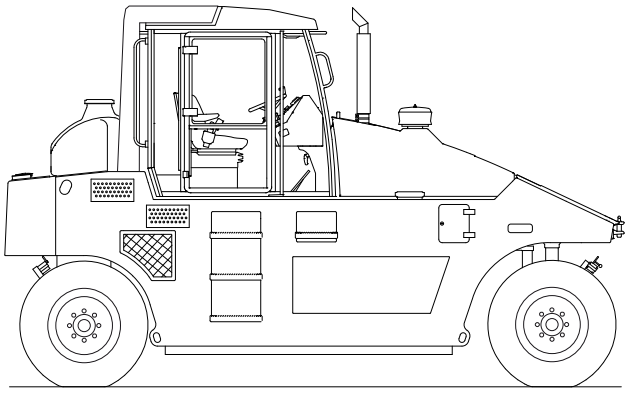
AMMANN

Operating manual

AP 240
Cummins



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AP 240
Pneu tyred roller
Cummins Tier 3

Operating manual

Edition 01/2012 EN
From Serial No. 4302395
Translation of Original Operating Manual

ES Prohlášení o shodě

(**Původní ES prohlášení o shodě /** *Original EC Declaration of conformity / Ursprüngliche EG-Konformitätserklärung*)

EC Declaration of conformity / EG-Konformitätserklärung

(**Překlad původního ES prohlášení o shodě /***Translation original EC Declaration of conformity / Übersetzung der ursprünglichen EG-Konformitätserklärung*)

Originální ES prohlášení o shodě je dodané s dokumenty během expedice stroje. / *The original EC Declaration of Conformity is supplied with documents during expedition of machine. / Das Original der EG-Konformitätserklärung wird mit den Unterlagen während des Versands der Maschine mitgeliefert.*

Výrobce / *Manufacturer / Hersteller:* **Adresa /** *Address / Adresse:* **IČ /** *Identification Number / Ident.-Nr:*	Ammann Czech Republic a.s. Náchodská 145, CZ-549 01 Nové Město nad Metují, Czech Republic 000 08 753
Jméno a adresa osoby pověřené sestavením technické dokumentace podle 2006/42/ES a jméno a adresa osoby, která uchovává technickou dokumentaci podle 2000/14/ES / *Name and address of the person authorised to compile the technical file according to 2006/42/EC and name and address of the person, who keeps the technical documentation according to 2000/14/EC / Name und Adresse der mit der Zusammenstellung der technischen Dokumentation beauftragten Person gemäß 2006/42/EG und Name und Adresse der mit der Aufbewahrung der technischen Dokumentation beauftragten Person gemäß 2000/14/EG:*	Ing. Radek Ostrý Ammann Czech Republic a.s. Náchodská 145, CZ-549 01 Nové Město nad Metují, Czech Republic
Popis strojního zařízení / *Description of the machinery / Beschreibung der Maschineneinrichtung:*	
Označení / *Designation / Bezeichnung:*	Pneumatikový válec / *Pneu tyred roller / Gummiradwalze*
Typ / *Type / Typ:*	AP 240
Verze / *Version / Version:*	
Výrobní číslo / *Serial number / Maschinennummer:*	
Motor / *Engine / Motor:*	Cummins QSB 3.3-C99, vznětový, jmenovitý výkon (ISO 3046-1): 74,0 kW, jmenovité otáčky: 2200 min^{-1} / *Cummins QSB 3.3-C99, Diesel, nominal power (ISO 3046-1): 74,0 kW, rated speed: 2200 RPM / Cummins QSB 3.3-C99, Dieselmotor, Nennleistung (ISO 3046-1): 74,0 kW, Nenndrehzahl: 2200 min^{-1}*
Prohlašujeme, že strojní zařízení splňuje všechna příslušná ustanovení uvedených směrnic / *We declare, that the machinery fulfils all the relevant provisions mentioned Directives / Wir erklären, dass die Maschineneinrichtung sämtliche entsprechenden Bestimmungen aufgeführter Richtlinien erfüllt:*	Strojní zařízení – směrnice 2006/42/ES / *Machinery Directive 2006/42/EC / Maschineneinrichtung – Richtlinie 2006/42/EG* Elektromagnetická kompatibilita – směrnice 2004/108/ES / *Electromagnetic Compatibility Directive 2004/108/EC / Elektromagnetische Kompatibilität – Richtlinie 2004/108/EG* Emise hluku – směrnice 2000/14/ES / *Noise Emission Directive 2000/14/EC / Lärmemissionen – Richtlinie 2000/14/EG*
Harmonizované technické normy a technické normy použité k posouzení shody / *The harmonized technical standards and the technical standards applied to the conformity assessment / Harmonisierte technische Normen und für die Beurteilung der Konformität verwendete Normen:*	ČSN EN ISO 12100-2, ČSN EN 500-1+A1, ČSN EN 500-4, ČSN EN ISO 4413, ČSN EN ISO 4414, ČSN EN 13309:2001
Osoby zúčastněné na posouzení shody / *Bodies engaged in the conformity assessment / An der Konformitätsbeurteilung beteiligte Personen:*	Notifikovaná osoba č. 1016 / *Notified Body No.: 1016 / Notifizierte Stelle Nr.: 1016* Státní zkušebna zemědělských, lesnických a potravinářských strojů, a. s., Třanovského 622/11, 163 04 Praha 6–Řepy, ČR / *The Government Testing Laboratory of Agricultural, Food Industry and Forestry Machines, Joint–stock company, Třanovského 622/11, 163 04 Praha 6–Řepy, Czech Republic / Staatliche Prüfanstalt für Land-, Forst- und Lebensmittelmaschinen, AG Třanovského 622/11, 163 04 Praha 6–Řepy, Tschechische Republik*
Použitý postup posouzení shody / *To the conformity assessment applied procedure / Verwendetes Vorgehen der Konformitätsbeurteilung:*	Na základě směrnice 2000/14/ES příloha VI / *Pursuant to the Noise Emission Directive 2000/14/EC, Annex VI / Aufgrund der Richtlinie 2000/14/EG, Anlage VI*
Naměřená hladina akustického výkonu / *Measured sound power level / Gemessener Schallleistungspegel:*	L_{WA} = 100 dB
Garantovaná hladina akustického výkonu / *Guaranteed sound power level / Garantierter Schallleistungspegel:*	L_{WA} = 101 dB

Místo a datum vydání / *Place and date of issue / Ort und Datum der Ausgabe:* Nové Město nad Metují,

Osoba zmocněná k podpisu za výrobce / *Signed by the person entitled to deal in the name of manufacturer / Zeichnungsberechtigter für den Hersteller:*

Jméno / *Name / Name:* Ing. Jiří Macháček
Funkce / *Grade / Stelle:* Quality Control Manager
Podpis / *Signature / Unterschrift:*

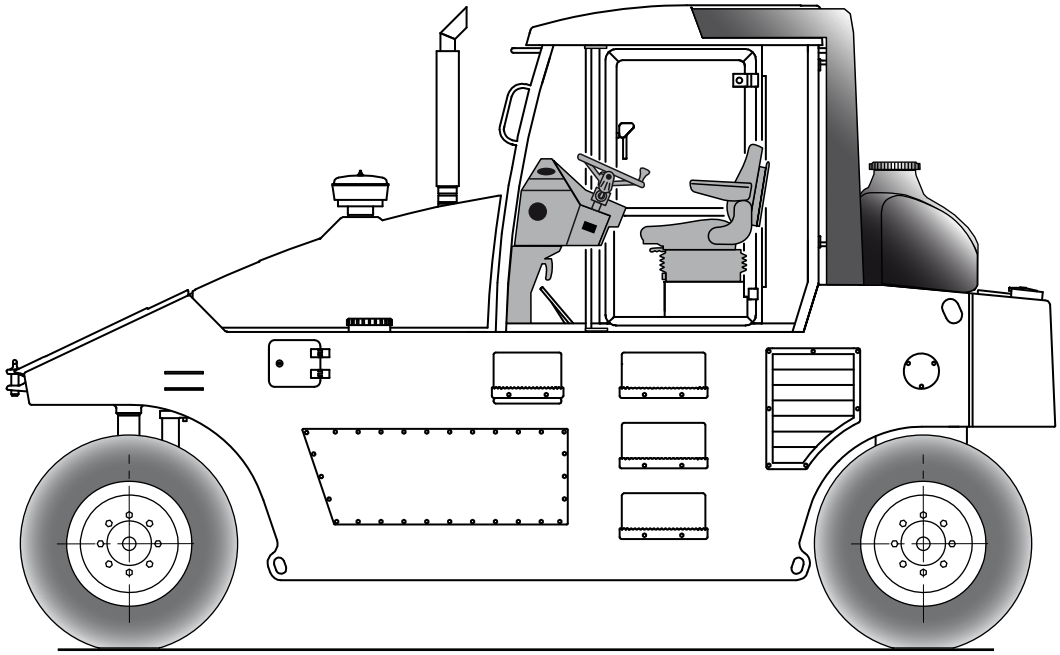
CZ / EN / DE

Congratulations on your purchase of an AMMANN road roller. This modern compaction device is characterised by simple operation and maintenance and is the product of many years of AMMANN experience in the field of road roller engineering. In order to avoid faults due to improper operation and maintenance we request that you read this operating manual with great care and keep it for later reference.

With kind regards,

Ammann Czech Republic a.s. | Náchodská 145 | CZ–549 01 Nové Město nad Metují

☎ + 420 491 476 111 | Fax + 420 491 470 215 | info@ammann-group.com | www.ammann-group.com



This manual consists of:

I. Specification manual

II. Operating instructions

III. Maintenance manual

The following explanations serve to familiarise the machinist (operator) with the roller and to support him during handling and maintenance. It is therefore absolutely necessary to provide the operator with these instructions and to ensure that he reads them carefully before using the road roller. This aids training comprehension during the first use of the road roller.

Subsequent faults due to improper operating are avoided.

Adherence to maintenance instructions increases the reliability and lifetime of the machinery. It reduces repair costs and down time.

AMMANN accepts no liability for continued safe functioning of the road roller if it is incorrectly operated and / or operating modes are employed which represent improper use.

Spare parts must meet AMMANN technical specifications. These requirements are fulfilled if only original AMMANN spare parts are used.

These instructions must always be kept available on the equipment.

Preface

Information, specifications, and recommended operation and maintenance instructions contained in this publication are basic and final information at the time of the printing of this publication. Printer's errors, technical modifications, and modifications of figures are reserved. All dimensions and weights are approximate and, therefore, not binding.

Ammann Czech Republic a.s. reserves the right to perform modifications without obligation to inform the machine user. If you identify any differences between the machine operated by you and the information contained in this publication, contact your local dealer.

SYMBOLS OF THE SAFETY NOTICES:

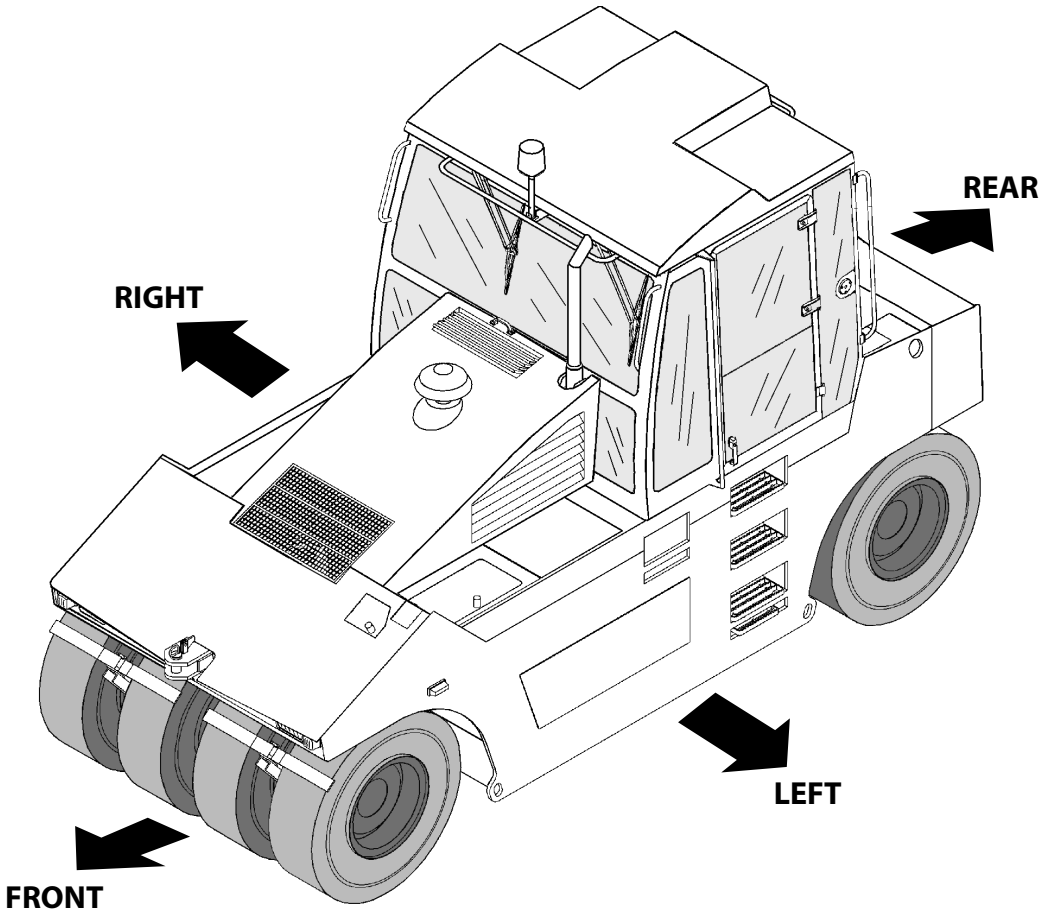
The notice warns of a serious risk of personal injury or other personal hazards.

The notice warns of possible damages to the machine or its parts.

The notice warns of the necessity of environmental protection.

! NOTICE !

As used in this operating manual, the terms „right“, „left“, „front“ and „rear“ indicate the sides of the machine moving forward.



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Content

Content

1. SPECIFICATION MANUAL

AP 240
(Cummins Tier 3)

1.1. Basic Data

Machine description

Pneu tyred roller with a rigid frame with a front steerable isostatic axle and rear drive axle. Each axle is mounted with four smooth tyres.

Machine application

The roller is intended for medium and large-sized compaction works in transport construction (roads and motorways, railways, airfields) and building construction (industrial zones, etc.).

The roller is suitable for compacting the asphalt mixtures up to a layer thickness (after compaction) of 120 mm, hydraulically consolidated mixtures up to a layer thickness of 150 mm, loam and clay soils up to a layer thickness of 150 mm, mixed soils up to a layer thickness of 200 mm, and sand and gravel materials up to a layer thickness of 250 mm.

The roller is not suitable for the compaction of rockfill.

The machine is intended for operation in conditions of the following types according to ČSN IEC 721-2-1 (038900): WT, WDr, MWDr (i.e. mild, warm dry, hot dry with a limited temperature range of from -15 °C (5 °F) to +45 °C (113 °F).

The standard type of the machine is not intended for road traffic. For more information, please contact your dealer.

Please fill in the following data:

(see Pin label, Label of the CUMMINS engine)

Type of machine

.....

ICV/PIN (Serial number of the machine)

.....

Production year

.....

Type of engine

.....

Serial number of the engine

.....

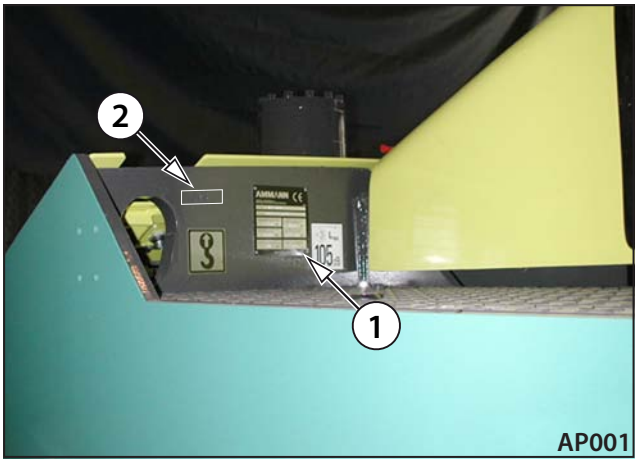
Please refer to the data in the table below always when approaching the dealer or the manufacturer.

The machine that complies with the requirements as to health protection and safety is identified with a name plate with CE marking.

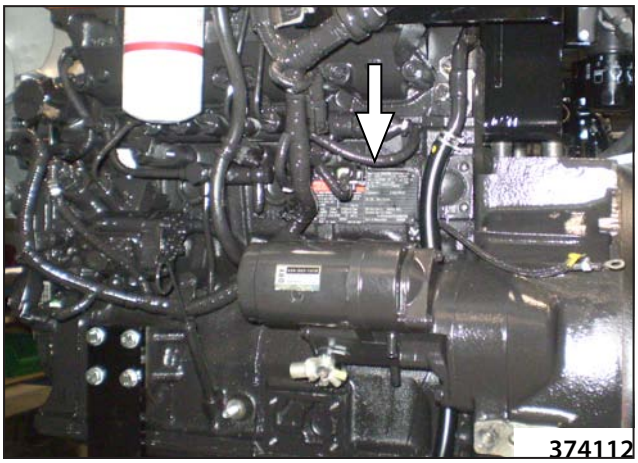
1 - Name – always mentioned only in the English version
2 - Type
3 - Version
4 - Serial number
5 - Operating weight
6 - Maximum weight
7 - Rated power
8 - Front axle load
9 - Rear axle load
10 - Year of manufacture

Name plate location

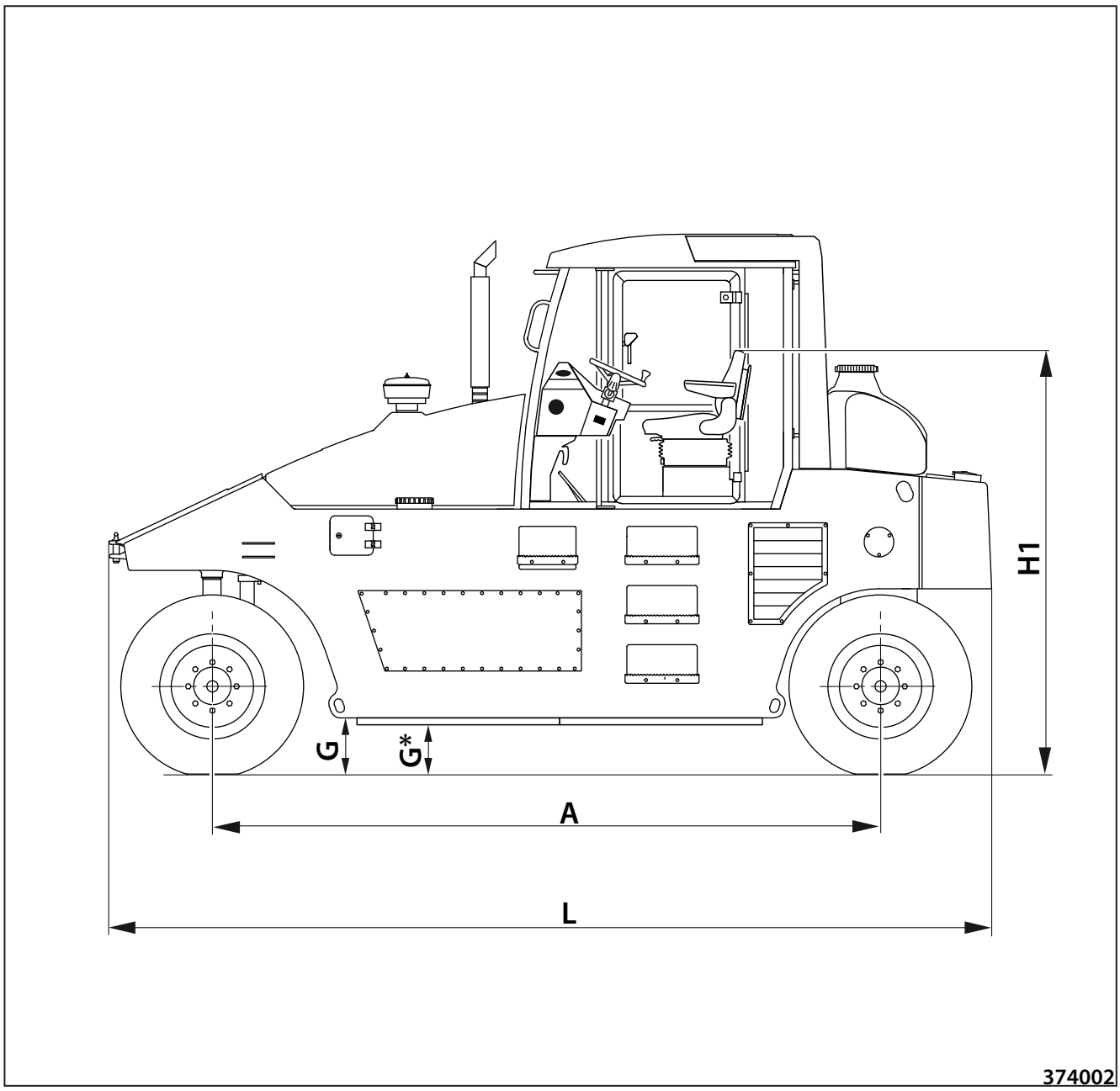
1 - Name plate
2 - Machine frame number



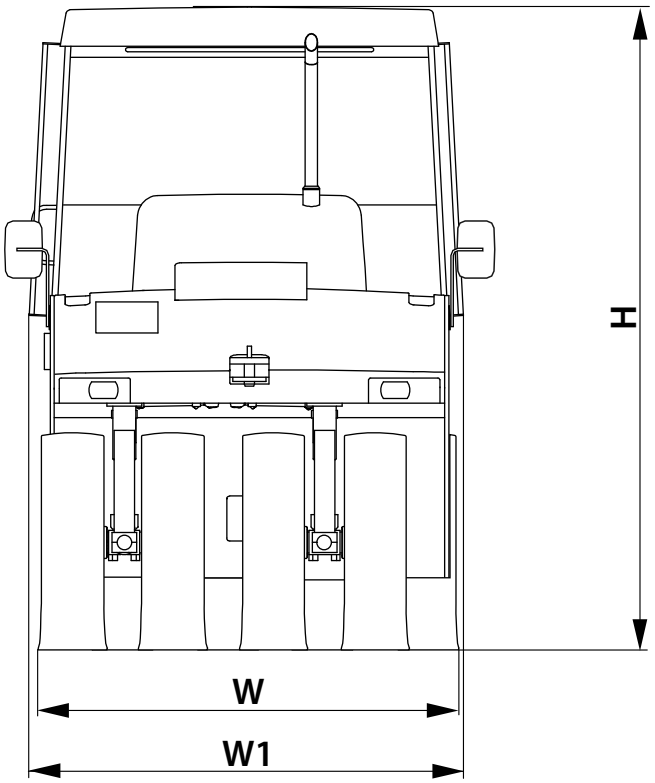
Engine name plate location



1.2. Dimensional machine drawing



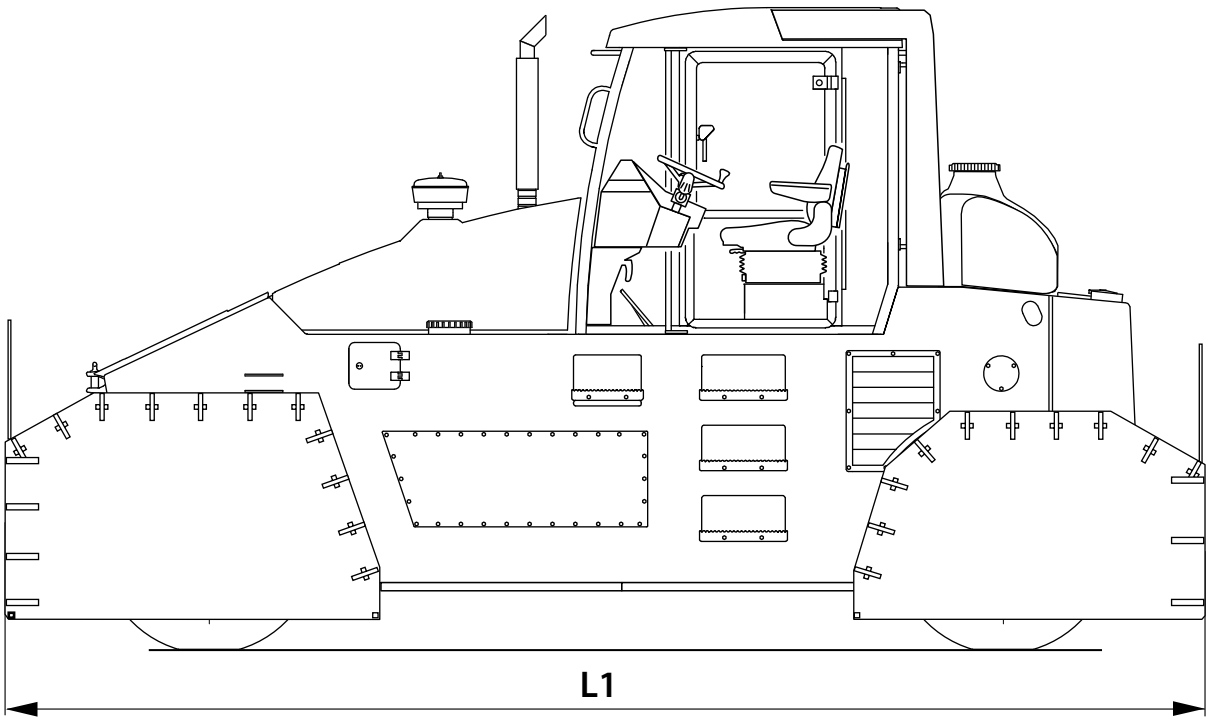
	A	G	G*	H	H1	L	L1	W	W1	W2
mm	3800	340	260	3110	2450	5020	5780	1986	2100	2310
(in)	(149,6)	(13,4)	(10,2)	(122,4)	(96,5)	(197,6)	(227,6)	(78,2)	(82,7)	(90,9)

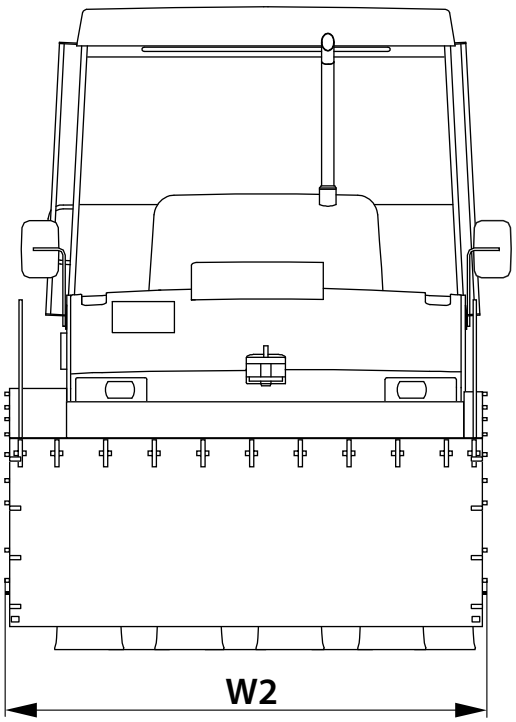


374001

	A	G	G*	H	H1	L	L1	W	W1	W2
mm	3800	340	260	3110	2450	5020	5780	1986	2100	2310
(in)	(149,6)	(13,4)	(10,2)	(122,4)	(96,5)	(197,6)	(227,6)	(78,2)	(82,7)	(90,9)

1.2. Dimensional machine drawing





374016

	A	G	G*	H	H1	L	L1	W	W1	W2
mm	3800	340	260	3110	2450	5020	5780	1986	2100	2310
(in)	(149,6)	(13,4)	(10,2)	(122,4)	(96,5)	(197,6)	(227,6)	(78,2)	(82,7)	(90,9)

Weight		
Operating weight of CECE with cab, ROPS	kg (lb)	9590 (21140)
Operating weight of CECE with cab	kg (lb)	9290 (20480)
Operating weight of CECE with platform, rail	kg (lb)	9060 (19970)
Weight of half fluid capacities	kg (lb)	340 (750)
Operating weight of ISO 6016 with cab, ROPS	kg (lb)	9930 (21890)
Max. weight – cab + ROPS (6016) + accessories + weighing	kg (lb)	24000 (52910)
Maximum permitted weight according to ROPS	kg (lb)	24000 (52910)
Weight of empty ballast tanks	kg (lb)	1100 (2430)
Balance weight 6 t	kg (lb)	6000 (13230)
Weight of ballast tanks filled with concrete	kg (lb)	2800 (6170)
Weight of ballast in frame – water	kg (lb)	3000 (6610)
Weight of ballast in frame – sand	kg (lb)	4500 (9920)
Weight of ballast in the frame – scrap up to the total machine weight	kg (lb)	24000 (52910)
Cab weight	kg (lb)	280 (620)
Weight of ROPS	kg (lb)	300 (660)
Weight of ROPS/FOPS (CNH design)	kg (lb)	530 (1170)
Weight of sheet roof on ROPS	kg (lb)	50 (110)
Weight of canopy	kg (lb)	50 (110)
Weight of canopy posts (version without ROPS)	kg (lb)	60 (130)
Weight of wheel insulation	kg (lb)	120 (260)
Weight of Ammann cutter	kg (lb)	150 (330)
Driving characteristics		
Number of speeds	-	3
Maximum transport speed	km/h (MPH)	0-19 (0-11,8)
Working speed 1	km/h (MPH)	0-5 (0-3,1)
Working speed 2	km/h (MPH)	0-11 (0-6,8)
Working speed 3	km/h (MPH)	0-19 (0-11,8)
Climbing ability	%	25
Lateral static stability	%	32
Turning radius inner (edge) left	mm (in)	6180 (243,3)
Turning radius inner (edge) right	mm (in)	6065 (238,8)
Turning radius outer (contour) left	mm (in)	9960 (392,1)
Turning radius outer (contour) right	mm (in)	8735 (343,9)
Type of drive	-	Hydrodynamic
Type of gearbox	-	Three-stage reversing
Number of driving axles	-	1
Number of driven wheels	-	4
Oscillation angle	°	3
Angle of steering	°	32
Steering		
Type of steering	-	Two-point suspension
Steering control	-	Hydraulic power steering
Linear hydraulic motors	-	1

1.3. Technical Data

Engine		
Manufacturer	-	Cummins
Type	-	QSB3.3-C99
Power according to DIN 6271	kW (HP)	74 (99)
Power according to ISO 3046/1	kW (HP)	74 (99)
Number of cylinders	-	4
Cylinder capacity	cm^3 (cu in)	3300 (199)
Nominal speed	min^{-1} (RPM)	2200
Maximum torque	Nm (ft lb)/rpm	412(304)/1400
Routine operation fuel consumption	l/h (gal US/h)	7,8 (2,0)
Engines complies with emission regulations	-	97/68/EU Level 3, EPA/CARB 40 CFR Part 89 Tier 3
Cooling system of engine	-	Liquid
Maximum permitted speed during engine braking	min^{-1} (RPM)	3250
Axle		
Maximum tyre pressure	MPa (PSI)	0,75 (109)
Minimum tyre pressure	MPa (PSI)	0,2 (29)
Pattern of tyres	-	COM HL.
Number of tyres	-	8
Number of front wheels	-	4
Number of rear wheels	-	4
Size of tyres	-	11,00x20´´
Type of tyres	-	Tube Type
Brakes		
Operating	-	Hydrostatic
Parking	-	Mechanical multiple-disc
Emergency	-	Mechanical multiple-disc
Watering		
Type of watering	-	Pressure
Number of pumps	-	1
Fluid capacities		
Fuel	l (gal US)	250 (66)
Water for tyre watering	l (gal US)	460 (122)
Engine (oil filling)	l (gal US)	7,0 (1,85)
Cooling system	l (gal US)	20,5 (5,4)
Gearbox oil	l (gal US)	21,5 (5,68)
Differential oil	l (gal US)	6 (1,58)
Oil in front axle disengaging	l (gal US)	6 (1,6)
End gear oil	l (gal US)	2x5,2 (2x1,4)
Hydraulic system oil	l (gal US)	22 (5,81)
Front wheel hydraulic system oil	l (gal US)	6 (1,6)
Brake fluid	l (gal US)	1,75 (0,46)
Wiring		
Voltage	V	12
Battery capacity	Ah	135

Noise and vibration emissions		
Declared value of sound pressure A at operator's place (cab)	dB	82
Guaranteed sound power level A	dB	101
Highest weighted effective value of acceleration of vibrations transmitted to the whole body (cab)	m/s^2 (ft/s^2)	<0,5 (<1,6)
Total value of acceleration of vibrations transmitted to hands (cab)	m/s^2 (ft/s^2)	<2,5 (<8,2)
Level of sound pressure affecting operator (platform)	dB	86

Optional equipment
Cab with ventilation and heating
ROPS protection*
ROPS canopy (mounted to ROPS)
Cab FOPS protection (mounted to ROPS)
Air conditioning
Radio preparation (box, 2 repro, antenna) (cab version only)
Radio, CD, MP3 (cab version only)
Waterproofed Frame
Towing hinge front
Thermal aprons
Edge cutter
Ammann Traction System / Diff lock
4 + 4 tyres MITAS radial instead of standard ones
4 + 4 tyres Dunlop radial instead of standard ones
4 + 4 tyres Michelin radial instead of standard ones
Spare part wheel with smooth diagonal tyre
Ballast 2.800 kg - Concrete
Ballast 6.000 kg - Steel
Ballast (metal into frame) per 1 ton
Fan safety screen
Warning beacon (rotating warning light)
Back-up alarm
Chock blocs
Mirror for front wheel
Cocoa scrapers instead of standard ones
Special colour ral up to 2 colors
Special paint schema
Fire extinguisher
First service kit for the first 500 h (engine filters, air filters)
Toolkit
Wheel spanner
Engine pre-filter
Set of documentation - printed hardcopy
* Compulsory equipment for CE

Notes

Notes

2. OPERATION MANUAL

AP 240
(Cummins Tier 3)

2.1.1. Safety measures during Machine operation

Safety measures stated in individual sections of Technical Documentation supplied with the Machine shall be added with the safety measures in force in the country the Machine is used at a work site, and this with regard to work organization, working process and the personnel.

2.1.1.1. Compaction Work Commencement

Construction work supplier (Machine operator) is liable to give such instructions for driver and maintenance personnel which will include the requirements to secure job safety during Machine operation.

- Construction work supplier must check and mark the following:
  - Utility lines
  - Underground areas (direction, depth)
  - Toxic material seepage and escape
  - Soil bearing capacity, travel plane slope
  - Other barriers incl. their removal

  He/she shall make Machine driver who will carry out the ground work, familiar with such condition.

- He/she shall set forth the technological procedure part of which is the work process for given labour activity, and such technological procedure will inter alia include:
  - Precautions during work under extraordinary conditions (work within protection zones, in extreme slopes, etc.)
  - Precautions for the sake of natural disaster hazard
  - Requirements to carry out work while adhering to work safety principles
  - Technical and organizational measures to provide for safety of employees, workplace and environment

  He/she must make Machine driver evidently familiar with the technological procedure!

2.1.1.2. Work in the dangerous area

Any damage of engineering technical services must be immediately communicated to their owner, and at the same time the precautions preventing entry of unauthorized persons to the endangered area must be carried out.

The workman must not work alone on such working place where there is not any another workman in view or within calling distance that if necessary would be able to provide help or to call for help in case the efficient form of control or connection is not ensured.

2.1.1.3 Ensurance of safety measures by the owner

- The owner must ensure that the machine is operated only in such conditions and only for such purposes to which the machine is technically capable according to conditions specified by the manufacturer and relevant standards.
- He must ensure that the roller is used only in such manner and on such working places without a danger to damage the close structures, sections, etc.
- He must ensure a regular inspection of operation and technical conditions, regular maintenance of the machine in intervals specified in the manuals for greasing and maintenance work. In case the technical condition of the machine does not meet the requirements to such extent it endangers safety of operation, people and property or it causes a damage and impairment to the environment, the machine must be put out of service until the defects are removed.
- He must specify who is allowed to carry out operation, maintenance and repairs of the machine as well as what activities can be carried out during the operation, maintenance and repair of the machine.
- The person (driver) who drives the machine and each person carrying out maintenance and repair of the machine must be acquainted with instructions specified in the operation manual of the machine.
- He must ensure that "Operation manual of the machine" and operational book are kept on specified place to be at disposal for the driver all the time.
- He must assign a workman for permanent supervision over the machine work during its operation on public roads and especially he is obliged to issue instructions to ensure safety of works.
- He must ensure that dangerous substances (such as fuel, oils, coolant, break fluid, etc. must be removed from places of leakage according to their nature to prevent from their adverse impact to the environment, safety of operation and health of people.

2.1.1.4. ROPS

The following precautions shall be observed while the protection frame ROPS is used:

- The machine frame must not be damaged (broken, bent, etc.) in the place of connection.
- The ROPS frame itself must not show the marks from corrosion, damage through cracks or splits.
- ROPS frame must not be loose during the machine operation.
- All bolted connections must meet the specifications requirements and must be tightened to the moment specified.
- Bolts and nuts must not be damaged, distorted and they must not show the marks from corrosion.
- None additional modifications can be carried out on the ROPS frame without the approval of the manufacturer because they can result in decrease of its strength (e.g. openings, welding, etc.).
- Weight of the machine with the protective frame must not exceed the permitted weight for which ROPS was approved.

2.1.2. Requirements for qualification of driver

- Only a driver trained to ISO 7130 and other local and international regulations and standards designed for drivers of this class, may operate the Roller.
- Only a person learning to drive under a direct and constant supervision by a professional lector or trainer in order to get a preliminary practice, may drive the Machine with no certificate of competency, with the approval by Machine Operator.
- Holder of the competency (licence) will be liable to duly keep the licence, and submit it, as requested, to the control authorities.
- Holder of the competency shall not make any entries, changes or corrections in the licence.
- Holder shall report immediately his/her licence loss to the one who issued such licence.
- Person mentally competent and physically fit person, over 18 years old may drive the Roller individually if:

  a) Authorized by Machine manufacturer, for the assembly work, testing and demonstrate the Machine, or eventually for training the drivers whereas he/she must have been made familiar with the work safety regulations effective in the workplace;

  or

  b) Assigned by construction work supplier to operate (carry out maintenance), trained and drilled with conclusive evidence, or eventually owning professional competency to operate and drive under special regulations (machinist certificate, or others).
- Machine driver shall be trained min. 1x every 2 years and examined in regulations to provide for occupational safety.

2.1.3. Duties of the driver

- Before Machine operation starts the driver shall be liable to get familiar with the instructions given in the documentation supplied together with the Machine, with the safety measures in particular, and observe these thoroughly. This applies also to the personnel in charge of maintenance, adjustments and repairs of the Machine.
- Do not drive the Roller unless fully made familiar with all the Machine's functions, working elements and operation elements, and until knowing exactly how to control the Machine.
- Follow the safety symbols placed on the Machine and keep these in legible condition.
- Before work is started, get familiar with the work site environment, i.e. with any barriers, slopes, utility line system, necessary types of workplace protection with respect to the environment (noise, vibrations, etc.).
- When you find out any hazard to health or life of persons, property hazard, failure, or upon technology equipment accident, or when finding any symptoms of such hazards in course of operation, then the driver, unless able to eliminate such hazard by himself/herself, must stop the work and secure the machine against any undesirable start; please attach "MACHINE REPAIR" warning sign onto steering wheel as depicted in Section called "Safety signs used on the machine", report this to the person in charge, and if possible, notify all persons exposed to such danger.
- Before starting Machine operation, get familiar with the records and operating deviations found out in course of previous work shift.
- Inspect the Machine and its accessories before work is started, check controllers, communication and safety equipment, whether these are able to work as per the Manual. If having found any defect that might endanger work safety and unable to repair by yourself, do NOT start the Machine, and report such defect to a person in charge.
- Fasten your seat belt when working with the Machine. Make sure the seat belt and its mounting are not damaged!
- If finding any defect during operation, stop the Machine instantly, lock safely against any undesired starting.
- Follow Machine run during its operation, and record any defects found in the Operation Logbook.
- Keep Operating Logbook designed to make Machine acceptance and handover records between drivers, records about defects and repairs during operation, evidence of major events during a work shit.
- Before starting the engine the controllers must be in their zero position, no persons may stay within hazardous reach of the Machine.
- Use sound or light signal everytime the Machine is put into operation, and this always before starting Machine engine.
- Before driving, make up air reservoir to 8 bar (116 PSI) pressure in order to brake off the Machine.
- Before starting Machine operation, check the function of brakes and steering.
- Following a warning signal the operator may start the Machine only when all the employees left a danger area. Concerning (blind) workplaces unable to overlook properly, put the Machine into operation only after the elapse of the time required to leave danger area.
- Observe safety regulations during Machine operation, carry out no activity that would jeopardise work safety, pay full attention to Machine steering.
- Respect the technological procedure or the instructions by a person accountable.
- When rolling in the workplace, adapt the rolling speed to the terrain condition, work carried out and weather conditions. Watch continuously the clearance so to avoid any collision with a barrier.
- Upon completion or stop of the Machine operation during which driver leaves the Machine, adopt measures against any unauthorized use of the Machine and its spontaneous start. Remove key from ignition box, turn ON the parking brake switch, lock the cab, (dashboard cover in the Machine with no cab), engine bonnet, use disconnector to cut off wiring.
- With the Machine parked on a road or highway, take measures in line with regulations valid for roads and highways.
- Having finished the operation, park the Machine at a proper place (flat, bearing area) so to avoid Machine stability endangered, Machine interfering with traffic roads, Machine exposed to falling objects (rock), and where exposed to no other disaster of different kind (floods, landslides or others.).
- When working with the Machine is completed, record in the Operation Logbook any Machine defects, damage or repairs made. During immediate switching of drivers there is the duty to notify directly the switching driver of the facts found.
- Driver must use Personal Protective Equipment - work clothing, safety shoes, the clothing shall not be too loose, damaged, hairs protected with proper head piece. During maintenance (lubricating, replacing operating media) make sure hands are protected with appropriate gloves.
- With the Machine that has no cab, or when driving with 3rd gear, use ear protection.
- Maintain the Machine fitted with the required equipment accessories and outfit.
- Keep the Machine free of any oil dirt or flammable materials. Keep driver's control stand, climbing irons, walkway (step-on) surfaces clean.
- In case Machine comes into contact with high voltage, please adhere to the following principles:
  - Try to move with the Machine away from the hazardous area
  - Do not leave driver's control stand
  - Give warning signal to others not to come near or touch the Machine.

2.1.4. Forbidden activities

The following is forbidden:

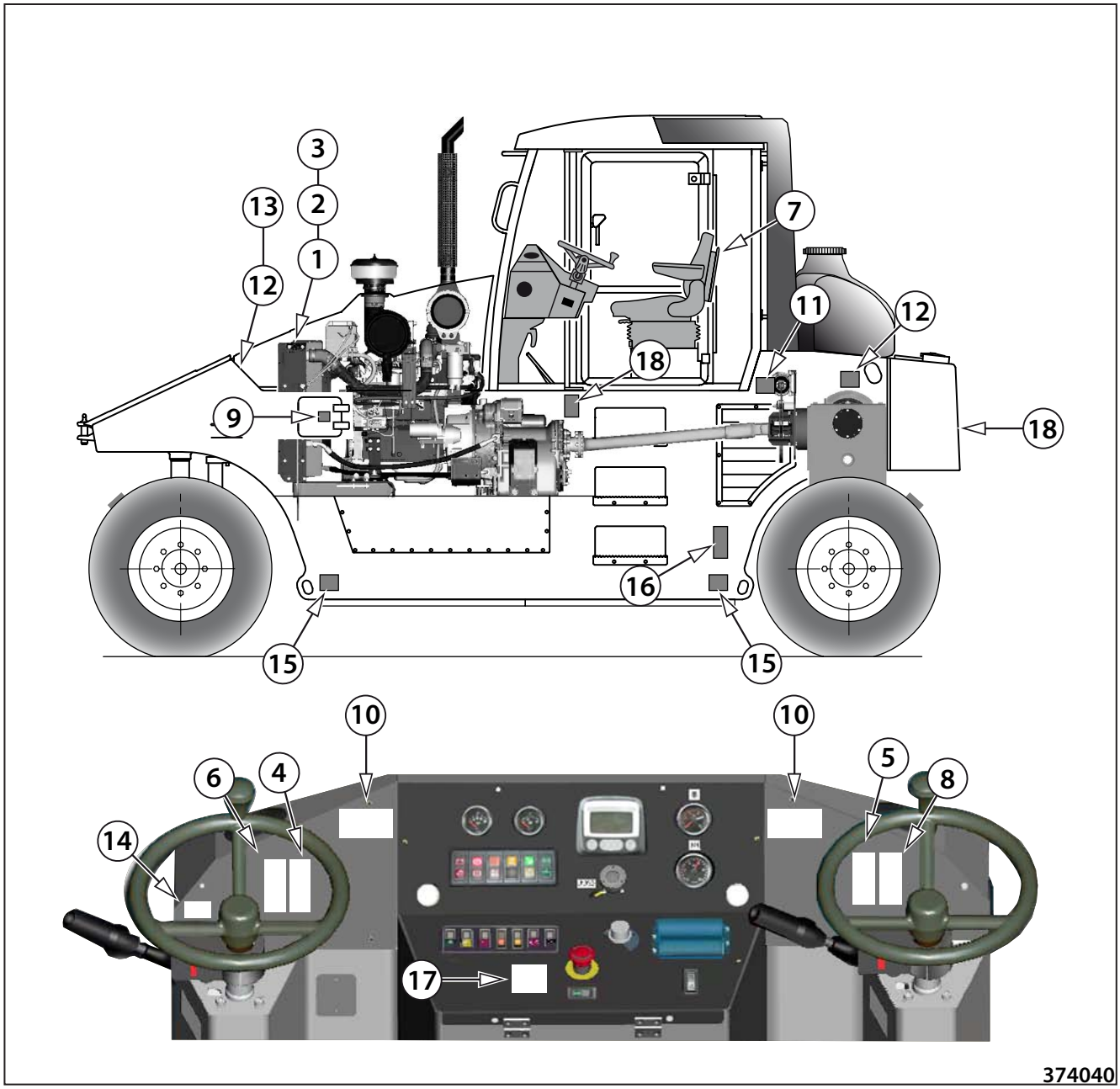
- Operate the machine in the explosive environment and underground.
- To use the Machine following ingestion of alcoholic beverages or narcotic substances.
- To use the Machine that would mean a threat to its technical condition, safety (life, health) of persons, sites, facilities and things, or eventually of road traffic and its continuity.
- To put into operation and use the Machine if other people are staying within its hazardous reach - except for training a driver by lector.
- To put into operation and use the Machine with some safety device (emergency brake, horn, etc.) dismounted or damaged.
- To travel and compact in such banks where Machine stability would be impaired (overturn). The mentioned static stability of the Machine lowers by dynamic effects of travel.
- To travel and compact in such gradients of slopes where hazard of ground torn off along with the Machine would occur, or loss of adhesion followed by uncontrolled skid.
- To control the Machine in some other way different from that stated in the Operation Manual.
- To travel and compact according to the soil bearing capacity at such distance from the edge of a slope, excavated trenches so to avoid any hazard of material fall (slide) or shoulder torn off along with the Machine.
- To travel and compact at such distance from the walls, cuts, slopes so to avoid any hazard of their sliding and covering the Machine.
- To displace and transport people on the Machine.
- To operate the Machine within the hazardous range of which there are other machines or transport vehicles except for those that operate in mutual coordination with the Machine.
- To operate the Machine in places invisible from driver's post and where hazard to the persons or property might occur unless work safety is secured another way, i.e. implicitly through signalling by a person duly instructed – refer to the Section named Hand Signals.
- To operate the Machine within protective zone of electric line system and substations, and of gas.
- To drive over electric cables unless these are properly protected against any mechanical damage.
- To operate the Machine under reduced visibility and at night unless Machine's working area and the site have sufficient lighting.
- To change driver's position at the control stand from the left to the right and vice versa while driving.
- Leave Machine driver's position with the Machine running.
- To leave unsecured Machine - move away from the Machine without preventing it from being misused.
- To disable safety system, protective system and locking system or change their parameters.
- To use the Machine with oil, fuel, cooling liquid or other media leaking therefrom.
- To start the engine in some other way than stated in the Operation Manual
- To locate other items (tools, instruments) at driver's control stand aside from items of personal needs.
- To lay away any material or other objects onto the Machine
- To remove any dirt or waste while the Machine is in operation
- To carry out maintenance, cleaning or repairs with the Machine not secured against its self-motion and accidental starting, and unless contact between operator and moving parts of the Machine is excluded.
- To touch moving parts of the Machine with human body or objects and tools held in hands.
- To smoke and handle open fire when checking or filling in fuels, changing or filling up oils, lubricating Machine, and when inspecting battery and filing up battery
- To carry rags soaked with flammable materials on the Machine (inside engine compartment), and flammable liquids stored in free vessels.
- To let the engine run in confined areas.
- Drive with open doors.
- Perform any adjustments on the machine without the prior consent of the manufacturer.
- Drive without the seat belt fastened.
- Shift electrical conductors.
- Use other than original spare parts.
- Interfere in the electrical and electronic units in any manner.

! CAUTION !

THE ADDITIONAL WEIGHT consists of 2 pcs and is mounted as option from the bottom of the Machine frame at Manufacturer. It is therefore considered to be the integral part of the Machine. Any handling of this weight is hazardous and is banned.

Please do not hesitate to contact your dealer, if required!

2.1.5. Safety inscriptions and symbols used on the Machine



1. Risk of burn

3409bz

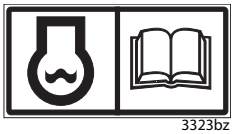
Do NOT open expansion tank lid until liquid cools down below 50 °C (122 °F). (Symbol located on expansion tank)

2. Risk of Injury

3322bz

Maintain safe distance from rotation and heat part of the Machine. (Symbol located on radiator)

3. Cooling Liquid



3323bz

Cooling liquid is deleterious. Please, read the Operation Manual when filling up or changing. (on radiator)

4. Adjust at Standstill

2584bz

Do NOT carry make any adjustment or maintenance with the engine running. Imminent risk of injury or being caught by the rotating parts of Machine. (on dashboard)

5. No Washing

2225bz

Cover electric devices when washing the Machine. (on dashboard)

6. Read the Manual

2702bz

Before you start the Machine, please, read thoroughly the safety measures and the way to control the Machine and its actuators, in the Manuals supplied with the Machine. (on dashboard)

7. Manual


2428bz

On the seat backrest stowage box.

8. Disconnect Alternator


2668bz

Disconnect alternator before welding on the Machine! (labelled on dashboard)

9. Danger of explosion


3017bz

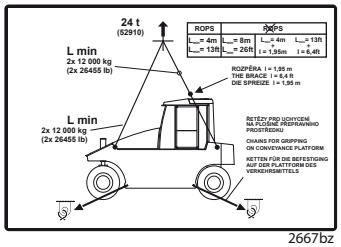
Imminent danger of explosion while handling the battery - read Operation Manual. (Symbol located inside box of the battery)

10. Fasten the Belt


2687bz

Fasten safety belt before starting to move the Machine. (symbol located on control panel)

11. Lifting and Rigging Diagram



2667bz

Use rigging of sufficient loading capacity. (symbol located on LH side behind cab)

12. Lifting Lugs


2153bz

Lift the Machine in these lugs. (symbol located near lifting lugs along both sides of the frame)

13. Noise Emitted

3038bz

External noise of the Machine. (symbol located on frame's LH side)

14. Ear Protectors (Muffs)


2408bz

Use muffs with the Machine that has no cab. (on LH sde of control panel)

15. Rigging Points


3048bz

Tie the Machine in these points only. (symbols located along both sides of frame)

16. Risk of Injury


3352bz

Observe safe distance when operating the trimmer. (symbol located on frame's RH side)

17. Machine braking


3407bz

Engage the gear before downhill driving! (symbol located on the instrument panel)

18. Distance from the machine


2942bz

Keep a safe distance from the machine. (Symbols located at the back and on both sides of frames)

19. Machine repair


2775bz

Do NOT start the engine! Hang the sign onto steering wheel. The sign is supplied together with machine accessories and should be kept in documentation locker.

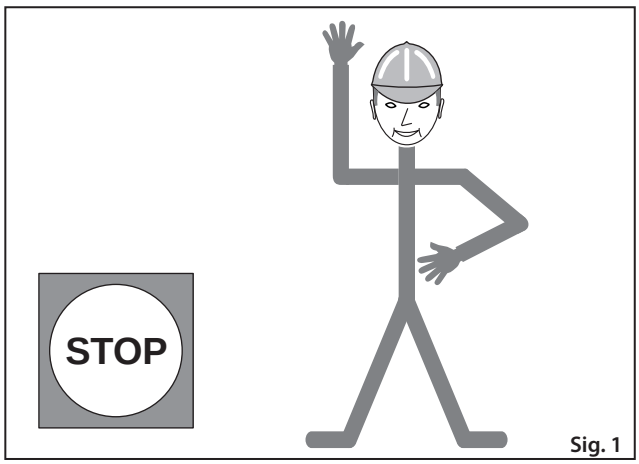
2.1.6. Hand signals

Signals given by an assistant operator if the operator cannot see the travelling or working area or machine work devices.

SIGNALS USED FOR ALL THE COMMANDS

Stop

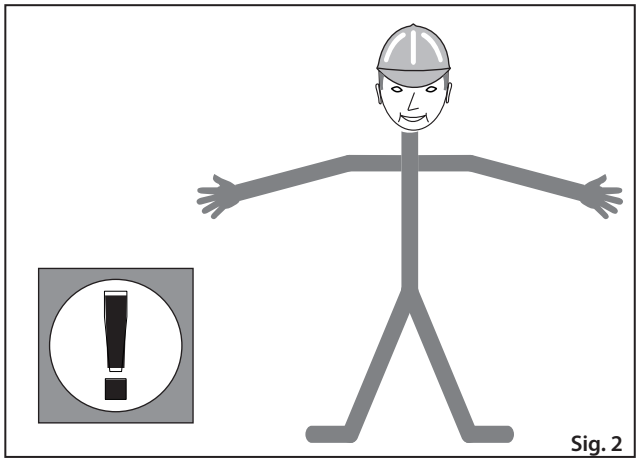
One arm stretched upward with open palm in the Operator direction, second arm akimbo.



Sig. 1

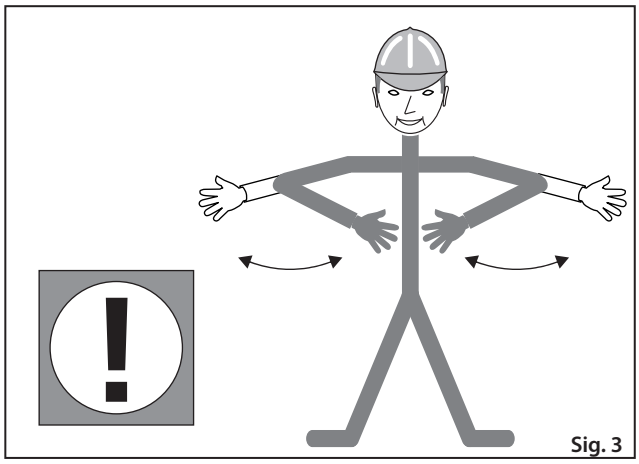
Attention!

Both arms horizontally sideways raised - palms facing forward.


Sig. 2

Attention, Danger!

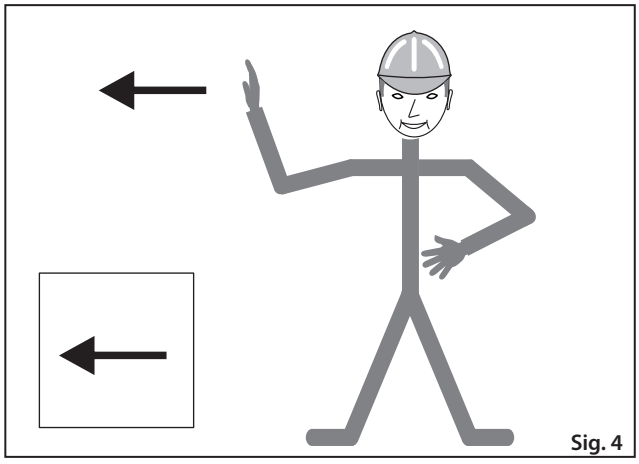
Oscillating motion of both arms with antebrachium from the position of arms horizontally sideways raised to the position or arms sideways raised - bent and back.


Sig. 3

SIGNALS FOR DRIVING

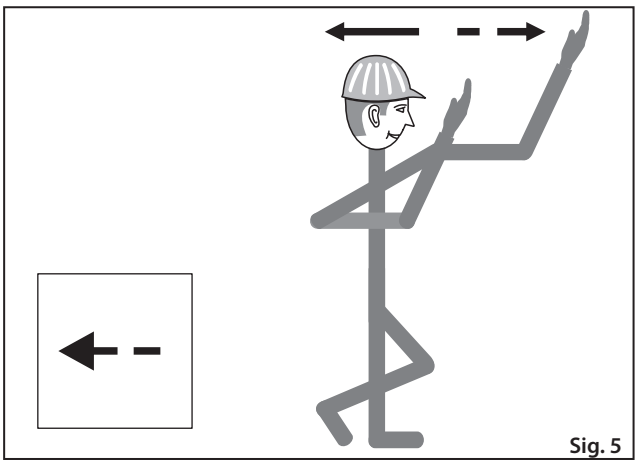
Drive away with the Machine

One arm stretched upward - bent with open palm, long motion of antebrachium in the direction of the movement required, second arm akimbo.


Sig. 4

Slow driving forward - towards me

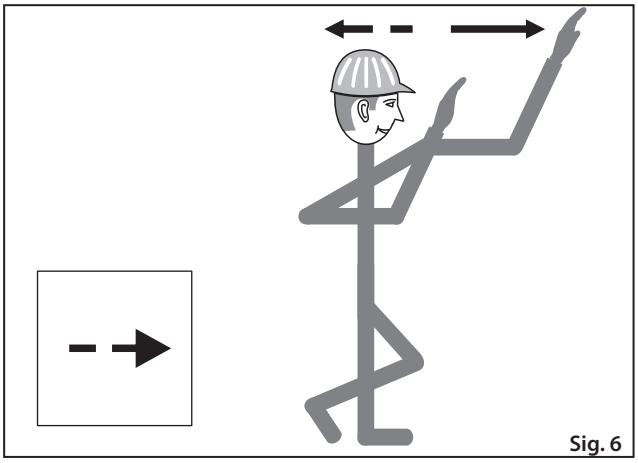
Both arms stretched upward, abreast, bent, with palms facing the body - short oscillating motions of antebrachium, towards the body, and back.



Sig. 5

Slow driving backward - away from me

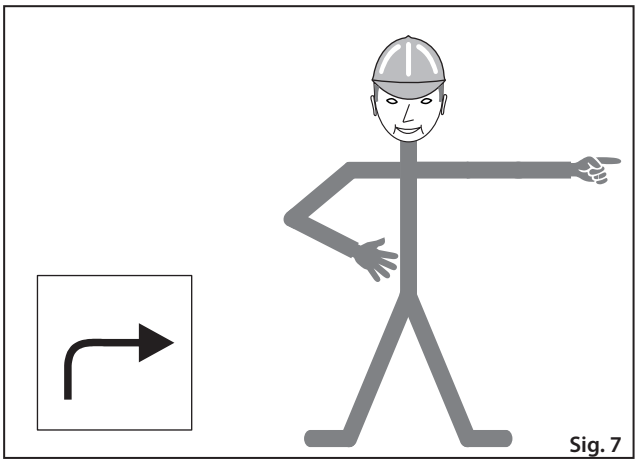
Both arms stretched upward, abreast, bent, with palms away from the body - short oscillating motions of antebrachium away from the body, and back.



Sig. 6

Driving on the right

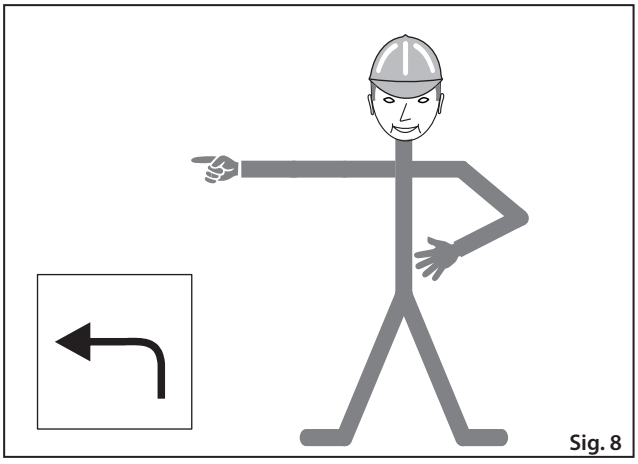
Left arm sideways raised, right arm akimbo.



Sig. 7

Driving on the left

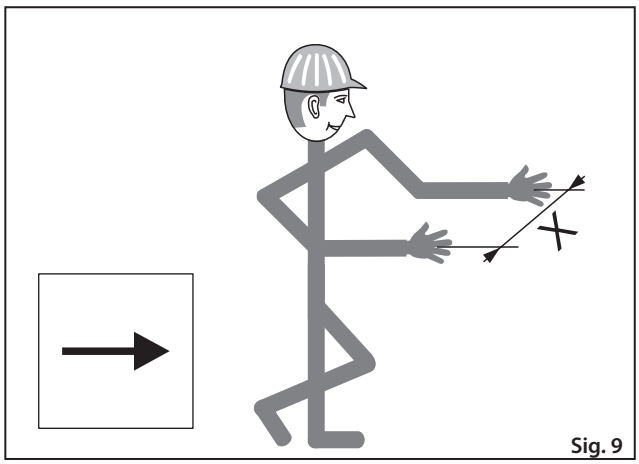
Right arm sideways raised, left arm akimbo.



Sig. 8

Short motion

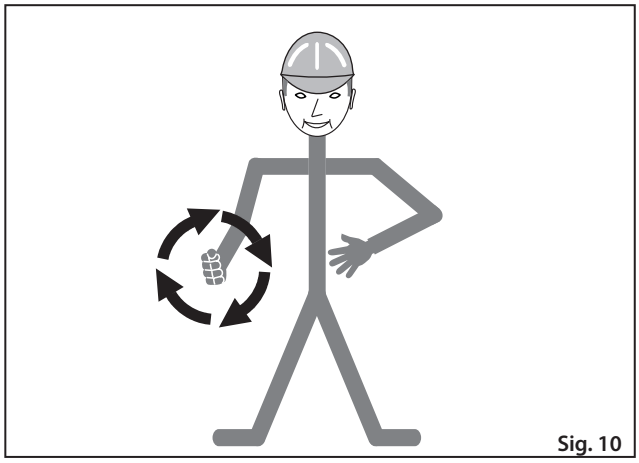
Both arms lifted forward, bent. Mark distance "X" between palms, then follows the motion signal.



Sig. 9

Engine start

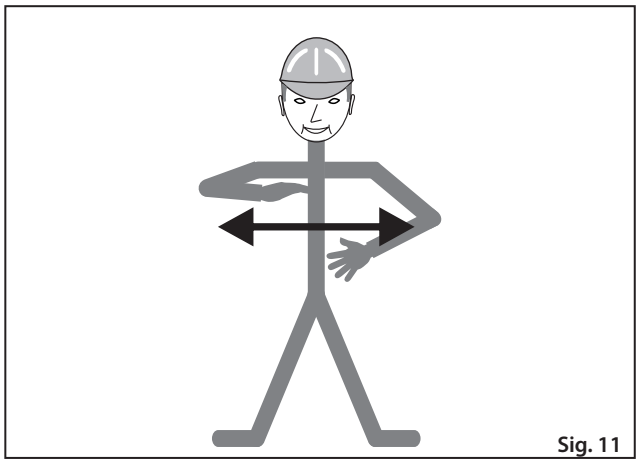
Circular motion of antebrachium of right hand, with tight fist.



Sig. 10

Engine cut off

Oscillating motion of right hand sideways raised in front of the body, to the sides.



Sig. 11

When operating and storing the Machine the User shall be liable to adhere to the general principles of health and environment protection, as well as the laws, regulations, and rules related to this issue, and effective within the territory where the Machine will be used.

2.2.1. Hygienic principles

- Oil products, cooling system media, battery media, and coating compositions incl. thinners are deleterious materials. Persons that come into contact with these products during Machine operation and maintenance shall be liable to follow general principles of own health protection and conform to the safety and hygienic directions from manufacturers of these products.

  Observe the following in particular:

  - Eye and skin protection when handling the batteries
  - Skin protection when handling oil products, coating compositions and cooling liquids
  - Wash your hands thoroughly upon work completion and before meal, treat your hands with proper tissue cream
  - When handling the cooling systems, please observe instructions given in the Operation Manual supplied with the Machine.

- Always store oil products, cooling system media, battery media and coating compositions incl. organic thinners, and the cleaning and preservation agents as well, in their original properly marked packages. Admit no storage of these materials in unidentified bottles or other vessels with regard to the risk of being interchanged. Especially hazardous is the potential of interchanging for eatables or drinks.
- If skin, mucosa or eyes are stained accidentally, or vapours inhaled, promptly apply the first air principles. Get prompt medical attention upon accidental ingestion of these products.

2.2.2. Ecological principles

- When discarded, the media for Machine's individual systems and some of the Machine's parts will become waste of hazardous properties against the environment.

  This waste product category includes the following in particular:

  - Organic and synthetic lubrication materials, oil and fuels,
  - Cooling liquids,
  - Battery media and the batteries themselves,
  - Tyre media
  - Cleaning and preservation agents,
  - All filters and filter elements removed,
  - All used and discarded hydraulic and fuel hoses, metal rubbers or other Machine's elements contaminated by the abovementioned products.

- Manufacturer and Manufacturer-accredited contracting service organizations or dealers take back these used materials or parts without cost:

  - oils
  - batteries
  - tyres

The mentioned materials and parts, when discarded, shall be handled in line with relevant national regulations to protect individual components of environment, and in conformity with the health protection regulations.

2.3. Machine preservation and storage

2.3.1. Short-term preservation and storage for a period of 1 – 2 months

Wash and clean thoroughly the entire Machine. Before shutting down the Machine for preservation and storage, please heat the engine to its operating temperature while running. Park the Machine on paved, flat surface, in safe location with no danger of of damage to the Machine due to natural disasters (floods, landslides, fire origination, etc.).

In addition:

- Repair spots where paint has been impaired,
- Lubricate all lubricating points, actuator cables (cable assemblies), joints of the actuators, etc.,
- Check water media have been drained,
- Confirm cooling liquid has the antifreezing properties required,
- Check condition of the battery charges; let them be recharged if required,
- Spread chromated surfaces of piston rods with preservation fat,
- We recommend to protect your Machine against corrosion through spraying the preservation agent (spray-applied), and this especially in places of corrosion hazard.

The Machine treated like that needs no special preparation (set-up) before its subsequent putting into operation.

! NOTE !

Fill the tank with fuel to the maximum level even in the case of short-term shut-down of the machine (for several days) as a protection against corrosion on the tank walls.

2.3.2. Preservation and storage for the period over 2 months long

To shut down the Machine the same principles apply like with short time preservation.

In addition, we recommend the following:

- Remove the batteries, check their condition and store in cold, dry room (recharge the batteries on regular basis),
- Bottom the drum frame up so the damping system has minimal sag,
- Protect rubber elements with paint using special preservation agent,
- Inflate tyres to their required pressure, and protect against sun radiation effects,
- Spread preservation fat over piston rods' chromated surfaces,
- Preserve the Machine through spraying with special agent, and this particularly in places of possible corrosion,
- Blind the induction manifold and exhaust of the engine with double PE foil, attach thoroughly with adhesive tape,
- Protect headlamps, external back mirrors and other elements of external wiring through spraying with special agent abd wrapping in PE foil,
- Preserve engine according to the Manufacturer's Directions - mark visibly the engine has been preserved.

! NOTE !

Following 6 months we recommend to inspect the condition of preservation and renew it if required.

If storing the Machine under field conditions, please check the parking place is not exposed to any flooding hazard due to deluges, or whether any other type of risk occurs within such area!

NEVER start the engine in course of storage!

Before restoration of the Machine service, please dewax and wash the preservation agents away with high pressure stream of hot water added with normal degreasers while observing Directions for Use along with ecological principles.

Carry out dewaxing and washing of the Machine at places equipped with collection sumps to catch rinsing water and dewaxing agents.

2.3.3. Dewaxing and inspection of a supplied machine

Check the Machine according to the shipping documents.

Check no parts of the Machine have been damaged during transportation, and that no parts are missing. Inform shipper about any deficiencies.

Before restoration of the Machine service, please dewax and wash the preservation agents away with high pressure stream of hot water added with normal degreasers while observing Directions for Use along with ecological principles.

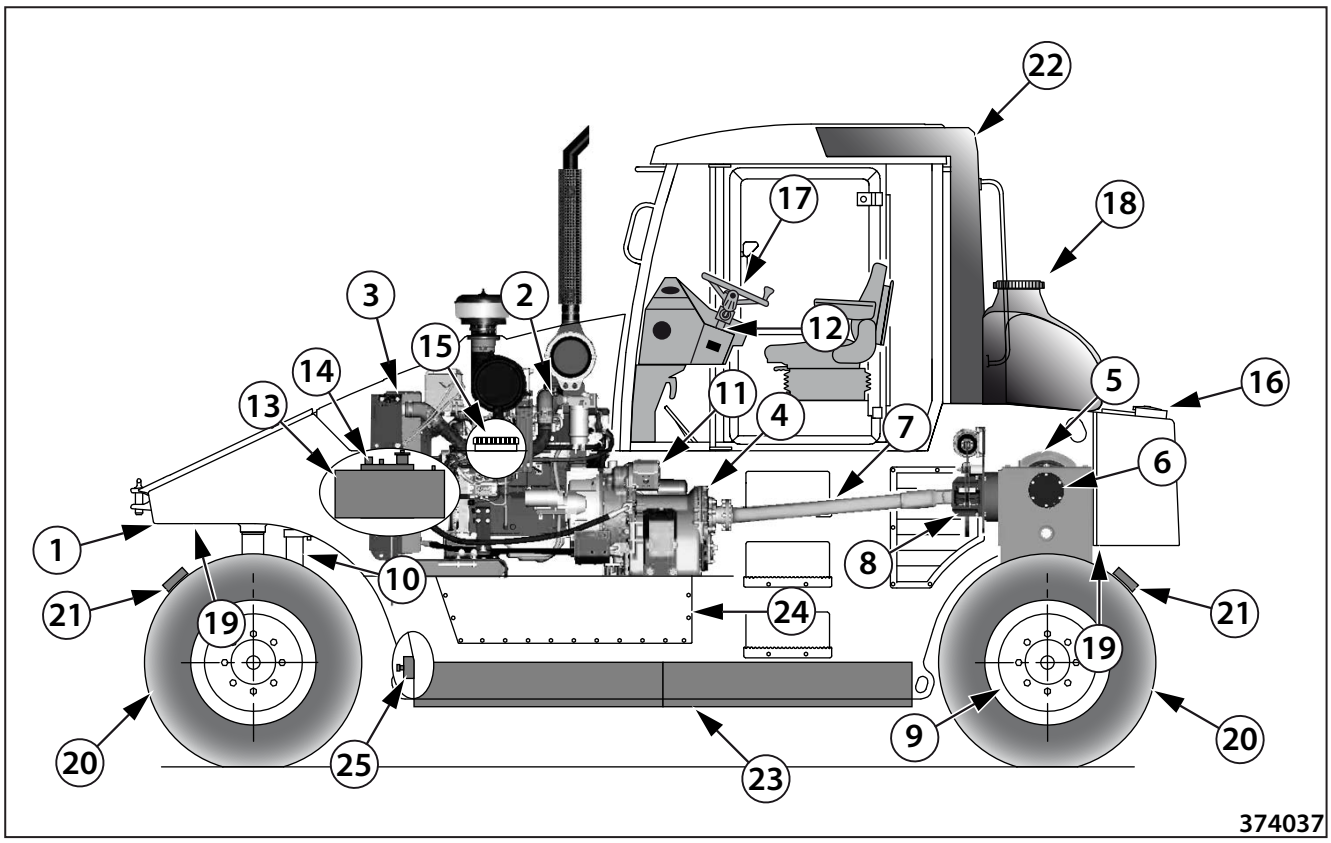
Carry out dewaxing and washing of the Machine at places equipped with collection sumps to catch rinsing water and dewaxing agents.

2.4. Machine disposal following its life cycle end

Upon Machine disposal following its life cycle end the User shall be liable to follow the national regulations, waste acts and environmental policy acts. We therefore recommend to always contact:

- Specialized companies with relevant authorization to deal with these operations,
- Machine Manufacturer or Manufacturer-appointed accredited contracting service organization.

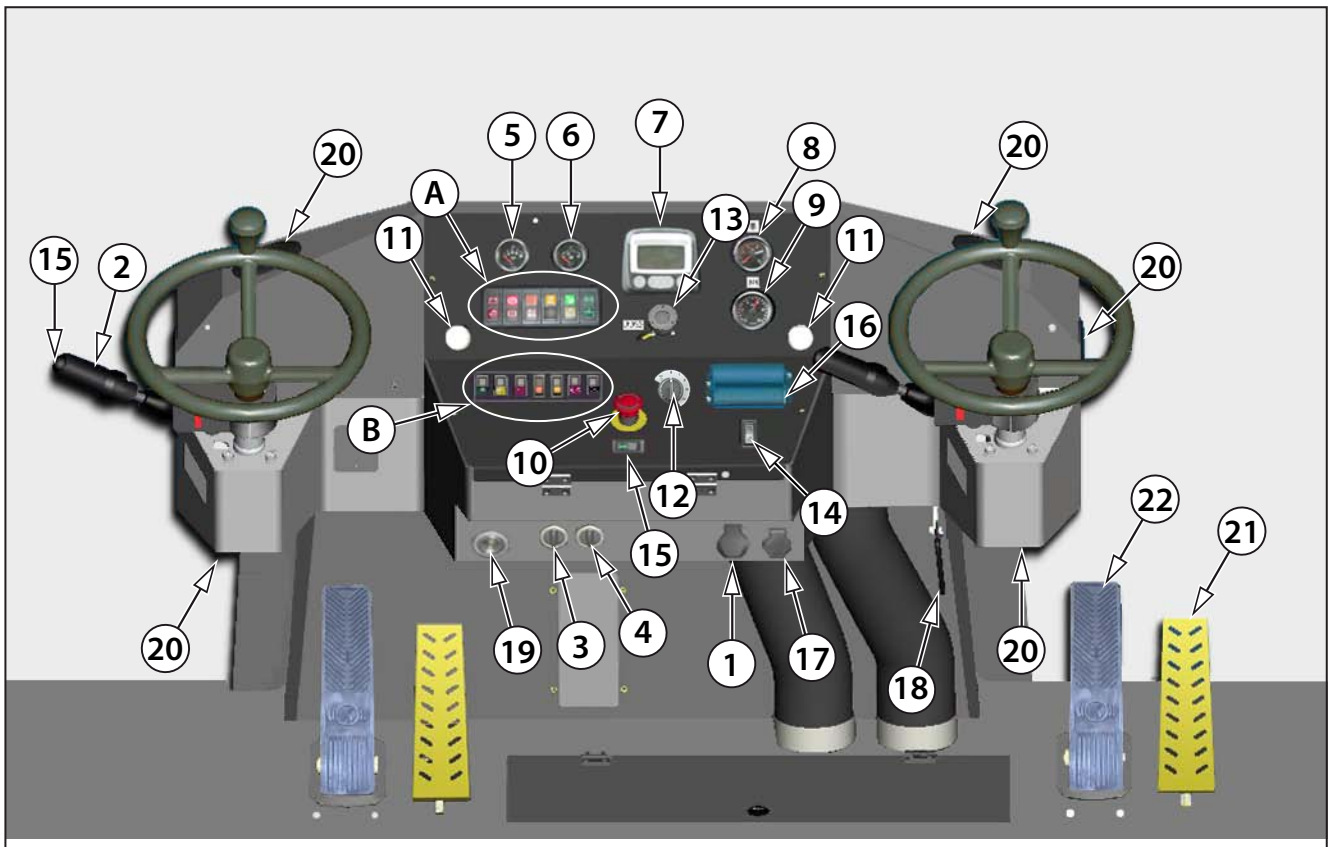
Manufacturer bears no responsibility for any damage caused to Users' health or for any damage to environment due to non-adherence to the aforementioned warning.



AP 240 Pneumatic Roller- Machine's individual parts

1 - Roller Frame
2 - Engine
3 - Engine Radiator + Hydraulic Circuit Cooler + Gearbox Cooler
4 - Gearbox incl. Torque Converter
5 - Final Drive Housing incl. Differential
6 - Final Transmissions
7 - Propeller Shaft
8 - Parking and Emergency Brake
9 - Driving Brakes (rear wheels only)
10 - Front Axle incl. Telescopic Cylinders
11 - Pump for Compressor Drive
12 - Power Assisted Steering
13 - Battery (cylinder's LH side)
14 - Hydraulic Tank (cylinder's RH side)
15 - Additional Water Weight Closure*
16 - Fuel Tank
17 - Driver's Control Stand
18 - Sprinkling Tank
19 - Tire Sprinkling
20 - Wheels
21 - Scrapers
22 - Protective ROPS Frame
23 - Additional Weight
24 - Ballast Space Lids
25 - Additional Water Weight Drain *

* - If waterproof frame for additional weight incl. water medium is used with the Machine, then please refer to Specification Manual - "The Weights".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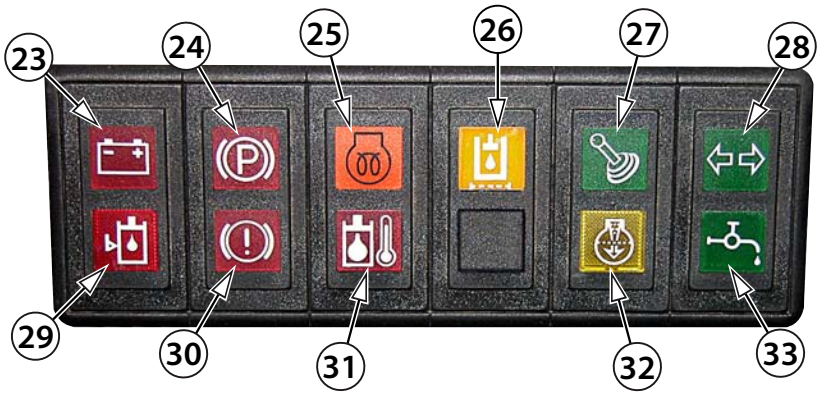
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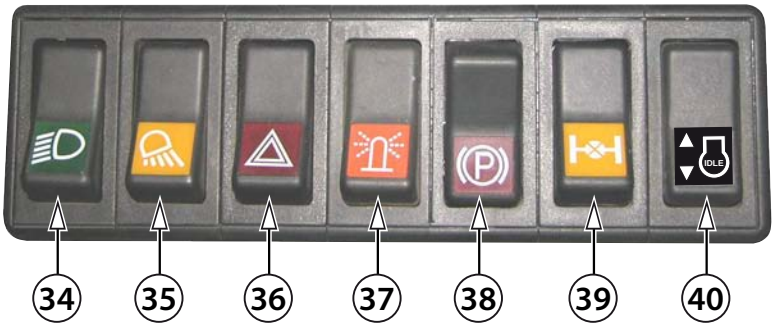
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374004

Driver's Position

1 - Ignition Box
2 - Travel Controller
3 - Tire Inflation - optional *
4 - Tire Deflation - optional
5 - Gearbox Lubrication Pressure Gauge
6 - Gearbox Thermometer
7 - Power View Display
8 - Brake Circuit Pressure Gauge
9 - Tire Pressure Gauge - optional
10 - TOTAL STOP Pushbutton
11 - Enabled Workplace Signalling
12 - Sprinkling Switch and Interval Control
13 - Engine ECM Diagnostics Socket
14 - Trimmer
15 - Direction-indicator lights
16 - Fuses
17 -Hand Lamp Socket
18 - Bonnet Lock to Unlock
19 - Acoustic Alarm for Brake Failure
20 - Ventilation Nozzles
21 - Accelerator Pedal - controls engine rpms - travel speed
22 - Brake Pedal - controls rear wheel brakes

A - Indicator Lamps

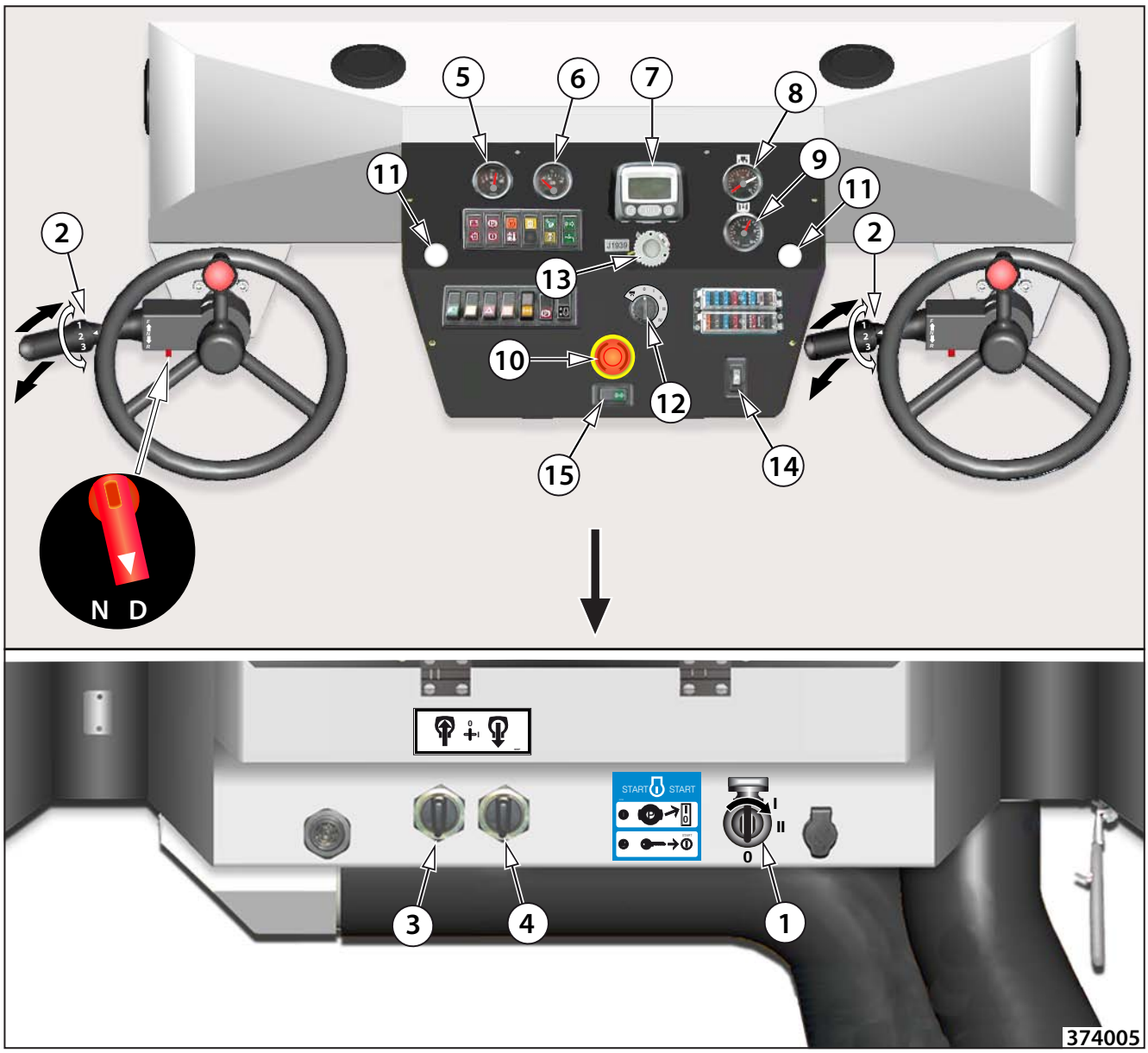
23 - Battery Recharging
24 - Parking brake
25 - Engine heating
26 - Hydraulic oil filter fouled
27 - Idle
28 - Direction - indicator lights
29 - Hydraulic oil level
30 - Brake failure
31 - Hydraulic oil overheated
32 - Air filter fouled
33 - Tire sprinkling

B - Switches

34 - Headlamps
35 - Rear lights
36 - Warning lights
37 - Hazard beacon
38 - Parking brake
39 - Differential interlock
40 - Idle RPM - stepping of engine idling

* - With the standard version of the Machine the valve has been replaced with the end piece to connect hose incl. pressure gauge for manual tire inflation (part of the equipment). For others, please refer to Maintenance Manual.

2.6. Controllers & Control Instruments



Ignition box (1)

In "0" position the Machine lighting will be connected along with hand lamp socket. In "I" position other consumers will be connected. Spring-loaded position "II" is used to start the engine. Key can be removed in "0" position only.

Note:

The key is identical to the key for locking the cabin door.

Travel controller (2)

It is used to adjust direction of running and for gear shifting via a turning handle.

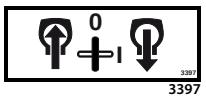
"F" position - forward

"N" position - idle (neutral)

"R" position - backward

Horn pushbutton and fuse are part of the controller.

Position of "N" fuse – controller interlocking.



Inflation valve (3), deflation valve (4)

It is used to make up or deflate tyre air. For pressure values, please refer to the Table in Section named Tyre Pressure Control.

Do NOT switch ON both valves simultaneously to "I" position!

Gearbox oil pressure gauge (5)

Operating oil medium pressure must move within 12,5-15,5 bar range.

! CAUTION !

When pressure drops below 12,5 bar, stop the Machine.

Gearbox oil temperature (6)

Operating temperature may move within 80 - 120 °C range. Max temperature is 120 °C.

Power view display (7)

Multifunctional instrument to display engine function and fuel reading.

Brake circuit pressure gauge (8)

White indicator shows air pressure inside air reservoir - adjusted to max 8 bar.

Red one indicates air pressure when braking - air pressure from air brake valve to brake booster.

Tire pressure gauge (9)

The minimum air pressure after air release from tyres has been adjusted to 1,5-2 bars.

TOTAL STOP (10)

Press to stop the Machine and its engine instantly in emergency event.

Indication of workplace enabled (11)

- Indicates from which position (seat) the Roller travel is controlled.
- If no indicator lamp (11) flashes with the ignition box key turned ON then the engine can be started. If indicator lamps (11) flash with the ignition key turned ON, then the engine cannot be started since one or two travel controllers are not in N position - idle indicator lamp does not light.

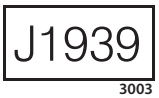
Sprinkling interval control (12)

Turn the switch left to start up the pump to run continuously - tires will be sprinkled constantly.

Turn the switch to any of four positions in clockwise direction to turn ON sprinkling interval control.

Position I	sprinkling for 10 s	dwell for 10 s
Position II	sprinkling for 10 s	dwell for 15 s
Position III	sprinkling for 10 s	dwell for 22 s
Position IV	sprinkling for 10 s	dwell for 33 s

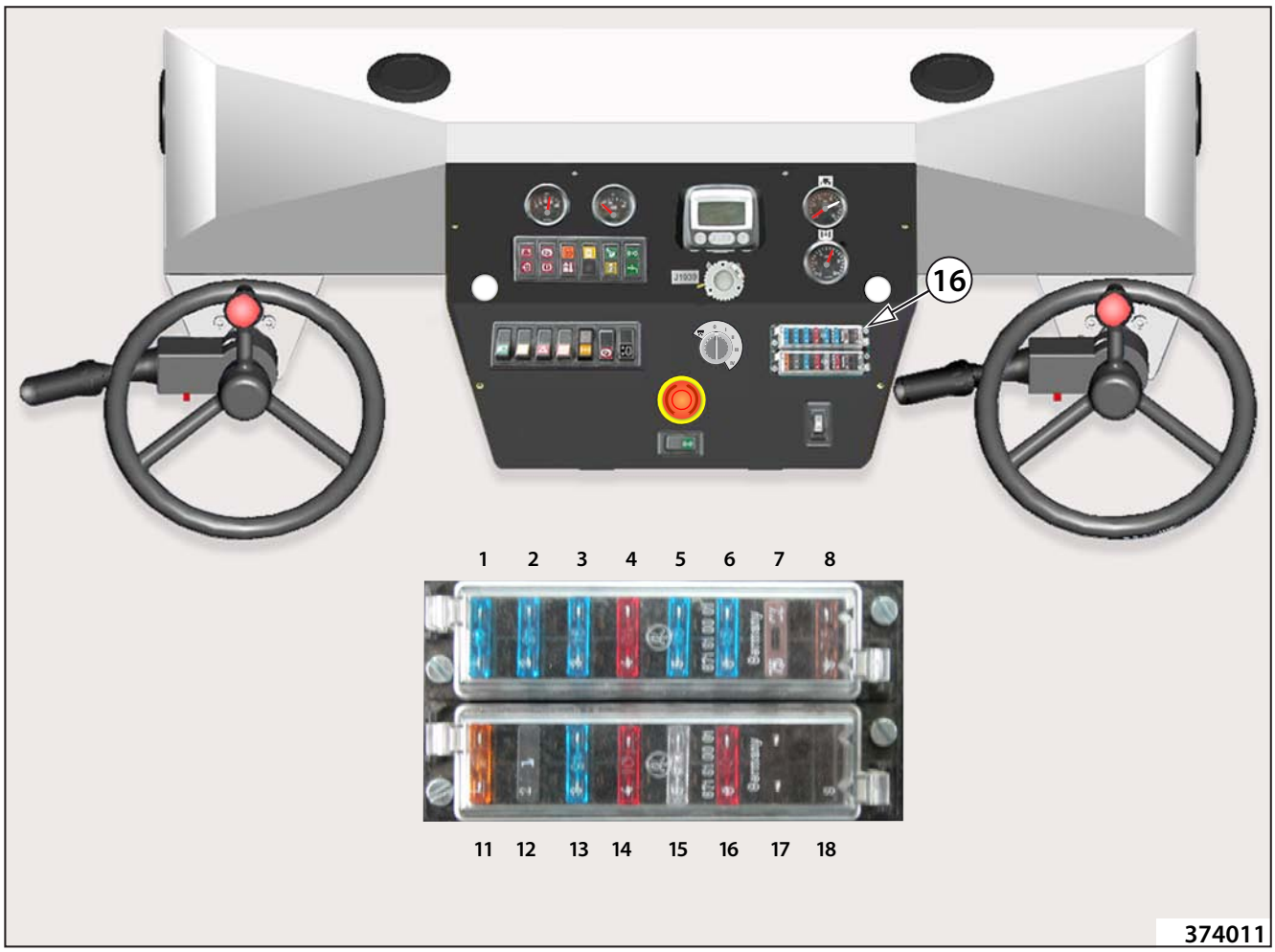
Sprinkling indicator lamp will light only when pump is running.



Socket (13) - to connect to ECM (Electronic Control Module) designed to diagnose any defects or to adjust engine parameters.

Trimmer (14) - downward, upward - optional

Direction-indicator lights (15)



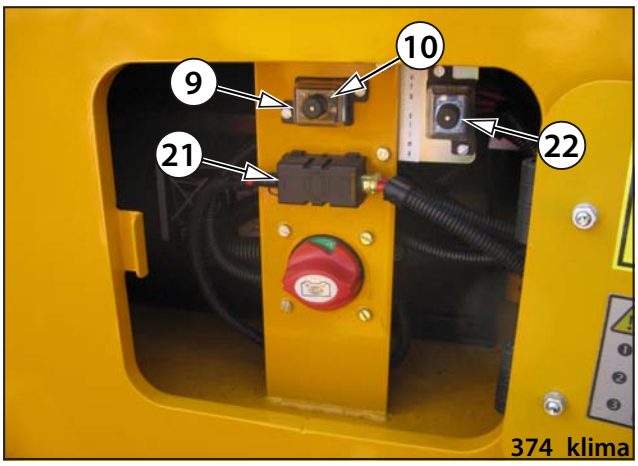
FUSES

Cut-out box (16)

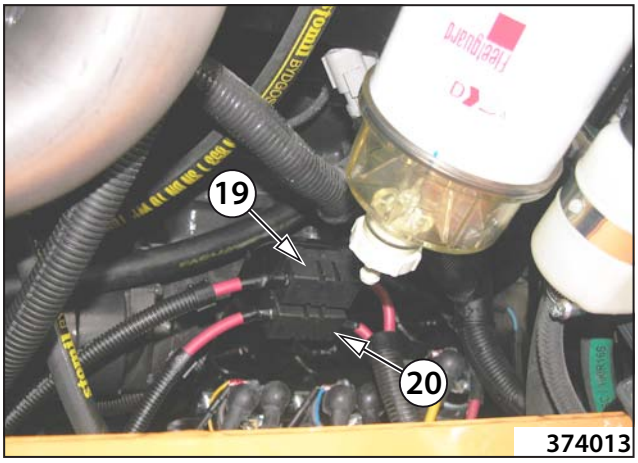
It includes fuses of the following instruments:

- 1 (15A) - Mounting socket
- 2 (15A) - Rear lights
- 3 (15A) - Beacon, brake lights, cab lighting, horn
- 4 (15A) - Direction-indicator lights
- 5 (5A) - Front fender lights, rear lamps, instrument illumination
- 6 (15A) - Headlamps
- 7 (7,5A) - Gearbox solenoids, backing horn
- 8 (7,5A) - Differential lock solenoids, hydraulic oil level, engine start relay
- 11 (5A) - Indicator lamps (LEDs), measuring instruments, brake failure
- 12 (1A) - Diagnostics, Power View
- 13 (15A) - Wipers, washers
- 14 (10A) - Sprinkling
- 15 (25A) - Fans
- 16 (10A) - Trimmer
- 17 (-A) - Reserve
- 18 (-A) - Reserve

9 (30A) - ECM electric motor supply
10 (-A) - Reserve for car radio
21 (80A) - Main fuse
22 (15A) - Air conditioner

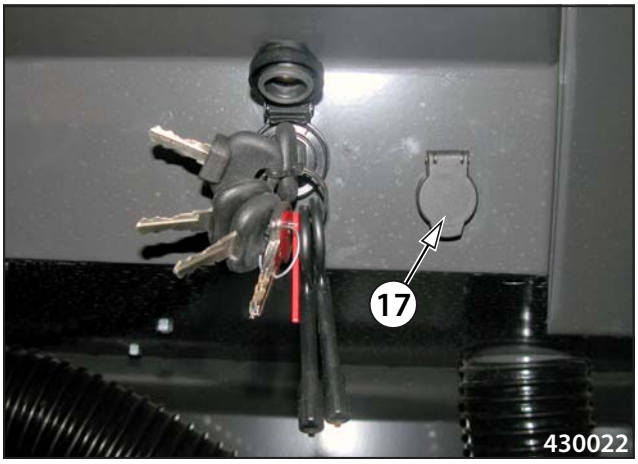


19 (125A) - Glowing
20 (125A) - Glowing

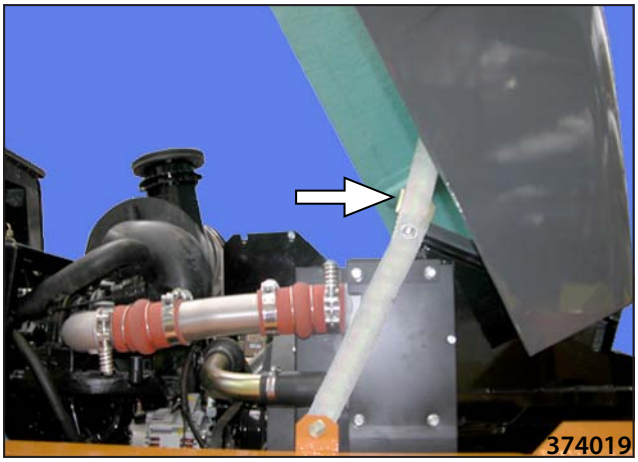


Assembling lamp socket (17)

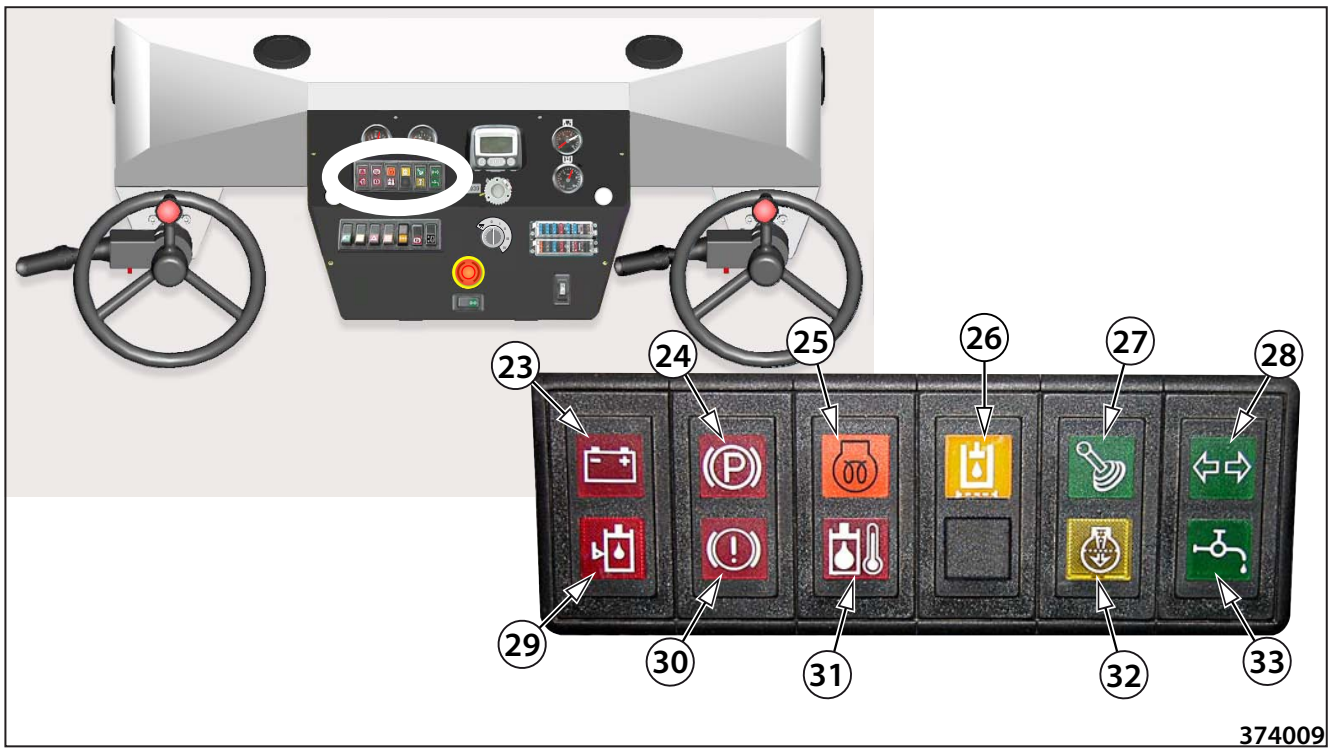
It serves to connection of the auxiliary assembling lamp 12 V on the dashboard.



Lock the bonnet (18) – by pressing the supports in marked-up direction.



2.6. Controllers & Control Instruments



2587

Battery Recharging (23) - goes off when engine is started.

2703

Parking brake (24) - indicates Machine is braked.

589502

Engine heating (25) - indicates necessity to heat engine.

2276

Hydraulic oil filter fouled (26) - indicates filter element to replace.

596653

Idle (27) - indicates position of both controllers in "N" idle (neutral).

! CAUTION !

When starting, please check both controllers are in idle position.

595200

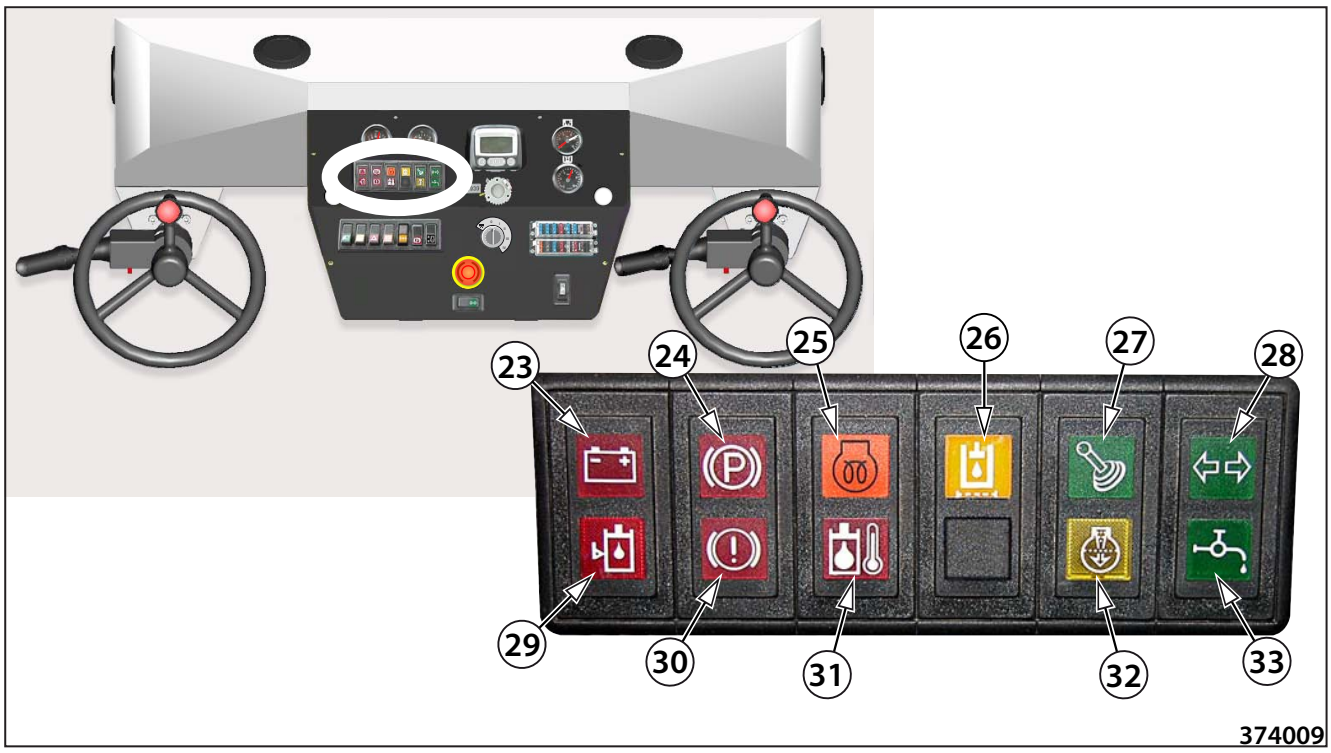
Direction-indicator lights (28) - LED lamp on workplace enabled will light.

591507

Hydraulic oil level (29) - indicates lowered level.

! CAUTION !

When there is alarm the Roller stops and the engine goes off - starting is interlocked until oil is filled up.



595148

Brake failure (30) - indicates air pressure lowered in the circuit below 5,2 bar - simultaneously with audio alarm.

After starting up, the pilot lamp is turned on until the sufficient pressure in the brake circuit is achieved.

If the pilot lamp turns on during driving, stop the machine. Before driving the machine again, it is necessary to repair the failure.

2635

Hydraulic oil overheated (31) - indicates max temperature admissible (reduce power, cool down).

594423

Air filter fouled (32) - indicates necessity to replace filter element.

Note:

Compressor air intake leads to the filter.

596128

Tire sprinkling (33) - sprinkling pump turned ON.

2.6. Controllers & Control Instruments

596303

Headlamps (34) - incl. fender lights

591668

Rear lights (35)

596191

Warning lights (36)

592348

Hazard beacon (37) - optional

2703

Parking brake (38)

While stopping the machine at any time, the driver must apply the parking brake!

596116A

Differential interlock (39) - optional

3348

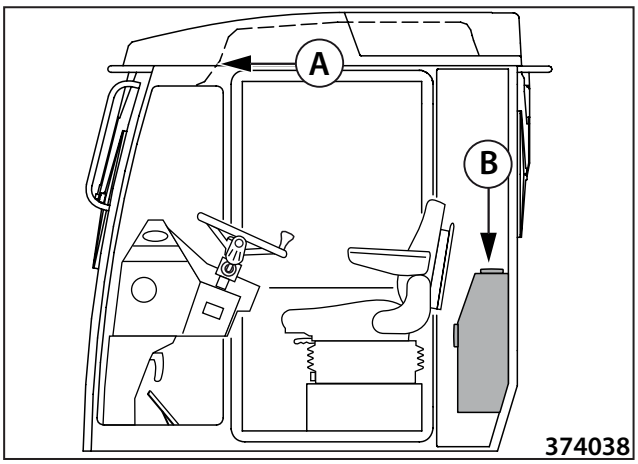
Idle RPM (40) - stepping of engine idling from 850÷1000 rpm

Note:

With cooling liquid temperature up to 30 °C the switch is disabled. ECM will adjust idle rpm automatically via air choke.

A Switches

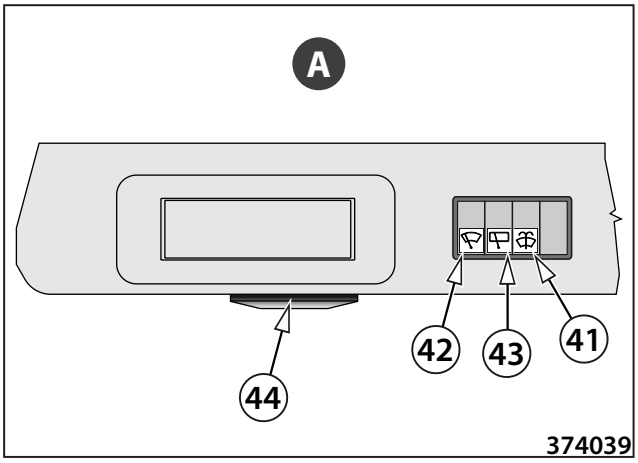
B Heating - Air Conditioner



Window Washer Switch (41)

Front Wiper Switch (42)

Rear Wiper Switch (43)

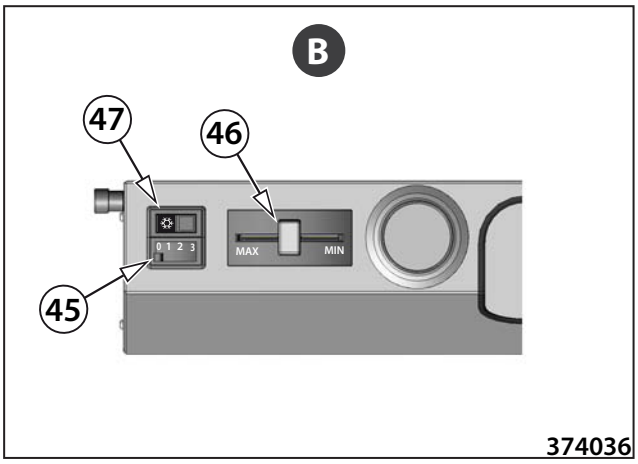


Cab Lighting (44)

Fan Switch (45)

Temperature Control (46)

Air Conditioner (optional) (47)



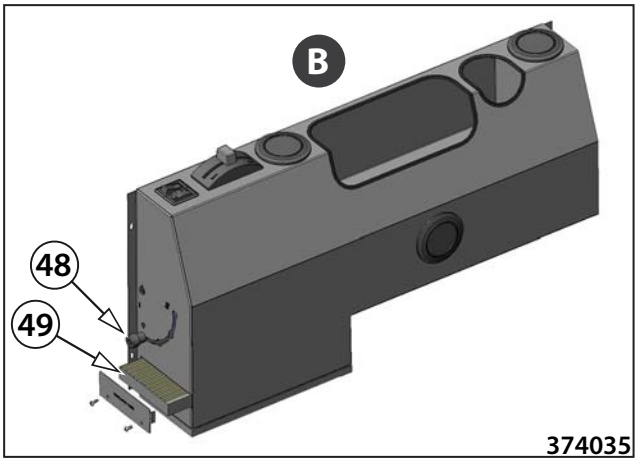
Cabin Induction Air Control (48)

Filter (49)

Do not handle the controllers when driving.

! CAUTION !

Close flap (48) to avoid any smell to penetrate into the cabin. Do not keep the flap closed for too long – fogging up of windows will occur.



Filter for internal air circulation.

Note:

"Air Conditioner Operation Manual" - supplied with air conditioner.

! CAUTION !

We recommend to start Air Conditioner 1x every 3 weeks.

Venting (50) - increases efficiency of cabin fans.

Driver's seat (51)

1 Backrest position

2 Longitudinal move

3 Seat suspension adjustment - as per driver weight indicator

4 Height adjustment - take the seat in your hand and slowly lift it to adjust its height to higher position where it will be arrested. When lifted to MAX position the seat will drop to its lowest position.

Adjust seat before driving, and fasten your seat belt!

2428

Document compartment (52)

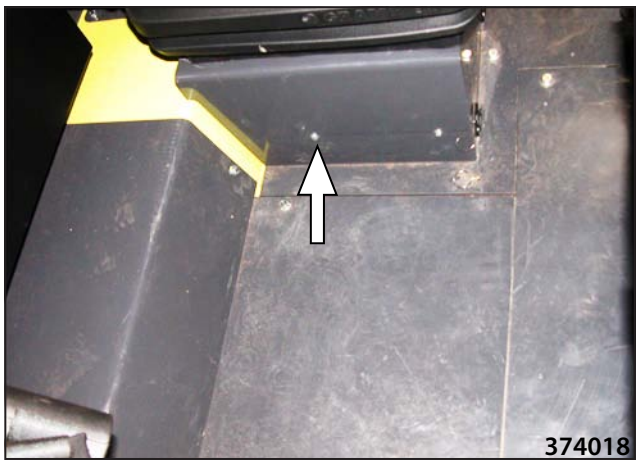
A document compartment is located on the rear side of the seat back.

Under both seats are locked box.

Air reservoir valve control (53) - to release air (condensate) from air reservoir

Fire extinguisher (54) – optional equipment

Place for the installation of a fire extinguisher holder.



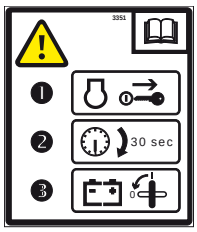
! CAUTION !

The manufacturer recommends that the machine be equipped with a fire extinguisher.

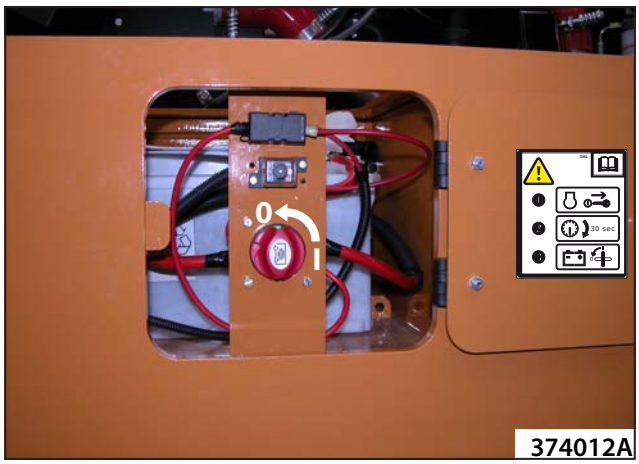
Window washer tank (55)

Refill with clean soft water - best is distilled water - incl. cleaning and degreasing agent.

Before winter season, please fill the tank with de-icing, or drain!

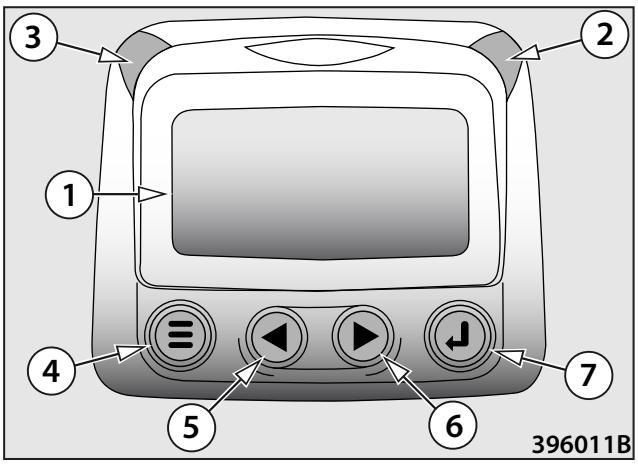


Battery cut off switch (56)



Turn OFF the master switch after 30 sec following the switch box key turned OFF to maintain the data in the engine control module - ECM.

2.6.1. Power View Display control



1 Display

2 Red LED lights – **ENGINE SHUTOFF – engine substantial defect alarm**

3 Yellow LED lights - **WARNING – engine failure alarm, or minimal fuel level in tank alarm**

4 Menu selection pushbutton – to enter or exit menu

5 Pushbutton – to move cursor UP – illuminates data on display or moves parameter option to the left or up

6 Pushbutton – to move cursor DOWN – illuminates data on display or moves parameter option to the right or down

7 ENTER pushbutton – selects menu or parameter, or conceals/displays active error code

Red LED lights – reduce engine power, stop the machine immediately at safe place and shut off the engine! Call Cummins service centre to repair the defect. Do NOT operate the machine unless the defect has been repaired!

Yellow LED lights - warning – engine failure alarm, or minimal fuel level in tank alarm. Reduce engine power, stop the machine immediately at safe place and shut off the engine! Repair the defect or call Cummins service centre. Do NOT operate the machine unless the defect has been repaired!

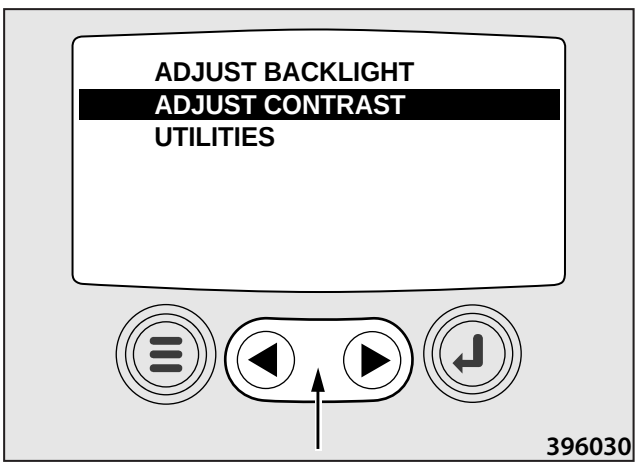
! CAUTION !

When Power View Murphy display shows code and engine failure outline, contact the regional representative of Cummins engines and report the failure code. List of representatives and contact data are given in the Engine Operation Manual supplied with the machine.

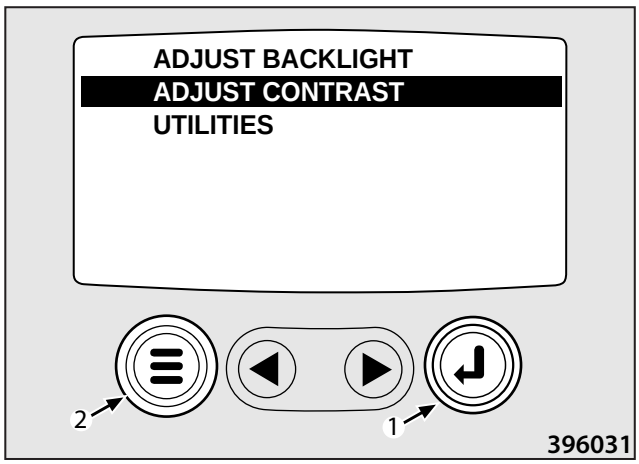
NAVIGATION BASIS

Menus have pages with other items. Use CURSOR (ARROWS) to select some of the items highlighted.

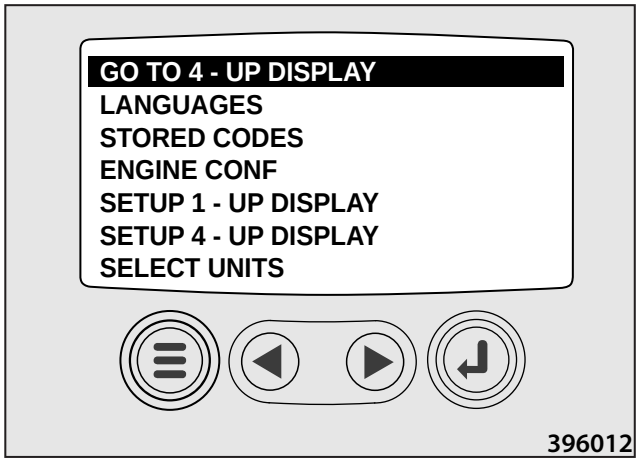
Operate pushbuttons with light touch.



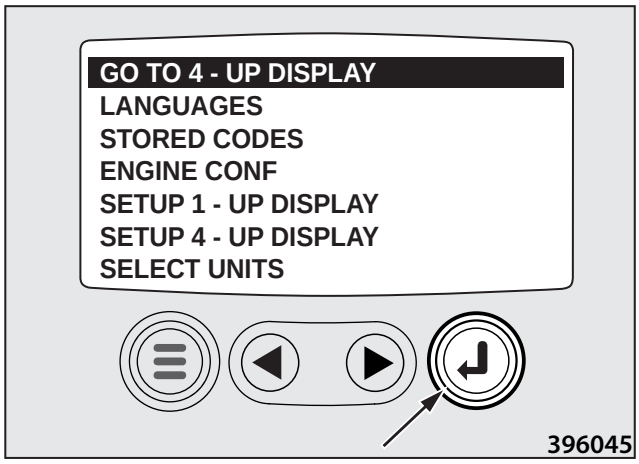
Use ENTER 1 to open highlighted item. Press buttons in Menu 2.



Main menu will be displayed (GO TO 4-UP DISPLAY).



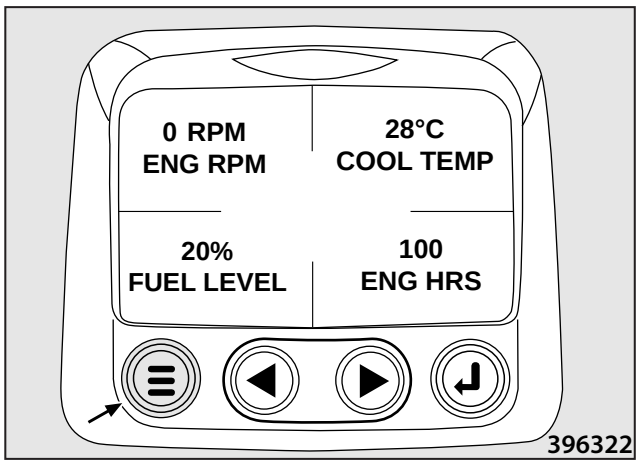
Press ENTER button.



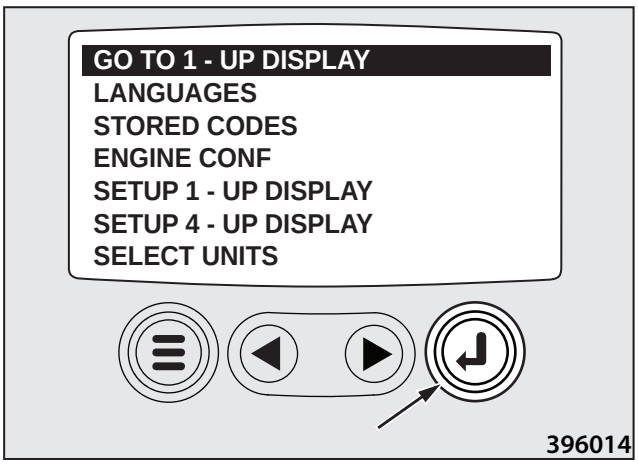
Four-parameter display will show. Press MENU button to display main menu.

Note

Four-parameter display is basic setting from the machine manufacturer; turn ON ignition box key to display it.



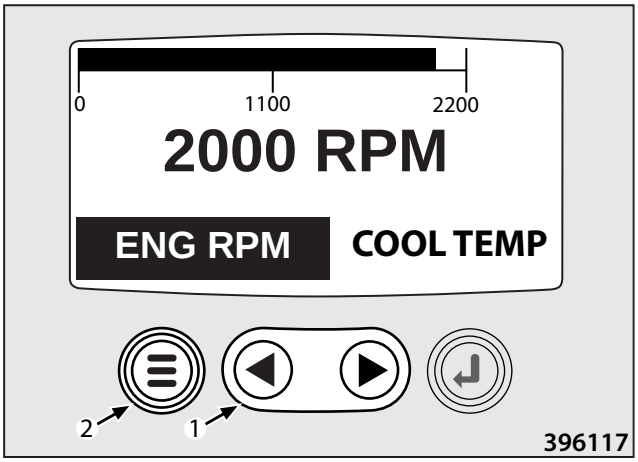
Press ENTER button to move to GO TO 1 - UP DISPLAY menu where parameters are displayed one by one.



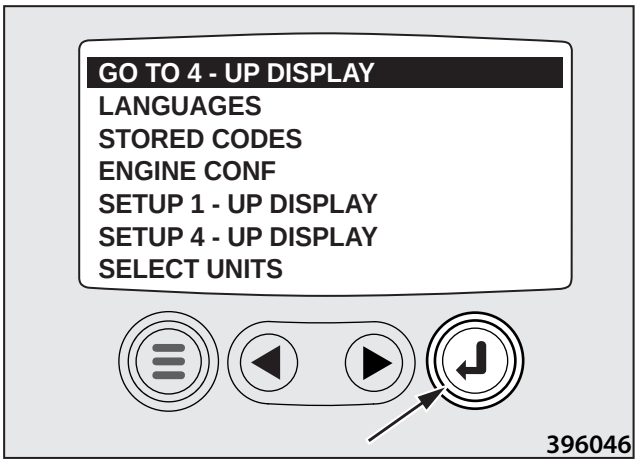
Use cursor 1 to display step by step nine parameters set (Number of engine operating hours, engine rpm, el. system voltage, engine load in % during actual engine speed, cooling liquid temperature, engine oil pressure, fuel level, instantaneous consumption). Press MENU 2 button.

Note

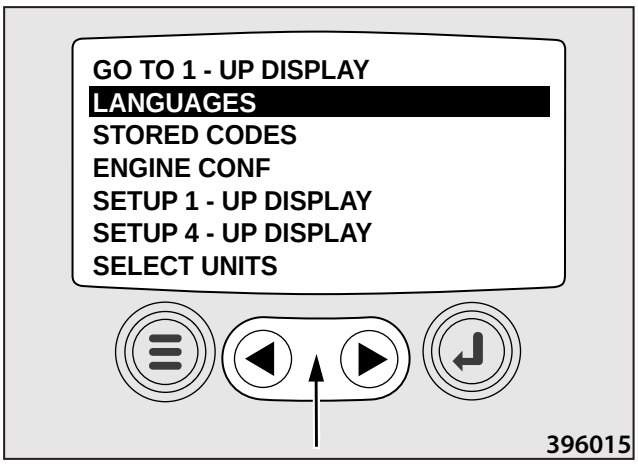
If the engine is at rest, the battery voltage is indicated. If the engine is running, then roller's el. system voltage is indicated.



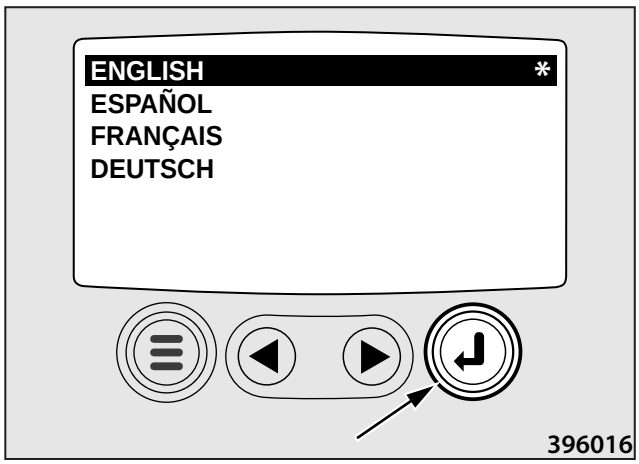
Main menu is displayed again. Press ENTER button to move back to four-parameter display.



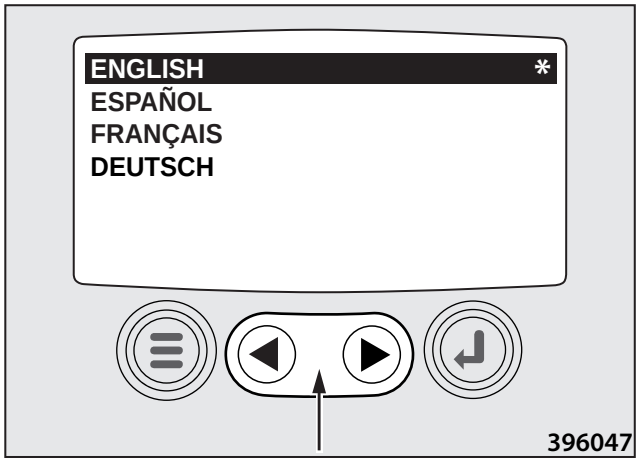
Use cursor in main menu to move to next item, i.e. LANGUAGES – to select language.



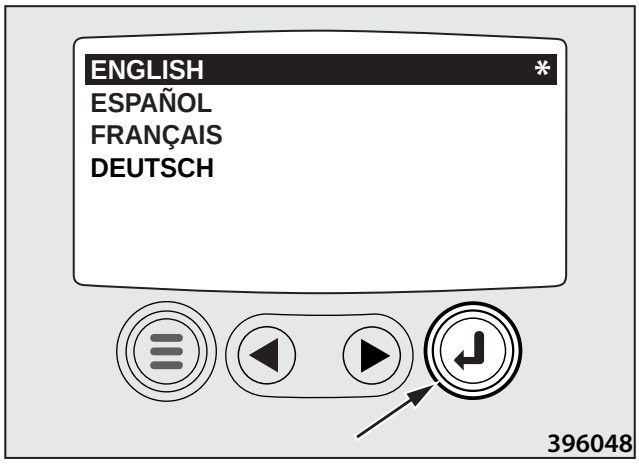
First, press ENTER to select language.



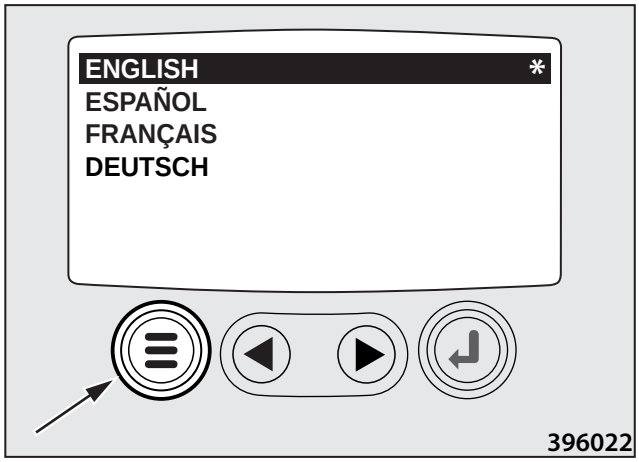
Another time, use cursor to select language.



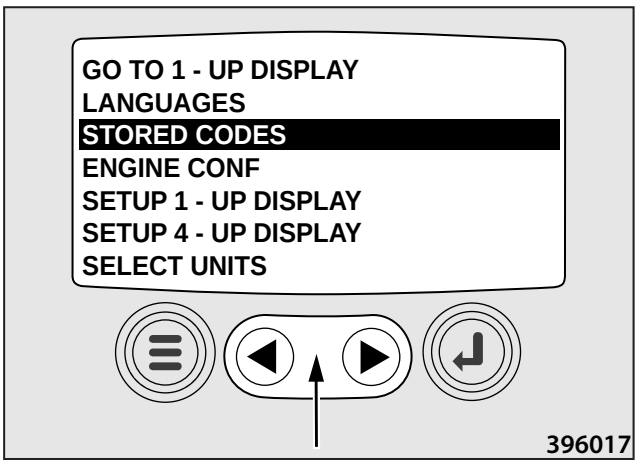
Press ENTER to confirm.



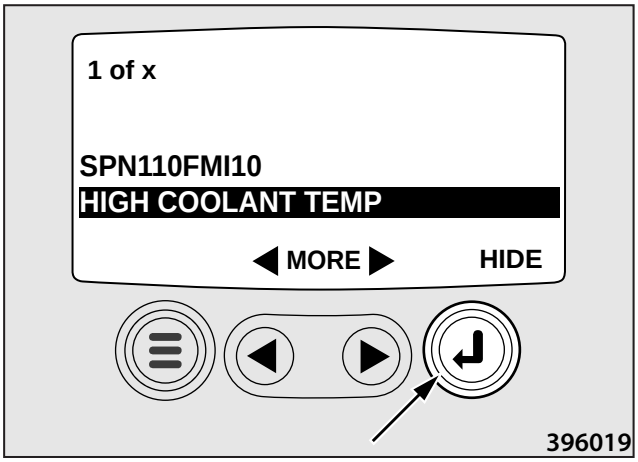
Press MENU to return to the menu.



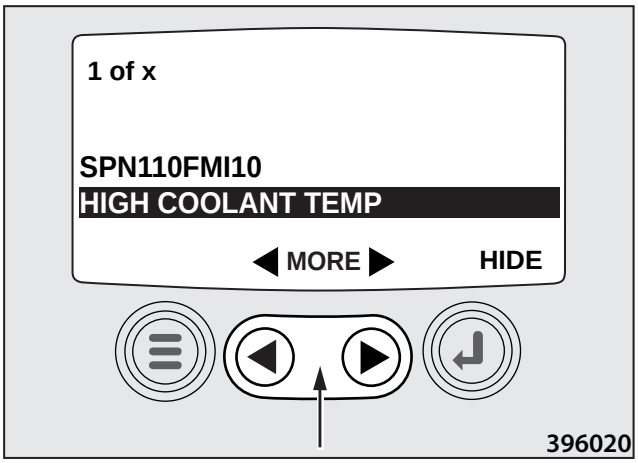
STORED CODES - stored defects not enabled. Move cursor in main menu to the item.



Continue with ENTER to display stored failures.



When the word MORE occurs use cursor to move to other stored failures.



Press Menu to return to main menu.

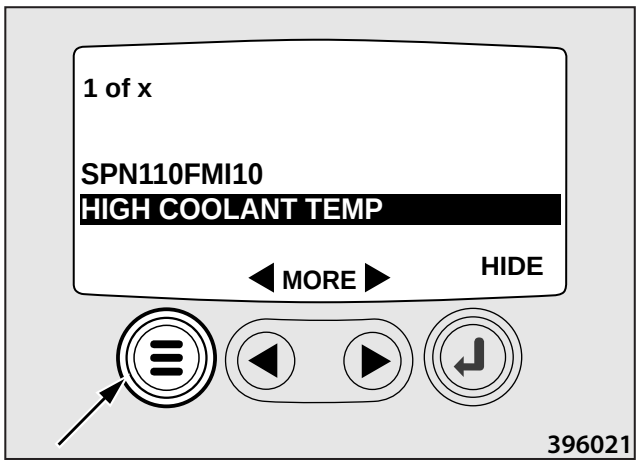
ENGINE CONF - menu to scan engine parameters, refer to CAUTION.

SETUP 1 - UP DISPLAY – press Enter to have various modifications of parameter display available.

CUSTOM SETUP – possible to select from displayed number of parameters, and to set the sequence in which parameters will be displayed (Number of engine operating hours, engine rpm, wiring voltage, battery voltage, engine load during actual engine speed in %, cooling liquid temperature, oil pressure, etc.). The following parameters have been set by the machine manufacturer.

1) ENG RPM
2) COOL TEMP
3) BAR OIL PRES
4) % LOAD@ RPM
5) VDC SYS VOLT
6) ENG HRS
7) FUEL LEVEL
8) FUEL RATE
9) ACCELERATOR PEDAL POSITION

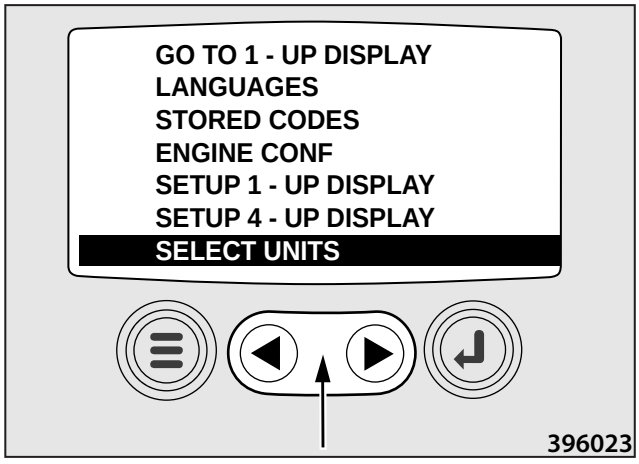
AUTOMATIC SCANNER – set parameters are displayed automatically one by one in time interval.



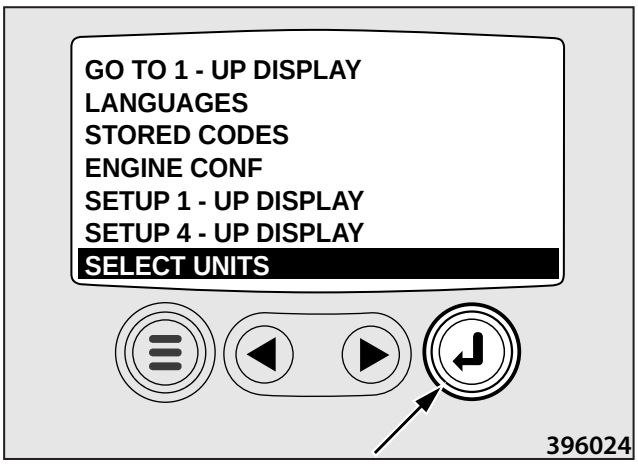
! CAUTION !

Roller manufacturer does not permit to alter the set parameters in CUSTOM SETUP. Parameters set up are the most appropriate optimum of set engine function check.

In main menu, with cursor to SELECT UNITS - selection of measurement unit for parameters displayed.

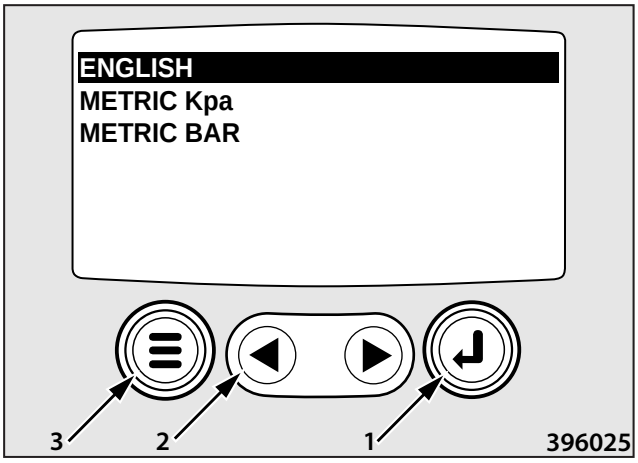


Press ENTER to open units menu:

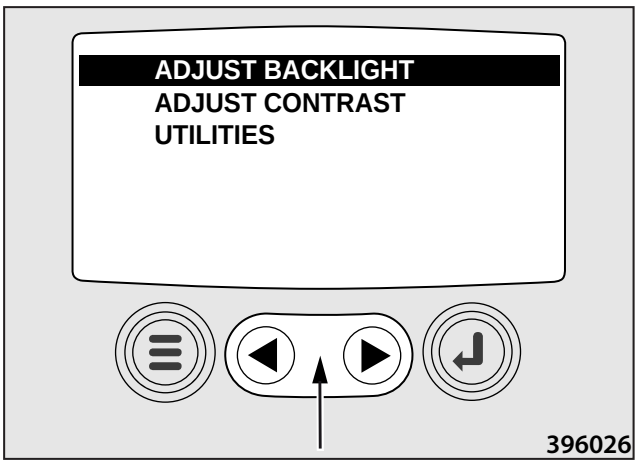


Use cursor to set 1 ENGLISH and the indicated variables will be displayed in PSI units (pressure), °F (temperature).

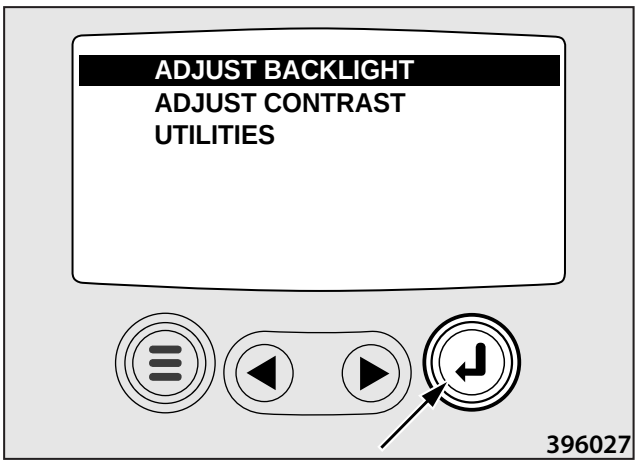
When METRIC KPA or METRIC BAR are set the variables displayed are in IS units, i.e. kPa, bar, °C, press Enter 2 to confirm selected variables. Press MENU 3 to return to main menu.



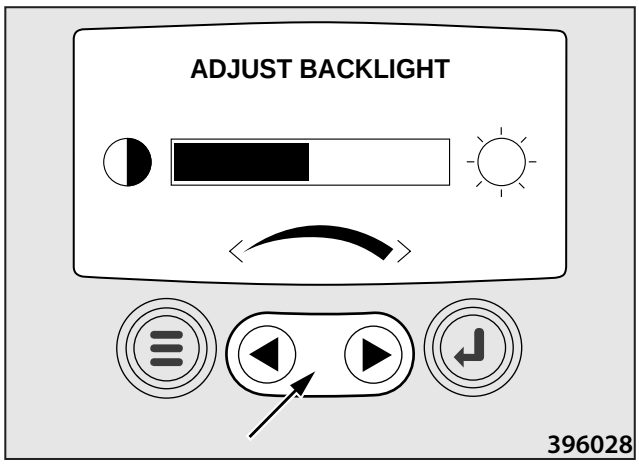
In main menu, move cursor to ADJUST BACKLIGHT - to adjust intensity of display backlight.



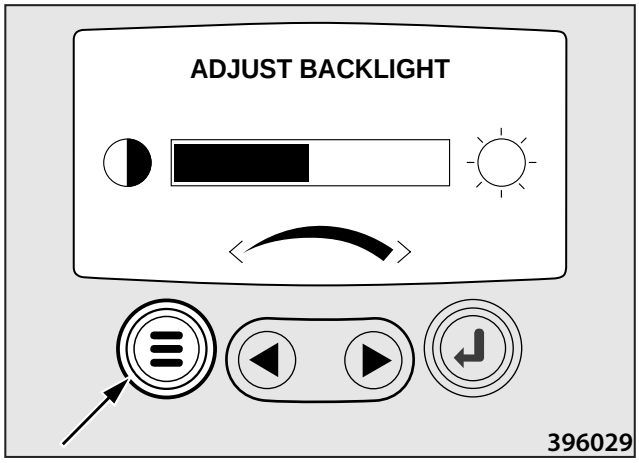
Press ENTER to open the item



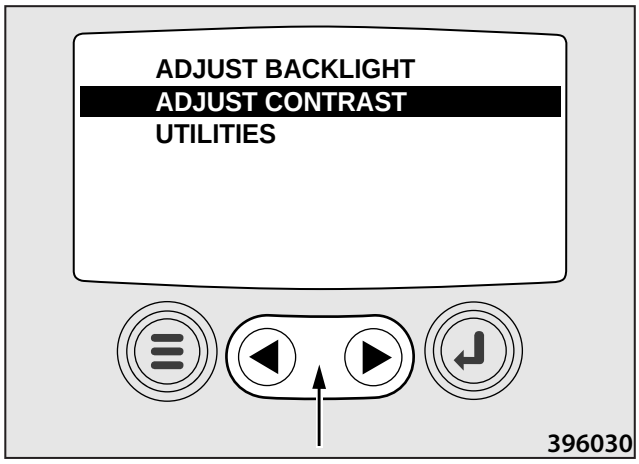
Use CURSOR to adjust backlight intensity



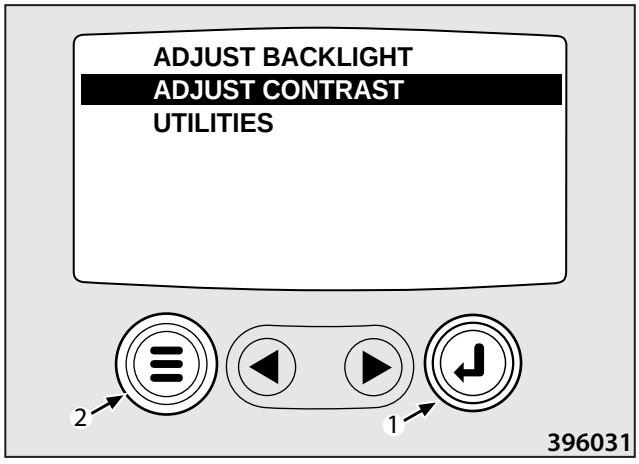
Press MENU to return to main menu



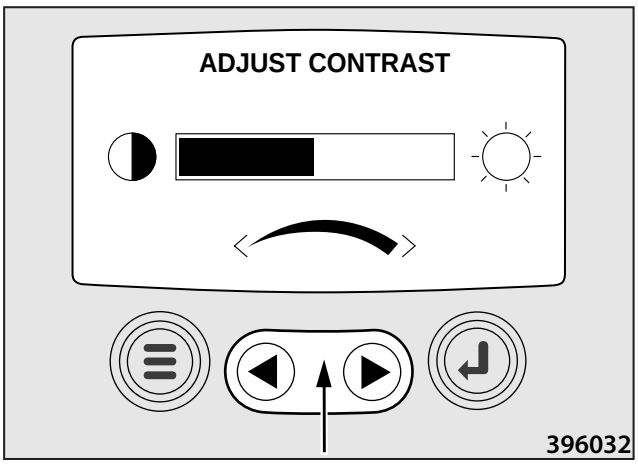
In main menu, move cursor to ADJUST CONTRAST - to adjust contrast.



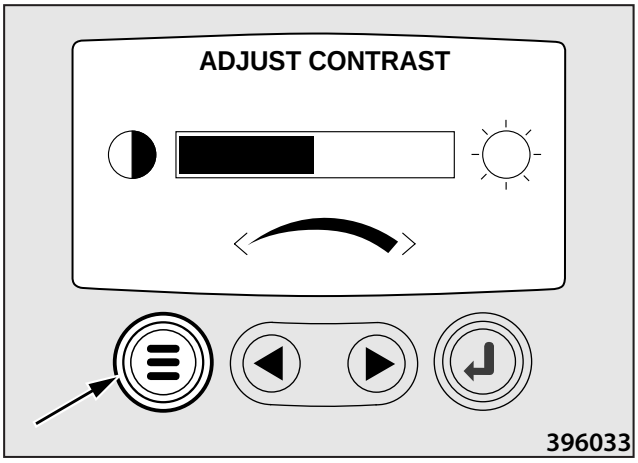
Press ENTER to open the item



Press CURSOR to adjust contrast



Press MENU to return to main menu

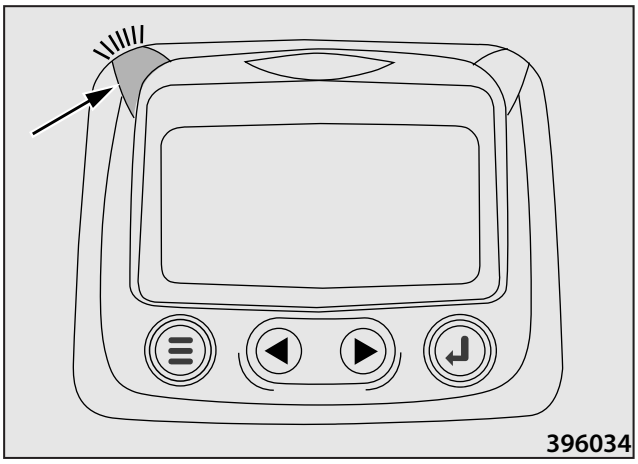


ENGINE FAULT SIGNALLING

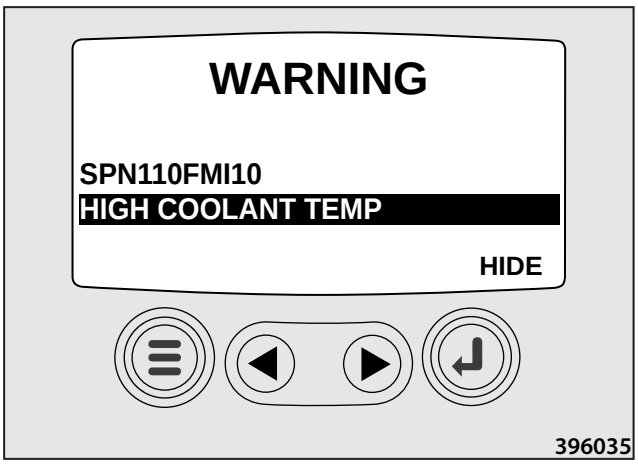
ALARM SIGNALLING

Alarm signal, indicated with yellow LED ON, informs about engine malfunction - **Warning**.

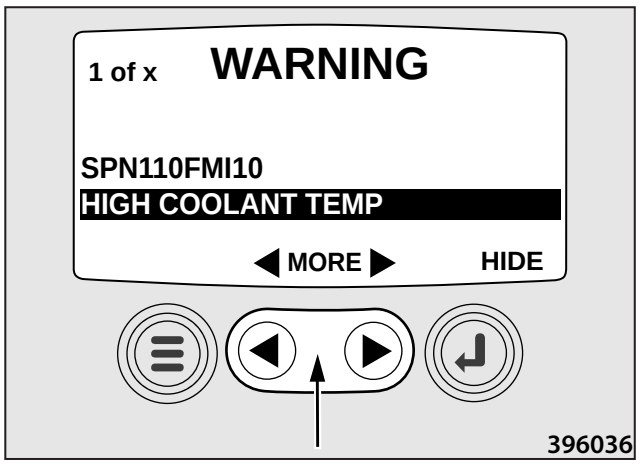
> **Engine failure alarm, or min fuel level in tank alarm. Reduce engine power, stop the machine immediately at safe place and shut off the engine! Repair the defect or call Cummins service centre. Do NOT operate the machine unless the defect has been repaired!**



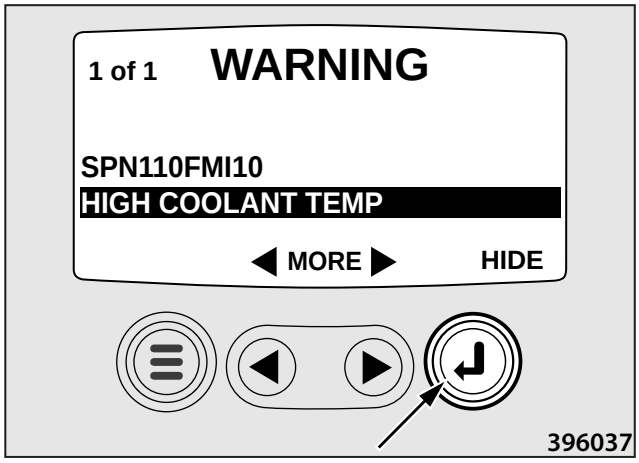
Engine failure registered from engine ECU (Electronic Actuator Unit) will be displayed via error code for a failure and description on the display.



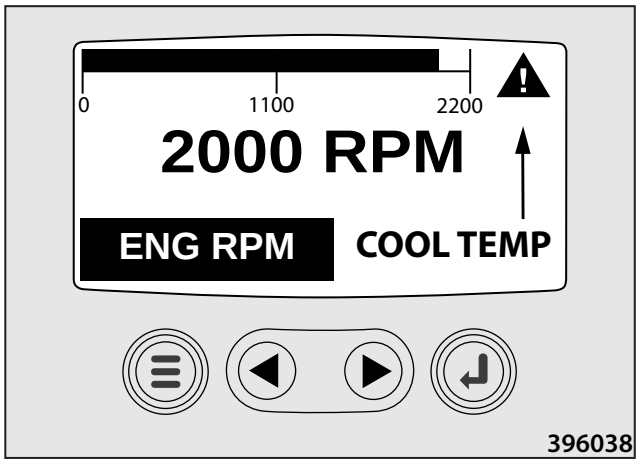
Upon registration of more errors, please use the cursor to display the registered failures step by step.



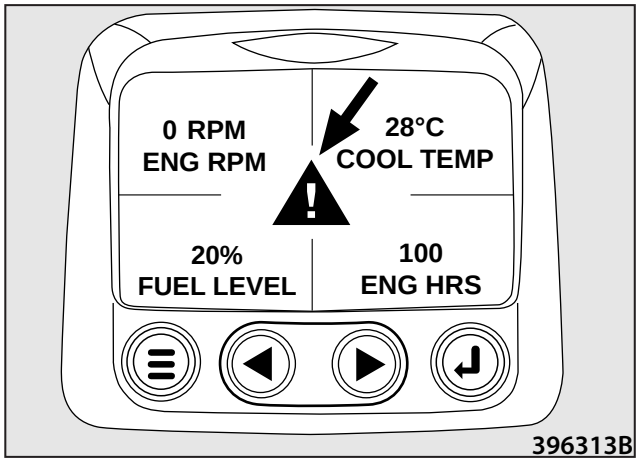
Press ENTER to acknowledge and hide the display.



Return to display 1 of parameter display with warning icon for active failure in RH corner



or display 4 of parameter display with warning icon for active failure in the centre.



Note

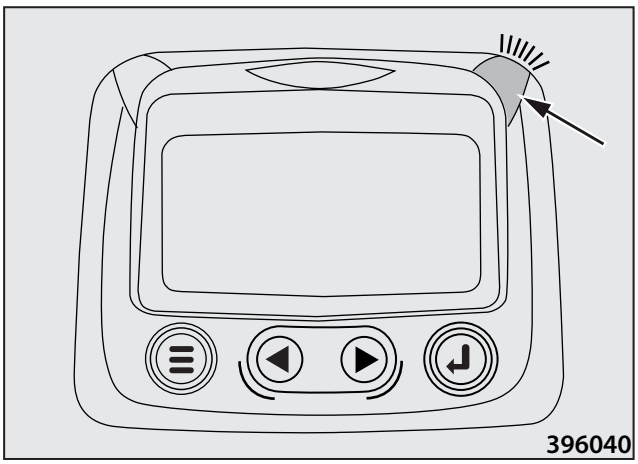
Press ENTER to display again the hidden error code for failures. Press ENTER again to display either with 1 parameter or 4 parameter. Until defect is eliminated the displaying of warning icon will remain active.

! CAUTION ! When failure outline and failure code are indicated on instrument board display, contact the regional representative of Cummins engines, unless the failure is possible to repair. Contact data are given in the Engine Operation Manual supplied with the machine.

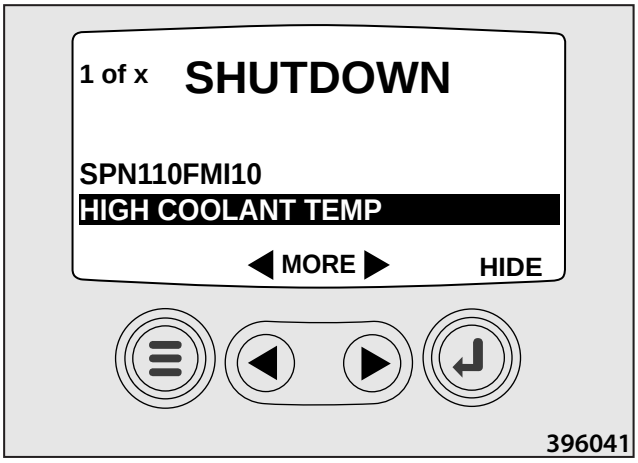
ENGINE CUT OFF ALARM

Alarm signal indicated by red LED ON informs about engine's substantial defect – **Shut off engine**.

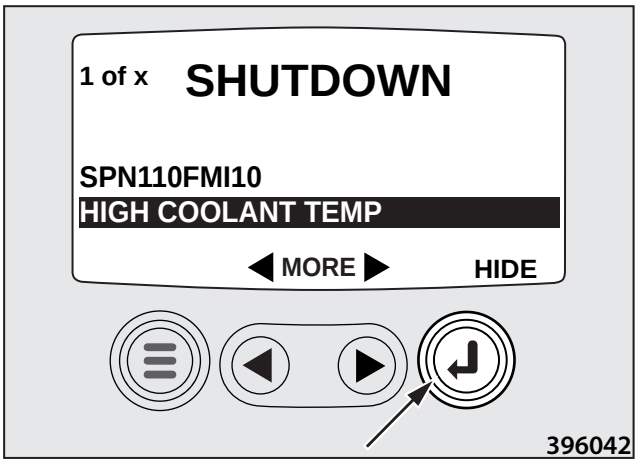
Reduce engine power, stop the machine immediately at safe place and shut off the engine! Call Cummins service centre to repair the defect. Do NOT operate the machine, unless the defect has been repaired!



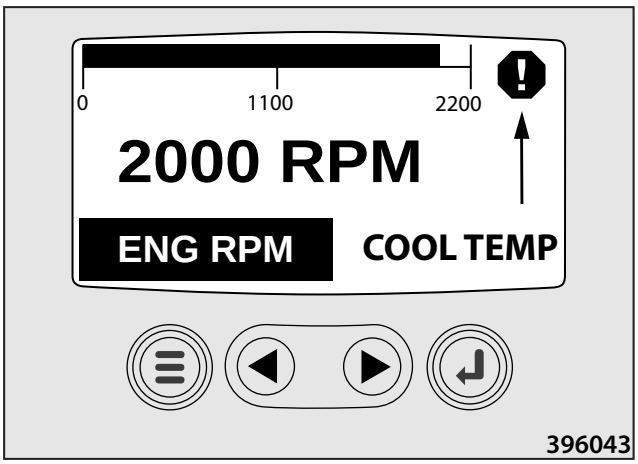
Engine failure registered from engine ECU (Electronic Actuator Unit) will be displayed via error code for a failure and description on the display warning to "SHUT DOWN".



Press ENTER to acknowledge and hide the display.



Return to display 1 of parameter display with "SHUT DOWN" warning icon in RH corner.



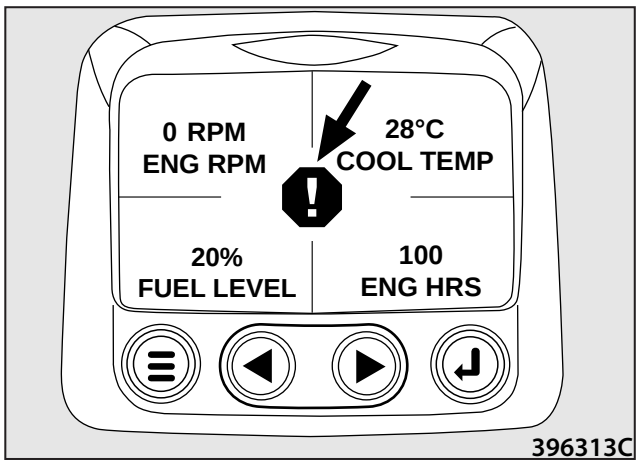
Or of 4 parameter display with warning icon for active failure in the centre.

Note

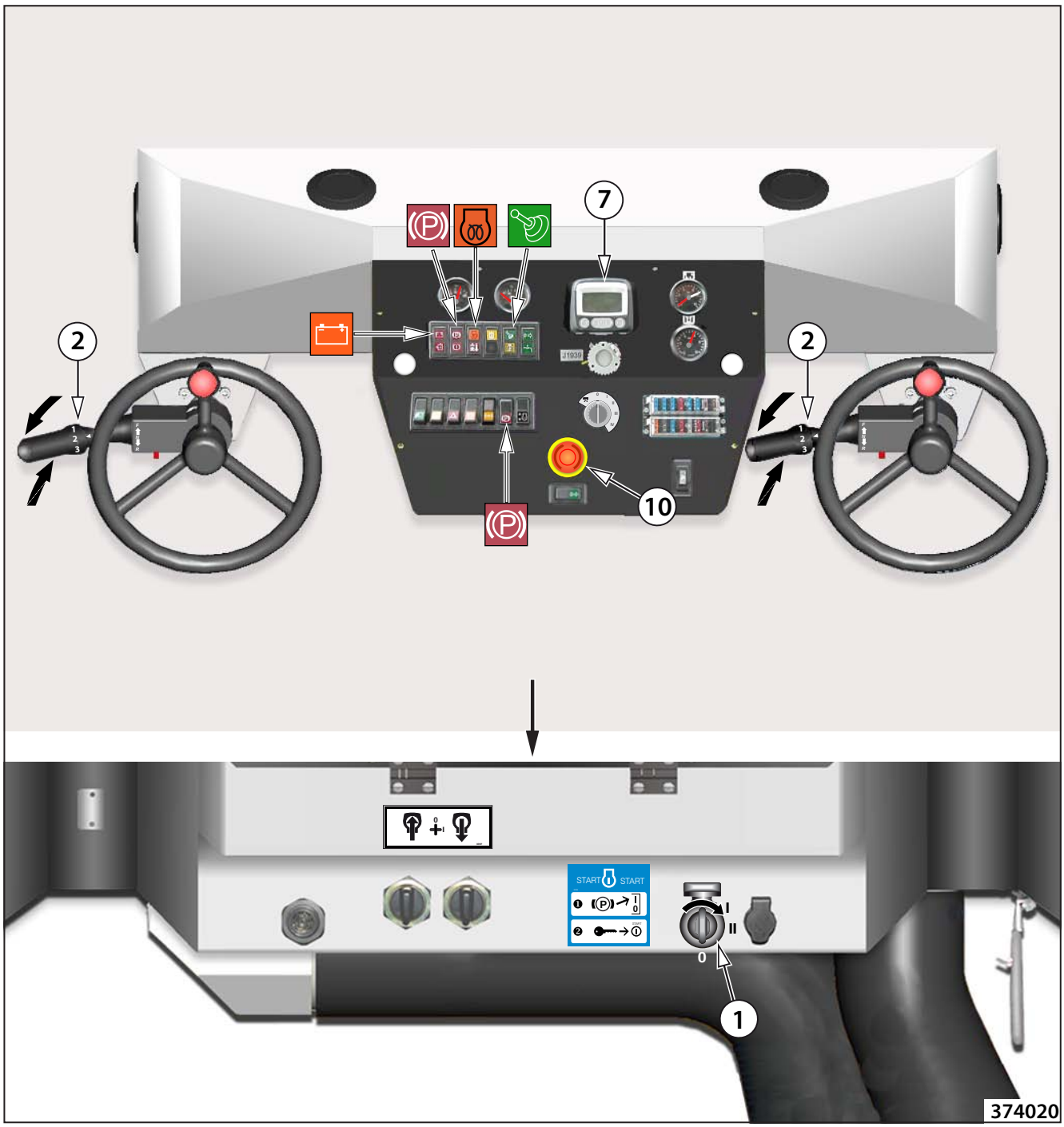
Press ENTER to display again the hidden error code for failure. Press ENTER again to display again either with 1 parameter or 4 parameters. Until defect is eliminated the displaying of warning icon will remain active.

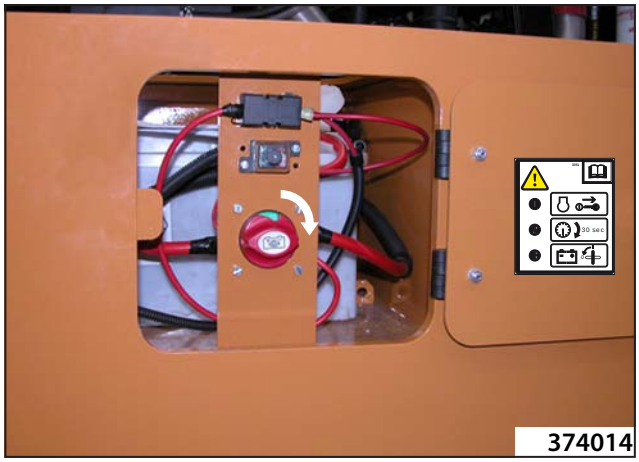
! CAUTION !

When failure outline and failure code are indicated on instrument board display, contact the regional representative of Cummins engines, whose contact data are given in the Engine Operation Manual supplied with the machine.



ERROR MESSAGES	
Error message	**Signature**
"**WAIT TO START PREHEATING**" is displayed	The ECU is broadcasting a ‚Wait To Start'message. Engine manufacturers typically recommend against starting the engine while the ECU is broadcasting this message. Once the ECU stops broadcasting this message,this screen will no longer be displayed on the Power View.
"**CANBUS FAILURE**" is displayed	The Power View has not received any valid J1939 CAN messages for at least 30 seconds.
"**TIMEOUT ECU NOT RESPONDING**" is displayed	The Power View sent a request to the ECU for Stored Fault Code (DM2) information, and the ECU did not respond to the request. This message on the PowerView indicates the ECU may not support Stored Fault Code (DM2) functionality over J1939.
"**NO STORED CODES**" is displayed	The Power View sent a request to the ECU for Stored Fault Code (DM2) information, and the ECU responded. There are zero stored codes.
"**NO GAGE DATA**" is displayed	The Power View has no record of gages connected to the RS485 bus.
"**NO DATA**" is displayed in place of a parameter value	The Power View has not received data for the selected parameter for at least 5 seconds.
"**NOT SUPPORTED**" is displayed in place of a parameter value	The ECU is sending a message that it does not support this parameter.
"**DATA ERROR**" is displayed in place of a parameter value	The ECU is sending a message that there is a data error with this parameter. Or (PV101 only) FUEL LEVEL has been selected for display, ANALOG INPUT has been set to FUEL LEVEL, but no Murphy Fuel Sender has been connected to the analog input.
One of the 4-UP quadrants is empty	No parameter has been selected for display in this quadrant.
Display is not readable, either very dim or very dark	The LCD contrast may have been over or under adjusted. Press and hold the MENU key for approximately 5 seconds. This will reset the LCD contrast setting to factory default.


7
2
2
10
1
START
START
I
II
0
374020


374014

2.7.1. Engine starting

Before first starting the engine, check daily the amount of oil in the engine and hydraulic tank, fuel level in fuel tank, oil level in gearbox, brake fluid level, cooling liquid level. Make sure no parts on the Machine are loose, worn-out or missing.

Before starting the engine, give horn alarm and make sure nobody is endangered due to engine start!

How to start the engine

- Switch ON battery disconnector.
- Check both travel controllers (2) are in idle position, parking brake enabled, TOTAL STOP (10) not switched on. Turn key (1) to position "I". Indicator lamps (LEDS) for recharging, idle, parking brake or glowing (depending on ambient temperature) will light up. Power View (7) (refer to section called "Power View Control") will get enabled. When glowing LED goes off, please start by turning ignition key to II position.

Note:

Use stepping IDLE switch to adjust engine idling speed from 850 ÷ 1000 rpm. Newly adjusted rpm is stored in engine's ECM for next starts. With cooling liquid temperature of up to 30 °C the switch will remain disabled. ECM will adjust idle rpm automatically via air choke.

! CAUTION !

Starting will be interlocked if:

TOTAL STOP pushbutton is switched ON.

Roller is not braked via parking brake.

Both travel controllers are not in idle position.

Hydraulic oil level LED is ON.

Do NOT use accelerator pedal to start the engine, start with engine idling!

Do NOT start for over 30 sec. Repeat starting only after 2 minutes.

Repeat starting max 3x, following that carry out troubleshooting within fuel system. Smoke absence in exhaust pipe indicates failed fuel supply.

When started, the recharge LED must go off within 15 sec.

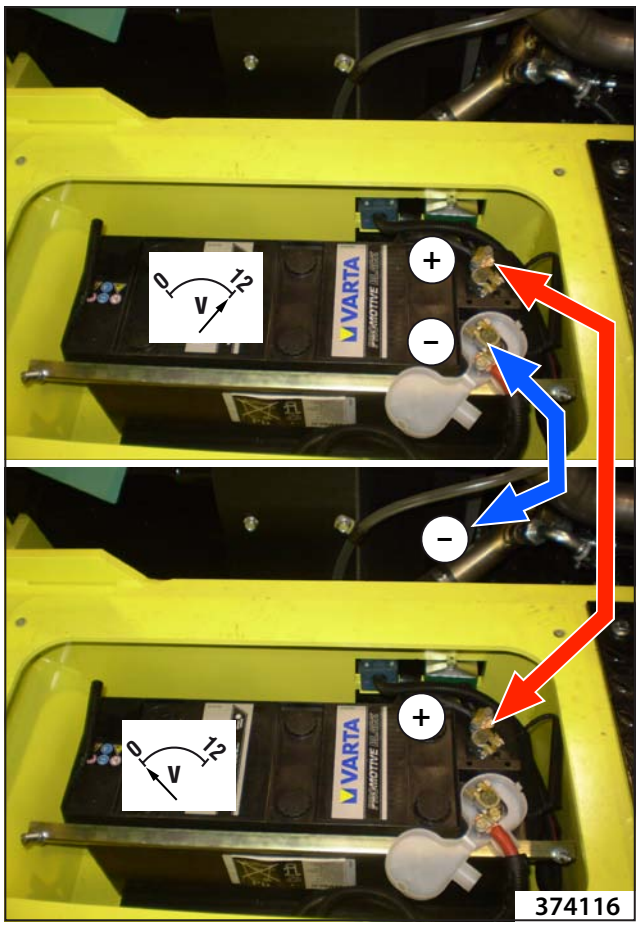
Do NOT increase rpm sharply, let the engine run unloaded, at idle thrust for 3÷5 minutes depending on ambient temperature for the period of filling the brake system up to 7 bar pressure. Do NOT leave engine run idle for over 10 minutes, otherwise engine may get damaged!

It is forbidden to tow-start the engine!

When starting with power supply (12 V), please adhere to the procedure designed for connecting the battery jump cables:

1. Connect cable to + pole of discharged battery.
2. Connect second cable end to +pole of charged battery.
3. Connect cable to - pole of charged battery.
4. Connect second cable end to such part of started Machine that is hard-wired with engine

Disconnect cables in reverse order.

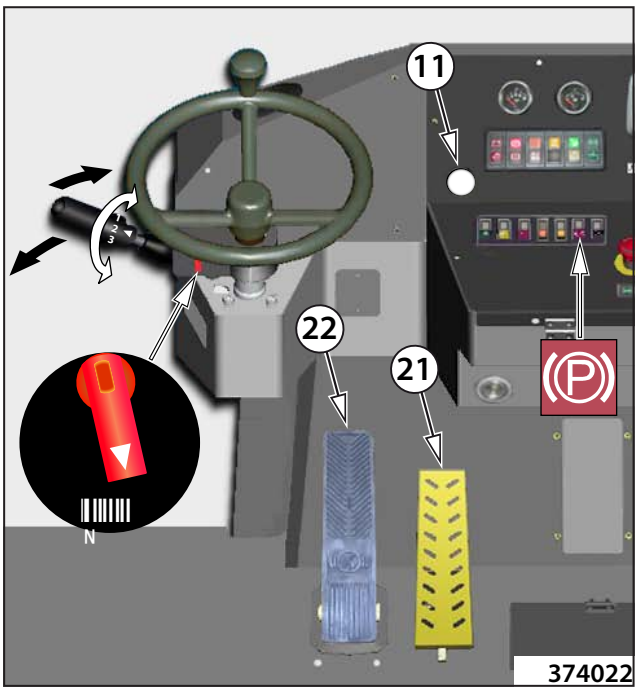


2.7.2. Travel & Reversation

Check both travel controllers (2) are in idle position, parking brake enabled, TOTAL STOP (10) not switched on.

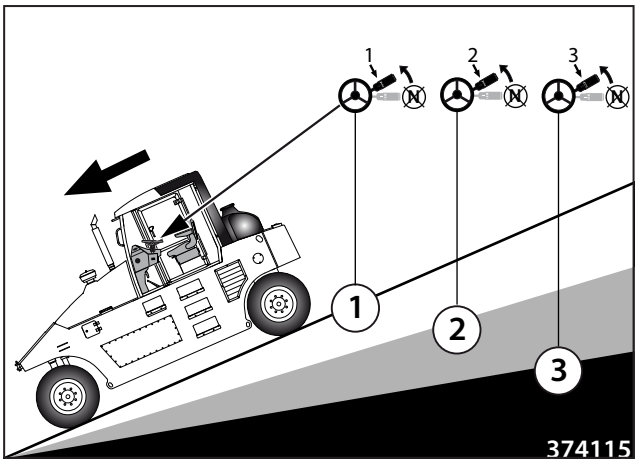
Before starting to move the Machine use horn to give a warning and wait long enough for any persons present to leave the hazardous area within the Machine vicinity in time (area beneath the Machine)!

Make sure the area in front of and behind the Machine is free and that no persons are within the working reach of the Machine!



- Adjust fuse to "D". Turn the controller to select gear 1÷3, select direction of running (indicator lamp for enabled workplace (11) goes ON), switch OFF parking brake (brake indicator lamp goes off). Increase rpm, use pedal (21) to start moving the Roller.
- Brake and stop the roller with a service brake (22) for speed reduction.

NEVER drive downhill with travel controller in "N" position (idle). The gear engaged during downhill driving must correspond to the gear engaged should there be uphill driving. (the higher the slope gradient the lower the gear).



NEVER drive a Roller over 18 tons of its weight on a slope with gradient over 25 %.

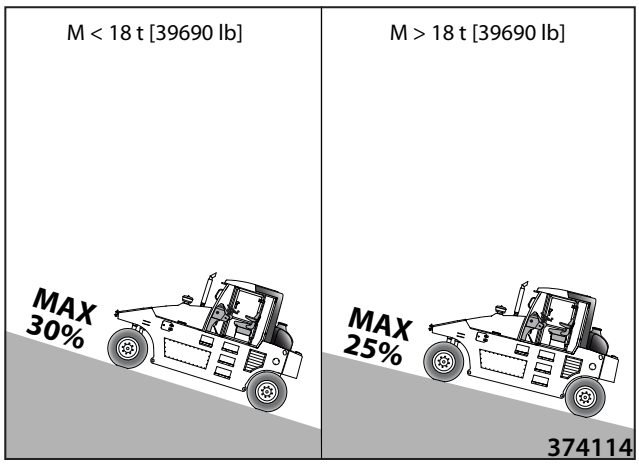
NEVER drive a Roller over 18 tons of its weight with 2nd and 3rd gear engaged on a slope that has gradient over 15 %.

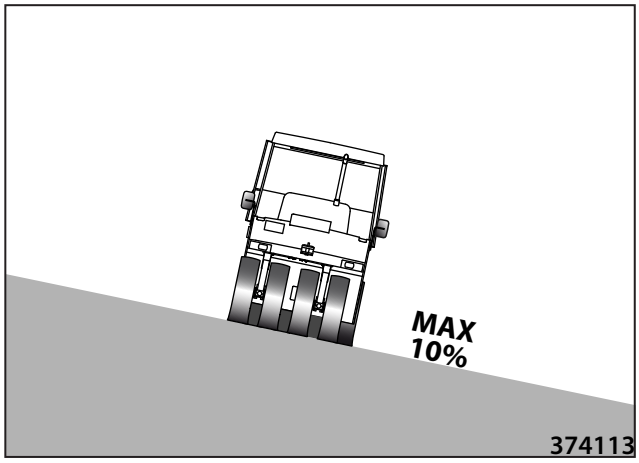
NEVER change steering place - shifting from LH seat to RH one and vice versa while driving. Stop the Roller, brake it a then change the seat!

For the maximum permissible slope gradient when driving uphill and across the slope gradient, see figures.

The values given are lower depending on adhesive conditions and the machine instantaneous weight!

M – machine weight





Unless the engine cooling liquid temperature reaches min 60 °C, do not load the engine at full capacity!

Never use 3rd gear to start moving! Never reverse with 2nd and 3rd gear!

During speed reduction, change in time to a lower gear! You can shift under load (Power shift).

Use differential interlock only when recovering the Machine! Switch OFF the interlock once heavy conditions are overcome - danger of damage to differential or tires.

When oil temperature in gearbox rises over 120 °C, stop the work, stop driving and cool gearbox oil down to optimal 80-100 °C in situ at increased engine speed of 1500 rpm. If oil heats up to 120 °C frequently, change the driving manner - shift gears more frequently, clean oil cooler!

Never use parking brake for normal brake application.

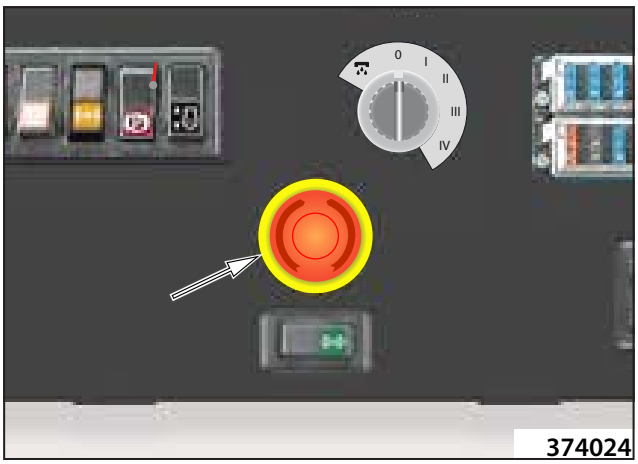
! CAUTION !

When you select direction of running via controller, and after braking off the Machine will start to move slowly even with the engine idling.

While driving, keep the engine at rather high rpm to achieve better controllability of steering the Machine.

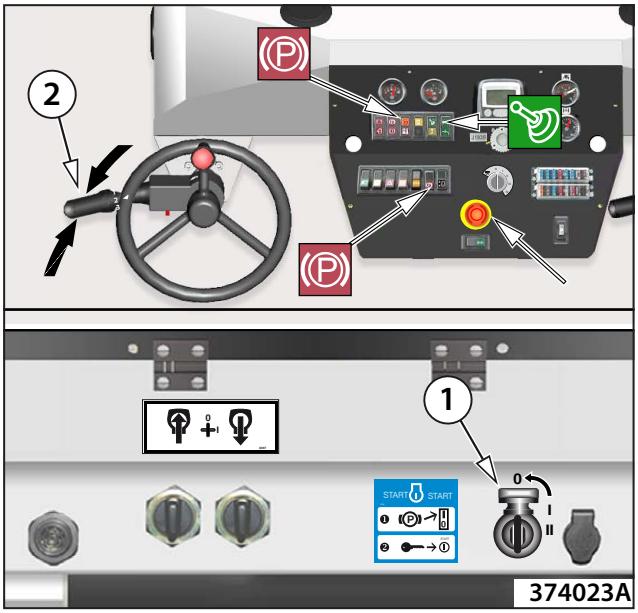
2.7.3. Emergency stop of the Machine

Use in the event of engine unable to shut off via its key, Machine unable to stop via shifting the controller to idle, or with the use of brake pedal, or with parking brake unable to apply.



- Press down TOTAL STOP pushbutton - Machine will stop (brake) and the engine will be shut off.

- Before starting the engine again, shift the controller (2) to idle, release TOTAL STOP pushbutton according to the arrow, switch ON parking brake. Turn ignition key to "0" position and then start the engine.



! CAUTION !

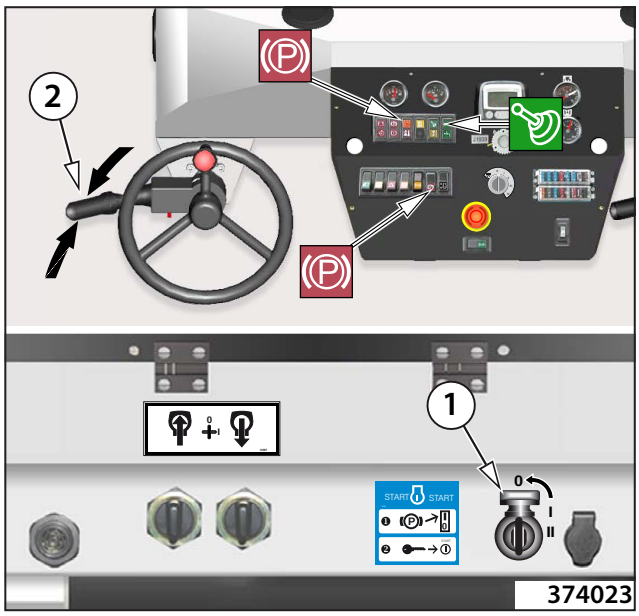
During normal operation, do NOT use emergency brake to stop the Machine or to shut off the engine.

2.7.4. How to stop the Machine and the engine

- Before braking to a stop, shift the controller (2) to neutral, and when stopped, switch ON the parking brake, shut OFF the engine and pull out the key (1).

Note:

With the key pulled out from ignition box the Roller will automatically be braked.



With the engine running the parking brake switch must be ON with the Roller at standstill!

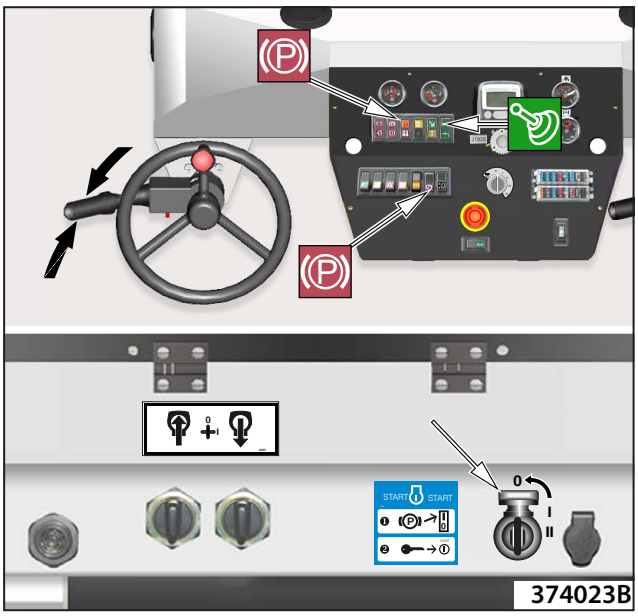
Do NOT shut off the engine immediately, instead let it run for 3 ÷ 5 minutes at idle thrust at 850 rpm for turbocharger to cool down.

When work is completed, always disconnect the battery via battery disconnector! Observe time limit of 30 sec. before disconnecting the battery following ignition box switched OFF so to maintain Machine operation data in ECM of the engine.

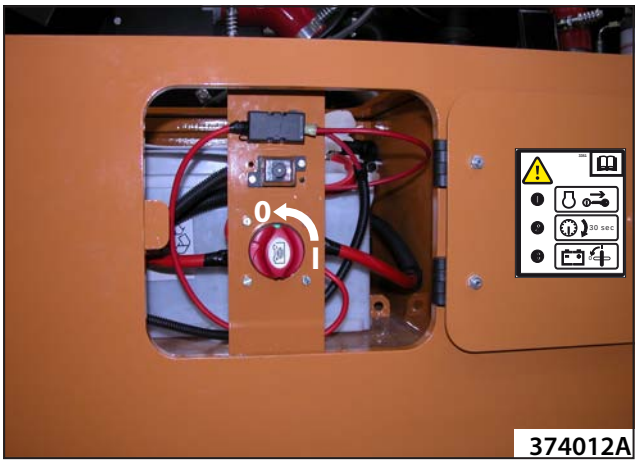
NEVER park your Roller on a slope with gradient of over 15 %!

2.7.5. Machine parking

- After Roller stops, turn ON parking brake, shut off engine.



- Switch off battery disconnector.



- Clean the Machine of any rough dirt (scrapers & tires).
- Make overall inspection of the Machine and repair any defects that have occurred during operation.
- Check pressure in tires and inflate up to 8 bar pressure.
- Secure the wheels with Scotch blocks (if supplied with the Machine).
- Lock the cab (or eventually dashboard cover with the Machine that has no cab).

NEVER dead-park the Roller on a slope with gradient of over 15 %!. Dead park the Machine on pavement area in place with no potential of natural hazard (landslide, potential flooding, etc.).

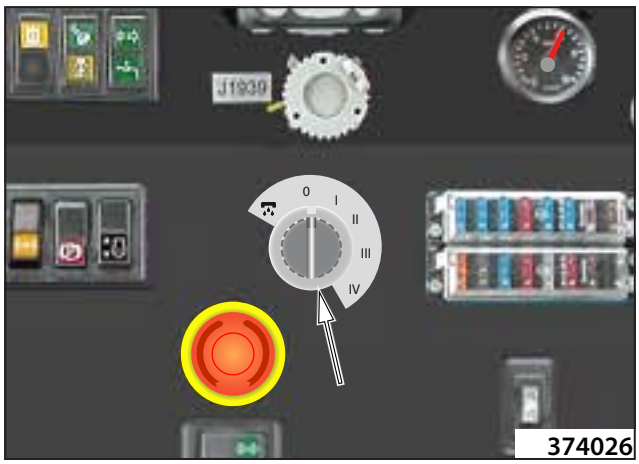
! CAUTION !

Fill up fuel in the filter following a rather long shut-down of the Roller.

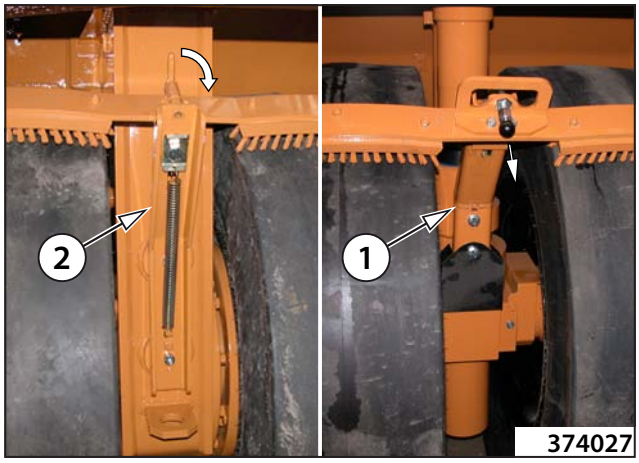
2.7.6. Watering and scrapers

- When compacting fresh-laid asphalt coat, please turn ON the sprinkling and set adequate sprinkling interval. Use appropriate separation emulsion.

Lift the scrapers during normal compaction work on soil and when driving.

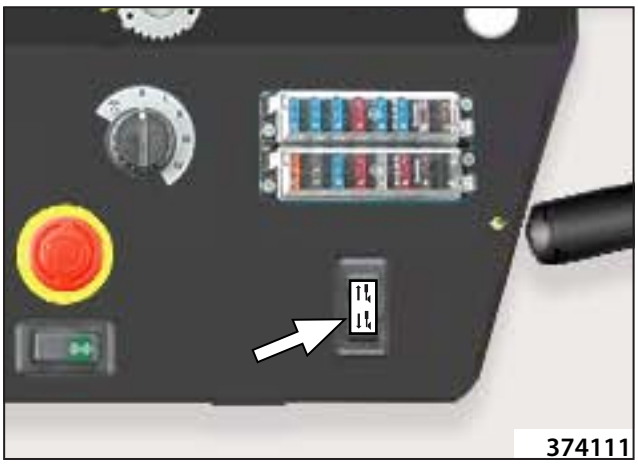


- Lower the front scrapers (1) and rear scrapers (2).

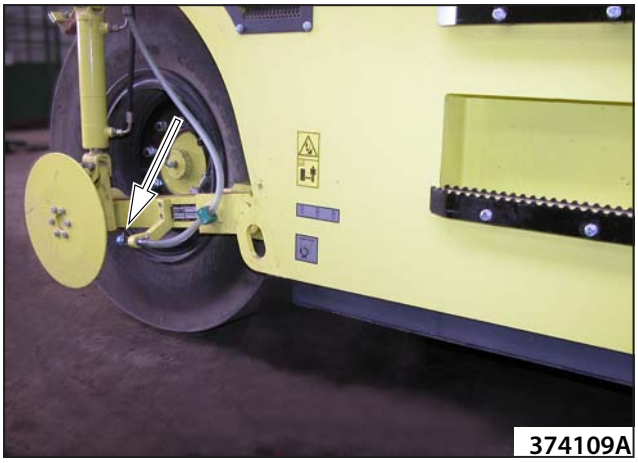


2.7.7. Edge Cutter

- Press the switch to lower the edge cutter to its end position and vice versa.

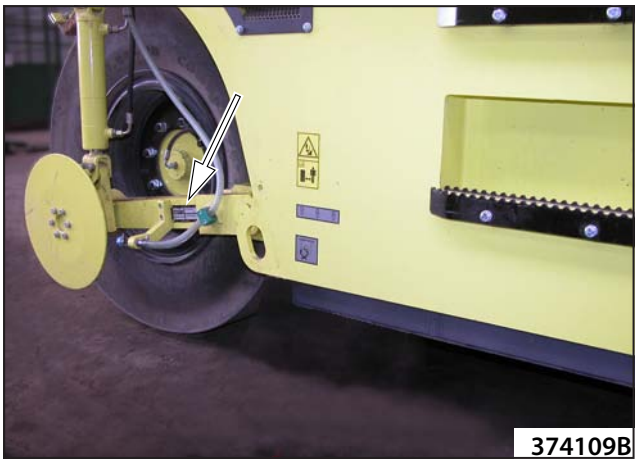


- When operating the edge cutter, switch ON the sprinkler and open the valve near edge cutter disc.



Confirm nobody is in hazard before lowering, lifting.

Scraper plate location.



Scraper plate

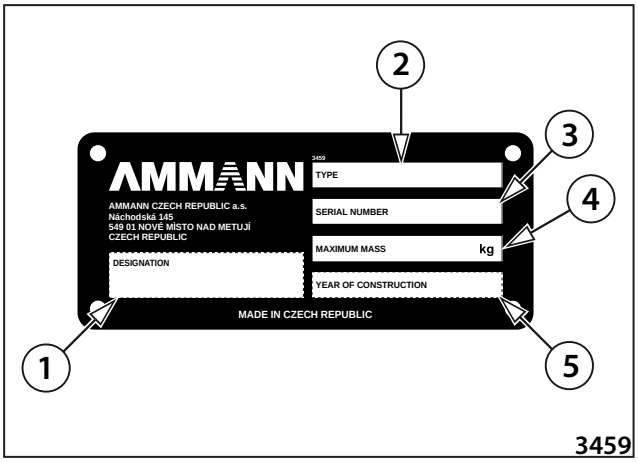
1 - Name – always mentioned only in the English version

2 - Type

3 - Serial number

4 - Maximum weight

5 - Year of manufacture



2.8. How to transport the Machine

- The machine can move on its own between working sites.

When moving, observe the safety measures applicable to the working site.

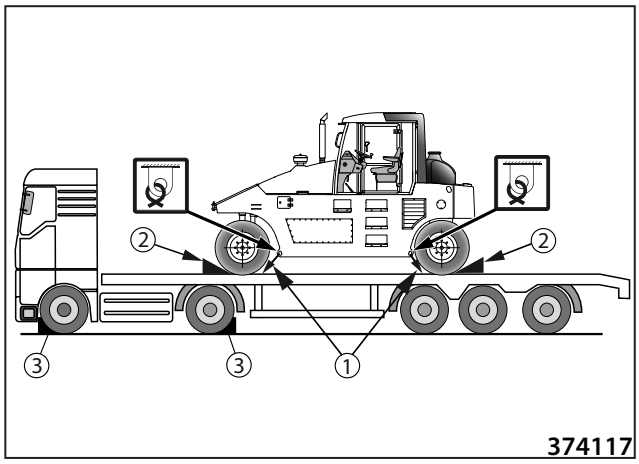
- When on the road, the machine should be transported on a vehicle.

When transporting the machine on a vehicle, observe the regulations in force in the given territory.

When loading and unloading, the vehicle transporting the machine must be braked and mechanically protected against accidental movement using scotch blocks (3).

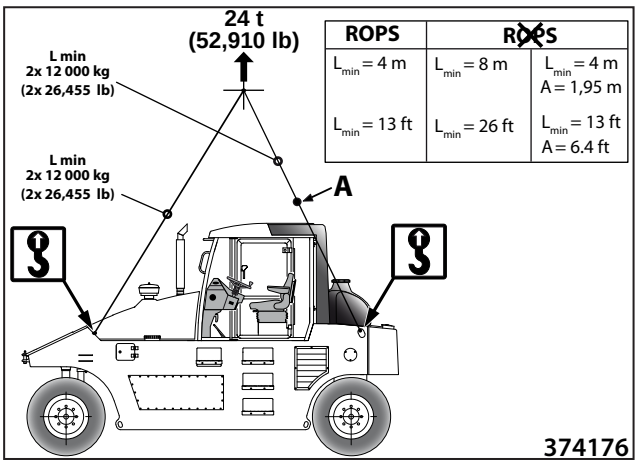
If the Machine has been equipped with differential interlock - then lock in the interlock before running onto the carrier's platform!

The machine on the vehicle must be properly tied and mechanically secured against longitudinal and lateral displacement as well as against tipping (1). The drums must be secured using scotch blocks (2).



2.8.1. Machine loading

- Loading is best to be carried out from the side of drive-up ramp. Unless such ramp is available, use a crane. Use lifting lugs to hang the ropes.



When loading and unloading the machine, it is necessary to observe the provisions of ISO 12480-1 and to use slings under EN 1492-4+A1.

! CAUTION !

When using ropes shorter than 8 m (26.3 ft), insert cross bar (A) 1,95 m (6.4 ft) long between the ropes overhead the cab.

Beware of Roller's actual mass incl. weight and additional load in ballast spaces of Roller!

Use only the designed lifting lugs intended to tie the ropes.

Binding may only be performed by a binder with a binding certificate.

Use lifting equipment and rigging of sufficient loading capacity.

Do NOT enter under the hung load!

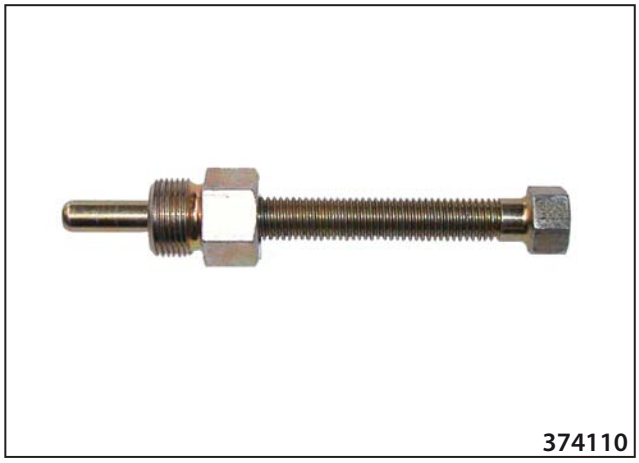
2.9. Machine work under heavy conditions

2.9.1. Machine towing

To tow the Roller, use towing hitch mounted in the Machine front. Towing hitch is optional.

When the roller has no coupling, towing the roller is banned. Move the roller using a crane. The loading capacity of the crane and slings must be higher than the machine instantaneous operating weight!

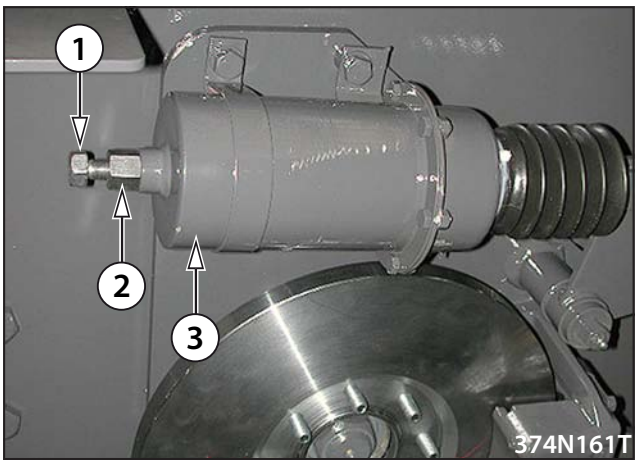
- Unless the brake circuit has pressure over 5,2 bars and unless the engine is working to make up the pressure, you must use a fixture (optional) to brake off the Roller for towing.



- Dismantle floor covers between the seats.

- Dismantle the bolting.

- Screw on the fixture (1), (2) into the spring cylinder (3) in order to release the shoes that grip the parking brake disc.



Before braking off, use Scotch blocks for wheels to secure the Roller against any spontaneous moving!

All the brakes are disabled!

No persons may dwell on the towed Roller with its engine not working.

With the engine of the towed Roller not working, the steering will not work, the operating brake is not fully operable (unable to generate air pressure). Fixture has been used to brake off the parking brake and consequently the Roller is not being braked. Therefore when towing the Roller, downhill in particular, NEVER use the hauling cable, use the tow-bar!

When towing, use intact hauling cables or tow-bar of loading capacity equal to 1,5 multiple of instantaneous weight of the Roller towed. NEVER use a chain!

When towing, make sure persons present stay within sufficient distance to avoid their injury if the hauling cable breaks or the hitch is damaged.

One must maintain the minimal angular displacement of straight angle of hauling. Maximal misalignment possible is at an angle of up to 30°.

One must maintain the continuous motion when towing. Do NOT exceed the towing speed of 2 km/hr. (1,2 mph).

Tow the Roller for a distance as short as possible – to recover it when bogged down, or to remove it as an obstruction during its defect. Do NOT tow for a distance over 300 m (0,19 mil) long.

The size of the towing machine should correspond with the broken Machine. Make sure it has sufficient pulling power, weight and brake effect.

Unless the engine works, secure the Roller immediately after towing against any motion, and then remove the fixture away from the parking brake.

! CAUTION !

These are general requirements for safe hauling of damaged Machine under normal conditions. Consult with your dealer any and all different situation that may occur when towing.

2.9.2. Machine operation during its running-in period

Upon the commencement of the operation of a new machine and during the first 30 hours of operation, do not load the machine at its full capacity.

2.9.3. Machine operation at low temperatures

The compaction in the winter period depends on the content of fine particles and water in the compacted soil. The soil becomes more solid and more difficult to compact with a decreasing temperature below the freezing point.

Dry soils and stony soils can be compacted and non-frozen materials (before the soil freezes up) can be quickly compacted at temperatures below 0 °C (32 °F).

Preparation for works at low temperatures

- Check the concentration of the engine cooling liquid.
- Exchange the engine oil with the recommended one for the respective low ambient temperatures.
- Use the hydraulic oil of the corresponding kinematic viscosity.
- Use the winter fuel.
- Check the battery charge.

Note

Heating the batteries to approximately 20 °C (68 °F) (by removing and storing the batteries in a warm room) will reduce the limiting starting temperature by 4 to 5 °C (39.2 to 41 °F).

The minimum temperature of the engine cooling liquid is 60 °C (140 °F). The maximum temperature is 100 °C (212 °F).

! CAUTION !

When using the HV 100 oil in the hydraulic system, the machine must not be started at ambient temperatures below +2 °C (36 °F).

2.9.4. Machine work under high temperatures and humidity

Engine power lowers with growing air temperature and humidity.

- Every 10 °C of temperature increase means power drop by up to 4 % (at constant humidity),
- Every 10 % of increased relative humidity means power drop by up to 2 % (at constant temperature).

Note

- In the environment where hydraulic oil temperature moves constantly round 90 °C (194 °F), we recommend to have hydraulic oil replaced by the oil with HV 100 kinematic viscosity.
- For planetary gearbox with hydraulic torque converter within the environment characterized as TROPICAL, we recommend to use oil of SAE 30 viscosity value that corresponds to the performance classification of Caterpillar TO-4.

2.9.5. Machine work in high altitudes

- With altitude growing the atmospheric pressure and specific gravity of intake air decrease, and in connection therewith the engine performance lowers.
- If engine smokes black in the altitudes of over 1500 m, please contact service department of engine manufacturer (Engine Operation and Maintenance Manual) and this manufacturer will adjust the injection pump accordingly to suit such conditions.

The engine power is affected by the environment in which the machine is working.

The machine may be used up to a maximum altitude of 3,658 m (12,000 ft).

2.9.6. Work of the machine in the dusty environment

- When working in a very dusty environment, please cut short the intervals for replacement of suction filter elements, cut short the interval for cleaning the coolers, for replacement of cabin's dust filter, refer to Machine Maintenance Table.

Notes

Notes

3. MAINTENANCE MANUAL

AP 240
(Cummins Tier 3)

3.1. Safety standards and other maintenance regulations

3.1.1. Safety of machine maintenance

Carry out lubrication, maintenance and adjustments:

- By professionally trained personnel
- In line with safety instructions given in the Operation Manual
- According to schedule given in the Lubrication Chart following the hours actually worked
- On the machine located on flat solid surface, secured against self-motion (scotch blocks), and this always with the engine OFF, key removed from ignition box, and the wiring cut off
- Only after **Machine Repair** sign is attached onto steering wheel (the sign is supplied together with machine accessories)
- On machine parts cooled out
- After having cleaned the machine, lubrication points and maintenance locations
- Using proper, undamaged tools
- Through replacement with new original parts as per the Spare Parts Catalogue
- With sufficient lighting of the entire machine in the event of lowered visibility and at night
- so the guards and safety elements are reinstalled again upon work completion
- through retightening bolted connections – with torque specified, and through checking the connection tightness
- with the operation media heated – beware of burns – use recommended media, only.

Upon completion of the adjustment or maintenance, please examine the function of all safeguard equipment!

3.1.2. Fire precautions during operation media exchanges

- In terms of fire hazard the flammable liquids used on the Machine have been divided into three hazard classes:

  IInd Hazard class – Diesel oil

  IVth Hazard class – mineral oils, lube greases
- Oil exchange point shall be located so it does not interfere with the explosion or fire hazard area.
- It shall be identified with notice boards and signs of no smoking and no use of open flame.
- Handling area shall be sized so the capture the amount to flammable liquid equal to the capacity of biggest vessel, transport container.
- It must be equipped with portable fire extinguishers.
- To handle the oil, Diesel oil, please use such vessels like metal barrels, canisters or sheet-metal cans.
- Transport containers shall be properly closed when stored.
- Vessels shall have one opening, be stored with the opening on top, and secured against any flowing out or dripping of their content.
- Vessels shall be designated with indelible inscription indicating the content and flammability class.

3.1.3. Ecological and hygienic standards

When operating and maintening the machine the owner is obliged to keep the common regulations of health and environment protection and the laws, regulations and promuglations, correlative to this problems and valid in the region of the machine use.

Hygienic standards

- The petroleum products, cooling systems fills, accumulators, brake liquids and fills and paints including the thinners are harmful materials. Workers that come into contact with these materials during the service and maintenance of the machine, are obliged to keep the common standards of health protection and they must keep the safety and hygienic manuals of the manufacturers of these materials.
- We want you to focus your attention mainly on these areas:
  - eyes and skin protection when manipulating with the accumulators
  - skin protection when manipulating with the petroleum products, paints, cooling liquids and brake liquids
  - proper washing the hands after finishing the work and before the meal, treat the hands using the appropriate regenerating cream
  - when manipulating with cooling systems, keep the machine manipulating manual instructions.

- The petroleum products, cooling systems fills, accumulators fills, brake liquids and paints including the organic thinners and also cleaning and preservative means always store on a original, properly signed covers. Don't allow storing of these materials in the non-marked vessels and other cans due to danger of exchange. Extremely danger may be the exchange with meal or drinks.
- In the case of accidental stain of the skin, mucous membranes, eyes or of inhalation of the vapour, apply immediately the first aid. In such case find the emergency first aid.
- When working with the machine unequipped with the cab, or with opened windows and cab door, always use the ears protections of convenient kind and design.

Ecological standards

The fills of individual machine systems and also some parts are after blackout (dismounting, changing the fills) the garbage with risk attributes for the environment.

- To this category of waste products includes:
  - organic and synthetic lubricants, oils and fuels
  - brake fluids
  - cooling liquids
  - accumulator filling and accumulators themselves
  - the conditioner systems fillings
  - cleaning and preservative materials
  - all dismounted filters and filter inserts
  - all used and blackouted hydraulic and fuel pipes, rubber steels and other machine parts, contaminated by materials above

With materials and parts listed we must work after blackout according to the appropriate national regulations for individual environment parts protection and according to the health protection regulations.

3.2.1. Engine Oil

Engine oil has been specified according to the performance classification and viscosity classification.

Performance classification as per

API (AMERICAN PETROLEUM INSTITUTE)

CCMC (COMMITTEE OF COMMON MARKET AUTOMOBILE CONSTRUCTORS)

ACEA (ASSOTIATION DES CONSTRUCTEUERS EUROPPÉENS DE AUTOMOBILE)

Viscosity classification

Ambient temperature and type of operation at the location where the Machine is used are decisive to determine the SAE (Society of Automotive Engineers) viscosity class.

Use of admissible oils under API: CH-4/SJ; CI-4

CCMC DHD1

ACEA: E-5

Year round SAE 15W-40, refer to the Table.

Note:

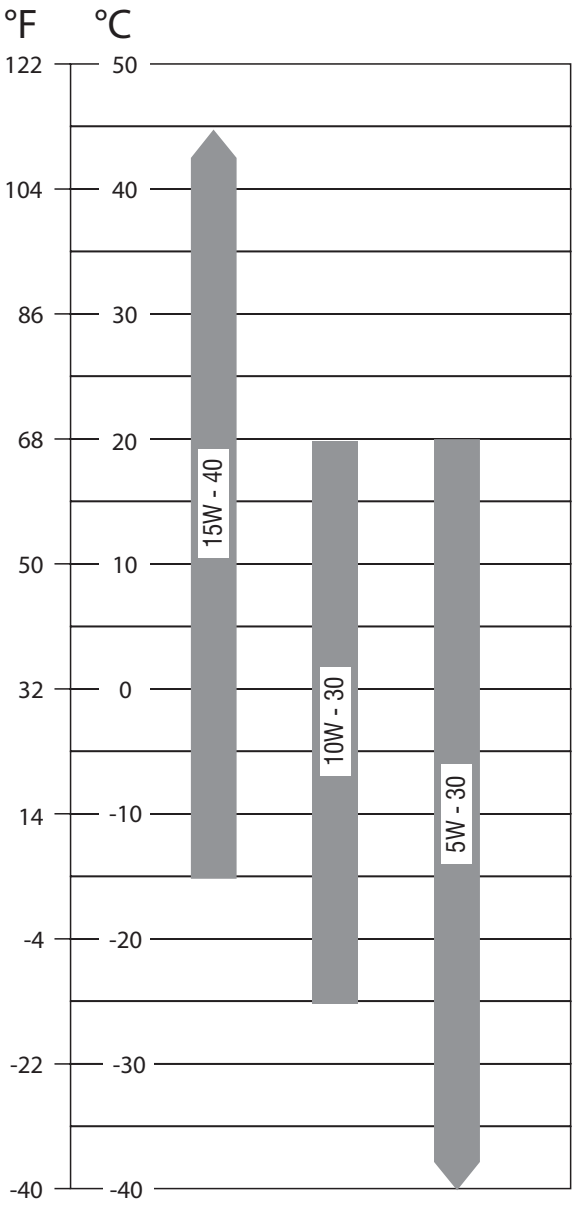
Exceeding low temperature limit will not lead to any engine damage. It may only cause problems when starting the engine.

It is appropriate to use universal multi/grade oils so there shall be no need to exchange oil due to ambient temperature change.

The use of synthetic engine oils is possible if performance and viscosity classification of oils corresponds to mineral oils recommended.

Exchange periods must be observed to be of identical intervals like when using mineral oils.

To make starting easier at the temperatures below 0 °C (32 °F) the engine oil producer recommends SAE 10W-30 oil.



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Exceeding upper temperature limit must not last too long due to lowered lubricating capability of oil.

When using oil under API CF-4/SH you must halve exchange interval, i.e. 125 hours or 6 weeks.

3.2.2. Fuel

The following Diesel oils are used as engine fuel:

EN 590

ASTM D 975-88: 1-D a 2-D

Therefore use winter Diesel fuel at outdoor temperatures below 0 °C (32 °F). Special Diesel fuel with additives intended for very low temperatures must be used at outdoor temperatures below -15 °C (5 °F) (”super Diesel”).

Use of biofuel (Diesel fuel)

Using the fuel mixture under the trade name of Bionafta is in principle approved by the engine manufacturer for the engine on the machine if it conforms to the specifications under EN 14214 or ASTM D6751.

Before using Bionafta on the machine, make sure that it is supplied by a reputable supplier who supplies fuels corresponding to the above-mentioned standards.

Always ask the supplier of Bionafta for information concerning the condition under which it can be used.

Guarantee for the engine will be rejected when using Bionafta not conforming to the above-mentioned standards and if the fuel system or engine is damaged as a result of using improper Bionafta!

! CAUTION !

When using Bionafta, power can be reduced by up to 12% depending on the used mixture of Bionafta. Therefore, do not adjust the engine or the setting of the injection pump for increasing the power in any case. Never mix the fuel mixture at the place of use.

Bionafta has a higher cloud point at a low ambient temperature, which leads to the creation of wax crystals in the fuel resulting in the fuel filter clogging.

When using Bionafta, it is necessary to shorten the intervals of the engine oil exchange and replacement of an oil filter and fuel filter.

When changing over to Bionafta, the action of Bionafta releases corrosion and impurities created on the fuel tank internal walls. Impurities are brought by the fuel to the filter catching them and the filter must be replaced afterwards.

Bionafta has a higher ability to absorb atmospheric moisture, which results in the condensation of atmospheric moisture on the internal walls of the tank and a higher content of water in the fuel and the need for more frequent discharging of water from the fuel filter separators. The possibility of the occurrence of the problem increases in cold weather.

If Bionafta (Biodiesel) is used all the year round, it is necessary to clean the fuel system under the engine operation with a clean diesel fuel for at least 30 minutes before parking the machine for longer than 3 months. Further, it is necessary to drain off the fuel tank, clean it, and either fill it with diesel fuel or minimise the occurrence of moisture and limit the microbiological growth inside the tank. Consult the measures with the fuel supplier.

3.2.3. Cooling Liquid

Fill engine cooling system with cooling liquid that consists 50% of ethylene-glycol antifreeze mixture and 50% of water.

Do NOT use earthy water with high content of calcium and magnesium which causes formation of scale (incrustation), and with high content of chlorides and sulphates which cause corrosion, refer to CUMMINS Engine Operation And Maintenance Manual.

Max content of calcium and magnesium compounds is 170 milligrams – hardness of water

Max content of chlorine compounds is 40 milligrams

Max content of sulphur compounds is 100 milligrams

Never use ratio between antifreeze cooling medium and cooling liquid of over 50 % (point of congelation is -36 °C [-34 °F], boiling point is 110 °C [228 °F]) unless badly required.

Never use ration of over 68 %!

We do not recommend antifreeze agents to be mutually mixed. Mixing together various types of cooling liquids may cause loss of antifreeze characteristics.

Check the portion of antifreeze coolant in cooling liquid always before winter period, using refractometer (density meter).

Health hazardous nitroamines occur when mixing nitride-based antifreeze coolant with amine-based agent.

3.2.4. Hydraulic Oil

Only the quality hydraulic oil of power class under ISO 6743/ HV (corresponds to DIN 51524, Part 3 HVLP; CETOP RP 91 H) must be used for the Machine's hydraulic system.

Fill the Machines with hydraulic oil of cinematic viscosity - 68 mm^2/s at 40 °C (104 °F), i.e. ISO VG 68. This oil is most appropriate for the use within the widest range of ambient temperatures.

Note:

Hydraulic system is possible to be filled with synthetic oil which during any leakage will be restless-degraded via microorganisms found in water and soil.

Please, always consult with the oil producer or dealer when switching to another type of oil or when blending oils of various brands together.

3.2.5. Oil – epicyclic transmission incl. torque converter

Gearbox can be filled alternatively with the following oils:

Mogul	ATF II
Caterpillar	TO-4
John Deere	J20 C,D
Military	MIL-PRF-2104G
Allison	C-4
General Motors	Dexron II Equivalent

! CAUTION !

NEVER use engine oils, transmission oils or DEXRON III.

With normal ambient temperature, please use multi-grade oil of low viscosity value 10W – 20 as if low-grade oil 10W was used. If you use oil C-4 instead of J20 then viscosity range not exceeding 10W, i.e. 10W – 20, is recommended. Use J20C, D oil during extensive fluctuation in temperatures.

Synthetic oil has been approved to be used for gearboxes if it corresponds to the abovementioned specifications.

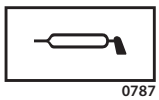
Concerning ambient temperature characterized as TROPIC we recommend to use oil of SAE 30 viscosity value that corresponds to the Caterpillar TO-4 performance classification.

3.2.6. Gear Oil

Use SAE 80W-90H API GL 5 or MIL-L-2105 B/C / LS oils to lubricate hypoid final drive.

Use SAE 80W-90H API GL 5 or MIL-L-2105 B/C / LS oils to lubricate down gearings.

3.2.8. Lube Grease



Use plastic lubricant with lithium content to lubricate the Machine under the following standards:

ISO 6743/9 CCEB2

DIN 51502 KP2K-30

3.2.7. Brake Fluid

The fluid should comply with international specification of ISO 4925, SAE J 1703 f, DOT 3. It is miscible with brake fluids of all brands that correspond with these specifications. Brake fluid is designed for brake systems that operate at ambient temperatures from –50 °C (–58 °F) to 60 °C (140 °F) and at operating temperature from –50 °C (–58 °F) to 205 °C (400 °F).

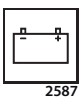
Note:

As for the brake system, you may also use brake fluid that corresponds to international classification of DOT 4.

3.2.9. Windscreen Sprayer Liquid

Use clean water up to 0 °C (32 °F) temperature when filling the windscreen sprayer tank. We recommend to use water with washing, antifreeze agent for motor vehicle windscreen sprayers at the ratio as per the Machine lubricating conditions – in CR it is Glacidet K.

When hazard of temperature drop below 0 °C (32 °F) exists then add antifreeze agent or drain water!

Part	Medium Type	Amount of Medium l (gal US)	Brand
Engine	Engine oil as per Section 3.2.1.	7,0 (1,85)	 2412
Engine	Cooling liquid as per 3.2.3.	11,5 (3) amount during exchange	 2152
Fuel tank	Diesel oil as per 3.2.2.	250 (66)	 2151
Hydraulic circuit	Hydraulic oil as per Section 3.2.4.	22 (5,81)	 2158
Hydraulic cylinders for front wheels	Hydraulic oil as per 3.2.4.	6 (1,6)	 2158
CLARK transmission	Oil as per Section 3.2.5.	21,5 (5,7)	 2186
Final drive	Transmission oil as per Section 3.2.6.	6 (1,6)	 2186
Case for end gear	Transmission oil as per section 3.2.6.	2x5,2 (2x1,4)	 2186
Brake system	Brake fluid as per Section 3.2.7.	1,75 (0,46)	
Lubrication according to Lubrication Chart	Plastic lubricant as er Section 3.2.8.	If required	 0787
Sprayer	Medium as per Section 3.2.9.	2,5 (0,66)	 2260
Water tank for tyre sprinkling	Water	460 (122)	 596128
Battery	Distilled water	If required	 2587

3.4. Lubrication and Maintenance Chart

After 20 hours of operation (daily)	
3.6.1.	Engine oil level check
3.6.2.	Engine cooling liquid level check
3.6.3.	Crankcase breather tube
3.6.4.	Check of the fan and engine belt condition
3.6.5.	Check air filter vacuum valve
3.6.6.	Hydraulic tank oil level check
3.6.7.	Check brake fuel
3.6.8.	Fill up sprinkling tank
3.6.9.	Cleaning of the water separator
3.6.10.	Check oil level in gearbox
3.6.11.	Check alarm and control instruments
After 100 hours of operation (weekly)	
3.6.12.	Checking the tyre pressure
After 250 hours of operation (3 months)	
3.6.13.	How to exchange oil in engine
3.6.14.	Check the engine induction manifold and air filter sensor
3.6.15.	Battery check
3.6.16.	Machine lubrication
After 500 hours of operation (6 months)	
3.6.17.	Fuel filter replacement
3.6.18.	Engine cooling liquid level check
3.6.19.	How to replace CLARK gearbox oil filter **
3.6.20.	Check oil for final drive and rear axle
3.6.21.	Check of wiring

After 1000 hours of operation (1 year)	
3.6.22.	Check and adjust brake clips
3.6.23.	Hydraulic Accumulator
3.6.24.	Checking the engine belt
3.6.25.	How to exchange CLARK gearbox oil
3.6.26.	How to replace final drive oil ***
3.6.27.	How to replace air drier
After 2,000 hours of operation (after 2 years)	
3.6.28.	Check, adjust valve clearance
3.6.29.	How to exchange oil in rear axle ***
3.6.30.	How to exchange hydraulic oil and filter
3.6.31.	How to exchange oil in hydraulic cylinders for front axle
3.6.32.	How to exchange brake fluid
3.6.33.	Exchanging the engine cooling liquid
3.6.34.	Check the compressor *
Maintenance if required	
3.6.35.	Fuel Pre Cleaner – Water Separator
3.6.36.	How to deaerate fuel filter
3.6.37.	How to replace air filter elements
3.6.38.	Cleaning of coolers
3.6.39.	Clean sprinkling filter
3.6.40.	Clean brush scrapers
3.6.41.	Cleaning the air cleaner of cabin ventilation
3.6.42.	Clean the Machine
3.6.43.	Confirm bolt connections are tightened

First after 50 hours - Make single check to confirm wheel nuts are tightened to 400 Nm (295 lb ft) torque

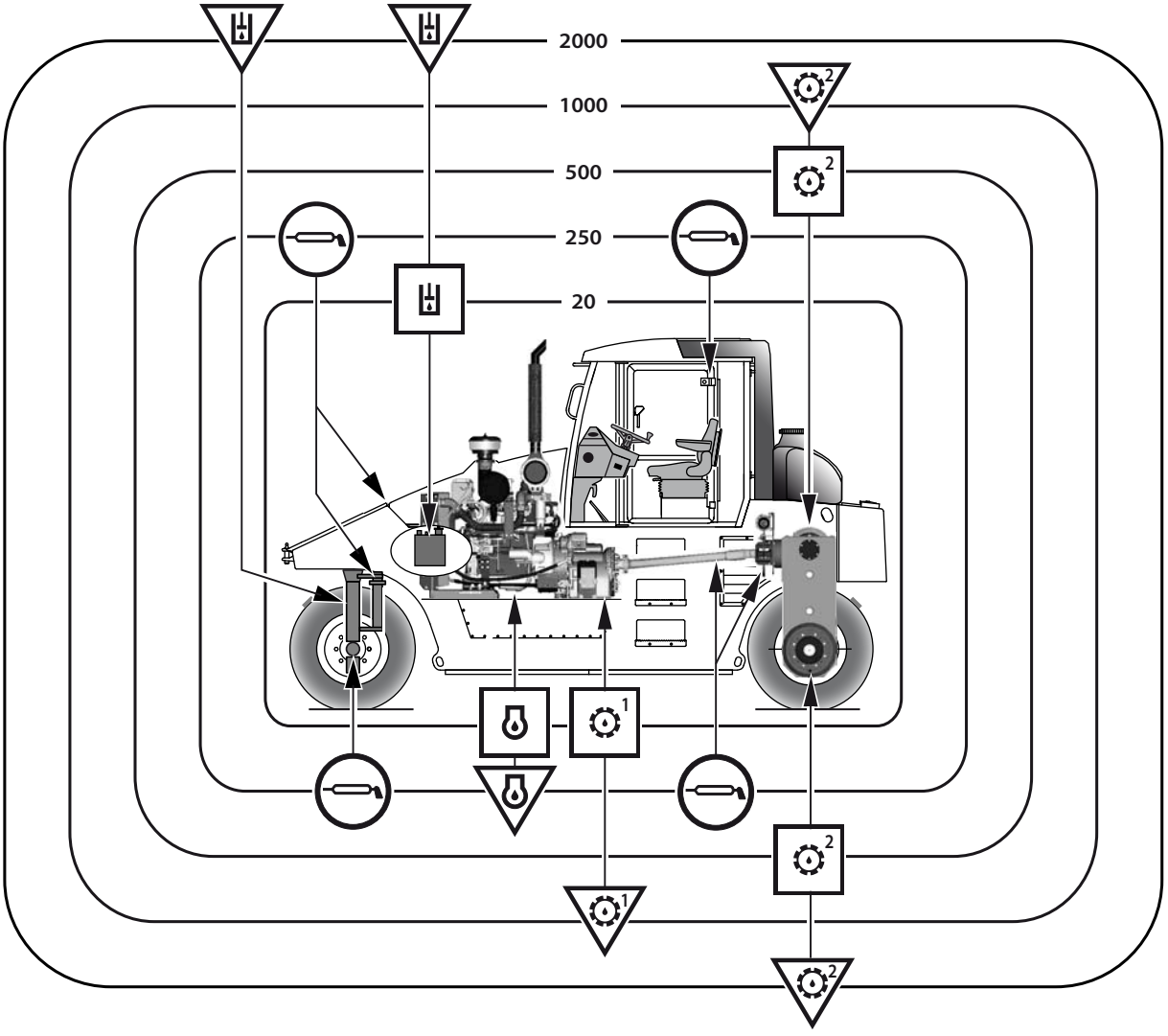
*** First after 50 hours**

**** First after 100 hours**

***** First after 250 hours**

LUBRICATION PLAN

□	INSPECTION
○	GREASING
▽	EXCHANGE



	Engine oil	**SAE 15W/40, API CI-4, CH-4**	
1	Fluid for automatic transmission see chapter 3.2.5.		
2	Gear oil	**SAE 80W-90H API GL-5**	
	Hydraulic oil	**ISO VG 68**	**ISO 6743/HV**
	Grease	**ISO 6743/9**	**CCEB 2**

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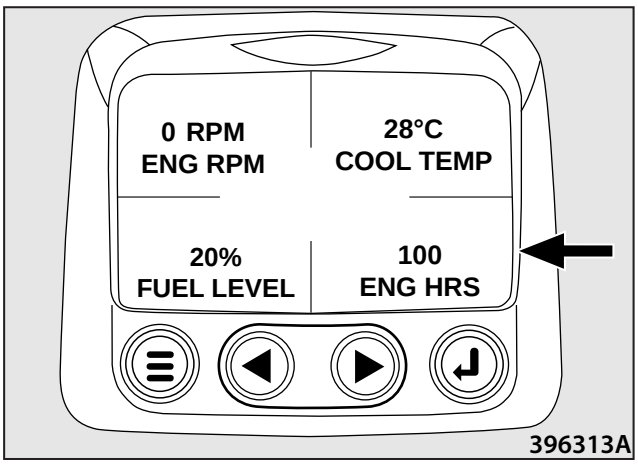
Carry out lubrication and maintenance in regularly repeated intervals as per the everyday data reading on the counter of hours actually worked.



Carry out maintenance with the Machine placed on flat, paved surface, and secured against any self-motion, always with the engine OFF, key removed from ignition box, and with the wiring disconnected (unless otherwise required).

! CAUTION !

Removed or loose bolts, plugs, threaded joints of the hydraulics, etc. shall be tightened with the torque according to the Tables in Section 3.6.43., unless a different value is given with the relevant operation.

This Manual includes only the basic information about the engine, other information is given in the "Cummins Engine Operation and Maintenance Manual" which is part of documentation supplied with the Machine.

Have the air tank inspected by a specialized service company no later than every 5 years. Make sure the inspection date and the service engineer sign are marked on the label. NO welding or heat treatment are admissible on the air tank. The air tank life is max 40 years, it shall be discarded afterwards.

Following the first 50 hours of operation of the new Machine (after Major Overhaul), please perform the following:

Make single check to confirm wheel nuts are tightened to 400 Nm (295 lb ft) torque

Following the first 50 hours of operation of the new Machine (following a major overhaul) carry out as per:

3.6.34. Check the compressor

Following the first 100 hours of operation of the new Machine (following a major overhaul) carry out as per:

3.6.19. How to replace CLARK gearbox oil filter

Following the first 250 hours of operation of the new Machine (following a major overhaul) carry out as per:

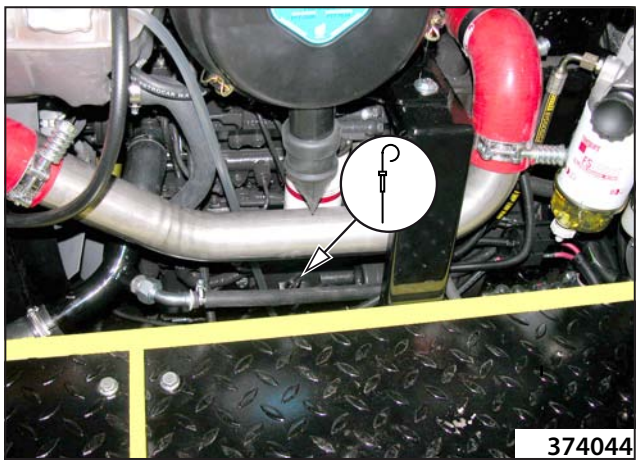
3.6.26. How to replace final drive oil

3.6.29. How to exchange oil in rear axle

After 20 hours of operation (daily)

3.6.1. Engine oil level check

- Shut off the engine, wait ca 3 min for oil to descend into crankcase sump.
- Pull out oil dipstick, wipe it, put it back and pull out again to read oil level.



- Maintain level between division lines stamped on oil dipstick. LOW division mark shows lowest possible oil level, HIGH division mark shows the highest one.

- Replenish oil via filler neck.

Note:

Oil level between the marks on dipstick corresponds to 1,5 l (1.6 US Quart) amount.

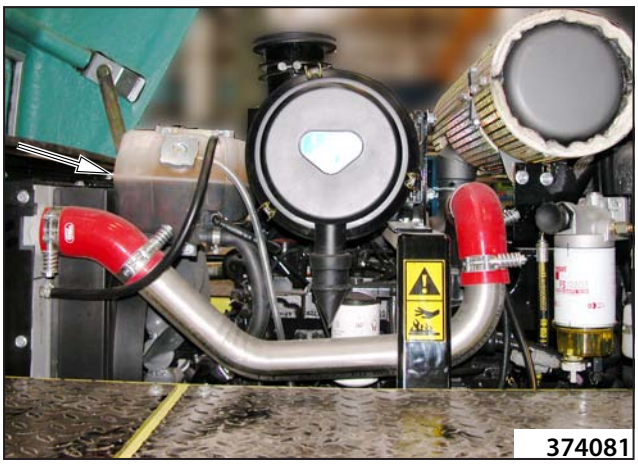
! CAUTION !

Refill oil of identical type, use oils as stated in Section. 3.6.1.

Do NOT run the engine unless there is correct oil level in the engine.

3.6.2. Engine cooling liquid level check

- Check cooling liquid level with the engine at rest, cooled down below 50 °C (120 °F), maintain this level between "MIN" and "MAX" marks.



Wait to remove the filler plug only after engine coolant temperature drops below 50 °C. If filler plug is removed at higher temperature then there is hazard of vapour scald or cooling liquid scald due to inner overpressure effect.

! CAUTION !

Top up cooling liquid the composition of which is given in Section 3.2.3.

Do NOT use any additives in the engine cooling liquid to eliminate cooling system leakage!

Do NOT refill cold coolant into hot engine! Danger of engine castings damaged.

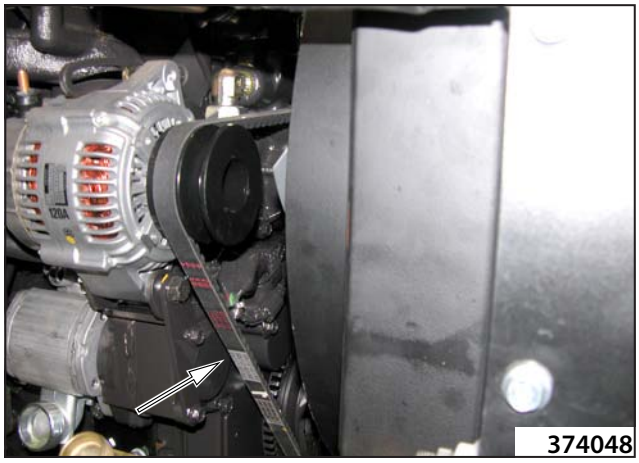
3.6.3. Crankcase breather tube

- Check the outlet is not clogged with deposits.

3.6.4. Check of the fan and engine belt condition

- Inspect visually cooling air blower. If for example you find missing part of the material, cracks, shape changes, etc. – please replace the cooling air blower.

- Inspect visually the belt. If longitudinal cracks, or smooth, bright flats occur on the belt, or belt edges are shattered, or there are extracted parts of material, then the belt must be adjusted or replaced, refer to Section called "Belt tension after 1000 hours".

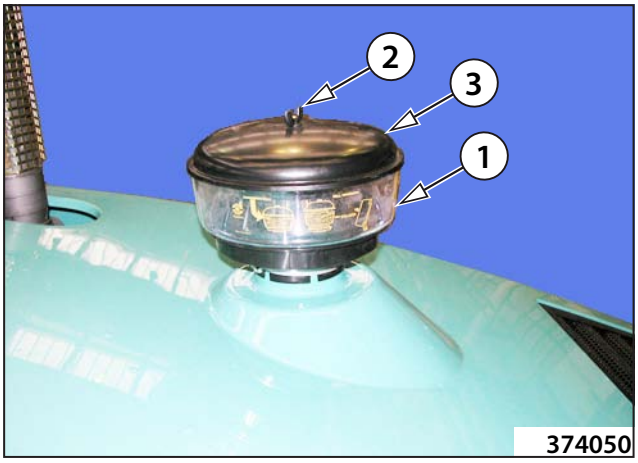


3.6.5. Check air filter vacuum valve

- Any dust trapped will automatically be emptied during Machine operation. We recommend to occasionally clean the exit slit, press to remove any dust trapped.

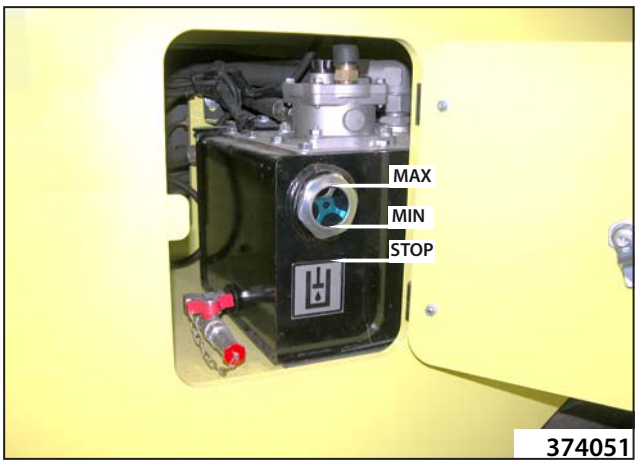
Do NOT operate the Machine when dust valve is damaged.

- Should the Machine be fitted with air pre cleaner, clean the vessel (1) when filled with dirt up to the mark, first unscrew nut (2) and remove cover (3).



3.6.6. Hydraulic tank oil level check

- Open oil tank cover. Check and maintain oil level. Pilot lamp will indicate any oil loss below STOP (engine stops).



! CAUTION !

Engine can be started only after oil is filled up. Fill up with the same type of oil via filling device, refer to Section called "Oil Exchange".

3.6.7. Check brake fuel

- Keep its level between "MIN" and "MAX". Clean filler cap and filler neck before filling up.

- Check the following when fuel has dropped:

  Pipes and hoses of the system

  Connection tightness

  brake master cylinder

  brake cylinders in rear axle wheels

Keep brake fluid in its original, well closed containers! When it is to be used, please follow instructions of brake fluid producer.

Brake fluid will cause damage to painted parts of the Machine.

When filling up, avoid and fluid spilled over the Machine or outside the Machine.

3.6.8. Fill up sprinkling tank

- Open the cap and fill up with clean water.

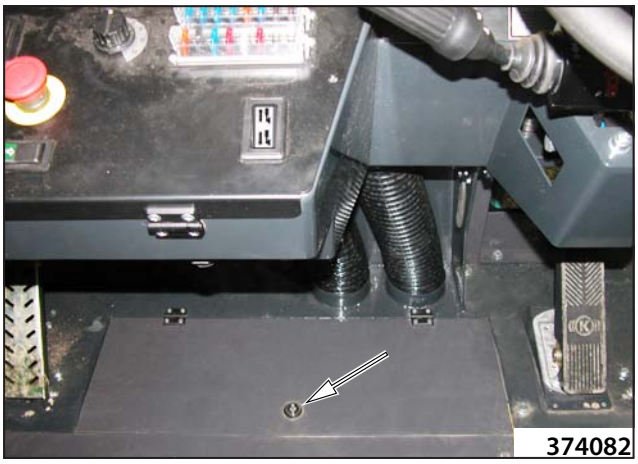
3.6.9. Cleaning of the water separator

- This should be performed with the full air pressure in the air reservoir (according to the brake circuit pressure gauge). Shut OFF engine, switch ON parking brake. Pull drain valve's chain to confirm valve operation is OK.

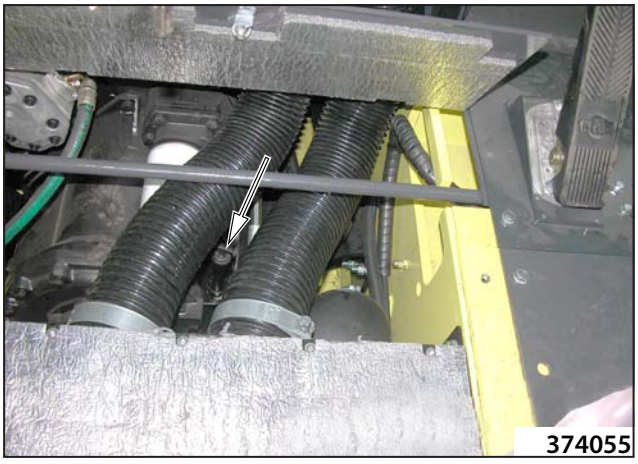
3.6.10. Check oil level in gearbox

! CAUTION !
Check with the engine idling at oil temperature of 82÷93 °C – best after Machine operation is ended.

- Open and lift off the cover between pedals on Machine's floor.



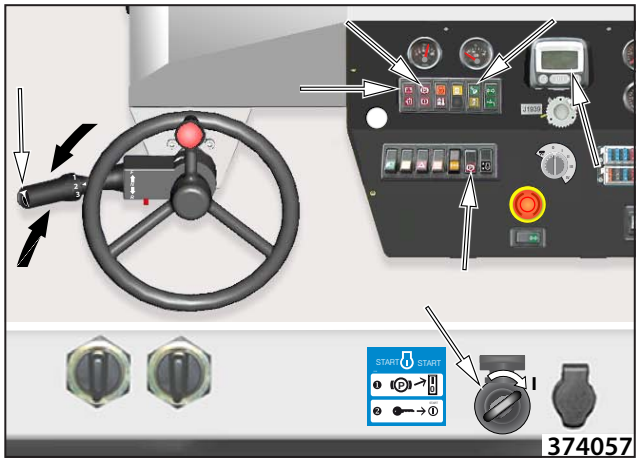
- Unscrew and pull out dipstick, wipe off and push in again. Pull it out once more and check oil level – it must reach the upper gauge line.
- Fill up oil using this neck and screw the oil level gauge back.



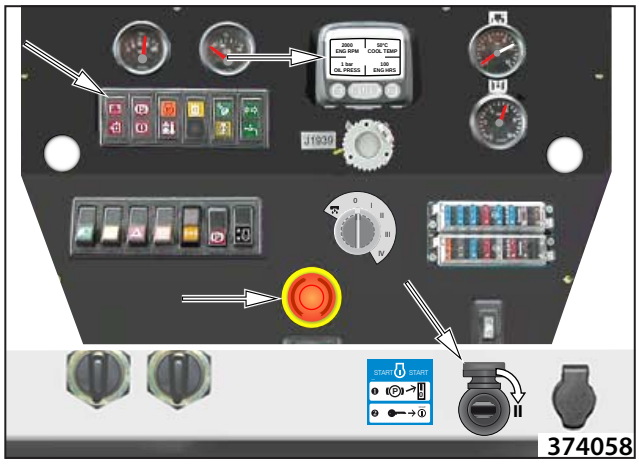
3.6.11. Check alarm and control instruments

- Turn ON the switches to test that lights, warning lamps, traffic indicator lights, flashing beacon.

- Turn ignition key to position "I" (confirm travel controllers are in idle position [neutral], parking brake switched ON), pilot lamps for recharging, idle position, parking brake must light up. Check Power View display and horn.

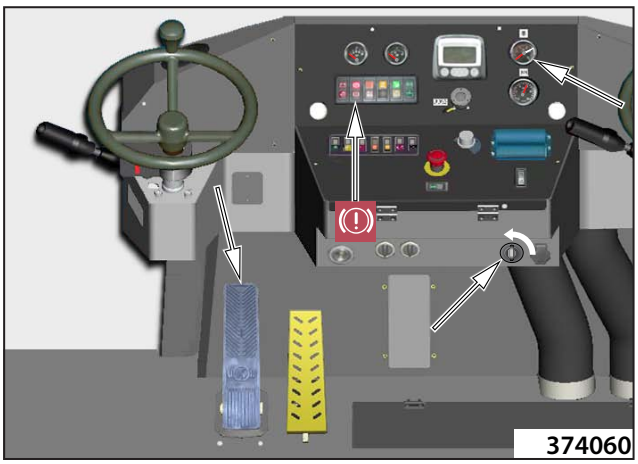


- Start the engine, pilot lamp for recharging must go off, check engine oil pressure via the display. Press TOTAL STOP button – engine will stall.



- Start the machine according to the respective instructions in the Operating Manual. When turning off the parking brake switch, make sure that the brake pilot lamp turns off. When driving off, make sure that the respective pilot lamp of the activated place turns on and whether the neutral pilot lamp turns off.

- Shut OFF the engine, try the pilot lamp for brake failure. “Floor” the brake pedal repeatedly several times to lower air pressure in line with pressure gauge to 5,2 bar – pilot lamp for brake failure must light up and alarm signal be heard.



When in operation, check continuously the instruments and pilot lamps.

Use acoustic alarm to warn engine will start, confirm there is no hazard for anybody when engine starts.

After 100 hours of operation (weekly)

3.6.12. Checking the tyre pressure

- Check the pressure in tyres inflated as required for operation depending on values in the Table when cold (before driving) at temperatures of 18÷21 °C (64.5÷70 °F). Connect the tyre inflation hose to the adaptor mounted instead of tyre inflating valve with standard version of the Roller (pressure gauge complete with inflation hose is included in the Machine equipment).

When inflating, check the following:

Valve, and whether it has protective cap.

Outer condition of tyres, whether not damaged (due to local deformation, part of rubber separated, cracks, fissures).

Contact area and effective load depending on the wheel load and tyre inflation

CONTACT AREA (cm²)						
11,00-20 / 18 PLY Compactor without pattern		Load per one wheel (kg)				
		1300	**1500**	**2000**	**2500**	**3000**
Tyre inflation (bar)	3	409	442	531	605	688
	4	385	416	495	570	642
	5	358	390	464	537	600
	6	334	364	434	507	560
	7	311	345	425	496	541
	8	292	328	399	463	512

EFFECTIVE LOAD (kg/cm²)						
11,00-20 / 18 PLY Compactor without pattern		Load per one wheel (kg)				
		1300	**1500**	**2000**	**2500**	**3000**
Tyre inflation (bar)	3	3,18	3,39	3,77	4,13	4,36
	4	3,38	3,61	4,04	4,39	4,67
	5	3,63	3,85	4,31	4,66	5,00
	6	3,89	4,12	4,61	4,93	5,36
	7	4,18	4,35	4,71	5,04	5,55
	8	4,45	4,57	5,01	5,40	5,86

After 250 hours of operation (3 months)

3.6.13. How to exchange oil in engine

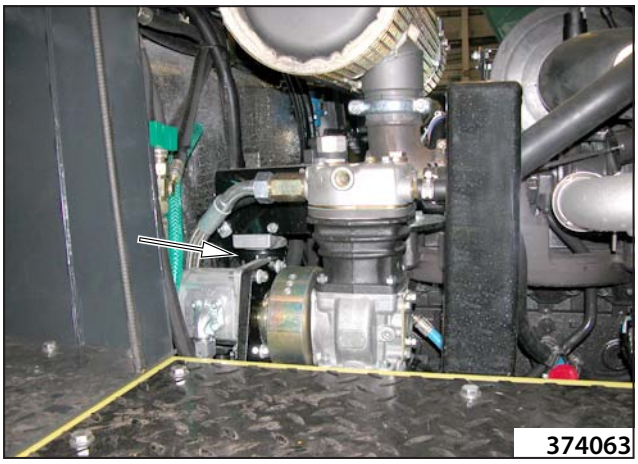
Drain oil when it is still hot after operation is ended, or while running, warm up the engine until cooling liquid reaches 60 °C.

Observe fire precautions!

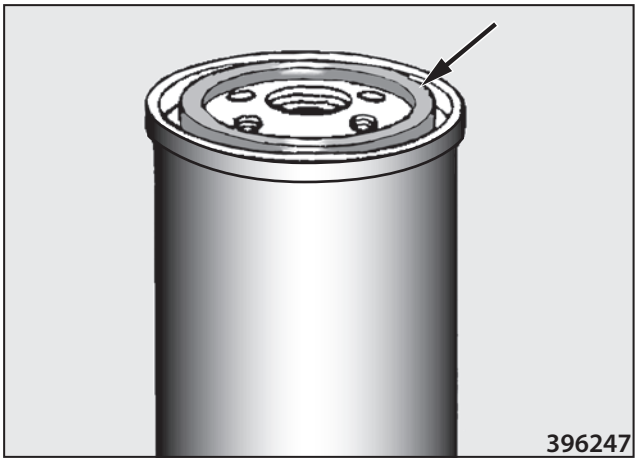
Beware of hot oil burn hazard when draining oil. Let oil cool down below 50 °C.

- Remove drain plug and let oil flow out into a vessel of ca 9 l (9,5 qt) capacity. Reinstall drain plug. Apply 80 Nm (59 lb ft) torque to tighten.

- Clean oil filter and its vicinity. Remove filter.



- Apply oil slightly across filter gasket.

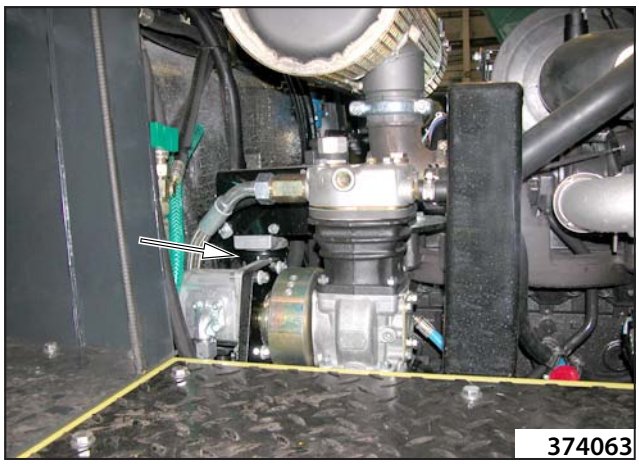


- Clean contact surface for filter gasket. Screw on the filter and tighten properly with hand.

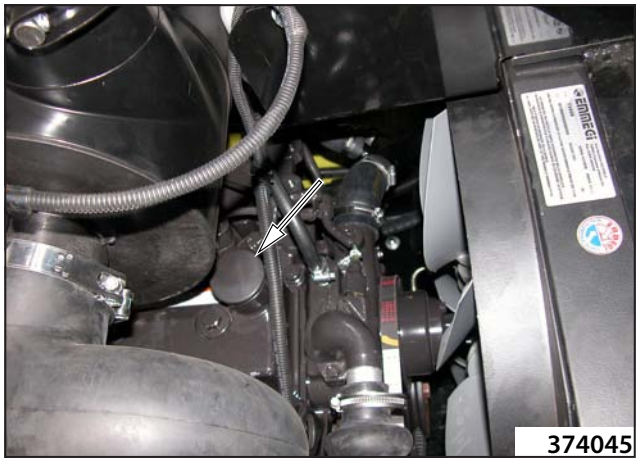
Do not tighten excessively the filter, its thread and gasket may get damaged.

Note:

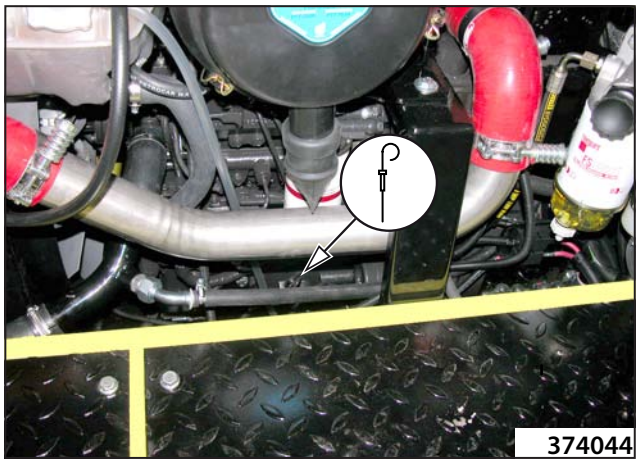
Refer to Engine Operation and Maintenance Manual for the special spanner required.



- Use filler neck to fill the engine – medium amount is 7 l (7.4 qt).



- Fill to upper gauge line of the dipstick. Amount of oil between gauge marks on the dipstick is 1,5 l (1.6 qt).



- When exchanged, start the engine for 2 - 3 min. Check tightness of drain plug and filter. Stop the engine and wait for 5 min. until oil flows down to crankcase sump. Then use dipstick to confirm oil level.

Exchange oil after 3 months at the latest even though 250 hours have not been actually operated. Exchange oil within interval that occurs as first.

Use recommended filters, refer to Catalogue of Spare Parts.

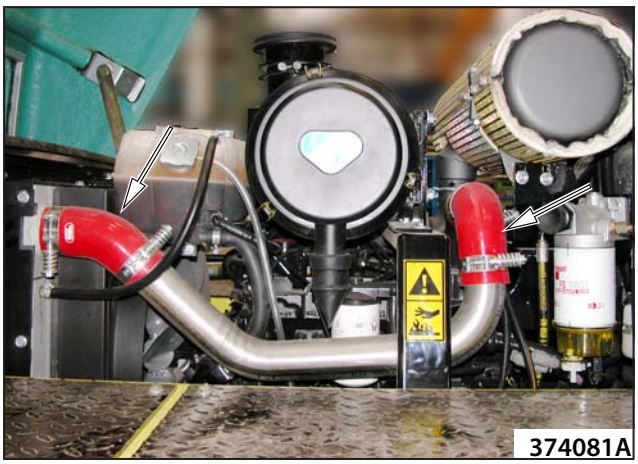
Use oil as per Section 3.2.1.

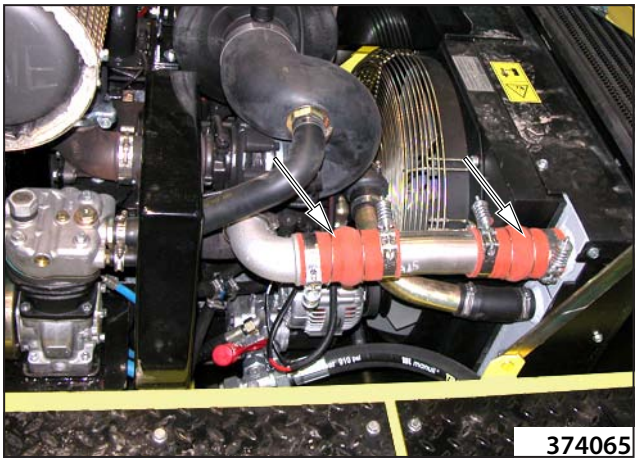
Drain oil into catch vessels.

Spent oil and filter are ecological waste – hand over for disposal.

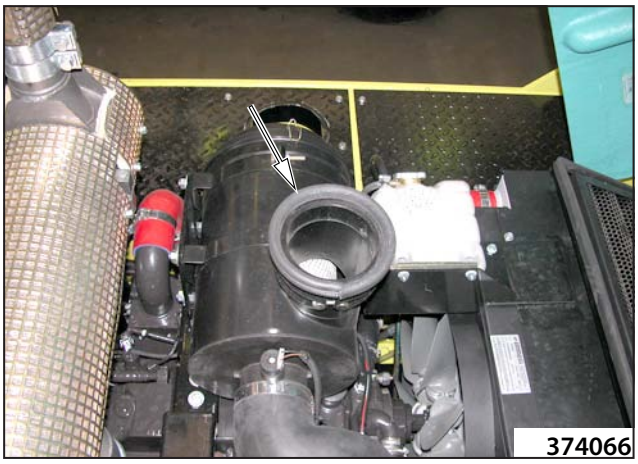
3.6.14. Check the engine induction manifold and air filter sensor

- Check pipe hoses and fixing of clips.

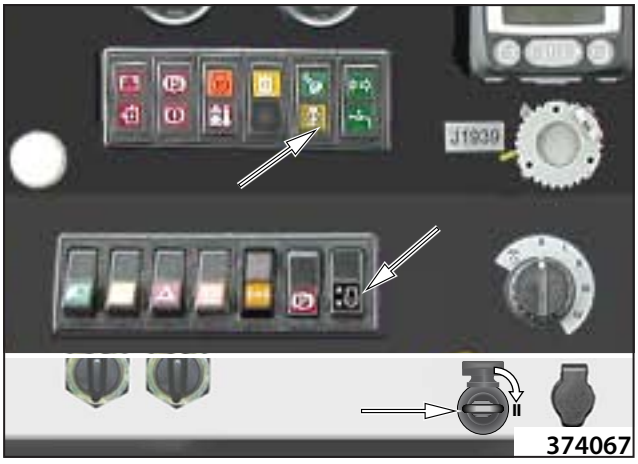




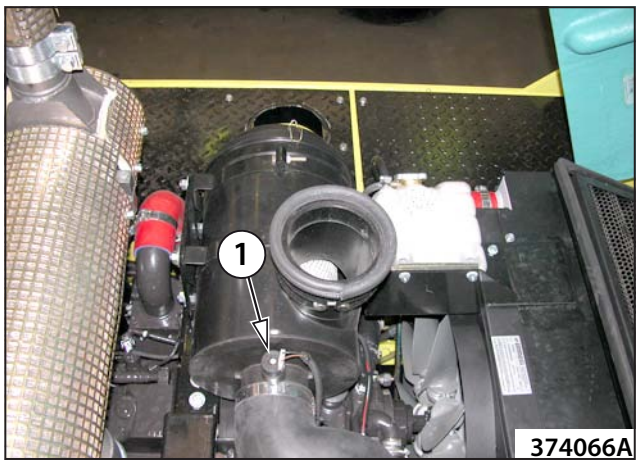
- Check air filter cuff. Cover suction hole.



- Start the engine, turn off IDLE switch, increase engine speed to max, check if pilot lamp lights up.



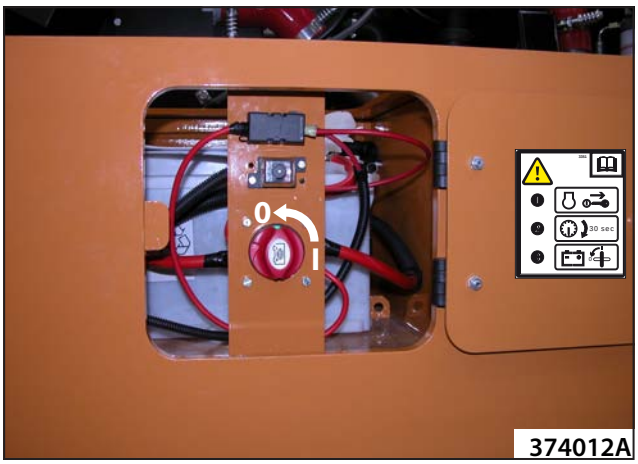
- Unless it lights up, check vacuum switch (1), pilot lamp on dashboard, wiring.



Do NOT operate the Machine if induction manifold, air filter cuff are damaged!

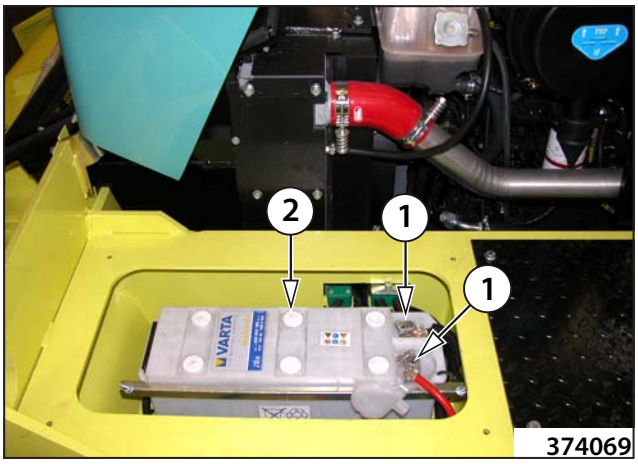
3.6.15. Battery check

- Use isolating switch to disconnect storage batteries.



- Open the cover.

- Clean storage battery surface. Check condition of terminals (1). Clean terminals, paint with grease. Open cell plugs of storage battery (2) to confirm electrolyte level in all cells reaches 5 ÷ 15 mm (0.2 ÷ 0.6 in) above electrodes or up to the bottom edge of dipstick in accumulator cells.



Note:

- Use glass tube to check the level.
- Measure the electrolyte density in individual cells with refractometer or density meter.
- Compare density meter-measured values with the Table.

	Density			
	in g/cm³		in °Be (Beume)	
	20 °C 68 °F	Tropics	20 °C 68 °F	Tropics
Well recharged	1,28	1,23	32°	27°
Half recharging	1,2	1,12	24°	16°
Discharged, please recharge	1,12	1,08	16°	11°

3.6. Lubrication and Maintenance Operations

! CAUTION!

Unless the Machine is going to be used during severe frosts, remove storage batteries and store them so to be protected against any frost. While stored, inspect their charging condition 1x per month and recharge.

Keep storage batteries dry and clean.

Close storage batteries when checking is completed.

Refill storage batteries with distilled water only – NEVER with acid.

Replenish distilled water just before operating the Machine or before storage battery recharging.

Recharge the undercharged storage battery.

Recharge storage battery off the Machine.

Open storage battery plugs before recharging.

NEVER disconnect storage battery with the engine running.

Always follow storage battery manufacturer's manual when working with the storage battery!

Use rubber gloves and safety glasses when handling storage battery.

Protect your skin with proper clothing against being stained by electrolyte.

Upon eye contact with electrolyte immediately flush eyes with large amounts of water for at least a couple of minutes. Get prompt medical attention.

Upon ingestion of electrolyte drink max amount of milk, water or solution of calcined magnesia in water. Get prompt medical attention.

Upon skin contact with electrolyte remove contaminated clothing, including shoes, wash affected spots as soon as possible with soap water or solution of soda and water. Get prompt medical attention.

Do not eat, drink, smoke, while at work!

Upon work completion, please wash your hands and your face thoroughly with water and soap!

Do NOT attempt to confirm a wire is energized through contacting Machine frame.

Disconnect storage battery before its repair or when handling wires or electric equipment within wiring circuit to avoid any short-circuit.

To disconnect storage battery you must first disconnect (–) pole of the cable. To connect, first connect (+) pole. NEVER attempt to make direct conductive connection between storage battery's both poles, short circuit will occur with the risk of storage battery explosion.

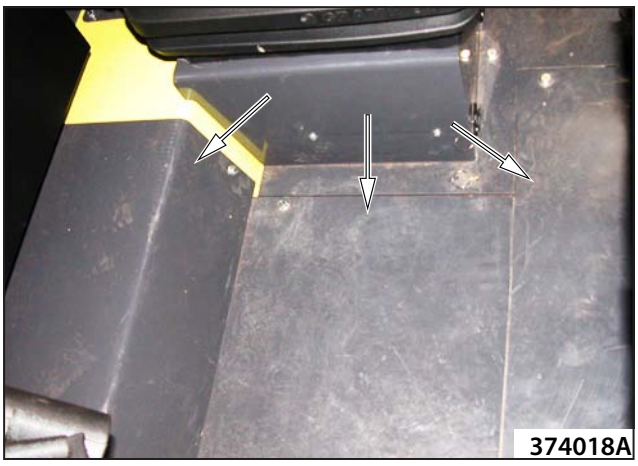
Do not turn storage battery upside down, electrolyte may pour down from the degassing plugs.

Flush with water and neutralize with lime the spot affected with spilled electrolyte.

Hand over the aged storage battery that does not work, for its disposal.

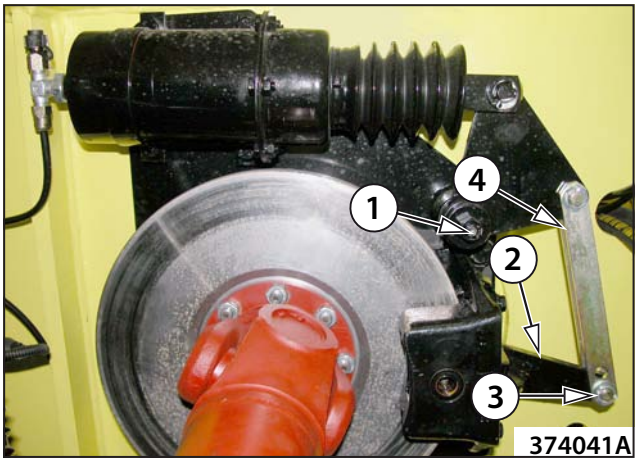
3.6.16. Machine lubrication

- Lubricate with grease as per Section 3.2.8.
- Remove floor coverings to make lubrication points accessible.

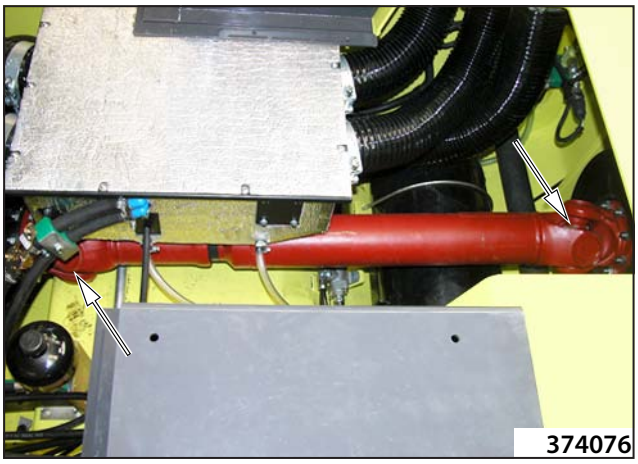


- Lubricate pin (1). If lever (2) is overhead the horizontal position when braked, then reposition pin (3) into another hole of pull rod (4).

Be careful grease does not get onto active surface of brake disc!



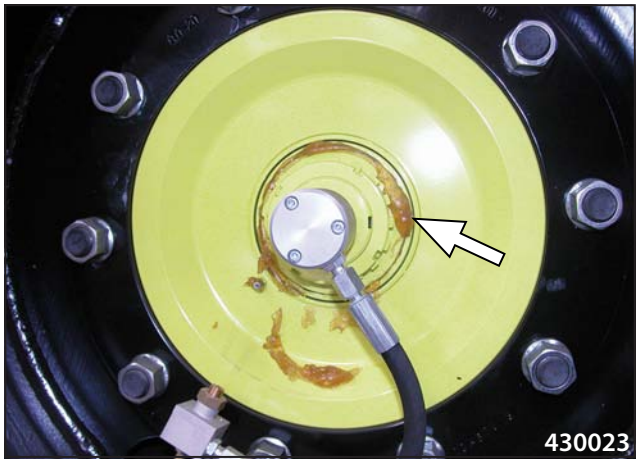
Shaft joints



External bearings of front wheels

Internal bearings of front wheels

In order to grease the inner and outer bearings of front axle wheels thoroughly, the lubricating grease must be pressed out around the flange.

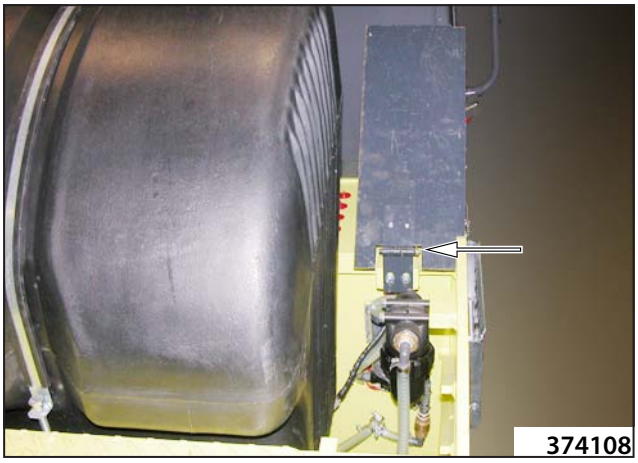


Steering pins

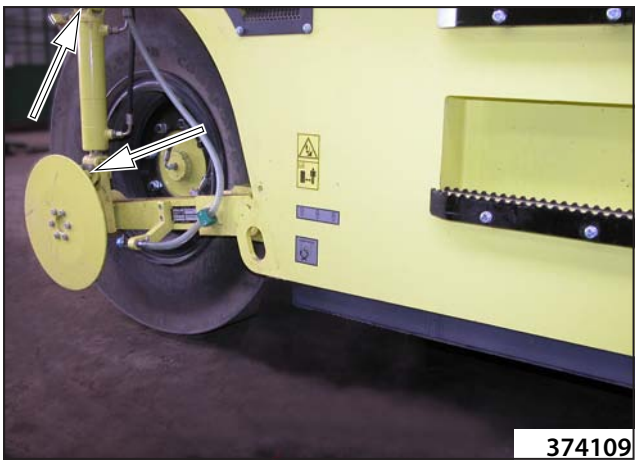
Bonnet hinges

Door hinges

Cover suspensions.



Edge cutter pins.



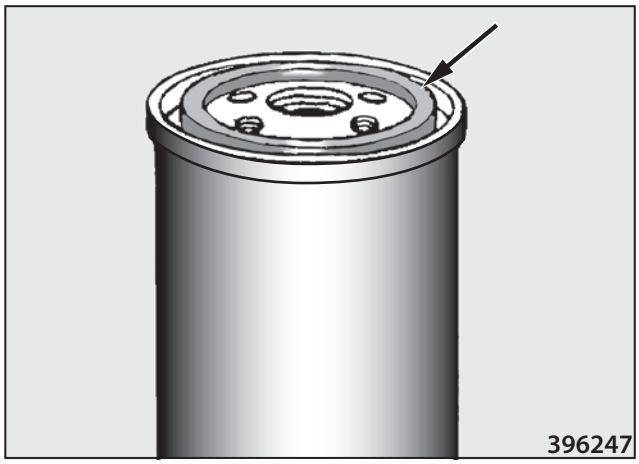
After 500 hours of operation (6 months)

3.6.17. Fuel filter replacement

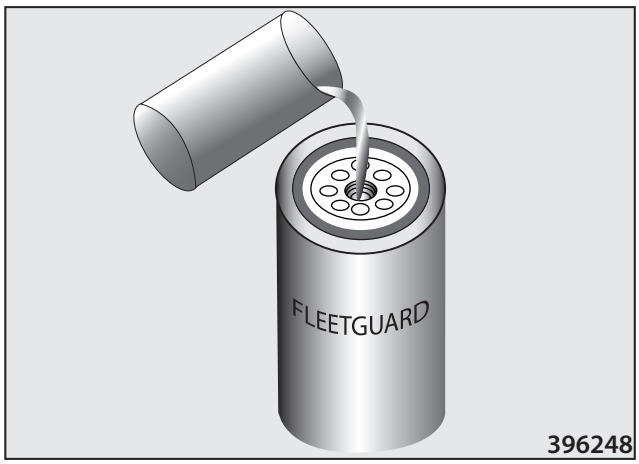
- Clean and remove filter.

- Clean seating face for filter.

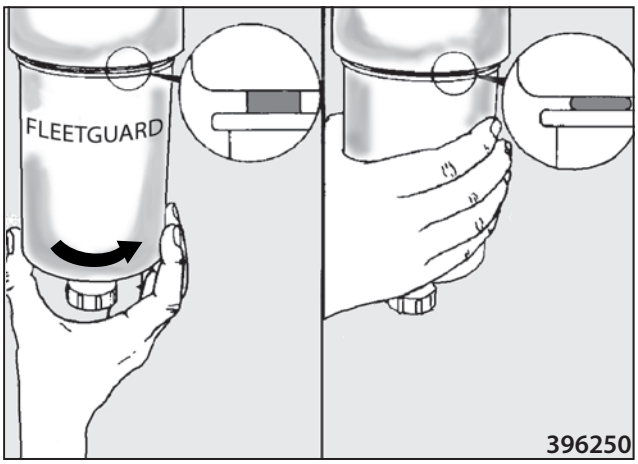
- Apply oil on sealing ring.



- Fill filter with clean fuel.



- Install filter and tighten properly with hand – as per filter manufacturer's data (by 2/3 of revolution once filter is seated properly).



- Disconnect water separator sensor connector, and proceed the same like in previous text, connect sensor once replaced.

Note:

Small amount of air that gets into the system during filter replacement will automatically deaerate if the replacement procedure described has been adhered to. Unless filters are filled with fuel, deaerate the system according to Section called "Fuel filter water separator".

Use original filters required, refer to Spare Parts Catalogue.

Do NOT tighten filters using force, the thread and gasket may get damaged.

NEVER smoke when at work, replace in well-ventilated rooms with no fire hazard.

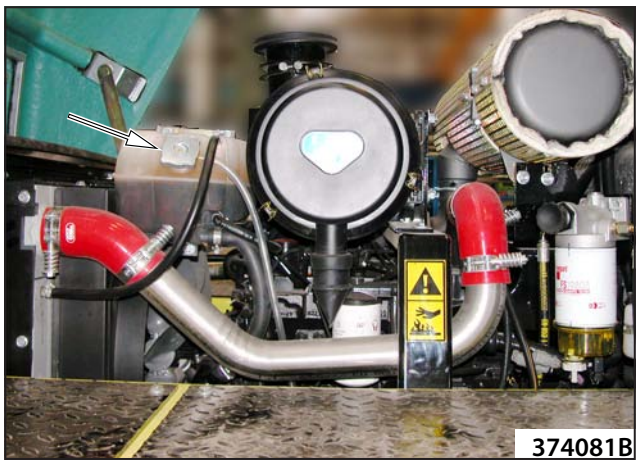
Collect fuel flowing out!

Store spent filters in separate containers and hand them over for their disposal.

3.6.18. Engine cooling liquid check

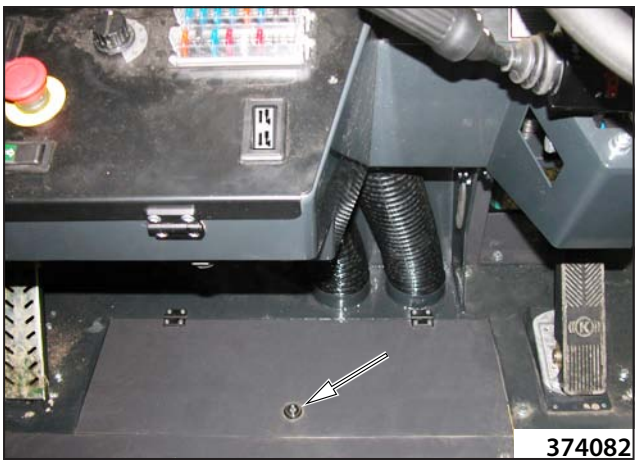
- Inspect cooling liquid concentration with the refractometer using cold engine.

Check always before winter season. Unless concentration for ambient temperatures of -36 °C (-33 °F) is found, adjust it or exchange cooling liquid according to Section 3.2.3.

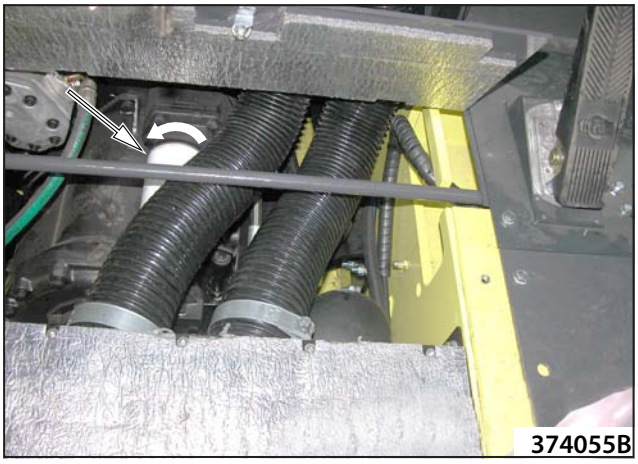


3.6.19. How to replace CLARK gearbox oil filter

- Open the cover in the floor.



- Unscrew oil filter, collect oil flowing out. Apply oil over new filter's packing ring. Screw on the new filter and tighten with 27 – 34 Nm (20 – 25 lb ft) torque.



Replace first after 100 hours of operation of new Machine of after Major Overhaul!

Use only CLARK filters recommended.

Do NOT tighten with force, danger of threads and gasket damaged.

Let gearbox cool down below 50 °C before replacing.

Spent filter is ecologically hazardous waste, hand over for disposal.

3.6.20. Check oil for final drive and rear axle

- Clean and unscrew inspection plug for final drive (Allen key 18). Check oil level is up to inspection hole. Tighten the plug with 80÷90 Nm (59÷66.4 lb ft). Fill up with oil as per Section named "Oil Exchange – after 1000 hours.

- Clean and remove plug on rear side of down gear housing, and check if level reaches up to the inspection hole or flows out slightly. Fill up with oil as per Section named "Oil Exchange – after 2000 hours.

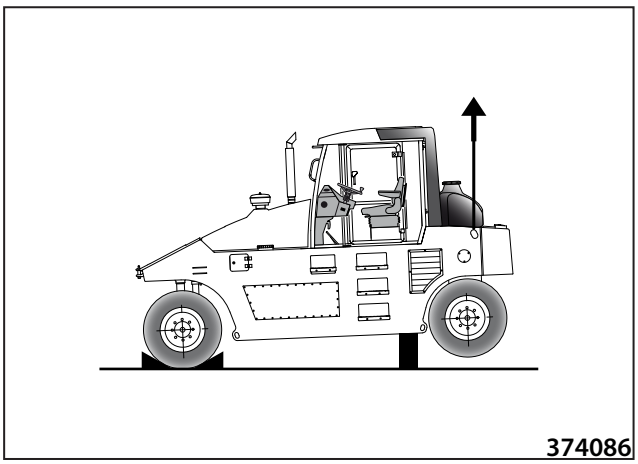
3.6.21. Check of wiring

- Check for any damage to cables, connectors, protective hoses, and their fastening, especially if in the vicinity of hot surfaces and moving parts of the machine including the engine. Replace damaged parts. Use only original spare parts.

After 1000 hours of operation (1 year)

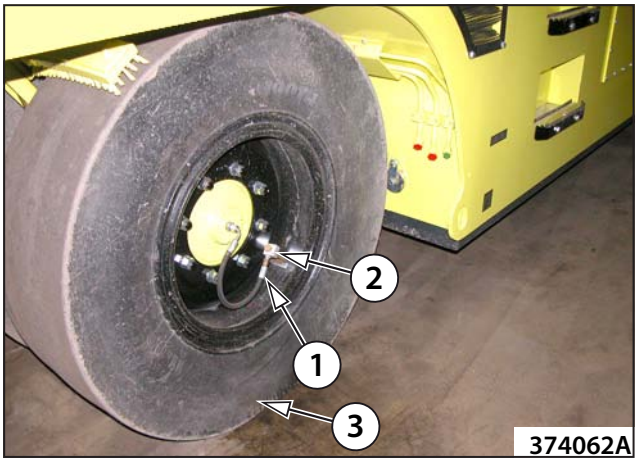
3.6.22. Check and adjust brake clips

Brake off the Roller before wheel removal !

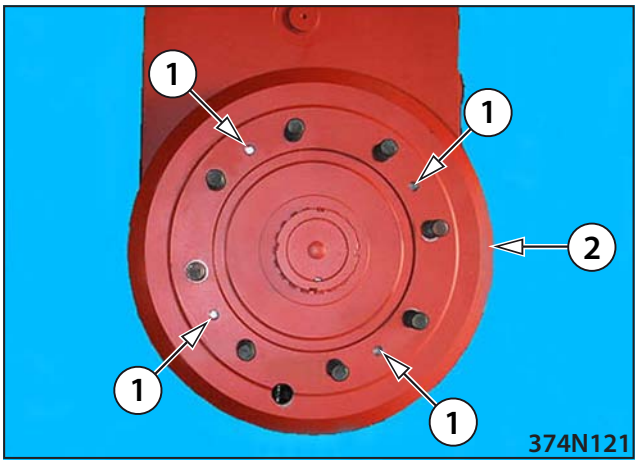


- Lift a bit the Machine onto the rear lugs of the frame so the rear wheels do not touch the ground. Chock the rear part of Machine frame. Secure front wheels with Scotch blocks on both sides.

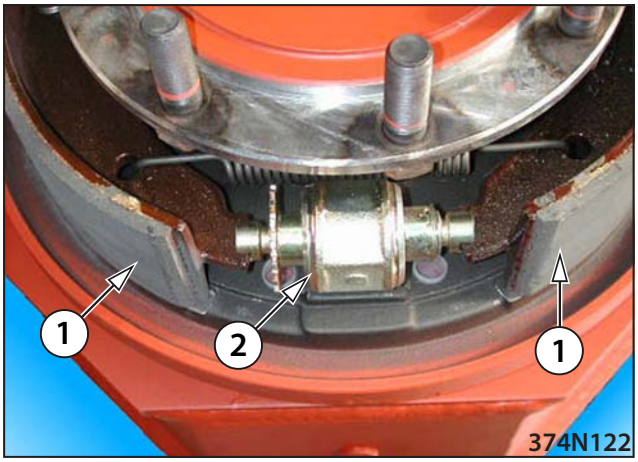
- Remove tyre inflating and blowing off hose (1) near small rotors (2). Remove wheels (3).



- Remove step by step the brake drums. When removal is complicated, use forcing-off screws M12-60 of min. 8G strength, into holes (1) of brake drum (2). Confirm there are no scratches or cracks across drum's internal diameter.



- Check thickness, uneven wear or contamination of lining (1).



If, while checking, you find lining thickness is 4 mm (0,16") or smaller, please check lining after next 500 operating hours.

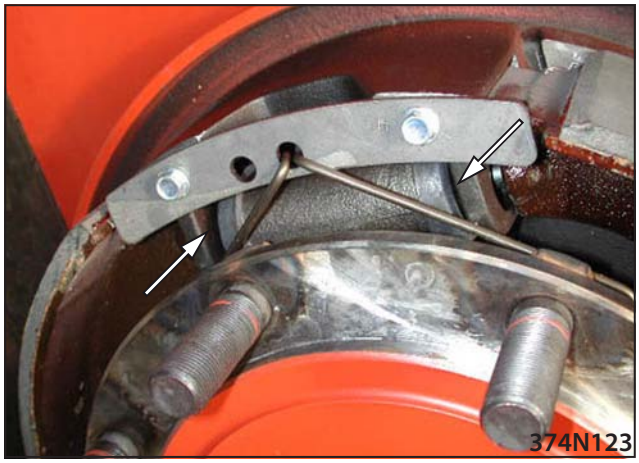
Replace lining always when thickness reaches min value of 2 mm (0,08").

Replace all brake clips at one time to maintain uniform braking!

Always replace adjusting mechanism defected with new one.

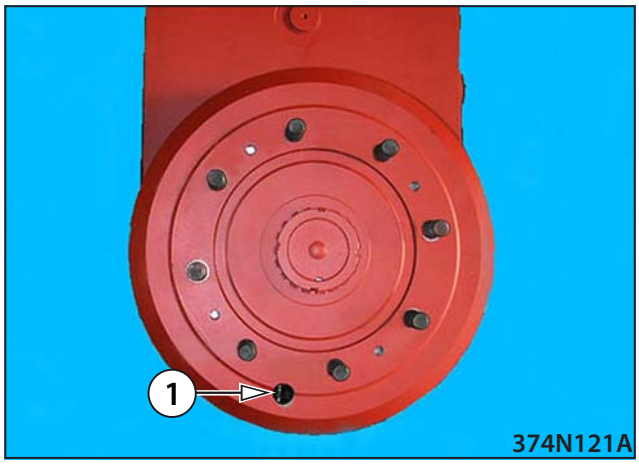
When replacing, use original brake clips only!

With brake shoe lining replaced the brake efficiency will lower and stopping distance will get longer. Adapt driving mode and braking mode to this case!



- Check brake cylinder for any leakage of brake fluid.

- When checking is completed reinstall the drums. Turn brake drum with its adjustment hole pointing downward towards adjusting wheel. Rotate adjusting wheel (1) until brake clips lean against brake drum (brake drum unable to rotate). Turn a bit the adjusting screw backward by only such turn so the brake clips get released (brake drum able to rotate freely).



Carry out brake clip adjustment during:

Insufficient brake efficiency (long step of brake pedal)

Replacement of worn clips for new ones

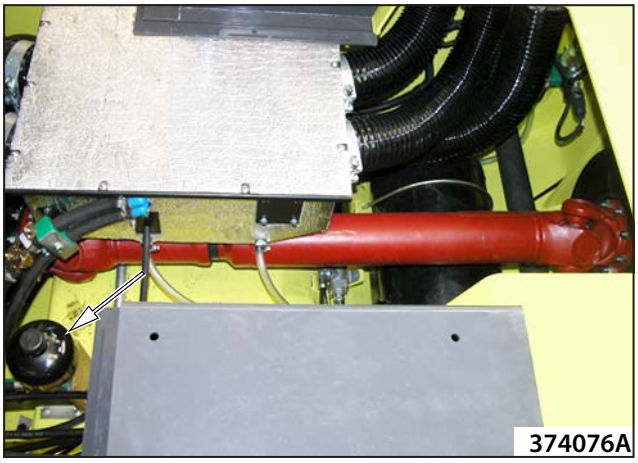
Following the installation of new brake drum or after brake drum's inner diameter is machined (refer to Workshop Service Manual).

- Before installing wheels onto the brake drums following the brake repair, please point the brake drum bolts against holes in the wheels using an appropriate lever so to avoid damage of bolt threads, reinstall wheels, tighten wheel nuts with 400 Nm (295 lb ft) torque.

3.6.23. Hydraulic Accumulator

- Remove floor covering.

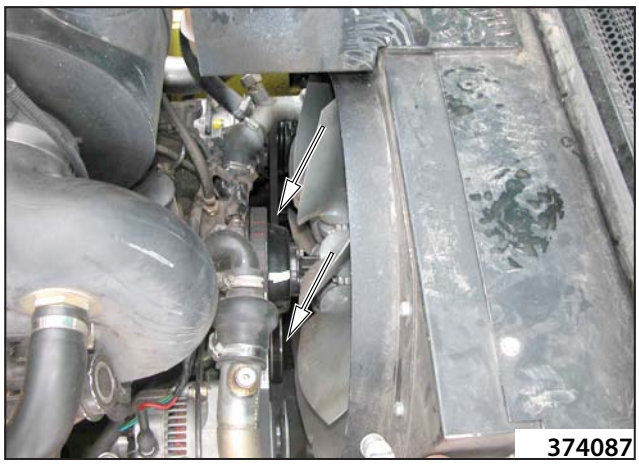
- Let filling pressure of 120 bar (on nameplate) be checked and made up by authorized service department.. Call your dealer if required.



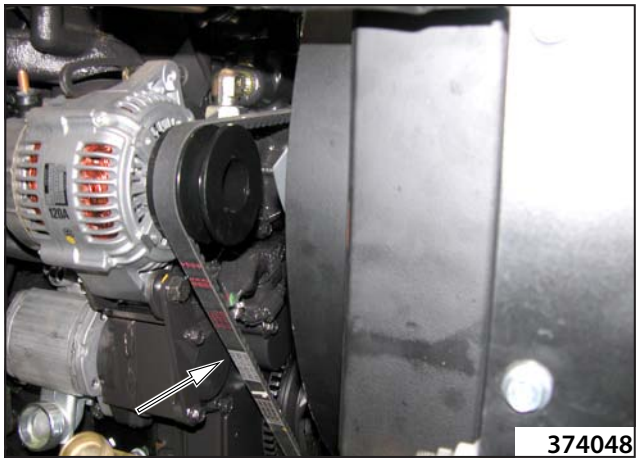
When operating the Roller at the temperatures constantly over 50 °C lower the checking interval to ½ the year.

3.6.24. Checking the engine belt

- With the engine running, check visually the pulley of alternator, cooling air blower, crank shaft, to confirm these do not oscillate.



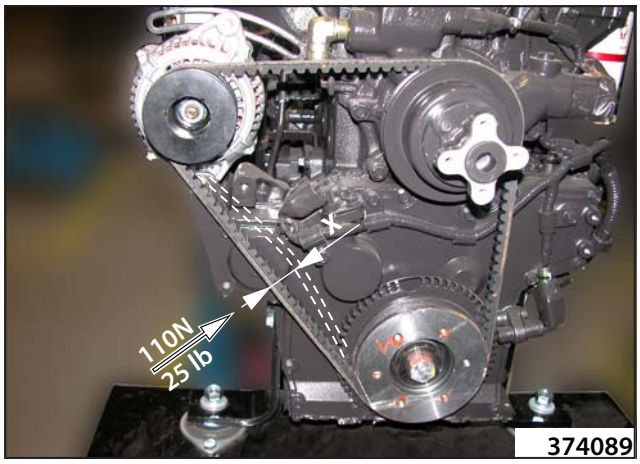
- **Stop the engine!** Check belt tension.



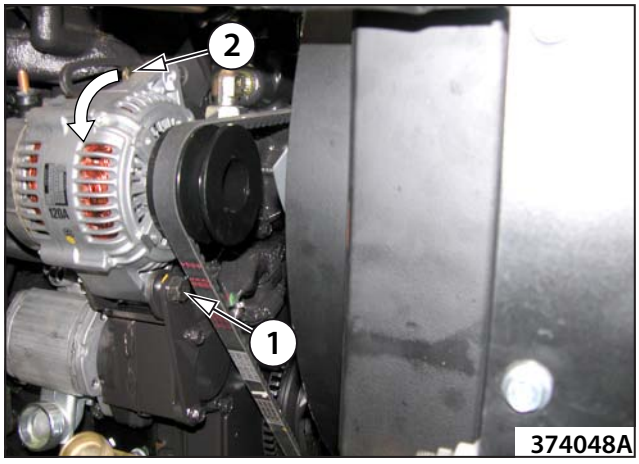
- Press belt with hand in the longest spot between pulleys (30 cm) with ca 110 N (25 lb) force, refer to the Fig. If slack X is higher than belt thickness, tighten the belt.

Note:

Please, measure accurately belt tension using a fixture possible to order with CUMMINS Company in line with Engine Maintenance Manual (Section V15) which is part of Machine documentation.



- Tighten the belt after you have slackened bolt for alternator holder (1), tensioning arm (2), by tilting out the alternator away from the engine, refer to the Fig. Tighten bolt (1) with 66 Nm (49 lb ft) torque, tighten bolt (2) with 31 Nm (23 lb ft) torque. Replace belt following its slackening, by tilting the alternator back to the engine.



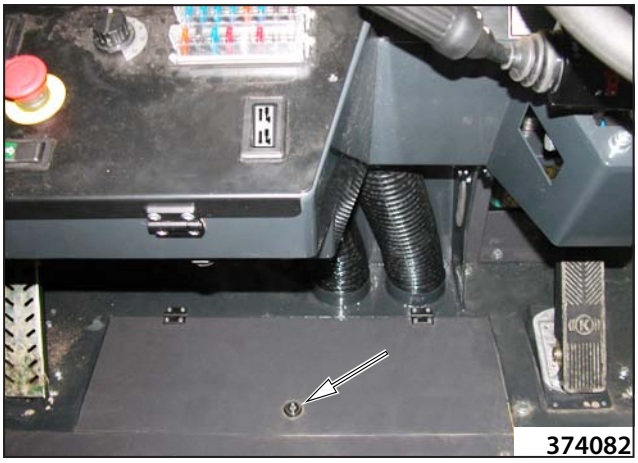
3.6.25. How to exchange CLARK gearbox oil

Drain oil when operation has ended after cooling down to 50 °C, or while driving you wait until oil warms up.

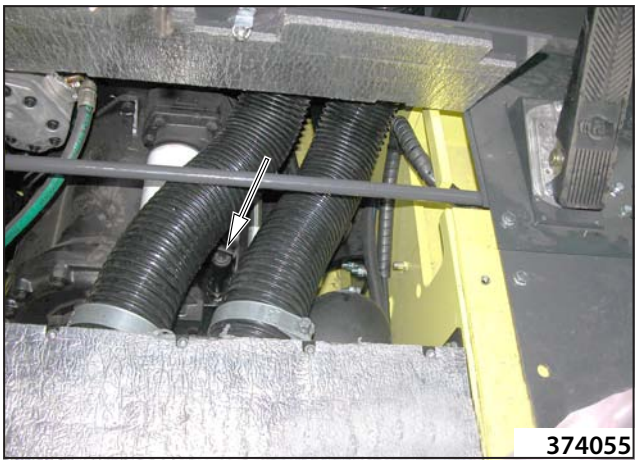
Beware of burn hazard when draining hot oil .

- Remove plug, drain oil to a prepared vessel of 21,5 l (5,7 gal US) and at the same time replace filter as per Section named "How to Replace Filter".

- Open the cover underneath control panel.



- Pour the amount of 21,5 l (5,7 gal US) through a hole after having pulled out check dipstick, up to FULL mark. Start the engine and while idling, check oil level to confirm it reaches up to ADD mark. With oil warmed up to 82÷93 °C, please check and fill up to FULL if required.



Observe fire precautions!

Use recommended oils according to Section 3.2.5.

Drain oil into collection vessels.

Spent oil is ecological waste – hand over for disposal.

3.6.26. How to replace final drive oil

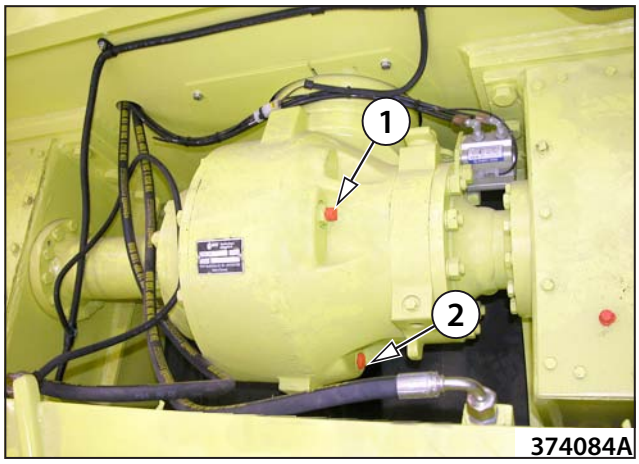
Drain oil when operation has ended, after oil has cooled down to 50 °C, or while driving, wait until oil warms up.

Carry out first replacement after 250 hours of operation of new Machine or after Major Overhaul.

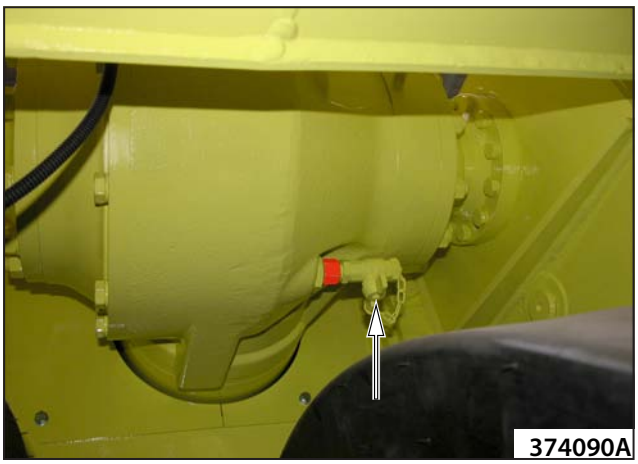
Beware of burn hazard when draining hot oil.

- Drain sprinkling tank, refer to Section called “How to clean sprinkling filter”. Remove the tank.

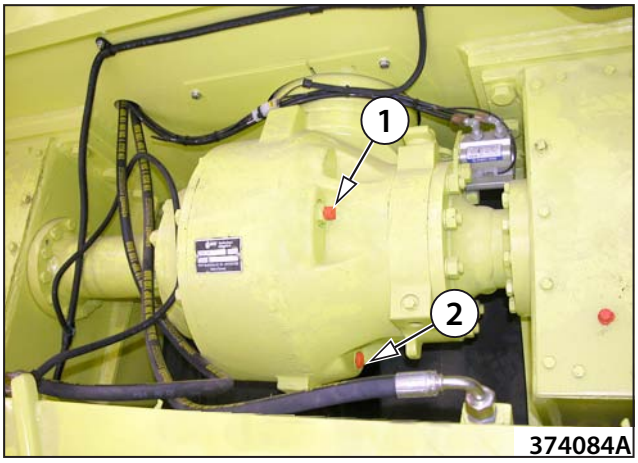
- Remove filler plug (1) and inspection plug (2).



- Drain oil.



- Use hole (1) to pour 6 l (1.58 gal US) of oil. Check oil level in hole (2) (oil must pour out slightly). Tighten inspection plug (2) with 80÷90 Nm (59÷66 lb ft) torque. Tighten filler plug (1) with 70÷80 Nm (52÷59 lb ft) torque.



Observe fire precautions!

Use recommended oils according to Section 3.2.6.

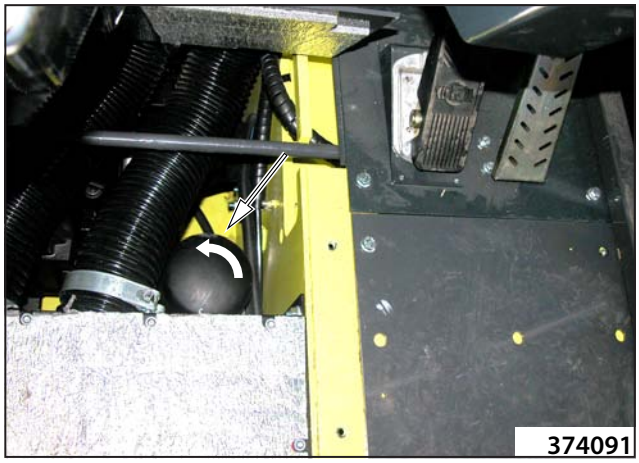
Drain oil into collection vessels.

Spent oil is ecological waste – hand over for disposal.

3.6.27. How to replace air drier

- Remove floor covering.

- Remove air drier cartridge. Clean upper part of the body. No dirt may enter the clean air area (non-return valve). Apply oil over the gasket of new drying cartridge. Tighten manually the cartridge – with 15 Nm (11 lb ft) torque.



If you find any traces of oil on drying cartridge, please inspect compressor's delivery piping, refer to Section called "Delivery Piping of Compressor".

Spent drying cartridge is ecological waste – hand over for disposal.

After 2,000 hours of operation (after 2 years)

3.6.28. Check, adjust valve clearance

- Please, contact your regional CUMMINS representatives, refer to "Engine Operation And Maintenance Manual" (supplied with the Machine), or your dealer.

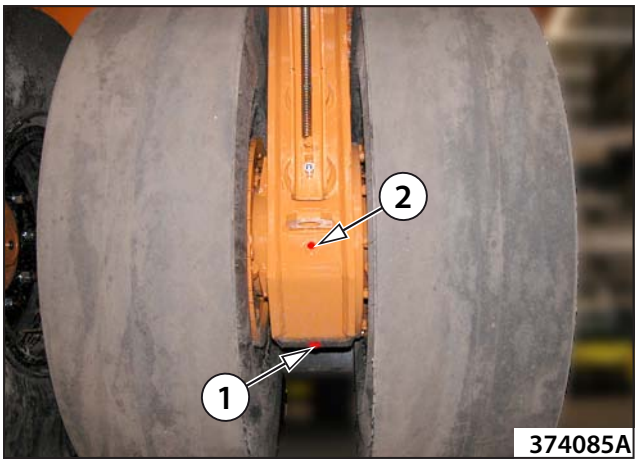
3.6.29. How to exchange oil in rear axle

Drain oil when operation has ended after cooling down to 50 °C, or while driving the Machine, wait until oil warms up.

Exchange oil first after 250 hours of operation of new Machine or after Major Overhaul.

Beware of burn hazard when draining hot oil.

- Clean and remove drain plugs (1), filling plugs (2) – in both housings. With oil drained, install plugs (1) and pour 5,2 l (1,4 gal US) amount through the holes into each housing as per Section 3.2.6., close with plugs. Oil may flow out slightly from holes (2).



Observe fire precautions!

Use recommended oils only, as per Section. 3.2.6.

Drain oil into collection vessel of 6 l (1.6 gal US) capacity.

Spent oil is ecological waste – hand over for disposal.

3.6.30. How to exchange hydraulic oil and filter

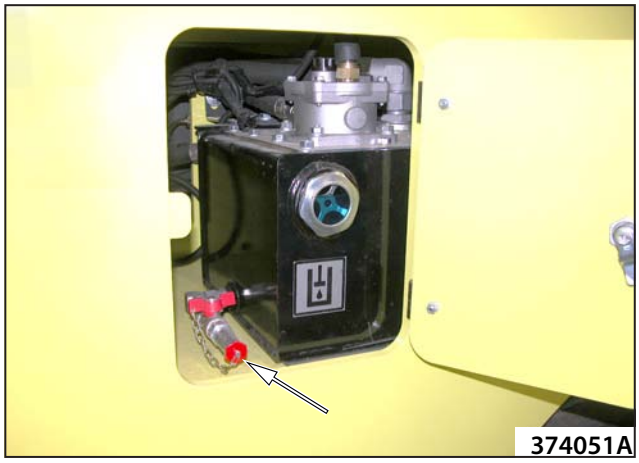
Exchange oil before season or following a long term shutdown of the Machine.

Drain oil when operation has ended after cooling down to 50 °C, or while driving the Machine, wait until oil warms up.

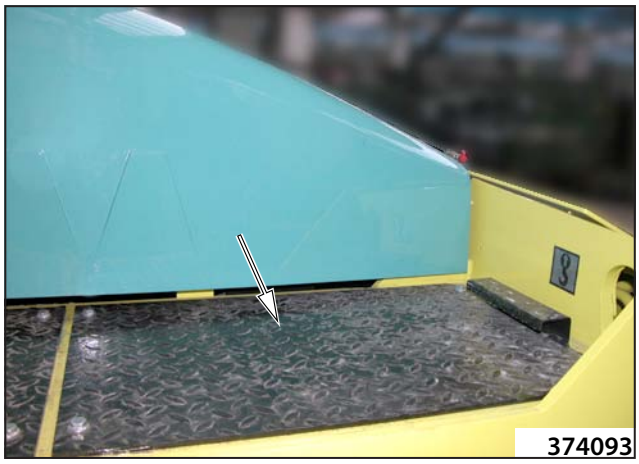
Observe fire precautions!

Beware of burn hazard when draining hot oil.

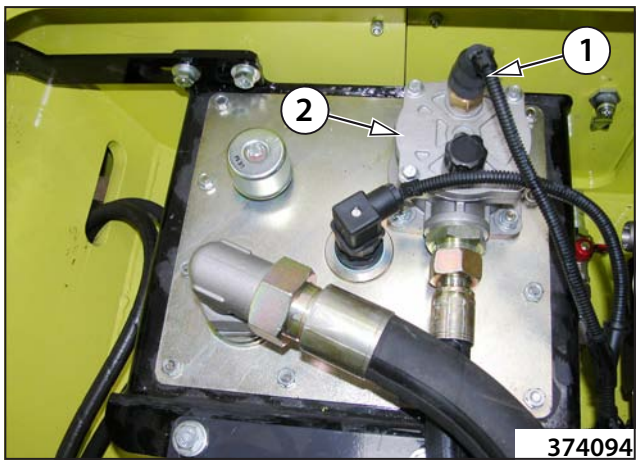
- Open the cover and drain 22 l (5,81 US gal) of oil via the valve. When drained, close the valve.



- Remove the cover.

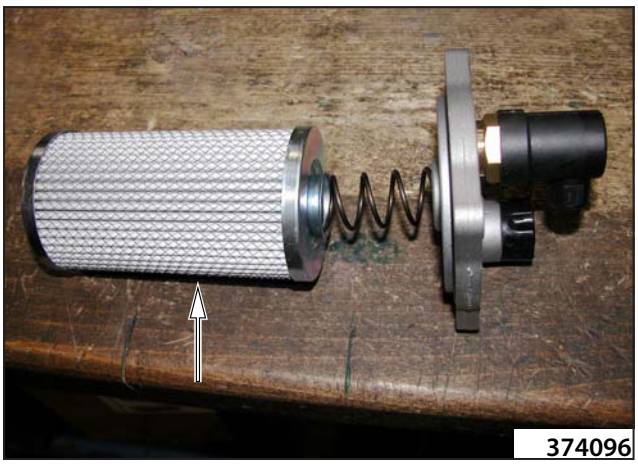


- Disconnect sensor for filter (1) clogged, remove filter cover (2).

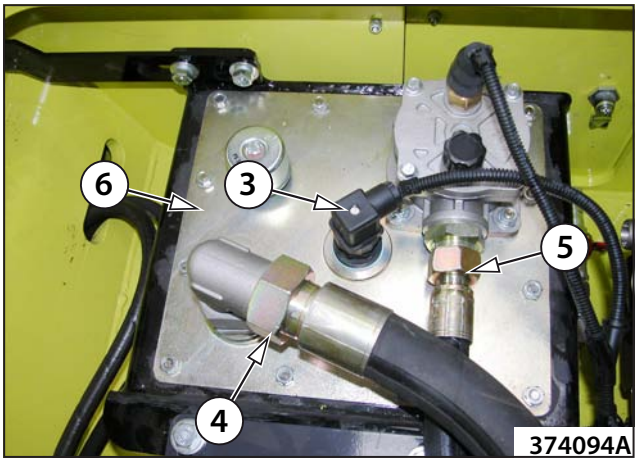


- Replace filter element.

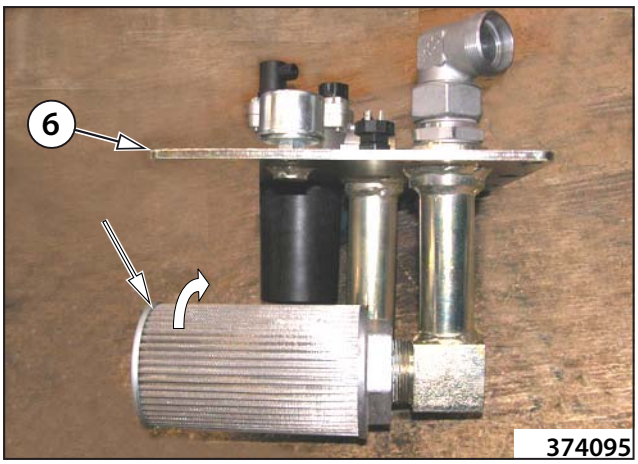
Replace the filter element always after the control lamp of the hydraulic oil filter clogging lights up, if the minimum operation temperature of oil of 50 °C (140 °F) is reached.



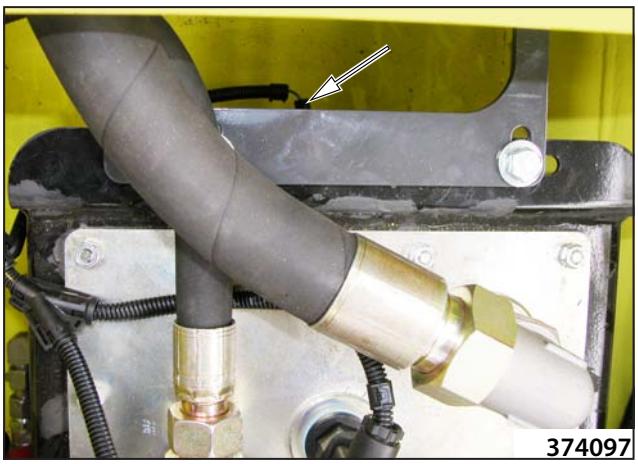
- Disconnect oil level sensor (3), remove pipe hoses (4) and (5) and cover (6), clean tank interior.



- Remove suction strainer, wash and blow out strainer with pressure air from inside. Check condition of suction strainer, in case of any damage to filtration part, replace the strainer. Use new gasket under the cover (6), refer to Spare Parts Catalogue.



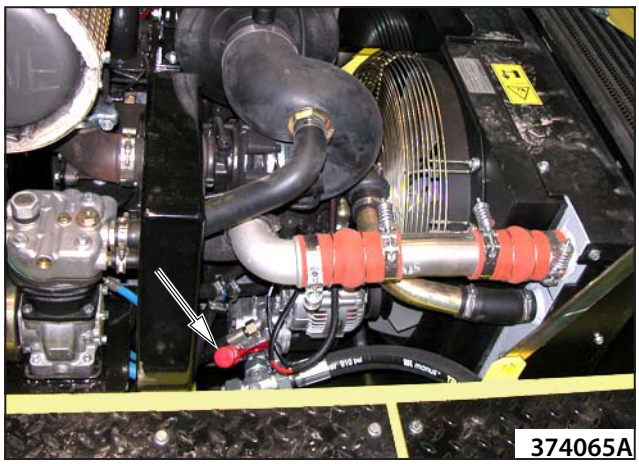
- Check temperature sensor – remove the sensor. Put in liquid heated to 88 °C (190 °F) temperature and check whether pilot lamp for oil overheating will light up.



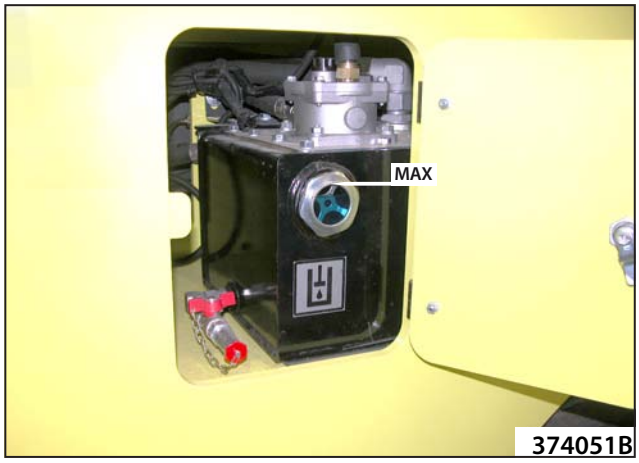
- Slip the fast coupling of filling device over the filler adapter with the following parameters: min. pressure of 6 MPa (870 PSI), 3 to 10 µm filtration.

Note:

Order the filling equipment with the Machine manufacturer or dealer.



- Fill oil up to max level.



Use alternative way of filling or refilling via filler neck on the tank only in emergency!

Observe cleanliness during work. Avoid any contamination of the system with materials that might cause damage to the units!

To clean the tank use cleaners with no fibre let-off, do NOT use chemical cleaners.

Use recommended filters, refer to Spare Parts Catalogue.

Use only recommended oil according to Section 3.2.4.

Exchange oil and filter always when destruction of internal parts of the units (hydromotors, hydrogenerators) occurs, or following a major repair of hydraulic system. Clean suction strainer and hydraulic tank. Fill new unit with oil before its installation. Test the Machine function with the engine running at high speed. Check tightness.

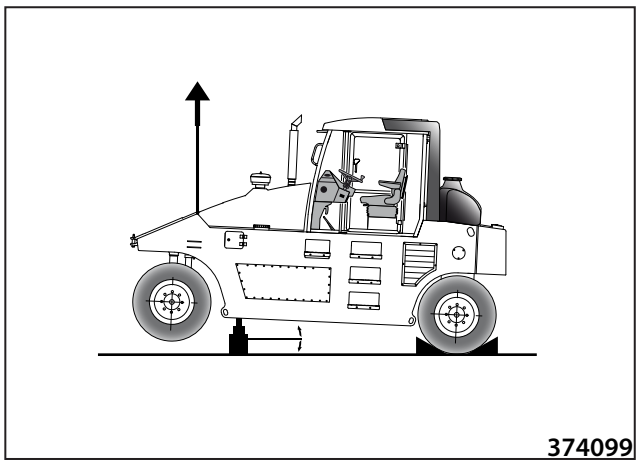
Blind all holes with plugs when hydraulic circuits are disconnected.

Collect drained oil and do not let it soak into ground.

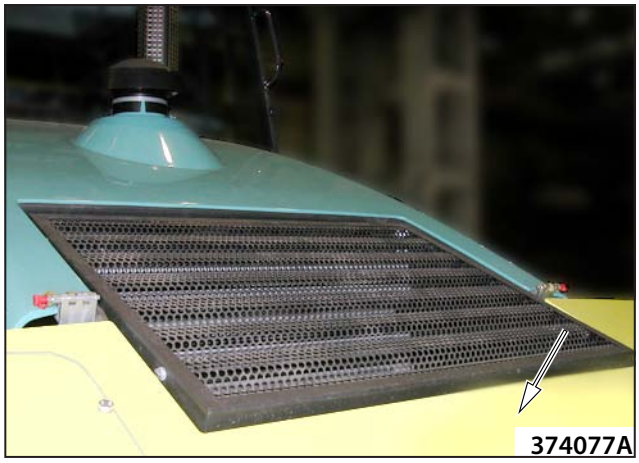
Spent oil and filters are ecologically hazardous waste – hand it over for disposal.

3.6.31. How to exchange oil in hydraulic cylinders for front axle

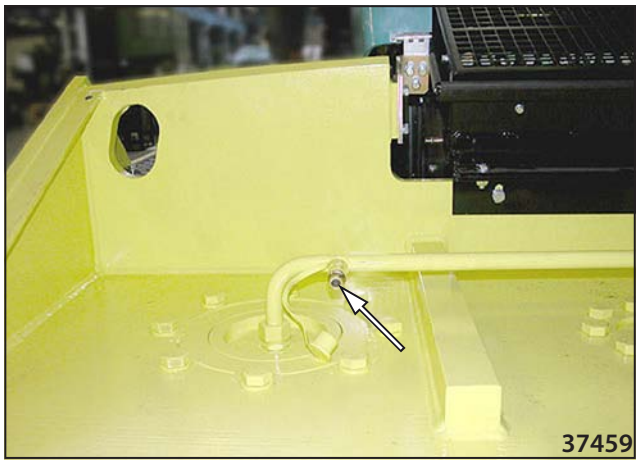
- Use front lifting lugs to lift a bit the front part of the Roller so its front wheels get relieved by means of crane, or use hand jack behind front wheels.



- Remove cover.



- Remove fast coupling on the pipe that connects hydraulic cylinders for front axles, put on the hose, and descend the Machine slowly to drain oil into a vessel set up. Screw back the filling fast coupling, fill hydraulic cylinders with new oil via filling equipment. The amount of oil medium is 6 l (1,6 gal US).



Observe fire precautions!

Use recommended oil as per Section 3.2.4.

Spent oil is ecological waste – hand over for disposal.

3.6.32. How to exchange brake fluid

! CAUTION !

To deaerate, there must be air pressure level inside brake system (air tank). Unless there is air level the system must be filled while the engine is running – follow safety measures during engine start.

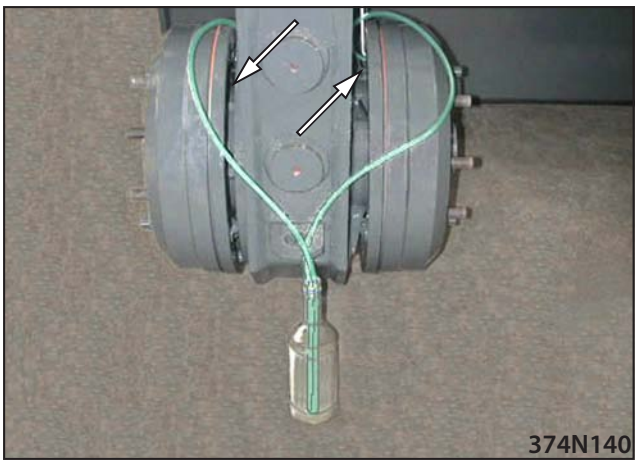
Two persons must work together to carry out deaeration.

Pump out brake fluid from the circuit:

- Remove rear wheel according to Section called "How to adjust brake clips".
- Slip box end wrench over the hose pipe No. 9.

- Slip hose pipe incl. key over the deaeration (air relief) screw.

- Locate hope pipe in the vessel and slacken deaeration screw for brake cylinder. It is possible to always handle the wheel couple simultaneously. Second person is to depress brake pedal repeatedly to force out fluid step by step from all brake cylinders into the vessel. Tighten deaeration screw.



- Fill equalizer tank with fluid and keep level above "MIN" when deaerating.

- Slacken deaeration screw at the brake master cylinder by 2 turns, and when filled up with fluid, close deaeration screw.

- Fill tanks with new brake fluid (immerse hose pipe end below level). Slacken deaeration screws. Press brake pedal slowly as long as fluid moves out with air bubbles. Then with the brake pedal pressed, close deaeration screws for brake cylinders, wipe them and install protective caps. Check circuit tightness, level in the tank, and adjust. Reinstall wheels. Tighten wheel nuts with 400 Nm (295 lb ft) torque.

Keep brake fluid inside original, well closed containers! When in use, proceed according to brake fluid producer's instructions.

Brake fluid will damage painted parts of the Machine.

Use recommended brake fluid under Section 3.2.3.

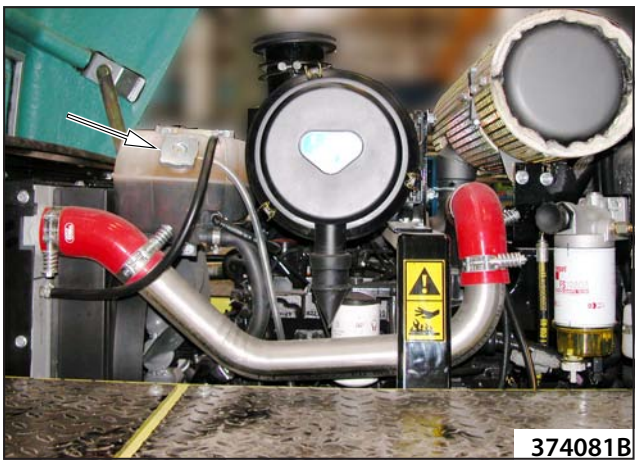
When filling up, avoid fluid spilled over the Machine and off the Machine as well.

Collect brake fluid in the vessel and hand it over for disposal!

3.6.33. Exchanging the engine cooling liquid

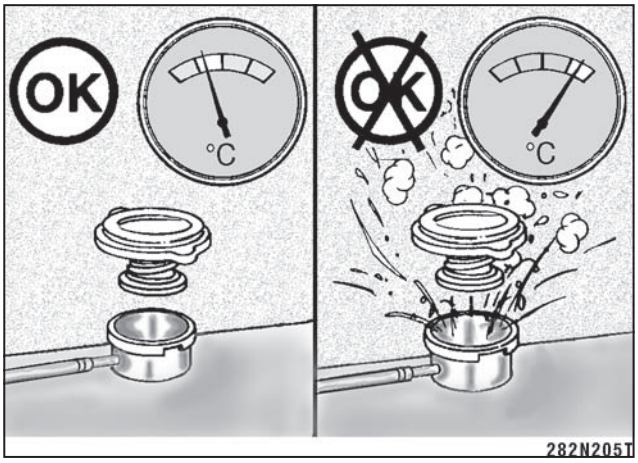
! CAUTION !

Drain liquid when operation is finished, and when driving the Machine, wait until liquid warms up to 80 °C (176 °F) temperature.



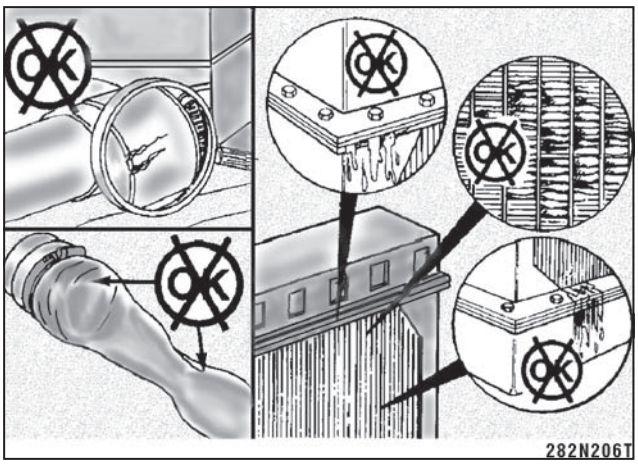
- Take off the lid from equalizer tank.

Do NOT remove the lid before cooling liquid drops below 50 °C (122 °F). Hot water scald hazard.



- Remove plug. Let liquid flow out into the vessel of 11,5 l (3 gal US) capacity.

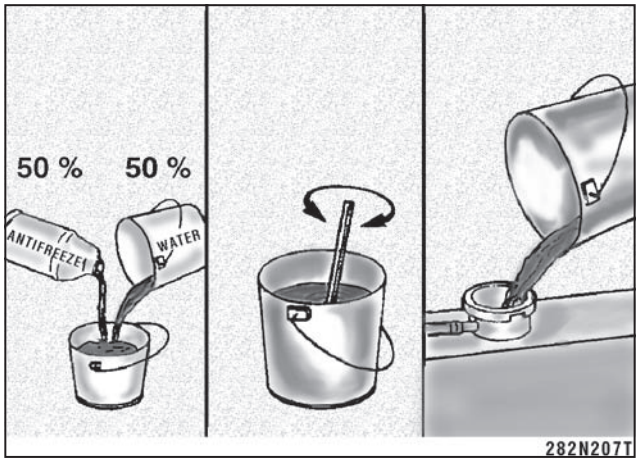
- Check no hose pipes are damaged within engine's cooling system and no hose clips are missing. Inspect condition of radiator whether it is not damaged, leaking, or whether radiator's plates are not clogged with dirt. Clean and repair it if required.



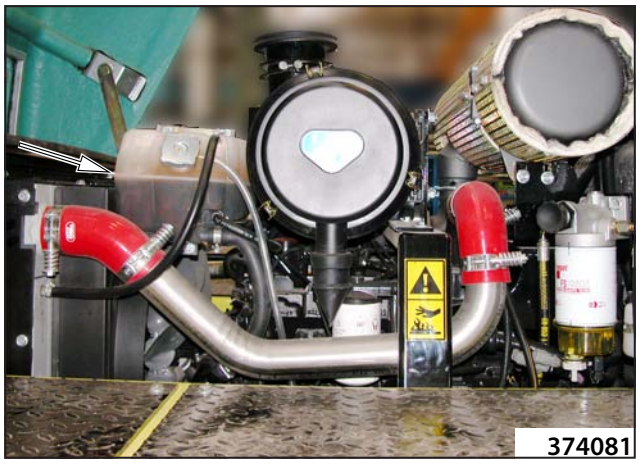
Flush the system:

- Follow Engine Operation and Maintenance Manual to flush the system during replacement, using mixture of water and soda (sodium carbonate) in the ratio of 0,5 kg (1.1 lb) of soda per 23 l (6.0 gal US) of water. Fill up the system with such mixture and warm up to 80 °C (176 °F) with the engine running – **do NOT install pressure closure for equalizer tank**. Shut off the engine and drain water, fill with new water and warm up the engine, d drain water again. Repeat this until water is clean.

- Fill cooling system with new cooling liquid in the ratio of 50 % water + 50 % antifreeze agent between MIN and MAX. Max. filling speed is 10 l/min (2,6 gal US per minute). Use the lid to close equalizer tank.



- Start the engine and wait until temperature reaches 80 °C (176 °F). Then stop the engine. At the same time check that no cooling liquid is leaking. Check level in equalizer tank, make up to MAX.



Before filling up, let temperature drop below 50 °C (122 °F). When plug is opened there is hazard liquid will splash out followed by scald hazard.

Follow anti-freeze producer's instructions when exchanging anti-freeze!

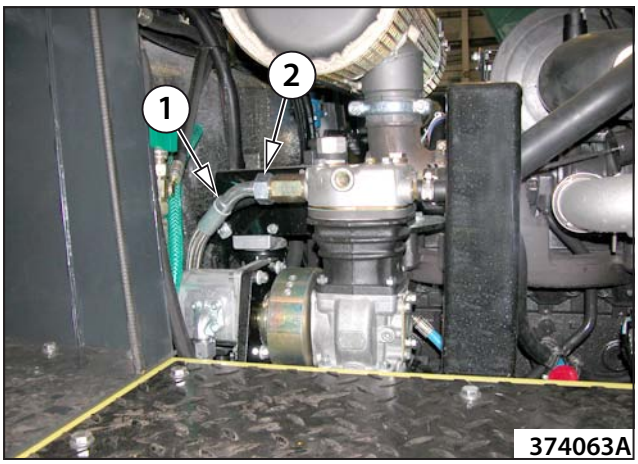
Use anti-freeze according to Section 3.2.3.!

Drain liquid into collection vessel!

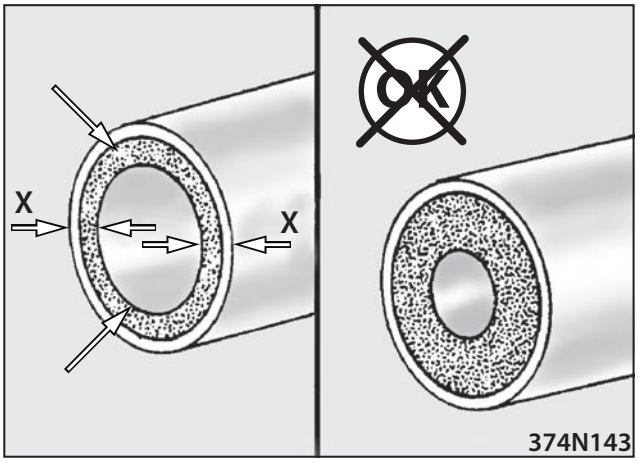
Hand over spent liquid for safe disposal in line with regulations!

3.6.34. Check the compressor

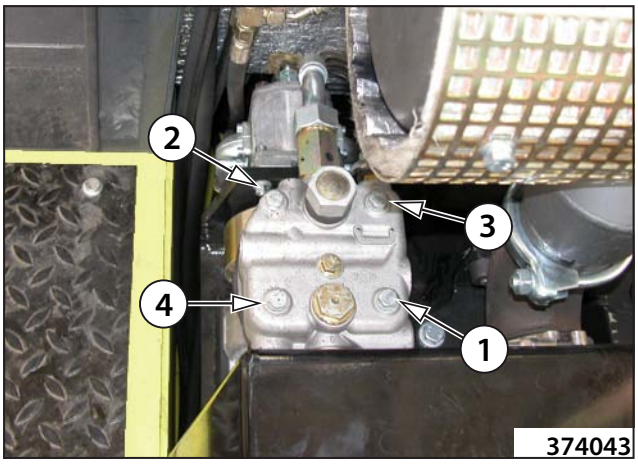
- Delivery air piping (1) must have no pressure. Slacken bolting (2). Drain pressure air from the system.
- Remove delivery air piping (1) away from compressor.



- When the overall extent of carbon deposited on the wall exceeds the value of X+X=2 mm (1/16 in), you must clean or replace delivery pipe leading from compressor, and please contact your dealer to carry out overall inspection and repair of the compressor.



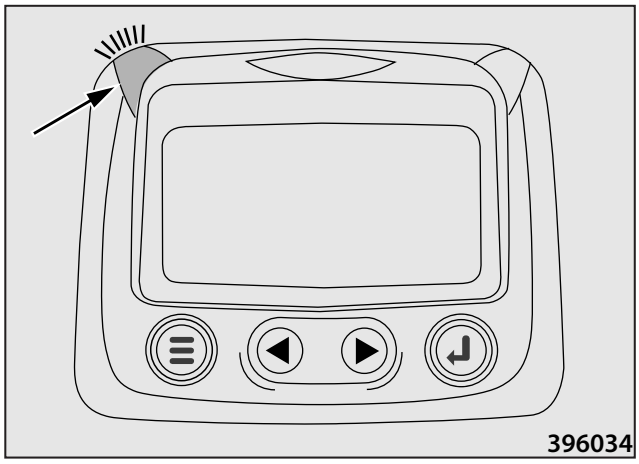
- Following first 50 hours, please tighten the bolts for compressor head in such sequence as per the Fig. using 30÷33 Nm (22÷24.5 lb ft) torque. Perform this on the cold engine after the machine has been stopped.



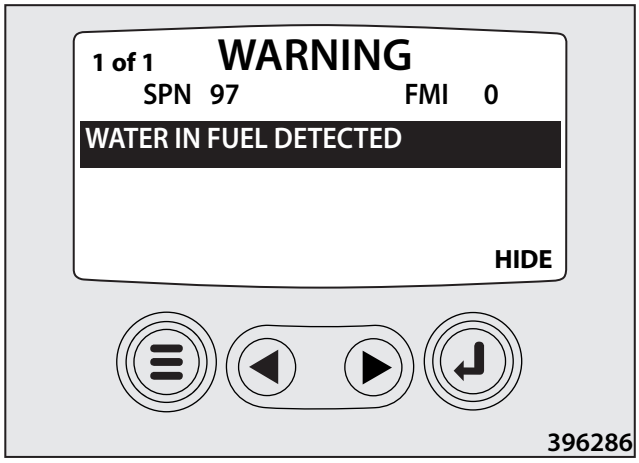
Maintenance if required

3.6.35. Fuel Pre Cleaner – Water Separator

- Alarm signal from yellow pilot lamp.



- Code No. 97 VODA V PALIVU will be displayed (WATER IN FUEL).



- Drain water from separator.

Do NOT smoke while at work.

Do NOT drain separator while engine is hot and running.

Collect drained fuel incl. sediment into a proper vessel.

! CAUTION !

If you drained more than 60 cm³ (0,63 quarts) of fuel, please fill up fuel in fuel filter according to the next Section called "Deaeration".

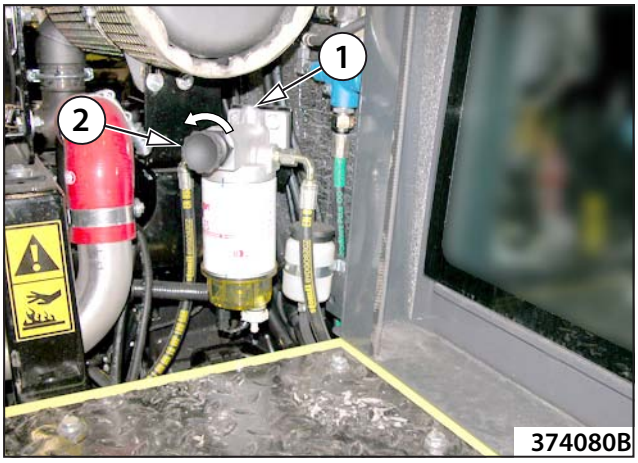
3.6.36. How to deaerate fuel filter

Deaerate fuel system before first starting:

- With fuel filters not filled with fuel – when replacing the filters
- During fuel pump replacement
- Upon long term shutdown of the Machine
- With fuel pumped out from the tank

Deaerate the filters:

- Slacken air relief screw (1) at fuel pre cleaner. Pump the fuel via delivery pump (2) until it flow out clean, with no air bubbles, tighten the screw.



- Deaerate second filter via air relief screw.

Do NOT deaerate while engine is hot, leaking fuel may cause fire.

Do NOT smoke!

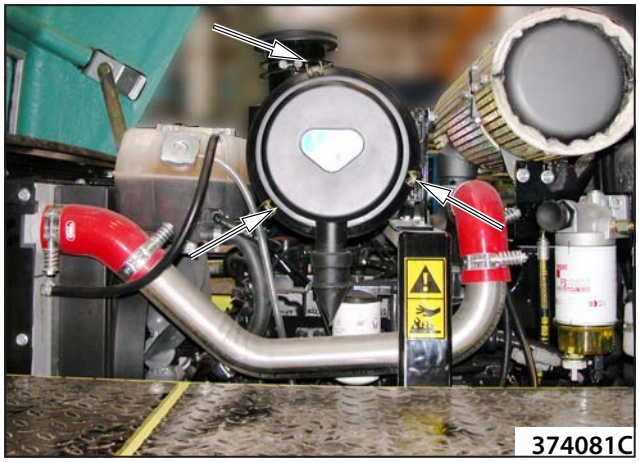
Collect leaking fuel!

3.6.37. How to replace air filter elements

Note:
Air filter contains the main element and safety element.

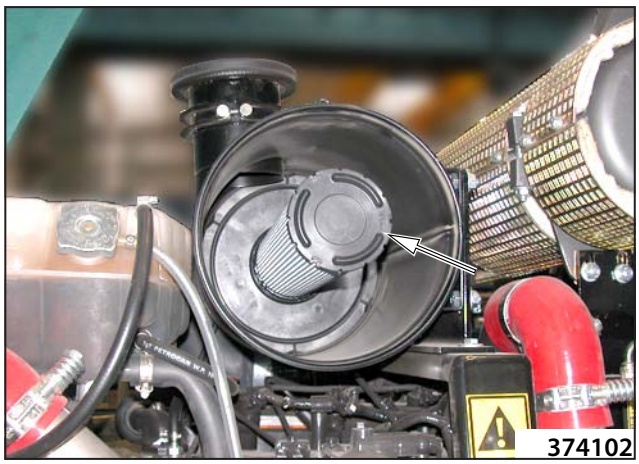
When pilot lamp lights up, please replace the main element. Replace safety element after three replacements of main element. Manufacturer does not recommend any cleaning of the element due to lowered filtration capacity by up to 40 % and due to potential of damaging the element when being cleaned.

- Slacken the clips and take off the lid.

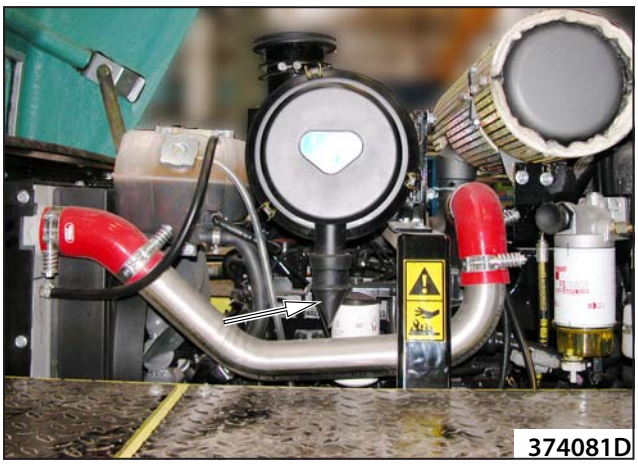


- Pull out the main element.

- Remove safety element and check for any damage – do NOT clean it. Clean inner space of the filter and the contact faces so to avoid any dust penetrating into the supply piping that leads to the engine. Put back safety element and new main element.



- Take off dust valve, clean it and reinstall.



NEVER clean inner space of the filter with pressure air to avoid any dust penetrating into engine induction manifold.

Use original elements, only.

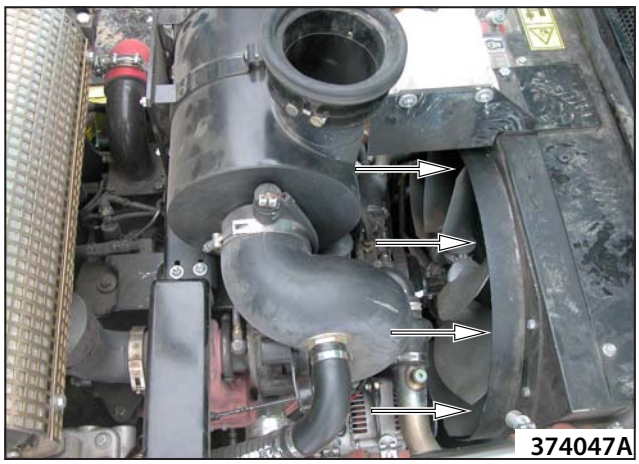
When washing the Machine be careful not to splash water into air filter.

Replace instantly vacuum valve damaged!

Do NOT operate Machine with filter body damaged or filter cover damaged.

3.6.38. Cleaning of coolers

- With regard to the Machine operating in various working environments no regular interval for cleaning can be determined. When working in very dusty environment, carry out cleaning on daily basis. Fouled radiator will cause increased temperature of engine cooling liquid and hydraulic system oil. Clean with pressure air or pressure water (steam) from the side of cooling air blower.



Do NOT use cleaners with too high pressure so to avoid any damage to radiators' plates.

With radiator contaminated with crude oil products (oil), use cleaning agent and proceed in line with producer's instructions! Find out the cause of contamination!

When cleaning, please proceed according to ecological standards and regulations!

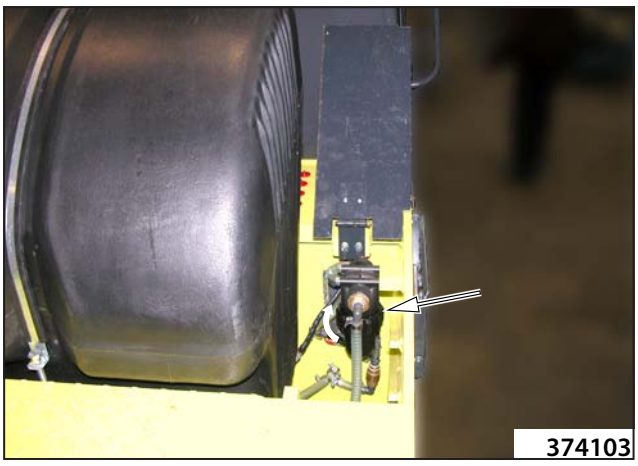
Perform cleaning at workplaces equipped with cleaning agent collection system to avoid any contamination of soil and water resources!

NEVER use banned cleaning agents!

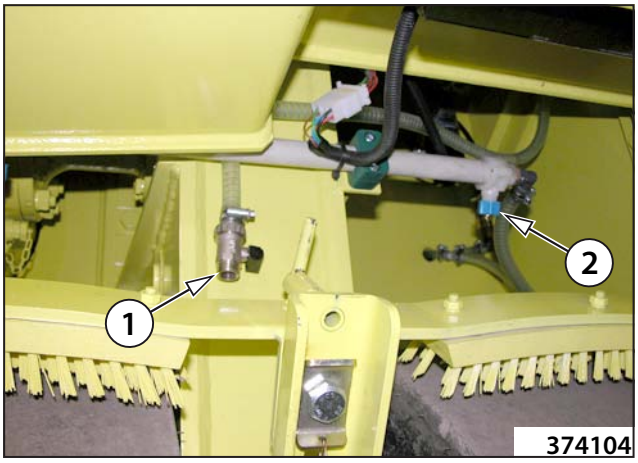
3.6.39. Clean sprinkling filter

- Remove the filter, clean its strainer.

Drain sprinkling tank and system always before ambient temperature lowers below 0 °C (32 °F)!

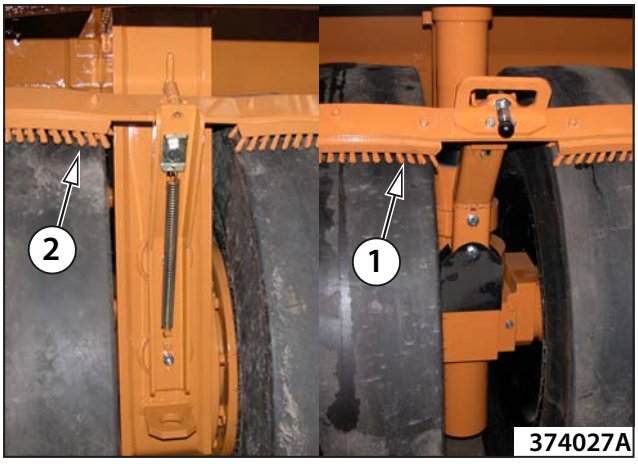


- Drain tank (1). Drain sprinkling pipes at the front and back by slackening the nozzles (2).

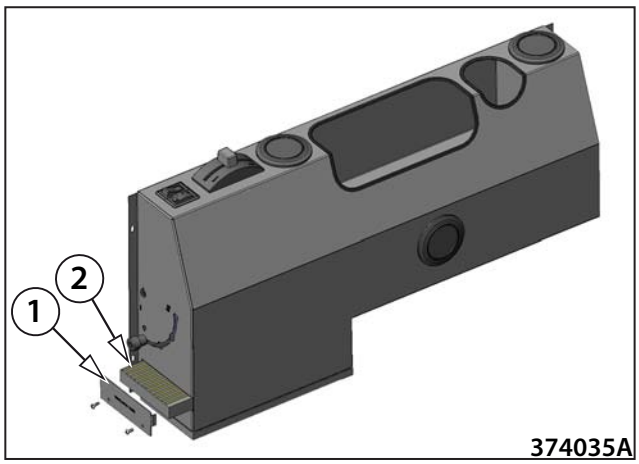


3.6.40. Clean brush scrapers

- Check condition of front brushes (1), rear brushes (2) – clean them and repair them.



3.6.41. Cleaning the air cleaner of cabin ventilation



- Remove cover (1). Replace filter element (2) (filtration of sucked air outside cabin), beat it out carefully and blow it out.

Note:

Clean it (beat out, blow out) 1x per month. In case you work in dusty environment, shorten the cleaning intervals. Replace element after 2 cleaning processes.

- Remove cover. Replace filtration element (filtration of sucked air from inside the cabin), beat it out carefully and blow it out.

Note:

Clean it (beat out, blow out) 1x per half a year. Replace element after 2 cleaning processes.

3.6.42. Clean the Machine

- When the work is completed clean the Machine to get rid of major dirt! Carry out overall cleaning on regular basis, at least once per week. When working on cohesive soils, soil cements and lime soil, carry out overall cleaning on daily basis. Pay attention to the function of scrapers!

Before pressure cleaning the Machine with water or steam, please blind all the ports into which a cleaner might penetrate (e.g. engine inlet port, cabin's ventilation port, etc.). With the Machine cleaned remove these blinds.

Disconnect master switch!

NEVER expose electric parts or insulation material (alternator, electric connections, etc.) to direct stream of pressure water or steam, always cover these locations.

Carry out the work with the engine stopped.

Follow producer's instructions when using cleaning agents.

NEVER use aggressive or easily ignitable cleaning agents (e.g. petrol and/or incendiary materials easy to ignite).

When cleaning, please proceed according to ecological standards and regulations.

Perform cleaning at workplaces equipped with cleaning agent collection system to avoid any contamination of soil and water resources.

Do NOT use forbidden cleaning agents.

3.6.43. Confirm bolt connections are tightened

- Check no main bolt connections (wheel nuts, axle mount, hydraulic connection mount, engine mount, mount of units attached to the engine) have been slackened). Use torque spanners to tighten these.

	TORQUE						TORQUE			
	For 8,8 (8G) bolts		For 10,9 (10K) bolts				For 8,8 (8G) bolts		For 10,9 (10K) bolts	
Thread	Nm	lb ft	Nm	lb ft		Thread	Nm	lb ft	Nm	lb ft
M6	10	7,4	14	10,3		M18x1,5	220	162,2	312	230,1
M8	24	25,0	34	25,0		M20	390	287,6	550	405,6
M8x1	19	14,0	27	19,9		M20x1,5	312	230,1	440	324,5
M10	48	35,4	67	49,4		M22	530	390,9	745	549,4
M10x1,25	38	28,0	54	39,8		M22x1,5	425	313,4	590	435,1
M12	83	61,2	117	86,2		M24	675	497,8	950	700,6
M12x1,25	66	48,7	94	69,3		M24x2	540	398,2	760	560,5
M14	132	97,3	185	136,4		M27	995	733,8	1400	1032,5
M14x1,5	106	78,2	148	109,1		M27x2	795	586,3	1120	826,0
M16	200	147,5	285	210,2		M30	1350	995,7	1900	1401,3
M16x1,5	160	118,0	228	168,1		M30x2	1080	796,5	1520	1121,0
M18	275	202,8	390	287,6						

The values given in the Table are torques at dry thread (at coefficient of friction = 0,14). These values DO NOT apply to greased thread.

Chart for torques of cap nuts with "O" sealing ring - hoses

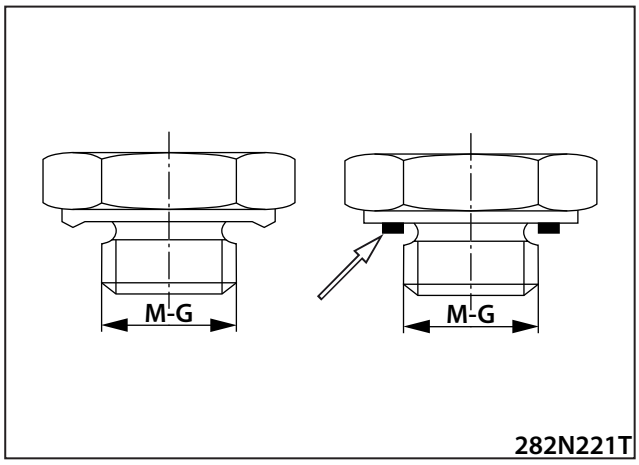
			Torques of cap nuts with "O" ring - hoses					
			Nm			lb ft		
Spanner size	Thread	Pipe	Nominal	Min	Max	Nominal	Min	Max
14	12x1,5	6	20	15	25	15	11	18
17	14x1,5	8	38	30	45	28	22	33
19	16x1,5	8	45	38	52	33	28	38
		10						
22	18x1,5	10	51	43	58	38	32	43
		12						
24	20x1,5	12	58	50	65	43	37	48
27	22x1,5	14	74	60	88	55	44	65
		15						
30	24x1,5	16	74	60	88	55	44	65
32	26x1,5	18	105	85	125	77	63	92
36	30x2	20	135	115	155	100	85	114
		22						
41	36x2	25	166	140	192	122	103	142
46		28						
50	42x2	30	240	210	270	177	155	199
50	45x2	35	290	255	325	214	188	240
	52x2	38	330	280	380	243	207	280
		42						

Chart for torques of necks with sealing edge or with flat gasket

	Neck Torques	
G -M	**Nm**	**lb ft**
G 1/8	25	18
G 1/4	40	30
G 3/8	95	70
G 1/2	130	96
G 3/4	250	184
G 1	400	295
G 11/4	600	443
G 11/2	800	590
10 x 1	25	18
12 x 1,5	30	22
14 x 1,5	50	37
16 x 1,5	60	44
18 x 1,5	60	44
20 x 1,5	140	103
22 x 1,5	140	103
26 x1,5	220	162
27 x 1,5	250	184
33 x 1,5	400	295
42 x 1,5	600	443
48 x 1,5	800	590

Chart for torques of plugs with flat gasket

	Plug Torques	
G -M	**Nm**	**lb ft**
G 1/8	15	11
G 1/4	33	24
G 3/8	70	52
G 1/2	90	66
G 3/4	150	111
G 1	220	162
G 11/4	600	443
G 11/2	800	590
10 x 1	13	10
12 x 1,5	30	22
14 x 1,5	40	30
16 x 1,5	60	44
18 x 1,5	70	52
20 x 1,5	90	66
22 x 1,5	100	74
26 x1,5	120	89
27 x 1,5	150	111
33 x 1,5	250	184
42 x 1,5	400	295
48 x 1,5	500	369



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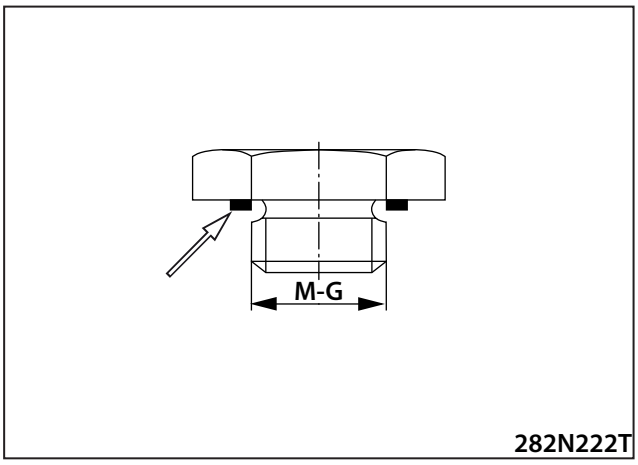

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Usually, defects are caused by incorrect operation of the machine. Therefore, in case of any troubles read again properly through the instructions given in the operation and maintenance manual for the machine and engine. If you cannot identify the cause, contact a service department of an authorised dealer or the manufacturer.

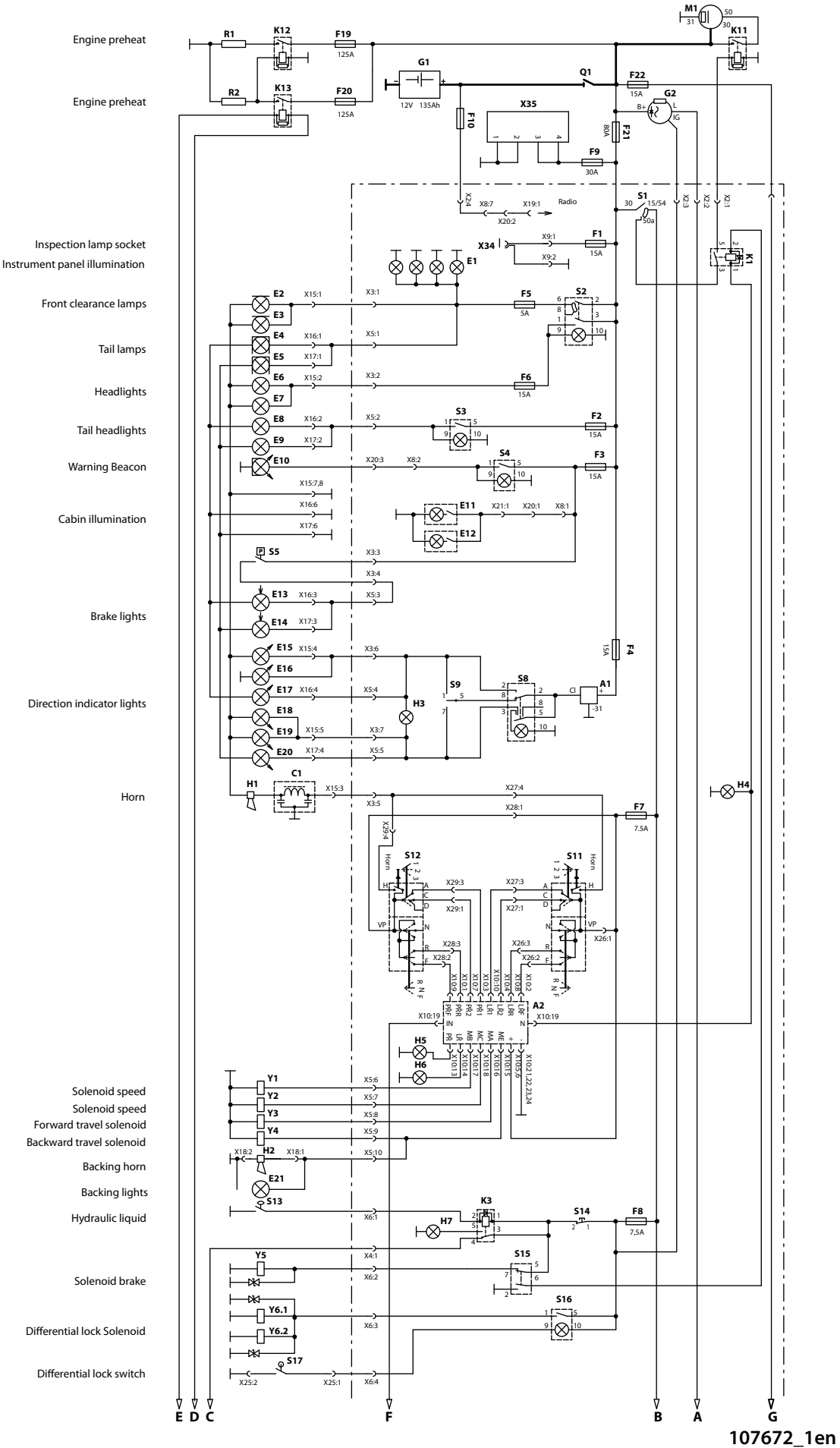
Troubleshooting in hydraulic and electric systems requires knowledge of these systems; therefore a service department of an authorised dealer or the manufacturer should be called to solve these problems.

3.8. Annexes

Wiring Diagram

Legend:

A1	Light interruptor
A2	Steering changeover electronics
A3	Multifunctional display device Murphy PV - 101
B1	Accelerator pedal position switch
B2	Gearbox temperature sensors
B3	Gearbox lubrication pressure gauge sensor
B4	Fuel gauge float
C1	Interference filter
E1	Instrument lighting
E2, 3	Front contour lamp
E4, 5	Tail lamps
E6, 7	Front lights
E8, 9	Rear lights
E10	Flashing beacon (optional)
E11,12	Cabin lighting
E13,14	Brake lights
E15-17	LH traffic indicator lights
E18-20	RH traffic indicator lights
E21	Backing headlight (optional)
F1-21	Drop out fuses
G1	Battery
G2	Alternator
H1	Horn
H2	Backing horn (optional)
H3	Pilot lamp for traffic indicator lights
H4	Pilot lamp for neutral
H5	Pilot lamp for RH steering
H6	Pilot lamp for LH steering
H7	Pilot lamp for hydraulic oil level
H8	Pilot lamp for engine glowing
H9	Pilot lamp for battery recharging
H10	Pilot lamp for brake failures
H11	Acoustic indicator for brake failure
H12	Pilot lamp for brake
H13	Pilot lamp for air filter fouled
H14	Pilot lamp for engine air filter fouled
H16	Pilot lamp for hydraulics overheating
H17	Pilot lamp for sprinkling
K1-3	Auxiliary relay
K5-8	Auxiliary relay
K11-13	Contactors
M1	Starter
M2	Front windscreen wiper
M3	Rear windscreen wiper
M4	Fron windscreen sprayer
M5	Rear windscreen sprayer
M6	Sprinkling pump motor
M7-9	Cooling air blowers
P1	Gearbox thermometer
P2	Gearbox lubrication pressure gauge
Q1	Master switch
R1,2	Engine glowing
R3	Resistor
S1	Ignition box
S2	Front light switch
S3	Rear light switch
S4	Flashing beacon switch (optional)
S5	Brake light pressure switch
S6, 7	Horn pushbuttons
S8	Warning light switch
S9	Traffic indicator light changeover switch
S11	LH gear selector
S12	RH gear selector
S13	Hydraulic tank float switch
S14	Emergency brake pushbutton
S15	Parking brake switch
S16	Differential lock switch (optional)
S17	Indication for differential lock contacted (optional)
S18	Double pushbutton to adjust engine idling speed
S19	Pressure switch for brake failure
S20	Pressure switch for brakes
S21	Hydraulic oil filter pressure switch
S22	Engine air filter pressure switch
S24	Hydraulic oil overheating switch
S25	Rear windscreen wiper changeover switch
S26	Rear windscreen wiper switch
S27	Double pushbutton for windscreen sprayers
S29	Cycling device for sprinkling
S30	Cooling air blower changeover switch
S31	Air conditioner switch (optional)
S32	Air conditioner thermostat (optional)
S33	Air conditioner overpressure safety piece (optional)
S34	Double pushbutton for edge cutter (optional)
V1, 2	Interlocking diodes
X1-33	Interconnecting connectors (X1, 11, 24, 32 and 33 are vacant)
X34	Field socket
X35,36	Engine connectors
X37	Engine diagnostics connectors
X38-43	Connectors J1939
Y1, 2	Electromagnets for valves, gear change
Y3	Electromagnet for valves, forward travel
Y4	Electromagnet for valves, back travel
Y5	Electromagnet for brake valves
Y6	Electromagnets for differential lock valve (optional)
Y7	Electromagnetic clutch for air conditioner compressor (optional)
Y8	Electromagnet for valve, edge cutter, upward (optional)
Y9	Electromagnet for valve, edge cutter, downward (optional)


Engine preheat
Engine preheat
Inspection lamp socket
Instrument panel illumination
Front clearance lamps
Tail lamps
Headlights
Tail headlights
Warning Beacon
Cabin illumination
Brake lights
Direction indicator lights
Horn
Solenoid speed
Solenoid speed
Forward travel solenoid
Backward travel solenoid
Backing horn
Backing lights
Hydraulic liquid
Solenoid brake
Differential lock Solenoid
Differential lock switch
Radio
E D C
F
B
A
G
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Wiring Diagram

Legend:

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B3	Gearbox lubrication pressure gauge sensor
B4	Fuel gauge float
C1	Interference filter
E1	Instrument lighting
E2, 3	Front contour lamp
E4, 5	Tail lamps
E6, 7	Front lights
E8, 9	Rear lights
E10	Flashing beacon (optional)
E11,12	Cabin lighting
E13,14	Brake lights
E15-17	LH traffic indicator lights
E18-20	RH traffic indicator lights
E21	Backing headlight (optional)
F1-21	Drop out fuses
G1	Battery
G2	Alternator
H1	Horn
H2	Backing horn (optional)
H3	Pilot lamp for traffic indicator lights
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H6	Pilot lamp for LH steering
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M5	Rear windscreen sprayer
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P2	Gearbox lubrication pressure gauge
Q1	Master switch
R1,2	Engine glowing
R3	Resistor
S1	Ignition box
S2	Front light switch
S3	Rear light switch
S4	Flashing beacon switch (optional)
S5	Brake light pressure switch
S6, 7	Horn pushbuttons
S8	Warning light switch
S9	Traffic indicator light changeover switch
S11	LH gear selector
S12	RH gear selector
S13	Hydraulic tank float switch
S14	Emergency brake pushbutton
S15	Parking brake switch
S16	Differential lock switch (optional)
S17	Indication for differential lock contacted (optional)
S18	Double pushbutton to adjust engine idling speed
S19	Pressure switch for brake failure
S20	Pressure switch for brakes
S21	Hydraulic oil filter pressure switch
S22	Engine air filter pressure switch
S24	Hydraulic oil overheating switch
S25	Rear windscreen wiper changeover switch
S26	Rear windscreen wiper switch
S27	Double pushbutton for windscreen sprayers
S29	Cycling device for sprinkling
S30	Cooling air blower changeover switch
S31	Air conditioner switch (optional)
S32	Air conditioner thermostat (optional)
S33	Air conditioner overpressure safety piece (optional)
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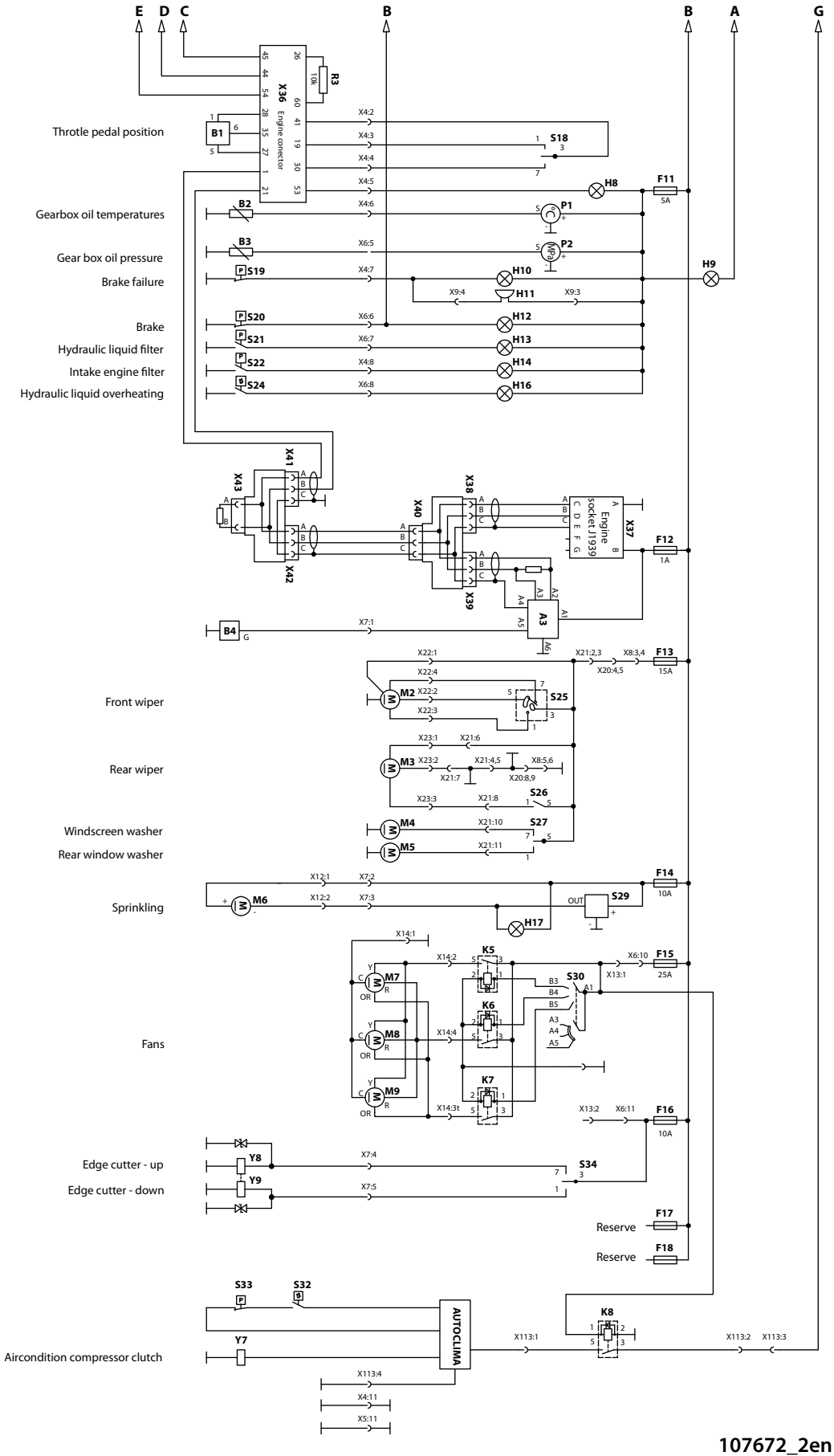
Y8	Electromagnet for valve, edge cutter, upward (optional)
Y9	Electromagnet for valve, edge cutter, downward (optional)


E D C B B A G
X36 Engine connector
R3 10k
Throttle pedal position
B1
Gearbox oil temperatures
B2
Gear box oil pressure
B3
Brake failure
S19
Brake
S20
Hydraulic liquid filter
S21
Intake engine filter
S22
Hydraulic liquid overheating
S24
S18
H8
F11 5A
P1
P2
H9
H10
H11
H12
H13
H14
H16
X41
X43
X42
X40
X38
X39
X37 Engine socket J1939
F12 1A
A3
B4
F13 15A
Front wiper
M2
S25
Rear wiper
M3
S26
Windscreen washer
M4
S27
Rear window washer
M5
F14 10A
Sprinkling
M6
S29
H17
Fans
M7
M8
M9
K5
K6
K7
S30
F15 25A
F16 10A
Edge cutter - up
Y8
Edge cutter - down
Y9
S34
F17
Reserve
F18
Reserve
S33
S32
Aircondition compressor clutch
Y7
AUTOCLIMA
K8

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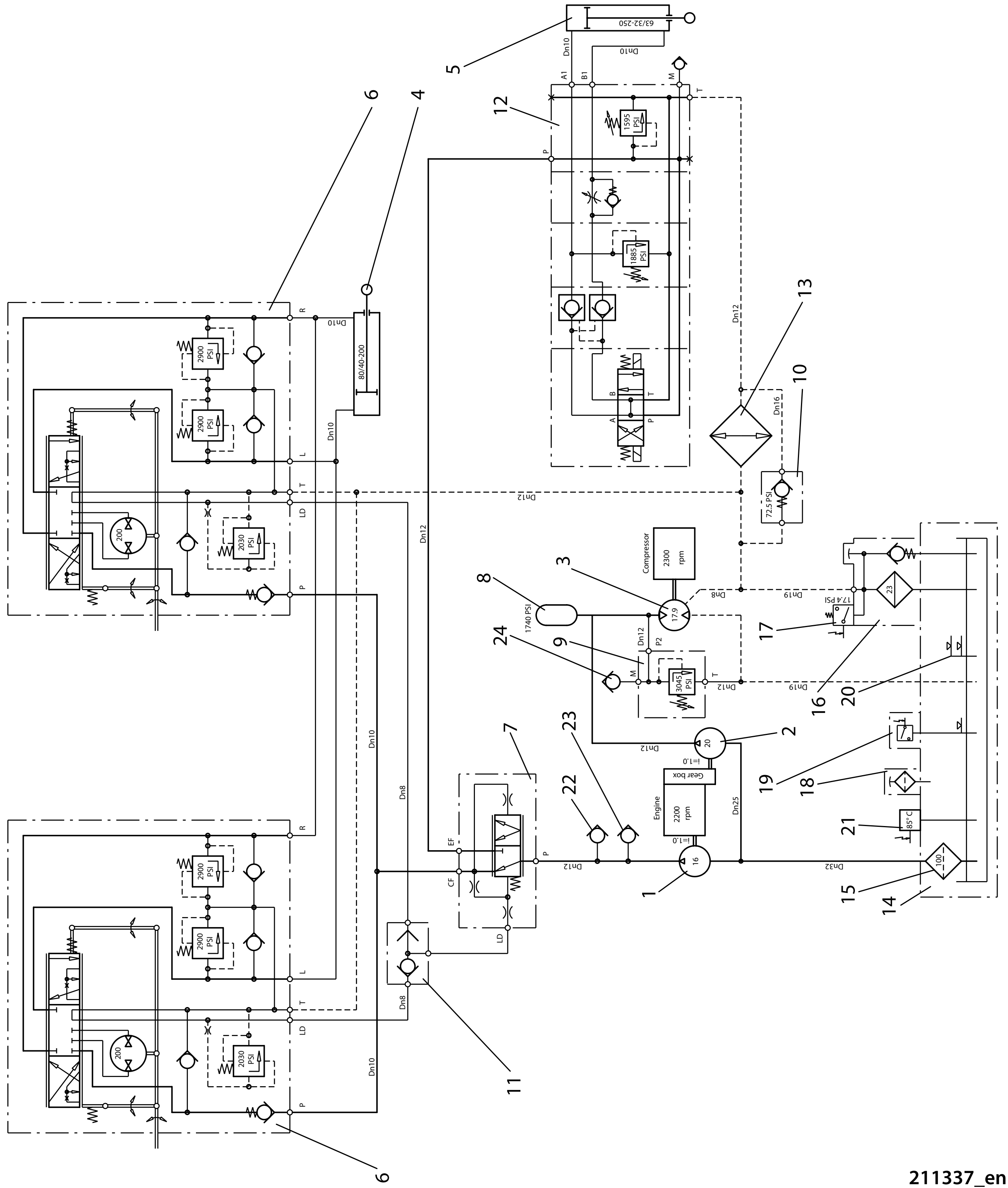
3.8. Annexes

Hydraulics Diagram

1 Steering pump
2 Compressor pump
3 Compressor hydromotor
4 Steering hydromotor
5 Edge cutter hydromotor
6 Servo-steering
7 Priority valve
8 Diaphragm-type accumulator
9 Safety valve
10 Non return valve
11 Logic valve
12 Edge cutter block
13 Combined cooler
14 Hydraulic tank
15 Suction strainer
16 Filter + element
17 Sensor for filter clogged
18 Bleeder valve
19 Level gauge
20 Oil gauge
21 Temperature switch 85±3 °C
22 Fast coupling filling-type
23 Fast coupling measuring-type
24 Fast coupling measuring-type


Compressor
2300 rpm
Engine
2200 rpm
Gear box
i=1.0
1740 PSI
72.5 PSI
17.4 PSI
3045 PSI
1595 PSI
1885 PSI
2900 PSI
2030 PSI
80/40-200
63/32-250
85°C
Dn8
Dn10
Dn12
Dn16
Dn19
Dn25
Dn32
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3.8. Annexes

Air Distribution

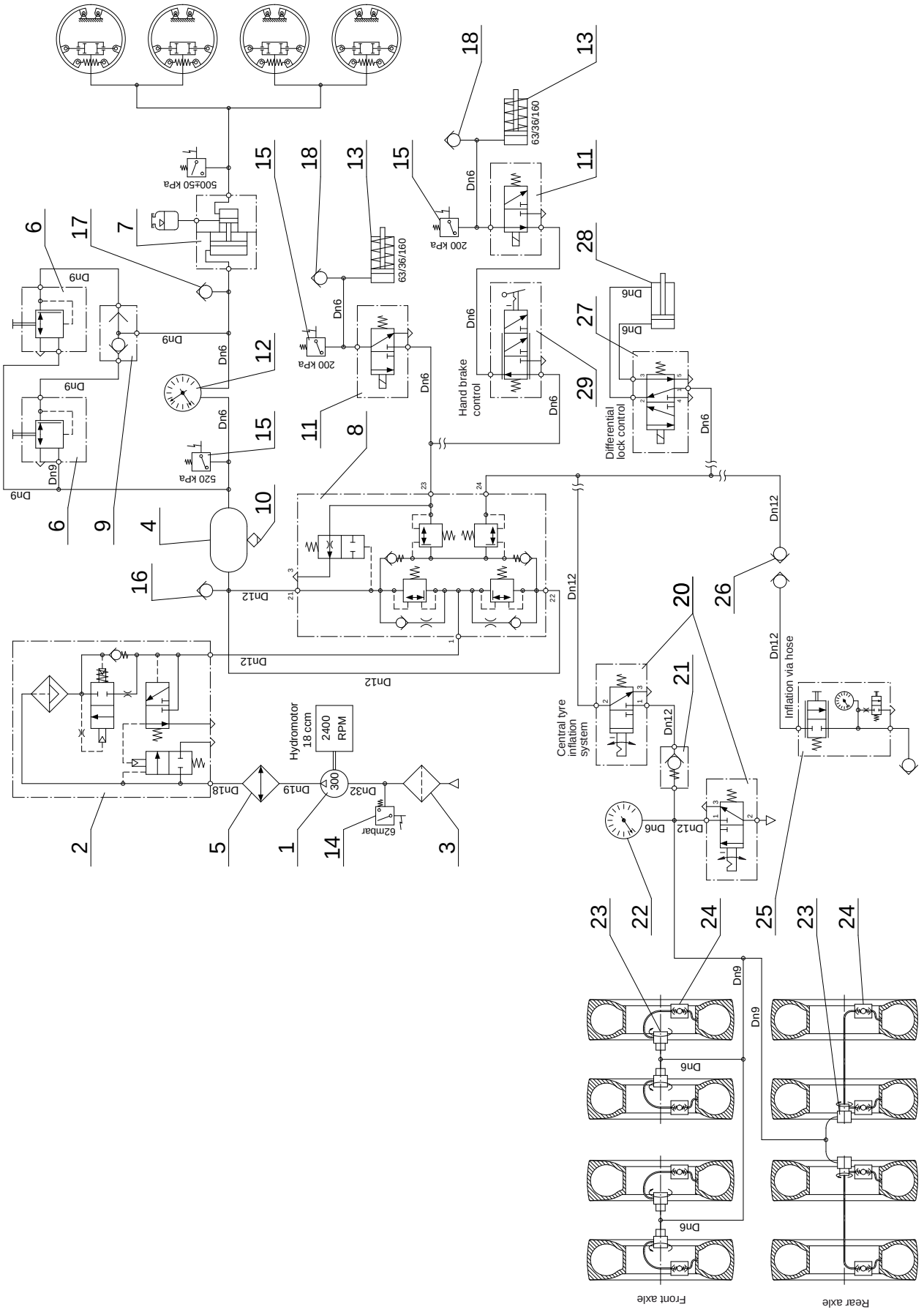
1 Compressor
2 Air drier
3 Air filter
4 Air tank 35 l
5 Cooler
6 Brake pedal
7 Diaphragm-type booster
8 Four-way valve
9 Two-way valve
10 Drain tap
11 Electric valve
12 Brake pressure gauge
13 Spring cylinder
14 Sensor for filter clogged
15 Pressure switch
16 Coupling T – measuring-type
17 Coupling T – measuring-type
18 Coupling T – measuring-type

Option: Central Tyre Inflation System
20 Control valve
21 Non return valve
22 Tyre pressure gauge
23 Rotary-type supply
24 Safety valve

Option: Tyre Inflation Via Hose
25 Air gun
26 Fast coupling measuring-type

Option: Differential lock control
27 Pneumatic distributor
28 Hydraulic cylinder

Option: Hand brake
29 Hand-operated valve


500±50 kPa
200 kPa
63/36/160
520 kPa
62mbar
Hydromotor
18 ccm
2400
RPM
300
Hand brake
control
Differential
lock control
Central tyre
inflation
system
Inflation via hose
Front axle
Rear axle
Dn6
Dn9
Dn12
Dn18
Dn19
Dn32

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Notes

Notes

Notes

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