

APEX 49

Compact Rider Sweeper

SERVICE MANUAL - LPG / Diesel /
Electric

Training

Troubleshooting

Adjustments

Components/Suppliers



Contents

1	WORKING PRINCIPLE OF THE APEX 49	4
2	TECHNICAL DATA	5
3	BODY AND MECHANICS	8
3.1	Cylindrical Broom and Broom Compartment	9
3.1.1	Replace Cylindrical Broom	9
3.1.2	Check Sweeping Track	9
3.1.3	Sweeping Track Adjustment	10
3.1.4	Check and Adjust Sealing Strips at the Broom Compartment	11
	Broom Wearing Compensation	12
3.1.6	Side Brush Adjustment	13
3.2	Filter System	14
3.2.1	Replace and Clean Filter Cassette	14
3.2.2	Extraction Fan Flap	14
3.3	Steering	15
3.3.1	Check and Adjust Chain Drive	15
3.4	Travel Drive Unit Apex 49	16
3.4.1	Front Wheel Drive – Bearing Plate	16
3.5	Travel Drive Unit Apex 49	17
3.5.1	Front Wheel Drive – Bearing Plate	17
3.5.2	Front Wheel Drive – Change Wheels	18
4	DRIVE	22
4.1	980 V / VH (6502.30 / 6502.50) Engine Version	23

4.1.1	Wiring Diagram Kawasaki Electric System	24
4.2	LPG – Kit	25
4.2.1	Adjusting of the LPG	26
5	HYDRAULICS	28
5.1	General	29
5.2	Brief Description of Apex 49 Travel Drive Unit	29
5.2.1	Hydraulic Scheme of Travel drive Unit	30
	Lifted-Up Disposal Description	32
5.3.1	Hydraulic Scheme Lifted-Up Disposal	32
6	ELECTRIC SYSTEM	33
6.1	Safety Provisions	34
6.2	Abbreviations Used in This Chapter	34
6.3	View on 980 V / VH (6502.30 / 6502.50) Relay Plate	35
	View on 980 E / EH (6502.40 / 6502.60) Relay Plate	36
6.5	View on Hydraulic Unit for Lifted-Up Disposal of Apex 49	37
6.6	LDS Description for Apex 49 (6502.40 / 6502.60)	38
6.6.1	LDS Setting Mode	38
6.6.2	LDS Programming	40
6.7	Description of the 980 E / EH (6502.40 / 6502.60) Travel Drive Unit	42

6.8	Diagnosis of Drive Control Unit	42
6.9	Error Codes	43
6.10	Settings of Drive Control Unit	44
6.10.1	General Description of Keys	44
6.10.2	Enter Password	45
6.10.3	Modify Parameter	45
6.10.4	Calibrate Potentiometer	46
6.10.5	Set Current Limiting	47
6.11	Drive Pedal	48
6.12	Current Consumption Apex 49	49
7	MAINTENANCE	50
7.1	Maintenance Schedule Apex 49 (6502.30 / 50)	51
7.2	Maintenance Schedule Apex 49 (6502.40 / 60)	51

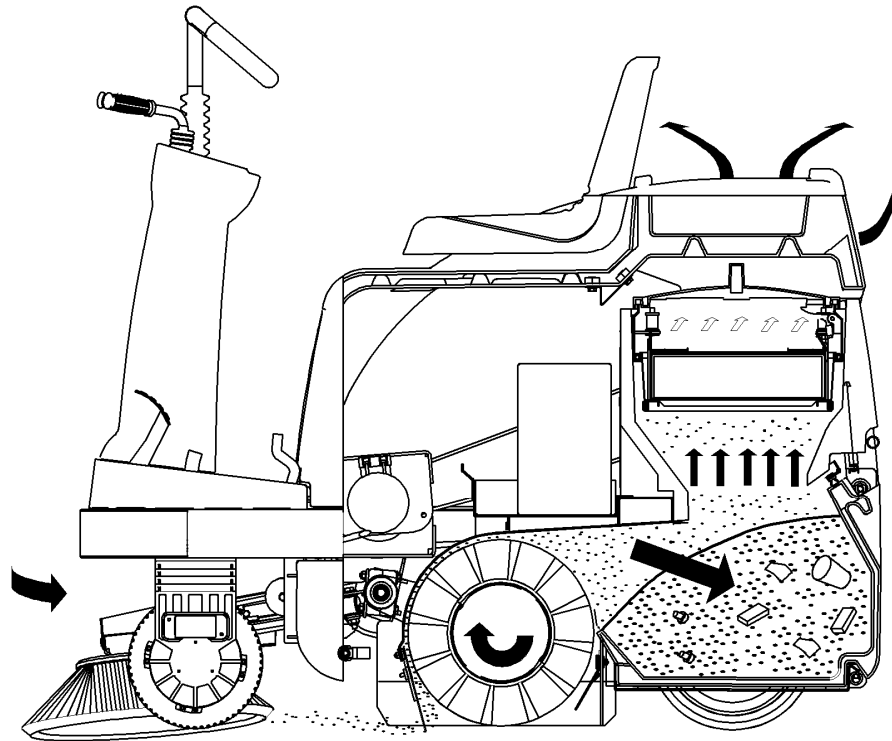
Note

The present document has been structured so as to allow further and continuous enlargement. You will receive these pages with the information that more or revised pages may follow in the future.

We have taken this decision in order to have the modifications made to the machines actually integrated into the documents.

Moreover, your suggestions and remarks on the present document are a good approach to improve its quality and we are grateful to receive such advice and suggestions.

1 Working Principle of the Apex 49



The side brush wipes the dirt at borders and edges into the collecting track of the wide cylindrical broom. This broom transports the debris overhead and into the dirt hopper. The fine dust raised during this operation is evacuated to the suspended filter by the suction fan where the dust is separated. The air returned into the environment is clean.

2 Technical Data

Vehicle dimensions and weights		Apex 49 E/EH	Apex 49 V/VH
Length with side brush	mm	1520	1520
Width with 1 side brush	mm	1120	1120
Height above steering wheel	mm	1300	1300
Empty weight – without batteries	kg		
Empty weight – serviceable	kg		

Driving and sweeping performance			
Forward/reverse speed	km/h	6.0 / 4.0	6.0 / 4.0
Sweeping speed	km/h	up to 6.0	up to 6.0
Sweeping track with/w/o 1 / with 2 side brushes	mm	700 / 970 / 1240	700 / 970 / 1240
Theoretical surface performance with 2 side brushes	m ² /h	up to 7450	up to 7450
Theoretical surface performance without side brush	m ² /h	up to 4200	up to 4200
Gradability (for 1 min. max.)	%	up to 16	up to 16

Tyres			
Tyre size (serial) front / rear		4.00 – 4 solid rubber	4.00 – 4 / 6 PR pneumatic tyres
Inflation pressure	bar		6.0

Cylindrical broom			
Diameter/ length	mm	345 / 700	345 / 700
Diameter (min. due to wearing)	mm	approx. 290	approx. 290
Speed	rpm	530 ± 20	530 ± 20
Sweeping track adjustment	mm	50 + 5	50 + 10
Bristling		PES	PA

Side brushes			
Diameter	mm	460	460
Speed	rpm	approx. 90	approx. 90
Bristling		PES	PA

Dirt hopper			
Hopper volume	Litre	2 x 30 / 70	2 x 30 / 70
Dust evacuation / filter system		Jonas 980 E/EH	Jonas 980 V/VH
Filter surface	m ²	2.8	2.8
Filter system – cassette filter	piece	1	1
Low pressure above plate filter	mm/water col.	≥ 9	>14



Hydraulic system			
Hydraulic fluid, e.g. Mobiloil			DTE 15 M or equivalent hydraulic fluid
Tank capacity	Litre		10
Travel drive unit	bar		100

Electric system			
Starter battery	V / Ah		12 / 45
Generator current	A		13
Service voltage	DC / V	24	
Travel drive unit	kW		
Main motor (fan/sweeping)	kW		
Total power consumption	kW		

Vibrations			
The frequency weighted acceleration which has an effect upon the upper limbs (hand-arm-system) and is measured under normal working conditions according to EN 1033 does not exceed	m/s ²	< 2.5	< 2.5
The frequency weighted acceleration which has an effect upon the lower limbs (feet and seat) and is measured under normal working conditions according to EN 1032 does not exceed	m/s ²	< 0.5	< 0.5

Noise emission			
The sound pressure level according to DIN EN ISO 3744, measured under standard operating conditions and maximum volume flow amounts to	dB (A)	82	77

Engine	Jonas 980 E/EH		Jonas 980 V/VH
Manufacturer, type			Kawasaki FE 250 D

Working/combustion procedure			4 cycle / fuel
Number of cylinders/arrangement			1
Bore/stroke	mm		
Cubic capacity	cm ³		249
Tappet clearance (w. cold engine) inlet/outlet valve	mm		0.15 / 0.15
Performance at 2,800 rpm	KW / PS		6 / 8.15
Service speed	rpm		2475 ± 25
Engine oil	SAE		15W -40
Filling with filter change	Litre		1.2
Spark plugs			NGK BP 5 ES
Fuel consumption	Litre/h		approx. 1.2
Fuel type			regular unleaded
Tank capacity	Litre		5,3

Combustion air – filter system			
Filter element	Order no.		11013 – 2128
Safety cartridge	Order no.		11013 – 2129



PowerBoss APEX 49

3 Body and Mechanics

3.1 Cylindrical Broom and Broom Compartment

3.1.1 Replace Cylindrical Broom

Dismount:

- Lower broom
- Remove l-h lateral fairing
- Loosen star-shaped knob (2) and remove left broom arm (1)
- Open both handles (3+5) and remove lateral plate (4)
- Remove broom by pulling

Mount:

Proceed in inverse order

Note:

Twist broom while inserting until it distinctly catches on the notch



3.1.2 Check Sweeping Track

- Park machine on level concrete or asphalt surface.

(check inflation pressure of pneumatic tyres and adjust pressure if required)

- Turn on cylinder broom and let it run dry for a short time.
- Lift broom and turn off, forward the machine a bit and measure sweeping track width.

With the correct broom adjustment the parallel sweeping marks have to appear on the floor (sweeping track)

The sweeping track width should be for the Jonas 900 E: $50 \pm 5\text{mm}$ and for the Jonas 900 V: $50 +10\text{mm}$.

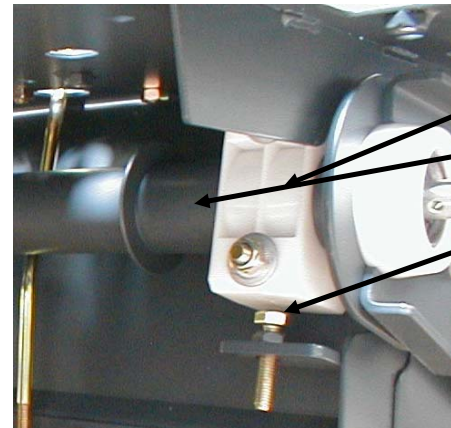
Note: Exceeding the specified sweeping track parameter has a negative effect on the service life of the cylindrical broom. The sweeping track reduced as the broom diameter reduces due to wearing of the bristles.

3.1.3 Sweeping Track Adjustment

The sweeping track is adjusted after loosening of the handle and turning the star-shaped knob in the engine compartment.

Adjust parallelism

- Loosen left bearing shell of the torsion shaft
- Adjust parallelism at the stop screw



Bearing shell

Torsion shaft

Stop screw

3.1.4 Check and Adjust Sealing Strips at the Broom Compartment

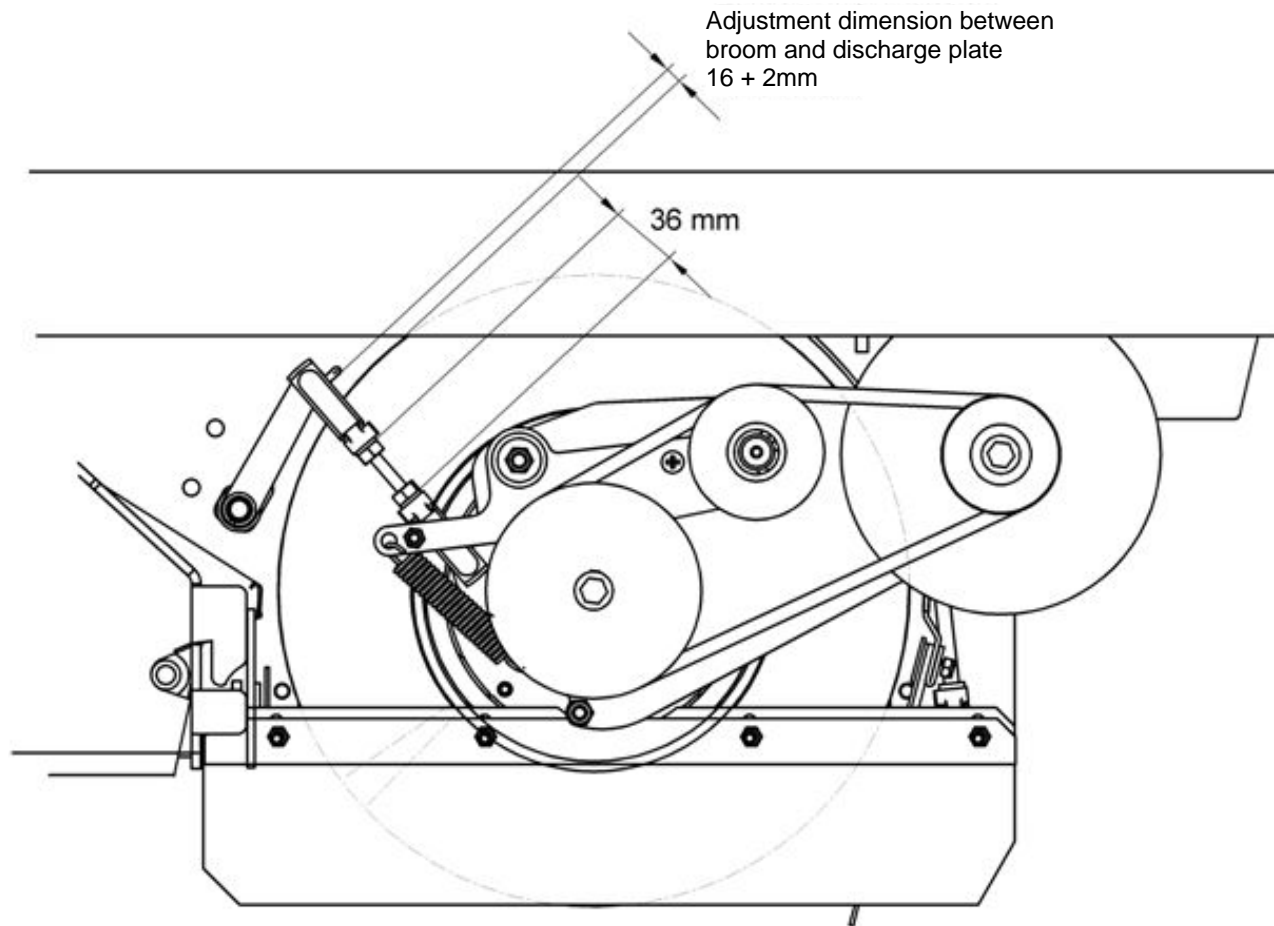
In order to assure good function of the sweeper, a perfect condition and correct adjustment of the sealing strips of the broom compartment are required, especially in order to attain the prescribed low pressure (**Jonas 900 E \geq 9mm water column; Jonas 900 V $>$ 14mm water column**) in the broom compartment, a clean sweeping result and the less possible wear of the sealing strips.

- Proceed to adjustment of the sealing strips at the bottom of the broom compartment on level ground only.
The lateral and rear sealing strips are adjustable in oblong holes, the front sealing strip by controlling mechanism.
- Check the inflation pressure of pneumatic tyres and modify pressure if required.
- The sealing strip at the front folding apron has to be lightly inclined backwards and stand on the floor.
- Ground clearance of the left- and right-hand sealing strips is 2mm
- Ground clearance of the rear sealing strip is approx. 5mm

Note: Replace defective sealing strips immediately

3.1.5 Broom Wearing Compensation

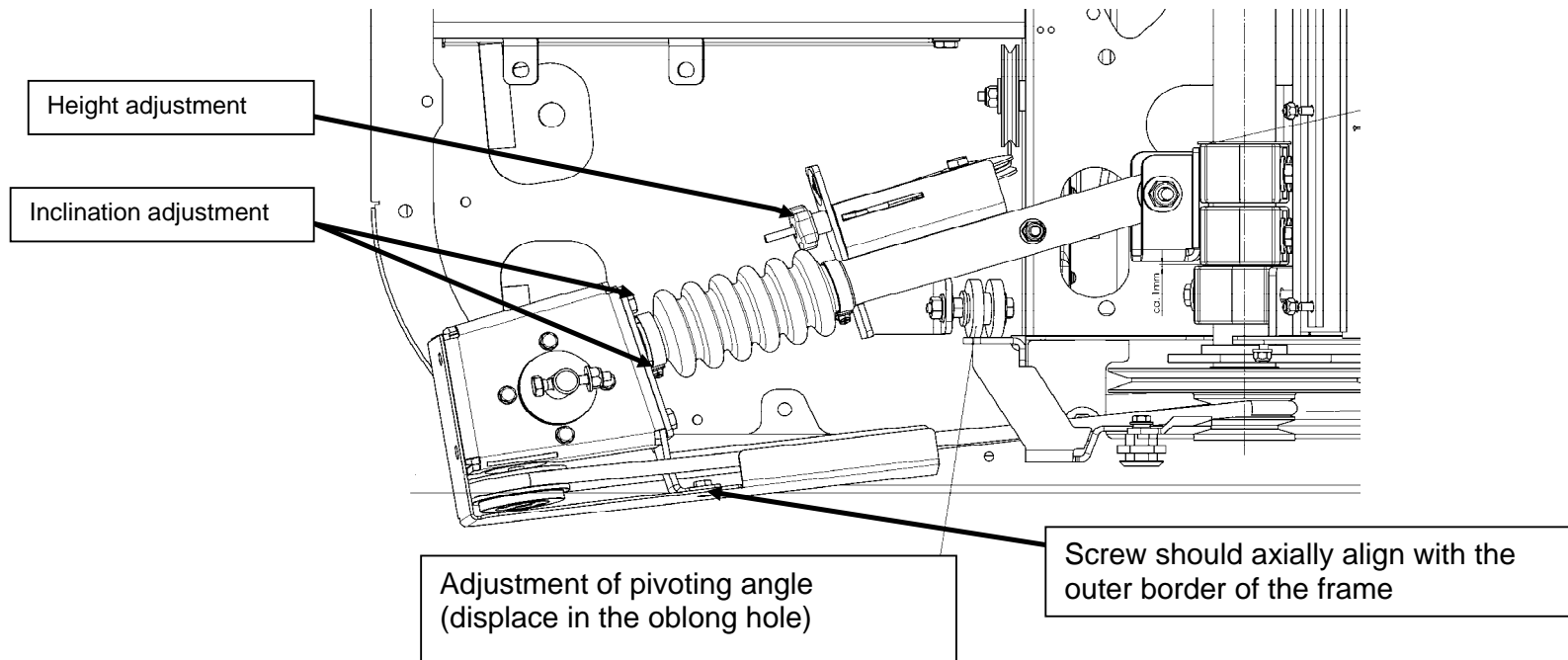
With the continuous wearing of the bristles, the discharging border of the main broom is tracked



3.1.6 Side Brush Adjustment

Adjust inclination of the side brush such that approx. $\frac{2}{3}$ of the brush perimeter has contact with the floor.
For right-hand side brush this ground contact is recommended between **11 and 15 o'clock** seen in direction of travel.
For left-hand side brush this ground contact is recommended between **9 and 13 o'clock** seen in direction of travel.

- Adjust inclination after loosening the gear holder and by displacing in the oblong holes.
- Adjust height of the lifted side brush at the Bowden cable such that the alignment of the top edges of the belt pulleys is approx. 10° less than vertical axis. Then the distance between the top side of the V-belt and the fairing holder is about 15mm.
- Tension of the V-belt is not adjustable but given by elastic force.



3.2 Filter System

3.2.1 Replace and Clean Filter Cassette

- Turn off engine and pull key
- Open seat hood
- Remove filter case cover
- Loosen wing screws at the angle points and remove
- Fold up jolter frame and hinge
- Remove filter cassette

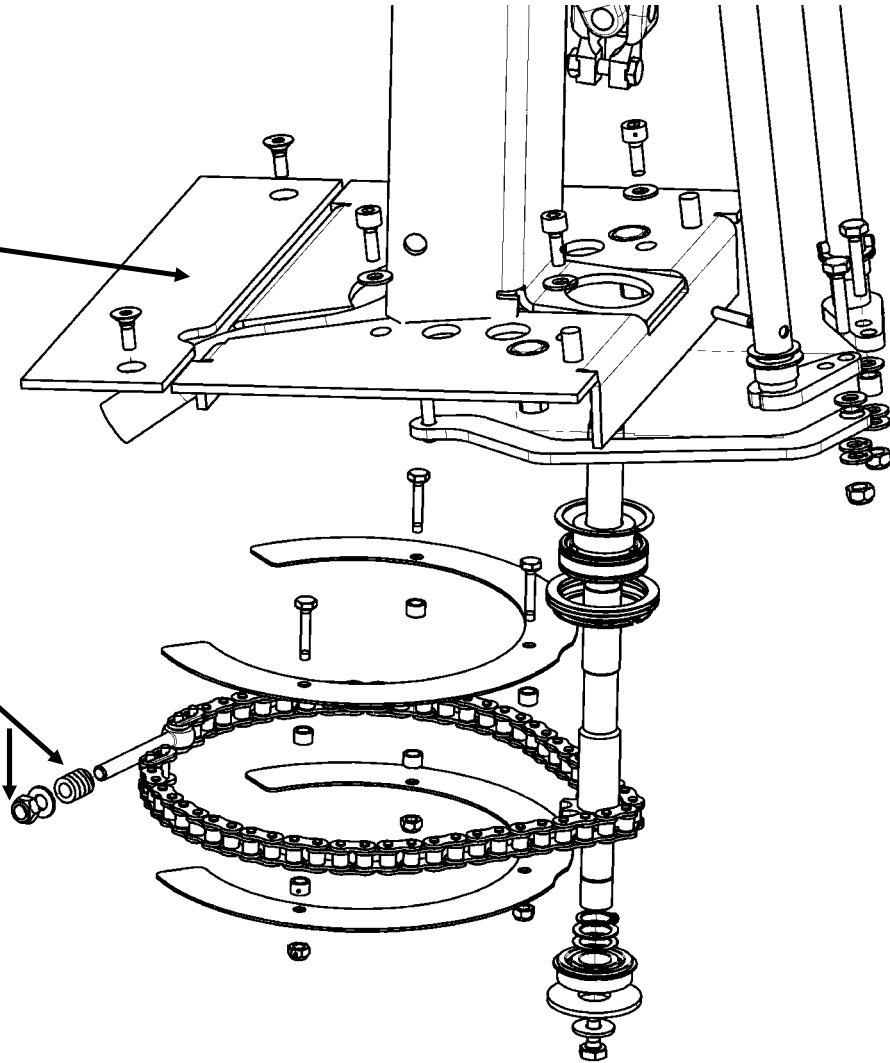
3.2.2 Extraction Fan Flap

- Open the bypass flap when sweeping wet dirt on humid surfaces.
- Actuation of the jolter motor is via (S10) micro-switch at the cable below the dashboard. The micro-switch (S11) at the bypass flap controls the open flap pilot lamp.

3.3 Steering

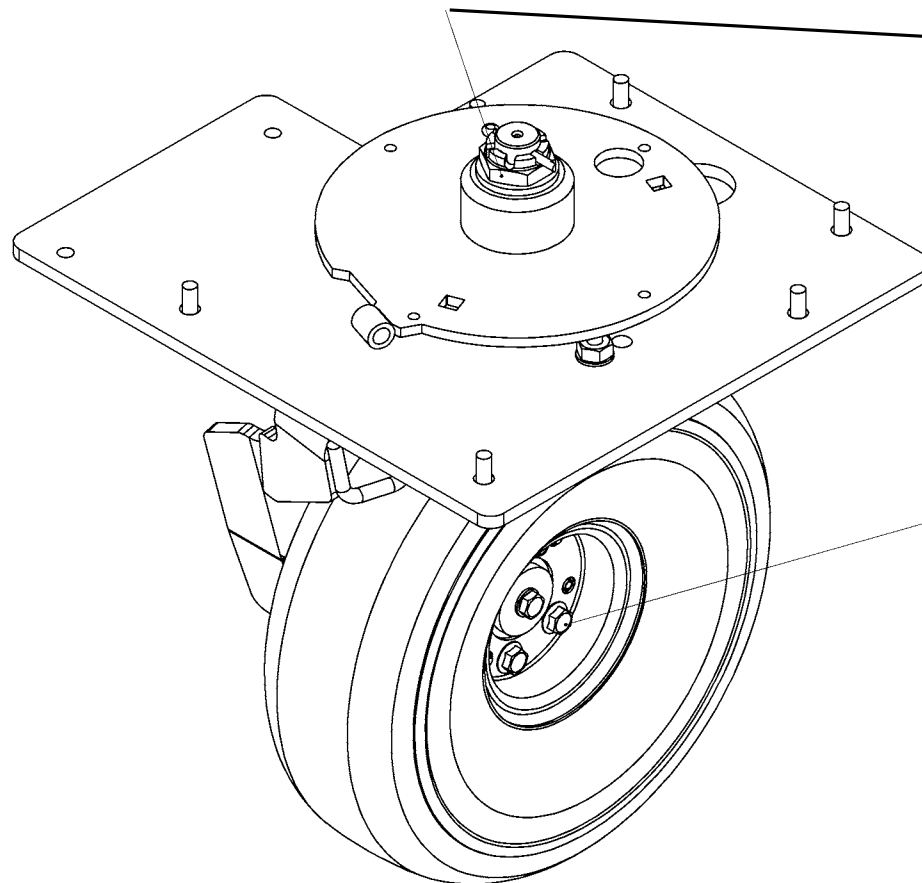
3.3.1 Check and Adjust Chain Drive

- Open maintenance flap
- Turn compression spring together with nut until 0.2mm play remains between turns (feeler gauge)



3.4 Travel Drive Unit Jonas 980 V/VH

3.4.1 Front Wheel Drive – Bearing Plate

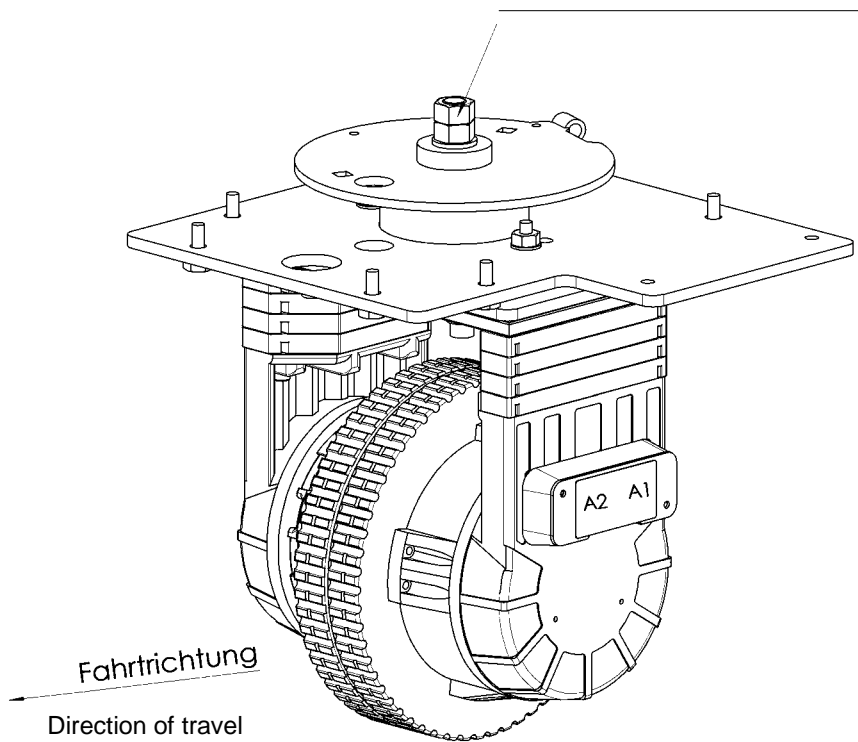


- Tighten nut with 60Nm and simultaneously pivot the wheel
- Loosen nut
- Tighten nut with 20Nm
- If the pinholes do not correspond, tighten nut till next pinhole appears

Tightening moment 32Nm

3.5 Travel Drive Unit Jonas 980 E/EH

3.5.1 Front Wheel Drive – Bearing Plate



Bottom nut tightened with 60 Nm and simultaneous pivoting of the wheel

Bottom nut loosened

Wheel pivoted by a half turn

Bottom nut tightened with 30 Nm

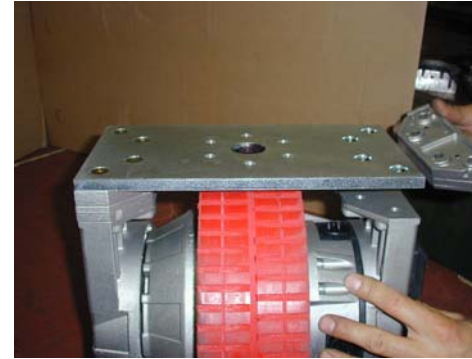
Top nut tightened with 120 Nm while bottom nut position towards the wheel position is maintained.

3.5.2 Front Wheel Drive – Change Wheels

Steps to be executed for wheel changing



1.
Dismount drive unit at the separation point between the wheel support plates



3.
Remove holder between the plate and the brush flange



2.
Loosen fixing screws of plate and holder



4.
Remove the lateral sealing plug



5.
Pull brush flange off the engine axle



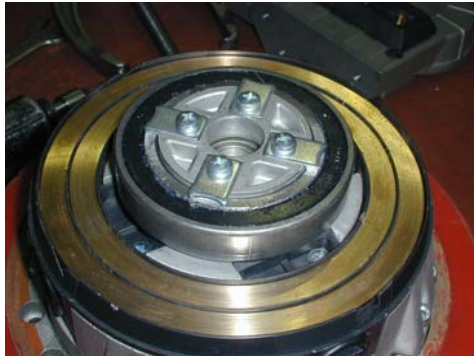
7.
Loosen wheel bolt (8x)



6.
Remove brush flange



8.
Pull off tyre



9.
Check condition and
cleanliness of slip rings



11.
Tighten wheel bolts
crosswise with 16Nm



10.
Insert new tyre and tighten
wheel bolts crosswise and
hand-tight



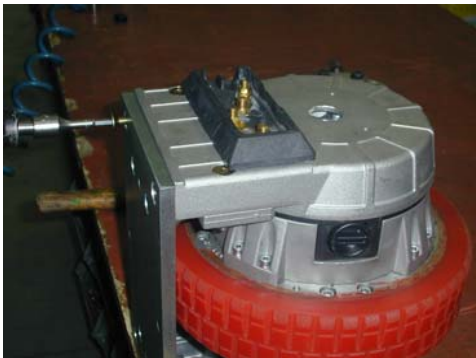
12.
Check carbon
brushes for wearing
and smooth running
in the brush holder



13.
Place brush flange and drive in
straight onto the engine shaft



15.
Insert sealing plug
into borehole



14.
Screw fastening plate



16.
Then maintenance is
completed.
Drive unit may be
mounted to the
machine.



PowerBoss Apex 49

4 Drive

4.1 980 V / VH (6502.30 / 6502.50) Engine Version

Air-cooled, single cylinder, 4-cycle Otto engine featuring 6kW at 3,600 rpm with electric starter

Manufacturer: Kawasaki

Type: FE 250 D

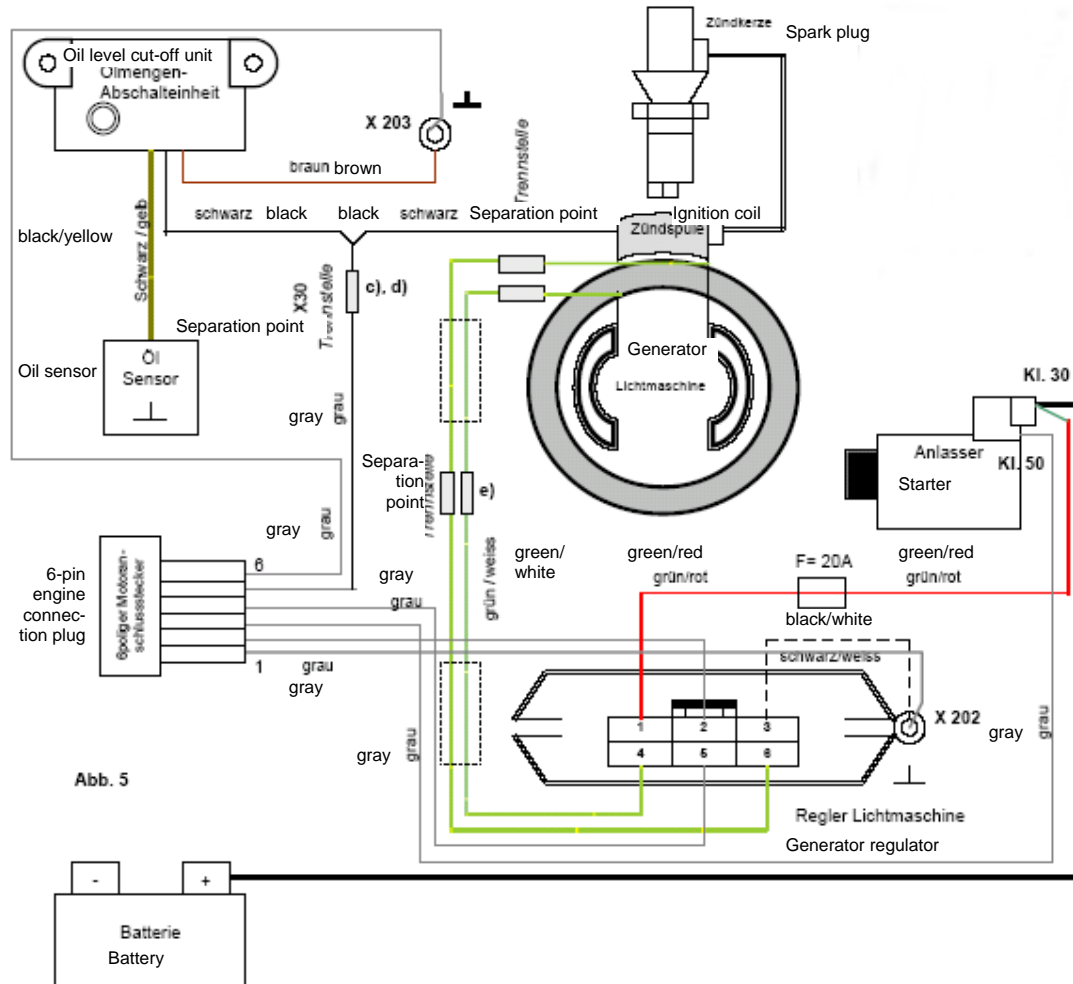
Service speed: (with cylindrical broom, side brush and fan being ON) $2,475 \pm 25$ rpm

The engine has been equipped with an oil switch turning the engine off in case of insufficient engine oil level.

Maintenance and repair of the drive units

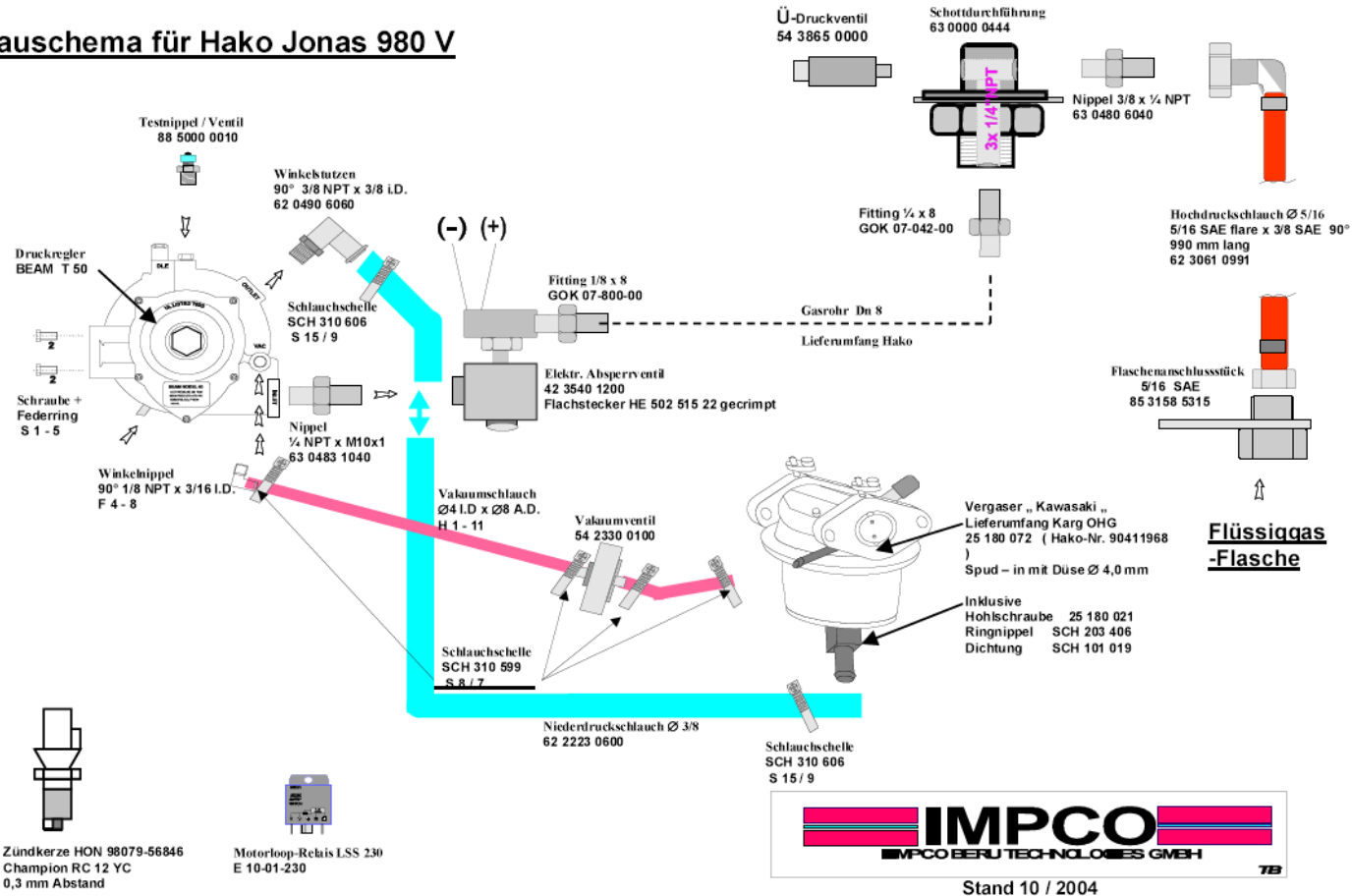
in compliance with the manufacturer's specifications

4.1.1 Wiring Diagram Kawasaki Electric System



4.2 LPG – Kit

Bauschema für Hako Jonas 980 V



4.2.1 Adjusting of the LPG

- 1) Check the position of the LPG bottle for gaseous outtaking
- 2) Check the LPG-kit for leaks, by pressure test
- 3) To do a correct CO test you have to :
 - a) Put the exhaust measuring sensor min. 300 mm into the exhaust pipe .
see Bild 7 - 8
 - b) Bridge the plug of the seat contact switch
- 4) For engine start; pull choke completely. After running of the engine push the choke back
(on low temperatures, let the engine first run warm)
see Bild 10
- 5) Bring engine to operating temperatur , at low idle (1400 +50 1/min) adjust Co < 0,1 % , at „IDLE“-screw
see Bild 9
- 6) Seal with the added alu-plate
- 7) Remove measuring sensor and bridge in plug (seat contact). Reconnect the seat contact plug and protect it with
a shrinking hose

Bild 7

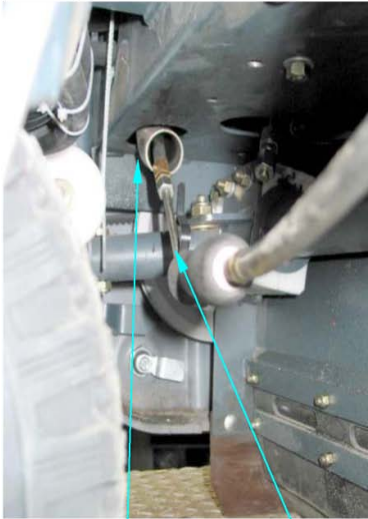


Bild 8

Exhaust pipe CO sensor

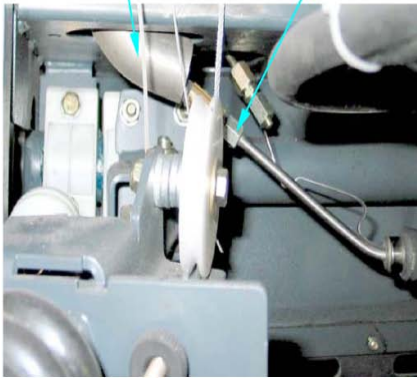
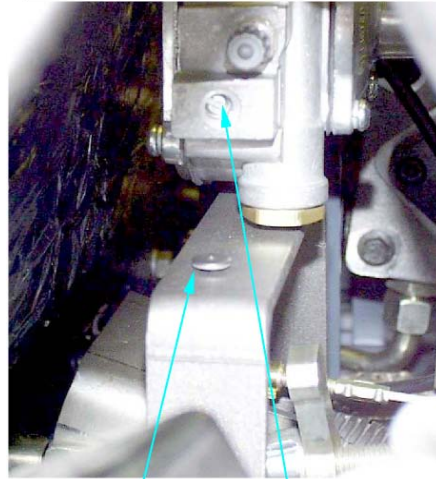


Bild 9



„Idle“-screw for adjusting the CO value

Alu-Plate to seal the „Idle“-Screw

Bild 10



- Pull choke completely
- Start the engine
- Push the choke back (on low temperatures, let the engine first run warm)



PowerBoss Apex 49

5 Hydraulics

5.1 General

The hydraulic units are maintenance-free.

In the sense of keeping the complete system clean, maintenance is reduced to fluid and filter changing.

Regular monitoring and periodic maintenance may preclude premature failures.

5.2 Brief Description of Jonas 980 V/VH Travel Drive Unit

A hydrostatic travel drive unit operating in a closed system is fitted to the machines equipped with combustion engine.

Forward and reverse travel drive speed can be regulated continuously via drive pedal which acts mechanically to the pump

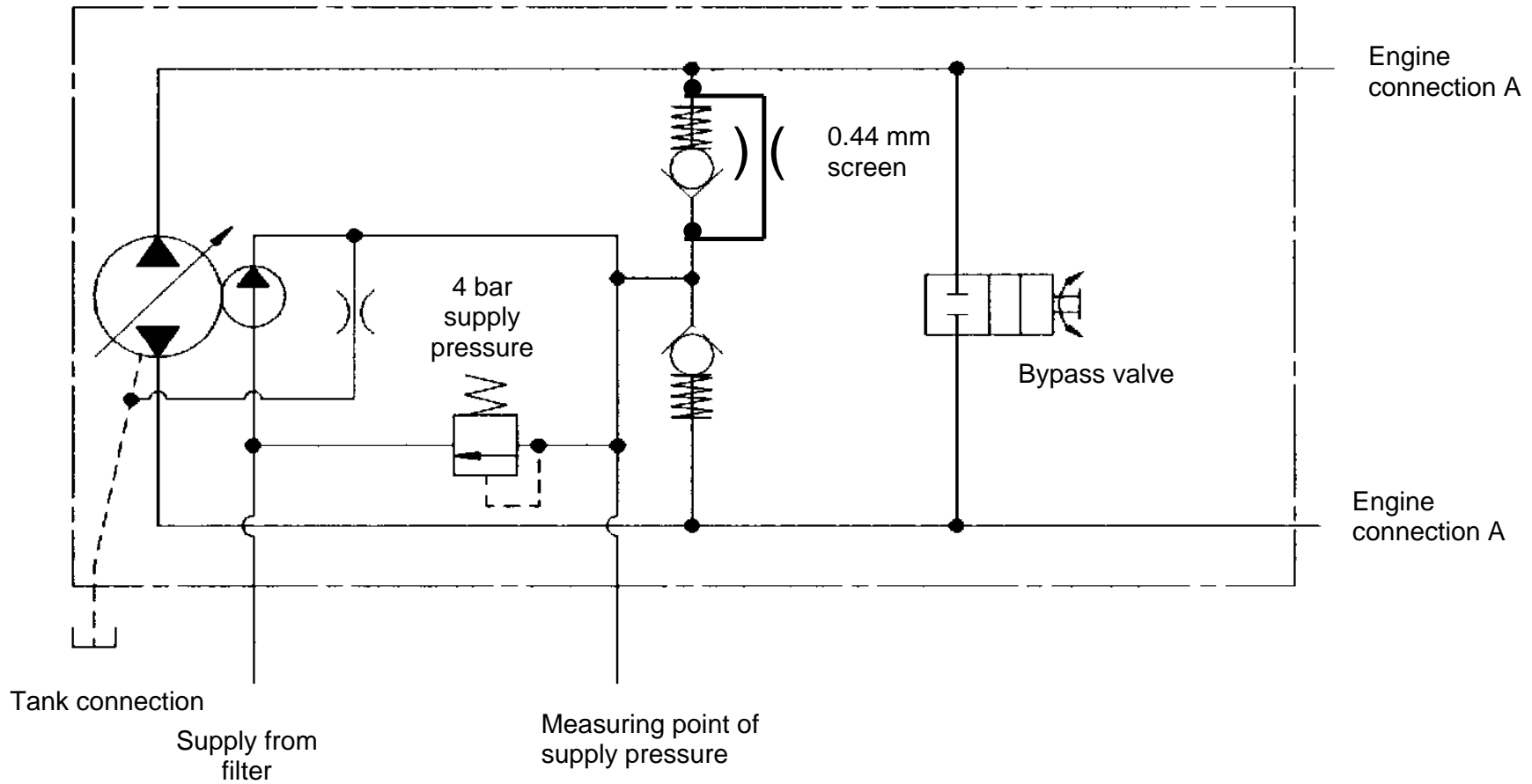
Automatic resetting to zero allows dynamic slowing down and self-locking against unintended rolling of the machine.

Should it be necessary to tow the machine with the engine not running, open the bypass valve located on the pump.

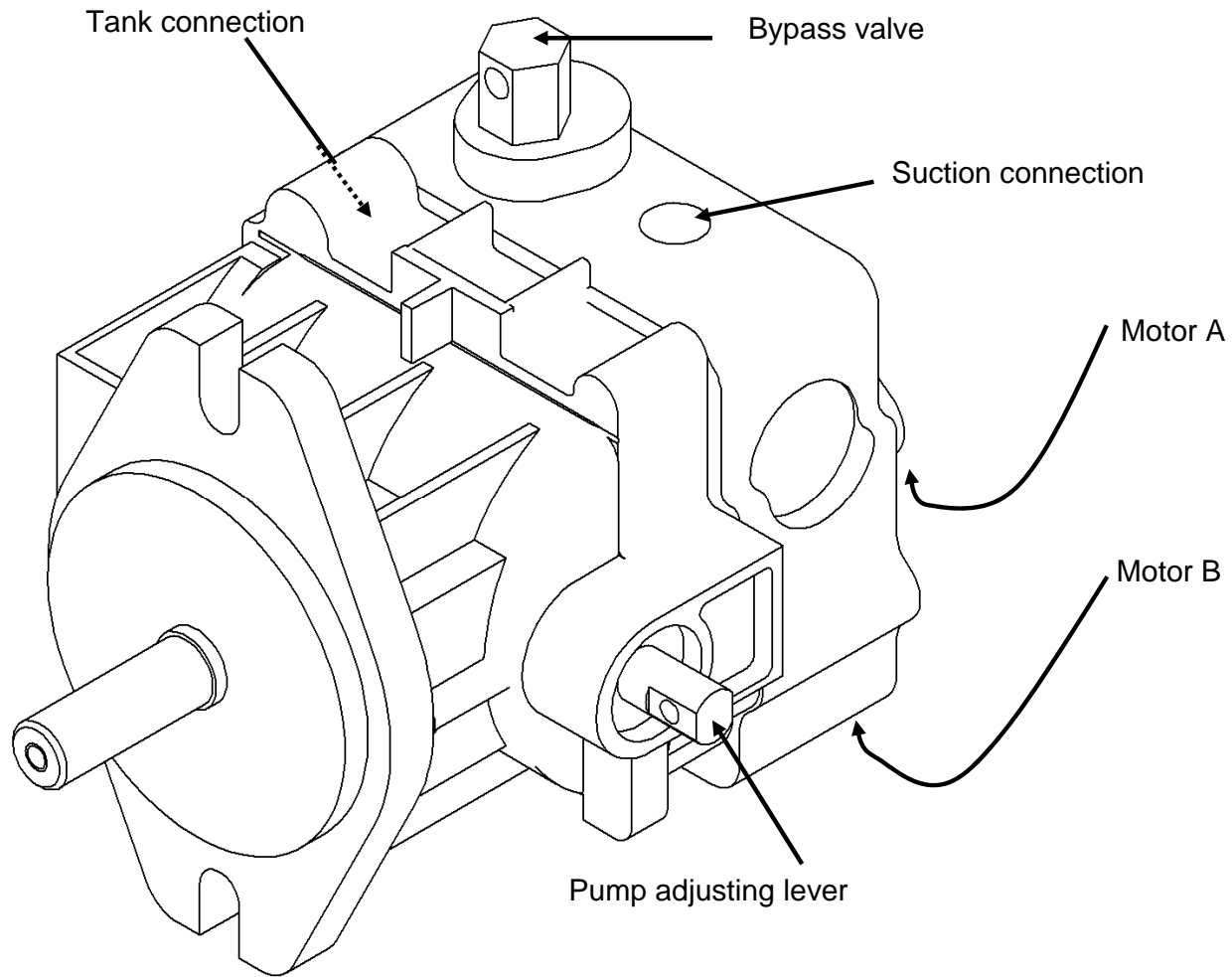
Pump pressure is not adjustable. At approx. 200bar working pressure the drive motor is pressed to die.

5.2.1 Hydraulic Scheme of Travel drive Unit

Drive pump



Drive pump



5.3 Lifted-Up Disposal Description

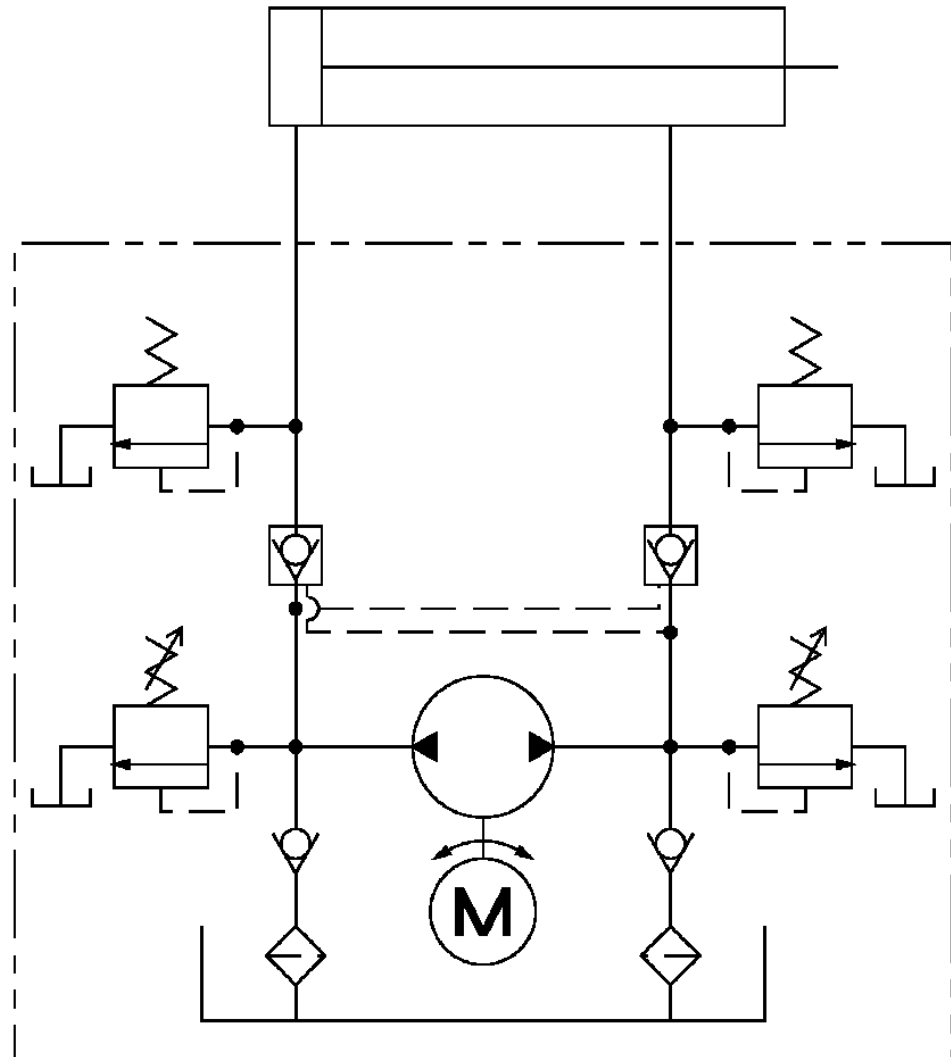
The lifting cylinder of the lifted-up disposal function is supplied by a hydraulic unit with reservoir.

Pressure for lifting and lowering is limited to **62 bar**.

5.3.1 Hydraulic Scheme Lifted-Up Disposal

Lifting cylinder is completely retracted.

Status: set to length of **590mm**



PowerBoss Apex 49

6 Electric System

6.1 Safety Provisions

Caution!

- Before working at the engine and at the electric system, disconnect battery (neg. lead).

Notes for the three-phase generator

- Let the engine run only with the battery connected.
- Do not use a charger unit as starting aid.
- Disconnect battery before recharging and when electro-welding at the appliance.

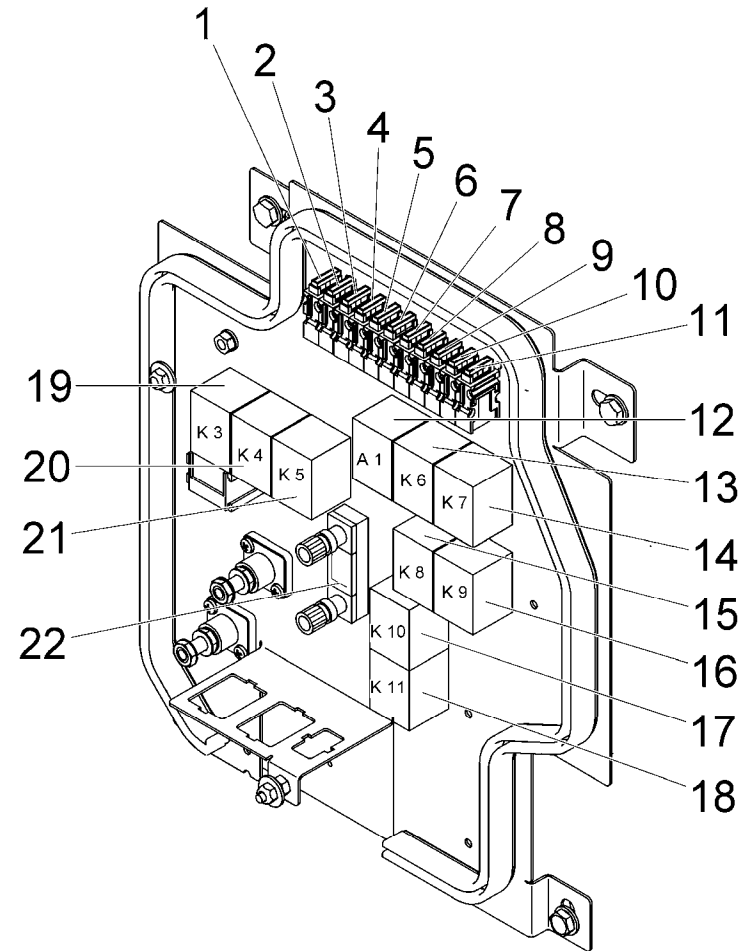
6.2 Abbreviations Used in This Chapter

LDS – Low discharge signal sender

6.3 View on 980 V / VH (6502.30 / 6502.50) Relay Plate

The relay plate comprises the following components and is located below the seat hood.

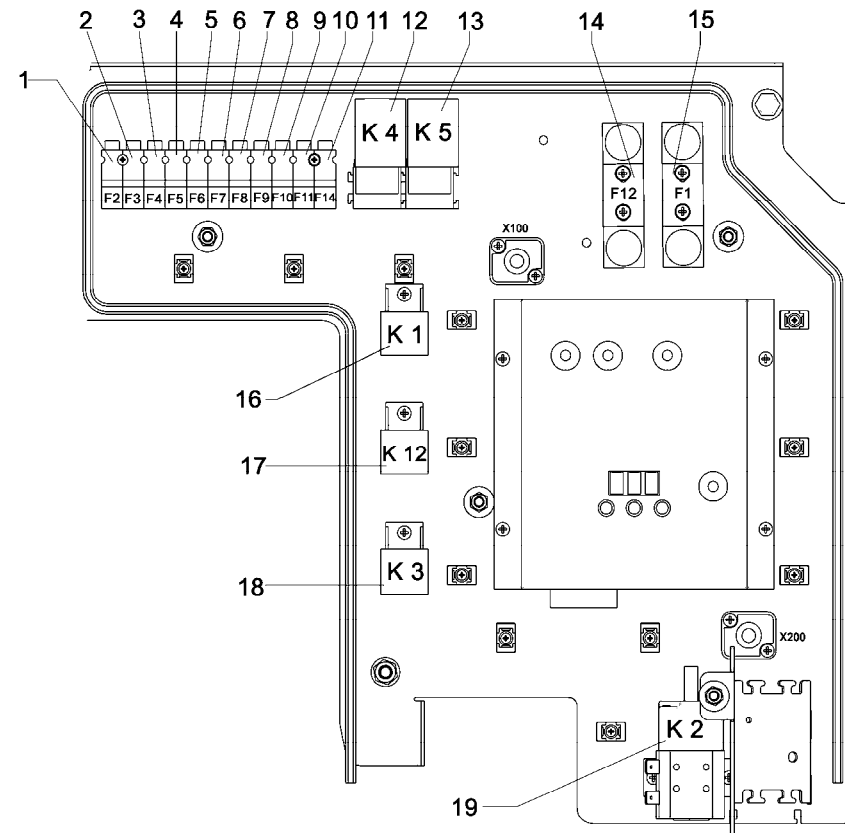
- 1.) F2 : 20 A pre-fuse (F3, F4, F5, F7, F8, F9, F10)
- 2.) F3 : 5 A engine cut-off; hourmeter
- 3.) F4 : 5 A control panel indicators; jolter control;
r-h rear light
- 4.) F5 : 10 A horn;
- 5.) F7 : 10 A LPG equipment option; gas valve
- 6.) F8 : 7.5 A front lighting, l-h rear light
- 7.) F9 : 7.5 A lifted-up disposal control
- 8.) F10: 10 A LPG equipment option; engine monitoring
- 9.) F11: 30 A jolter motor
- 10.) F12: 5 A generator charge control
- 11.) F14: 5 A flashlight option
- 12.) A1 : LPG equipment option; switching unit
- 13.) K 6 : self-holding relay for lifting
- 14.) K 7 : interlocking relay for lowering
- 15.) K 8 : interlocking relay for lifting
- 16.) K 9 : self-holding relay for lowering
- 17.) K 10 : working relay for lifting
- 18.) K 11 : working relay for lowering
- 19.) K 3 : relay for main motor cut-off (discharge point)
- 20.) K 4 : time relay for filter monitoring
- 21.) K 5 : impulse relay jolting
- 22.) F13 : 30 A hydraulic unit



6.4 View on 980 E / EH (6502.40 / 6502.60) Relay Plate

The relay plate comprises the following components and is located below the seat hood.

- 1.) F2 : 20 A pre-fuse (F3, F4, F5, F6, F8, F9)
- 2.) F3 : 10 A drive control unit control
- 3.) F4 : 5 A control panel indicators; jolter control;
r-h rear light
- 4.) F5 : 10 A horn
- 5.) F6 : 5 A LDS indicator, main motor control
- 6.) F7 : 5 A battery charge indicator
- 7.) F8 : 7.5 A front lighting, l-h rear light
- 8.) F9 : 7.5 A lifted-up disposal control
- 9.) F10: 30 A vacuum cleaner option
- 10.) F11: 30 A jolter motor
- 11.) F14: 5 A flashlight option
- 12.) K 4: time relay for filter monitoring
- 13.) K 5: impulse relay jolting
- 14.) F12: 63 A main motor
- 15.) F1 : 63 A power unit for travel drive control
- 16.) K1 : relay for speed reduction (Multimode)
- 17.) K12: relay for speed reduction (discharge point)
- 18.) K 3 : relay main motor cut-off (discharge point)
- 19.) K 2 : relay main motor performance



6.5 View on Hydraulic Unit for Lifted-Up Disposal of Jonas 980 EH

20.) K6 : Self-holding relay for lifting

21.) K7 : Interlocking relay for lowering

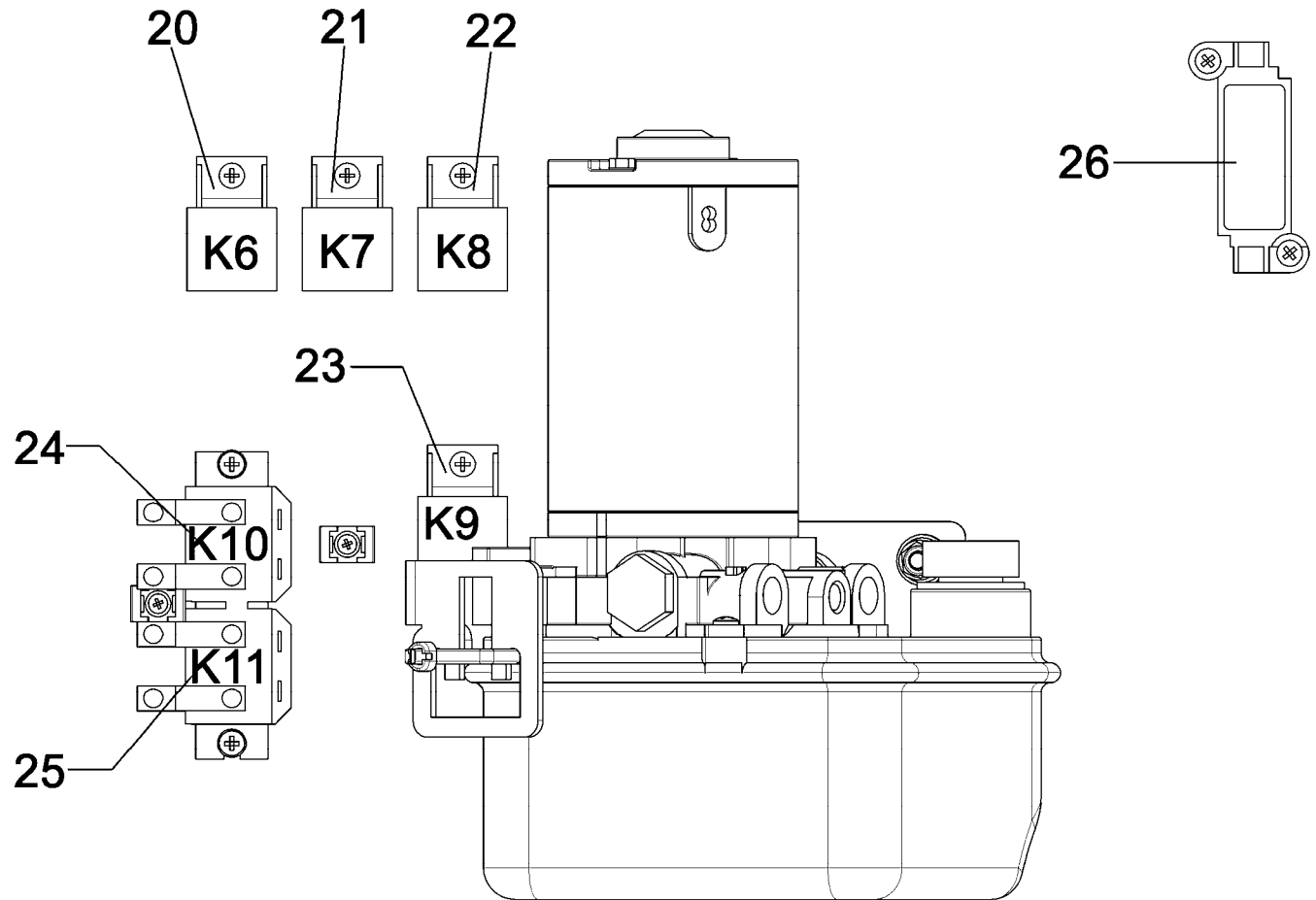
22.) K8 : Interlocking relay for lifting

23.) K9 : Self-holding relay for lowering

24.) K10: Working relay for lifting

25.) K11: Working relay for lowering

26.) F13: 30 A Hydraulic unit



6.6 LDS Description for Apex 49

This component has been designed to protect the battery from low discharge with simultaneous full utilization of the existing capacity.

Before taking the battery-driven machine into operation, set the low discharge signal sender (LDS) with combined battery charge indicator to the used battery type.

Two different battery types are admissible.

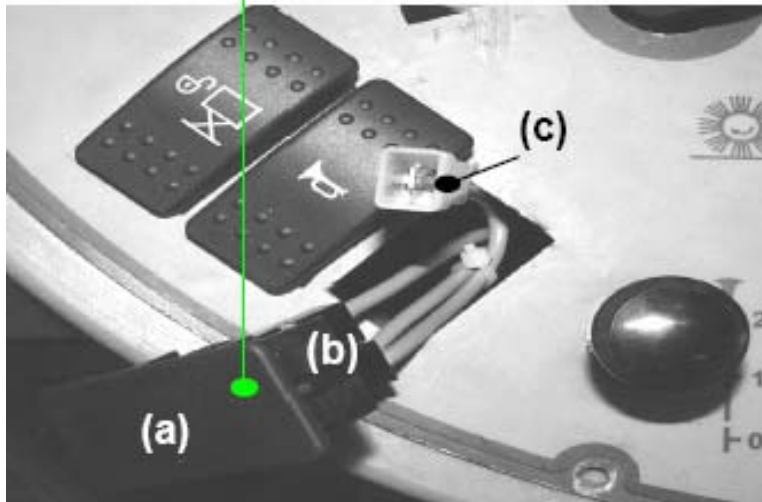
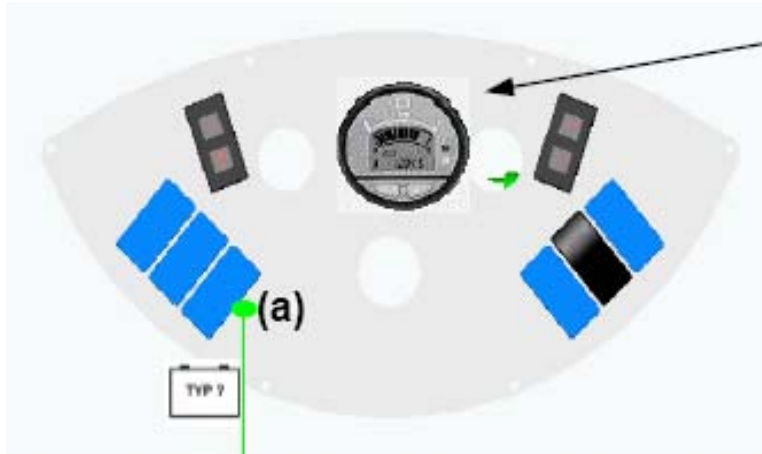
- a) maintenance-free block battery, 4 batteries 6V / 240Ah Type: GiV (order no. 7401) = **factory setting**
- b) low-maintenance tray-type battery, 24V / 210Ah Type: ironclad plate (EpzB) (order no. 4201)

6.6.1 LDS Setting Mode

Before invoking the setting mode, switch on the machine and switch the configuration input of the LDS to pos. battery lead. To do so, remove the blind cap (a) from the control panel and connect the plug contact below the blind cap. Only then programming of the LDS is possible.

Note:

Disconnect the plug contact after setting!



Battery charge indicator with LDS

- 1.) Remove blind cap (a) from dashboard
- 2.) Disconnect plug contact (b) and blind cap
- 3.) Connect plug contact (b) and push-on receptacle (c)
- 4.) Proceed to setting of the LDS as described under 6.6.2
- 5.) Separate connection of (b)+(c) after LDS setting
- 6.) Plug contact (b) onto blind cap (a) again
- 7.) Place blind cap (a) back into the space of the dashboard

6.6.2 LDS Programming

In order to enter the programming level, press the left key „▲/●“ and hold until the indicator flashes, then release key.



Set battery type:



In the display, three digits flash: discharge characteristic – charged (set to 2.08V/cell in the factory).

Press the right key “▶” to increase the “charged” parameter by one step of 0.01V/cell and hold to continue increasing.

After display of 2.30 V/cell has been attained, it automatically starts displaying the parameter 1.80V/cell again.

After the desired “charged” value has been attained, press left key “▲/●” once.



In the display, three digits flash: discharge characteristic – discharged (set to 1.92V/cell in the factory).

Press the right key “▶” to increase the “discharged” parameter by one step of 0.01V/cell and hold to continue increasing.

After display of 1.98V/cell has been attained, it automatically starts displaying the parameter 1.50V/cell again.

After the desired “discharged” value has been attained, press left key “▲/•” once.

Configuration mode is quit by pressing the left key. Display changes to display charge status.

Disconnect plug contact in the dashboard after setting.

Setting parameter:

Order no.	Battery type	Characteristic "charged"	Characteristic "discharged"
7401	4 x 6V/240Ah GiV, maintenance-free	2.08	1.92
4201	24V/210Ah EPzB, low maintenance	2.08	1.84

6.7 Description of the 980 E / EH (6502.40 / 6502.60) Travel Drive Unit

The drive motor is operated by the electronic drive control unit.

The operator selects travel direction in the first section of the lever arm of the drive pedal by the corresponding micro-switch. Then, travel speed is transferred to the drive control unit with the potentiometer operating continuously and for both forward and reverse mode.

Speed of reverse ride will be reduced by the electronic board to 60% even if the potentiometer is fully deviated.

The drive motor temperature is monitored and together with the LDS, this control reduces travel speed by 50% in case of overheating or insufficient charging status of the battery. Further discharging or overheating of the main motor cause cut-off of this function


Do not exceed duration of 1 minute of max. 12% uphill ride. Steeper slopes or longer rides on less steep paths lead to overload and thus to shutdown of the travel drive unit.

6.8 Diagnosis of Drive Control Unit

If an error occurs during first operation of the controller or during operation, the controller recognizes some of the errors and displays them.

Bypass the seat switch for diagnosis since otherwise the non-actuated switch displays the error code „A12“.

6.9 Error Codes

Display	Cause	Remedy
A1	Incorrect start sequence Selection of "forward" mode	Check pedal position Check micro-switch "forward" Check micro-switch wiring
A2	Incorrect start sequence Selection of "forward" mode	Check pedal position Check micro-switch "forward" Check micro-switch wiring
A3	Potentiometer defective	Check potentiometer Check potentiometer wiring
A4	Potentiometer out of neutral position during first operation	Check mechanic of drive pedal Check calibration of controller or re-calibrate if required
A5	Inadmissible controller temperature	Exceeding engine current, exceeding ambient temperature Insufficient heat dissipation by controller
A6	Seat contact or contact breaker active	Seat contact activated (driver not seated) or wire broken
A7	Engine current 1 exceeded	Engine current exceeded (e.g. extensive uphill ride) Error at engine or wiring
A8	Engine current 2 exceeded	Engine current exceeded (e.g. extensive uphill ride) Error at engine or wiring
A9	Undervoltage (< 18 V)	Low discharge of battery Check battery feed line
A10	Overvoltage (< 45 V)	Wrong battery type installed, faulty connection Voltage peaks at electric on-board system
A11	Overload controller / engine	Engine current; check controller setting (overload protection)
A12	Controller deactivated 	Seat contact activated; switch off/on controller; check wiring (PIN 6)
A13	Control voltage supply interrupted	Control fuse defective, check control line from ignition lock and earth line (PIN 15/16)
A14	Internal software error	Switch controller off and on again
A15	Short-circuit or exceeding current at control output	Switch controller off and on again



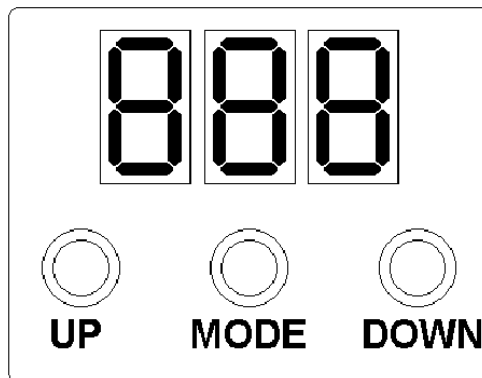
6.10 Settings of Drive Control Unit

The trained and authorized Hako personnel only are admitted to execute parameterization of the controller. Incorrect setting may cause defects of the controller and important malfunctions leading to uncontrollable riding behaviour of the machine.

6.10.1 General Description of Keys

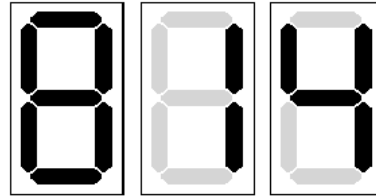
Three keys are located below the 7-segment LED display. Start programming by pressing the “MODE” key and the first parameter “F0” appears. Use the “UP” key to step forward to the next parameter (F1, F2 ...) and the “Down” key to step back. After having attained the desired parameter, select it by pressing the “Mode” key. The parameter appears in the display.

If the programming mode has not yet been invoked before pressing the “UP” or “Down” key, display directly changes to the password level and shows “F00” or “100” while the left cipher flashes.



6.10.2 Enter Password

(Password for potentiometer setting only)



Use the “UP” and “Down” keys to select the first and flashing number of the three-digit password and acknowledge by pressing the “Mode” key. Then, enter and acknowledge the next flashing central cipher alike. Upon entering and acknowledging the last, right-hand cipher and in total, the correct password, display changes to the last parameter or to “F0”
If entering of one of the three ciphers is incorrect, complete the procedure until after entering if the last cipher and acknowledgement by “MODE” the display shows “Err” briefly. Then repeat the complete entering procedure.

6.10.3 Modify Parameter

In some cases, the 5-pin plug of the K3 relay in the machine has to be disconnected before programming the controller.

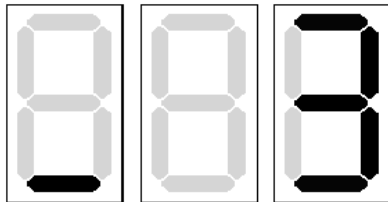
After correct entering of password, the parameter “F..” selected before appears in the display. Invoke the numeric value of the parameter by pressing the “MODE” key.
Modify this numeric value of the selected parameter by the “UP/“DOWN” keys. Acknowledge modification by pressing the “MODE” key. Then the selected parameter “F..” is displayed.

It is possible to quit the parameter mode immediately by simultaneous pressing the “MODE” and “UP” keys. The mode is automatically quit after 20 seconds without actuation of key. The controller then attains its operating mode. Viewing parameters is possible without entering the password while modification of parameters always requires entering of password.

6.10.4 Calibrate Potentiometer

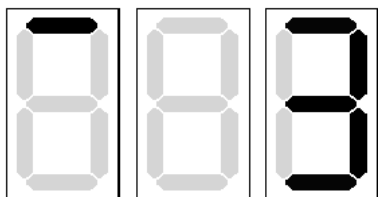
When replacing the controller or the drive potentiometer, the controller has to be adapted to the potentiometer.

1. Press “MODE” key and select parameter “F20” using the “UP” key, acknowledge with “MODE” key.
2. Set numeric value of “F20” to “1” using the “UP” key.
(Caution: if the programming level has not yet been invoked, password level is displayed)
3. Enter password and acknowledge with “Mode” key.
4. Re-select parameter “F20” with “UP”/“DOWN” keys and acknowledge with “MODE” key.
Set numeric value of “F20” to “1” using the “UP” key and acknowledge.
5. Select parameter “F10” with “DOWN” key and acknowledge with “MODE” key
6. The display then shows the “0” value. If not, use the “UP”/“DOWN” keys to set it to “0” and acknowledge with “MODE”.
7. The display then shows “F10” again.
8. While the displays shows “F10“, press the “UP” and “DOWN” keys simultaneously for some seconds until the display changes.



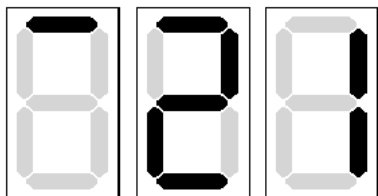
The left **bottom** LED segment then shows a “-“ (minus sign) while the right-hand LED segment displays a potentiometer voltage parameter between “0” and “5”. Acknowledge this value with “MODE” key while the drive pedal is in neutral position.

9. Display changes. The **top** left LED segment shows a “-“ (minus sign) while the right-hand LED segment displays a potentiometer voltage parameter between “0” and “5”.



(example)

10. Actuate drive pedal in forward direction until stop. Then, a value between “10...30” shall appear on the display. If drive pedal is actuated to maximum, acknowledge with “MODE” key.

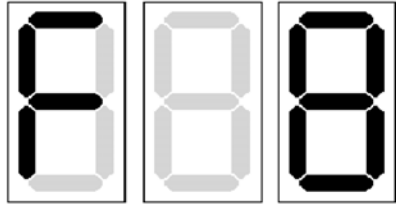


11. Display automatically changes to “F0” parameter. The potentiometer is read in.
12. Programming mode is automatically quit after 20 seconds or can be left immediately by simultaneous pressing the “UP” and “MODE” keys.
13. Re-plug 5-pin plug to K3 relay.
14. Switch machine off and on again, check function of travel drive direction and speed.

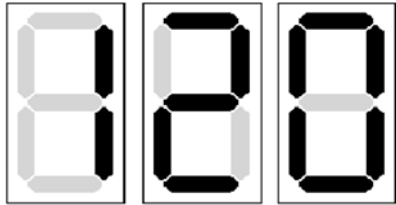
6.10.5 Set Current Limiting

The Jonas **980 E / EH** requires setting of the current limiting parameter.

1. Press “MODE” key, select the “F8” parameter via “UP” key and acknowledge with “MODE”.



2. Set numeric value of “F8” to “120” using the “UP” key.

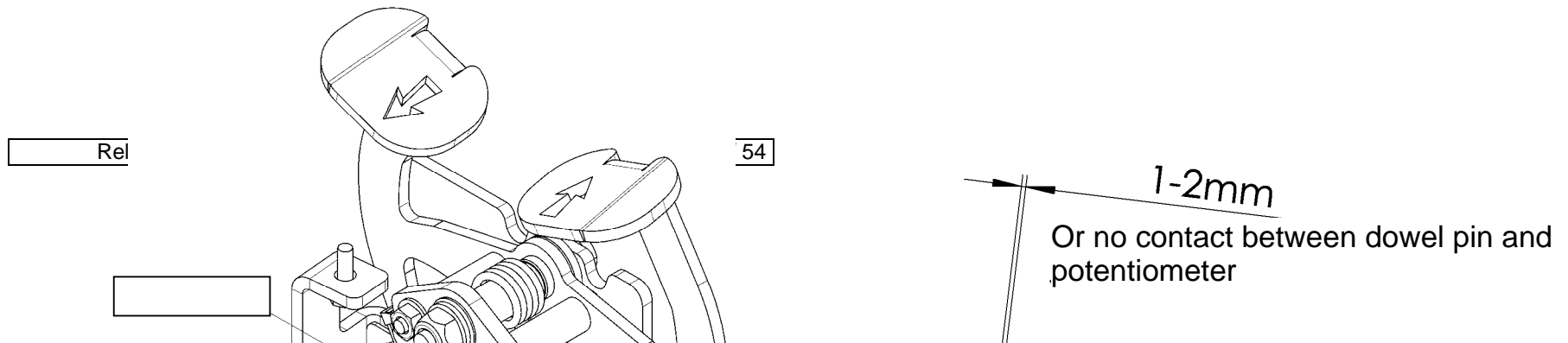


(Caution: if the programming level has not yet been invoked, password level is displayed)

3. Enter password and acknowledge with “Mode” key.
 4. Select parameter “F8” again with “UP”/“DOWN” key and acknowledge with “MODE” key.
 Set numeric value of “F8” to “120” using the “UP” key and acknowledge.

Should you have modified the parameters inadvertently, use the parameter “F0” = “2” to reset the controller to the state of delivery. Reading-in the drive potentiometer is required again then.

6.11 Drive Pedal



6.12 Current Consumption Apex 49

Drive motor

Blocking current	desired:	120 ± 5 A	
Nominal current			Wheel speed
forward ride	desired:	17 ± 3 A	110 ± 5 min ¹
reverse ride	desired:	12 ± 2 A	65 ± 5 min ¹

Main motor

Nominal current desired: ≤ 40 A
(Main and side brush switched ON)

APEX 49

Service Manual



PowerBoss APEX 49

7 Maintenance

7.1 Maintenance Schedule Apex 49)

Service intervals	daily	after first	every 100 h	every 200 h	every 500 h
Check engine oil level and re-fill if required (engine oil SAE 15 W-40)	X				
Check fuel level and re-fill if required	X				
Replace fuel filter				X	
Change engine oil (engine oil SAE 15 W-40) 0.6 litre		5	X		
Check engine air cleaner, replace if required			X		
Visual check for leakage at engine and at the hydraulic system	X				
Check idling and service speed and adjust if required (1200 and 2475 ± 25)				X	
Check air gap of spark plugs (0.75mm)			X		
Replace spark plug				X	
Check tappet clearance and adjust if required (inlet/outlet 0.15 to 0.15mm)				X	
Check battery acid level and top with distilled water if required; clean and grease battery poles			X		
Replace hydraulic fluid filter of travel drive assembly		100			X
Check function of seat contact switch				X	
Check exhaust gas system for condition and leakage				X	
Visual check of tread of wheels				X	
Check inflation pressure (6 bar)	X				
Check cylindrical broom for wearing and captured foreign matters (e.g. wire, straps) and replace if required	X				
Check sweeping track and re-adjust if required or as sweeping result is reducing			X		
Check sealing strips of broom compartment and adjust if required, replace defective sealing strips			X		
Check dirt hopper sealing, replace defective sealing				X	
Check side brush adjustment and bristling for wearing, re-adjust or replace if required			X		
Visual check of V-belts	X				
Check tension and condition of V-belts, re-adjust tension or replace if required		5	X		
Check service and parking brake, adjust if required			X		
Check filter system for leakage, replace defective filter cassette			X		
Dismount filter cassette, proceed to basic cleaning if required			X		
Check hydraulic fluid level of lifted-up disposal system and refill if required			X		
Check tightening moment of fixing screws for lifted-up disposal system and re-tighten if required (49 Nm)		5	X		
Check hydraulic hoses and replace if required				X	
Check tension of steering chain and re-adjust tension if required				X	

7.2 Maintenance Schedule Apex 49

Service intervals	daily	after first	every 100 h	every 200 h	every 500 h
Check battery acid level and top with distilled water if required; (with charged battery only)	X				
Check acid density of battery			X		

APEX 49

Service Manual



Clean and grease battery poles			X		
Check wires for damages and plugged connections for tight seating				X	
Check function of seat contact switch				X	
Visual check of front tyres			X		
Check cylindrical broom for wearing and captured foreign matters (e.g. wire, straps) and replace if required	X				
Check sweeping track and re-adjust if required or as sweeping result is reducing			X		
Check sealing strips of broom compartment and adjust if required, replace defective sealing strips			X		
Check dirt hopper sealing, replace defective sealing				X	
Check side brush adjustment and bristling for wearing, re-adjust or replace if required			X		
Check tension and condition of V-belts, re-adjust tension or replace if required		5	X		
Visual check of V-belts	X				
Check service and parking brake, adjust if required			X		
Check filter system for leakage, replace defective filter cassette			X		
Dismount filter cassette, proceed to basic cleaning if required			X		
Clean travel drive unit, brush drive, jolter motor			X		
Check tread of wheels				X	
Check function of electro-motors, carbon brushes for smooth running and wearing, clean engine from carbon dust and replace carbon brushes if required		500		X	
Check carbon brushes of the travel drive unit (by qualified personnel only)		500		X	
Check hydraulic hoses and replace if required				X	
Check hydraulic fluid level of lifted-up disposal system and refill if required			X		
Check tightening moment of fixing screws for lifted-up disposal system and re-tighten if required (49 Nm)		5	X		
Check tension of steering chain and re-adjust tension if required				X	