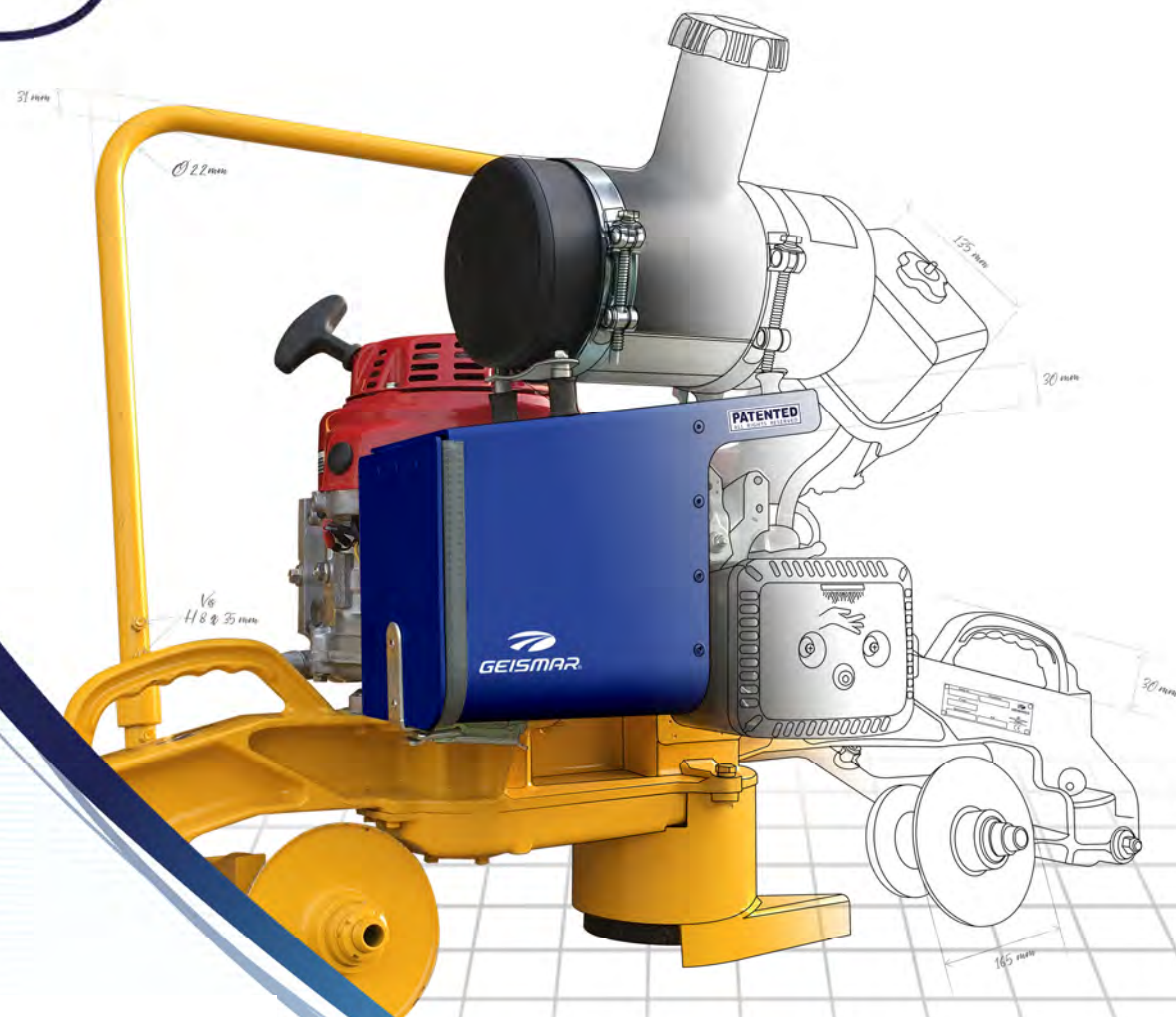


ANGLAIS

French Original handbook

Ref. : 450100 Gb



RAIL PROFILE GRINDING MACHINE

MP.12





GEISMAR, the quality choice!

You have just acquired a machine for laying and servicing railway lines. We thank you for choosing equipment developed and constructed by GEISMAR / STUMEC, the fruit of over eighty years' experience.

Every day since 1924, the GEISMAR Group has been investing in research and state-of-the-art construction to offer you the quality and reliability so essential to the requirements of the world of railways.

This machine, built entirely in France from design through to delivery, has been subjected to continuous, extremely strict controls. Formed of different mechanical elements assembled by highly qualified fitters, your machine has been tested, calibrated and controlled at every stage of its production.

We are convinced that it will give you every satisfaction and are, of course, at your service to offer you any recommendations you may require for its use or its maintenance.

We thank you for the confidence you have shown in us and, in the hope that we will remain one of your privileged partners, we would like to confirm that we are totally available for any comments or recommendations you may care to make.

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The data contained in this manual are not binding on the manufacturer, who reserves the right to modify them at any time, for technical or sales reasons or in order to adapt them to the regulations of the various countries.

Any alterations or modifications to these devices without the express written consent of GEISMAR shall render **CE** Certification invalid, as well as, in certain cases, PAB Guarantee and Certification.

READ THE INSTRUCTION HANDBOOK CAREFULLY PRIOR TO USE



This handbook is protected by copyright. All rights are reserved, in particular all rights regarding copying, translation and processing with electronic systems.

What is the instruction handbook used for?

This instruction handbook was drafted as per the information provided by the Machines Directive 2006/42/EC.

Its aim is to guarantee easy, correct understanding of its use for operators responsible for operating and performing maintenance on the battery-operated machine.

Should anything not be clear in the handbook, we ask operators to immediately request explanations from the manufacturer, so as to avoid misinterpretations that could jeopardise safety.

This instruction handbook forms an integral part of the machine and must be kept for all future reference until the latter's demolition. This handbook must always be available to the operators assigned to work on the machine.

The manufacturer cannot be held liable for damage to people, animals or property due to failure to comply with the standards and warnings laid down in this instruction handbook.

In event of loss of or damage to the instruction handbook, we recommend that you request a copy of it from the manufacturer, specifying the machine model and the revision marked in the above revision chart.

This instruction handbook identifies the state-of-the-art of the technology at the time of machine sale, but can be updated without prior notice.

This instruction handbook must be delivered with the machine in event of transfer to another user.

Information concerning the instruction handbook

This instruction handbook refers to the rail profile grinding machine with combustion engine known as MP12.

Explanations of the various types of text, pictograms and framed boxes used in this handbook:

■ **DANGER** of a risk of accident or injury.










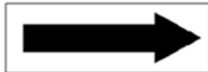
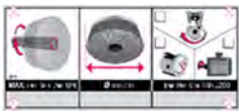

■ **WARNING** against a risk of serious material damage and/or physical injuries.

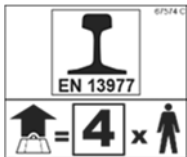






■ **REMARK** to identify a procedure or throw light on a matter.



■ **BOLD TEXT**: highlights the notion.

Pictograms	Combustion engine explanations
	Read this instruction handbook thoroughly and fully before first use. Keep it in a safe place so you can read it again for future use.
	Visual protective equipment must be worn
	Hearing protective equipment must be worn as per applicable site regulations
	Engine speed regulation
	Storage direction requirement
	Fuel tank identification
	Wheel raising and lowering
	Wheel lowering direction
	Information on engine and wheel rotation speed and wheel diameter
	Oil filling information

Pictograms	Combustion engine explanations
	Minimum number of carriers
	Location of unobvious carrying handles
	Wheel rotation direction
	To stop the Honda engine
	On the lifting zones

CHAPTER 1 - Safety

1.1 - Foreword

You will find below a set of rules, observance of which will guarantee the safety of people and goods as part of machine operation.

As failure to observe these rules could have serious (injuries, etc.) or even fatal consequences, we draw your attention to the fact that all people concerned by the use, servicing, storage or possession of the machine described in this handbook must familiarise themselves with these rules.

Users causing an accident due to failure to observe these rules run the risk of being held responsible for the accident.



All machine users must conform to applicable work regulations.

1.2 – Safety and general usage instructions

You must possess the necessary training, skills and tools to use, service and repair the equipment correctly.

Prior to using the equipment, including in maintenance, you must familiarise yourself with the instruction handbook, its attachments and the safety requirements prevailing on the workplace.

You must strictly comply with the site general safety instructions, laid down by the site supervisor, particularly if work is conducted without interruption of traffic.

Use, servicing and repair of equipment must be carried out by competent personnel having received thorough training beforehand. While the technical documentation and instructions will usefully complete knowledge acquired during training sessions, on no account can they replace theoretical and practical skills training provided according to the state-of-the-art rules.

Should the company feel unable to provide its personnel with such training, as is its duty, GEISMAR Alpes remains at its disposal to provide advice concerning the necessary training programme.

Training must cover explanations of the various functions of the equipment, the instructions for use and servicing and the safety rules to be observed, as well as the hands-on exercises.



GEISMAR Alpes cannot be held responsible for modifications made without its written consent or for non-conform assemblies, particularly if original manufacturer parts are not used.

1.3 – General safety requirements

1.3.1 – The operator and his environment

- To guard against the risk of accident or injury, operators must wear:
 - Solid, tight-fitting and non-flammable clothing
 - Strong gloves (of the non-slip type)
 - Safety footwear
 - Protective goggles
 - Hard hat
 - Any other equipment required on the site or for using the machine.
- If hearing protection is used, strict compliance with applicable site safety instructions is always required.
- Ensure that machine vibrations do not lead to a lack of feeling in your hands. Adapt working time to the vibratory level of the machine, which is indicated as part of normal use.
- For underground use (tunnel, gallery) and in enclosed premises, ensure there is good ventilation or extraction to prevent the risks generated by the inhalation and concentration of grinding particles or any other gases (welding, grinding, etc.)
- Do not work with the machine until you are certain you can control it. Do not begin to work with the machine until you are sure you can do so in complete safety, both for yourself (good visibility and light conditions: minimum 50lx, comply with the requirements of EN 1837) and for others (work calmly and carefully).
- Ensure you maintain a very stable position on the ground, banning all unbalanced working positions.
- Users must possess the necessary physical and mental conditions to allow risk-free work.
- The work zone must be free of obstacles. The work zone (and its surroundings) must be clear of flammable materials.
- If something is not clear, whether concerning the machine or the work to be performed, ask a qualified person. Do not make assumptions.
- This equipment must not be used in explosive atmospheres.
- Avoid working positions where exhaust fumes could touch parts of the body (whether or not protected).
- Do not smoke near or when handling the machine.
- Do not work near a conductive rail.
- Generally speaking, take all necessary precautions to prevent flammable products from coming into contact with sources of ignition.
- Operators must ensure that there is no-one else within their range of action and work and, in particular, that they are not likely to collide with anyone in their machine operating path. If, however, someone is in their path, operators must stop and alert of their passage.
- Particular attention must be paid to trucks (if applicable) that take up the entire width of the track and that could cause leg injuries in event of a collision.
- When installed on the track, the machine must only be handled by the number of operators strictly necessary for its normal use.
- As machine dimensions do not allow the fitting of fire extinguishers, we strongly recommend that extinguishers suitable for the fire risk types are installed in the vicinity of the machine.
- Users shall comply with all regulatory environmental requirements regarding their machine.

1.3.2 – The operator and the machine

- Before each use, check that machine operation and condition conform to the instructions. In particular, ensure that the control devices operate freely and are in the “off” or “disengaged” position. Do not make any modifications that would affect proper operation of these devices.
- All the protective parts must be kept strictly in place and in good condition.
- Always keep the machine in a good state of cleanliness and eliminate any accumulation of dust, in particular when it could soak up flammable products.
- Always work moving in a forward direction.
- When working, always hold the machine with both hands in order to remain in control at all times and to be certain to operate it safely.
- Never place the machine near a flame or a source of heat (except when weld grinding).
- Never place the machine on hot or protruding parts that could damage any of its parts (tanks, exhaust, casings, etc.).
- Never leave the machine with the engine running, even when idling. Stop the engine immediately when you stop using the machine. After stopping the engine, wait for the moving parts to come to a complete standstill.

■ Operations on the electrical installations of the machine can only be carried out by accredited persons.

■ It is necessary to read and understand all the signs placed on the machine and to comply with their instructions.

■ The signs present on the machine contain pictograms, nameplates and instruction labels. They must be cleaned, or replaced if they are damaged, missing or illegible. If one of these items is found on a replaced part, a new item must be present on the spare part. Please contact us in this matter.

■ Perform the hoisting operations using the hooking points specially provided on the machine.

■ Insofar as possible, hoisting operations should be limited to machine handling. If a machine has to remain suspended (e.g. for a maintenance operation), the hazardous area must be marked out to ensure that no-one stands under the machine or moves around near it.

■ Never use fuel for cleaning work. Only use fireproof, non-toxic products that are harmless for both the user and the equipment.



Never touch a moving part with a utensil, with your hand or with any other part of your body.



It is essential to stop the engine and leave the control device on the OFF position before carrying out:

- Handling work
- Tool or wrench changes
- Work involving fuel and oils (filling, level monitoring, draining, etc.)
- Repair, maintenance and cleaning work



The machine must never be used for any other purpose than that for which it was intended.

■ Using and handling fuel and oils

- Always keep appropriate extinguishers ready to use in all oil handling areas (storage, filling, etc.).
- Only store fuel and oils in separate drums, specially provided for this purpose, labelled as per regulations. They shall be stored in a safe place away from all sources of ignition.
- On each start-up and during operation, check there are no fuel leaks from machine parts. If you suspect a leak, immediately stop the motor and only start the machine again when the leak has been repaired.
- Never work on an oil tank or handle oil for filling or for any other purpose in areas that might contain: a source of ignition (e.g. blow torch, sparks, etc.) or incandescent materials or materials at high temperatures (e.g. lit cigarettes, welding deposits, miscellaneous slag, etc.). Always carry out these operations outdoors and on properly ventilated premises.
- All mobile phones must be switched off when filling or handling fuel.
- Carefully screw on the tank fuel filler cap after each use and check that no oil is leaking.

- Always unscrew tank fuel filler caps slowly so as to allow pressure, if any, to dissipate without spraying fuel. Pay particular attention in the case of high ambient temperatures.

- Never completely fill tanks with fuel when the machines have been heated. Never exceed three quarters of tank capacity.

- When refuelling machines that have been heated, if fuel starts to bubble in the tank, screw back on the filler cap immediately and let the machine cool down.

- Only use fuel appropriate for the engine with which the machine is equipped. Consult the engine handbook.

- Never breathe in fuel fumes.

- If you need to empty the oil tank, pour the oil into a specially provided recipient, labelled as per regulations. Close the recipient hermetically even if it contains only small quantities of oil. Never use glass recipients.

- Do not use fuel for cleaning. Use only non-flammable and non-toxic products that are harmless for the user, the equipment and the environment.

- If, for any reason, fuel has been spilled around the filling area, clean it up immediately. Clean immediately any fuel sprayed on skin. Check that fuel has not been sprayed onto your clothes and, if it has, change them immediately. Discard cloths or any other wiping materials soaked with fuel, and store them in a safe place away from all sources of ignition and combustion. Start the engine at a sufficient distance from the place where the fuel was spilt (more than 6 metres away) and do not move over this area with the engine in operation.



In some cases, oil handling comprises risks of the same kinds as for fuel. It is then essential to take the same precautions as described above for fuel.

■ The tools to be used on the machine

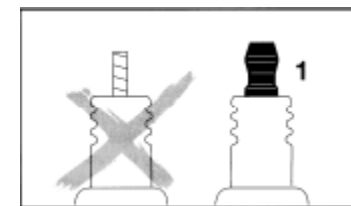
- Only use the types of tools provided for normal use of the machine.
- Regularly measure the speed of the rotating tools.
- Never use tools at speeds higher than the maximum speed for which they were designed and approved.
- Do not use damaged or excessively worn tools.

■ The machine engine

- Never touch the hot parts of the engine, particularly the exhaust. If a special operation has to be performed on the engine, wait for the latter to cool down.
- The engine factory setting corresponds to the conditions of the production site (fuel, temperature, altitude, etc.). On machine takeover, check the engine rotation speed and correct if necessary.
- Regularly take engine rotation speed measurements, particularly after reassembling the machine. Correct if necessary.
- Never exceed the speed stipulated in the technical characteristics.
- After launching with a starter, do not forget to put the engine back in normal position.
- Do not wind the launch rope around your hand or release it suddenly.
- After starting, if machine operation is not satisfactory, stop the engine and alert the maintenance manager.
- For petrol engines, only use spark plugs, the end of which conforms to sketch 1 opposite. If a nut is used, ensure it is properly locked in place. After reassembling the spark plug, check that its cap is in good condition and secured properly onto the spark plug. Generally speaking, check the fastening to ensure, that under no conditions, sparks can be generated.

■ Using trucks (if applicable)

- A machine designed to work on a truck must not be used without it. The truck then forms an integral part of the machine.
- The machine and truck must not be separated in their use.
- All trucks, use of which is dedicated to a machine, must not be used as a means of transporting equipment or personnel or be attached to a vehicle.
- Before installing the machine on its truck, it must first be positioned correctly on the track so that it can run freely. If the track is sloping, ensure that the truck is locked in position when the machine is placed on and taken off the track.
- Caution: the truck takes up the entire width of the track and may cause leg injuries in event of a collision.



1.4 – Specific safety instructions

1.4.1 – Risks that can be generated by use of the MP.12 type grinding machine

The main risks that “MP12” type rail grinding machines may generate for their users and those around them, are as follows:

- **FIRES** further to fuel handling.
- **FIRES** caused by sparks encountering a flammable material.
- **BURSTING** of wheels used in abnormal conditions.
- **INJURIES** by flying sparks (eye protection is particularly necessary) or, in some cases, flying wheel debris.
- **BURNS**, severe, should part of the body come into contact with the rotating wheel.
- **BREATHING IN** of particles due to grinding: if necessary wear a protective device preventing you from absorbing these particles.

General notions

- Do not use wheels that are damaged, split or cracked
- Rotate new or reassembled wheels off-load for 30 seconds. Personnel should stand away during this test, except for the control operator who should remain at the controls of his machine outside the wheel rotating area, ready to stop the engine if required.
- During grinding, do not stand in a direct line with the grinding sparks. If necessary, insert a shield that will intercept the jet before it reaches any dangerous points (bush fire hazard in summer).
- Ensure the wheel is not struck during its operation, as this could result in it bursting.
- Ensure that the wheel is never in contact with a sleeper or ballast or with any other foreign object.
- Before starting the machine, check proper condition and fastening of the wheel protective cap. Never modify it.
- Fit a new cap if the wheel bursts or whenever its resistance appears to be decreased.
- Regularly take wheel and engine rotation speed measurements, particularly after reassembling the machine. Correct if necessary.

- Only use authorised wheel types, both in terms of dimensions and composition characteristics.
- Never use wheels at speeds greater than the maximum speed recommended by the manufacturer. This speed must be marked on each wheel.
- Before derailing the machine, or between two grinding sequences causing a displacement, stop the engine and put back the wheel, so that it is retracted inside its protective guard.



ONLY USE WHEELS:

- With a maximum operating speed greater than the maximum speed of the wheel-holder shaft, marked on the machine.
- With an outer diameter less than or equal to the maximum authorised diameter marked on the machine.
- Authorised by applicable regulations for this machine type.



Due to the engine tilt possibilities imposed during work, the following rules must be complied with:

- Always bring the wheel to vertical position, stop grinding, and stop the engine before opening the fuel filler cap.
- Never fill the fuel tank with more than $\frac{3}{4}$ of its capacity (to avoid seepage when working with slanting engine).
- Never work on a fuel tank, or handle fuel for filling or any other reasons in zones where there may be:
 - Ignition sources (e.g. blow torch, sparks, etc.)
 - Incandescent materials or materials at high temperatures (for example: lit cigarette, weld deposits, various slag, etc.)
 - Always work outdoors and on properly ventilated premises.
- Thoroughly seal the tank fuel filler cap after each use and ensure that there are no fuel leaks.

1.4.2 – Environmental conditions

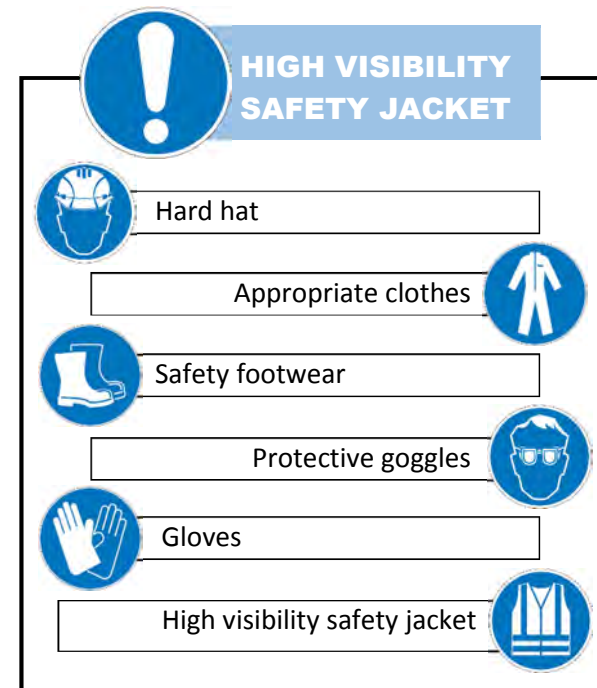
- The machine must not be used in explosive atmospheres.
- In event of underground work or work on closed premises, ensure that appropriate ventilation or extraction means are provided.

1.4.3 – Personal protective equipment

- Personnel using this equipment must wear the clothes stated in *Chapter 1.3* –.
- They must wear a hard hat and safety footwear with non-slip soles and steel tip.
- They must wear spark-resistant clothes: flame-retardant apron and gaiters or boots
- Also, use of a protective device avoiding breathing in of grinding particulates is recommended.



Use of hearing protection is also recommended. However, strict reference must be made to railway regulations applicable on the site to determine whether or not they can be used.



1.4.4 – During use

“Conform use” assumes compliance with the requirements inherent in the use and maintenance of the machine described in this handbook.

Moreover, it is necessary to comply with all the industrial injury prevention instructions described and recommended, while also taking into account of the general safety rules and the legislation applicable in the country concerned.

- The machine must only be used by a single authorised operator.
- The engine must be started as described in chapter 4.1 – Starting and stopping.
- The operator must be positioned as described in chapter 2.7 – Operator work position.
- Never operate the machine without its protective casings and filter.
- If compressed air is used for cleaning, wear protective clothes, a mask, goggles and hearing protection.
- If work takes place on a two-way track, pay particular attention to the traffic running on the track remaining free for circulation.
- In all cases, the machine must be used in accordance with the railway instructions applicable on its place of operation.
- Use of the MP12 is strictly forbidden in event of absorption of alcohol, drugs, or any other medication reducing the operator’s attention (drowsiness) and with a risk of limiting his ability to react.







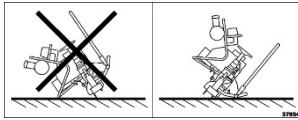


This machine was designed and built solely for grinding railway rail profiles
Uses other than those described in this instruction handbook shall be considered to be *“non-conform”* and shall free the manufacturer from all liability; only the user shall be held liable


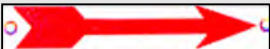
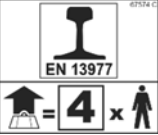

1.4.5 – Safety instructions and pictograms

The safety instructions and pictograms must be present on the machine in the positions provided.

Should one of them be missing or damaged, a new one must be ordered immediately and fitted in the position provided.

If a part bearing a pictogram has been replaced, check that a new pictogram has been fitted on the new part.

REF	Visual	Position
12528		Stuck on the machine chassis next to the operating arm locking handle (Yellow background)
---		Riveted to the machine frame <i>(For SNCF approved machine)</i>
		Riveted to the machine frame <i>(Except SNCF)</i>
12937		Stuck to the engine air filter (Blue background)
37654		Stuck to the storage box on the operator side (White background)
12569		Stuck on each of the machine carrying arms (Blue background)
12670		Riveted to the machine chassis, above the wheel casing

REF	Visual	Position
12623		Stuck to the handling zones (Blue background)
12412		Riveted to the machine chassis, above the wheel casing (for the positioning direction of this plate, see § 3.1 "Positioning the wheel")
67574		Stuck near the handling points (White background)
12543		Stuck on the tank (White background)

1.4.6 – Training programme instructions

- General and specific safety instructions
- Reading the instruction handbook
- Machine field testing
- First level maintenance training



1.4.7 – Dismantling / Recycling

Recycling is a waste treatment process (for industrial waste or household refuse), allowing the re-introduction, in a product production cycle, of the materials that made up a similar product having reached its end of life, or manufacturing residues.



Recycling has two major ecological consequences:

- Reduction in waste volume and thus in the pollution that this waste would cause (some materials take decades and even centuries to decompose)
- Preservation of natural resources as the recycled material is used in the stead of the material that should have been extracted.
- The GEISMAR product must be recycled



This operation can only be carried out by a company or by companies competent in the recycling of industrial waste, and conducted as per applicable regulations.

CHAPTER 2 - Description of the machine

2.1 - General

Manufacturer:	GEISMAR ALPES Route d'Italie 38110 LA TOUR DU PIN
Equipment description:	Rail profile grinding machine
Type:	MP.12

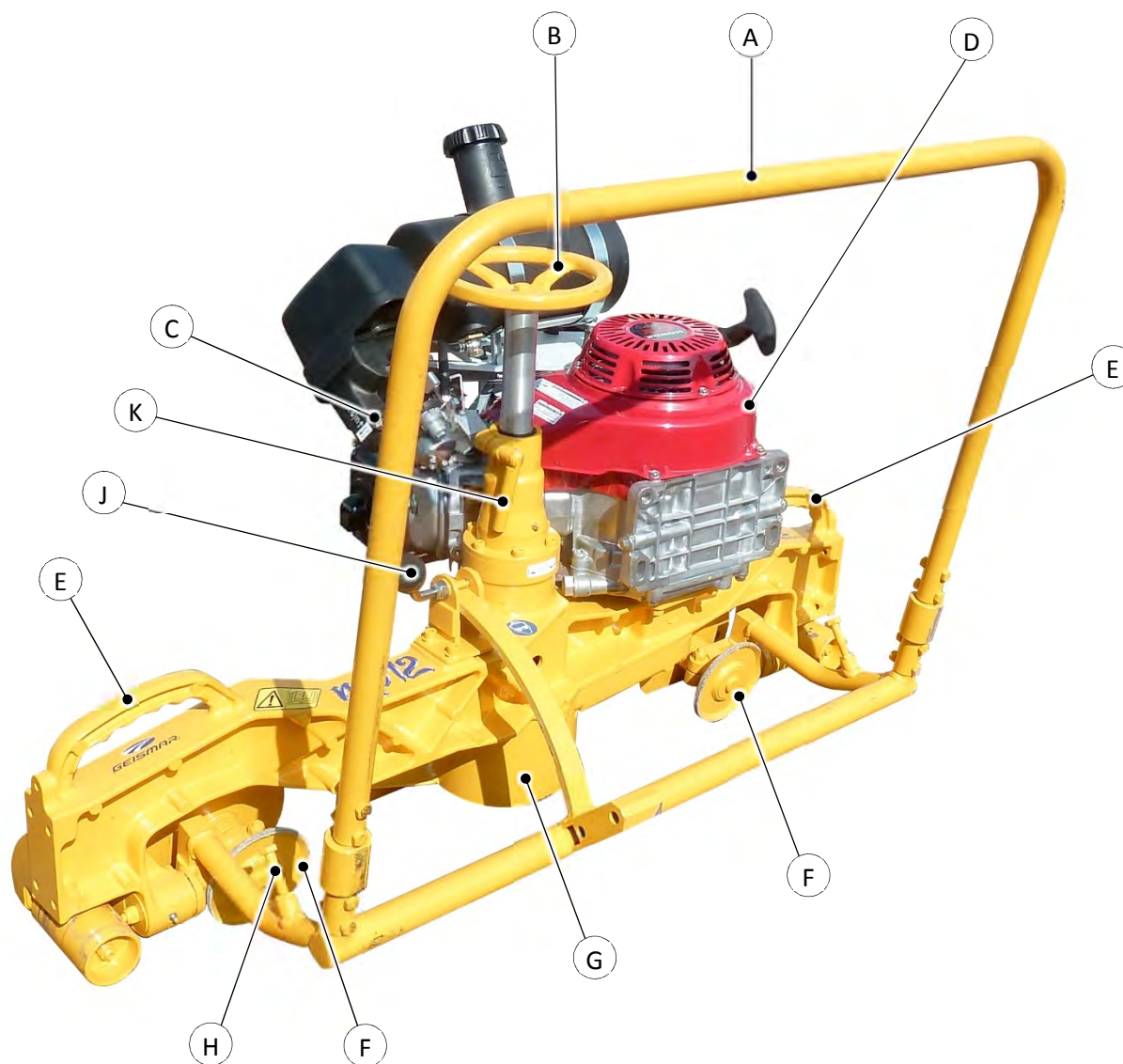
The MP.12 rail profile grinding machine was designed to grind rail heads and welds, including the radius of curvature and sides.

Its outstanding performances and sturdiness due to its non-deformable alloy rigid chassis ensure operators an optimum comfort of use.

Its guide rollers and wide wheelbase guarantee continuity of grinding from the horizontal to the vertical position.

It has been entirely designed using the cutting-edge techniques employed in the machine-tool industry.

2.2 - Overview



Item	Description
A	Operating handle
B	Wheel adjustment flywheel
C	Engine stop
D	Engine
E	Handle
F	Guide roller
G	Wheel casing
H	Limit stop
J	Operating arm locking handle
K	Wheel lowering locking handle

Photographs and illustrations for information only and non-binding: they may include options

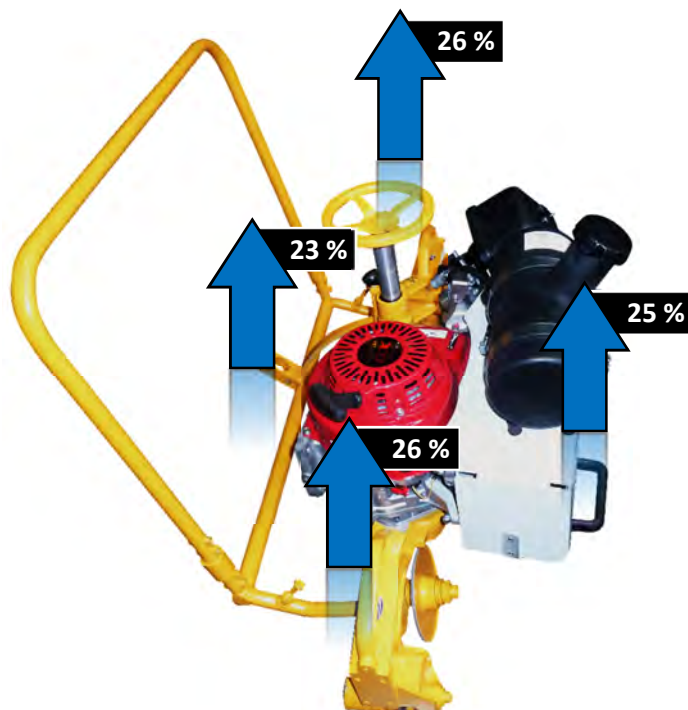
2.3 – Technical characteristics

Engine Model		L48R	
Type		4-stroke, vertical cylinder, air-cooled diesel engine	
No. of cylinders		1	
Bore x stroke		2.76 X 2.24 in. (70 x 57 mm)	
Displacement		13.4 cu. in (0.219 L)	
Continuous rated output	Rpm (min ⁻¹)	3600	3000
	kW	3.1	2.8
	PS	4.2	3.8
Max. rated output (net)	Rpm (min ⁻¹)	3600	3000
	kW	3.5	3.1
	PS	4.7	4.2
High idling	rpm (min ⁻¹)	3800 ± 30	3175 ± 30
Engine weight (dry)	with electric start	70.5 lb (32.0 kg)	
	without electric start	59.5 lb (27.0 kg)	
Cooling system		Forced air by flywheel fan	
Lubricating system		Forced lubrication with trochoid pump	
Starting system		Electric start/recoil start	
Dimensions (L x W x H)		13.1 X 15.1 X 16.4 in. (332 x 384 x 417 mm)	
Engine oil pan capacity	Dipstick upper limit	0.85 qt (0.8 L)	
	Dipstick lower limit	0.58 qt (0.55 L)	
Fuel tank capacity (Limit Value)		2.0 qt (1.9 L)	

2.4 – General information

2.4.1 – Load distribution

The diagram below defines load distribution as a percentage of machine weight.



Load distribution when lifting, using the carrying areas or handles.



ADVICE CONCERNING CARRYING OF HEAVY LOADS

- Keep a straight back aligned with your pelvis and head, respecting the natural curvature of the spine
- Force with your legs to prevent placing all the strain on your back.
You thus need to bend your legs and avoid bending your back!
- Swivel on your feet to avoid twisting your trunk,
- Stand so your feet are apart at shoulder width and place your feet flat on the ground to help you keep your balance



2.4.2 – Handling the machine



Before moving the machine, ensure that the engine is stopped

In accordance with the requirements of standard EN 13977:2011, the authorised weight per person must not exceed 20kg per gripping zone, when the load is distributed over several persons, or 25kg for lifting by one person.

■ By human strength:

The machine can be handled by means of 4 carrying zones *Item* ① (see chapter 2.4.1 – Load distribution) identified by this label when they are not obvious:



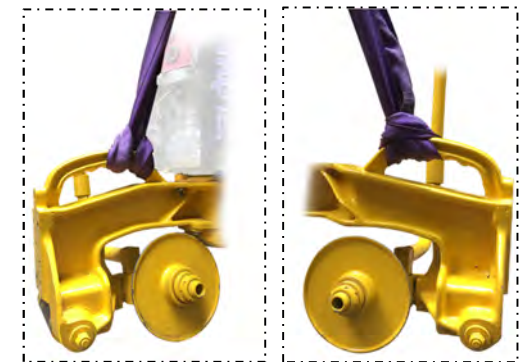
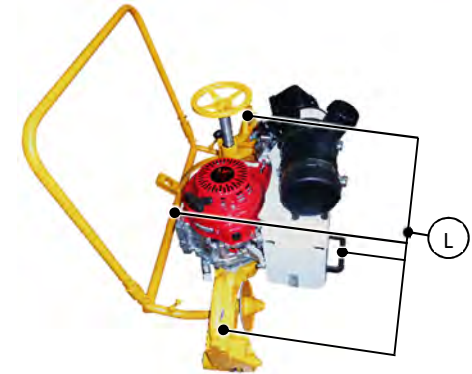
■ Using a lifting system:

The machine can also be lifted using a crane or any other lifting device, the lifting capacity of which exceeds the machine weight defined in Chapter 2.3-Technical characteristics:

- Pass inside the lifting points, approved slings or straps appropriate for the weight to be lifted (See Fig.1)
- Lift the machine, gently and smoothly
- A safety perimeter defined by the site foreman must be complied with to prevent incorrect operations while the machine is being lifted
- This perimeter could be modified by the site supervisor, particularly if work is performed without interruption of traffic.
- Ensure that no-one is near the machine while it is being lifted or moved.

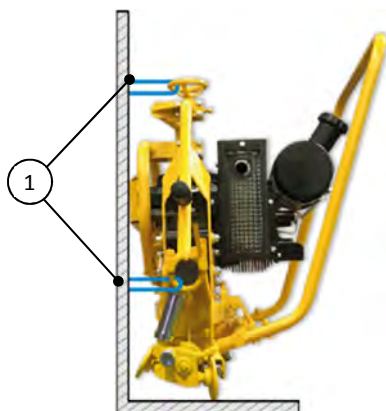


The Labour Code obliges all people using lifting accessories to have their equipment checked by competent and qualified personnel.



2.4.3 – Transporting the machine

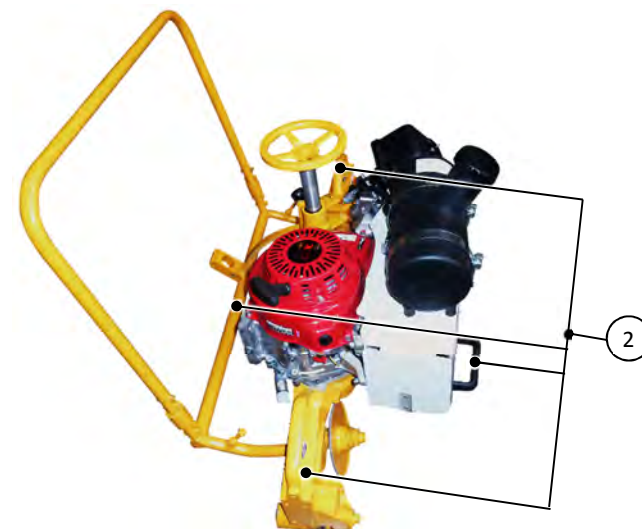
- The machine must be transported by a means of locomotion appropriate for its weight and size.
- Secure it thoroughly with straps at the points defined *Item ①*
- Never transport the machine when the engine is running.
- The machine must be transported only in the position shown opposite, in order to avoid fuel leaks or oil backflows that could cause starting problems the next time it is used. The wheel must be disassembled.
- Never transport the rail profile grinding machine in a vehicle when the wheel is assembled.



To transport the machine, the engine must be stopped.

2.4.4 – Installing the machine on the rail

- With the help of 4 operators, grip the machine by the 4 carrying zones *Item ②* (see chapter 2.4.1 – Load distribution)
- In a coordinated movement and on the orders of one of the operators, lift the machine in order to move it and place it on the rail to be ground (See chapter 2.7 – Operator position)
- The operator must be positioned inside the track, with the engine outside the track *Item ④*
- The rollers must run freely on the rail.
- The machine must be held in horizontal position or be wedged to prevent it from toppling backwards or forwards



2.4.5 - Storage

■ General storage instructions

When the equipment is not in use, it must be stored to preserve its integrity.

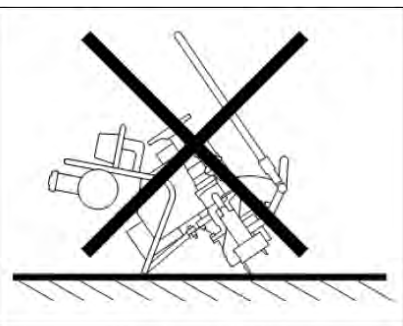
Badly stored equipment could deteriorate during its use. Therefore, it is important that the personnel responsible for the storage operations take the greatest care with its execution and strictly comply with the stipulated measures.

■ Specific storage instructions

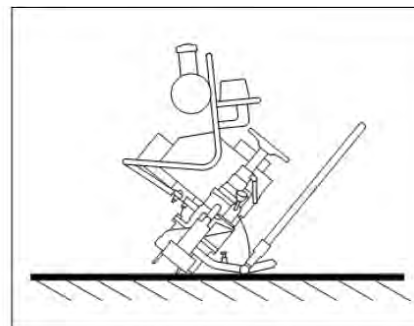
- Empty the fuel tank in the event of prolonged machine storage.
- Never store the machine when a wheel is mounted.
- Store the wheels in a dry place, protected from frost, sunlight and intense heat. Place them so they are not subjected to strain in order to prevent all risk of warping. Storage time must not exceed 2 years maximum.

The machine must be stored on the operating arm holder. The aim of the holder is to keep the engine in the horizontal position throughout storage.

- Check engine hoses after prolonged storage.



Incorrect storage



Correct storage

■ Storage protection

Choice of storage protection systems depends on 2 main factors:

- storage duration
- storage conditions: “unsheltered” storage (exposure to the elements) and “sheltered” storage (building, closed or open shed, awning, etc.)

Equipment must only be stored once it has been run in.

■ Storage premises

Generally speaking, the premises intended for equipment storage must guarantee the best possible protection against:

- dust, exhaust fumes, humidity
- direct sunlight
- rapid temperature fluctuations

■ Placement in storage

The condition of the equipment when it is put back in operation, after storage, depends on how it was prepared and protected prior to its placement in storage:

- equipment cleaning (after cleaning, protect moving parts with grease).
- technical inspections to detect potential anomalies.

2.4.6 – Control and ergonomic parts

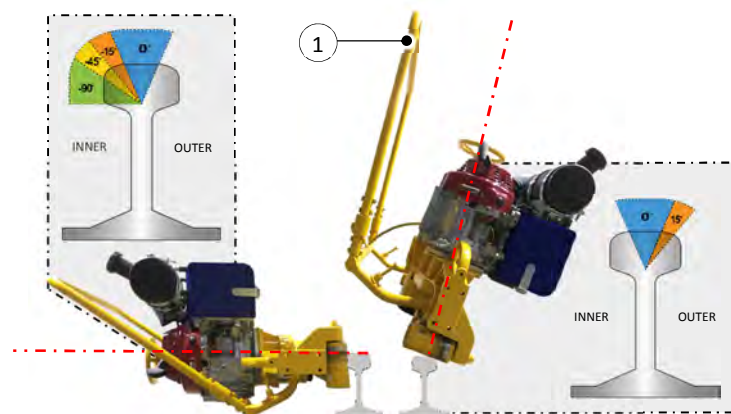
■ Operating arm locking handle:

- Operating arm *Item ①* FOLDED the operator can tilt the machine against himself to -90°
- Operating arm *Item ①* UNFOLDED the operator can tilt the machine in front of himself to 15°

■ Operating handle *Item ①*



This handle lets the operator:

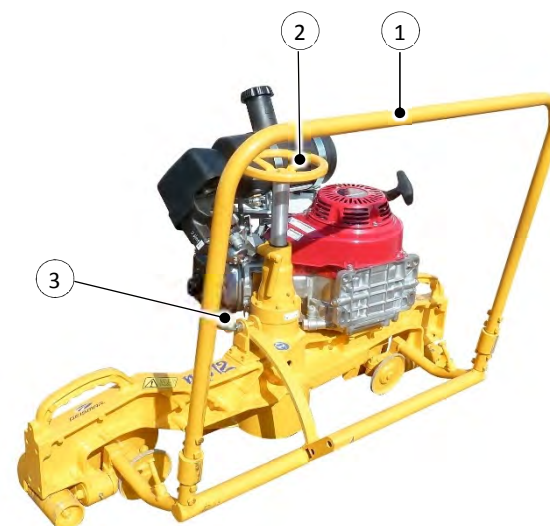
- Move the machine from right to left on the weld.
- Tilt the machine against himself up to -90° .
- Tilt the machine in front of himself up to 15°



■ Wheel adjustment flywheel *Item ②*

Used to adjust wheel lowering

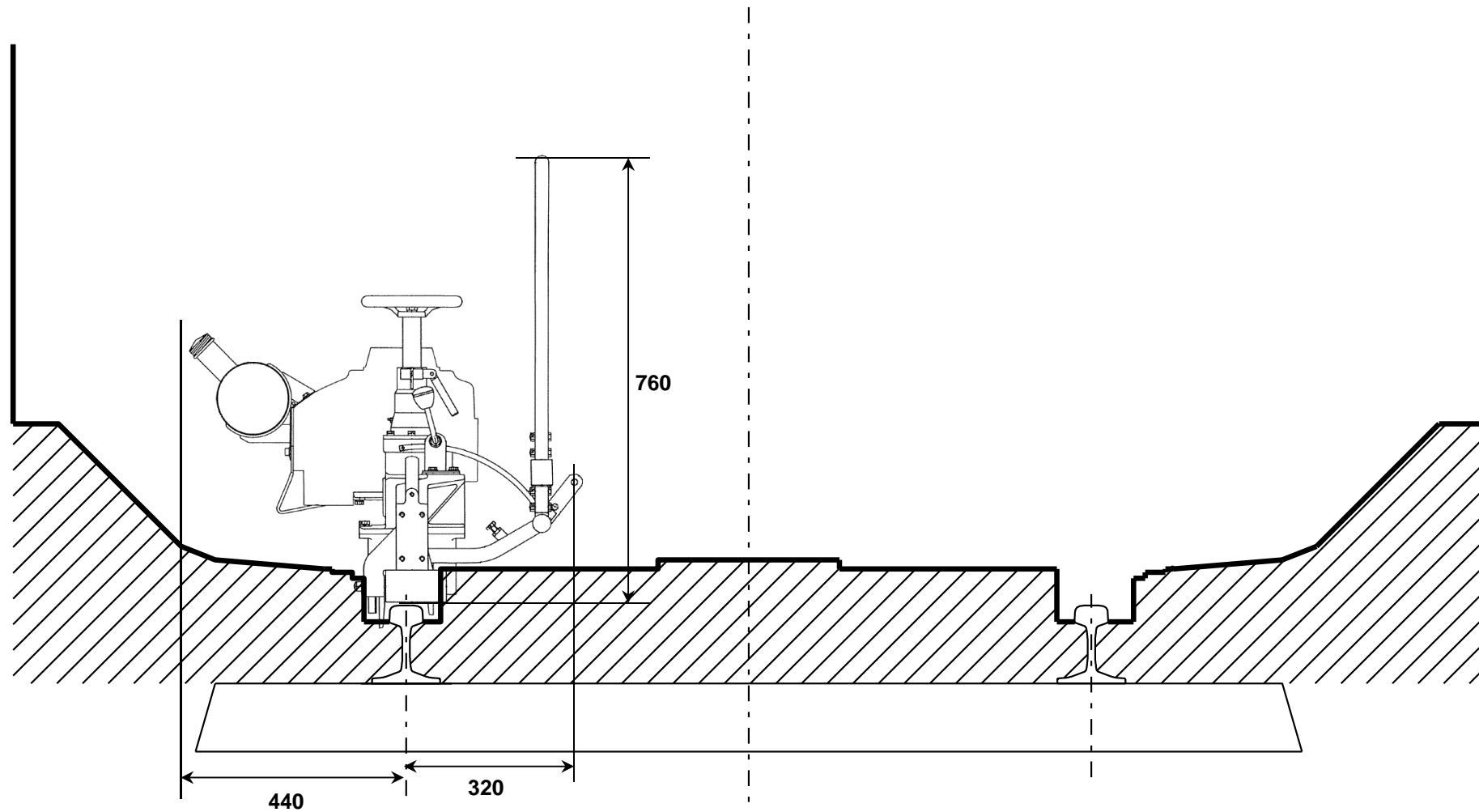
- Turn the flywheel in a clockwise direction  to lower the wheel
- Turn the flywheel in an anticlockwise direction  to raise the wheel



Beyond 15° the engine will automatically cut off.

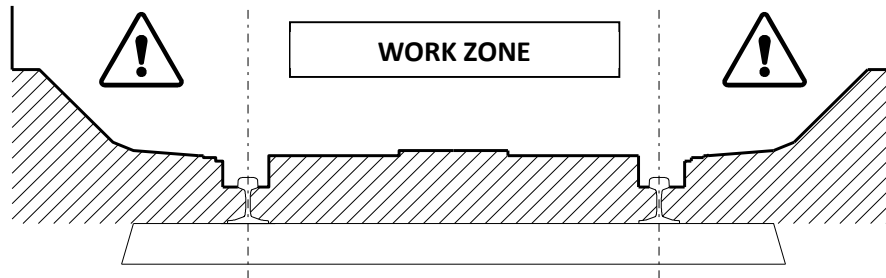
2.5 – Machine position in the gauge

The diagram below shows the machine dimensions with respect to gauge UIC 505-1 (nominal track gauge of 1435).



2.6 – Operator work zone

The operator work zone is located between the two rails of the same track. This work zone guarantees that the operator works in optimum safety conditions. Consequently (insofar as possible), the operator must always be inside this zone.



! If work calls for the operator to be outside this work zone, safety conditions must be guaranteed, particularly if work takes place without interruption of traffic.

2.7 – Operator work position

During work, the operator must always be in the position shown in the photo below with his hands firmly holding the operating handle. To adjust wheel height, he must hold the operating handle in one hand and, with the other, operate the wheel adjustment flywheel.

This work position guarantees perfect machine control.



Operator position

CHAPTER 3 - Installation and implementation

3.1 – Inspecting the machine

Each machine part must be examined by a competent person prior to putting into operation, so as to detect any faults.

Inspection shall mainly comprise a visual and a functional part.

The inspection phase shall ensure that the parts are reliable and that they have not been damaged during transport or storage.

■ Checking the all-welded assemblies *(this check is performed with the engine stopped)*

Visually check there are no external faults, deformations, surface cracks, wear signs or corrosion marks.

■ Checking tightening

Check that all the accessible screws and nuts are properly tightened.

■ Checking levels *(this check is performed with the engine stopped)*

- Fuel level: check the fuel level and top up if required (be sure to refer to 1.3 "General safety requirements, part *Using and handling fuel* before doing anything).
- Engine oil level: check the engine oil level using the dipstick and top up if required. The level must be slightly lower than the maximum mark on the dipstick, but must never exceed it.

■ Checking the safety equipment

Start the engine (be sure to refer to 4.1 Stopping and starting) and check proper operation of the safety equipment (engine remote stopping).

■ Checking operation

Check the operation of the control devices. Check that the wheel raising/lowering flywheel and the tilt control function properly, i.e. that when they are operated, device movement is as smooth as possible with no sticking points.

■ Checking the wheel and its fastening

Visually check the condition of the wheel and its holder. Check that the wheel is retracted into its protective cap.

■ Checking the protective cap

Check there are no impacts or cracks on the protective cap.



If an anomaly is detected during this inspection phase or during use, the machine must be reworked to conformity by competent personnel or by the manufacturer before it is used again.

3.2 – Installing the wheel

Proceed as follows to install the wheel:

■ Disassembling the wheel:

- Lower the wheel as far as it will go (flywheel anti-clockwise direction), then disassemble the wheel casing Item ② by unscrewing the 2 screws Item ① (17 wrench) (see fig.1).
- Lock in place the spindle Item ④ using a 23 open-end wrench, then unscrew the “wheel+wheel-holder” assembly using a second 23 open-end wrench.
- Separate the wheel Item ⑥ from the wheel-holder plate Item ⑤:
 - **assembly Fig.2** → Unscrew the fastening screws Item ③ (13 open-end wrench).
 - **assembly Fig.3** → Lock in place the wheel Item ⑥, then unscrew the wheel-holder plate Item ⑤ (23 open-end wrench).

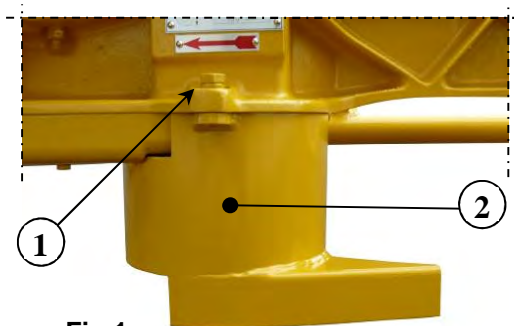


Fig.1



The wheels to use must conform to the technical characteristics defined in chapter 2.3 – Technical characteristics / Wheel.



The wheel must be installed with the engine stopped and the machine placed on the ground.

■ Assembling the wheel:

- **assembly Fig.2** - Position the wheel Item ⑥ so that its inner \varnothing bears on the shoulder of the wheel-holder plate Item ⑤. Place the fastening screws Item ③ on the wheel Item ⑥ and bring them up until they touch. Then tighten their screws.
- **assembly Fig.3** - Lock in place the wheel Item ⑥, then screw on the wheel-holder plate Item ⑤ (23 open-end wrench).
- To reassemble the “wheel+wheel-holder” assembly, carry out operations 2 and 1 in the reverse order to disassembling.

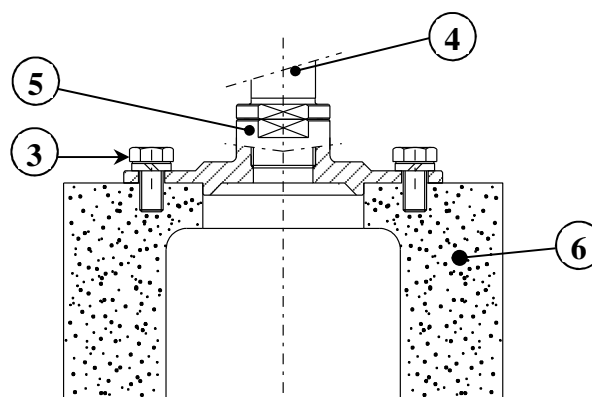


Fig.2

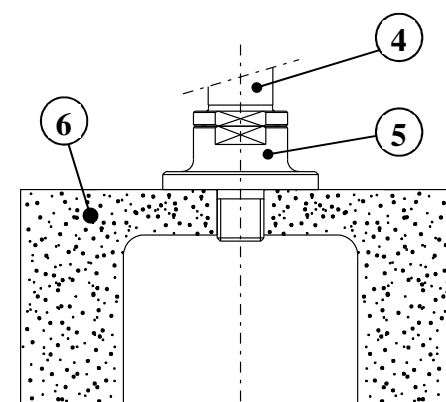


Fig.3



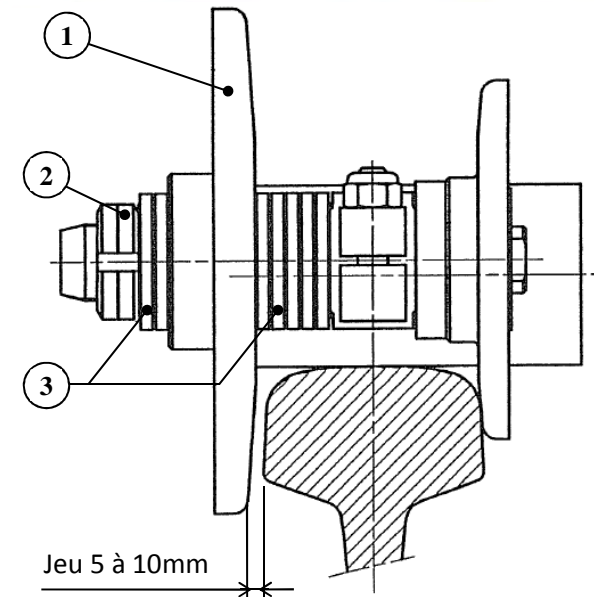
The wheels have use-by dates. Ensure that these dates are not exceeded.

3.3 - Adjusting the guide rollers

Guide roller spacing can be adjusted so as to be able to place the machine on all rail types, irrespective of head width.

3.3.1 - Adjustment for Vignole rails

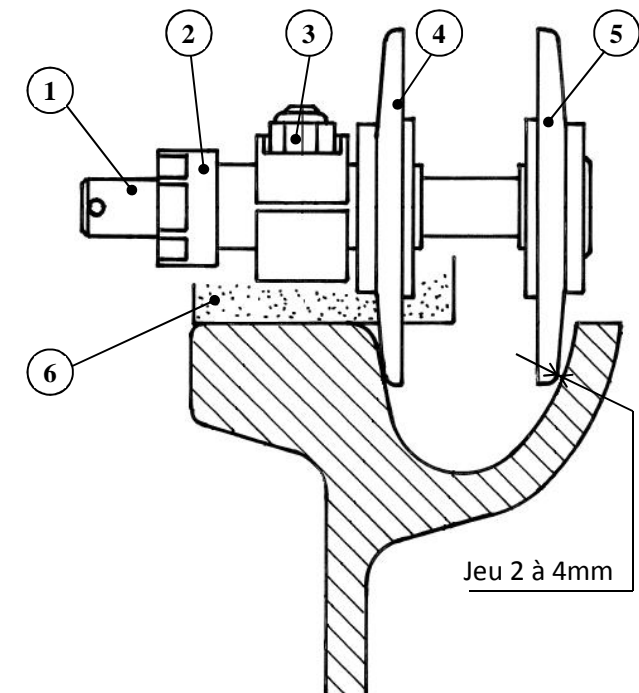
- Adjust one of the two guide rollers of the machine as follows:
 - Disassemble the two guide flanges Item ① held in place by the nuts and counter nuts Item ② (25 pin wrench).
 - remove or put back, on each of the two roller axles, the number of spacers Item ③ required (the same number on each side) to obtain a clearance from 5 to 10mm between the rail head and one of the two guide flanges Item ① (see sketch).
 - Place the unused spacers outside the guide flanges Item ①.
 - Put back and thoroughly tighten the nuts and counter nuts Item ②.
- Repeat this assembly on the second guide roller.



3.3.2 – Adjustment for grooved rails (if equipped with grooves)

- Adjust one of the two guide rollers of the machine as follows:
 - Release the nuts Item ② and Item ③.
 - Place the machine on the rail, positioning the guide rollers Item ④ and Item ⑤ in the groove.
 - Position the wheel Item ⑥ aligning the outer edges of the rail and the wheel (see diagram) by progressively moving the machine to the outside of the track.
 - Bring up the guide roller Item ④ so it touches the outer side of the groove and lock in place the nuts Item ③.
 - Push the axle Item ① to draw up to the guide roller Item ⑤ a few millimetres from the inner side of the groove and lock in place the nut Item ②.

We recommend use of a Ø80 mm wheel and an appropriate wheel protective cap (Ref. 37101), designed to raise the fillet.



3.4 - Fuel

3.4.1 – General instructions

The rail grinding machine four-stroke engine must be supplied by petrol with an octane rating of at least 90 RON. Standard unleaded petrol can be used if it does not contain more than 10% ethanol (E10) or 5% of methanol in volume. Oil is a decisive factor in engine performance and service life. 4-stroke automotive oil must be used.



Petrol:

GASOHOL and ALCOHOL are **FORBIDDEN**



Engine oil:

Use a 4-stroke engine oil equivalent to or higher than engine requirements.



Petrol storage:

Petrol oxidises and deteriorates over time. Empty the fuel tank and let the engine run until it stops each time before the machine stops running.

3.4.2 – Refuelling

Take care when opening the fuel canister.



Pressure can build up in the canister. Open it with care.

Before refuelling, thoroughly clean the fuel filler cap and its surrounding area to ensure that no impurities can enter the tank.

Position the machine vertically so that the tank fuel filler cap faces upwards.



Never refuel when the engine is running or overheated.

■ Opening the fuel filler cap

- ① Turn the cap manually as far as it will go in an anti-clockwise direction.
- ② Remove the cap.



Open the tank fuel filler cap with care so that internal overpressure can escape slowly, without any fuel spray.



Never open the cap with a tool, as the cap could be damaged and fuel could escape.

Fill the tank in a properly ventilated place away from possible ignition sources such as blow torches, sparks, welding deposits.

To start the machine, place it more than 6m from the filling point.

■ Closing the fuel filler cap

- ① Present the tank fuel filler cap opposite the filling orifice.
- ② Screw on the cap.



During filling, do not spill fuel and never fill the tank up completely.

Only introduce a quantity of fuel equal to $\frac{3}{4}$ of its maximum capacity.

CHAPTER 4 – Using the machine

4.1 – Starting and stopping



The machine must only be started once it is on the track

■ Starting

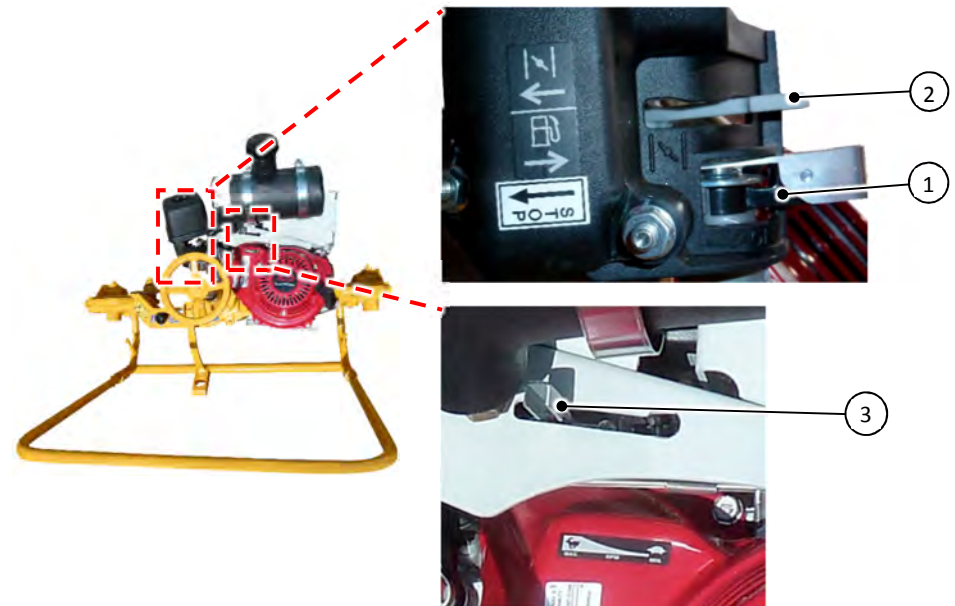
- Open the fuel valve Item ①.
- Place the starter pull cord Item ② on the closing position (if necessary, do not use the starter when the engine is hot or when atmospheric temperature is high) and adjust the engine speed to the slowest speed.
- Start the engine:
 - Gently pull on the automatic starter until the compression point is reached
 - Give a brisk tug to start the engine
 - Repeat if necessary
- Let the engine idle for a few moments until speed stabilises and engine temperature rises.
- When the engine starts to heat, gradually bring the starter pull cord to the opening position.
- Once the engine is hot, increase speed up to the maximum limit stop Item ③ (factory setting).



The wheel must be retracted inside its protective guard once grinding is complete. This precaution prevents operators from accidentally coming into contact with a moving wheel and also avoids destruction of the wheel or flying stones in the event of incorrect operation.

■ Stopping the machine

Stop the engine by closing the fuel valve Item ① (STOP position).



4.2 – Operating the machine

4.2.1 – Use on Vignole rail

Roll the machine on the rail using its two flat rollers. The guide flanges, located on either side of the rail, hold it in place laterally (Refer to 3.3 Adjusting the guide rollers).

■ Start the engine (refer to the engine handbook and to 4.1 Starting and stopping).

■ Release the handle Item ③ to raise and lower the wheel.

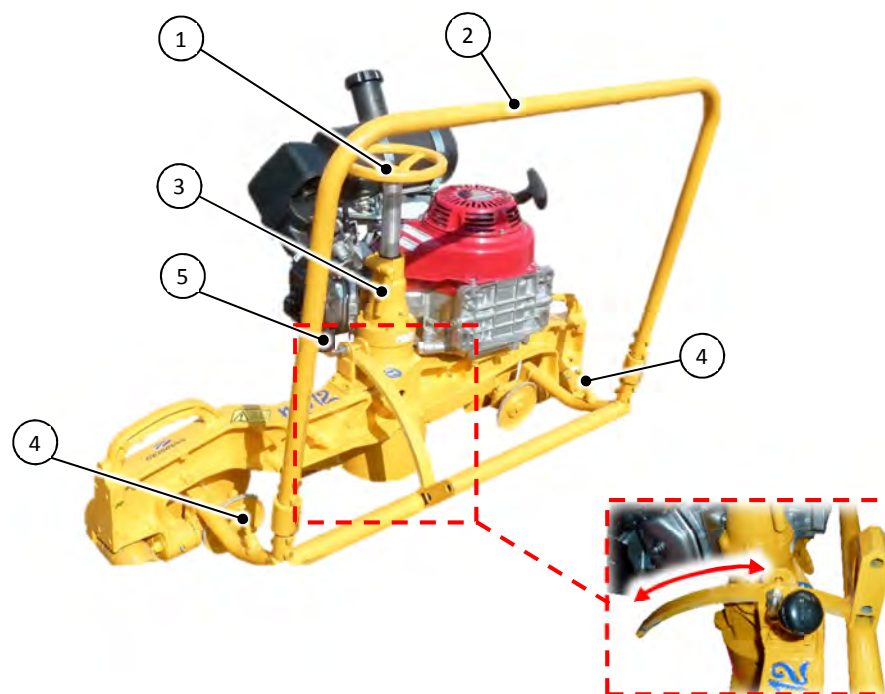
■ Start by trimming the part to be ground, up to roughly 1mm of rail surface. To do this, work in a series of quick runs, driving the machine in short movements back and forth along the rail. On each run, turn by a fraction of a turn the flywheel Item ① moving the wheel forward. Start with the horizontal surface choosing the position of the operating arm Item ② furthest with respect to the machine. To this end, loosen the handle Item ⑤, separate the two parts (arm/machine) as far as possible, and retighten the handle Item ⑤.

■ Trim the sides, having first brought the operating arms Item ② as close as possible to the machine. To do this, release the handle Item ⑤ and bring up the two parts until they touch the limit stops Item ④. Two intermediate positions are indicated by a ball-type clip-on mechanism. These positions must be chosen to grind the rail curve. However, it is also possible to work in any other position.

■ To finish, return to the rail top grinding position. Then adjust the wheel precisely with respect to the rail profile. To do this, skim the wheel along the rail (some sparks will appear). You do not need to perform this operation in zones close to the weld but rather in zones where rail profile is correct.

■ Grind the entire profile until all weld traces have vanished (starting with the top, then the side and finally the curve). Finish by spreading the fillet over roughly 10 cm on either side of the weld. Check flatness using a perfectly rectilinear rule. If necessary, compensate wheel wear using the flywheel Item ①. On no account can an indentation be formed if these instructions are complied with.

Once grinding is complete, rotate by 3 or 4 turns in an anti-clockwise direction the wheel forward flywheel Item ①. The wheel is protected in its casing and there is no risk of it coming into contact with the next weld.



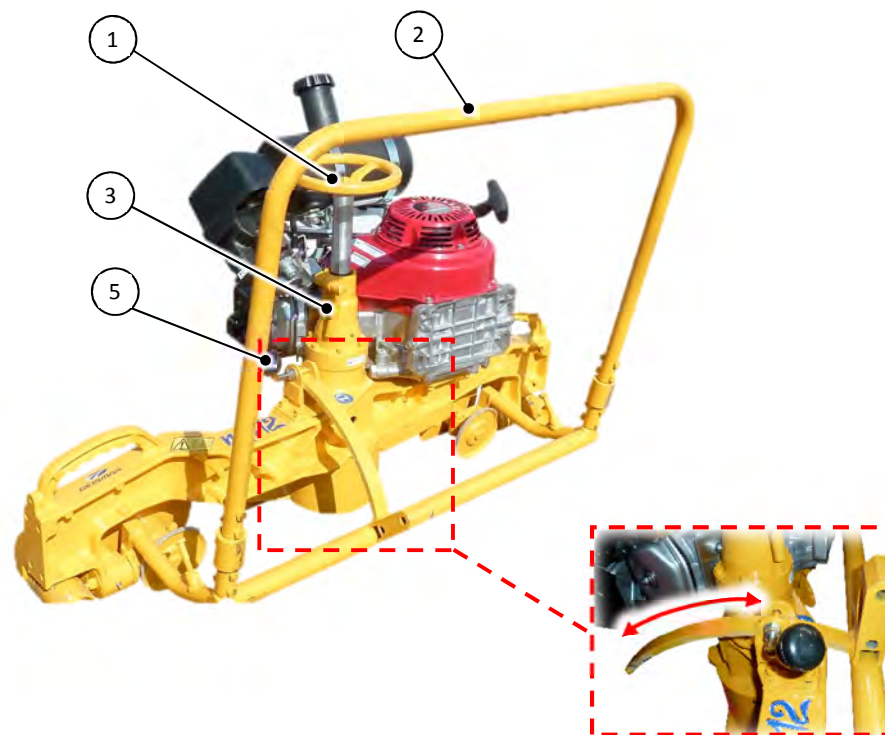
4.2.2 – Use on a grooved rail

(if the machine is equipped with grooved rollers)

Roll the machine on the rail using its two flat rollers. The guide flanges, centred in the groove, hold it in place laterally (Refer to 3.3 Adjusting the guide rollers).

- Start the engine (refer to 4.1 Starting and stopping).
- Release the handle Item ③ to raise and lower the wheel.
- Start by trimming the part to be ground up to roughly 1mm of rail surface. To do this, work in a series of quick runs, driving the machine in short movements back and forth along the rail. On each run, turn by a fraction of a turn the flywheel Item ① moving the wheel forward. Grind the horizontal surface as well as the inner radius of the flange choosing the position of the operating arm Item ② furthest with respect to the machine. To this end, loosen the handle Item ⑤, separate the two parts (arm/machine) as far as possible, and retighten the handle Item ⑤.
- To finish, return to the rail top grinding position. Then adjust the wheel precisely with respect to the rail profile. To do this, skim the wheel along the rail (some sparks will appear). You do not need to perform this operation in zones close to the weld but rather in zones where rail profile is correct.
- Grind the entire profile until all weld traces have vanished. Finish by spreading the fillet over roughly 10 cm on either side of the weld. Check flatness using a perfectly rectilinear rule. If necessary, compensate wheel wear using the flywheel ①. On no account can an indentation be formed if these instructions are complied with.

Once grinding is complete, rotate by 3 or 4 turns in an anti-clockwise direction the wheel forward flywheel Item ①. The wheel is protected in its casing and there is no risk of it coming into contact with the next weld.



4.3 – Placing the machine off the track

According to the situation (varying length of time to place the machine off the track), the machine must be placed off the track according to the NORMAL or the EMERGENCY procedure.

■ NORMAL procedure

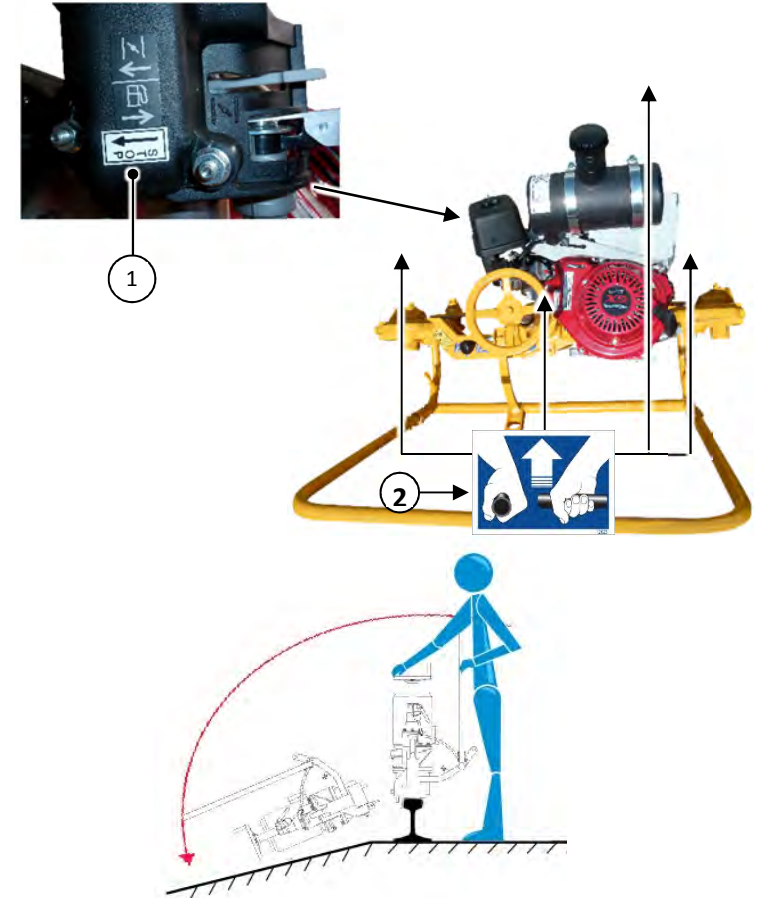
- Reassemble the wheel so that a space of at least 3mm is available between the wheel and the rail head (roughly $\frac{3}{4}$ of a turn).
- Bring the machine back to the vertical position.
- Reduce engine speed before stopping it by setting the engine stop switch Item ① to **STOP**. Then wait for the wheel to come to a complete standstill.
- Free the machine from the track by proceeding in reverse order from placing the machine on the track described in 2.4.4 (carrying points Item ②).

■ EMERGENCY procedure

- Stop the engine by setting the fuel valve to the STOP position item ①.
- Grasp the machine by the operating handle and move the entire assembly off the track.



Emergency placing off the track of the machine shall take place in less than 15s and shall require a single operator.



Important: following application of the emergency procedure for placing the machine off the track, it is essential to ensure that no machine parts have been damaged and that the wheel is in good condition. The machine can only be restarted once it has been inspected and repaired.

CHAPTER 5 – Servicing and maintenance

5.1 - Servicing

It is necessary to possess the training, skills and tooling required to correctly service and repair the equipment.

Equipment servicing and repair can be performed only by personnel with sound general mechanical knowledge.

Servicing and maintenance operation waste (worn cloths, filters, etc.) must be treated as per prevailing regulations and environmental protection directives.





Usage safety relies largely on proper machine servicing.



Immediately replace or repair all worn, damaged or missing parts.

5.1.1 – List of necessary equipment and accessories for maintenance

The following tools are required to perform servicing and maintenance operations correctly:

 Operating tools <i>(Supplied with the machine)</i>		Servicing and maintenance tools <i>(not supplied with the machine)</i>
MP12 2-stroke engine <ul style="list-style-type: none"> - 13x23 open-end wrench - Pin wrench - 10 bent tube wrench - 17 open-end wrench - 4 H8x15 screws - 4 W8 washers - 2-stroke oil -100 mL - Measuring cup - 100 mL - Spark plug wrench 	MP12 4-stroke engine <ul style="list-style-type: none"> - 13x23 open-end wrench - Pin wrench - 10 bent tube wrench - 17 open-end wrench - 4 H8x15 screws - 4 W8 washers - Spark plug wrench 	<ul style="list-style-type: none"> - 10, 13, 16 and 18 open-end wrench - Intra-screw wrench (Allen) 5, 6 and 8 - For special bracket wheel-holder <ul style="list-style-type: none"> * 8 open-end wrench * 13 bent tube wrench - For 600Y wheel-holder: rod <div>  <p>This equipment list does not exclude routine but essential maintenance equipment items such as cloths, brushes, grease, etc.</p> </div>

5.1.2 – Cleaning



Cleaning is performed with the engine cooled

Ensure the machine is kept as clean as possible. Equipment lifetime and proper operation will depend on how carefully the machine is cleaned.

Clean the machine thoroughly using a clean cloth to remove any dirt deposited on it, in particular near the moving parts. As a precaution, systematically wear gloves to avoid injuring your hands.

Regularly clean the guide rollers and the support rollers. Clean on both sides of the machine.

5.1.3 – Engine rotation speed

When leaving the factory, the carburettor is delivered with the optimum setting corresponding to the barometric and climatic conditions prevailing on the manufacturing plant site. For optimum use of the machine, the engine speed must correspond to that marked in chapter 2.3 Technical characteristics.

Apart from routine servicing during use, we recommend that you have any carburettor repairs or adjustments carried out by GEISMAR sales or troubleshooting operators. All carburettor adjustments must be performed when the engine is heated. To perform these adjustments, refer strictly to the manufacturer's instructions.

Regularly check engine idling maximum rotation speed using an electronic counter. A check must be run before putting into service for the first time, as atmospheric conditions and altitude may markedly modify this adjustment.

When checking or adjusting, the machine must be installed on the work position on an assembly locked in place in order to measure engine speed.

Too high or too low rotation speed may result in early wear of some parts or even in serious operating incidents.

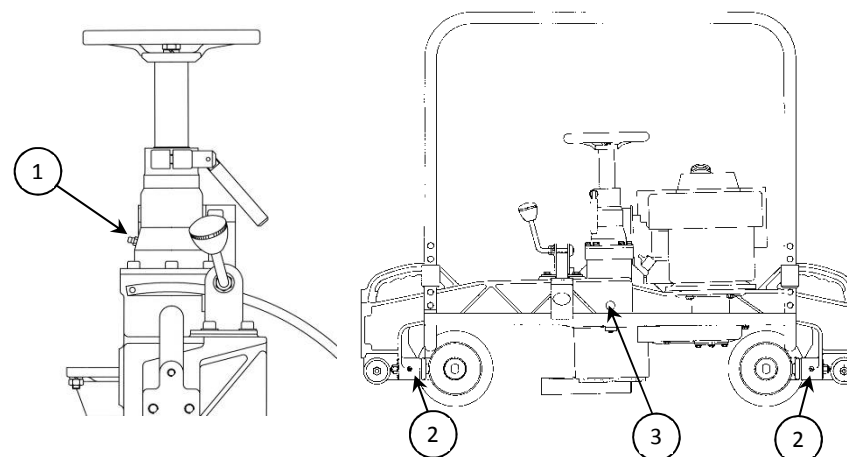
5.1.4 - Lubrication

Regularly lubricate the threadings of the various machine locking levers.

For each week of use, fill the 4 grease guns Items ①, ② and ③ of the machine.

Use one of the recommended greases (TOTAL: MULTIS EP 2, KLÜBER: CENTOPLEX 2 EP) or any of the other greases complying with standard DIN 51 354 or ISO.L.XBBFB.00 (00 grade viscous spray grease for heavily loaded gear. Operating temperature ranging from – 20°C to + 120°C).

The spindle thrust bearing is life-lubricated with CASTROL Longtime PD2 synthetic grease. In case of filling after an operation, contact us or use NLGI.2 grade grease, with an operating temperature range from -20 to +150°C and satisfying standard MIL.G23827A.



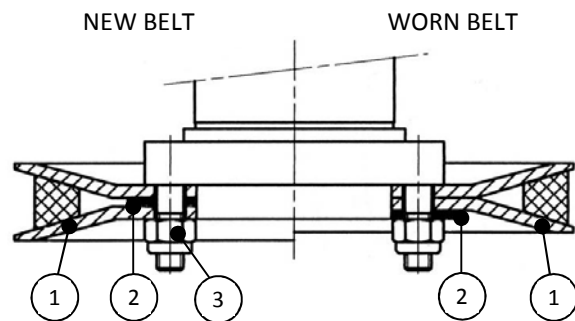
5.1.5 – Drive belt tension

(must be carried out with the engine stopped)

Belt tension is given by the variation in pitch diameter of pulleys by means of wedge sets. The drive pulley and the driven pulley are both adjustable. To access the pulleys, disassemble the wheel, the wheel casing and the belt casing.

Every 50 operating hours, check belt tension and adjust if necessary as follows:

- Disassemble the flange from the pulley Item ① held by nuts Item ③.
- Remove a wedge Item ②.
- Reassemble the flange Item ① placing the wedge Item ② between the flange and the nuts Item ③.
- Progressively tighten the six nuts Item ③, while rotating the pulley manually so that the belt assumes its position without being stuck between the two flanges.



If the resulting tension is not sufficient, repeat the operation.

To guarantee proper belt alignment, the same adjustment must be performed on each pulley.

When there are no more wedges between the flanges of the two pulleys and the belt spins, the belt must be replaced with a new belt.

To assemble a new belt, fit all the wedges (2 per pulley) between the pulley flanges.



When replacing or putting back a belt, check that the pulley grooves are in proper condition and clean them as well as the belt grooves thoroughly.

Run a first belt tension check after 10 hours' use of the machine, then check and adjust tension if necessary every 50 hours.

5.1.6 – Engine oil

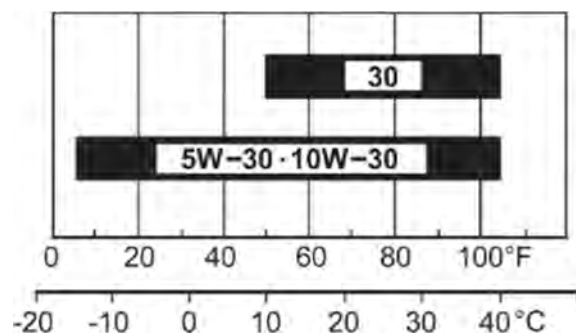
5.1.6.1 – Engine oil type

- RECOMMENDED OIL:

Use a detergent 4-stroke automotive oil equivalent to or higher than the requirements for the API SJ service category, higher or equivalent. Always check the API service label on the oil canister to ensure it is marked with the label SJ or higher (or equivalent).

- AMBIENT TEMPERATURE:

SAE 10W-30 oil is recommended for general use. The other viscosities indicated in the table can be used when the average temperature for the place of use is within the indicated range.



Use of the engine with a low oil level may damage the engine. This type of damage is not covered by the distributors's limited warranty.

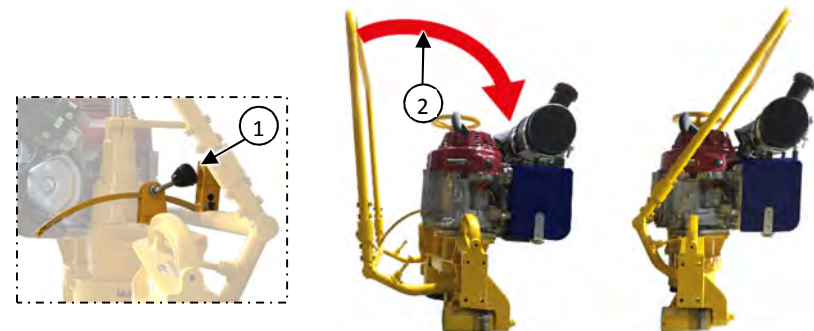
5.1.6.2 – Checking and adjusting oil level

Check oil level daily and adjust if necessary.



The Honda GX.270 engine mounted on the MP.12 type machine must contain 1 litre of oil

- Cold engine
- Install the machine on a flat, horizontal surface
- Release the handle *Item ①* and completely fold the operating arm *Item ②* holding back the machine to prevent it from suddenly toppling.



- Gently topple the machine into its operating arm and wedge it in place so that the arm base is horizontal.



- Also adjust side horizontality so that the engine base is parallel to the ground

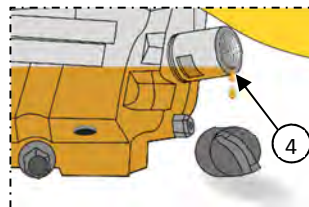
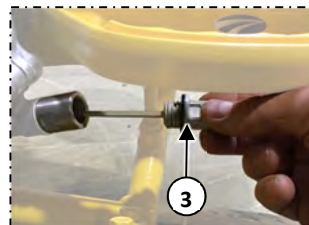


To avoid oil from spilling onto the ground, during level checking, tilt the machine slightly towards the operating arm before unscrewing the engine oil filler cap.

Then gently bring the machine to the checking position described above.



- Open the oil filler cap/gauge *Item* ③
- Adjust the oil level as *Item* ④
- The level must arrive flush with the cap screwing orifice, just at the overflow point
- Close the oil filler cap/gauge.
- Wipe away any spilt oil residues



5.1.6.3 – Renewing engine oil (only 4-stroke engine)

Drain engine oil after or 100 hours' work.

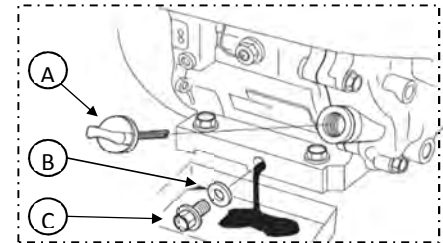
Worn oil is replaced when the engine is hot and has run for 5 min.

Drainage is performed more quickly and fully when oil is tepid.



CAUTION: RISK OF BURNS

- Place an appropriate recipient under the engine to collect the worn oil
- Remove the oil filler cap/gauge *Item* ③ and the washer *Item* ⑥



- Leave to flow out to the last drop to fully drain the worn oil
- Replace the oil drain plug with a new washer and fully tighten it
- With the engine in horizontal position, fill the tank with fresh oil up to the maximum limit mark (overflow point) (See 5.1.6.2 – Checking and adjusting oil level).



Dispose of waste engine oil in an environmentally friendly manner.

We recommend you:

- Have it collected by a specialised organisation
- Transport it in a closed recipient to a local dump
- Transport it to a service station for recycling

5.1.7 - Filters

A soiled filtering system can cause the following problems:

- abnormal fuel consumption
- engine start-up problems
- engine power drop
- engine early wear

To prevent dirt from entering the intake side, the replacement operation must be carried out in a clean place such as a maintenance workshop or warehouse.

If the engine is used without air filter or with a damaged air filter, dirt will enter the engine, which will thus wear more quickly.

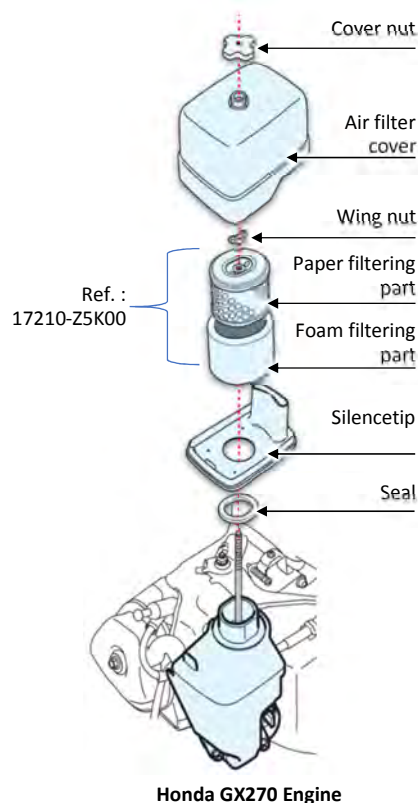
This type of damage is not covered by the distributor's limited guarantee.



NEVER USE THE MACHINE WITHOUT AN AIR FILTER

5.1.7.1 Air filter

- Remove the air filter cover and nuts and disassemble the cover
- Remove the filter(s), taking care that the surrounding impurities do not fall into the carburettor.
- Replace the filtering part (Ref. :17210-Z5K-W00) as per the frequencies marked in the maintenance program (5.2.1 – Preventive maintenance schedule)



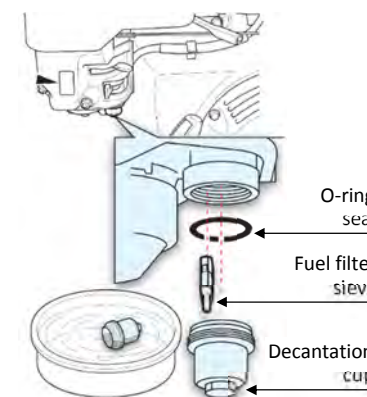
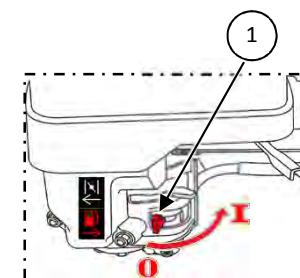
5.1.7.2 – Petrol filter

■ Disassembling

- Place the fuel valve Item ① to the left, in the CLOSED position (0)
- Unscrew the fuel decantation cup
- Remove the fuel filter sieve and the O-ring seal.
- Wash the decantation cup in a fireproof solvent and dry it completely

■ Reassembling

- Place the O-ring seal in the decantation cup.
- Tighten the decantation cup to its maximum.
- Place the fuel valve on the ON position (I) and check there are no leaks.
- Replace the O-ring seal if there are leaks.



Wear safety goggles while cleaning/replacing the fuel filter

5.1.8 – Cleaning the spark plug



Recommended spark plugs: BPR6ES (NGK); W20EPR-U (Denso)

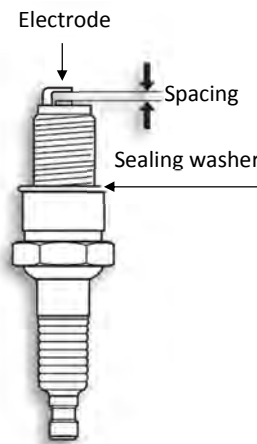
The recommended spark plug has the correct thermal index for normal engine operating temperatures.

A defective spark plug can cause engine damage.

If the engine has just run, let it cool down before working on the spark plug.

To ensure good performances, the spark plug must have correct electrode spacing and not be soiled.

- Disconnect the spark plug hood and clean around the spark plug to prevent dirt from entering the combustion chamber
- Unscrew the spark plug with the spark plug wrench supplied
- Visually inspect the spark plug.
- Replace it if it is damaged or extremely soiled, if its sealing washer is in poor condition or if its electrode is worn.
- Measure electrode spacing with a wire thickness gauge.
 - * If necessary, correct it by bending the side electrode.
 - * Electrode spacing must be between 0.7 and 0.8 mm.



- Put back the spark plug manually, taking care not to damage its threading
- Once the spark plug has touched its centre, continue to tighten it using a spark plug wrench to compress the sealing washer
 - * If the spark plug is new, tighten it by 1/2 turn after it has touched its centre in order to compress the washer.
 - * If it has already been used, tighten it by 1/8 to 1/4 of a turn after it has touched its centre in order to compress the washer.
- Fasten the spark plug hood to the spark plug



An insufficiently tightened spark plug could overheat and damage the engine.

An excessively tightened spark plug could damage the threading in the cylinder head.

5.2 - Maintenance

5.2.1 – Preventive maintenance schedule

PARTS	TYPE OF OPERATION	FREQUENCY							
		Before each use	After each use	Each week	After the first 10h	Every 50h	Every year or 300h	In case of damage	As required
Complete machine	Inspect the machine	✓							
	Carry out overall cleaning with a clean cloth or a blow gun to eliminate any dirt deposited on the machine		✓						
Greasing	Grease			✓					
Drive belt	Adjust tension				✓	✓			
	Replace							✓	
Air filter	Replace					✓		✓	
Engine oil	Check level	✓							
	Replace								
Spark plug	Check/Adjust								
	Replace						✓	✓	
Decantation cup	Clean								
Idle engine rotation speed	Check			✓					
Valve clearance	Check/adjust						✓		✓

PARTS	TYPE OF OPERATION	FREQUENCY										
		Before each use	After each use	Each week	After the first 10h	First month or 20h	Every 50h	Every 6 months or 100h	Every year or 300h	Every 1000h	In case of damage	As required
Combustion chamber	Clean									✓		
Fuel tank and filter	Clean							✓				
Fuel pipe	Check								✓			
	Replace										✓	✓
Pictogram	Inspect the machine	✓										
	Replace										✓	✓
The machine must be overhauled regularly												

The information provided in this preventive maintenance schedule is for routine use;
In case of more difficult conditions or longer work days, the frequencies indicated must be shortened.



This advice is not limited. Continuous monitoring of the machine and carefully organised preventive maintenance will prolong machine lifetime.

5.2.5 – List of normal wear parts

We define below the list of machine normal wear parts together with their replacement conditions.

However, it is essential to change or replace all worn, damaged or missing parts, particularly when there is a safety risk.

Description	Nb	Replacement conditions
Ø 35 x 45 x 7/10 wiper seal	1	Grease leak or incorrect operation
No.25 O-ring seal	1	
AS 28 x 40 x 7/10 wiper seal	1	
35 x 47 x 6 seal	1	
V-belt	1	Wear or breakage
40 mm bakelite ball	1	
Ø 18 x 34 x 36 x 32 Flexibloc	2	
Air filter	1	Periodic maintenance or incorrect operation
Fuel filter	1	
Spark plug	1	
Hoses	/	Periodic maintenance or case of leakage

CHAPTER 6 – Accessories and options

6.1 – Optional equipment

6.1.1 – Take-off unit

Machines equipped with a take-off unit require two operators for use with the grinding hose.



Stop the engine before working on the wheel or hose.

■ Assembling the hose

Having first checked that the petrol tank is not too full to avoid fuel leaks (if applicable), reassemble the wheel so that it is retracted as far as possible inside its protective guard.

Tilt the machine to the operating arm side so as to make the take-off unit accessible. Remove the take-off unit protective cap and fasten the hose drive.

■ Starting the engine

If the hose is equipped with a clutch (*compulsory for EC use*), use of the take-off unit only calls for one operator.

Two operators are required if the hose has no clutch. The first operator who fastened the selected tool must take over control of the wheel-holder and wait for operation to start, controlled by the second operator. He must not put down the wheel-holder until the engine has been completely stopped by the second operator. As long as the engine is running, one of the operators must remain in place close to the engine in order to stop it immediately should an incident of any kind occur.

■ Precautions of use

During grinding, take all necessary precautions to avoid directing the spark jet towards the second operator (he must be equipped with goggles and gloves).

Do not bend the hose excessively, as this could damage the drive and, in some cases, lead to accidents in the case of sudden breakage due to improper use.

After stopping the engine, the hose shall be disassembled, and the take-off cap properly put back in place. To continue work, put the machine back on the track prior to operation.

■ **Take-off unit** (ref. 37000 DS – addition to the original supply)

Hoses (for use of wheel-holders)

Hose without clutch	Hose with clutch (Compulsory for EC machines equipped with take-off device)
3 m long (ref. 16300 A)	3 m long (ref. 16300 E)
4 m long (ref. 16300 B)	4 m long (ref. 16300 G)

Reinforced resin bonded wheel (for wheel-holder with hose)

- For straight wheel-holder 230 x 20 x 16 mm (code N00742);
- For wheel-holder with bracket return 230 x 6.4x 22.2 mm (code N00730);
- For wheel-holder with bracket return 150 x 72 mm (code N00734).

Wheel-holders for hoses:

- Straight wheel-holder for grinding of device cores, and rail web and ends (ref. 600 W);
- Wheel-holder with bracket return, for weld grinding (ref. 600 X);
- Wheel-holder with bracket return, for weld grinding (ref. 600 Y).



6.1.2 – Centre-to-centre distance extension

Centre-to-centre distance extension (ref. 37000 V)



6.1.3 – Adaptation kit for wave wear grinding

(non-EC)

Wave wear grinding device to transform an MP12 into an MOD12 with balancing bar (Ref. 37000 BH and 37000 K)

6.1.4 – Adaptation kit for grooved rail grinding

It is essential that the machine be equipped with an Ø 80mm wheel and a casing of the same diameter to perform proper rail grinding.

Wheel casing (ref. 37101)

6 Ø 80 x 72 – M20 type cup wheel (ref. N03313)

Roller device for Vignole rail grooved rail passage (ref. 37000 BB)

6.1.5 - Anti-vibration operating arm

Anti-vibration operating arm (ref. 37000 GF)

6.1.6 – Emergency stop button

Emergency stop button all models MP.12 and MOD.12 (ref. 12000 EZ)



6.1.7 – Wheel lowering limit

Wheel lowering limiting device (ref. 37000 JZ)



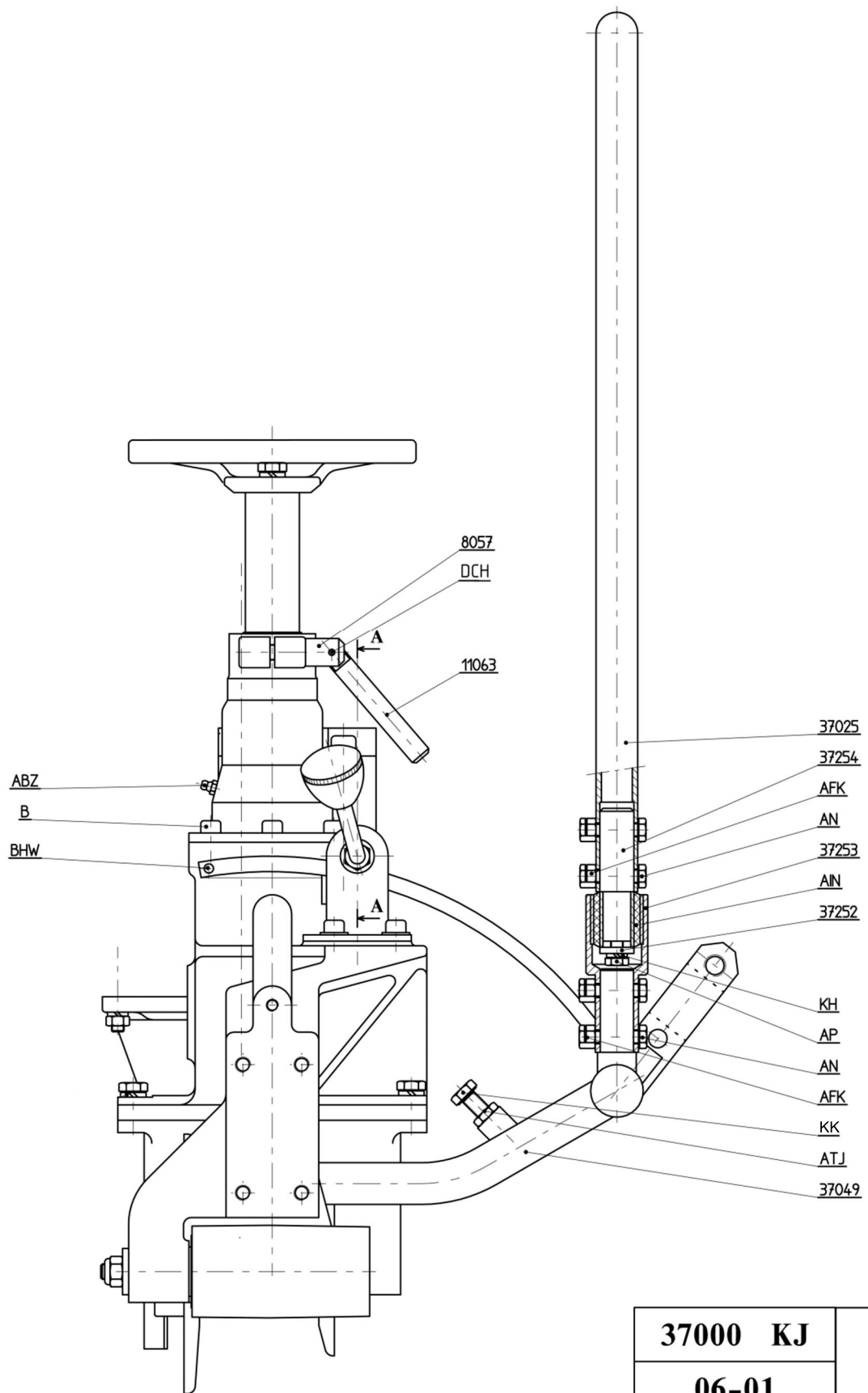
6.2 - Consumables

■ Reinforced resin bonded cup wheel for:

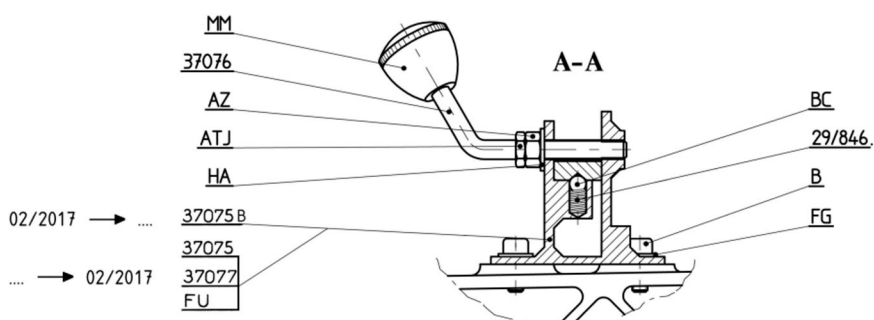
- M8 4-hole wheel-holder plate:
 - 150 x 72 mm (code N00734) ;
 - 125 x 60 mm (code N00733).
- M8 6-hole wheel-holder plate:
 - 150 x 65 mm (code N00738) ;
- M20 wheel-holder plate or end:
 - 125 x 65 mm (code N02780) ;
 - 80 x 72 mm (code N03313).
- 5/8" wheel-holder end:
 - 150 x 65 mm (code N00737) ;
 - 80 x 72 mm (code N00731) ;
 - 6" x 3" (code N03243).

■ Wheel-holder ends and plates (accessories):

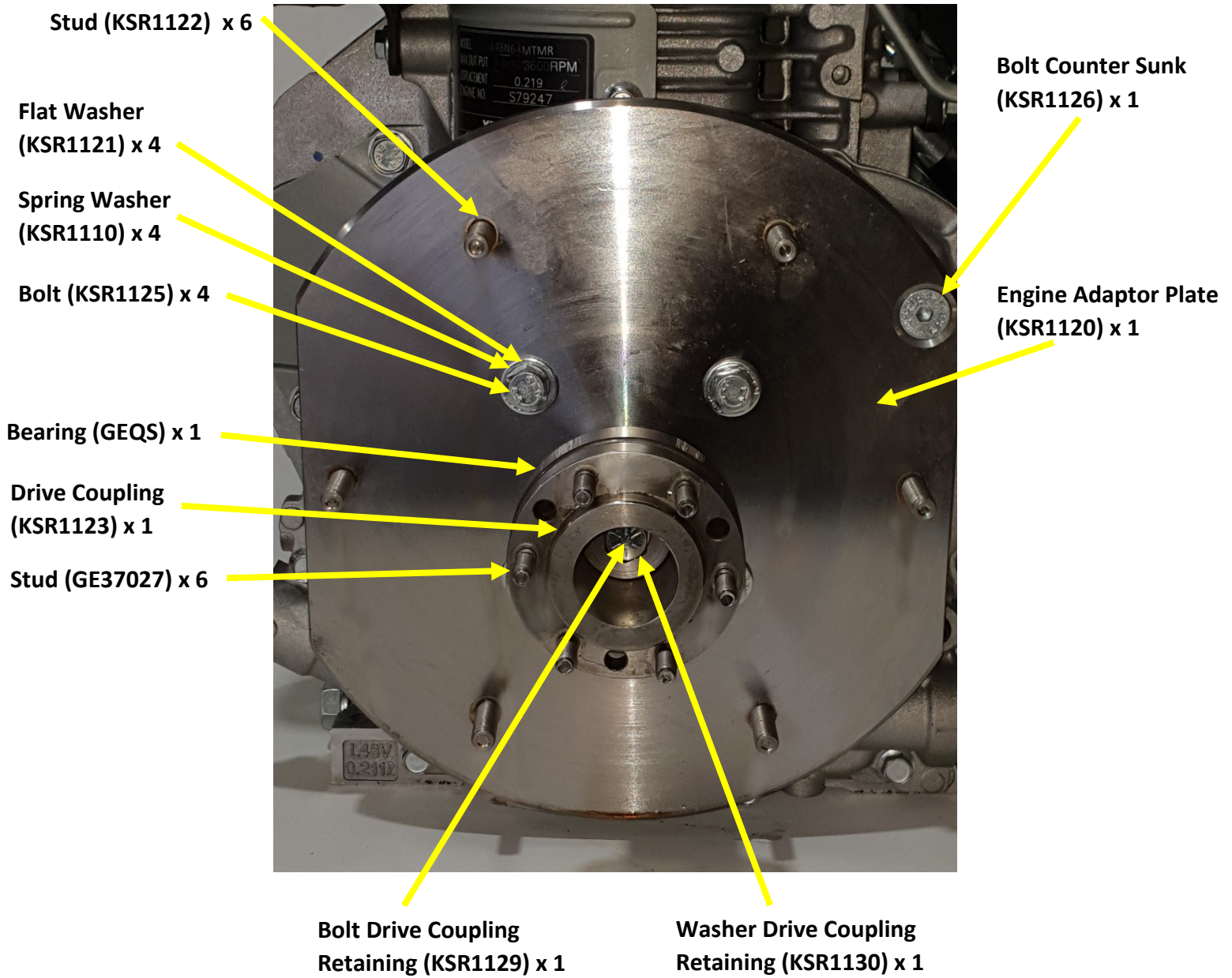
- 5/8" wheel-holder end (ref. 16356) ;
- M20 wheel-holder end (ref. 16356 A) ;
- Ø125 - M20 wheel-holder plate (ref. 16356 C) ;
- 4-hole wheel-holder plate (M8 screws) (ref. 37042).
- 6-hole wheel-holder plate (M8 screws) (ref. 37006).



37000 KJ	R2
06-01	



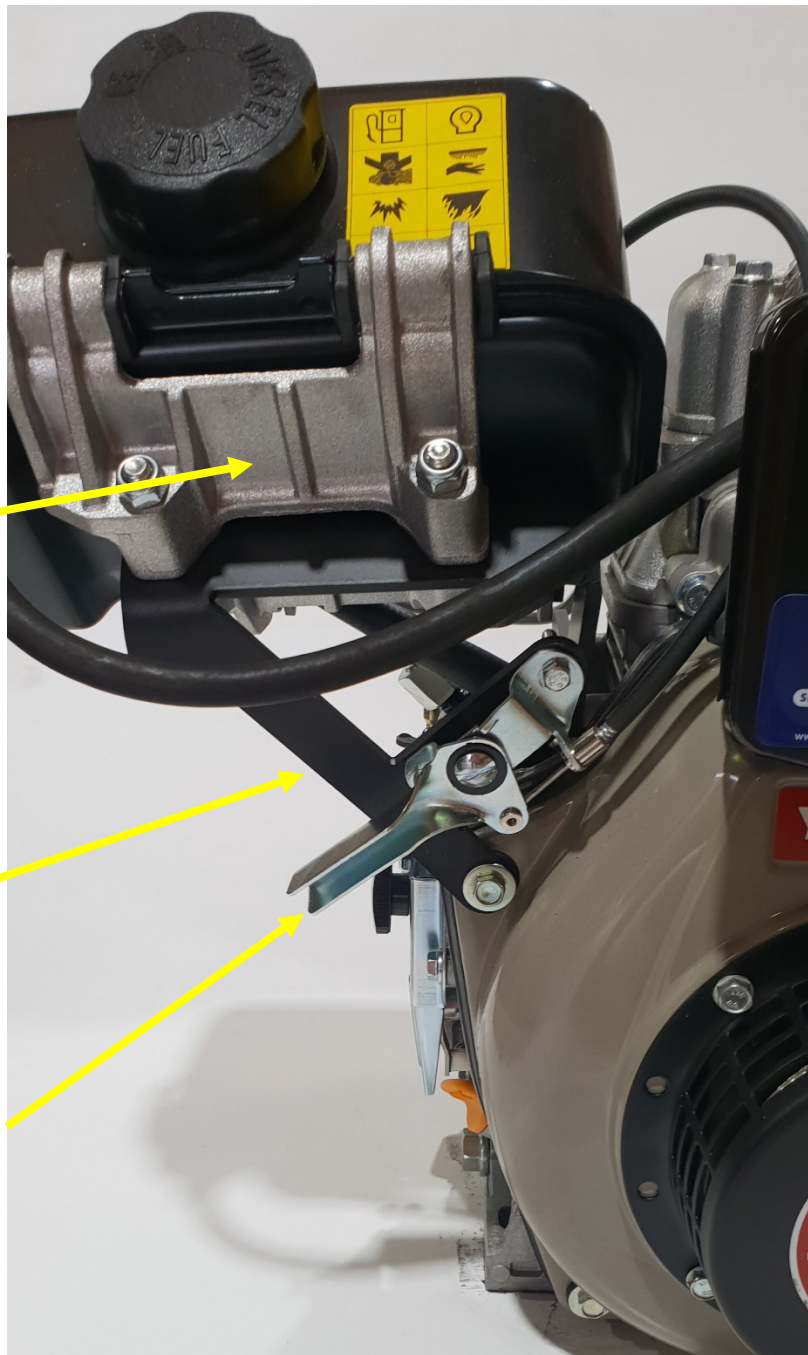
Ref	Qty	Français Fr	Anglais Gb	Danois Dk
29/846	1	Ressort de bille	Position ball-spring	Positions kuglefjeder
8057	1	Chape de serrage	Tightening cap	Tætningslås
11063	1	Poignée de serrage	Hand-lever of feedwheel brake	Håndgreb til bremse på sjernehjul
37025	1	Bras de manœuvre	Operating handle-bar (removable)	Betjeningshåndtag (aftageligt)
37049	1	Support du bras de manœuvre	Lower part of operating hand-bar	Øvre del af styrehåndtag
37075 B	1	Support de la poignée de blocage	Clamping-body	Klemme
37076	1	Poignée de blocage	Hand-lever of clamp	Håndgreb på klemme
37252	2	Rondelle Ø 8,2 x 21 x 3	Washer 8,2 x 21 x 3	Spændskive 8,2 x 21 x 3
37253	2	Support de flexibloc	Support	Holder
37254	2	Embout de bras	Axle	Aksel
B	10	Vis Chc 8 x 20	Screw Chc 8 x 20	Skrue Chc 8 x 20
AN	8	Vis H 8 x 35	Screw H 8 x 35	Skrue H 8 x 35
AP	2	Vis H 8 x 20	Screw H 8 x 20	Skrue H 8 x 20
AZ	1	Ecrou H 10	Nut H 10	Møtrik H 10
BC	1	Bille acier Ø 8,7	Steel ball Ø 8,7	Stålkugle Ø 8,7
FG	4	Rondelle M 8 U	Washer M 8 U	Spændskive M 8 U
HA	1	Rondelle M 10 U	Washer M 10 U	Spændskive M 10 U
KH	2	Rondelle W 8	Washer W 8	Spændskive W 8
KK	2	Vis H10 x 55	Screw H10 x 55	Skrue H10 x 55
MM	1	Boule bakélite de 40	Polyamide knob dia. 40	Polyamid knop dia. 40
ABZ	1	Graisser BEC M 6 x 100	Lubricator BEC M 6 x 100	Smørenippel BEC M 6 x 100
AFK	8	Ecrou frein de 8	Brake nut of 8	Bremsemøtrik 8
AIN	2	Flexibloc 861 152	Flexibloc 861 152	Flexibloc 861 152
ATJ	3	Ecrou Hm 10	Nut Hm 10	Møtrik Hm 10
BHW	1	Goupille élastique Ø 6 x 35	Elastic pin 6 x 35	Elastisk stift 6 x 35
DCH	1	Goupille élastique Ø 4 x 18	Elastic pin Ø 4 x 18	Elastisk stift Ø 4 x 18

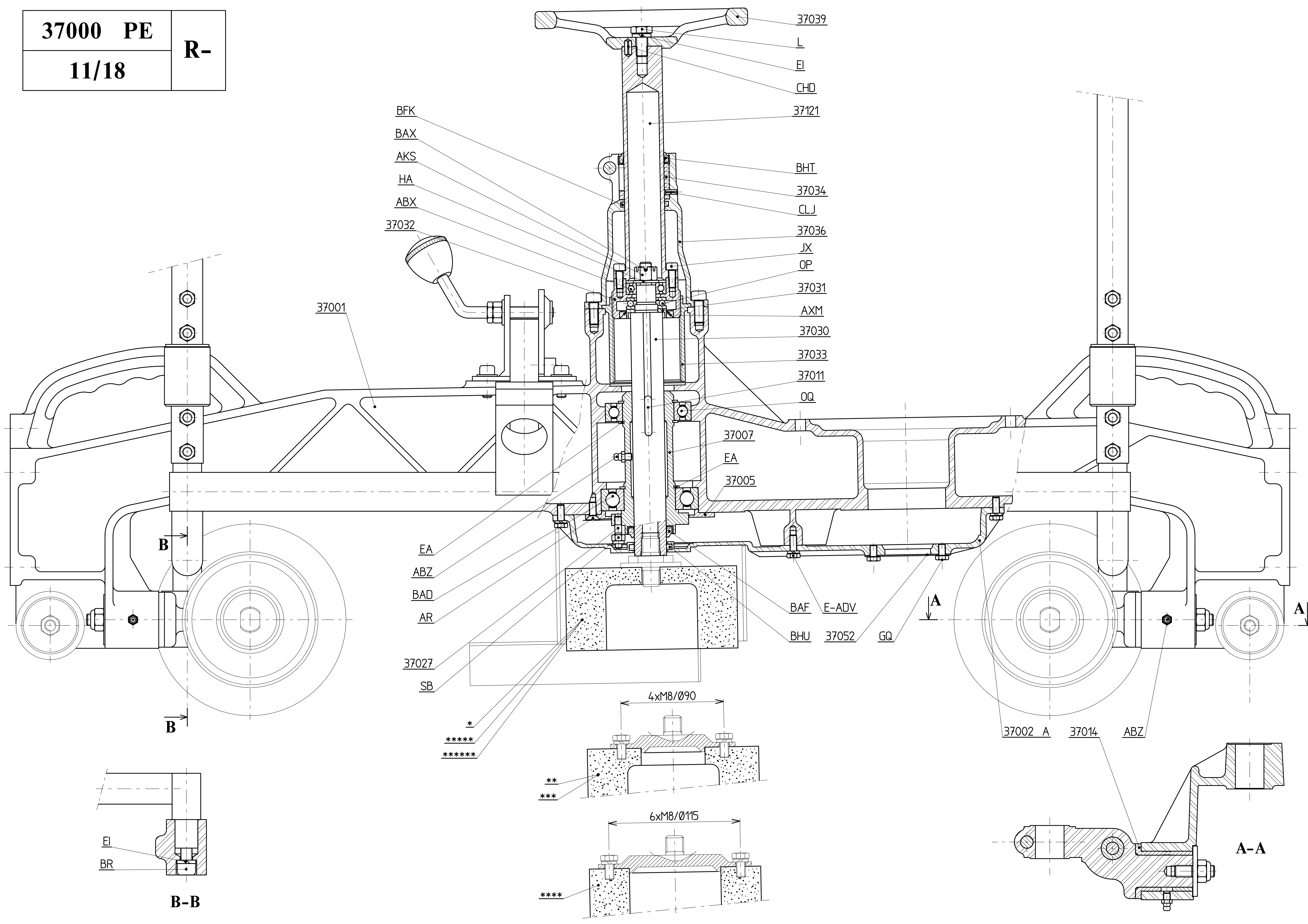


**Fuel Tank Clamp Bracket
(11429955230) x 1**

**Bracket Fuel Tank
(KSR1127) x 1**

**Throttle Control with
Cable (KSR21181) x 1**





Ref	Qty	Français Fr	Anglais Gb
37001	1	Châssis	Frame
37002 A	1	Carter de courroie	Belt casing
37005	1	Rondelle de calage	Bearings-plug
37007	1	Moyeu de poulie réceptrice	Receiving-pulley hub
37011	1	Clavette	Key of spindle
37014	2	Bague	Ring of flange-support
37027	6	Goujon M 6 x 28 x 14 bm = 8	Pin M 6 x 28 x 14 bm = 8
37030	1	Arbre de meule	Grindstone spindle
37031	1	Rondelle épaulée	Spindle-cap
37032		Vis de descente de la meule	Grindstone feed-screw
37033	1	Ecrou de descente de la meule	Grindstone feed-nut
37034	1	Appairage (37032-37033)	Pairing (37032-37033)
37036	1	Bague fendue	Split ring of feedwheel-brake
37039	1	Palier de l'axe du volant	Feedwheel axle housing
37121	1	Volant de manœuvre	Hand operating feedwheel
		Axe du volant de manœuvre	Feed-wheel axle
37052	1	Obturbateur du carter de courroie → Non monté sur MP12 H	Belt casing locking device → Not used on MP12 H
GQ	4	Vis H 6 x 10 → Non montée sur MP12 H	Screw H 6 x 10 → Not used on MP12 H
E	5	Vis H 6 x 15	Screw H 6 x 15
L	1	Vis H 10 x 20	Screw H 10 x 20
AR	6	Vis TF/90° 6 x 15	Screw TF/90° 6 x 15
BR	2	Vis Chc 10 x 30	Screw Chc 10 x 30
EA	3	Circlips 45 e	Circlips 45 e
EI	3	Rondelle W 10	Washer W 10
HA	1	Rondelle M 10 U	Washer M 10 U
JX	4	Vis Chc 6 x 15	Screw Chc 6 x 15
OP	1	Butée à billes n° 51104	Thrust ball bearing n° 51104
OQ	1	Roulement à billes n° 6009 EE	Ball bearing n° 6009 EE
SB	6	Ecrou nylistop de 6	Nylistop nut of 6
ABX	1	Roulement à billes n° 6003 EE	Ball bearing n° 6003 EE
ABZ	3	Graisser BEC M 6 x 100	Lubricator BEC M 6 x 100
ADV	5	Rondelle W 6	Washer W 6
AKS	1	Ecrou HK M 10	Nut HK M 10
AXM	1	Joint d'étanchéité 35 x 47 x 6	Seal 35 x 47 x 6
BAD	1	Roulement à billes n° 6209 EE	Ball bearing n° 6209 EE
BAF	1	Joint racler AS 28-40 7/10	Scraper joint AS 28-40 7/10
BAX	1	Goupille élastique Ø 2,5 x 15	Elastic pin Ø 2,5 x 15
BFK	1	Joint torique n° 25	O-ring n° 25
BHT	1	Joint racler 35-1	Scraper joint 35-1
BHU	1	Joint feutre 5 x 5 x 100	Felt-sealing 5 x 5 x 100
CHD	1	Goupille élastique Ø 6 x 12	Elastic pin Ø4 x 18
CLJ	1	Goupille élastique Ø 4 x 10	Elastic pin Ø 4 x 10

* Meule type 6 Ø 150 x 75 x 5/8" with - 50 m/s

** Meule type 6 Ø 150 x 72 x 4 x M 8 / Ø 90 - 50 m/s

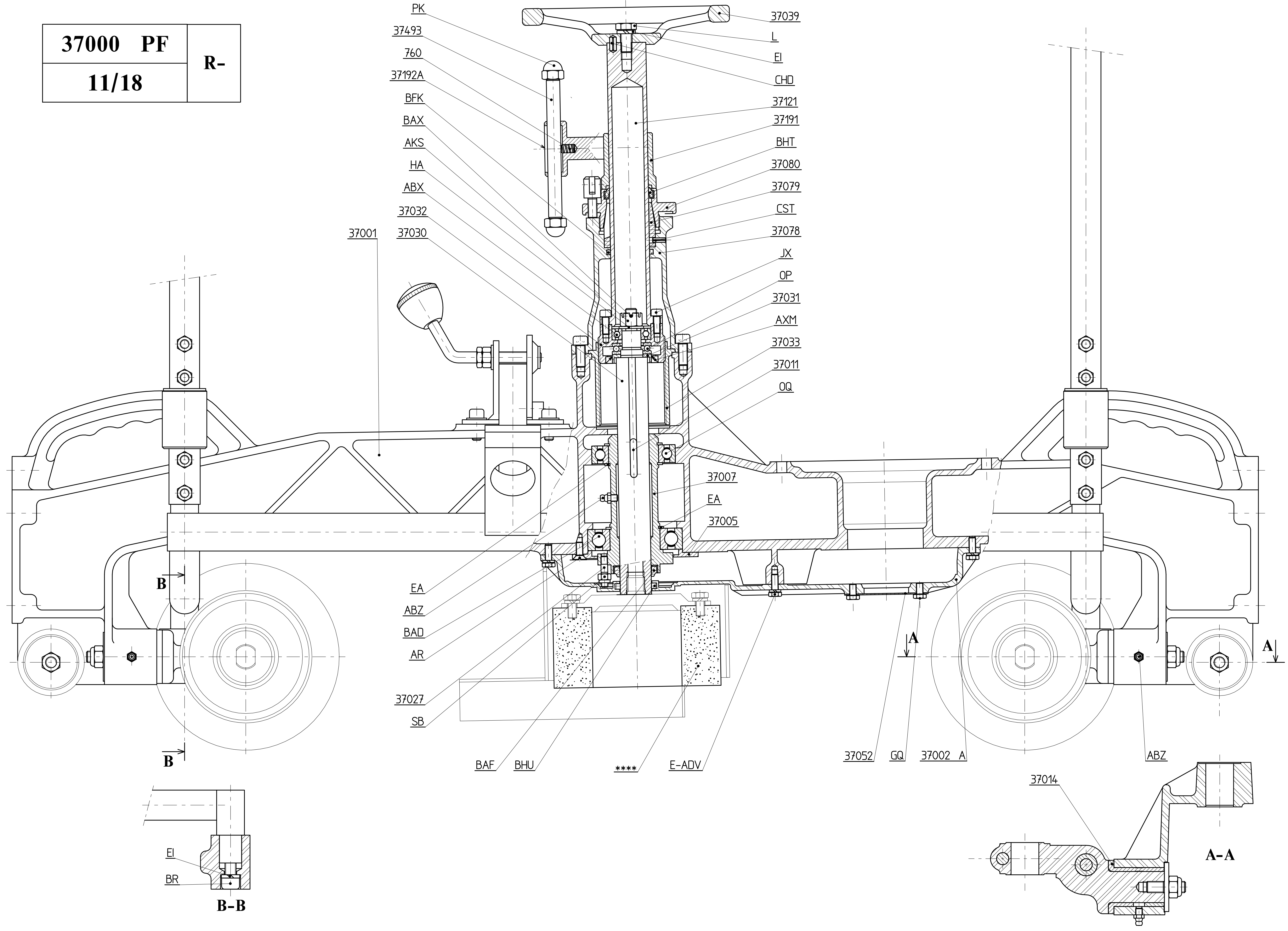
*** Meule type 6 Ø 125 x 60 x 4 x M 8 / Ø 90 - 50 m/s

**** Meule type 6 Ø 150 x 72 x 6 x M 8 / Ø 115 - 50 m/s

***** Meule type 6 Ø 125 x 65 x M 20 - 50 m/s

***** Meule type 6 Ø 80 x 72 x 5/8" - 50 m/s

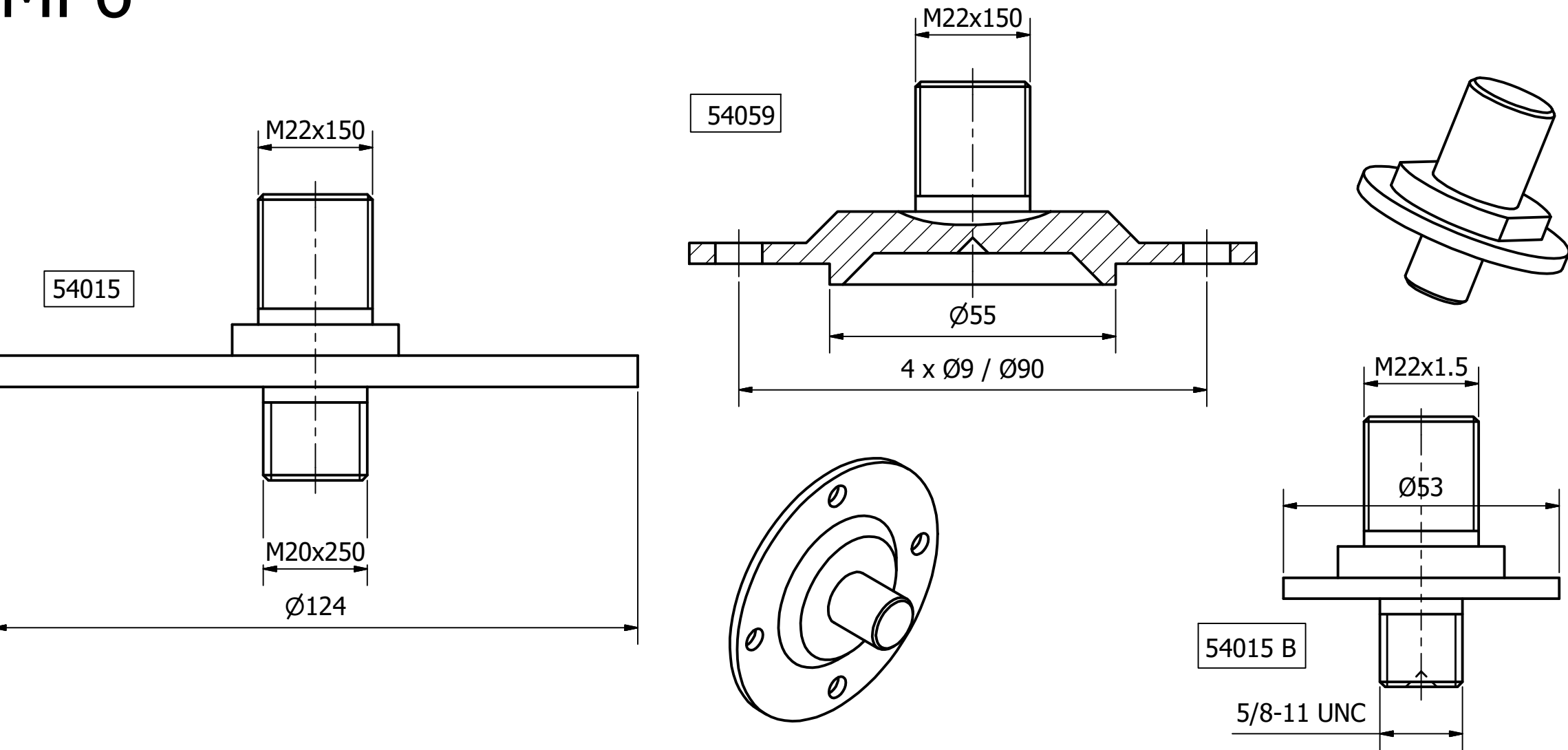
37000 PF	R-
11/18	



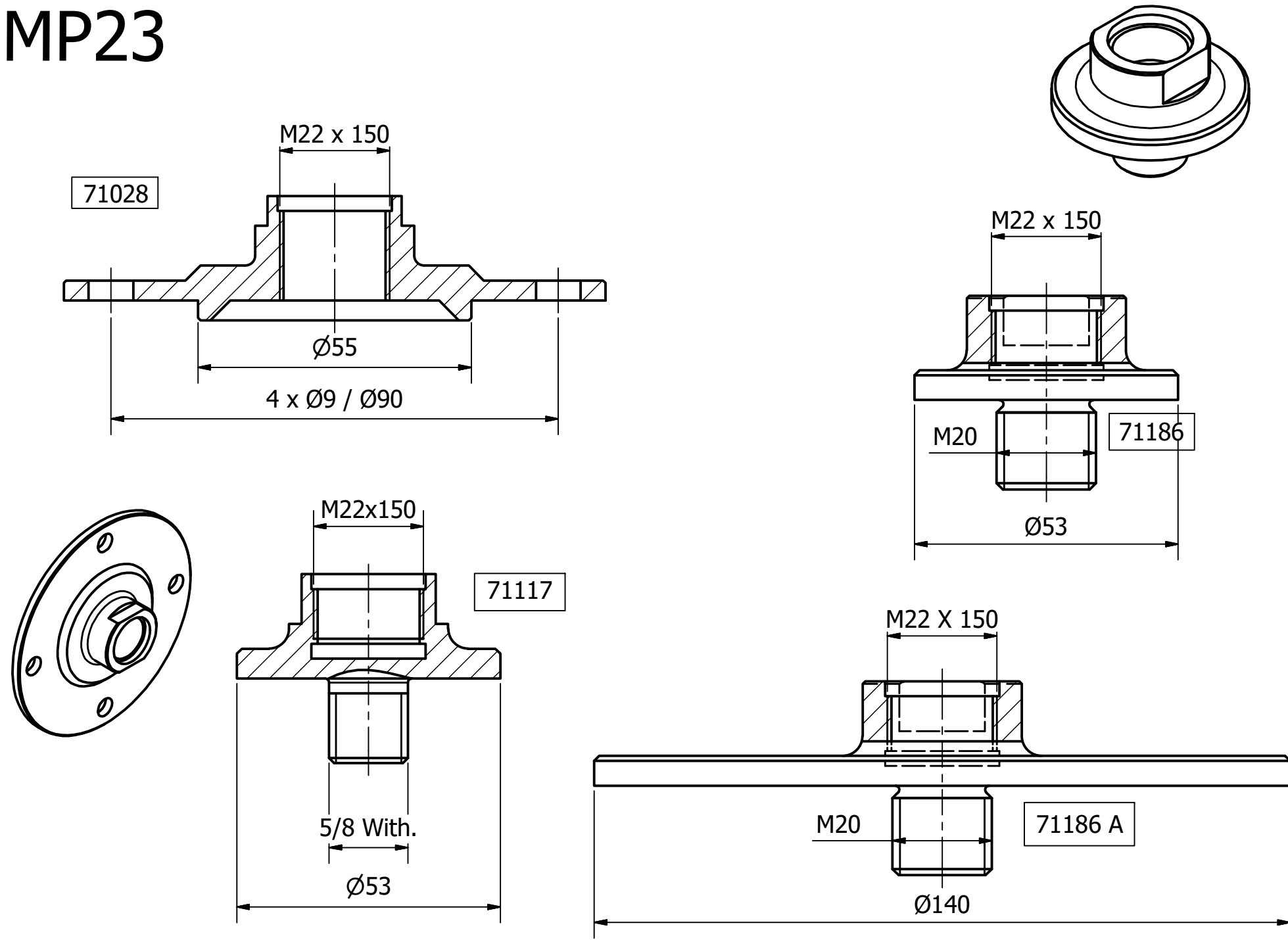
Ref	Qty	Français Fr	Anglais Gb
760	1	Ressort	Spring
37001	1	Châssis	Frame
37002 A	1	Carter de courroie	Belt casing
37005	1	Rondelle de calage	Bearings-plug
37007	1	Moyeu de poulie réceptrice	Receiving-pulley hub
37011	1	Clavette	Key of spindle
37014	2	Bague	Ring of flange-support
37027	6	Goujon M 6 x 30 x 14 J = 10	Pin M 6 x 30 x 14 J = 10
37030	1	Arbre de meule	Grindstone spindle
37031	1	Rondelle épaulée	Spindle-cap
37032		Vis de descente de la meule	Grindstone feed-screw
37033	1	Ecrou de descente de la meule	Grindstone feed-nut
		Appairage (37032-37033)	Pairing (37032-37033)
37039	1	Volant de manœuvre	Hand operating feedwheel
37052	1	Obturateur du carter de courroie	Belt casing locking device
37078	1	Palier de l'axe du volant	Upper casing of feedwheel axle
37079	1	Bague conique	Conical brake-ring
37080	1	Ecrou de blocage	Knurled hand-nut of feed-brake
37121	1	Axe du volant de manœuvre	Feed-wheel axle
37191	1	Butée réglable du niveau de meule	Adjustable thrust for stone-level
37192 A	1	Bouton de blocage	Locking knob
37493	1	Levier	Lever
E	5	Vis H 6 x 15	Screw H 6 x 15
L	1	Vis H 10 x 20	Screw H 10 x 20
AR	6	Vis TF/90° 6 x 15	Screw TF/90° 6 x 15
BR	2	Vis Chc 10 x 30	Screw Chc 10 x 30
EA	3	Circlips 45 e	Circlips 45 e
EI	3	Rondelle W 10	Washer W 10
GQ	4	Vis H 6 x 10	Screw H 6 x 10
HA	1	Rondelle M 10 U	Washer M 10 U
JX	4	Vis Chc 6 x 15	Screw Chc 6 x 15
OP	1	Butée à billes n° 51104	Thrust ball bearing n° 51104
PK	2	Ecrou borgne H10	Recessed nut H 10
OQ	1	Roulement à billes n° 6009 EE	Ball bearing n° 6009 EE
SB	6	Ecrou nylstop de 6	Nylstop nut of 6
ABX	1	Roulement à billes n° 6003 EE	Ball bearing n° 6003 EE
ABZ	3	Graisseur BEC M 6 x 100	Lubricator BEC M 6 x 100
ADV	5	Rondelle W 6	Washer W 6
AKS	1	Ecrou HK M 10	Nut HK M 10
AXM	1	Joint d'étanchéité 35 x 47 x 6	Seal 35 x 47 x 6
BAD	1	Roulement à billes n° 6209 EE	Ball bearing n° 6209 EE
BAF	1	Joint racleur AS 28-40 7/10	Scraping joint AS 28-40 7/10
BAX	1	Goupille élastique Ø 2,5 x 15	Elastic pin Ø 2,5 x 15
BFK	1	Joint torique n° 25	O-ring n° 25
BHT	1	Joint racleur 35-1	Scraping joint 35-1
BHU	1	Joint feutre 5 x 5 x 100	Felt-sealing 5 x 5 x 100
CST	1	Goupille élastique Ø4 x 12	Elastic pin Ø4 x 12
CHD	1	Goupille élastique Ø 6 x 12	Elastic pin Ø4 x 18

Meule type 6 Ø 150 x 72 x 6 x M 8 / Ø 115 - 50 m/s

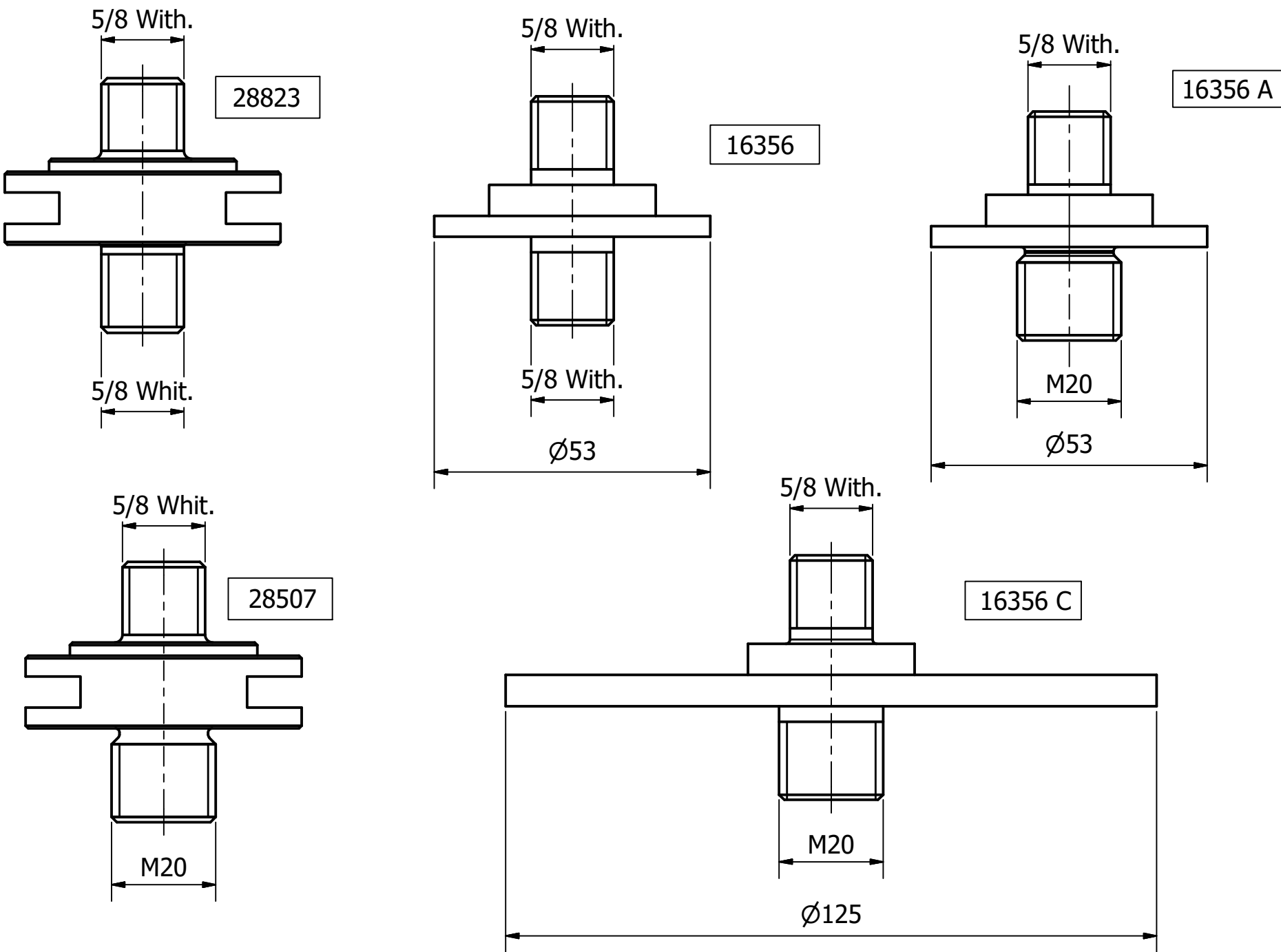
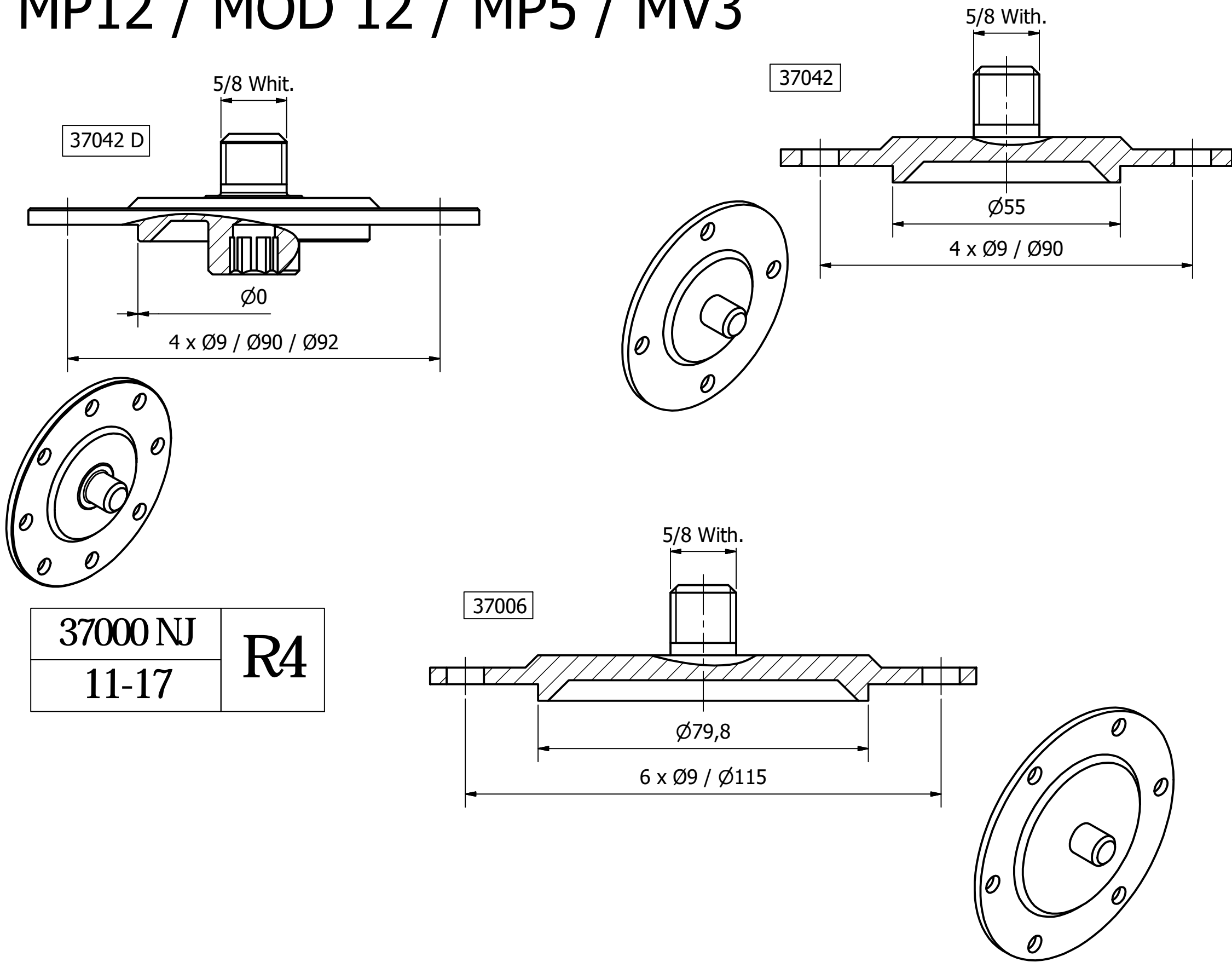
MP6

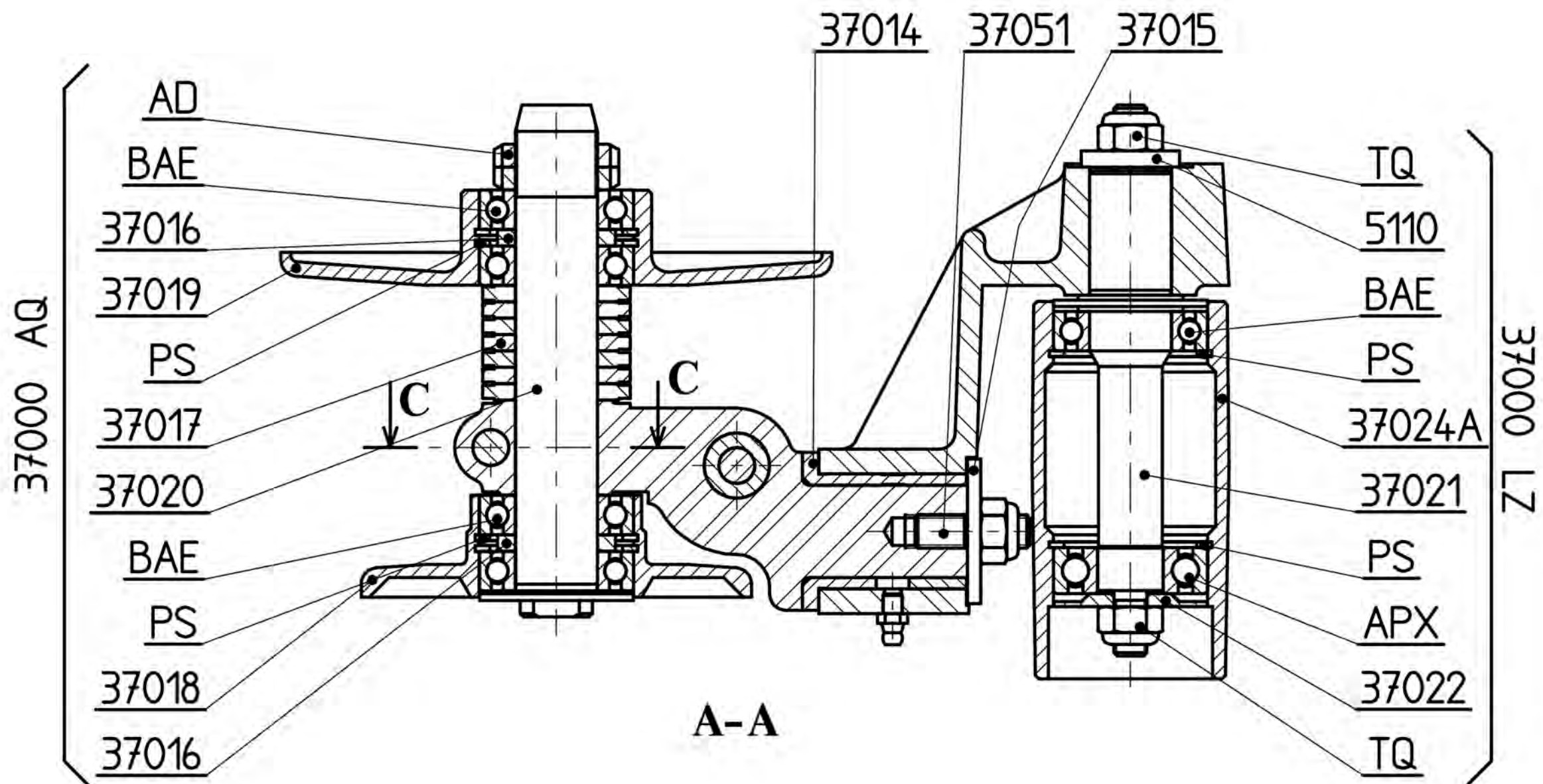


MP23



MP12 / MOD 12 / MP5 / MV3





37000 AQ-LZ

01-2004

MEULEUSE DE PROFILS MP.12

37 000 LZ - 2 - Galets porteurs comprenant chacun :

Rep.	Nb	Désignation	Rep.	Nb	Désignation
5 110	1	Rondelle 10,5 x 30 x 5	PS	2	Circlips 47 i
37 021	1	Axe de galet-porteur	TQ	2	Ecrou nylstop de 10
37 022	1	Obturateur	APX	1	Roulement à billes n° 6204 ZZ
37 024 A	1	Galet-porteur	BAE	1	Roulement à billes n° 6005 ZZ

37 000 AQ - 2 - Galets-guides comprenant chacun :

Rep.	Nb	Désignation	Rep.	Nb	Désignation
37 016	2	Entretoise de roulements	AD	2	Ecrou de serrage KM.5
37 017	7	Bague d'épaisseur	PS	4	Circlips 47 i
37 018	1	Lèvre de guidage Ø 120 mm	BAE	4	Roulement à billes n° 6005 ZZ
37 019	1	Lèvre de guidage Ø 170 mm			
37 020	1	Axe de lèvre de guidage			

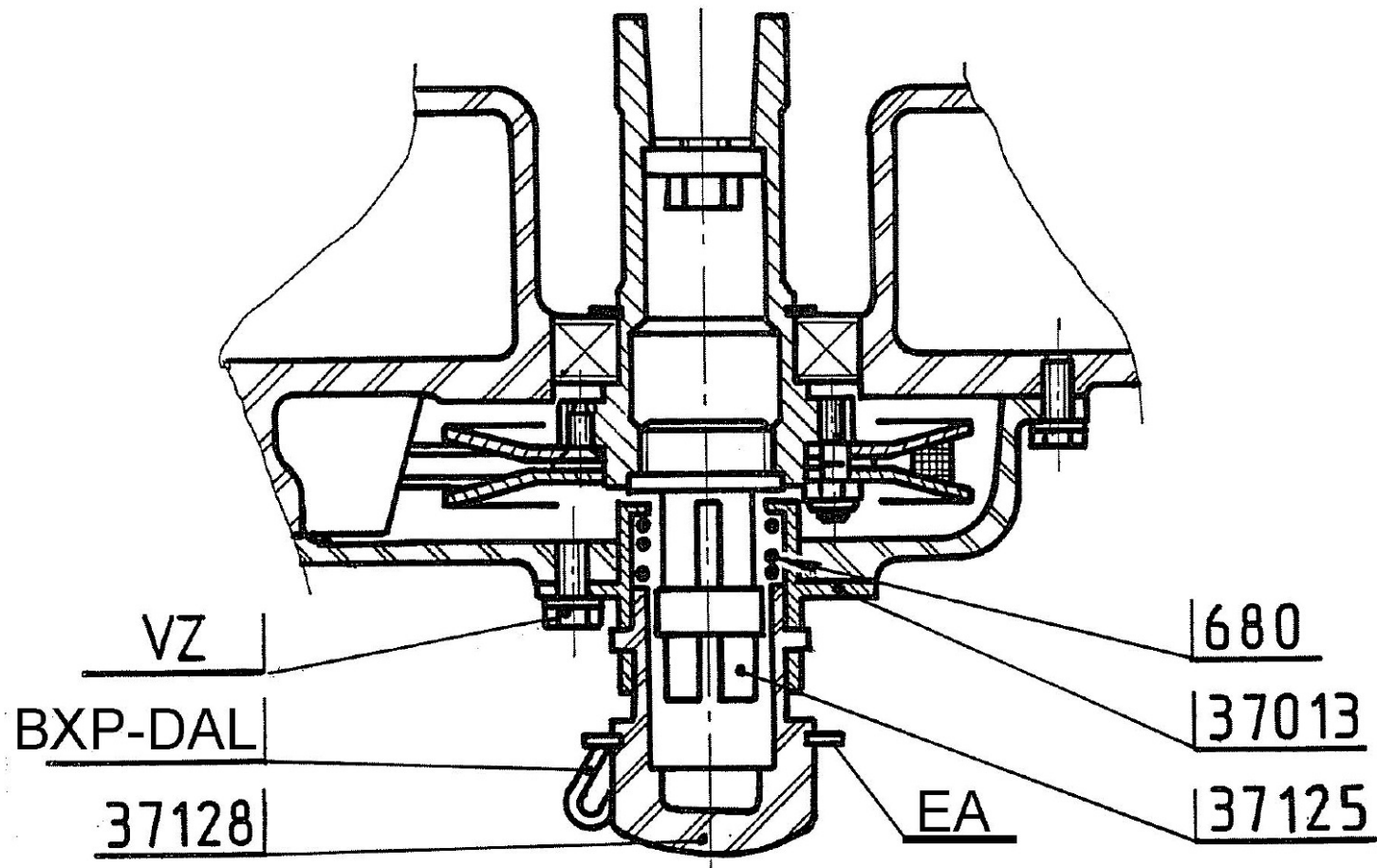
1RAIL PROFILE GRINDING MACHINE Model MP.12

37 000 LZ - 2 - Runner Assy, each including :

Ref.	Qty	Description	Ref.	Qty	Description
5 110	1	Washer DIA 10,5 x 30 x 5	PS	2	Circlips 47 i
37 021	1	Runner-axle	TQ	2	Nylstop nut of 10
37 022	1	Runner-plug	APX	1	Ball bearing n° 6204 ZZ
37 024 A	1	Runner	BAE	1	Ball bearing n° 6005 ZZ

37 000 AQ - 2 - Guide flanged-rollers, Assy, each including :

Ref.	Qty	Description	Ref.	Qty	Description
37 016	2	Ball-bearing spacer	AD	2	Tightening nut KM.5
37 017	7	Guiding roller adjustment-ring	PS	4	Circlips 47 i
37 018	1	Guide flange DIA 120 mm	BAE	4	Ball bearing n° 6005 ZZ
37 019	1	Guide flange DIA 170 mm			
7 020	1	Guide flange axle			

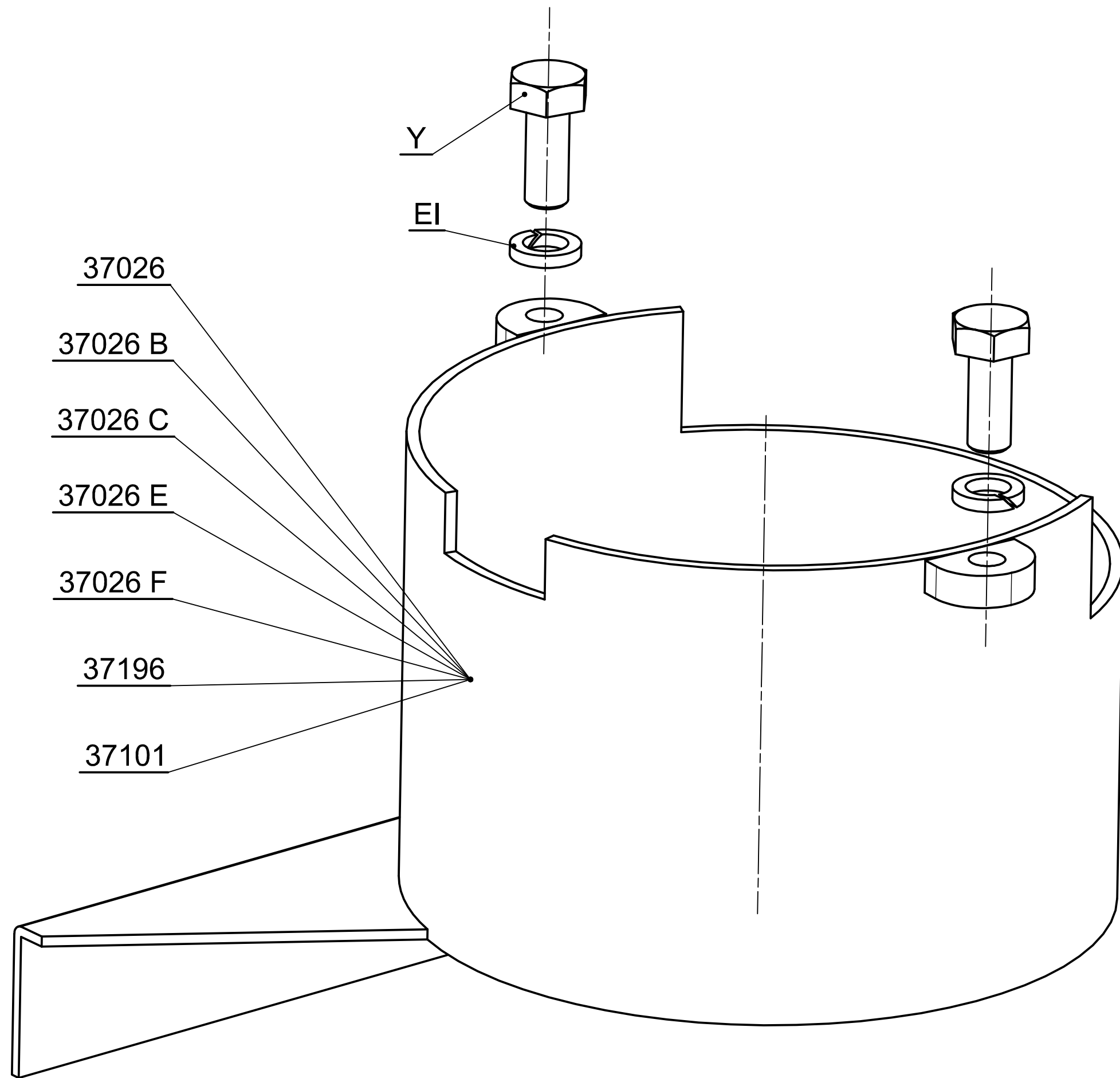


37000 DS	R1
07/86	

37000 DS


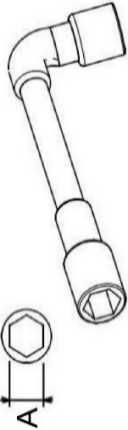
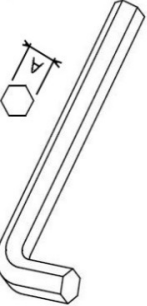



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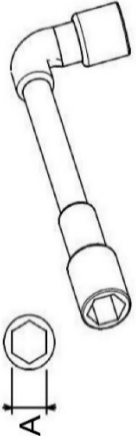



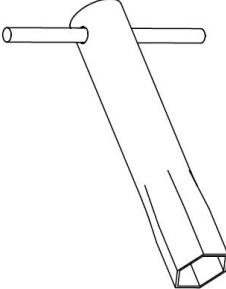
Ref	Qty	Français Fr	Anglais Gb
680	1	Ressort	Spring
37013	1	Douille de raccordement de la gaine	Connecting sheath
37125	1	Entraîneur de flexible	Driving part of flexible shaft
37128	1	Bouchon baïonnette	Bayonet-plug
EA	1	Circlips 45 e	Circlips 45 e
VZ	4	Vis H 6 x 12	Screw H 6 x 12
BXP	0,25	Chaînette	Chain
DAL	2	S de chainette	S of chainette



37000 NN	R-
03/18	

N° KIT	Ref	Qty	Français Fr	Anglais Gb
			Machine : ST471Z50 - ST471E03 - ST471A50 - ST471A03-A - ST471A01 - ST471E51	Machine : ST471Z50 - ST471E03 - ST471A50 - ST471A03-A - ST471A01 - ST471E51
-	37026	1	Carter pour meule Ø150	Grindstone casing Ø150
	Y	2	Vis H10 x 25	Screw H10x25
	EI	2	Rondelle W10	Washer W10
-	37026 B	1	Carter pour meule Ø150 (RATP)	Grindstone casing Ø150 (RATP)
	Y	2	Vis H10 x 25	Screw H10x25
	EI	2	Rondelle W10	Washer W10
-	37026 C	1	Carter renforcé pour meule Ø150	Reinforced grindstone casing Ø150
	Y	2	Vis H10 x 25	Screw H10x25
	EI	2	Rondelle W10	Washer W10
			Machine : ST471H50	Machine : ST471H50
-	37026 E	1	Carter pour meule Ø150 (Øint.168)	Grindstone casing Ø150-(in.Ø168)
	Y	2	Vis H10 x 25	Screw H10x25
	EI	2	Rondelle W10	Washer W10
-	37026 F	1	Carter pour meule Ø150 (fente de démontage de meule)	Grindstone casing Ø150 (wheel disassembly)
	Y	2	Vis H10 x 25	Screw H10x25
	EI	2	Rondelle W10	Washer W10
-	37101	1	Carter pour meule Ø80	Grindstone casing Ø80
	Y	2	Vis H10 x 25	Screw H10x25
	EI	2	Rondelle W10	Washer W10
			Machine : ST471E50 - ST471B50	Machine : ST471E50 - ST471B50
-	37196	1	Carter pour meule Ø125	Grindstone casing Ø125
	Y	2	Vis H10 x 25	Screw H10x25
	EI	2	Rondelle W10	Washer W10

Ref	Qty	A	Pict
37685	1	13 - 23	
37686	1	17	
GBF	1	32	
FCC	1	10	
GBN	1	8	
37088	1		
GBS	1		
AS KH	4 4	M8 x 15 W8	

Ref	Qty	A	Pict
37685	1	13 - 23	
37686	1	17	
FCC	1	10	
37088	1		
GBS	1		
AF KH	4 4	M8 x 16 W8	
FJP	1	19 / 21	

OPERATION MANUAL

L48R

YANMAR ENGINE

MODIFIED BY KSR FOR USE ON

MP12 GEISMAR GRINDER

SAFETY

SAFETY STATEMENTS

YANMAR is concerned for your safety and your machine's condition. Safety statements are one of the primary ways to call your attention to the potential hazards associated with YANMAR L-N Series engine operation. Follow the precautions listed throughout the manual before operation, during operation and during periodic maintenance procedures for your safety, the safety of others and to protect the performance of your engine. Keep the labels from becoming dirty or torn and replace them if they are lost or damaged. Also, if you need to replace a part that has a label attached to it, make sure you order the new part and label at the same time.



This safety alert symbol appears with most safety statements. It means attention, become alert, your safety is involved! Please read and abide by the message that follows the safety alert symbol.

DANGER

DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE

NOTICE indicates a situation which can cause damage to the machine, personal property and/or the environment or cause the equipment to operate improperly.

SAFETY PRECAUTIONS

Before You Operate

NOTICE



- Never permit anyone to operate the engine or driven machine without proper training.

- Read and understand this Operation Manual before you operate the machine to ensure that you follow safe operating practices and maintenance procedures.
- Machine safety signs and labels are additional reminders for safe operating and maintenance techniques.
- See your authorized YANMAR industrial engine dealer or distributor for additional training.

During Operation and Maintenance

⚠ DANGER

Explosion Hazard!



- Keep the area around the battery well ventilated. While the engine is running or the battery is charging, hydrogen gas is produced which can be easily ignited.
- Keep sparks, open flame and any other form of ignition away.
- Never check the remaining battery charge by shorting out the terminals. This will result in a spark and may cause an explosion or fire. Use a hydrometer to check the remaining battery charge.
- If the electrolyte is frozen, slowly warm the battery before you recharge it.
- Failure to comply will result in death or serious injury.

⚠ DANGER

Fire and Explosion Hazard!



- Diesel fuel is extremely flammable and explosive under certain conditions.
- When you remove any fuel system component to perform maintenance (such as changing the fuel filter) place an approved container under the opening to catch the fuel.
- Never use a shop rag to catch the fuel. Vapors from the rag are extremely flammable and explosive.
- Wipe up any spills immediately.
- Wear eye protection. The fuel system is under pressure and fuel could spray out when you remove any fuel system component.
- Only use the key switch to start the engine.
- Never jump start the engine. Sparks caused by jumping the battery to the starter terminals may cause a fire or explosion.
- Never use diesel fuel as a cleaning agent.
- Never remove the fuel cap with the engine running.
- Only fill the fuel tank with diesel fuel. Filling the fuel tank with gasoline may result in a fire.
- Never refuel with the engine running.
- Wipe up all spills immediately.
- Keep sparks, open flames or any other form of ignition (match, cigarette, static electric source) away when fueling/refueling.
- Never overfill the fuel tank.
- Fill the fuel tank and store fuel in a well-ventilated area only.

⚠ DANGER (Continued)

- Be sure to place the diesel fuel container on the ground when transferring the diesel fuel from the pump to the container. Hold the hose nozzle firmly against the side of the container while filling it. This prevents static electricity build-up which could cause sparks and ignite fuel vapors.
- Never place diesel fuel or other flammable material such as oil, hay or dried grass close to the engine during engine operation or shortly after shut down.
- Before you operate the engine, check for fuel leaks. Replace rubberized fuel hoses every two years or every 2000 hours of engine operation, whichever comes first, even if the engine has been out of service. Rubberized fuel lines tend to dry out and become brittle after two years or 2000 hours of engine operation, whichever comes first.
- Do not let fuel exceed the fuel level mark on the fuel filter (inlet) of the fuel tank filler port. The fuel oil may expand when the ambient temperature is high, and overflow the fuel tank cap.
- Failure to comply will result in death or serious injury.

Crush Hazard!

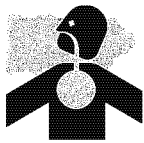
- When you need to transport an engine for repair, have a helper assist you to attach it to a hoist and load it on a truck.
- Never stand under a hoisted engine. If the hoist mechanism fails, the engine will fall on you, causing serious injury or death.
- Failure to comply will result in death or serious injury.

⚠ WARNING**Sever Hazard!**

- Keep hands and other body parts away from moving/rotating parts such as the cooling fan/flywheel.
- Wear tight fitting clothing and keep your hair short or tie it back while the engine is running.
- Remove all jewelry before you operate or service the machine.
- Never start the engine in gear. Sudden movement of the engine and/or machine could cause death or serious personal injury.
- Never operate the engine without the guards in place.
- Before you start the engine make sure that all bystanders are clear of the area.
- Keep children and pets away while the engine is operating.
- Check before starting the engine that any tools or shop rags used during maintenance have been removed from the area.
- Stop the engine before you begin to service it.
- Never leave the key in the key switch when you are servicing the engine. Someone may accidentally start the engine and not realize you are servicing it. This could result in a serious injury.
- If you must service the engine while it is operating, remove all jewelry, tie long hair back, and keep your hands, other body parts and clothing away from moving/rotating parts.
- Failure to comply could result in death or serious injury.

⚠ WARNING

Exhaust Hazard!



- Never operate the engine in an enclosed area such as a garage, tunnel, underground room, manhole or ship's hold without proper ventilation.
- Never block windows, vents, or other means of ventilation if the engine is operating in an enclosed area. All internal combustion engines create carbon monoxide gas during operation. Accumulation of this gas within an enclosure could cause illness or even death.
- Make sure that all connections are tightened to specifications after repair is made to the exhaust system.
- Failure to comply could result in death or serious injury.

Alcohol and Drug Hazard!



- Never operate the engine while you are under the influence of alcohol or drugs.
- Never operate the engine when you are feeling ill.
- Failure to comply could result in death or serious injury.

⚠ WARNING

Exposure Hazard!



- Wear personal protective equipment such as gloves, work shoes, eye and hearing protection as required by the task at hand.
- Never wear jewelry, unbuttoned cuffs, ties or loose fitting clothing when you are working near moving/rotating parts such as the cooling fan, flywheel or PTO shaft.
- Always tie long hair back when you are working near moving/rotating parts such as a cooling fan, flywheel, or PTO shaft.
- Never operate the engine while wearing a headset to listen to music or radio because it will be difficult to hear the warning signals.
- Failure to comply could result in death or serious injury.

Burn Hazard!



- Batteries contain sulfuric acid. Never allow battery fluid to come in contact with clothing, skin or eyes. Severe burns could result.
- Always wear safety goggles and protective clothing when servicing the battery. If contact with the skin and/or eyes should occur, flush with a large amount of water and obtain prompt medical treatment.
- Failure to comply could result in death or serious injury.

⚠ WARNING**High Pressure Hazard!**

- Avoid skin contact with the high pressure diesel fuel spray caused by a fuel system leak such as a broken fuel injection line. High pressure fuel can penetrate your skin and result in serious injury. If you are exposed to high pressure fuel spray, obtain prompt medical treatment.
- Never check for a fuel leak with your hands. Always use a piece of wood or cardboard. Have your authorized YANMAR industrial engine dealer or distributor repair the damage.
- Failure to comply could result in death or serious injury.

Shock Hazard!

- Turn off the battery switch (if equipped) or disconnect the negative battery cable before servicing the electrical system.
- Check the electrical harnesses for cracks, abrasions, and damaged or corroded connectors. Always keep the connectors and terminals clean.
- Failure to comply could result in death or serious injury.

⚠ WARNING**Burn Hazard!**

- If you must drain the engine oil while it is still hot, stay clear of the hot engine oil to avoid being scalded. Make sure you wear eye protection.
- Keep your hands and other body parts away from hot engine surfaces such as the muffler, exhaust pipe, turbocharger (if equipped) and engine block during operation and shortly after you shut the engine down. These surfaces are extremely hot while the engine is operating and could seriously burn you.
- Failure to comply could result in death or serious injury.

Cautions when Stopping the Engine!

- Do not suddenly accelerate from a low-speed state which was right before stopping. The engine may rarely rotate reversely.
- If the reversing occurs, white smoke blows out from the air cleaner. In that case, immediately stop the engine, and inspect the air cleaner. If you find anything wrong, replace the parts.

⚠ CAUTION**Flying Object Hazard!**

- Always wear eye protection when servicing the engine and when using compressed air or high-pressure water. Dust, flying debris, compressed air, pressurized water or steam may injure your eyes.
- Failure to comply may result in minor or moderate injury.

NOTICE

- Only use diesel fuels recommended by YANMAR for the best engine performance, to prevent engine damage.
- Only use clean diesel fuel.
- Never remove inlet strainer from the filler port. If removed, dirt and debris could get into the fuel system causing it to clog.

Never attempt to adjust the low or high idle speed limit screw. This may impair the safety and performance of the machine and shorten its life. If adjustment is ever required, contact your authorized YANMAR industrial engine dealer or distributor.

If any problem is noted during the visual check, the necessary corrective action should be taken before you operate the engine.

Never hold the key in the START position for longer than 15 seconds or the starter motor will overheat.

After an unsuccessfully attempt allow the starter motor to cool down for 2 minutes.

The illustrations and descriptions of optional equipment in this manual, such as the operator's console, are for a typical engine installation. Refer to the documentation supplied by the optional equipment manufacturer for specific operation and maintenance instructions.

If any indicator illuminates during engine operation stop the engine immediately. Determine the cause and repair the problem before you continue to operate the engine.

NOTICE

Observe the following environmental operating conditions to maintain engine performance and avoid premature engine wear:

- Avoid operating in extremely dusty conditions.
- Avoid operating in the presence of chemical gases or fumes.
- Avoid operating in a corrosive atmosphere such as salt water spray.
- Never install the engine in a floodplain unless proper precautions are taken to avoid being subject to a flood.
- Never expose the engine to the rain.
- Never run the engine if the ambient temperature is above +104 °F (+40 °C) or below +14 °F (-10 °C)
 - If the ambient temperature exceeds +104 °F (+40 °C) the engine may overheat and cause the engine oil to break down with consequent heavy damages to the engine moving parts.
 - If the ambient temperature falls below +14 °F (-10 °C) rubber components such as gaskets and seals will harden causing premature engine wear and damage.
 - Contact your authorized YANMAR industrial engine dealer or distributor if the engine will be operated in either temperature extreme.
- The engine should be used under an altitude of 1200 m. Contact your authorized YANMAR industrial engine dealer or distributor if you need to operate the engine at high altitudes more than 1200 m. At high altitudes the engine will lose power, run rough, and produce exhaust gases that exceed the design specifications.

Never allow the recoil handle to snap back against the engine. Return the handle to the starting position gently to prevent damage to the starter.

NOTICE

- Only use the engine oil specified. Other engine oils may affect warranty coverage, cause internal engine components to seize, or shorten engine life.
 - Prevent dirt and debris from contaminating the engine oil. Carefully clean the oil cap/dipstick and the surrounding area before you remove the cap.
 - Never mix different types of engine oil. This may adversely affect the lubricating properties of the engine oil.
 - Never overfill. Overfilling may result in white exhaust smoke, engine overspeed or internal damage.
-
- Never overfill the engine with engine oil.
 - Always keep the oil level between the upper and lower lines on the oil cap/dipstick.
-

For maximum engine life, YANMAR recommends that when shutting the engine down, you allow the engine to idle, without load, for 5 minutes. This will allow the engine components that operate at high temperatures, such as exhaust system, to cool slightly before the engine itself is shut down.

Never use an engine starting aid such as ether. Engine damage will result.

Make sure the engine is installed on a level surface. If a continuously running engine is installed at an angle greater than 20° (in any direction) or if an engine runs for short periods of time (less than 3 minutes) at an angle greater than 30° in any direction, engine oil may enter the combustion chamber causing excessive engine speed and generate white smoke and also may occur unsatisfactory oil pressure. These may cause serious engine damage.

NOTICE

New engine break in:

- On the initial engine start-up, allow the engine to idle for approximately 15 minutes while you check for proper engine oil pressure, diesel fuel leaks, engine oil leaks, and for proper operation of the indicators and/or gauges.
 - During the first hour of operation, vary the engine speed and the load on the engine. Short periods of maximum engine speed and load are desirable. Avoid prolonged operation at minimum or maximum engine speeds and loads for the next 100 hours.
 - During the break-in period, carefully observe the engine oil pressure and engine temperature.
 - During the break-in period, check the engine oil levels frequently.
-

Never engage the starter motor while the engine is running. This may damage the starter motor pinion and/or ring gear.

- Never attempt to modify the engine's design or safety features such as defeating the engine speed limit control or the fuel injection quantity control.
- Failure to comply may impair the engine's safety and performance characteristics and shorten the engine's life. Any alterations to this engine may affect the warranty coverage of your engine.
See YANMAR LIMITED WARRANTY on page iii.

NOTICE



- Be environmentally responsible. Follow these procedures for hazardous waste disposal. Failure to follow these procedures may seriously harm the environment.
- Follow the guidelines of the governmental agency for the proper disposal of hazardous materials such as engine oil, diesel fuel and engine coolant. Consult the local authorities or reclamation facility.
- Never dispose of hazardous materials irresponsibly by dumping them into a sewer, on the ground or into ground water or waterways.

Protect the air cleaner, and electric components from damage when you use steam or use high-pressure water to clean the engine.

The tightening torque in the *STANDARD TORQUE CHART* on page 37 should be carefully observed.

- Apply 60 % torque to bolts that are not listed.
- Apply 80 % torque when tightened to aluminum alloy.

Establish a periodic maintenance plan according to the engine application and make sure you perform the required periodic maintenance at intervals indicated. Failure to follow these guidelines will impair the engine's safety and performance characteristics, shorten the engine's life and may affect the warranty coverage on your engine. See *YANMAR LIMITED WARRANTY* on page iii.

Consult your authorized YANMAR industrial engine dealer or distributor for assistance when checking items marked with a ●.

NOTICE

It is important to perform daily checks. See *DAILY CHECKS* on page 23.

Periodic maintenance prevents unexpected downtime, reduces the number of accidents due to poor machine performance and helps extend the life of the engine.

- When the engine is operated in dusty conditions, clean the air cleaner element more frequently.
- Never operate the engine with the air cleaner or element(s) removed or not properly fitted in its seat. This may cause foreign material to enter the engine and damage it.

Tips while starting engine with recoil starter (See *Start the engine* on page 29.):

- Pulling out the recoil starter handle too hard or fast will damage the equipment.
- Always pull recoil starter handle all the way out or the engine will not start.
- Never allow the recoil starter handle to snap back against the engine. Return the handle to the starting position gently to prevent damage to the recoil starter.

If the engine continues to run after you position the engine speed control to the STOP position, turn the fuel cock to the CLOSED position.

BEFORE YOU OPERATE

This section of the *Operation Manual* describes the diesel fuel and engine oil specifications and how to replenish them. It also describes the daily engine checkout.

DIESEL FUEL

Diesel Fuel Specifications

Diesel fuel should comply with the following specifications. The table lists several worldwide specifications for diesel fuels.

Diesel fuel specification	Location
ASTM D975 No. 1D S15, S500 No. 2D S15, S500	USA
EN590:96	European Union
ISO 8217 DMX	International
BS 2869-A1 or A2	United Kingdom
JIS K2204 Grade No.2	Japan
KSM-2610	Korea
GB252	China

■ Additional technical fuel requirements

- The fuel cetane number should be equal to 45 or higher.
- The sulfur content must not exceed 0.5 % by volume. Less than 0.05 % is preferred.
- Bio-Diesel fuels. *See Bio-diesel fuels on page 18.*
- Never mix kerosene, used engine oil, or residual fuels with the diesel fuel.
- Water and sediment in the fuel should not exceed 0.05 % by volume.
- Keep the fuel tank and fuel-handling equipment clean at all times.
- Poor quality fuel can reduce engine performance and/or cause engine damage.
- Fuel additives are not recommended. Some fuel additives may cause poor engine performance. Consult your YANMAR representative for more information.
- Ash content not to exceed 0.01 % by volume.
- Carbon residue content not to exceed 0.35 % by volume. Less than 0.1 % is preferred.

- Total aromatics content should not exceed 35 % by volume. Less than 30 % is preferred.
- PAH (polycyclic aromatic hydrocarbons) content should be below 10 % by volume.
- Metal content of Na, Mg, Si, and Al should be equal to or lower than 1 mass ppm. (Test analysis method JPI-5S-44-95)
- Lubricity: Wear mark of WS1.4 should be Max. 460 µm at HFRR test.

■ Bio-diesel fuels

In Europe and in the United States, as well as some other countries, non-mineral oil based fuel resources such as RME (Rapeseed Methyl Ester) and SOME (Soybean Methyl Ester), collectively known as FAME (Fatty Acid Methyl Esters), are being used as extenders for mineral oil derived diesel fuels.

YANMAR approves the use of bio-diesel fuels that do not exceed a blend of 7 % (by volume) of FAME with 93 % (by volume) of approved mineral oil derived diesel fuel. Such bio-diesel fuels are known in the marketplace as B7 diesel fuels.

These B7 diesel fuels must meet certain requirements.

1. The bio-fuels must meet the minimum specifications for the country in which they are used.
 - In Europe, bio-diesel fuels must comply with the European Standard EN14214.
 - In the United States, bio-diesel fuels must comply with the American Standard ASTM D-6751.
2. Bio-fuels should be purchased only from recognized and authorized diesel fuel suppliers.

Precautions and concerns regarding the use of bio-fuels:

1. Free methanol in FAME may result in corrosion of aluminum and zinc FIE components.
2. Free water in FAME may result in plugging of fuel filters and increased bacterial growth.
3. High viscosity at low temperatures may result in fuel delivery problems, injection pump seizures, and poor injection nozzle spray atomization.
4. FAME may have adverse effects on some elastomers (seal materials) and may result in fuel leakage and dilution of the engine lubricating oil.
5. Even bio-diesel fuels that comply with a suitable standard as delivered, will require additional care and attention to maintain the quality of the fuel in the equipment or other fuel tanks. It is important to maintain a supply of clean, fresh fuel. Regular flushing of the fuel system, and/or fuel storage containers, may be necessary.
6. The use of bio-diesel fuels that do not comply with the standards as agreed to by the diesel engine manufacturers and the diesel fuel injection equipment manufacturers, or bio-diesel fuels that have degraded as per the precautions and concerns above, may affect the warranty coverage of your engine.
See YANMAR LIMITED WARRANTY on page iii.
7. In case of doubt, call the YANMAR representative for information, collecting in advance all the useful information on the fuel subject of your inquiry.

Filling the Fuel Tank**⚠ DANGER****Fire and Explosion Hazard!**

- Diesel fuel is extremely flammable and explosive under certain conditions.

- Only fill the fuel tank with diesel fuel. Filling the fuel tank with gasoline may result in a fire.
- Never refuel with the engine running.
- Wipe up all spills immediately.
- Keep sparks, open flames or any other form of ignition (match, cigarette, static electric source) away when fueling/refueling.
- Never overfill the fuel tank.
- Fill the fuel tank and store fuel in a well-ventilated area only.
- Be sure to place the diesel fuel container on the ground when transferring the diesel fuel from the pump to the container. Hold the hose nozzle firmly against the side of the container while filling it. This prevents static electricity build-up which could cause sparks and ignite fuel vapors.
- Never place diesel fuel or other flammable material such as oil, hay or dried grass close to the engine during engine operation or shortly after shut down.
- Before you operate the engine, check for fuel leaks. Replace rubberized fuel hoses every two years or every 2000 hours of engine operation, whichever comes first, even if the engine has been out of service. Rubberized fuel lines tend to dry out and become brittle after two years or 2000 hours of engine operation, whichever comes first.
- Do not let fuel exceed the fuel level mark on the fuel filter (inlet) of the fuel tank filler port. The fuel oil may expand when the ambient temperature is high, and overflow the fuel tank cap.
- Failure to comply will result in death or serious injury.

BEFORE YOU OPERATE

NOTICE

- Only use diesel fuels recommended by YANMAR for the best engine performance, to prevent engine damage.
- Only use clean diesel fuel.
- Never remove inlet strainer from the filler port. If removed, dirt and debris could get into the fuel system causing it to clog.

Be sure that the fuel you are filling the tank with is having no water inside, the fuel filtration system is capable to protect the fuel equipment against solid particles entry, water can pass through the fuel filter screen and cause damages to the high pressure components.

Note that a typical fuel tank is shown. The fuel tank on your engine may be different. **Always make sure the inlet strainer remains inside of the fuel tank while fueling!**

1. Clean the area around the fuel cap (1, **Figure 1**).
2. Remove the fuel cap (1, **Figure 1**) from the fuel tank (3, **Figure 1**).
3. Stop fueling when the fuel is at the same level as the red ring (4, **Figure 1**) at the bottom of the inlet fuel screen.

CAUTION

Never supply the fuel beyond the red ring. It may bring exudation from the fuel cap.

4. Replace the fuel cap (1, **Figure 1**) and hand tighten. Over-tightening the fuel cap will damage it.

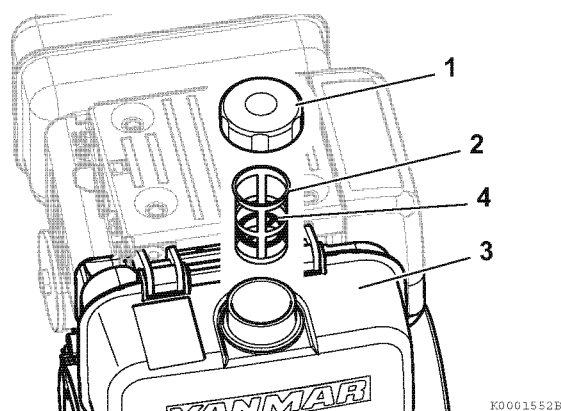


Figure 1

Fuel tank capacity

The following are the fuel tank capacity for various YANMAR L-N series engines.

Engine model	Fuel tank capacity (Limit value)
L48N	1.9 L
L70N	2.7 L
L100N	4.7 L

Note: Fuel tank capacity will vary depending upon which optional fuel tank is used. Refer to the operation manual provided by the driven machine manufacturer for the actual fuel tank capacity of your machine.

ENGINE OIL

NOTICE

- Only use the engine oil specified. Other engine oils may affect warranty coverage, cause internal engine components to seize, or shorten engine life.
- Prevent dirt and debris from contaminating the engine oil. Carefully clean the oil cap/dipstick and the surrounding area before you remove the cap.
- Never mix different types of engine oil. This may adversely affect the lubricating properties of the engine oil.
- Never overfill. Overfilling may result in white exhaust smoke, engine overspeed or internal damage.

Engine Oil Specifications

Use an engine oil that meets or exceeds the following guidelines and classifications:

■ Service categories

- API service categories CD or higher
- ACEA service categories E-3, E-4, and E-5
- JASO service category DH-1

■ Definitions

- API classification (American Petroleum Institute)
- ACEA classification (Association des Constructeurs Européens d'Automobiles)
- JASO (Japanese Automobile Standards Organization)

NOTICE

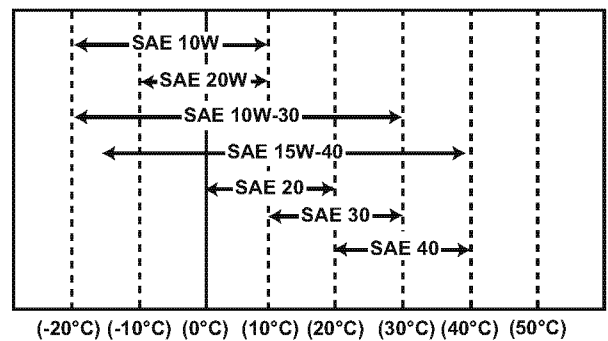
- Be sure the engine oil, engine oil storage containers, and engine oil filling equipment are free of sediments and water.
- Change the engine oil after the first 50 hours of operation and then at every 200 hours thereafter.
- Select the oil viscosity based on the ambient temperature where the engine is being operated. See SAE service grade viscosity chart (**Figure 2**).
- YANMAR does not recommend the use of engine oil "additives".

■ Additional technical engine oil requirements:

The engine oil must be changed when the Total Base Number (TBN) has been reduced to 2.0. TBN (mgKOH/g) test method; JIS K-201-5.2-2 (HCl), ASTM D4739 (HCl)

Engine Oil Viscosity

Select the appropriate engine oil viscosity based on the ambient temperature and use the SAE service grade viscosity chart in **Figure 2**.



K0000005A01

Figure 2

Checking Engine Oil

1. Make sure engine is level.
2. Remove oil cap/dipstick (1, **Figure 3**) from either location and wipe with clean cloth.
3. Fully reinsert oil cap/dipstick **but do not screw in**.
4. Remove oil cap/dipstick. The oil level should be between upper (2, **Figure 3**) and lower (3, **Figure 3**) lines on the oil cap/dipstick.
5. Fully reinsert oil cap/dipstick (1, **Figure 3**) and hand tighten. Over-tightening the oil cap/dipstick will damage it.

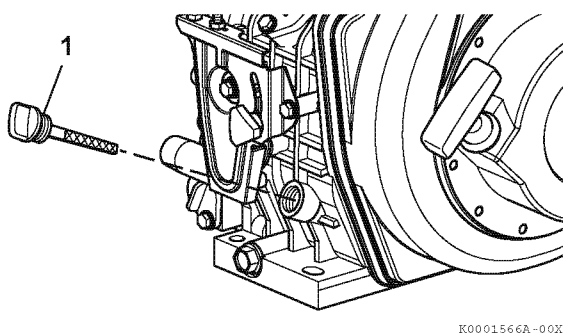
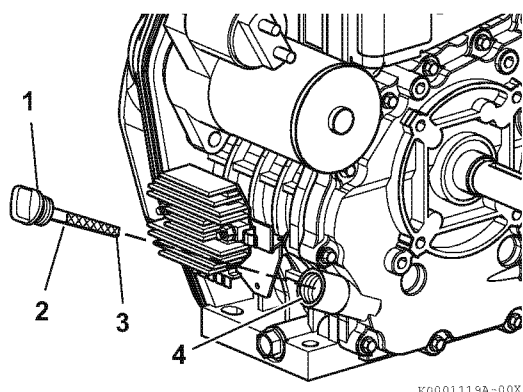


Figure 3

Adding Engine Oil

1. Make sure engine is level.
2. Remove oil cap/dipstick (1, **Figure 3**).
3. Add indicated amount of engine oil at either one of the engine oil filler ports (4, **Figure 3**).
4. Wait one minute and check oil level.
5. Add more oil if necessary.
6. Fully reinsert oil cap/dipstick (1, **Figure 3**) and hand tighten. Over-tightening the oil cap/dipstick will damage it.

Engine Oil Capacity (Typical)

The following are the engine oil capacities for various YANMAR L-N Series engines.

Engine model	Dipstick upper limit/ lower limit
L48N	0.85/0.58 qt (0.80/0.55 L)
L70N	1.11/0.69 qt (1.05/0.65 L)
L100N	1.7/1.06 qt (1.6/1.0 L)

Note: Oil capacity will vary depending upon which optional oil pan is used. Refer to the operation manual provided by the driven machine manufacturer for the actual engine oil capacity of your machine.

DAILY CHECKS

Before you begin any job, make sure the YANMAR L-N Series engine is in good operating condition. Make sure you check the following items before you start your shift and have any repairs completed before you start work.

WARNING

High Pressure Hazard!



- **Avoid skin contact with the high pressure diesel fuel spray caused by a fuel system leak such as a broken fuel injection line. High pressure fuel can penetrate your skin and result in serious injury. If you are exposed to high pressure fuel spray, obtain prompt medical treatment.**
- **Never check for a fuel leak with your hands. Always use a piece of wood or cardboard. Have your authorized YANMAR industrial engine dealer or distributor repair the damage.**
- **Failure to comply could result in death or serious injury.**

Visual Checks

1. Check for engine oil leaks.
2. Check for fuel leaks.
3. Check for damaged or missing parts.
4. Check for loose, missing, or damaged fasteners.
5. Check the electrical harnesses for cracks, abrasions, and damaged or corroded connectors.
6. Check hoses for cracks, abrasions, and damaged, loose or corroded clamps.

NOTICE

If any problem is noted during the visual check, the necessary corrective action should be taken before you operate the engine.

Check Diesel Fuel and Engine Oil

Follow the procedures in *DIESEL FUEL* on page 18 and *ENGINE OIL* on page 21 to check these levels.

Check Engine Speed Control (First Time Only)

1. Check the engine speed control for smooth operation and lubricate or clean as necessary.
2. Check engine speed control for proper adjustments.

Check Indicators

If your engine has an electric starter, check the battery indicator. Also check any other indicators supplied by the driven machine manufacturer.

Never run the machine without a battery in good condition of charge and connected properly, failing to comply will result in an electrical shock that could damage the internal circuit of the current regulator.

■ Battery

Stays On until the engine is running and the dynamo is supplying charging current. This indicator does not indicate whether the battery is discharged.

In case of remove or replacement of the battery, be sure to connect the terminal correctly, inverted polarities will result in the damage of the electrical parts of the engine/equipment.

Here is a summary of how these indicators function. The table shows what happens when you turn the key in a certain direction (e.g., OFF to ON).

Indicator	OFF to ON	START to ON
Battery	ON	OFF (Stays on until dynamo is supplying charging current. Remains on if there is a problem in the charging system. This indicator does not indicate whether the battery is discharged.)

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ENGINE OPERATION

This section of the *Operation Manual* describes the procedures for starting the engine, checking engine performance during operation, and shutting the engine down.

STARTING THE ENGINE

Recoil Start

NOTICE

Never use an engine starting aid such as ether or any other liquids or gaseous substances to be introduced through the intake.

Use the following procedure to start the engine.

■ Daily checks

1. Make sure you follow the procedures stated in *DAILY CHECKS* on page 23.
2. Make sure the fuel cock is in the ON position (1, **Figure 1**).

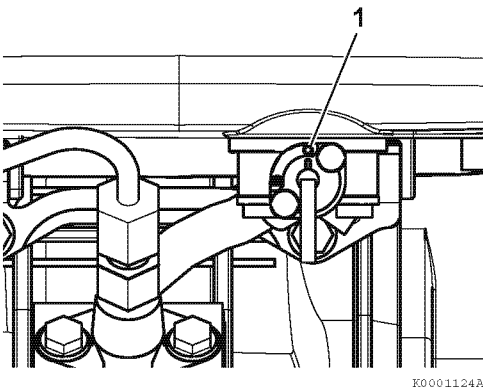


Figure 1

■ Set engine speed control to START

Several types of engine speed controls are used in L-N engine applications. The following procedures are for three typical applications. Refer to the operating instructions for the driven machine.

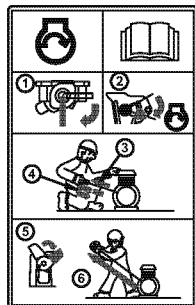
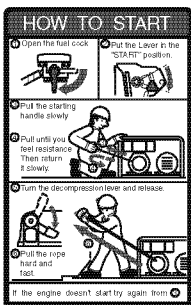


Figure 2

1. If your engine speed control is similar to **Figure 3** slide the engine speed control lever (1, **Figure 3**) to the RUN position (2, **Figure 3**).

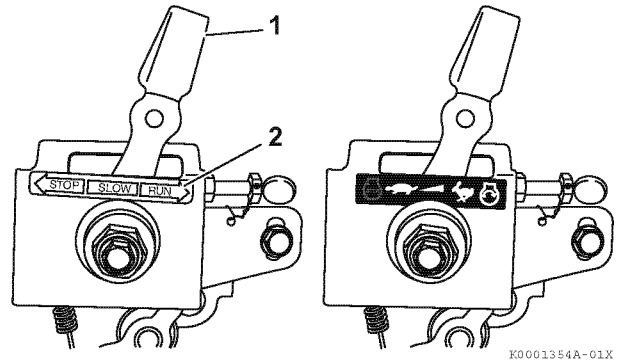


Figure 3

2. If your engine speed control is similar to **Figure 4** slide the engine speed control lever (1, **Figure 4**) to the RUN position (2, **Figure 4**).

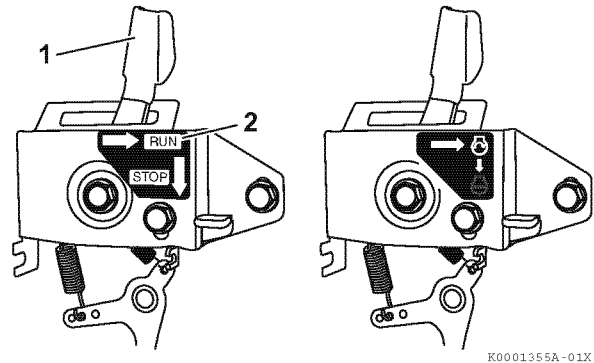


Figure 4

3. If your engine speed control is similar to **Figure 5**:
 - 1- Turn the engine speed control knob (1, **Figure 5**) to the left (2, **Figure 5**).
 - 2- Slide the engine speed control knob to the START position (3, **Figure 5**).
 - 3- Turn the engine speed control knob to the right (4, **Figure 5**) to tighten it.

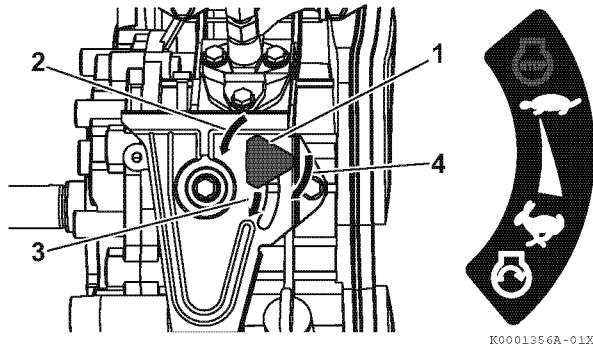


Figure 5

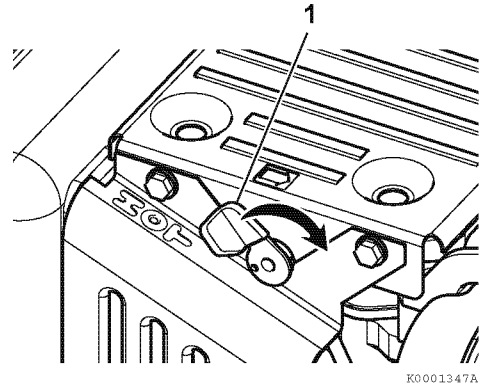


Figure 6

■ Start the engine

NOTICE

Tips while starting engine with recoil starter:

- Pulling out the recoil starter handle too hard or fast will damage the equipment.
- Always pull recoil starter handle all the way out or the engine will not start.
- Never allow the recoil starter handle to snap back against the engine. Return the handle to the starting position gently to prevent damage to the recoil starter.
- Never use an engine starting aid such as ether. Engine damage will result.

Engine with manual decompression device

This engine is equipped with a decompression lever (1, **Figure 6**).

1. Grasp the recoil starter handle (1, **Figure 7**).
2. Pull the handle out slowly until you feel strong resistance.
3. Slowly return the recoil starter handle to the initial position.
4. Push the decompression lever (1, **Figure 6**) down and release it. The decompression lever will automatically return to the original position when the engine starts.

5. Grasp the recoil starter handle (1, **Figure 7**).
6. Pull the handle all the way out with a strong and even motion. Use two hands if necessary.
7. Slowly return the recoil starter handle to the initial position.
8. If the engine does not start, repeat the *Start The Engine* procedure from Step 1.

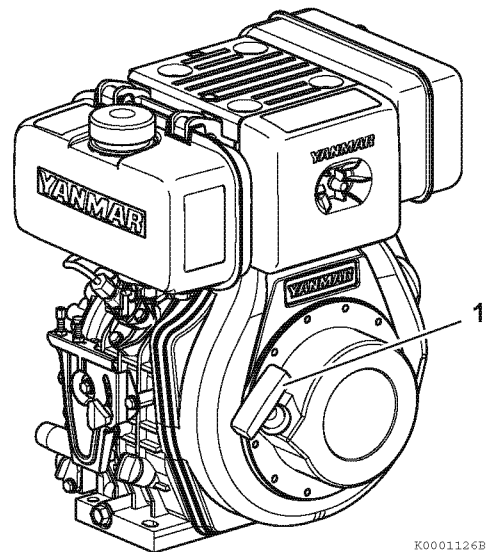


Figure 7

Engine with auto-decompression device

Some L-N model engines are equipped with an automatic, internal compression release mechanism and do not have the decompression lever (1, **Figure 6**). In this case, follow the procedure below.

ENGINE OPERATION

1. Grasp the recoil starter handle (1, **Figure 7**).
2. Pull the handle all the way out with a strong and even motion. Use two hands if necessary.
3. Slowly return the recoil starter handle to the initial position.
4. If the engine does not start, repeat the procedure from Step 1.

■ In cold weather - L48N only

If you have trouble pulling the recoil handle on an L48N engine in cold weather follow this procedure:

1. Remove the oil plug (1, **Figure 8**).

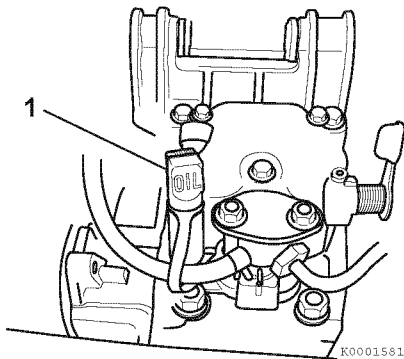


Figure 8

2. Add 2 cc of engine oil to the oil port (1, **Figure 9**).

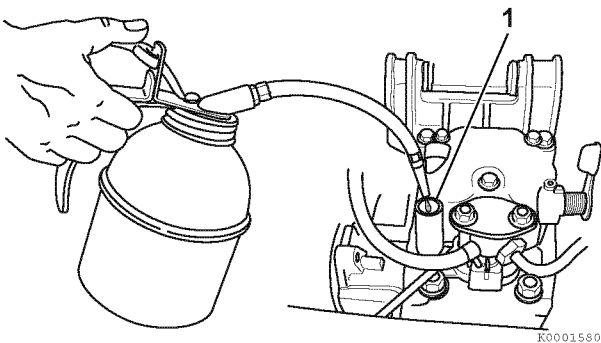


Figure 9

3. Reinsert the oil plug (1, **Figure 8**).

Electric Start

Use the following procedure to start the engine.

■ Daily checks

1. Make sure you follow the procedures stated in *DAILY CHECKS* on page 23.
2. Make sure the fuel cock is in the ON position (1, **Figure 10**).

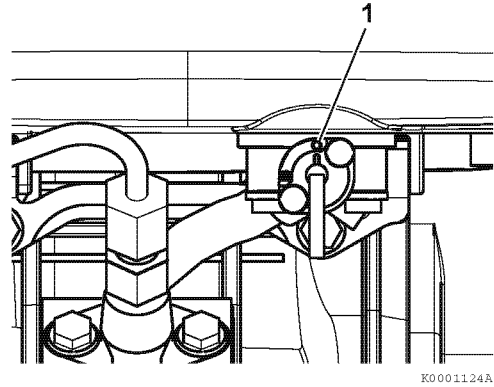


Figure 10

■ Set engine speed control to START

Several types of engine speed controls are used in L-N engine applications. The following procedures are for three typical applications. Refer to the operating instructions for the driven machine.

1. If your engine speed control is similar to **Figure 11** slide the engine speed control lever (1, **Figure 11**) to the RUN position (2, **Figure 11**).

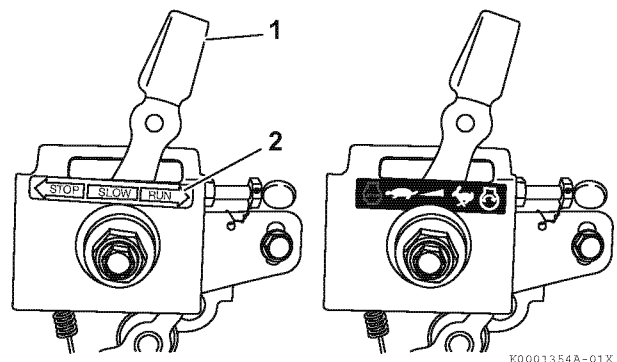


Figure 11

2. If your engine speed control is similar to **Figure 12** slide the engine speed control lever (1, **Figure 12**) to the RUN position or (2, **Figure 12**).

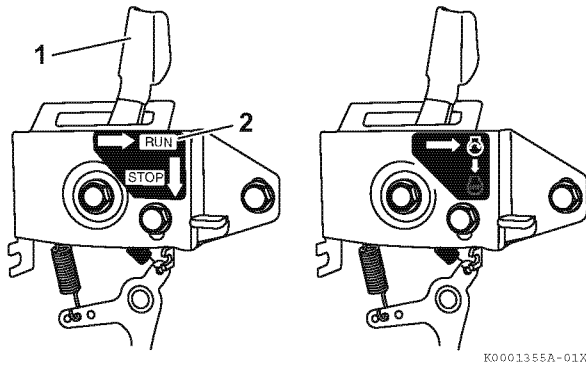


Figure 12

3. If your engine speed control is similar to **Figure 13**:
 - 1- Turn the engine speed control knob (1, **Figure 13**) to the left (2, **Figure 13**).
 - 2- Slide the engine speed control knob to the START position (3, **Figure 13**).
 - 3- Turn the engine speed control knob to the right (4, **Figure 13**) to tighten it.

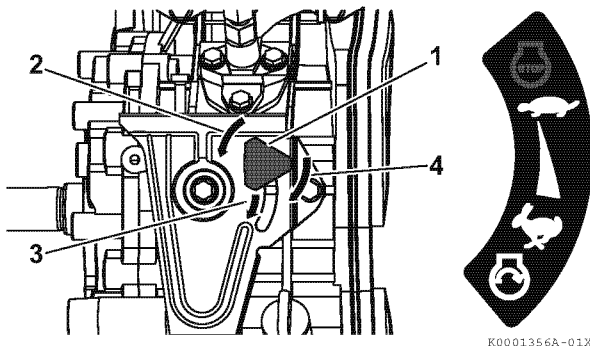


Figure 13

■ Start the engine

Use the following procedure to start the engine.

1. Insert the key into the key switch.

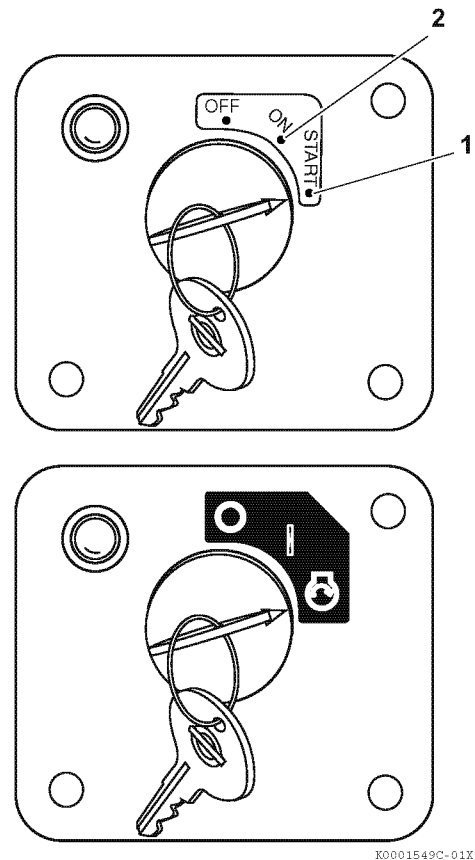


Figure 14

2. Turn the key clockwise to the START position (1, **Figure 14**). Release the key as soon as the engine starts. It will return to the ON position (2, **Figure 14**).
3. If the engine fails to start:
 - 1- Wait until the engine comes to a complete stop before you attempt to start it again. Engaging the starter while the engine is still rotating will result in damage to the starter motor and flywheel.
 - 2- Wait at least 2 minutes before you attempt to start the engine again. This pause will allow the battery voltage to recover to prevent damage to the starter motor due to the low battery voltage.

CHECK THE ENGINE DURING OPERATION

NOTICE

Make sure the engine is installed on a level surface. If a continuously running engine is installed at an angle greater than 20° (in any direction) or if an engine runs for short periods of time (less than 3 minutes) at an angle greater than 30° in any direction. These may cause serious engine damage.

New engine break in:

- On the initial engine start-up, allow the engine to idle for approximately 15 minutes while you check for proper engine oil pressure, diesel fuel leaks, engine oil leaks, and for proper operation of the indicators and/or gauges.
- During the first hour of operation, vary the engine speed and the load on the engine. Short periods of maximum engine speed and load are desirable. Avoid prolonged operation at minimum or maximum engine speeds and loads for the next 100 hours.
- During the break-in period, carefully observe the engine oil pressure and engine temperature.
- During the break-in period, check the engine oil levels frequently.

⚠ WARNING

High Pressure Hazard!



- Avoid skin contact with the high pressure diesel fuel spray caused by a fuel system leak such as a broken fuel injection line. High pressure fuel can penetrate your skin and result in serious injury. If you are exposed to high pressure fuel spray, obtain prompt medical treatment.
 - Never check for a fuel leak with your hands. Always use a piece of wood or cardboard. Have your authorized YANMAR industrial engine dealer or distributor repair the damage.
 - Failure to comply could result in death or serious injury.
1. After the engine has reached operating temperature, all of the indicators (if equipped) should be Off. If any of the indicators are On, shut down the engine and have the necessary repairs performed.
 2. Check for any fuel or engine oil leaks. If any leaks are found shut down the engine and have the necessary repairs performed.
 3. Check for abnormal sounds or vibration. In some applications the engine and its mounting may start to resonate and cause unusual vibrations at certain engine speeds. Avoid running the engine at these speeds. If the abnormal sounds or vibration cannot be resolved, shut down the engine and have the necessary repairs performed.
 4. Check for white or black smoke from the exhaust system. A small amount of white exhaust smoke is normal on start-up of a cold engine. Black exhaust smoke could mean the engine is overloaded or being over-fueled. If either of these conditions persists, contact your authorized YANMAR industrial engine dealer or distributor.
 5. Check the fuel level during operation. If the fuel level runs low, stop the engine and refuel.

ADJUST ENGINE SPEED

NOTICE

New engine break in:

- On the initial engine start-up, allow the engine to idle for approximately 15 minutes while you check for proper engine oil pressure, diesel fuel leaks, engine oil leaks, and for proper operation of the indicators and/or gauges.
- During the first hour of operation, vary the engine speed and the load on the engine. Short periods of maximum engine speed and load are desirable. Avoid prolonged operation at minimum or maximum engine speeds and loads for the next 100 hours.
- During the break-in period, carefully observe the engine oil pressure and engine temperature.
- During the break-in period, check the engine oil levels frequently.

Use the engine speed control to adjust the engine speed for the task that will be performed.

Several types of engine speed controls are used in L-N engine applications. The following procedures are for three typical applications. Refer to the operating instructions for the driven machine.

1. If your engine speed control is similar to **Figure 15** slide the engine speed control lever (1, **Figure 15**) in the direction shown to adjust the engine speed.

Note: This is a friction adjustment. If the speed control will not maintain a given speed, tightening the nut will increase the friction on the speed control lever.

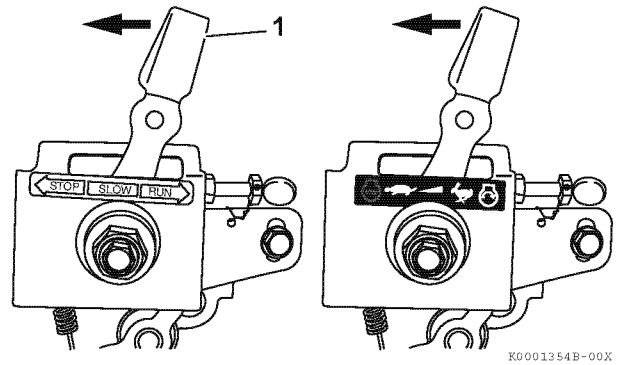


Figure 15

2. If your engine speed control is similar to **Figure 16** slide the engine speed control lever (1, **Figure 16**) in the direction shown to adjust the engine speed.

Note: This type of speed control, typically used on a generator set, has only one speed setting. When you move the lever to the right, it clicks into the RUN position. The speed control lever is spring-loaded so when you push down on the STOP button, the speed control lever moves back to the shut-off position. There is no idle position or intermediate speeds.

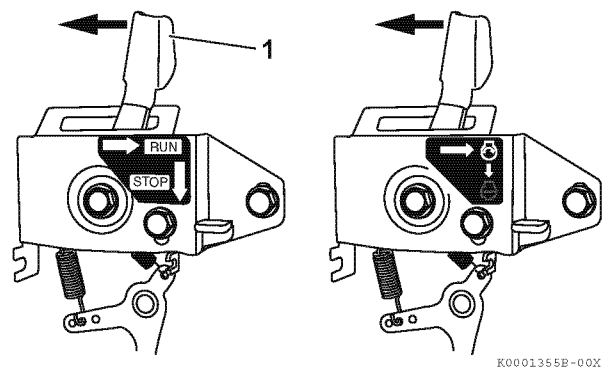


Figure 16

ENGINE OPERATION

3. If your engine speed control is similar to **Figure 17**:
 - 1- Turn the engine speed control knob (1, **Figure 17**) to the left (2, **Figure 17**).
 - 2- Slide the engine speed control knob in the direction shown to adjust the engine speed.
 - 3- Turn the engine speed control knob to the right (3, **Figure 17**) to tighten it.

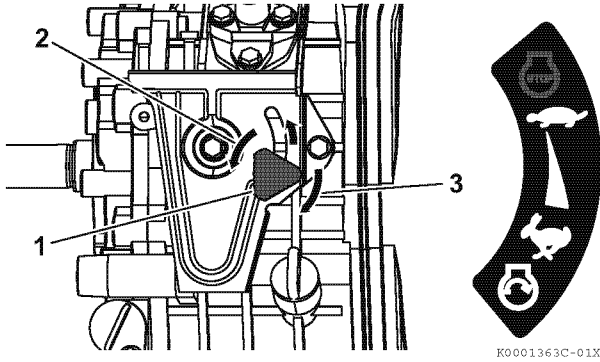


Figure 17

SHUTTING DOWN THE ENGINE

⚠ WARNING

Cautions when Stopping the Engine!



- Do not suddenly accelerate from a low-speed state which was right before stopping. The engine may rarely rotate reversely.
- If the reversing occurs, white smoke blows out from the air cleaner. In that case, immediately stop the engine, and inspect the air cleaner. If you find anything wrong, replace the parts.

NOTICE

For maximum engine life, YANMAR recommends that when shutting the engine down, you allow the engine to idle, without load, for 5 minutes. This will allow the engine components that operate at high temperatures, such as exhaust system, to cool slightly before the engine itself is shut down.

Preparing To Stop Engine

Follow these steps to shut down the engine:

1. Disengage the PTO.
2. Set the engine speed control to its lowest setting.
3. Run the engine at low idle speed or run without load for at least five minutes before you shut it down.

Set Engine Speed Control to STOP

NOTICE

If the engine continues to run after you position the engine speed control to the STOP position, turn the fuel cock to the CLOSED position.

Several types of engine speed controls are used in L-N engine applications. The following procedures are for three typical applications. Refer to the operating instructions for the driven machine.

1. If your engine speed control is similar to **Figure 18** slide the engine speed control lever (1, **Figure 18**) to the STOP position (2, **Figure 18**).

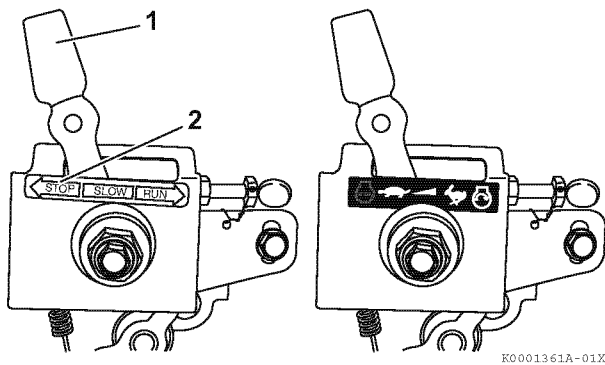


Figure 18

2. If your engine speed control is similar to **Figure 19** press the STOP button (1, **Figure 19**) and the engine speed control lever (2, **Figure 19**) will automatically return to the STOP position.

Note: The speed control lever is spring-loaded so when you push down on the STOP button, the speed control lever moves back to the shut-off position. There is no idle position or intermediate speeds.

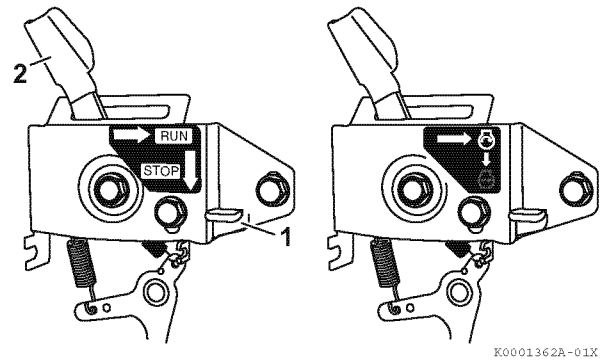


Figure 19

3. If your engine speed control is similar to **Figure 20**:
 - 1- Turn the engine speed control knob (1, **Figure 20**) to the left (2, **Figure 20**).
 - 2- Slide the engine speed control knob to the STOP position (3, **Figure 20**).
 - 3- Turn the engine speed control knob to the right (4, **Figure 20**) to tighten it.

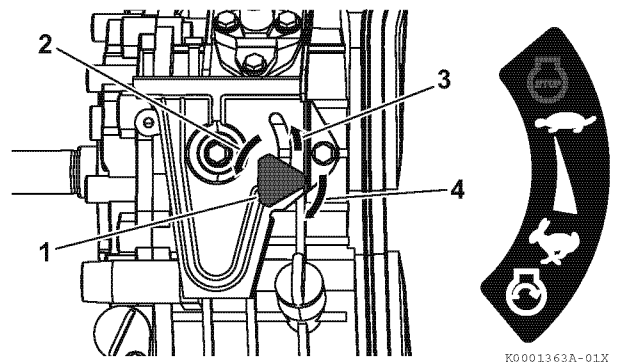


Figure 20

Electric Start Models

Turn the key to the OFF position (1, **Figure 21**) and remove it from the key switch.

Some equipment could be provided with an electric fuel cut valve, if this is your version, the shut down of the engine is done returning the key in the stop position, check the equipment manufacture manuals for more details.

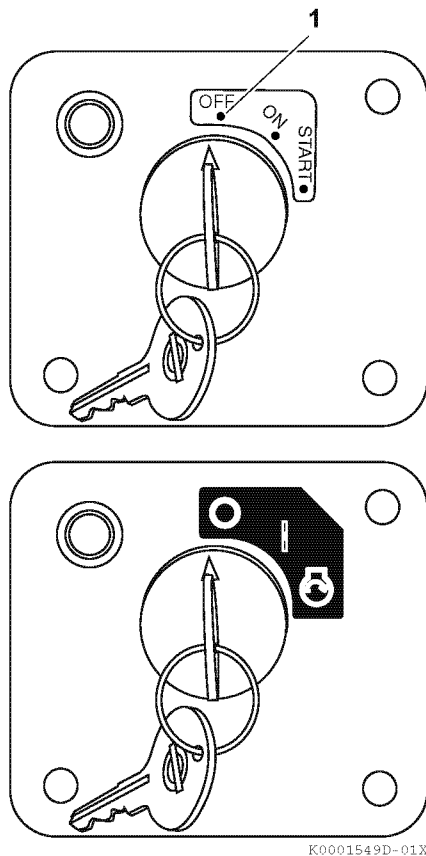


Figure 21

After the Engine Stops

1. Move the fuel cock lever to the closed position (1, **Figure 22**).

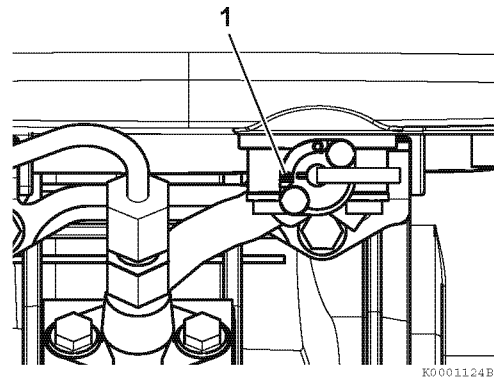


Figure 22

2. Slowly pull the recoil starter handle out to the point of resistance (the point in the compression stroke where the intake and exhaust valves are closed). This helps to prevent rust while the engine is not in use.
3. If the engine will not be used for six months or longer, follow the additional instructions in *LONG TERM STORAGE* on page 59.

PERIODIC MAINTENANCE

This section of the *Operation Manual* describes the procedures for proper care and maintenance of the engine.

PRECAUTIONS

The Importance of Periodic Maintenance

Engine deterioration and wear occurs in proportion to length of time the engine has been in service and the conditions the engine is subject to during operation. Periodic maintenance prevents unexpected downtime, reduces the number of accidents due to poor machine performance and helps extend the life of the engine.

Performing Periodic Maintenance

WARNING

Exhaust Hazard!



- **Never operate the engine in an enclosed area such as a garage, tunnel, underground room, manhole or ship's hold without proper ventilation.**
- **Never block windows, vents, or other means of ventilation if the engine is operating in an enclosed area. All internal combustion engines create carbon monoxide gas during operation. Accumulation of this gas within an enclosure could cause illness or even death.**
- **Make sure that all connections are tightened to specifications after repair is made to the exhaust system.**
- **Failure to comply could result in death or serious injury.**

Perform periodic maintenance procedures in an open, level area free from traffic. If possible, perform the procedures indoors to prevent environmental conditions, such as rain, wind, or snow, from damaging the machine.

The Importance of Daily Checks

Periodic Maintenance Schedules assume that the daily checks are performed on a regular basis. Make it a habit of performing daily checks before the start of each shift. *See DAILY CHECKS on page 23.*

Keep a Log of Engine Hours and Daily Checks

Keep a log of the number of hours the engine is run each day and a log of the daily checks performed. Also note the date, type of repair (e.g., replaced alternator), and parts needed for any service needed between the periodic maintenance intervals. Periodic maintenance intervals are every 50, 200, 400, 1000, 1500 and 2000 engine hours. Failure to perform periodic maintenance will shorten the life of the engine.

YANMAR Replacement Parts

YANMAR recommends that you use genuine YANMAR parts when replacement parts are needed. Genuine replacement parts help ensure long engine life.

Tools Required

Before you start any periodic maintenance procedure make sure you have the tools you need to perform all of the required tasks.

Ask Your Authorized YANMAR Industrial Engine Dealer or Distributor for Help

Our professional service technicians have the expertise and skills to help you with any maintenance or service related procedures you need help with.

Tightening Fasteners

Use the correct amount of torque when you tighten fasteners on the machine. Applying excessive torque may damage the fastener or component and not enough torque may cause a leak or component failure.

If you are unsure about the correct torque for an unspecified component, please contact the YANMAR representative for instructions.

NOTICE

The tightening torque in the *STANDARD TORQUE CHART* on page 37 should be carefully observed.

- Apply 60 % torque to bolts that are not listed.
- Apply 80 % torque when tightened to aluminum alloy.

STANDARD TORQUE CHART

Thread size × pitch	mm	M6 × 1.0	M8 × 1.25	M10 × 1.5	M12 × 1.75	M14 × 1.5	M16 × 1.5
Tightening torque	in. lbs	96.0 ± 9.0	—	—	—	—	—
	ft lbs	—	19.0 ± 2.0	36.0 ± 4.0	65.0 ± 7.0	101.0 ± 7.0	167.0 ± 7.0
	N·m	10.8 ± 1.0	25.5 ± 2.9	49.0 ± 4.9	88.3 ± 9.8	137.0 ± 9.8	226.0 ± 9.8
	kgf·m	1.1 ± 0.1	2.6 ± 0.3	5.0 ± 0.5	9.0 ± 1.0	14.0 ± 1.5	23.0 ± 2.0

PERIODIC MAINTENANCE

PERIODIC MAINTENANCE SCHEDULE

Daily and periodic maintenance is important to keep the engine in good operating condition. The following is a summary of maintenance items by periodic maintenance intervals. Periodic maintenance intervals vary depending on engine application, loads, diesel fuel and engine oil used and are hard to establish definitively. The following should be treated only as a general guideline.

NOTICE

Establish a periodic maintenance plan according to the engine application and make sure you perform the required periodic maintenance at intervals indicated. Failure to follow these guidelines will impair the engine's safety and performance characteristics, shorten the engine's life and may affect the warranty coverage on your engine. See *YANMAR LIMITED WARRANTY on page iii*.

Consult your authorized YANMAR industrial engine dealer or distributor for assistance when checking items marked with a ●.

Periodic Maintenance Chart

○: Check ◇: Replace ●: Contact your authorized YANMAR industrial engine dealer or distributor for these maintenance services

System	Check item	Daily	Periodic maintenance interval					
			Every 50 hours	Every 200 hours	Every 400 hours	Every 1000 hours	Every 1500 hours	Every 2000 hours
Air intake	Clean or replace air cleaner element - may need more frequent service in dusty conditions			○ 100 hours	◇ 500 hours			
Cylinder head	Adjust intake/exhaust valve clearance				●			
	Check compression					●		
Electrical equipment	Check battery and add water as necessary	○ Before operation						
	Check battery indicator (if equipped) and other driven machine indicators (if equipped)	○ When engine is started						
Fuel injector	Inspect, clean and test fuel injection nozzle						●	

PERIODIC MAINTENANCE

○: Check ◇: Replace ●: Contact your authorized YANMAR industrial engine dealer or distributor for these maintenance services

System	Check item	Daily	Periodic maintenance interval					
			Every 50 hours	Every 200 hours	Every 400 hours	Every 1000 hours	Every 1500 hours	Every 2000 hours
Engine oil	Check engine oil level and add engine oil as necessary	○ Before operation						
	Drain and refill engine oil			◇ 2nd and after				
	Clean, check or replace engine oil filter - replace if damaged May need more frequent service in dusty conditions		◇ 1st time	○	◇ 2nd and after			
	Check for engine oil leakage	○ Before and after operation						
Engine speed control	Check for proper operation Verify adjustment	○ 1st time only		○ 2nd and after				
Exhaust system	Check spark arrestor for clogging	○ Before operation						
Fuel	Check fuel tank level and add fuel as necessary	○ Before operation						
	Drain and clean fuel tank			○				
	Clean inlet fuel screen		○					
	Replace outlet fuel filter				◇			
	Check for fuel leakage	○ Before and after operation						
Hoses	Replace fuel system hose(s)							● or every 2 yrs. whichever comes first

PERIODIC MAINTENANCE PROCEDURES

Daily, Before Operation

Perform the following maintenance daily before operation.

- Check battery (if equipped)
- Check battery indicator (if equipped)
- Check engine oil level
- Check for engine oil leakage
- Check engine speed control (1st time only)
- Check spark arrestor (if equipped)
- Check fuel level
- Check for fuel leakage

■ Check battery (if equipped)

⚠ DANGER

Explosion Hazard!



- **Never check the remaining battery charge by shorting out the terminals. This will result in a spark and may cause an explosion or fire. Use a hydrometer to check the remaining battery charge.**
 - If the electrolyte is frozen, slowly warm the battery before you recharge it.
 - Failure to comply will result in death or serious injury.
-
- Electric parts will be damaged if operating without a battery in good condition and properly connected.

⚠ WARNING

Burn Hazard!



- Batteries contain sulfuric acid. Never allow battery fluid to come in contact with clothing, skin or eyes. Severe burns could result.
- Always wear safety goggles and protective clothing when servicing the battery. If contact with the skin and / or eyes should occur, flush with a large amount of water and obtain prompt medical treatment.
- Failure to comply could result in death or serious injury.

NOTICE



- Be environmentally responsible. Follow these procedures for hazardous waste disposal. Failure to follow these procedures may seriously harm the environment.
- Follow the guidelines of the governmental agency for the proper disposal of hazardous materials such as engine oil, diesel fuel and engine coolant. Consult the local authorities or reclamation facility.
- Never dispose of hazardous materials irresponsibly by dumping them into a sewer, on the ground or into ground water or waterways.

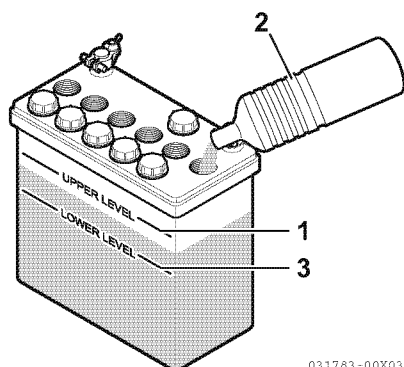


Figure 1

- When the amount of fluid nears the lower limit (3, **Figure 1**), fill with distilled water (2, **Figure 1**) so it is at the upper limit (1, **Figure 1**). If operation continues with insufficient battery fluid, the battery life is shortened, and the battery may overheat and explode. During the summer, check the fluid level more often than specified.
- If the engine cranking speed is so slow that the engine does not start, recharge the battery.
- If the engine still will not start after charging, have your authorized YANMAR industrial engine dealer or distributor check the battery and the engine's starting system.

If operating the machine where the ambient temperature could drop to 14 °F (-10 °C) or less, remove the battery from the machine at the end of the day. Store the battery in a warm place until the next use. This will help start the engine easily at low ambient temperatures.

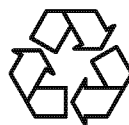
■ Check battery indicator (if equipped)

Visually check the battery indicator (if equipped) and any other indicator provided by the driven machine manufacturer. See *INDICATORS AND CONTROLS – ELECTRIC STARTER* on page 15.

■ Check engine oil level

NOTICE

- Only use the engine oil specified. Other engine oils may affect warranty coverage, cause internal engine components to seize, or shorten engine life.
- Prevent dirt and debris from contaminating the engine oil. Carefully clean the oil cap/dipstick and the surrounding area before you remove the cap.
- Never mix different types of engine oil. This may adversely affect the lubricating properties of the engine oil.
- Never overfill. Overfilling may result in white exhaust smoke, engine overspeed or internal damage.



- Be environmentally responsible. Follow these procedures for hazardous waste disposal. Failure to follow these procedures may seriously harm the environment.
- Follow the guidelines of the governmental agency for the proper disposal of hazardous materials such as engine oil, diesel fuel and engine coolant. Consult the local authorities or reclamation facility.
- Never dispose of hazardous materials irresponsibly by dumping them into a sewer, on the ground or into ground water or waterways.

Before you operate the engine check the engine oil level. See *Checking Engine Oil* on page 22.

PERIODIC MAINTENANCE

■ Check for engine oil leakage

⚠ WARNING

Burn Hazard!



- Keep your hands and other body parts away from hot engine surfaces such as the muffler, exhaust pipe, turbocharger (if equipped) and engine block during operation and shortly after you shut the engine down. These surfaces are extremely hot while the engine is operating and could seriously burn you.

- Failure to comply could result in death or serious injury.

Before you operate the engine check for any engine oil leaks. If you discover an engine oil leak see your authorized YANMAR industrial engine dealer or distributor to repair the engine.

■ Check engine speed control (1st time only)

Before you operate the driven machine for the first time check the engine speed control. See the instructions for your driven machine for proper adjustments.

1. Check the engine speed control for smooth operation and lubricate or clean as necessary.
2. Check engine speed control for proper adjustments.

■ Check spark arrestor (if equipped)

⚠ WARNING

Burn Hazard!



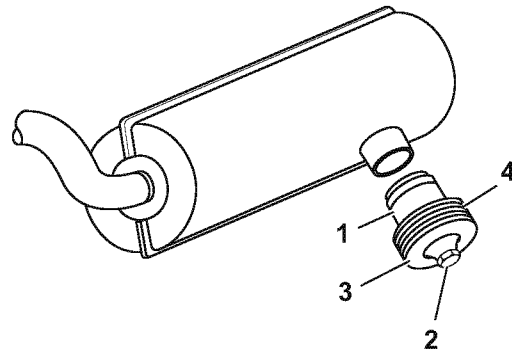
- Keep your hands and other body parts away from hot engine surfaces such as the muffler, exhaust pipe, turbocharger (if equipped) and engine block during operation and shortly after you shut the engine down. These surfaces are extremely hot while the engine is operating and could seriously burn you.

- Failure to comply could result in death or serious injury.

A clogged spark arrestor hinders exhaust gas flow which reduces engine output, increases fuel consumption, and makes starting difficult. Clean the spark arrestor regularly.

Clean the spark arrestor (1, **Figure 2**) as follows:

1. Remove the locknut (2, **Figure 2**), end cap (3, **Figure 2**) and diffuser discs (4, **Figure 2**) from the spark arrestor.



R0001567A-00X

Figure 2

2. Clean any carbon deposits from the spark arrestor.
3. Install the diffuser discs (4, **Figure 2**) and end cap (3, **Figure 2**) on the spark arrestor (1, **Figure 2**) and secure with the locknut (2, **Figure 2**).

■ Check fuel level

DANGER

Fire and Explosion Hazard!



- Diesel fuel is extremely flammable and explosive under certain conditions.

- Only fill the fuel tank with diesel fuel. Filling the fuel tank with gasoline may result in a fire.
- Never refuel with the engine running.
- Wipe up all spills immediately.
- Keep sparks, open flames or any other form of ignition (match, cigarette, static electric source) away when fueling/refueling.
- Never overfill the fuel tank.
- Fill the fuel tank and store fuel in a well-ventilated area only.
- Be sure to place the diesel fuel container on the ground when transferring the diesel fuel from the pump to the container. Hold the hose nozzle firmly against the side of the container while filling it. This prevents static electricity build-up which could cause sparks and ignite fuel vapors.
- Never place diesel fuel or other flammable material such as oil, hay or dried grass close to the engine during engine operation or shortly after shut down.
- Before you operate the engine, check for fuel leaks. Replace rubberized fuel hoses every two years or every 2000 hours of engine operation, whichever comes first, even if the engine has been out of service. Rubberized fuel lines tend to dry out and become brittle after two years or 2000 hours of engine operation, whichever comes first.
- Do not let fuel exceed the fuel level mark on the fuel filter (inlet) of the fuel tank filler port. The fuel oil may expand when the ambient temperature is high, and overflow the fuel tank cap.
- Failure to comply will result in death or serious injury.

NOTICE

- Only use diesel fuels recommended by YANMAR for the best engine performance, to prevent engine damage.
- Only use clean diesel fuel.
- Never remove inlet fuel screen from the filler port. If removed, dirt and debris could get into the fuel system causing it to clog.

Before you operate the engine check the fuel level. See *Filling the Fuel Tank* on page 19.

■ Check for fuel leakage

WARNING

High Pressure Hazard!



- Avoid skin contact with the high pressure diesel fuel spray caused by a fuel system leak such as a broken fuel injection line. High pressure fuel can penetrate your skin and result in serious injury. If you are exposed to high pressure fuel spray, obtain prompt medical treatment.
- Never check for a fuel leak with your hands. Always use a piece of wood or cardboard. Have your authorized YANMAR industrial engine dealer or distributor repair the damage.
- Failure to comply could result in death or serious injury.

WARNING

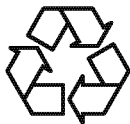
Burn Hazard!



- Keep your hands and other body parts away from hot engine surfaces such as the muffler, exhaust pipe, turbocharger (if equipped) and engine block during operation and shortly after you shut the engine down. These surfaces are extremely hot while the engine is operating and could seriously burn you.

- Failure to comply could result in death or serious injury.

NOTICE



- Be environmentally responsible. Follow these procedures for hazardous waste disposal. Failure to follow these procedures may seriously harm the environment.
- Follow the guidelines of the governmental agency for the proper disposal of hazardous materials such as engine oil, diesel fuel and engine coolant. Consult the local authorities or reclamation facility.
- Never dispose of hazardous materials irresponsibly by dumping them into a sewer, on the ground or into ground water or waterways.

Before you operate the engine check for any fuel leaks. Never use your hands! If you discover a fuel leak see your authorized YANMAR industrial engine dealer or distributor to repair the engine.

Daily, After Operation

- Check for engine oil leakage
- Check for fuel leakage

■ Check for engine oil leakage

WARNING

Burn Hazard!



- Keep your hands and other body parts away from hot engine surfaces such as the muffler, exhaust pipe, turbocharger (if equipped) and engine block during operation and shortly after you shut the engine down. These surfaces are extremely hot while the engine is operating and could seriously burn you.
- Failure to comply could result in death or serious injury.

After you shut down the engine check for any engine oil leaks. If you discover an engine oil leak see your authorized YANMAR industrial engine dealer or distributor to repair the engine.

■ Check for fuel leakage

⚠ WARNING

High Pressure Hazard!



- Avoid skin contact with the high pressure diesel fuel spray caused by a fuel system leak such as a broken fuel injection line. High pressure fuel can penetrate your skin and result in serious injury. If you are exposed to high pressure fuel spray, obtain prompt medical treatment.
- Never check for a fuel leak with your hands. Always use a piece of wood or cardboard. Have your authorized YANMAR industrial engine dealer or distributor repair the damage.
- Failure to comply could result in death or serious injury.

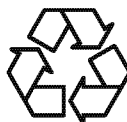
⚠ WARNING

Burn Hazard!



- Keep your hands and other body parts away from hot engine surfaces such as the muffler, exhaust pipe, turbocharger (if equipped) and engine block during operation and shortly after you shut the engine down. These surfaces are extremely hot while the engine is operating and could seriously burn you.
- Failure to comply could result in death or serious injury.

NOTICE



- Be environmentally responsible. Follow these procedures for hazardous waste disposal. Failure to follow these procedures may seriously harm the environment.
- Follow the guidelines of the governmental agency for the proper disposal of hazardous materials such as engine oil, diesel fuel and engine coolant. Consult the local authorities or reclamation facility.
- Never dispose of hazardous materials irresponsibly by dumping them into a sewer, on the ground or into ground water or waterways.

After you shut down the engine check for any fuel leaks. Never use your hands! If you discover a fuel leak see your authorized YANMAR industrial engine dealer or distributor to repair the engine.

After Initial 50 Hours of Operation

Perform the following maintenance after the initial 50 hours of operation.

- Replace engine oil
- Replace engine oil filter

■ Replace engine oil

WARNING

Burn Hazard!



- If you must drain the engine oil while it is still hot, stay clear of the hot engine oil to avoid being scalded. Make sure you wear eye protection.
- Failure to comply could result in death or serious injury.

WARNING

Sudden Movement Hazard!

- Allow the engine to warm up for at least 5 minutes to allow the engine idle speed to return to normal before engaging the transmission or any PTO attachments. Engaging the transmission or PTO at an elevated engine speed could result in an unexpected movement of the equipment.
- Failure to comply could result in death or serious injury.

NOTICE



- Be environmentally responsible. Follow these procedures for hazardous waste disposal. Failure to follow these procedures may seriously harm the environment.
 - Follow the guidelines of the governmental agency for the proper disposal of hazardous materials such as engine oil, diesel fuel and engine coolant. Consult the local authorities or reclamation facility.
 - Never dispose of hazardous materials irresponsibly by dumping them into a sewer, on the ground or into ground water or waterways.
-
- Only use the engine oil specified. Other engine oils may affect warranty coverage, cause internal engine components to seize, or shorten engine life.
 - Prevent dirt and debris from contaminating the engine oil. Carefully clean the oil cap/dipstick and the surrounding area before you remove the cap.
 - Never mix different types of engine oil. This may adversely affect the lubricating properties of the engine oil.
 - Never overfill. Overfilling may result in white exhaust smoke, engine overspeed or internal damage.
-

The engine oil on a new engine becomes contaminated from the initial break-in of internal parts. The initial 50 hour oil change and filter cleaning is very important.

Drain the engine oil as follows:

1. Make sure the engine is level.
2. Start the engine and bring it up to operating temperature.
3. Stop the engine.
4. Remove the oil cap/dipstick (1, **Figure 3**) to allow the engine oil to drain more easily.

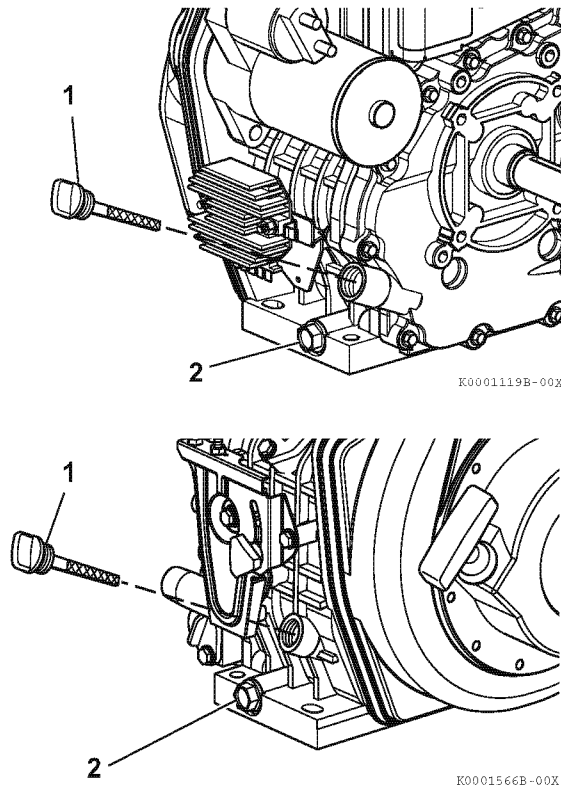


Figure 3

5. Position a container under the engine to collect waste oil.
6. Remove the drain plug located on the bottom of the cylinder block (2, **Figure 3**). Allow oil to drain.
7. After all oil has been drained from the engine, install the drain plug (2, **Figure 3**) and tighten to 14 - 17 ft lbs (19.6 - 23.5 N·m, 2.0 - 2.4 kgf·m).
8. Dispose of used oil properly.

■ Replace engine oil filter

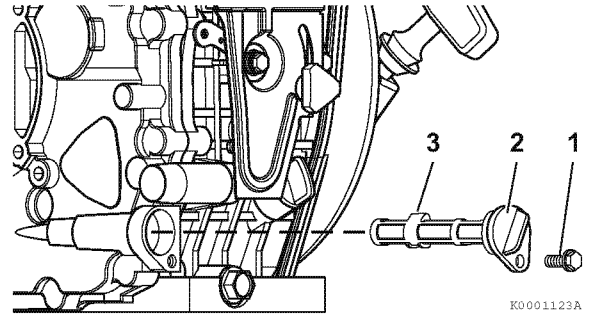


Figure 4

Replace the engine oil filter as follows:

1. Remove the oil filter retaining bolt (1, **Figure 4**).
2. Pull the oil filter cap (2, **Figure 4**) out and remove the oil filter (3, **Figure 4**).
3. Install the new oil filter (3, **Figure 4**).
4. Make sure the oil filter cap is fully seated (2, **Figure 4**).
5. Install and tighten the oil filter retaining bolt (1, **Figure 4**).

Applicable engine oil filter Part No.	
L48N, L70N and L100N	114299-35110
	114250-35070

6. Add new engine oil to the engine as specified in *Adding Engine Oil* on page 22.

NOTICE

- Never overfill the engine with engine oil.
 - Always keep the oil level between the upper and lower lines on the oil cap/dipstick.
7. Warm up the engine by running it for 5 minutes and check for any engine oil leaks.
 8. After engine is warm, shut it off and let it sit for 10 minutes.

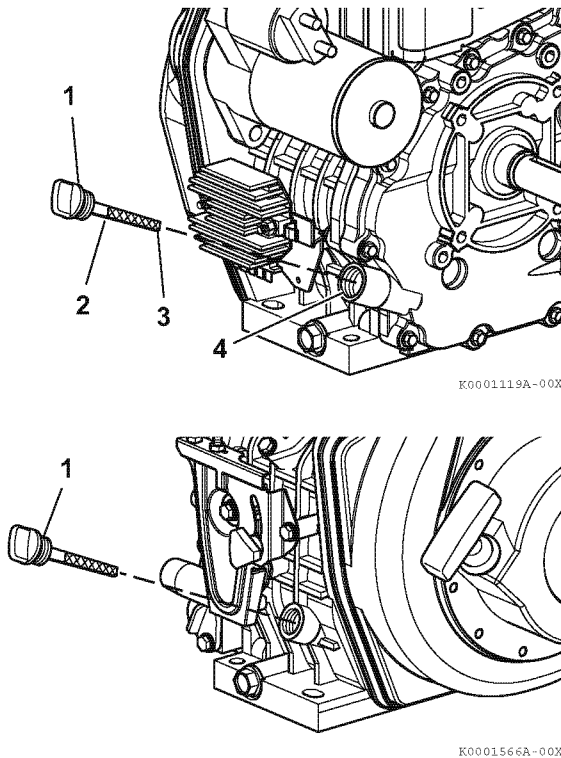


Figure 5

9. Recheck the engine oil level by fully inserting, but not screwing in, the dipstick.
10. Add engine oil (4, **Figure 5**) as needed until the level is between the upper (2, **Figure 5**) and lower lines (3, **Figure 5**) on the oil cap/dipstick (1, **Figure 5**).
11. Replace the oil cap/dipstick (1, **Figure 5**) and tighten by hand. Over-tightening may damage the cap. If any engine oil is spilled, wipe it away with a clean cloth.

Every 50 Hours of Operation

Perform the following maintenance every 50 hours of operation.

- Clean inlet fuel screen

■ Clean inlet fuel screen

⚠ DANGER

Fire and Explosion Hazard!

- Diesel fuel is extremely flammable and explosive under certain conditions.



- When you remove any fuel system component to perform maintenance (such as changing the fuel filter) place an approved container under the opening to catch the fuel.
- Never use a shop rag to catch the fuel. Vapors from the rag are extremely flammable and explosive.
- Wipe up any spills immediately.
- Wear eye protection. The fuel system is under pressure and fuel could spray out when you remove any fuel system component.
- Failure to comply will result in death or serious injury.

1. Clean the area around the fuel cap (1, **Figure 6**).
2. Remove the fuel cap (1, **Figure 6**) from the fuel tank (2, **Figure 6**).

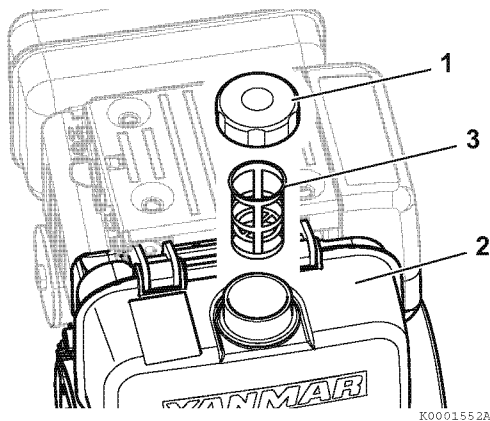


Figure 6

3. Lift out the inlet fuel screen (3, **Figure 6**).
4. Clean the inlet fuel screen or replace if damaged.
5. Install the inlet fuel screen (3, **Figure 6**).
6. Replace the fuel cap (1, **Figure 6**) and hand tighten. Overtightening the fuel cap will damage it.

Applicable inlet fuel screen Part No.	
L48N, L70N and L100N	114250-55100
	114299-55100

Every 200 Hours of Operation

Perform the following maintenance every 200 hours of operation.

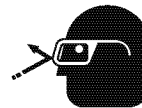
Clean the air cleaner element every 100 hours of operation.

- Clean air cleaner element
- Replace engine oil and clean/inspect engine oil filter
- Check engine speed control
- Drain the fuel tank

■ Clean air cleaner element

⚠ CAUTION

Flying Object Hazard!



- Always wear eye protection when servicing the engine and when using compressed air or high-pressure water. Dust, flying debris, compressed air, pressurized water or steam may injure your eyes.
- Failure to comply may result in minor or moderate injury.

NOTICE

- When the engine is operated in dusty conditions, clean the air cleaner element more frequently.
- Never operate the engine with the air cleaner or element(s) removed. This may cause foreign material to enter the engine and damage it.

PERIODIC MAINTENANCE

The engine performance is adversely affected when the air cleaner element is clogged with dust. Be sure to clean the air filter element periodically.

1. Remove the wing nut (1, **Figure 7**).
2. Remove the air cleaner cover (2, **Figure 7**).

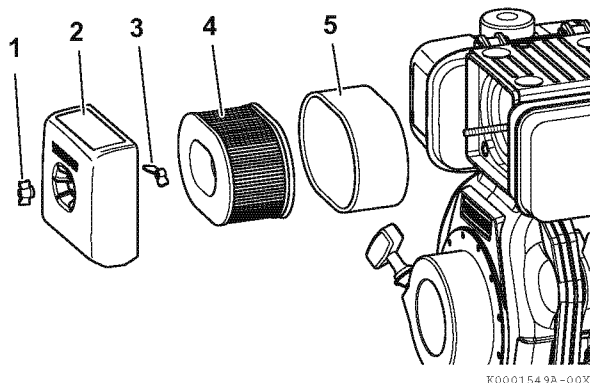


Figure 7

3. Remove the wing nut (3, **Figure 7**).
4. Remove the air cleaner element (4, **Figure 7**) and outer foam element (5, **Figure 7**).
5. Blow air through both elements using 42 - 71 psi (0.29 - 0.49 MPa, 3.0 - 5.0 kgf/cm²) compressed air to remove the particulates. Use the lowest possible air pressure to remove the dust without damaging the elements.
6. If either element is damaged replace both of them (they are not sold individually).

Applicable air cleaner element Part No.	
L48N	114250-12581
L70N and L100N	114210-12590

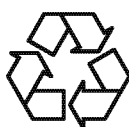
7. Clean the inside of the air cleaner cover (2, **Figure 7**).
8. Install the air cleaner element (4, **Figure 7**) into the air cleaner case. And check accurately that the air filter cartridge is properly fitted and aligned with its own seat of the air filter box.
9. Install the wing nut (3, **Figure 7**) and hand tighten. Overtightening the wing nut will damage the air cleaner assembly.
10. Slide the outer foam element (5, **Figure 7**) over the air cleaner element (4, **Figure 7**).
11. Install the air cleaner cover (2, **Figure 7**).

12. Install the wing nut (1, **Figure 7**) and hand tighten. Overtightening the wing nut will damage the air cleaner assembly.

■ Replace engine oil and clean/inspect engine oil filter

NOTICE

- Only use the engine oil specified. Other engine oils may affect warranty coverage, cause internal engine components to seize, or shorten engine life.
- Prevent dirt and debris from contaminating the engine oil. Carefully clean the oil cap/dipstick and the surrounding area before you remove the cap.
- Never mix different types of engine oil. This may adversely affect the lubricating properties of the engine oil.
- Never overfill. Overfilling may result in white exhaust smoke, engine overspeed or internal damage.



- Be environmentally responsible. Follow these procedures for hazardous waste disposal. Failure to follow these procedures may seriously harm the environment.
- Follow the guidelines of the governmental agency for the proper disposal of hazardous materials such as engine oil, diesel fuel and engine coolant. Consult the local authorities or reclamation facility.
- Never dispose of hazardous materials irresponsibly by dumping them into a sewer, on the ground or into ground water or waterways.

Change the engine oil every 200 hours of operation after the initial change at 50 hours. Clean and inspect the engine oil filter at the same time. Replace if damaged.

See Replace engine oil on page 46 and Replace engine oil filter on page 47.

■ Check engine speed control

After you operate the engine for 200 hours, check the engine speed control. See the instructions for your driven machine for proper adjustments.

1. Check the engine speed control for smooth operation and lubricate or clean as necessary.
2. Check engine speed control for proper adjustments.

■ Drain the fuel tank

⚠ DANGER

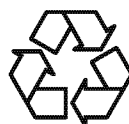
Fire and Explosion Hazard!



- Diesel fuel is extremely flammable and explosive under certain conditions.

- When you remove any fuel system component to perform maintenance (such as changing the fuel filter) place an approved container under the opening to catch the fuel.
- Never use a shop rag to catch the fuel. Vapors from the rag are extremely flammable and explosive.
- Wipe up any spills immediately.
- Wear eye protection. The fuel system is under pressure and fuel could spray out when you remove any fuel system component.
- Failure to comply will result in death or serious injury.

NOTICE



- Be environmentally responsible. Follow these procedures for hazardous waste disposal. Failure to follow these procedures may seriously harm the environment.
- Follow the guidelines of the governmental agency for the proper disposal of hazardous materials such as engine oil, diesel fuel and engine coolant. Consult the local authorities or reclamation facility.
- Never dispose of hazardous materials irresponsibly by dumping them into a sewer, on the ground or into ground water or waterways.

1. Position an approved container under the fuel tank to collect the fuel.
2. Remove the fuel cap (1, **Figure 8**).
3. Remove the fuel tank drain plug (2, **Figure 8**) and gasket (3, **Figure 8**) to drain the fuel.

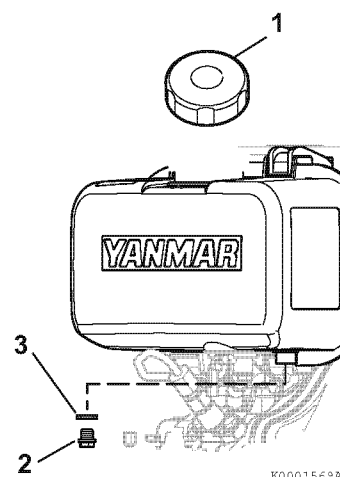


Figure 8

4. Tighten the fuel tank drain plug (2, **Figure 8**) with new gasket (3, **Figure 8**).
5. Refill fuel tank. Replace the fuel cap (1, **Figure 8**) and hand tighten. Overtightening the fuel cap will damage it.
See Filling the Fuel Tank on page 19.

Every 400 Hours of Operation

Perform the following maintenance every 400 hours of operation.

Replace the air cleaner element every 500 hours of operation.

- Adjust intake and exhaust valve clearance
- Replace engine oil filter
- Replace outlet fuel filter
- Replace air cleaner element

■ Adjust intake and exhaust valve clearance

WARNING

High Pressure Hazard!



- Avoid skin contact with the high pressure diesel fuel spray caused by a fuel system leak such as a broken fuel injection line. High pressure fuel can penetrate your skin and result in serious injury. If you are exposed to high pressure fuel spray, obtain prompt medical treatment.
- Never check for a fuel leak with your hands. Always use a piece of wood or cardboard. Have your authorized YANMAR industrial engine dealer or distributor repair the damage.
- Failure to comply could result in death or serious injury.

Proper operation of the intake and exhaust valves is required to obtain optimum engine performance. See your authorized YANMAR industrial engine dealer or distributor for this service.

■ Replace engine oil filter

See *Replace engine oil filter* on page 47.

■ Replace outlet fuel filter

DANGER

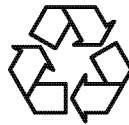
Fire and Explosion Hazard!



- Diesel fuel is extremely flammable and explosive under certain conditions.

- When you remove any fuel system component to perform maintenance (such as changing the fuel filter) place an approved container under the opening to catch the fuel.
- Never use a shop rag to catch the fuel. Vapors from the rag are extremely flammable and explosive.
- Wipe up any spills immediately.
- Wear eye protection. The fuel system is under pressure and fuel could spray out when you remove any fuel system component.
- Failure to comply will result in death or serious injury.

NOTICE



- Be environmentally responsible. Follow these procedures for hazardous waste disposal. Failure to follow these procedures may seriously harm the environment.
- Follow the guidelines of the governmental agency for the proper disposal of hazardous materials such as engine oil, diesel fuel and engine coolant. Consult the local authorities or reclamation facility.
- Never dispose of hazardous materials irresponsibly by dumping them into a sewer, on the ground or into ground water or waterways.

1. Position an approved container under the fuel tank to collect the fuel.
2. Remove the fuel cap (1, **Figure 9**).
3. Remove the fuel tank drain plug (2, **Figure 9**) and gasket (3, **Figure 9**) to drain the fuel.

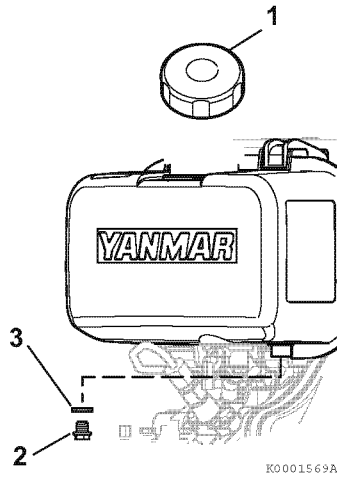


Figure 9

4. Loosen the fuel cock nuts (1, **Figure 10**) on either side of the fuel cock (2, **Figure 10**).
5. Remove and discard the O-ring (3, **Figure 10**).
6. Pull the outlet fuel filter (4, **Figure 10**) and gasket (5, **Figure 10**) out of the fuel tank filler port (6, **Figure 10**).

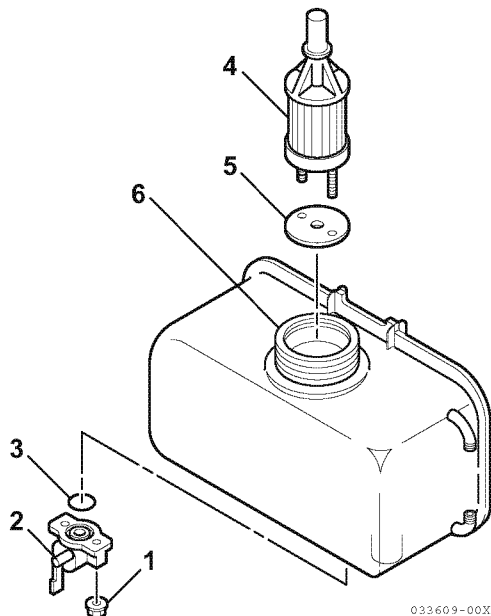


Figure 10

7. Install a new outlet fuel filter (4, **Figure 10**) and gasket (5, **Figure 10**) through the fuel tank filler port (6, **Figure 10**) and seat in the fuel tank.

Applicable outlet fuel filter Part No.	
L48N, L70N and L100N	114250-55121

Applicable O-ring Part No.	
L48N, L70N and L100N	24341-000150

8. Install a new O-ring (3, **Figure 10**) on the fuel cock (2, **Figure 10**) and fasten the assembly to the fuel tank using the fuel cock nuts (1, **Figure 10**).
9. Tighten the fuel tank drain plug (2, **Figure 9**) with new gasket (3, **Figure 9**).
10. Refill fuel tank. Replace the fuel cap (1, **Figure 9**) and hand tighten. Overtightening the fuel cap will damage it.
See Filling the Fuel Tank on page 19.

■ Replace air cleaner element

See Clean air cleaner element on page 49.

Every 1000 Hours of Operation

Perform the following maintenance every 1000 hours of operation.

- Check compression

■ Check compression

Checking the engine compression is required every 1000 hours to obtain optimum engine performance. See your authorized YANMAR industrial engine dealer or distributor for this service.

Every 1500 Hours of Operation

Perform the following maintenance every 1500 hours of operation.

- Inspect, clean and test fuel injection nozzle

■ Inspect, clean and test fuel injection nozzle

WARNING

High Pressure Hazard!



- Avoid skin contact with the high pressure diesel fuel spray caused by a fuel system leak such as a broken fuel injection line. High pressure fuel can penetrate your skin and result in serious injury. If you are exposed to high pressure fuel spray, obtain prompt medical treatment.
- Never check for a fuel leak with your hands. Always use a piece of wood or cardboard. Have your authorized YANMAR industrial engine dealer or distributor repair the damage.
- Failure to comply could result in death or serious injury.

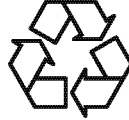
Proper operation of the fuel injectors is required to obtain the optimum injection pattern for full engine performance. The injectors should be inspected, cleaned and tested every 1500 hours. See your authorized YANMAR industrial engine dealer or distributor for this service.

Every 2000 Hours of Operation

Perform the following maintenance every 2000 hours of operation.

- Check and replace fuel hoses

NOTICE



- Be environmentally responsible. Follow these procedures for hazardous waste disposal. Failure to follow these procedures may seriously harm the environment.
- Follow the guidelines of the governmental agency for the proper disposal of hazardous materials such as engine oil, diesel fuel and engine coolant. Consult the local authorities or reclamation facility.
- Never dispose of hazardous materials irresponsibly by dumping them into a sewer, on the ground or into ground water or waterways.

■ Check and replace fuel hoses

Regularly check the fuel system hoses. If they are cracked or degraded, replace them. Replace the hoses at least every two years, or 2000 hours, whichever occurs first. Consult your authorized YANMAR industrial engine dealer or distributor to replace fuel system hoses.

TROUBLESHOOTING

If a problem occurs, stop the engine immediately.
Refer to the SYMPTOM column in the
Troubleshooting Chart to identify the problem.

NOTICE

If any indicator fails to illuminate when the key switch is in the ON position, see your authorized YANMAR industrial engine dealer or distributor for service before operating the engine.

If any indicator illuminates during engine operation stop the engine immediately. Determine the cause and repair the problem before you continue to operate the engine.

TROUBLESHOOTING CHART

Symptom	Probable cause	Action	Refer to
Indicator turns ON - Engine running			
Engine oil pressure indicator (If equipped)	<ul style="list-style-type: none">• Low level of engine oil• Too high an oil level	<ul style="list-style-type: none">• Check and adjust oil level as necessary	<i>Checking Engine Oil on page 22</i>
	<ul style="list-style-type: none">• Clogged engine oil filter	<ul style="list-style-type: none">• Replace engine oil filter element	<i>Replace engine oil on page 46</i>
Battery indicator	<ul style="list-style-type: none">• Battery failure	<ul style="list-style-type: none">• Check battery condition	<i>Check Indicators on page 23</i>
	<ul style="list-style-type: none">• Faulty dynamo	<ul style="list-style-type: none">• See authorized YANMAR industrial engine dealer or distributor	—
Indicator does not turn ON - Key switch is turned to ON (OFF → ON)			
	<ul style="list-style-type: none">• Faulty electrical wiring or faulty indicator	<ul style="list-style-type: none">• See authorized YANMAR industrial engine dealer or distributor	—
Indicator stays ON - Key switch is turned from Start to ON (START → ON)			
Battery indicator stays ON	<ul style="list-style-type: none">• Faulty alternator	<ul style="list-style-type: none">• See authorized YANMAR industrial engine dealer or distributor	—
Engine oil pressure indicator stays ON	<ul style="list-style-type: none">• Faulty engine oil pressure switch		—
Engine does not start			
Starter motor operates but engine does not start	<ul style="list-style-type: none">• No diesel fuel	<ul style="list-style-type: none">• Refuel fuel system	<i>Filling the Fuel Tank on page 19</i>
	<ul style="list-style-type: none">• Improper diesel fuel	<ul style="list-style-type: none">• Replace with recommended diesel fuel	<i>Diesel Fuel Specifications on page 18</i>
	<ul style="list-style-type: none">• Clogged fuel filter	<ul style="list-style-type: none">• Replace fuel filter	<i>Drain the fuel tank on page 51</i>
	<ul style="list-style-type: none">• Closed fuel cock	<ul style="list-style-type: none">• Check the fuel cock position	—
	<ul style="list-style-type: none">• Poor fuel injection	<ul style="list-style-type: none">• See authorized YANMAR industrial engine dealer or distributor	—
	<ul style="list-style-type: none">• Compressed air leakage from intake/exhaust valves		—
	<ul style="list-style-type: none">• Faulty engine stop solenoid (if equipped)		—

Symptom	Probable cause	Action	Refer to
Starter motor does not operate or rotates too slowly (engine can be turned manually)	• Battery needs charging	• Check electrolyte, recharge	<i>Check battery (if equipped) on page 40</i>
	• Faulty cable connection at battery terminals	• Clean terminals, retighten	—
	• Faulty starter switch	• See authorized YANMAR industrial engine dealer or distributor	—
	• Faulty starter motor		—
Engine cannot be manually turned	• Inner parts seized or damaged		—
White or black exhaust smoke			
Black exhaust smoke	• Engine overloaded	• Reduce load	—
	• Clogged air cleaner element	• Clean element or replace	<i>Clean air cleaner element on page 49</i>
	• Improper diesel fuel	• Replace with recommended diesel fuel	<i>Diesel Fuel Specifications on page 18</i>
	• Faulty spraying of fuel injection	• See authorized YANMAR industrial engine dealer or distributor	—
	• Excessive intake/exhaust valve clearance		—
White exhaust smoke	• Improper diesel fuel	• Replace with recommended diesel fuel	<i>Diesel Fuel Specifications on page 18</i>
	• Faulty spray pattern of fuel injection	• See authorized YANMAR industrial engine dealer or distributor	—
	• Fuel injection timing delay		—
	• Engine burning oil		—

TROUBLESHOOTING INFORMATION

If your engine does not operate properly, refer to the troubleshooting chart or consult your authorized YANMAR industrial engine dealer or distributor.

Supply the authorized YANMAR industrial engine dealer or distributor with the following information:

- Model name and serial number of your engine
- The driven machine type (tractor, generator, skid steer loader), manufacturers name, model and serial number
- How long the engine has been in service (the number of engine hours or the number of calendar months)
- Operating conditions when problem occurs:
 - Engine rpm
 - Color of exhaust smoke
 - Type of diesel fuel
 - Type of engine oil
 - Any abnormal noises or vibration
 - Operating environment such as high altitude or extreme ambient temperatures, etc.
- Engine maintenance history and previous problems
- Other factors that contribute to the problem