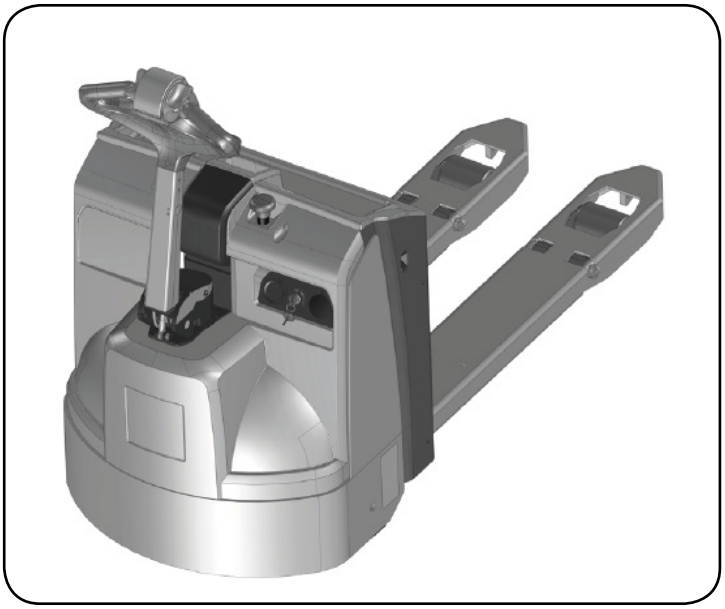
Part no.: **5501279398** Revision: **3 (12/2020)**

Technical information for Yale service centres



This manual is intended solely for the specialized technicians of the Yale service network

A428.....

MP16 - MP18
MP20 - MP22

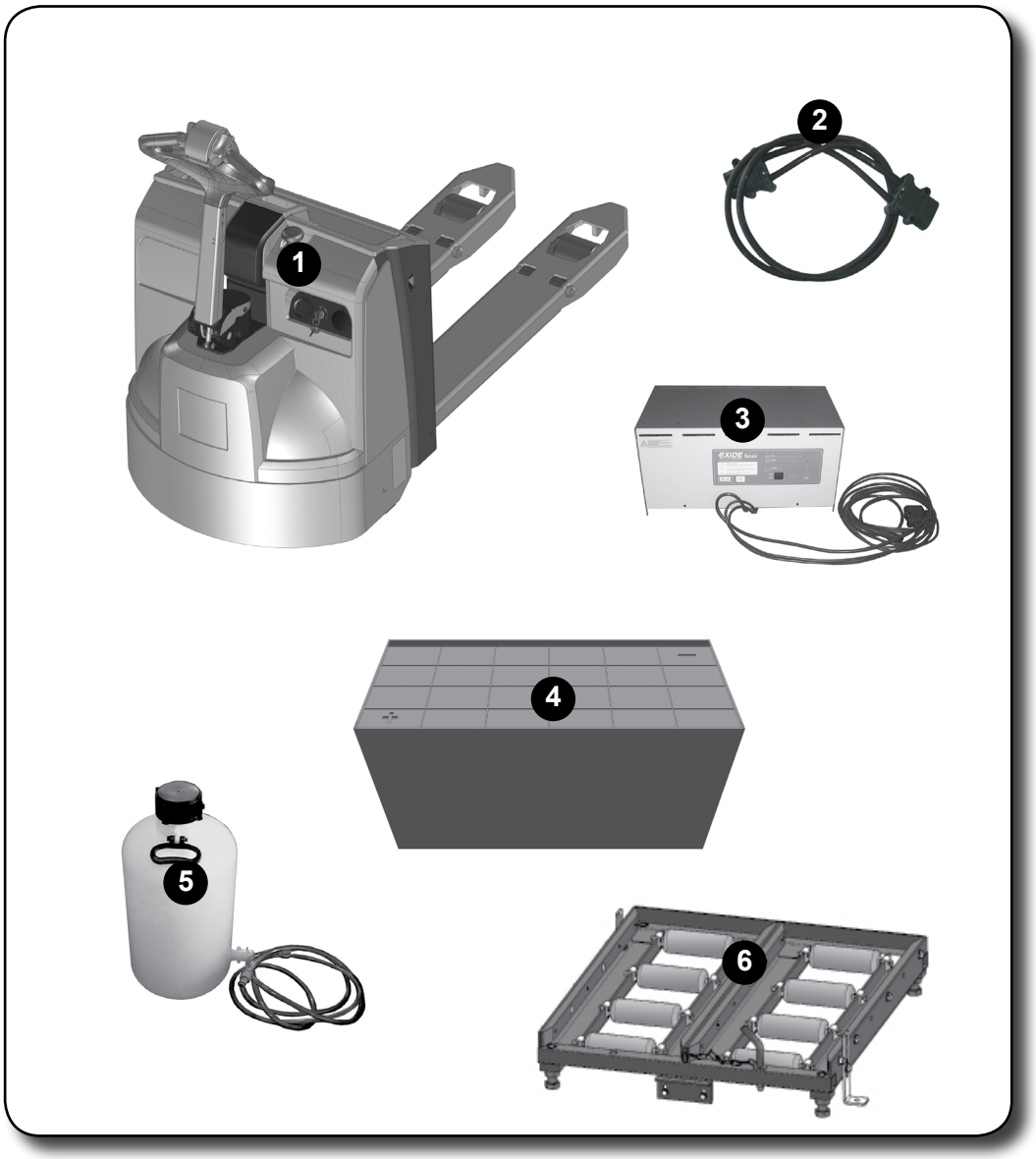
Yale

SECTION CONTENTS

		GENERAL SPECIFICATIONS			
CHARACTERISTICS	1.0	Manufacturer (abbreviation)		Yale	Yale
	1.2	Manufacturer's type designation		MP 20	MP22
	1.3	Drive: electric (battery or mains), diesel, petrol, fuel gas		Battery	Battery
	1.4	Operator type: Hand, pedestrian, standing, seated, orderpicker		Pedestrian	Pedestrian
	1.5	Rated capacity / rated load	Q (t)	2.0	2.2
	1.6	Distance from load centre of gravity(2)	c (mm)	600	600
	1.8	Distanced of load from centre of drive axle to the fork(2)	x (mm)	955	955
	1.9	Wheelbase (2)	y (mm)	1440	1440
WEIGHTS	2.1	Service weight (1) (2)	kg	632	632
	2.2	Load on axle, with front/rear load (2)	kg	983 / 1649	1032 / 1800
	2.3	Load on axle, without front/rear load (2)	kg	489 / 143	489/ 143
WHEELS AND CHASSIS	3.1	3.1 Tyres: polyurethane, topthane, NDII-Thane, front/rear		polyurethane	polyurethane
	3.2	Front tyre size	ø (mmxmm)	250 x 75	250 x 75
	3.3	Rear tyre size	ø (mmxmm)	85 x 110	85 x 110
	3.4	Additional wheels (dimensions)	ø (mmxmm)	100 x 40	100 x 40
	3.5	Wheels, number front/rear (x = non-driven wheels)		1x + 2/2	1x + 2/2
	3.6	Tread, front	b_{10} (mm)	461	461
	3.7	Tread, rear	b_{11} (mm)	390	390
DIMENSIONS	4.4	Lifting	h_3 (mm)	130	130
	4.9	Height of tiller in drive position (min/max)	h_{14} (mm)	744 / 1221	744 / 1221
	4.15	Height, lowered	h_{13} (mm)	85	85
	4.19	Overall length (pedestrian) (2)	l_1 (mm)	1806	1806
	4.20	Length to face of forks (pedestrian) (2)	l_2 (mm)	650	650
	4.21	Overall width	b_1/b_2 (mm)	712	712
	4.22	Fork size (2)	s / e / l (mm)	64 / 172 / 1156	64 / 172 / 1156
	4.25	Outside Fork Width	b_5 (mm)	560	560
	4.32	Ground clearance, centre of wheelbase	m_2 (mm)	21	21
	4.33	Dimensions of load $b_{12} \times l_6$ crossways	$b_{12} \times l_6$ (mm)	-	-
	4.34.1	Aisle width for pallets 1000mm x 1200mm crossways (pedestrian) (2)	A_{st} (mm)	2409	2409
	4.34.2	Aisle width for pallets 800 mm x 1200mm wide lengthways (pedestrian) (2)	A_{st} (mm)	2276	2276
	4.35	Turning radius (pedestrian) (2)	W_a (mm)	1607	1607
PERFORMANCE	5.1	Travel speed with/without load	km/h	6/6	6/6
	5.1.1	Travel speed, laden/unladen, reverse	km/h	6/6	6/6
	5.2	Lifting speed with/without load	m/s	0.04 / 0.05	0.04 / 0.05
	5.3	Lowering speed with/without load	m/s	0.09 / 0.04	0.09 / 0.04
	5.7	Gradeability with/without load	%	4.5 / 15	4 / 15
	5.8	Gradeability with/without load	%	8 / 20	7.5 / 20
	5.10	Service brake		electromagnetic	electromagnetic
ELECTRICAL MOTORS	6.1	Drive Motor, S2 60 minute rating	kW	1.25	1.25
	6.2	Lift motor S3 15% rating	kW	1.2	1.2
	6.3	Battery in compliance with DIN 43531/365/36 A, B, C, no (1)		B	B
	6.4	Battery voltage/nominal capacity (2)	V/Ah	24 / 375 (4)	24 / 375 (4)
	6.5	Battery weight (2) (1)	kg	288	288
	6.6	Energy consumption per VDI cycle	kWh/h at number of cycles	0.384	0.384
DRIVE	8.1	Type of drive unit		CA control unit	CA control unit
Upd. data	10.7	Sound pressure level at driver's position	dB (A)	< 70	< 70

MACHINE ASSEMBLY

LIST OF MATERIALS RECEIVED FROM THE DEALER



The materials received from the dealer may vary according to whether or not optional accessories are included.

Ref.	Description
1	Truck
2	Battery connection plug extension lead (with lateral removal)
3	External battery charger (optional)
4	Battery
5	Top up bottle for battery electrolyte
6	Rollerway for side battery removal (optional)

12 – Not used
13 – +24V coil power supply output
14 – Lifting block optional sensor input
15 – Not used
16 – Accelerator potentiometer input
17 – Accelerator potentiometer input
18 – Not used
19 – Not used
20 – Horn negative
21 – Can bypass termination pin 34
22 – Belly Switch digital input
23 – Can High
24 – Not used
25 – 12V BDI output
26 – 5V output
27 – Not used
28 – Serial line transmission
29 – Serial line reception
30 – Not used
31 – Encoder phase A input
32 – Encoder phase B input
33 – Not used
34 – Can bypass termination pin 21
35 – Can Low

DISTANCE SINCE STOP
Total distance travelled by the truck, calculated as the sum of distances travelled in both directions. This value is reset to zero each time the truck is stopped.

DISTANCE FINE
Net distance travelled by the truck calculated as the sum of the distances travelled in the direction the operator is facing (positive value) and in the opposite direction (negative value).

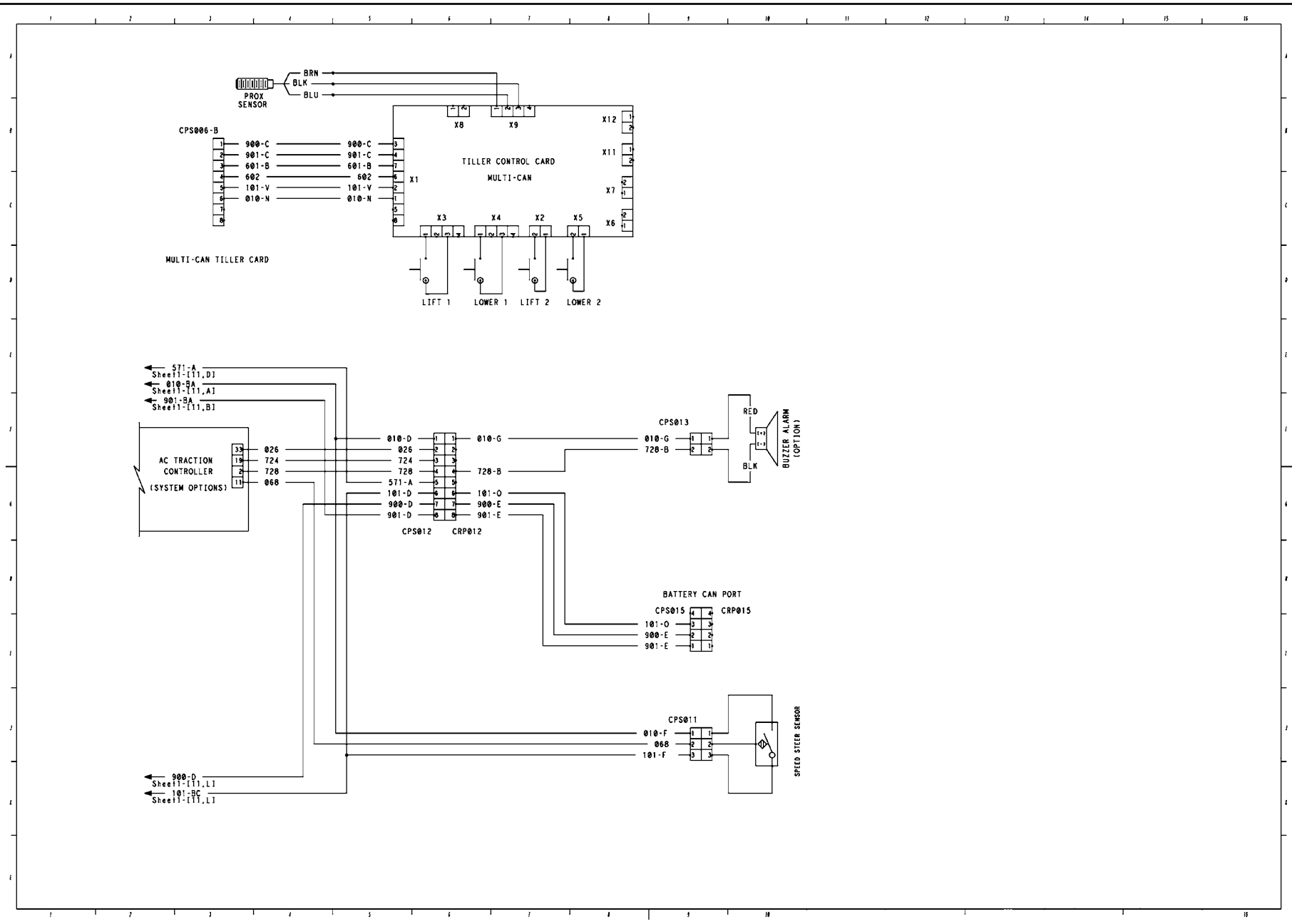
MONITOR MAIN MENU ▶ CAN Status

PARAMETER
CAN NODE ID
Displays the Can node of the controller
CONTROLLER TEMP CUTBACK
Displays the Can NMT status 0= initialization 4=stopped 5= operational 127=pre-operation

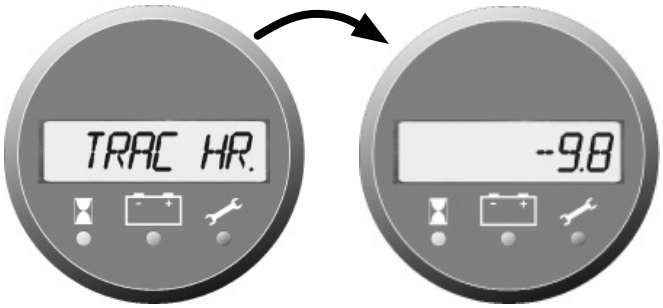
ALARM		troubleshooting
DTC CODE	**MDI TXT**	
30201	**Startup**	
Description: Incorrect start-up and firing sequence.		
Possible causes: A. Incorrect start up sequence B. Wiring or connectors or pushbuttons damaged		• Carry out a visual inspection of all the connectors paired with the error code. Restart the truck and check whether the error code is still present. CAUSE A • Follow the correct start up sequence CAUSE B • Check the tiller wiring and the electrical panel wiring • Check condition of pushbutton connectors, clean if necessary. • Check that all the tiller controls have been released.

ALARM		troubleshooting
DTC CODE	**MDI TXT**	
30227	**Stalled**	
Description: The Combi controller has detected the traction motor is stalled.		
Possible causes: A. Encoder wiring harness damaged B. Motor encoder damaged C. Traction motor faulty D. Combi controller faulty		• Make sure there is nothing obstructing the transmission and the wheels. • Carry out a visual inspection of all the connectors paired with the fault code. Restart the truck and check whether the error code is still present. • Make sure the electromagnetic brake is raised when a request is made for traction and that it lets the motor turn freely. • CAUSE A • Check the encoder connections: check the continuity of wires 250, 577, 578 and 102. Check the condition of the connector CPS03. CAUSE B • With the battery connected and the traction motor running, compare the Motor>MotorSpeed A and Motor>MotorSpeedB parameters with the Controller>Frequency parameter to check the state of the encoder. CAUSE C • Check continuity of the 3 traction motor phases. If two phases do not have continuity, replace the traction motor. CAUSE D • If no trouble is found, replace the Combi controller.

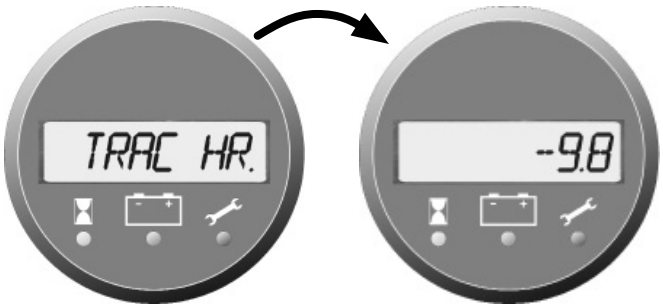
ALARM		troubleshooting
DTC CODE	**MDI TXT**	
30231	**Maintremnd**	
Description: Warning that you need to perform regular maintenance.		
Possible causes: A. Time interval until regular maintenance is due.		• Perform regular maintenance. • Reset the regular maintenance counters.


BRN
BLK
BLU
PROX SENSOR
CPS006-B
900-C
901-C
601-B
602
101-V
010-N
X1
X8
X9
X12
X11
X7
X6
X3
X4
X2
X5
TILLER CONTROL CARD
MULTI-CAN
MULTI-CAN TILLER CARD
LIFT 1
LOWER 1
LIFT 2
LOWER 2
571-A
Sheet1-[11,D]
010-BA
Sheet1-[11,A]
901-BA
Sheet1-[11,B]
AC TRACTION CONTROLLER
(SYSTEM OPTIONS)
026
724
728
068
010-D
010-G
571-A
101-D
900-D
901-D
901-E
CPS012
CRP012
CPS013
728-B
RED
BLK
BUZZER ALARM (OPTION)
BATTERY CAN PORT
CPS015
CRP015
101-O
900-E
CPS011
010-F
101-F
SPEED STEER SENSOR
900-D
Sheet1-[11,L]
101-BC
Sheet1-[11,L]

When the tiller is lowered or a traction command is given, the total number of traction hours are displayed for a few seconds.

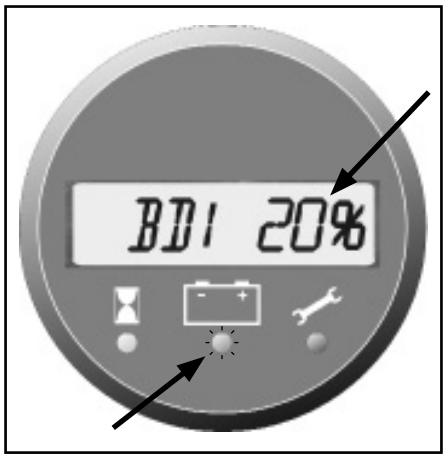


When a lifting or lowering command is given, the total operating hours of the truck pump appear on the display for a few seconds.



BATTERY CHARGE STATUS INDICATOR

The battery charge status is indicated on the display.
When the battery charge state reaches 20% the fork lifting is inhibited.
The "battery low" indicator LED illuminates.
To reset the low battery charge indicator, recharge the battery. When the charge level reaches 75%% the "battery low" indicator it resets and fork lifting is enabled.



ALARMS AND MAINTENANCE INDICATOR

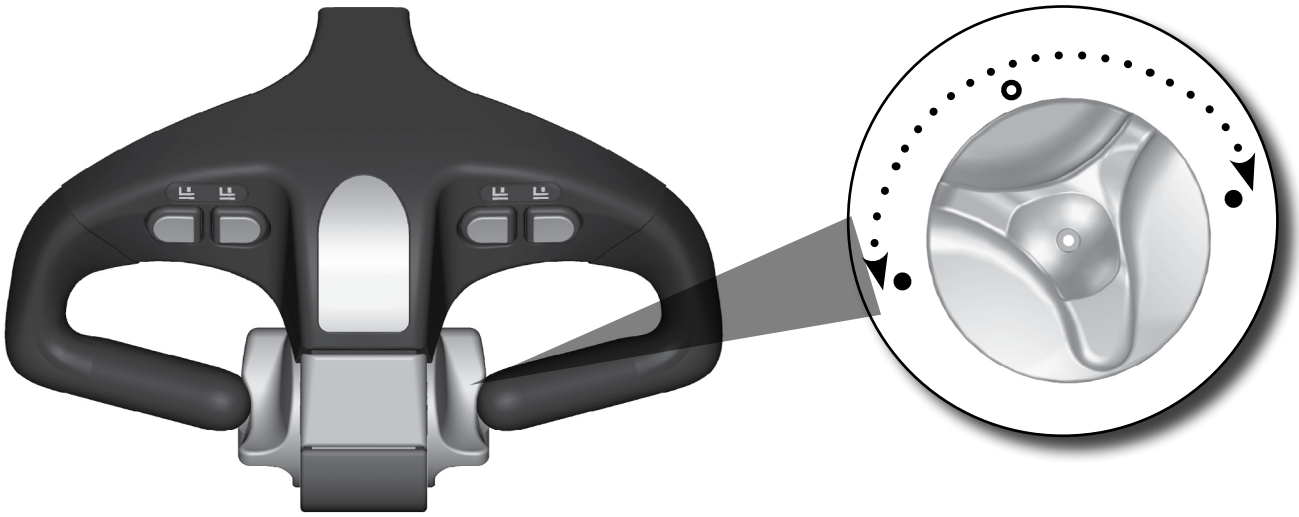
The MDI provides an indication of the truck alarm status. When an alarm signal is generated, the red LED will start flashing.
The display shows the error code that generated the alarm identified by a number (see “DIAGNOSTICS” section).

On reaching the number of hours of operation after which maintenance is required, the red LED lights up. After carrying out the necessary maintenance, reset the parameters MAIN MENU PROGRAM / display functions / maintenance timers / reset total maintenance - reset traction maintenance - reset pump maintenance (see “DESCRIPTION OF MODULE PARAMETERS”).

TRUCK FUNCTIONS

FORWARD/REVERSE TRACTION

ACTUATION CONTROLS



To activate traction, turn the butterfly control in the desired direction.
The drive direction is acquired via two hall effect sensors, one for forward travel and the other for reverse travel.

Actuators involved	Status
Key switch	ON
Emergency switch	ON
Tilted tiller sensor	ON*
Forward/reverse traction control throttle	forward/reverse rotation

* OFF if the “snail” button is pressed

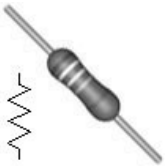
MAIN MENU PROGRAM

PARAMETER OR MENU LEV.2	PARAMETER OR MENU LEV.3	PARAMETER MENU LEV.4	level
DISPLAY FUNCTIONS	MAINTENANCE TIMERS	TOTAL MAINTENANCE ENABLE	1
		TRACTION MAINTENANCE ENABLE	1
		PUMP MAINTENANCE ENABLE	1
		MAINTENANCE INTERVAL	1000 h
		RESET TOTAL MAINTENANCE	0
		RESET TRACTION MAINTENANCE	0
		RESET PUMP MAINTENANCE	0
	HOUR METER PRESET	10S OF HOURS	0
		REMAINING HRS IN MINS	0
		PRESET TOTAL HOURMETER	0
		PRESET TRACTION HOURMETER	0
		PRESET PUMP HOURMETER	0
MOTOR	TYPICAL MAX SPEED		3550
BATTERY	NOMINAL VOLTAGE		24V
	USER OVERVOLTAGE		125%
	USER UNDERVOLTAGE		70%
	RESET VOLTS PER CELL		2.080V
	FULL VOLTS PER CELL		2.040V
	EMPTY VOLTS PER CELL		1.745V
	DISCHARGE TIME		150 min
	BDI RESET PERCENT		75%

MODULE REPLACEMENT: INSTRUCTIONS

Equipment and tools

open ended wrench 10 mm



resistor 100 Ohm 25w isolated

socket wrench 10 - 13 mm

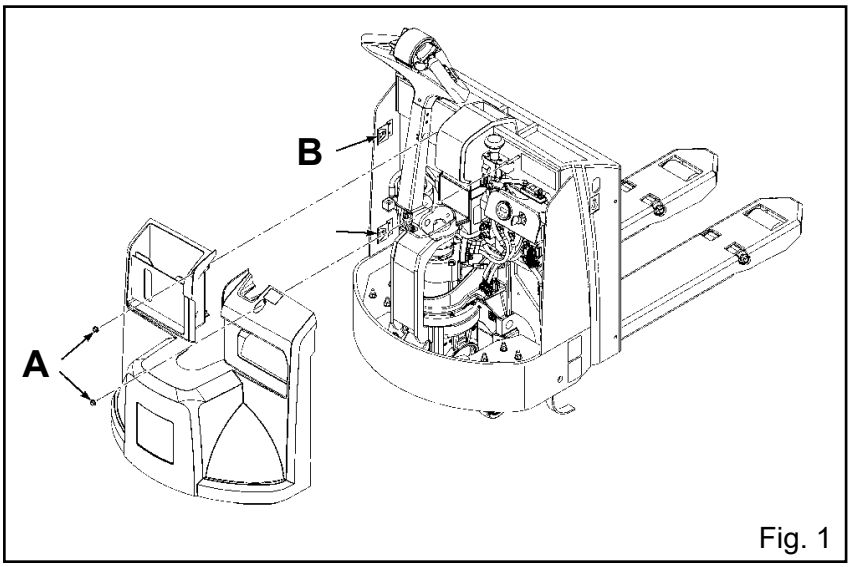


Fig. 1

Procedure

Before starting work, ensure that you are wearing suitable protective clothing. Move the truck to a safe place, away from areas of transit of other vehicles and all pedestrians. Turn the keyswitch to OFF and disconnect the battery.

Phase 1

SOCKET WRENCH SIZE 13 mm

Use the socket wrench to unscrew and remove the motor cover fixing nuts **(ref.A fig.1)**.
Remove the motor cover by pressing your hands first on the left and then on the right-hand side to trip the locking clips **(ref.B fig.1)**.

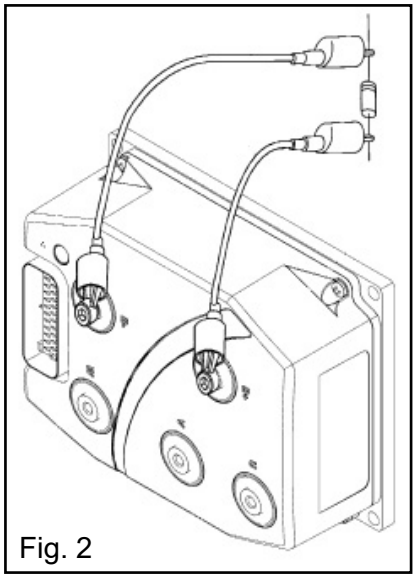


Fig. 2

Phase 2

RESISTANCE 100 Ohm 25 W

Connect a resistance between the positive **(B+)** and negative **(B-)** of the module **(fig.2)**.
Wait approximately 10 seconds for the internal capacitors to lose their charge and then disconnect the resistance.

To avoid short circuits, it is important that the resistance is insulated.

If it is not possible to have an external resistance to run down the capacitors, it will be necessary to wait at least 90 seconds before disconnecting the power cables.

BUTTERFLY CONTROL SPRING

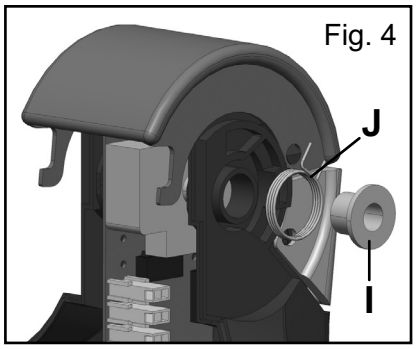


Fig. 4

Phase 4

SMALL FLAT BLADE SCREWDRIVER

With the screwdriver, prise out the butterfly guide bush **(ref.I fig.4)** and remove it. In the same way, prise up the butterfly control spring**(ref.J fig.4)** and remove it.
Proceed with replacement.

BELLY AND HORN BUTTON SPRINGS

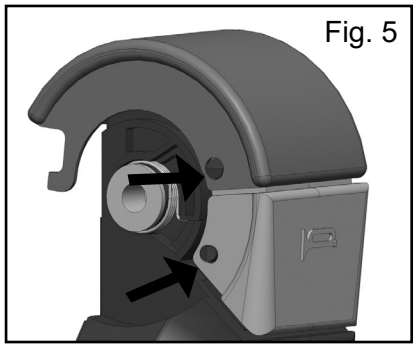


Fig. 5

Phase 4

SMALL FLAT BLADE SCREWDRIVER

With the screwdriver, apply leverage under the belly switch near the locking pin **(fig.5)**. Remove the switch **(ref.K fig.6)** and recover the spring **(ref.L fig.6)**.
In the same way apply leverage under the horn button at the lug**(fig.5)**. Remove the button **(ref.M fig.6)** and recover the spring **(ref.N fig.6)**.
Proceed with replacement.

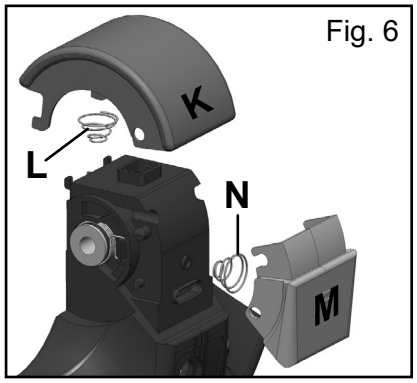


Fig. 6

HYDRAULIC COMPONENTS

REMOVAL OF THE PRESSURE RELIEF VALVE

Equipment and tools


socket wrench
13 mm


oil resistant
gloves


Torx key
T30


open ended
spanner
12 mm

Procedure

Before starting work, ensure that you are wearing suitable protective clothing.
Move the truck to a safe place, away from areas of transit of other vehicles and all pedestrians. Lower the forks to the ground, turn the keyswitch to OFF and disconnect the battery.

The hydraulic fluid gets very hot during system operation and can cause burns. It is advisable to wear gloves that are resistant to oil and high temperatures.

Phase 1

SOCKET WRENCH SIZE 13 mm

Use the socket wrench to unscrew and remove the motor cover fixing nuts **(ref.A fig.1)**.
Remove the motor cover by pressing your hands first on the left and then on the right-hand side to trip the locking clips **(ref.B fig.1)**.

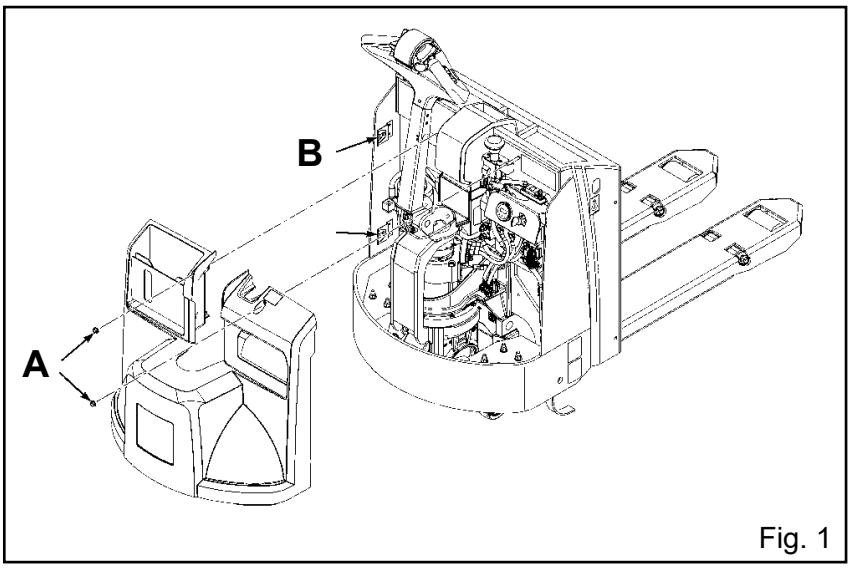


Fig. 1

Phase 2

Carry out the procedure to remove the lift pump (see "REMOVAL OF THE LIFT PUMP").

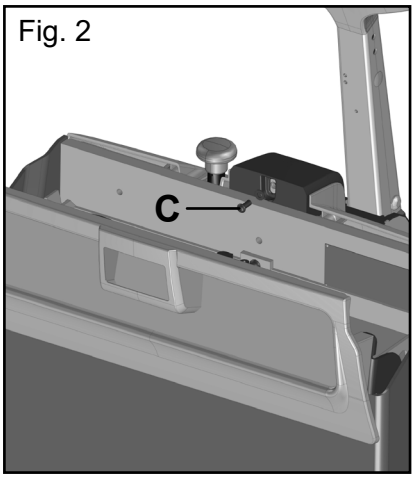
Turn the keyswitch to OFF and disconnect the battery.

Phase 3

5 mm T HANDLE HEX KEY

Open the cover of the battery compartment. From the battery compartment, with the T-handle hex key, unscrew and remove the screw securing the upper cover of the cylinder **(ref.C fig.2)**. Remove the upper cover of the cylinder by sliding it out upwards.

Fig. 2

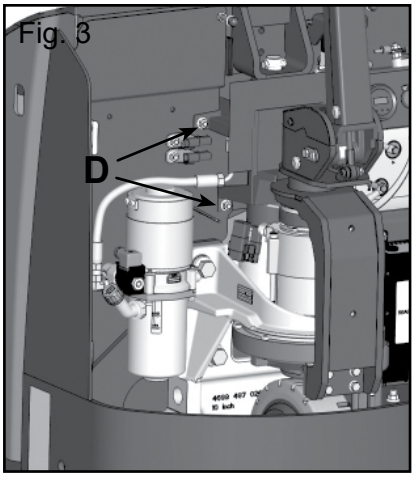


Phase 4

13 mm SOCKET WITH FLEXIBLE HANDLE

With the swivel socket wrench loosen the three nuts of the cylinder's central cover **(ref.D fig.3)**. Raise the cover upwards to remove it.

Fig. 3



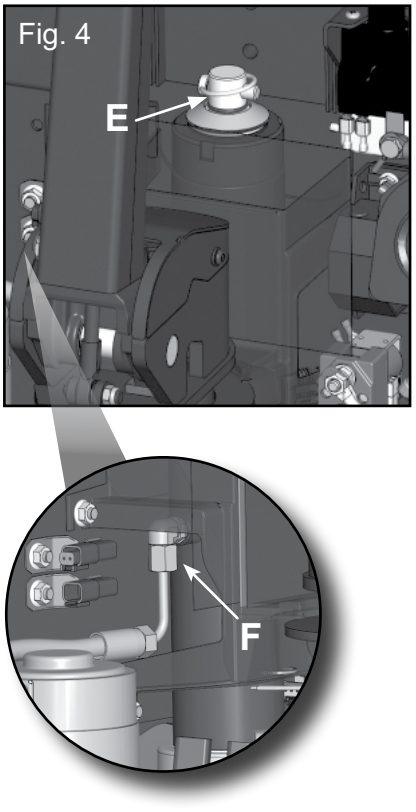
Connect the battery and turn the keyswitch to ON.

Phase 5

OIL RESISTANT GLOVES - 18 mm OPEN ENDED SPANNER - "PARKER" SERVICE PLUG

Wear the oil resistant gloves.
Remove the cylinder locking key **(ref.E fig.4)** and press the forks down button, use your hand to push the stem down to its limit stop. Switch off the truck.
Using the spanner, unscrew the hydraulic hose union **(ref.F fig.4)**.
Fit the service plug to the hydraulic hose.
Withdraw the cylinder from its housing, place it on a clean workbench with a vice and proceed with disassembly or replacement.

Fig. 4

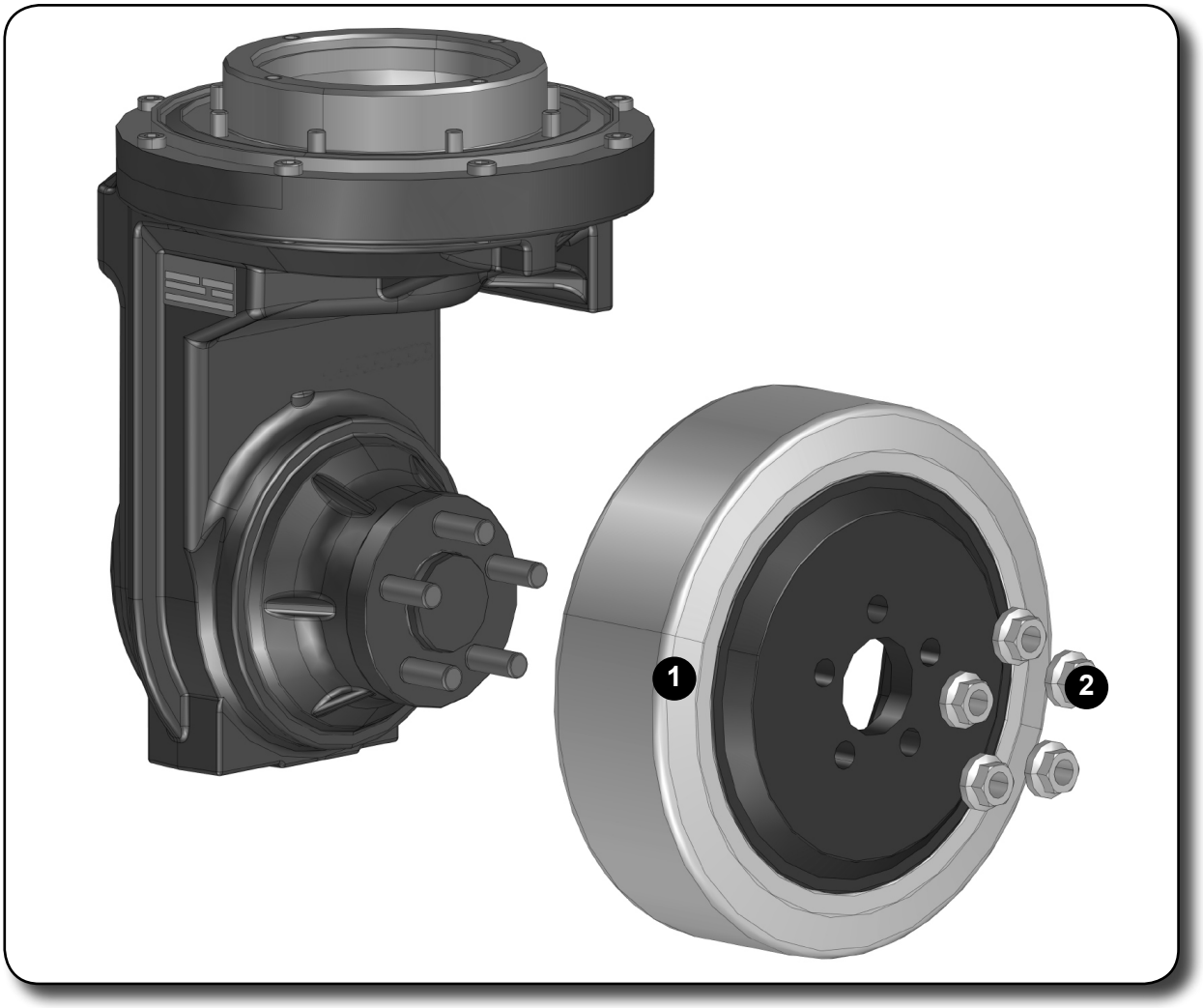


INSTALLATION

Before tightening the hydraulic connection fittings, consult the reference table, (see "CORRECT METHOD FOR APPLYING FEMALE FITTINGS'', "FOREWORD" section).

DRIVE WHEEL

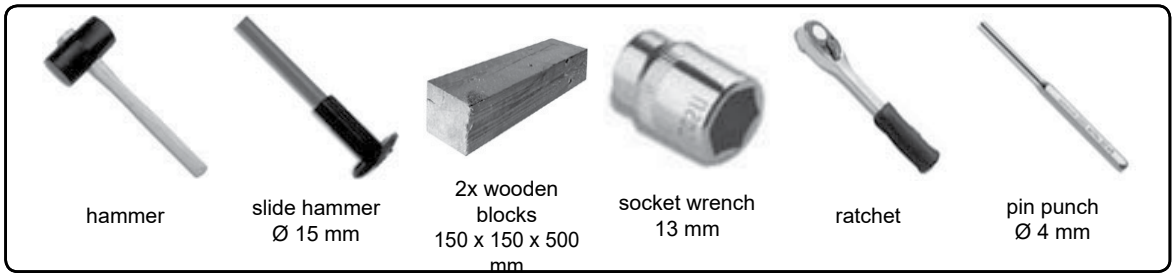
KEY TO DRIVE WHEEL COMPONENTS



Ref.	Description
1	Drive wheel
2	Drive wheel retaining nut

REPLACEMENT OF THE LOAD WHEEL ASSEMBLY

Equipment and tools



Procedure

Before starting work, ensure that you are wearing suitable protective clothing. Move the truck to a safe place, away from areas of transit of other vehicles and all pedestrians. Raise the forks to the maximum height.

Phase 1

2 WOODEN BLOCKS

Position the wooden blocks under the forks **(fig.1)**. Lower the forks so that they rest on the wooden blocks and continue lowering until the load wheels are raised off the ground by about 2 cm.

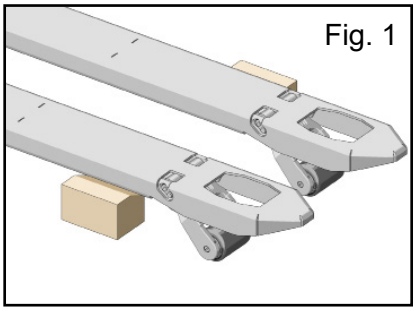


Fig. 1

Turn the key switch to OFF and disconnect the battery.

Phase 2

13MM SOCKET WRENCH - RATCHET

Using the socket wrench and ratchet, unscrew the screw **(ref.A fig.2)**. Drive out the pivot pin using the driving tool and the hammer **(ref.B fig.2)**.

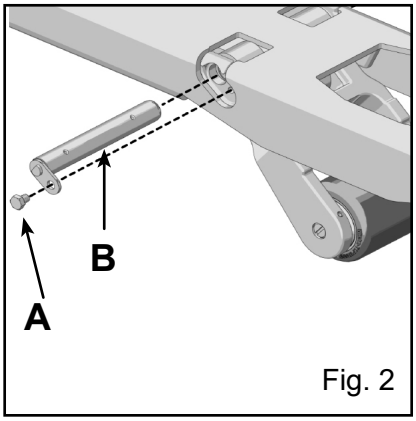


Fig. 2

Phase 3

HAMMER - PIN PUNCH - DRIVING TOOL

Using the hammer and the pin punch, drive out the spring pin securing the pivot pin **(ref.C fig.3)**. Extract the pivot **(ref.D fig.3)** using the clamp gudgeon and the hammer. Withdraw the load wheel assembly from its housing.

Proceed with replacement.

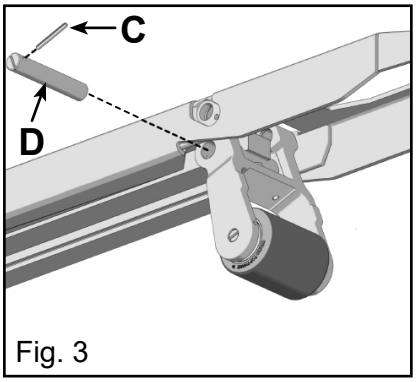
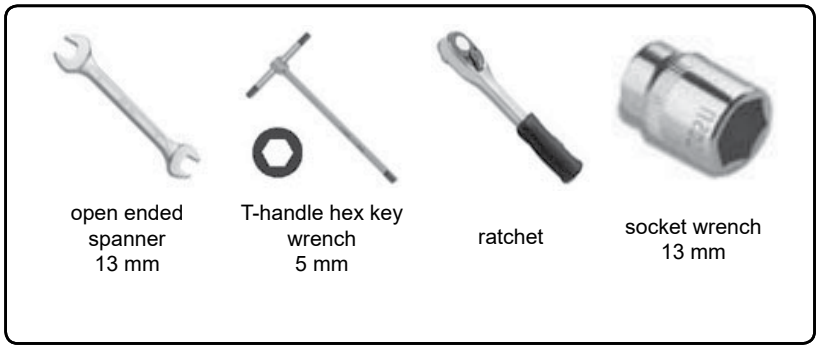


Fig. 3

REPLACEMENT OF THE TILLER SPRING

Equipment and tools



Procedure

Before starting work, ensure that you are wearing suitable protective clothing. Move the truck to a safe place, away from areas of transit of other vehicles and all pedestrians. Lower the forks to the ground, turn the keyswitch to OFF and disconnect the battery.

Phase 1

SOCKET WRENCH SIZE 13 mm

Use the socket wrench to unscrew and remove the motor cover fixing nuts **(ref.A fig.1)**.
Remove the motor cover by pressing your hands first on the left and then on the right-hand side to trip the locking clips **(ref.B fig.1)**.

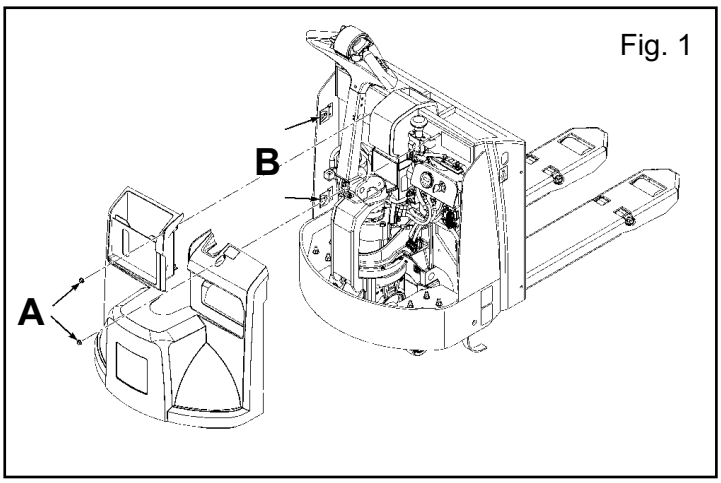


Fig. 1

Phase 2

Remove the plastic caps to access the tiller spring **(ref. C fig. 2)** and then release the spring pressure.

The tiller spring contains pressurized gas and lubricating hydraulic oil.

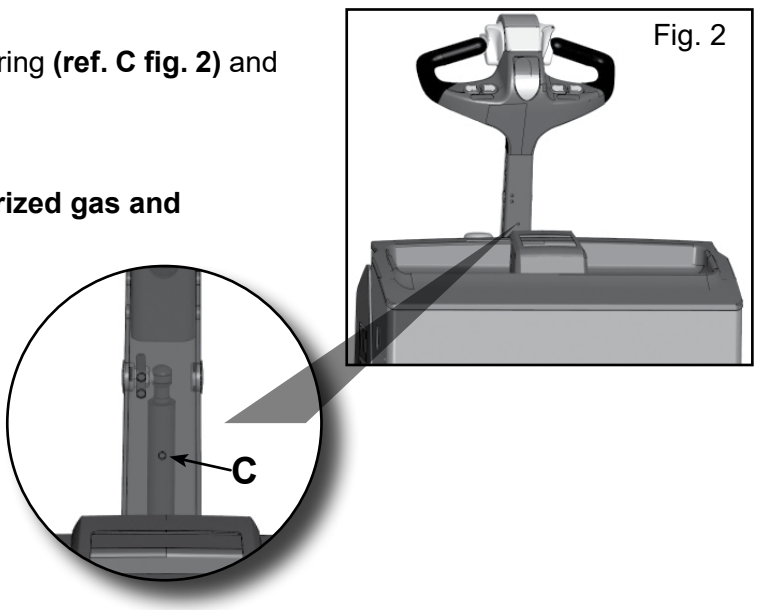


Fig. 2

CHANGE REDUCTION GEAR BEARING

Equipment and tools

vice

6 mm hex socket wrench

oil resistant gloves

Procedure

Before starting work, ensure that you are wearing suitable protective clothing.

Phase 1

OIL RESISTANT GLOVES

Wear the oil resistant gloves.
Carry out the reduction unit removal procedure (see “REMOVAL OF THE REDUCTION UNIT”).

Phase 2

VICE - MEDIUM FLAT BLADE SCREWDRIVER

Position the reduction unit in the vice and clamp firmly.

Phase 3

SOCKET WRENCH

Unscrew the 8 screws **(ref.A fig.1)** securing the bearing **(ref.B fig.1)** to the reduction gear, then remove the bearing and make the change.

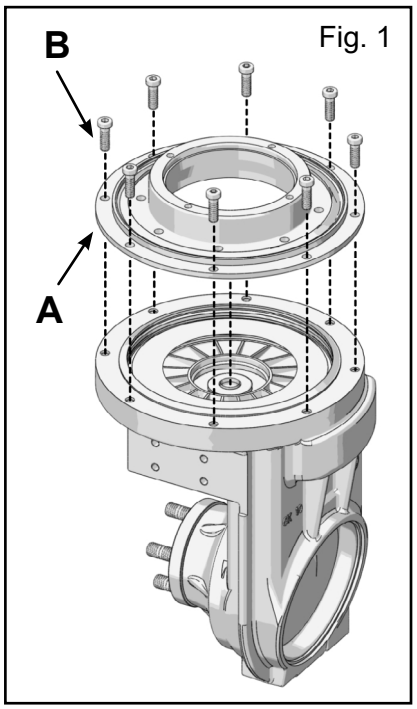


Fig. 1

- The acid in the electrolyte can cause injury. If the electrolyte gets spilled it should be cleaned up with water. Neutralize the acid with a solution of sodium bicarbonate (soda). Areas of the skin that come into contact with the acid must be rinsed with water immediately. Acid splashed into the eyes must be washed away with water constantly for at least 10 minutes, then call a doctor.
- The batteries belong to the counterweight system of the lift truck. When installing a battery that is too small, the lift truck might not have enough weight for the nominal load. When replacing a battery, see the truck identification data plate to check that the battery has the rated capacity and correct dimensions. See “TRUCK AND LOAD CAPACITY IDENTIFICATION DATA” in the “PRESENTATION” section for the exact battery specifications for the lift truck at issue.
- Do not work under a raised fork carriage. Lower the fork carriage or use a safety chain to prevent the fork carriage from dropping during maintenance work on the mast and lifting chains.
- Never repair damaged forks using heat or welding. The forks are made of steel that is hardened with special procedures. Replace damaged forks.
- Before servicing the hydraulic system you must eliminate any residual circuit pressure.
  Close the valves at the end of the maintenance work.

1.0 KEY TO SYMBOLS

This symbol indicates the necessity to refer to this manual before using and charging the battery. Failure to follow the instructions for correct use may result in damage to the equipment.

DANGER: An exclamation mark inside a triangle alerts the user to the existence of important use and maintenance (service) instructions in the documentation supplied with the product. Denotes an imminently hazardous situation which, if not avoided, could result in serious injury or even death. The use of this term is limited to the most extreme situations.

This symbol denotes important information or potentially hazardous situations which, if not avoided, could result in minor injury or damage to the equipment.

DANGER: The symbol of a lightning bolt inside a triangle alerts the user to presence of a "hazardous electrical voltage" that is not isolated inside the structure or cover; this voltage could be sufficiently high to constitute an electrical shock hazard.

MANDATORY SIGN: Indicates that the operator must wear the necessary PPE (Personal Protective Equipment).

RECYCLE: Indicates that packaging elements are recyclable.

DISPOSAL: Disposal of Lithium ion (Li-ion) batteries and battery changers. Components marked with the "recycle" symbol must be taken to an authorised waste recycling centre. Used batteries must not be mixed with domestic or industrial refuse.

LIFTING: Indicates that the battery pack must be lifted with care, in accordance with its dimensions and weight, and with the load in equilibrium.

The battery pack conforms to the requirements of Directives:
2014/30/EU, 2001/95/CE, 2006/66/CE (and subsequent amendments). As regards the Directives and Standards concerning the battery charger, refer to the specific manual supplied with the charger.

6.0 TECHNICAL SPECIFICATIONS

The table gives the technical specifications of lithium ion (Li-ion) battery packs of the type: LFP 25.6V and LFP 51.2V.

TECHNICAL SPECIFICATIONS	A428	A428	D852 (with adapter) C845	D852 D843
Minimum voltage [V]	20	20	20	20
Average rated voltage [V]	25.6	25.6	25.6	25.6
Maximum voltage [V]	28.8	28.8	28.8	28.8
Nominal capacity [Ah]	50	100	100	200
Min. charge temperature [°C]	0			
Max. charge temperature [°C]	45			
Min. discharge temperature [°C]	-10			
Max. discharge temperature [°C]	55			
Max charge current [A]	50	100	100	200
Max discharge current [A]	50	80	100	160
Maximum discharge impulse current (5s) [A]	75	150	150	300
Battery dimensions (LxDxH) [mm]	650x150x560	650x150x560	650x150x560	624x212x627
Max. battery weight [kg]	153	153	153	223
Storage temperature range [°C]	-10°C - 35°C			
Maximum relative humidity [%]	95 (no condensation)			
Maximum altitude [m]	2000			

For versions with Rema socket, the maximum current output is limited by the socket. Temperature affects the maximum charge and discharge currents (see table on page 16).

Configuration with membrane keypad

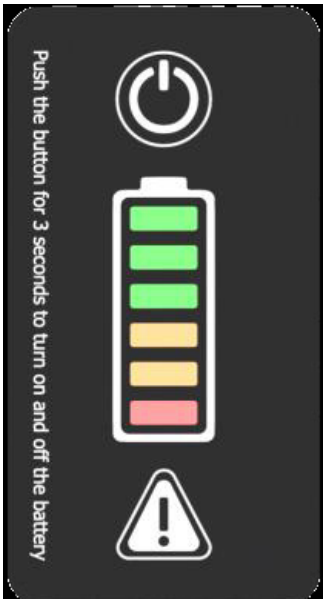
The membrane is comprised of the following parts:

Press the button for 3 seconds to turn the battery on and off.

1 – Battery On/Off button.
2 – Charge indicator with 6 backlit segments: 3 green, 2 yellow, 1 red.
3 – Warning light that illuminates when the battery enters SAFE mode, indicating a problem..

TURNING THE BATTERY ON AND OFF:
To activate or deactivate the battery, press activation button 1 for 3 seconds.

STATE OF CHARGE DISPLAY:
A short press of the activation button when the battery is in stand-by mode accesses the state of charge display. The state of charge (SoC) is shown by the illuminated segments of the charge indicator. When the battery is fully charged, all the segments of the charge indicator are lit (see figure).



WARNINGS AND ALARMS THAT MAY APPEAR ON THE D843 TRUCK EQUIPPED WITH LITHIUM BATTERY:

ALARM	CODE MDI	Cause	Effect
CHARGE BATT	0	This alarm is generated if the parameter HYG LI-ION BATT is set to ON, but the BMS activates limited performance mode	Traction is reduced in accordance with the parameter BMS RED. SPEED and the pump lifting function is inhibited.
CAN BUS KO BMS	55	This alarm is generated if the parameter HYG LI-ION BATT is set to ON, but no communication is received from the BMS	After 15 seconds, traction and pump are stopped.
BMS TRUCK INHIBIT	66	The battery has detected an anomaly and consequently the need to open the contactor to power off the truck. This alarm is generated 15 seconds after activation of the WARNING INHIBIT or following a traction/pump/steering request is received when the battery charging connector cap is open or the battery is connected to the battery charger (1).	Traction and pump stopped
BMS ALARM	0	Battery charge level (SoC)<= 0 % Charging connector cap open(1)	After 15 seconds, traction and pump are stopped.
BMS SHUTDOWN (only fault log)	0	The BMS disables the battery's internal contactor	Traction and pump stopped
BMS MISMATCH	54	This alarm is generated if the parameter HYG LI-ION BATT is set to OFF, but messages are received from the BMS	Traction and pump stopped
CHARGE STATUS	0	The battery charger connector is connected to the battery. Battery charge socket cap open with truck stationary and no requests from operator (1).	Traction and pump stopped

(1)In the case of battery with double socket