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| **Assembly information** |
| **KDI 1903 M-MP Workshop manual (Rev.02.2)** |



Sommario

[1. TITOLO 1 2](#_Toc495648770)

[1.1. Asdfsdfsdf 2](#_Toc495648771)

[1.2. Asdfsdfsdfggg 2](#_Toc495648772)

# Assembly information

## Assembly recommendations

* The information is laid out in sequence, the intervention methods have been selected, tested and approved by the manufacturer's technicians.
* This chapter describes the installation procedures for the assemblies and/ or individual components which have already been checked, overhauled or possibly replaced with original spare parts.
* Where necessary, reference to special tools during assembly operations is indicated and identified in [**Cap.12**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=1205&parent=1614) , hereinafter in **Tab. 9.1** an example of a special tool ( **ST\_05** ).

**Tab. 9.1**

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| **SPECIAL TOOLS** | | | |
| **"ST" Code** | **Picture /draw** | **DESCRIPTION** | **PART NUMBER** |
| **ST\_05** | ST_05.jpg | Six nicks Key SN 8 | ED0014603650-S |

Z_importante.jpg **Important**

* Before proceeding with operations, read [**Cap. 3**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=282&parent=1614) .
* To easily locate specific topics, the reader should refer to the **analytical index** or **chapter index** .
* The operator must check that:
  + the components, the assemblies, the coupling surfaces of the parts are washed, clean and thoroughly dried;
  + the coupling surfaces are undamaged;
  + the equipment and tools are ready so that all work can be carried out correctly and safely;
  + ensure that the working environment is safe.
* The operator must:
  + carry out the procedures smoothly and safely. It is thus recommended to install the engine on a special rotating stand used when servicing engines to ensure the safety of the operator and the other individuals involved;
  + tighten the assemblies and / or components in a criss-cross or alternating pattern, initially with a value lower than that preset, and then subsequently, with the tightening torque specified in the procedure;
  + replace all seal gaskets after each assembly for all components on which they are provided.

## Engine block assembly

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| **9.2.1 Crankshaft bushings**    Z_importante.jpg **Important**       * Execute the procedure in [**Par. 8.2.1 and 8.2.2**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=1175&parent=1614) , before proceeding with assembly.. * The crankshaft half-bearings are made of special material. Therefore, they must be replaced every time they are assembled to prevent seizures.  1. Fit the new half-bearings **B** onto the crankcase upper half **E** adhering to the reference notches **C** .     Z_importante.jpg **Important**     * After the half-bearings are fitted, check that the lubrication holes **D** correspond with the crankcase grooves **E** . * The lower and upper half bearings **CANNOT** be singularly replaced, and both halves must be replaced together.  1. Fit the new half-bearings **A** onto the lower crankcase **F** using the reference notches **G** . 2. Lubricate the half-bearings **A and B** with **oil.** | Fig._9.1.jpg **Fig 9.1**Fig._9.2.jpg **Fig 9.2** |
| **9.2.2 Tappets**   1. Lubricate the tappets **G** with oil. 2. Insert the tappets **G** into the housings **H** of the upper crankcase. | Fig._9.3.jpg **Fig 9.3** |
| **9.2.3 Camshaft**   1. Check that the bushing **Q** is correctly fitted. 2. Lubricate the pins **L** , the cams **M** of the camshaft **N** , all the housing **P** ( [**Par. 8.2.4 or 8.2.6**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=1175&parent=1614) )and the bushing **Q** with oil. 3. Insert the camshaft **N** all the way into its housing **P** . 4. Fit the lock ring **R** on to the crankcase **E** to hold the position of the camshaft **N** . 5. Manually rotate the camshaft **N** ensuring that it is free. | Fig._9.4.jpg **Fig 9.4** |
| **9.2.4 Vent compartment closure lid**   1. With the screws **CF** tighten the cover **CG** and the gasket **CH** (tightening torque to **10 Nm** ). | Fig._9.5.jpg **Fig 9.5** |
| **9.2.5 Crankshaft**    Z_importante.jpg **Important**       * Carry out the checks described in [**Par. 8.4.1 and Par. 8.4.2**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=313&parent=1614) .  1. Check that the crankshaft half-bearings are mounted correctly on the upper crankcase **E** . 2. Lubricate the main journal and crankpin **J** , with oil. 3. Insert the crankshaft **W** into its seat on the upper crankcase **E** . 4. Insert the 2 shoulder half-rings **K** , between the crankshaft **W** and the upper crankcase **E** ( **AB** detail). | imm9.6.jpg **Fig 9.6** |
| **9.2.6 Lower crankcase**   1. Check that the crankshaft half-bearings are mounted correctly on the lower crankcase **F** ( **AC** detail). 2. Assemble the 2 shoulder half-rings **AD** onto the lower crankcase **F** applying two drops of oil to keep them in their seat. 3. Check that the coupling surfaces **AE** are free from dirt and grit. | imm9.7.jpg **Fig 9.7** |
| 1. Spread a bead of **Loctite 5660 (rif. AL)** of approx **1 mm** thickness on the surface **AM** of the upper crankshaft half **C** being careful not to block the oil feed grooves **AG** and the return oil sump **AH** . 2. Join the two crankshaft halves **E and F** observing the guide pins **AN** . | imm9.8.jpg **Fig 9.8** |
| Z_importante.jpg **Important**       * Failure to follow the bolting procedures compromises the functionality of the engine and can cause damage to people and property.  1. Tighten the fastening screws strictly following the sequence and the tightening torque indicated. **Tightening sequence for 3 cylinders** Tightening Screws **Torx M12x1,25** (from the **n° 1** to the **n° 8** ): CYCLE 1 - with a torque of **40 Nm** ; CYCLE 2 - with a torque of **70 Nm** ; CYCLE 3 - with a torque of **120 Nm** .     Tightening Screws **Torx M8** (from the **n° 9** to the **n° 21** ): CYCLE 4 - with a torque of **20Nm** ; CYCLE 5 - with a torque of **35** **Nm** ;   1. Perform the operations described in [**Par. 8.4.2**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=313&parent=1614) . 2. Check that crankshaft **W** rotates smoothly.     **NOTE:** In the next illustrations of **Par. 9.3** the coupled crankcase half will be indicated with the letter **E** . | ***3******Cylinders***  Fig._9.9.jpg   **Fig 9.9** |
| 1. **Tightening sequence for 3 cylinders** Tightening Screws **Torx M12x1,25** (from the **n° 1** to the **n° 10** ): CYCLE 1 - with a torque of **40 Nm** ; CYCLE 2 - with a torque of **70 Nm** ; CYCLE 3 - with a torque of **120 Nm** .     Tightening Screws **Torx M8** (from the **n° 11** to the **n° 27** ): CYCLE 4 - with a torque of **20Nm** ; CYCLE 5 - with a torque of **35** **Nm** ;   1. Perform the operations described in  [**Par. 8.4.2**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=313&parent=1614) . 2. Check that crankshaft **W** rotates smoothly. | ***4******Cylinders***  Fig._9.10.jpg **Fig 9.10** |
| **9.2.7 Piston rings**   1. Perform the operations described in [**Par. 8.5.3**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=315&parent=1614) . 2. Put the scraper ring **AP** onto the piston **AQ** . 3. Put the 2° seal ring **AR** on the piston **AQ** . 4. Put the 1° seal ring **AS** onto the piston **AQ** . | imm9.11.jpg **Fig 9.11** |
| 1. Perform the operations described in [**Par. 8.5.4**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=315&parent=1614) . 2. Position the segment openings with a 120° angle between them ( **Y** ).   **NOTE:**  do not use the segment opening with the pin hole ( **N** )   1. Lubricate the piston skirt and piston rings with oil. | 9_3_7.png **Fig 9.12** |
| **9.2.8 Piston and connecting rod**    Z_importante.jpg **Important**       * Before proceeding to the assembly of the piston and connecting rod, carry out the checks described in [**Par. 8.5.1**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=315&parent=1614) . * Always replace the bearings **CE** after each assembly.      1. Loosen the screws **AU** and remove the connecting rod cap **AV** . 2. Fit the new bearings **CE** . 3. Insert the connecting rod **AZ** into the piston **AQ** and align the seats **BA** . 4. Insert the gudgeon pin **BB** into the seat **BA** for the assembly of the connecting rod and piston unit. 5. Insert the lock rings **BD** inside the seat **BE** of the piston **AQ** to lock the gudgeon pin **BB** . | imm9.13_9.14.jpg **Fig 9.13**imm9.14_9.15.jpg **Fig 9.14** |

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| **9.2.9** **Piston and connecting rod assembly**    Z_importante.jpg **Important**         * Before assembling the piston and connecting rod assemblies, execute the controls described in  [**Par. 8.5**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=315&parent=1614)      1. Rotate the crankshaft **W** by moving the crankpin **BG** to a TDC position of the affected cylinder. 2. Push the piston **AQ** downwards by centering the crankpin **BG** with the connecting rod **AZ** . 3. Turn the crankshaft on support to assemble the con rod capp on cylinder 1 and 4. | Fig._9.17.jpg **Fig 9.15** |
| 1. Check that the half-bearing **AS** is mounted correctly on the connecting rod cap **AV** .     Z_importante.jpg **Important**       * As the rods are divided by breaking pay particular attention to the coupling of the cap on the connecting rod. * Check before you screw and tighten the bolts that the breaking surfaces are perfectly flush.  1. Couple the connecting rod cap **AV** to the connecting rod **AZ** using the marks made at disassembly ( [**Par. 7.13.2**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=309&parent=1614) ) 2. Screw in the screws **AU** . 3. Repeat the operations from 1 to 6 for the cylinders 2 and 3. | Fig._9.18.jpg  **Fig 9.16** |
| Z_importante.jpg **Important**       * Failure to follow the assembly procedures compromises the functionality of the engine and can cause damage to people and property.  1. Tighten the screws **AU** , alternately, strictly following the tightening torques indicated.     Tightening sequence of screws **Torx M10x1:**    **1° PHASE** - with a torque of **40 Nm** ; **2° PHASE** - with a torque of **85 Nm** ;     1. Check that the connecting rods have axial play and the crankshaft **W** rotates smoothly.     **NOTE** : After the check carried out at point 8, position the shaft **W** with the first cylinder to TDC. | Fig._9.19.jpg  **Fig 9.17** |

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| **9.2.10 Crankshaft gasket flange**        Z_importante.jpg **Important**       * Check that the contact surface between the flange and the crankcase is free of grit and dirt. * Always replace the gasket **BS** after each assembly.      1. Check that there are bushings **BT** on the crankcase **E** . 2. Lubricate the oil seal lip **BU** . 3. Position the gasket **BS** and flange **BV** on the crankcase **E** in correspondence with the bushings **BT** . 4. Put **Loctite 243** on the **2** screws **BW** matching the bushings **BT** . 5. Screw the fastening screws all the way in **BW** without tightening them. 6. Tighten all the screws **BW** strictly following the tightening sequence indicated (tightening torque to **10 Nm** ). | imm9.24.jpg **Fig 9.18**imm9.25.jpg **Fig 9.19** |
| **9.2.11 Flange 3 rd PTO**    Z_importante.jpg **Important**       * Replace capscrews **CA** with each assembly or alternatively apply **Loctite 2701** on the thread.  1. Secure the cover **CB** with the screws **CA** and **CC** inserting the gasket **CD** (tightening torque **25 Nm** ). | 9.20.jpg **Fig 9.20** |

## Oil sump unit assembly

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| **9.3.1 Oil fume pipes**   1. Apply **Loctite 648** on the pipe threads **A** . 2. Screw and tighten the pipes **A** (tightening torque of  **15 Nm** ). | Fig._9.23.jpg **Fig 9.21** |
| **9.3.2** **Oil suction pipe**    Z_importante.jpg **Important**       * It is mandatory to replace the gasket **B** after each assembly. * Always replace capscrews **D** with new ones or alternatively apply **Loctite 2701** .      1. Insert the new gasket **B** in the seat of the oil suction hose flange **D** . 2. Secure the hose **C** on the crankcase **E** with the screws **D** (tightening torque **10 Nm** ). | Fig._9.24.jpg **Fig 9.22** |
| **9.3.3 Oil Sump**   1. Ensure that the contact surfaces **F** of the oil sump **G** and the crankcase **E** are completely clean. 2. Apply a bead of approx. **2.5 mm** of sealant **(Loctite 5660)** on the surface **F** of the oil sump **G** . 3. **Note** : alternatively apply **Loctite 5699** . | imm9.29.jpg **Fig 9.23** |
| Z_importante.jpg **Important**       * Tighten the screws **L** , strictly following the sequence and tightening torque indicated.      1. Tighten the screws **L** following the sequence indicated (tightening torque **25 Nm** ). 2. Remove the two studs **ST\_18** with the appropriate screws (tightening torque 25 Nm) 3. After tightening all of the screws, loosen screw **n°1** and retighten it to the torque value specified in step **4** . 4. Check that the oil drain plugs **M** are tight (tightening torque **35 Nm** ). | imm9.30.jpg **Fig 9.24** |

## Cylinder head unit assembly

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| **9.4.1 Valve stem gasket**    Z_importante.jpg **Important**       * Carry out the checks described in [**Par. 8.6.4**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=316&parent=1614) before proceeding with the following operations. * Always replace gasket **A** with every assembly * Lubricate the gaskets **A** on the inside.  1. Fit the oil seals **A** on the valve guides **B** using the tool [**ST\_08**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=1205&parent=1614) . | Fig._9.38.jpg **Fig 9.25** |
| **9.4.2 Injector sleeves** ( operazione_utile.gif **)**   1. Insert the seals **C** in the seats of the sleeve **D** . 2. Insert the seal **E** with the convex side facing upward at the base of the sleeve **D** . 3. Lubricate the gaskets **C** . 4. Insert and carefully screw the sleeve **D** into the seat of the head **F** .     **NOTE:** The sleeve **D** must not protrude above the surface of the head **BF** .     1. Clamp the sleeve **D** (tightening torque at **30 Nm** ). | imm9.42.jpg **Fig 9.26** |
| **9.4.3 Injectors projection**   1. Insert the injector **G** inside the sleeve **H** . 2. Mount the injector fixing bracket **M** and secure it with the screw **N** , without performing the calibration. 3. Check protrusion of injectors by means of the tool [**ST\_03**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=1205&parent=1614) **(Fig. 9.28)** , check the projection of the injector, which must range between 1.68 ÷ 2.42 mm.     **NOTE** : if the value detected does not correspond, replace gasket **Q** with a different thickness. | Fig._9.40.jpg **Fig 9.27**Fig._9.41.jpg **Fig 9.28** |
| **9.4.4 Valves**   1. Pre-lubricate and insert the valves **X** into the head **F** taking care to fit them in the original positions as per the reference marks made in [**Par. 7.13.4.1**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=309&parent=1614) . 2. Position the spring **Y** on the seat of the head **F** . 3. Position the disk **S** on the spring **Y** centering the valve **X** . 4. Mount the tool [**ST\_07**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=1205&parent=1614) on the head **F** fixing it on one of the holes for securing the rocker arm cover.     **NOTE:** Change the fixing hole according to the position of the valves to be fitted.     1. Position the tool [**ST\_07**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=1205&parent=1614) on the valve as shown in the figure. 2. Push the lever of the tool [**ST\_07**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=1205&parent=1614) downwards, in order to lower the valve disks **S** in the direction of the arrow **AK** , and insert the valve cotters **AJ** inside the disk **S** . 3. Check that the valve cotters **AJ** are properly mounted on the valve seats **X** and release the tool [**ST\_07**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=1205&parent=1614) .     **NOTE:** repeat all the steps for the relevant valves and remove the tool [**ST\_07**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=1205&parent=1614) . | imm9.45.jpg **Fig 9.29** |
| imm9.46.jpg **Fig 9.30** |
| imm9.47.jpg **Fig 9.31** |
| **9.4.5 Cylinder head**   1. Fix the eyebolts **AW** with the screws **AX** onto the head **F** (tightening torque of **25 Nm** ). 2. Position the piston **P** at the TDC. 3. Position the tool [**ST\_03**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=1205&parent=1614) on the crankcase surface of the head and measure the piston protrusion **P** from head level **K** in 4 diametrically opposed points **R.** Repeat the operation for all pistons **P** and take note of the highest average value, determining valu **e S (Tab. 9.2)** .     **Tab. 9.2**   |  |  | | --- | --- | | **S (mm)** | **Hole number** | | 0.030 - 0.126 | 1 1foro.jpg | | 0.127 - 0.250 | 2 2fori.jpg | | 0.251 - 0.375 | 3 3fori.jpg |  1. Based on the value detected at point **3** , select the relevant gasket **T** as shown in the **Tab. 9.2 (Fig. 9.34** detail **U** ). 2. Check that the crankcase surface **K** and the gasket **T** are completely free of dirt and grit.       Z_importante.jpg **Important**       * The head gasket must be replaced for each assembly.  1. Position the gasket **T** on the surface **K** with reference to the centering bushings **J** . | imm9.48.jpg **Fig 9.32**imm9.49.jpg **Fig 9.33**   9.34.jpg **Fig 9.34** |
| 1. Check that the surface head **W** is free from impurities. 2. Position the head **F** on the crankcase **Z** with reference to the centering bushings **J** .       Z_importante.jpg **Important**       * The fastening bolts **V** must be replaced every time they are assembled.  1. Secure the head **F** by tightening the screws **V** strictly following the sequence indicated in the **Fig. 9.36 or Fig. 9.37** and the tightening torque indicated in the **Tab. 9.3** . | 9.35.jpg  **Fig 9.35** |
| Z_importante.jpg **Important**       * Failure to adhere to the bolt fixing procedures may compromise the functionality of the engine, and also may cause damage to persons and property. * Tighten capscrews **V** observing the cycles, tightening, and subsequent rotation as indicated in **Tab. 9.3** . * For engine **KDI 1903 M** : 8 screws **Torx M12x1,25 (Fig. 9.36)** . * For engine **KDI 2504 M** : 10 screws **Torx M12x1,25 (Fig. 9.37)** . | **3 CYLINDERS**  Fig._9.49.jpg **Fig 9.36** |
| **Tab. 9.3**   |  |  | | --- | --- | | **CYCLE** | **TORQUE** | | 1 | 40 Nm | | 2 | 70 Nm | | 3 | 100 Nm | | 4 | 90° | | 5 | 90° | | 6 | 90° | | **4 CYLINDERS**  Fig._9.50.jpg  **Fig 9.37** |
| **9.4.6 Rods and valve bridges**   1. Insert the rocker control rods **AA** into the niches of the head **F** .     Z_importante.jpg **Important**       * Properly centre the rods **AA** into the spherical housing of the camshaft tappets **AB** .  1. Mount the valve bridge **AC** on to the pairs of discharge and suction valves. | imm9.54.jpg **Fig 9.38** |
| imm9.55.jpg **Fig 9.39** |
| **9.4.7 Rocker arms**    Z_importante.jpg **Important**       * To correctly position the rocker arms, turn the rocker arm pin **AH** with the lower height **AL** towards the timing system side as in **Fig. 9.40** . * The discharge rocker arm **AT** is shorter than the suction arm **AR** .      1. Fit the lock ring **AM** into the seat **AN** of the rocker arm pin **AH** . 2. Position the pin **AH** with the screw support surface **AP** facing upwards and insert the 2 shoulder rings **AQ** . 3. Insert in sequence the suction rocker arm **AR** , the holder **AS** and the discharge rocker arm **AT** in the pin **AH .** 4. Insert the spring **AU** in the pin **AH** . 5. Repeat points **3, 4** for all the rocker arms. **NOTE:** The holder **AV** must be fitted with the last pair of rocker arms towards the flywheel. 6. Insert 2 shoulder rings **AQ** and the lock ring **AN** to lock all the components inserted in the pin **AH** . **NOTE** : The spring **AU** ensures that the supports **AS** and **AV** are kept in place. | imm9.57.jpg **Fig 9.40**imm9.58.jpg **Fig 9.41** |
| **9.4.8 Rocker arm pin assembly**    Z_importante.jpg **Important**       * Position the rocker arm pin assembly **BB** on a level to align all the support surfaces. * Check that the pistons are positioned half way between the TDC and BDC. Rotate the crankshaft 90° counterclockwise with regard to the 1st cylinder TDC, positioning the crankshaft pin **BP** as shown in Fig **9.44** . If the crankshaft pulley and the timing gear cover have not been removed, rotate the crankshaft positioning the reference **BQ** located on the target wheel in correspondence of the speed sensor, as shown in **Fig. 9.45** .      1. Position the rocker arm pin assembly **BB** on the head **F** , respecting the plug **BC** on the head using the holder indicated **AV** . 2. Check the correct positioning of all the rocker arms and the u-bolt control valves (detail **BD** ). House the tappet in the seat of the rocker arms control rod. 3. Secure the rocker arm pin **BB** tightening the screws **BE** (tightening torque to **25 Nm** ). Adhere to the screw tightening sequence **BE** as shown in **Fig. 9.43** . | imm9.59.jpg **Fig 9.42**imm9.60.jpg **Fig 9.43** |
| imm9.60A.jpg **Fig 9.44** | 9.34.jpg **Fig 9.45** |

## Flange unit assembly

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| **9.5.1 Bell housing**    Z_Pericolo.jpg **Danger**       * Bell **A** is very heavy; pay special attention during assembly operations to avoid dropping and causing serious risks to the operator.  1. Install the bell housing **A** in accordance with the reference pins **B** on the base **C** . | 9.46.jpg **Fig 9.46** |
| Z_importante.jpg **Important**       * Failure to adhere to the assembly procedures may compromise the functionality of the engine, and also cause damage to persons and property.  1. Tighten the fastening screws **D** strictly following the tightening sequence indicated (tightening torque **50 Nm** ). | 9.47.jpg **Fig 9.47** |
| **9.5.2 Flywheel**    Z_Pericolo.jpg **Danger**       * Flywheel **F** is very heavy; pay special attention during assembly operations to avoid dropping and causing serious risks to the operator.  1. Screw the special tool [**ST\_09**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=1205&parent=1614) on the crankshaft **E** instead of the screws **G** positioned higherup ( **Fig. 9.33** ). 2. Insert the flywheel **F** on the crankshaft **E** using the tool as a guide [**ST\_09**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=1205&parent=1614) and manually tighten all the screws **G** (the last screw is fitted in the place of the tool [**ST\_09**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=1205&parent=1614) ). 3. Mount the tool [**ST\_34**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=1205&parent=1614) in the seat of the starter motor **H** and fit it with the two starter motor fixing screws. 4. Tighten the screws **G** (tightening torque at **140 Nm** ). | 9.5.jpg **Fig 9.48** |

## Assembling the flexible coupling

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| **Important**   * Leave the special flywheel locking tool [**ST\_34**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=1205&parent=1614) assembled .  1. Fasten coupling **A** onto flywheel **B** by means of capscrews **C** and washers **D** ( **Loctite 243** on the thread - tightening torque **25 Nm** ). | 9.49.jpg  **Fig. 9.49** |

## Assembling the reversing gear

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| 1. Insert shaft **A** into the seat on coupling **B** . 2. Place reversing gear **C** onto bell **D** . 3. Fasten reversing gear **C** by means of capscrews **E** and **E1** and washers **F** onto bell **D** (tightening torque of **50 Nm** ). | 9.50.jpg  **Fig. 9.50** |

## Timing system gear assembly and injection pump

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| **9.8.1 Timing system gear assembly**   1. Check that the key **A** is correctly fitted on the camshaft **B** . 2. Position the gear **C** on the camshaft **B** adhering to the key reference **A** . 3. Screw capscrew **D** until the end. 4. Tighten the middle gear pin **H** , in the housing **J** of the crankcase, with the screws **K** (tightening torque **25 Nm** ). | 9.51.jpg **Fig 9.51** |
| Z_importante.jpg **Important**       * The fitting of the middle gear pin **H** has only one position, the 4 screw holes **K** are asymmetric. * Always replace the gasket **L** at each assembly.  1. Insert the shoulder ring **M** . 2. Check the integrity of the bushing N into the middle gear **P** , and ensure that it is free from impurities. 3. Thoroughly lubricate the pin **H** and the bushing **N** . 4. Position the gear **P** on the pin **H** observing all the marks **W** of the gears **C** and **S (Fig. 9.54) .** | 9.52.jpg **Fig 9.52** |
| Z_importante.jpg **Important**       * Failure to comply with the marks **W** on the gears **C, P and S** , causes engine malfunction and serious damage.  1. Insert the shoulder ring **Q** and the lock ring **R.** 2. Tighten the screw **D** ( **Fig. 9.51** - tightening torque at **100 Nm** ). | 9.53.jpg **Fig 9.53** 9.54.jpg **Fig 9.54** |
| Z_importante.jpg **Important**     * Always replace the gaskets at each assembly. * Check that the perforated screw **AF** is free of impurities inside. * Lubricate the thread and under the head of the **AF** screw with **Molyslip** .  1. Position the gear unit **AH** on the bushing **AM** to centre. 2. Secure the gear **AH** using the screw **AF** inserting the gasket **AG** (tightening torque at **40 Nm** ). | 9.55.jpg  **Fig. 9.55** |
| 1. Loosen and tighten the screw **AF** again (tightening torque at  **20 Nm + 20°** ). 2. Insert the gear **AN** in the flange **AP** . 3. Insert the shoulder ring **AQ** on the flange **AP** and clamp the gear **AN** using the retainer ring **AR** . | 9.56.jpg  **Fig. 9.56**  9.57.jpg  **Fig. 9.57** |
| 1. Insert the centring ring **AS** in the flange **AP** . 2. Secure the plate **AT** using the screws **AV** on the flange **AP** (tightening torque at **20 Nm** ) | 9.58.jpg  **Fig. 9.58** |
| **9.8.2 Injection pump**    Z_importante.jpg **Important**       * Always change screws **T** with new ones or alternatively apply **Loctite 270 (Fig. 9.59)** to the threads.  1. Perform the operations described in the warning in  [**Par. 6.1.5** .](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=1147&parent=1614) 2. Place a dial gauge to detect the TDC on piston N° **1** , then bring the indicator of the dial gauge to **0** .   **NOTE** : During the detection phase of the TDC, check that cylinder N° **1** is in compression phase (align the notches **W** as in **Fig. 9.33** ). | 9.59.jpg **Fig 9.59** |
| 1. By means of the identified pump code, refer to **Tab. 6.1** to know the advance degrees and the corresponding value to lower the piston. 2. Mount tool [**ST\_34**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=1205&parent=1614) in the seat of starter motor **H (Fig. 9.61)** and fix it with two motor fixing screws. 3. Having identified the value to lower the piston, rotate the crankshaft anti-clockwise by going beyond the value described in **Tab. 6.1** , once again, rotate the crankshaft clockwise stopping at the correct advance value by using tool [**ST\_03**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=1205&parent=1614) - [**ST\_34**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=1205&parent=1614) . 4. Lock the [**ST\_34**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=1205&parent=1614) , ensure that the crankshaft does not rotate, which would alter the correct advance value. If this happens, repeat the instructions described in points **4, 5 and 6.** | 9.60.jpg **Fig 9.60** |
| 1. Fix pump **Z** into housing **V** by means of screws **T** ( **Fig. 9.59** - tightening torque at **25 Nm** ). 2. Position the gear **AC** onto shaft **AB** of the pump.   **NOTE:** You are not required to respect the reference **Q** gear **AE** ( **Fig.** **9.61** ).   1. Insert washer **U** and tighten nut **AD** (tightening torque at **70 Nm** ). | 9.6.jpg **Fig 9.61** |

## Fuel system assembly

|  |  |
| --- | --- |
| Z_importante.jpg **Important**       * Replace the high pressure pipes after two disassemblies. * When repaired, **RSN-A** injectors must be certified by a Stanadyne centre to check their correct operation - check the type of engine mounted injectors on the spare parts list ( **RSN-A** is specified in the description). * Remove the protective caps from all the components of the fuel circuit just before assembly [**(Par. 2.9.7)**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=1132&parent=1614) **.** | Fig._9.59.jpg **Fig 9.62** |
| **9.9.1** **Injectors**     1. Perform the operations described in [**Par 6.1.7**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=1147&parent=1614) **.** | |
| **9** **.9.2** **Fuel injector ricicle pipe**     1. Perform the operations described in [**Par 6.1.8**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=1147&parent=1614) **.** | |
| **9.9.3** **Rocker arm cover**     1. Perform the operations described in [**Par 6.1.9**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=1147&parent=1614) **.** | |
| **9.9.4** **Installation of the fuel injector pipes (injection pump/injectors)**   1. Perform the operations described in [**Par 6.1.10**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=1147&parent=1614) . | |
| **9.9.5** **Fuel filter**   1. Fasten fuel filter **C** with capscrews **A** and washers **B** onto bell **D** (tightening torque of **27 Nm** ). | 9.63.jpg **Fig 9.63** |
| **9.9.6 Fuel pipes**   1. Fasten union **E** by means of capscrews **L1** with the relative gasket **N1** (tightening torque of **15 Nm** ). 2. Fasten tubes **G** and **H** by means of capscrews **L2** and **L3** with the relative copper gaskets **N2** and **N3** (tightening torque of **25 Nm** ).   9.64.jpg  **Fig 9.64** | |

## Lubrication circuit assembly

|  |  |
| --- | --- |
| **9.** **10 .1** **Oil filter**   1. Perform the operations described in [**Par 6.10.2**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=1155&parent=1614) **.** | |
| **9.** **10 .2** **Oil pump**   1. Perform the operations described in [**Par 6.8.5**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=1154&parent=1614) **.** | |
| **9.** **10 .3** **Timing system crankcase**   1. Perform the operations described in [**Par 6.8.6**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=1154&parent=1614) **.** | |
| **9.** **10 .4** **Crankcase oil filler flange Timing System**    Z_importante.jpg **Important**       * Always replace the gasket **A** after each assembly.  1. Position the gasket **A** in the seat on the flange **B** . 2. Clamp the flange **B** on the crankcase **C** with the screws **D** (tightening torque of **10 Nm -** [**ST\_06**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=1205&parent=1614) ). | 9.65.jpg   **Fig 9.65** |
| **9.** **10 .5** **Oil pressure relief valve**   1. Perform the operations described in  [**Par 6.9.2.**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=1156&parent=1614) | |
| **9.10.6 Oil extraction pump**   1. Fasten pump **E** on the fastening hollow stud of flange **F** by means of capscrew **P** (tightening torque of **25** **Nm** ). 2. Fasten union **G** onto oil sump **H** , inserting gasket **N1** ( **Loctite 277** + tightening torque of **25** **Nm** ). 3. Fasten tube **L** by means of capscrew **M** with gaskets **N2** (tightening torque of **25 Nm** ). | 9.66.jpg  **Fig. 9.66** |

## Crankshaft pulley assembly

|  |  |
| --- | --- |
| 1. Perform the operations described in [**Par 6.7.2**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=1153&parent=1614) **.** | |

## Coolant circuit assembly

|  |  |
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| **9.12.1** **Thermostatic valve**    Z_importante.jpg **Important**       * Always replace the gasket **A** after each assembly.      1. Check the condition of the seal gasket **A** and fit it on the thermostatic valve **B** . 2. Position the thermostatic valve **B** in the seat on the head **C** (detail **D** ). 3. Secure the cover **E** with the screws **F** on the head **C** (tightening torque of **10 Nm** ). | 9.67.jpg **Fig 9.67** |
| **9.12.2** **Coolant pump**   1. Perform the operations described in [**Par 6.6.2**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=1152&parent=1614) **.** | |
| **9.12.3 External water pump**   1. Position capscrews **N** onto pump **L** and place gasket **V** . 2. Insert hub **G** of pump **L** inside gear **H** . 3. Fasten pump **L** onto timing system carter **M** by mean of capscrews **N** (tightening torque of **10 Nm** ). 4. Fasten clamp **J** onto crankcase **K** by means of capscrew **P** (tightening torque of **25** **Nm** ). 5. Fasten clamp **Q** onto bell **R** by means of capscrew **S** with washer **T** (tightening torque of **25 Nm** ). | 9.68.jpg  **Fig. 9.68**  9.69.jpg  **Fig. 9.69** |

## Electric component assembly

**9.13.1** **Sensors and switches**

|  |  |
| --- | --- |
| **9.13.1.1** **Coolant temperature sensor**   1. Secure the sensor **D** onto the head **E** (tightening torque of **20 Nm** ). | 9.70.jpg **Fig 9.70** |
| **9.13.1.2** **Oil pressure switch and sensor**   1. Fasten union **E** onto crankcase **F** by means of capscrew **G** with gaskets **H** (tightening torque of **25** **Nm** ). | 9.71.jpg **Fig 9.71** |
| **9.13.1.3 Coolant temperature switch**   1. Tighten switch **J** onto cylinder head **K** , inserting gasket **J1** ( **Loctite 511** - tightening torque of **10 Nm** ). | 9.72.jpg  **Fig 9.72** |

|  |  |
| --- | --- |
| **9.13.2 Belts and alternator**  Important   * The belts must always be replaced every time it is disassembled, even if they have not reached the scheduled hours for replacement.  1. Tighten hollow stud **L** onto crankcase **M** ( **Loctite 243** - (tightening torque of **40 Nm** ). 2. Assemble alternator **N** onto hollow stud **L** by means of capscrew **P** with washer **Q** .     **NOTE** : Do not tighten capscrew **P** .     1. Fasten support **R** onto cylinder head **S** by means of capscrews **T** with washers **U** , inserting spacers **V** between **R** and **S** ( **Loctite 243** - tightening torque of **25 Nm** ). 2. Loosen hollow stud **W** . 3. Perform the operations described in [**Par. 6.5.2**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=1151&parent=1614) - [**6.4.2.**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=1150&parent=1614) | 9.73.jpg  **Fig 9.73** |
| **9.13.3 Electric fuel pump**   1. Fasten pump **B** onto support **A** by means of nuts **X** and washers **Y** (tightening torque of **10 Nm** ). 2. Fasten tube **F1** onto Pump **B** by means of capscrew **G1** with gaskets **H1** (tightening torque of **25 Nm** ). | 9.74.jpg  **Fig. 9.74** |
| **9.13.4** **Starter Motor**    Z_importante.jpg **Important**       * Remove the tool if still there [**ST\_34**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=1205&parent=1614) .  1. Fit the starter **E1** with the screws **C** on to the flange bell **D1** (tightening torque of **45 Nm** ). | 9.75.jpg   **Fig 9.75** |
| **9.13.5 Electric wiring**   1. Connect the engine’s wiring.     **NOTE:** refer to [**Par. 2.13.1.3**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=1136&parent=1614) to connect all connectors. | |

## Assemble the intake line

|  |  |
| --- | --- |
| 1. Insert tool [**ST\_18**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=1205&parent=1614) into the holes, as shown in the figure. 2. Place gasket **A** and manifold **B** onto cylinder head **C** . 3. Fasten manifold **A** by means of capscrews **D** (tightening torque of **25 Nm** ). 4. Insert tube **E** into rocker arm cover union **F** and fasten it with clamp **G** . 5. Fasten oil dipstick tube **M** with hollow stud **H1** onto manifold **B** , tighten hollow stud **H2** with the washer **L** on manifold **B** (tightening torque of **10 Nm** ). 6. Fasten plate **P** onto hollow studs **H1** and **H2** using capscrews **Q** with washers **R** (tightening torque of **10 Nm** ). | 9.76-9.77.jpg  **Fig 9.76 - Fig. 9.77** |

## Assembly of the discharge line

|  |  |
| --- | --- |
| 1. Insert tool [**ST\_18**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=1205&parent=1614) into the holes of cylinder head **D** . 2. Place manifold **A** onto cylinder head **D** , inserting gaskets **C** . 3. Fasten manifold **A** onto cylinder head **D** by means of capscrews **B** (tightening torque of **30 Nm** ). | 9.78.jpg  **Fig 9.78** |

## Tightening torques and the use of sealants

**Tab. 9.4** - \* Alternatively to the capscrew replacements, with "Dri-loc"

|  |  |  |  |
| --- | --- | --- | --- |
| **BASE CONFIGURATION** | | | |
| **SHORT BLOCK** | | | |
| **Component** | **Thread (mm)** | **Torque (Nm)** | **Sealer** |
| Breather room closing cover fastening capscrew (EXHAUST SIDE) | M6x1 | 10 |  |
| **Lower crankcase fastening capscrew** | **M12x1.25** | **3 Torque cycles** |  |
| 1st Cycle |  | 40 |  |
| 2nd Cycle |  | 70 |  |
| 3rd Cycle |  | 120 |  |
| **Lower crankcase fastening capscrew** | **M8x1.25** | **2 Torque cycles** |  |
| 1st Cycle |  | 20 |  |
| 2nd Cycle |  | 35 |  |
| **Connecting rod screw** | **M8x1** | **2 Torque cycles** |  |
| 1st Cycle |  | 40 |  |
| 2nd Cycle |  | 85 |  |
| Crankshaft gasket flange fastening capscrew | M6x1 | 10 |  |
| Flange fastening capscrew 3 rd PTO | M8x1.25 | 25 | Loctite 2701\* |
| Coolant drain hole closing cap | M16x1.5 | 50 |  |
| **OIL SUMP ASSEMBLY** | | | |
| **Component** | **Thread (mm)** | **Torque (Nm)** | **Sealer** |
| Oil fumes tube | M12x1,5 | 15 | Loctite 648 |
| Oil suction hose fastening capscrew | M6x1 | 10 | Loctite 2701\* |
| Oil sump fastening capscrew | M8x1.25 | 25 |  |
| Oil drain cap | M18x1.5 | 35 |  |
| Oil extraction pump tube reduction union | M18x1.5 | 25 | Loctite 2701 |
| Oil extraction pump tube fastening screw | M14x1.5 | 25 |  |
| Oil extraction pump fastening screw | M8x1.5 | 25 |  |
| **FLANGE ASSEMBLY AND REVERSING GEAR(1st PTO)** | | | |
| **Component** | **Thread (mm)** | **Torque (Nm)** | **Sealer** |
| Flange bell fastening capscrew | M10x1,5 | 50 |  |
| Flywheel fastening capscrew | M12x1,25 | 140 |  |
| Flexible coupling fastening screw | 5/16"-18UNC | 25 | Loctite 243 |
| Reversing gear stud | M8x1.25 | 25 | Loctite 2701 |
| Reversing gear flange fastening screw | M8x1.25 | 30 | Loctite 243 |
| Reversing gear flange nut | M8x1.25 | 30 | Loctite 243 |
| Reversing gear flange on bell flange fastening screw | M10x1.25 | 50 |  |
| Bell flange fastening screw for reversing gear | 3/8" 16UNC | 50 |  |
| **GEAR DISTRIBUTION** | | | |
| **Component** | **Thread (mm)** | **Torque (Nm)** | **Sealer** |
| Intermediate gear gudgeon fastening screw | M8x1.25 | 25 |  |
| Camshaft gear control fastening capscrew | M10x1 | 100 |  |
| Fastening nut on fuel injection pump gear | M14x1.5 | 65 |  |
| Idler gear fastening screw | **M14x1.5** | **2 Torque cycles** |  |
| 1st Cycle |  | **See** [**Par. 9.8.1**](https://iservice.lombardini.it/jsp/Template2/manuale.jsp?id=1188&parent=1614) |  |
| 2nd Cycle |  |  |
| **ENGINE CYLINDER HEAD ASSEMBLY** | | | |
| **Component** | **Thread (mm)** | **Torque (Nm)** | **Sealer** |
| Air bleeding cap | M6x1 | 8 |  |
| Lifting brace fastening capscrew | M8x1.25 | 25 |  |
| Injector manifold | M12x1 | 30 |  |
| **Cylinder head fastening capscrew** | **M12x1.25** | **6 Torque cycles** |  |
| 1st Cycle |  | 40 |  |
| 2nd Cycle |  | 70 |  |
| 3rd Cycle |  | 100 |  |
| 4th Cycle |  | 90° |  |
| 5th Cycle |  | 90° |  |
| 6th Cycle |  | 90° |  |
| Rocker arm gudgeon fastening capscrew | M8x1,25 | 25 |  |
| Rocker arm cover fastening capscrew | M6x1 | 10 |  |
| **INJECTION SYSTEM** | | | |
| **Component** | **Thread (mm)** | **Torque (Nm)** | **Sealer** |
| Injector brace fastening capscrew | M8x1.25 | 20 |  |
| Waste line fastening drilled capscrew/nipple on Cyl. head | M8x1 | 15 |  |
| Waste line fastening drilled capscrew on injectors | M6x1 | 14 |  |
| Injector side injection tube nuts | M12x1.5 | 25 |  |
| Injection pump side injection tubes nuts | M12x1.5 | 25 |  |
| Injection pump fastening capscrew | M8x1.25 | 25 | Loctite 2701\* |
| Fuel injection pump locking screw | ... |  |  |
| Fuel delivery fastening drilled capscrew (on injection pump) | M12x1.5 | 25 |  |
| Waste line fastening drilled capscrew (on injection pump) | M12x1.5 | 25 |  |
| Bleeding screw injection pump (on waste line fastening drilled capscrew) | M10x1.5 | 50 |  |
| Fuel filter fastening capscrew | 1/8" | 25 |  |
| Drilled capscrew on fuel feed (electric pump) | M14x1.5 | 25 |  |
| Drilled capscrew on fuel filter | M8x1.25 | 27 |  |
| Fuel filter bracket fastening screw | M12x1.5 | 25 |  |
| Drilled capscrew on fuel return tube | M12x1.5 | 25 |  |
| **INTAKE MANIFOLD** | | | |
| **Component** | **Thread (mm)** | **Torque (Nm)** | **Sealer** |
| Fastening screw intake manifold | M8x1.25 | 25 |  |
| Intake manifold line fastening screw | M8x1.25 | 25 |  |
| **EXHAUST MANIFOLD** | | | |
| **Component** | **Thread (mm)** | **Torque (Nm)** | **Sealer** |
| Cooled exhaust manifold fastening screw | M8x1.25 | 30 |  |
| Exhaust gas outlet closing cover fastening screw (on cooled exhaust manifold) | M8x1.25 | 30 |  |
| Raiser fastening screw | M8x1.25 | 27 |  |
| **LUBRICATION CIRCUIT** | | | |
| **Component** | **Thread (mm)** | **Torque (Nm)** | **Sealer** |
| Oil filter fastening union | M20x1.5 | 15 | Loctite 2701\* |
| Oil filter | M20x1.5 | 15 |  |
| Oil pump carter fastening capscrew | TG6 | 10 |  |
| Carter distribution fastening capscrew | M8x1.25 | 25 |  |
| Hollow stud timing system carter fastening | M8x1.25 | 25 |  |
| Fastening capscrew for plug on timing system cover | TG6 | 10 |  |
| Side oil load flange fastening capscrew (onto carter distribution) | TG6 | 10 |  |
| Pressure relief valve cap | M16x1.5 | 50 |  |
| Breather system cover fastening capscrew (on rocker arms cover) | M6x1 | 10 |  |
| Hollow stud oil dipstick fastening | M6x1 | 10 |  |
| **CRANKSHAFT PULLEY** | | | |
| **Component** | **Thread (mm)** | **Torque (Nm)** | **Sealer** |
| Crankshaft pulley fastening screw | M16x1.5 | 360 | Molyslip |
| Spacer capscrew | M10x5 | 40 | Loctite 2701 |
| Alternator drive pulley fastening screw | M8x1.25 | 25 | Loctite 243 |
| **COOLANT CIRCUIT** | | | |
| **Component** | **Thread (mm)** | **Torque (Nm)** | **Sealer** |
| Thermostatic valve cover fastening capscrew | M6x1 | 10 |  |
| Coolant pump fastening capscrew | M8x1.25 | 25 |  |
| External water pump support fastening screw | M6x1 | 10 |  |
| External water pump fastening screw | M8x1.25 | 25 |  |
| Water delivery clamp fastening screw (on crankcase) | M12x1.75 | 50 |  |
| Water delivery clamp fastening screw (on bell) | M8x1.25 | 25 |  |
| 3rd PTO flange closing cover fastening screw | M8x1.25 | 25 |  |
| External water feed cap capscrew on cooled exhaust manifold | M6x1 | MIN 5 - MAX 7.5 |  |
| Zinc anode capscrew on external water feed cap | M18x1.5 | 30 |  |
| **ELECTRICAL COMPONENTS** | | | |
| **Component** | **Thread (mm)** | **Torque (Nm)** | **Sealer** |
| Coolant temperature sensor | M12x1.5 | 10 | Loctite 511 |
| Oil pressure switch | M12x1.5 | 10 | Loctite 511 |
| Oil pressure sensor | M14x1.5 | 10 | Loctite 511 |
| Coolant temperature sensor/switch | M16x1.5 | 10 | Loctite 511 |
| Electric fuel pump fastening screw/nut | M6x1 | 10 |  |
| Alternator bracket fastening capscrew | M8x1.25 | 25 | Loctite 243 |
| Alternator bracket hollow stud (on crankcase) | M10x1.5 | 40 | Loctite 243 |
| Alternator bracket hollow stud | M10x1.5 | 40 |  |
| Alternator fastening capscrew | M10x1.5 | 40 |  |
| Alternator protection fastening screw | M6x1 | 10 |  |
| Starter motor fastening capscrew | M10x1.5 | 45 |  |
| Supply cable fastening nut (starter motor) | M8x1.25 | 10 |  |
| **CONTROLS** | | | |
| **Component** | **Thread (mm)** | **Torque (Nm)** | **Sealer** |
| Accelerator bracket fastening capscrew | M6x1 | 10 |  |

\* Alternatively to the capscrew replacements, with "Dri-loc"

|  |  |  |  |
| --- | --- | --- | --- |
| **ENGINE SUPPORT** | | | |
| **Component** | **Thread (mm)** | **Torque (Nm)** | **Sealer** |
| Rear engine support fastening screw | M12x1.75 | 60 |  |
| Front engine support fastening screw | M16x2 | 160 |  |
| Vibration damping fastening nut | M12x1.75 | ... |  |

