C4E180
C3E180L	C4E180L
C3E200	C4E200



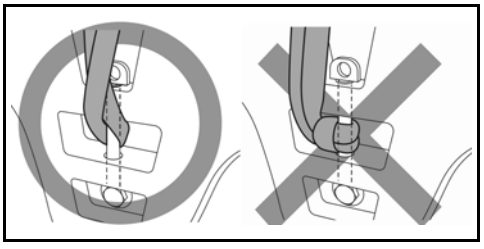
Code 036-0437-00

05/2012

TECHNICAL OPERATING DATA			FORKLIFT TRUCK (Standard Version)											
CHARACTERISTICS														
1.1	Manufacturer		CESAB		CESAB		CESAB		CESAB		CESAB		CESAB	
1.2	Model		**B 415**		**B 416**		**B 416L**		**B 418**		**B 418L**		**B 420**	
1.3	Power unit: electric (battery), diesel, petrol, LPG		Electric		Electric		Electric		Electric		Electric		Electric	
1.4	Operation: manual, pedestrian, stand-on, driver seated		Driver seated		Driver seated		Driver seated		Driver seated		Driver seated		Driver seated	
1.5	Load capacity	Q [t]	1,5		1,6		1,6		1,8		1,8		2,0	
1.6	Load centre	c [mm]	500		500		500		500		500		500	
1.8	Axle centre to fork face	x [mm]	351,5	b	351,5	b	351,5	b	365,5	b	365,5	b	365,5	b
1.9	Wheel-base	y [mm]	1312		1420		1528		1420		1528		1528	
WEIGHTS														
2.1	Weight	kg	2991	a	3055	a	3239	a	3243	a	3321	a	3427	a
2.2	Axle load with load, front/rear	kg	3894 / 597		4067 / 588		4083 / 756		4494 / 549		4505 / 616		4813 / 614	
2.3	Axle load without load, front/rear	kg	1421 / 1570		1508 / 1547		1592 / 1647		1597 / 1646		1685 / 1636		1680 / 1747	
WHEELS - CHASSIS														
3.1	Tyres: C=Cushion, PN=Pneumatic, SE=Superelastic, TW=Twin		C / SE	c	C / SE	c	C / SE	c	C / SE	c	C / SE	c	C / SE	c
3.2	Tyre size, front		432x152 / 18x7-8		432x152 / 18x7-8		432x152 / 18x7-8		457x178 / 200/50-10		457x178 / 200/50-10		457x178 / 200/50-10	
3.3	Tyre size, rear		381x127 / 16x6-8		381x127 / 16x6-8		381x127 / 16x6-8		381x127 / 16x6-8		381x127 / 16x6-8		381x127 / 16x6-8	
3.5	Wheel: number front/rear (x = driven)		2x / 2		2x / 2		2x / 2		2x / 2		2x / 2		2x / 2	
3.6	Track width, front	b10 [mm]	889 / 901	c	889 / 901	c	889 / 901	c	879 / 916	c	879 / 916	c	879 / 916	c
3.7	Track width, rear	b11 [mm]	841 / 842	c	841 / 842	c	841 / 842	c	841 / 842	c	841 / 842	c	8841 / 842	c
DIMENSIONS														
4.1	Mast tilt: forward / backward	α / β [°]	5° / 7°	e	5° / 7°	e	5° / 7°	e	5° / 7°	e	5° / 7°	e	5° / 7°	e
4.2	Height of mast, lowered	h1 [mm]	2160		2160		2160		2160		2160		2160	
4.3	Free lift	h2 [mm]	80		80		80		80		80		80	
4.4	Lift height	h3 [mm]	3170		3170		3170		3170		3170		3170	
4.5	Height of mast, extended	h4 [mm]	3720		3720		3720		3720		3720		3720	
4.7	Height of overhead guard	h6 [mm]	2050		2050		2050		2050		2050		2050	
4.8	Height of driver's seat	h7 [mm]	937		937		937		937		937		937	
4.12	Towing coupling height	h10 [mm]	500		500		500		500		500		500	
4.19	Overall lenght	l1 [mm]	2946	b	3054	b	3162	b	3068	b	3176	b	3176	b
4.20	Length to fork face	l2 [mm]	1946	b	2054	b	2162	b	2068	b	2176	b	2176	b
4.21	Overall width	b1\b2 [mm]	1050		1050		1050		1057 / 1109	c	1057 / 1109	c	1057 / 1109	c
4.22	Fork dimensions	s/e/l [mm]	35x100x1000		35x100x1000		35x100x1000		35x120x1000		35x120x1000		35x120x1000	
4.23	Fork carriage to DIN 15173, class/form A, B		II A		II A		II A		II A		II A		II A	
4.24	Width of fork carriage	b3 [mm]	1020		1020		1020		1020		1020		1020	
4.31	Floor clearance, mast (with load)	m1 [mm]	100		100		100		100		100		100	
4.32	Floor clearance, centre of wheel-base (with load)	m2 [mm]	90		90		90		90		90		90	
4.33	Aisle width pallets 1000x1200 across forks	Ast [mm]	3224		3329		3436		3343		3449		3449	
4.34	Aisle width pallets 800x1200 along forks	Ast [mm]	3379		3483		3589		3497		3603		3603	
4.35	Turning radius	Wa [mm]	1616		1719		1823		1719		1823		1823	
4.36	Minimum slewing distance	b13 [mm]	205		196		186		196		186		186	
PERFORMANCE														
5.1	Travel speed, with/without load	km/h	19 / 19		19 / 19		19 / 19		19 / 19		19 / 19		19 / 19	
5.2	Lifting speed, with/without load	m/s	0,4/0,6		0,4/0,6		0,4/0,6		0,4/0,6		0,4/0,6		0,38/0,6	
5.3	Lowering speed, with/without load	m/s	0,55 / 0,50		0,55 / 0,50		0,55 / 0,50		0,55 / 0,50		0,55 / 0,50		0,55 / 0,50	
5.5	Tractive force, with/without load	N	5200/5400		5200/5400		5200/5400		5200/5400		5200/5400		5200/5400	
5.6	Maximum tractive force, with/without load, S2 5 minute rating	N	14450/15000	d	14450/15000	d	14450/15000	d	14450/15000	d	14450/15000	d	14450/15000	d
5.7	Climbing ability, with/without load, S2 30 minute rating	%	14/16,5		13,5/ 16		13,5/ 16		13 / 15,5		13 / 15,5		13 / 15,5	
5.8	Maximum climbing ability, with/without load, S2 5 minute rating	%	28 / 32	d	27 / 31	d	27 / 31	d	25 / 30	d	25 / 30	d	23 / 29	d
5.9	Acceleration time, with/without load	s	---		---		---		---		---		---	
5.10	Service brake: mechanical / hydraulic / electric / pneumatic		Electric/Hydraulic		Electric/Hydraulic		Electric/Hydraulic		Electric/Hydraulic		Electric/Hydraulic		Electric/Hydraulic	
ELECTRIC MOTOR														
6.1	Drive motor, power S2 60 minute rating	kW	6 x 2		6 x 2		6 x 2		6 x 2		6 x 2		6 x 2	
6.2	Lift motor, power S3 15% rating	kW	15,8		15,8		15,8		15,8		15,8		15,8	
6.3	Battery to DIN 43531/35/36 A, B, C, NO													
6.4	Battery voltage / rated capacity (K5)	V/Ah	48 / 420-500		48 / 525-625		48 / 690-750		48 / 525-625		48 / 690-750		48 / 690-750	
6.5	Battery weight	kg	708		856		1013		856		1013		1013	
6.6	Power consumption according to VDI cycle	kWh/h	---		---		---		---		---		---	
OTHERS														
8.1	Type of drive control		Inverter MOSFET		Inverter MOSFET		Inverter MOSFET		Inverter MOSFET		Inverter MOSFET		Inverter MOSFET	
8.2	Working pressure for attachments	bar	140		140		140		140		140		140	
8.3	Quantity of oil for attachments	l/min	---		---		---		---		---		---	
8.4	Noise level at driver's ear	dB (A)	---		---		---		---		---		---	
8.5	Tow hook / DIN type		---		---		---		---		---		---	

a) The weight is referred to the truck with the battery
b) + 34 mm with sideshift incorporated
c) C / SE
d) The referred values indicate the capacity of the electric motor and of the transmission
e) 5° backward with cabin front panel
f)
g)
h)
i)

TOWING THE TRUCK



The standard fork lift trucks are not suited for towing.

In special case, the rear draw bar can be used to tow a faulty lift truck.
In this case it is obligatory to use a stiff towing bar, fastened between the rear draw bar of the truck and the towing vehicle. You must proceed carefully and slowly, if possible on a level surface.

- while towing, do not carry any other loads on the forks;
- as far as possible, avoid driving on gradients. In any case, do not go over the figure for driving on gradients with a load.

Note the cautions below when towing the vehicle with back wheels lifted.

- Lift the rear wheels for towing
- The traveling speed when towing must not exceed the maximum traveling speed of the forklift
- Before starting towing, always set the key switch to OFF, the direction switch to the neutral position and parking brake of released
- Before towing, either remove the fork or take action to prevent the fork from coming into contact with the ground due to bouncing

When making a curve, towed loads tend to reduce the curving radius; therefore it is important to widen the entrance radius in order to avoid striking against any obstacle.

MAINTENANCE CYCLE (Based on total operating hours or months of truck life cycle, whichever comes first)	every	1 week	6	12	months
	every	40	1000	2000	hours
Seat					
Mounting integrity and fastening			I	←	
Seat switch operating condition		I*	I	←	
Seat belt integrity and operating condition			I	←	
OPS					
Operating conditions		I*	I	←	
Emergency stop button					
Operating conditions			I	←	
Instrument panel					
Operating conditions			I	←	
Horn					
Operating and mounting conditions			I	←	
Lighting system (OPT)					
Operating and mounting conditions			I	←	
Turn signals (OPT)					
Operating and mounting conditions			I	←	
Reverse acoustic warning (OPT)					
Operating conditions			I	←	
Rear-view mirrors (OPT)					
Integrity and cleaning			I	←	
Rear reflection			I	←	
Cabin (OPT)					
Roof integrity			I	←	
Doors, side window, tailgate integrity and operating condition			I	←	
Heated windows integrity and operating condition			I	←	
Wiper integrity and operating condition			I	←	
Heater integrity and operating condition			I	←	
Lubrication					
General status - see Lubrication Chart section			I	←	

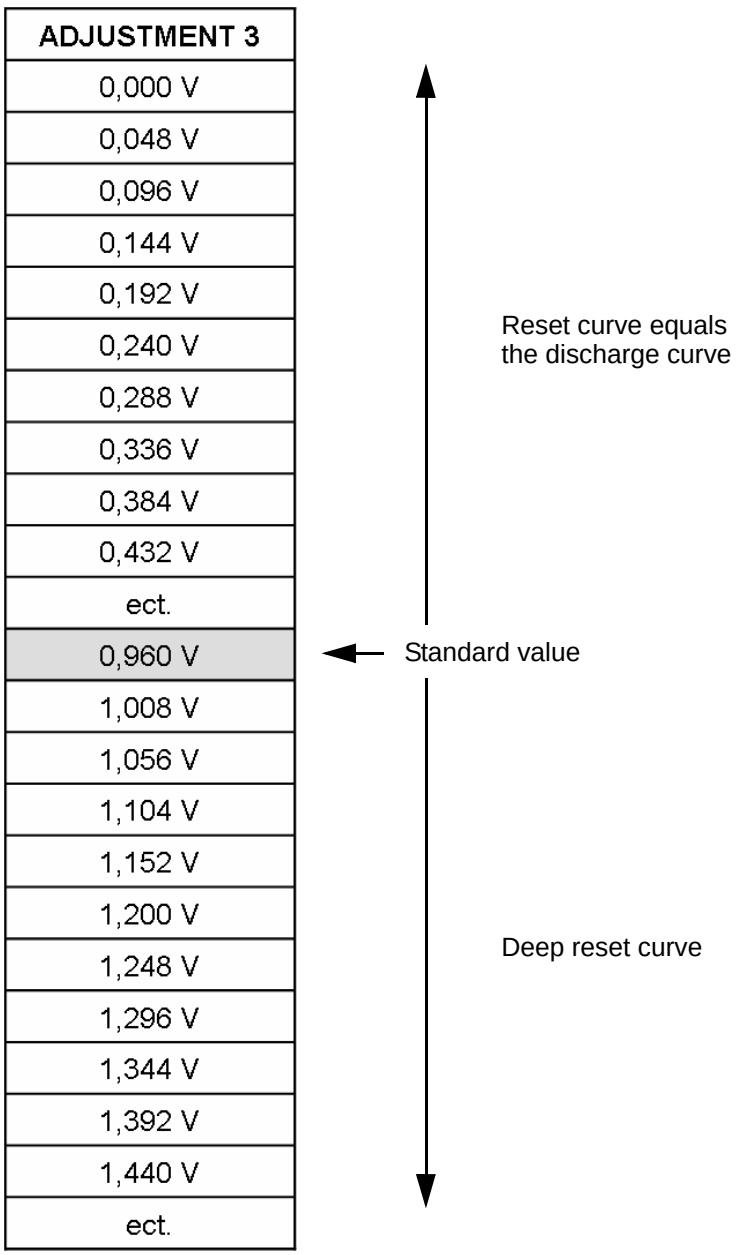
WARNING:
Complete the information concerning all maintenance operations with those mentioned in the relevant safety and operator manuals

ADJUSTMENT 3

The ADJUSTMENT 3 parameter determines the reset curve.

Discharge curve + ADJUSTMENT 3 = Reset curve

Parameter	Min value	Max value	Step	Standard
ADJUSTMENT 3	0.000 V	12.240 V	0.048V	0.960 V



GEL BATTERIES

The following paragraph provides general information on gel batteries.
For more detailed information, refer to the supplier of the installed battery.

It is possible to install and use GEL batteries on the forklift truck; always adapt their weight so as to respect the minimum weight required, as indicated in the table in the paragraph "BATTERY CASE AND REQUIRED WEIGHTS".

In GEL batteries the electrolyte is immobilized (sulphuric acid in gel form), unlike traditional batteries where the electrolyte is in liquid form.

Notes: In GEL batteries the density cannot be measured.

In place of the caps, valves are fitted which perform the function of adjusting the internal pressure of the elements, opening in the event of excess pressure to let out the excess gases developed during charging and, at the same time, preventing the oxygen in the atmosphere from getting inside.

MAINTENANCE

The GEL battery does not need intense maintenance like traditional batteries.
- The battery never needs topping up.
- The valve caps must not be removed.

If the valves should accidentally be damaged, contact the service center of the battery supplier to have them replaced.

The battery must be kept clean and dry to prevent current leakage. Any liquid present inside the battery case must be removed. Immediately repair any breaks in the coating of the case, to prevent drops in insulation and corrosion of the case. If this operation requires the removal of the elements, call the service centre of the battery supplier.

Every month, at the end of charging and with the battery disconnected from the battery charger, check the battery voltage and the voltage of every single element, recording it on a special chart.
If a significant variation is found with respect to the previous record, carry out a new series of checks on the data found and, if necessary, request the intervention of the service center of the battery supplier .

If the autonomy is not sufficient, proceed as follows:
- Check that the work being done is compatible with the battery capacity;
- Check the state of the rectifier;
- Check the discharge limiter.

DISCHARGE

In order to guarantee a good battery life, the battery must not be discharged below 80% of the rated capacity (full discharge) which corresponds to **1.83 V per element.**

Notes: Notes:It is important for the battery temperature to remain between +5°C and + 35 °C during the work cycle. The battery life will be optimal with a temperature between 25-30 °C.

CHARGE

The complete charge of the battery must be carried out at the end of every shift. Do not leave the batteries discharged for long periods of time.
The batteries must be charged using high-frequency battery chargers indicated by the battery supplier, choosing a rectifier different from the one indicated by the supplier may cause damage to the battery.
The room where the battery is being charged must be ventilated.

NOTES: It is necessary to wait a sufficient time for the battery to cool before using it once charging is complete.

CONNECTOR INSPECTION

When inspect each board and find the cause of the trouble, do not replace the board immediately but check the following items.

- **Anomalies in related harnesses**
- **Looseness of the related connectors**
- **Bending or damage of connector pin and defective contact of any related connector pin**

If any of the above is the cause of the trouble and the board is replaced with a new one, the new board will be damaged.
Always replace the board after careful inspection.
When the trouble derives from a logic unit or board, measure the voltage and resistance of every part involved in the substitution. Always disconnect the battery plug before measuring the resistance.

Important:
Disconnect the battery plug before connecting or disconnecting the logic unit.
Note:
When a logic unit is determined to be the cause of trouble as the result of troubleshooting, always measure the applied voltage and resistance of each related portion when replacing.

(2)Setting Method
(a)Key switch OFF and battery plug disconnected.
(b)Connect the multimeter to the corresponding connector pin

Important:
As connection of the wrong connector pin may damage normal portions, make sure to confirm the connector pin number.

(3)Measurement method and standard list
How to read the list

CN (pin-colour) ⇔ CN (pin-colour) From ⇔ To	Description	Standard	Notes

Arriving connector
Starting connector

JAT (1-B9)	J15 (1-B9)	EN1 encoder + V	+ 12 V	

Colour
Connector pin n.
Connector n.

Value of the measurement

COLOUR CODING

	COLORI	COLOURS	FARBEN	COULEURS	COLORES
C	arancio	orange	orange	orange	naranja
A	azzurro	blue	blau	bleu	azul
B	bianco	white	weiß	blanc	blanco
L	blu	dark blue	dunkelblau	bleu marine	azul intenso
G	giallo	yellow	gelb	jaune	amarillo
H	grigio	grey	grau	gris	gris
M	marrone	brown	braun	marron	castaño
N	nero	black	schwarz	noir	negro
S	rosa	pink	pink	rose	rosa
R	rosso	red	rot	rouge	rojo
V	verde	green	grün	vert	verde
Z	viola/porpora	purple	violett	violet	púrpura

CN (pin-colour) ⇔ CN (pin-colour) From ⇔ To		Description	Standard	Notes
P5 (15-SN)	J49 (7-SN)	Cursor load sensor		
P5 (16-SL)	P70 (2-SL)	Out buzzer	48V	
P5 (17-S3)	---	+V battery	48V	
P5 (18-S3)	---	+V battery	48V	
P5 (19-N)	---	GND IN	GND	
P5 (20-N)	---	GND IN	GND	
P5 (21-N)	---	GND IN	GND	
P5 (22-N)	---	GND IN	GND	
P5 (23)	---	Unused		
P5 (24-AL)	J49 (9-AL)	+V load sensor	5V	
P5 (25-N)	---	GND IN	GND	
P5 (26-AV)	J49 (8-AV)	GND load sensor	GND	
P5 (27-C)	P96 (4-C)	+24V IN from DC/DC converter	24V	
P5 (28-S3)	---	+V battery	48V	
P5 (29-CN)	P102 (1-CN) [via J145 (2-CN)]	+V right stop light	24V	
P5 (30-CR)	P91 (1-CR) [via J145 (4-CR)]	+V left stop light	24V	
P5 (31-BC)	P92 (1-BC) [via J145 (3-BC)] and P93 (1-BC) [via J145 (3-BC)]	+V backing light	24V	
P5 (32-H)	J115 (2-H) [via J51 (13-H)]	GND EV9 5th way	GND	
P5 (33-BH)	J115 (1-BH) [via J51 (14-BH)]	+V EV9 5th way	48V	
P5 (34-A)	J116 (2-A) [via J51 (15-A)]	GND EV9 5th way	GND	
P5 (35-BS)	J116 (1-BS) [via J51 (16-BS)]	+V EV9 5th way	48V	

CONTROL UNIT

MAIN CONTROL UNIT

	Traction Logic Unit Master ACE-2	**Traction Logic Unit Slave ACE-2**	**Logic Unit breather ACE-2**
Inverter for AC asynchronous 3-phase motors	√	√	√
Regenerative braking functions	√	√	√
Can-bus interface	√	√	√
Flash Memory	√	√	√
Digital control based upon a microcontroller	√	√	√
Power	48 V	48 V	48 V
Maximum current	250 A (RMS)	250 A (RMS)	350 A (RMS)
Operating frequency	8 Khz	8 Khz	8 Khz
External temperature range	-30° C + 40° C	-30° C + 40° C	-30° C + 40° C
Maximum inverter temperature	75° C	75° C	75° C

DESCRIPTION OF CONTACTORS

K1 = Pump contactor

Lifting logic	Contactor	Description	V	V holding
+Vb	K1	Coil power supply	+Vb	70% +Vb
P3 (16-Z)	K1	Coil negative	GND	

K2 = Traction contactor

Drive logic	Contactor	Description	V	V holding
+Vb	K2	Coil power supply	+Vb	80% +Vb
P1 (16-A)	K2	Coil negative	GND	

K3 = Line contactor

Display	Contactor	Description	V	V holding
P137 (5-M)	K3	Coil power supply	+Vb	+Vb
- Vb	K3	Coil negative	GND	

NECESSARY ADJUSTMENTS AFTER A HARDWARE COMPONENT REPLACED

MCB CARD

Acquisition	Reset the card (RESET JOY FLAG)
	Serial number (LEARN SERIAL NUMBER)
	Accelerator potentiometer (LEARN TRAC POT)
	Lifting potentiometer (only in the mechanic distributor version) (LEARN LIFT POT)
	3/4 wheels configuration (STEER TABLE)
	Balanced pedal configuration (SWAYING PEDAL)
	Speed reduction in case of mast with height more than 6250mm (HIGH MAST)

MASTER TRACTION LOGIC UNIT

Acquisition	Serial number (LEARN SERIAL NUMBER)
	Steering potentiometer (SET STEER ZERO/SET STEER LEFT/SET STEER RIGHT)
	3/4 wheels configuration (STEER TABLE)
	GEL battery (BDI GEL)

SLAVE TRACTION LOGIC UNIT

Acquisition	Serial number (LEARN SERIAL NUMBER)

LIFTING LOGIC UNIT

Acquisition	Serial number (LEARN SERIAL NUMBER)

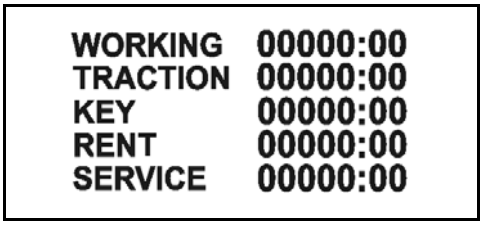
ARMREST CARD

Acquisition	Serial number (LEARN SERIAL NUMBER)
	Optional 5th way configuration via fingertips (VTH ENABLE)
	Configuration of optional clamp pilotage button (CLAMPS)

DASHBOARD

Acquisition	Date and hour regulation
	Serial number (LEARN SERIAL NUMBER)
	Start icon (START ICON) *(acquisition with BT version truck)*

HOUR METER

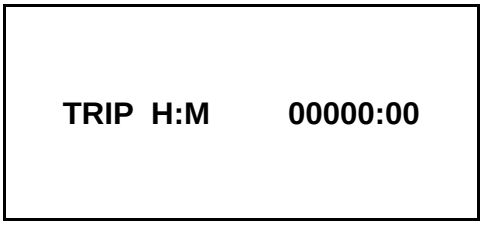


Enter the user menu
[see USER MENU PASSWORD INSERTION PROCEDURE paragraph]

Press ⬆ or ⬇ to view the information referred to the hour meter

To exit the menu use lateral flowing arrows

TRIP



Press ⬇ to view the information referred to the trip
Press I to reset the hour counter

To exit the menu use lateral flowing arrows

SERVICE MENU FUNCTIONS

Menu	Description
MENU SOFT VERS ◁ ▷	**SOFTWARE VERSION** Visualizes the software version of boards and logic units
MENU PARAM CHANGE ◁ ▷	**PARAMETER CHANGE** Modify the selected program parameters
MENU TRUCK CONF ◁ ▷	**TRUCK CONFIGURATION** Modify the configuration parameters
MENU SERVICE RENT ◁ ▷	**SERVICE RENT** It allows to set up the programmed maintenance menu and rent menu
MENU PSW MODIFY ◁ ▷	**MODIFY PASSWORD** It allows to modify the passwords or to restore default ones
MENU TESTER ◁ ▷	**TESTER** Visualizes analog and digital values to analyze the truck status
MENU ALARMS ◁ ▷	**ALARMS** Memorizes truck alarm codes (maximum 20 alarms). This function visualizes alarms in real time
MENU LEARNING ◁ ▷	**LEARNING** Used to set the truck serial number, to acquire the status of the potentiometers and execute the ADJUST BATTERY
MENU DEFAULT RST ◁ ▷	**DEFAULT RESTART** It allows to restore the default parameters of the truck

18 - T CURVE DEC DEL

DESCRIPTION	MIN.	MAX	STEP	UNIT
Determines the deceleration ramp between the steering angle defined by "ANGLE INC" and the steering angle defined by "ANGLE MAX"	0.4	3.0	0.2	Sec
Image reference 3				

19 - ANGLE START

DESCRIPTION	MIN.	MAX	STEP	UNIT
This parameter determines the steering angle without speed reduction	0	10	1	a°
Image reference 3				

20 - ANGLE INC

DESCRIPTION	MIN.	MAX	STEP	UNIT
Starting from "ANGLE START" this parameter determines a steering angle on reaching which a speed reduction is activated, the maximum value of which is defined by the parameter "% CURVE CUTBACK INC"	12	35	1	a°
Image reference 3				

21 - ANGLE MAX

DESCRIPTION	MIN.	MAX	STEP	UNIT
Determines the steering angle in which the maximum speed reduction is defined by the parameter "CURVE CUTBACK MAX"	50	90	1	a°
Image reference 3				

22 - % CURVE CUTB INC

DESCRIPTION	MIN.	MAX	STEP	UNIT
This parameter determines the speed reduction on reaching the steering angle defined by "ANGLE INC" and it is a percentage of the speed reduction fixed by the parameter "CURVE CUTBACK MAX"	10	100	5	%
Minimum value = Minimum speed reduction Maximum value = Maximum speed reduction				
Image reference 3				

16 - P THROTTLE X

DESCRIPTION	MIN.	MAX	STEP	UNIT
Determines an X value zone in the acceleration curve	10	100	10	%

Only for version with mechanical distributor
(Image reference 8)

17 - P THROTTLE Y

DESCRIPTION	MIN.	MAX	STEP	UNIT
Determines an Y value zone in the acceleration curve	10	100	10	%

Only for version with mechanical distributor
(Image reference 8)

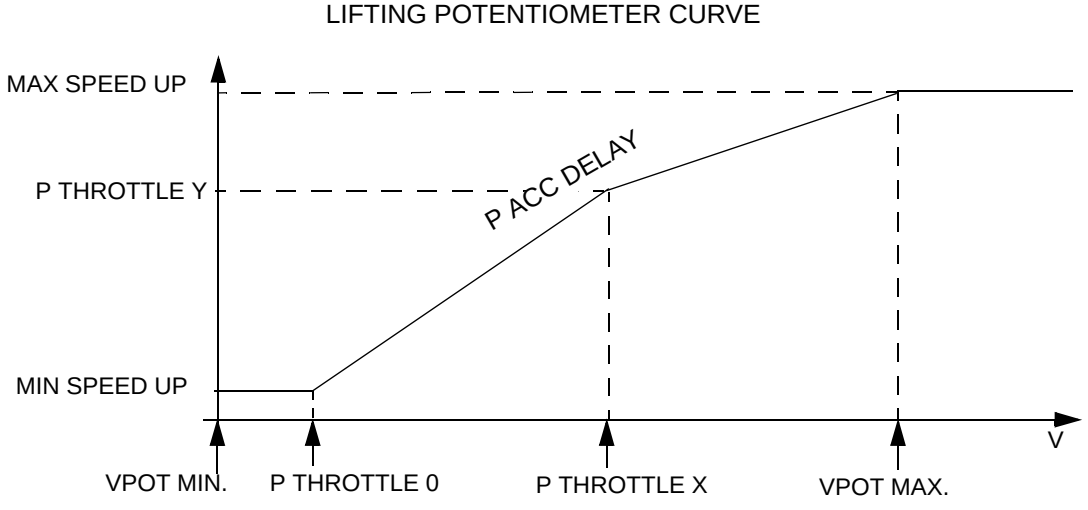


IMAGE 8

18 - PUMP TORQUE PROF

DESCRIPTION	MIN.	MAX	STEP	UNIT
Determines the pump motor torque	0	4	1	

Minimum value = minimum torque (low current consumption)
Maximum value = maximum torque (high current consumption)

WIPERS/WASHER FUNCTION

Enables/disables the wind-screen wipers and sets the activation mode

WIPERS/WASHER			
No	**Parameter**	**Description**	**Notes**
1	**FW**	This parameter enables/disables the front wiper ON = enabled OFF = disabled	ON-OFF
2	**BW**	This parameter enables/disables the rear wiper ON = enabled OFF = disabled	ON-OFF
NOTES: To use the other options, the parameters FW and BW must be activated			
3	**MOTION**	This parameter enables/disables the wiper according to the traction direction ON = enabled OFF = disabled	ON-OFF
4	**AUTO BW**	Whit this parameter the front wiper is always active and the rear only if BW direction is selected ON = enabled OFF = disabled	ON-OFF
5	**WASHER FW**	This parameter enables/disables the front washer ON = enabled OFF = disabled	ON-OFF
6	**WASHER BW**	This parameter enables/disables the rear washer ON = enabled OFF = disabled	ON-OFF

DIR LIGHTS FUNCTION

Enables/disables the direction indicators

DIR LIGHTS			
No	**Parameter**	**Description**	**Notes**
1	**2 FW + STOP**	This parameter enables/disables the turn light ON = enabled OFF = disabled	ON-OFF
2	**2FW + 2 BW**	This parameter enables/disables the turn light for the road circulation lighting system ON = enabled OFF = disabled	ON-OFF

No	Function	Description	Notes
1	**SERV TIMER EN (service timer enable)**	Enables/disables the programmed maintenance timer	
2	**RESET SERV HM (reset service hour meter)**	This function resets the SERV TIMER EN timer	
3	**SERV REQ TIME (service request time)**	This function determines the maintenance interval: **A** reference (PROGRAMMED MAINTENANCE DIAGRAM)	When the set time expires the red led starts to blink
4	**SERV TIME BLINK (service time blink)**	SERV REQ TIME expired notice: **C** reference (PROGRAMMED MAINTENANCE DIAGRAM)	Spanner icon and red led flash when the truck is switched on
5	**SERV CUT TIME (service cutback time)**	This function determines, SERV REQ TIME expired, after how much time the truck enters in limited working system: B reference (PROGRAMMED MAINTENANCE DIAGRAM)	
6	**T SERV CUTBACK (traction service cutback)**	Sets the percentage of traction system reduction when the SERV REQ TIME expires: D reference (PROGRAMMED MAINTENANCE DIAGRAM)	
7	**P SERV CUTBACK (pump service cutback)**	This function sets the percentage of working reduction when SERV CUT TIME is expired; D reference (PROGRAMMED MAINTENANCE DIAGRAM)	
8	**RENT TIMER EN (rental timer enable)**	This function enables/disables the timer of the rental duration	
9	**RENT TIME/DAY**	This function determines (selects) the Timer Rent working in hours or days; if the DAY function is selected it is not possible to modify the date in the USER menu	WH = hours DAY = days
10	**T RENT CUTBACK (traction rental cutback)**	Sets the percentage of traction system reduction when the RENT CUT TIME or RENT CUT DAY expires	
11	**P RENT CUTBACK (pump rental cutback)**	Sets the percentage of lifting system reduction when the RENT CUT TIME or RENT CUT DAY expires	
12	**RESET RENT HM (reset rental hour meter)**	This function resets the timer RENT TIMER EN	
13	**RENT REQ TIME (rental request time)**	This function determines the rent interval; **A** reference (PROGRAMMED RENT DIAGRAM)	

MAT. HANDLING

Distribuidor electroproporcional

Displays the hydraulic system settings for the electro-proportional version

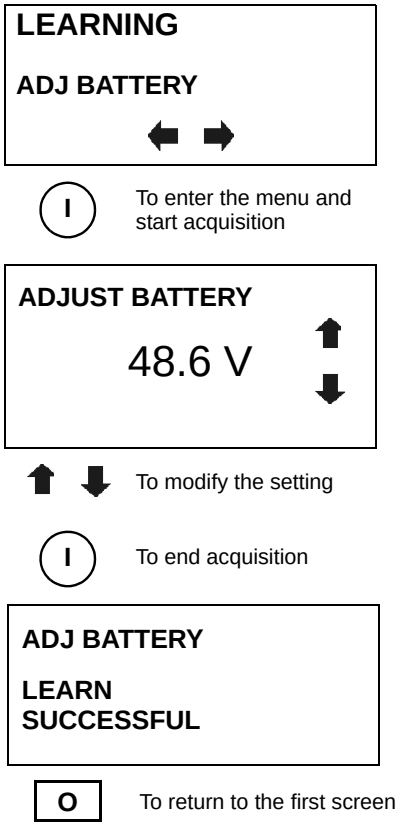
MAT. HANDLING - JOYSTICK / FINGERTIPS			
No	**Parameter**	**Description**	**Notes**
1	**LIFE PUMP**	Working hour counter from the first start	Hours
	LIFE KEY	Working hour counter from the first start	Hours
2	**P SPD SET**	Motor theoretical speed requested referred to speed reduction	Hz
	P MOT SPD	Lifting motor encoder frequency	Hz
3	**P MOT TMP**	Motor temperature	C°
4	**P CTR TMP**	Temperature of the hardware section that controls the motor	C°
5	**P SLIP**	Flowing values of the left motor, or the speed difference between the rotating megnetic field and the motor rotor: P SLIP (Hz) = FREQUENCY (Hz) - ENCODER (Hz)	Hz
6	**P FREQU**	Frequency of the current and voltage signals supplyed to the motor	Hz
7	**CURRENT RMS**	Current supplied to the lifting motor	A
8	**LIFT**	Lifting fingertips/joysticks S1 and S2 microswitches status	ON-OFF
	LIFT AUX	Auxiliary digital input status (optional): not used	OFF
9	**TILT**	Tilting fingertips/joysticks S1 and S2 microswitches status	ON-OFF
	TILT AUX	Auxiliary digital input status (optional): not used	OFF
10	**SSH**	Tilting fingertips/joysticks S1 and S2 microswitches status	ON-OFF
	SSH AUX	Auxiliary digital input status (optional): not used	OFF
11	**IV**	4th way fingertips/joysticks S1 and S2 microswitches status	ON-OFF
	IV AUX	Auxiliary digital input status (optional): not used	OFF
12	**V**	5th way fingertips/joysticks S1 and S2 microswitches status	ON-OFF
	V AUX	5th way microswitch	OFF
13	**IN6_1**	Reverse direction micro	ON-OFF
	IN6_2	Forward direction micro	ON-OFF
14	**IN6_3**	Button for 4th way activation	OFF
	IN6_4	Unused	OFF
15	**IN6_5**	Unused	OFF
	IN6_6	Available lifting speed reduction (optional)	OFF
16	**LIFT POT**	Lifting potentiometer (neutral position 2,45V ± 0,2 V)	V
	LIFT SET	Current value requested from the armrest board to the EVCB for lifting/lowering group	Amp
17	**TILT POT**	Tilting potentiometer (neutral position 2,45V ± 0,2 V)	
	TILT SET	Current value requested from the armrest board to the EVCB fortilting group	Amp

5 - ADJ BATTERY

DESCRIPTION

Acquisition used to set the voltmeter inside the traction logic unit for reading the battery voltage

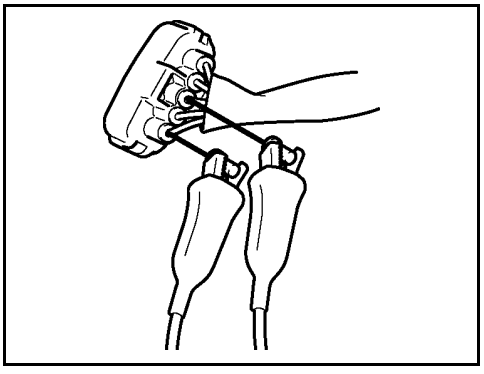
See chapter 1 paragraph ADJUSTING THE BATTERY VOLTAGE



Remarks: If the display does not memorize the acquisition data, repeat the SERIAL NUMBER acquisition and then repeat all the other acquisitions

WIRE HARNESS AND CONNECTOR INSPECTION PROCEDURE

When any trouble occurs, first inspect the connectors and wire harness of the related circuit according to the following procedure:



Continuity check

1.Disconnect the connectors at both ends of the corresponding harness

2.Measure the resistance between corresponding terminals of the connectors at both ends.

Standard: 10 W or less

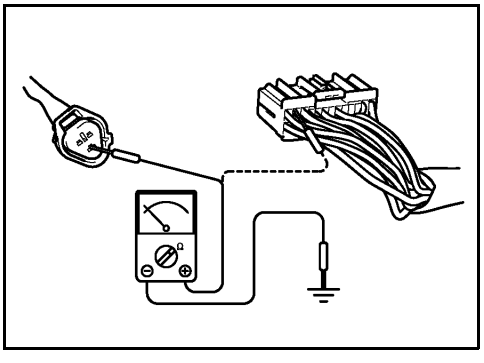
Notes:

Measure while lightly shaking the wire harness up and down and sideways.

Reference:

Open circuit at the wire harness occurs rarely partway through a vehicle wiring but mostly at connectors.

Inspect especially the sensor connectors with sufficient care



Short circuit check

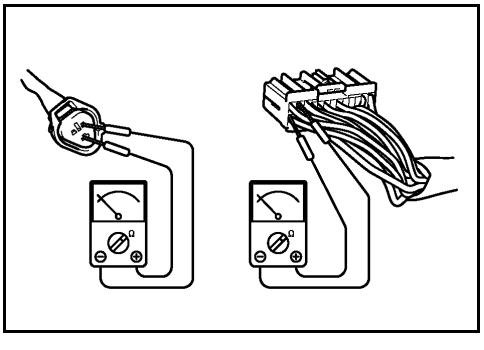
3.Disconnect the connectors at both ends of the corresponding harness

4.Measure the resistance between the corresponding connector terminal and negative. Always inspect the connectors at both ends

Standard: 1 MΩ or more

Notes:

Measure while lightly shaking the wire harness up and down and sideways.



5.Measure the resistance between a terminal corresponding to the connector terminal and N1. Always inspect the connectors at both ends.

Standard: 1 MΩ or more

Notes:

The wiring may short-circuit due to pinching by the body or defective clamping.

When an Error Code is Displayed			
Numb.	Alarm specification	Error mode	Page
A2	RELOAD_PARAM_ WARN	MCB CARD: Parameters loaded	4-68
A3	PARAM LOAD ERROR	MCB CARD: Parameter loading unsuccessful	4-68
A4	NOT_REP_ERROR	MCB CARD: Board in waiting information	4-68
A5	CHKSUM_ERROR	UNUSED	4-68
A6	BOOT_ERROR	MCB CARD: Board in waiting information	4-68
A7	HI SIDE DRIVER SHORT	MCB CARD: Board internal problem	4-69
A8	EV1_1 OPEN	MCB CARD: Lowering solenoid valve coil failure	4-69
A9	EV2_1 OPEN	MCB CARD: Lifting solenoid valve coil failure	4-69
AA	EV1_2 OPEN	MCB CARD: Tilt backward solenoid valve coil failure	4-69
AB	EV2_2 OPEN	MCB CARD: Tilt forward solenoid valve coil failure	4-70
AC	EV1_3 OPEN	MCB CARD: Right sideshift solenoid valve coil failure	4-70
AD	EV2_3 OPEN	MCB CARD: Left sideshift solenoid valve coil failure	4-70
AE	EV1_4 OPEN	MCB CARD: 4th way solenoid valve coil failure	4-70
AF	EV2_4 OPEN	MCB CARD: 4th way solenoid valve coil failure	4-71
B0	TRCB_MICRO_ ERROR	MCB CARD: Board internal problem	4-71
B1	GROUP1 DRIVER SHORT	MCB CARD: Coil failure	4-71
B2	GROUP2 DRIVER SHORT	MCB CARD: Coil failure	4-71
B3	GROUP3 DRIVER SHORT	MCB CARD: Coil failure	4-72
B4	GROUP4 DRIVER SHORT	MCB CARD: Coil failure	4-72
B5	AUX_OUT_SHORT	MCB CARD: Coil failure	4-72
B6	DASH_KO	MCB CARD: Comunication problem between the MCB and the dashboard	4-72
B7	ERR_SEAT	MCB CARD: Seat open microswitch	4-73
B8	JOY_STUFFING_ ERR	MCB CARD: Comunication problem between the MCB and the joystick board	4-73
B9	SET_SERIAL_ NUMBER	MCB CARD: Automatic setting of the serial not occurred	4-73
BA	POT TILT NOT OK	MCB CARD: Incorrect reading of the tilting potentiometer voltage	4-73
C1	PUMP INCORRECT START	MCB CARD: Incorrect starting sequence.	4-79
C2	BAD_CONF_ WHEELS	MCB CARD: 3-4 wheel version configuration recognition unsuccessful	4-79
C3	PEDAL WIRE KO	MCB CARD: Failure on the accelerator potentiometer	4-79
C4	BAD MICROSWITCH	MCB CARD: Pedal microswitch failure	4-79

14	THERMIC SENSOR KO

Condition for error detection

Logic unit thermal detector out of range, check:
- The state of the wiring harness and the temperature sensor connector
- Connect a 600 ohm resistance to the sensor connector:
  - If the alarm disappears, replace the temperature sensor
  - If the alarm persists replace the logic unit.

15	SAFETY IN

Condition for error detection

Arrest of the Master traction logic.
Verify:
- Alarms in the MD2 Slave logic unit
- If YES, the alarm it is only a consequence. Verify the Slave diagnostic
- If NO, presence/connection wiring harness on P1 connector, pin11, cable CN of the MD1 Master logic
- If NO, that the pin A19, connector P2, cable CN of the MD2 Slave logic is a GND
- If NO, check the status of the coils of the brakes solenoid valves EB1 and EB2
- If NO, internal fault of the logic unit

Reference wiring diagram page 2/7 (chapter 17, section WIRING DIAGRAMS)

16	CAN BUS KO

Condition for error detection

Can-bus communication failure. The alarm appears if the Master traction logic unit does not receive the information from the MCB board or from the lifting logic unit or from the Slave traction logic unit.
Before to replace every board, verify:
- The dashboard alarms, to identify exactly the board that does not communicate
- Enter the SOFT VERS menu to see which card is not present on the can-bus line
- Can-bus pull-up resistance presence
- dashboard 180 Ohm
- MCB 180 Ohm
- armrest 180 Ohm

2C	GAIN ACQUISITION

Condition for error detection

This warning communicates that the logic is in current acquisition phase.
In this phase the logic doesn't work.
Reset the MASTER logic unit with the RESET function and repeat all acquisitions.
Update the logic unit to the latest version of the software via the PROGRAMMER and repeat all acquisitions
If the alarm persists replace the logic unit

2D	WRONG 0 VOLT

Condition for error detection

Control internal error.
Invert the MASTER and SLAVE traction logic units
If alarm 8D appears, replace the logic unit
if alarm 2D persists, the problem is external to the logic unit:

- check the tuck and motor insulation (INSULATION CONTROL PROCEDURE and MOTOR WINDING CONTROL PROCEDURE)
- check the power circuit and the battery
- check the connections and wiring harnesses
- check the sensors and potentiometers connected to the logic unit.

2E	UNUSED

2F	WRONG RAM MEMORY

Condition for error detection

Activated protection against the electrostatic charges.
Switch the machine off and back on again.

79	DRIVER SHORTED

Condition for error detection

Alarm not used in Slave configuration.
Verify:
- the presence of +Vb on pin 1 and 4 connector P2
- Short circuit between pins 16 and 17 connector P2 (replace the logic unit)
- Resistive value between pin 16 connector P2 and -BATT of the logic unit (standard open circuit)

Reference wiring diagram page 2/7 (chapter 17, section WIRING DIAGRAMS)

80	CONTACTOR DRIVER

Condition for error detection

Alarm not used in Slave configuration.
Verify:
- the presence of +Vb on pin 1 and 4 connector P2
- Short circuit between pins 16 and 17 connector P2 (replace the logic unit)
- Resistive value between pin 16 connector P2 and -BATT of the logic unit (standard open circuit)

Reference wiring diagram page 2/7 (chapter 17, section WIRING DIAGRAMS)

81	AUX COIL SHORTED

Condition for error detection

Alarm not used in Slave configuration.
Verify:
- the presence of +Vb on pin 1 and 4 connector P2
- Short circuit between pins 16 and 17 connector P2 (replace the logic unit)
- Resistive value between pin 16 connector P2 and -BATT of the logic unit (standard open circuit)

Reference wiring diagram page 2/7 (chapter 17, section WIRING DIAGRAMS)

82	VACC NOT OK

Condition for error detection

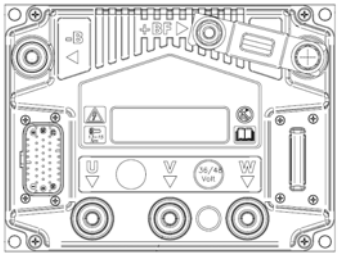
Alarm not used in Slave configuration.
Verify:
- the presence of +Vb on pin 1 and 4 connector P2

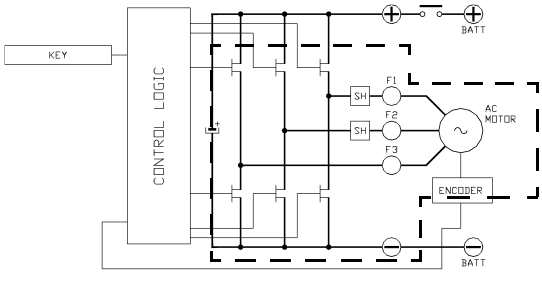
Reference wiring diagram page 2/7 (chapter 17, section WIRING DIAGRAMS)

36	VMN LOW

Condition for error detection

Failure in the VMN test.
The test begins at the switching on; check the connections of the 3 supplying cables from the logic unit to the traction motor, the status of the cables and the status of the coil of the K1 contactor (100 Ω). If the coil is interrupted the truck will signal the alarm at the switching on. If the coil value is OK, proceed following one of the test below described in order to establish if the failure is produced by a cause internal or external to the logic:





TEST 1

- Operate the parking brake and switch off the machine
- Open the compartment and disconnect the battery
- Check the power cables on the motor are tight
- Check the power cables on the logic unit are tight
- Check the continuity values between the following points on the control unit using a tester:

Values on control with connected motor		
Red cap	Black cap	Resistance
U	+BF	~ 13 Kohm
V	+BF	~ 13 Kohm
W	+BF	~ 13 Kohm
U	-B	~ 13 Kohm
V	-B	~ 13 Kohm
W	-B	~ 13 Kohm
U	V	0 Kohm
V	W	0 Kohm
W	U	0 Kohm

Values on control with disconnected motor		
Red cap	Black cap	Resistance
U	+BF	~ 32 Kohm
V	+BF	~ 27 Kohm
W	+BF	~ 32 Kohm
U	-B	~ 32 Kohm
V	-B	~ 27 Kohm
W	-B	~ 32 Kohm
U	V	~ 46 Kohm
V	W	~ 46 Kohm
W	U	~ 46 Kohm

If very different values are measured compared to those referred to in the above table, disconnect all the power cables from the logic unit and repeat the measurements

If an open circuit is detected, replace the logic unit

Self-diagnostic

Connect the Master traction logic unit to the pump motor and vice versa, check if on the display appears the “36” alarm code.
YES: replace the logic unit
If alarm “06“ appears check the motor state (see paragraph INSULATION CONTROL PROCEDURE and MOTOR WINDING CONTROL PROCEDURE)

3A	SAFETY OUTPUT - NOT USED

3B	SLIP PROFILE

Condition for error detection

Error in the memory data where the flowing parameters are loaded.
RESET the lifting logic unit to re-load the default parameters.
If the error persists when the machine is switched back on, install the last version of the software using the programmer.
If the problem persists replace the logic unit.

3C	ANALOG INPUT

Condition for error detection

Control internal error.
- check the tuck and motor insulation (INSULATION CONTROL PROCEDURE and MOTOR WINDING CONTROL PROCEDURE)
- check the connections and wiring harnesses
- check the sensors and potentiometers connected to the logic unit

Replace the logic unit.

3D	HARDWARE FAULT

Condition for error detection

Control internal error.
- check the tuck and motor insulation (INSULATION CONTROL PROCEDURE and MOTOR WINDING CONTROL PROCEDURE)
- check the connections and wiring harnesses
- check the sensors and potentiometers connected to the logic unit

Replace the logic unit.

B7	ERR_SEAT

Condition for error detection

The alarm signals the seat micro opened with activated hydraulic functions.

B8	JOY_STUFFING_ERR

Condition for error detection

The alarm signals a communication problem between the MCB board and the joystick board.
Use the RESET JOY FLAG function for re-establish the communication between the cards; if the problem persists, verify:
- The can-bus connections between the MCB board and the joystick board
- Joystick board supplying (JCAN connector pin 5 cable M and pin 6 cable N)
- Replace the joystick card

B9	SET_SERIAL_NUMBER

Condition for error detection

The alarm signals the failed automatic serial number setting.
- Insert truck serial number (function LEARNING parameter SERIAL NUMBER)
Switch off and switch on again the truck.

BA	POT TILT NOT OK

Condition for error detection

The alarm signals an incorrect reading of the voltage of the tilting potentiometer (optional):
- Repeat the tilting potentiometer acquisition
-If the alarm persists, check the potentiometer status and the relevant wiring harness.

E1	INCORRECT_START

Condition for error detection

Incorrect start sequence (mechanical control valve version). Check:
- The forward and reverse microswitches and their respective cables
- The parking brake microswitch and its respective cables
- The mechanic distributor microswitches

E3	BAD TILT POT

Condition for error detection

Failure on the RP2 tilting potentiometer in the fingertips / joysticks group.
Check the voltages on the potentiometer at rest
Enter the function TESTER menu MAT HANDLING and verify the parameters IN2 1(TILTING SWITCH) and TILT J.
Conditions of rest:
- TILT J = 2,5 ± 0,2 V
- IN2 1(TILTING SWITCH) = OFF

If the conditions of rest are different the potentiometer could be mechanically jammed or defective.
Check:
- exchange the tilting potentiometer with the lifting potentiometer (fingertips version) and verify the correct operation through console
- exchange the tilting potentiometer with the 4th way potentiometer (joystick version) and verify the correct operation through console

If the alarm persists replace the logic unit.

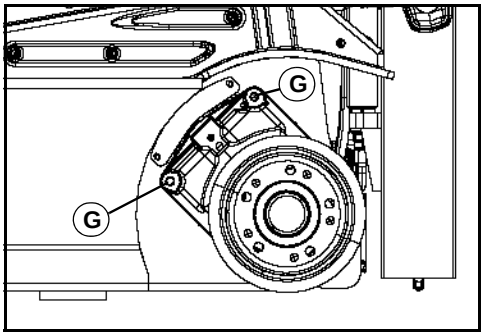
E4	BAD SIDESH. POT

Condition for error detection

Failure at the RP3 sideshift potentiometer in the joystick-fingertip group.
Check the voltages on the potentiometer at rest
Enter the function TESTER menu MAT HANDLING and verify the parameters IN3 1(SIDESHIFT SWITCH) and SIDESHIFT J.
Conditions of rest:
- SIDESHIFT J = 2,5 ± 0,2 V
- IN3 1(SIDESHIFT SWITCH) = OFF

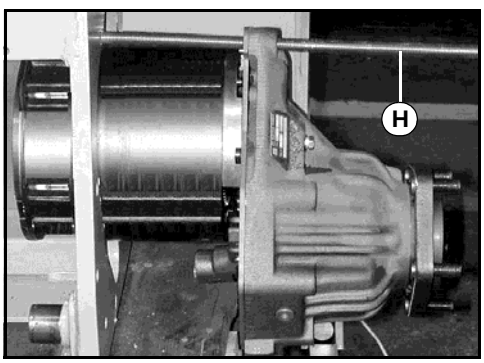
If the conditions of rest are different the potentiometer could be mechanically jammed or defective.
Check:
- exchange the sideshift potentiometer with the tilting potentiometer (fingertips version) and verify the correct operation through console
- exchange the sideshift potentiometer with the lifting potentiometer (joystick version) and verify the correct operation through console

If the alarm persists replace the logic unit.



[Point 5]
Disassembly:

Remove the fixing screws **(G)** of the motor reduction gear and insert a M14 bar **(H)** in the hole

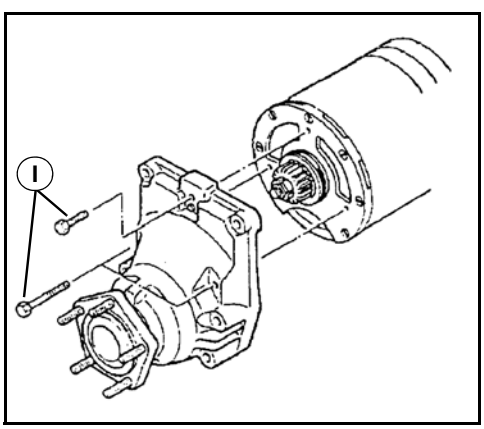


Remove the remaining 6 fixing screws and extract the motor reduction gear as shown in the picture

Assembly:

After installation, tightening torque of fixing screws **= 130 Nm**

Remarks:
Use Loctite 243

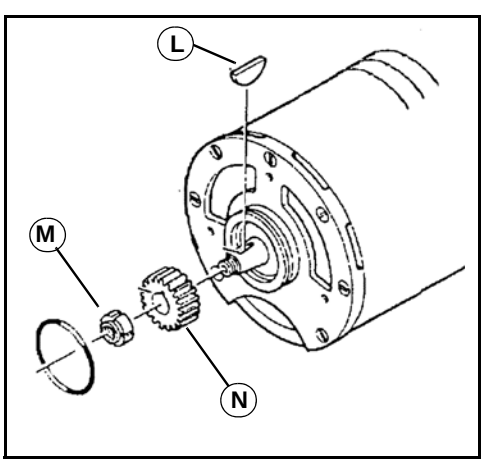


[Point 6]
Disassembly:

Remove the 3 fixing screws **(I)** and extract the motor

Assembly:

After installation, tightening torque of fixing screws **= 23 Nm**



[Point 7]
Disassembly:

Mount the seal **(M)**
Remove the pinion **(N)** using an extractor separator

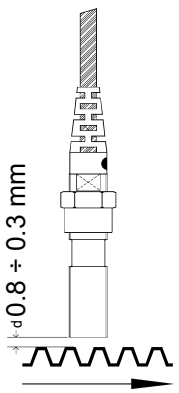
Assembly:

Insert the tongue **(L)** in the right place.
Insert the pinion **(N)** and tighten the seal **(M)** to a tightening torque of **55 Nm**

Remarks:
In case of complete reduction gear substitution, replace the pinion also

ENCODER

The encoder generates a feedback signal from the motor and sends it to the command logic to monitor: motor status, rpm and direction of rotation.
The encoder is positioned in the back part of the motor.

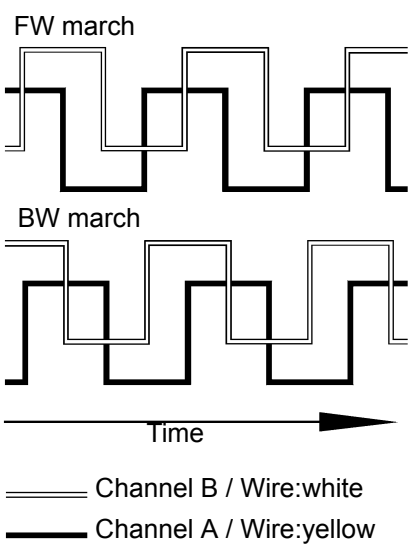


Direction of the gear wheel motion in FW march

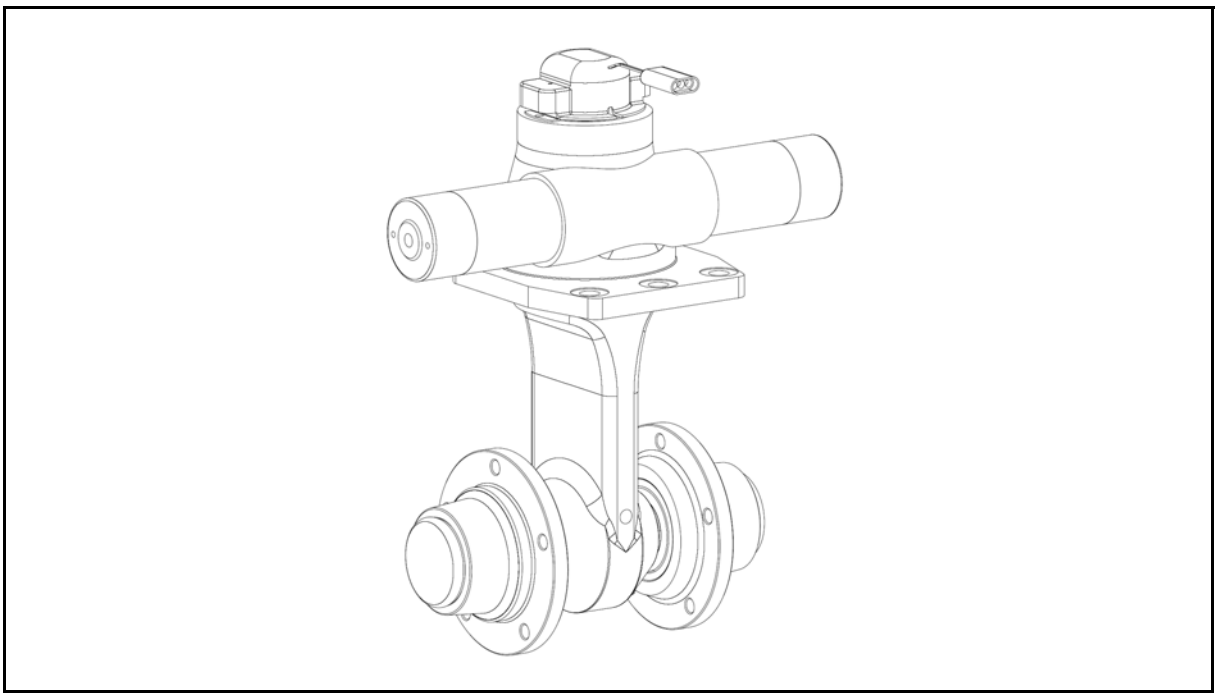
Irreversible damage:

- + V > 13 Volts
- Short circuit between the signal and the power supply
- Heating by induction
- Assembly with hammer

Channel image on oscilloskope:



REMOVAL • INSTALLATION



Dismantling procedure

1.Park the vehicle on a level surface and apply the parking brake
2.Switch off the truck
3.Open the compartment and disconnect the battery
4.Remove the battery
5.Jack up the back part of the vehicle and position apposite blocks under the chassis **[Point 1]**
6.Remove the boot
7.Remove the counterweight (*)
8.Disconnect the wiring of the potentiometer **[Point 2]**
9.Disconnect the cylinder pipes of the steering axle
10.Loosen and remove the fixing screws **[Point 3]**
11.Remove the steering axle

Assembly procedure

The reassembly procedure is the reverse of the disassembly procedure.

(*)Warning:
Always make sure to lock temporaly the overhead guard before remove the counterweight

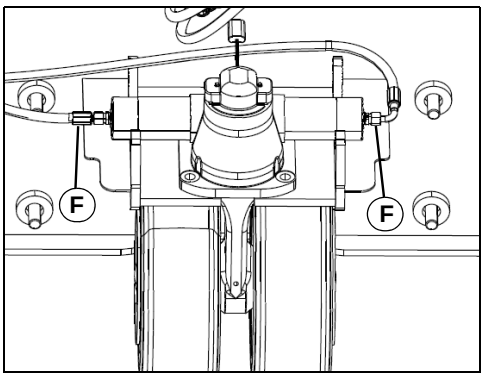
STEERING SYSTEM

Page

STEERING UNIT

CHECKING SEALS AND CLEANING POWER STEERING SYSTEM

3 wheels version



Every 1000 hours
- check the entire system to identify any leaks; any intervention must be carried out without pressure in the system

Every 5000 hours
- replace the hoses **(F)** connecting the power steering to the steering cylinder

Every 10 000 hours
- replace the hydraulic piping system

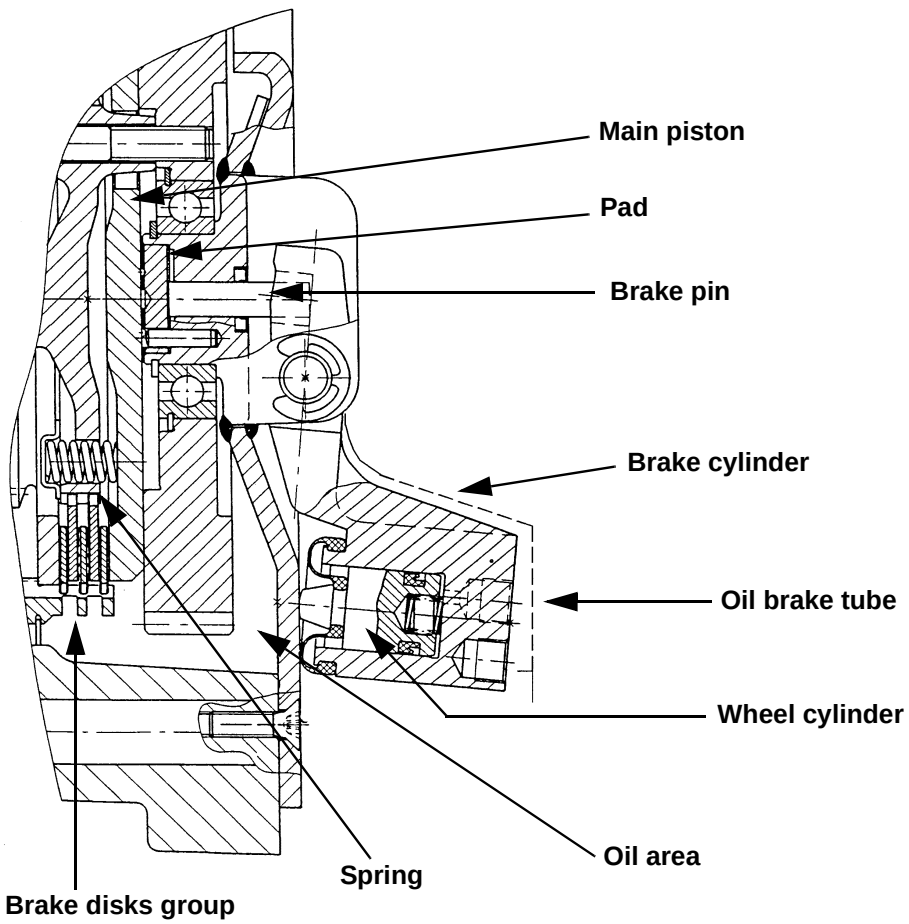
4 wheels version

Every 1000 hours
- check the entire system to identify any leaks; any intervention must be carried out without pressure in the system

Every 5000 hours
- replace the hoses **(F)** connecting the power steering to the steering cylinder

Every 10 000 hours
- replace the hydraulic piping system

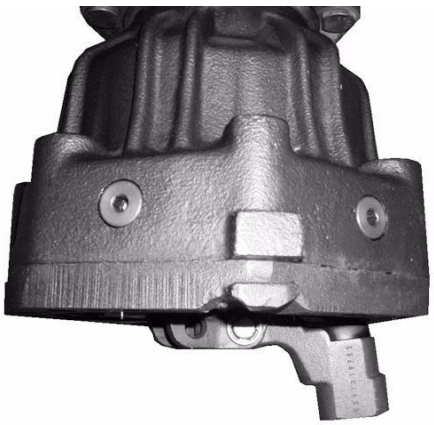
SERVICE BRAKE



The braking effect is due to the rotation of the brake cylinder hinged to the reduction gear through a pivot fixed by two seegers.
The parking brake lever or service brake pedal operation causes the cylinder rotation and, consequently, the braking system intervention.
When the brake pedal is pressed, the oil pressure pushes out of brake cylinder that, acting on the reduction, causes to the rotation of the cylinder itself.
The cylinder turns around the fulcrum and presses against the brake pin that pushes the pad.
The pad pushes the main piston that compacts the brake disks, obtaining the braking effect.
When the brake pedal is released the springs push the main piston in neutral position, freeing the disks.

BRAKES LEVER

REMOVAL • INSTALLATION



Dismantling procedure

1.Park the vehicle on a level surface and apply the parking brake
2.Place 2 shims under the mast
3.Tilt the mast forward until the end stroke
4.Turn off the truck
5.Open the compartment and disconnect the battery
6.Remove the gearmotor
7.Remove the elastic washer from the cylinder pivot **[Point 1]**
8.Remove the brake lever pin **[Point 2]**
9.Remove the brake lever
10.Remove the pressure pin **[Point 3]**

Assembly procedure

1.Insert the brake lever in the cover **[Point 4]**
2.Measure the clearance of the brake lever **[Point 5]**
3.Test the brake manually **[Point 6]**

ELECTRIC BRAKE TROUBLESHOOTING

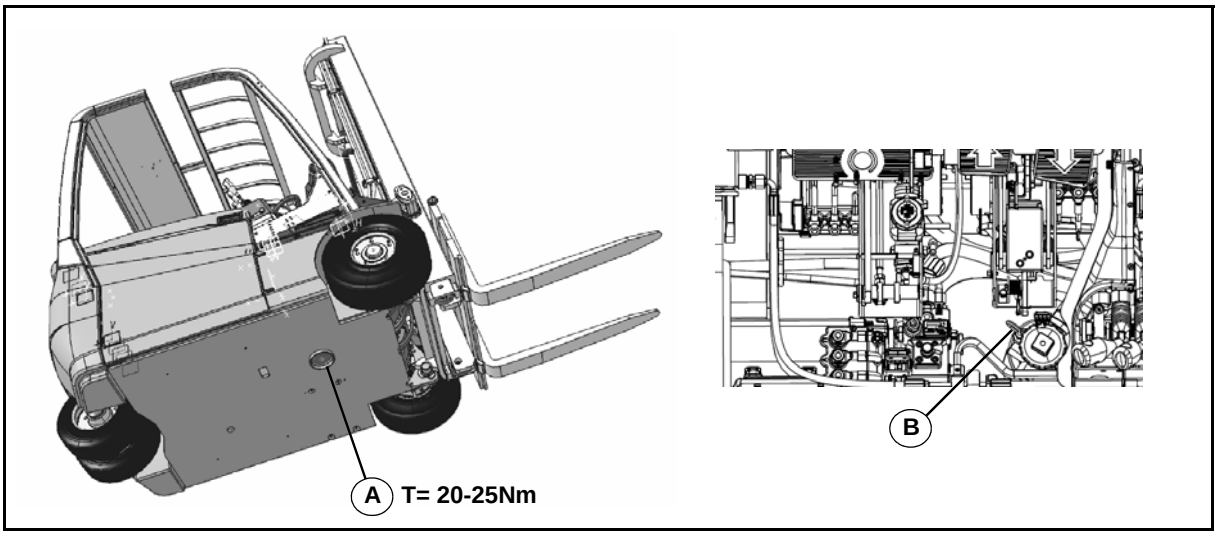
Troubleshooting and fault elimination		
Fault	Cause	Remedy
Brake not release	- Power supply is too low - Power supply is interrupted - Airgap too large - Worn disc - Coil is damaged - Airgap too small	- Adjust power supply - Reconnect power supply - Re-adjust the airgap - Change the disc and re-adjust the airgap - Replace the brake - Re-adjust the airgap
Brake does not brake	- Enabling the brake: power on - Grease on friction faces	- Adjust power supply - Change the disc and re-adjust the airgap
Nuisance braking	- Power supply is too low	- Adjust power supply

MATERIAL HANDLING SYSTEM

HYDRAULIC OIL

REPLACEMENT

Tightening torque T =Nm



Replacement Procedure

1.Park the vehicle on a level surface and apply the parking brake
2.Turn off the truck
3.Open the compartment and disconnect the battery
4.Remove the footboard and the tank plug
5.Remove the filter
6.Lift the truck
7.Loosen and remove the oil drain plug **(A)**
8.Let flow all the oil in a suitable recipient
9.Check the oil level using the oil dipstick
10.Reposition the oil drain plug **(A)**
11.Introduce new oil
12.Reinsert the filter
13.Reposition the plug and the footboard

Remarks:

- **Check the state of seals and if there are no oil leakages;**
- **Check the oil level in the tank, using the dip-stick (B) with mast in vertical position and forks lowered.**

Oil/filter changing:

After the first 40 hours of operation

- first changing of the filter

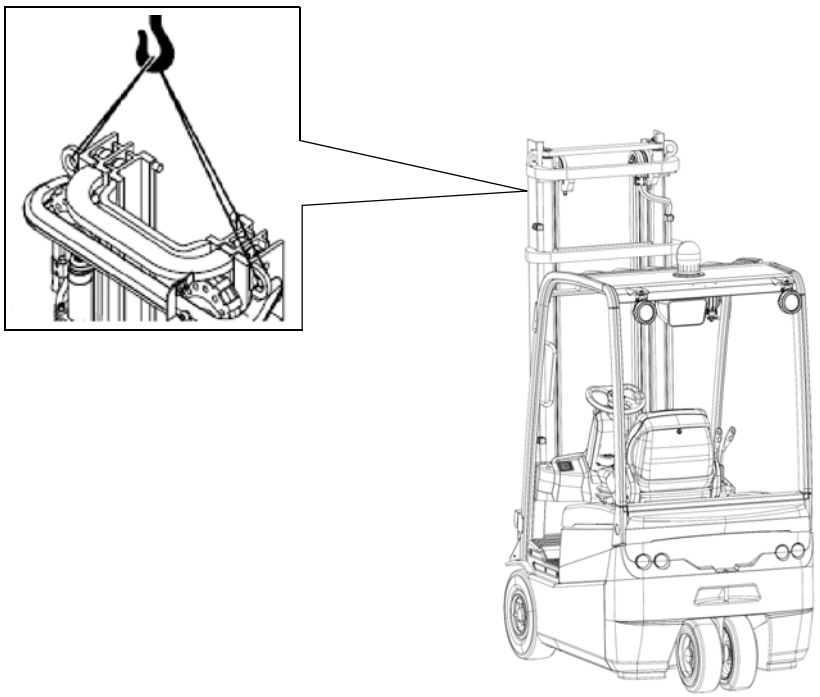
Every 1000 hours

- check the oil level in the tank using the dipstick **(B)**

Every 2000 hours

- change the oil of the system and the filter

FORK CARRIAGE GROUP AND MAST REMOVAL
DISASSEMBLY • REASSEMBLY



Disassembly Procedure

1. Set the mast in vertical position and lower the forks completly
2. Disconnect the chain from the mast side
3. Remove the chain wheel, if needed
4. Remove the fork carriage (raise the inner mast until it comes off the fork carriage, and slowly run the vehicle in reverse to detach from the fork carriage)
5. Disconnect the overflow hose and high pressure hoses (before hose disconnection, fully lower the mast completly)
6. Hoist the mast slightly **[Point 1]**
7. Remove the bolts of the mast **[Point 2]**
8. Remove the tilt cylinder front pin from the mast side **[Point 3]**
9. Remove the mast support cap
10. Remove the mast
11. Verify the bushing condition on the mast support

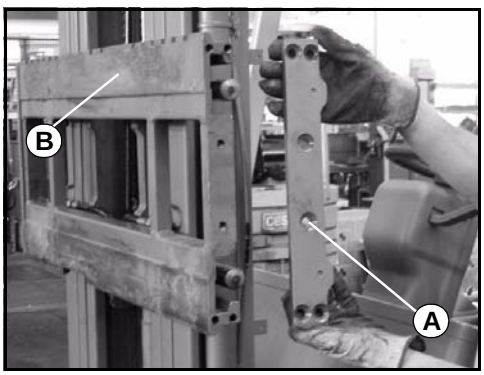
Reassembly Procedure

The reassambly procedure is the reverse of the disassembly procedure.

Note:

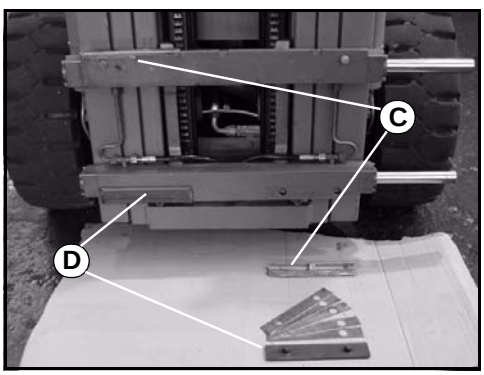
- **Apply molybdenum disulfide grease on the mast support bushing and mast support cap interior surfaces. Apply MP grease to the tilt cylinder front pin**
- **Perform shim adjustment of the lift cylinder rod when the mast ASSY, outer mast, inner mast or either lift cylinder is replaced**
- **Adjust the chain tension after installation**

Points of Operation



[Point 1]
Disassembly:

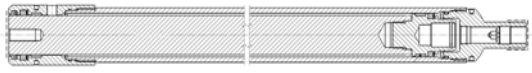
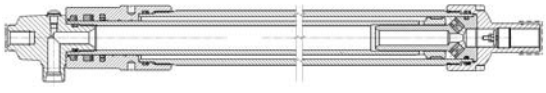
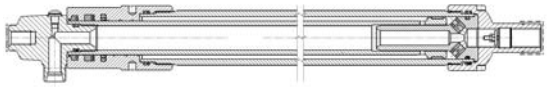
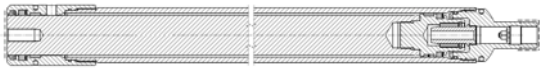
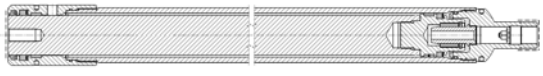
Remove one of two side panels **(A)** from the sideshift.
Extract the mobile portion **(B)** of the sideshift

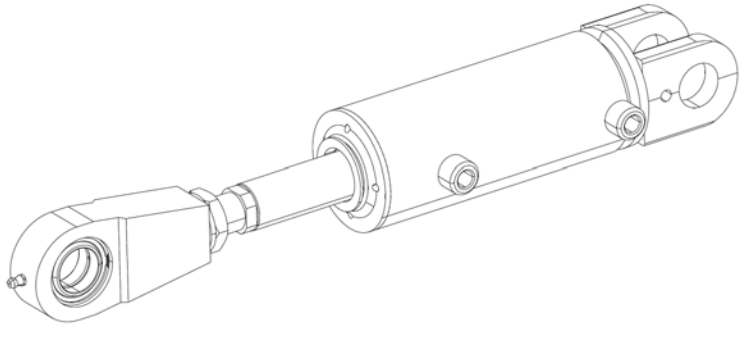


[Point 2]
Disassembly:

Replace the upper **(C)** and lower **(D)** guide shoes

REAR CYLINDER

1.5 to 1.8 t	2.0 t	
2 telescopic cylinders without braking effect (standard)  2 displacement cylinders with brake effect on the lowering (optional) 	2 telescopic cylinders without braking effect (standard)  2 displacement cylinders with brake effect on the lowering (optional) 	**T.V.**
2 displacement cylinders with brake effect on the lowering (standard) 	2 displacement cylinders with brake effect on the lowering (standard) 	**2M F.F.L.**
2 telescopic cylinders with brake effect on the lowering (standard) 	2 telescopic cylinders with brake effect on the lowering (standard) 	**3M F.F.L.**



Mast's type	Tilting angle (std)	Tilting angle (opt)	Note
T.V.	5° FW - 7° BW	5° FW - 7° BW	
2M F.F.L.	5° FW - 7° BW	5° FW - 5° BW	(std W cabin)
3M F.F.L.	5° FW - 7° BW	5° FW - 5° BW	(std W cabin)

CYLINDER CHECKING METHODS

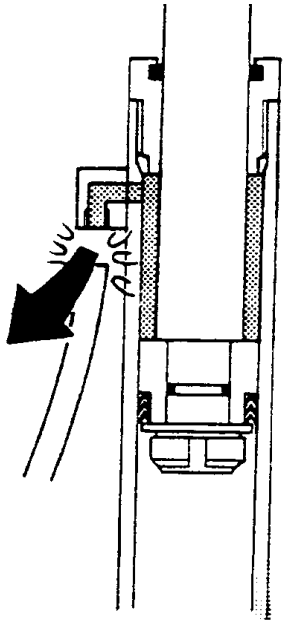
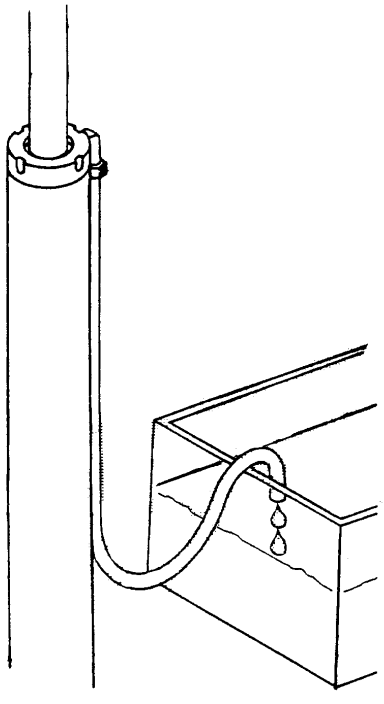


Fig. C



1st CHECK
Remove the drain pipe from the cylinder (**fig. C**)

Lift the cylinder some times to end stroke, so as to discharge any residual oil.

Put a load on the forks and lift it so the cylinder moves by at least 200 mm.

After 10 minutes, measure the amount by which the load has lowered (lowering by a few millimetres is to be considered natural since there is always some seepage in the control valve).
Now send the cylinder to its limit stop:
if no oil leaks from the drain pipe coupling, it means that the load lowering is only due to the seepage on the control valve and that the packing is in a good state of repair.

In case of leakages, it will be necessary to replace the seal. Should this be the case, inspect the cylinder liner.

2nd CHECK
(To be carried out if the 1st inspection has been successful and after seal replacement).

Remove the drain pipe from the cylinder.

Lift the cylinder a few times to end stroke, in order to discharge any residual oil.

Put a load on the forks. Lift and lower it for 10 minutes, making sure that the limit stop is never reached.

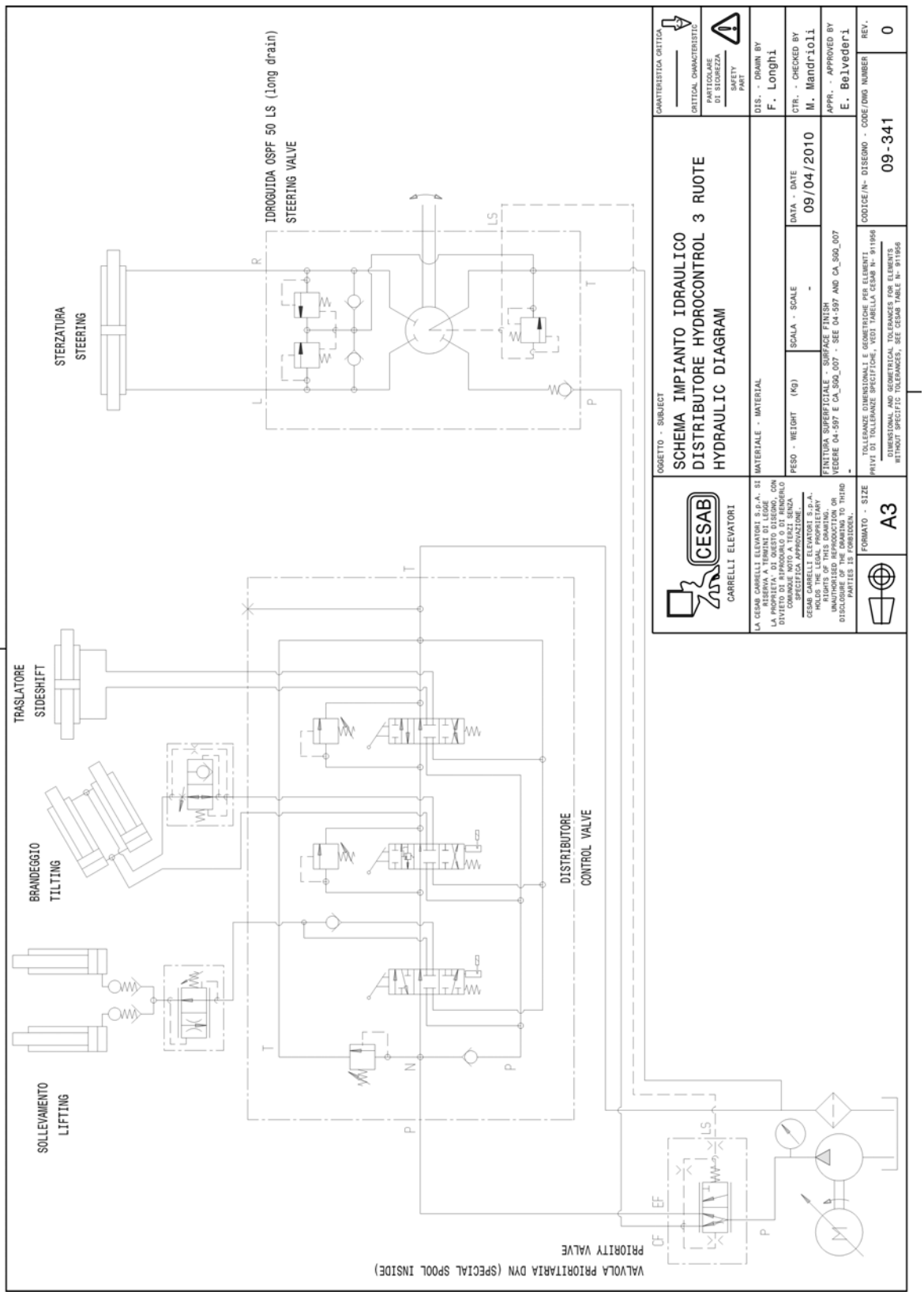
Send the cylinder to its limit stop.

If any leakages will be still present, the cylinder is damaged and must be replaced.

OIL PUMP

Page

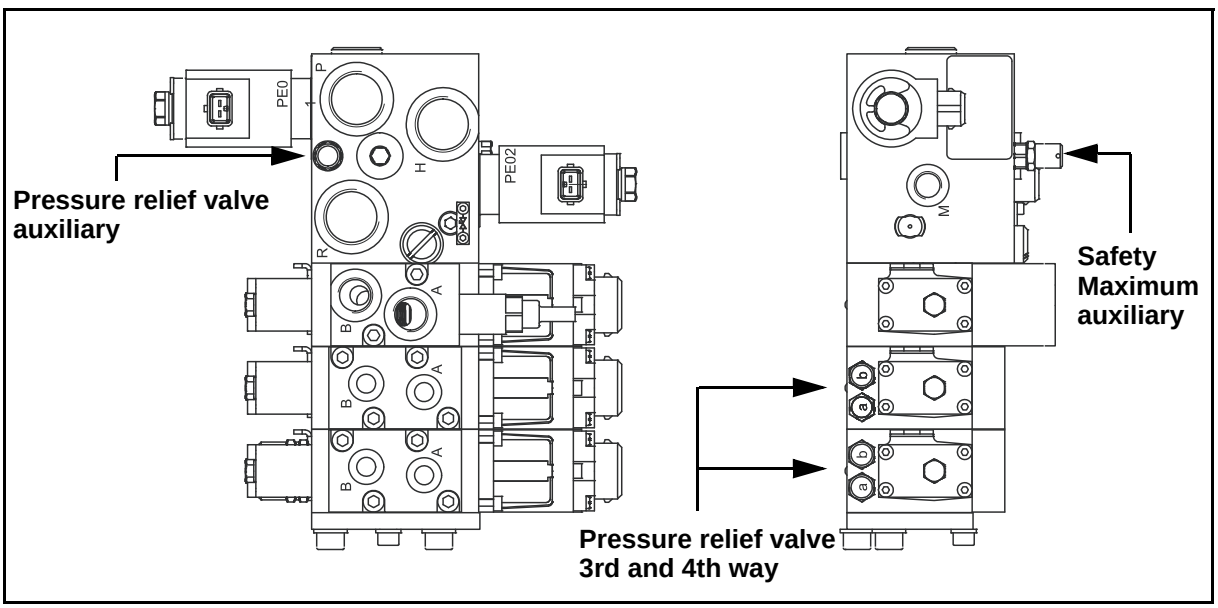
MECHANIC OIL CONTROL VALVE HYDRAULIC CIRCUIT



PRESSURE RELIEF VALVE ADJUSTMENT

Remarks:

- **Always follow the procedure below for adjustment. Careless adjustment may cause high-pressure generation, resulting in damage to equipment such as the oil pump**
- **There is no adjustment if the pressure relief valve is replaced in conformity with the mast supplied with the vehicle**



1.Remove the plug of the pressure gauge on the priority valve and connect a manometer. Pressure gauge end stroke reading: 250 bar o superior.

2.Loosen the counter nut on the relief valve adjustment screw and adjust the screw (only for lifting section).

3.Adjust the oil pressure as follows:

(a)Turn the key switch ON

(b)Lift the mast to the end stroke and check the pressure on the pressure gauge (without load)

(c)Adjust the pressure if necessary bearing in mind that:

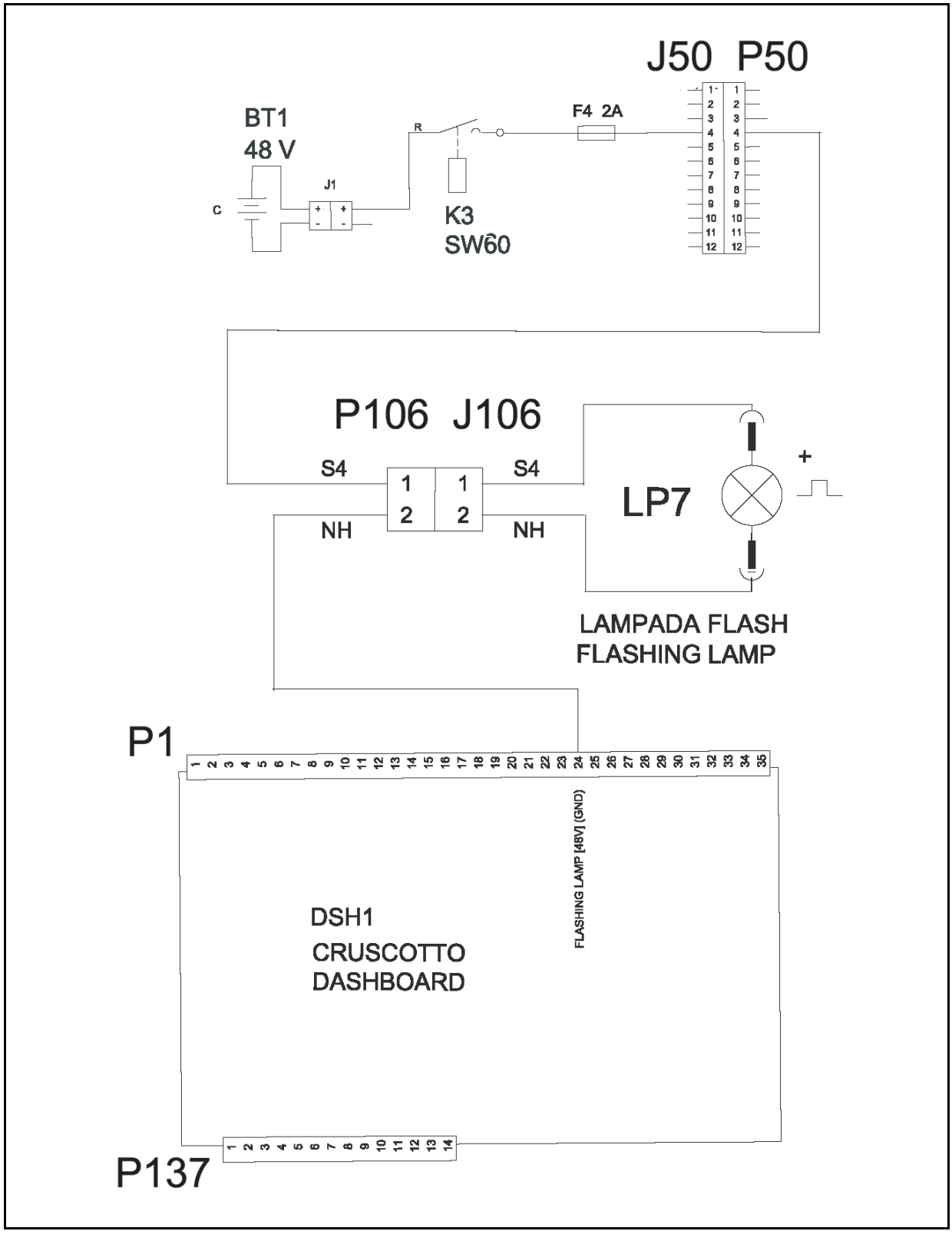
screwing in = increasing of pressure

screwing out = decreasing of pressure

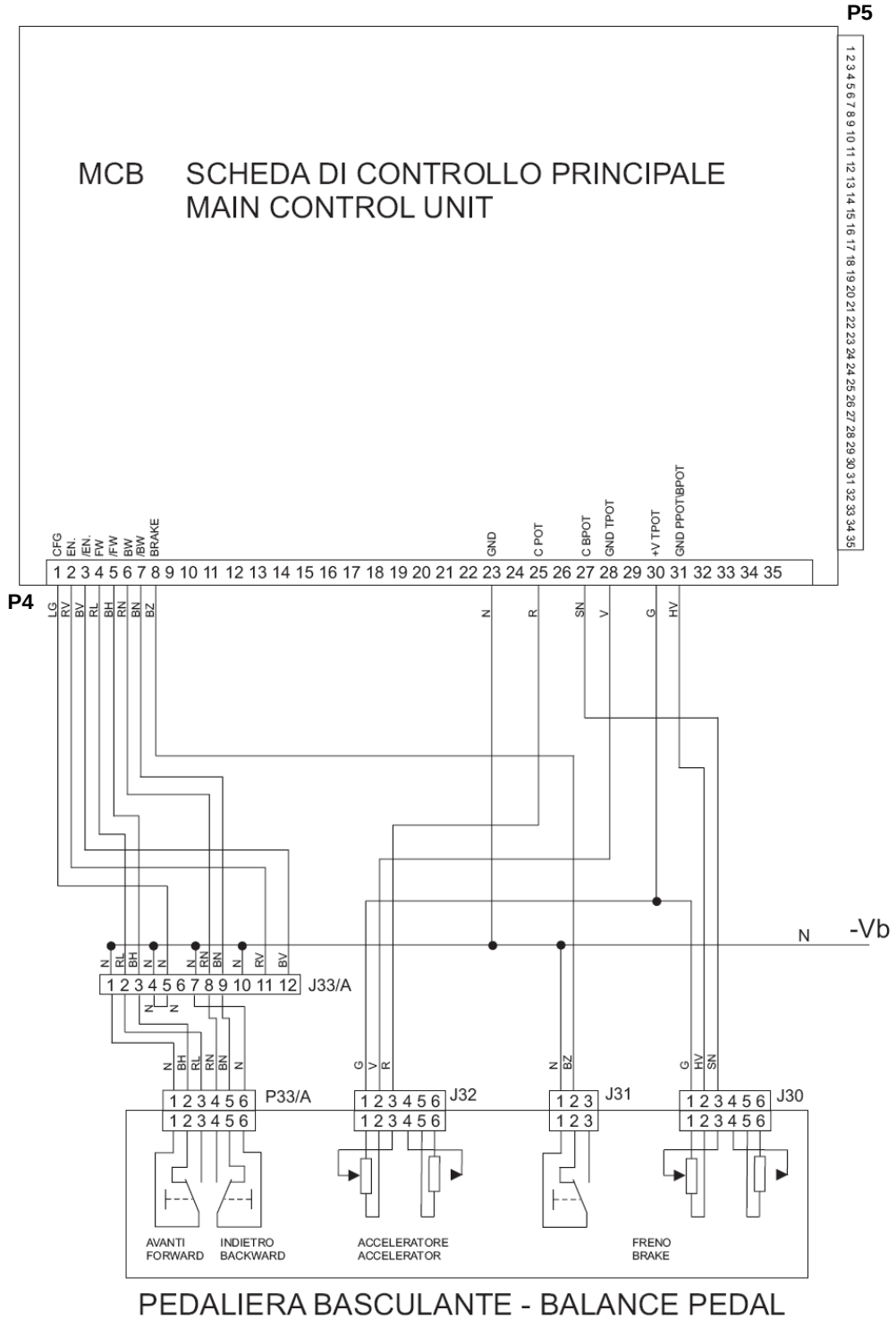
(d)Tighten the counter nut when the measured pressure reaches the correct value according to the mast performance table

4.Remove the pressure gauge and screw in the plug.

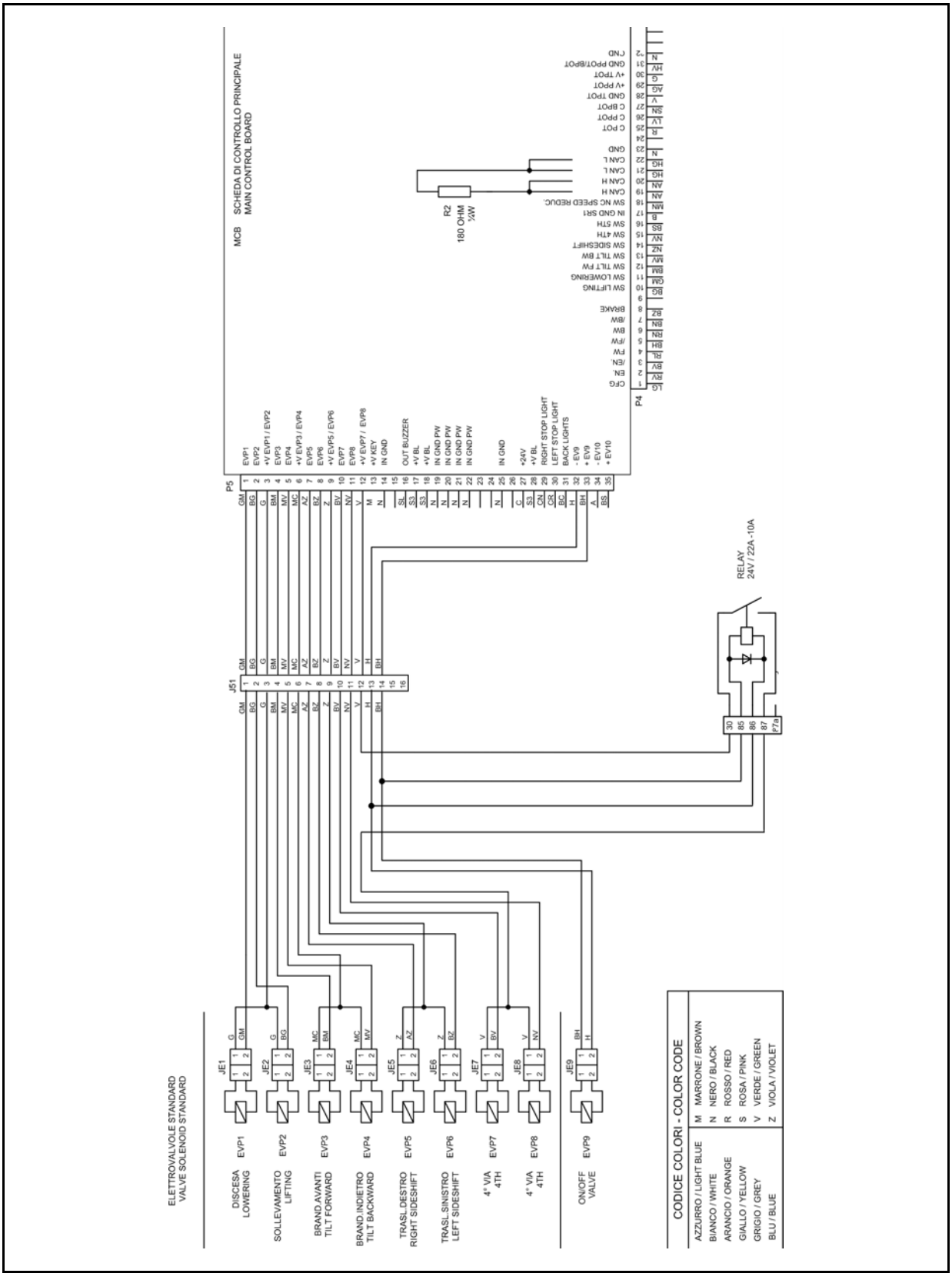
SIMPLE WIRING DIAGRAM



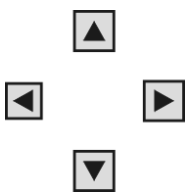
SIMPLE WIRING DIAGRAM

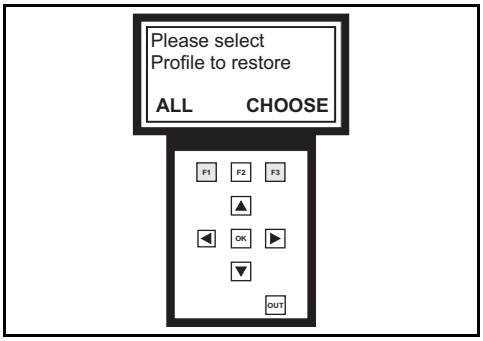


SIMPLE WIRING DIAGRAM



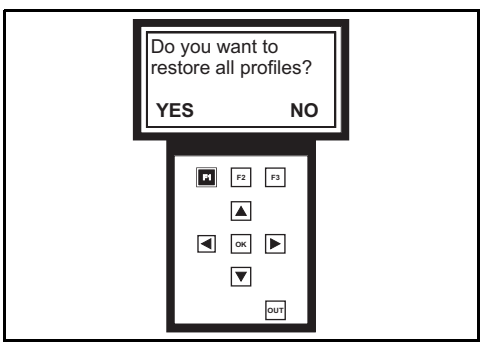
LEGEND

	Function buttons
	Possible choices
	Confirm choice
	Change screen
	Confirm
	Return to previous screen
OLD	Software version out of date
UPDATE	Software version updated
NOT CONNECTED	Card not connected or not powered



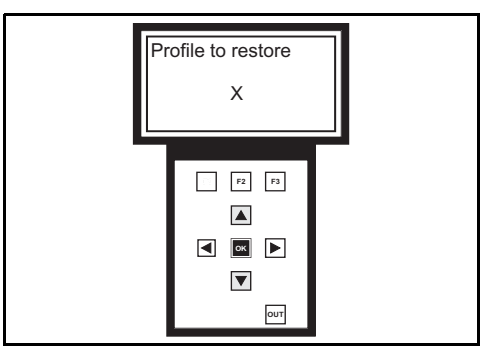
5. Press **F1** if you intend to load all the profiles present in the file

   Press **F3** if you intend to load only one of the profiles present in the file



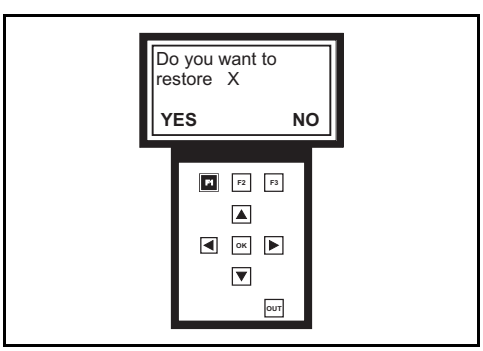
6. Press **F1** to confirm

   Press **F3** to return to the previous screen



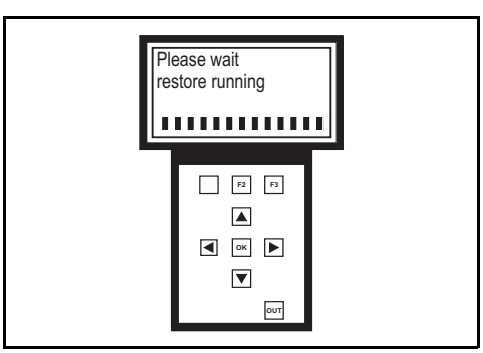
7. Press the buttons ▲ ▼ to select the profile

   Press **OK** to confirm your choice



8. Press **F1** to start restoring

   Press **F3** to return to the previous screen



9. Wait until the end of restoring

Note:
Do not turn off the truck, disconnect the programmer or the battery during restoring

Model	1.5 ton	1.6 ton	1.8 ton	2.0 ton
Transmission				
Model	ZF GP25			
Reduction ratio	1:22			
Number of satellites	4			
Oil quantity	0.35			
Oil type (standard version)	ATF DEXRON II			
Oil type (refrigeration cell type)				
Tightening torque for reducer/chassis fixing	130 Nm			
Tightening torque for motor/reducer fixing	24 Nm (± 15%)			

Service brake	
Type of service brake	With discs in oil bath
Number of discs	4
Disc rated thickness	1.80 mm
Number of counter-discs	3
Counter-disc rated thickness	1.80 mm
Service brake force	4,00 kN
Brake lever rated stroke	0.90 mm
Brake lever clearance	0.5 mm
Brake pump clearance	0.2 - 0.5 mm

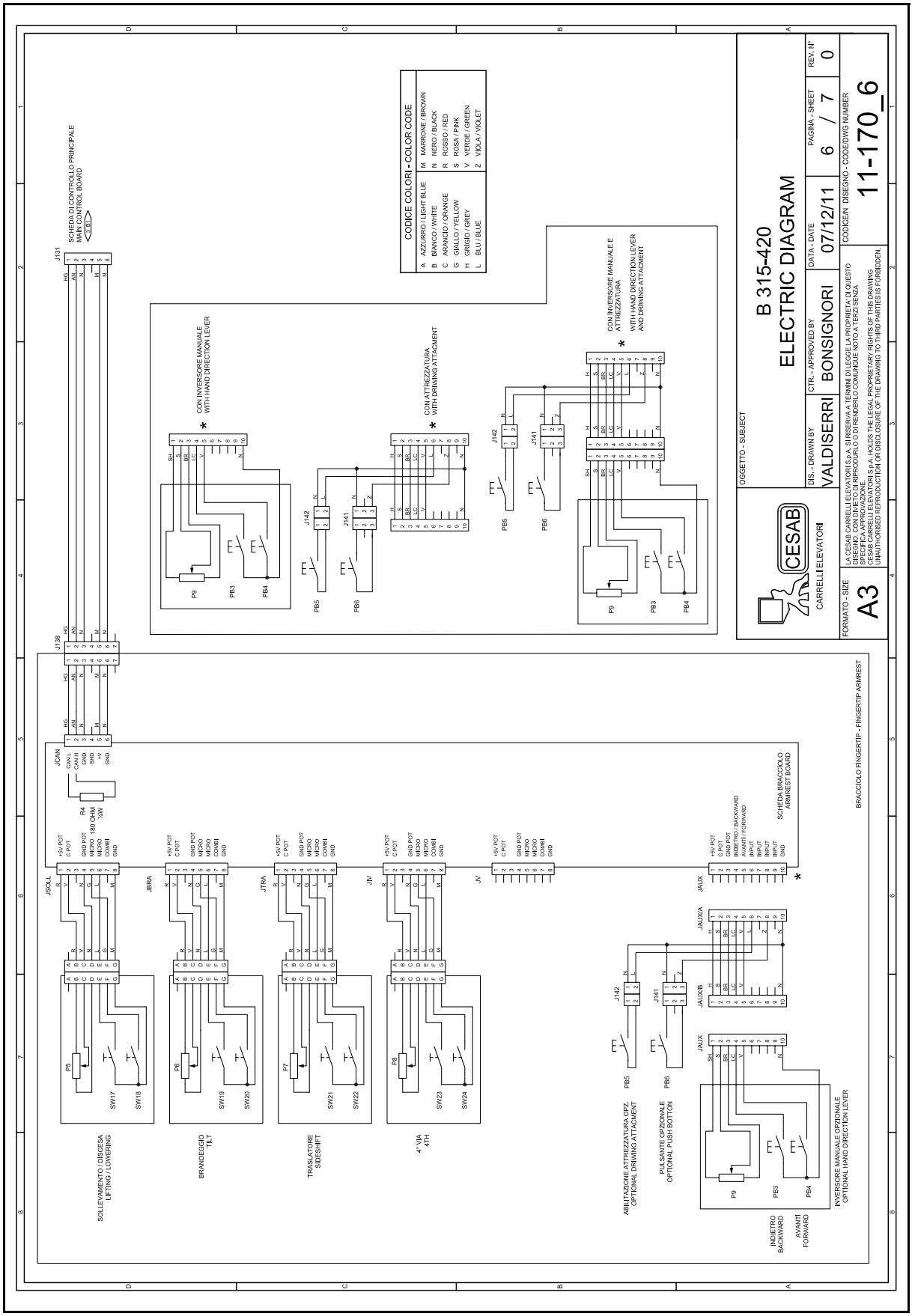
Parking brake	
Type of parking brake	Electric
Brake nominal torque	70 Nm
Nominal play	0.35 mm
Coil Resistance	34 ohm
Activation voltage	48 V
Maintenance voltage	36 V
Maximum rotation speed	5000 rpm
New disk thickness	6.6 - 7.0 mm
Maximum disk thickness wear	6.4 - 6.5 mm
Hand brake release screws	TE UNC 1/4”-20x1 1/4”-8.8
Tightening torque for brake unit fixing	5 Nm
Tightening torque for brake/motor fixing	28 Nm (± 10%)

P1							74	MASTER INVERTER TRACTION (RIGHT MOTOR)
PIN	COL	mm²	MARK	TW	TERM	DEST		
						CONN	PIN	FUNCTION
1	M	0.50			77	S4		+V KEY
2	H	0.50			77	P14	C	+V POT (5V)
3					78			
4					78			
5	N	0.50			77	P14	B	GND STEER POT
6	HN	0.50			77	S10		SEAT INPUT
7	V	0.50			77	J15	4	A
8	RV	0.50			77	J15	1	+12V OUT ENCODER
9	NL	0.50			77	P20	1	SEAT OUT (GND)
10	R	0.50			77	P14	A	C POT BR
11	CN	0.50			77	P2	19	SAFETY INPUT
12					78			
13					78			
14	LH	0.50			77	J15	3	B
15	MV	0.50			77	J15	2	GND ENCODER
16	A	0.50			77	P50	12	GND COIL CONTACTOR
17	S	0.50	3		77	S6		+V CONTACTOR COIL
18	SL	0.50			77	P6	1	BR VALVE COIL OUT
19	LG	0.50			77	P2	11	SAFETY OUT
20	HG	0.50		TW2	77	S9		CAN L
21	AN	0.50		TW2	77	S8		CAN H
22	RL	0.50			77	J15	6	+V TEMPERATURE SENSOR
23	L	0.50			77	J15	5	GND TEMPERATURE SENSOR

P2							74	SLAVE INVERTER TRACTION (LEFT MOTOR)
PIN	COL	mm²	MARK	TW	TERM	DEST		
						CONN	PIN	FUNCTION
1	M	0.50			77	S4		+V KEY
2					78			
3					78			
4	M	0.50			77	S4		SLAVE CONFIGURATION
5					78			
6	HN	0.50			77	S10		SEAT INPUT
7	BL	0.50			77	J16	4	A
8	BS	0.50			77	J16	1	+12V ENCODER
9					78			
10					78			
11	LG	0.50			77	P1	19	SAFETY INPUT
12					78			
13					78			
14	NV	0.50			77	J16	3	B
15	BV	0.50			77	J16	2	GND ENCODER
16					78			
17	S	0.50	3		77	S6		+V CONTACTOR COIL
18	SN	0,50			77	P7	1	BR VALVE COIL OUT
19	CN	0.50			77	P1	11	SAFETY OUT
20	HG	0.50		TW3	77	S9		CAN L
21	AN	0.50		TW3	77	S8		CAN H
22	SL	0.50			77	J16	6	+V TEMPERATURE SENSOR
23	L	0.50			77	J16	5	GND TEMPERATURE SENSOR

P3							74	M10 INVERTER PUMP
PIN	COL	mm²	MARK	TW	TERM	DEST		
						CONN	PIN	FUNCTION
1	M	0.50			77	S4		+V KEY
2					78			
3					78			
4					78			
5					78			
6					78			
7	HV	0.50			77	J12	4	A
8	BZ	0.50			77	J12	1	+12V OUT ENCODER
9	H	0.50			77	P3	11	SAFETY IN
10					78			
11	H	0.50			77	P3	9	SAFETY OUT
12					78			
13					78			
14	AV	0.50			77	J12	3	B
15	GN	0.50			77	J12	2	GND ENCODER
16	Z	0.50			77	P50	10	GND COIL CONTACTOR
17	S	0.50	3		77	S6		+V CONTACTOR COIL
18					78			
19					78			
20	HG	0.50		TW4	77	S9		CAN L
21	AN	0.50		TW4	77	S8		CAN H
22	LG	0.50			77	P13	1	+V TEMP. SENSOR
23	L	0.50			77	P13	2	GND TEMP. SENSOR

P4							75	I/O CONTROL BOARD
PIN	COL	mm²	MARK	TW	TERM	DEST		
						CONN	PIN	FUNCTION
1	LG	0.50			77	P33	5	CONFIG.
2	RV	0.50			77	P33	11	EN
3	BV	0.50			77	P33	12	/EN
4	RL	0.50			77	S11		FW
5	BH	0.50			77	P33	3	/FW
6	RN	0.50			77	S12		BW
7	BN	0.50			77	P33	9	/BW
8	BZ	0.50			77	P31	2	BRAKE PEDAL
9					78			
10	BG	0.50			77	J53	1	LIFTING
11	GM	0.50			77	J53	2	LOWERING
12	BM	0.50			77	J53	3	FORWARD TILT
13	MV	0.50			77	J53	4	BACKWARD TILT
14	NZ	0.50			77	J53	5	SIDESHIFT
15	NV	0.50			77	J53	6	4 TH
16	BS	0.50			77	J53	7	5 TH
17	B	0.50			77	P135	1	3-4 WHEELS CONFIGURATION
18	MN	0.50			77	J49	10	N.C. SW MAST SPEED RED.
19	AN	0.50		TW5	77	S8		CAN H
20	AN	0.50		TW10	77	S21		CAN H
21	HG	0.50		TW5	77	S9		CAN L
22	HG	0.50		TW10	77	S13		CAN L
23	N	0.50			77	S2		OUT GND
24					78			
25	R	0.50			77	P32	3	C ACC POT
26	LV	0.50			77	J53	9	C LIFT POT
27	SN	0.50			77	J30	3	C BR POT
28	V	0.50			77	J32	2	GND ACC POT
29	AG	0.50			77	J53	10	+V LIFT+TILT POT
30	G	0.50			77	S18		+V ACC POT
31	HV	0.50			77	S14		GNG LIFT+TILT POT
32	N	0.50			77	J53	8	OUT GND
33					78			
34					78			
35	RV	0.50			77	J49	12	N.O. SW MAST SPEED RED.


B 315-420
ELECTRIC DIAGRAM
OGGETTO - SUBJECT
CESAB
CARRELLI ELEVATORI
DIS. - DRAWN BY
VALDISERRI
CTR. - APPROVED BY
BONSIGNORI
DATA - DATE
07/12/11
PAGINA - SHEET
6 / 7
REV. N°
0
FORMATO - SIZE
A3
CODICE COLORI - COLOR CODE
A AZZURRO / LIGHT BLUE
B BIANCO / WHITE
C ARANCIO / ORANGE
G GIALLO / YELLOW
H GRIGIO / GREY
L BLU / BLUE
M MARRONE / BROWN
N NERO / BLACK
R ROSSO / RED
S ROSA / PINK
V VERDE / GREEN
Z VIOLA / VIOLET
SCHEDA DI CONTROLLO PRINCIPALE
MAIN CONTROL BOARD
SCHEDA BRACCIOLO
ARMREST BOARD
CON INVERSORE MANUALE
WITH HAND DIRECTION LEVER
CON ATTREZZATURA
WITH DRINING ATTACMENT
CON INVERSORE MANUALE E ATTREZZATURA
WITH HAND DIRECTION LEVER AND DRINING ATTACMENT
SOLLEVAMENTO / DISCESA
LIFTING / LOWERING
BRANDEGGIO
TILT
TRASLATORE
SIDESHIFT
4° VIA
4TH
ABILITAZIONE ATTREZZATURA OPZ.
OPTIONAL DRINING ATTACMENT
PULSANTE OPZIONALE
OPTIONAL PUSH BOTTON
INVERSORE MANUALE OPZIONALE
OPTIONAL HAND DIRECTION LEVER
INDIETRO
BACKWARD
AVANTI
FORWARD
BRACCIOLO FINGERTIP - FINGERTIP ARMREST
LA CESAB CARRELLI ELEVATORI S.p.A. SI RISERVA A TERMINI DI LEGGE LA PROPRIETA' DI QUESTO DISEGNO E CONTRATTO CON IL DIVIETO DI COPIARLO O DI RENDERLO COMUNQUE NOTO A TERZI SENZA SPECIFICA APPROVAZIONE.
CESAB CARRELLI ELEVATORI S.p.A. HOLDS THE LEGAL PROPRIETARY RIGHTS OF THIS DRAWING UNAUTHORISED REPRODUCTION OR DISCLOSURE OF THE DRAWING TO THIRD PARTIES IS FORBIDDEN.
CODICE N° DISEGNO - CODE/DWG NUMBER
11-170_6