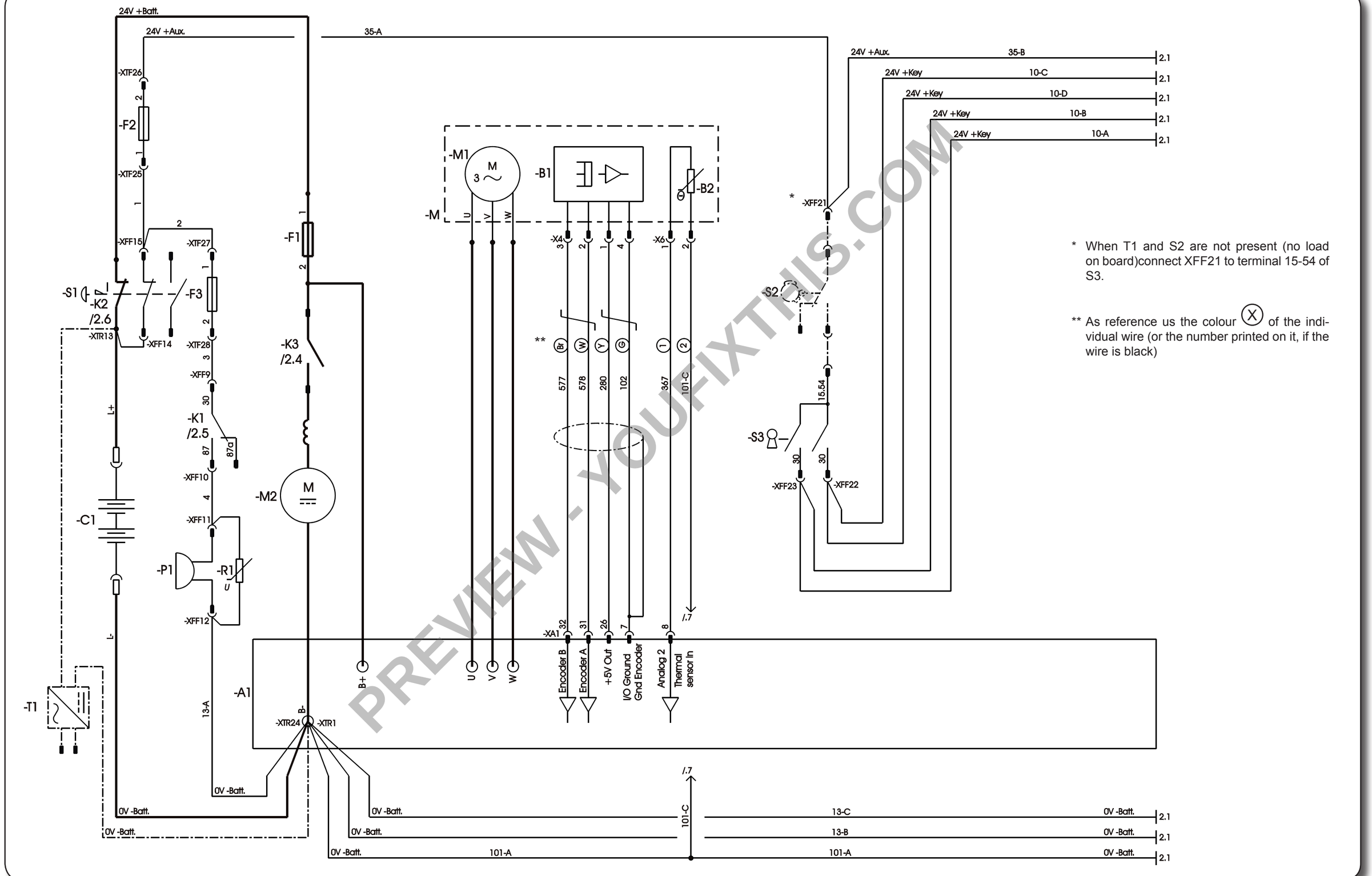



* When T1 and S2 are not present (no load on board)connect XFF21 to terminal 15-54 of S3.

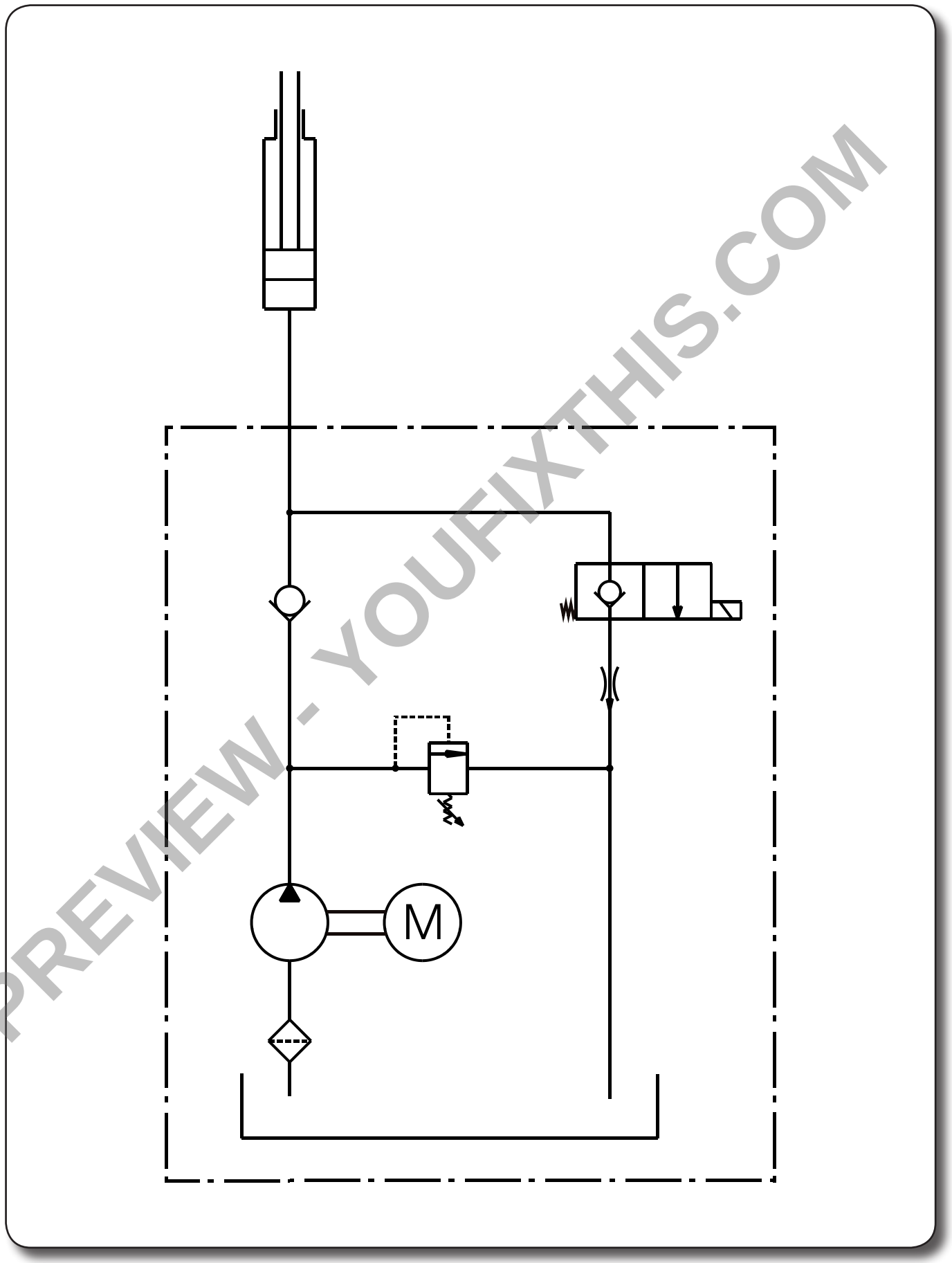
** As reference us the colour (X) of the individual wire (or the number printed on it, if the wire is black)

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## MAIN HYDRAULIC DIAGRAM




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## DRIVING TORQUE OF SCREWS, NUTS AND CONNECTORS

**Before the disassembly of the various parts and of the bolts and screws, read carefully the instructions below.**

To tighten the screws use the product LOCTITE 270 in order to ensure the safety of the threaded couplings.

If it is not possible to loosen the screws because this product is used, do not add extensions to the tools, but heat the area (maximum 50°C) in oder to eliminate the effect of LOCTITE 270.

In the above-mentioned cases use a small quantity of LOCTITE 270 in the assembly phase (30% of the connection surface).

The driving torque with which the threaded couplings are tightened is very important to ensure the safety of the truck connection.

The bolts and nuts and the corresponding driving torques are shown in the tables on this page.

| Nominal diameter | DRIVING TORQUE Nm | |
|---|---|---|
| | Class 8 | Class 10 |
| M 3 | 4 | 5,2 |
| M 4 | 7 | 9,15 |
| M 5 | 12,14 | 14,8 |
| M 6 | 17,2 | 20,9 |
| M 8 | 31,8 | 38,1 |
| M 10 | 50,5 | 60,3 |
| M 12 | 74,2 | 88,5 |
| M 14 | 101,2 | 120,8 |
| M 16 | 138,2 | 164,9 |
| M 18 | 176,6 | 203,5 |
| M 20 | 225,4 | 259,7 |
| M 22 | 278,8 | 321,2 |
| M 24 | 324,8 | 374,2 |
| M 27 | 422,3 | 486,5 |
| M 30 | 516,1 | 594,7 |

| | | | | Preloading N | DRIVING TORQUE Nm | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Class 5.8 | | Class 8.8 | | Class 10.9 | |
| | | | | | | | | | | |
| M 4 | 0,7 | 7 | 3 | 2400 | 1,92 | 1,44 | 3,07 | 2,3 | 4,17 | 3,13 |
| M 5 | 0,8 | 8 | 4 | 3880 | 3,88 | 2,91 | 6,2 | 4,65 | 8,43 | 6,33 |
| M 6 | 1 | 10 | 5 | 5490 | 6,58 | 4,94 | 10,5 | 7,9 | 14,3 | 10,8 |
| M 8 | 1,25 | 13 | 6 | 9990 | 16 | 12 | 25,6 | 19,2 | 34,8 | 26,1 |
| M 8 | 1 | 13 | 6 | 10700 | 17,1 | 12,8 | 27,4 | 20,5 | 37,3 | 27,9 |
| M 10 | 1,5 | 16 | 8 | 15825 | 31,7 | 23,8 | 51 | 38 | 69 | 52 |
| M 10 | 1,25 | 16 | 8 | 16700 | 33,4 | 25,1 | 53 | 40,1 | 73 | 55 |
| M 12 | 1,75 | 18 | 10 | 23025 | 55 | 41,4 | 88 | 66 | 120 | 90 |
| M 12 | 1,25 | 18 | 10 | 25150 | 60 | 45,3 | 96 | 72 | 130 | 98 |
| M 14 | 2 | 21 | 12 | 31400 | 88 | 66 | 140 | 105 | 190 | 145 |
| M 14 | 1,5 | 21 | 12 | 34125 | 96 | 72 | 155 | 115 | 210 | 155 |
| M 16 | 2 | 24 | 14 | 42850 | 135 | 105 | 220 | 165 | 300 | 225 |
| M 16 | 1,5 | 24 | 14 | 45600 | 145 | 110 | 235 | 175 | 320 | 240 |
| M 20 | 2,5 | 30 | 17 | 66875 | 270 | 200 | 430 | 320 | 580 | 435 |
| M 20 | 1,5 | 30 | 17 | 74250 | 295 | 225 | 475 | 355 | 650 | 485 |

= with lubricant

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## TROUBLESHOOTING: MODULE DIAGNOSIS SYSTEM

The module is equipped with two LEDs (one red, one yellow) which, in the event of a fault, will flash the corresponding error code. The red LED flashes once to indicate that the system is about to signal first digit of the error code, then the yellow LED will emit the number of flashes corresponding to this first digit. The red LED now flashes twice to indicate that the system is about to signal second digit of the error code, then the yellow LED will emit the number of flashes corresponding to this second digit.
The two LEDs have four operating modes which are used to signal different type of information.

| RED LED | YELLOW LED | STATUS |
|---|---|---|
| Off | Off | The controller is switched off or damaged. |
| Off | Flashing | The controller is in operation. |
| On | On | The controller is in Flash Program mode. |
| On | Off | Watchdog error or software not installed. Turn off and restart the truck or install the software. |
| Flashing | Flashing | The controller has detected an error. The two digit code is signalled by the flashing of the two LEDs in a cyclical sequence. |

### ALARMS

| ALARM | troubleshooting |
|---|---|
| **12 - "Controller Overcurrent"**<br>Possible causes:<br>- External shortcircuit on connections of phases U, V or W to the motor<br>- Motor parameters incorrect<br>- Controller fault<br>Effects:<br>- Main contactor K2 open<br>- All truck functions disabled<br>- Electromagnetic brake activated | • Turn off and restart the truck.<br>• Check the wiring and for a short-circuit or low impedance on the phases U, V and W.<br>• Check the motor parameters are correct.<br>• If no fault is found in the wiring or the parameters but the alarm persists, then the problem lies in the module. |
| **13 - "Current Sensor Fault"**<br>Possible causes:<br>- Dispersion of current from phases U, V or W to the truck chassis (short circuit of motor stator)<br>- Controller fault<br>Effects:<br>- Main contactor K2 open<br>- All truck functions disabled<br>- Electromagnetic brake activated | • Turn off and restart the truck.<br>• Check motor insulation<br>• If no fault is found and the alarm persists, then the problem lies in the module. |

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## UNLOADING THE TRUCK

### Equipment and tools



fork lift truck
load capacity
1000 kg



bridge crane
load capacity
1000 kg



2 lifting slings
load capacity
1000 kg

### Procedure

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



**Phase 1**

FORKLIFT TRUCK

Pick up the pallet using the lift truck, raise it and carry it to a safe place, away from the transit areas of other vehicles and pedestrians.

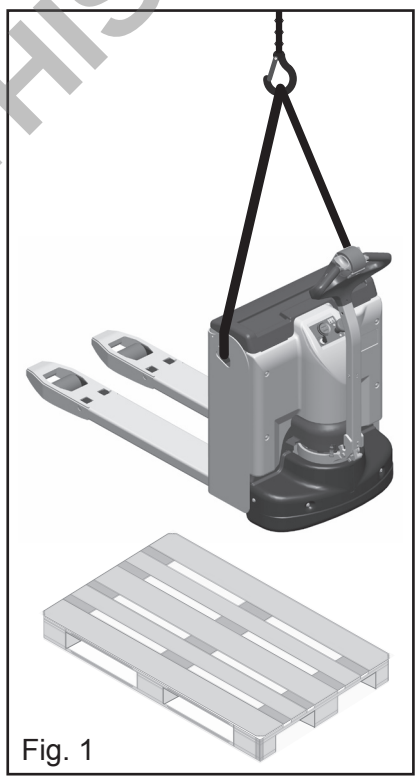


Fig. 1

**Phase 2**

BRIDGE CRANE - 2 LIFTING SLINGS

Remove the packaging.

Attach the two lifting slings to the lifting attachments on the truck base **(fig.1)**.

**Ensure that the bridge crane is positioned vertically above the truck to be lifted.**

Attach the lifting slings to the bridge crane, lift the truck off the pallet and slowly lower it to the ground.

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| | | GENERAL SPECIFICATIONS | | | |
|---|---|---|---|---|---|
| CHARACTERISTICS | 1.2 | model | | **P1.8** | **P2.0** |
| | 1.3 | power: battery, diesel, LPG, petrol, electric | | Battery | Battery |
| | 1.4 | steering: tiller, pedestrian, standing, sitting | | tiller | tiller |
| | 1.5 | load capacity, load | Q (t) | 1.8 | 2.0 |
| | 1.6 | centre of gravity | c (mm) | 600 | 600 |
| | 1.8 | load distance from load wheel axle | x (mm) | 1001 | 1001 |
| | 1.9 | wheelbase (WB) | y (mm) | 1331 | 1331 |
| WEIGHTS | 2.1 | unladen weight | kg | 503 | 503 |
| | 2.2 | load per axle when loaded (front/rear) | kg | 806 / 1497 | 876 / 1627 |
| | 2.3 | load per axle when unladen (front/rear) | kg | 399 / 104 | 399 / 104 |
| WHEELS AND CHASSIS | 3.1 | tyres: full rubber, polyurethane, vulkollan (front/rear) | | polyur. / vulk. | polyur. / vulk. |
| | 3.2 | front wheel size | | ø 230 x 75 | ø 230 x 75 |
| | 3.3 | rear wheel size | | ø 85 x 90 | ø 85 x 90 |
| | 3.4 | additional wheels (size) | | ø 100 x 40 | ø 100 x 40 |
| | 3.5 | wheels: quantity, (x= traction) (front/rear) | | 1x+2 / 2 | 1x+2 / 2 |
| | 3.6 | front track width | b 10 (mm) | 470 | 470 |
| | 3.7 | rear track width | b 11 (mm) | 395 | 395 |
| DIMENSIONS | 4.4 | lifting | h3 (mm) | 130 | 130 |
| | 4.9 | height of tiller in operating position (min/max) | h14 (mm) | 735 / 1200 | 735 / 1200 |
| | 4.15 | fully lowered forks height | h13 (mm) | 88 | 88 |
| | 4.19 | total length | l1 (mm) | 1683 | 1683 |
| | 4.20 | length to fork heel | l2 (mm) | 500 (1) | 500 (1) |
| | 4.21 | total length | b1/b2 (mm) | 700 | 700 |
| | 4.22 | fork size | s/e/l (mm) | 55 / 170 / 1180 | 55 / 170 / 1180 |
| | 4.25 | width over forks | b5 (mm) | 560 | 560 |
| | 4.32 | ground clearance at wheelbase centre | m2 (mm) | 20 | 20 |
| | 4.33 | working aisle width with 1000 x 1200 pallet | Ast (mm) | 1711 (1) | 1711 (1) |
| | 4.34 | working aisle width with 800 x 1200 pallet | Ast (mm) | 1911 (1) | 1911 (1) |
| | 4.35 | turning radius | Wa (mm) | 1512 (1) | 1512 (1) |
| PERFORMANCE | 5.1 | travel speed with/without load | km/h | 6 / 6 | 6 / 6 |
| | 5.2 | fork lifting speed with/without load | m/s | 0.032 / 0.046 | 0.034 / 0.046 |
| | 5.3 | fork lowering speed with/without load | m/s | 0.08 / 0.08 | 0.08 / 0.08 |
| | 5.8 | maximum gradeability with/without load | % | 10 / 20 | 10 / 20 |
| | 5.10 | service brakes | | electromagnetic | electromagnetic |
| ELECTRICAL MOTORS | 6.1 | traction motor, S2 60 minutes | kW | 1.2 | 1.2 |
| | 6.2 | lifting motor | kW | 1 | 1 |
| | 6.3 | battery BS, DIN 43531/35/36 A,B,C, no | | no | no |
| | 6.4 | battery voltage/nominal capacity | V/Ah | 24 / 150 (200) | 24 / 150 (200) |
| | 6.5 | battery weight (+/- 5%) | kg | 150 (225) | 150 (225) |
| | 8.1 | type of control | | AC ~ Mosfet | AC ~ Mosfet |

(1) Tiller in vertical position

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# TILLER BOARD: CONFIGURATION AND CALIBRATION

CONFIGURATION

When should this procedure be carried out?

*- When the tiller board is replaced.*

**In order to avoid accidentally operating the horn microswitch during the configuration operation, it is advisable to carry out the procedure before inserting the card in the tiller casing.**

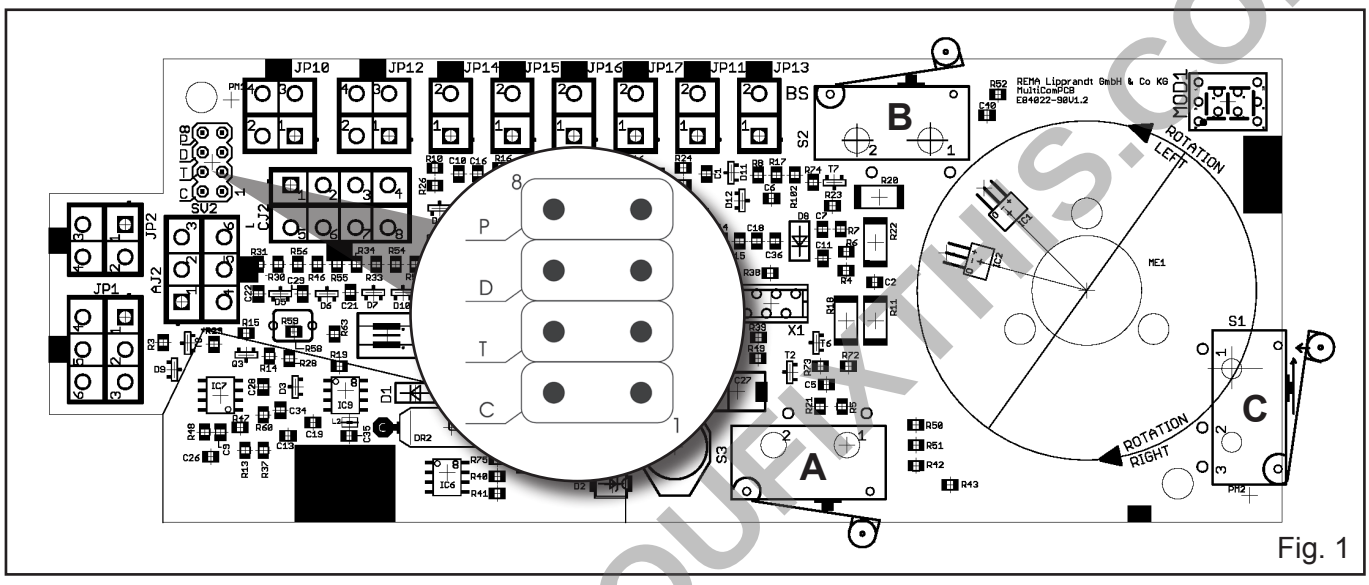



Fig. 1

**Procedure**

**Turn the keyswitch to OFF and disconnect the battery.**

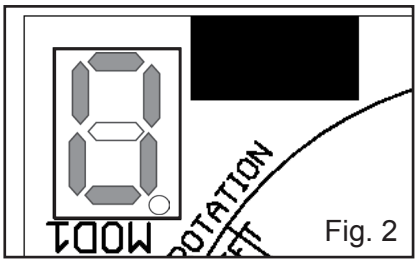



Fig. 2

**Phase 1**

Move the jumper on the tiller board from position **P** (Parking) to position **C** (Configuration) (**fig.1**).

**Connect the battery and turn the starter key to ON.**

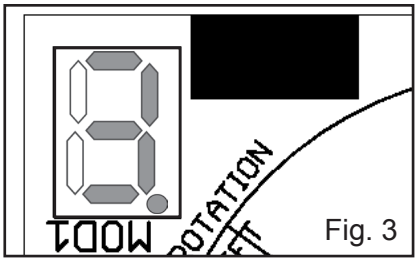



Fig. 3

**Phase 2**

The LED display shows 0 (no configuration) or a number identifying the type of configuration saved on the board (**fig.2**).

Press the Snail microswitch (**ref.B fig.1**) to increase the value until the configuration number 3 (trucks with on-off type lifting and lowering buttons) appears on the LED display.

To decrease the value, press the horn microswitch (**ref.A fig.1**).

**Phase 3**

Confirm the configuration by pressing the Bellyswitch microswitch (**ref.C fig.3**). On the LED display a decimal point appears after the configuration number (**fig.3**).

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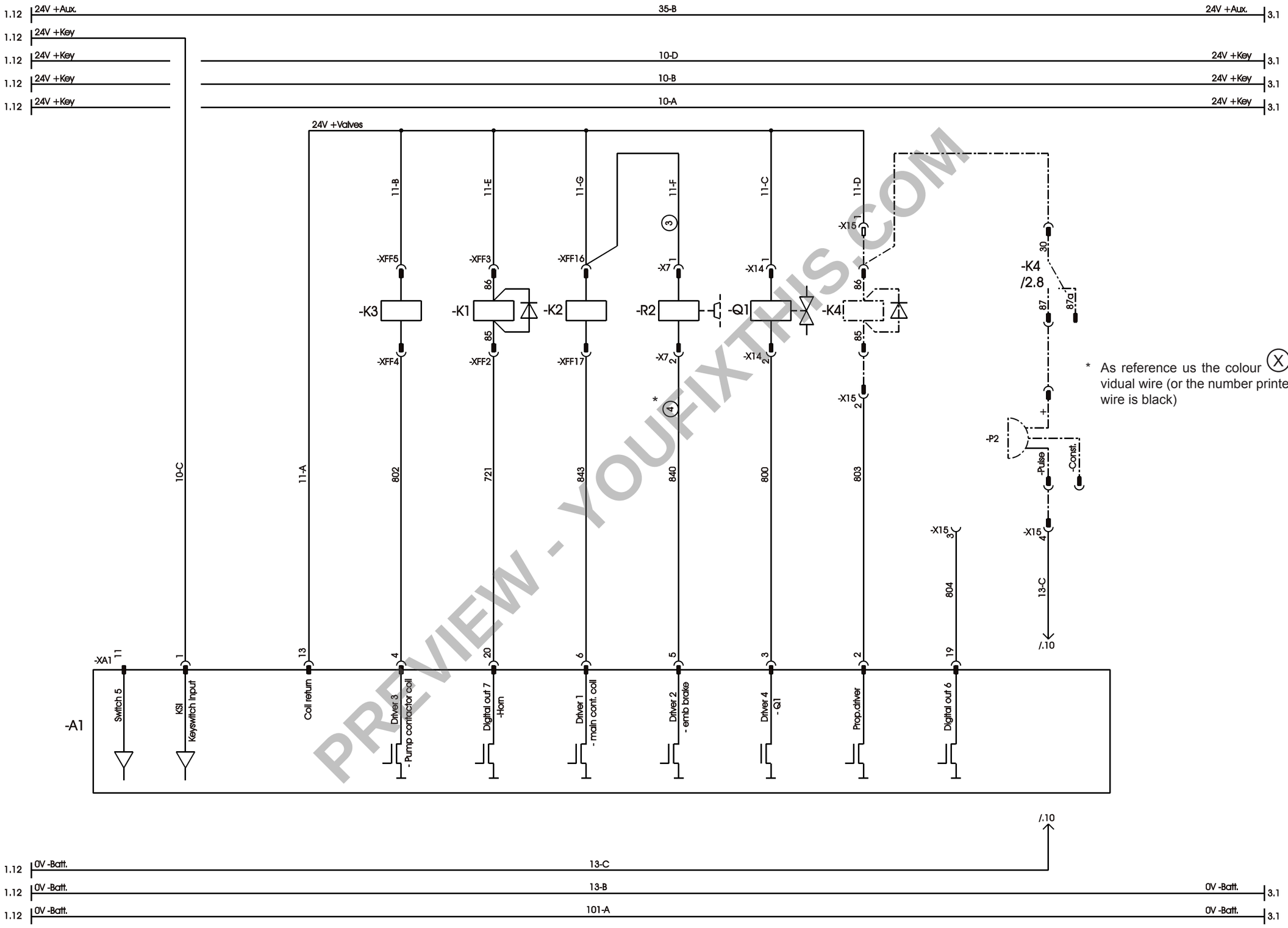
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## PLANNED MAINTENANCE

| | ● = check and maintenance<br>■ = operator check<br>x = replacement | Maintenance intervals | | | | |
|---|---|---|---|---|---|---|
| | Operation description | every 8 hours 1 day | every 500 h 6 months | every 1000 h 12 months | every 2000 h 24 months | every 3000 h 36 months |
| TRUCK BASE | Check welded joints | | | | | ● |
| | Lubrification of tiller gudgeon | | | | | ● |
| | Greasing the linkage pivot pins | | | | | ● |
| | Lubrication of linkage pivot pins-forks-carriage (3) | | | | | ● |
| | Check efficiency of tiller gas spring | ■ | | | | |
| | Check tiller control housing | ■ | | | | |
| | Check steering thrust block bearing | ■ | | ● | | |
| | Lubrification of steering thrust block | | | | ● | |
| | General cleaning | | | | | ● |
| BRAKING SYSTEM | Check the efficiency of the electromagnetic brake coil | ■ | | ● | | |
| | Check brake lining wear (1) | | | ● | | |
| | Check release braking | ■ | | ● | | |
| | Check reverse braking | ■ | | ● | | |
| | Check emergency braking | ■ | | ● | | |
| | Check parking mode braking | ■ | | ● | | |
| | General cleaning | | | ● | | |
| MOTORS | Check motor insulation | | | ● | | |
| | Check cable connections | | | ● | | |
| | Check fastening bolts | | | ● | | |
| | General cleaning with compressed air | | | ● | | |
| HYDRAULIC SYSTEM | Check for oil leaks at pump connections | ■ | | ● | | |
| | Check for oil leaks at cylinder head connections | ■ | | ● | | |
| | Check for oil leaks at motor housing distributor connections | ■ | | ● | | |
| | Check flexible pipes (2) | | | | ● | |
| | Replace oil in hydraulic tank | | | | | x |
| | Oil filter cleaning | | | | | ● |
| | Check valve operation | ■ | | | | |
| REDUCER | Reducer oil replacement | | | | x | |
| | Visual oil leak check | ■ | | ● | | |
| | Check general condition of reducer | | | ● | | |
| | Check steering crown gear and steering pinion wear | | | | | ● |
| | General cleaning | | | ● | | |
| PLANT ELECTRICAL | Check all electrical connections | | | ● | | |
| | Check the condition of electric cables | | | ● | | |
| | Sensor check | | | ● | | |
| | General cleaning of electrical panel, remote-control switches and contacts using dry air at low pressure | | | ● | | |
| WHEELS | Check traction wheel wear (1) | | ■ | ● | | |
| | Check the tightening of traction wheel fastening nuts | | | ● | | |
| | Check tightening of pivoting wheel fastening nuts | | | ● | | |
| | Check load bearing wheel wear (1) | | ■ | ● | | |
| | Check load bearing wheel bearings (1) | | | ● | | |

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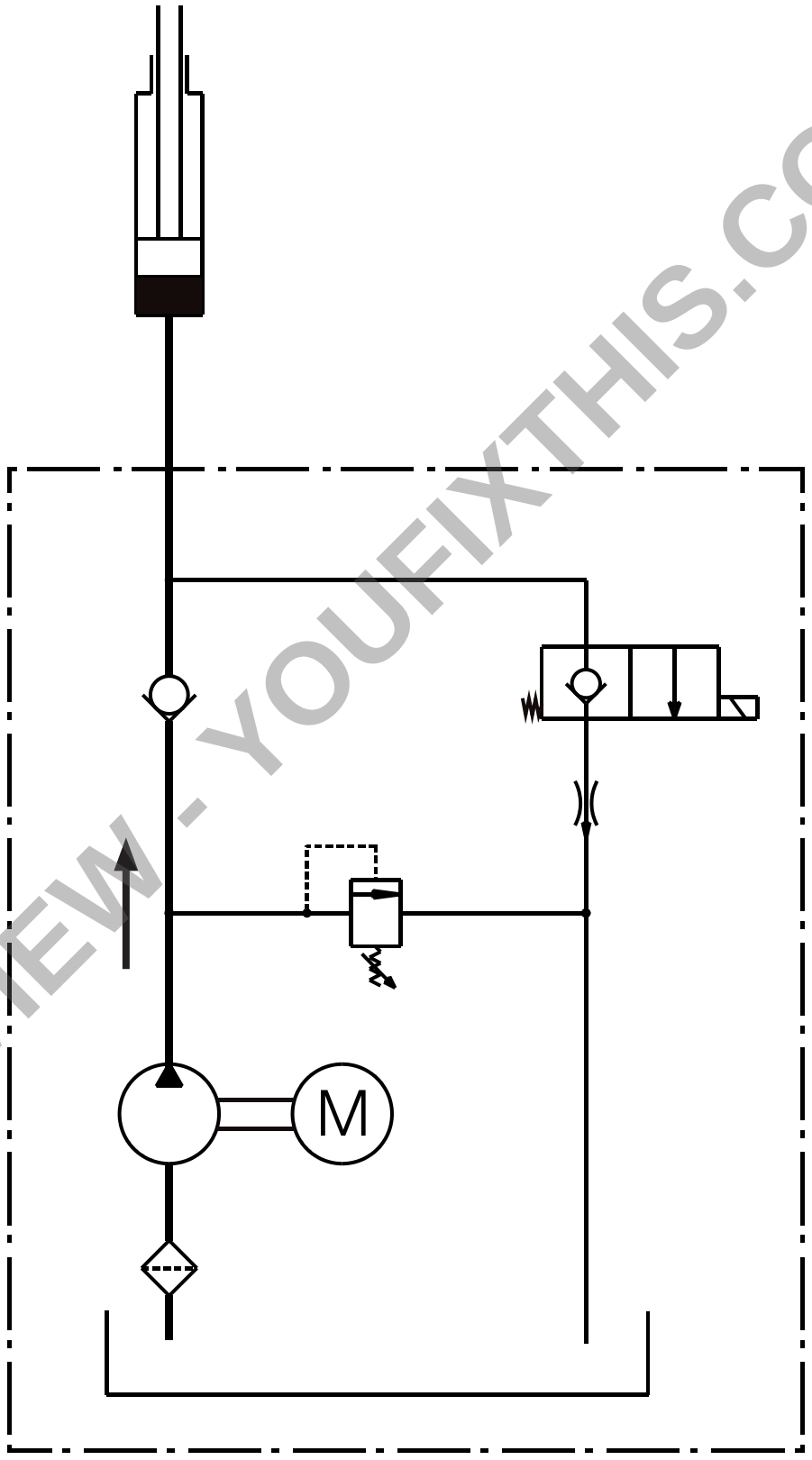



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## HYDRAULIC DIAGRAM FOR FORK LIFTING




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## CORRECT METHOD TO APPLY THE FEMALE CONNECTORS

To ensure an optimum connection between the female connectors and the adapters mentioned in this manual, it is necessary to carry out the following procedure, which is different from the one for the assembly of the rigid pipes.

**Female connectors without gasket (metal/metal connection)**

Screw the nut manually and then tigthen 1/4 turn by means of a spanner.

**Female connectors with O-RING**

Screw the nut manually and then tighten 1/4 turn by means of a spanner.

In any case make sure that the pipe is correctly aligned before tightening the nut to the adapter.

### DRIVING TORQUE

| ROTARY METRIC FEMALE CONNECTOR | | | |
|---|---|---|---|
| Thread UNF | External diameter of the pipe | Driving torque Nm | |
| | | Nominal torque | min / max |
| M 12x1,5 | 6 | 20 | 15 -25 |
| M 14x1,5 | 8 | 38 | 30 - 45 |
| M 16x1,5 | 8 | 45 | 38 - 52 |
| | 10 | | |
| M 18x1,5 | 10 | 51 | 43 - 85 |
| | 12 | | |
| M 20x1,5 | 12 | 58 | 50 - 65 |
| M 22x1,5 | 14 | 74 | 60 - 88 |
| | 15 | | |
| M 24x1,5 | 16 | 74 | 60 - 88 |
| M 26x1,5 | 18 | 105 | 85 - 125 |
| M 30x2 | 20 | 135 | 115 - 155 |
| | 22 | | |
| M 36x2 | 25 | 166 | 140 - 192 |
| | 28 | | |
| M 42x2 | 30 | 240 | 210 - 270 |
| M 45x2 | 35 | 290 | 255 - 325 |
| M 52x2 | 38 | 330 | 280 - 380 |
| | 42 | | |

| ROTARY METRIC FEMALE CONNECTOR jic 37° | | | |
|---|---|---|---|
| Thread UNF | Dimension | Driving torque Nm | |
| | | Nominal torque | min / max |
| 7/16-20 | -4 | 15 | 9 - 21 |
| 1/2-20 | -5 | 20 | 13 - 27 |
| 9/16-18 | -6 | 30 | 18 - 42 |
| 3/4-16 | -8 | 50 | 30 - 70 |
| 7/8-14 | -10 | 69 | 44 - 94 |
| 1.1/16-12 | -12 | 98 | 63 - 133 |
| 1.3/16-12 | -14 | 118 | 73 - 163 |
| 1.5/16-12 | -16 | 140 | 90 - 190 |
| 1.5/8-12 | -20 | 210 | 135 - 285 |
| 1.7/8-12 | -24 | 290 | 200 - 380 |
| 2.1/2-12 | -32 | 450 | 300 - 600 |

| ROTARY FEMALE CONNECTOR BSP | | |
|---|---|---|
| Thread UNF | Driving torque Nm | |
| | Nominal torque | max |
| G1/4 | 20 | 15 - 25 |
| G3/8 | 34 | 27 - 41 |
| G1/2 | 60 | 42 - 76 |
| G5/8 | 69 | 44 - 94 |
| G3/4 | 115 | 95 - 135 |
| G1 | 140 | 115 - 165 |
| G1.1/4 | 210 | 140 - 280 |
| G1.1/2 | 290 | 215 - 365 |
| G2 | 400 | 300 - 500 |

| ROTARY FEMALE CONNECTOR ORFS | | | |
|---|---|---|---|
| Thread UNF | Dimension | Driving torque Nm | |
| | | Nominal torque | max. |
| 9/16-18 | -4 | 14 | 16 |
| 11/16-16 | -6 | 24 | 27 |
| 13/16-16 | -8 | 43 | 47 |
| 1-14 | -10 | 60 | 68 |
| 1.3/16-12 | -12 | 90 | 95 |
| 1.3/16-12 | -14 | 90 | 95 |
| 1.7/16-12 | -16 | 125 | 135 |
| 1.11/16-12 | -20 | 170 | 190 |
| 2-12 | -24 | 200 | 225 |
| 2-1/2-20 | -32 | 460 | 490 |

**The values shown in the tables refer to to galvanized steel connectors. Different values correspond to connectors of different materials.**

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| ALARM | troubleshooting |
|---|---|
| **14 - "Precharge failed"** | • Release all the tiller controls.<br>• Check the value of the parameter MAIN MENU MONITOR / Battery / **Capacitor Voltage**<br>• If no fault is found and the alarm persists, then the problem lies in the module. |
| Possible causes:<br>- External load on capacitor bank (connected to B+) preventing capacitors from charging | |
| Effects:<br>- Main contactor K2 open<br>- All truck functions disabled<br>- Electromagnetic brake activated | |
| **15 - "Controller Severe Undertemp"** | • Check the value of the parameter MAIN MENU MONITOR / Controller / **Temperature**<br>• Bring the temperature to above the lower limit of -40°C, release all tiller controls, turn off and restart the truck.<br>• If no fault is found and the alarm persists, then the problem lies in the module. |
| Possible causes:<br>- The controller is operating in too low temperature conditions (below -40°C) | |
| Effects:<br>- Main contactor K2 open<br>- All truck functions disabled<br>- Electromagnetic brake activated | |
| **16 - "Controller Severe Overtemp"** | • Check the value of the parameter MAIN MENU MONITOR / Controller / **Temperature**<br>• Return the temperature to below the maximum limit of 95°C, release all the tiller controls, remove all loads from the truck, turn off and restart the truck.<br>• Check that the module is installed correctly.<br>• If no fault is found and the alarm persists, then the problem lies in the module. |
| Possible causes:<br>- The controller is operating in too high temperature conditions (above 95°C)<br>- Truck overloaded<br>- Controller incorrectly installed | |
| Effects:<br>- Main contactor K2 open<br>- All truck functions disabled<br>- Electromagnetic brake activated | |
| **17 - "Severe Undervoltage"** | • Check the value of the parameter MAIN MENU MONITOR / Battery / **Capacitor Voltage**<br>• Return the capacitor voltage to above the minimum critical value.<br>• Check the battery parameters.<br>• Check the battery wiring.<br>• Check the fuses<br>• Check the status of the main contactor.<br>• If no fault is found and the alarm persists, then the problem lies in the module. |
| Possible causes:<br>- Incorrect battery parameters<br>- Battery resistance too high<br>- Battery disconnected during truck operation<br>- Loss of capacitor charge to below critical limit<br>- Fuse on positive feed to key switch disconnected or blown<br>- The main contactor did not close | |
| Effects:<br>- Drive reduced | |

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