HYUNDAI
HEAVY INDUSTRIES EUROPE

2014

Forklift Service Training:

35-50 Diesel -9A

We build a better future

Introduction Hyundai's production plant (Ulsan)

Table of content

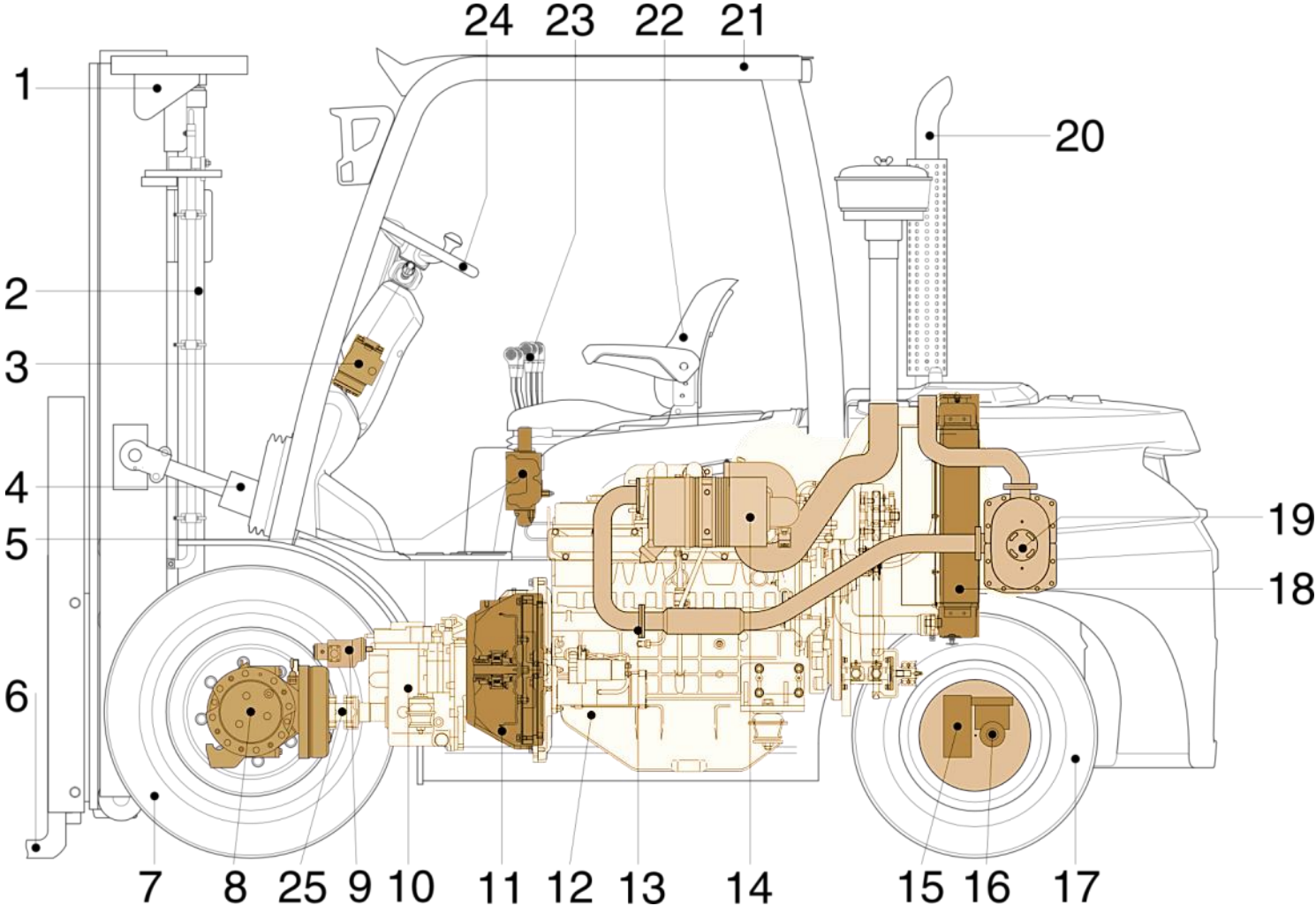
35D / 40D / 45D / 50DA – 9A Introduction

- Engine: Kubota V3800-CR-TE4
- Rated Power: 61.0Kw / 2200 rpm.
- Max Torque: 335.5 Nm / 1500 rpm
- Noise level Lpa: 82.6/83.7 dBA
- Noise level Lwa: 106.4 dBA
- Vibration level: 0.401 m/s2
- Speed: +/- 27 km/h
- Fuel consumption acc. 60 VDI: 5.5l (45D-9A)

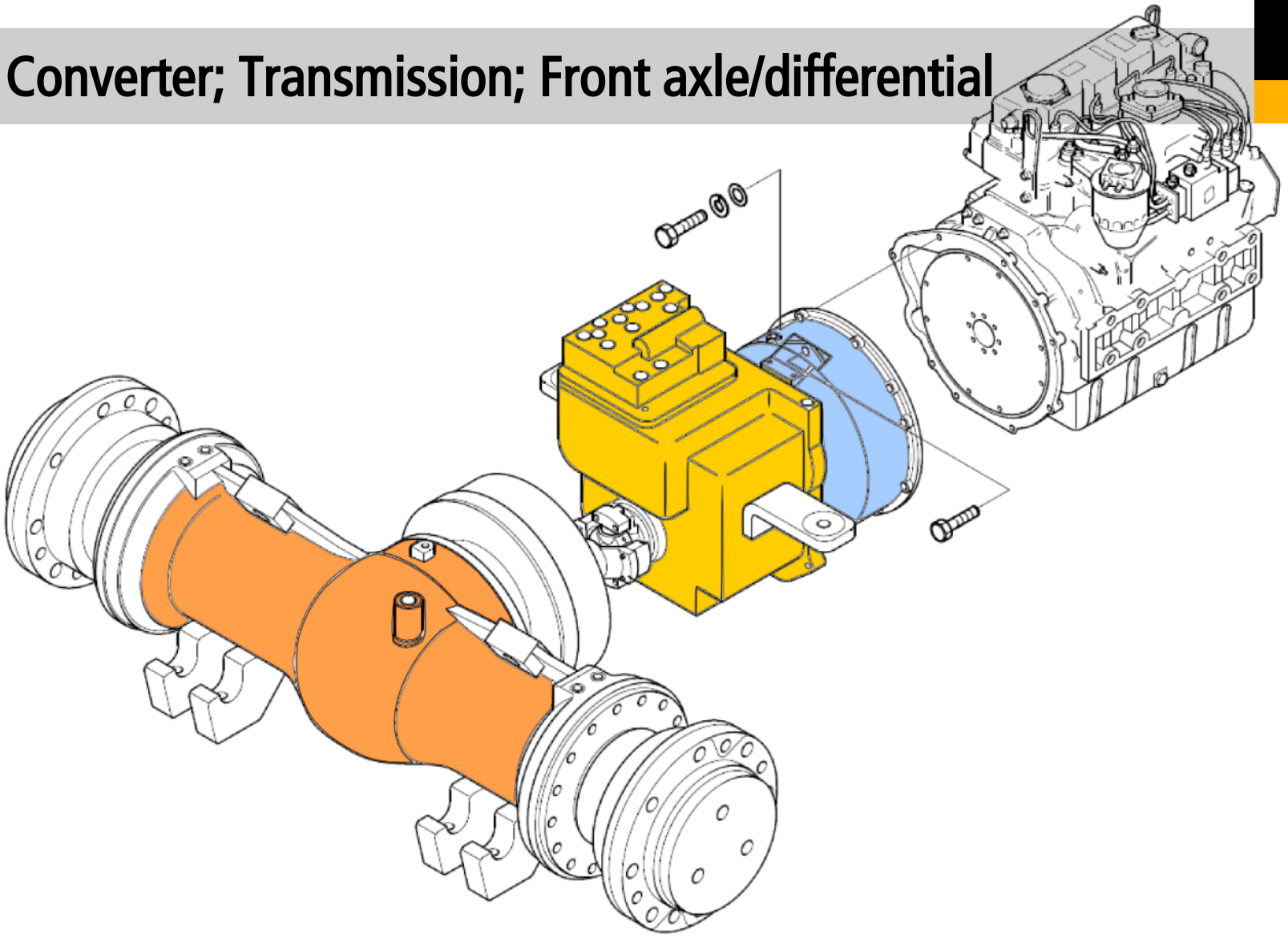
45D-9A fuel consumption.pdf

35D / 40D / 45D / 50DA – 9A Component location

1 Mast
2 Lift cylinder
3 Steering unit
4 Tilt cylinder
5 Control valve
6 Fork
7 Front wheel
8 Drive axle
9 Hydraulic pump
10 Transmission
11 Torque converter
12 Engine
13 Exhaust pipe
14 Air cleaner
15 Steering axle
16 Steering cylinder
17 Rear wheel
18 Radiator
19 Muffler
20 Silencer
21 Overhead guard
22 Seat
23 Control lever
24 Steering wheel
25 Drive shaft

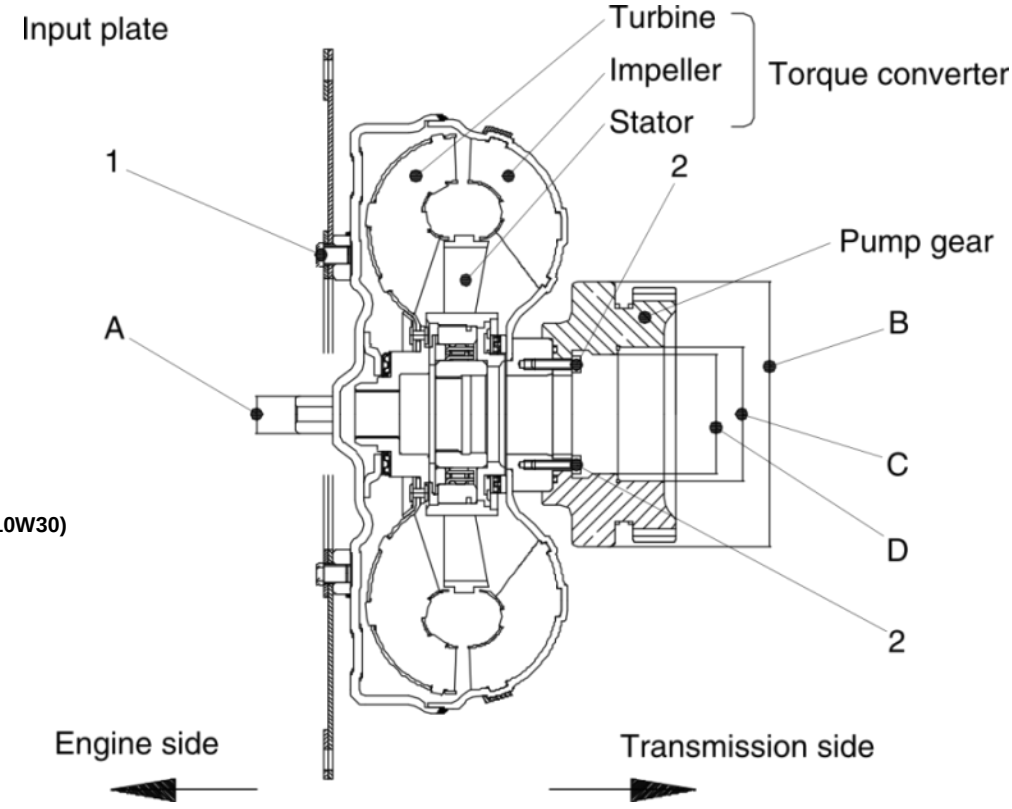


Torque Converter; Transmission; Front axle/differential



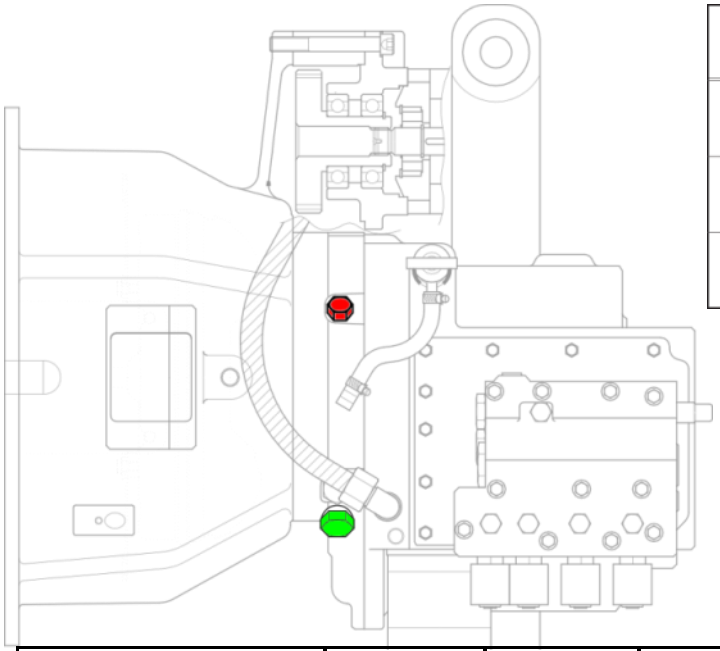
Torque Converter – basic data

Item			Unit	Specification
Torque converter	Type		-	3 elements 2 phase 1 stage
	Power transmit		-	Torque converter
Transmission	Type/Gear shift		-	POWER SHIFT / F2 : R2
	Gear ratio	FR/RR 1 stage	-	2.550
		FR/RR 2 stage	-	1.218
	P.T.O system		-	Included
	T/M oil		-	DEXRON 3
	Oil quantity		*l*	12
T/M valve	Type		-	Electric
Charging pump	Displacement		cc/rev	20.6
Drive axle	Gear ratio	Differential	-	2.923
		Planetary	-	4
		Total	-	11.692
	Axle oil		-	MOBILFLUID 424 + **Shell Donax TD(10W30)**
	Oil quantity		*l*	10.5
Brake	Service brake		-	Wet disk brake
	Brake oil		-	AZOLLA-ZS32
	Parking brake		-	Seperated drum brake
Differential	Gear type		-	Spiral bevel gear
	Differential type		-	4 pinions



No	Item	Specification
1	Torque converter input plate	4.5±0.3 kg·m (32.5±2.2 lbf·ft)
2	Torque converter pump gear	2.0±0.3 kg·m (14.5±2.2 lbf·ft)
A	Pilot boss outer diameter	19.959 - 19.980 mm (0.786 - 0.787 in)
B	Oil seal outer diameter	134.9 - 135.0 mm (5.311 - 5.315 in)
C	Needle bearing outer diameter	68.000 - 68.019 mm (2.677 - 2.678 in)
D	Seal ring inner diameter	60.333 - 60.363 mm (2.375 - 2.376 in)

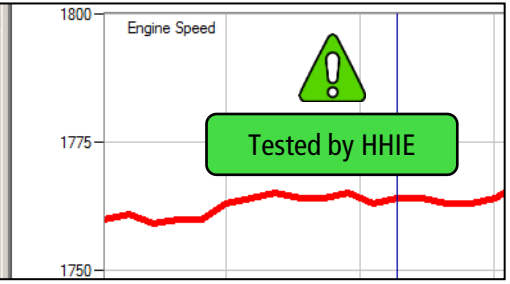
Torque Converter - troubleshooting

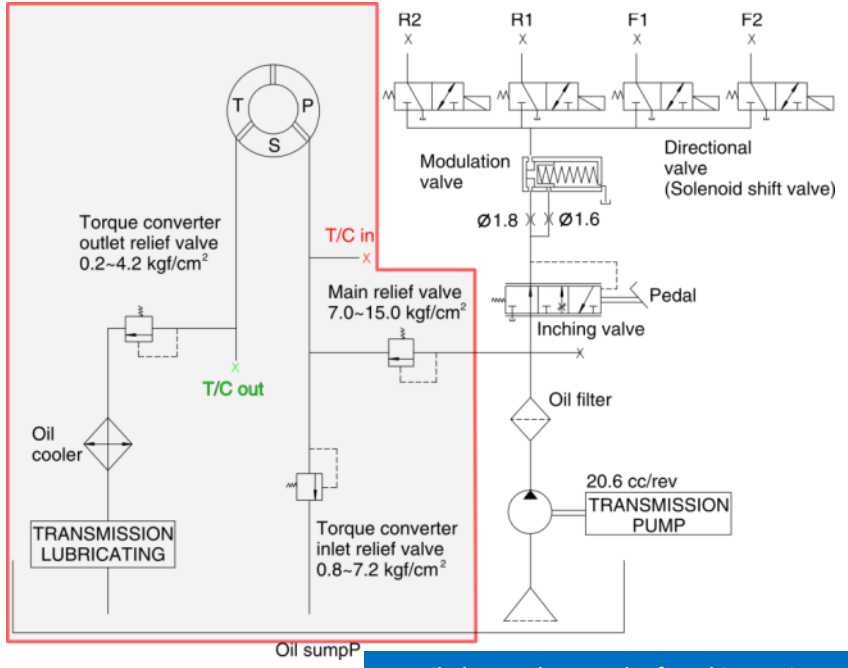


Engine rpm	Unit	Main line (Neutral)	T/C input port (Neutral)	T/C output port (Neutral)	FR 1,2 stage clutch	RR 1,2 stage clutch
Idle	kgf/cm² (psi)	6.5~13.2 (92.5~187.7)	0.7~4.2 (9.9~59.7)	0.2~1.2 (2.8~17.1)	6.5~13.2 (92.5~187.7)	6.5~13.2 (92.5~187.7)
1300	kgf/cm² (psi)	7.5~14.5 (106.7~206.2)	1.5~9.1 (21.3~129.4)	0.7~2.5 (10.0~35.6)	7.5~14.5 (106.7~206.2)	7.5~14.5 (106.7~206.2)
2200	kgf/cm² (psi)	7.5~15.0 (106.7~213.4)	2.6~11.1 (37.0~157.9)	1.0~4.2 (14.2~59.7)	7.5~15.0 (106.7~213.4)	7.5~15.0 (106.7~213.4)

Model	Engine Max	T/C Stall	Hyd. Stall	Full Stall
35/40/45D-9A, 50DA-9A	2450	1770	2300	1200

Signal	Value	Unit
Final Fuel Injection Quantity	76.54	mm3/st
Engine Speed	1764	/min(rpm)
Coolant Temperature	77	℃
Differential Pressure 1	3.22	kPa
Exhaust Gas Temperature 0	245	℃
Exhaust Gas Temperature 1	229	℃
Exhaust Gas Temperature 2	161	℃
PM Sedimentation Quantity 1	4000	mg
PM Sedimentation Quantity 2	13262	mg
Fuel Quantity after Regeneration	12	L
DPF Regeneration Last Active Time	38.80	h

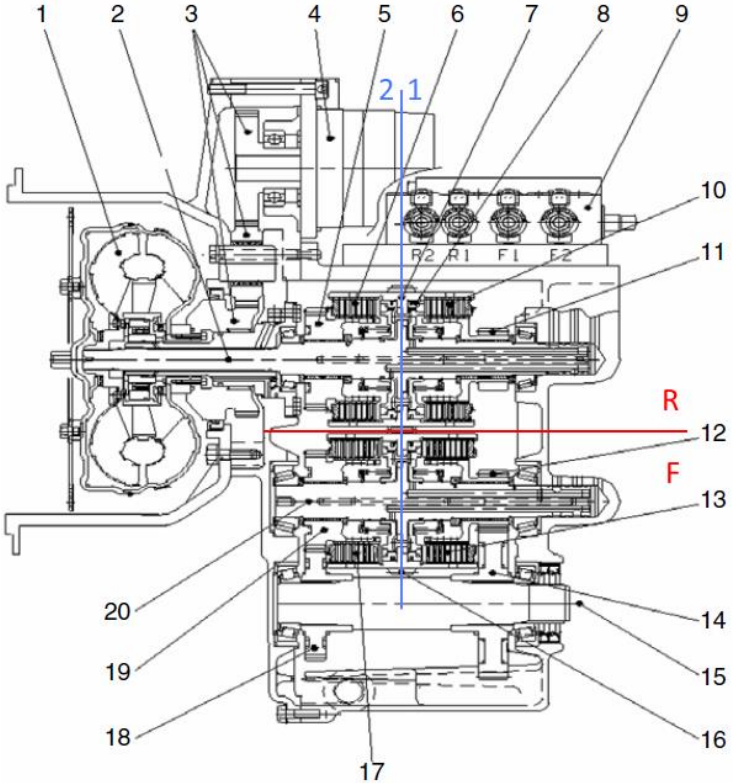


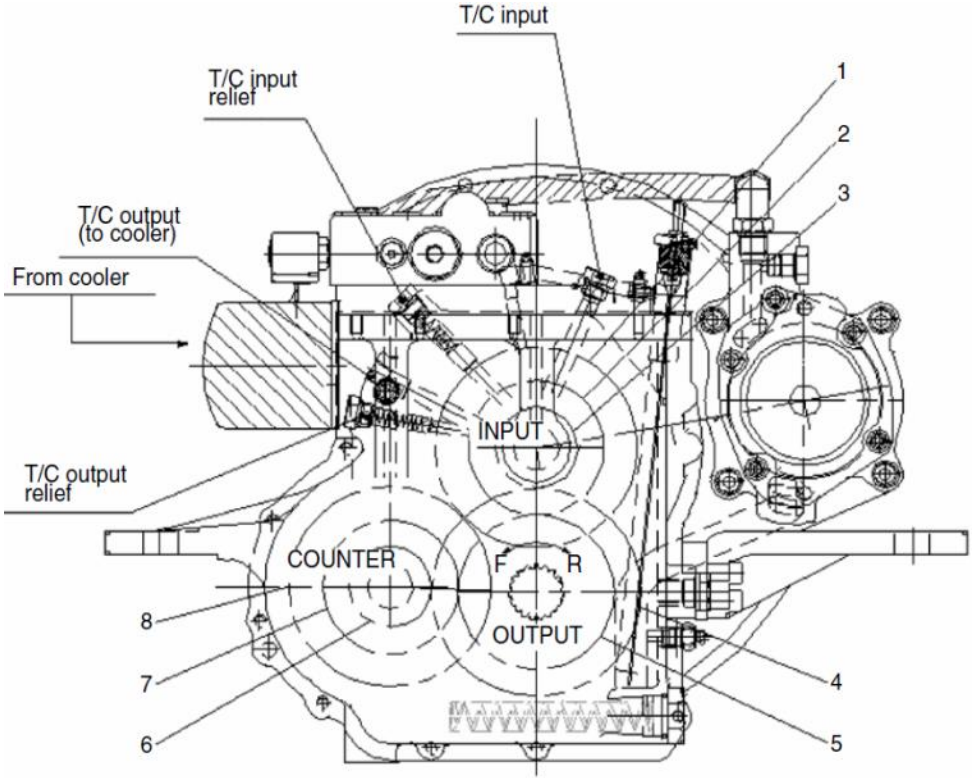


Detailed procedure can be found in Service Manual

Transmission – basic data

SB-I-2015-011 Transmission Parts update.pdf



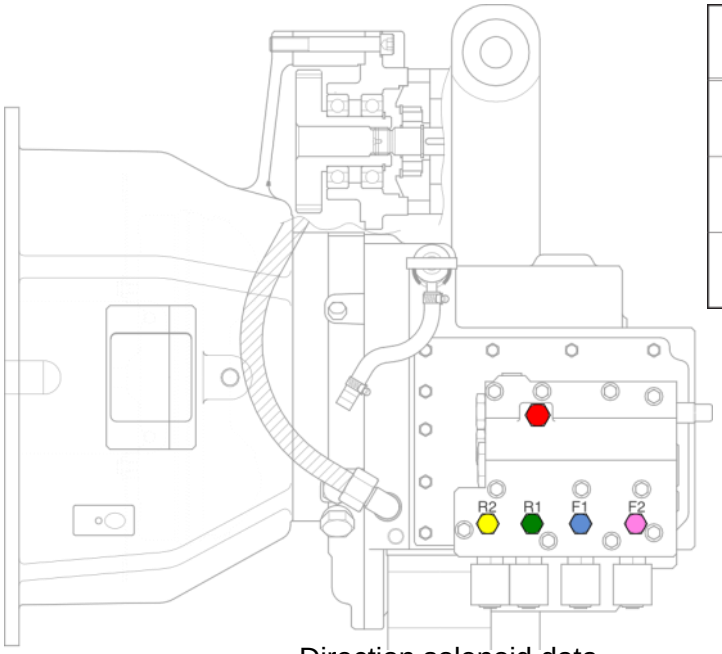


1	Torque converter	8	Clutch piston	15	Output shaft		
2	Input shaft	9	Valve assembly	16	Clutch drum (FR)		
3	3 P.T.O gears	10	Clutch (RR, 1 stage)	17	Clutch (FR, 2 stage)		
4	Pump assembly	11	Gear (RR, 1 stage)	18	Gear (Output, 2 stage)		
5	Gear (RR, 2 stage)	12	Gear (FR, 1 stage)	19	Gear (FR, 2 stage)		
6	Clutch (RR, 2 stage)	13	Clutch (FR, 1 stage)	20	Counter shaft		
7	Clutch drum(RR)	14	Gear (Output, 1 stage)				

1	Cylinder clutch (RR)	4	Gear (Output, 1st stage)	7	Gear (FR, 2nd stage)
2	Gear (RR, 2nd stage)	5	Gear (Output, 2nd stage)	8	Gear clutch (FR)
3	Gear (RR, 1st stage)	6	Gear (FR, 1st stage)		

※ Selection of either forward or reverse gear makes all of the parts inside the T/M operate.

Transmission - troubleshooting



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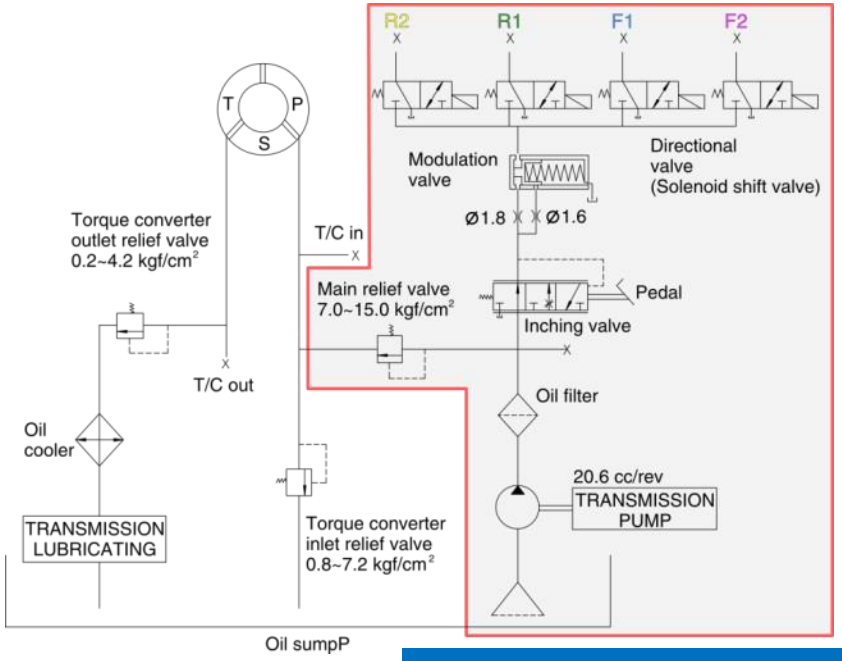


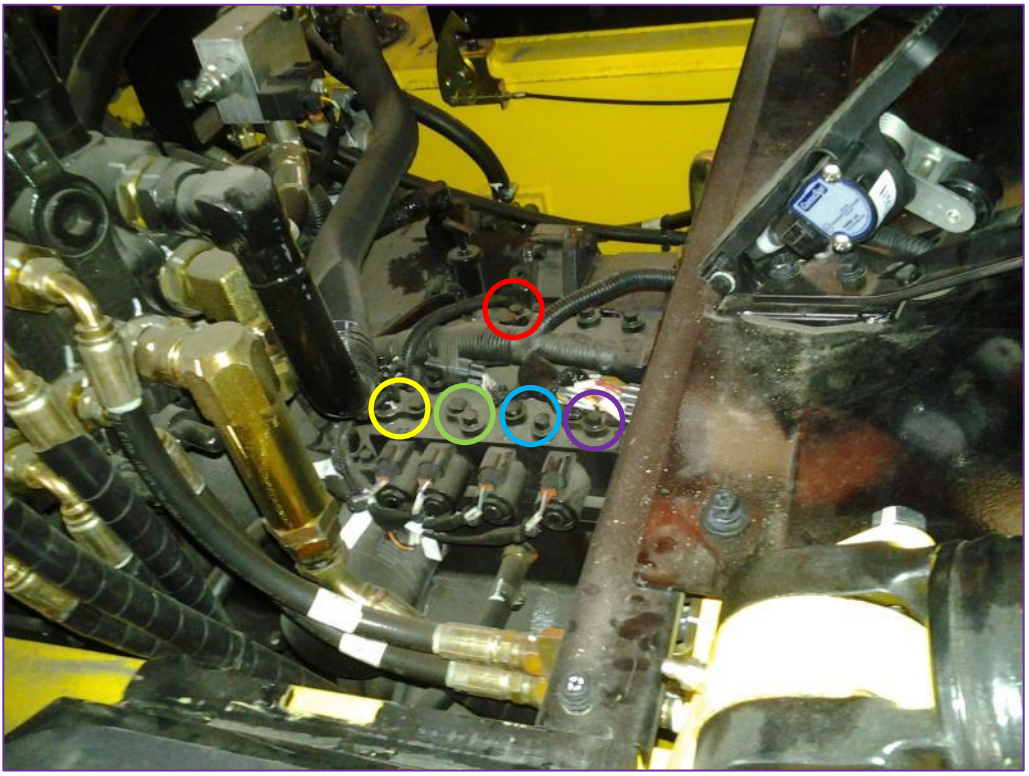
Direction solenoid data

Item	Unit	Specification
Initial coil current at 20°C	A / VDC	0.7/24
Resistance at 20°C	Ω	39.3
Shifting time	sec	1.0 ~ 1.6
Connector	-	DR/D Models With Diode

Item	Unit	Specification
Rated flow	ℓ /rpm	37.4 / 2200
Main relief pressure	kgf/cm² (psi)	7.0 ~ 15.0 (99.6~213.4)
T/C relief pressure	kgf/cm² (psi)	0.8 ~ 7.2 (11.4~102.4)
Clutch pressure	kgf/cm² (psi)	7.0 ~ 15.0 (99.6~213.4)
Residual pressure (Clutch release condition)	kgf/cm² (psi)	Max. 0.3(4.3)

Detailed procedure can be found in Service Manual

Transmission - troubleshooting



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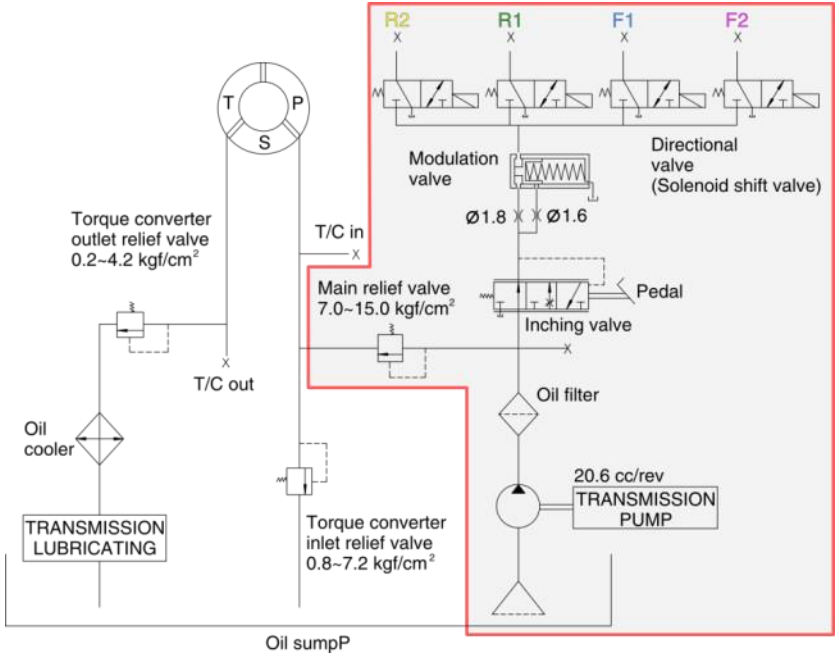
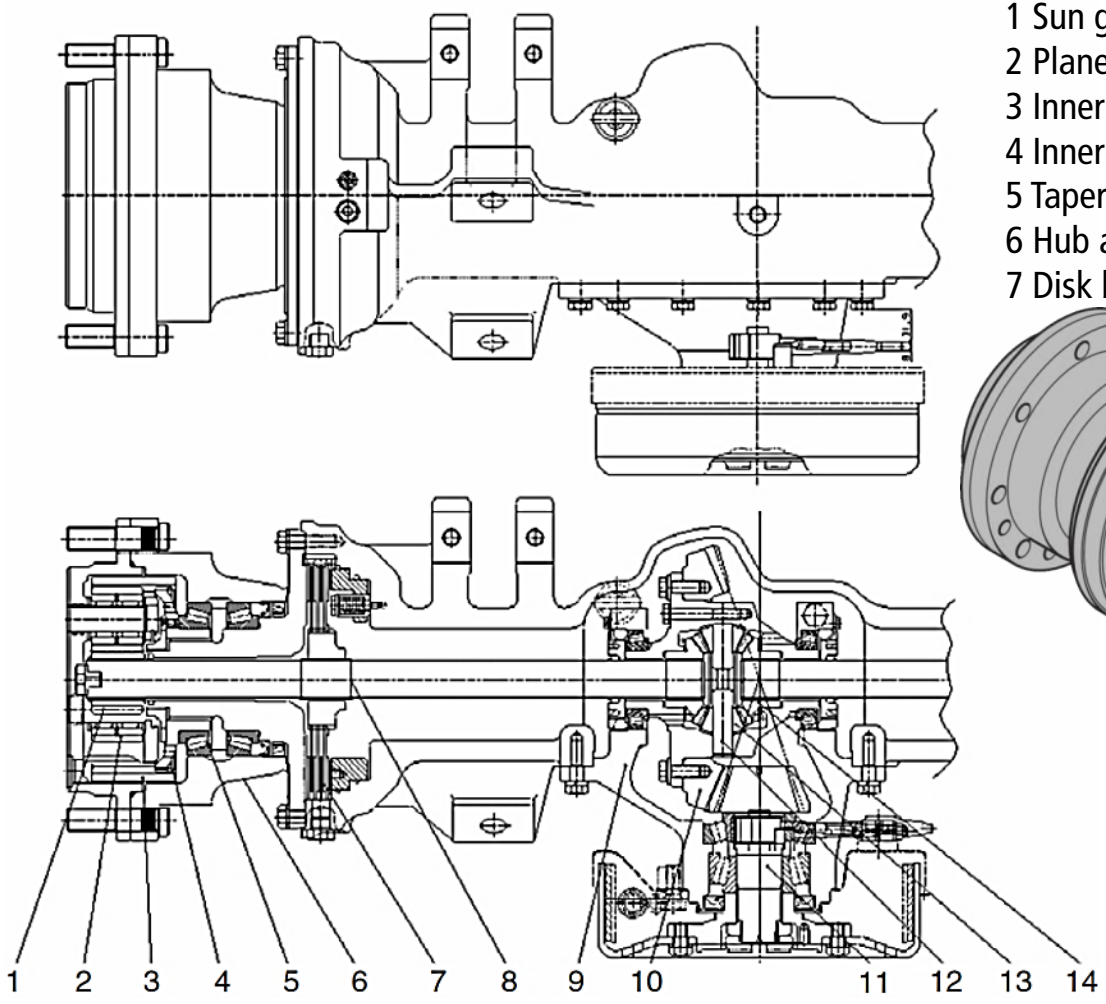
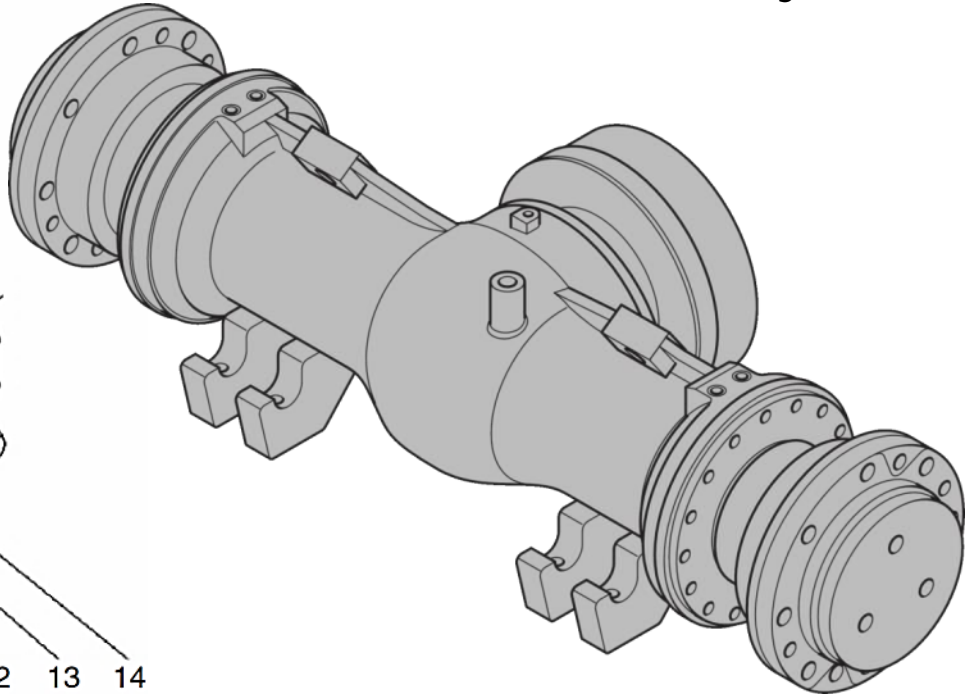


Detailed procedure can be found in Service Manual

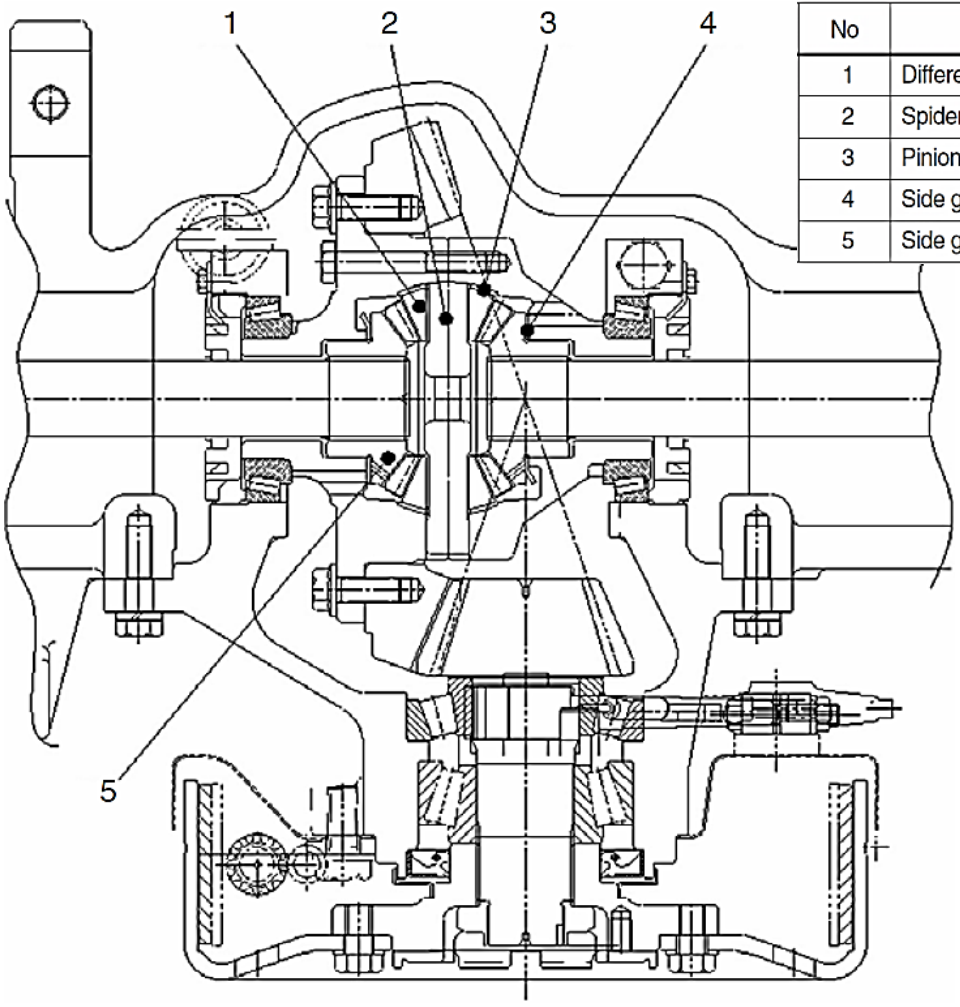
Front axle – outlook



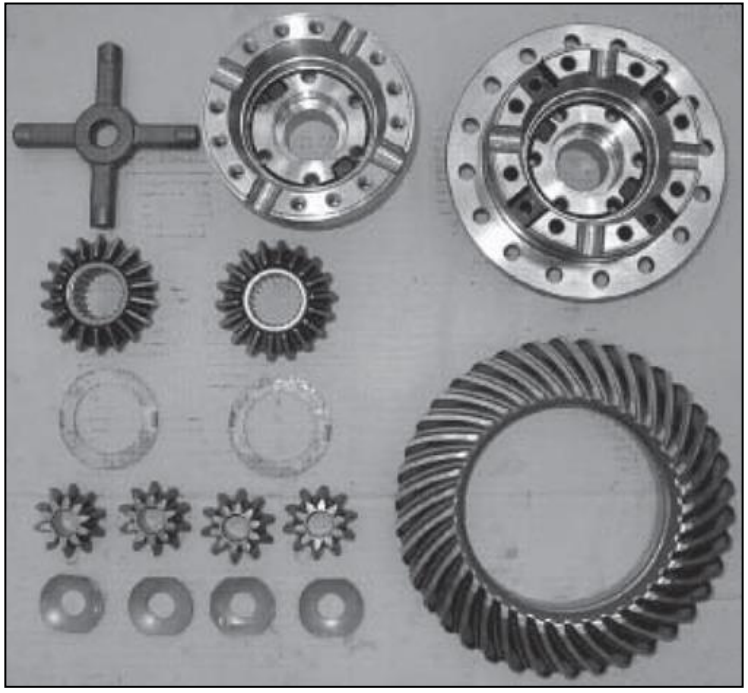
1 Sun gear
2 Planetary gear
3 Inner gear
4 Inner gear carrier
5 Tapered bearing
6 Hub assy
7 Disk brake
8 Drive shaft
9 Differential carrier assy
10 Ring gear
11 Pinion shaft
12 Spider
13 Differential pinion gear
14 Differential side gear



Differential – structure



No	Item	Unit	Specification
1	Differential pinion gear inner diameter	mm (in)	20.000 - 20.021 (0.787~0.788)
2	Spider outer diameter	mm (in)	19.959 - 19.980 (0.786~0.787)
3	Pinion gear washer	mm (in)	1.92 - 2.08 (0.076~0.082)
4	Side gear washer	mm (in)	1.95 - 2.05 (0.077~0.081)
5	Side gear	-	-



Differential – adjustment

ADJUSTMENT OF BEVEL PINION SHAFT

Adjusting shim of bevel pinion shaft.

Adjust shim thickness and bevel pinion shaft with following method.

① Measure "E" at the housing.

② By the equation " X = E - B - T ± C ", define the the shim thickness(1).

B : Mounting dimension of bevel pinion shaft , 133.20mm (5.2 in)

T : Height of bearing.

C : Dimension of carved seal on the pinion. If there's no carved seal **C**=0.

EX) : From the housing

"E" = 162.85 mm

B is factory dimension

"B" = 131.20 mm

From the bearing

"T" = 31.5 mm

Mark on the pinion

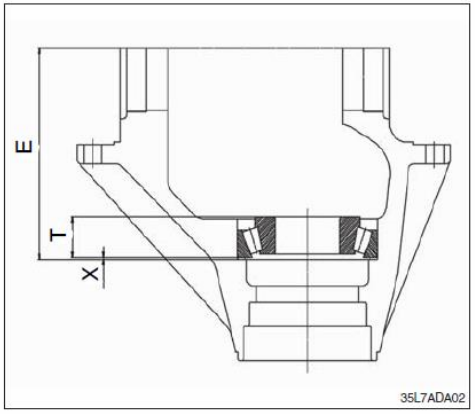
"C" = 0.05 mm

Shim thickness :

"X" = 162.85 -131.20 - 31.5 - 0.05

= 0.10 mm

※ **If teeth are damaged, replace it as a set (Bevel gear and shaft). Do not reuse damaged shims and bearing.**



Install differential assembly into the carrier.

Place the bearing cup and screw into the housing.

At that moment, using a screw adjust rotation backlash.

Install the dial gauge on the gear tooth and measure the backlash while rotating bevel gear.

※ Rotation backlash : 0.18~0.23 mm

Assemble bearing cap.

※ Fix bearing cap with hexagon bolt.

· Tightening torque : 15~17 kg·m

Measure rolling resistance of tapered roller bearing.

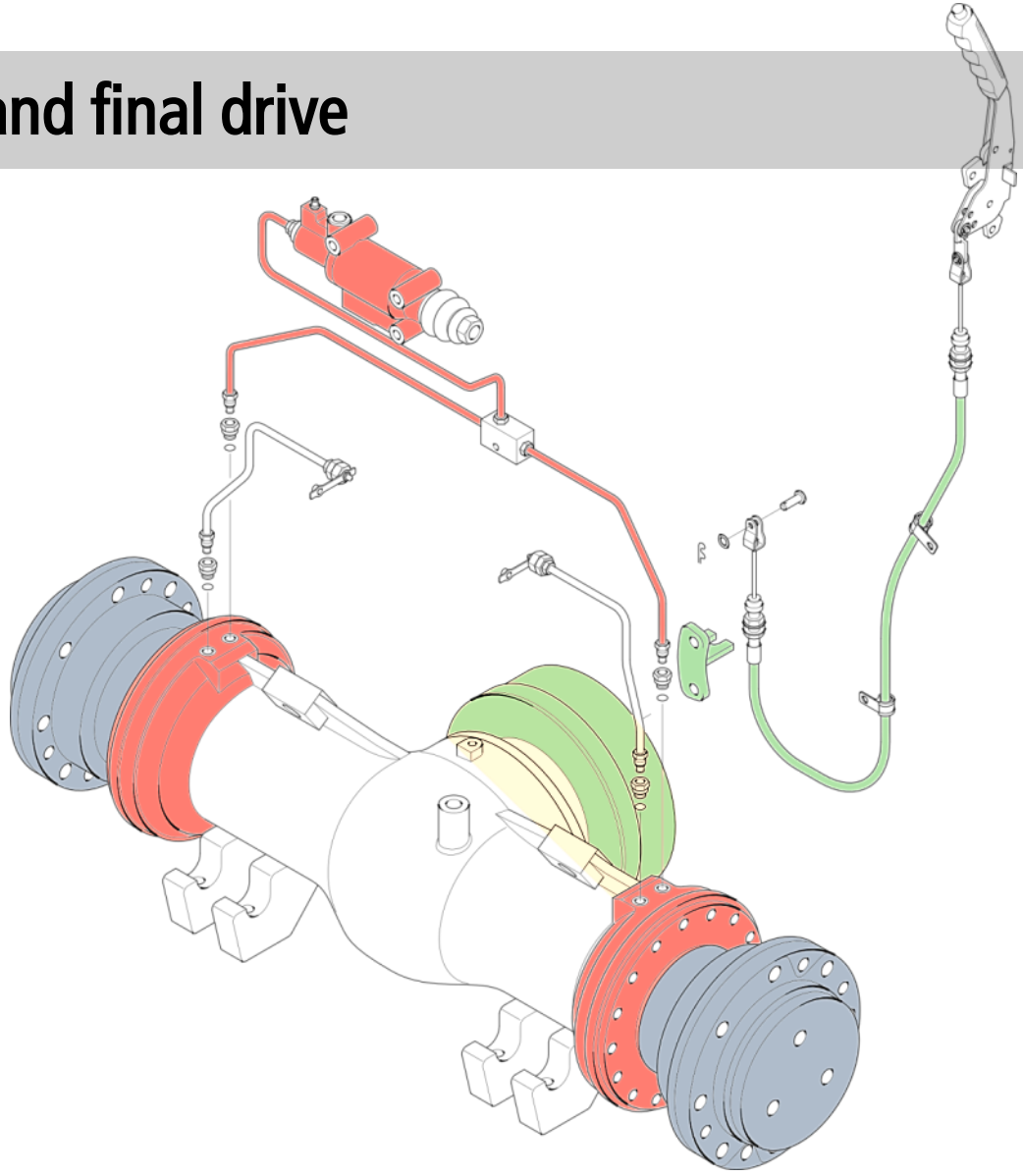
The following table shows the relation between preload (P) of bevel pinion shaft and rollring resistance (Z). (Calculated at ADJUSTMENT OF PINION SHAFT ②)

Unit : kgf·m

P	Z
0.20 (1.45)	0.44~0.47
0.25 (1.81)	0.49~0.52
0.30 (2.17)	0.55~0.58
0.35 (2.53)	0.59~0.62

Detailed procedure can be found in Service Manual

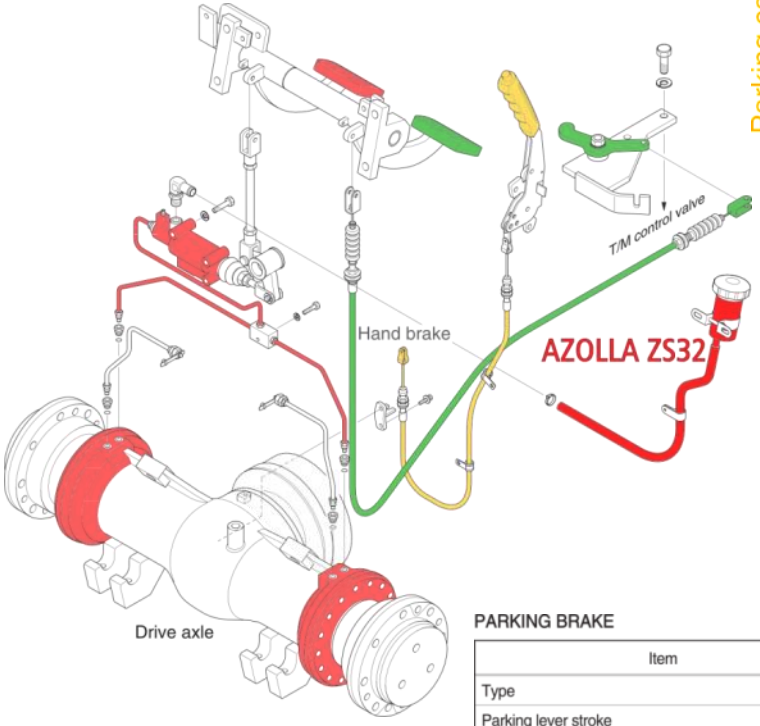
Brake systems and final drive

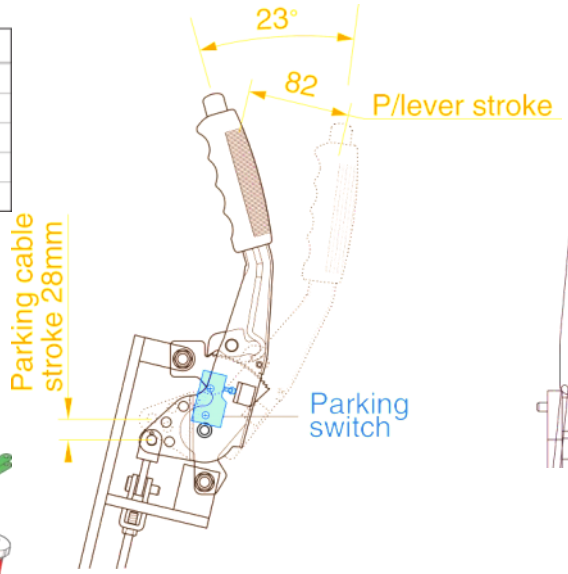


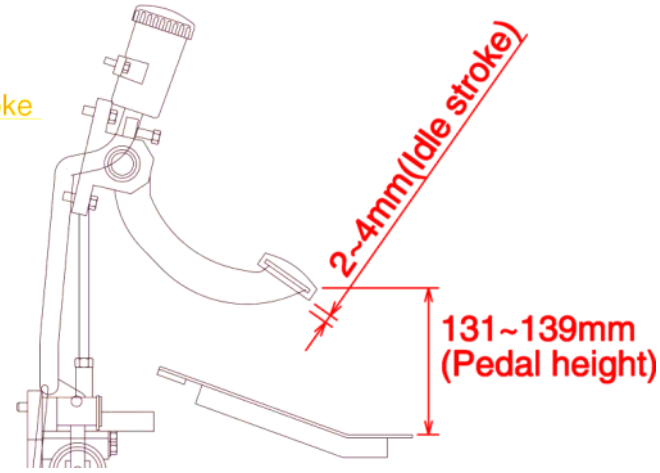
Brake systems – structure / adjustment (including inching linkage)

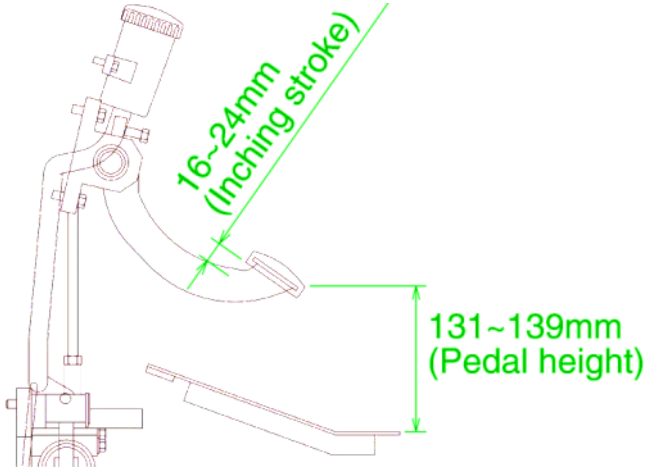
DISK BRAKE

Item		Specification
Type		Wet disk brake
Brake valve step/bore piston diameter		40 mm (1.6 in) / 30 mm (1.2 in)
Pedal adjustment	Pedal height	131~139 mm (5.16~5.47 in)
	Play	2~4 mm (0.08~0.16 in)
Brake oil		Azolla ZS32 (ISO VG32 hydraulic oil)





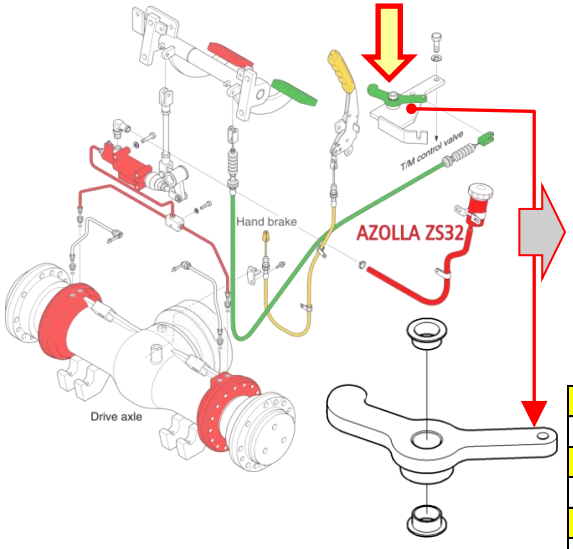




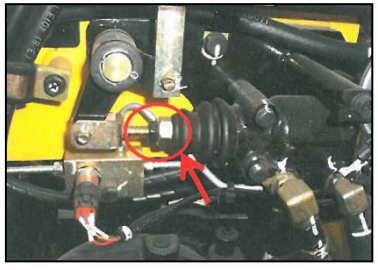
PARKING BRAKE

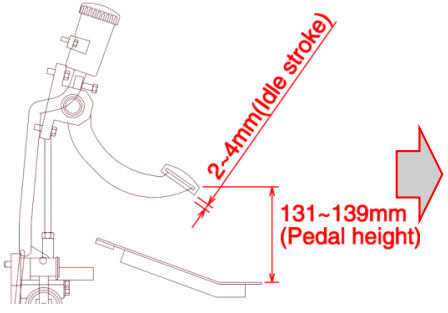
Item	Specification
Type	Ratchet, internal expanding mechanical type
Parking lever stroke	23°
Parking cable stroke	28 mm (1.1 in)

Brake systems – structure / adjustment (new longer inching link)

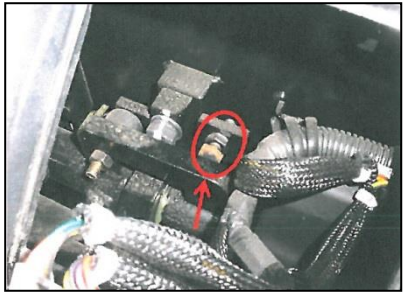


1. Adjust brake pedal play to 3 mm





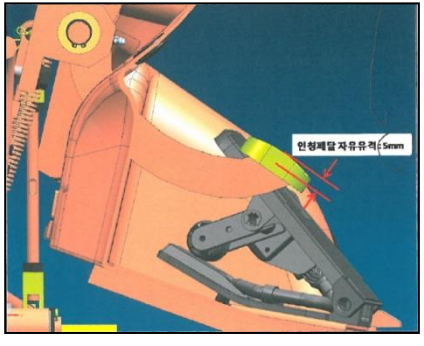
2. Adjust market gap to 0 mm



89FV-40822	#0028 -	B	35D-9A
89FV-40821	- #0021		40D-9A
89FV-40822	#0022 -	B	40D-9A
89FV-40821	- #0066		45D-9A
89FV-40822	#0067 -	B	45D-9A
89FV-40821	- #0059		50DA-9A
89FV-40822	#0060 -	B	50DA-9A

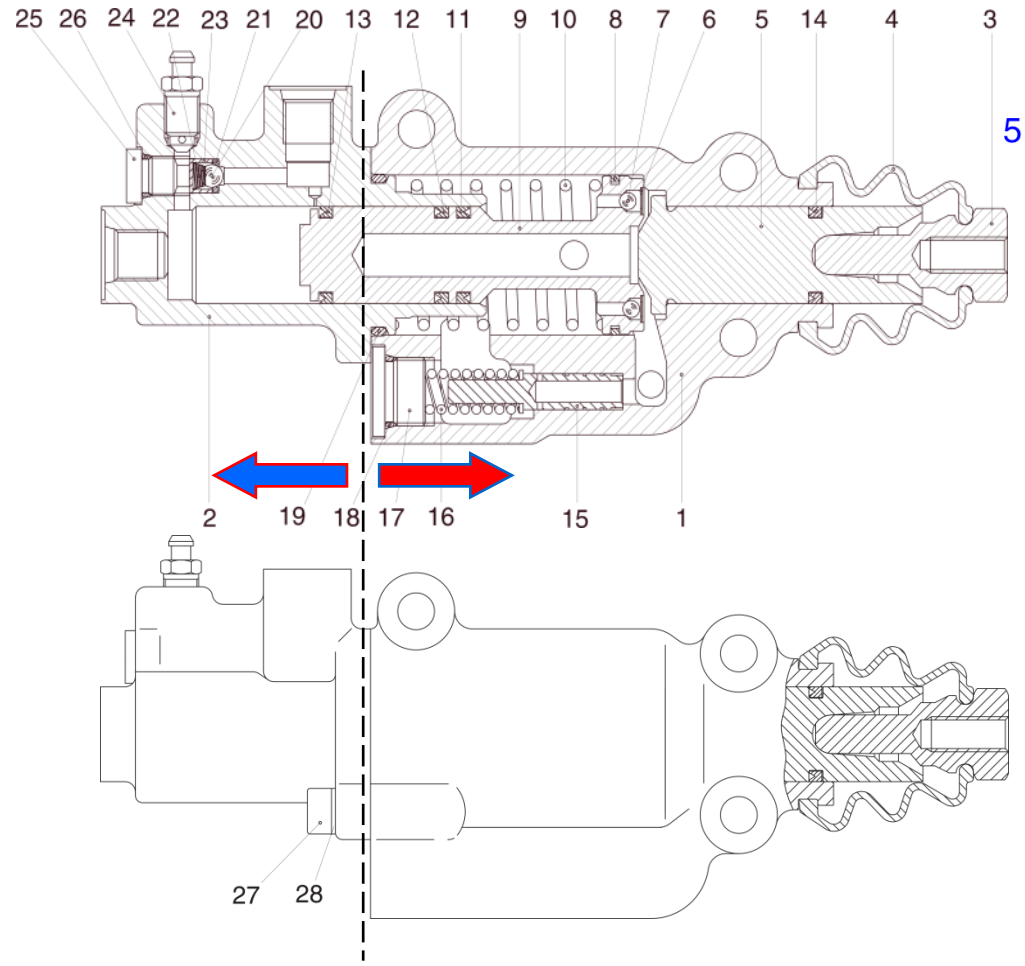
3. Check T/M pressure whether is "0" bar when inching pedal fully pressed and brake pressure if it is max 3 bar @ drive off.

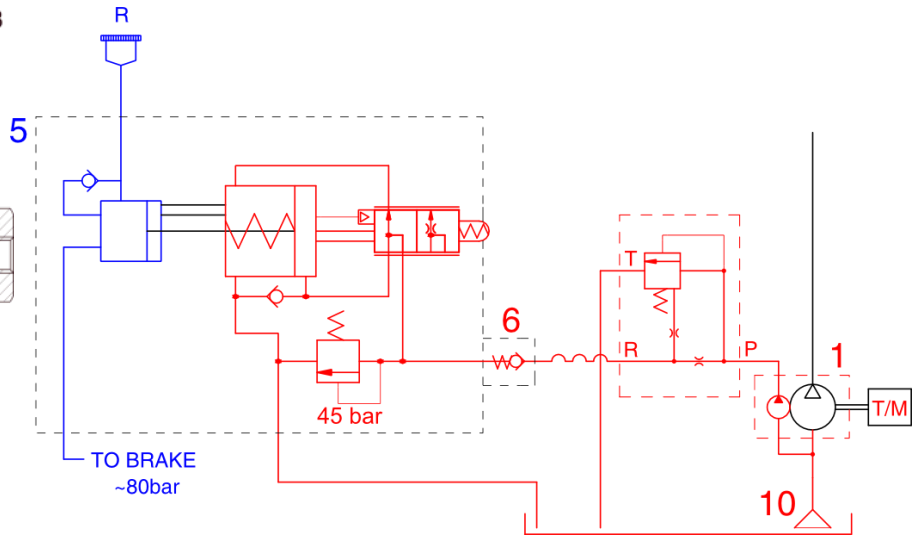
4. Adjust inching pedal free play – 5 mm by cable.



5. After brake pedal releasing, brake pressure should be "0".

Brake systems – structure of brake valve

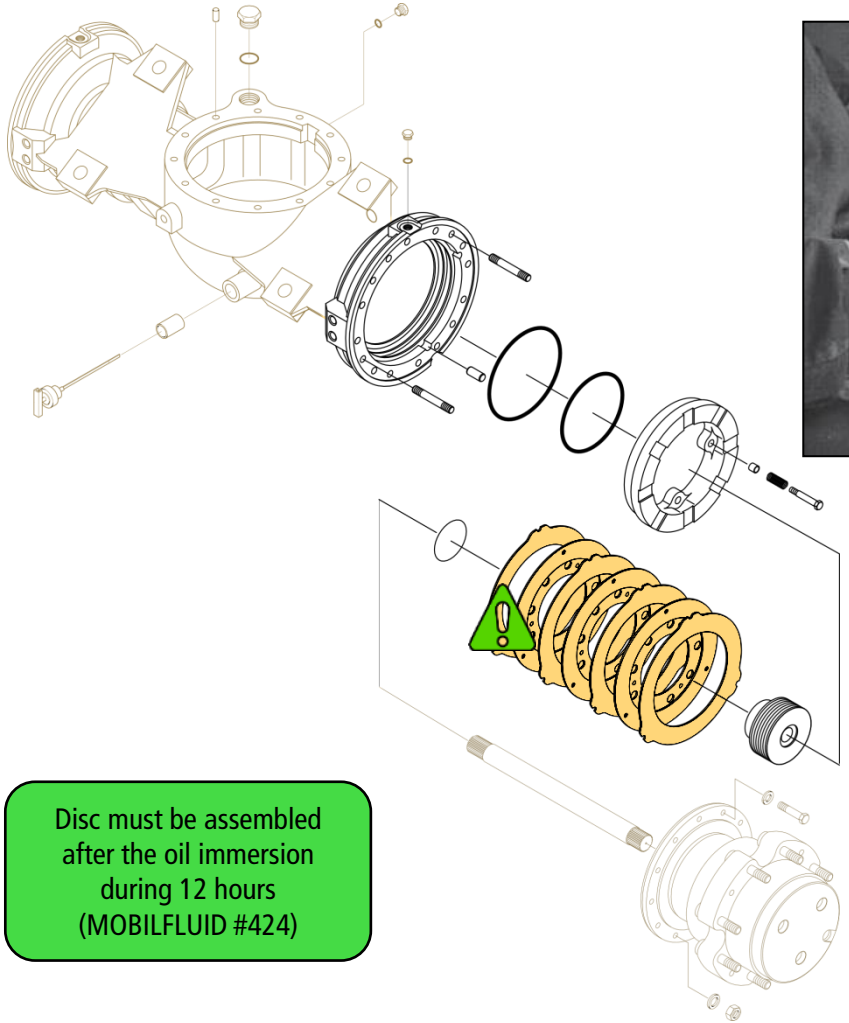




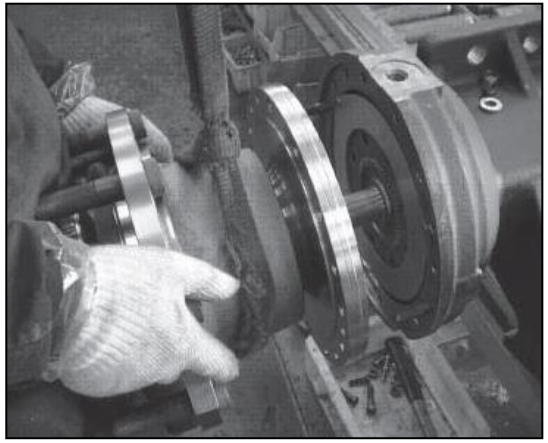
1 Front housing	11 U-cup seal	21 O-ring
2 Rear housing	12 U-cup seal	22 Spring
3 Push rod	13 U-cup seal	23 Gauge
4 Bellows	14 U-cup seal	24 Air bent
5 Master piston	15 Relief piston	25 Plug
6 Lock washer	16 Relief spring	26 O-ring
7 Piston ball	17 Relief plug	27 Bolt
8 Piston ring	18 O-ring	28 Spring washer
9 Servo piston	19 O-ring	
10 Servo spring	20 Ball	

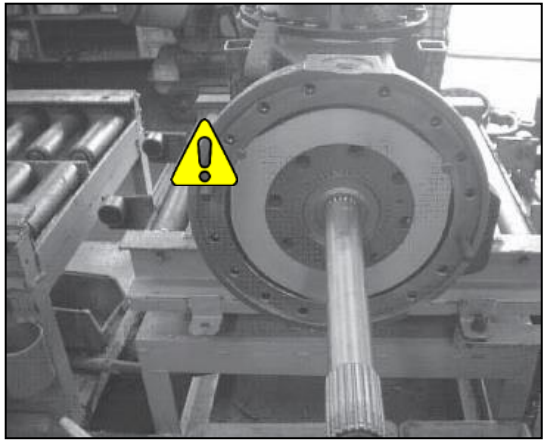
Detailed procedure can be found in Service Manual

Brake systems – structure of wheel brake

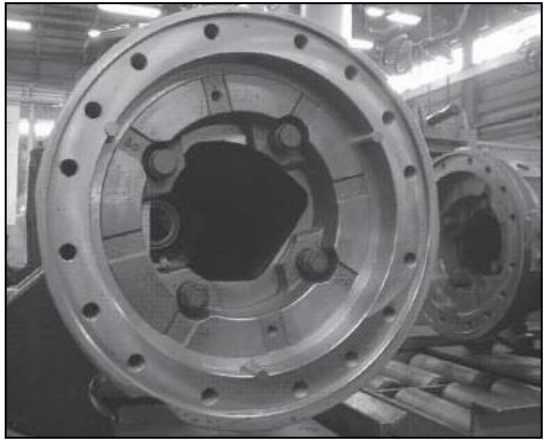


Disc must be assembled after the oil immersion during 12 hours (MOBILFLUID #424)



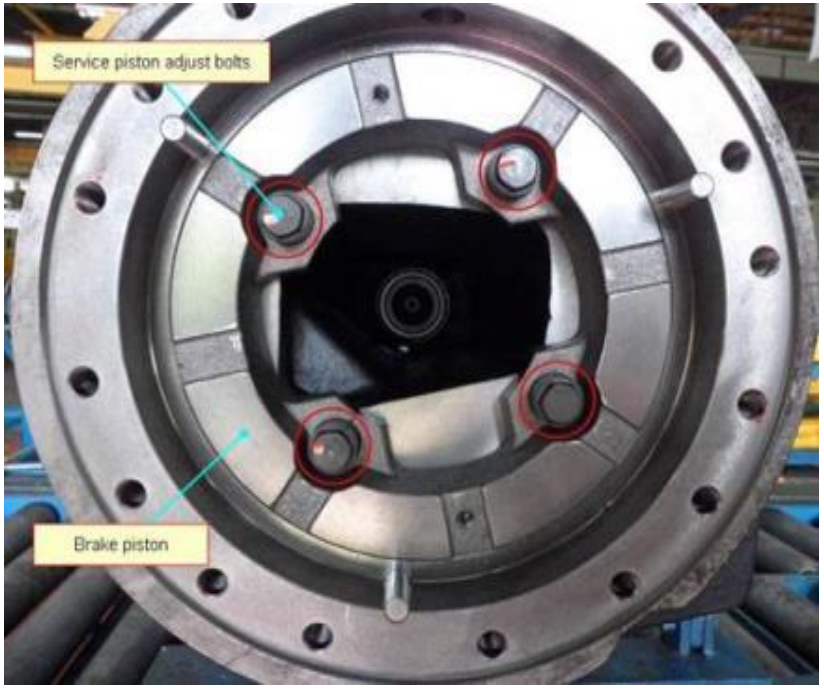


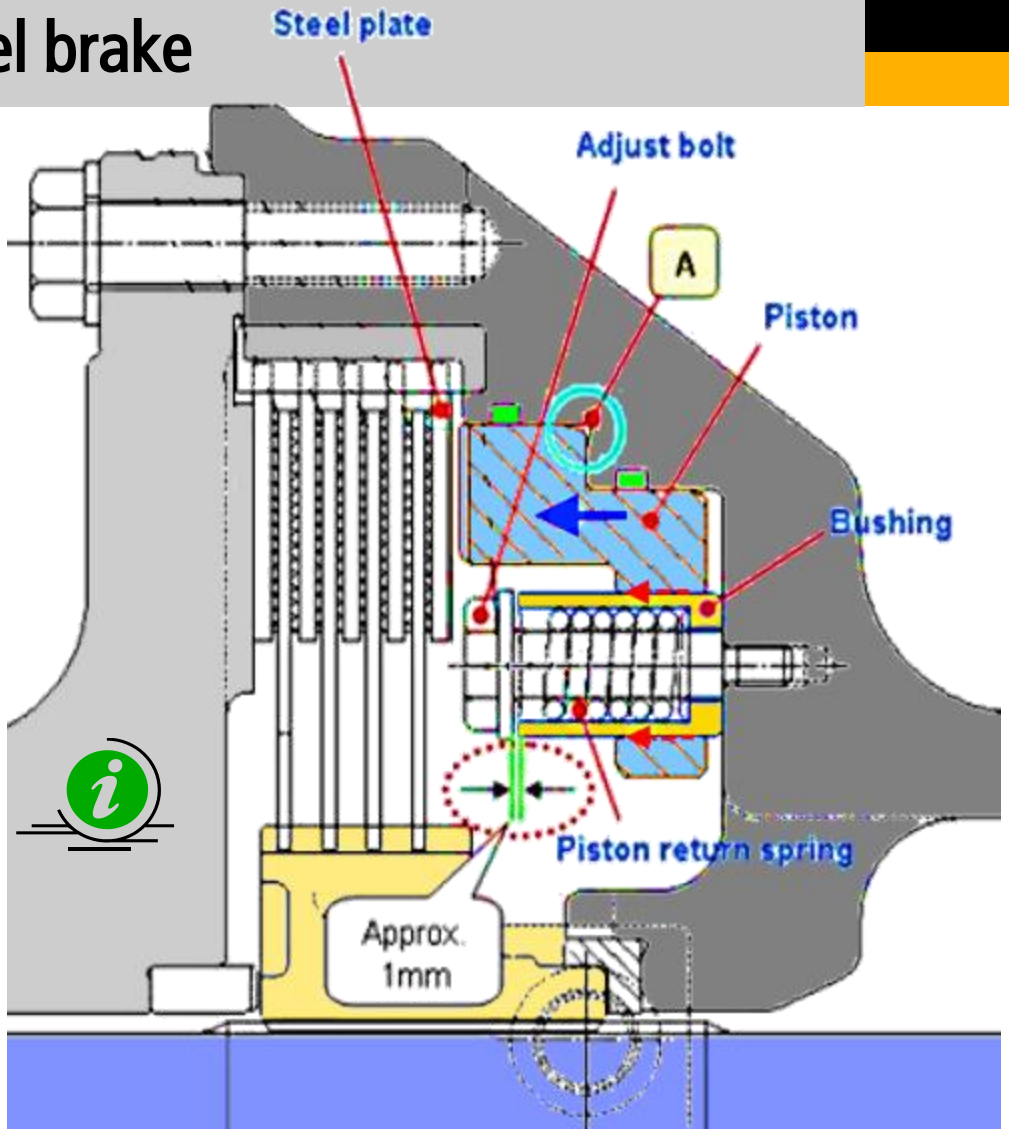
After assembling, confirm that the clearance between the outer plate and the axle housing surface is 2.1~2.6 mm



Detailed procedure can be found in Service Manual

Brake systems – structure of wheel brake





• **Condition that brake discs become worn out.**

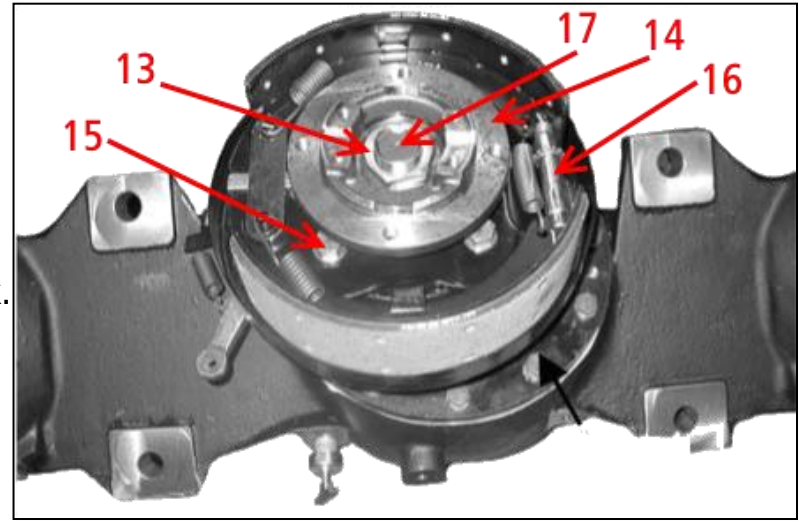
Then, the distance between disc plate and piston will be increased, which will also request piston to travel more for brake activation.

But, before piston moves to left more, travel distance for bushing is quite limited and will soon stopped.

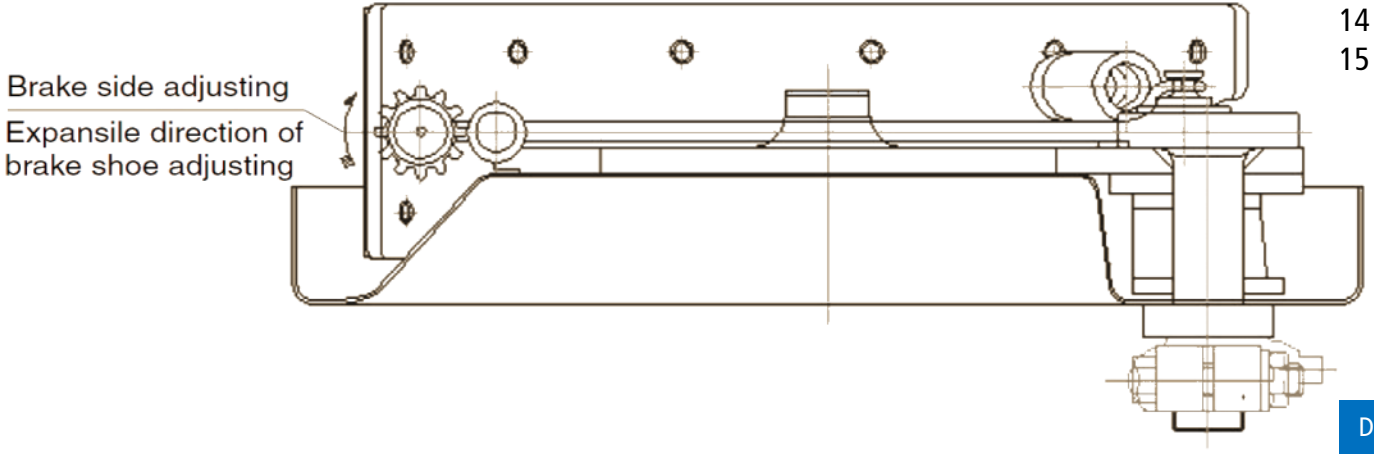
In this stage, piston will be slipped on bushing in order to move left more for brake activation thanks to brake oil pressure

Brake systems – structure of parking brake and adjustment

The following procedures should be applied for brake shoe adjustment
Open rubber plug on brake drum.
Adjuster should be turned according to arrow direction until occurring drum touch condition.
Adjuster should be turned to opposite direction of the arrow sign by four click.
At that case, lining clearance is 0.1~0.25 mm.
Check drum drag after operating lever several times.
(Repeat from beginning if drag is occurred)

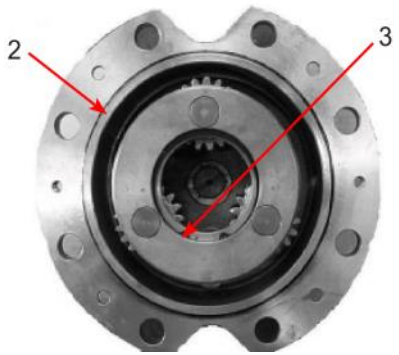


13 lock nut
14 yoke
15 bolts
16 parking brake
17 pinion shaft

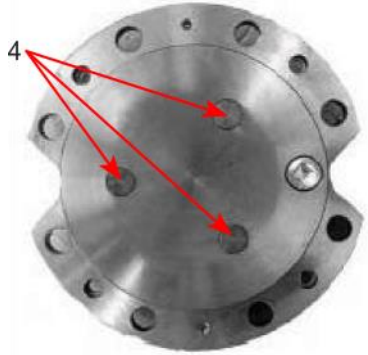


Detailed procedure can be found in Service Manual

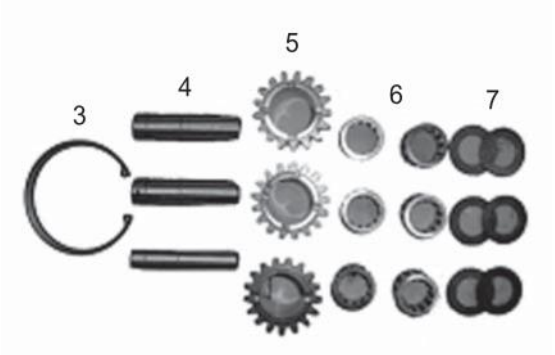
Final drive – structure



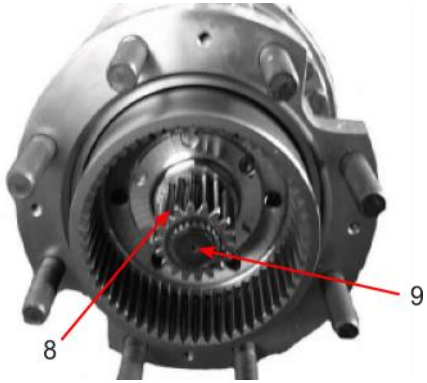
o-ring (2)
snap ring (3)
pins (4)



planet gears (5)
needle bearings (6)
thrust washers (7)

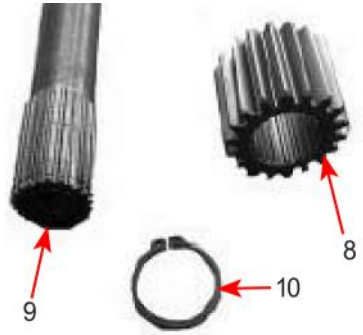


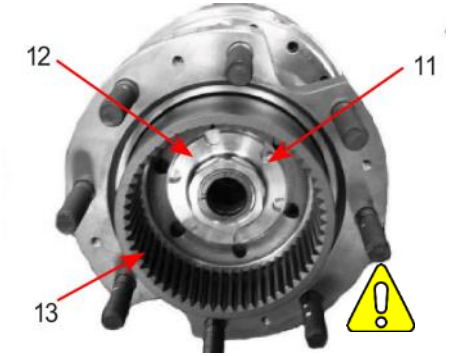
gear (8)
drive shaft (9)
snap ring (10)

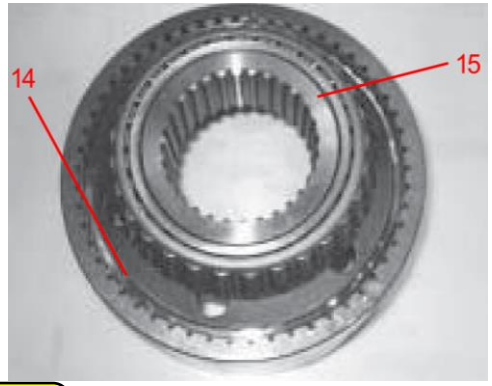


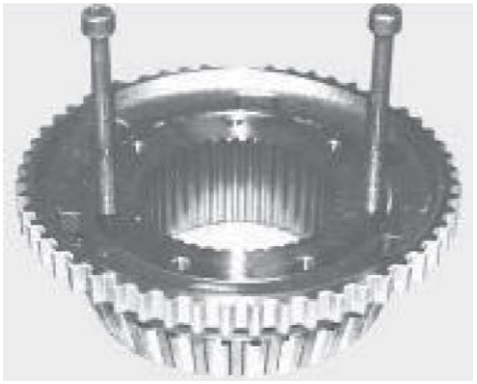
bolt (11)
plate assembly (12)
ring gear (13)

c-ring (14)
spindle (15)









Necessary to measure the rolling resistance of tapered roller bearing before disassembly (value needed for reassembly later

Detailed procedure can be found in Service Manual

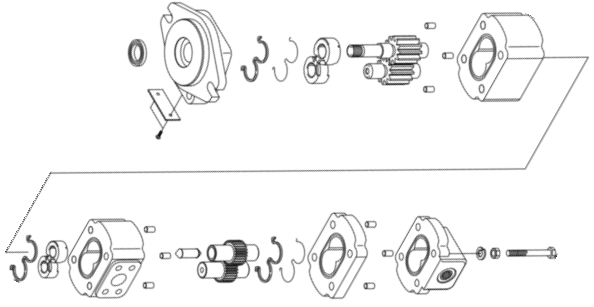
Hydraulic system

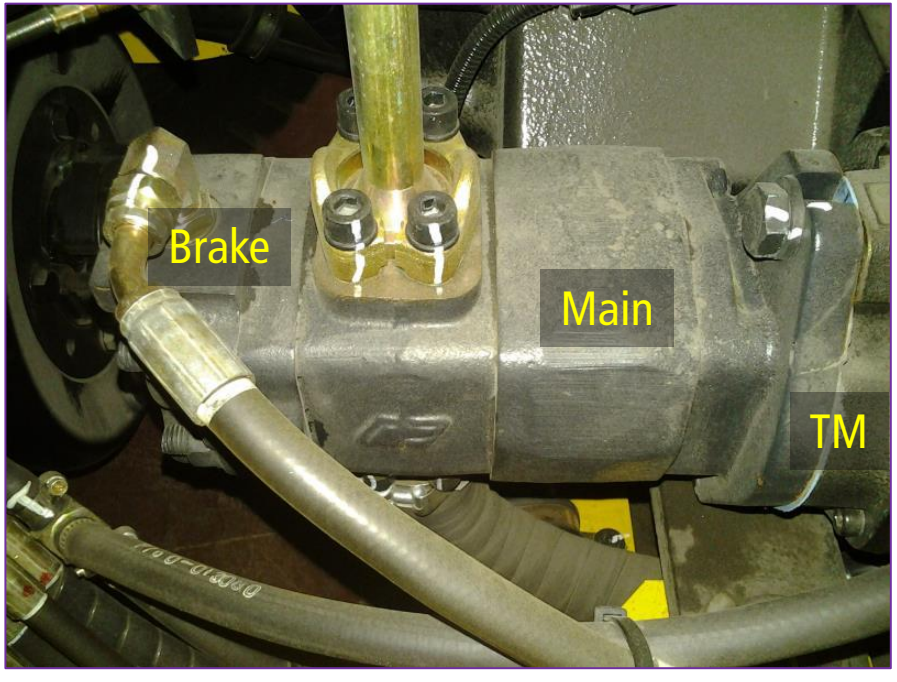
Hydraulic system – diagram

1 Hydraulic gear pump
2 Main control valve
3 Steering unit
4 Priority valve
5 Brake valve
6 Check valve
7 Steering cylinder
8 Tilt cylinder
9 Lift cylinder
10 Suction filter
11 Return filter
12 Down safety valve
13 Down control valve
14 DPF solenoid valve
15 Flow control valve ?
16 Hydraulic oil tank

Model	Main	Aux	Steering	DPF valve	Brake boost
35D-9A	175 +5/-0	150 +5/-0	135 +5/-0	55 ±3	45±2
40D-9A	195 +5/-0	150 +5/-0	135 +5/-0	55 ±3	45±2
45D-9A	210 +5/-0	150 +5/-0	135 +5/-0	55 ±3	45±2
50DA-9A	210 +5/-0	150 +5/-0	135 +5/-0	55 ±3	45±2

Hydraulic system – Pump and priority valve improvement

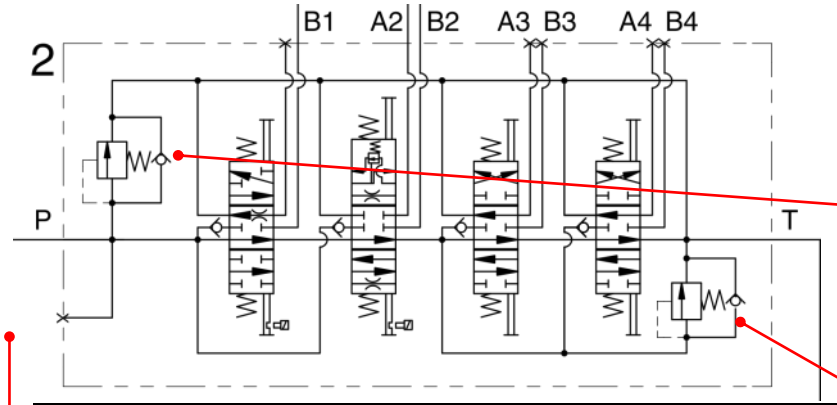


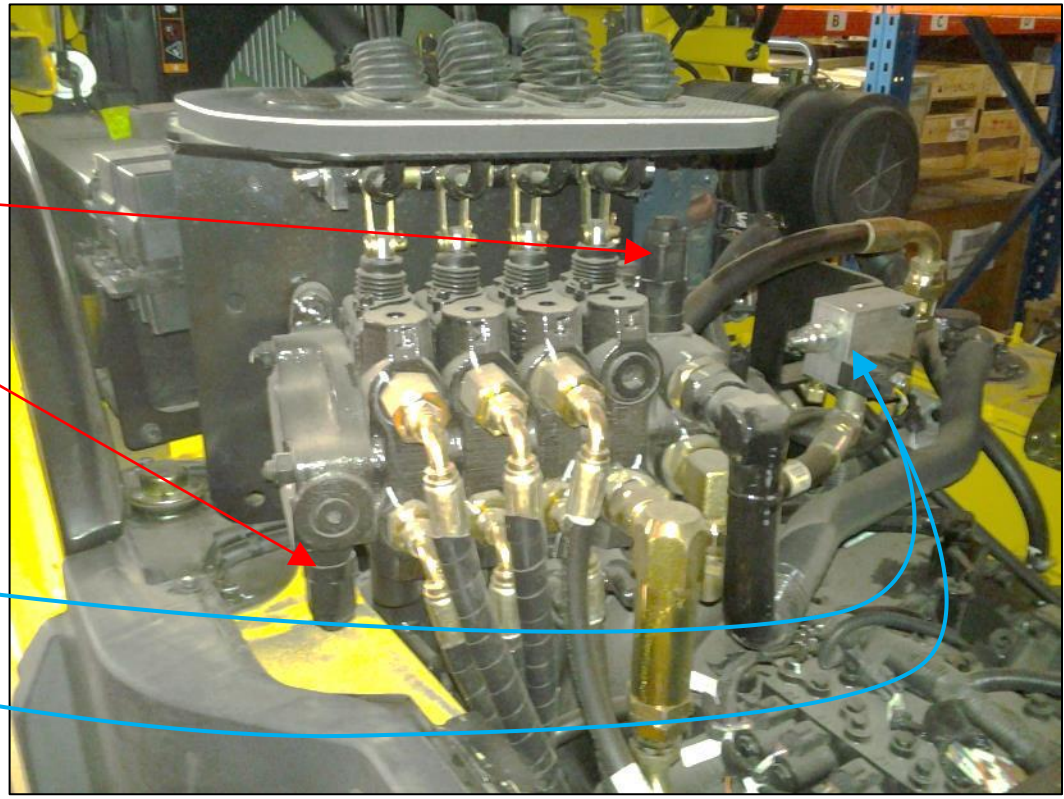


Description	Old	New
	Round head plug	Hex head plug
Picture		
Part No.	31HP-03010	←
Information	Control pressure of LS-spool change (7 → 10 kgf/㎠)	
Remark	LS-spool repair kit (XKAU-00546)  	

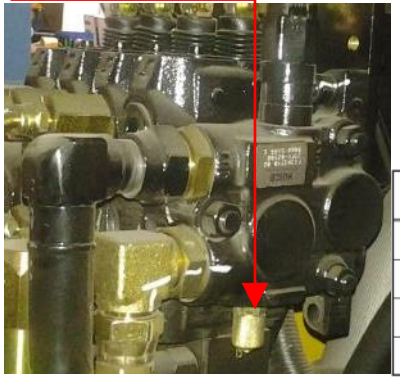
Item	Unit	Specification
Type	-	Fixed displacement gear pump
Capacity	cc/rev	50
Maximum operating pressure	bar	250
Rated speed (Max/Min)	rpm	3000/600

Hydraulic system – MCV





Model	Main	Aux	Steering	DPF valve	Brake boost
35D-9A	175 +5/-0	150 +5/-0	135 +5/-0	55 ±3	45±2
40D-9A	195 +5/-0	150 +5/-0	135 +5/-0	55 ±3	45±2
45D-9A	210 +5/-0	150 +5/-0	135 +5/-0	55 ±3	45±2
50DA-9A	210 +5/-0	150 +5/-0	135 +5/-0	55 ±3	45±2



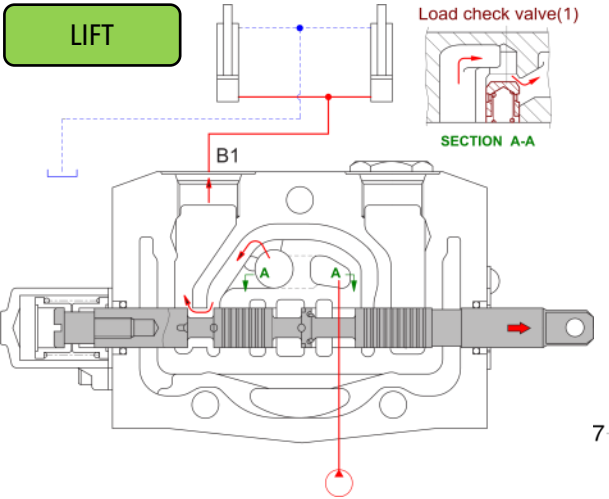
To set pressure for DPF valve machine should be either in DPF level 1 or 2, or valve must be powered (24V) externally.

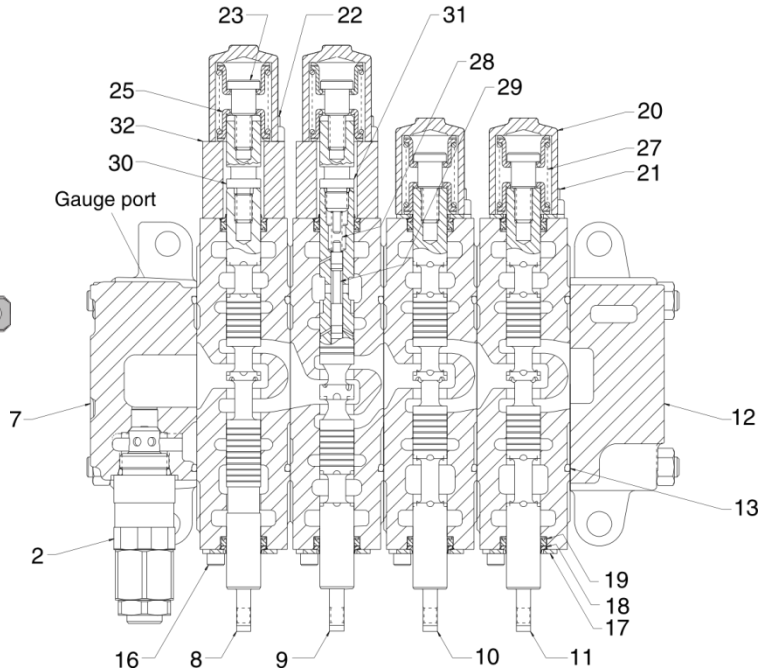
Port name	Size
Inlet port	1-5/16-12UN
Outlet port	1-5/16-12UN
Gauge port	PF1/4
3 Work port	1-1/16-12UN

Item	Unit	Specification
Type	-	Sectional
Operating method	-	Mechanical
Main relief valve pressure	bar	210/150
Flow capacity	lpm	125

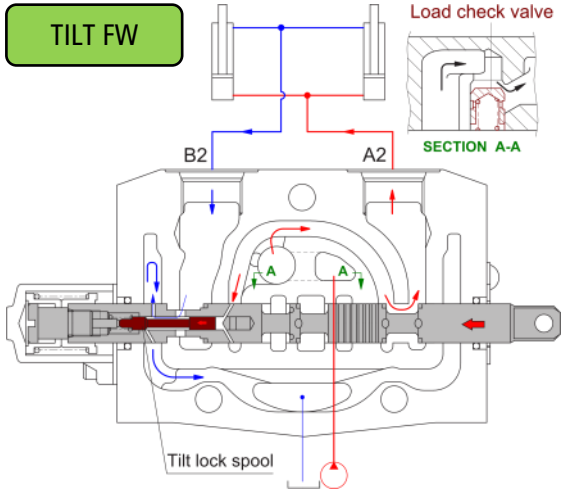
Hydraulic system – MCV

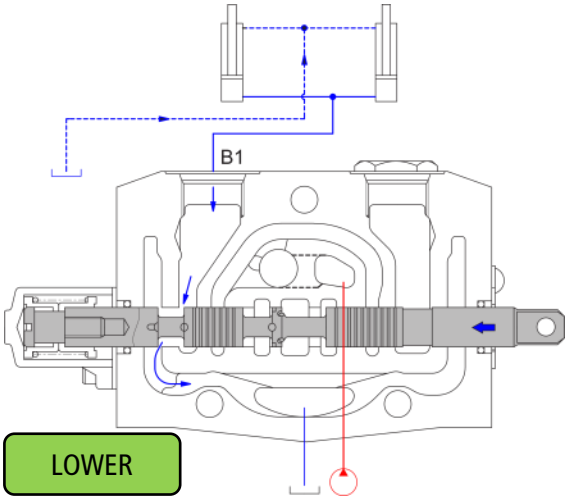
LIFT





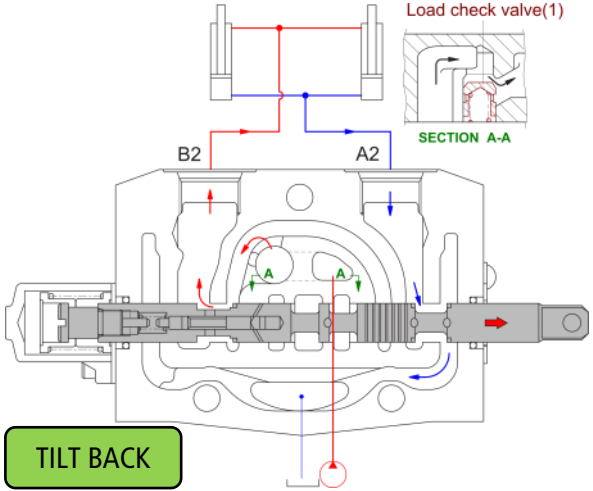
TILT FW





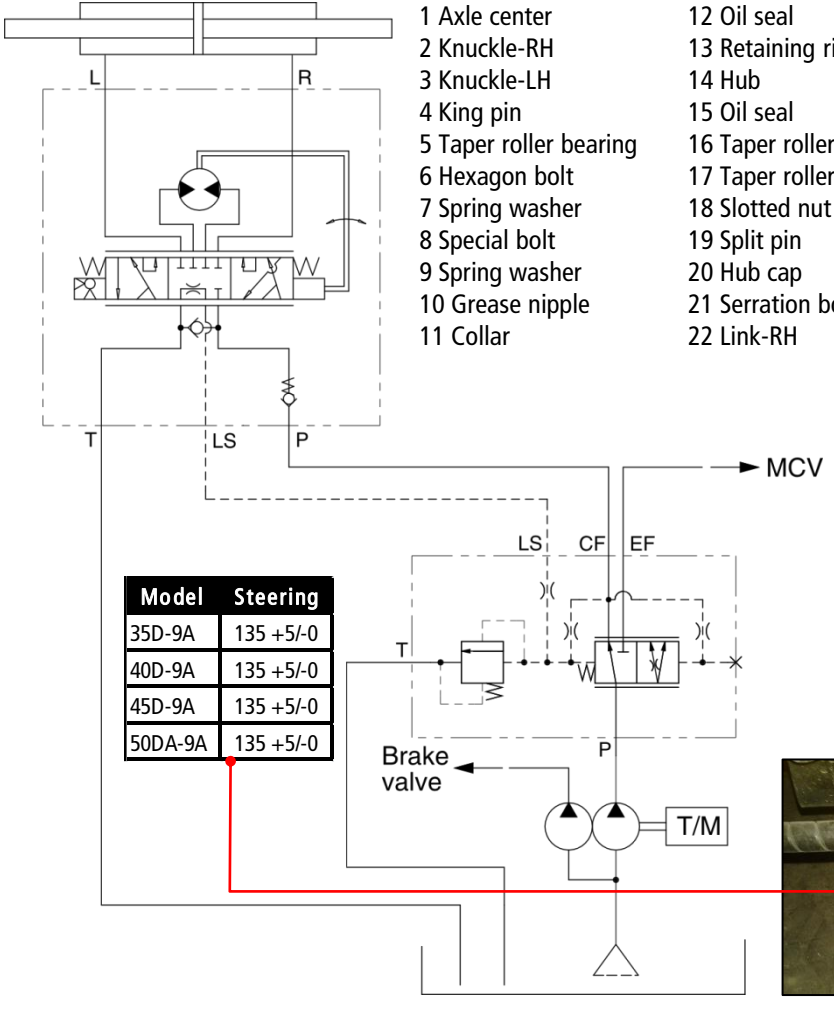
LOWER

2 Main relief valve	16 Screw	25 Spring seat
7 Inlet section assy	17 Seal plate	27 Spring
8 Spool section-lift	18 Wiper	28 Spring
9 Spool section-tilt	19 Spool seal	29 Piston
10 Spool section-A1	20 Spool cap	30 Spool end
11 Spool section-A2	21 Screw cap	31 Spool end
12 Outlet section assy	22 Screw cap	32 Spool cap
13 O-ring	23 Spool end	



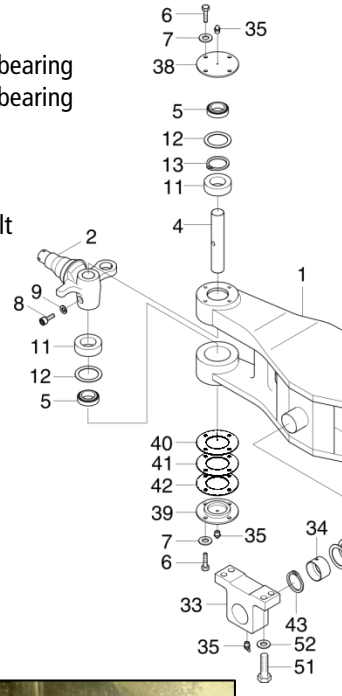
TILT BACK

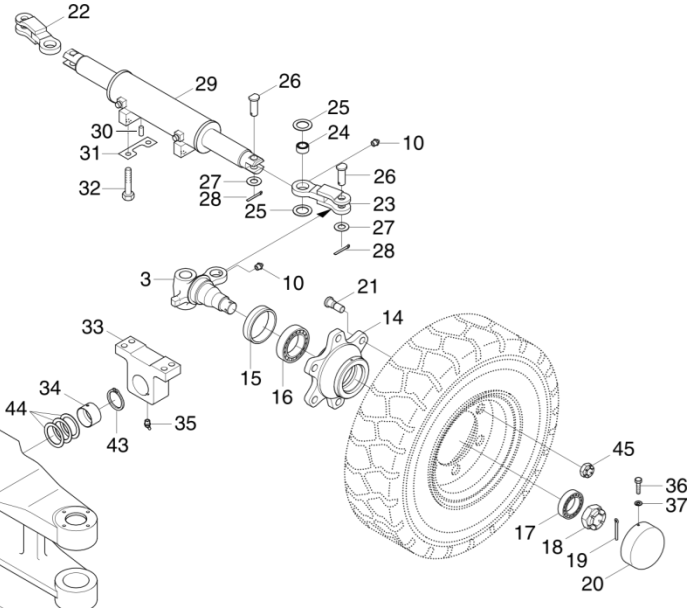
Hydraulic system – Steering (incl. axle structure)



Model	Steering
35D-9A	135 +5/-0
40D-9A	135 +5/-0
45D-9A	135 +5/-0
50DA-9A	135 +5/-0

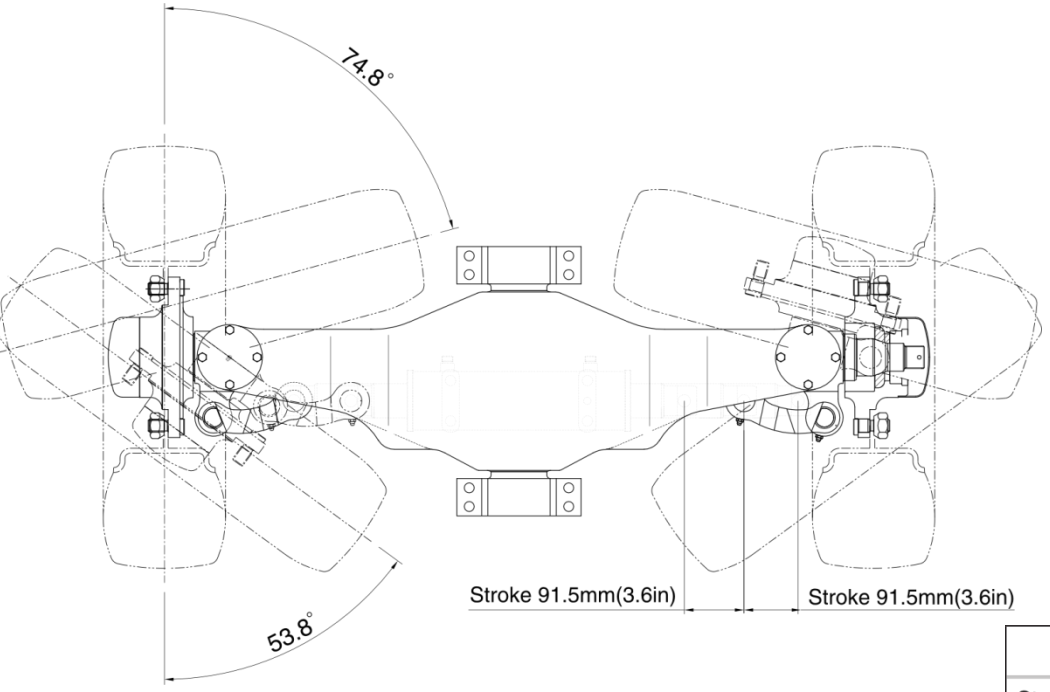
1 Axle center
2 Knuckle-RH
3 Knuckle-LH
4 King pin
5 Taper roller bearing
6 Hexagon bolt
7 Spring washer
8 Special bolt
9 Spring washer
10 Grease nipple
11 Collar
12 Oil seal
13 Retaining ring
14 Hub
15 Oil seal
16 Taper roller bearing
17 Taper roller bearing
18 Slotted nut
19 Split pin
20 Hub cap
21 Serration bolt
22 Link-RH
23 Link-LH
24 SPH plain bearing

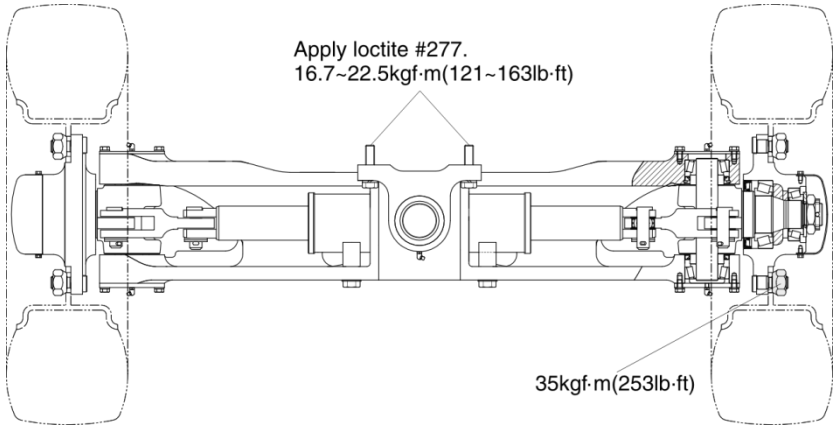




25 Thrust washer
26 Clevis pin
27 Plain washer
28 Split pin
29 Steering cylinder
30 Pin
31 Lock plate
32 Hexagon bolt
33 Support
34 Bushing
35 Grease nipple
36 Hexagon bolt
37 Spring washer
38 Upper cover
39 Lower cover
40 Shim (0.1t)
41 Shim (0.15t)
42 Shim (0.3t)
43 Retaining ring
44 Shim (0.5t)
45 Hub nut
51 Hexagon bolt
52 Spring washer

Hydraulic system – Steering (incl. axle structure)

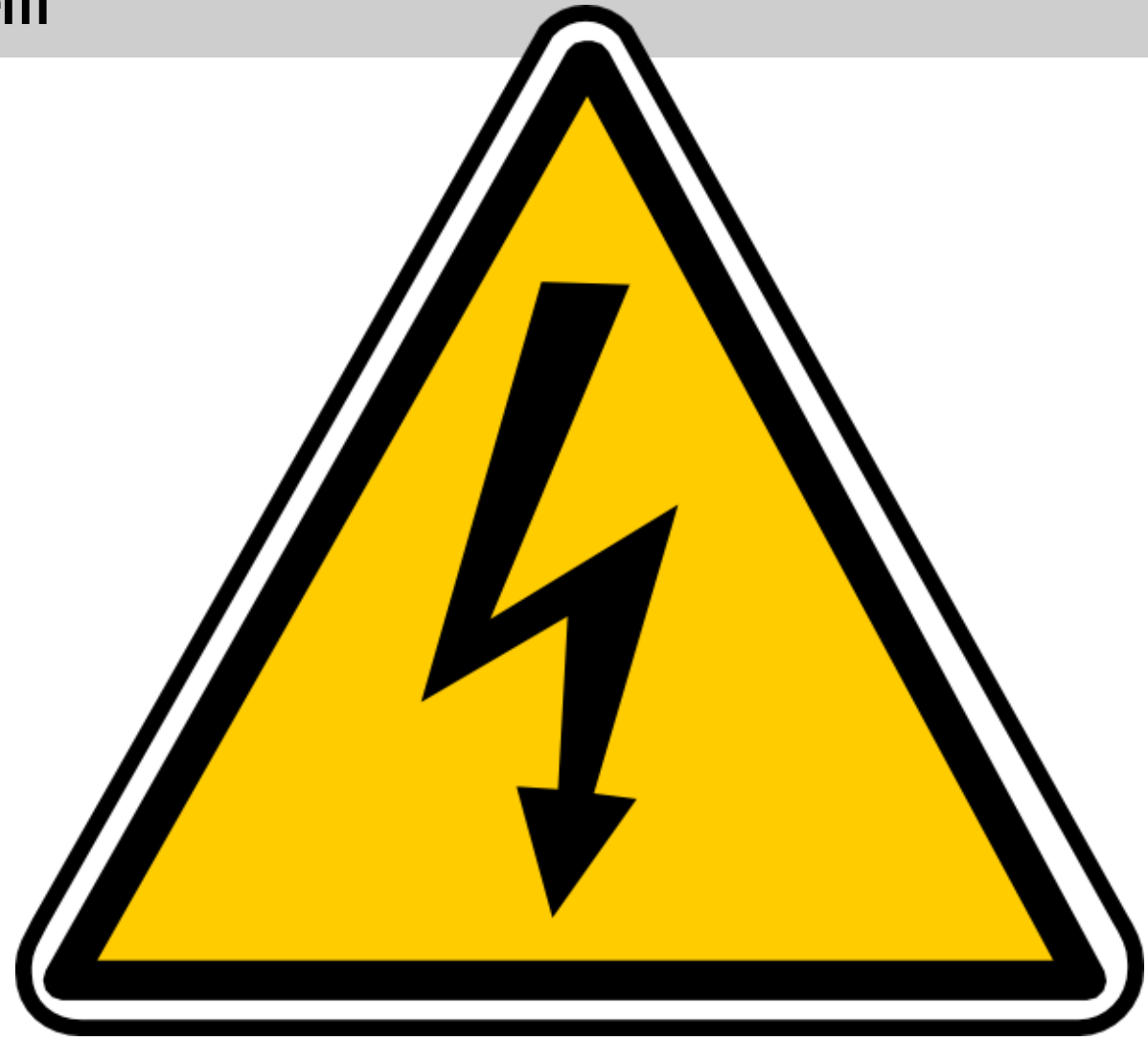




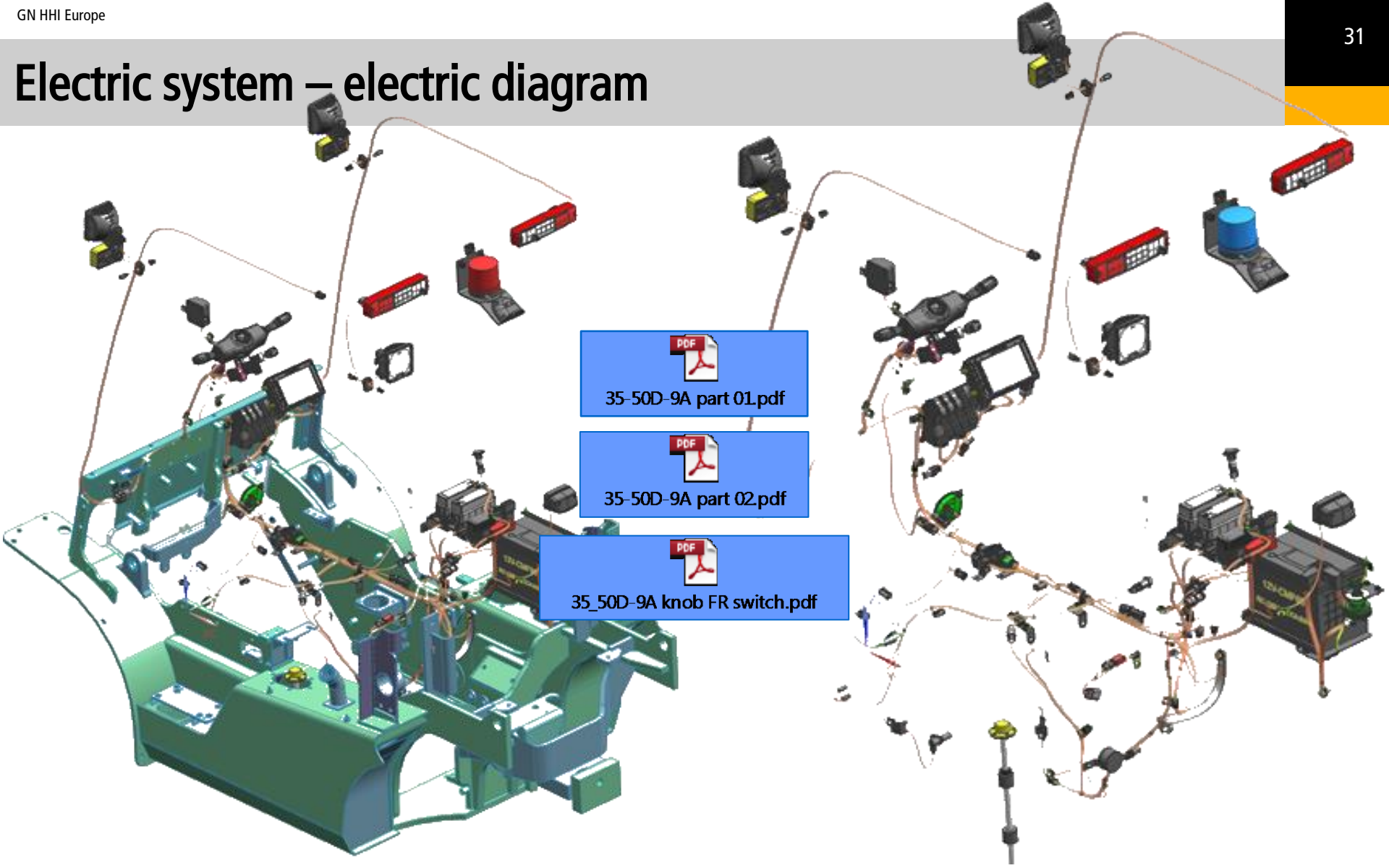
Min. turning radius:
35D-9A - 2868 mm (113 in)
40D-9A - 2915 mm (115 in)
45D-9A - 2965 mm (117 in)
50DA-9A - 3004 mm (118 in)

Type	Unit	Center pin support single shaft
Structure of knuckle	-	Elliott type
Toe-in	degree	0
Camber	degree	0
Caster	degree	0
King pin angle	degree	0
Max steering angle of wheels(Inside/Outside)	degree	74.8/53.8
Tread	mm (in)	1140 (45)

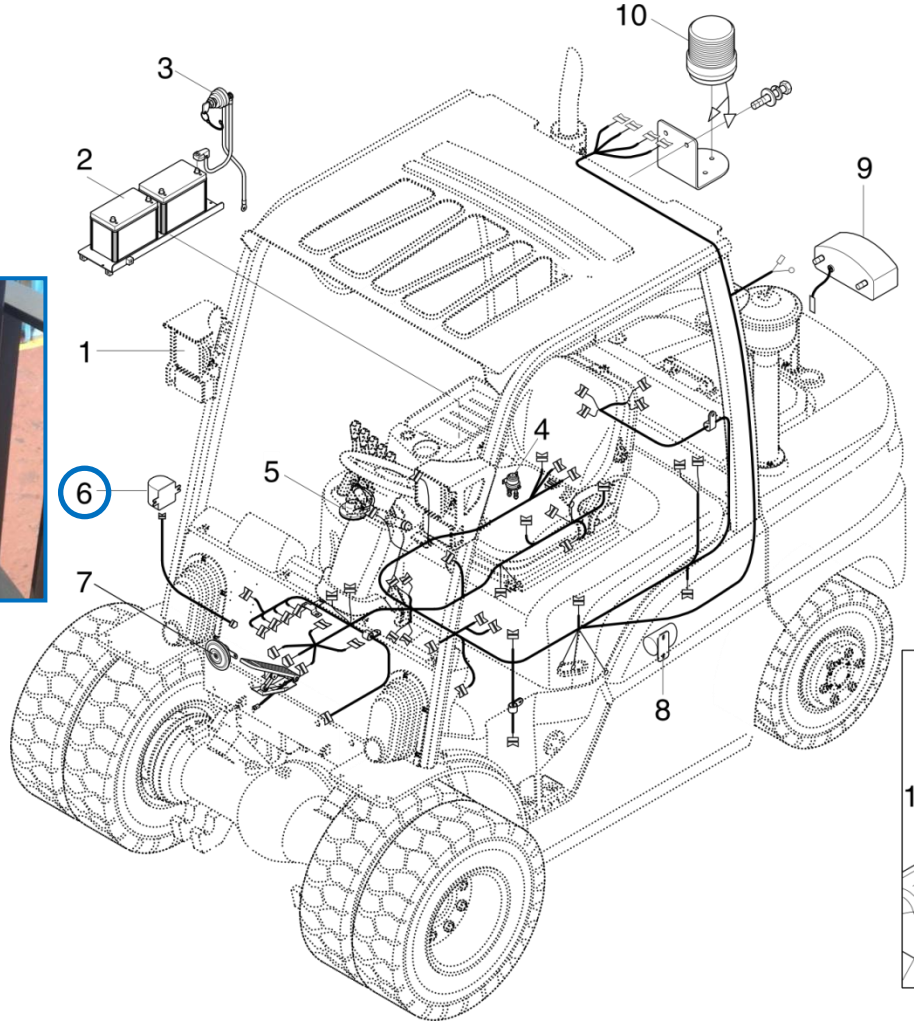
Electric system

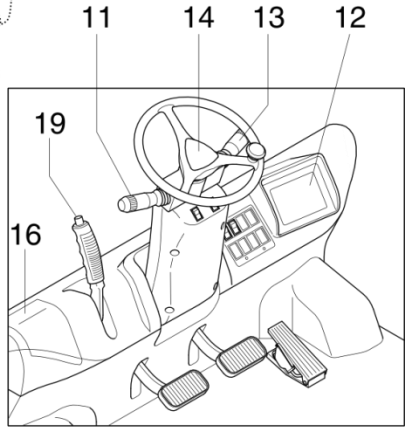


Electric system – electric diagram



Electric system – components location



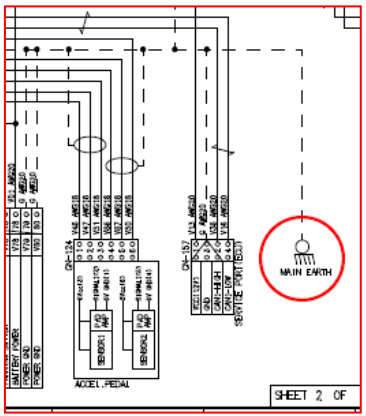


1 Work lamp
2 Battery
3 Master switch
4 Start relay
5 Fuel sender
6 Mast angle sensor*
7 High horn
8 Back buzzer
9 Licence plate lamp
10 Beacon lamp
11 Forward-reverse lever
12 Cluster
13 Head lamp switch
Illumination lamp
Turn signal switch
14 Horn button
16 Brake oil switch
17 Work lamp switch (opt)
19 Parking lever

*Only mast angle indicator available, no option for auto-tilt

Electric system – tip

To avoid potential problems with gear shifting, please double re-check all ground connections to the machine frame



Electric system – tip

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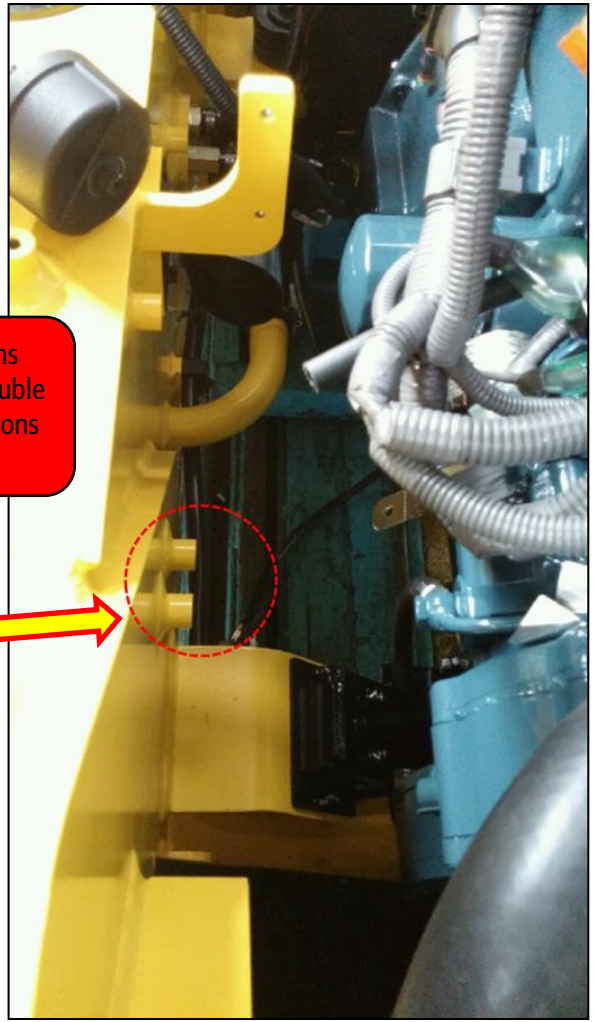
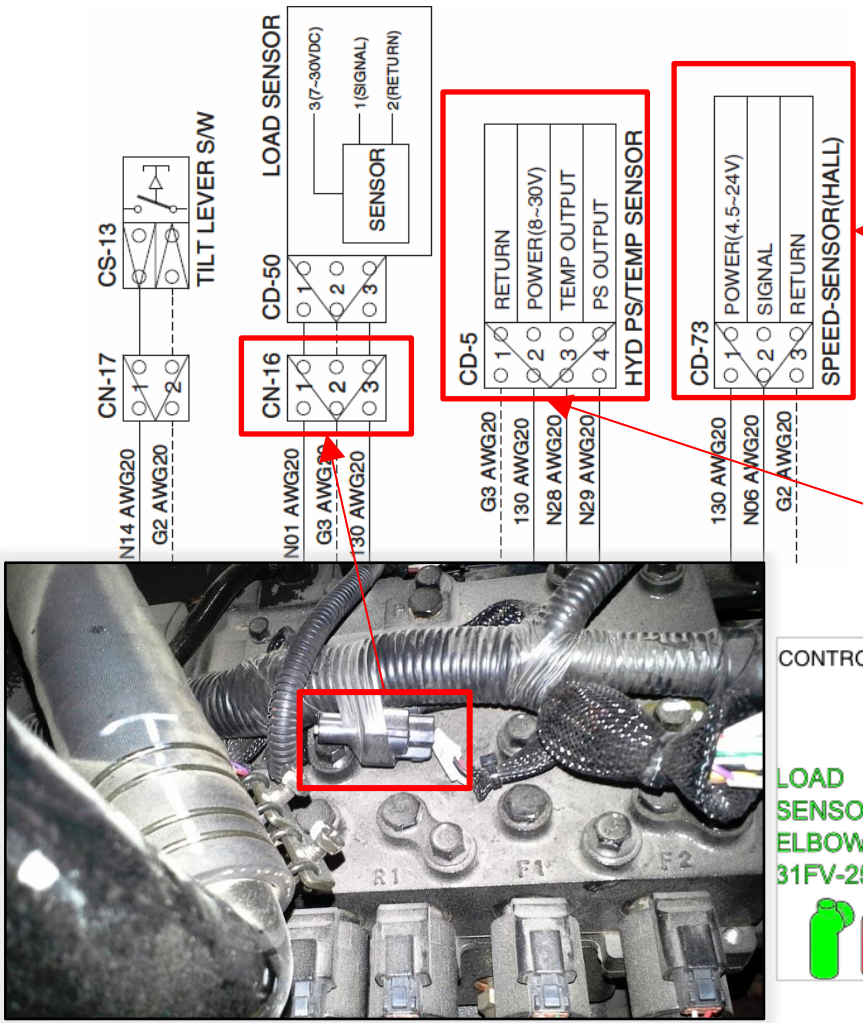
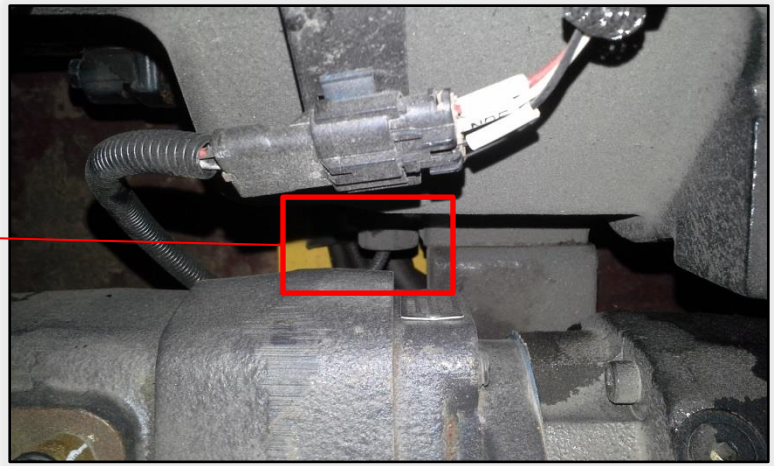
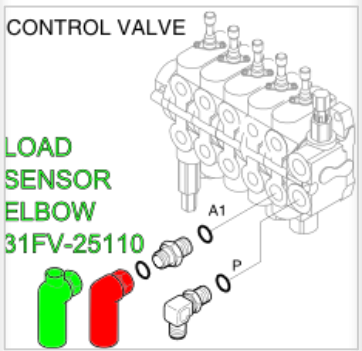


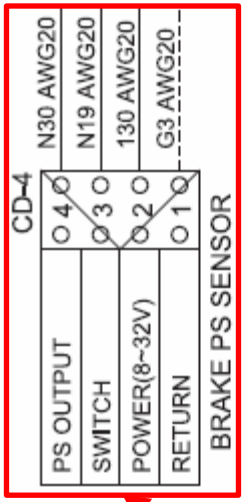
Electric system – sensors' location, examples

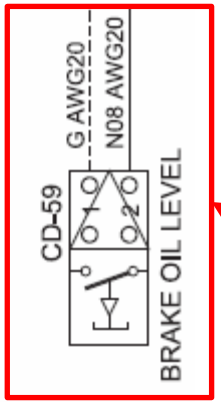


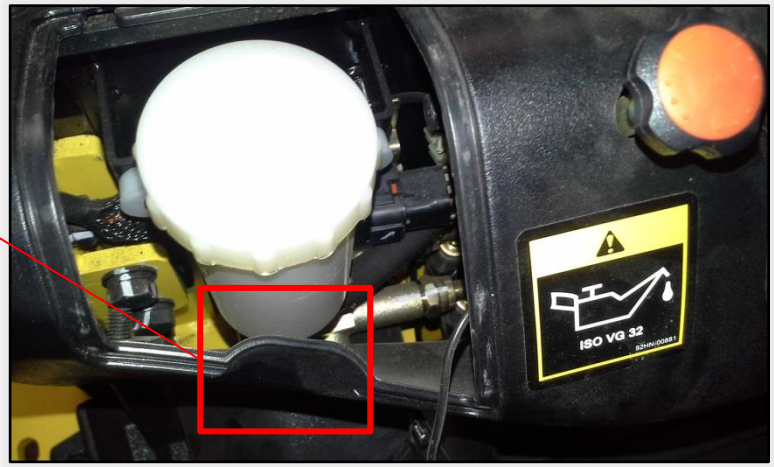


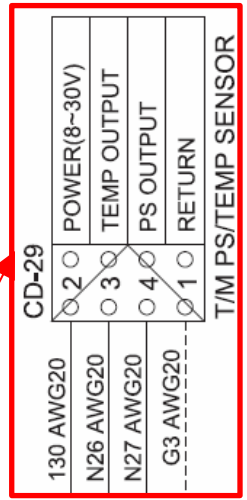


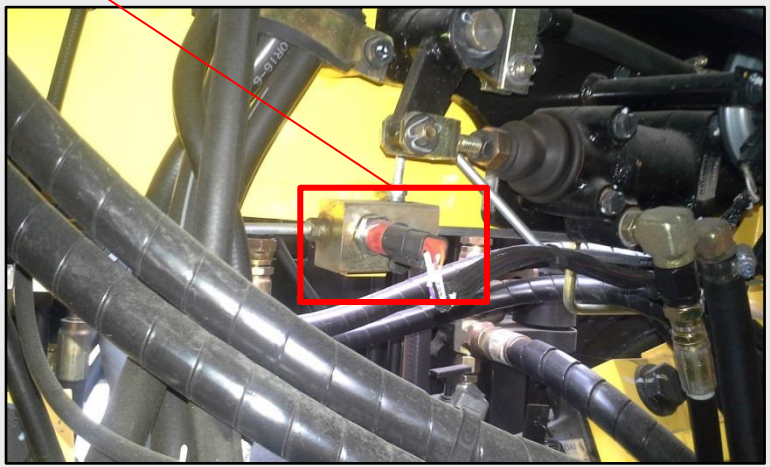
Electric system – sensors' location, examples

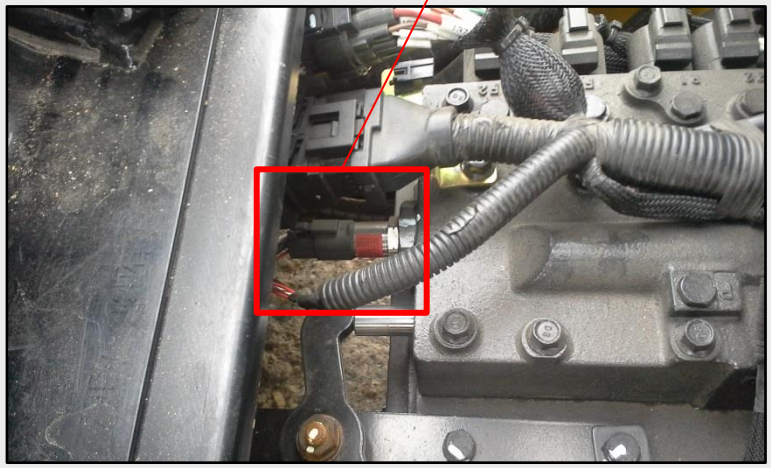




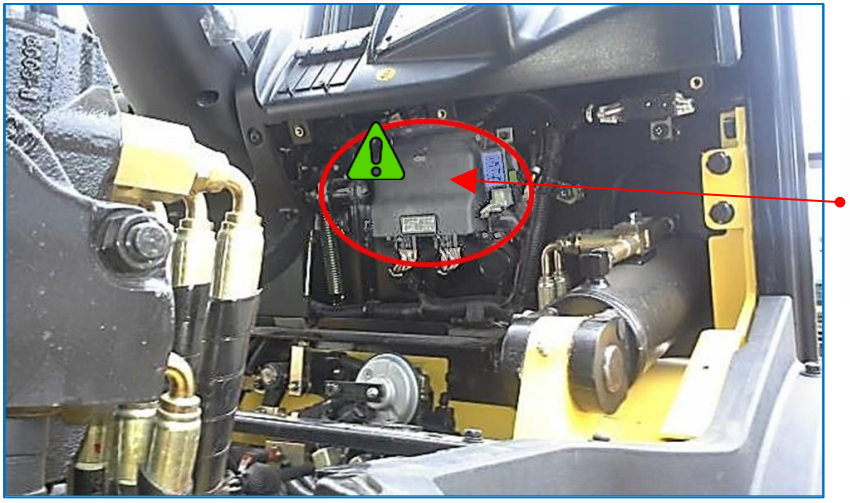








Electric system – components' location, examples



Internal G-sensor

CN-59IN(N CONNECTOR)

GROUND	34	O
RS232 RX(for test)	33	O
RS232 TX(for test)	32	O
RELAY-BRAKE LAMP	31	O
SENSOR-BRAK OIL PS	30	O
SENSOR-HYD OIL PS	29	O
SENSOR-HYD OIL TEMP	28	O
SENSOR-T/M OIL PS	27	O
SENSOR-T/M OIL TEMP	26	O
ANALOG-AIN(5V)	25	O
DIGITAL-AIN7(GND)	24	O
DIGITAL-AIN6(GND)	23	O
DIGITAL-AIN5(GND)	22	O
DIGITAL-AIN10(POWER)	21	O
E/G START SIGNAL	20	O
SWITCH-BRAKE	19	O
DIGITAL-IN(GND)	18	O
SWITCH-GEAR SELECTION	17	O
SWITCH-AIN11(HIGH REGEN)	16	O
SWITCH-PARKED REGEN.	15	O
SWITCH-TILT LEVER	14	O
SWITCH-SEAT	13	O
E/G CHECK LAMP	12	O
E/G PREHEAT LAMP S/W	11	O
S/W-PG EMPTY PS	10	O
SWITCH-PARKING	9	O
SWITCH-BRAKE OIL LEVEL	8	O
ANALOG-AIN(RESISTOR)	7	O
SPEED SENSOR(HALL)	6	O
SPEED SENSOR(VRS)	5	O
SENSOR-FUEL LEVEL	4	O
SENSOR-COOLANT TEMP	3	O
ANALOG-AIN7(5V)	2	O
SENSOR-CANCEL INDICATOR	1	O

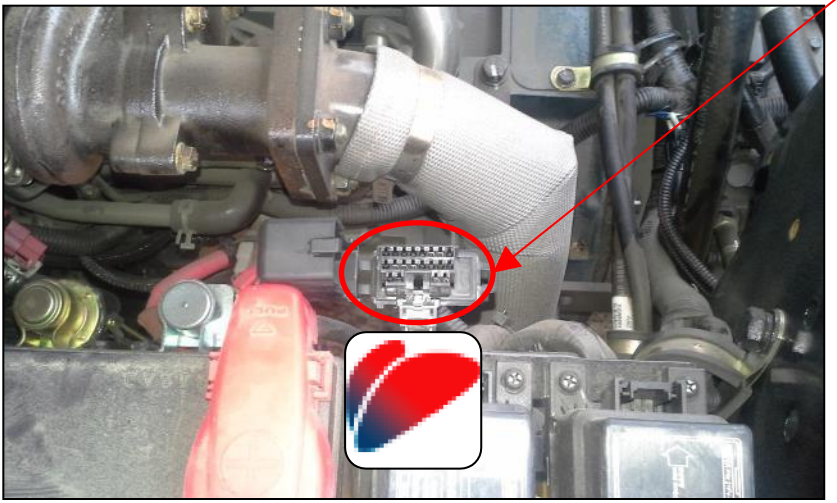
MCU

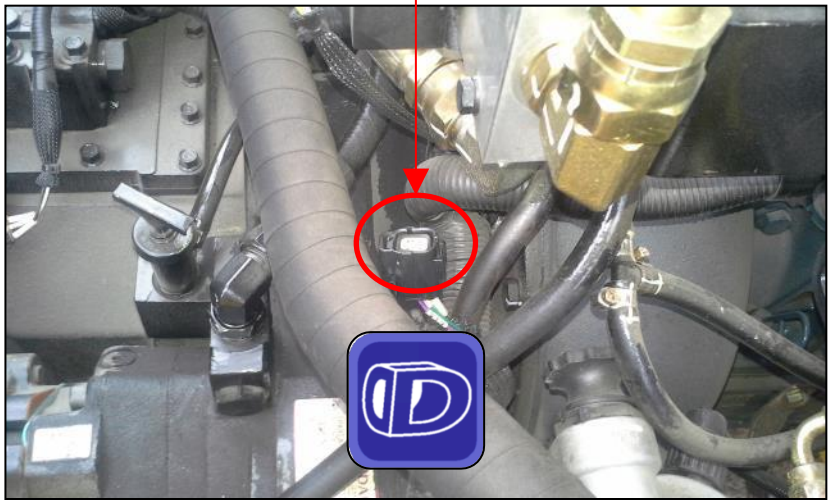
CN-59IM(M CONNECTOR)

GROUND	34	O
GROUND	33	O
5V OUTPUT	32	O
RELAY-E/G PREHEAT	31	O
5V RETURN	30	O
CAN2-(500K)	29	O
CAN2-H(500K)	28	O
CAN2-H(SHIGH(500K)	27	O
DIGITAL-OUT11	26	O
DIGITAL-OUT10	25	O
DIGITAL-OUT9	24	O
CAN1-(250K)	23	O
CAN1-L(DW(250K)	22	O
CAN1-H(IGH(250K)	21	O
SWITCH-WATER IN FUEL	20	O
SWITCH-AIR INTAKE PS	19	O
SWITCH-E/G OIL PS	18	O
SWITCH-NEUTRAL GEAR	17	O
SWITCH-REVERSE GEAR	16	O
SWITCH-FORWARD GEAR	15	O
SWITCH-FUEL WARMER	14	O
SWITCH-HH TURN	13	O
SWITCH-L-H TURN	12	O
ALTERNATOR-L	11	O
RELAY-HYD AUTO REGEN	10	O
RELAY-AUTO SHIFT	9	O
RELAY-AUTO LEVEL	8	O
WARNING BUZZER	7	O
RELAY-ATTACH CUT	6	O
RELAY-TRAVEL CUT	5	O
RELAY-ANTI RESTART	4	O
RELAY-AUTO PARKING	3	O
KEY ON POWER	2	O
BATT. POWER	1	O

MCU and CLUSTER upgrade connector (FL-CDT)

Kubota service tool connector (DIAGMASTER)





Electric system – electric diagram (power circuit)

1. POWER CIRCUIT

The negative terminal of the battery is grounded to the machine chassis.
When the start switch is in the off position, the current flows from the positive battery terminal.

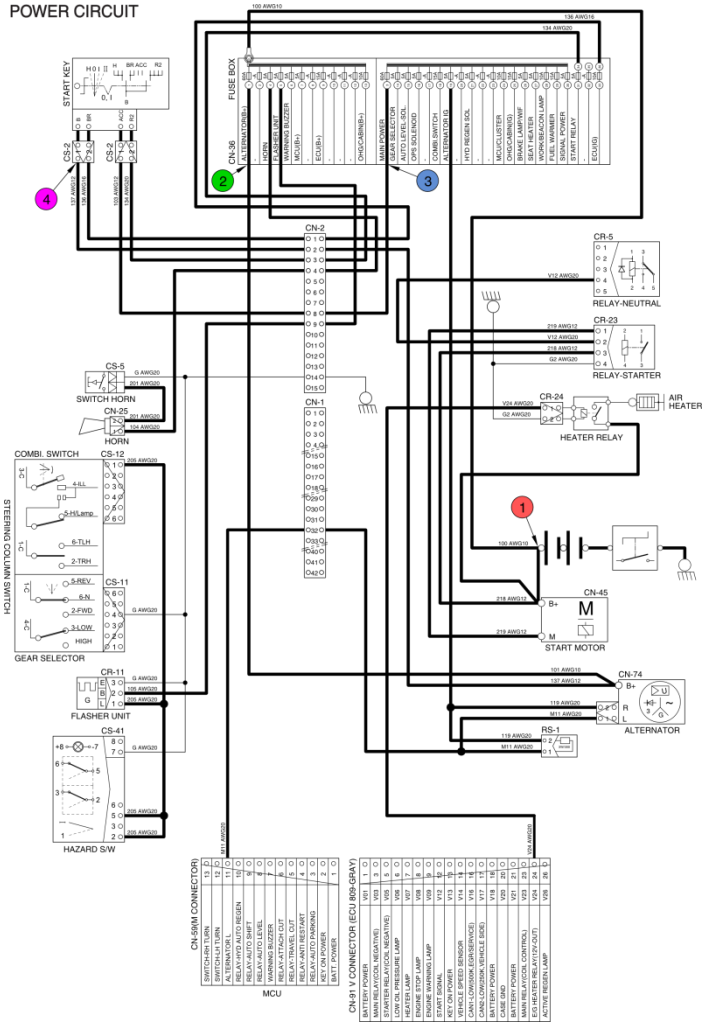
1) OPERATING FLOW

Battery(+) → Start motor [CN-45 (B+)]
- → Heater relay [CR-24] → Air heater
- → Start relay [CR-23]
- → Fuse box [CN-36 (1)] → I/conn [CS-2 (1)] → Alternator [CN-74 (B+)] → I/conn [CN-2 (2)]
  - → Start switch [CS-2 (1)]
- → Fuse box [No.4] → I/conn [CN-2 (4) → Horn [CN-25 (1)]
- → Fuse box [No.5] → I/conn [CN-2 (9)] → Flasher unit [CR-11 (2)→(1)]
  - → Hazard switch [CS-41 (5, 2)]
  - → Combi switch [CS-12 (1)]

2) CHECK POINT

Engine	Key switch	Check point	Voltage
OFF	OFF	① - GND (Battery(+)) ② - GND (Fuse No.1) ③ - GND (Fuse No.3) ④ - GND (Start key)	24V

※ GND : Ground



Electric system – electric diagram (starting circuit)

2. STARTING CIRCUIT

1) OPERATING FLOW

Battery (+) terminal → Fuse box [CN-36 (1)] → Alternator [CN-74 (B+)] → I/conn [CN-2 (2)] → Start switch [CS-2 (1)] → Start motor [CN-45 (B+)] → Start relay [CR-23]

※ The engine can be started only when the gearshift is in neutral position.

(1) When start key switch is in ON position

Start switch ON [CS-2 (2)] → I/conn[CN-2 (1)] → Fuse box [No.36 →33] → ECU (IG)

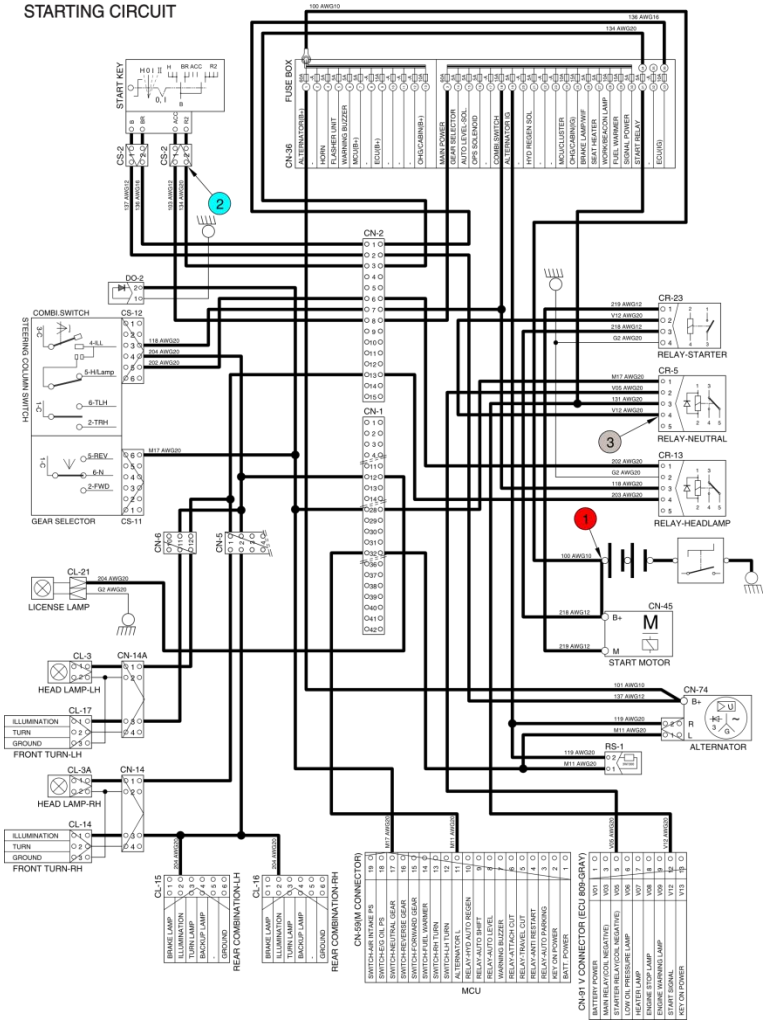
(2) When start key switch is START position

Start switch START [CS-2 (2)] → I/conn [CN-2 (3)] → Fuse box [No. 34 →31] → Neutral relay [CR-5(3) → (4)] → Start relay [CR-23]; ECU [CN-91 (12)]

2) CHECK POINT

Engine	Key switch	Check point	Voltage
Running	ON	1 - GND (Battery B+) 2 - GND (Start key) 3 - GND (Neutral relay)	24V

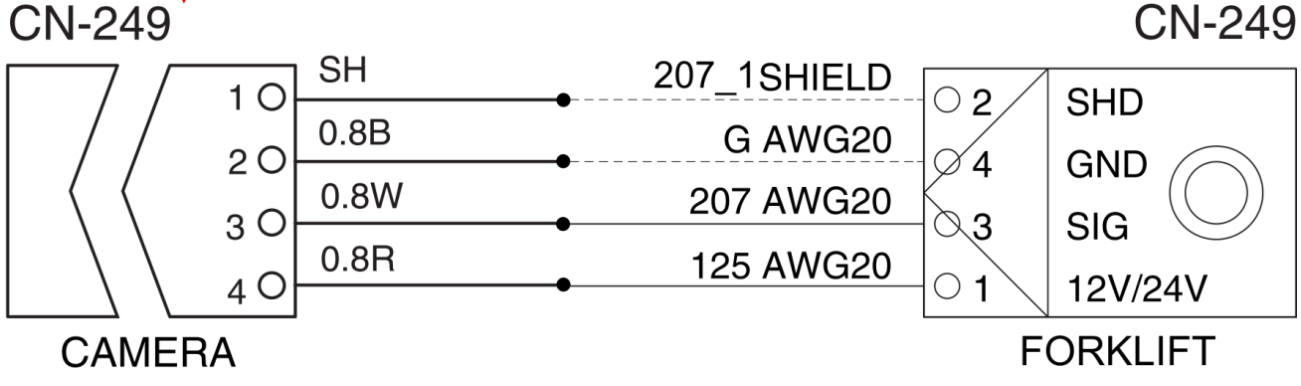
※ GND : Ground



Electric system – extra: rear camera as front camera

For this retrofitting we use the ready harness, located in the rear of OHG.
Part number of the camera to be ordered – **21AB-30041**.
Installation of camera/bracket and harness must be arranged individually.

Connectors don't match
Manual modification is necessary



Electric system – Cluster

Electric system – Display

Electric system – Display

For Cluster software higher than v1.5

Auto re-gen active

Mast inclination

Fuel

Machine F/R inclination

Weight indicator

Hour meter

Park re-gen available

Speed indicator

E/G temperature

Machine L/R inclination

ODO meter

Electric system – Display – Warnings 01

S/No.	Warning lamp types	Symbol	Warning and indicator lamp	Causes and correction
1	Engine oil pressure warning		Engine oil pressure warning lamp	Engine oil pressure is low. Please the engine oil refill.
2	Engine warm-up indicator		Engine warm-up indicator lamp	Warm-up will be started.
3	Air cleaner warning		Air cleaner warning lamp	Replace the filter.
4	Water in fuel warning		Water in fuel warning lamp	Please drain the water of water separator.
5	Engine check warning		Engine check warning lamp	Check the failure code of cluster.
6	Engine stop warning		Engine stop warning lamp	Check the failure code of cluster.
7	DPF regeneration warning		DPF regeneration warning lamp	If necessary, display the regeneration DPF.
8	DPF inhibit indicator		DPF inhibit indicator lamp	DPF regeneration status is prohibited.
9	Exhaust high temperature warning		Exhaust system high temperature warning lamp	High temperature state of exhaust system.
10	Fuel warmer indicator		Fuel warmer indicator lamp	warming up the fuel.
11	TM oil temperature warning		TM oil temperature warning lamp	TM oil is over temperature condition.
12	Parking brake indicator lamp		Parking brake indicator lamp	Parking brake is operating.
13	Brake oil level warning		Brake oil level warning lamp	Brake oil level is low. Please the brake oil refill.
14	Battery charging warning		Battery charging warning lamp	Charging the battery is bad. Please check alternator and wiring.
15	Tilt lock indicator		Tilt lock indicator lamp	Auto-leveling is the operational status.
16	OPSS indicator		OPPS indicator lamp	OPPS is working. Blocking driving or operation of the device.
17	Fuel warning		Fuel warning lamp	Fuel level is low. Please the diesel oil refill.
18	Coolant temperature warning		Engine coolant temperature warning lamp	Engine coolant is over temperature condition.
19	T/M oil warning or clutch protection		T/M oil warning lamp	Clutch protection system operating or TM oil level is low. Please the T/M oil refill. *
20	Communication error warning		Communication error warning lamp	Communication with between MCU and ECU is fail condition. Check communication line.
21	Communication error warning		Communication error warning lamp	Communication with between CLUSTER and MCU is fail condition. Check communication line.
22	LH Turn indicator		LH Turning pilot lamp	-
23	RH Turn indicator		RH Turning pilot lamp	-
24	Forward first gear		Forward first gear indicator lamp	-
25	Forward second gear		Forward second gear indicator lamp	-
26	Reverse first gear		Reverse first gear indicator lamp	-
27	Reverse second gear		Reverse second gear indicator lamp	-

Electric system – Display – Warnings 02

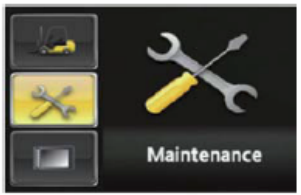
28	Expendables		expendables replacement	light up only 3 minutes since KEY ON, and then light off.
29	Engine warm-up		Ignition ON	Start crancking after light off
30	Speed warning indicator		Set speed exceeded	Alarm buzzer will ring every two seconds
31	DPF regeneration		Auto Regeneration Activated	DPF in Lv1 and auto re-gen ongoing
32	DPF regeneration		Parked Regeneration Available	DPF in Lv2, parked regeneration possible

* - Conditions:

When T/M main pressure stays between 0,8~5,7 bar for more than 2 seconds = warning lamp ON

When accelerator is pressed more than 10 seconds at above T/M main pressure(condition. 1) = warning lamp ON + buzzer sound

Electric system – Display – Structure – old [soft ~MCU v1.6; CLUSTER v1.5]

No	Main menu	Sub menu	Explanation
1		Model select	Diesel, LPG
		Vehicle tilt Initialize	Vehicle tilt Initialize
		Weight sensor setup	Enter the cylinder cross section area , Adjust load weight, Weight display setup
		Ignition control setup	Ignition control, Change password
		Camera setup	Interoperate with reverse gear
		Auto-shift speed setup	1st gear-> Switching speed to 2nd gear, 2nd gear -> Switching speed to 1st gear
		DCSR speed setup	DCSR On, Block driving speed, Restore driving speed
		Maximum speed warning	Maximum speed warning
		MCU Monitor information	MCU/Monitor Information
2		Failure History	Current engine failure, Engine failure history
		Expendables management	Change oil and filter replacement cycle
		I/O Information	Analog Input, Digital input/output
		A/S Contact	Change A/S contact
3		LCD Brightness	Automatic, Manual
		Time Setup	Clock
		Unit Setup	Speed, Weight, Temperature, Pressure, Date type
		Language Setting	Korean, English

Electric system – Display – Structure – new [soft MCU v1.6; CLUSTER v1.5~]

Main menu		Sub menu	Explanation
	password	Model select	Diesel, LPG, capacity
		Tilt setup	Calibration of tilt sensors
		Weight sensor setup	Calibration of pressure sensor, lift cylinder cross area
		ESL setup	**on/off, delay**
		Camera	on/off; settings
		Auto-shift speed setup	on/off; settings
		DCSR speed setup	on/off; settings
		Maximum speed warning	on/off; settings
		MCU Monitor information	info
	password	Engine failure history	info
		Maintenance management	**confirmation/interval change**
		Signals information	**digital/analog; info [5 new analog signals added]**
		User password change	**! service password change ! 00000 → XXXXX !**
	open	LCD Brightness	
		Time Setup	
		Unit Setup	
		Language Settings	
		A/S Contact	
		ESL password setup	**Password setup/change**
		Maintenace management	**info**

ENTERING PASSWORD FOR EACH SUB-MENU IS NOT NECESSARY ANY MORE

On some of next slides you can find old configuration

Electric system – Display – Equipment – Model Select

Model select

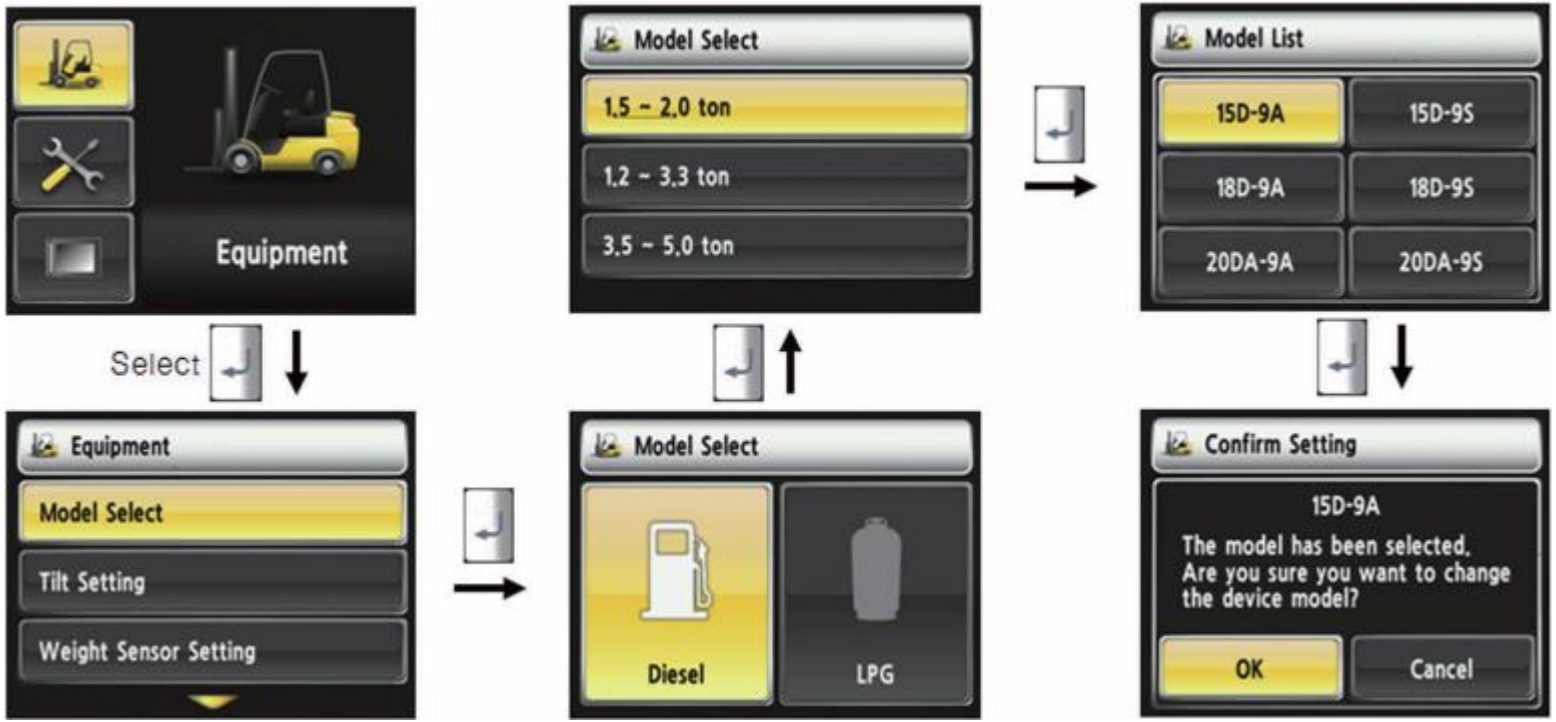
Device setup > Model select

Please select the fuel type.

Please select the vehicle capacity range.

Please select the exact model name.

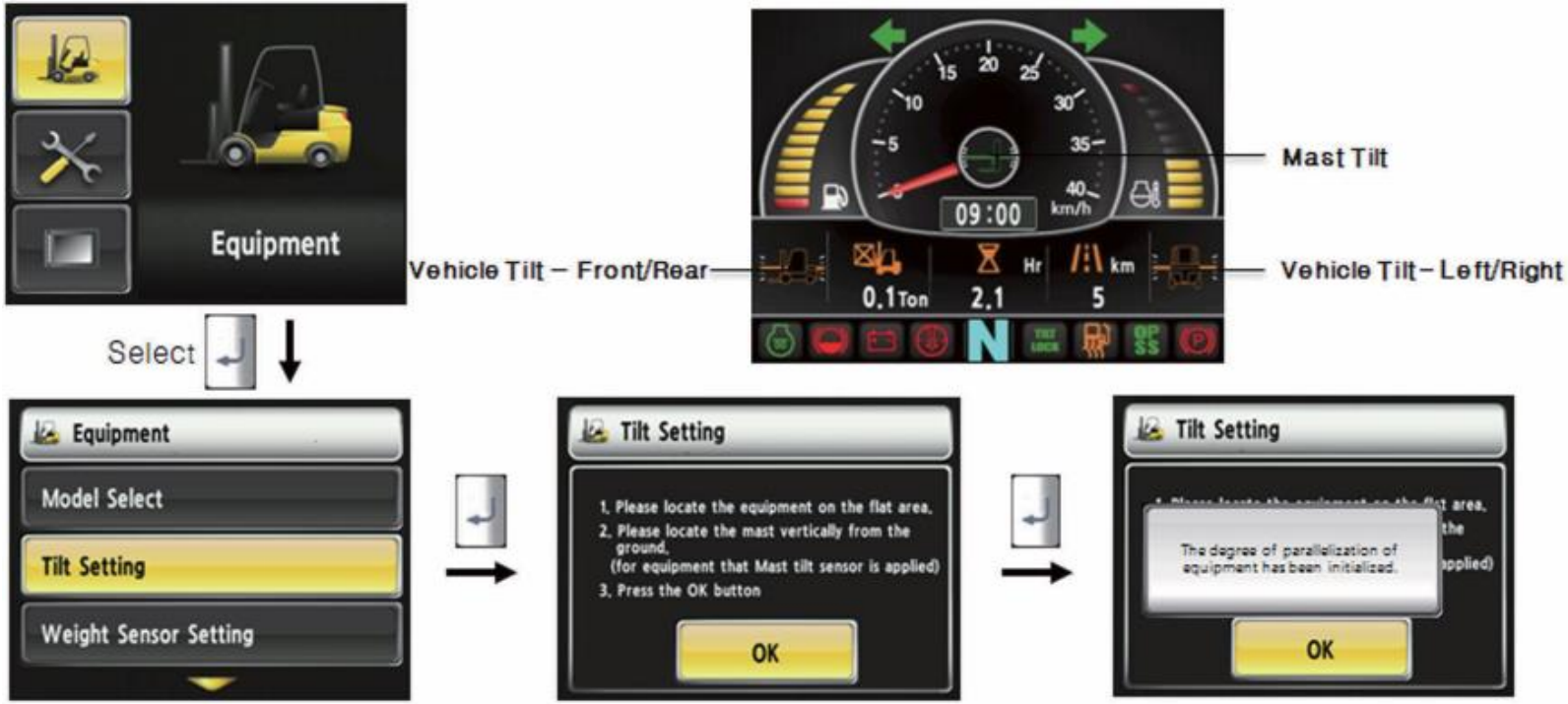
* Selection will be cancelled if press the cancel button or ESC
* To use full function of vehicle, exact model must be selected.



Electric system – Display – Equipment – Tilt setup

Tilt setup

The tilt sensor has already been initialized when deliver the vehicle from factory.
Initialize vehicle tilt if the tilt sensor figure or vehicle tilt is not horizontal in the flatland.
Vehicle set up > Initialize vehicle tilt
You must position the machine on flat horizontal surface.
*If tilt sensor for mast is mounted (optional), locates the mast vertically.
*Mast maximum angle depends on the vehicle.



Electric system – Display – Equipment – Weight indicator 01

Weight sensor set up

The weight sensor has already been set when deliver the vehicle from factory.

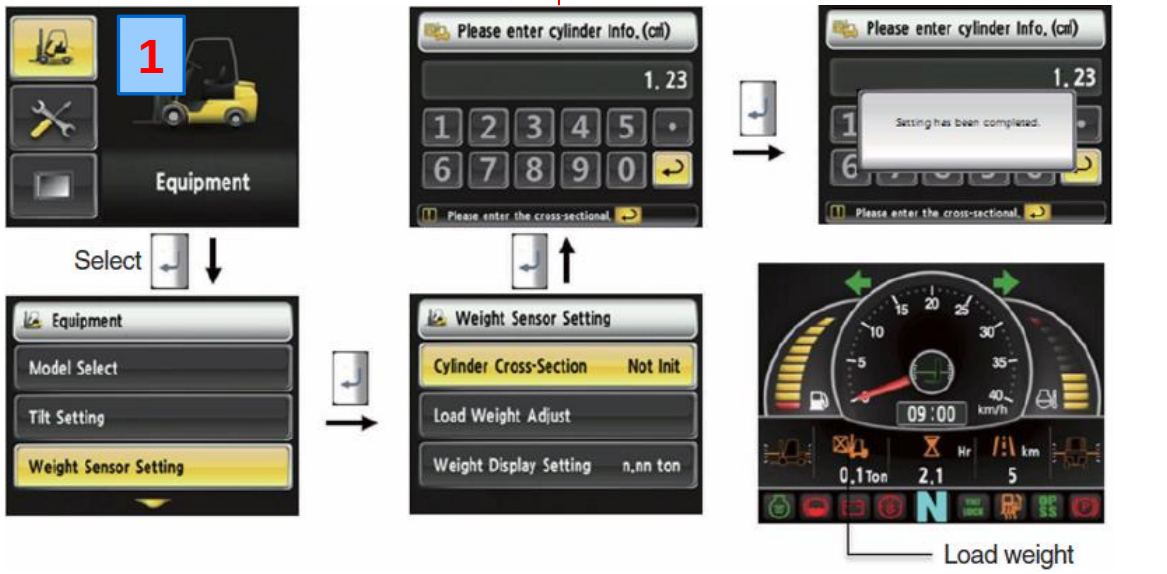
Device setup > Weight sensor setup

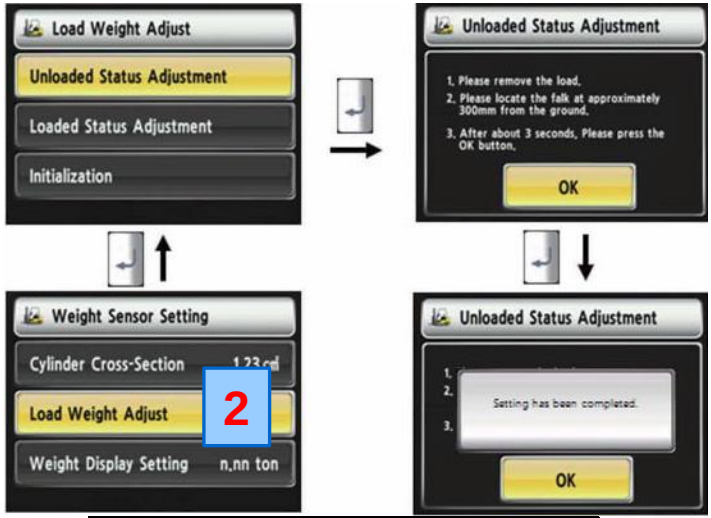
There are 4 steps to activate weight indicator

1. A cylinder cross sectional area value will be displayed in initial screen, please enter the cross sectional area using scroll buttons and ENTER button.

Please finish setup using ENTER button when input is done.

2. Unload condition. Wait 3 seconds after lifting no-load fork approximately 30 cm from the ground level, then press OK.

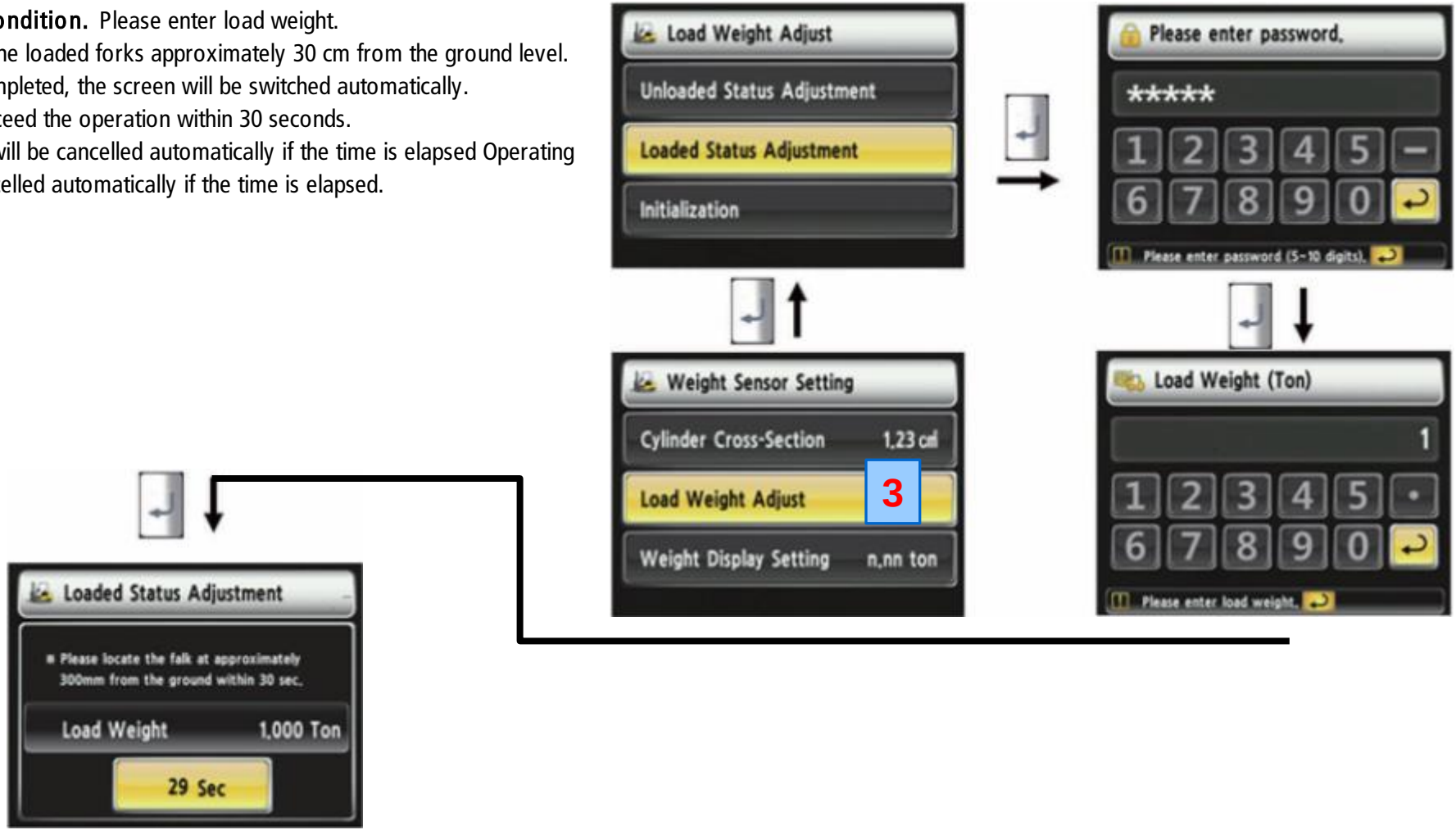




No	Model	Mast Type	Cyl. Cross Section(cm^2)
1	15/18/20D-9 15/18/20D-9S	V	**31.81**
		VF	**44.18**
		TF	**33.18**
		TS	**39.27**
2	22/25D-9 22/25D-9T 22/25D-9S 22/25D-9W	V	**39.27**
		VF	**44.18**
		TF	**44.18**
		TS	**47.52**
		QF	**88.36**
3	30/33D-9 30/33D-9T 30/33D-9S 30/33D-9W	V	**47.52**
		VF	**56.75**
		TF	**56.75**
		TS	**56.55**
		QF	**88.36**
4	35/40/45D-9A 35/40/45D-9S	V	**66.37**
		VF	**86.59**
		TF	**86.59**
		TS	**88.36**
5	50DA-9A 50D-9SA	V	**76.97**
		VF	**86.59**
		TF	**86.59**
		TS	**88.36**

Electric system – Display – Equipment – Weight indicator 02

3. Load condition. Please enter load weight.
Please lift the loaded forks approximately 30 cm from the ground level.
If set is completed, the screen will be switched automatically.
Please proceed the operation within 30 seconds.
Operating will be cancelled automatically if the time is elapsed Operating will be cancelled automatically if the time is elapsed.

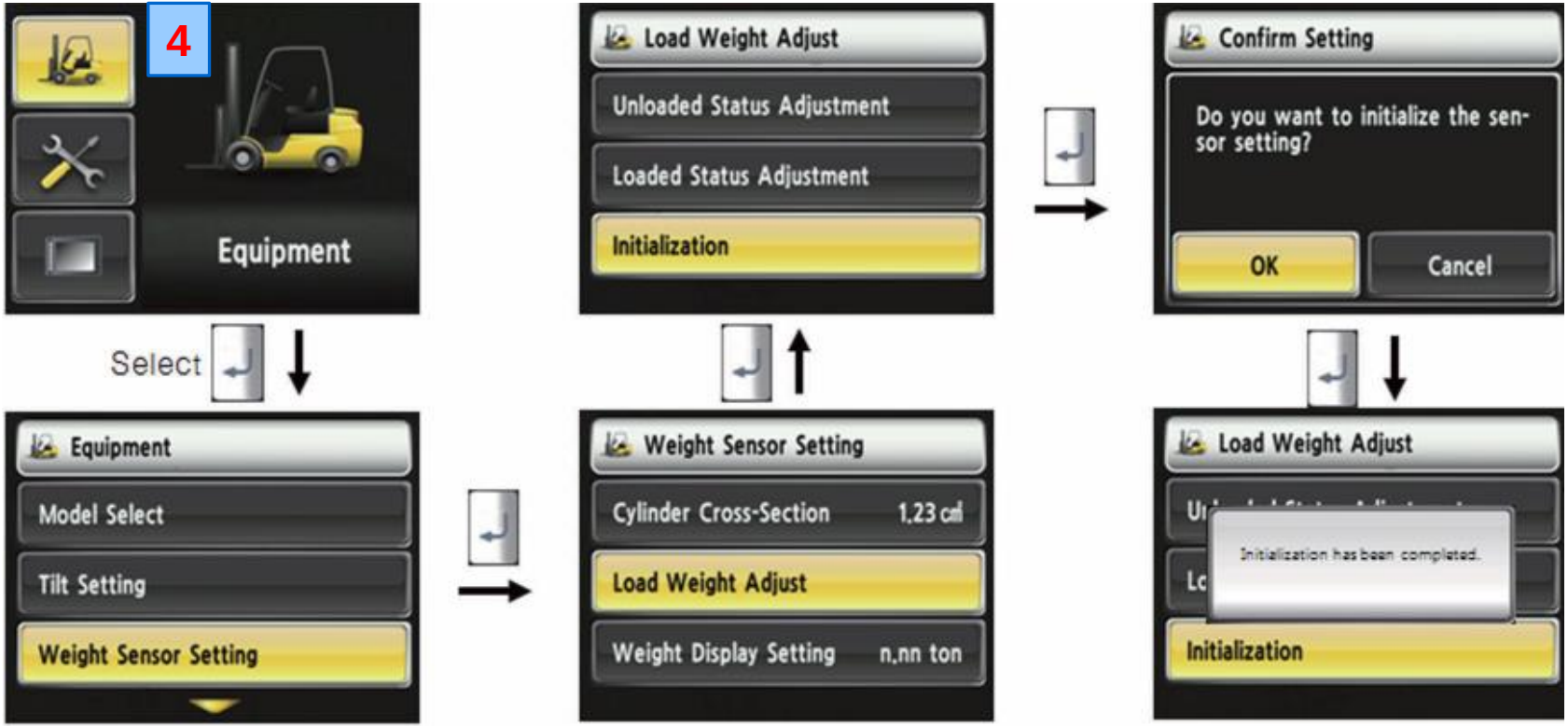


Electric system – Display – Equipment – Weight indicator 03

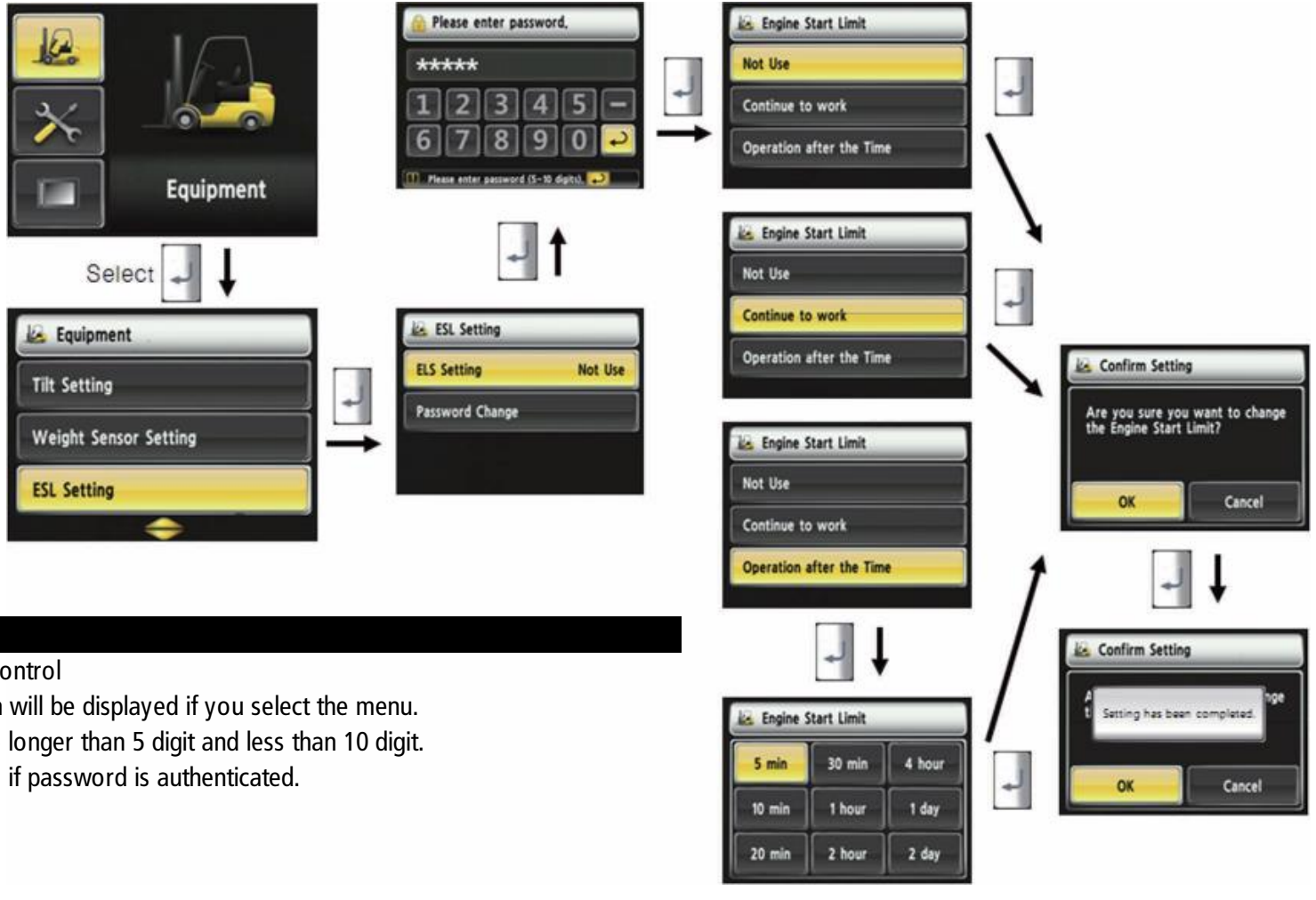
4. Initialization.

Initialization

Necessary in case of sensor or MCU exchage to delete old settings



Electric system – Display – Equipment – ESL



ESL Settings

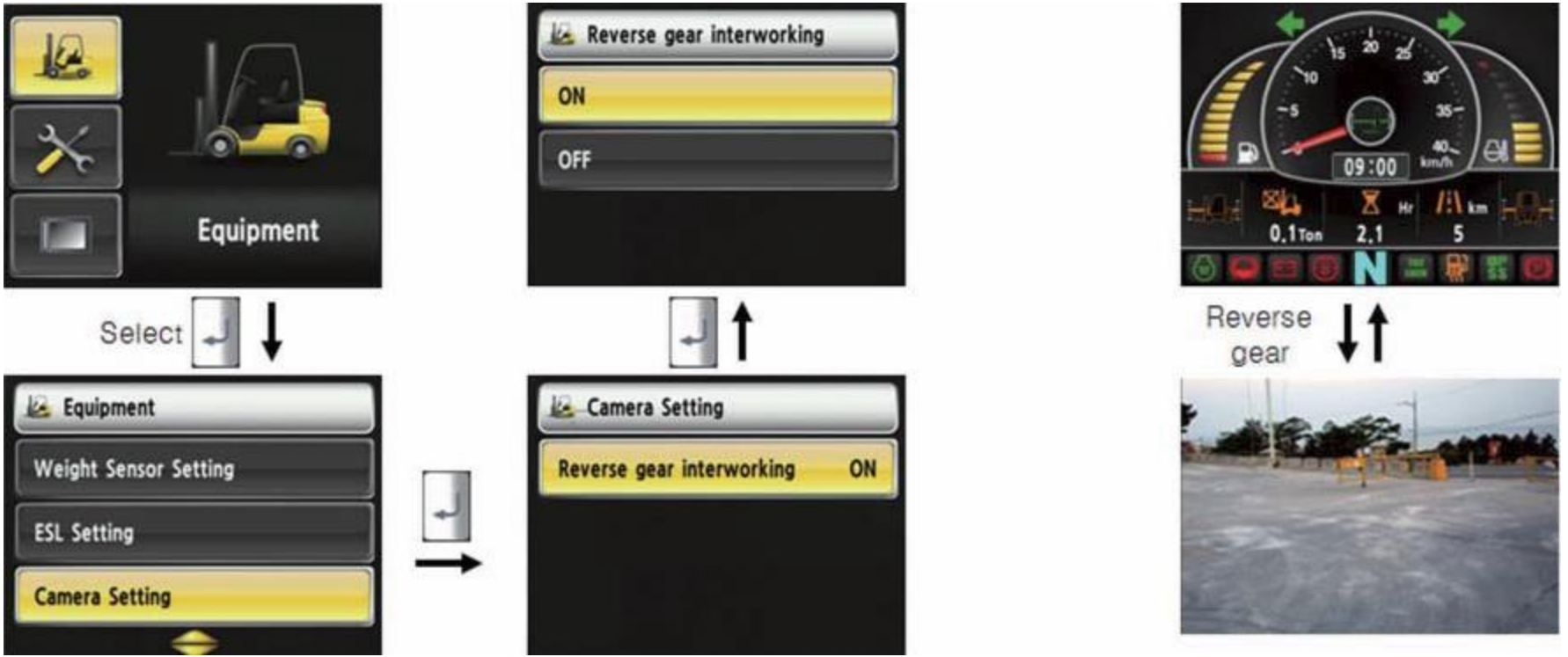
Device Setup > Ignition control

Password request screen will be displayed if you select the menu.

Password length must be longer than 5 digit and less than 10 digit.

Next step is allowed only if password is authenticated.

Electric system – Display – Equipment – Camera

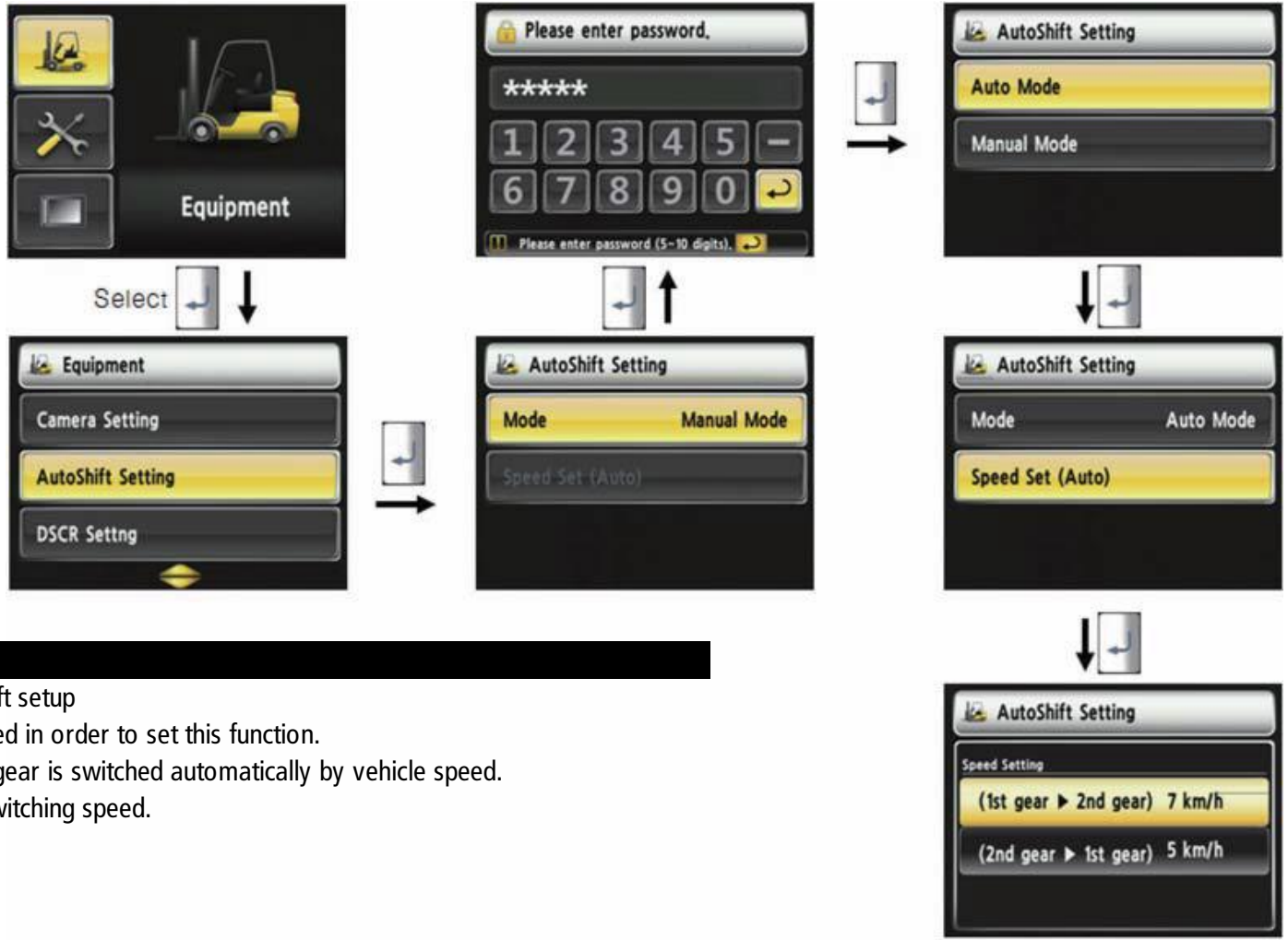


Camera setup

Device setup > Camera setup

After set the reverse gear interoperation as ON, the screen will be changed from main screen to camera mode if put gear into reverse, and if the gear is changed, screen will be back to the main screen.

Electric system – Display – Equipment – Auto-Sift Mode



Auto-shifting mode

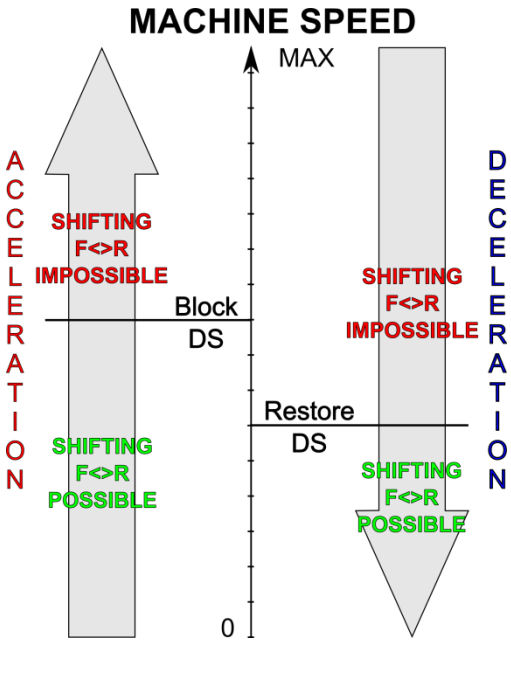
Device Setup > Auto-Shift setup

User password is required in order to set this function.

In automatic mode, the gear is switched automatically by vehicle speed.

Enable to set the gear switching speed.

Electric system – Display – Equipment – DCSR



Direction Change Shock Reliefe

Device setup > DCSR setup

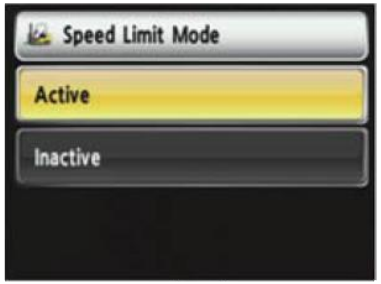
User password is required in order to set this function.

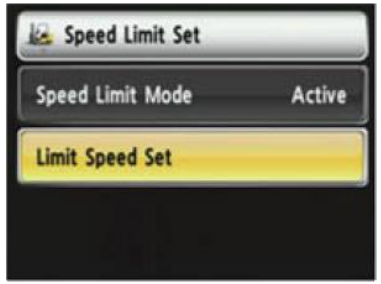
If the setting is ON, driving will be blocked if the driving speed is over the specified speed.

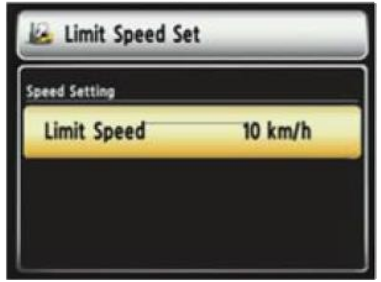
Driving will be continued if the driving speed is not over the specified speed

Electric system – Display – Equipment – Speed Warning

Select







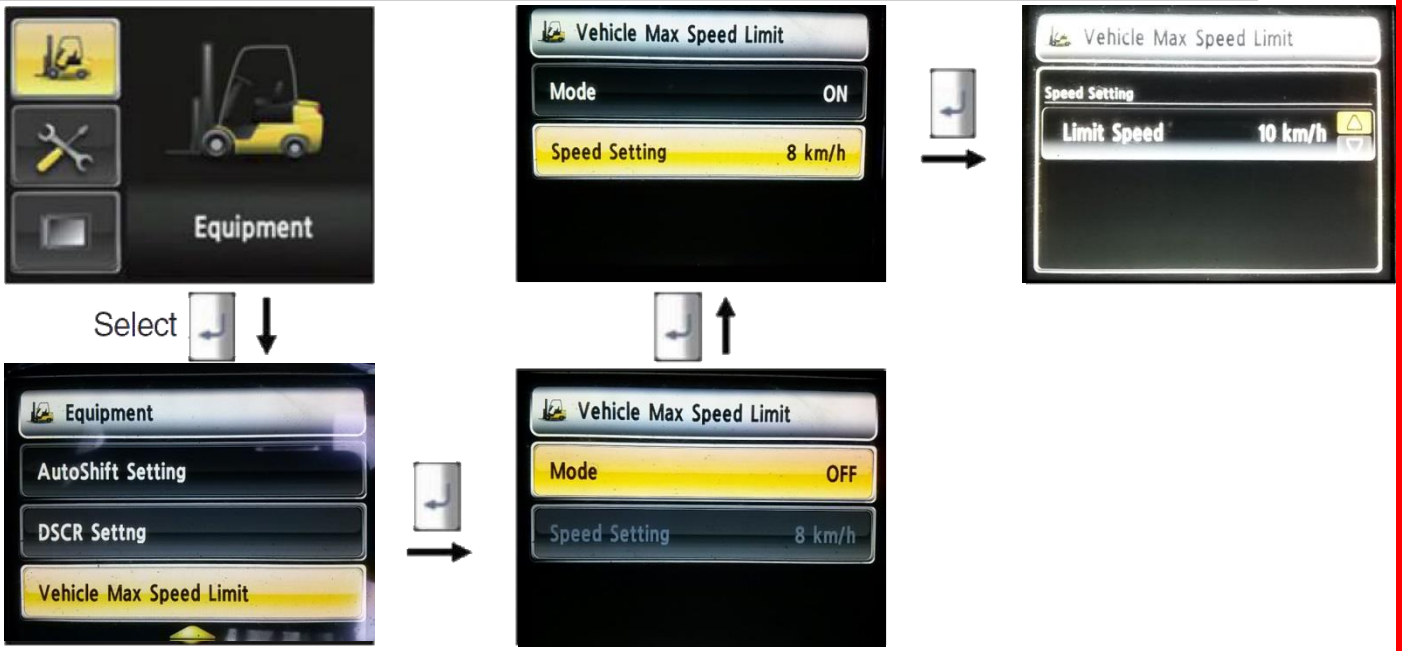
Driving speed warning

Device Setup > Driving speed warning

User password is required in order to set this function.

If alarm is set as enable, setting speed will be displayed on the screen, and the buzzer rings every 2 seconds

Electric system – Display – Equipment – Speed Limiter



Driving speed limit

Device Setup > Driving speed Limit

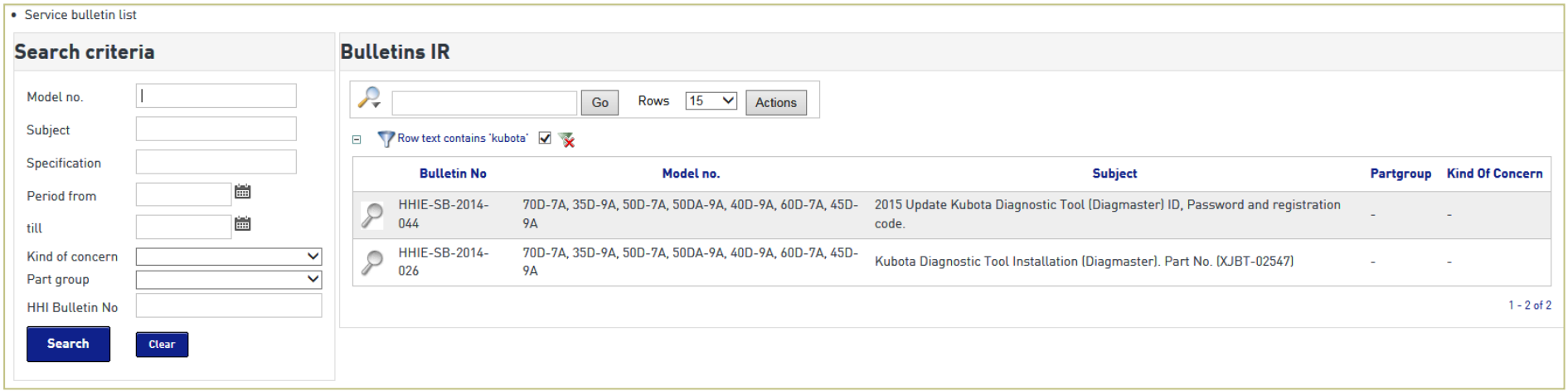
Minimum speed = 8 km/h

Package is available on-line in CERES, Additional Info FK section, IC forklifts

Electric system – Display – Equipment – Speed Limiter

For update you need:

1. Diagmaster tool (KUBOTA) + preinstalled software - refer to Service Bulletins on-line:

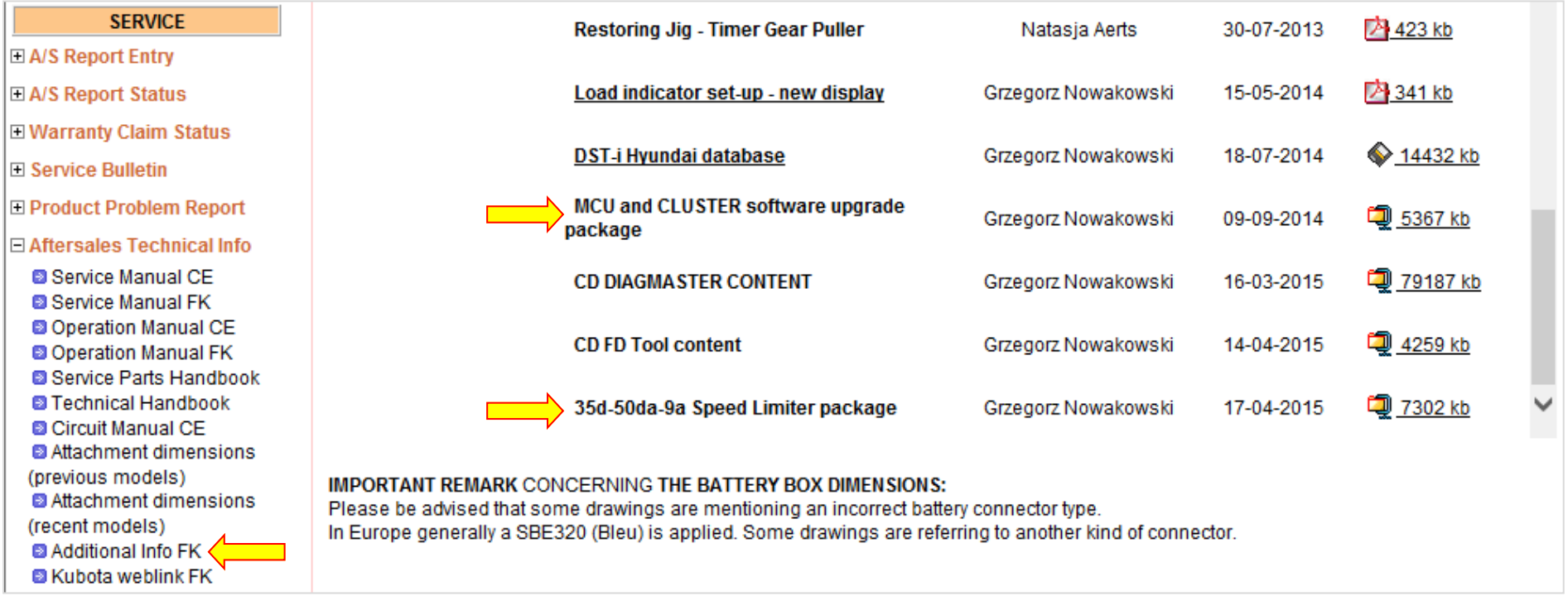


See also slide no 106

Electric system – Display – Equipment – Speed Limiter

For update you need:

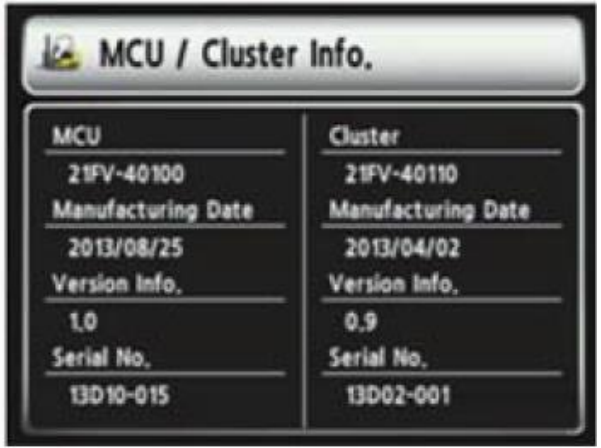
2. FL-CDT tool (CLUSTER and MCU) + preinstalled software - refer to information on-line:



See also slide no 105

Electric system – Display – Equipment – Information

Select

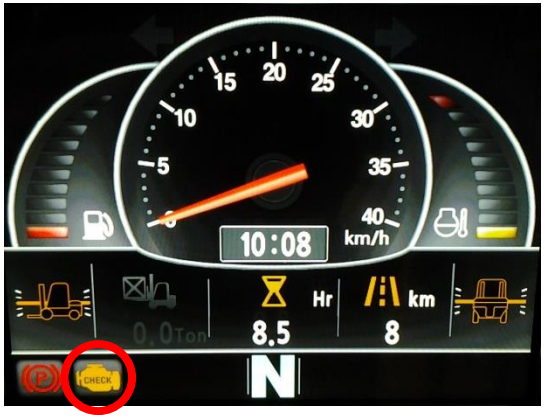


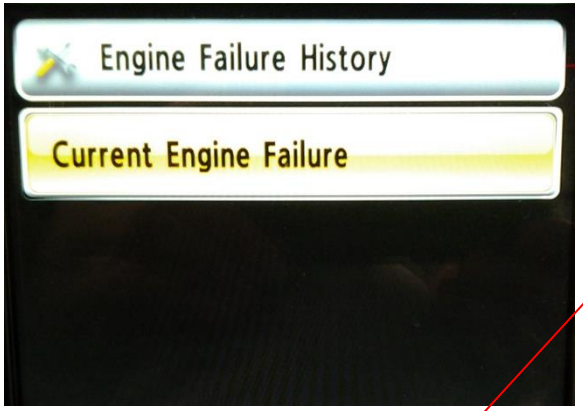
MCU / Monitor information

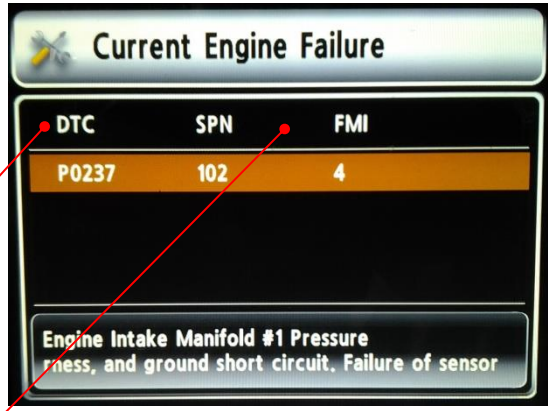
Device Setup > MCU/Monitor information

MCU, manufactured date and version of monitor, and serial number will be displayed

Electric system – Display – Maintenance – Engine error codes

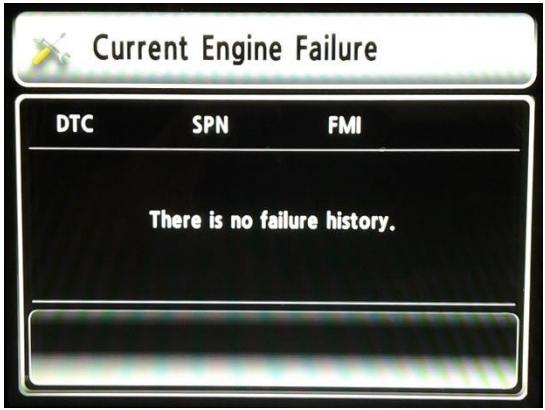






Suspect Parameter Number
Failure Mode Identifier

Repair

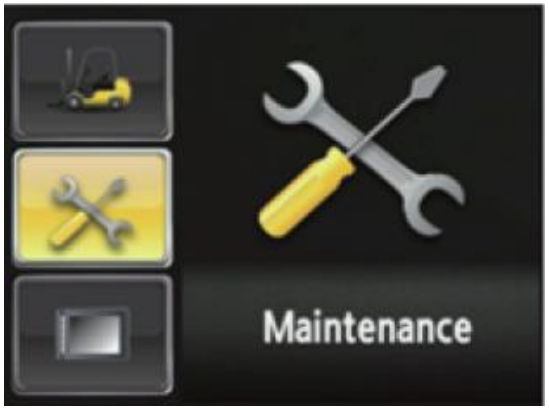


KUBOTA V3800-CR-TE4 DM.pdf

Examples of SPI_FMI.pdf

Back to slide 106

Electric system – Display – Maintenance – Expendables 01



How to replace expendables

Device setup > Expendables management.

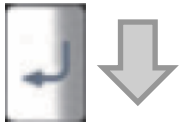
If the expendables replacement cycle has been passed, alarm will be displayed as ON.

Press the "Expendables replacement" if replaced the expendables.

Information about recent replacement (max. 9) will be displayed.

If you want to change the cycle, please press the "Change cycle" button.

Electric system – Display – Maintenance – Expendables 02



How to replace expendables

Device setup > Expendables management

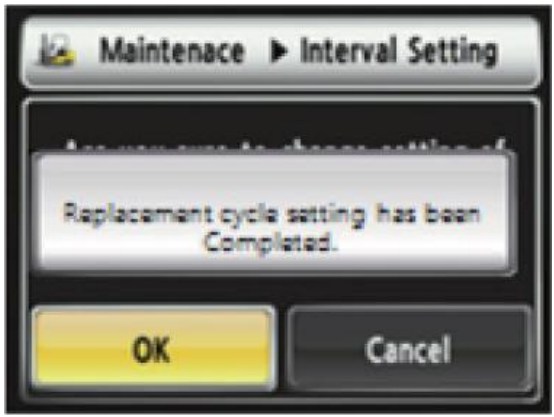
If the expendables replacement cycle has been passed, alarm will be displayed as ON.

Press the "Expendables replacement" if replaced the expendables.

Information about recent replacement (max. 9) will be displayed.

If you want to change the cycle, please press the "Change cycle" button.

Electric system – Display – Maintenance – Expendables 03



How to replace expendables

Device setup > Expendables management

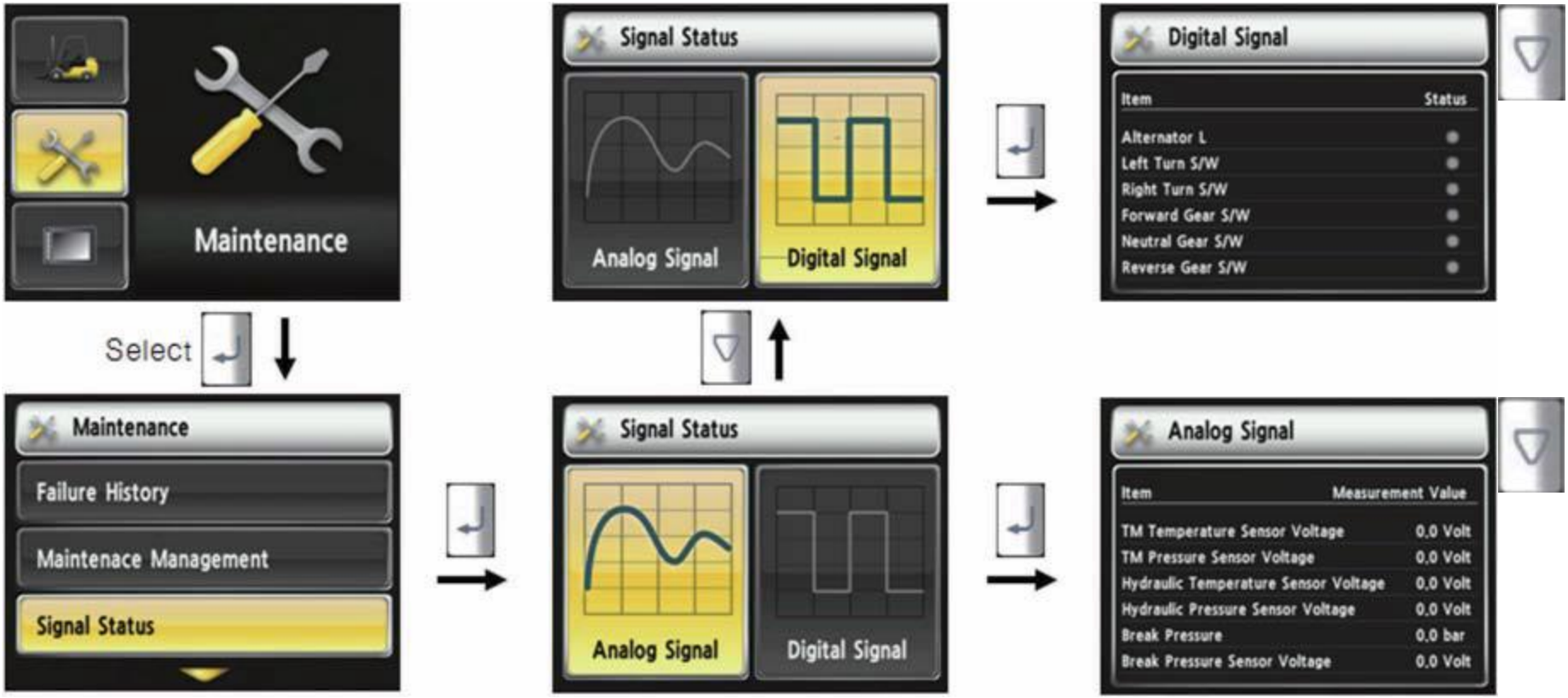
If the expendables replacement cycle has been passed, alarm will be displayed as ON.

Press the "Expendables replacement" if replaced the expendables.

Information about recent replacement (max. 9) will be displayed.

If you want to change the cycle, please press the "Change cycle" button.

Electric system – Display – Maintenance – Signals



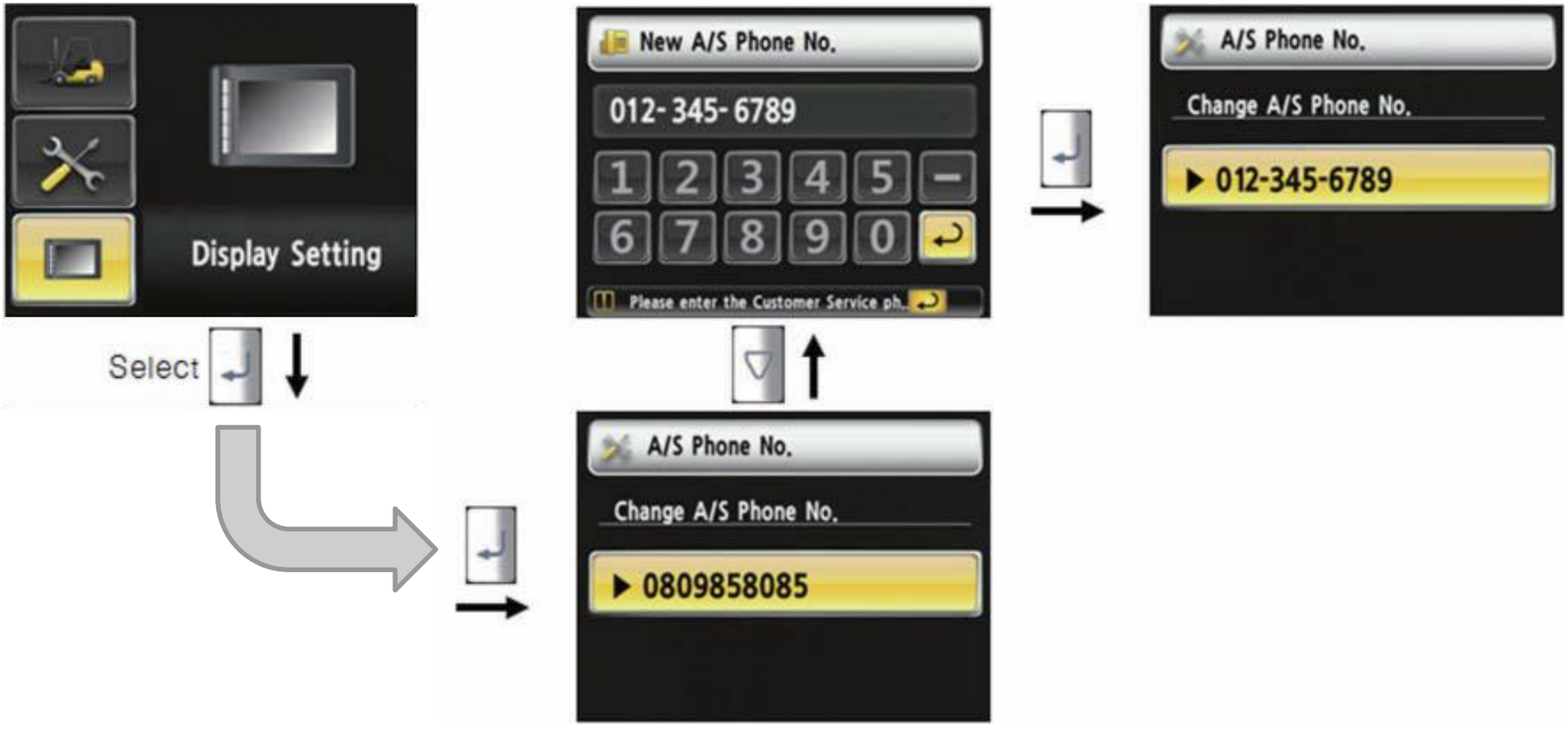
Electric system – Display – Maintenance – Change user password

Select

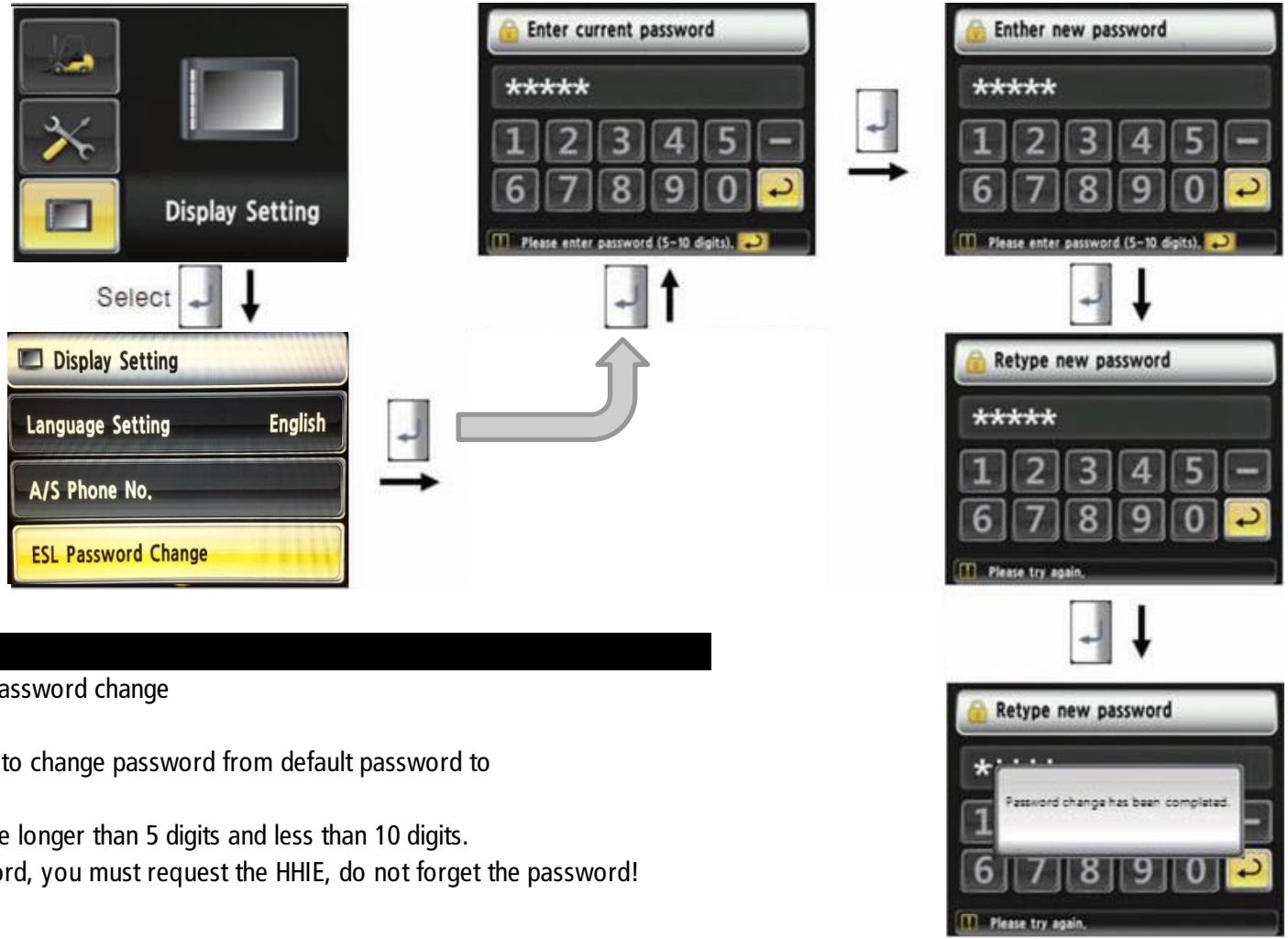
User password change

Before releasing machine to end-customer
please change default password "00000" to your own
and record it safely.

Electric system – Display – Display Settings – A/S info



Electric system – Display – Display Settings – ESL – Change password



Change password

Display settings > ESL Password change

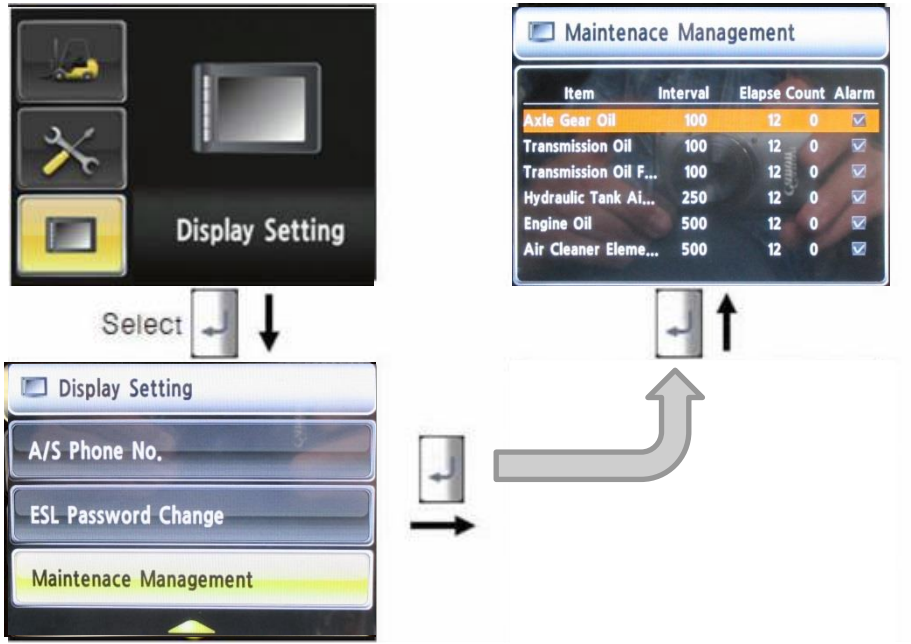
Change password

This function is to allow to change password from default password to user defined password.

Password length must be longer than 5 digits and less than 10 digits.

If you forget the password, you must request the HHIE, do not forget the password!

Electric system – Display – Display Settings – Maintenance info



Maintenance Informattion

Display settings > Maitenence management

Information about:

1. Interval between services
2. Elapsed hours from last maintenance
3. Number of services done
4. Alarm active/inactive

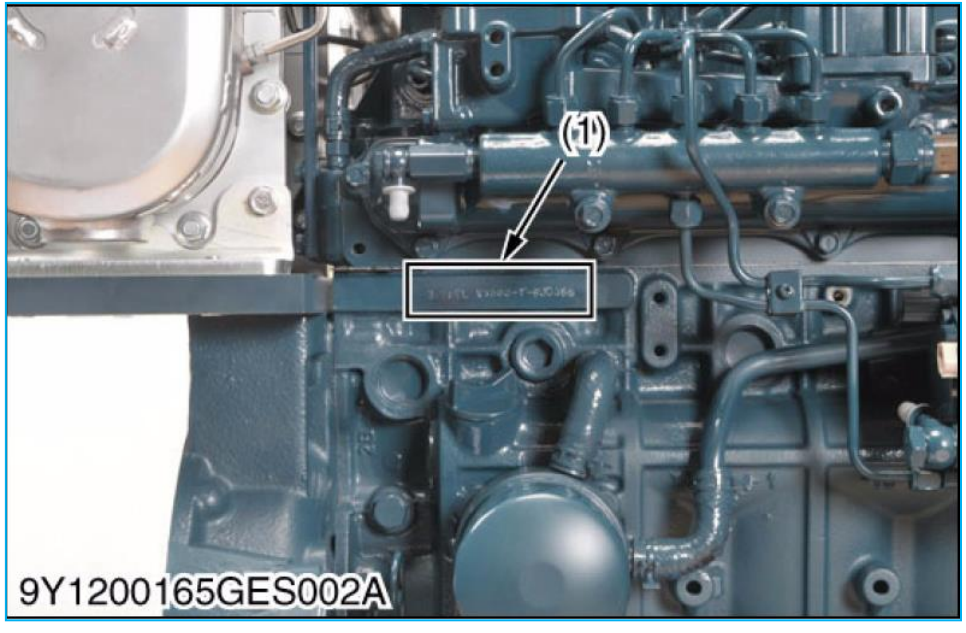
Engine

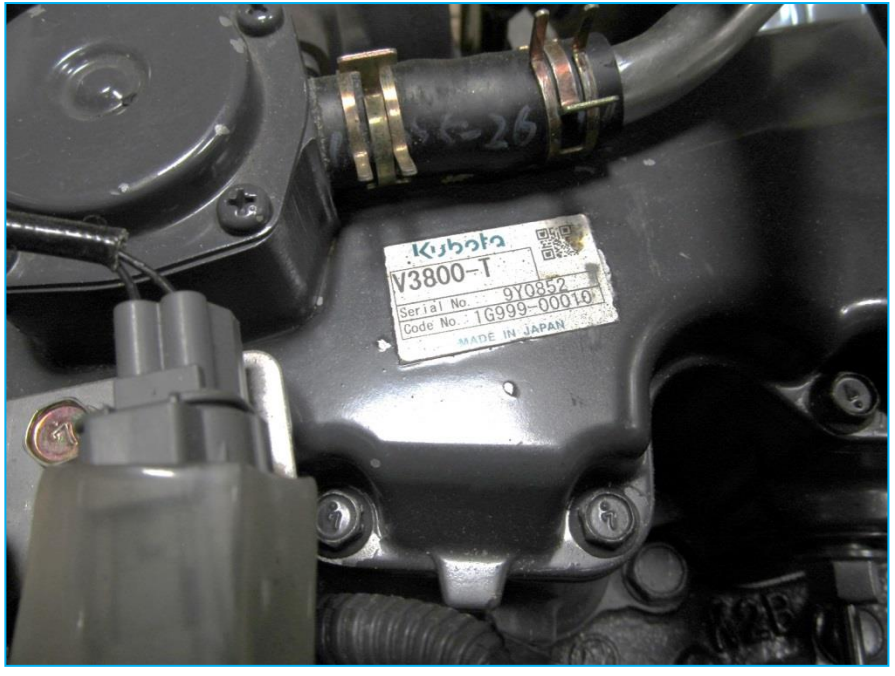
Engine – Specification

Model Name	V3800-CR-TE4B-HHI-1	V3800-CR-TIE4B-HHI-1 (50~70D-7A)
Engine Type	Vertical, water-cooled, 4-cycle DI diesel engine	
Bore x Stroke	100 x 120 mm (x 4 = 3769 cm^3)	
SAE Gross Continuous	61.0 kW (82.9 PS) / 2200 rpm	68.3 kW (92.9 PS) / 2200 rpm
SAE Gross Intermittent	70.2 kW (95.4 PS) / 2200 rpm	78.6 kW (107 PS) / 2200 rpm
Maximum Speed	2550 rpm	2525 rpm
Minimum Idling Speed	875 - 925 rpm	
Direction of Rotation	Counter-clockwise (Viewed from flywheel side)	
Firing Order	1-3-4-2 (1 : Fan side)	
Compression Ratio	17.5	
Oil Pressure Indicating	Electrical Type Switch	
Starter Motor	24 V, 3.2 kW	
Fuel	Ultra Low Sulfur (max 15 p.p.m.)	
Lubricating Oil	CJ-4 (capacity : 13.2L)	
Weight (Dry)	316 kg	
Application	Forklift Truck	

Engine – Specification – Model – Serial number

V	Number of cylinder = Vier | 4 cylinder
3800	Total displacement = approx. 3800 cm^3 (3.8 L)
CR	Common Rail system
T	Turbocharged
I	Intercooler (only for 50~70D-7A)
E4	Emission regulation = Tier4





Engine – Electronic control

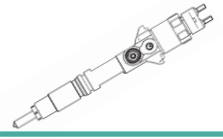
ECU controls electrical valves position according to sensors' values

Sensor

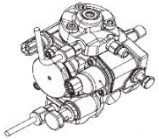
1. Rail Pressure
2. Fuel Temp
3. Coolant Temp
4. Intake Air Temp
5. Intake Air Pressure
6. Crank Position (NE)
7. Cam Position (G)
8. Barometric Pressure
9. Air Flow Sensor
10. Differential Pressure
11. T0
12. T1
13. T2

ECU

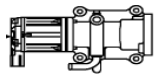
Two Way Valve



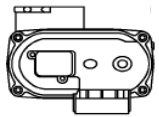
Suction Control Valve



EGR Valve



Throttle Valve

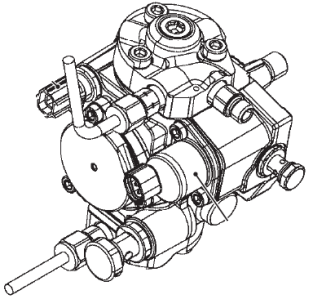


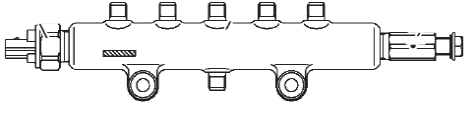
Engine – Electronic control

Controllable injection timing and multiple injection.

High pressure fuel injection.

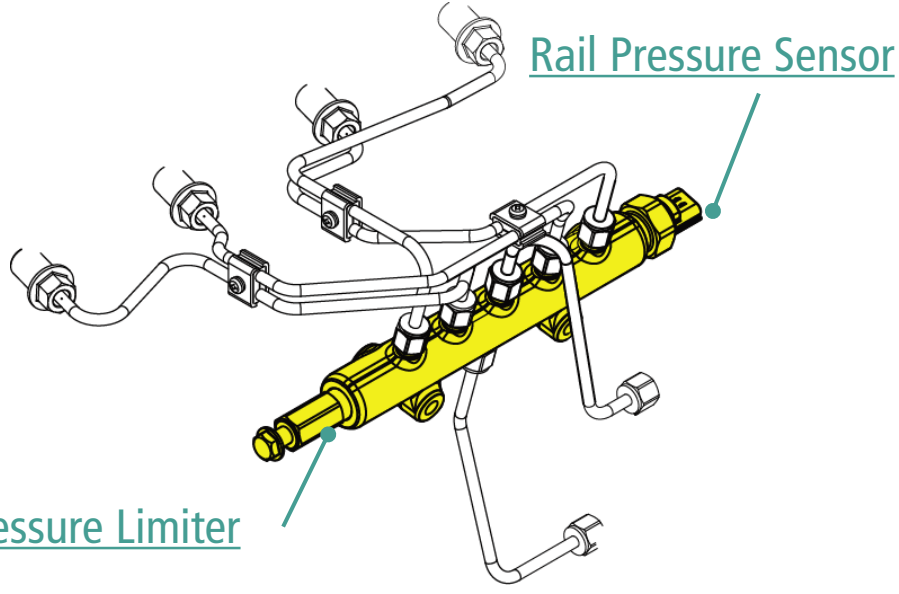
High Pressure Fuel System

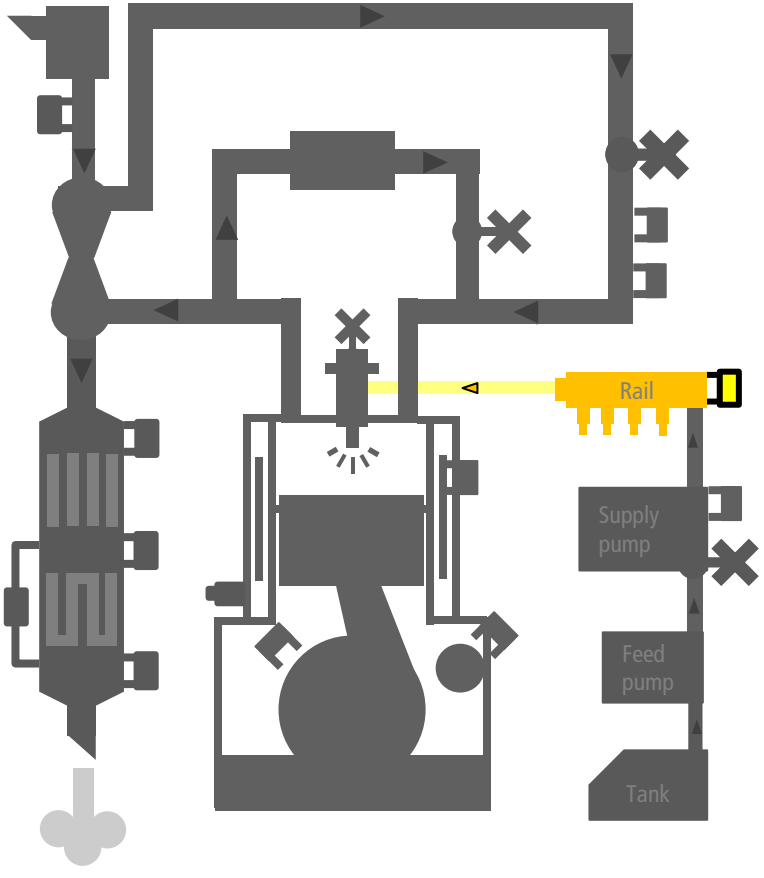




Supply Pump	Rail	Injector
compress fuel and send to Rail	always keep high pressure fuel	inject fuel into combustion chamber

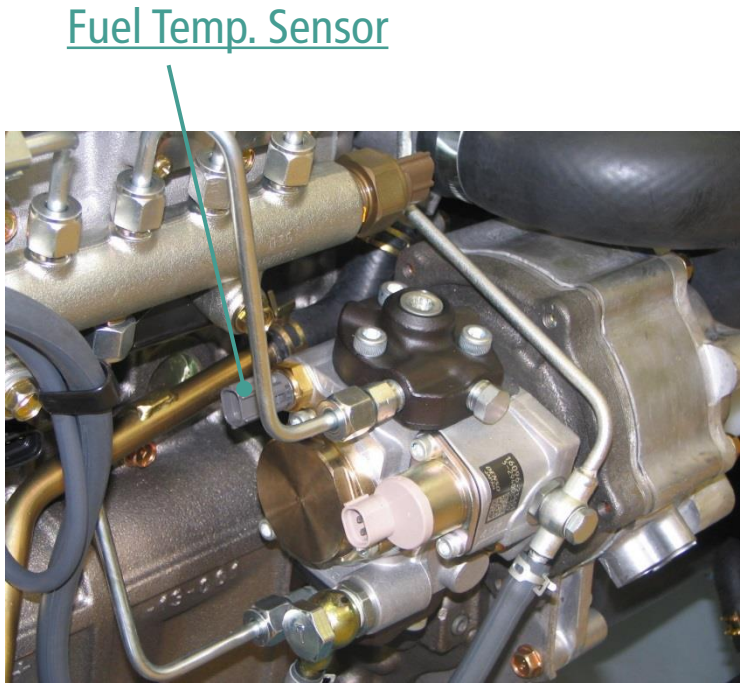
Engine – Sensors – Rail Pressure

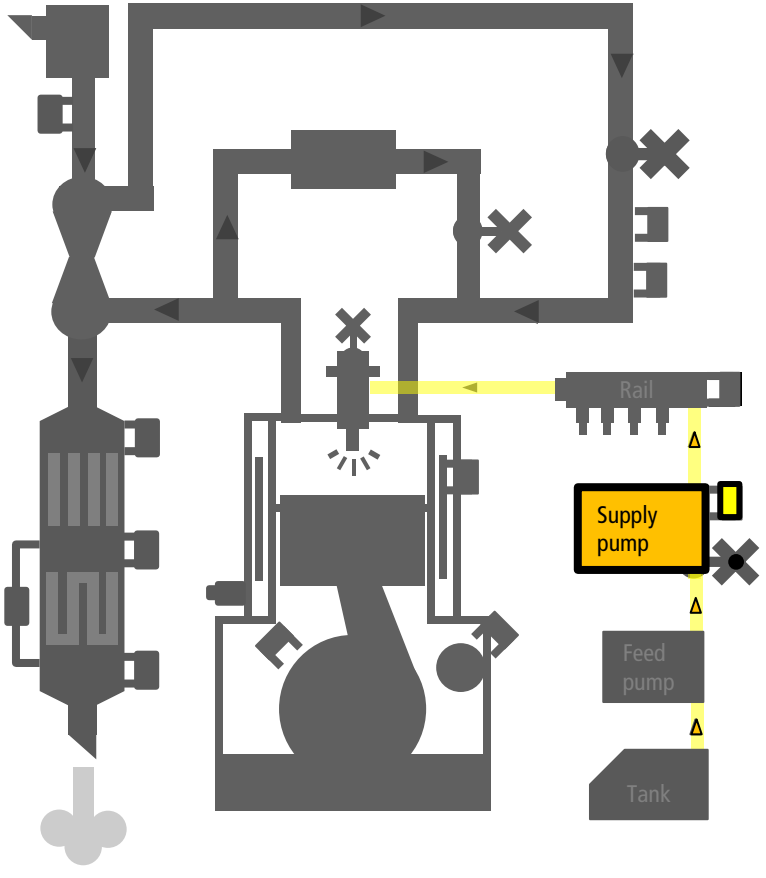




- ***Rail Pressure***: below 160 Mpa.
- ***Pressure Limiter***: emergency open at 200 MPa.
- Rail Pressure Sensor and Pressure Limiter are **not service parts.** (change with Rail Assembly)

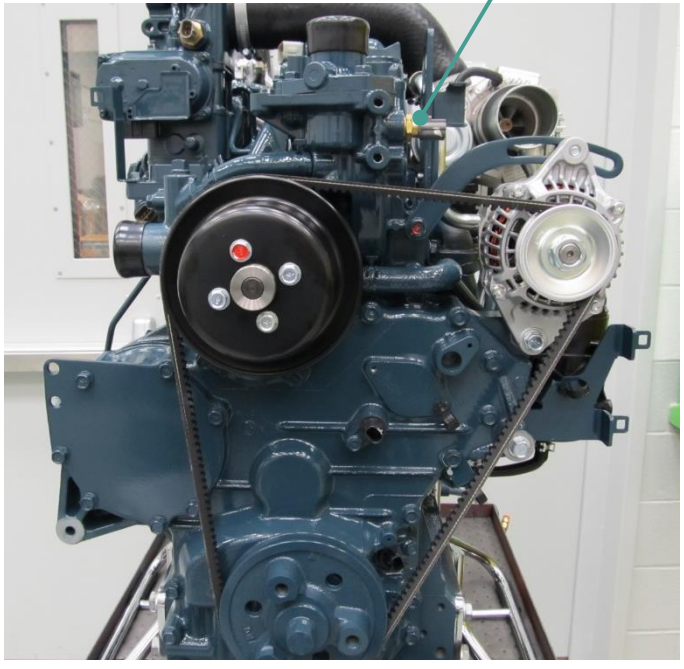
Engine – Sensors – Fuel Temperature Sensor

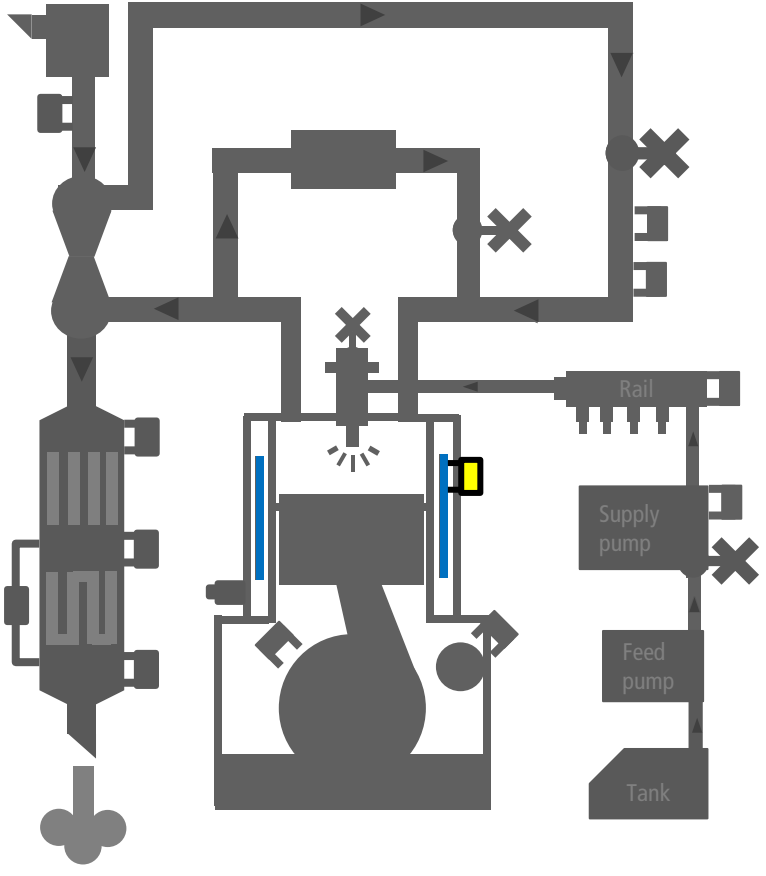




- The sensor is service parts, but **replacing makes warranty expired**.
- (recommend replace by pump assembly in warranty period.)

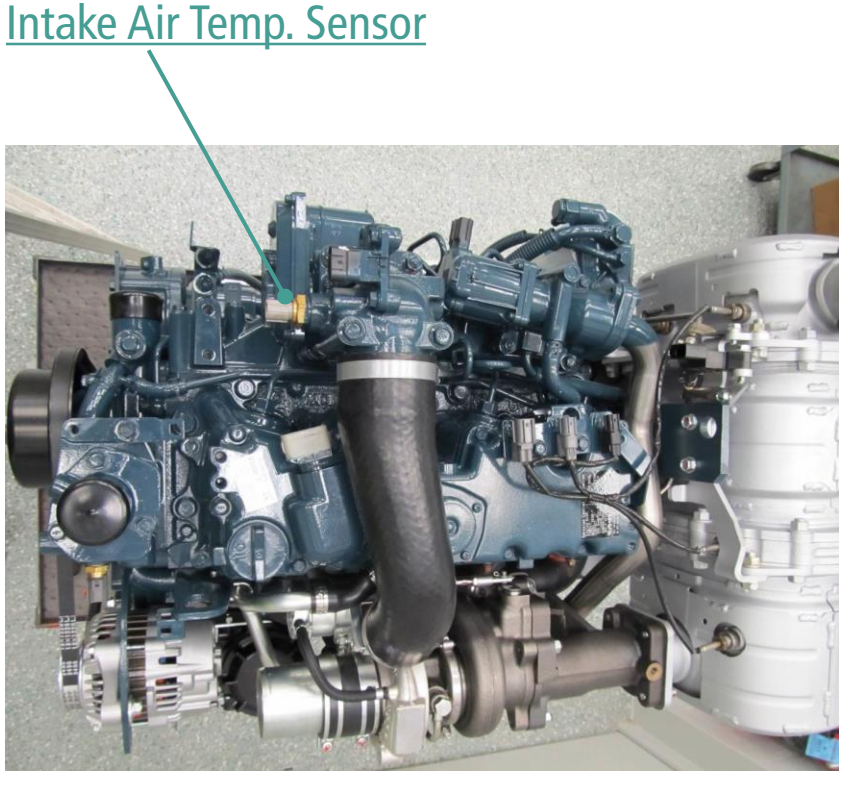
Engine – Sensors – Coolant Temperature Sensor

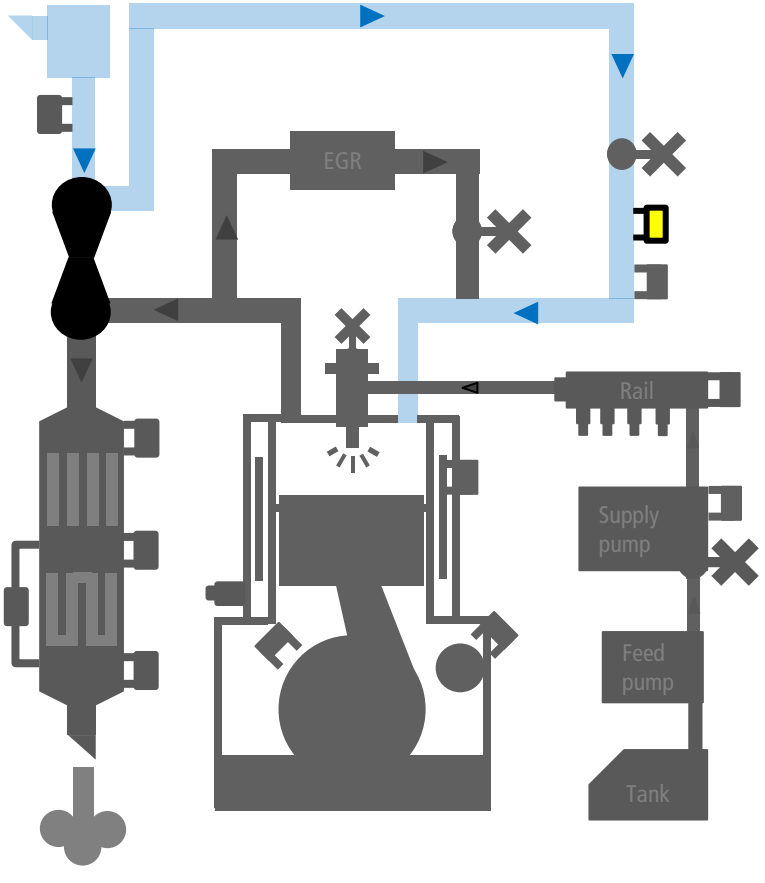




- Checking overheat. Overheat is over 120°C.
- 65°C - start control for emission (ex. EGR valve, Regeneration...)

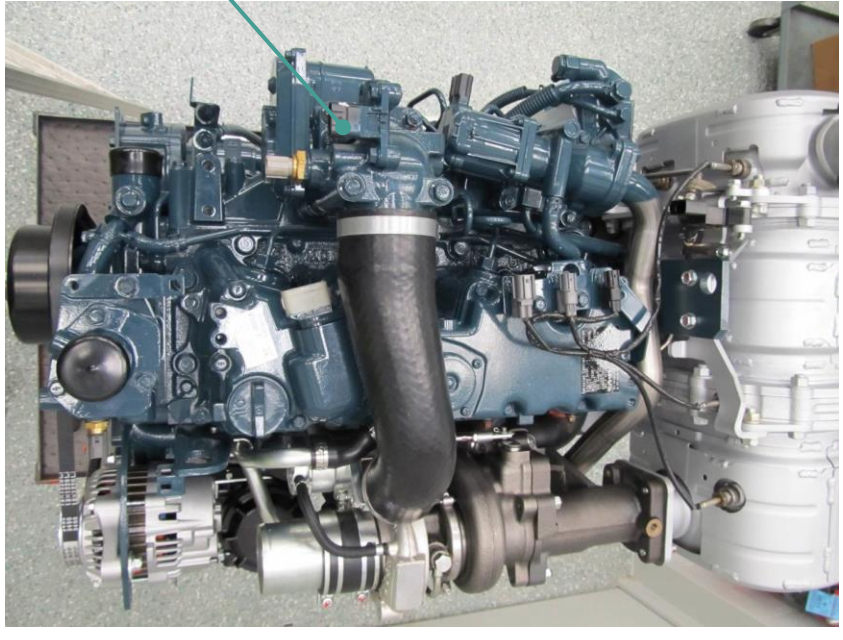
Engine – Sensors – Intake Air Temperature Sensor

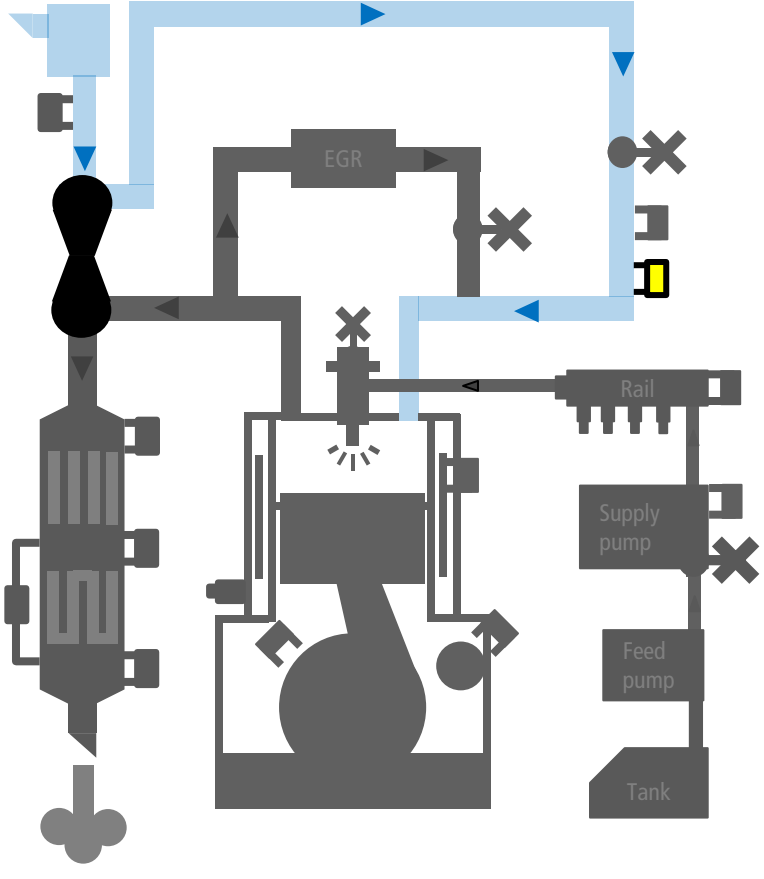




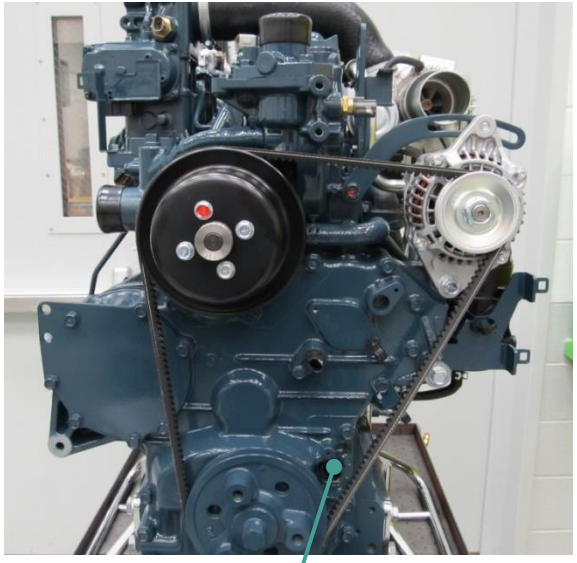
Engine – Sensors – Intake Air Pressure Sensor

Intake Air Pressure Sensor

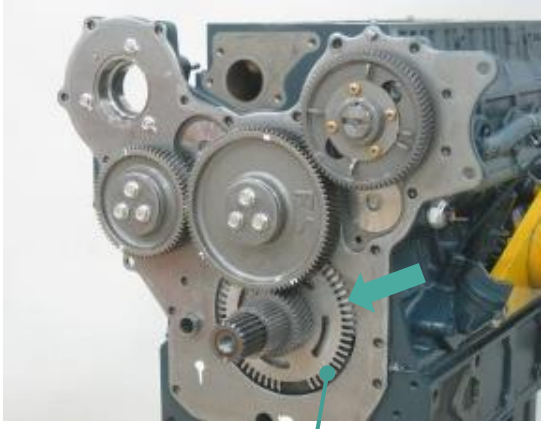




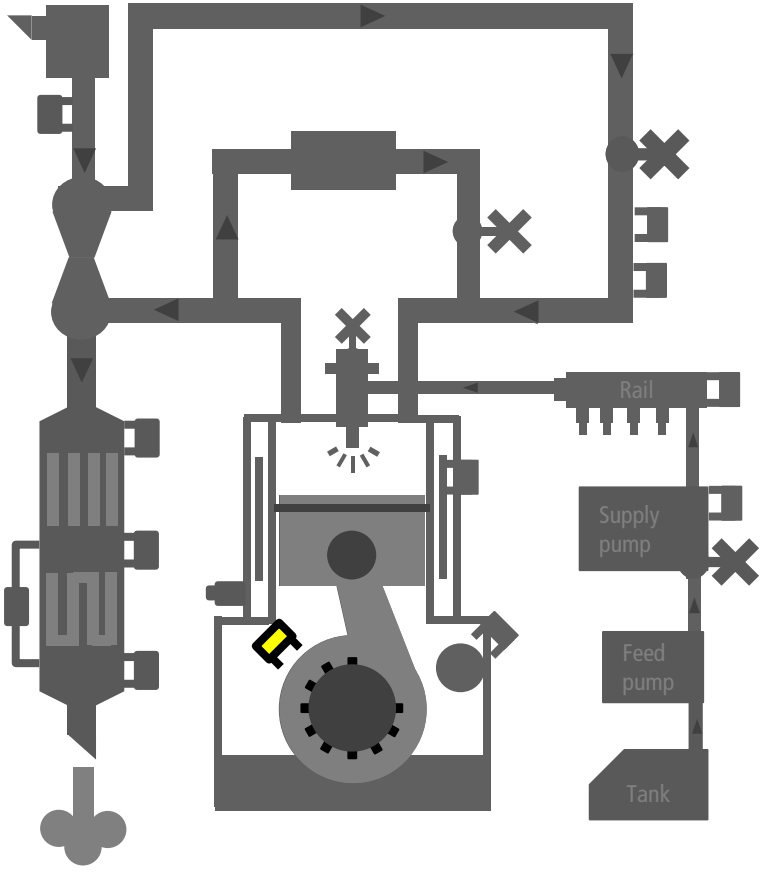
Engine – Sensors – Crankshaft Position Sensor (NE sensor)



NE sensor

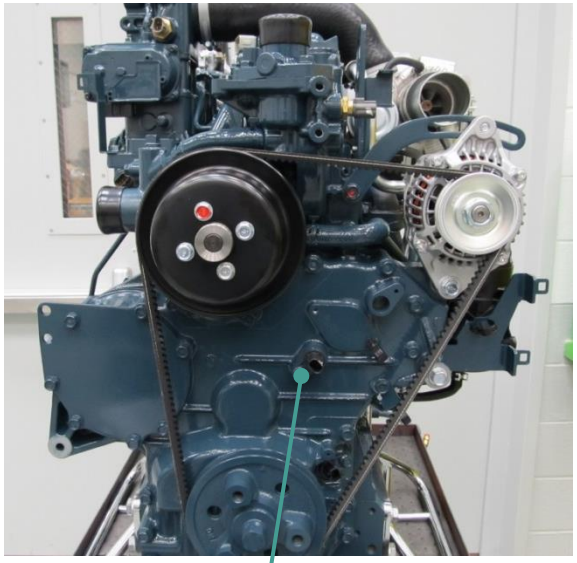


Pulsar gear

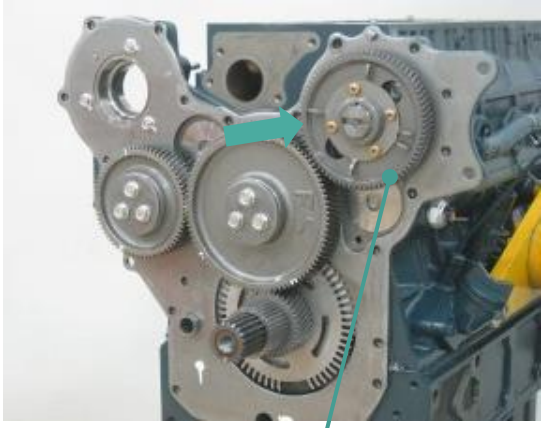


- for control **Injection timing**, measures **Engine rpm**

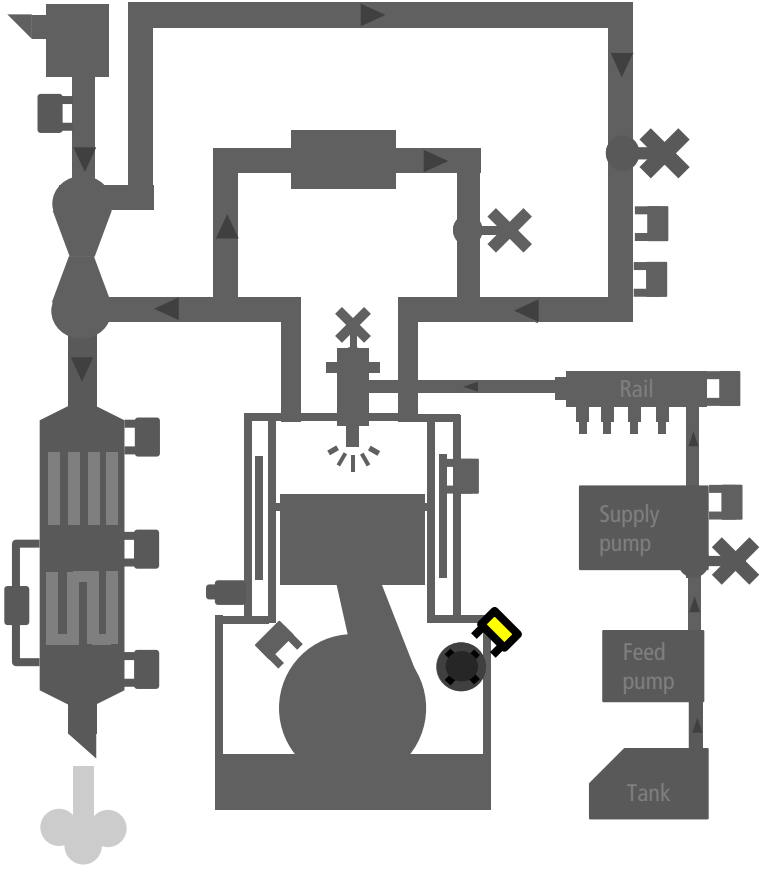
Engine – Sensors – Camshaft Position Sensor (G sensor)



G sensor



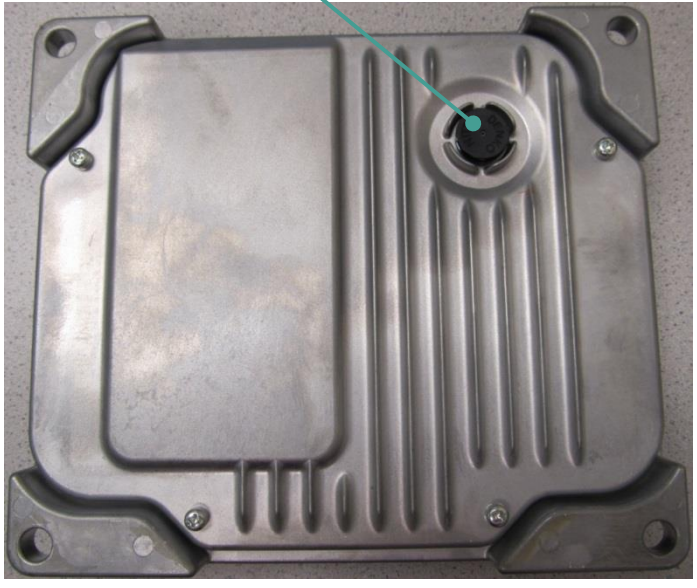
Pulsar gear



- For judging that piston is at Compression Top or Overlap Top

Engine – Sensors – Barometric Pressure Sensor

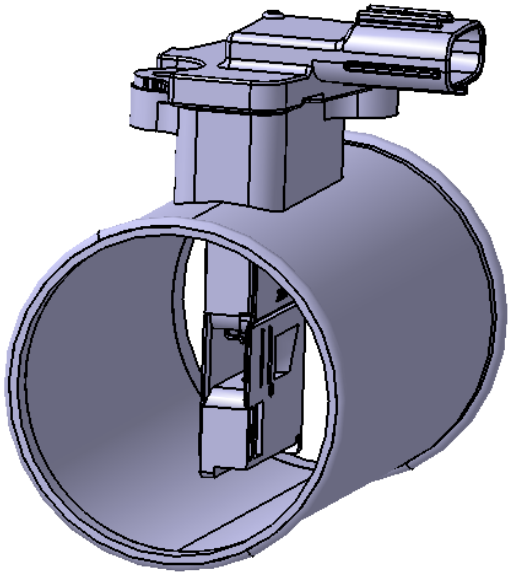
Vent for Barometric Pressure sensor

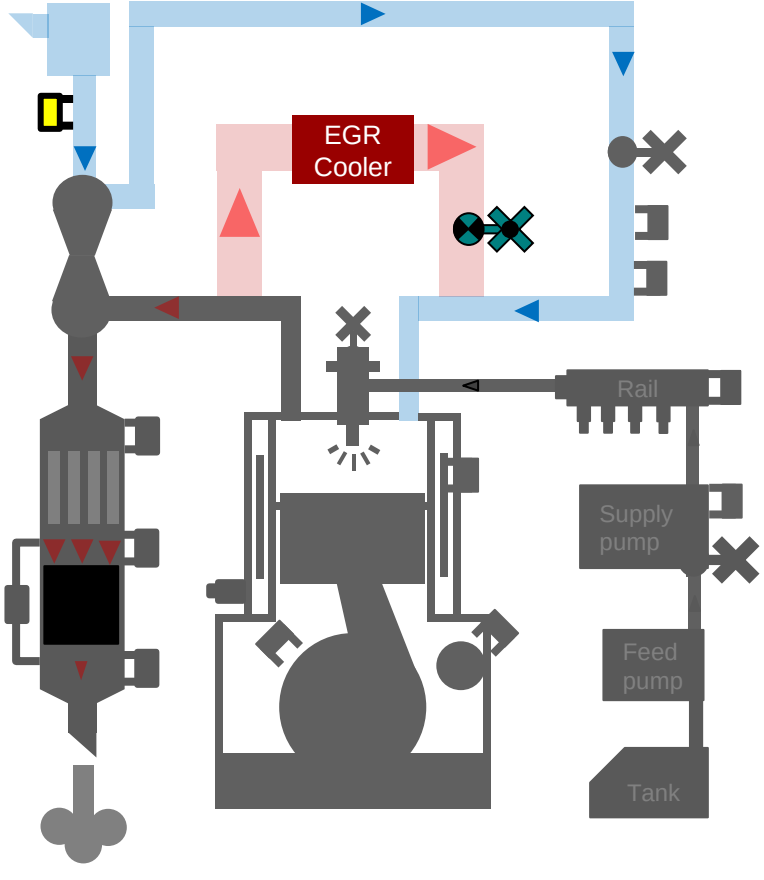


ECU

- ECU base plate has circuit for sensing barometric pressure
- If broken, change by Assembly

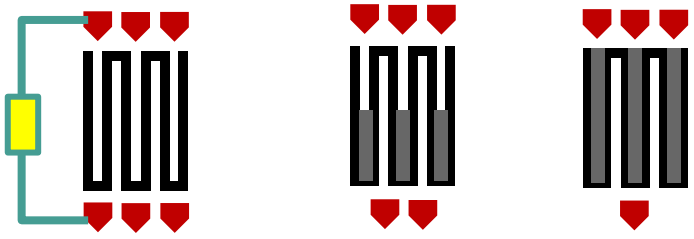
Engine – Sensors – Air flow sensor

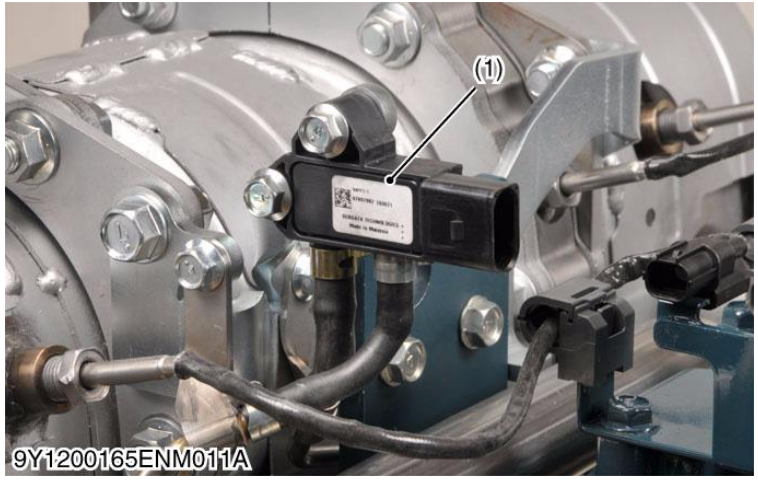


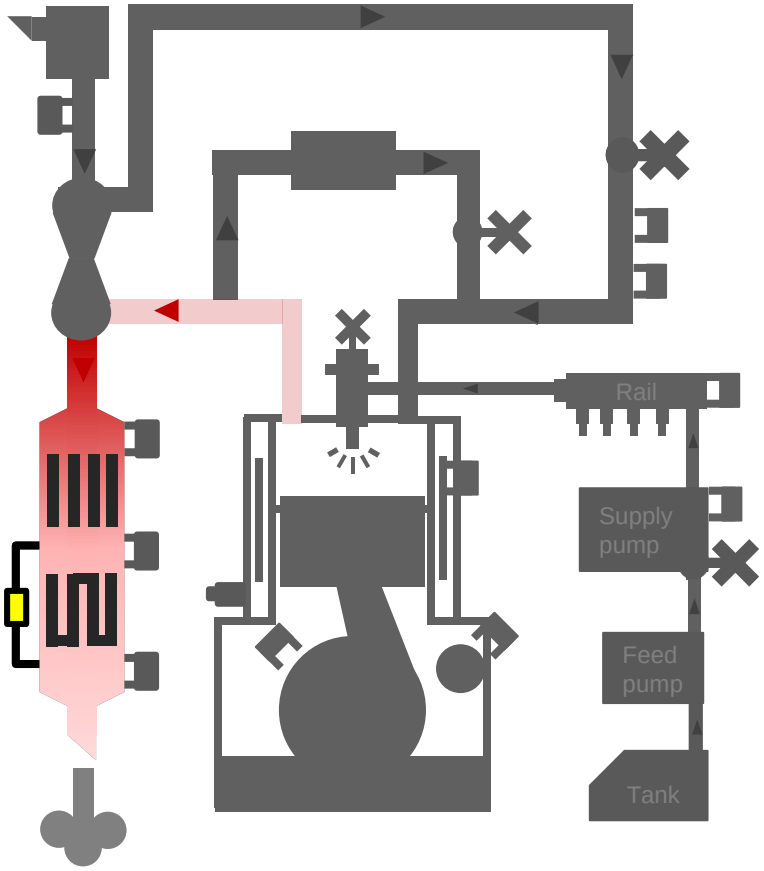


- Checking quantity of fresh air.
- For better control of EGR function

Engine – Sensors – Differential Pressure Sensor

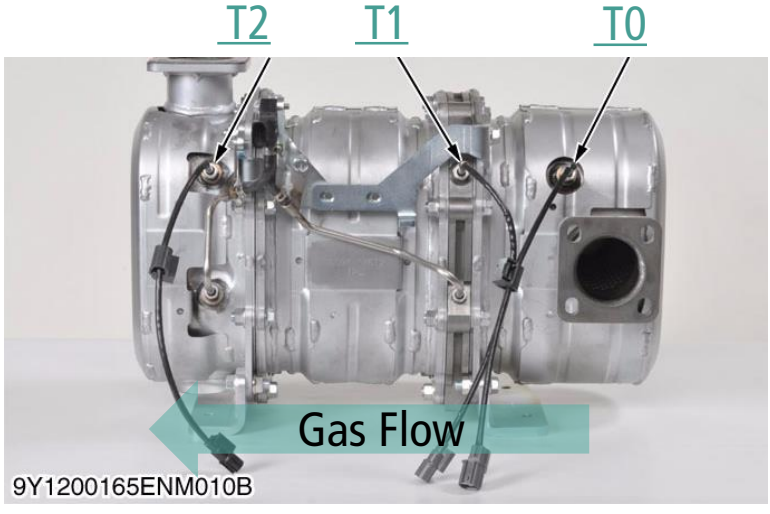


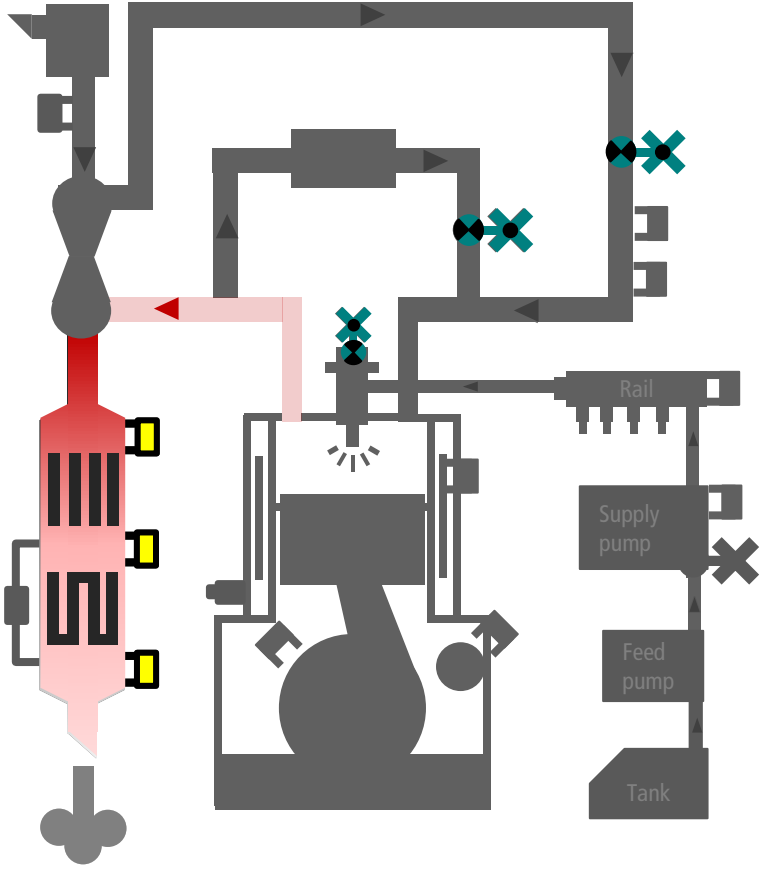




- Measures pressure before and after the DPF
- Used to calculate PM accumulation

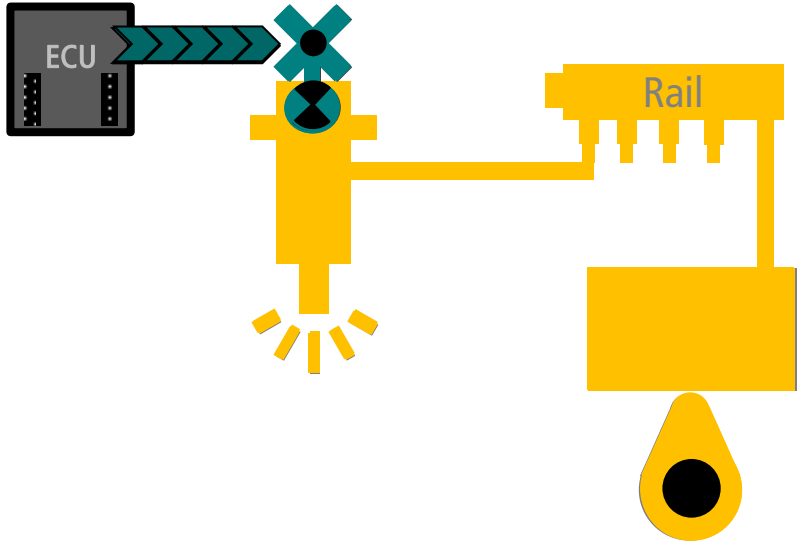
Engine – Sensors – Exhaust Gas Temperature Sensor (T0, T1, T2)



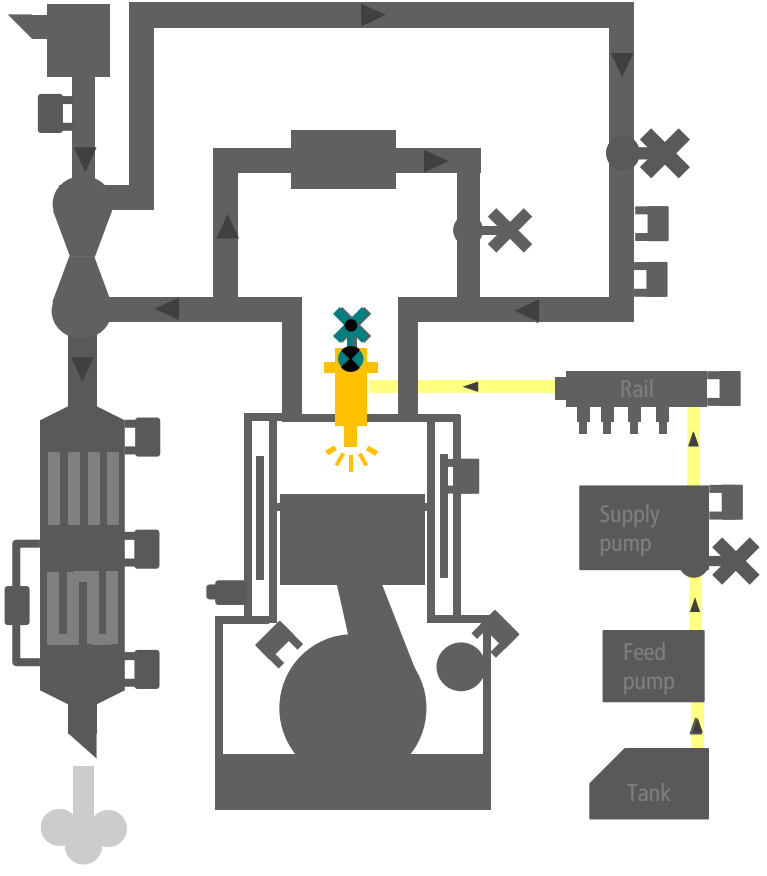


- For control of Regeneration process in DPF

Engine – Valves – INJECTOR | Two Way Valve [TWV]



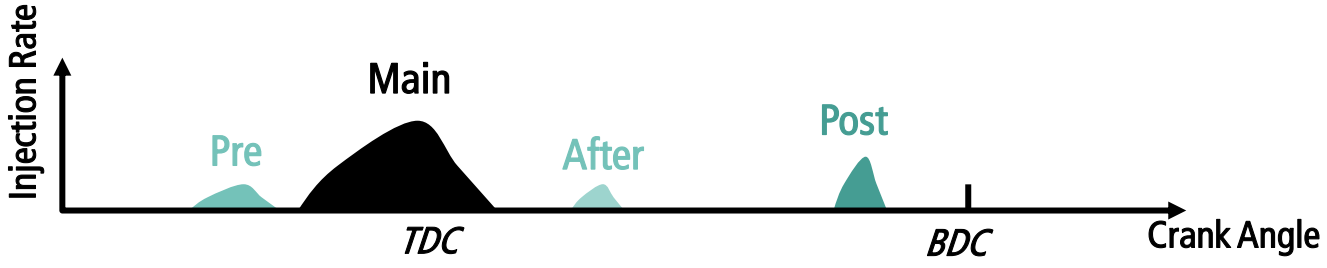
Always High pressure

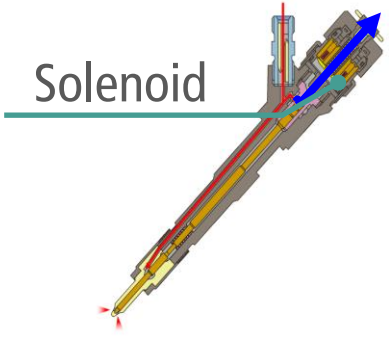


▸ [Fuel flow] Supply pump → Rail → Injector

Engine – Valves – INJECTOR | Two Way Valve [TWV]

Timing	When the ECU applies the current to the solenoid ?
Quantity	How long the ECU applies the current to the solenoid ?
Number of times	How many times the ECU applies the current to the solenoid ?





Pre — Smooth explosion

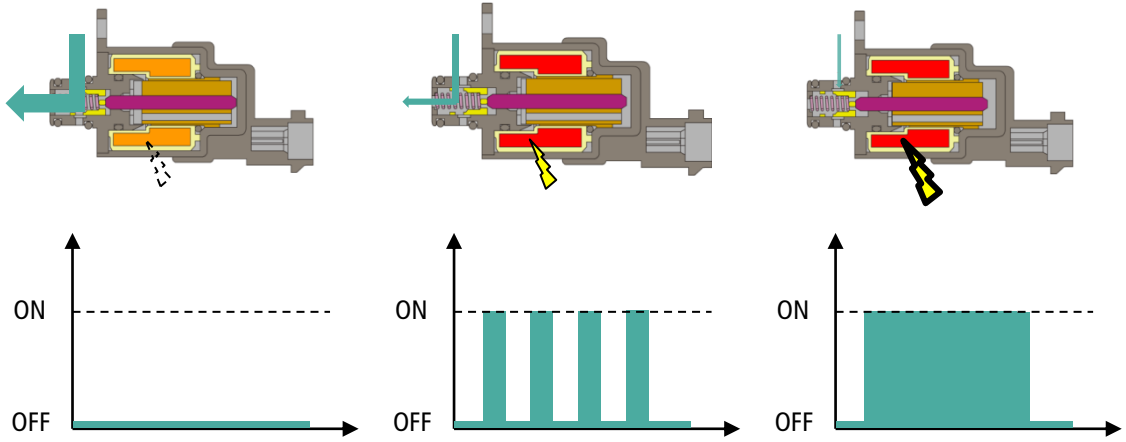
Main — Power

After — burn unburnt fuel again

Post — Regeneration

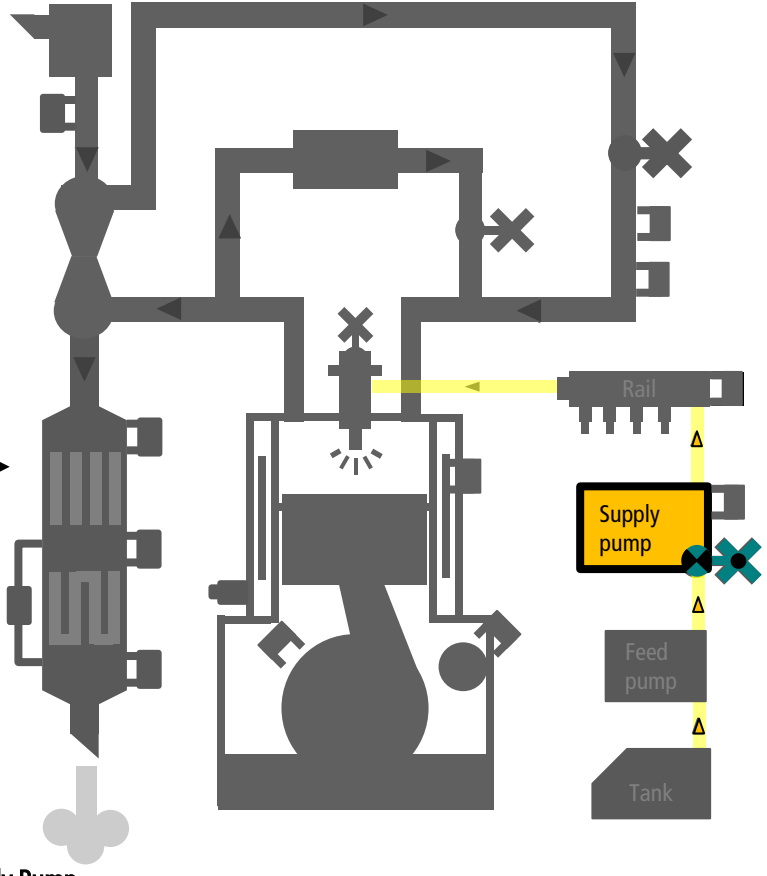
- Injection timing, quantity, and number of times are controlled by electrical solenoid in the injector.
- Injector is always filled with high pressure fuel.
- **1500h** maintenance (execute Injection Stop by Diagmaster)

Engine – Valves – Suction Control Valve [SCV]



Valve open

Valve closed



SCV

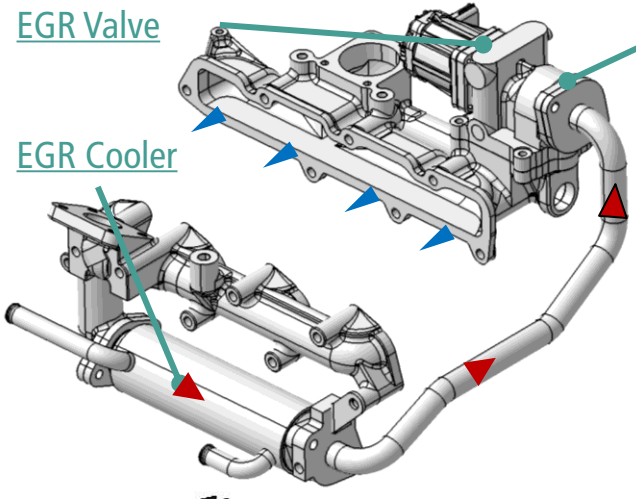
- Equipped on Supply Pump and control **fuel quantity flow in Supply Pump**.
- Valve position is controlled by time length of currency | Duty Control
- SCV is **service part**. But replacing makes warranty expire (recommend to replace by pump assembly in warranty period).

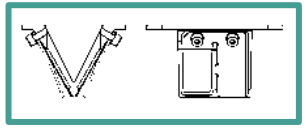
Engine – Valves – EGR System

EGR Valve

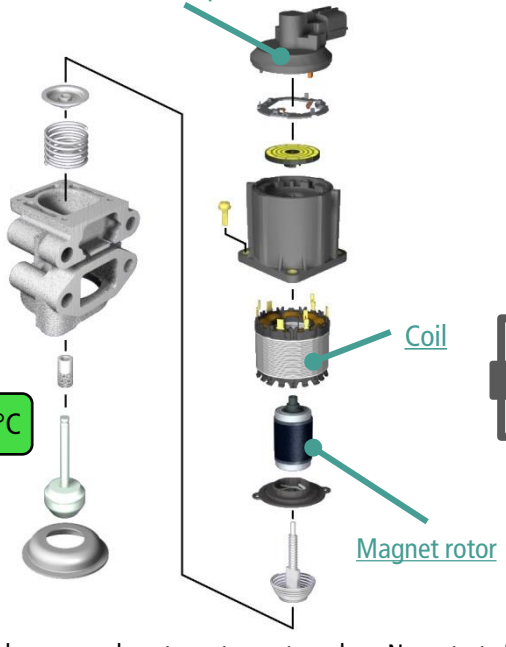
Reed Valve

EGR Cooler



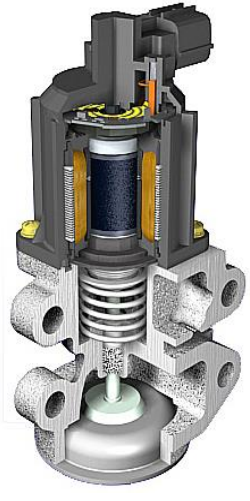


EGR valve position sensor

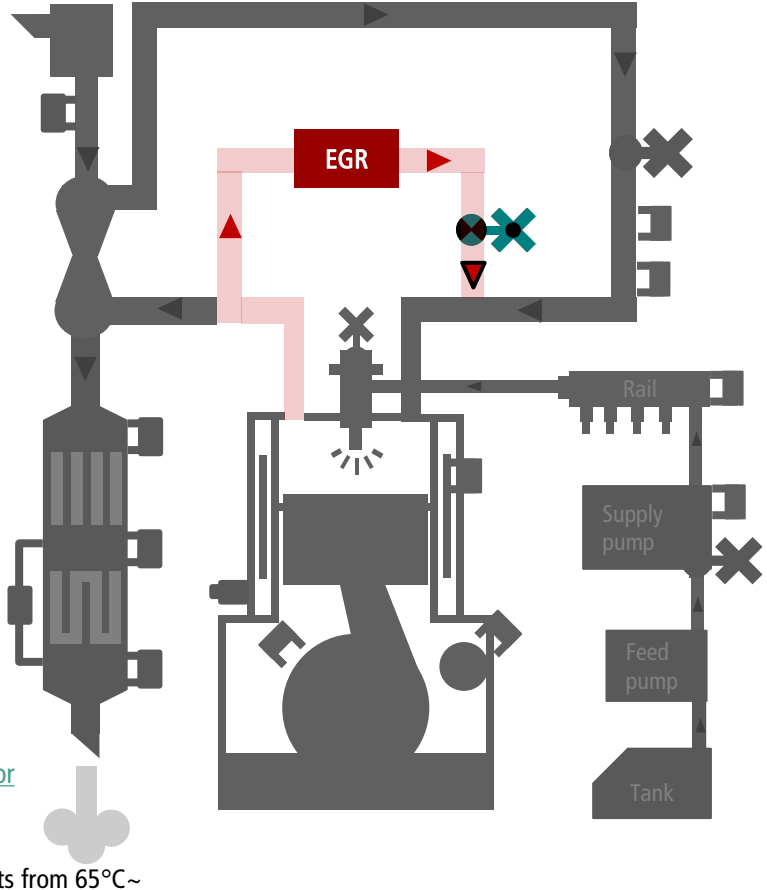


Coil

Magnet rotor

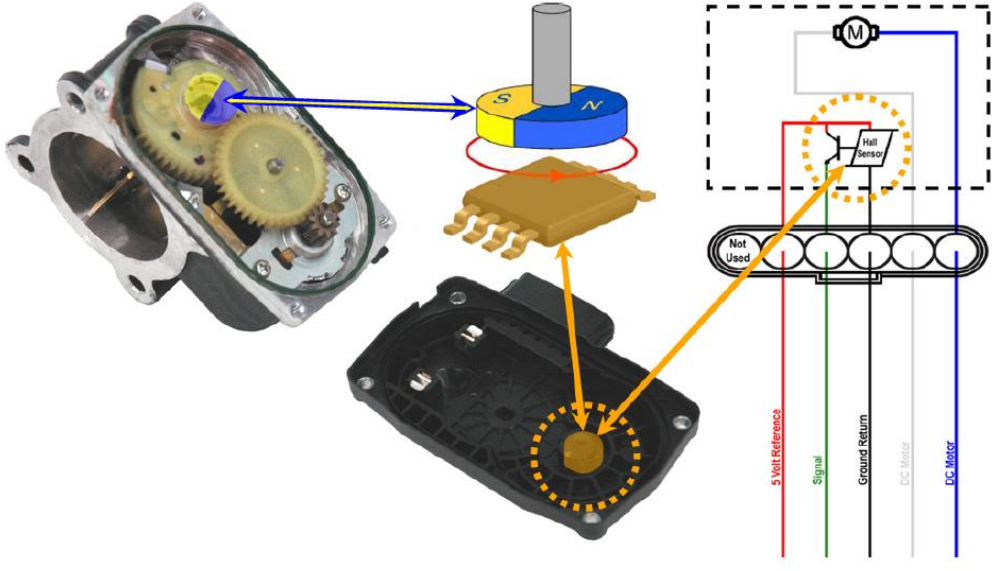


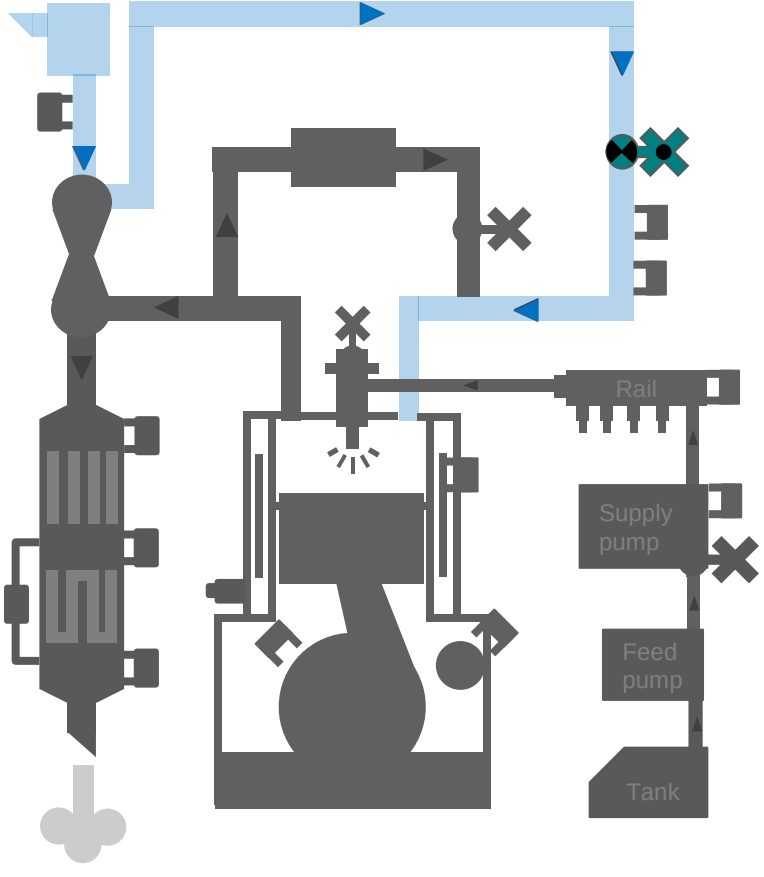
Min operating temp - 65°C



- EGR system is to decrease exhaust gas temp. to reduce Nox, starts from 65°C~
- Reed valve is to prevent back flow
- **Ultra Low Sulfur Fuel** required

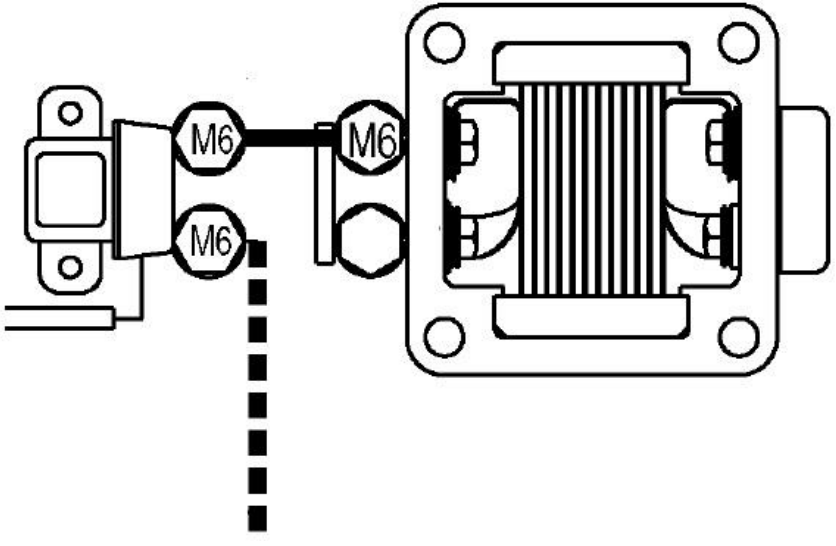
Engine – Valves – Throttle Valve

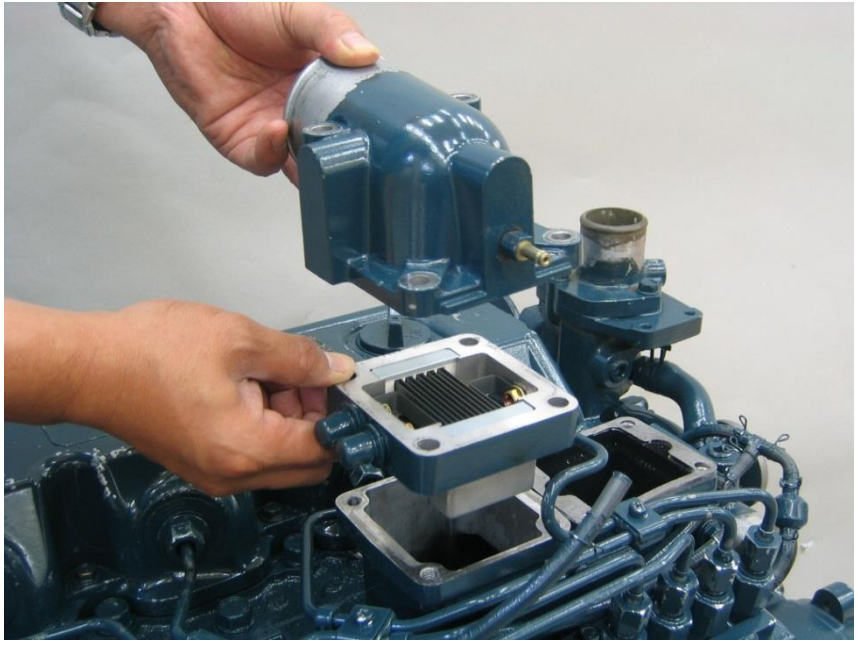




- Increase exhaust gas temperature for Regeneration.
- Built-in valve position sensor

Engine – Intake Air Heater



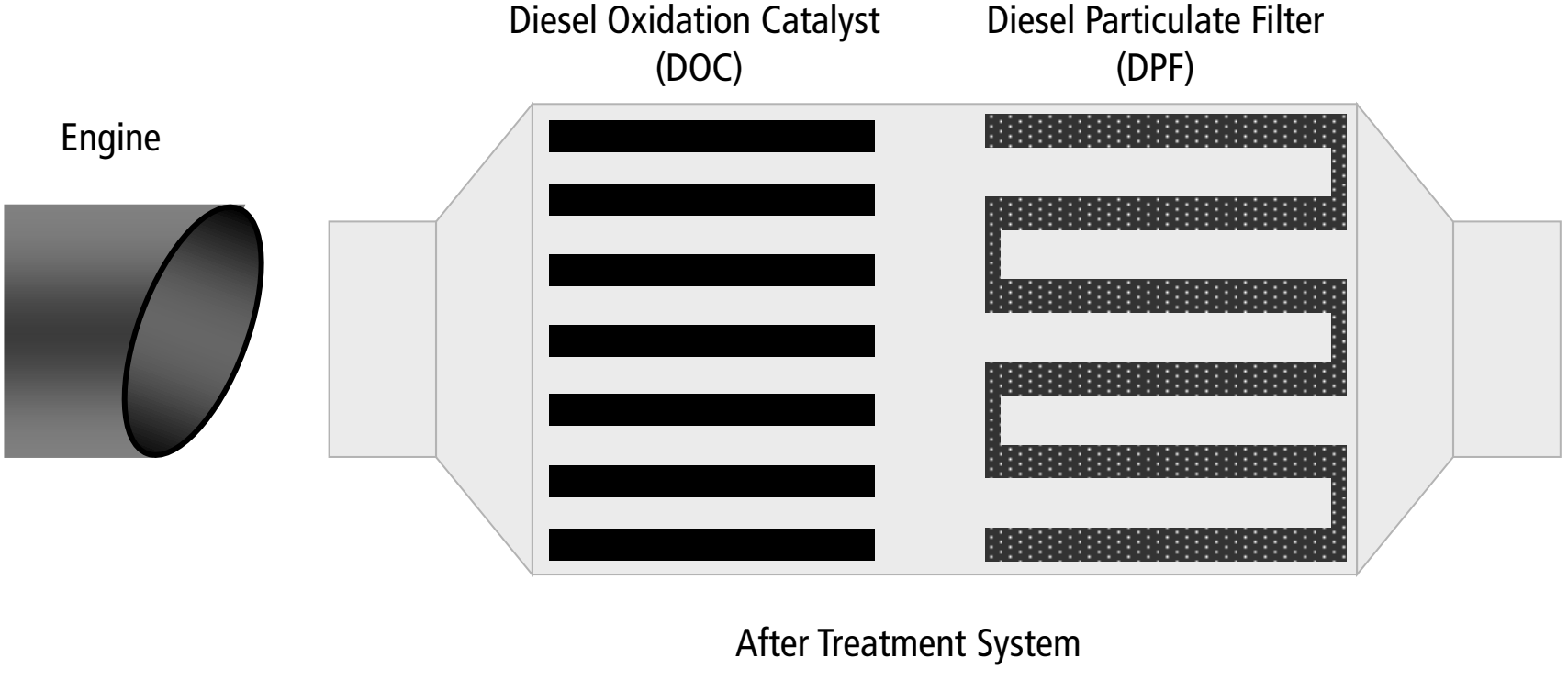


- draws approx. 50 amps per element.
- controlled by Coolant Temp. Sensor value.

After Treatment Device

After Treatment Device

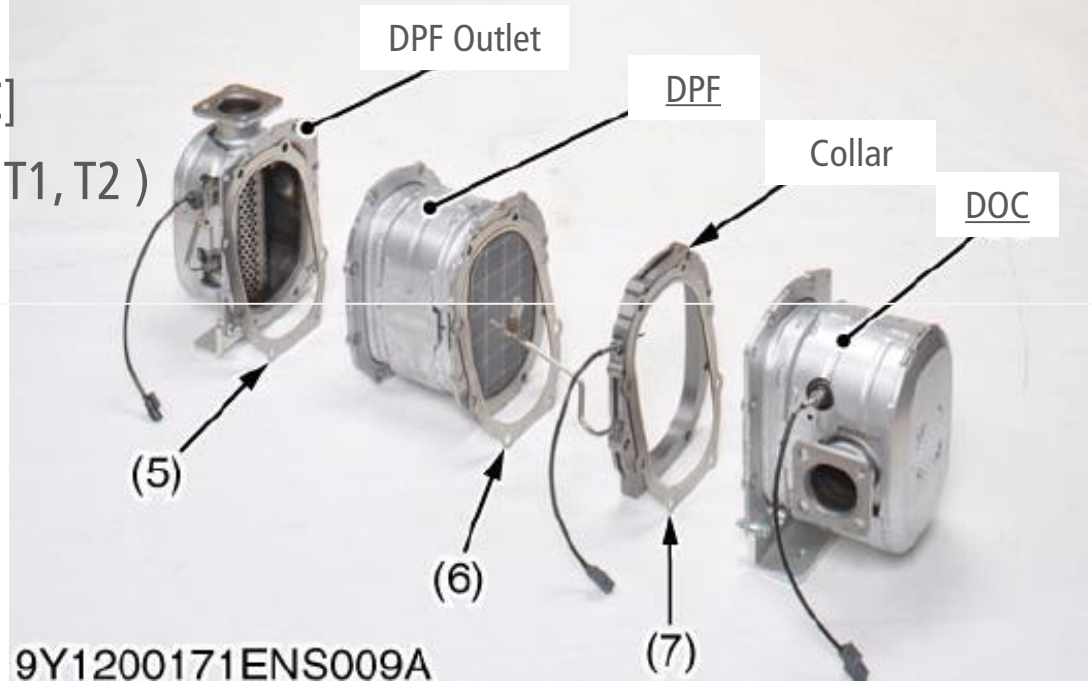
Trap *Regeneration* *Cleaning*



After Treatment Device

Main Components

- Diesel Particulate Filter [DPF]
- Diesel Oxidation Catalyst [DOC]
- Three Temperature Sensor (T0, T1, T2)
- Differential Pressure Sensor



- ***After Treatment Device*** is assembly to clean exhaust gas, especially PM.

After Treatment Device

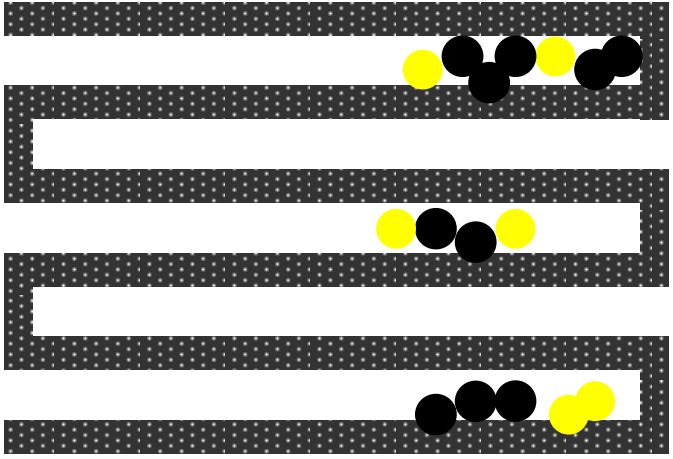
Trap → *Regeneration* → *Cleaning*

EXHAUST GAS

CO_2 H_2O		Exhaust Gas Recirculation
CO C_pH_q		*Tier3 / Stage IIIA* Common rail
C(soot) Metal	PM Ash	*Int. Tier4 / Stage IIIB* After Treatment System
NO_X		*Final Tier4 / Stage IV*

PM : Particulate Matter

Diesel Particulate Filter (DPF)



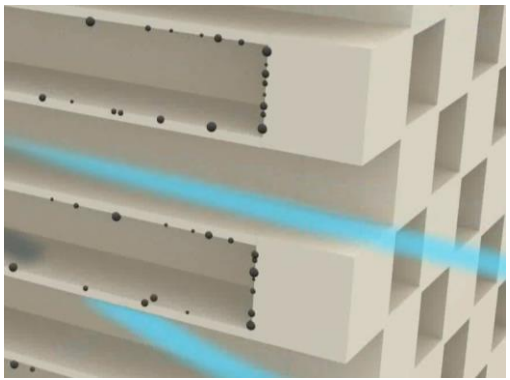
After Treatment Device

Trap | Regeneration | Cleaning

Structure

- honeycomb structure to create more surface area.
- a lot of small holes on the wall.
- made from Silicon Carbide.
- covered with catalyst which react with PM during regeneration.
  (Activation Temperature : 550 °C)

Trap PM



- ***DPF*** is a filter to trap PM

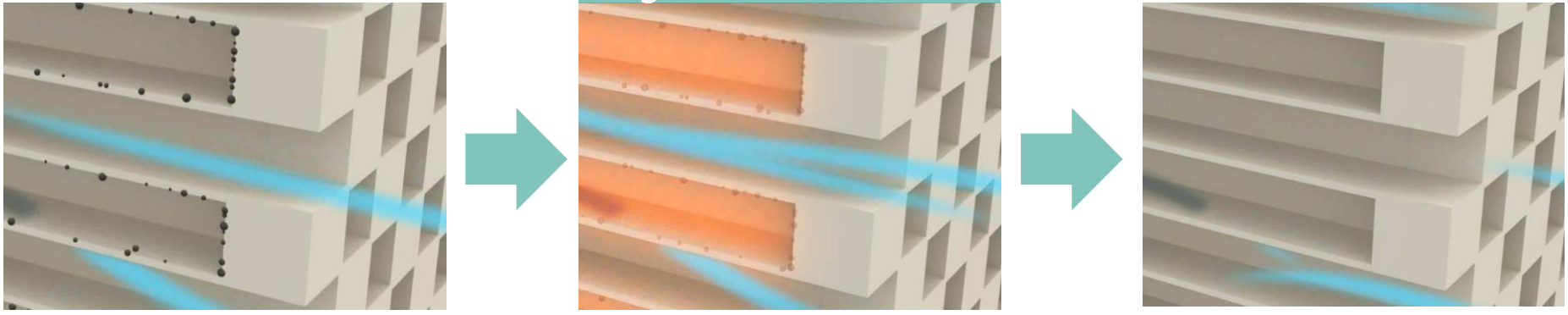
After Treatment Device

Trap | *Regeneration* | Cleaning

Mechanism

Thanks to catalyst on DPF,
PM can combine with O_2 in exhaust gas to form CO_2 at 550 °C.
CO_2 is so small that get out through holes of DPF wall.

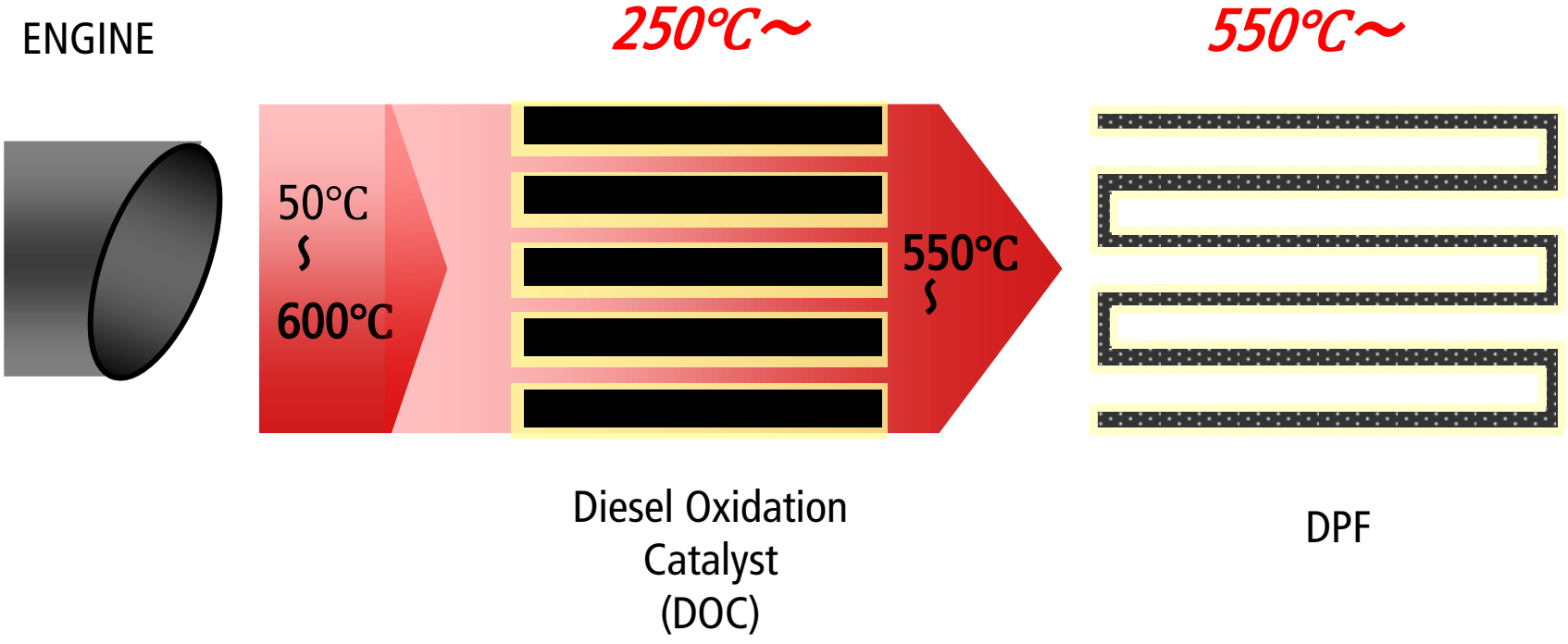
Regeneration



- ***Regeneration*** is a process to change PM into CO_2 by chemical reaction (catalytic reaction) in order to restore filtering function without replacement.

After Treatment Device

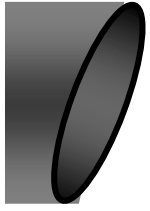
Trap → Regeneration → Cleaning

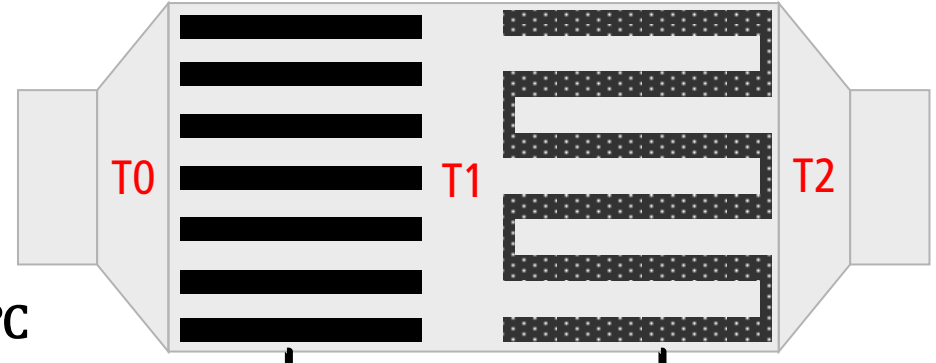


After Treatment Device

Trap | Regeneration | Cleaning

Engine (DOC) (DPF)





50°C

Throttle valve
- by limiting air flow

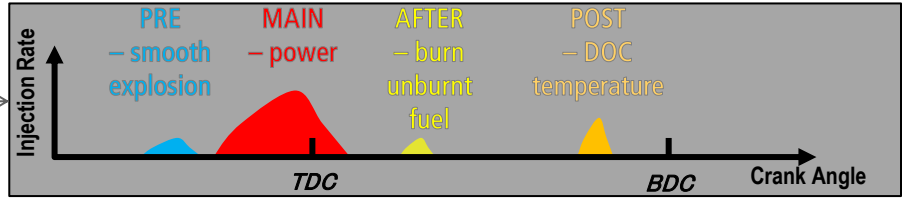
250°C (DOC)

DOC + Post injection
- by chemical reaction in DOC (oxidation)

550°C (DPF)

PM
- by burning the soot

600°C



After Treatment Device

There are 3 types of Regeneration.

All regeneration have same purpose: removing accumulated PM.

Auto Regeneration

If Auto Re-gen is permitted, ECU starts Re-gen automatically according to PM level.
Application can continue operation.

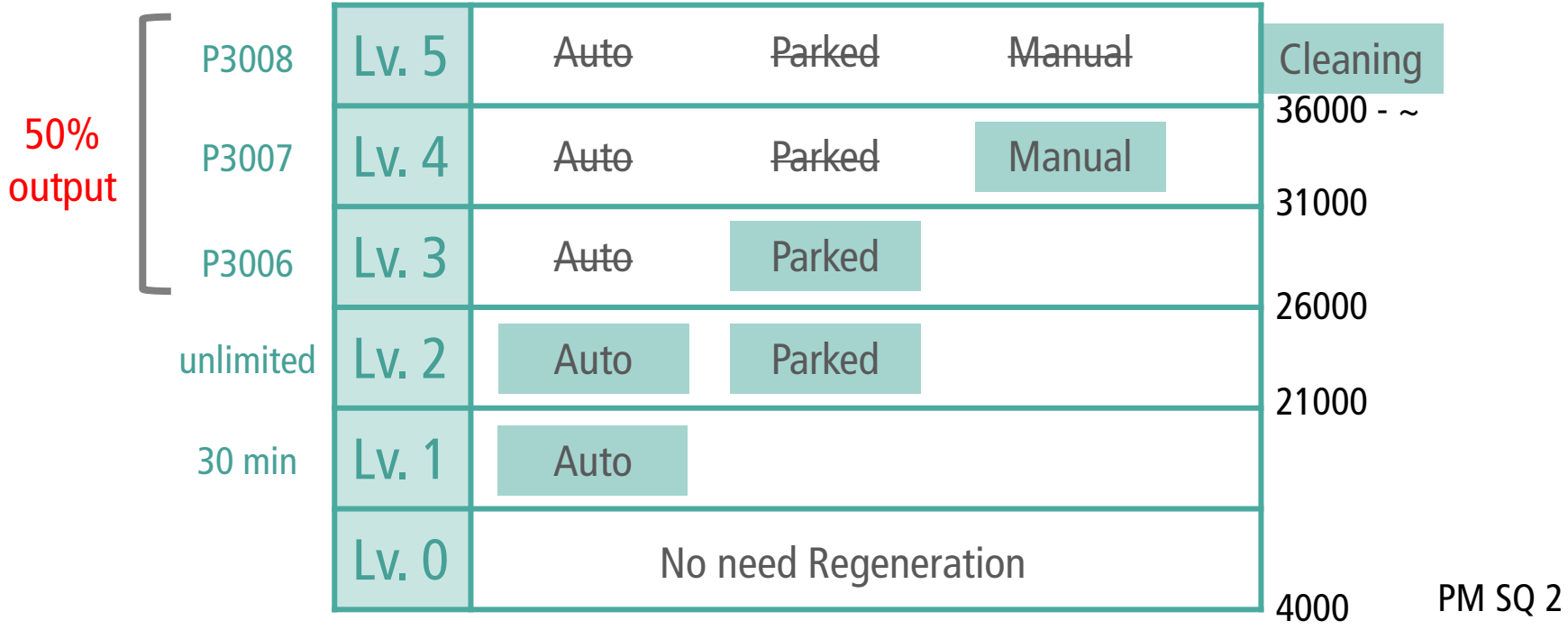
Parked Regeneration

If PM doesn't burn enough by Auto Re-gen, ECU requires to stop operation and concentrate Parked Re-gen.

Manual Regeneration (with Diagmaster)

Too much PM could generate too much heat when Re-gen and it is dangerous for end user.
Only service staff can regenerate with Diagmaster.

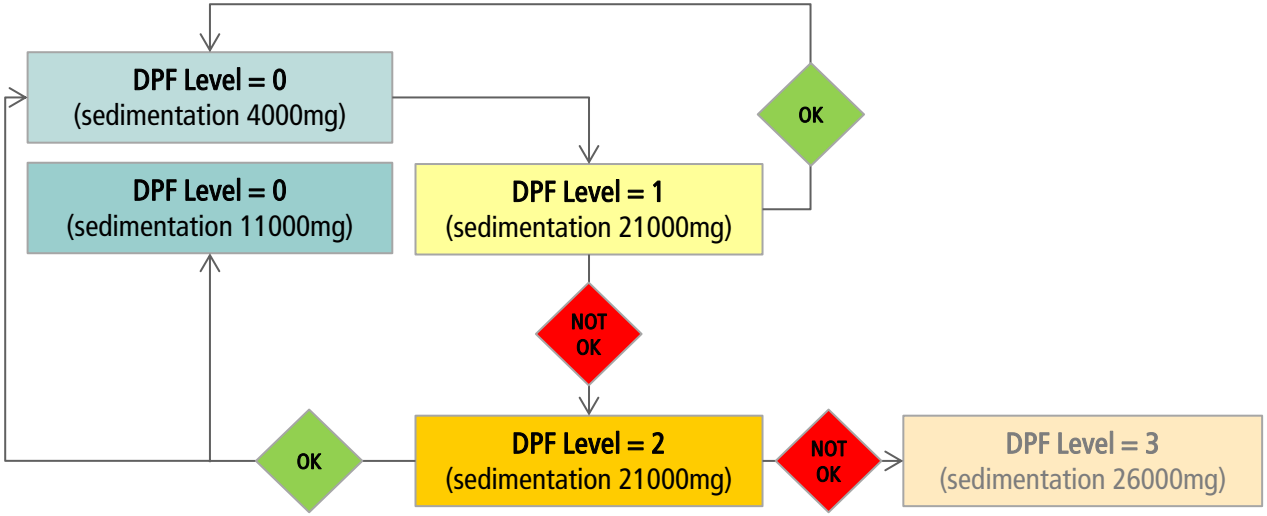
After Treatment Device



PM sedimentation level

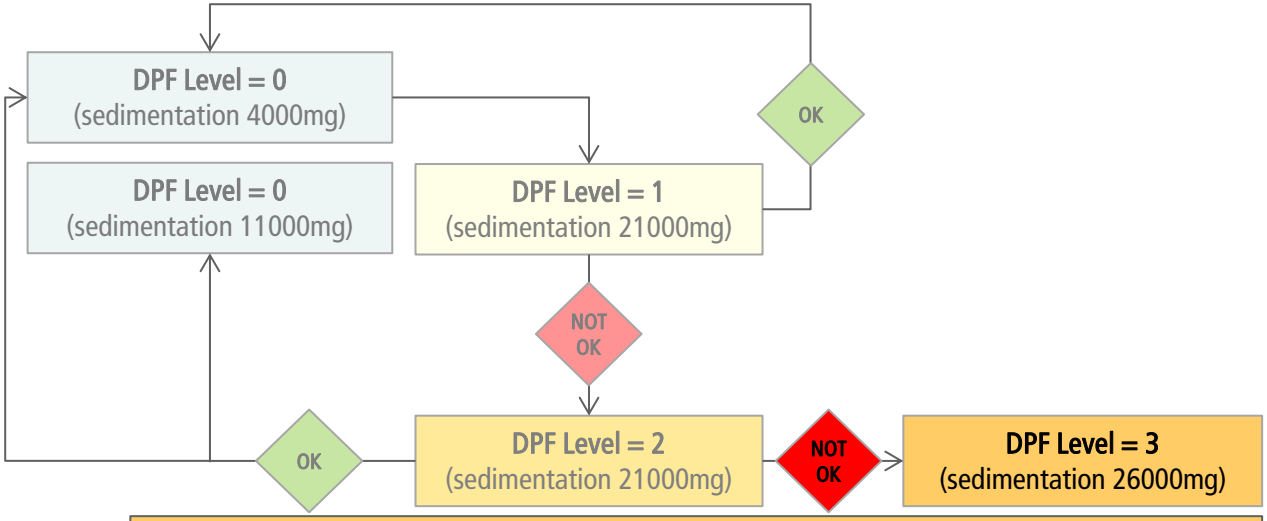
PM quantity is calculated by ECU according to rpm, temperature, fuel quantity, differential pressure
PM Sedimentation Quantity 1: calculated from Differential Pressure.
PM Sedimentation Quantity 2: calculated from many parameters.

After Treatment Device – Auto Regeneration Lv1 and Lv2



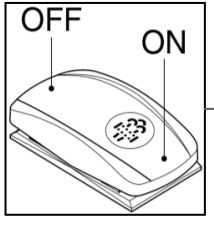
Automatic regeneration logic				
Level	Regeneration condition	Regeneration environment		
L1	10 min @ 580° or 20 min @ 500° within 30 min timeframe (but not continously necessary "accumulated") when succesfully done - system goes to Lv = 0 and sedimentation = 4000 mg	Idle 905 rpm post injection	DPF valve 56 bar (when system pressure reaches 80 bar - DPF valve off by software)	seat switch off 1 min → rpm ↑ 1100 rpm seat switch closed - back to 905 rpm
L2	~ the same conditions as in Lv1 but without time frame ~ system checks only sedimentation level as it may not exceed 26000 mg -> to Lv3 when 10 min @ 580° successfully done - system goes to Lv = 0 and sedimentation = 4000 mg when 20 min @ 500° successfully done - system goes to Lv = 0 and sedimentation = 11000 mg ~ system tries to reach one of above conditions without exceeding pm level higher than 26000 mg			

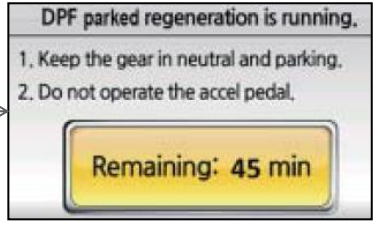
After Treatment Device – Parked Regeneration Lv3

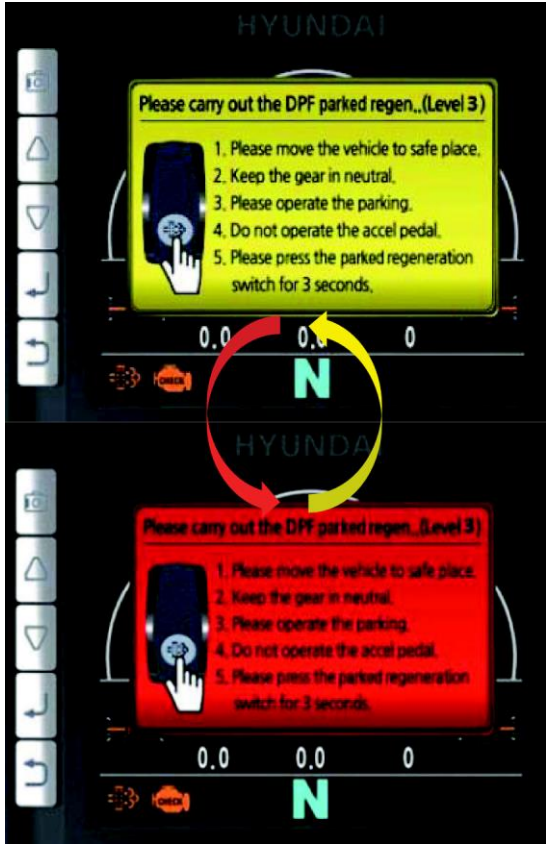


Step 1: Move the vehicle to safe(fireproof) place
Step 2: Stop and park the machine
- Parking brake – ON
- Accelerator pedal – 0%
- F/R switch – N

Step 3: Wait until coolant reaches 65 °C
Step 3: Push the parked regeneration switch for 3 seconds







After Treatment Device – extra: Cluster and MCU upgrade

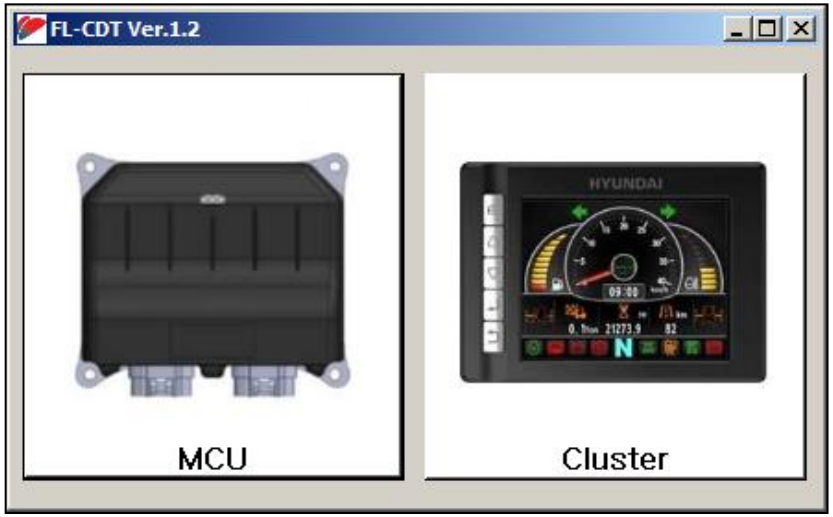
In case of problems with **frequent** Parked Regeneration, we recommend upgrading software version of Cluster and MCU as in package available on-line in CERES.

ZIP file in CERES contains all necessary manuals to guide you through installation and updating process.

Additional info FK

[bps9901]
[HHIE - Service department]

Trucks	Description	Writer	Date	Evidence
	MCU and CLUSTER software upgrade package	Grzegorz Nowakowski	09-09-2014	5367 kb



After Treatment Device – Manual Regeneration Lv4

Lv4

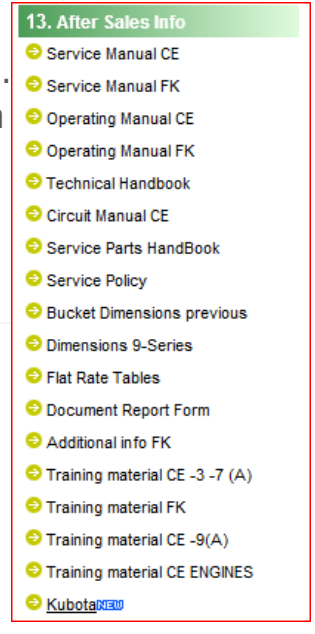
To execute regeneration in Lv4 – DIAGMASTER diagnostic tool is necessary [DST-i Kit p/n: XJBT-02547]
User cannot start this procedure. Only authorized services have authority to perform this regeneration.
Regeneration in Lv4 is the same Parked Regeneration as Lv3. DIAGMASTER just activates the switch, which in Lv4 is deactivated due to safety reasons.

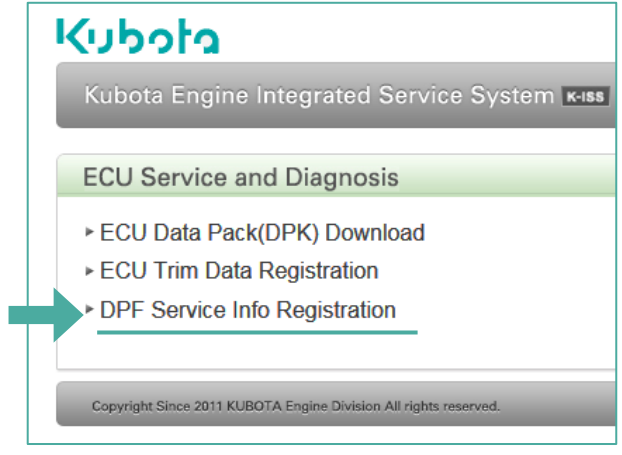
After Treatment Device – Status Lv5

Lv5 → Trap → Regeneration → Cleaning

If system goes to Lv5, cleaning of filter is necessary.
Cleaning will done by KUBOTA service network .....
To avoid unnecessary machine down-time filter exchange program .....
The fact of cleaning or replacing the filter, must be manually registered on KUBOTA website via KiSS system.

Access to KiSS system is possible via CERES





	Engine Serial No.	Engine Model Name	Engine Model Code	DPF Part No.	DPF Serial No.	Hourmeter	Serviced Date
	2DY3530	V3800-CR-TE4B-HHI-1	1J43312000	1J50018252	3UKA004B10		

	DPF COMP		DOC COMP		Hourmeter	Serviced Date (YYYY/MM/DD)
	Part No.	Serial No.	Part No.	Serial No.		
Old	1J50018252	3UKA004B10	1J43318151	3UJB097A10		
New						

DST-i Tool - Features

Diagnosis

- Checking DTC
- Checking parameters
- Checking valves

DPF control

- Soot Load Reset
- Regeneration Interval Reset
- Manual Regeneration

Calibration

- Supply Pump Learning
- Injector Compensation
- Injection Timing Correction

DST-i Kit p/n:
XJBT-02547

DST-i Tool - Installation

Three files are necessary:

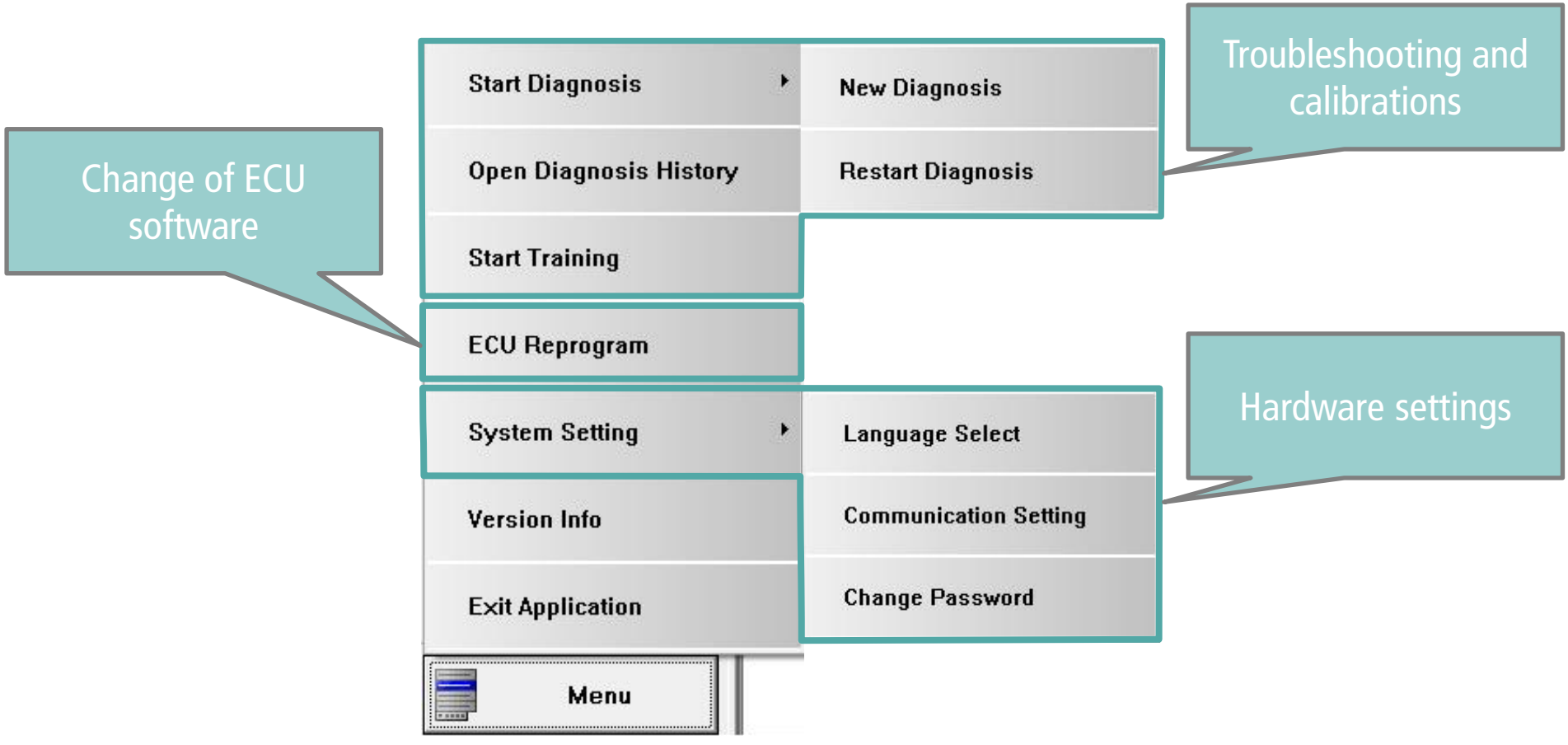
Driver: Setup_DST-iV110.exe [Kubota CD]
Program: SetUp_Diagmaster_Ver333.exe [Kubota CD]
Database: SetUp_Diagmaster_DB_For_Hyundai_Ver3.3.2.exe [CERES]

Details in attached files:

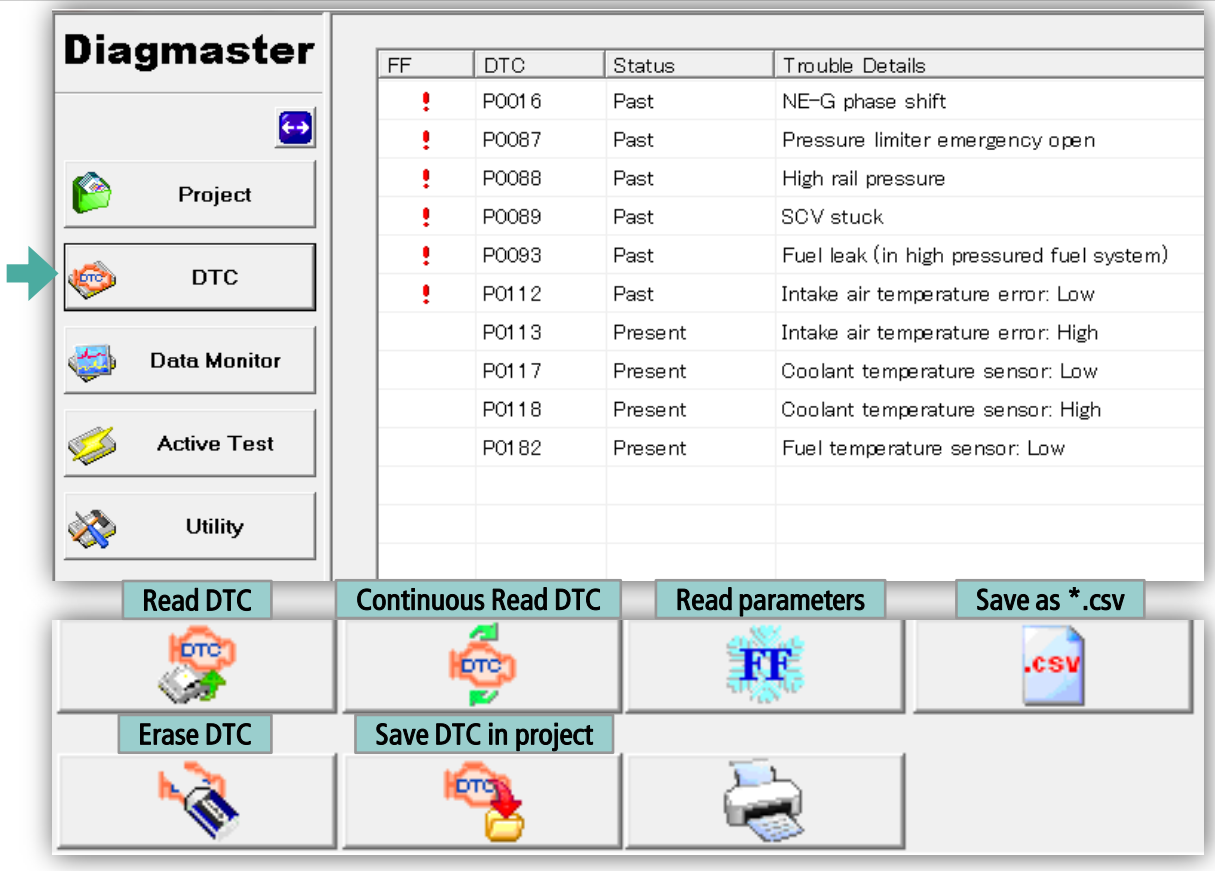
Installation sequence (Read first before starting installation as advised through HHIE-SB-2014-026).pdf

HHIE-SB-2014-026 Kubota Diag Tool inst - Update Dec 2014.pdf

DST-i Tool – Menu Structure



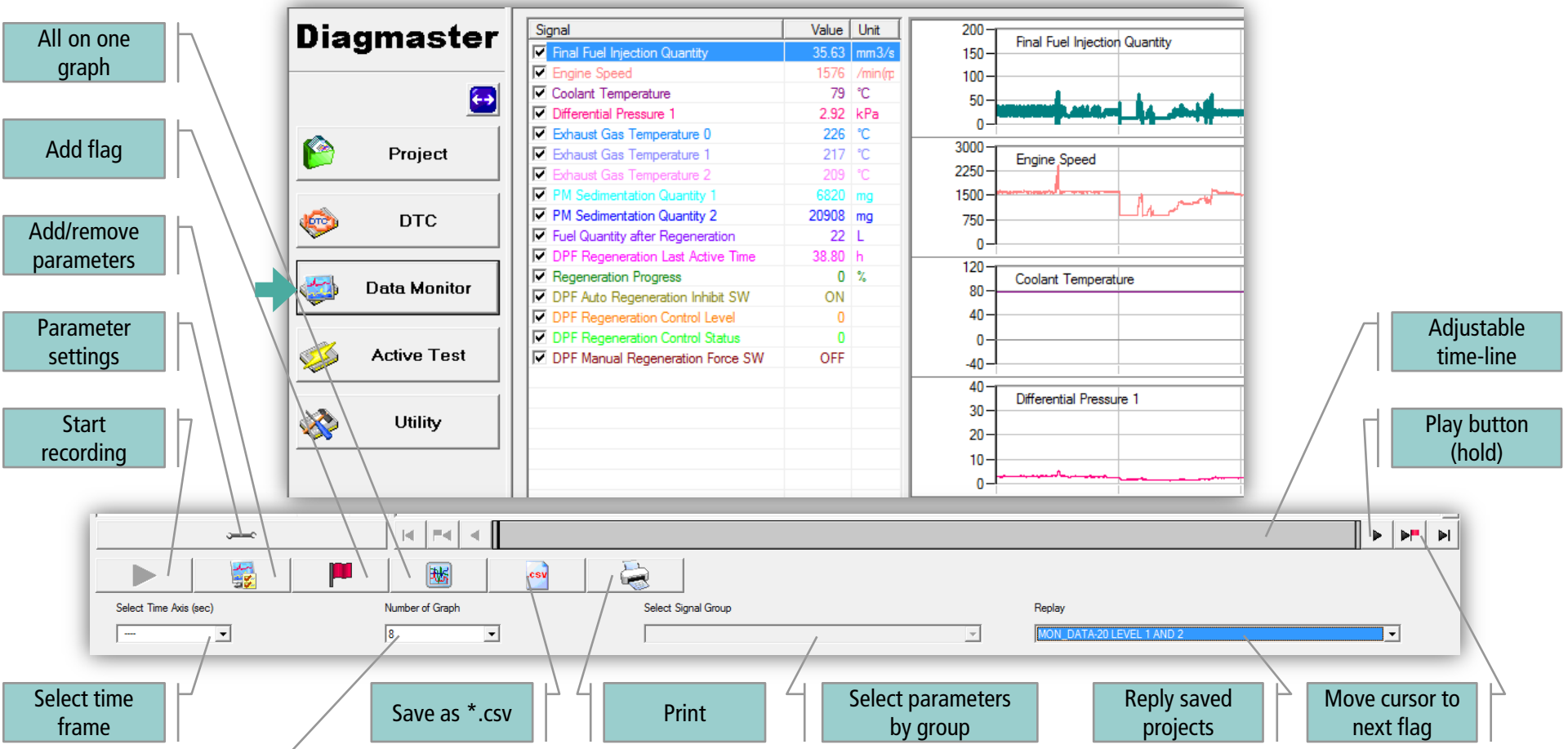
DST-i Tool – Diagnosis – DTC



Error code list
- see slide no 58

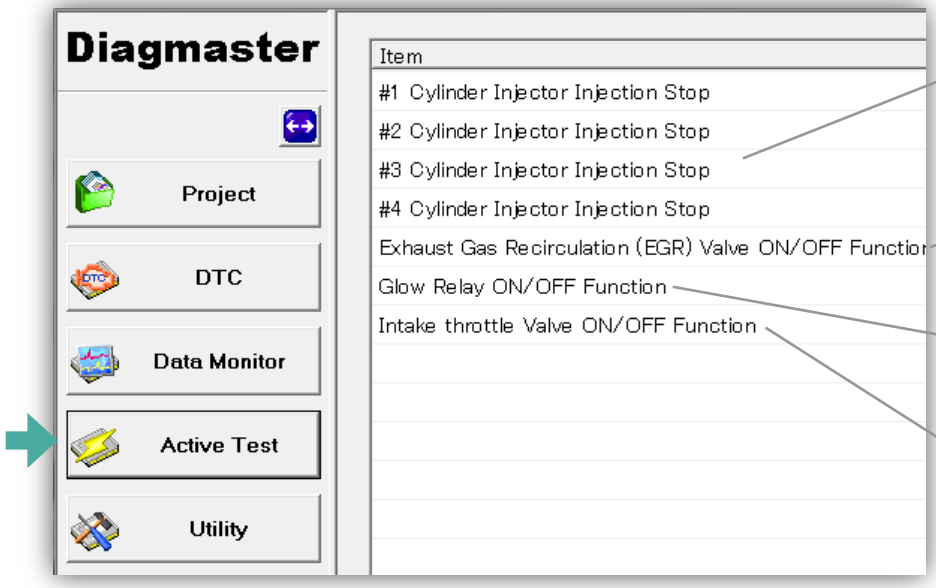
- **DTC** is signals from ECU according to calculation from sensor value or other electrical signals.
- **FF | Freeze Frame data** is engine status when the DTC occurred.
- ! means it has FF.

DST-i Tool – Diagnosis – Data Monitor



- **DTC** cannot support all of troubles. Sometimes it is necessary to figure out the cause of troubles from parameters.

DST-i Tool – Diagnosis – Active tests



Injection Stop – required for injectors maintenance each 1500h

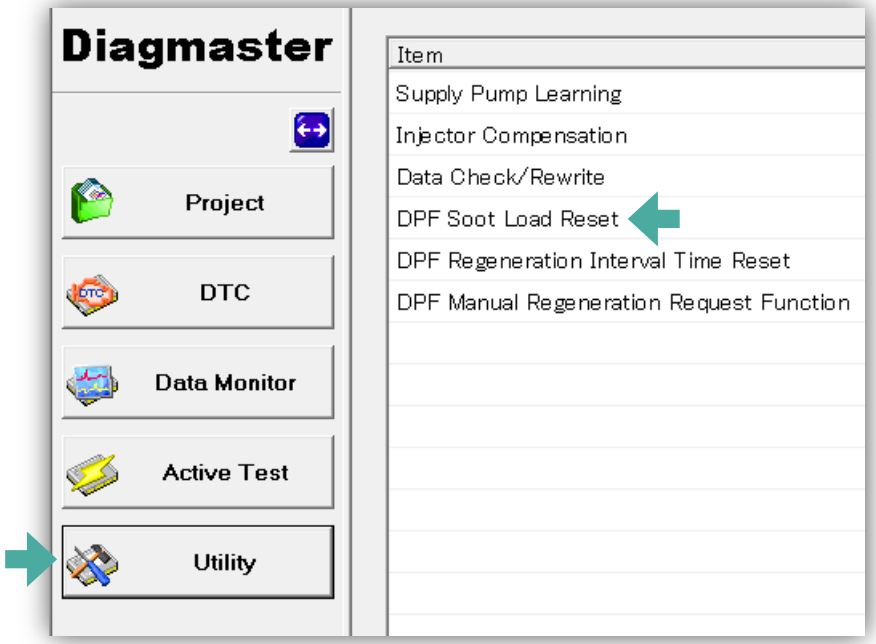
EGR test 65°C~

Glow Relay

Throttle

- For better test results, please choose related parameters

DST-i Tool – DPF Control – Soot Load Reset



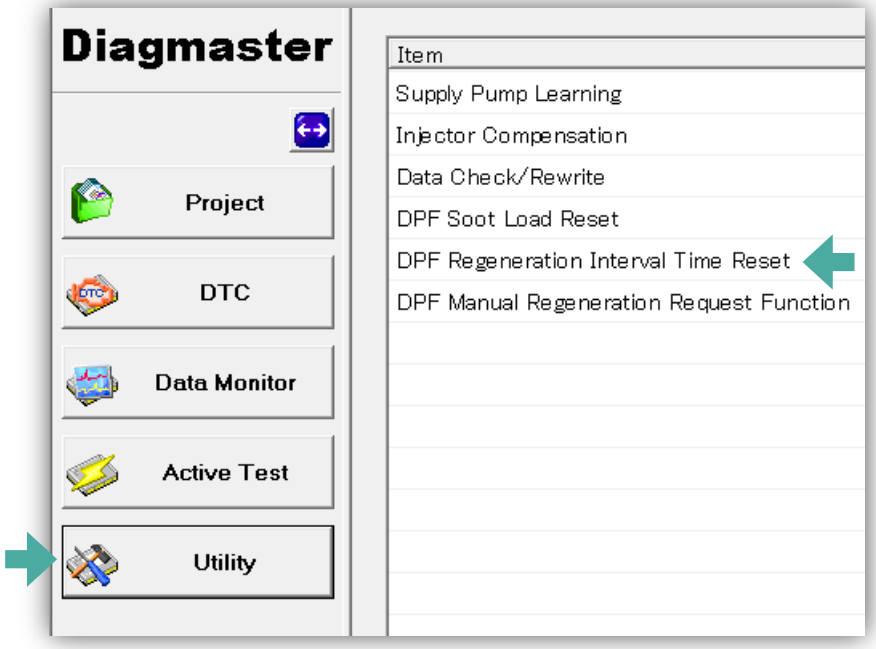
When Required ?

After replacing DPF.

- 3000 hour
- P3008 | PM Level = 5
- P3024 | **High Frequency of Re-gen**

- **Reset the value of PM which ECU memorize.**
- **At PM Lv.5, DO NOT reset soot load and execute Manual Re-gen. Too much PM generates too much heat.**

DST-i Tool – DPF Control – DPF Regeneration Interval Time Reset



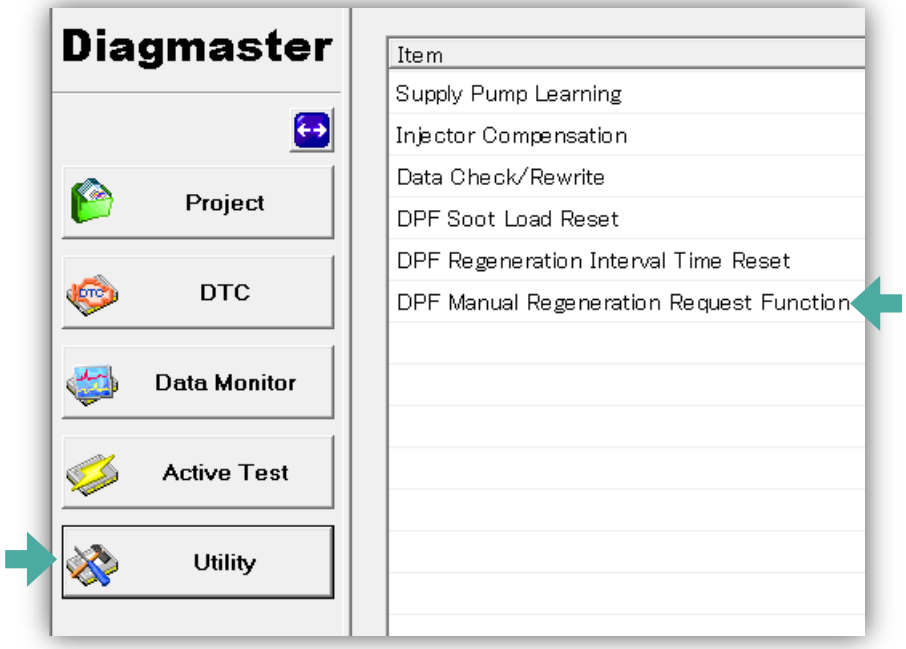
When Required ?

After replacing DPF because of P3024.

- P3024 | High Frequency of Re-gen

- Bring ***Interval Time*** back to zero.
- ***Interval Time*** is time length since the last Regeneration which ECU counts.
- Too short interval time cause **P3024**

DST-i Tool – DPF Control – DPF Manual Regeneration Request Function



When Required ?

After replacing DPF, or After replacing ECU or PM Lv.4

- P3007 | PM accumulation Lv.4
- after Cleaning because of P3008
- after Cleaning because of P3024
- When ECU changed

- Order ECU to send regeneration request signal forcibly.

  To execute Regeneration, need to push Re-gen button of application (depends on application)

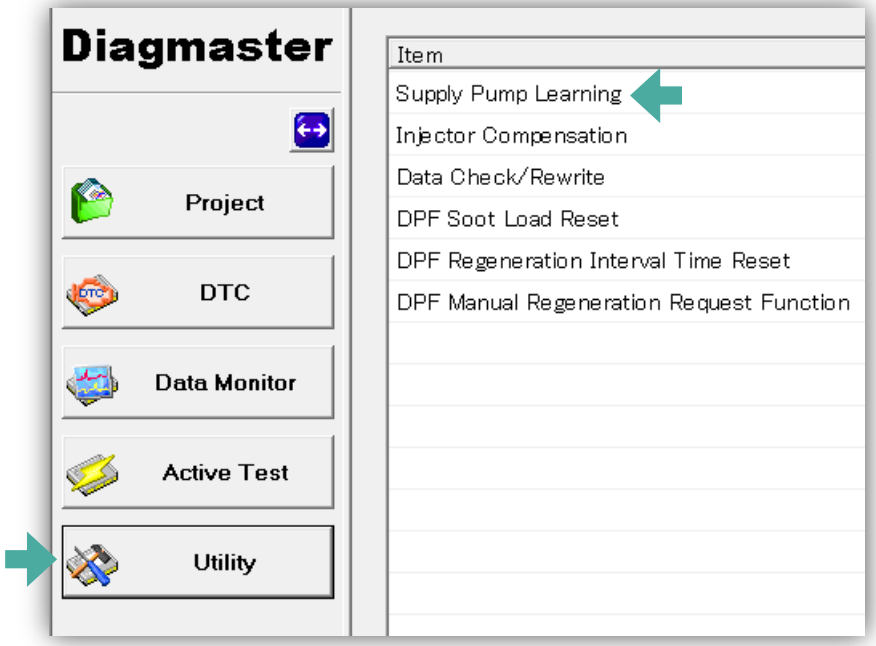
- After Manual Re-gen, check 2 parameter at Data monitor.

  (1). "***DPF Regeneration Control Level***" shows "Level 0"

  (2). "***DPF Regeneration Control Status***" shows "Level 0"

- 3 Preconditions | Parking Brake ON , Neutral SW ON, Idling Speed.

DST-i Tool – Calibration – Supply Pump Learning



When Required ?

Supply pump recognized by ECU is different from equipped supply pump.

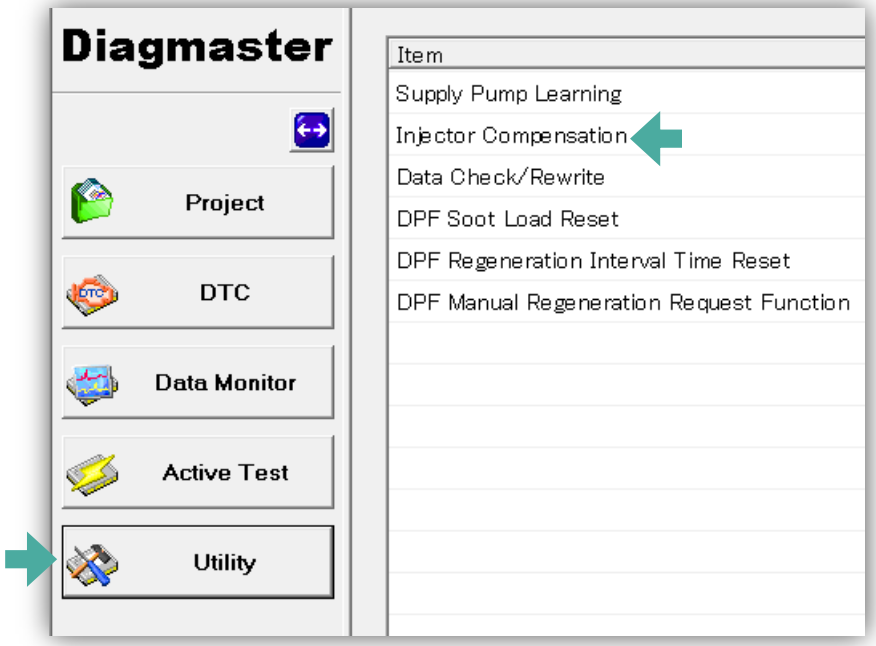
- When Supply Pump changed
- When SCV changed
- When ECU changed

	SCV Current (Duty Time)		Rail Pressure (Idling)
Standard	1.0 [A]	→	35 MPa
Old pump	1.0 + 0.1 [A]	→	35 MPa
Replaced Pump	1.0 - 0.2 [A]	→	35 MPa

※Value is reference

- In order to adjust individual difference of every pumps, input the correction current value of SCV. (Fuel quantity is controlled by SCV position.)

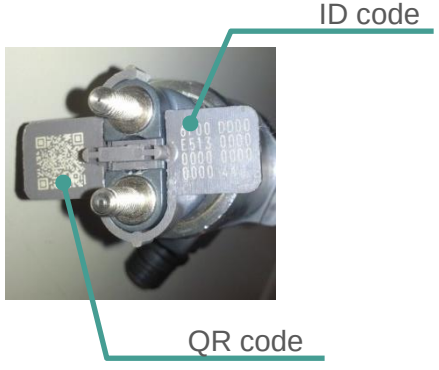
DST-i Tool – Calibration – Injector Compensation



When Required ?

Injector of each cylinder recognized by ECU is different from equipped Injector.

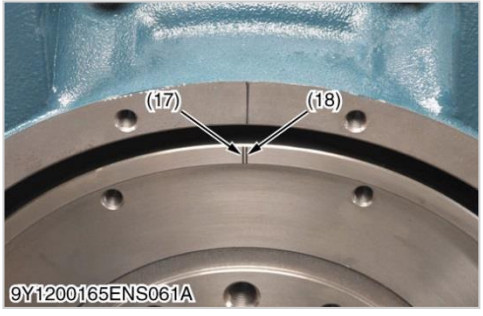
- When Injector changed
- When Injector swapped with other cylinder
- When ECU changed



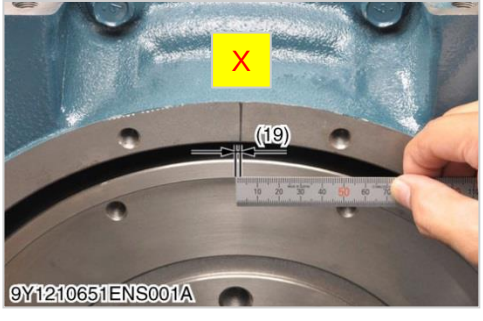
- In order to correct for variations of injection quantity caused by individual difference of Injectors, input ID code of equipped Injectors into ECU
- ***ID code*** is for Diagmaster. (printed by DENSO)
- ***QR code*** is for manufacturing line. (we don't use)

DST-i Tool – Calibration – Injection Timing Correction 01

Mechanical T.D.C



Electrical T.D.C

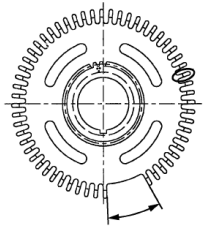


When Required ?

When position relation of NE sensor and pulsar gear change.

- When pulsar gear changed
- When crankshaft changed
- When gear case changed
- When ECU changed

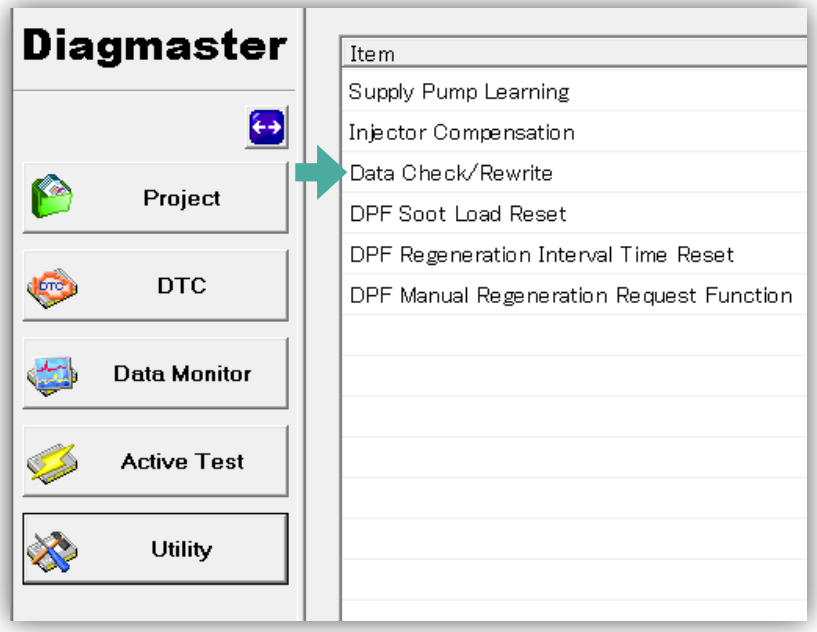
For details, please refer to Kubota Service Manual

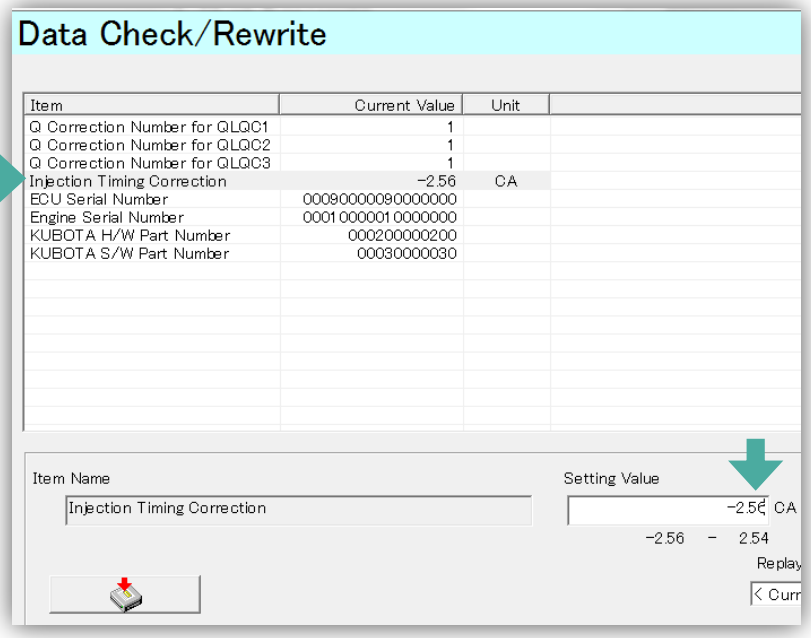


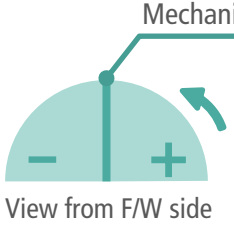
- Match Mechanical T.D.C and Electrical T.D.C (at #4 cylinder) in order to correct injection timing
- (#17) Mechanical T.D.C is when #4 cylinder's piston comes top.
- (#18) Electrical T.D.C is when NE sensor detects 14th teeth (0V > 5V).

Injection timing depends on Electrical T.D.C (NE sensor value)

DST-i Tool – Calibration – Injection Timing Correction 02







- Convert #19[mm] X to [degree] when input crank angle. (F/W Diameter = 385 mm → 1 mm = 0.298 CA)
- Electrical T.D.C is to the RIGHT (comes AFTER Mechanical) → POSITIVE
- Electrical T.D.C is to the LEFT (comes BEFORE Mechanical) → NEGATIVE

DST-i Tool – Calibration – Website Registration

13. After Sales Info

- Service Manual CE
- Service Manual FK
- Operating Manual CE
- Operating Manual FK
- Technical Handbook
- Circuit Manual CE
- Service Parts HandBook
- Service Policy
- Bucket Dimensions previous
- Dimensions 9-Series
- Flat Rate Tables
- Document Report Form
- Additional info FK
- Training material CE -3 -7 (A)
- Training material FK
- Training material CE -9(A)
- Training material CE ENGINES
- KubotaNEW

Kubota

Kubota Engine Integrated Service System K-ISS

ECU Service and Diagnosis

- ECU Data Pack(DPK) Download
- ECU Trim Data Registration
- DPF Service Info Registration

ECU Service and Diagnosis

ECU Trim Data Registration (Injector, Injection Timing)

	Engine Serial No.	Engine Model Name
	2DY3530	V3800-CR-TE4B-HHI-1

Injector Compensation

Original

Cylinder No.1	Cylinder No.2	Cylinder No.3	Cylinder No.4
6FCB AB00	6FDE CAF4	6FAC AD00	6FCB B4F4
C205 EA00	CF00 D900	B0F3 C800	B800 CD00
0000 0000	0000 0000	0000 0000	0000 0000
0000 22	0000 99	0000 E5	0000 91

Cylinder Number

New

Cylinder No.1	Cylinder No.2	Cylinder No.3	Cylinder No.4

Injection Timing Correction

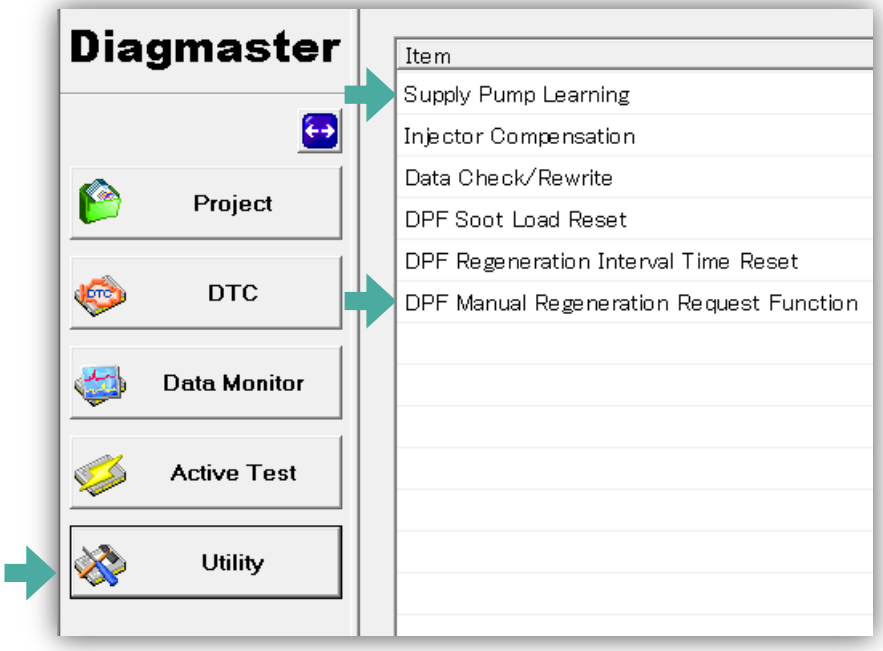
Original

0.2

New

- New Injectors and Injection Timing have to be registered at KiSS.
- Ceres -> After Sales Info -> Kubota

DST-i Tool – ECU EXCHANGE



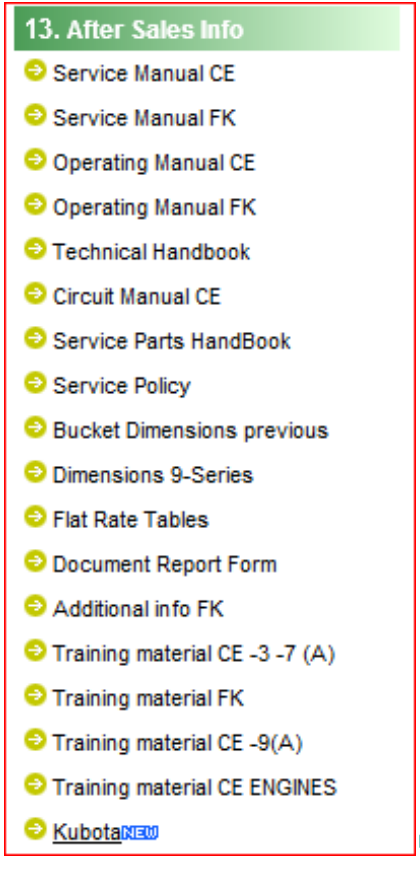
After replacing ECU...

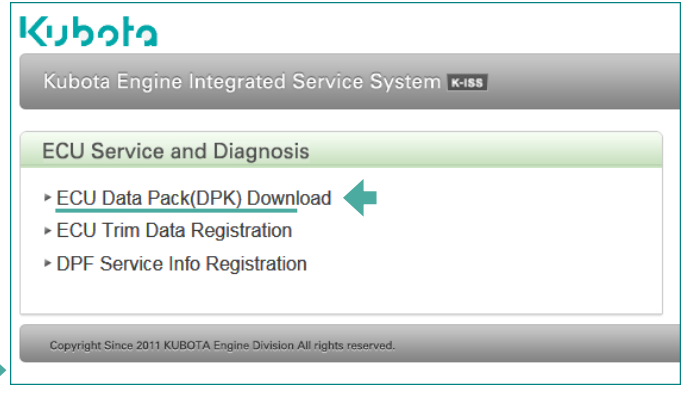
Reset DPF data or calibration required, because new ECU doesn't know your engine well.

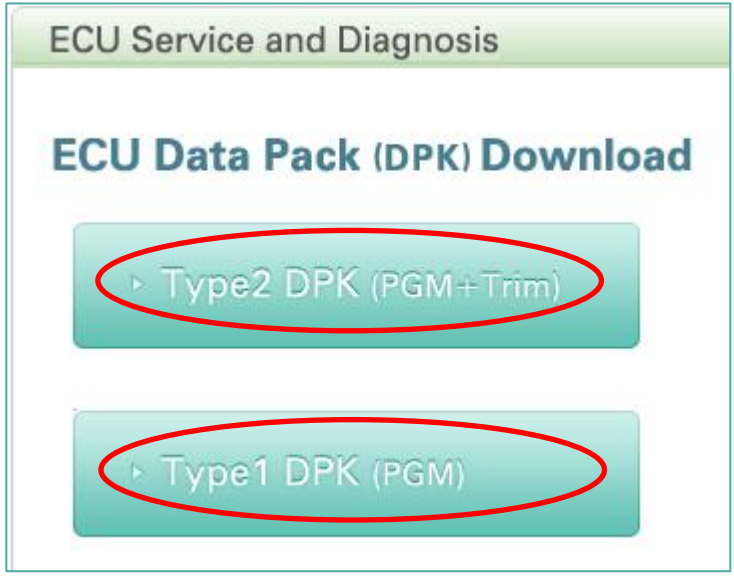
- Supply Pump Learning
- DPF Manual Regeneration
- Check ECU Trim data is correct

- New ECU have to be written many information. Only Kubota can write them. When ECU requires changing, please contact HHIE with Engine S/N.
- ***If Injector Compensation and Injection Timing Correction registered at KiSS***, KBT send new ECU with those data. (you do not need to input them.)
- New ECU doesn't know the real DPF status such as PM Level, it could cause wrong control.
  Manual Re-gen conform actual PM Lv to ECU's PM Lv.

DST-i Tool – ECU Software Upgrade



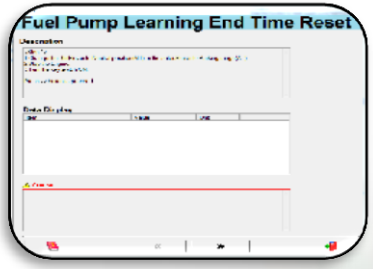




- **New ECU software can be downloaded from KiSS.**
- Ceres -> After Sales Info -> Kubota

DPF- exchange: Set the pictures into the right order!

In case of an error code: P3008 (Level 5) or P3024 (Ash) you need to change the DPF filter



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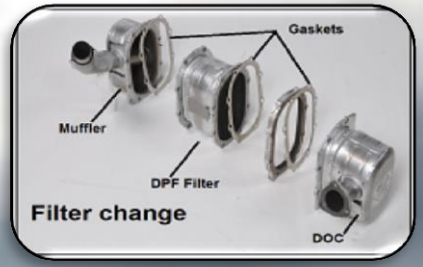

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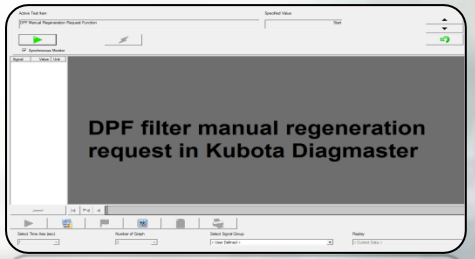

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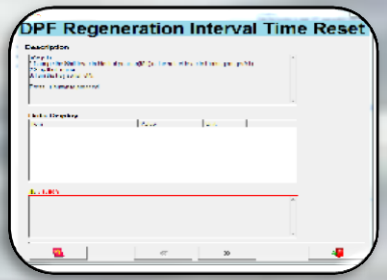

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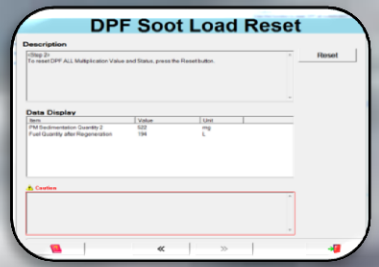

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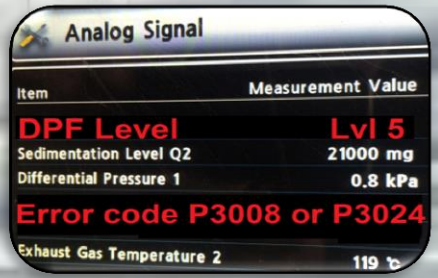

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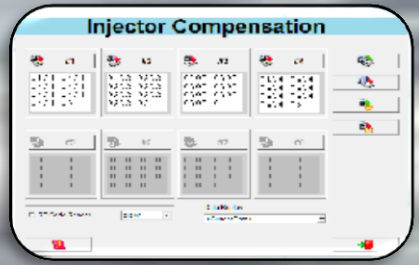
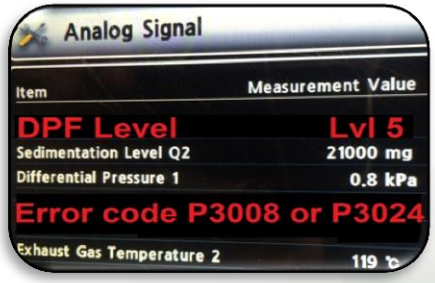


DONE!

This is the right way to do it!!!



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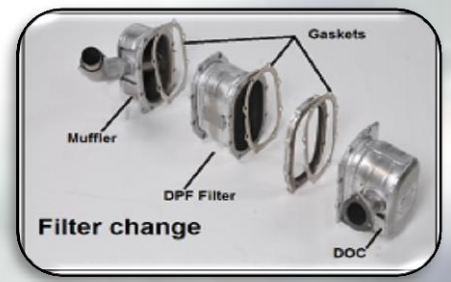

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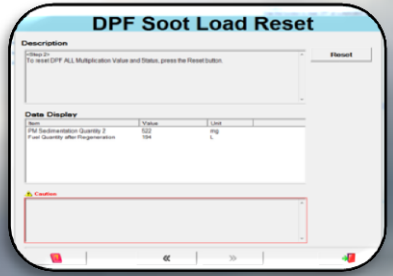

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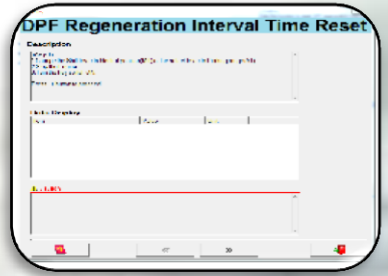

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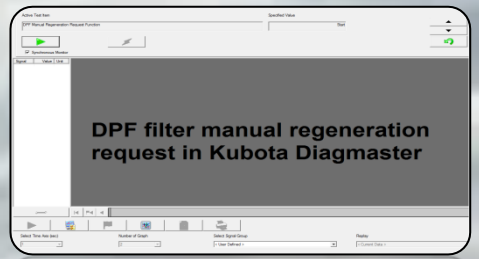

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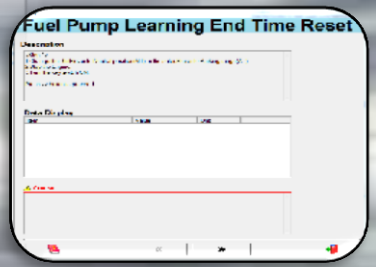
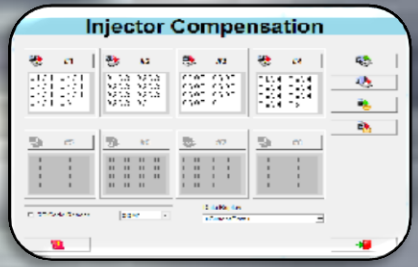
6

7

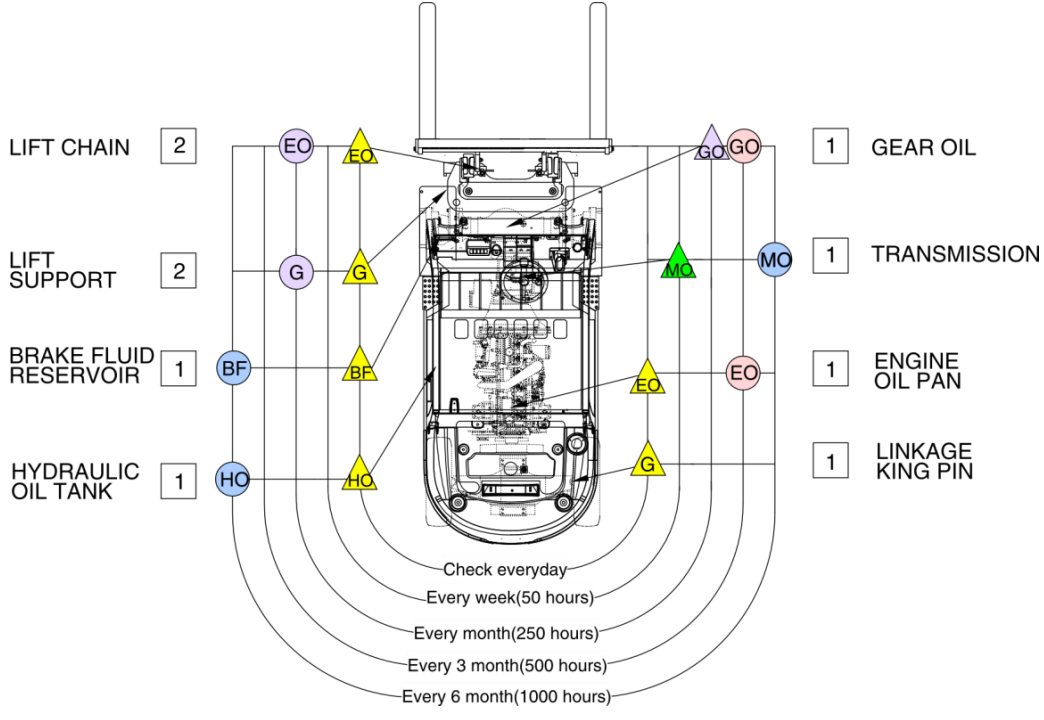
DONE!





Maintenance

Maintenance – Lubrication Chart



NOTES

① △: Check, add oil when needed.
② ○ : Change oil or add oil.
③ Figures in squares indicate number of lubricating points.
④ All service intervals in the chart are based on daily, 2 weeks, 1 month, 3 months, 6 months, and service meter readings.

Mark	Kind of lubricants	In moderate weather	Cold region
EO	Engine oil	API CJ-4 class or better	
MO	T/M oil	ATF DEXRON III	
GO	Gear oil	MOBILFLUID 424 + Shell Donax TD (10W30)	
HO	Hydraulic oil	ISO VG 46, VG 68	ISO VG 15
BF	Brake fluid	AZOLLA ZS32 (Hydraulic oil ISO VG32)	
G	Grease	NLGI No. 2	NLGI No.1

New machine uses following fuel, coolant and lubricant.

Description	Specification
Engine oil	SAE 15W-40 (API CJ-4 class)
T/M oil	ATF DEXRON III
Gear oil	MOBIL FLUID 424 + Shell Donax TD (10W30)
Hydraulic oil	ISO VG46/VG68, Hyundai genuine long life hydraulic oil ISO VG15, Conventional hydraulic oil★1
Brake oil	AZOLLA ZS32 (Hydraulic oil ISO VG32)
Grease	Lithium base grease NLGI No.2
Fuel	ASTM D975-No.2 ★2 Ultra low sulfur diesel
Coolant	Mixture of 50% ethylene glycol base antifreeze and 50% water

- SAE : Society of Automotive Engineers
- API : American petroleum Institute
- ISO : International Organization for Standardization
- NLGI : National Lubricating Grease Institute
- ASTM : American Sociery of Testing and Material

★1 : Cold region
Russia, CIS, Mongolia
★2 Ultra low sulfur diesel
- sulfur content < 15 ppm

Maintenance – Intervals

35~50D-9A SM (35~50D-9A SM.pdf)

35~50D-9A OM (35~50D-9A OM.pdf)

Service interval	Item No.	Description	Service Action	Oil symbol	Capacity (l)	Service point No.
10 Hours or daily	1	Tilt pin & Mast roller	Check, Add	G	-	2
	2	Lift chain	Check, Add	EO	-	2
	4	Brake oil	Check, Add	BF	0.5	1
	5	Parking brake operation	Check, Adjust	-	-	1
	6	Hydraulic oil level	Check, Add	HO	66	1
	8	Engine oil level	Check, Add	EO	13.2	1
	10	Hyd. tank air breather element	Check, Clean	-	-	1
	15	Pedal linkage operation	Check, Adjust	-	-	1
	16	Drive rim & Tire air pressure	Check, Add	-	-	2
	19	Lamp operation	Check, Replace	-	-	9
	21	Fuel level	Check, Add	DF	100	1
	22	Water separator	Check, Drain	-	-	1
	24	Radiator coolant	Check, Add	C	21.5	1
	25	Steer rim & Tire air pressure	Check, Add	-	-	2
	26	Fan belt tension	Check, Adjust	-	-	1
	27	Horn operation	Check, Replace	-	-	1
50 Hours or weekly	11	Air cleaner element	Check, Clean	-	-	1
	12	Hydraulic pump drive	Check, Add	G	-	1
	13	Steering axle linkage	Check, Add	G	-	1
	17	Transmission oil level	Check, Add	MO	12	1
Initial 50 Hours	8	Engine oil	Change	EO	13.2	1
	9	Engine oil filter	Replace	-	-	1
Initial 100 Hours	14	Differential gear oil	Change	GO	10.5	1
	17	Transmission oil	Change	MO	12	1
	18	Transmission oil filter	Replace	-	-	1

Maintenance – Intervals

250 Hours or monthly	1	Tilt pin & Mast roller	Check, Lubricate	G	-	2
	2	Lift chain	Check, Lubricate	EO	-	2
	10	Hyd. tank air breather element	Replace	-	-	1
	14	Differential gear oil	Check, Add	GO	10.5	1
	28	Fork condition and wear	Check, Replace	-	-	2
500 Hours or 3 monthly	3	Trunnion bolt	Check, Adjust	-	-	4
	8	Engine oil	Change	EO	13.2	1
	9	Engine oil filter	Replace	-	-	1
	11	Air cleaner element	Replace	-	-	1
	20	Fuel filter	Replace	-	-	1
	23	Battery electrolyte	Check, Add	-	-	1 (2)
1000 Hours or 6 monthly	4	Brake oil	Change	BF	0.5	1
	7	Hydraulic oil return filter	Replace	-	-	1
	14	Differential gear oil	Change	GO	10.5	1
	16	Brake condition and wear	Check, Replace	-	-	2
	17	Transmission oil	Change	MO	12	1
	18	Transmission oil filter	Replace	-	-	1
	29	Steering axle wheel bearing	Check, Add	G	-	2
1500 Hours	30	PCV valve	Check, Replace	-	-	1
	31	Oil separator element	Replace	-	-	1
	32	EGR cooler	Check, Replace	-	-	1
2000 Hours	6	Hydraulic strainer	Check, Clean	HO	-	1
	6	Hydraulic oil*1	Change	HO	66	1
	24	Radiator coolant	Change	C	21.5	1
3000 Hours	30	DPF muffler	Clean	-	-	1
5000 Hours	6	Hydraulic oil*2	Change	HO	66	1

Maintenance – Recommended Lubricants

Service point	Kind of fluid	Capacity ℓ (U.S. gal)	Ambient temperature ˚C (˚F)
			-50 (-58) / -30 (-22) / -20 (-4) / -10 (14) / 0 (32) / 10 (50) / 20 (68) / 30 (86) / 40 (104)
Engine oil pan	Engine oil	13.2 (3.49)	★SAE 5W-40 SAE 30 SAE 10W SAE 10W-30 SAE 15W-40
Torque converter transmission	Transmission oil	12 (3.2)	ATF DEXRON III
Axle	Gear oil	10.5 (2.8)	MOBIL FLUID 424 + Shell Donax TD (10W30)
Hydraulic tank	Hydraulic oil	66 (17.4)	★ISO VG 15 ISO VG 46 ISO VG 68
Fuel tank	Diesel fuel★1	100 (26.4)	★ASTM D975 NO.1 ASTM D975 NO.2
Fitting (Grease nipple)	Grease	-	★NLGI NO.1 NLGI NO.2
Brake reservoir tank	Brake oil	-	★AZOLLA ZS10 (Hydraulic oil, ISO VG10) AZOLLA ZS32 (Hydraulic oil, ISO VG32)
Radiator	Antifreeze : Water	21.5 (5.7)	Ethylene glycol base permanent type (50:50) ★Ethylene glycol base permanent type (60 : 40)

NOTES

- Engine oil should be API classification CJ-4.
- Change the type of engine oil according to the ambient temperature.
  When using oil of different brands from the previous one, be sure to drain all the previous oil before adding the new engine oil.
- On DPF-equipped engines, part of the fuel may get mixed with engine oil during the regenerating process. This may dilute the oil and increase its quantity. If the oil rises above the oil level gauge upper limit, it means the oil has been diluted too much, resulting in a trouble. In such case, immediately change the oil for new one.
- If the interval of DPF regeneration becomes 5 hours or less, be sure to change the oil for new one.

★1 Ultra low sulphur diesel – sulphur content < 15 ppm

★ Cold region Russia, CIS, Mongolia

Q & A