VM MOTORI S.p.A.

D700 - D750

D 700-D750 series

This manual has been written and published by the Service Department of VM Motori S.p.A. to aid our authorized dealers' mechanics and company service personnel when servicing the products described herein. We reserve the right to make changes to this manual without prior notification.

ED. 5 - 07/2011

LUNGHEZZA - *Length* (1m=1000mm)

m	in	ft	yd
1	39.370	3.2808	1.0936
0.0254	1	0.08333	0.02778
0.3048	12	1	0.33333
0.9144	36	3	1

AREA ($1m^2 = 1000000mm^2$)

m^2	in^2	ft^2	yd^2
1	1550	10.764	1.1960
0.00065	1	0.00694	0.00077
0.0929	144	1	0.11111
0.83613	1296	9	1

VOLUME ($1dm^3 = 1000cm^3 = 1000000mm^3$)

m^3	dm^3, (liter)	in^3	ft^3	Imperial gallon	US gallon
1	1000	61024	35.315	219.97	264.17
0.001	1	61.024	0.03532	0.21997	0.26417
.	0.01639	1	0.00058	0.00360	0.00433
0.02832	28.317	1728	1	6.2288	7.4805
0.004546	4.546	277.420	0.16054	1	1.2010
0.003785	3.785	231	0.13368	0.83268	1

PESO - *Mass* (1kg=1000g)

kg	lb (pound)	oz (ounce)	stug, UK	ton, UK	short ton, US
1	2.2046	35.274	0.06852	0.00984	0.0011
0.45359	1	16	0.03108	0.00045	0.0005
0.02835	0.0625	1	0.00194	.	.
14.5939	32.174	514.78	1	0.01436	0.01609
1016	2240	35840	69.621	1	1.12
907.18	2000	32000	62.162	0.89286	1

POTENZA - *Output* (1kW=1000W)

kW, kNm/s, kJ/s	hk, metric hp	hp (PS), UK, US	ft x lbf/s
1	1.3596	1.3410	737.56
0.7355	1	0.98632	542.48
0.7457	1.0139	1	550
0.00136	0.00184	0.00182	1

FORZA LAVORO - *Energy work* (1kWs=1000Ws)

kWs, kJ, kNm	kWh	kpm	hkh (metric hph)	ft x lbf (foot pound-force)
1	0.00028	101.97	0.00038	737.56
3600	1	367100	1.3596	2655200
0.00981	.	1	.	7.2330
2631.6	0.7355	270000	1	1952910
0.00136	.	0.13826	.	1

COPPIA - *Torque*

Nm	kpm	lbf x in	lbf x ft
1	0.10197	8.8508	0.73756
9.8067	1	86.796	7.2330
0.11299	0.011521	1	0.08333
1.3558	0.13826	12	1

PRESSIONE - *Pressure stress*

N/m^2, Pa	bar (=1000 mbar)	mm Hg	kp/cm^2	kp/mm^2	lbf/in^2, psi
1	0.00001	0.0075	.	.	.
100000	1	750.062	1.0197	0.01097	14.503
133.32	0.00133	1	0.00136	.	0.01934
98066	0.98066	735.56	1	0.010	14.223
9806650	98.066	73556	100	1	1422.2
6894.76	0.06895	51.715	0.07031	.	1

DENSITA' - *Density*

kg/dm^3	g/mm^3	lb/in^3	lb/ft^3
1	0.001	0.03613	0.06243
1000	1	36.1273	62.428
27.679	0.02768	1	1728
0.01602	.	0.00058	1

TEMPERATURA - *Temperature*

°C	°F
Formula (1.8 x C)+32 = F	Formula (F-32) x 0.5556 = C
Example, 100°C (1.8 x 100)=180+32=212°F	*Example*, 100°F (100-32)=68 x 0.5556=38°C

SERVICE MANUAL COMMENTS

What errors(s) have you found?

In order for us to assist you, please include as much details as possible when reporting an error
Comments / Suggestions

☐ **DEALER**

Retail Customer ☐

Please poste this page using the envelope contained in this manual
or
write to below e-mail address:
sluciani@vmmotori.com

UPDATING

Edition	Chapter	Paragraph	Description
0 - 10/2005	1	1.1	new engine identification plate
		1.2	engine codes for D703TE2 - D754TE2.
	3	3.5	new engine oil specifications Mobil Super S 10W 40
	6	6.12	new special tool to dissamble crankshaft gear in relation to front crankshaft end shape (cilindrical type)
		6.34	updated injection pump timing advance values and introduced regulator springs table for D703 engine models
	7	7.8	new torque value for flywheel housing bolts with grade 10.9
		7.11	torquing procedure for fractured connecting rods
		7.27	grease Molykote on injector O-rings to avoid blocked injectors into cylinder heads
		7.31	torquing procedure for water pump with bigger housing
		7.35	torquing procedure for crankshaft nut pulley depending on front crankshaft end shape (cone or cilindrical)
		7.42	introduced table for timing inj. pump gear in relation to marked teeth on it
	11		grouped 4 tools in a kit to measure the inj.timing advance

Edition	Chapter	Paragraph	Description
1 - 10/2006	3	3.11	Relation between an hour counter an odometer if the hour counter is not available,
	5	5.44	During the disassembling inspection of liner shims, responsible of liner protrusion..
	5	5.46	Introduction oil piston cooling jets in the crankcase instead of their installing in the main center bearing carriers.
	7	7.2	new procedure to install liners with or without shims. Introduced new interval limits of liner protrusion in relation to shims presence in the block or under liner neck .

Edition	Chapter	Paragraph	Description
2 - 04/2008	1	1.2	New engine codes about D700EPA3 and D700TPE/IPE 2 models
	2	2.1	D700 EPA 3 engines dimensions
	2	2.2	Techdata about D700 EPA3
	3	3.1 - 3.2 - 3.3	STORAGE: New protective oil Castrol Rustilo/Safecoat for injection system
	3	3.5	Updated engine oil specifications (API and ACEA)
		3.8	Updated engine fuel specifications (EN590 and use of biodiesel)
		3.11	Updating of routine maintenance: at first 50 running hours it is advisable to change the lube oil but it is necessary to change the oil filter For engine D754SE3,TE3,IE3 with low oil pan capacity it is necessary to change the engine oil at 200 hours instead of 300. In this case a label is applied on rocker arms cover.
	4	4.6	added new electrical wiring 16662043F about exclusion of engine crank when the engine is running, electrical wiring 16662047 ***D756IE2_706IE2_754TPE2_754TE2 / 12-24V ,*** electrical wiring 16662048 ***D703E2_TE2_E3_TE3_IE3 / 12-24V***
	5		**5.1 INJECTOR**: added note about spacer thickness under injector in relation to different engine model - **5.2.1: OIL SEPARATOR KIT INSTALLED ON ROCKER ARMS COVER** added new installation kit - **5.46 OIL PISTON COOLING JETS: i**ntroduced new component, oil jet installed on the block.
	6		Deleted value of cylinder head resurfacing because the cyl. heads can not be resurfaced - Update injection pump advance about D704TE2 D703EPA3 D754EPA3
	7		**7.27 INJECTOR**: added note about spacer thickness under injector in relation to different engine model - **7.33 CRANKSHAFT PULLEY**: update procedure to tighten the crankshaft pulley nut - **-7.11: CAMSHAFT O-RING AND MAIN REAR BEARING CARRIER O-RING:** application of silicon bead - **7.43 D703 INJECTION PUMP SHIMMING:** new chart to select the specific shim in relation to reading value.- **7.45 LDA VALVE**: updated installation procedure - **7.46 RADIATOR**: introduced new paragraph - **7.47: OIL SEPARATOR KIT INSTALLED ON ROCKER ARMS COVER** added new installation kit
	8		**8.2.6 OIL PISTON COOLING JETS=** introduced opening oil pressure about oil piston cooling jets installed on crankcase.
	9		**9.2: OIL PAN CAPACITY:** inserted advice concerning oil pan capacity in relation to engine configuration.
	11		Inserted new special tool **B** for extracting injector. Special tool **AJ** about hydraulic test pressure for cylinder head. Special tool **AK** for removal alternator pulley on alternator with idler pulley. Special tool **AL** to adjust the LDA valve lever

Edition	3 - 04/2010

Chapter	Paragraph	Description
0		MAIN TECHICAL DATA: updating torque values and related procedures
1	1.1	Insert picture to identify engine s/n for products D753
	1.2	Insert Engine Code for products D753E3/TE3/IE3 - D703E0/TE0
2	2.1	Insert engine dimensions for products D753E3/TE3/IE3 - D703E0/TE0 - D754TPE2 - D756IPE2
	2.2	Insert Technical Specifications for D753E3/TE3/IE3 - D703E0/TE0 - D754TPE2 - D756IPE2
5		ALTERNATOR BELT: insert belt type Poly-V
		INJECTION PUMP: updated removal procedure STANADYNE injection pump
		INJECTION PUMP: updated removal procedure STANADYNE injection pump for products D753E3/TE3/IE3
		OIL PUMP: insert oil pump drive gear for products D753
6	6.12	CRANKSHAFT: Insert indications for installation crankshaft gear for engine with crankshaft front end cylindrical shape
	6.34	INJECTION TIMING ADVANCE: updated advance values for products D703E0/TE0 - D753E3/TE3/IE3
7	7.15	OIL PUMP: insert oil pump drive gear for products D753
	7.28	INJECTION PUMP: updated installation procedure STANADYNE injection pump for products D753E3/TE3/IE3
	7.33	CRANKSHAFT HUB / CRANKSHAFT PULLEY: updated torque value
	7.37/7.38	ALTERNATOR BELT: insert Poly-V belt

Edition	4 - 06/2011

Chapter	Paragraph	Description
5		INJECTION PUMP: updating of D756IPE2 / D754TPE2 injection timing advance. Updating of D753 engine models injection pump removal procedure by using the special tool "timing pin".
6		INJECTION PUMP: updating of D756IPE2 / D754TPE2 injection timing advance
7		INJECTION PUMP: updating of dynamic timing advance check through the special tool "stroboscope device".
11		New special tool "timing pin" for D753 engine models Stanadyne injection pump and stroboscope device to check dynamic injection pump timing Stanadyne. Both special tools are only uselful for D753 engine models

Edition	5 - 07/2011

Chapter	Paragraph	Description
6		INJECTION PUMP: updating of D754IE3 injection timing advance

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0 FOREWORD

0.0 WORKSHOP PROCEDURES

The models illustrated can be identified by the code indicating the bore, number of cylinders and aspiration type (see Chap. 1 'Identification').

In the event of a fault, check that the problem is not due to some external factor before proceeding to dismantle the engine.

If it is necessary to dismantle the engine, label all those parts which must be fitted in a certain position, so as to avoid problems and save time during reassembly.

DURING DISASSEMBLY AND REASSEMBLY, THE ENGINE MUST BE SUPPORTED ON A SUITABLE PURPOSE-BUILT STAND OF THE TYPE INDICATED IN CHAPS. 5 AND 7.

Fix the engine to the stand using the bolts provided with the stand or similar.

_WARNING: TO SUPPORT OR MOVE THE ENGINE, ALWAYS USE A COMMERCIAL PURPOSE-BUILT STAND OF THE TYPE INDICATED IN CHAPS. 5 AND 7.

_WARNING: RISK OF CRUSHING AND/OR SHEARING OF LIMBS DURING ENGINE ROTATION ON STAND.

_WARNING: ALWAYS USE THE CORRECT TOOLS FOR THE TASK. DO NOT USE UNSUITABLE TOOLS TO AVOID RISK OF PERSONAL INJURY AND DAMAGING COMPONENTS.

If difficulty is encountered separating parts during disassembly, use only gentle blows with a synthetic rubber or wooden mallet or use a metal hammer and interpose soft material (synthetic resin, wood).

Keep the component parts of different assemblies separate and label any unmarked parts to facilitate reassembly.

If you use abrasive materials (emery cloth, etc.) to clean any parts, always clean the parts thoroughly afterwards using a suitable solvent to remove any abrasive particles **(see Chapter 3)**.

Lubricate all moving parts with a suitable lubricant prior to reassembly **(see Chapter 3)**.

When reassembling the engine, renew all seals, gaskets, spring washers, tab washers, and any parts which appear worn or defective.

DANGER: ALWAYS TAKE SUITABLE PRECAUTIONS WHEN HANDLING LUBRICANTS, THREAD-LOCKING COMPOUNDS, REFRIGERANTS, FUEL AND SOLVENTS ETC. AND AVOID INGESTION, INHALATION OF FUMES AND CONTACT WITH THE EYES AND SKIN.

0.1 USING THE WORKSHOP MANUAL

0.1.1 Importance of the manual

This workshop manual is published for use in **"VM"** Service Centers and contains instructions for the servicing, repair and overhaul of **D700** engines.

We recommend that you follow all the instructions in this manual scrupulously, as the effectiveness of any servicing operation depends on the correct and methodical application of the information contained herein.

If you run into difficulties or setbacks, **VM MOTORI S.p.A. SERVICE DEPARTMENT** will be happy to provide you with the necessary advice and assistance.

VM MOTORI S.p.A. declines any liability for any injury or damage resulting from incorrect or unsuitable operations.

VM MOTORI S.p.A. reserves the right to make any modifications aimed at improving its products without prior notification.

Please ensure that any amendments or updates you may receive are kept with the original version of this manual.

0.1.2 Conserving the manual

When using the manual, take care not to damage or deface it.

Do not tear or remove pages from the manual, or overwrite any parts of the manual for any reason.

Keep the manual in safe place protected from excess heat and humidity.

0.1.3 Consulting the manual

This manual comprises:

- COVER PAGE IDENTIFYING THE TYPE OF ENGINE
- TABLE OF CONTENTS
- INSTRUCTIONS AND/OR NOTES ON THE PRODUCT

The **COVER PAGE** indicates the engine model dealt with in the manual.

The **TABLE OF CONTENTS** indicates the **CHAPTER** and **PARAGRAPH** to be consulted for information about a particular topic.

The **INSTRUCTIONS AND/OR NOTES ON THE PRODUCT** define the safe working practices, correct procedures and skills required to service the engine correctly.

Please note that some of the illustrations in the manual, which are included to help you identify the parts described in the text, show standard engines and therefore may differ in some respects from the engine in your possession.

0.1.4 Symbols used in the manual

The Safety symbols and notices shown below are used throughout this manual to draw the reader's attention to the hazards associated with particular procedures and operations which could result in damage to the engine or personal injury, or to indicate good working practices.

GENERAL OPERATIONAL NOTE

Safety notices (rectangular): you must use the protection shown in the notices when carrying out the operation in question to avoid risk of personal injury:

PROTECT YOUR HANDS (WEAR GLOVES)

PROTECT YOUR EYES (WEAR SAFETY GOGGLES)

PROTECT RESPIRATORY PASSAGES (WEAR A MASK)

Danger warning signs (triangular) (General warning of risk of personal injury or damage to the engine):

_DANGER (GENERAL HAZARD - RISK OF PERSONAL INJURY OR DAMAGE TO THE ENGINE)

_DANGER (ELECTRICAL HAZARD - RISK OF ELECTROCUTION OR DAMAGE TO THE ENGINE)

DANGER (HIGH TEMPERATURE HAZARD - RISK OF BURNS OR DAMAGE TO THE ENGINE)

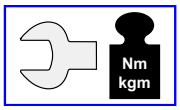
Prohibition notices (circular) denoting operations which are expressly prohibited to avoid risk of personal injury.

THE OPERATION INDICATED IN THE TEXT IS STRICTLY PROHIBITED

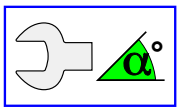
IT IS STRICTLY PROHIBITED TO CARRY OUT MAINTENANCE WORK IN THE PRESENCE OF MOVING PARTS.

IT IS STRICTLY PROHIBITED TO REMOVE OR TAMPER WITH THE SAFETY DEVICES.

PAY ATTENTION TO THE SYMBOLS AND ADHERE TO THE INSTRUCTIONS IN THE ADJACENT TEXT.



USE TORQUE WRENCH



USE ANGULAR TORQUE WRENCH

0.2 ORDERING ORIGINAL REPLACEMENT PARTS

To help us provide a fast and efficient service, always specify the following information when ordering replacement parts:

- **Engine type** as indicated on nameplate;
- **Serial number** as indicated on nameplate and stamped on crankcase;
- **Part number** and drawing of component required;
- **Quantity** of each item required.

Otherwise from INTERNET :

http://www.vmmotori.it

0.3 QUALITY SYSTEM CERTIFICATION ISO 9001 ; QS-9000 ; ISO 14001

VM MOTORI has obtained and maintains the official certification of its quality system in compliance with UNI EN ISO 9001 and in according with the prescriptions of Ford, Chrysler and GM car manufacturing association for the production of Diesel engines, set down in Quality System Standard QS 9000.

The company has also obtained the certification of its environmental management system, in accordance with ISO 14001 standards.

This is the result of an operating programme that has involved all levels of the company in a drive for constant structural improvement.

Quality policy and the environment, with particular reference to the principle of continuous improvement, are essential components of VM's top management functions in accordance with internationally accepted quality and environment management systems, in the full respect of the environment and the population.

Customer satisfaction, productivity and motivation of the employees as the sum of all services rendered outside and inside the company are the most important elements of VM's concept of quality.

All VM's employees are committed to the quality policy and the protection of the environment.

Regular training ensures that their qualifications are constantly brought up to date.

VM regards quality as a dynamic process of continuous improvement in all activities in order to achieve the company's goals.

PRINCIPALI DATI TECNICI - MAIN TECHNICAL DATA

componente	component	coppia serraggio - tightening value		Lubrificanti - Sigillanti	Lubrificats - Sealant	Note
		Nm	Kgm			
Contrappesi D703	D703 counterweights	68,6	7			
Supporti centrali di banco	Main center bearing carriers	44,1	4,5	lubrificare la filettatura e sottotesta con grasso MOLYguard LMP 180 -	lubricate the thread and underside bolt with grease MOLYguard LMP 180	
Biella Brocciata	Broached Con-Rod	30 + 60°				vedere procedura - see procedure
Biella Fratturata	Fractured Con-Rod	30 + 40°				vedere procedura - see procedure
Ingranaggio Regolatore	Governor gear	44,1	4,5			
Flangia albero camme D704-D754-D706	Camshaft flange D704-D754-D706	27,5	2,8			
Ingranaggio albero camme D703	Camshaft gear D703	30	3.1			
Pompa olio	Oil pump	27,5	2,8			
Staffa pompa olio D703	Oil pump support D703	27,5	2,8			
Ingranaggio Rinvio -viti Ingranaggio Rinvio D753	Idler Gear - screws Idler Gear - D753	27,5 32.4	2,8 3.3			
Pompa del vuoto	Vacuum pump	27,5	2,8			
Volano	Flywheel	50/20 + 75°				vedere procedura - see procedure
Campana Volano - vite	Flywheel Housing - bolt	47.5	4.8			vite classe 8.8 - screw type 8.8
		68.6	7			vite classe 10.9 - screw type 10.9
Supporto Posteriore	Rear Main carrier	24.5	2.5			
Bocchettone fissaggio supporti centrali di banco	Main center bearing carrier special fixing bolt	53.9	5.5			
Pompa Iniezione D753	Injection pump D753					vedere procedura - see procedure
Pompa iniezione bassa pressione D703 (3 viti di fissaggio)	Injection pump LOW PRESSURE D703 (no.3 fixing bolts)	27.5	2.8			
Pompa iniezione alta pressione D703 (2 dadi di fissaggio)	Injection pump HIGH PRESSURE D703 (no.2 fixing nuts)	18	1.8			vite classe 10.9 - screw type 10.9
Ingranaggio pompa iniezione D704-D754-D706	Injection pump gear D704-D754-D706	86.3	8.8			
Pompa acqua (vecchio tipo con 4 viti di fissaggio)	Coolant pump (old type with no.4 fixing screws)	27.5	2.8			
Pompa acqua (nuovo tipo con 6 viti di fissaggio)	Coolant pump (old type with no.6 fixing screws)	32.4	3.3			
Puleggia Pompa acqua	Coolant pump pulley	27.5	2.8			

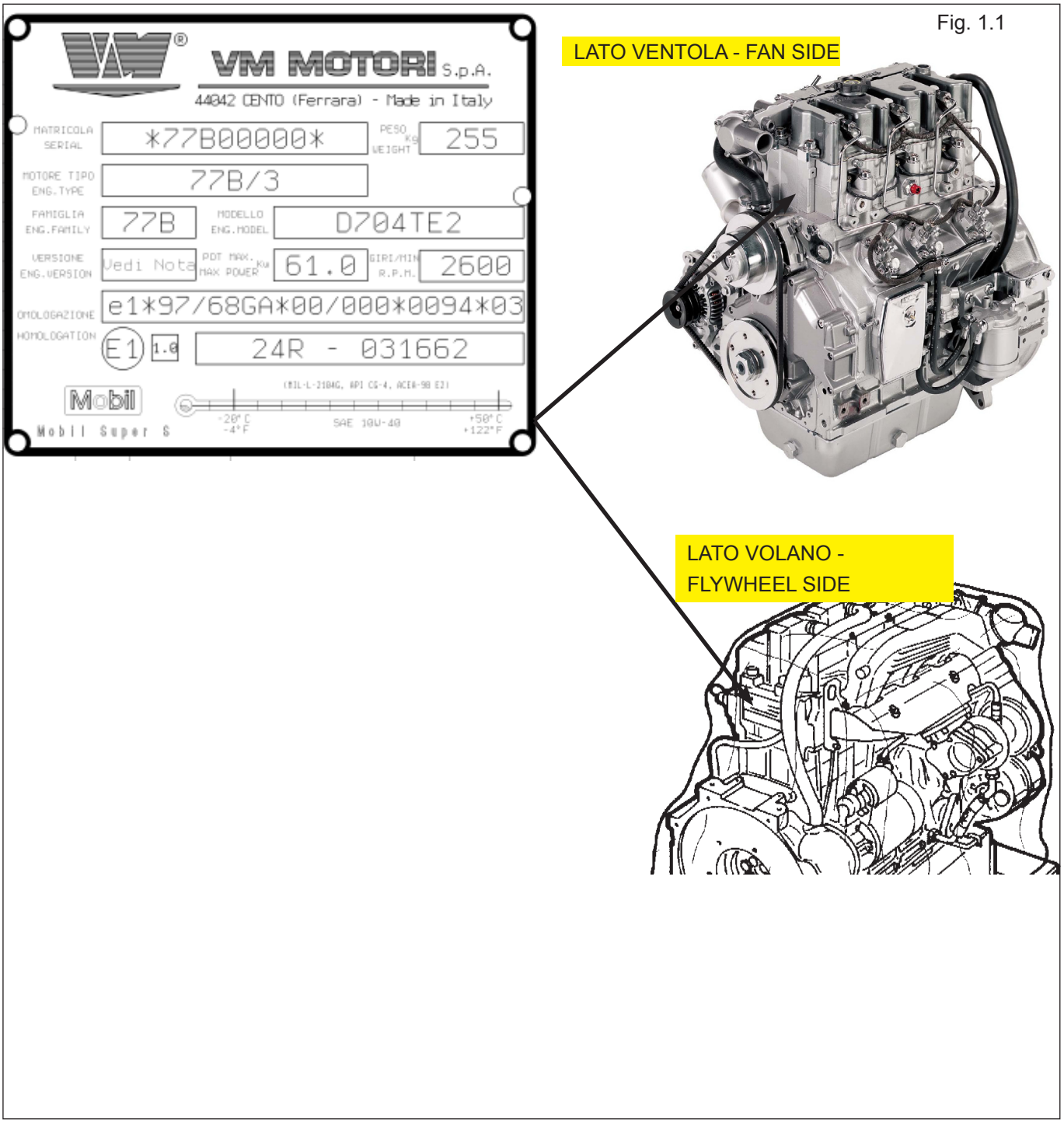
componente	component	coppia serraggio - tightening value		Lubrificanti - Sigillanti	Lubrificats - Sealant	Note
		Nm	Kgm			
Tubo aspirazione olio in coppa	Oil pickup pipe in oil pan	12.7	1.3			
Coppa olio	Oil pan	12.7	1.3	Silicone sul coperchio Loctite 510 sulla guarnizione	Silicon on cover Loctite 510 on the gasket	
Tubo raccolta acqua da teste	Coolant Manifold	11.8	1.2			
Bilanciere	Rocker Arms assembly	29	2.9			
Coperchio bilancieri	ROcker arms cover	11.8	1.2			
Candeletta	Glow Plug	14.2	1.45			
Tappo candeletta	Glow Plug (plug)	11.8	1.2			
Tubi iniezione (da pompa iniezione a iniettori) D704-D754-D706 - D703 con pompa iniezione bassa pressione	Injection pipe (from injection pump to injectors) D704-D754-D706 - D703 with LOW PRESSURE injection pump	22	2.24			
Tubi iniezione (da pompa iniezione a iniettori) D703 con pompa iniezione alta pressione	Injection pipe (from injection pump to injectors) D703 with HIGH PRESSURE injection pump	20	2.1			
Tubi iniezione (da pompa iniezione a iniettori)	Injection pipe (from injection pump to injectors)	22	2.24			
Iniettore	Injector	21.6	2.2	Molykote P1500	Molykote P1500	
Dado puleggia albero motore - CODOLO ANTERIORE CILINDRICO - FILETTAURA SINISTRORSA	Crankshaft pulley nut - CRANKSHAFT FRONT END “CYLINDRICAL SHAPE” - LEFT HAND THREAD	400/400		Molykote G Rapid Plus Paste	Molykote G Rapid Plus Paste	vedere procedura - see procedure
Dado puleggia albero motore - CODOLO ANTERIORE CONICO - FILETTAURA DESTRORSA	Crankshaft pulley nut - CRANKSHAFT FRONT END “CONE SHAPE” - RIGHT HAND THREAD	254	25	LOCTITE 510	LOCTITE 510	vedere procedura - see procedure
Collettore aspirazione	Intake manifold	27.5	2.8			
Collettore scarico	Exhaust Manifold	32.4	3.3			
Turbocompressore	Turbocharger	32.4	3.3			
Motorino avviamento	Starter motor	83.4	8.5			
Alternatore Alternatore D753	Alternator Alternator D753	27.5 27.5/83.4	2.8 2.8/8.5			
Staffa Alternatore	Alternator bracket	78.5	8			

1 IDENTIFICATION

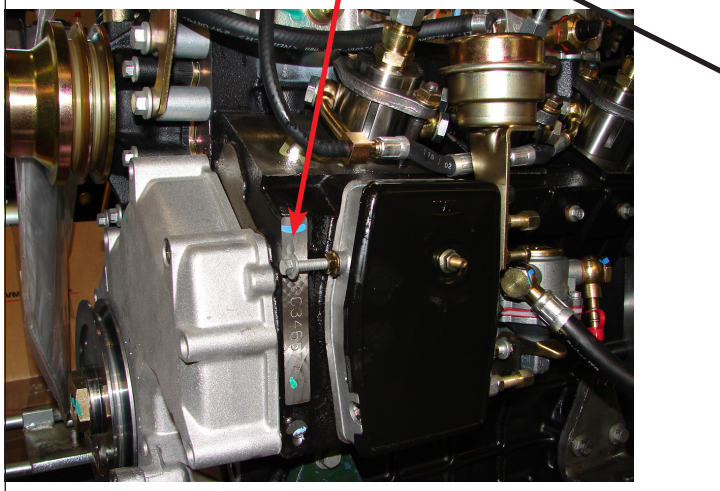
1.1 IDENTIFICATION DATA

The engine identification data can be found in the following positions:
- engine nameplate showing identification data (fig. 1.1):

Fig. 1.1

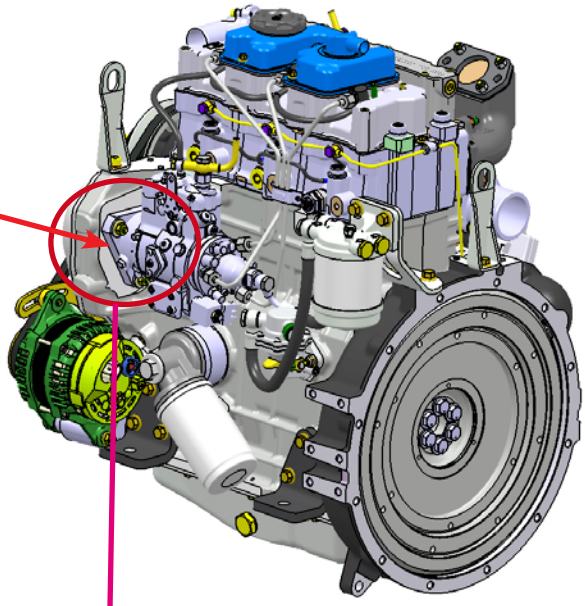


- SERIAL NUMBER STAMPED ON THE ENGINE CRANKCASE

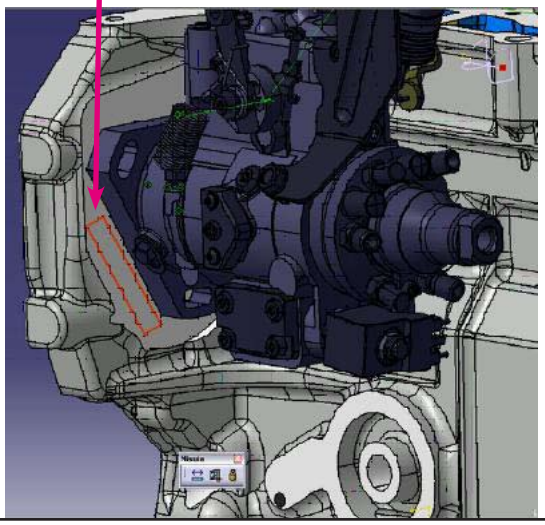


D753

Injection Pump



Injection Pump crankcase flange



1.2 ENGINE TYPE IDENTIFICATION

ENGINE MODEL	CODE
D703L	28B
D703LE	90B
D703LT	29B
D703LTE	75B
D703LTS	66B
D703TSE	92B
D703E2/E3	15C
D703TE1/TE2	16C
D703TE3	84C
D703IE3	87C
D704L	21B
D704LE	76B
D704LT	22B
D704LTE/TE2	77B
D754E1/E2	13C
D754TE2	33C
D754SE3	92C
D754TE3	83C
D754IE3	82C
D754TPE2	97C

ENGINE MODEL	CODE
D706LT	27B
D706LI	91B
D706LTE	78B
D706IE2	24C
D756IPE2	93C
D753E3	02D
D753TE3	03D
D753IE3	04D
D703E0	15D
D703TE0	16D

1.2.1 Model description

EXAMPLE: D703TE2
1° POS. **D:** Direct injection
2°-3° POS. **70:** unitary displacement\10 (cu. cm)
4° POS. **3:** Number of cylinders
5° POS.**T:** Turbocherged
I: Turbocharged intercooled
N: Natural
P: Power Unit (fire pump, genset application)
6° POS. **E:** EPA Homologation
7° POS. **2:** Homologation step

1.3 MANUFACTURER IDENTIFICATION

MANUFACTURER: VM MOTORI S.p.A.
Via Ferrarese, 29
44042 CENTO (FERRARA) ITALIA
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PÁGINA INTENCIONALMENTE BLANCA

2 TECHNICAL SPECIFICATIONS

SUMMARY

2.1 ENGINE DIMENSIONS (STANDARD VM ENGINE)

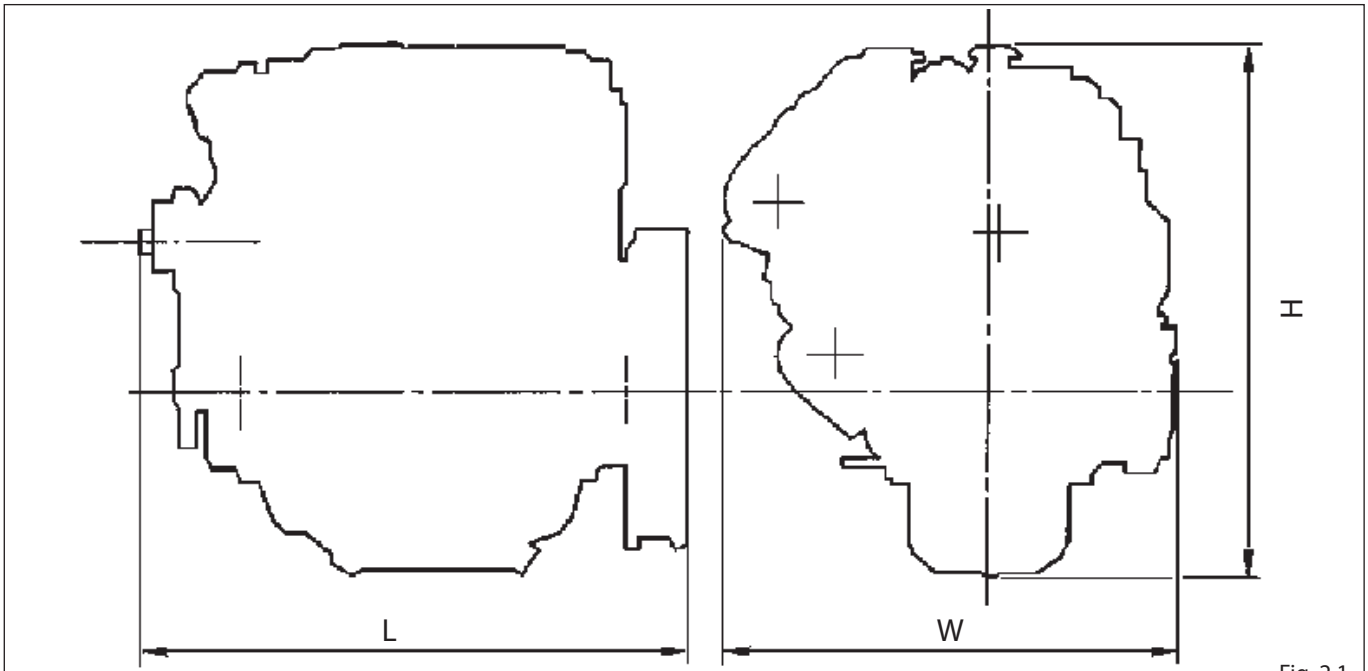

Fig. 2.1

STANDARD ENGINE

ENGINE	DIMENS.	L	W	H
D703L	mm (in)	631 (24,84)	537 (21.13)	661,5(26)
D703LE	mm (in)	568(22,36)	491,5(19,35)	661,5(26)
D703LT	mm (in)	631 (24,84)	547 (21,53)	733(28,85)
D703LTE	mm (in)	568(22,36)	501 (19,72)	733(28,85)
D703LTS	mm (in)	631 (24,84)	547 (21,53)	733(28,85)
D703TSE	mm (in)	568(22,36)	501 (19,72)	733(28,85)
D703E2	mm (in)	582(22,91)	491,5(19,35)	677(26,65)
D703TE1	mm (in)	616(24,25)	503,5(19,82)	730(28,74)
D703TE2	mm (in)	582(22,91)	503,5(19,82)	730(28,74)
D704L	mm (in)	733(28,86)	481 (18,93)	668(26,3)
D704LE	mm (in)	680(26,77)	505,5(19,90)	668(26,3)
D704LT	mm (in)	735(28,94)	586(23,07)	668(26,3)
D704LTE	mm (in)	694(27,32)	596(23,46)	668(26,3)
D704TE2	mm (in)	694(27,32)	556,7(21,91)	735,9(28,97)
D754E1	mm (in)	728(28,66)	508(20)	667,5(26,28)
D754E2	mm (in)	694(27,32)	518,5(29,41)	684,8(26.96)
D754TE2	mm (in)	694(27,32)	556,7(21,91)	735,9(28,97)
D706LT	mm (in)	976(38,42)	536(21,10)	685(26,96)
D706LTE	mm (in)	918(36,14)	547(21,53)	685(26,96)
D706IE2	mm (in)	918(36,14)	556,2(21,89)	682(26,96)

STANDARD ENGINE				
Engine	Dimens.	L	W	H
D703E3	mm	582	492	677
D703TE3	mm	616	504	730
D703IE3	mm	616	505	730
D754SE3	mm	720	546	687
D754TE3	mm	720	508	740
D754IE3	mm	720	508	736
D753E3	mm	592,5	592,5	592,5
D753TE3	mm	516	534	533.3
D753IE3	mm	669.1	706.3	713.2

MOTOR PUMP

ENGINE	DIMENS.	L	W	H
D703LE.P26	mm (in)	993(39,09)	571(22,48)	829(32,63)
D703LTE.P26	mm (in)	996(39,21)	571(22,48)	829(32,63)
D704LE.P26	mm (in)	1105(43,50)	531(20,90)	571(22,48)
D704LTE.P26	mm (in)	1139(44,84)	531(20,90)	571(22,48)
D706LTE.P26	mm (in)	1402(55,20)	705(27,75)	859(33,81)

GEN-SET POWER

ENGINE	DIMENS.	L	W	H
D703LE.G15-G.18	mm (in)	993(39,11)	564.5(22.22)	829(32,63)
D703LTE.G15-G.18	mm (in)	996(39,21)	533(21)	829(32,63)
D704LTE.G15-G.18	mm (in)	1138(44,8)	541,5(21.31)	864(34)
D706LTE.G15-G.18	mm (in)	1403(55,2)	705(27,75)	859(33,81)

2.1.1 Maximum inclination

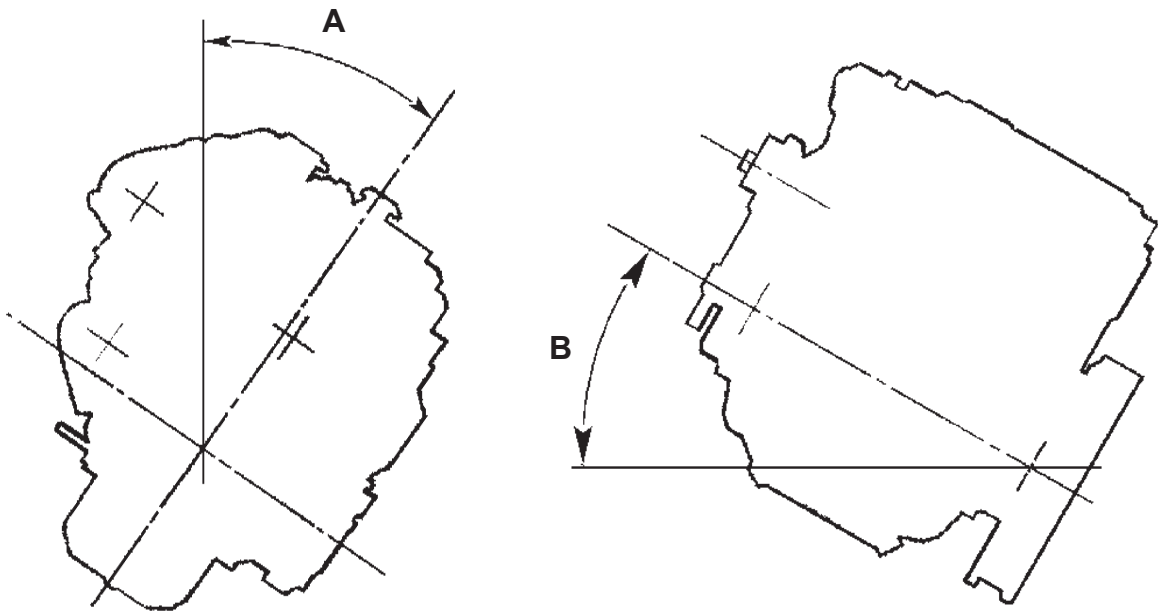

Fig. 2.1.1

ENGINE	A=Transverse inclination, continuous max.	B=Longitudinal inclination, continuous max. driving end up	B=Longitudinal inclination, continuous max. driving end down
D700-754	30°	30°	35°

2.2 TECHNICAL DATA (STANDARD VM ENGINE)

D703

		UNITS' OF MEASURE	D703L	D703LT
POWER & TORQUE				
Engine rated speed	rpm		3000	
Max Power "B" DIN 6271	kW (CV)		37 (50)	53 (72)
Max Torque	Nm (kgm)		147(15) @ 1500 rpm	206 (21) @ 1600 rpm
GENERAL TECHNICAL DATA				
N° cylinders			3	
Bore	mm		94	
Stroke	mm		100	
Displacement, cylinder	liters		0.694	
Displacement, total	liters		2.082	
Compression ratio			17:1	
Injection			Direct	
Intake			Natural	With turbocompressor
Cooling			Water	
Rotation (looking at the flywheel)			Anticlockwise	
Firing order			1-3-2	
Minimum idling speed (standard VM engine)		rpm	1000 - 1100	
Dry weight		kg	184	190
CONSUMPTIONS				
Specific fuel consumption	g/kWh (g/CVh)		243 (178)@2300 rpm	222 (163)@2300 rpm
Lubricating oil	g/kWh (g/CVh)		0.7 - 1.35 (0.5 - 1)	
INTAKE				
Intake air depression (new filter)	mbar		25 (oil) - 15 (dry)	
Intake air depression, max.	mbar			
EXHAUST				
Exhaust back pressure	mbar			
Exhaust back pressure, max.	mbar		100	
Exhaust temperature after turbocharger	°C		660	655
WATER				
Coolant operating temperature, from	°C		80±2	
Coolant operating temperature, to	°C		95	
Coolant temperature after engine, alarm	°C		107	
Breather valve (expansion tank) opening pressure (excess pressure)	bar		1.0 (ø 60) - 1.2 (ø 70)	
OIL				
Lube oil operating pressure (low idle)	bar		1 - 2	
Lube oil pressure before engine, alarm	bar			
INJECTION				
Opening injector pressure	bar		250 - 258	
CAPACITIES (OIL-WATER)				
see chapter 9 "Running tests & Adjustments"				

	UNITS OF MEASURE	D703LE	D703LTE
POWER & TORQUE			
Engine rated speed	rpm		3000
Max Power ISO 3046/1	kW (CV)	33 (45)	46 (63)
Max Torque	Nm (kgm)	147(15) @ 1200 rpm	206 (21) @ 1800 rpm
GENERAL TECHNICAL DATA			
N° cylinders		3	
Bore	mm	94	
Stroke	mm	100	
Displacement, cylinder	liters	0.694	
Displacement, total	liters	2.082	
Compression ratio		17:1	
Injection		Direct	
Intake		Natural	With turbocompressor
Cooling		Water	
Rotation (looking at the flywheel)			Anticlockwise
Firing order			1-3-2
Minimum idling speed (standard VM engine)	rpm.		1000 - 1100
Dry weight	kg	190	196
CONSUMPTIONS			
Specific fuel consumption	g/kWh (g/CVh)	231 (170)@1800 rpm	228 (168)@1800 rpm
Lubricating oil	g/kWh (g/CVh)	0.7 - 1.35 (0.5 - 1)	
INTAKE			
Intake air depression (new filter)	mbar	25 (oil) - 15 (dry)	
Intake air depression, max.	mbar		
EXHAUST			
Exhaust back pressure	mbar		
Exhaust back pressure, max.	mbar	100	
Exhaust temperature after turbocharger	°C	660	480
WATER			
Coolant operating temperature, from	°C	80±2	
Coolant operating temperature, to	°C	95	
Coolant temperature after engine, alarm	°C	107	
Breather valve (expansion tank) opening pressure (excess pressure)	bar	1.0 (ø 60) - 1.2 (ø 70)	
OIL			
Lube oil operating pressure (low idle)	bar	1 - 2	
Lube oil pressure before engine, alarm	bar		
INJECTION			
Opening injector pressure	bar	250 - 258	
CAPACITIES (OIL-WATER)			
see chapter 9 "Running tests & Adjustments"			

	UNITS OF MEASURE	D703E2	D703TE1
POWER & TORQUE			
Engine rated speed	rpm	2600	
Max Power ECE R24	kW (CV)	35 (47.6)	50 (68)
Max Torque	Nm (kgm)	145 (14.7) @ 1200 rpm	220 (22.4) @ 1400 rpm
GENERAL TECHNICAL DATA			
N° cylinders		3	
Bore	mm	94	
Stroke	mm	100	
Displacement, cylinder	liters	0.694	
Displacement, total	liters	2.082	
Compression ratio		17:1	
Injection		Direct	
Intake		Natural	With turbocompressor
Cooling		Water	
Rotation (looking at the flywheel)		Anticlockwise	
Firing order		1-3-2	
Minimum idling speed (standard VM engine)	rpm	950 - 1050	1000 - 1100
Dry weight	kg	205	205
CONSUMPTIONS			
Specific fuel consumption	g/kWh (g/CVh)	242 (178)@1400 rpm	241 (177)@1900 rpm
Lubricating oil	g/kWh (g/CVh)	0.7 - 1.35 (0.5 - 1)	
INTAKE			
Intake air depression (new filter)	mbar	15	
Intake air depression, max.	mbar	35	
EXHAUST			
Exhaust back pressure	mbar	200	
Exhaust back pressure, max.	mbar	250	
Exhaust temperature after turbocharger	°C	645	636
WATER			
Coolant operating temperature, from	°C	80±2	
Coolant operating temperature, to	°C	95	
Coolant temperature after engine, alarm	°C	107	
Breather valve (expansion tank) opening pressure (excess pressure)	bar	1.0 (ø 60) - 1.2 (ø 70)	
OIL			
Lube oil operating pressure (low idle)	bar	1 - 2	
Lube oil pressure before engine, alarm	bar	0.5	
INJECTION			
Opening injector pressure	bar	230 - 238	270 - 278
CAPACITIES (OIL-WATER)			
see chapter 9 "Running tests & Adjustments"			

	UNITS OF MEASURE		D703TE2
POWER & TORQUE			
Engine rated speed	rpm		2600
Max Power ECE R24	kW (CV)		48 (65.3)
Max Torque	Nm (kgm)		225 (22.9) @ 1400 rpm
GENERAL TECHNICAL DATA			
N° cylinders			3
Bore	mm		94
Stroke	mm		100
Displacement, cylinder	liters		0.694
Displacement, total	liters		2.082
Compression ratio			17:1
Injection			Direct
Intake			With turbocompressor
Cooling			Water
Rotation (looking at the flywheel)			Anticlockwise
Firing order			1-3-2
Minimum idling speed (standard VM engine)		rpm	950 - 1050
Dry weight	kg		215
CONSUMPTIONS			
Specific fuel consumption	g/kWh (g/CVh)		234 (172)@1900 rpm
Lubricating oil	g/kWh (g/CVh)		0.7 - 1.35 (0.5 - 1)
INTAKE			
Intake air depression (new filter)	mbar		15
Intake air depression, max.	mbar		35
EXHAUST			
Exhaust back pressure		mbar	200
Exhaust back pressure, max.	mbar		250
Exhaust temperature after turbocharger	°C	634	
WATER			
Coolant operating temperature, from		°C	80±2
Coolant operating temperature, to		°C	95
Coolant temperature after engine, alarm		°C	107
Breather valve (expansion tank)			
opening pressure (excess pressure)		bar	1.0 (ø 60) - 1.2 (ø 70)
OIL			
Lube oil operating pressure (low idle)		bar	1 - 2
Lube oil pressure before engine, alarm		bar	0.5
INJECTION			
Opening injector pressure		bar	230 - 238
CAPACITIES (OIL-WATER)			
see chapter 9 "Running tests & Adjustments"			

D703 E3

	UNITS OF MEASURE		
POWER & TORQUE			
Engine rated speed	rpm		2600
Max Power ECE R24	kW (CV)		36 (49) D703E3 41.2 (56) D703TE3 48.6 (66) D703IE3
Max Torque	Nm (kgm)		145@1200 rpm D703E3 195@1400 rpm D703TE3 260@1200 rpm D703IE3
GENERAL TECHNICAL DATA			
N° cylinders			3
Bore	mm		94
Stroke	mm		100
Displacement, cylinder	liters		0.694
Displacement, total	liters		2.082
Compression ratio			18 ± 0.5 :1
Injection			Direct
Intake			Natural D703E3 With Turcocharger D703TE3 With Intercooler D703IE3
Cooling			Water
Rotation (looking at the flywheel)			Anticlockwise
Firing order			1-3-2
Minimum idling speed (standard VM engine)		rpm	1000 ± 50
Dry weight	kg		205 D703E3 - 215 D703TE3/IE3
CONSUMPTIONS			
Specific fuel consumption	g/kWh (g/CVh)		254.3 (187) full load
Lubricating oil	g/kWh (g/CVh)		0.7 - 1.35 (0.5 - 1)
INTAKE			
Intake air depression (new filter)	mbar		150
Intake air depression, max.	mbar		300
EXHAUST			
Exhaust back pressure		mbar	
Exhaust back pressure, max.	mbar		250
Exhaust temperature after turbocharger	°C	634	
WATER			
Coolant operating temperature, from		°C	80±2
Coolant operating temperature, to		°C	95
Coolant temperature after engine, alarm		°C	105
Breather valve (expansion tank) opening pressure (excess pressure)		bar	1.0 (ø 60) - 1.2 (ø 70)
OIL			
Lube oil operating pressure (low idle)		bar	1.2 - 1.6
Lube oil pressure before engine, alarm		bar	0.5
INJECTION			
Opening injector pressure		bar	230 - 238

CAPACITIES (OIL-WATER)

see chapter 9 "Running tests & Adjustments"

MODEL		D703TE3	D703IE3
DIMENSIONS			
A	mm	616	
B	mm	504	
C	mm	730	
GENERAL TECHNICAL DATA			
Combustion cycle		Diesel Four stroke	
Displacement, total	liters	2.082	
No. cylinders	n.	3	
Bore x Stroke	mm	94 x 100	
Compression ratio		17,8 +/- 0.5 : 1	
Intake		with turbocharger - Dry air filter	With Intercooler - Dry air filter
Cooling		coolant	
Heat exchanger		coolant/oil	
Rotation (looking at the flywheel)		counterclockkwise	
Firing Order		1-3-2	
Timing		Pushrods and rocker arms with hydraulic tappets and camshaft	
		Gear cascade control and camshaft fitted on the crankcase	
Minimum idling speed (standard engine)	rpm	1000 +/- 50	
Dry engine weight	Kg	215	
Maximum permanent lengthwise inclination (with handwheel up)	Grades	30°	
Maximum permanent lengthwise inclination (with handwheel down)	Grades	35°	
Maximum permanent crosswise inclination	Grades	30°	
POWER AND TORQUE			
Maximum operating speed	(rpm)	2600	2600
Maximum power	k W (CV)	41,2 (56)	48,6 (66,1)
Maximum torque	N m (k g m) @ rpm	195Nm (19,9 Kgm)@1400rpm	260Nm (26,5 Kgm) @ 1200 rpm
CONSUMPTION AT MAXIMUM POWER			
Specific fuel consumption	g/kWh (g/CV)	/	
Specific oil consumption	g/CVh	0,5 - 1	
FUEL SUPPLY CIRCUIT			
Type of injection		Direct Injection	
Type of fuel		The engine has been designed to be powered by standard fuels available on the European market (according to specifications DIN EN 590). If it is to be powered by BIODIESEL fuels (according to specifications UNI EN 14214), it can be mixed, up to 5%, with fuel available on the European market (according to regulation DIN EN 590).	
Fuel supply		Diaphragm pump	
Injector supply		n° 1 immersed injection pump per cylinder	

LUBRICATION CIRCUIT			
Type of lubrication		Forced lubrication	
Circuit fuel supply		Rotorpump	
Oil change including filter (standard sump)	liters (kg)	/	/
Oil quantity at minimum level (standard sump)	liters (kg)	see chapter 9 "Running tests & Adjustments"	
Oil quantity at maximum level (standard sump)	liters (kg)	see chapter 9 "Running tests & Adjustments"	
Oil pressure at minimum speed (with started engine)	bar	1,2 - 1,6	
Alarm for oil pressure too low	bar	0,4	
Oil cooling		Oil heat exchanger (oil/coolant)	
COOLING CIRCUIT			
Total capacity of the cooling circuit (excluding radiator and relevant pipes)	liters	3,7	3,7
Setting pressure of the expansion tank plug	bar	1	1
Coolant		Demineralised cold water 50% + Antioxidant and anti-freeze fluid 50% (Inhibited glycol ethylene in compliance with ASTM D 3306)	
Coolant maximum temperature alarm	°C	107	107
Opening value (start/finish) of thermostatic valve	°C	80(+/- 2) / 95	80(+/- 2) / 95
ELECTRIC SYSTEM			
Nominal voltage	V	12	
Alternating current generator (nominal voltage)	V	14	
Alternating current generator (nominal current)	A	70	
Starter motor output	kW	2,3	
Recommended battery capacity	Ah	110	
Battery breakaway current	A	880	
INTAKE CIRCUIT			
Maximum depression allowed with new air filter	mbar	15	15

VM MOTORI S.p.A.

CARATTERISTICHE TECNICHE / *Technical Features*					rev.01	pag.1/2
MOTORE / *Engine* :		D753E3			02D/3 @ 2600 rpm 02D/4 @ 2350 rpm	
as of (y-m)	2009/03					
Alesaggio x Corsa (mm x mm) *Bore x Stroke (in x in)*		**94 x 107** *3,70 x 4,21*	**Ordine di accensione** *Injection Order*		**1 - 3 - 2**	
Cilindri - Valvole Cylinder-Valvle Numbers		**3 - 2**	**n° giri min a vuoto** *Idling rpm*		**1000 - 1050**	
Cilindrata totale (l) *Total Displacement (cu.in)*		**2.228** *136,0*	**n°giri min servizio continuo (rpm)** *Min. rpm for cont. Duty (rpm)*		*/*	
Rapporto di compressione *Compression ratio*		**17,8 ± 0.5 : 1**	**Coppia max @ 2100 rpm (Nm)** *Max Torque @ 2100 rpm (Nm)*		**140**	
Vel. media pistone(m/s a 1000rpm) *Mean piston speed (ft/min at 1000 rpm)*		**3,57** *702,8*	**Potenza max prelevabile dalla PTO** *Max power downloadable from PTO*		**vedi: "Linee guida all'installazione"** *see: "Installation guidelines*	
Tipo Iniezione *Injection Type*		**Diretta** *Direct*	**Criteri di installazione radiatori** *Radiator installation guidelines*			
Aspirazione *Intake*		**Naturale** *Natural aspirated*	**Carico assiale** *Axial load*			
Raffreddamento *Cooling*		**ad acqua** *Water cooled*	**Pesi** *Weights*	**A secco (kg)** *Dry (lbs)*	*/*	
Senso di rotazione (dal volano) *Engine Rotation (Looking at flywheel)*		**Antiorario** *Anticlockwise*		**Con radiatore (kg)** *With Water Cooler*	*/*	

Potenze *Ratings*	**giri/min**		*r.p.m.*	**1500**	**1800**	**2000**	**2350**	**2600**
	1CV = 0,735 Kw 1Kw =1,36CV	**ECE R120**	kW	18,4	22,9	28,5	34,0	36,1
			CV	25,0	31,1	38,8	46,2	49,1
Pressioni Medie Effettive *B.M.E.P*			bar	6,6	6,9	7,7	7,8	7,5
			lb/sq in	95,8	99,4	111,3	113,0	108,4
Consumi Specifici Fuel Consumption	**A pieno carico** / *Full Load*		g/CVh	174	175	185	198	207
			g/kWh	236	238	252	269	282
	giri minimo / *At idle* (kg/h)	**1000rpm a pieno carico**/full load*(Kg/h)*		0,5			3,5	
	Alla coppia max / *Max Torque*		*(g/kWh)*	252				
	Olio lubrificante / *Lubricating Oil*		*(g/CVh)*	0,5 - 1				

Olio *Oil*	**Portata pompa olio** / *Oil Pump Delivery*		l/min	25,32	30,38	33,76	39,67	43,89
	Temp.max ammessa in coppa (°C) *Max Admissible temp.in oil sump (°F)*		130 266	**Capacità motore con coppa std.(Kg)** *Engine with standard sump Capacity(lb)*			5,2 11,46	
	Temp. min. funzion. continuo (°C) *Continuous Operating Min. Temp.(°F)*		70 158	**Press.olio a 80°C** *Oil pressure at 176°F*		**Al minimo** / *At Idle* (***bar***)		2,2
						A regime / *Max Rating* (***bar***)		4,3

Cartucce *Cartridges*	**Olio** - *Oil*	**Capacità l**	**0,47**	*Capacity cu.in*	28,68	**Cambio ogni 300 ore** *Renew every 300 hs.*	**Specifiche olio**
		Super.filtrante cm²	**1700**	*Filter. Surf. sq.in*	263,5		*Oil specific*
		Grado di filtraggio - *Filtration*		Reale-*Actual (µ)*	/		Da 45°C (113°F) a -20°C (-4°F)
				Nominale-*Nominal (µ)*	21-25		ACEA A3/B4 API CG-4 API CH-4 API CI-4
	Gasolio - *Gasoil*	**Super.filtrante cm²**	**4250**	*Filter. Surf. sq.in*	658,75		
		Grado filtraggio (µ) *Filtration (µ)*	**4 : 5**				
Pompa alimentazione: *Feeding Pump:*			a membrana diaphragm				SAE 10W40

VM MOTORI S.p.A.

CARATTERISTICHE TECNICHE / Technical Features							rev.01	pag.2/2
MOTORE / Engine:		D753E3					02D/3 @ 2600 rpm 02D/4 @ 2350 rpm	
	n/1' r.p.m.		1500	1800	2000	2350	2600	
Aspirazione *Intake*	**Consumo aria comburente** *Air Cosumption*	kg/h	105	121	131	149	160	
	Depressione ammessa filtro nuovo secco (kPa) *Permissible depressure with new filter dry (Ib.sq.in)*		1,5 0,22					
	Depressione max omologata (kPa) *Max Homologated Depressure (Ib.sq.in)*		2,5 0,36					
Ventilatore *Fan*	**Assiale su asse pompa** *Axial on Pump axle*	kW CV	disponibile solo per applicazioni genset *only for genset application*					
	Portata aria *Air Capacity*	m3/h cu ft/min	disponibile solo per applicazioni genset *only for genset application*					
Acqua *Water*	**Portata pompa acqua con deltaP radiatore=0.60 bar a 2600 rpm motore [l/min]**		95	115	128	147	167	
	Giri pompa acqua giri/min / Water Pump r.p.m.		1695	2034	2260	2656	2938	
	Capacità circuito (l, senza radiatore) *Circuit capacity (cu.in, without radiator)*	l /	**Press.circ.H_2O a 2600rpm (bar)** *Water circuit press.2600rpm (bar)*			1,1		
	Inizio/Fine apert.valv.termostatica °C *Therm.valve start/end opening °F*	80 - 95 176-203	**Max temp.acqua in funz.to (°C)** *Max water temp. in operation (°F)*			107 224,6		
Momento inerzia *Inertia Moment*	**Volano standard** - *standard flywheel*		**(SAE 4) J=** 0,46 **kgm²**					
	Motore senza volano - *eng. without flywheel*		**J=** 0,057 **kgm²**					
	Volano G.E. - *generator set flywheel*		**J=** 1,26 **kgm²**					
Pendenze coppa standard *Standard Oil Sump Slopes*			**Permanente** - *Permanent*					
	Longitudinale volano in basso - *flywheel low*		35°			70%		
	Longitudinale volano in alto - *flywheel up*		30°			57%		
	Trasversale nei due sensi - *bank in both directions*		30°			57%		
Temp. gas di scarico *Exhaust Gas Temp*	**ECE R120**	°C	510	584	675	779	795	
		°F	950	1083	1247	1434	1463	
Bilancio termico *Heat Balance*	**Potenza termica totale** *Total Thermal Power*	kW	51,4	66,2	83,3	107,6	118,7	
	Potenza utile - *Useful Power*	kW	18,4	22,9	28,5	34,0	36,1	
	Pot. raff.acqua - *Water Cooling Power*	kW	13,0	14,3	19,3	25,2	29,6	
	Pot. raff.olio - *Oil Cooling Power*							
	Potenza allo scarico - *Exhaust Power*	kW	15,4	21,1	27,2	36,8	41,5	
	Potenza all'intercooler	kW						
	Pot. di irraggiamento - *Issued Power*	kW	4,6	7,9	8,3	11,6	11,5	
Gas di scarico *Exhaust Gas*	**Portata Gas di Scarico** *Exhaust Gas Volume*	kg/h	109,3	126,5	138,2	158,3	170,0	
	Contropressione max allo scarico *Exhaust max Backpressure*	kPa	20					
Radiatore aria - H_2O *Radiator air-H_2O*	**ΔP max Radiatore** - *ΔP max Radiator*	mbar	350					
Avv. Elettrico *Elect.Starter*	**Capacità batteria (Temp.+5°C) (Ah)** *Battery Capacity (temp+41°F) (Ah)*	88 - 110	**Potenza motorino avviamento (kW)** *Starter motor power (kW)*				1,7 - 2,3	
	Corrente di spunto max(A) *Max starting current max(A)*	750 EN 880 EN	**Tensione alimentazione motorino avv. (V)** *Starter motor voltage (V)*				12	
	Velocità avviamento (rpm) *Starting speed (rpm)*	210 - 230	**Coppia in avviamento (Nm)** *Starting torque (Nm)*				/	
	Min.temp.avv.senza mezzi ausiliari(°C) *Extra Power Source free start (°F)*	-20 up to -4	**Corrente all'avviamento a -15°C (A)** *Current when starting 5°F (A)*				/	
	Caratteristche alternatore (W - A) *Alternator Output (W-A)*	980-70	**Corrente in trascinamento a -15°C (A)** *Current when starting (during running) 5°F (A)*				/	

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CARATTERISTICHE TECNICHE / *Technical Features*			rev.01	pag.1/2
MOTORE / *Engine* :		D753TE3		03D/3 @ 2600 rpm
as of (y-m)	2009/03			

Alesaggio x Corsa (mm x mm) *Bore x Stroke (in x in)*	**94 x 107** *3,70 x 4,21*	**Ordine di accensione** *Injection Order*	**1 - 3 - 2**
Cilindri - Valvole Cylinder-Valvle Numbers	**3 - 2**	**n° giri min a vuoto** *Idling rpm*	**1000 - 1050**
Cilindrata totale (l) *Total Displacement (cu.in)*	**2.228** *136,0*	**n°giri min servizio continuo (rpm)** *Min. rpm for cont. Duty (rpm)*	*/*
Rapporto di compressione *Compression ratio*	**17,8 ± 0.5 : 1**	**Coppia max @ 1950 rpm (Nm)** *Max Torque @ 1950 rpm (Nm)*	**185**
Vel. media pistone(m/s a 1000rpm) *Mean piston speed (ft/min at 1000 rpm)*	**3,57** *702,8*	**Potenza max prelevabile dalla PTO** *Max power downloadable from PTO*	**vedi: "Linee guida all'installazione"** *see: "Installation guidelines*
Tipo Iniezione *Injection Type*	**Diretta** *Direct*	**Criteri di installazione radiatori** *Radiator installation guidelines*	
Aspirazione *Intake*	**Turbocompressore** *Turbocharger*	**Carico assiale** *Axial load*	
Raffreddamento *Cooling*	**ad acqua** *Water cooled*	**Pesi** *Weights* — **Con olio (kg)** *With oil (lbs)*	**215** *474*
Senso di rotazione (dal volano) *Engine Rotation (Looking at flywheel)*	**Antiorario** *Anticlockwise*	**Con radiatore (kg)** *With Water Cooler*	*/*

Potenze *Ratings*	**giri/min** *r.p.m.*			**1500**	**1800**	**2000**	**2300**	**2600**
	1CV = 0,735 Kw 1Kw =1,36CV	**ECE R120**	kW	26,1	34,0	38,8	41,0	41,2
			CV	35,5	46,2	52,8	55,8	56,0
Pressioni Medie Effettive *B.M.E.P*			bar	9,4	10,2	10,4	9,6	8,5
			lb/sq in	135,9	147,5	151,5	139,2	123,8
Consumi Specifici Fuel Consumption	**A pieno carico** / *Full Load*		g/CVh	201	201	200	210	225
			g/kWh	273	273	272	285	306
	giri minimo / *At idle* (kg/h)	**1000rpm a pieno carico**/full load*(Kg/h)*		0,6			4,5	
	Alla coppia max / *Max Torque*		*(g/kWh)*	272				
	Olio lubrificante / *Lubricating Oil*		*(g/CVh)*	0,5 - 1				

Olio *Oil*	**Portata pompa olio** / *Oil Pump Delivery*		l/min	25,32	30,38	33,76	34,51	43,89
	Temp.max ammessa in coppa (°C) *Max Admissible temp.in oil sump (°F)*		130 266	**Capacità motore con coppa std.(Kg)** *Engine with standard sump Capacity(lb)*			5,2 11,46	
	Temp. min. funzion. continuo (°C) *Continuous Operating Min. Temp.(°F)*		70 158	**Press.olio a 80°C** *Oil pressure at 176°F*		**Al minimo** / *At Idle* (**bar)** **A regime** / *Max Rating* (**bar)**		3,3 4,7

Cartucce *Cartridges*	**Olio** - *Oil*	**Capacità l**	**0,47**	*Capacity cu.in*	28,68	**Cambio ogni 300 ore** *Renew every 300 hs.*	**Specifiche olio**
		Super.filtrante cm²	**1700**	*Filter. Surf. sq.in*	263,5		
		Grado di filtraggio - *Filtration*		Reale-*Actual (µ)*	/		*Oil specific*
				Nominale-*Nominal (µ)*	21-25		Da 45°C (113°F) a -20°C (-4°F)
	Gasolio - *Gasoil*	**Super.filtrante cm²**	**4250**	*Filter. Surf. sq.in*	658,75		ACEA A3/B4 API CG-4 API CH-4 API CI-4
		Grado filtraggio (µ) *Filtration (µ)*	**4 : 5**				
Pompa alimentazione: *Feeding Pump:*			a membrana diaphragm				SAE 10W40

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CARATTERISTICHE TECNICHE / Technical Features							rev.01	pag.2/2
MOTORE / Engine:		D753TE3					03D/3 @ 2600 rpm	
	n/1' r.p.m.		1500	1800	2000	2300	2600	
Aspirazione *Intake*	**Consumo aria comburente** *Air Cosumption*	kg/h	138	177	204	234	259	
	Depressione ammessa filtro nuovo secco (kPa) *Permissible depressure with new filter dry (lb.sq.in)*		1,5 0,22					
	Depressione max omologata (kPa) *Max Homologated Depressure (lb.sq.in)*		3,0 0,51					
Ventilatore *Fan*	**Assiale su asse pompa** *Axial on Pump axle*	*kW* *CV*	disponibile solo per applicazioni genset *only for genset application*					
	Portata aria *Air Capacity*	*m3/h* *cu ft/min*	disponibile solo per applicazioni genset *only for genset application*					
Acqua *Water*	**Portata pompa acqua con deltaP radiatore=0.65 bar a 2600 rpm motore [l/min]**		90	108	121	139	158	
	Giri pompa acqua giri/min / Water Pump r.p.m.		1695	2034	2260	2599	2938	
	Capacità circuito (l, senza radiatore) *Circuit capacity (cu.in, without radiator)*	*l* */*	**Press.circ.H_2O a 2600rpm(bar)** *Water circuit press.2600rpm(bar)*			1,1		
	Inizio/Fine apert.valv.termostatica °C *Therm.valve start/end opening °F*	**80 - 95** *176-203*	**Max temp.acqua in funz.to(°C)** *Max water temp. in operation(°F)*			107 *224,6*		
Momento inerzia *Inertia Moment*	**Volano standard** - *standard flywheel*		**(SAE 4) J=** 0,46 **kgm²**					
	Motore senza volano - *eng. without flywheel*		**J=** 0,057 **kgm²**					
	Volano G.E. - *generator set flywheel*		**J=** 1,26 **kgm²**					
Pendenze coppa standard *Standard Oil Sump Slopes*			**Permanente** - *Permanent*					
	Longitudinale volano in basso - *flywheel low*		35°			70%		
	Longitudinale volano in alto - *flywheel up*		30°			57%		
	Trasversale nei due sensi - *bank in both directions*		30°			57%		
Temp. gas di scarico *Exhaust Gas Temp.*	**ECE R120**	**°C**	579	613	624	639	644	
		°F	1074	1135	1155	1182	1191	
Bilancio termico *Heat Balance*	**Potenza termica totale** *Total Thermal Power*	**kW**	81,2	106,5	121,3	134,9	145,5	
	Potenza utile - *Useful Power*	**kW**	26,1	34,0	38,8	41,0	41,2	
	Pot. raff.acqua - *Water Cooling Power* **Pot. raff.olio** - *Oil Cooling Power*	**kW**	28,4	34,1	38,2	42,1	44,7	
	Potenza allo scarico - *Exhaust Power*	**kW**	21,7	30,4	36,0	43,1	49,0	
	Potenza all'intercooler	**kW**	/	/	/	/	/	
	Pot. di irraggiamento - *Issued Power*	**kW**	5,0	8,0	8,3	8,7	10,6	
Gas di scarico *Exhaust Gas*	**Portata Gas di Scarico** *Exhaust Gas Volume*	**kg/h**	145,1	186,3	214,5	245,7	271,5	
	Contropressione max allo scarico *Exhaust max Backpressure*	**kPa**	20					
Radiatore aria - H_2O *Radiator air-H_2O*	**ΔP max Radiatore** - *ΔP max Radiator*	mbar	350					
Avv. Elettrico *Elect.Starter*	**Capacità batteria (Temp.+5°C) (Ah)** *Battery Capacity (temp+41°F) (Ah)*	88 - 110	**Potenza motorino avviamento (kW)** *Starter motor power (kW)*					1,7 - 2,3
	Corrente di spunto max(A) *Max starting current max(A)*	750 EN 880 EN	**Tensione alimentazione motorino avv. (V)** *Starter motor voltage (V)*					12
	Velocità avviamento (rpm) *Starting speed (rpm)*	210 - 230	**Coppia in avviamento (Nm)** *Starting torque (Nm)*					/
	Min.temp.avv.senza mezzi ausiliari(°C) *Extra Power Source free start (°F)*	-20 up to -4	**Corrente all'avviamento a -15°C (A)** *Current when starting 5°F (A)*					/
	Caratteristche alternatore (W - A) *Alternator Output (W-A)*	980-70	**Corrente in trascinamento a -15°C (A)** *Current when starting (during running) 5°F (A)*					/

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CARATTERISTICHE TECNICHE / *Technical Features*					rev.01	pag.1/2
MOTORE / *Engine* :		D753IE3			04D/4 @ 2300 rpm	
as of (y-m)	2009/03					
Alesaggio x Corsa (mm x mm) *Bore x Stroke (in x in)*		**94 x 107** *3,70 x 4,21*	**Ordine di accensione** *Injection Order*			**1 - 3 - 2**
Cilindri - Valvole Cylinder-Valvle Numbers		**3 - 2**	**n° giri min a vuoto** *Idling rpm*			**1000 - 1050**
Cilindrata totale (l) *Total Displacement (cu.in)*		**2.228** *136,0*	**n°giri min servizio continuo (rpm)** *Min. rpm for cont. Duty (rpm)*			*I*
Rapporto di compressione *Compression ratio*		**17,8 ± 0.5 : 1**	**Coppia max @ 1650 rpm (Nm)** *Max Torque @ 1650 rpm (Nm)*			**255**
Vel. media pistone(m/s a 1000rpm) *Mean piston speed (ft/min at 1000 rpm)*		**3,57** *702,8*	**Potenza max prelevabile dalla PTO** *Max power downloadable from PTO*			**vedi: "Linee guida all'installazione"** *see: "Installation guidelines*
Tipo Iniezione *Injection Type*		**Diretta** *Direct*	**Criteri di installazione radiatori** *Radiator installation guidelines*			
Aspirazione *Intake*		**Turbo-intercooler** *Turbo-intercooler*	**Carico assiale** *Axial load*			
Raffreddamento *Cooling*		**ad acqua** *Water cooled*	**Pesi** *Weights*	**A secco (kg)** *Dry (lbs)*	**207** *456*	
Senso di rotazione (dal volano) *Engine Rotation (Looking at flywheel)*		**Antiorario** *Anticlockwise*		**Con radiatore (kg)** *With Water Cooler*	*I*	

Potenze *Ratings*	**giri/min**		*r.p.m.*	**1500**	**1800**	**2000**	**2300**
	1CV = 0,735 Kw 1Kw =1,36CV	**ECE R120**	kW	37,8	46,0	48,7	51,5
			CV	51,4	62,6	66,2	70,0
Pressioni Medie Effettive *B.M.E.P*			bar	13,6	13,8	13,1	12,1
			lb/sq in	196,8	199,6	190,2	174,9
Consumi Specifici Fuel Consumption	**A pieno carico** / *Full Load*		g/CVh	172	179	187	196
			g/kWh	234	244	254	266
	giri minimo / *At idle* (kg/h)	**1000rpm a pieno carico**/full load*(Kg/h)*		0,6			4,5
	Alla coppia max / *Max Torque*	*(g/kWh)*		236			
	Olio lubrificante / *Lubricating Oil*	*(g/CVh)*		0,5 - 1			

Olio *Oil*	**Portata pompa olio** / *Oil Pump Delivery*	l/min	25,32	30,38	33,76	34,51		
	Temp.max ammessa in coppa (°C) *Max Admissible temp.in oil sump (°F)*	130 / 266	**Capacità motore con coppa std.(Kg)** *Engine with standard sump Capacity(lb)*			5,2 / 11,46		
	Temp. min. funzion. continuo (°C) *Continuous Operating Min. Temp.(°F)*	70 / 158	**Press.olio a 80°C** *Oil pressure at 176°F*		**Al minimo** / *At Idle* (***bar***)		3,3	
					A regime / *Max Rating* (***bar***)		4,6	

Cartucce *Cartridges*	**Olio** - *Oil*	**Capacità l**	**0,47**	*Capacity cu.in*	28,68	**Cambio ogni 300 ore** *Renew every 300 hs.*	**Specifiche olio**
		Super.filtrante cm²	**1700**	*Filter. Surf. sq.in*	263,5		*Oil specific*
		Grado di filtraggio - *Filtration*		Reale-*Actual (µ)*	/		Da 45°C (113°F) a -20°C (-4°F)
				Nominale-*Nominal (µ)*	21-25		ACEA A3/B4 API CG-4 API CH-4 API CI-4
	Gasolio - *Gasoil*	**Super.filtrante cm²**	**4250**	*Filter. Surf. sq.in*	658,75		
		Grado filtraggio (µ) *Filtration (µ)*	**4 : 5**				
Pompa alimentazione: *Feeding Pump:*			a membrana diaphragm				SAE 10W40

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CARATTERISTICHE TECNICHE / Technical Features						rev.01	pag.2/2
MOTORE / Engine:	D753IE3					04D/4 @ 2300 rpm	
Aspirazione *Intake*	**n/1' r.p.m.**		**1500**	**1800**	**2000**	**2300**	
	Consumo aria comburente *Air Cosumption*	**kg/h**	203	244	262	282	
	Depressione ammessa filtro nuovo secco (kPa) *Permissible depressure with new filter dry (Ib.sq.in)*		1,5 0,22				
	Depressione max omologata (kPa) *Max Homologated Depressure (Ib.sq.in)*		3,0 0,43				
Ventilatore *Fan*	**Assiale su asse pompa** *Axial on Pump axle*	*kW* *CV*	disponibile solo per applicazioni genset *only for genset application*				
	Portata aria *Air Capacity*	*m3/h* *cu ft/min*	disponibile solo per applicazioni genset *only for genset application*				
Acqua *Water*	**Portata pompa acqua con deltaP radiatore=0.45 bar a 2300 rpm motore [l/min]**		92	111	123	142	
	Giri pompa acqua giri/min / Water Pump r.p.m.		1695	2034	2260	2599	
	Capacità circuito (l, senza radiatore) *Circuit capacity (cu.in, without radiator)*	*/* */*	**Press.circ.H_2O a 2600rpm(bar)** *Water circuit press.2600rpm(bar)*			1,1	
	Inizio/Fine apert.valv.termostatica °C *Therm.valve start/end opening °F*	**80 - 95** *176-203*	**Max temp.acqua in funz.to(°C)** *Max water temp. in operation(°F)*			107 *224,6*	
Momento inerzia *Inertia Moment*	**Volano standard** - *standard flywheel*		**(SAE 4) J=** 0,46 **kgm²**				
	Motore senza volano - *eng. without flywheel*		**J=** 0,057 **kgm²**				
	Volano G.E. - *generator set flywheel*		**J=** 1,26 **kgm²**				
Pendenze coppa standard *Standard Oil Sump Slopes*			**Permanente** - *Permanent*				
	Longitudinale volano in basso - *flywheel low*		35°			70%	
	Longitudinale volano in alto - *flywheel up*		30°			57%	
	Trasversale nei due sensi - *bank in both directions*		30°			57%	
Temp. gas di scarico *Exhaust Gas Temp.*	**ECE R120**	**°C**	514	562	596	620	
		°F	957	1044	1105	1148	
Bilancio termico *Heat Balance*	**Potenza termica totale** *Total Thermal Power*	**kW**	105,3	133,7	147,1	161,9	
	Potenza utile - *Useful Power*	**kW**	37,8	46,0	48,7	51,5	
	Pot. raff.acqua - *Water Cooling Power*	**kW**	28,3	35,6	38,0	41,1	
	Pot. raff.olio - *Oil Cooling Power*						
	Potenza allo scarico - *Exhaust Power*	**kW**	29,4	39,9	46,2	54,3	
	Potenza all'intercooler	**kW**	4,3	5,3	5,8	6,4	
	Pot. di irraggiamento - *Issued Power*	**kW**	5,5	6,9	8,4	8,6	
Gas di scarico *Exhaust Gas*	**Portata Gas di Scarico** *Exhaust Gas Volume*	**kg/h**	211,9	255,2	274,4	295,6	
	Contropressione max allo scarico *Exhaust max Backpressure*	**kPa**	20				
Radiatore intercooler *Radiator intercooler*	**ΔP max Radiatore** - *Δ P max Radiator*	**mbar**	350				
	Temp.Out max intercool.-*T.max out int.*	**°C**	60° (a 25°C temperatura ambiente)				
	ΔP max Intercooler - *ΔP max Intercooler*	**mbar**	100				
Avv. Elettrico *Elect.Starter*	**Capacità batteria (Temp.+5°C) (Ah)** *Battery Capacity (temp+41°F) (Ah)*	88 - 110	**Potenza motorino avviamento (kW)** *Starter motor power (kW)*			1,7 - 2,3	
	Corrente di spunto max(A) *Max starting current max(A)*	750 EN 880 EN	**Tensione alimentazione motorino avv. (V)** *Starter motor voltage (V)*			12	
	Velocità avviamento (rpm) *Starting speed (rpm)*	210 - 230	**Coppia in avviamento (Nm)** *Starting torque (Nm)*			/	
	Min.temp.avv.senza mezzi ausiliari(°C) *Extra Power Source free start (°F)*	-20 up to -4	**Corrente all'avviamento a -15°C (A)** *Current when starting 5°F (A)*			/	
	Caratteristche alternatore (W - A) *Alternator Output (W-A)*	980-70	**Corrente in trascinamento a -15°C (A)** *Current when starting (during running) 5°F (A)*			/	

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CARATTERISTICHE TECNICHE / *Technical Features*			rev.00	pag.1/2
MOTORE / *Engine* :		D703E0		15C - 3000 rpm
as of (y-m)/release	2009/12			

Alesaggio x Corsa (mm x mm) *Bore x Stroke (in x in)*	**94 x 100** *3,70 x 3,93*	**Ordine di accensione** *Injection Order*	**1 - 3 - 2**
Cilindri - Valvole Cylinder-Valvle Numbers	**3 - 2**	**n° giri min a vuoto** *Idling rpm*	**1000 ± 50**
Cilindrata totale (l) *Total Displacement (cu.in)*	**2.082** *127,0*	**n°giri min servizio continuo (rpm)** *Min. rpm for cont. Duty (rpm)*	**1500**
Rapporto di compressione *Compression ratio*	**17,8 ± 0.5 : 1**	**Coppia max @ 1800 rpm (Nm)** *Max Torque @ 1800 rpm (Nm)*	**145**
Vel. media pistone(m/s a 1000rpm) *Mean piston speed (ft/min at 1000 rpm)*	**3,33** *655,5*		
Tipo Iniezione *Injection Type*	**Diretta** *Direct*	**A secco (kg)** *Dry (lbs)*	**215** **474**
Aspirazione *Intake*	**Naturale** *Natural aspirated*	**Nelle condizioni di spedizione (Kg)** *As shipped (lbs)*	/ /
Raffreddamento *Cooling*	**ad acqua** *Water cooled*	**Condizioni di funzionamento PTO** *PTO working condition*	*Vedi manuale installazione* *See Installation Manual*
Senso di rotazione (dal volano) *Engine Rotation (Looking at flywheel)*	**Antiorario** *Anticlockwise*		

Potenze *Ratings*	**giri/min** *r.p.m.*			**1500**	**1800**	**2000**	**2300**	**2600**	**3000**
	1CV = 0,735 Kw =1,36CV	1Kw	Secondo ECE R120 *Conform to ECE R120*	Kw	22,4	27,4	30,2	32,6	33,5	35,0
				CV	30,4	37,3	41,0	44,3	45,5	47,6
	Scarto giri a vuoto/carico *Governor Drop*				/	/	/	/	/	/
Pressioni Medie Effettive *B.M.E.P*				bar	8,55	8,75	8,66	8,17	7,26	6,71
Consumi Specifici *Fuel Consumption*	**A pieno carico** / *Full Load*			g/CV h	304,6	303,3	306,0	316,9	332,4	363,3
				g/kW h	224,0	223,0	225,0	233,0	244,4	267,1
	Giri minimo At low idle			Kg/h	0,49					
	Misurato a / Measured @ (low idle)			rpm	1000					
	Alla coppia max / *Max Torque*			*(g/kWh)*	223,0					
	Olio lubrificante max. (g/Cvh) *Lubricating oil max. (lb/Bhp-h)*				1					
	Secondo DIT ND 023/*Conform to DIT ND 023*									
Olio *Oil*	**Portata pompa olio** / *Oil Pump Delivery*			l/min	14,2	17,0	19,0	21,8	24,5	28,3
	Temperatura max ammessa di picco (°C) *Max Peak Admissible Temperature (°F)*			130 266	**Press.olio a 80°C** *Oil pressure at 176°F*		**Al minimo** / *At Idle* (**bar**) **A regime** / *Max Rating* (**bar**)			1,2 : 1,6 3,5 : 4,0
	Pressione funzion. olio allarme (bar) *Oil alarm working pressure (bar)*			0,3 - 0,5						

Cartucce *Cartridges*	**Olio** - *Oil*	**Capacità l**	0,44	*Capacity cu.in*	26,85	**Caratteristiche olio**	
		Super.filtrante cm²	1770	*Filter. Surf. sq.in*	274,35	*Oil charact*	
		Grado di filtraggio - *Filtration*		Reale-*Actual (µ)*	/	Gradazione	SAE 10W40
				Nominale-*Nominal (µ)*	21 - 25	Grade	
	Gasolio *Gasoil*	**Super.filtrante cm²**	4250	*Filter. Surf. sq.in*	658,75	API	CG-4 / CH-4 / CI-4
		Grado filtraggio (µ) *Filtration (µ)*		4 : 5		ACEA	A3/B4
						Intervallo Sostituzione **(vedi manuale di uso e manutenzione)** *Change interval* *(see maintenance manuale)*	

Pompa pre-alimentazione: a membrana
Pre-filling Pump: diaphragm

Sistema di iniezione *Fuel System*	**Pressione combustibile in aspirazione, min.** - Fuel pressure at fuel feed connection, min.	bar /
	Portata alimentazione combustibile max, attraverso il filtro - Fuel supply flow via filter, max.	l/min /

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CARATTERISTICHE TECNICHE / Technical Features						rev.00	pag.2/2
MOTORE / Engine:	D703E0					15C - 3000 rpm	
	giri/min r.p.m.		1500	1800	2000	2300	2600	3000
Aspirazione / Intake	**Consumo aria comburente** / *Air Cosumption*	kg/h	96,9	119,4	134,2	152,5	152,8	166
	Pressione aria dopo compressore (P_2) / *BOOST pressure after compressor (P2)*	mbar	/	/	/	/	/	/
	Temperatura aria dopo compress. T_{amb}=25°C	°C	/	/	/	/	/	/
	Air temperature after compressor T_{amb} =25°C	F	/	/	/	/	/	/
	Depressione ammessa filtro nuovo secco (kPa)	1,5						
	Permissible depressure with new filter dry (lb.sq.in)	0,22						
	Depressione max omologata (kPa)	3	Temperatura aria massima dopo intercooler (°C)					/
	Max Homologated Depressure (lb.sq.in)	0,43	*Maximum air temperature after intercooler (°F)*					/
Ventilatore / Fan	**Assiale su asse pompa (KW)**	/						
	Axial on Pump axle (CV)	/						
	Portata aria (m3/h)	/						
	Air Capacity (cu ft/min)	/						
Acqua (50% Glicole) / Water (50% Antifreeze)	**Portata pompa acqua (l/min)** / *Water Pump Flow (l/min)*	V.grafico / *see graph*	Press.circ.H_2O a nnnn rpm(bar) / *Water circuit press.@ nnnn rpm(bar)*				1,1	
	Inizio/Fine apert.valv.termostatica °C / *Therm.valve start/end opening °F*	80 - 95 / 176 - 203	Max temp.acqua in funz.to(°C) / *Max water temp. in operation(°F)*				107 / *224,6*	
			Pressione aperura tappo espansione / Expansion tank cap opening pressure				bar	1,1
Momento inerzia / Inertia Moment	**Volano standard** - *standard flywheel*		J= 0,46 kgm²			Note (SAE ...) :		
	Motore compl.senza volano - *eng. without flywheel*		J= 0,057 kgm²			Note :		
	Volano G.E. - *generator set flywheel*		J= 1,26 kgm²			Note :		
	Baricentro (fra asse motore e profilo basamento) e relativi momenti di inerzia-*Barycenter (bw cranckshaft assy and block side) and related inertia moment*		X= / mm			Jx= /		kgm²
			Y= / mm			Jy= /		kgm²
			Z= / mm			Jz= /		kgm²
Pendenze/Inclinazioni coppa std. / Std. Oil Sump Slopes/Incline	**Max raggiungibili e in movimento**/*max achievable and moving*							
	Longitudinale volano in basso - *flywheel low*		35°			70%		
	Longitudinale volano in alto - *flywheel up*		30°			57%		
	Trasversale nei due sensi - *bank in both directions*		30°			57%		
Temp. gas di scarico / Exhaust Gas Temp.	Secondo ECE R120 Conform to ECE R120	°C	602	619	629	665	732	751
		°F	115,6	1146	1164	1229	1350	1384
Bilancio termico / Heat Balance	**Potenza termica totale**	kcal/hx1000	56,3	67,8	75,4	83,9	91,3	/
	Total Thermal Power	kJ/h x 1000	235,7	283,8	315,6	351,2	382,1	/
	Potenza utile - *Useful Power*	%	34,8	34,6	34,3	33,9	33,0	/
	Pot. raff.acqua - *Water Cooling Power* **Pot. raff.olio -** *Oil Cooling Power*	%	26,9	26,3	25,8	25,2	25,1	/
	Potenza allo scarico - *Exhaust Power*	%	29,0	31,0	32,5	34,5	36,5	/
	Potenza all'intercooler	%	/	/	/	/	/	/
	Pot. di irraggiamento - *Issued Power*	%	9,3	8,1	7,4	6,3	5,4	/
Gas di scarico / Exhaust Gas	**Portata Gas di Scarico**	m^3/h	231,6	281,3	320,6	364,8	379,6	/
	Exhaust Gas Volume	cu.ft/min	136,3	165,6	188,7	214,7	223,4	/
	Contropressione max allo scarico (Kpa)	25	Temp. massima dopo turbo(°C) / *Max temp. after turbocharger(°F)*				/ /	
	Exhaust max Backpressure (Kpa)							
Avv. Elettrico / Elect.Starter	**Tensione e capacità batteria. (V-Ah)**	12 - 110	Potenza Mot.Avv. - *Starter Output (kW))*					2,3
	Battery Voltage and Capacity (V-Ah)		Corrente all'avviamento -15°C (A)					560
	CCA (Cold Cranking Amps) (A) EN (EuroNorm)	880	*Starting current 5°F (A)*					
	Velocità avv. *Starting speed (rpm)*	210 - 230	Intensità all'avv.(nel trascinamento) -15°C (A)					360
	Avviamento a freddo senza mezzi ausiliari (°C)	fino a - 10	*Current when starting(during running) 5°F (A)*					
	Cold start without aux. device (°F)	up to 14	Caratteristche alternatore *Alternator Output(W-A)*					770 - 55
	Olio utilizzato per test avv. a freddo *Cold Start test oil type*							
Capacità / Capacities	**Capacità circuito di raffreddamento -** *Engine coolant capacity (with cooling equipment)* *OPU&Marine engine only*						l	/
	Capacità circuito di raffreddamento(solo motore)-*Engine coolant capacity(engine only)*						l	3,7
	Capacità circuito olio primo riempimento - *Engine oil capacity, initial filling*						l	5,1
	Quantità olio sostituzione, max - *Oil change quantity, max.*						l	/
	Capacità coppa olio - *Oil pan capacity*						l	/
Circuito acqua mare / Raw water circuit (open circuit)	**Pompa acqua mare: max portata-***Raw water pump:max flow rate*						l/min	/
	NPSHr						m H2O	/

VM MOTORI S.p.A.

CARATTERISTICHE TECNICHE / *Technical Features*			rev.00	pag.1/2
MOTORE / *Engine* :		D703TE0		16C - 3000 rpm
as of (y-m)/release	2009/12			

Alesaggio x Corsa (mm x mm) *Bore x Stroke (in x in)*	**94 x 100** *3,70 x 3,93*	**Ordine di accensione** *Injection Order*	**1 - 3 - 2**
Cilindri - Valvole Cylinder-Valvle Numbers	**3 - 2**	**n° giri min a vuoto** *Idling rpm*	**1000 ± 50**
Cilindrata totale (l) *Total Displacement (cu.in)*	**2.082** *127,0*	**n°giri min servizio continuo (rpm)** *Min. rpm for cont. Duty (rpm)*	**1300**
Rapporto di compressione *Compression ratio*	**17,8 ± 0.5 : 1**	**Coppia max @ 1600 rpm (Nm)** *Max Torque @ 1600 rpm (Nm)*	**237**
Vel. media pistone(m/s a 1000rpm) *Mean piston speed (ft/min at 1000 rpm)*	**3,33** *655,5*		
Tipo Iniezione *Injection Type*	**Diretta** *Direct*	**A secco (kg)** *Dry (lbs)*	**225** **496**
Aspirazione *Intake*	**Turbocompressore** *Turbocharger*	**Nelle condizioni di spedizione (Kg)** *As shipped (lbs)*	/ /
Raffreddamento *Cooling*	**ad acqua** *Water cooled*	**Condizioni di funzionamento PTO** *PTO working condition*	*Vedi manuale installazione* *See Installation Manual*
Senso di rotazione (dal volano) *Engine Rotation (Looking at flywheel)*	**Antiorario** *Anticlockwise*		

Potenze *Ratings*	**giri/min** *r.p.m.*			**1500**	**1800**	**2000**	**2300**	**2600**	**3000**
	1CV = 0,735 Kw =1,36CV	1Kw	Secondo ECE R120 *Conform to ECE R120*	Kw	36,8	44,2	47,6	50,6	52,1	53,0
				CV	50,0	60,1	64,7	68,9	70,9	72,1
	Scarto giri a vuoto/carico *Governor Drop*				/	/	/	/	/	/
Pressioni Medie Effettive *B.M.E.P*				bar	10,50	10,57	10,26	9,50	8,66	7,54
Consumi Specifici *Fuel Consumption*	**A pieno carico** / *Full Load*			g/CV h	330,5	316,9	315,9	324,6	338,4	369,6
				g/kW h	243,0	233,0	232,3	238,7	248,8	271,8
	Giri minimo At low idle			Kg/h	0,52					
	Misurato a / Measured @ (low idle)			rpm	1000					
	Alla coppia max / *Max Torque*			*(g/kWh)*	239,0					
	Olio lubrificante max. (g/Cvh) *Lubricating oil max. (lb/Bhp-h)*				1					
	Secondo DIT ND 023/*Conform to DIT ND 023*									
Olio *Oil*	**Portata pompa olio** / *Oil Pump Delivery*			l/min	14,2	17,0	19,0	21,8	24,5	28,3
	Temperatura max ammessa di picco (°C) *Max Peak Admissible Temperature (°F)*			130 266	**Press.olio a 80°C** *Oil pressure at 176°F*		**Al minimo** / *At Idle* (**bar**)			1,2 : 1,6
							A regime / *Max Rating* (**bar**)			3,5 : 4,0
	Pressione funzion. olio allarme (bar) *Oil alarm working pressure (bar)*			0,3 - 0,5						

Cartucce *Cartridges*	**Olio** - *Oil*	**Capacità l**	0,44	*Capacity cu.in*	26,85	**Caratteristiche olio**	
		Super.filtrante cm²	1770	*Filter. Surf. sq.in*	274,35	*Oil charact*	
		Grado di filtraggio - *Filtration*		Reale-*Actual (µ)*	/	Gradazione	SAE 10W40
				Nominale-*Nominal (µ)*	21 - 25	Grade	
	Gasolio *Gasoil*	**Super.filtrante cm²**	4250	*Filter. Surf. sq.in*	658,75	API	CG-4 / CH-4 / CI-4
		Grado filtraggio (µ) *Filtration (µ)*		4 : 5		ACEA	A3/B4
						Intervallo Sostituzione **(vedi manuale di uso e manutenzione)** *Change interval* *(see maintenance manuale)*	

Pompa pre-alimentazione: a membrana
Pre-filling Pump: diaphragm

Sistema di iniezione *Fuel System*	**Pressione combustibile in aspirazione, min.**-Fuel pressure at fuel feed connection, min.	bar /
	Portata alimentazione combustibile max, attraverso il filtro - Fuel supply flow via filter, max.	l/min /

VM MOTORI S.p.A.

CARATTERISTICHE TECNICHE / Technical Features							rev.00	pag.2/2
MOTORE / Engine:	D703TE0						16C - 3000 rpm	
	giri/min r.p.m.		1500	1800	2000	2300	2600	3000
Aspirazione *Intake*	**Consumo aria comburente** *Air Cosumption*	kg/h	147,0	191,0	216,5	249,8	275,1	305,1
	Pressione aria dopo compressore (P_2) *BOOST pressure after compressor (P2)*	*mbar*	735	960	1050	1099	1102	1118
	Temperatura aria dopo compress. T_{amb}=25°C	°C	116	127	131	134	136	138,0
	Air temperature after compressor T_{amb}=25°C	*F*	*240,8*	*260,6*	*267,8*	*273,2*	*276,8*	*280,4*
	Depressione ammessa filtro nuovo secco (kPa)	1,5						
	Permissible depressure with new filter dry (lb.sq.in)	*0,22*						
	Depressione max omologata (kPa)	3	**Temperatura aria massima dopo intercooler (°C)**					/
	Max Homologated Depressure (lb.sq.in)	*0,43*	*Maximum air temperature after intercooler (°F)*					/
Ventilatore *Fan*	**Assiale su asse pompa (KW)**	/						
	Axial on Pump axle (CV)	/						
	Portata aria (m3/h)	/						
	Air Capacity (cu ft/min)	/						
Acqua (50% Glicole) *Water (50% Antifreeze)*	**Portata pompa acqua (l/min)** *Water Pump Flow (l/min)*	V.grafico *see graph*	**Press.circ.H_2O a nnnn rpm(bar)** *Water circuit press.@ nnnn rpm(bar)*				1,1	
	Inizio/Fine apert.valv.termostatica °C *Therm.valve start/end opening °F*	80 - 95 *176 - 203*	**Max temp.acqua in funz.to(°C)**				107	
			Max water temp. in operation(°F)				*224,6*	
			Pressione aperura tappo espansione **Expansion tank cap opening pressure**				bar	1,1
Momento inerzia *Inertia Moment*	**Volano standard** - *standard flywheel*		**J=** 0,46 **kgm²**			Note (SAE ...) :		
	Motore compl.senza volano - *eng. without flywheel*		**J=** 0,057 **kgm²**			Note :		
	Volano G.E. - *generator set flywheel*		**J=** 1,26 **kgm²**			Note :		
	Baricentro (fra asse motore e profilo basamento) e relativi momenti di inerzia-*Barycenter (bw cranckshaft assy and block side) and related inertia moment*		**X=** / **mm**			**Jx=** / **kgm²**		
			Y= / **mm**			**Jy=** / **kgm²**		
			Z= / **mm**			**Jz=** / **kgm²**		
Pendenze/Inclinazioni coppa std. *Std. Oil Sump Slopes/Incline*	**Max raggiungibili e in movimento**/*max achievable and moving*							
	Longitudinale volano in basso - *flywheel low*		35°			70%		
	Longitudinale volano in alto - *flywheel up*		30°			57%		
	Trasversale nei due sensi - *bank in both directions*		30°			57%		
Temp. gas di scarico *Exhaust Gas Temp.*	Secondo ECE R120 Conform to ECE R120	°C	644	616	609	614	625	628
		°F	1191	1141	1128	1137	1157	1162
Bilancio termico *Heat Balance*	**Potenza termica totale**	kcal/hx1000	81,3	96,3	106,6	117,2	128,9	/
	Total Thermal Power	*kJ/h x 1000*	340,4	403,3	446,2	490,8	539,5	/
	Potenza utile - *Useful Power*	%	35,5	35,8	34,8	33,8	32,0	/
	Pot. raff.acqua - *Water Cooling Power*	%	31,5	29,0	28,2	27,6	27,1	/
	Pot. raff.olio - *Oil Cooling Power*							
	Potenza allo scarico - *Exhaust Power*	%	29,0	29,7	30,7	31,1	32,7	/
	Potenza all'intercooler	%	/	/	/	/	/	/
	Pot. di irraggiamento - *Issued Power*	%	4,0	5,5	6,3	7,5	8,2	/
Gas di scarico *Exhaust Gas*	**Portata Gas di Scarico**	m^3/h	417,5	431,0	465,0	486,0	533,6	/
	Exhaust Gas Volume	*cu.ft/min*	245,6	253,5	273,5	285,8	313,9	/
	Contropressione max allo scarico (Kpa)	25	**Temp. massima dopo turbo(°C)**				/	
	Exhaust max Backpressure (Kpa)		*Max temp. after turbocharger(°F)*				/	
Avv. Elettrico *Elect.Starter*	**Tensione e capacità batteria. (V-Ah)**	12 - 110	**Potenza Mot.Avv. -** *Starter Output (kW))*					2,3
	Battery Voltage and Capacity (V-Ah)		**Corrente all'avviamento -15°C (A)**					560
	CCA (Cold Cranking Amps) (A) EN (EuroNorm)	880	*Starting current 5°F (A)*					
	Velocità avv. *Starting speed (rpm)*	210 - 230	**Intensità all'avv.(nel trascinamento) -15°C (A)**					360
	Avviamento a freddo senza mezzi ausiliari (°C)	fino a - 10	*Current when starting(during running) 5°F (A)*					
	Cold start without aux. device (°F)	up to 14	**Caratteristche alternatore** *Alternator Output(W-A)*					770 - 55
	Olio utilizzato per test avv. a freddo *Cold Start test oil type*							
Capacità *Capacities*	**Capacità circuito di raffreddamento -** *Engine coolant capacity (with cooling equipment) OPU&Marine engine only*						l	/
	Capacità circuito di raffreddamento(solo motore)-*Engine coolant capacity(engine only)*						l	3,7
	Capacità circuito olio primo riempimento - *Engine oil capacity, initial filling*						l	5,1
	Quantità olio sostituzione, max - *Oil change quantity, max.*						l	/
	Capacità coppa olio - *Oil pan capacity*						l	/
Circuito acqua mare *Raw water circuit (open circuit)*	**Pompa acqua mare: max portata-***Raw water pump:max flow rate*						l/min	/
	NPSHr						m H2O	/

D704

		UNITS OF MEASURE	D704L		D704LT
POWER & TORQUE					
Engine rated speed		rpm		3000	
Max Power "B" DIN 6271		kW (CV)	51(69)		62 (84)
Max Torque		Nm (kgm)	195 (20) @ 1800 rpm		300 (31) @ 1500 rpm
GENERAL TECHNICAL DATA					
N° cylinders				4	
Bore		mm		94	
Stroke		mm		100	
Displacement, cylinder		liters		0.694	
Displacement, total		liters		2.776	
Compression ratio				17:1	
Injection				Direct	
Intake			Natural		With turbocompressor
Cooling				Water	
Rotation (looking at the flywheel)				Anticlockwise	
Firing order				1-3-4-2	
Minimum idling speed (standard VM engine)		rpm		950 - 1050	
Dry weight		kg	254		262
CONSUMPTIONS					
Specific fuel consumption	g/kWh (g/CVh)		232 (171)@1500 rpm		217 (160)@1800 rpm
Lubricating oil		g/kWh (g/CVh)		0.7 - 1.35 (0.5 - 1)	
INTAKE					
Intake air depression (new filter)	mbar			25 (oil) - 15 (dry)	
Intake air depression, max	mbar				
EXHAUST					
Exhaust back pressure	mbar			100	
Exhaust back pressure, max.	mbar				
Exhaust temperature after turbocharger		°C	653		530
WATER					
Coolant operating temperature, from		°C		80±2	
Coolant operating temperature, to		°C		95	
Coolant temperature after engine, alarm		°C		107	
Breather valve (expansion tank) opening pressure (excess pressure)		bar		1.0 (ø 60) - 1.2 (ø 70)	
OIL					
Lube oil operating pressure (low idle)		bar		1 - 2	
Lube oil pressure before engine, alarm		bar			
INJECTION					
Opening injector pressure		bar		250 - 258	
CAPACITIES (OIL-WATER)					
see chapter 9 "Running tests & Adjustments"					

	UNITS OF MEASURE	D704LE	D704LTE
POWER & TORQUE			
Engine rated speed	rpm	3000	
Max Power SAE J 1995	kW (CV)	46 (63)	62 (84)
Max Torque	Nm (kgm)	190 (19) @ 1800 rpm	290 (30) @ 1400 rpm
GENERAL TECHNICAL DATA			
N° cylinders		4	
Bore	mm	94	
Stroke	mm	100	
Displacement, cylinder	liters	0.694	
Displacement, total	liters	2.776	
Compression ratio		17:1	
Injection		Direct	
Intake		Natural	With turbocompressor
Cooling		Water	
Rotation (looking at the flywheel)		Anticlockwise	
Firing order		1-3-4-2	
Minimum idling speed (standard VM engine)	rpm	950 - 1050	
Dry weight	kg	254	262
CONSUMPTIONS			
Specific fuel consumption	g/kWh (g/CVh)	224 (164)@1400 rpm	225 (165)@2000 rpm
Lubricating oil	g/kWh (g/CVh)	0.7 - 1.35 (0.5 - 1)	
INTAKE			
Intake air depression (new filter)	mbar	25 (oil) - 15 (dry)	
Intake air depression, max.	mbar		
EXHAUST			
Exhaust back pressure	mbar	100	
Exhaust back pressure, max.	mbar		
Exhaust temperature after turbocharger	°C	450	460
WATER			
Coolant operating temperature, from	°C	80±2	
Coolant operating temperature, to	°C	95	
Coolant temperature after engine, alarm	°C	107	
Breather valve (expansion tank) opening pressure (excess pressure)	bar	1.0 (ø 60) - 1.2 (ø 70)	
OIL			
Lube oil operating pressure (low idle)	bar	1 - 2	
Lube oil pressure before engine, alarm	bar		
INJECTION			
Opening injector pressure	bar	250 - 258	
CAPACITIES (OIL-WATER)			
see chapter 9 "Running tests & Adjustments"			

		UNITS OF MEASURE	D704TE2
POWER & TORQUE			
Engine rated speed	rpm		3000
Max Power ECE R24	kW (CV)		60.5 (82.3)
Max Torque	Nm (kgm)		290 (29.6) @ 1400rpm
GENERAL TECHNICAL DATA			
N° cylinders			4
Bore	mm		94
Stroke	mm		100
Displacement, cylinder	liters		0.694
Displacement, total	liters		2.776
Compression ratio			17:1
Injection			Direct
Intake			With turbocompressor
Cooling			Water
Rotation (looking at the flywheel)			Anticlockwise
Firing order			1-3-4-2
Minimum idling speed (standard VM engine)		rpm	850 - 950
Dry weight	kg		255
CONSUMPTIONS			
Specific fuel consumption	g/kWh (g/CVh)		230 (196)@1400 rpm
Lubricating oil	g/kWh (g/CVh)		0.7 - 1.35 (0.5 - 1)
INTAKE			
Intake air depression (new filter) mbar			15
Intake air depression, max.	mbar		35
EXHAUST			
Exhaust back pressure		mbar	200
Exhaust back pressure, max.	mbar		250
Exhaust temperature after turbocharger	°C		615
WATER			
Coolant operating temperature, from		°C	80±2
Coolant operating temperature, to		°C	95
Coolant temperature after engine, alarm		°C	107
Breather valve (expansion tank) opening pressure (excess pressure)		bar	1.0
OIL			
Lube oil operating pressure (low idle)		bar	1 - 2
Lube oil pressure before engine, alarm		bar	0.5
INJECTION			
Opening injector pressure		bar	230 - 238
CAPACITIES (OIL-WATER)			
see chapter 9 "Running tests & Adjustments"			

D754 E1/E2

	UNITS OF MEASURE	D754E1		D754E2
POWER & TORQUE				
Engine rated speed	rpm		2600	
Max Power ECE R24	kW (CV)		50 (68)	
Max Torque rpm	Nm (kgm)	214 (21.8) @ 1400 rpm		210 (21.4) @ 1400
GENERAL TECHNICAL DATA				
N° cylinders			4	
Bore	mm		94	
Stroke	mm		107	
Displacement, cylinder	liters		0.742	
Displacement, total	liters		2.970	
Compression ratio			17:1	
Injection			Direct	
Intake			Natural	
Cooling			Water	
Rotation (looking at the flywheel)			Anticlockwise	
Firing order			1-3-4-2	
Minimum idling speed (standard VM engine)	rpm		900- 950	
Dry weight	kg		254	
CONSUMPTIONS				
Specific fuel consumption	g/kWh (g/CVh)	234 (172)@1400 rpm		235 (173)@1400 rpm
Lubricating oil	g/kWh (g/CVh)		0.7 - 1.35 (0.5 - 1)	
INTAKE				
Intake air depression (new filter)	mbar		15	
Intake air depression, max.	mbar		35	
EXHAUST				
Exhaust back pressure	mbar		200	
Exhaust back pressure, max.	mbar		250	
Exhaust temperature after turbocharger	°C		678	
WATER				
Coolant operating temperature, from	°C		80±2	
Coolant operating temperature, to	°C		95	
Coolant temperature after engine, alarm	°C		107	
Breather valve (expansion tank) opening pressure (excess pressure)	bar		1.0	
OIL				
Lube oil operating pressure (low idle)	bar		1 - 2	
Lube oil pressure before engine, alarm	bar		0.5	
INJECTION				
Opening injector pressure	bar	270 - 278		230 - 278
CAPACITIES (OIL-WATER)				
see chapter 9 "Running tests & Adjustments"				

D754 EPA 3 (D754SE3-D754TE3-D754IE3)

MODEL		D754TE3	D754SE3	D754IE3
DIMENSIONS				
A	mm	702		
B	mm	557		
C	mm	736		
GENERAL DATA				
Cycle		Four Strokes Diesel		
Total Displacement	liters	2.970		
No. of cylinders	n.	4		
Bore x Stroke	mm	94 x 107		
Compression Ratio		18 +/- 0.5 : 1		
Intake		with turbocharger - Dry air filter	Natural - Dry air filter	with intercooler - Dry air filter
Cooling		coolant		
Heat Exchanger		Coolant/Engine oil		
Crankshaft rotation		Anticlockwise (observing the engine from the handwheel side)		
Firing Order		1-3-4-2		
Timing		Pushrods and rocker arms with hydraulic tappets and camshaft		
		Gear cascade control and camshaft fitted on the crankbase		
Minimum idling speed (standard engine)	rpm	800 - 850		
Dry engine weight	Kg	250		
Maximum permanent lengthwise inclination (with handwheel up)	Grades	30°		
Maximum permanent lengthwise inclination (with handwheel down)	Grades	35°		
Maximum permanent crosswise inclination	Grades	30°		
POWER AND TORQUE				
Maximum operating speed	(rpm)	2600	2600	2600
Maximum power	k W (CV)	59,8 (81,3)	51,5 (70)	70 (95,2)
Maximum torque	N m (k g m) @ rpm	274 (27,9) @1800	220 (22,4) @1400	400 (40,7) @ 1000
CONSUMPTION AT MAXIMUM POWER				
Specific fuel consumption	g/kWh (g/CV)	/		
Specific oil consumption	g/CVh	0,5 - 1		
FUEL SUPPLY CIRCUIT				
Type of injection		Direct injection		
Type of fuel		The engine has been designed to be powered by standard fuels available on the European market (according to specifications DIN EN 590). If it is to be powered by BIODIESEL fuels (according to specifications UNI EN 14214), it can be mixed, up to 5%, with fuel available on the European market (according to regulation DIN EN 590).		
Fuel supply		Diaphragm pump		
Injector supply		Mechanical rotary injection pump		

LUBRICATION CIRCUIT				
Type of lubrication		Forced lubrication		
Circuit fuel supply		Rotor pump		
Oil change including filter (standard sump)	Liters - kg	/	/	/
Oil quantity at minimum level (standard sump)	Liters - kg	see chapter 9 "Running tests & Adjustments"		
Oil quantity at maximum level (standard sump)	Liters - kg	see chapter 9 "Running tests & Adjustments"		
Oil pressure at minimum speed (with started engine)	bar	1,2 - 1,6		
Alarm for oil pressure too low	bar	0,4		
Oil cooling		Heat Exchanger (Engine oil/Coolant)		
COOLING CIRCUIT				
Total capacity of the cooling circuit (excluding radiator and relevant pipes)	litri	5		
Setting pressure of the expansion tank plug	bar	1		
Coolant		Demineralised cold water 50% + Antioxidant and anti-freeze fluid 50% (Inhibited glycol ethylene in compliance with ASTM D 3306)		
Coolant maximum temperature alarm	°C	107		
Opening value (start/finish) of thermostatic valve	°C	80(+/- 2) / 95		
ELECTRICAL SYSTEM				
Nominal voltage	V	12		
Alternating current generator (nominal voltage)	V	14		
Alternating current generator (nominal current)	A	55	70 (**D754SE3 - D754IE3)**	
Starter motor output	kW	2,3		
Recommended battery capacity	Ah	92	110 (**D754SE3 - D754IE3)**	
Battery breakaway current	A	480	880 (**D754SE3 - D754IE3)**	
INTAKE SYSTEM				
Maximum depression allowed with new air filter	mbar	15		

	UNITS OF MEASURE	D754TE2
POWER & TORQUE		
Engine rated speed	rpm	2600
Max Powrer ECE R24	kW (CV)	70 (95.2)
Max Torque	Nm (kgm)	335(34.1) @ 1300 rpm
GENERAL TECHNICAL DATA		
N° cylinders		4
Bore	mm	94
Stroke	mm	107
Displacement, cylinder	liters	0.742
Displacement, total	liters	2.970
Compression ratio		17:1
Injection		Direct
Intake		With turbocompressor
Cooling		Water
Rotation (looking at the flywheel)		Anticlockwise
Firing order		1-3-4-2
Minimum idling speed (standard VM engine)	rpm	900- 950
Dry weight	kg	257
CONSUMPTIONS		
Specific fuel consumption	g/kWh (g/CVh)	238 (175)@1600 rpm
Lubricating oil	g/kWh (g/CVh)	0.7 - 1.35 (0.5 - 1)
INTAKE		
Intake air depression (new filter)	mbar	15
Intake air depression, max.	mbar	35
EXHAUST		
Exhaust back pressure	mbar	200
Exhaust back pressure, max.	mbar	250
Exhaust temperature after turbocharger	°C	623
WATER		
Coolant operating temperature, from	°C	80±2
Coolant operating temperature, to	°C	95
Coolant temperature after engine, alarm	°C	107
Breather valve (expansion tank)		
opening pressure (excess pressure)	bar	1.0
OIL		
Lube oil operating pressure (low idle)	bar	1 - 2
Lube oil pressure before engine, alarm	bar	0.5
INJECTION		
Opening injector pressure	bar	230 - 238
CAPACITIES (OIL-WATER)		
see chapter 9 "Running tests & Adjustments"		

D706

		UNITS OF MEASURE	D706LT	D706LTE
POWER & TORQUE				
Engine rated speed	rpm		3000	
Max Power "B" DIN 6271	kW (CV)	97 (132)		87 (118)
Max Torque	Nm (kgm)	432 (44) @ 1400 rpm		490 (50) @ 1300 rpm
GENERAL TECHNICAL DATA				
N° cylinders			6	
Bore	mm		94	
Stroke	mm		100	
Displacement, cylinder	liters		0.694	
Displacement, total	liters		4.164	
Compression ratio			17:1	
Injection			Direct	
Intake			With turbocompressor	
Cooling			Water	
Rotation (looking at the flywheel)			Anticlockwise	
Firing order			1-5-3-6-2-4	
Minimum idling speed (standard VM engine)		rpm	800 - 850	
Dry weight	kg		373	
CONSUMPTIONS				
Specific fuel consumption	g/kWh (g/CVh)	228 (167)@1800 rpm		237 (174)@2600 rpm
Lubricating oil	g/kWh (g/CVh)		0.7 - 1.35 (0.5 - 1)	
INTAKE				
Intake air depression (new filter)	mbar		25 (oil) - 15 (dry)	
Intake air depression, max.	mbar			
EXHAUST				
Exhaust back pressure	mbar		100	
Exhaust back pressure, max.	mbar			
Exhaust temperature after turbocharger	°C	535		480
WATER				
Coolant operating temperature, from		°C	80±2	
Coolant operating temperature, to		°C	95	
Coolant temperature after engine, alarm		°C	107	
Breather valve (expansion tank) opening pressure (excess pressure)		bar	1.0 (ø 60) - 1.2 (ø 70)	
OIL				
Lube oil operating pressure (low idle)		bar	1 - 2	
Lube oil pressure before engine, alarm		bar		
INJECTION				
Opening injector pressure		bar	250 - 258	
CAPACITIES (OIL-WATER)				
see chapter 9 "Running tests & Adjustments"				

	UNITS OF MEASURE	D706IE2
POWER & TORQUE		
Engine rated speed	rpm	3000
Max Power ECE R24	kW (CV)	93.5 (127.2)
Max Torque	Nm (kgm)	480(48.9) @ 1300rpm
GENERAL TECHNICAL DATA		
N° cylinders		6
Bore	mm	94
Stroke	mm	100
Displacement, cylinder	liters	0.694
Displacement, total	liters	4.164
Compression ratio		17:1
Injection		Direct
Intake		With turbocompressor and intercooled
Cooling		Water
Rotation (looking at the flywheel)		Anticlockwise
Firing order		1-5-3-6-2-4
Minimum idling speed (standard VM engine)	rpm	800 - 900
Dry weight	kg	325
CONSUMPTIONS		
Specific fuel consumption	g/kWh (g/CVh)	210(154)@1500 rpm
Lubricating oil	g/kWh (g/CVh)	0.7 - 1.35 (0.5 - 1)
INTAKE		
Intake air depression (new filter)	mbar	15
Intake air depression, max.	mbar	35
EXHAUST		
Exhaust back pressure	mbar	200
Exhaust back pressure, max.	mbar	250
Exhaust temperature after turbocharger	°C	566
WATER		
Coolant operating temperature, from	°C	80±2
Coolant operating temperature, to	°C	95
Coolant temperature after engine, alarm	°C	107
Breather valve (expansion tank) opening pressure (excess pressure)	bar	1.0
OIL		
Lube oil operating pressure (low idle)	bar	1 - 2
Lube oil pressure before engine, alarm	bar	0.5
INJECTION		
Opening injector pressure	bar	230 - 238
CAPACITIES (OIL-WATER)		
see chapter 9 "Running tests & Adjustments"		

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CARATTERISTICHE TECNICHE / *Technical Features*	rev.01	pag.1/2
MOTORE / *Engine* :	D754TPE2.FRP	97C

as of (y-m)	2009/07				
Alesaggio x Corsa (mm x mm) *Bore x Stroke* (in x in)	**94 x 107** *3,70 x 4,21*	**Ordine di accensione** *Injection Order*	**1 - 3 - 4 - 2**		
Cilindri - Valvole Cylinder-Valvle Numbers	**4 - 2**	**n° giri min a vuoto** *Idling rpm*	**1400**		
Cilindrata totale (l) *Total Displacement* (cu.in)	**2.970** *181,2*	**n°giri min servizio continuo** (rpm) *Min. rpm for cont. Duty* (rpm)	**2300**		
Rapporto di compressione *Compression ratio*	**17,8 ± 0.5 : 1**	**Coppia max @ 2000 rpm** (Nm) *Max Torque @ 2000 rpm* (Nm)	**315**		
Vel. media pistone (m/s a 1000rpm) *Mean piston speed* (ft/min at 1000 rpm)	**3,57** *702,8*	**Potenza max prelevabile dalla PTO** *Max power downloadable from PTO*	**vedi: "Linee guida all'installazione"** *see: "Installation guidelines"*		
Tipo Iniezione *Injection Type*	**Diretta** *Direct*	**Criteri di installazione radiatori** *Radiator installation guidelines*			
Aspirazione *Intake*	**Turbocompressore** *Turbocharger*	**Carico assiale** *Axial load*			
Raffreddamento *Cooling*	**Ad acqua** *Water cooled*	**Pesi** *Weights* — **A secco** (kg) *Dry* (lb)	**n.a.** *n.a.*		
Senso di rotazione (dal volano) *Engine Rotation (Looking at flywheel)*	**Antiorario** *Anticlockwise*	**Con radiatore** (kg) *with water cooler*(lb)	**292** *643,7*	**senza olio, senza refrigerante** *without oil and coolant empty*	

Potenze *Ratings*	**giri/min**		*r.p.m.*	**1500**	**1800**	**2000**	**2300**	**2600**	**3000**
	1 CV = 0,735 kW 1 kW =1,36 CV	**ECE R120**	kW	/	64,9	66,0	73,3	73,4	73,5
			CV	/	88,3	89,8	99,7	99,8	100,0
Pressioni Medie Effettive *B.M.E.P*			bar	/	14,6	13,3	12,9	11,4	9,9
			lb/sq in	/	211,2	193,3	186,7	165,4	143,5
Consumi Specifici *Fuel Consumption*	**A pieno carico** / *Full Load*		g/CVh	/	166	167	172	181	200
			g/kWh	/	225	227	234	246	272
	giri minimo / *At idle*		kg/h	1,3					
	2000rpm a pieno carico / *full load*		kg/h	15,7					
	Alla coppia max / *Max Torque*		g/kWh	227					
	Olio lubrificante / *Lubricating Oil*		g/CVh	/					
Olio *Oil*	**Portata pompa olio** / *Oil Pump Delivery*		l/min	/	44,90	49,89	57,37	64,86	74,84
	Temp.max ammessa in coppa (°C) *Max Admissible temp.in oil sump* (°F)		125 *257*	**Capacità motore con coppa std.** (Kg) *Engine with standard sump Capacity* (lb)				8,8 *19,4*	
	Temp. min. funzion. continuo (°C) *Continuous Operating Min. Temp.* (°F)		/ /	**Press.olio a 125°C** *Oil pressure at 257°F*	**Al minimo** / *At Idle* (*bar*) **A regime** / *Max Rating* (*bar*)			4,2 4,5	

Cartucce *Cartridges*	**Olio** *Oil*	**Capacità** (l)	**0,44**	*Capacity cu.in*	26,85	**Cambio ogni 300 ore** *Renew every 300 hs.*	**Specifiche olio**
		Super.filtrante (cm^2)	**1770**	*Filter. Surf. sq.in*	274,35		*Oil specific*
		Grado di filtraggio - *Filtration*		Reale-*Actual* (μ)	/		Da 45°C (113°F) a -20°C (-4°F)
				Nominale-*Nominal* (μ)	26		
	Gasolio *Gasoil*	**Super.filtrante** (cm^2)	**5300**	*Filter. Surf. sq.in*	821,5		ACEA A3/B4 API CG-4 API CH-4 API CI-4
		Grado filtraggio (μ) *Filtration* (μ)	**4 ÷ 5**				
Pompa alimentazione: *Feeding Pump:*			a membrana diaphragm				SAE 10W40

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CARATTERISTICHE TECNICHE / Technical Features							rev.01	pag.2/2
MOTORE / Engine:	D754TPE2.FRP						97C	
	n/1' r.p.m.		1500	1800	2000	2300	2600	3000
Aspirazione *Intake*	**Consumo aria comburente** *Air Cosumption*	kg/h	/	295	326	369	406	457
	Depressione ammessa filtro nuovo secco (kPa) *Permissible depressure with new filter dry*		3,0					
	Depressione max omologata (kPa) *Max Homologated Depressur*		5,5					
Ventilatore *Fan*	**Assiale su asse pompa** *Axial on Pump axle*	kW / CV	/ /					
	Portata aria *Air Capacity*	m3/h / cu ft/min	/ /					
Acqua *Water*	**Portata pompa acqua con ΔP radiatore=1.3 bar a 3000 rpm motore** / *water pump flow* (l/min)		/	130,2	144,8	167,9	191,6	222,0
	Giri pompa acqua giri/min / *Water Pump* (rpm)		/	2351	2612	3004	3396	3918
	Capacità circuito senza radiatore (litri) *Circuit capacity without radiator*	5	**Pressione Circuito H_2O (bar)** *Water Circuit Pressure (bar)*			0,9÷1,1		
	Inizio/Fine apert.valv.termostatica °C *Therm.valve start/end opening °F*	80 ÷ 95 / 176÷203	**Max temp.acqua in funz.to(°C)** *Max water temp. in operation(°F)*			107 / 224,6		
Momento inerzia *Inertia Moment*	**Volano standard** - *standard flywheel*		**(SAE 4) J=** 0,46 **kgm²**					
	Motore senza volano - *eng. without flywheel*		**J=** 0,057 **kgm²**					
	Volano G.E. - *generator set flywheel*		**J=** / **kgm²**					
Pendenze coppa standard *Standard Oil Sump Slopes*			**Permanente** - *Permanent*					
	Longitudinale volano in basso - *flywheel low*		35°			70%		
	Longitudinale volano in alto - *flywheel up*		30°			57%		
	Trasversale nei due sensi - *bank in both directions*		30°			57%		
Temp. gas di scarico *Exhaust Gas Temp.*	**ECE R120**	°C	/	598	605	614	629	650
		°F	/	1108	1121	1137	1164	1202
Bilancio termico *Heat Balance*	**Potenza termica totale** *Total Thermal Power*	kW	/	173,3	186,0	203,5	219,8	239,1
	Potenza utile - *Useful Power*	kW	/	64,9	66,0	73,3	73,4	73,5
	Pot. raff.acqua - *Water Cooling Power* / **Pot. raff.olio** - *Oil Cooling Power*	kW	/	47,0	48,5	54,1	57,9	64,2
	Potenza allo scarico - *Exhaust Power*	kW	/	53,2	59,6	68,7	77,8	91,2
	Potenza all'intercooler	kW	/	0,0	0,0	0,0	0,0	0,0
	Pot. di irraggiamento - *Issued Power*	kW	/	8,2	11,9	7,4	10,7	10,2
Gas di scarico *Exhaust Gas*	**Portata Gas di Scarico** *Exhaust Gas Volume*	kg/h	/	310	341	386	424	477
	Contropressione max allo scarico *Exhaust max Backpressure*	kPa	20					
Radiatore intercooler *Radiator intercooler*	**ΔP max Radiatore** - *ΔP max Radiator*	kPa	35					
	Temp. max intercooler out	°C	n.a.					
	ΔP max Intercooler	kPa	n.a.					
Avviamento Elettrico *Elect.Starter*	**Capacità batteria (Ah)** *Battery Capacity (Ah)*	110	**Potenza motorino avviamento (kW)** *Starter motor power (kW)*					2,3
	Corrente di spunto max CCA EN (A) *Max starting current CCA EN (A)*	880	**Tensione alimentazione motorino avviam. (V)** *Starter motor voltage (V)*					12
	Velocità avviamento (rpm) *Starting speed (rpm)*	>120	**Coppia in avviamento (Nm)** *Starting torque (Nm)*					/
	Min.temp.avv.senza mezzi ausiliari(°C) *Extra Power Source free start (°F)*	-20 up to -4	**Corrente all'avviamento a -15°C (A)** *Current when starting 5°F (A)*					/
	Caratteristche alternatore (W - A) *Alternator Output (W - A)*	770 - 55	**Corrente in trascinamento a -15°C (A)** *Current when starting (during running) 5°F (A)*					/

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CARATTERISTICHE TECNICHE / *Technical Features*										rev.01	pag.1/2
MOTORE/*Engine*:			D754TPE2.GEN							97C-P/15@1500; 97C-P/18@1800	
as of (y-m)	2009/07										
Alesaggio x Corsa (mm x mm) *Bore x Stroke* (in x in)			**94 x 107** *3,70 x 4,21*		**Ordine di Scoppio** *Injection Order*					**1-3-4-2**	
Cilindri - Valvole Cylinder-Valvle Numbers			**4 - 2**		**n° giri min a vuoto** *Idling rpm*					**1200±50**	
Cilindrata Totale (l) *Total Displacement* (cu.in)			**2.970** *181,2*		**Coppia max @ 1200 rpm** (Nm) *Max Torque @ 1200 rpm* (Nm)					**366**	
Rapporto di Compressione *Compression ratio*			**17,8 ±0.5 : 1**		**Riserva di Coppia** *Torque reserve*					*/*	
Velocità medie Pistone (m/s 1000 n/1) *Mean piston speed (ft/min at 1000 rpm)*			**3,57** *702,8*		**Potenza max prelevabile dalla PTO** *Max power downloadable from PTO*					**vedi: "Linee guida all'installazione"** *see: "Installation guidelines"*	
Tipo Iniezione *Injection Type*			**Diretta** *Diretta*		**Criteri di installazione radiatori** *Radiator installation guidelines*						
Aspirazione *Intake*			**Turbocompressore** *Turbocharger*		**Carico assiale** *Axial load*						
Raffreddamento *Cooling*			**Ad Acqua** *Water cooled*		**Pesi** *Weights*	**A secco** (kg) *Dry* (lb)		**n.a.** *n.a.*			
Senso di Rotazione (dal volano) *Engine Rotation (Looking at flywheel)*			**Antiorario** *Anticlockwise*			**Con radiatore (kg)** *with water cooler(lb)*		**330** *727,5*		**senza olio, senza refrigerante** *without oil and coolant empty*	

Potenze *Ratings*	**n/1'** *r.p.m.*				**1500**	**1800**	**2000**	**2300**	**2600**	**3000**	
	1CV = 0,735 Kw 1Kw =1,36CV	**ECE Directive R120**	kW		56,0	61,0					
			CV		76,2	83,0					
	Scarto Giri A Vuoto/Carico *Governor Drop*				1575	1890					
Pressioni Medie Effettive *B.M.E.P*				bar	15,1	13,7					
				lb/sq in	218,8	198,6					
Consumi Specifici *Fuel Consumption*	**A Pieno Carico** / *Full Load*			g/CV h	182,7	182,5					
				g/kW h	248,5	248,2					
	giri minimo / *At idle*		1200 n/1' - *r.p.m.*		1.0 kg/h						
	Alla Coppia Max / *Max Torque*			(g/kWh)	250						
	Olio Lubrificante / *Lubricating Oil*			(gr/CVh)	/						
Olio *Oil*	**Portata Pompa Olio** / *Oil Pump Delivery*			l/min	37,42	44,90					
	Temp.max ammessa in coppa (°C) *Max Admissible temp.in oil sump* (°F)			125 *257*	**Capacità motore con coppa std.** (Kg) *Engine with standard sump Capacity* (lb)			8,8 *19,4*			
	Temp. min. funzion. continuo (°C) *Continuous Operating Min. Temp.* (°F)			/ /	**Press.olio a 125°C**	**Al Minimo** / *At Idle* (*bar*)		2,0			
					Oil pressure at 257°F	**A Regime** / *Max Rating* (*bar*)		4,5			

Cartucce *Cartridges*	**Olio** *Oil*	**Capacità** (l)	**0,44**	*Capacity cu.in*	26,85	**Cambio ogni 300 ore** *Renew every 300 hs.*	**Specifiche olio**	
		Super.filtrante (cm^2)	**1770**	*Filter. Surf. sq.in*	274,35		*Oil specific*	
		Grado di filtraggio - *Filtration*		Reale-*Actual* (μ)	/		Da 45°C (113°F) a -20°C (-4°F)	
				Nominale-*Nominal* (μ)	26			
	Gasolio *Gasoil*	**Super.filtrante** (cm^2)	**5300**	*Filter. Surf. sq.in*	821,5		ACEA A3/B4 API CG-4 API CH-4 API CI-4	
		Grado filtraggio (μ) *Filtration* (μ)	**4 ÷ 5**					
Pompa alimentazione: *Feeding Pump:*			a membrana diaphragm				SAE 10W40	

VM MOTORI S.p.A.

CARATTERISTICHE TECNICHE / *Technical Features*								rev.01	pag.2/2
MOTORE/Engine:	D754TPE2.GEN							97C-P/15@1500; 97C-P/18@1800	
	n/1' r.p.m.		1500	1800	2000	2300	2600	3000	
Aspirazione *Intake*	**Consumo Aria Comburente** *Air Cosumption*	kg/h	249	296					
	Depressione Ammessa con Filtro Nuovo (secco) *Permissible depressure with new filter (dry) [mbar]*		20	25					
	Depressione max Omologata [mbar] *Max Homologated Depressure*		20	25					
Ventilatore *Fan*	**Assiale su asse pompa** *Axial on Pump axle*	*kW* / *CV*	/ /	/ /					
	Portata Aria *Air Capacity*	*m3/h* / *cu ft/min*	/ /	/ /					
Acqua *Water*	**Portata Pompa Acqua** *Water Pump Flow*	l/min	179,3	215,2					
	Giri Pompa Acqua n/1' / Water Pump r.p.m.		2521	3025					
	Capacità circuito senza radiatore (litri) *Circuit capacity without radiator*	5	**Pressione Circuito H_2O (bar)** *Water Circuit Pressure (bar)*			0,9÷1,1			
	Inizio/Fine apert.valv.termostatica °C *Therm.valve start/end opening °F*	80 ÷ 95 / *176÷203*	**Max temp.acqua in funz.to(°C)** *Max water temp. in operation(°F)*			107 / *224,6*			
Momento inerzia *Inertia Moment*	**Volano Standard** - *Standard Flywheel*		**(SAE 4) J=** 0,46 **kg*m²**						
	Motore senza Volano - *Eng. Without Flywheel*		**J=** 0,057 **kg*m²**						
	Volano G.E. - *Generator Set Flywheel*		**J=** 1,26 **kg*m²**						
Pendenze coppa standard *Standard Oil Sump Slopes*			**Permanente** - Permanent						
	Longitudinale Volano in basso - *Flywheel Low*		35°			70%			
	Longitudinale Volano in alto - *Flywheel Up*		30°			57%			
	Trasversale nei due sensi - *Bank in both directions*		30°			57%			
Temp. Gas di Scarico *Exhaust*	**ECE REGULATION R120**	°C	651	653					
		°F	1204	1207					
Bilancio Termico *Heat Balance*	**Potenza Termica Totale** *Total Thermal Power*	kW	159,3	175,2					
	Potenza Utile - *Useful Power*	kW	56,0	61,0					
	Pot. Raff.Acqua - *Water Cooling Power*	kW	48,5	51,2					
	Pot. Raff.Olio - *Oil Cooling Power*								
	Potenza allo Scarico - *Exhaust Power*	kW	45,9	54,5					
	Potenza all'intercooler	kW	0,0	0,0					
	Pot. di Irraggiamento - *Issued Power*	kW	8,9	8,5					
Gas di scarico *Exhaust Gas*	**Portata Gas di Scarico** *Exhaust Gas Flow*	kg/h	263	311					
	Contropress. Max allo scarico *Exhaust max Backpressure*	mbar	110	150					
Rad. Olio *Oil Cool*	**Fa parte dell'allestimento standard**		*It's a standard engine component*						
Avviamento Elettrico *Elect.Starter*	**Capacità batteria (Ah)** *Battery Capacity (Ah)*	110	**Potenza motorino avviamento (kW)** *Starter motor power (kW*					2,3	
	Corrente di spunto max CCA EN (A) *Max starting current CCA EN (A)*	880	**Tensione alimentazione motorino avviam. (V)** *Starter motor voltage (V*					12	
	Velocità avviamento (rpm) *Starting speed (rpm*	>120	**Coppia in avviamento (Nm)** *Starting torque (Nm*					/	
	Min.temp.avv.senza mezzi ausiliari(°C) *Extra Power Source free start (°F)*	-20 / up to -4	**Corrente all'avviamento a -15°C (A)** *Current when starting 5°F (A*					/	
	Caratteristche alternatore (W - A) *Alternator Output (W - A*	770 - 55	**Corrente in trascinamento a -15°C (A)** *Current when starting (during running) 5°F (A)*					/	

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CARATTERISTICHE TECNICHE / *Technical Features*	rev.01	pag.1/2
MOTORE/*Engine*:	D754TPE2.MTP	97C-P/23@2300

as of (y-m)	2009/07

Alesaggio x Corsa (mm x mm) *Bore x Stroke* (in x in)	**94 x 107** *3,70 x 4,21*	**Ordine di Scoppio** *Injection Order*	**1-3-4-2**
Cilindri - Valvole Cylinder-Valvle Numbers	**4 - 2**	**n° giri min a vuoto** *Idling rpm*	**1200±50**
Cilindrata totale (l) *Total Displacement* (cu.in)	**2.970** *181,2*	**Coppia max @ 1200 rpm** (Nm) *Max Torque @ 1200 rpm* (Nm)	**366**
Rapporto di Compressione *Compression ratio*	**17,8 ±0.5 : 1**	**Riserva di Coppia** *Torque reserve*	*/*
Vel. media pistone (m/s a 1000rpm) *Mean piston speed* (ft/min at 1000 rpm)	**3,57** *702,8*	**Potenza max prelevabile dalla PTO** *Max power downloadable from PTO*	**vedi: "Linee guida all'installazione"** *see: "Installation guidelines"*
Tipo Iniezione *Injection Type*	**Diretta** *Diretta*	**Criteri di installazione radiatori** *Radiator installation guidelines*	
Aspirazione *Intake*	**Turbocompressore** *Turbocharger*	**Carico assiale** *Axial load*	
Raffreddamento *Cooling*	**Ad Acqua** *Water cooled*	**Pesi** *Weights*: **A secco** (kg) / *Dry* (lb)	**n.a.** *n.a.*
Senso di Rotazione (dal volano) *Engine Rotation (Looking at flywheel)*	**Antiorario** *Anticlockwise*	**Con radiatore** (kg) *with water cooler*(lb)	**292** *643,7* con SAE4, senza olio, senza refrigerante *with SAE4, without oil and coolant empty*

Potenze *Ratings*	**n/1'** *r.p.m.*			**1500**	**1800**	**2000**	**2300**	**2600**	**3000**
	1CV = 0,735 Kw 1Kw =1,36CV	**ECE Directive R120**	kW	56,0	61,0		62,0		
			CV	76,2	83,0		84,3		
	Scarto Giri A Vuoto/Carico *Governor Drop*			1575	1890		2470		
Pressioni Medie Effettive *B.M.E.P*			bar	15,1	13,7		10,9		
			lb/sq in	218,8	198,6		158,0		
Consumi Specifici *Fuel Consumption*	**A Pieno Carico** / *Full Load*		g/CV h	182,7	182,5		198,0		
			g/kW h	248,5	248,2		269,3		
	giri minimo / *At idle*	1200 n/1' - *r.p.m.*		1.0 kg/h					
	Alla Coppia Max / *Max Torque*		*(g/kWh)*	250					
	Olio Lubrificante / *Lubricating Oil*		*gr/CVh*	/					
Olio *Oil*	**Portata Pompa Olio** / *Oil Pump Delivery*		l/min	37,42	44,90		57,37		
	Temp.max ammessa in coppa (°C) *Max Admissible temp.in oil sump* (°F)		125 *257*	**Capacità motore con coppa std.** (Kg) *Engine with standard sump Capacity* (lb)			8,8 *19,4*		
	Temp. min. funzion. continuo (°C) *Continuous Operating Min. Temp.* (°F)		/ /	**Press.olio a 125°C** *Oil pressure at 257°F*		**Al Minimo** / *At Idle* (*bar*) **A Regime** / *Max Rating* (*bar*)		2,0 4,5	

Cartucce *Cartridges*	**Olio** *Oil*	**Capacità** (l)	**0,44**	*Capacity cu.in*	26,85	**Cambio ogni 300 ore** *Renew every 300 hs.*	**Specifiche olio**
		Super.filtrante (cm^2)	**1770**	*Filter. Surf. sq.in*	274,35		*Oil specific*
		Grado di filtraggio - *Filtration*		Reale-*Actual* (μ)	/		Da 45°C (113°F) a -20°C (-4°F)
				Nominale-*Nominal* (μ)	26		ACEA A3/B4 API CG-4 API CH-4 API CI-4
	Gasolio *Gasoil*	**Super.filtrante** (cm^2)	**5300**	*Filter. Surf. sq.in*	821,5		
		Grado filtraggio (μ) *Filtration* (μ)	**4 ÷ 5**				
Pompa alimentazione: *Feeding Pump:*			a membrana diaphragm				SAE 10W40

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CARATTERISTICHE TECNICHE / *Technical Features*							rev.01	pag.1/2
MOTORE/*Engine*:	D754TPE2.MTP						97C-P/23@2300	
	n/1' r.p.m.		1500	1800	2000	2300	2600	3000
Aspirazione *Intake*	**Consumo Aria Comburente** *Air Cosumption*	kg/h	249	296		359		
	Depressione Ammessa con Filtro Nuovo (secco) *Permissible depressure with new filter (dry) [mbar]*		20	25		40		
	Depressione max Omologata [mbar] *Max Homologated Depressure*		20	25		40		
Ventilatore *Fan*	**Assiale su asse pompa** *Axial on Pump axle*	*kW*	/	/		/		
		CV	/	/		/		
	Portata Aria *Air Capacity*	*m3/h*	/	/		/		
		cu ft/min	/	/		/		
Acqua *Water*	**Portata Pompa Acqua** *Water Pump Flow*	l/min	140,3	168,8		215,8		
	Giri Pompa Acqua n/1' / Water Pump r.p.m.		1973	2367		3025		
	Capacità circuito senza radiatore (litri) *Circuit capacity without radiator*	5	**Pressione Circuito H_2O (bar)** *Water Circuit Pressure (bar)*			**0,9÷1,1**		
	Inizio/Fine apert.valv.termostatica °C *Therm.valve start/end opening °F*	80 ÷ 95 *176÷203*	**Max temp.acqua in funz.to(°C)** *Max water temp. in operation(°F)*			107 *224,6*		
Momento inerzia *Inertia Moment*	**Volano Standard** - *Standard Flywheel*		**(SAE 4) J=** 0,46 **kg*m²**					
	Motore senza Volano - *Eng. Without Flywheel*		**J=** 0,057 **kg*m²**					
	Volano G.E. - *Generator Set Flywheel*		**J=** 1,26 **kg*m²**					
Pendenze coppa standard *Standard Oil Sump Slopes*			**Permanente** - Permanent					
	Longitudinale Volano in basso - *Flywheel Low*		35°			70%		
	Longitudinale Volano in alto - *Flywheel Up*		30°			57%		
	Trasversale nei due sensi - *Bank in both directions*		30°			57%		
Temp. Gas di Scarico *Exhaust*	**ECE REGULATION R120**	°C	651	653		670		
		°F	1204	1207		1238		
Bilancio Termico *Heat Balance*	**Potenza Termica Totale** *Total Thermal Power*	kW	159,3	175,2		198,7		
	Potenza Utile - *Useful Power*	kW	56,0	61,0		62,0		
	Pot. Raff.Acqua - *Water Cooling Power*	kW	48,5	51,2		57,0		
	Pot. Raff.Olio - *Oil Cooling Power*							
	Potenza allo Scarico - *Exhaust Power*	kW	45,9	54,5		71,1		
	Potenza all'intercooler	kW	0,0	0,0		0,0		
	Pot. di Irraggiamento - *Issued Power*	kW	8,9	8,5		8,6		
Gas di scarico *Exhaust Gas*	**Portata Gas di Scarico** *Exhaust Gas Flow*	kg/h	263	311		375		
	Contropress. Max allo scarico *Exhaust max Backpressure*	mbar	110	150		230		
Rad. Olio *Oil Cool*	**Fa parte dell'allestimento standard**		*It's a standard engine component*					

Avviamento Elettrico *Elect.Starter*	**Capacità batteria (Ah)** *Battery Capacity (Ah)*	110	**Potenza motorino avviamento (kW)** *Starter motor power (kW*	2,3
	Corrente di spunto max CCA EN (A) *Max starting current CCA EN (A)*	880	**Tensione alimentazione motorino avviam. (V)** *Starter motor voltage (V*	12
	Velocità avviamento (rpm) *Starting speed (rpm*	>120	**Coppia in avviamento (Nm)** *Starting torque (Nm*	/
	Min.temp.avv.senza mezzi ausiliari(°C) *Extra Power Source free start (°F)*	-20 up to -4	**Corrente all'avviamento a -15°C (A)** *Current when starting 5°F (A*	/
	Caratteristche alternatore (W - A) *Alternator Output (W - A*	770 - 55	**Corrente in trascinamento a -15°C (A)** *Current when starting (during running) 5°F (A)*	/

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CARATTERISTICHE TECNICHE / *Technical Features*			rev.01	pag.1/2
MOTORE / *Engine* :		D756IPE2.FRP		93C
as of (y-m)	2009/07			

Alesaggio x Corsa (mm x mm) *Bore x Stroke* (in x in)	**94 x 107** *3,70 x 4,21*	**Ordine di accensione** *Injection Order*	**1 - 5 - 3 - 6 - 2 - 4**	
Cilindri - Valvole Cylinder-Valvle Numbers	**6 - 2**	**n° giri min a vuoto** *Idling rpm*	**1600**	
Cilindrata totale (l) *Total Displacement* (cu.in)	**4.455** *271,8*	**n°giri min servizio continuo** (rpm) *Min. rpm for cont. Duty* (rpm)	**2500**	
Rapporto di compressione *Compression ratio*	**17,8 ± 0.5 : 1**	**Coppia max @ 1800 rpm** (Nm) *Max Torque @ 1800 rpm* (Nm)	**520**	
Vel. media pistone (m/s a 1000rpm) *Mean piston speed* (ft/min at 1000 rpm)	**3,57** *702,8*	**Potenza max prelevabile dalla PTO** *Max power downloadable from PTO*	**vedi: "Linee guida all'installazione"** *see: "Installation guidelines"*	
Tipo Iniezione *Injection Type*	**Diretta** *Direct*	**Criteri di installazione radiatori** *Radiator installation guidelines*		
Aspirazione *Intake*	**Turbo-intercooler** *Turbo-intercooler*	**Carico assiale** *Axial load*		
Raffreddamento *Cooling*	**Ad acqua** *Water cooled*	**Pesi** *Weights* — **A secco** (kg) *Dry* (lb)	**n.a.** *n.a.*	
Senso di rotazione (dal volano) *Engine Rotation (Looking at flywheel)*	**Antiorario** *Anticlockwise*	**Con radiatore** (kg) *with water cooler*(lb)	**426** *939,1*	**con olio; senza refrigerante** *with oil; without coolant empty*

Potenze *Ratings*	**giri/min** *r.p.m.*			**1500**	**1800**	**2000**	**2300**	**2600**	**3000**
	1 CV = 0,735 kW 1 kW =1,36 CV	**ECE R120**	kW	/	97,9	108,0	112,2	113,3	110,3
			CV	/	133,1	146,9	152,6	154,1	150,0
Pressioni Medie Effettive *B.M.E.P*			bar	/	14,7	14,5	13,1	11,7	9,9
			lb/sq in	/	212,4	210,9	190,5	170,2	143,6
Consumi Specifici Fuel Consumption	**A pieno carico** / *Full Load*		g/CVh	/	153	158	164	175	196
			g/kWh	/	208	214	224	239	266
	giri minimo / *At idle*		kg/h	1,6					
	1800rpm a pieno carico / *full load*		kg/h	20,3					
	Alla coppia max / *Max Torque*		g/kWh	208					
	Olio lubrificante / *Lubricating Oil*		g/CVh	/					

Olio *Oil*	**Portata pompa olio** / *Oil Pump Delivery*		l/min	/	52,50	58,33	67,08	75,83	87,5
	Temp.max ammessa in coppa (°C) *Max Admissible temp.in oil sump* (°F)		125 *257*	**Capacità motore con coppa std.** (Kg) *Engine with standard sump Capacity* (lb)				12,3 *27,1*	
	Temp. min. funzion. continuo (°C) *Continuous Operating Min. Temp.* (°F)		/ /	**Press.olio a 125°C** *Oil pressure at 257°F*		**Al minimo** / *At Idle* (**bar**) **A regime** / *Max Rating* (**bar**)		3,0 3,2	

Cartucce *Cartridges*	**Olio** *Oil*	**Capacità l**	**0,98**	*Capacity cu.in*	59,80	**Cambio ogni 300 ore** *Renew every 300 hs.*
		Super.filtrante cm²	**4300**	*Filter. Surf. sq.in*	666,5	
		Grado di filtraggio - *Filtration*		Reale-*Actual* (μ)	/	
				Nominale-*Nominal* (μ)	26	
	Gasolio *Gasoil*	**Super.filtrante cm²**	**5300**	*Filter. Surf. sq.in*	821,5	
		Grado filtraggio (μ) *Filtration (μ)*	**4 ÷ 5**			

Pompa alimentazione: *Feeding Pump:*	a membrana diaphragm	**Specifiche olio**	
		Oil specific	
		Da 45°C (113°F) a -20°C (-4°F)	
		ACEA A3/B4 API CG-4 API CH-4 API CI-4	
		SAE 10W40	

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CARATTERISTICHE TECNICHE / Technical Features							rev.01	pag.2/2
MOTORE / Engine:	D756IPE2.FRP						93C	
	n/1' r.p.m.		1500	1800	2000	2300	2600	3000
Aspirazione *Intake*	**Consumo aria comburente** *Air Cosumption*	kg/h	/	457	522	595	654	704
	Depressione ammessa filtro nuovo secco (kPa) *Permissible depressure with new filter dry*		3,5					
	Depressione max omologata (kPa) *Max Homologated Depressur*		6,0					
Ventilatore *Fan*	**Assiale su asse pompa** *Axial on Pump axle*	kW CV	/ /					
	Portata aria *Air Capacity*	m3/h cu ft/min	/ /					
Acqua *Water*	**Portata pompa acqua con ΔP radiatore=1.2 bar a 3000 rpm motore** / *water pump flow* (l/min)		/	124,0	138,2	159,2	182,4	212,9
	Giri pompa acqua giri/min / Water Pump r.p.m.		/	2045	2272	2613	2954	3408
	Capacità circuito senza radiatore (litri) *Circuit capacity without radiator*	7,5	**Pressione Circuito H_2O (bar)** *Water Circuit Pressure (bar)*			0,9÷1,1		
	Inizio/Fine apert.valv.termostatica °C *Therm.valve start/end opening °F*	80 ÷ 95 176÷203	**Max temp.acqua in funz.to(°C)** *Max water temp. in operation(°F)*			107 224,6		
Momento inerzia *Inertia Moment*	**Volano standard** - *standard flywheel*		**(SAE 4) J=** 0,46 kgm²					
	Motore senza volano - *eng. without flywheel*		**J=** 0,057 kgm²					
	Volano G.E. - *generator set flywheel*		**J=** / kgm²					
Pendenze coppa standard *Standard Oil Sump Slopes*			**Permanente** - *Permanent*					
	Longitudinale volano in basso - *flywheel low*		35°			70%		
	Longitudinale volano in alto - *flywheel up*		30°			57%		
	Trasversale nei due sensi - *bank in both directions*		30°			57%		
Temp. gas di scarico *Exhaust Gas Temp.*	**ECE R120**	°C	/	496	533	535	552	589
		°F	/	925	991	995	1026	1092
Bilancio termico *Heat Balance*	**Potenza termica totale** *Total Thermal Power*	kW	/	240,9	273,9	297,0	320,0	345,2
	Potenza utile - *Useful Power*	kW	/	97,9	108,0	112,2	113,3	110,3
	Pot. raff.acqua - *Water Cooling Power*	kW	/	57,8	62,6	69,0	75,5	83,0
	Pot. raff.olio - *Oil Cooling Power*							
	Potenza allo scarico - *Exhaust Power*	kW	/	65,6	81,9	93,7	107,0	124,7
	Potenza all'intercooler	kW	/	9,7	11,0	12,2	13,8	15,7
	Pot. di irraggiamento - *Issued Power*	kW	/	9,9	10,4	9,9	10,4	11,5
Gas di scarico *Exhaust Gas*	**Portata Gas di Scarico** *Exhaust Gas Volume*	kg/h	/	478	545	620	681	733
	Contropressione max allo scarico *Exhaust max Backpressure*	kPa	20					
Radiatore intercooler *Radiator intercooler*	**ΔP max Radiatore** - *Δ P max Radiator*	kPa	35					
	Temp. max intercooler out	°C	60° (a 25°C temperatura ambiente)					
	ΔP max Intercooler	kPa	10					
Avviamento Elettrico *Elect.Starter*	**Capacità batteria (Ah)** *Battery Capacity (Ah)*	110	**Potenza motorino avviamento (kW)** *Starter motor power (kW)*					2,3
	Corrente di spunto max CCA EN (A) *Max starting current CCA EN (A)*	880	**Tensione alimentazione motorino avviam. (V)** *Starter motor voltage (V)*					12
	Velocità avviamento (rpm) *Starting speed (rpm)*	>120	**Coppia in avviamento (Nm)** *Starting torque (Nm)*					/
	Min.temp.avv.senza mezzi ausiliari(°C) *Extra Power Source free start (°F)*	-20 up to -4	**Corrente all'avviamento a -15°C (A)** *Current when starting 5°F (A)*					/
	Caratteristche alternatore (W - A) *Alternator Output (W - A)*	770 - 55	**Corrente in trascinamento a -15°C (A)** *Current when starting (during running) 5°F (A)*					/

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CARATTERISTICHE TECNICHE / *Technical Features*										**rev.01**	**pag.1/2**
MOTORE/*Engine*:			D756IPE2.GEN							93C-P/15@1500 93C-P/18@1800	
as of (y-m)	2009/07										
Alesaggio x Corsa (mm x mm) *Bore x Stroke* (in x in)			**94 x 107** *3,70 x 4,21*		**Ordine di Scoppio** *Injection Order*					**1 - 5 - 3 - 6 - 2 - 4**	
Cilindri - Valvole Cylinder-Valvle Numbers			**6 - 2**		**n° giri min a vuoto** *Idling rpm*					**1200±50**	
Cilindrata totale (l) *Total Displacement* (cu.in)			**4.455** *271,8*		**Coppia max @ 1200 rpm** (Nm) *Max Torque @ 1200 rpm* (Nm)					**613**	
Rapporto di compressione *Compression ratio*			**17,8 ± 0.5 : 1**		**Riserva di Coppia** *Torque reserve*					*/*	
Vel. media pistone (m/s a 1000rpm) *Mean piston speed* (ft/min at 1000 rpm)			**3,57** *702,8*		**Potenza max prelevabile dalla PTO** *Max power downloadable from PTO*					**vedi: "Linee guida all'installazione"** *see: "Installation guidelines"*	
Tipo Iniezione *Injection Type*			**Diretta** *Direct*		**Criteri di installazione radiatori** *Radiator installation guidelines*						
Aspirazione *Intake*			**Turbo-intercooler** *Turbo-intercooler*		**Carico assiale** *Axial load*						
Raffreddamento *Cooling*			**Ad acqua** *Water cooled*		**Pesi** *Weights*	**A secco** (kg) *Dry* (lb)		**n.a.** *n.a.*			
Senso di rotazione (dal volano) *Engine Rotation (Looking at flywheel)*			**Antiorario** *Anticlockwise*			**Con radiatore** (kg) *with water cooler*(lb)		**464** *1022,9*		**con olio; senza refrigerante** *with oil; without coolant empty*	

Potenze *Ratings*	**n/1'** *r.p.m.*			**1500**	**1800**	**2000**	**2300**	**2600**	**3000**	
	1CV = 0,735 Kw 1Kw =1,36CV	**ECE Directive R120**	kW	90,0	98,0					
			CV	122,4	133,3					
	Scarto Giri A Vuoto/Carico *Governor Drop*			1575	1890					
Pressioni Medie Effettive *B.M.E.P*			bar	16,2	14,7					
			lb/sq in	234,4	212,7					
Consumi Specifici *Fuel Consumption*	**A Pieno Carico** / *Full Load*		g/CV h	157,6	162,4					
			g/kW h	214,4	220,8					
	giri minimo / *At idle*	1200 n/1' - *r.p.m.*		1.2 kg/h						
	Alla Coppia Max / *Max Torque*		(g/kWh)	230						
	Olio Lubrificante / *Lubricating Oil*		(gr/CVh)	/						
Olio *Oil*	**Portata Pompa Olio** / *Oil Pump Delivery*		l/min	43,75	52,50					
	Temp.max ammessa in coppa (°C) *Max Admissible temp.in oil sump* (°F)		125 *257*	**Capacità motore con coppa std.** (Kg) *Engine with standard sump Capacity* (lb)				12,3 *27,1*		
	Temp. min. funzion. continuo (°C) *Continuous Operating Min. Temp.* (°F)		/ /	**Press.olio a 125°C** *Oil pressure at 257°F*	**Al minimo** / *At Idle* (bar) **A regime** / *Max Rating* (bar)			1,5 2,0		

Cartucce *Cartridges*	**Olio** *Oil*	**Capacità l**	**0,98**	*Capacity cu.in*	59,80	**Cambio ogni 300 ore** *Renew every 300 hs.*	**Specifiche olio**
		Super.filtrante cm²	**4300**	*Filter. Surf. sq.in*	666,5		*Oil specific*
		Grado di filtraggio - *Filtration*		Reale-*Actual* (μ)	/		Da 45°C (113°F) a -20°C (-4°F)
				Nominale-*Nominal* (μ)	26		ACEA A3/B4 API CG-4 API CH-4 API CI-4
	Gasolio *Gasoil*	**Super.filtrante cm²**	**5300**	*Filter. Surf. sq.in*	821,5		
		Grado filtraggio (μ) *Filtration (μ)*	**4 ÷ 5**				
Pompa alimentazione: *Feeding Pump:*			a membrana diaphragm				SAE 10W40

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CARATTERISTICHE TECNICHE / *Technical Features*							rev.01	pag.2/2
MOTORE/Engine:	D756IPE2.GEN						93C-P/15@1500 93C-P/18@1800	
	n/1' r.p.m.		1500	1800	2000	2300	2600	3000
Aspirazione *Intake*	**Consumo Aria Comburente** *Air Cosumption*	kg/h	400,2	459				
	Depressione Ammessa con Filtro Nuovo (secco) *Permissible depressure with new filter (dry) [mbar]*		20	25				
	Depressione max Omologata [mbar] *Max Homologated Depressure*		20	25				
Ventilatore *Fan*	**Assiale su asse pompa** *Axial on Pump axle*	kW CV	/ /	/ /				
	Portata Aria *Air Capacity*	m3/h cu ft/min	/ /	/ /				
Acqua *Water*	**Portata Pompa Acqua** *Water Pump Flow*	l/min	173,2	207,2				
	Giri Pompa Acqua n/1' / Water Pump r.p.m.		2521	3025				
	Capacità circuito senza radiatore (litri) *Circuit capacity without radiator*	7,5	**Pressione Circuito H_2O (bar)** *Water Circuit Pressure (bar)*			0,9÷1,1		
	Inizio/Fine apert.valv.termostatica °C *Therm.valve start/end opening °F*	80 ÷ 95 176÷203	**Max temp.acqua in funz.to(°C)** *Max water temp. in operation(°F)*			107 224,6		
Momento inerzia *Inertia Moment*	**Volano Standard** - *Standard Flywheel*		**(SAE 4) J=** 0,46 **kg*m²**					
	Motore senza Volano - *Eng. Without Flywheel*		**J=** 0,057 **kg*m²**					
	Volano G.E. - *Generator Set Flywheel*		**J=** 1,26 **kg*m²**					
Pendenze coppa standard *Standard Oil Sump Slopes*			**Permanente** - Permanent					
	Longitudinale Volano in basso - *Flywheel Low*		35°			70%		
	Longitudinale Volano in alto - *Flywheel Up*		30°			57%		
	Trasversale nei due sensi - *Bank in both directions*		30°			57%		
Temp. Gas di Scarico *Exhaust*	**ECE REGULATION R120**	°C	555	574				
		°F	1031	1065				
Bilancio Termico *Heat Balance*	**Potenza Termica Totale** *Total Thermal Power*	kW	225,1	254,5				
	Potenza Utile - *Useful Power*	kW	90,0	98,0				
	Pot. Raff.Acqua - *Water Cooling Power*	kW	61,7	68,3				
	Pot. Raff.Olio - *Oil Cooling Power*							
	Potenza allo Scarico - *Exhaust Power*	kW	59,6	73,3				
	Potenza all'intercooler	kW	8,7	9,0				
	Pot. di Irraggiamento - *Issued Power*	kW	5,1	5,9				
Gas di scarico *Exhaust Gas*	**Portata Gas di Scarico** *Exhaust Gas Flow*	kg/h	420	480				
	Contropress. Max allo scarico *Exhaust max Backpressure*	mbar	110	150				
Radiatore intercooler *Radiator intercooler*	**ΔP max Radiatore** - *Δ P max Radiator*	kPa	35					
	Temp. max intercooler out	°C	60° (a 25°C temperatura ambiente)					
	ΔP max Intercooler	kPa	10					
Avviamento Elettrico *Elect.Starter*	**Capacità batteria (Ah)** *Battery Capacity (Ah)*	110	**Potenza motorino avviamento (kW)** *Starter motor power (kW*					2,3
	Corrente di spunto max CCA EN (A) *Max starting current CCA EN (A)*	880	**Tensione alimentazione motorino avviam. (V)** *Starter motor voltage (V*					12
	Velocità avviamento (rpm) *Starting speed (rpm*	>120	**Coppia in avviamento (Nm)** *Starting torque (Nm*					/
	Min.temp.avv.senza mezzi ausiliari(°C) *Extra Power Source free start (°F)*	-20 up to -4	**Corrente all'avviamento a -15°C (A)** *Current when starting 5°F (A*					/
	Caratteristche alternatore (W - A) *Alternator Output (W - A*	770 - 55	**Corrente in trascinamento a -15°C (A)** *Current when starting (during running) 5°F (A)*					/

D756IPE2 - MotoPompa - MotoPump

VM MOTORI S.p.A.

CARATTERISTICHE TECNICHE / *Technical Features*									rev.01	pag.1/2
MOTORE/*Engine*:			D756IPE2.MTP						93C-P/23@2300	
as of (y-m)	2009/07									
Alesaggio x Corsa (mm x mm) *Bore x Stroke* (in x in)			**94 x 107** *3,70 x 4,21*		**Ordine di Scoppio** *Injection Order*				**1 - 5 - 3 - 6 - 2 - 4**	
Cilindri - Valvole Cylinder-Valvle Numbers			**6 - 2**		**n° giri min a vuoto** *Idling rpm*				**1200±50**	
Cilindrata totale (l) *Total Displacement* (cu.in)			**4.455** *271,8*		**Coppia max @ 1200 rpm** (Nm) *Max Torque @ 1200 rpm* (Nm)				**613**	
Rapporto di compressione *Compression ratio*			**17,8 ± 0.5 : 1**		**Riserva di Coppia** *Torque reserve*				*I*	
Vel. media pistone (m/s a 1000rpm) *Mean piston speed* (ft/min at 1000 rpm)			**3,57** *702,8*		**Potenza max prelevabile dalla PTO** *Max power downloadable from PTO*				**vedi: "Linee guida all'installazione"** *see: "Installation guidelines"*	
Tipo Iniezione *Injection Type*			**Diretta** *Direct*		**Criteri di installazione radiatori** *Radiator installation guidelines*					
Aspirazione *Intake*			**Turbo-intercooler** *Turbo-intercooler*		**Carico assiale** *Axial load*					
Raffreddamento *Cooling*			**Ad acqua** *Water cooled*		**Pesi** *Weights*	**A secco** (kg) *Dry* (lb)		**n.a.** *n.a.*		
Senso di rotazione (dal volano) *Engine Rotation (Looking at flywheel)*			**Antiorario** *Anticlockwise*			**Con radiatore** (kg) *with water cooler*(lb)		**426** *939,2*	**con SAE4, con olio, senza refrigerante** *with SAE4, with oil and without coolant empty*	
Potenze *Ratings*	**n/1'** *r.p.m.*				**1500**	**1800**	**2000**	**2300**	**2600**	**3000**
	1CV = 0,735 Kw 1Kw =1,36CV	**ECE Directive R120**		kW	90,0	98,0		102,0		
				CV	122,4	133,3		138,7		
	Scarto Giri A Vuoto/Carico *Governor Drop*				1575	1890		2440		
Pressioni Medie Effettive *B.M.E.P*				bar	16,2	14,7		11,9		
				lb/sq in	234,4	212,7		173,3		
Consumi Specifici *Fuel Consumption*	**A Pieno Carico** / *Full Load*			g/CV h	157,6	162,4		183,1		
				g/kW h	214,4	220,8		249,0		
	giri minimo / *At idle*		1200 n/1' - *r.p.m.*		1.2 kg/h					
	Alla Coppia Max / *Max Torque*			(g/kWh)	230					
	Olio Lubrificante / *Lubricating Oil*			(gr/CVh)	/					
Olio *Oil*	**Portata Pompa Olio** / *Oil Pump Delivery*			l/min	43,75	52,50		67,08		
	Temp.max ammessa in coppa (°C) *Max Admissible temp.in oil sump* (°F)			125 *257*	**Capacità motore con coppa std.** (Kg) *Engine with standard sump Capacity* (lb)			12,3 *27,1*		
	Temp. min. funzion. continuo (°C) *Continuous Operating Min. Temp.* (°F)			/ /	**Press.olio a 125°C** *Oil pressure at 257°F*		**Al Minimo** / *At Idle* (**bar**) **A Regime** / *Max Rating* (**bar**)		1,5 3,0	

Cartucce *Cartridges*							**Cambio ogni 300 ore** *Renew every 300 hs.*	**Specifiche olio**
Olio *Oil*	**Capacità l**	**0,98**	*Capacity cu.in*	59,80				*Oil specific*
	Super.filtrante cm²	**4300**	*Filter. Surf. sq.in*	666,5				Da 45°C (113°F) a -20°C (-4°F)
	Grado di filtraggio - *Filtration*		Reale-*Actual* (μ)	/				
			Nominale-*Nominal* (μ)	26				ACEA A3/B4 API CG-4 API CH-4 API CI-4
Gasolio *Gasoil*	**Super.filtrante cm²**	**5300**	*Filter. Surf. sq.in*	821,5				
	Grado filtraggio (μ) *Filtration (μ)*	**4 ÷ 5**						
Pompa alimentazione: *Feeding Pump:*		a membrana diaphragm						SAE 10W40

VM MOTORI S.p.A.

CARATTERISTICHE TECNICHE / *Technical Features*							rev.01	pag.2/2
MOTORE/Engine:	D756IPE2.MTP						93C-P/23@2300	
	n/1' r.p.m.		1500	1800	2000	2300	2600	3000
Aspirazione *Intake*	**Consumo Aria Comburente** *Air Cosumption*	kg/h	400,2	459		568,1		
	Depressione Ammessa con Filtro Nuovo (secco) *Permissible depressure with new filter (dry) [mbar]*		20	25		35		
	Depressione max Omologata [mbar] *Max Homologated Depressure*		20	25		35		
Ventilatore *Fan*	**Assiale su asse pompa** *Axial on Pump axle*	*kW*	/	/		/		
		CV	/	/		/		
	Portata Aria *Air Capacity*	*m3/h*	/	/		/		
		cu ft/min	/	/		/		
Acqua *Water*	**Portata Pompa Acqua** *Water Pump Flow*	l/min	135,6	163,0		208,0		
	Giri Pompa Acqua n/1' / Water Pump r.p.m.		1973	2367		3025		
	Capacità circuito senza radiatore (litri) *Circuit capacity without radiator*	7,5	**Pressione Circuito H_2O (bar)** *Water Circuit Pressure (bar)*			0,9÷1,1		
	Inizio/Fine apert.valv.termostatica °C *Therm.valve start/end opening °F*	80 ÷ 95 / 176÷203	**Max temp.acqua in funz.to(°C)** *Max water temp. in operation(°F)*			107 / 224,6		
Momento inerzia *Inertia Moment*	**Volano Standard** - *Standard Flywheel*		**(SAE 4) J=** 0,46 **kg*m²**					
	Motore senza Volano - *Eng. Without Flywheel*		**J=** 0,057 **kg*m²**					
	Volano G.E. - *Generator Set Flywheel*		**J=** 1,26 **kg*m²**					
Pendenze coppa standard *Standard Oil Sump Slopes*			**Permanente** - Permanent					
	Longitudinale Volano in basso - *Flywheel Low*		35°			70%		
	Longitudinale Volano in alto - *Flywheel Up*		30°			57%		
	Trasversale nei due sensi - *Bank in both directions*		30°			57%		
Temp. Gas di Scarico *Exhaust*	**ECE REGULATION R120**	°C	555	574		582		
		°F	1031	1065		1080		
Bilancio Termico *Heat Balance*	**Potenza Termica Totale** *Total Thermal Power*	kW	225,1	254,5		294,7		
	Potenza Utile - *Useful Power*	kW	90,0	98,0		102,0		
	Pot. Raff.Acqua - *Water Cooling Power*	kW	61,7	68,3		80,2		
	Pot. Raff.Olio - *Oil Cooling Power*							
	Potenza allo Scarico - *Exhaust Power*	kW	59,6	73,3		93,3		
	Potenza all'intercooler	kW	8,7	9,0		10,9		
	Pot. di Irraggiamento - *Issued Power*	kW	5,1	5,9		8,3		
Gas di scarico *Exhaust Gas*	**Portata Gas di Scarico** *Exhaust Gas Flow*	kg/h	420	480		593		
	Contropress. Max allo scarico *Exhaust max Backpressure*	mbar	110	150		220		
Radiatore intercooler *Radiator intercooler*	**ΔP max Radiatore** - *Δ P max Radiator*	kPa	35					
	Temp. max intercooler out	°C	60° (a 25°C temperatura ambiente)					
	ΔP max Intercooler	kPa	10					
Avviamento Elettrico *Elect.Starter*	**Capacità batteria (Ah)** *Battery Capacity (Ah)*	110	**Potenza motorino avviamento (kW)** *Starter motor power (kW*			2,3		
	Corrente di spunto max CCA EN (A) *Max starting current CCA EN (A)*	880	**Tensione alimentazione motorino avviam. (V)** *Starter motor voltage (V*			12		
	Velocità avviamento (rpm) *Starting speed (rpm*	>120	**Coppia in avviamento (Nm)** *Starting torque (Nm*			/		
	Min.temp.avv.senza mezzi ausiliari(°C) *Extra Power Source free start (°F)*	-20 / up to -4	**Corrente all'avviamento a -15°C (A)** *Current when starting 5°F (A*			/		
	Caratteristche alternatore (W - A) *Alternator Output (W - A*	770 - 55	**Corrente in trascinamento a -15°C (A)** *Current when starting (during running) 5°F (A)*			/		

3 MAINTENANCE

3.1 STORAGE

WARNING:
ALL ENGINES WHICH REMAIN IDLE ARE SUBJECT TO RUST AND CORROSION OF MACHINED SURFACES WHICH ARE NOT PROTECTED BY PAINT. THE DEGREE OF CORROSION DEPENDS ON THE CLIMATIC CONDITIONS TO WHICH THE ENGINE IS EXPOSED. THE INDICATIONS BELOW ARE THEREFORE INTENDED ONLY AS A GENERAL ONLY TO PROTECTING THE ENGINE FROM CORROSION.

3.2 TEMPORARY PROTECTION

Prepare a container with a mixture of 10% **CASTROL Safecoat DW30X, Rustilo 181, Rustilo DWX31** and diesel fuel, disconnect the fuel feed and diesel fuel return lines from the fuel tank and connect them to this container.

Run the engine at low speed for a few minutes.

Run the engine for about 10 minutes at a speed between ½ and ¾ of nominal rpm so that the pipelines, nozzles, pumps and filters are completely filled with the protective mixture.

Stop the engine and wait for it to cool down.

Reconnect the pipelines to the fuel tank.

Completely refill the diesel fuel service tank.

Spray the specific protective oil for electrical contacts into the non-protected contact points.

For disposal of used oils contact an authorised disposal company.

3.3 PERMANENT PROTECTION (SIX MONTHS OR LONGER)

Drain the oil from the sump and refill with new oil.

Prepare a container with a 10% mixture of **CASTROL Safecoat DW30X, Rustilo 181, Rustilo DWX31** and diesel fuel, disconnect the fuel feed and diesel fuel return lines from the fuel tank and connect them to this container.

Run the engine at low speed for a few minutes.

Run the engine for about 10 minutes at a speed between ½ and ¾ of nominal rpm so that the pipelines, nozzles, pumps and filters are completely filled with the protective mixture.

Stop the engine and wait for it to cool down.

Reconnect the pipelines to the fuel tank.

Completely refill the service diesel fuel tank.

Loosen the trapezoidal belt driving the alternator.

Spray the specific protective oil for electrical contacts into the non-protected contact points.

3.4 THREAD-LOCKING COMPOUNDS AND/OR SEALANTS

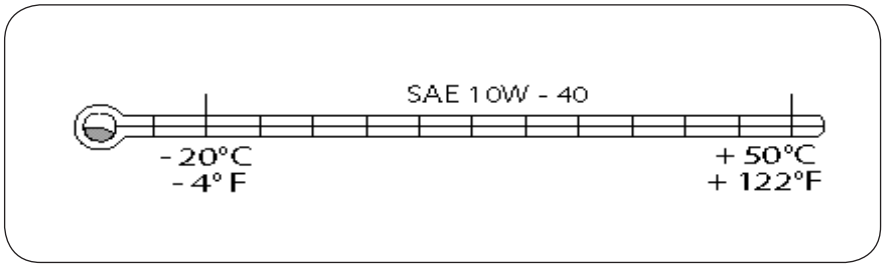
VM recommends use of the products as indicated below:

BRAND	FOR EUROPE	FOR USA	BRAND	FOR EUROPE	FOR USA
Loctite	222	222	Loctite	510	51
Loctite	573	510	Loctite	601	603
Loctite	986	586 - 620	Dow Corning	791	791

3.5 LUBRICANTS

Specifications

API CG-4, CH-4, CI-4
ACEA A3 / B4



NOTE DISPOSAL OF WASTE MATERIAL MUST BE CARRIED OUT IN CONFORMITY WITH ESTABLISHED LEGISLATION IN THE COUNTRY OF INSTALLATION.

IDENTIFICATION OF DANGERS

EFFECTS OF OVEREXPOSURE: No relevant effects expected.

FIRST AID MEASURES

CONTACT WITH EYES: Rinse immediately with copious amount of water and seek medical advice.

CONTACT WITH SKIN: Wash with soap and water.

INHALATION: No problems expected.

INGESTION: Not considered to be a problem. However, if more than 1/2 liter is swallowed or a feeling of discomfort is noted, administer 1 or 2 glasses of water and call a doctor or an ambulance. Do not induce vomit or administer substances orally to unconscious persons.

A. HOW TO SELECT LUBRICATING OIL

LUBRICANT SELECTION IN NORTH AMERICA

The selection of the proper lubricating oil is important to achieve the long and trouble-free service which Detroit Diesel engines are designed to provide.

The proper lubricating oil for all Detroit Diesel engines is selected based on SAE viscosity grade and API (American Petroleum Istitute) service designation.

Onlyoils licensed to display the American Petroleum Institute (API) symbol shown should be used. See Figure B.

Lubricants meeting these criteria have provided maximum enginelife when used in conjunction with specified oil drain and filter maintenance schedules.

API CF-4 or CG-4 oil may be used when CH-4 oils are not available; however, their use may require a reduction in oil drain interval depending upon the application and the fuel sulfur level.

At ambient temperatures below -20°C (-4°F) when sufficient starter speed cannot be achieved with SAE 15W-40 oils, the use of 5W-XX and 10W-XXoils, where XX is 30 or 40, is allowed to improve startability, provided they are API CH-4 and have demonstrated field performance in DDC engines. These oils must possess a HT/HS of 3.7 cp minimum.

Monograde oils should not be used in DDC D700 engines regardless of API Service Classification.

LUBRICANT REQUIREMENTS

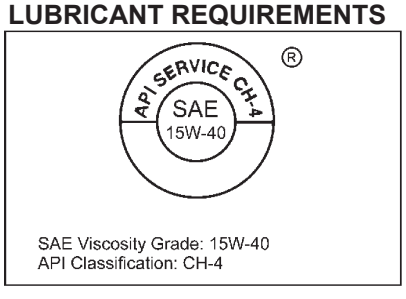


Figure B. API Lubricant Service Mark

DISPOSAL

The product can be incinerated, according to standard regulations.

Wear protective gloves when handling the product.

Operate according to standard regulations in the country of use and in relation to the characteristics of the product at the moment of disposal.

3.6 COOLANTS

Inhibited Ethylene Glycol

% VOL	TEMPERATURE		Density kg/dm³ a 15 °C
	FREEZING POINT	BOILING POINT	
10	- 4	101	1.014
20	- 10	102	1.028
30	- 17	104	1.042
40	- 27	106	1.056
50	- 40	109	1.070
60	- 47	114	1.084

To obtain the best operating conditions we recommend using a coolant mixture with a solution of 50% fresh demineralised water and 50% anti-rust anti-freeze liquid (inhibited ethylene glycol) that meets the reguirements of **ASTM standard D3306**.

Inhibited ethylene glycol is a special ethylene glycol liquid used for permanent type antifreeze mixture for use in internal combustion engine cooling circuits and for any other heat exchange circuit operating at low temperature.

The antifreeze also features efficient anti-rust and corrosion properties for cooling circuit metals. It does not contribute to temperature-related deterioration of the rubber hoses or couplings which connect the various circuit components.

HAZARDS

Ingestion of ethylene glycol can cause nausea, vomiting, stomach cramps, convulsions, pulmonary swelling, cardiopulmonary side-effects (metabolic acidosis), pneumonia and kidney defects which can be lethal.

The lethal single dose for humans is approximately 100 ml.

Inhalation over extended periods of time of high concentrations of vapours or mist is also harmful.

This product is harmful if swallowed.

FIRST AID

CONTACT WITH EYES

Bathe thoroughly with water immediately. If irritation occurs, seek medical attention.

CONTACT WITH SKIN

Wash with soap and water. Remove any contaminated clothing. Wash contaminated clothing before re-use.

INHALATION

Bring the person outside the exposed area. If irritation occurs in the respiratory system, or in the event of vertigo, nausea or unconsciousness, seek medical attention immediately. In the event of respiratory arrest, carry out artificial respiration immediately

INGESTION

Induce vomiting immediately with ipecac syrup followed by 1 or 2 glasses of water and seek medical assistance. If ipecac syrup is not available, induce vomiting under the supervision of medical personnel. Never induce vomiting or attempt to put substances into the mouth if the person is unconscious.

DISPOSAL

WASTE DISPOSAL:

Wear impermeable gloves and drain the cooling circuit into a suitable receptacle. Dispose of coolant in conformity with established legislation and in accordance with the type of product.

3.7 SOLVENTS

VM Motori prescribes the following products or equivalents.

3.7.1 Pickling diluent

SUBSTANCE

CHEMICAL COMPOSITION
Mixture of aromatic hydrocarbons, ketones, dichloropropane, isobutyl alcohol.
COMMERCIAL NAME
Diluente Decapaggio 15
FORMULA ---
KEMLER NUMBER 33
ONU NUMBER 1203

CHARACTERISTICS - INGREDIENTS

Acetone mixture	15% - 25%
Isopropyl alcohol mixture	10% - 20% Xn R 20
Dichloropropane mixture	15% - 25% Xn R 20
Totuol mixture	35% - 45% Xn R 20

COMPONENT IDENTIFICATION NUMBERS:

	n° CEE	n° CAS
Acetone	606-001-00-8	67-64-1
Isopropyl alcohol	603-003-00-0	67-63-0
Dichloropropane	602-020-00-0	78-87-5
Totuol	601-021-00-3	108-88-3

HAZARDS
Highly inflammable.
Harmful if inhaled and in contact with skin.
Injurious to health if ingested.
R 11 - Highly inflammable
R 20 - Harmful if inhaled.

Skin	irritant
Eyes	irritant
Ingestion	harmful
Inhalation	harmful

FIRST AID

CONTACT WITH SKIN
Remove contaminated clothing. Wash affected parts of the body with cold or tepid water immediately. Use neutral soap if available.

CONTACT WITH EYES
Rinse immediately with copious amounts of fresh water for at least 15 minutes. Seek medical advice.

INHALATION

Take patient away from the sources of fumes and keep outside in fresh air. Apply artificial respiration if the patient stops breathing.

Seek medical advice.

INGESTION

Rinse out mouth with water without swallowing. Do not induce vomiting. Seek medical advice.

EXPOSURE CONTROL - PERSONAL PROTECTION

Maximum exposure limit LV mg/mc. 491

According to DPR n° 303 19/03/65 medical examinations are required every three months.

RESPIRATORY PROTECTION

Full mask facepiece respirator with filter for highly concentrated organic vapor.

HAND PROTECTION

Solvent-resistant gloves.

EYE PROTECTION

Goggles providing splash and spray protection.

SKIN PROTECTION

Overalls and apron.

Do not eat, drink or smoke in areas where solvents are used.

3.7.2 Trichloroethane

CHEMICAL NAME

1,1,1 - Trichloroethane

Synonyms: Tri-Ethane 377 - Tri-Ethane 348

EEC No.	602-013-00-2
Einecs No.	200-766
Cas No.	71-55-6

CONTAINS:

< 5% Polymer stabilizer (the product does not contain significant concentrations of substances classified as hazardous for health).

HAZARDS

MAJOR HAZARDS

Harmful if inhaled

SPECIFIC HAZARDS

A concentration significantly higher than that permitted in the work area could cause damage to the central nervous system and collapse.

FIRST AID

GENERAL INFORMATION

Show this safety sheet to the doctor in charge.

Avoid contact with solvents and adopt protective measures whenever possible in accordance with general standards of industrial hygiene.

INHALATION

Take patient outside in fresh air. Administer oxygen.

CONTACT WITH SKIN

Remove all contaminated clothing, shoes, etc.. Wash immediately with plenty of water and soap. Seek medical advice.

CONTACT WITH EYES

Rinse thoroughly with copious amounts of water for at least 15 minutes while keeping the patient's eyes wide open.

Seek medical advice.

INGESTION

Drink plenty of water. Do not induce vomiting.

Seek immediate medical advice.

Do not administer any substances whatsoever if the patient loses consciousness.

PROTECTION WHILE ADMINISTERING FIRST AID

Wear protective clothing to avoid contact with skin. Solvents can remove natural oils from skin.

EXPOSURE CONTROL - PERSONAL PROTECTION

WORK AREA DESIGN
Ensure that the work area is adequately ventilated, particularly if the area is enclosed.

CONTROL PARAMETERS
OSHA PEL 8 hr - TWA = 350 ppm
OSHA STEL 15 min = 450 ppm

PERSONAL PROTECTION

RESPIRATORY PROTECTION
If the work area is insufficiently ventilated, use a suitable respirator.
For emergency rescue operations and when working in storage tanks, use self-contained breathing apparatus.

HAND PROTECTION
Solvent-resistent gloves.

EYE PROTECTION
Safety goggles/faceshield visor

SKIN AND BODY PROTECTION
Protective clothing, solvent-resistent apron.
Remove and wash contaminated gloves and clothing before re-use.

HYGIENE
Avoid contact with eyes, skin and clothing.
Do not eat, drink or smoke during use.

3.8 FUEL (EUROPEAN MARKET)

Use diesel fuel conforming to the specifications given below.

When filling the fuel tank, use a funnel fitted with a metal mesh to filter out any solid impurities which could otherwise block the injector nozzles.

Do not use diesel fuel mixed with water and/or other substances.

THE ENGINE HAS BEEN DESIGNED TO BE POWERED BY STANDARD FUELS AVAILABLE ON THE EUROPEAN MARKET (ACCORDING TO SPECIFICATIONS DIN EN 590). IF IT IS TO BE POWERED BY BIODIESEL FUELS (ACCORDING TO SPECIFICATIONS UNI EN 14214), IT CAN BE MIXED, UP TO 5%, WITH FUEL AVAILABLE ON THE EUROPEAN MARKET (ACCORDING TO REGULATION DIN EN 590).

WARNING:
THE USE OF DIESEL FUEL WHICH DOES NOT MEET THE ABOVE STANDARDS WILL CAUSE DAMAGE TO THE FUEL INJECTION SYSTEM AND CONSEQUENTLY TO THE ENGINE ITSELF AND WILL INVALIDATE THE WARRANTY.

3.8.1 Fuel (North American market)

Use diesel fuel conforming to the specifications given below.

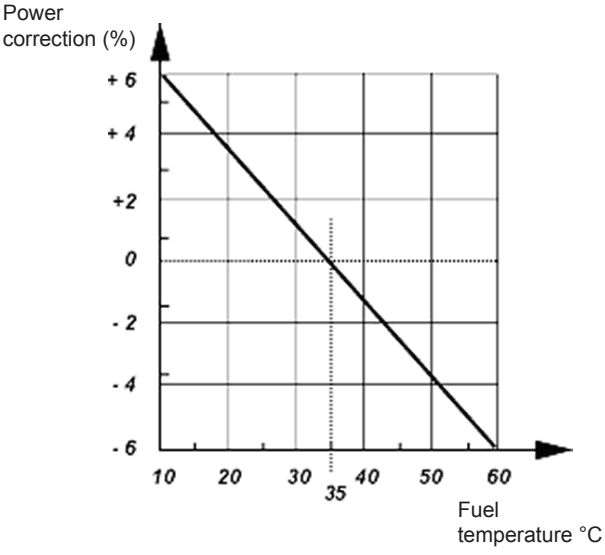
When filling the fuel tank, use a funnel fitted with a metal mesh to filter out any solid impurities which could otherwise block the injector nozzles.

Do not use diesel fuel mixed with water and/or other substances.

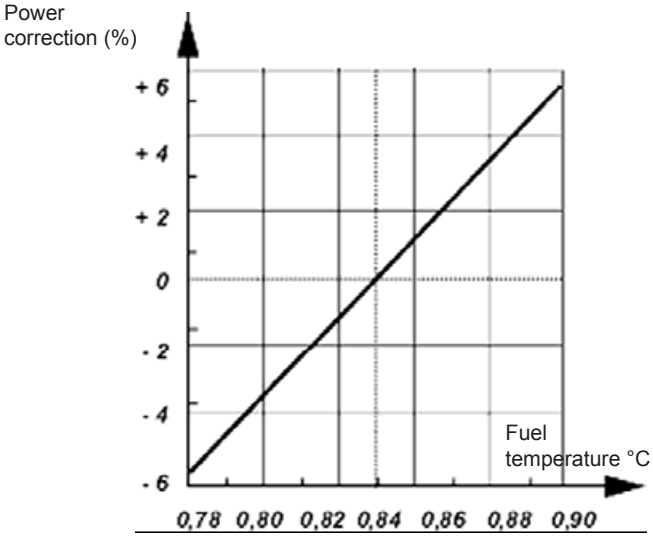
THE ENGINE HAS BEEN DESIGNED TO BE POWERED BY STANDARD FUELS AVAILABLE ON THE EUROPEAN MARKET (ACCORDING TO SPECIFICATIONS DIN EN 590). IF IT IS TO BE POWERED BY BIODIESEL FUELS (ACCORDING TO SPECIFICATIONS UNI EN 14214), IT CAN BE MIXED, UP TO 5%, WITH FUEL AVAILABLE ON THE EUROPEAN MARKET (ACCORDING TO REGULATION DIN EN 590).

WARNING:
THE USE OF DIESEL FUEL WHICH DOES NOT MEET THE ABOVE STANDARDS WILL CAUSE DAMAGE TO THE FUEL INJECTION SYSTEM AND CONSEQUENTLY TO THE ENGINE ITSELF AND WILL INVALIDATE THE WARRANTY.

Effect of fuel temperature on engine power.
The normal temperature is +35 (95) °C (°F) (0%).



Effect of fuel temperature on engine power.
The normal temperature is +38 (100) °C (°F) (0%).



3.9 POWER ADJUSTMENT FOR VARIATION OF FUEL PROPERTIES (EUROPEAN MARKET)

FUEL PROPERTIES - POWER OUTPUT CORRECTION ACCORDING TO THE PROPERTIES OF THE FUEL USED.

The specified power output ratings are valid for fuel with the following properties:

Energy value 42 700 kJ/kg
Temperature before fuel supply pump: 35 °C
Density 0.84 kg/dm^3 at 15 °C

If the fuel deviates from these values, consult the graph below to determine the power correction factor (in %). Apply these factors to calculate engine power.

3.9.1 Power Adjustment for varation of fuel properties (North American market)

FUEL PROPERTIES - POWER OUTPUT CORRECTION ACCORDING TO THE PROPERTIES OF THE FUEL USED.

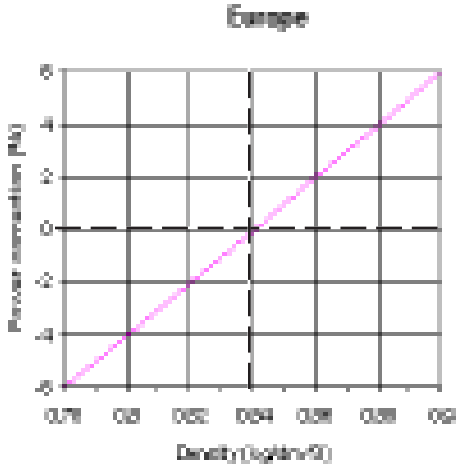
The specified power output ratings are valid for fuel with the following properties:

Temperature before fuel supply pump: 35 °C

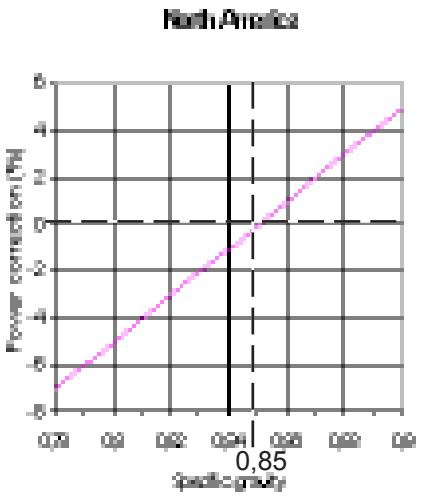
Density 0.85 kg/dm^3 at 15 °C

If the fuel deviates from these values, consult the graph below to determine the power correction factor (in %). Apply these factors to calculate engine power.

Effect of fuel density on engine power.
Normal value 0.84 kg/dm^3 at +15 (59) °C (°F) (0%).



Effect of fuel density on engine power.
Normal value 0.85 kg/dm^3 at +15 (59) °C (°F) (0%).



3.10 POWER ADJUSTMENT FOR VARIATION OF COMBUSTION AIR PROPERTIES (EUROPEAN MARKET)

AIR PROPERTIES - POWER OUTPUT CORRECTION ACCORDING TO AIR PROPERTIES

The specified power ratings are valid for air with following properties (as per ISO 3046):

Air pressure	100kPa (1000 mbar)
Air temperature	25 °C
Humidity	30%, normally aspirated engines only (humidity is eliminated in the heat of turbochargers).

If the air deviates from these values, consult the graph below to determine the power correction factor.

Apply these factors to calculate the engine power.

Note: if the engine is used at air pressures (e.g. high altitudes) and/or temperatures exceeding the above standard values, the engine will have to be derated in order to compensate for the lower air pressure.

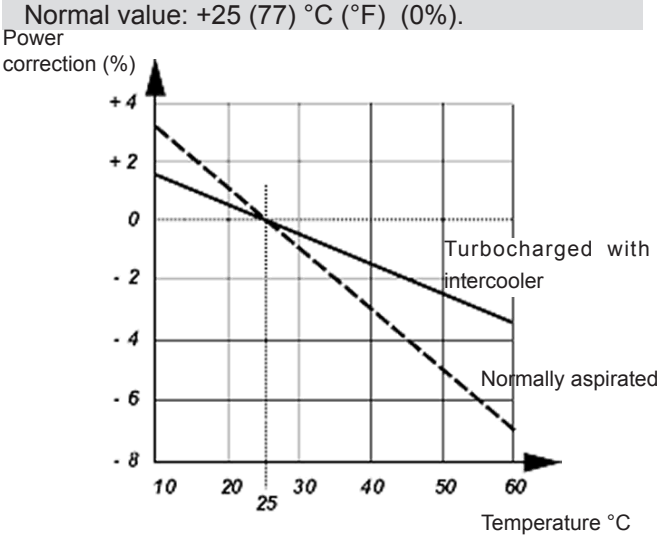
Reduced air density will negatively affect engine performance.

Incomplete combustion will result in black exhaust fumes and increased fuel consumption. There is also a risk of overrevving and overheating of the turbocharger.

To avoid these problems, the engine must be derated in accordance with “Derating of engine”.

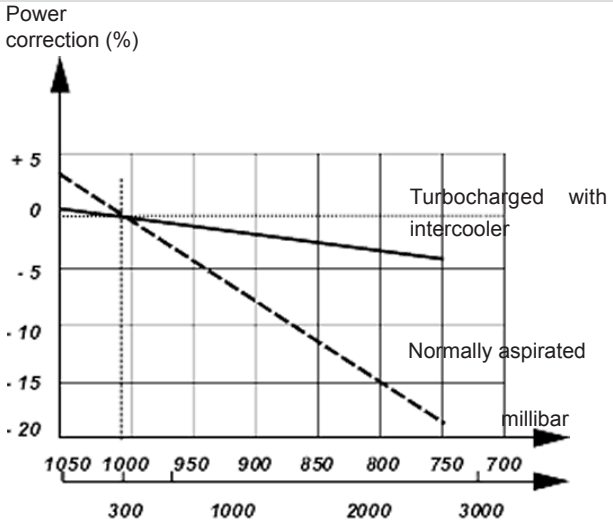
Effect of intake air temperature on engine performance

Normal value: +25 (77) °C (°F) (0%).



Effect of intake air pressure on engine power

Normal value: 100 kPa (1000 mbar) (0%)



m = meters above sea level

3.10.1 Power adjustment for variation of combustion air properties (North American market)

AIR PROPERTIES - POWER OUTPUT CORRECTION ACCORDING TO AIR PROPERTIES

The specified power ratings are valid for air with following properties (as per SAE J1995):

Air pressure 99kPa (990 mbar)
Air temperature 25 °C

If the air deviates from these values, consult the graph below to determine the power correction factor.

Apply these factors to calculate the engine power.

Note: if the engine is used at air pressures (e.g. high altitudes) and/or temperatures exceeding the above standard values, the engine will have to be derated in order to compensate for the lower air pressure.

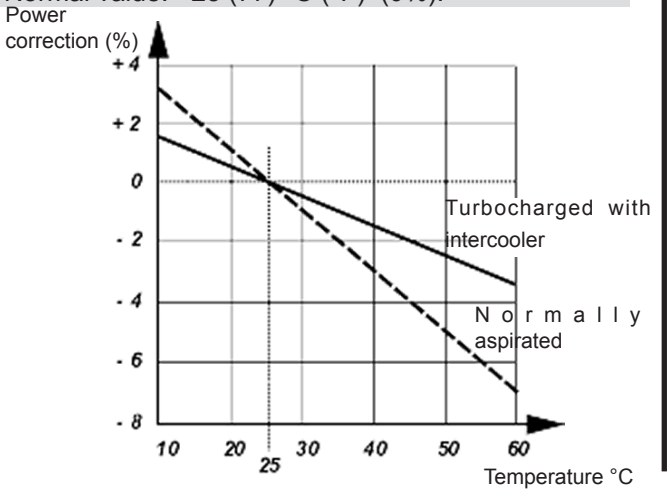
Reduced air density will negatively affect engine performance.

Incomplete combustion will result in black exhaust fumes and increased fuel consumption. There is also a risk of overrevving and overheating of the turbocharger.

To avoid these problems, the engine must be derated in accordance with “Derating of engine”.

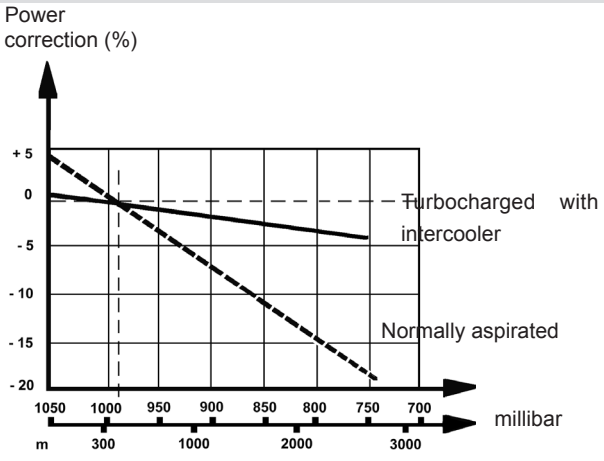
Effect of intake air temperature on engine performance

Normal value: +25 (77) °C (°F) (0%).



Effect of intake air pressure on engine power

Normal value: 99 kPa (990 mbar) (0%)



m = meters above sea level

3.11 MAINTENANCE

CARRY OUT MAINTENANCE MORE FREQUENTLY WHEN THE ENGINE IS USED IN HARSH CONDITIONS (FREQUENT STOPS AND STARTS, DUSTY ENVIRONMENTS, LONG HARSH WINTERS, OPERATION UNDER NO-LOAD CONDITIONS).

IT IS STRICTLY FORBIDDEN TO CLEAN THE ENGINE WITH COMPRESSED AIR.

ADHERE SCRUPULOUSLY TO MAINTENANCE INTERVALS REPORTED BELOW.

NOTE: IF AN HOUR COUNTER IS NOT AVAILABLE, THE FREQUENCY OF THE INTERVENTIONS SHOULD BE CALCULATED ON THE BASIS OF A CALENDAR DAY: ONE CALENDAR DAY CORRESPONDS TO 12 HOURS OF OPERATION.

EVERY 10 HOURS OR EVERY DAY

CHECK Engine oil level (see chapter 9 "Running tests and adjustments" for oil capacity)

CHECK Coolant mixture level (see chapter 9 "Running tests and adjustments" for coolant capacity)
(if necessary it must be topped up with identical mixture).
(Avoid to refill with different refrigerant mixture different from the one which is already in the circuit).

CLEANING Dry air filter
(to carry out the maintenance operation in function of the use conditions).

CLEANING Radiator
(the radiator must be frequently cleaned using a soft brush even daily if necessary).

AFTER 50 HOURS

CHANGE Oil filter cartridge *

CHECK Vee belt

CHECK Cooling circuit

* **IN CASE OIL FILTER CHANGE, IT IS RECOMMENDED TO CHANGE THE ENGINE OIL** (see chapter 9 "Running tests and adjustments" for oil capacity)

EVERY 150 HOURS

CLEANING Fuel pump filter

CHECK Vee belt

AFTER 150 ÷ 200 HOURS

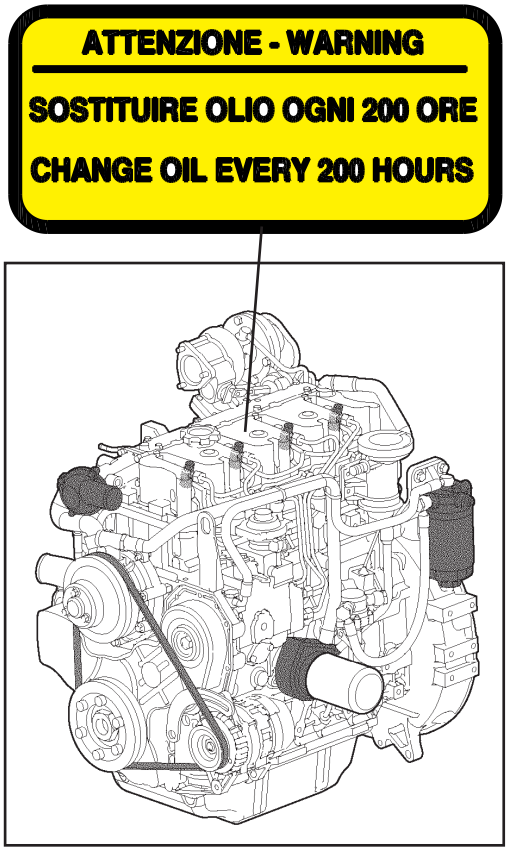
CHECK Tighten head bolts
(only for engines with single gasket head for single head)

EVERY 200 HOURS

(ONLY FOR D754 SE3_TE3_IE3 WITH STANDARD OIL PAN AND DECAL ON ROCKER ARMS COVER)

CHANGE Engine oil (see chapter 9 "Running tests and adjustments" for oil capacity)

Change the engine oil on D754 SE3_TE3_IE3 if these models are equipped with a standard pan oil: these models are recognizable from a decal-label on rocker arms cover.



EVERY 300 HOURS

TIGHTEN Fuel line union screws and nuts

CHANGE Engine oil (see chapter 9 "Running tests and adjustments" for oil capacity)
(must be changed at least once every 12 months in any event).

OWING TO THE FACT THAT THE ENGINE WORKS IN HARSCH CONDITIONS SUCH AS DUSTY ENVIRONMENTS AND HEAVY LOADS, MAKE SURE TO CHANGE THE ENGINE OIL EVERY 150 HOURS

CHANGE Oil filter cartridge

CHANGE Fuel filter cartridge
(the fuel filter cartridge must be renewed at least once every 12 months, regardless of the hours of duty).

EVERY 500 HOURS

CHECK Injectors

CHECK Glowplugs (when fitted)

CHANGE Air filter cartridge

CHANGE Coolant mixture (must be performed at least once every 24 months in any event).
(see chapter 9 "Running tests and adjustments" for coolant capacity)

EVERY 1000 HOURS

CLEANING Fuel tank

CHANGE Alternator drive belt

EVERY 2000 HOURS

CHECK Starter motor brushes

CHECK Turbocharger

AFTER 4000 HOURS

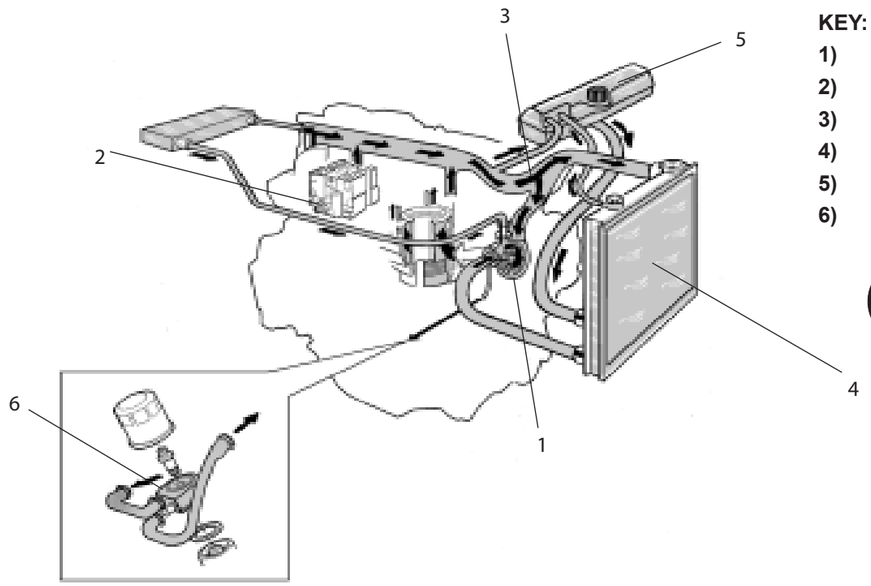
OVERHAUL Partial engine

AFTER 8000 HOURS

OVERHAUL Major engine

4 SYSTEM DIAGRAMS

SOMMARIO



KEY:

1) Water pump
2) Max. water temperature indicator
3) Thermostat valve
4) Radiator
5) Expansion tank
6) Water-cooled oil cooler

WARNING! OIL, FUEL, COOLANT MIXTURES, ETC. ARE HARMFUL IF INGESTED.

Fig. 4.1

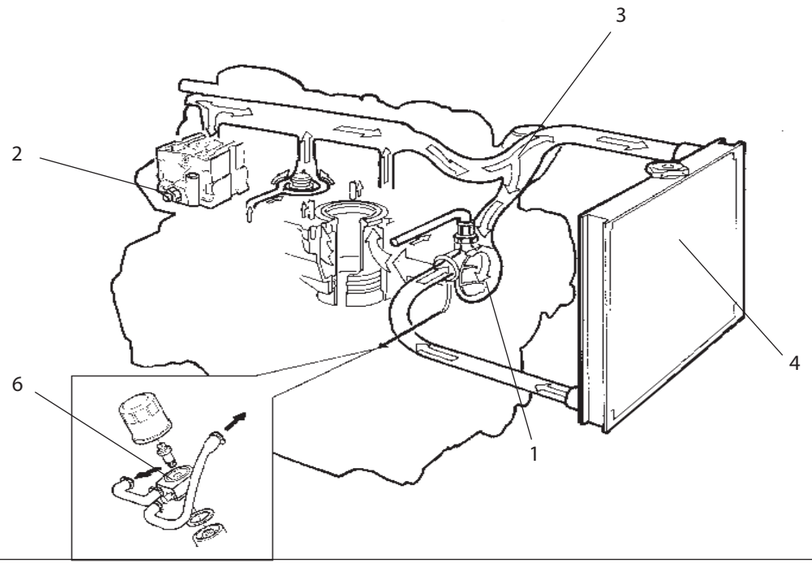
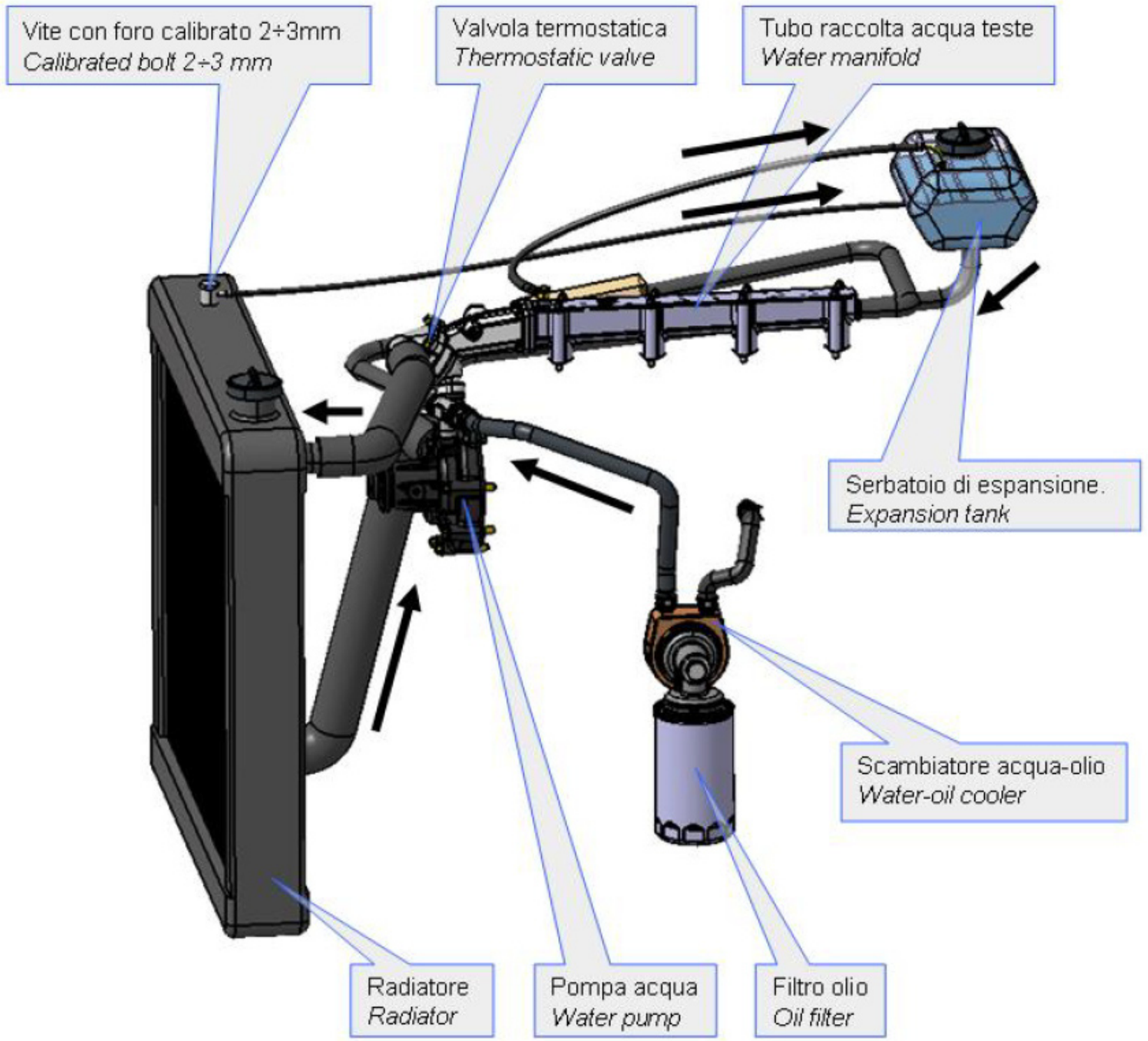
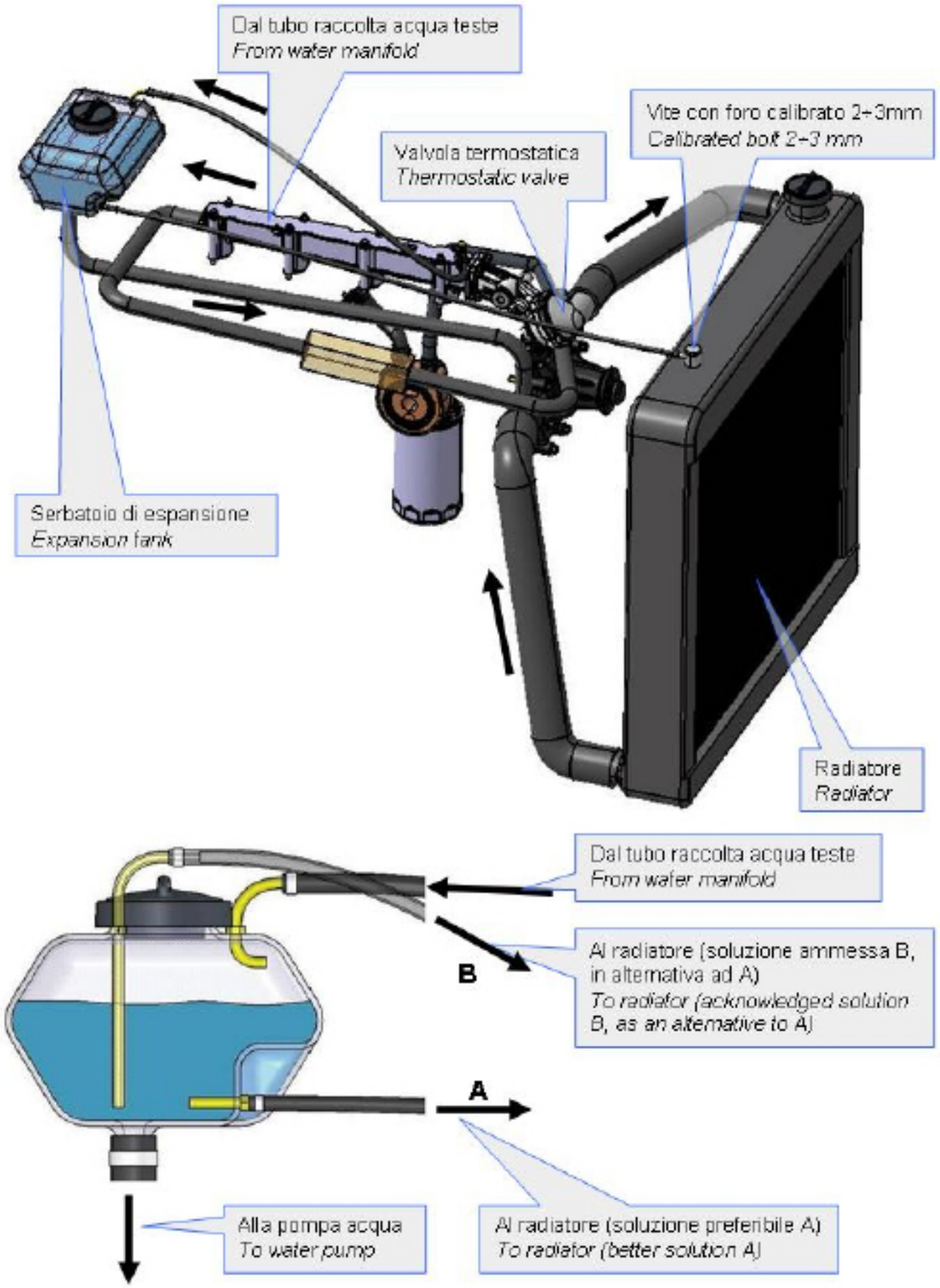
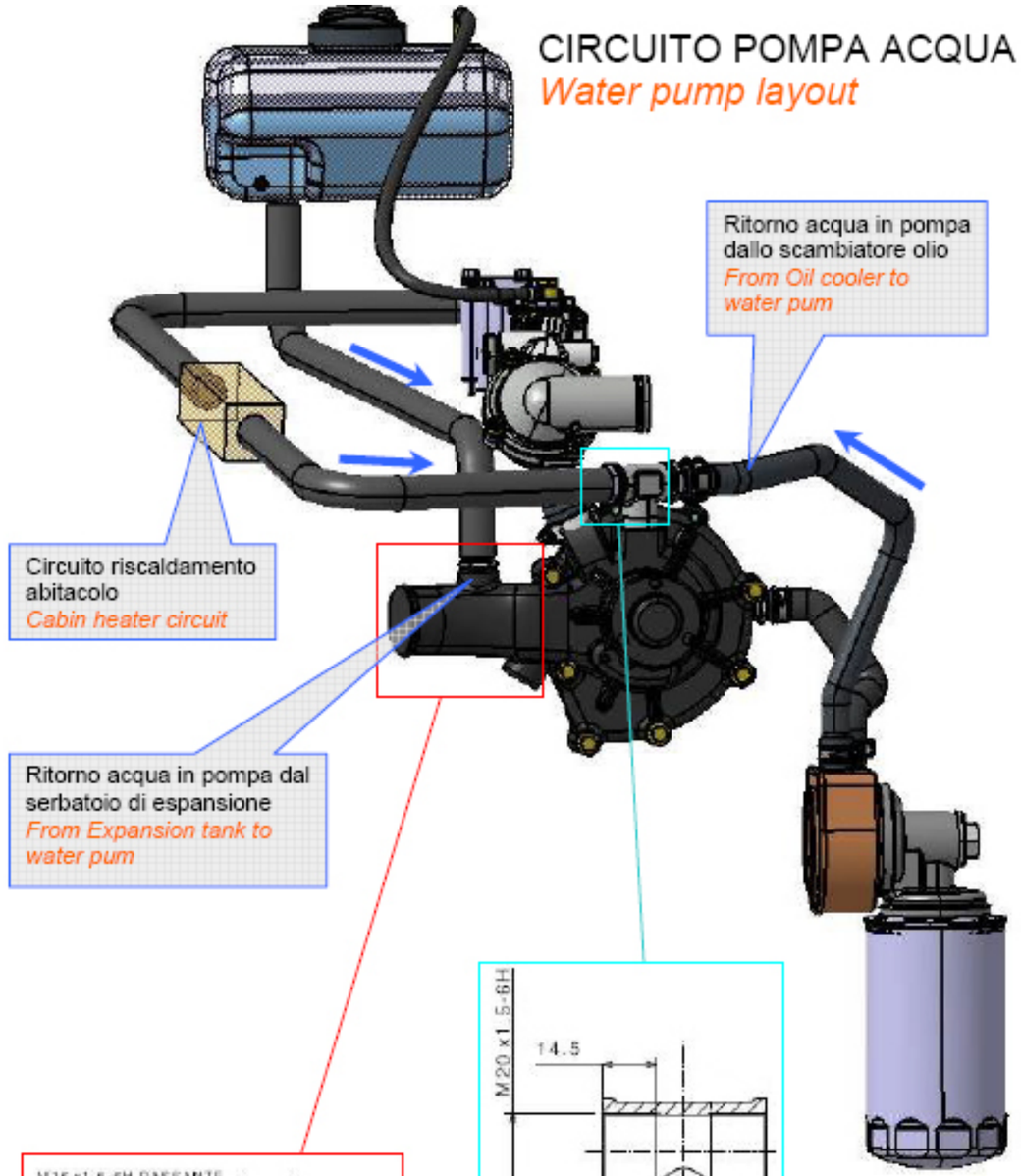


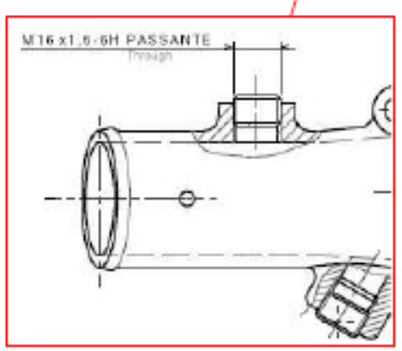
Fig. 4.1A


Vite con foro calibrato 2÷3mm
Calibrated bolt 2÷3 mm
Valvola termostatica
Thermostatic valve
Tubo raccolta acqua teste
Water manifold
Serbatoio di espansione.
Expansion tank
Scambiatore acqua-olio
Water-oil cooler
Radiatore
Radiator
Pompa acqua
Water pump
Filtro olio
Oil filter



CIRCUITO POMPA ACQUA
Water pump layout





4.2 LUBRICATION SYSTEM

KEY:

1) Oil pick-up pipe,
2) Pressure relief valve,
3) Oil pump,
4) Water-cooled oil cooler,
5) Filter cartridge,
6) Crankshaft main bearings,
7) Oil jet valve,
8) Camshaft bearing/s,
9) Rocker arms

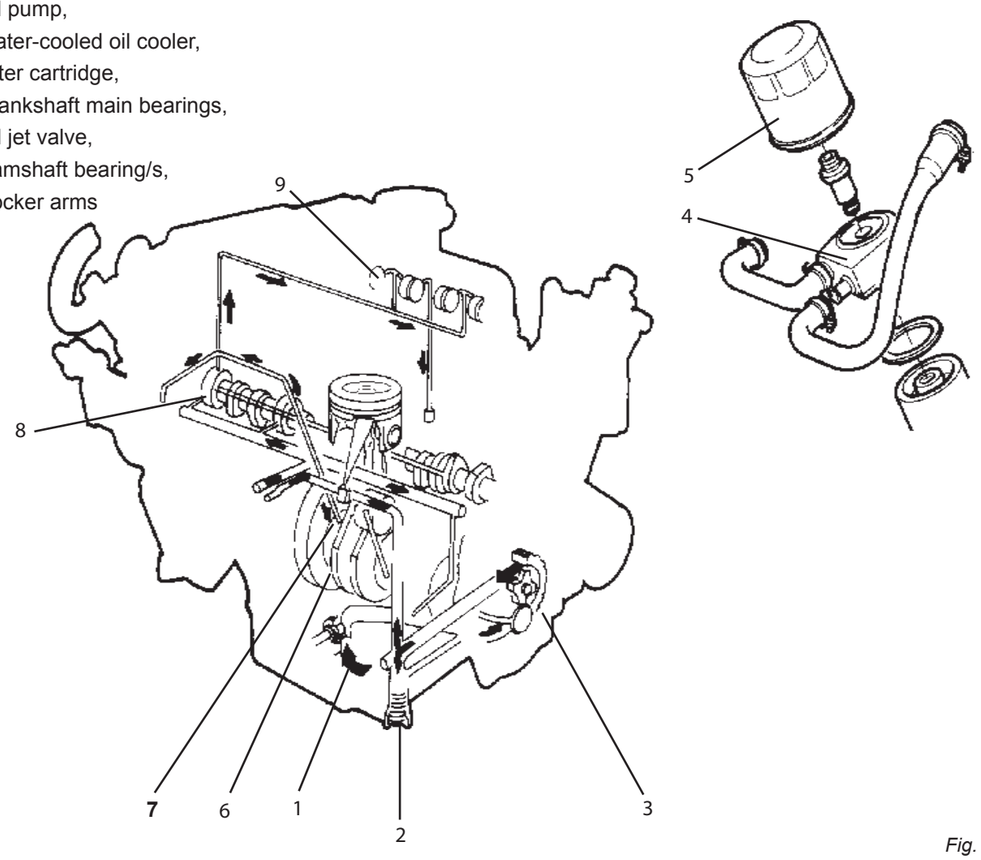


Fig. 4.2

The lubricating oil is forced around the system by a rotor pump and filtered before being sent to the various points requiring lubrication. The oil from the pump is sent through a pressure regulating valve to the filter and then to the crankshaft main bearings, and through external pipes to the rocker arms and the turbocharger.

WARNING! OIL, FUEL, COOLANT MIXTURES, ETC. ARE HARMFUL IF INGESTED.

4.3 FUEL CIRCUIT

4.3.1 Internal injection pump for each cylinder (D703 series)

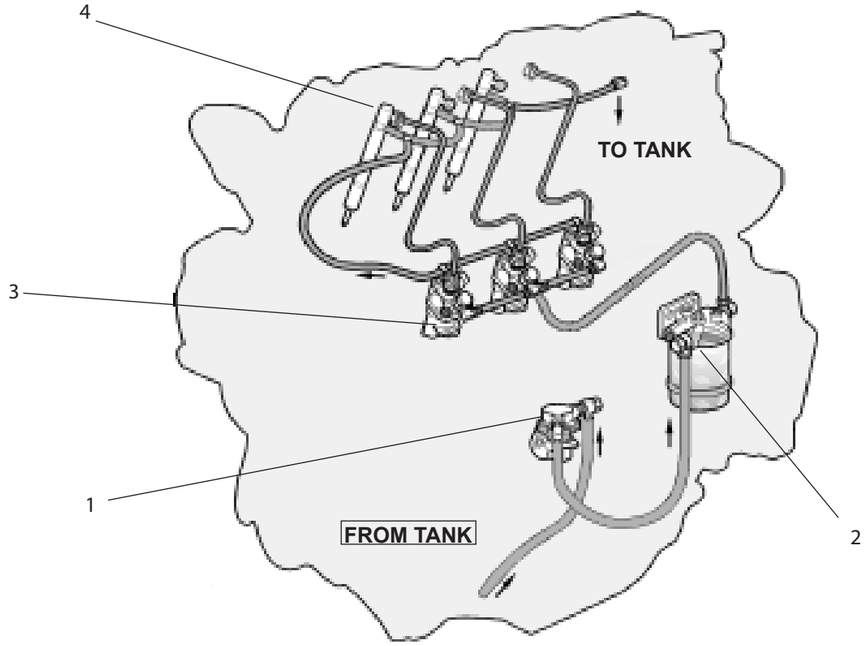


Fig. 4.3

KEY:

1) Fuel supply pump
2) Fuel filter
3) Injection pump
4) Injector

WARNING! OIL, FUEL, COOLANT MIXTURES, ETC. ARE HARMFUL IF INGESTED.

4.3.2 Rotary injection pump STANADYNE (D753 - D704/6 L-LT-LE-LTE)

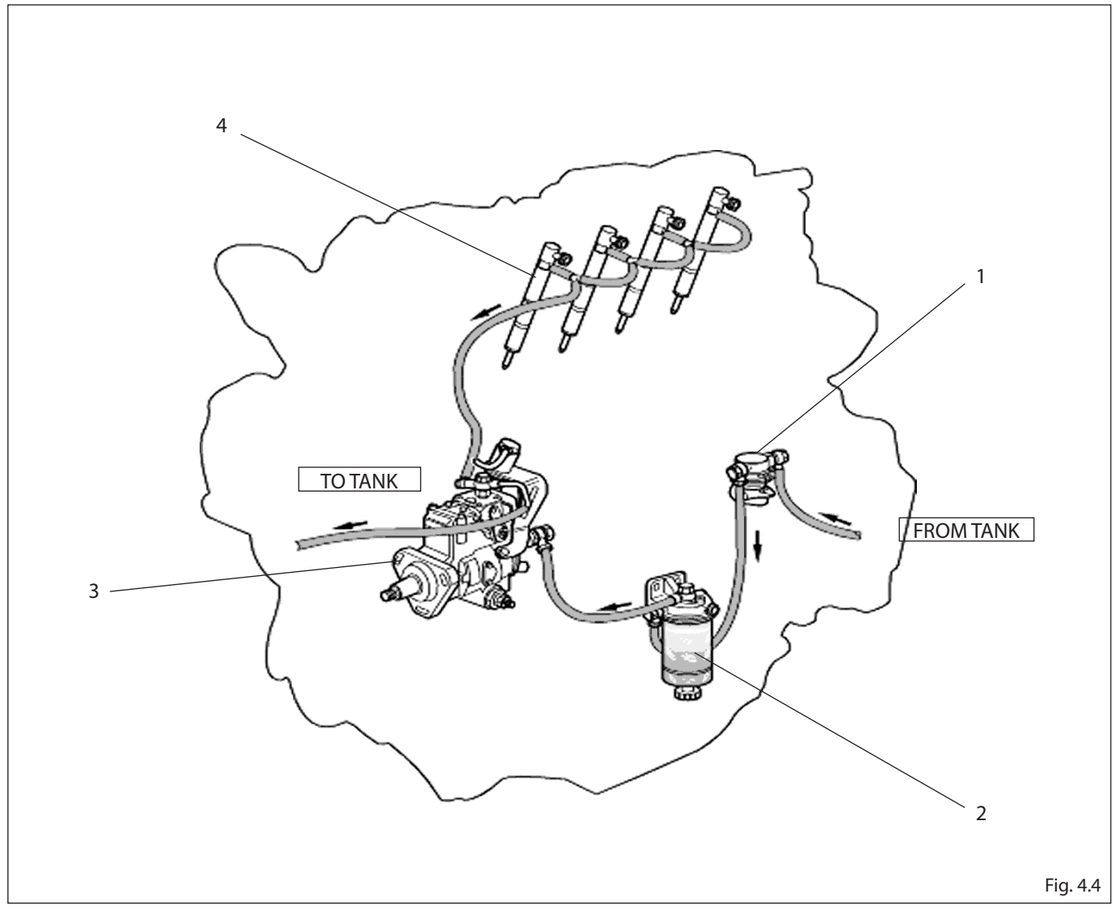


Fig. 4.4

KEY:

1) Fuel supply pump
2) Fuel filter
3) Injection pump
4) Injector

WARNING! OIL, FUEL, COOLANT MIXTURES, ETC. ARE HARMFUL IF INGESTED.

4.3.3 Rotary injection pump BOSCH (D704/6 L-LT-LE-LTE)

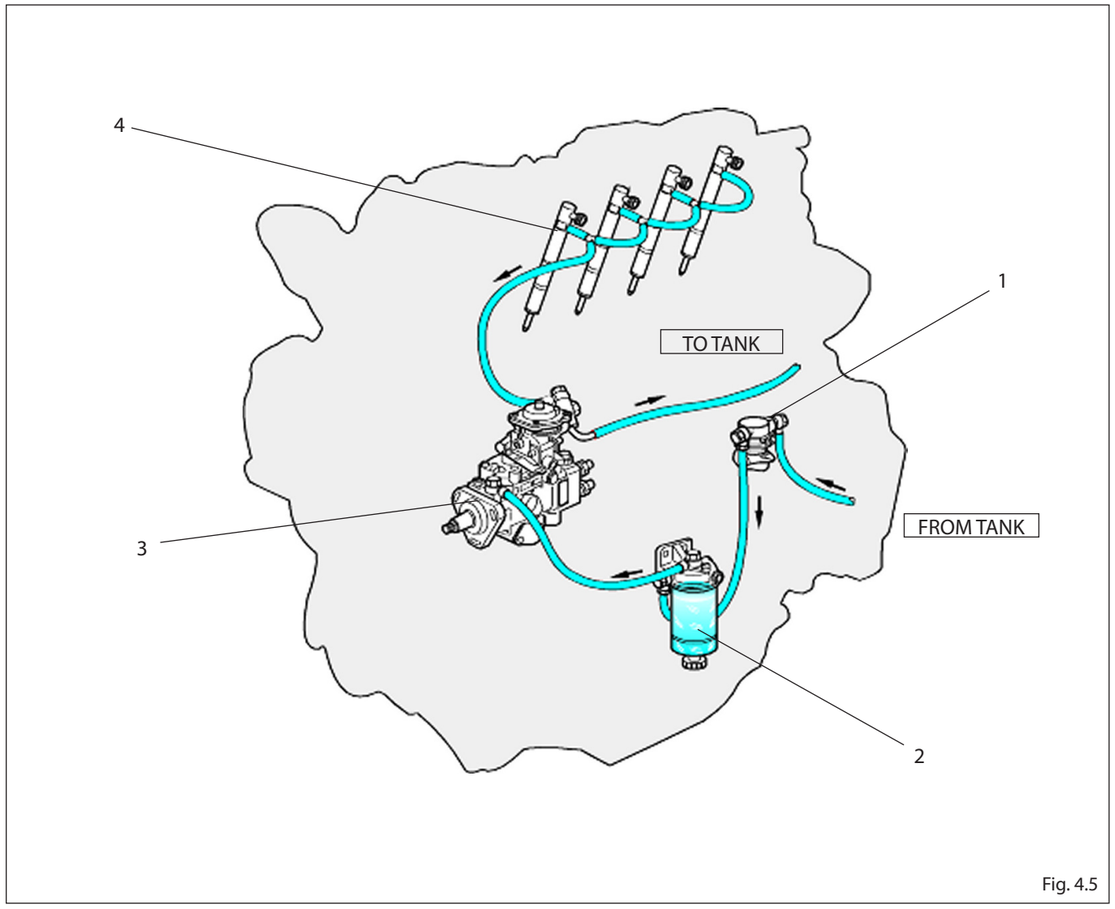


Fig. 4.5

KEY:

1) Fuel supply pump
2) Fuel filter
3) Injection pump
4) Injector

WARNING! OIL, FUEL, COOLANT MIXTURES, ETC. ARE HARMFUL IF INGESTED.

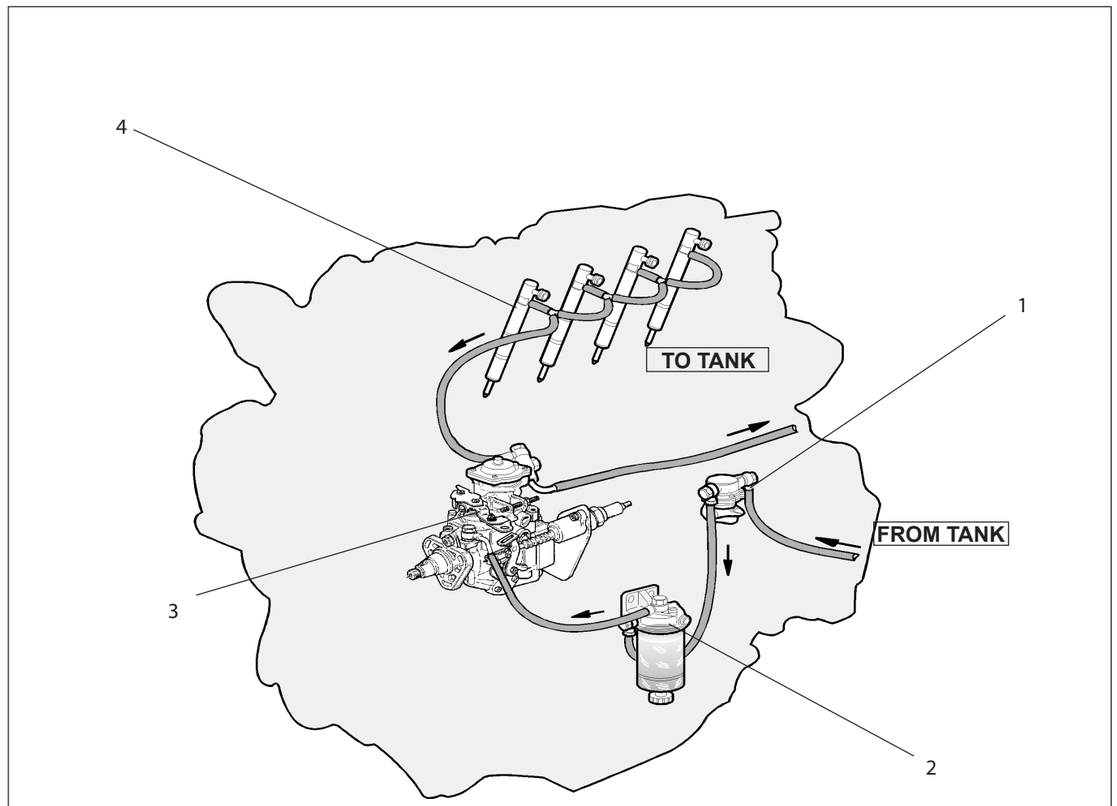


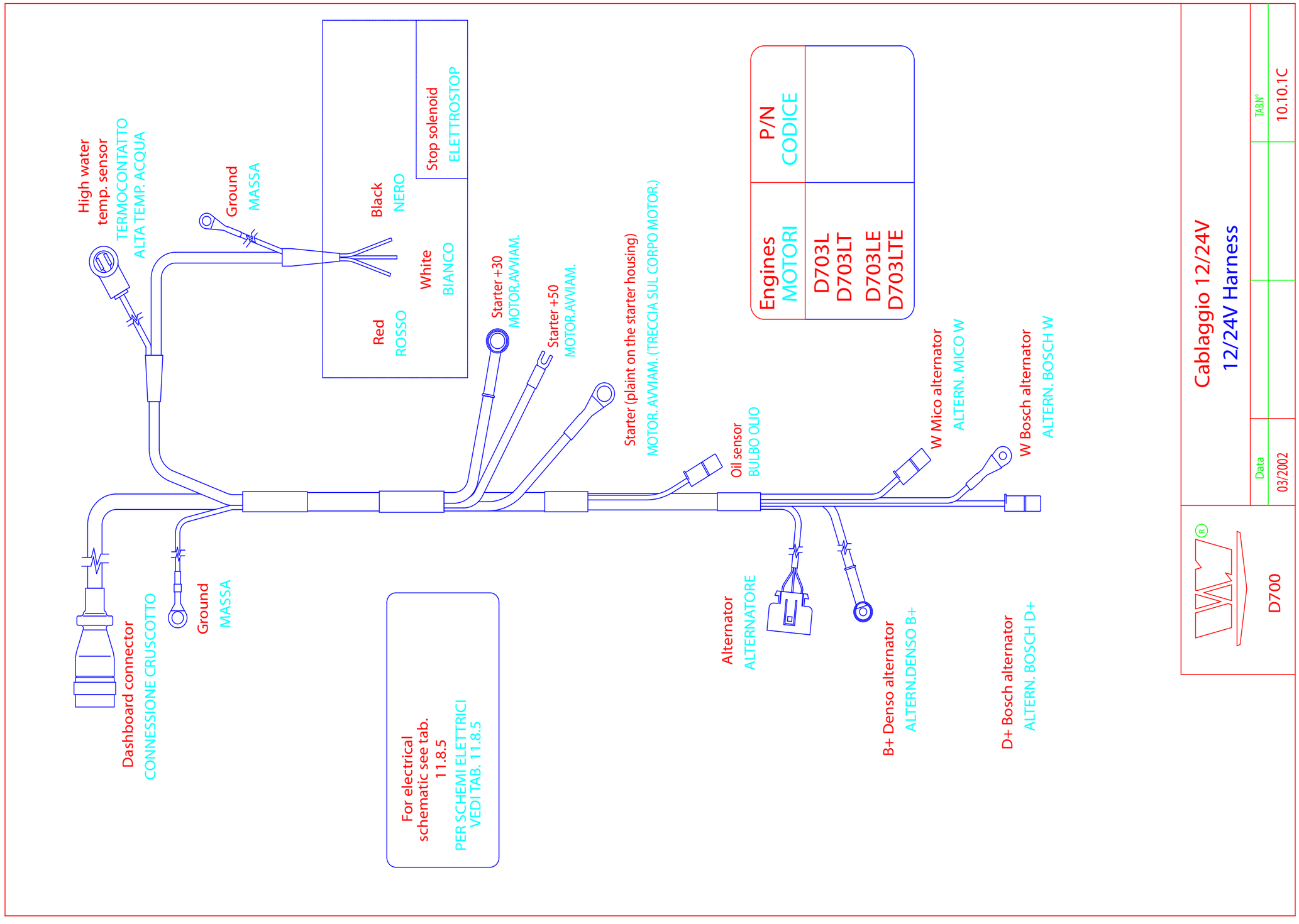
Fig. 4.6

KEY:

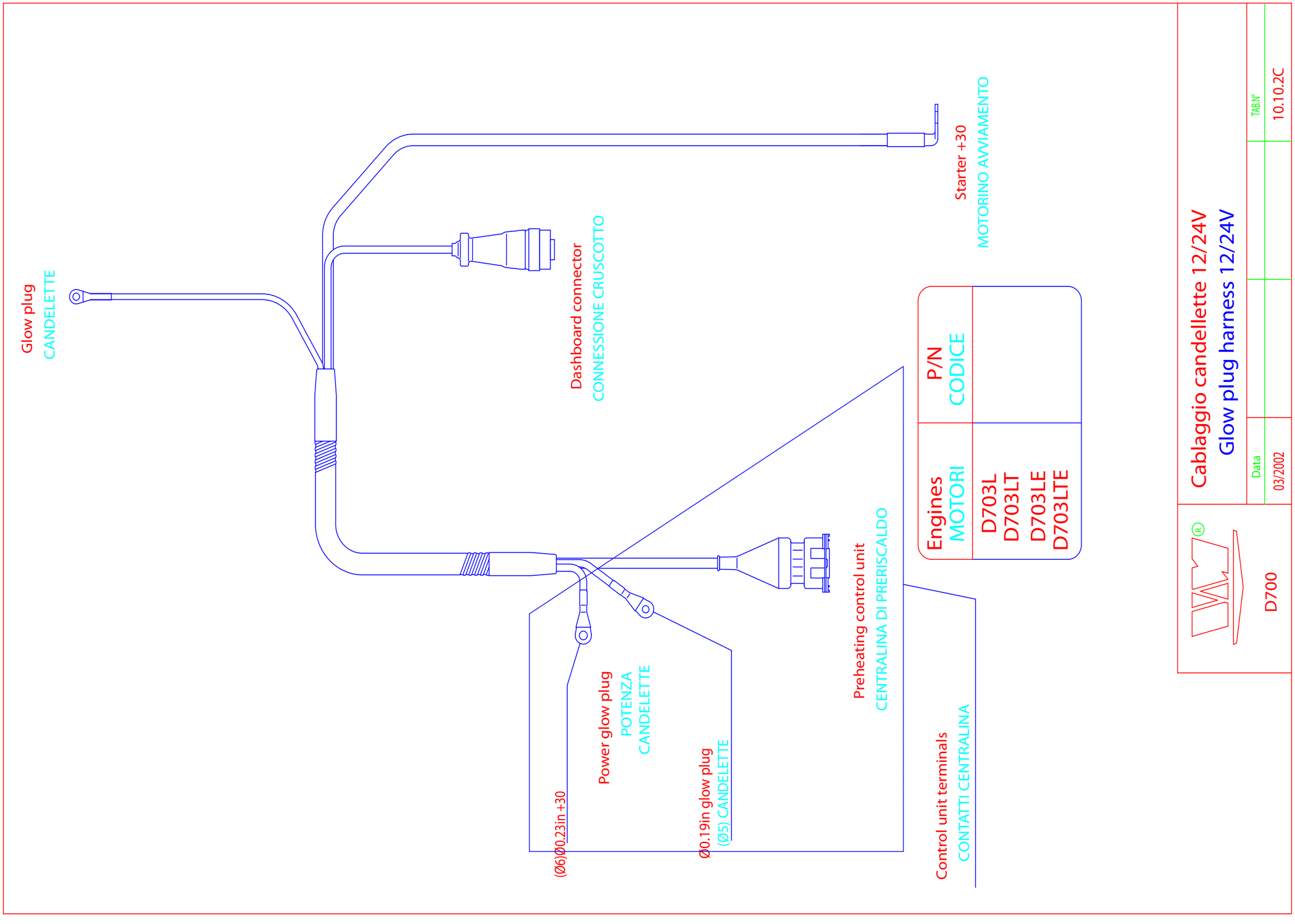
1) Fuel supply pump
2) Fuel filter
3) Injection pump
4) Injector

WARNING! OIL, FUEL, COOLANT MIXTURES, ETC. ARE HARMFUL IF INGESTED.

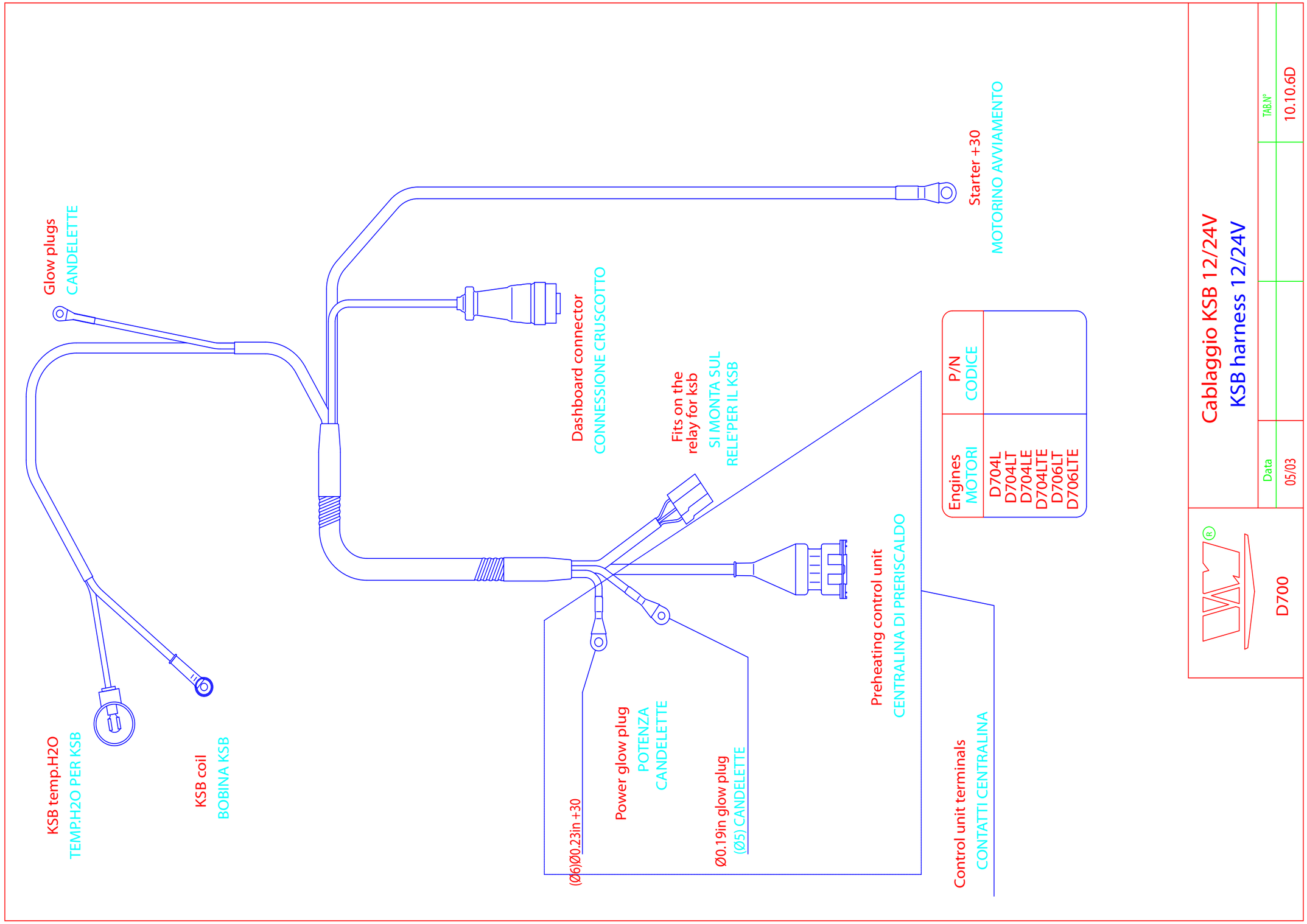
4.4.1 Engine harness 12-24 V D703L/LE/LT/LTE



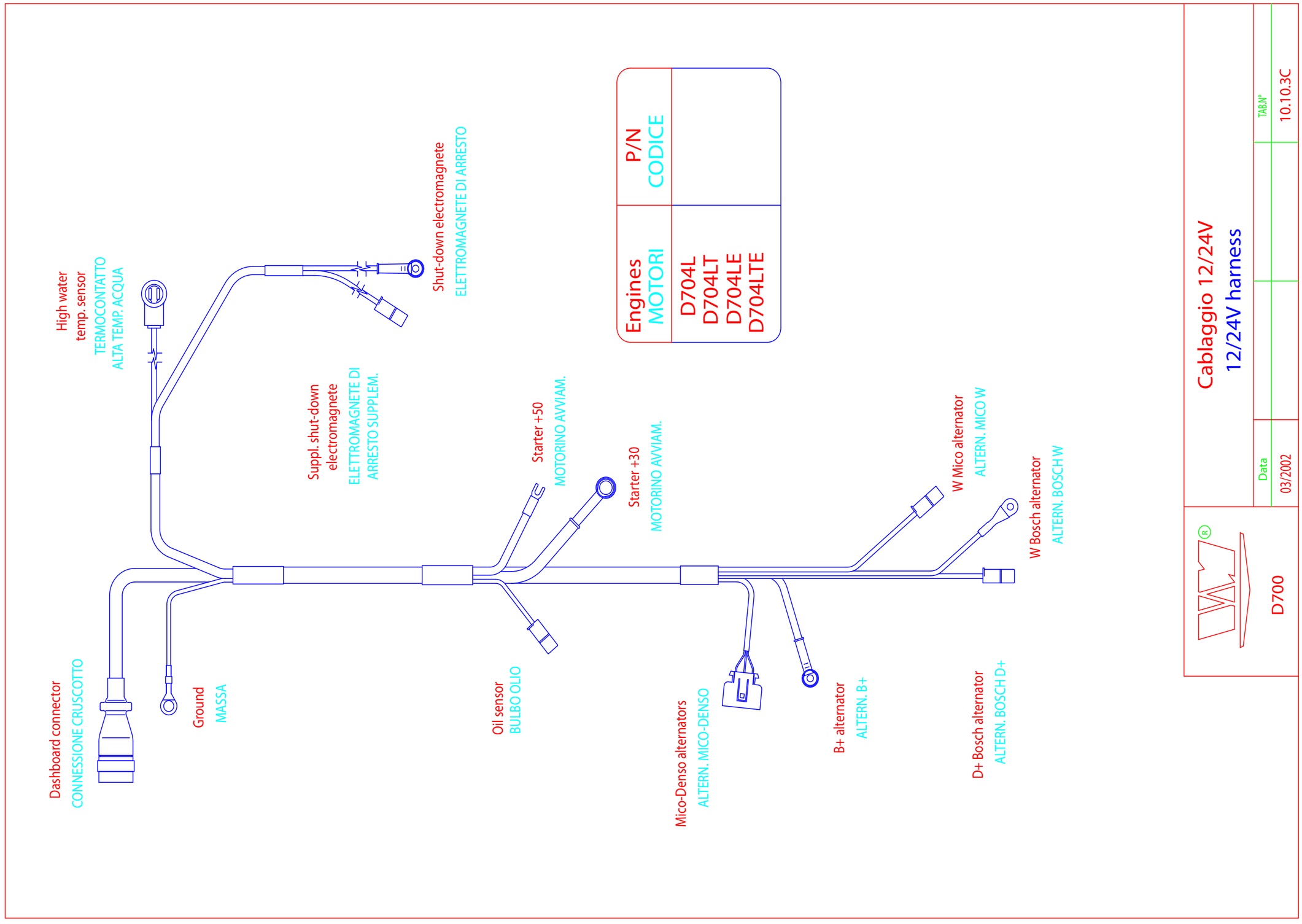
4.4.2 Glow plugs harness 12-24 V D703L/LE/LT/LTE

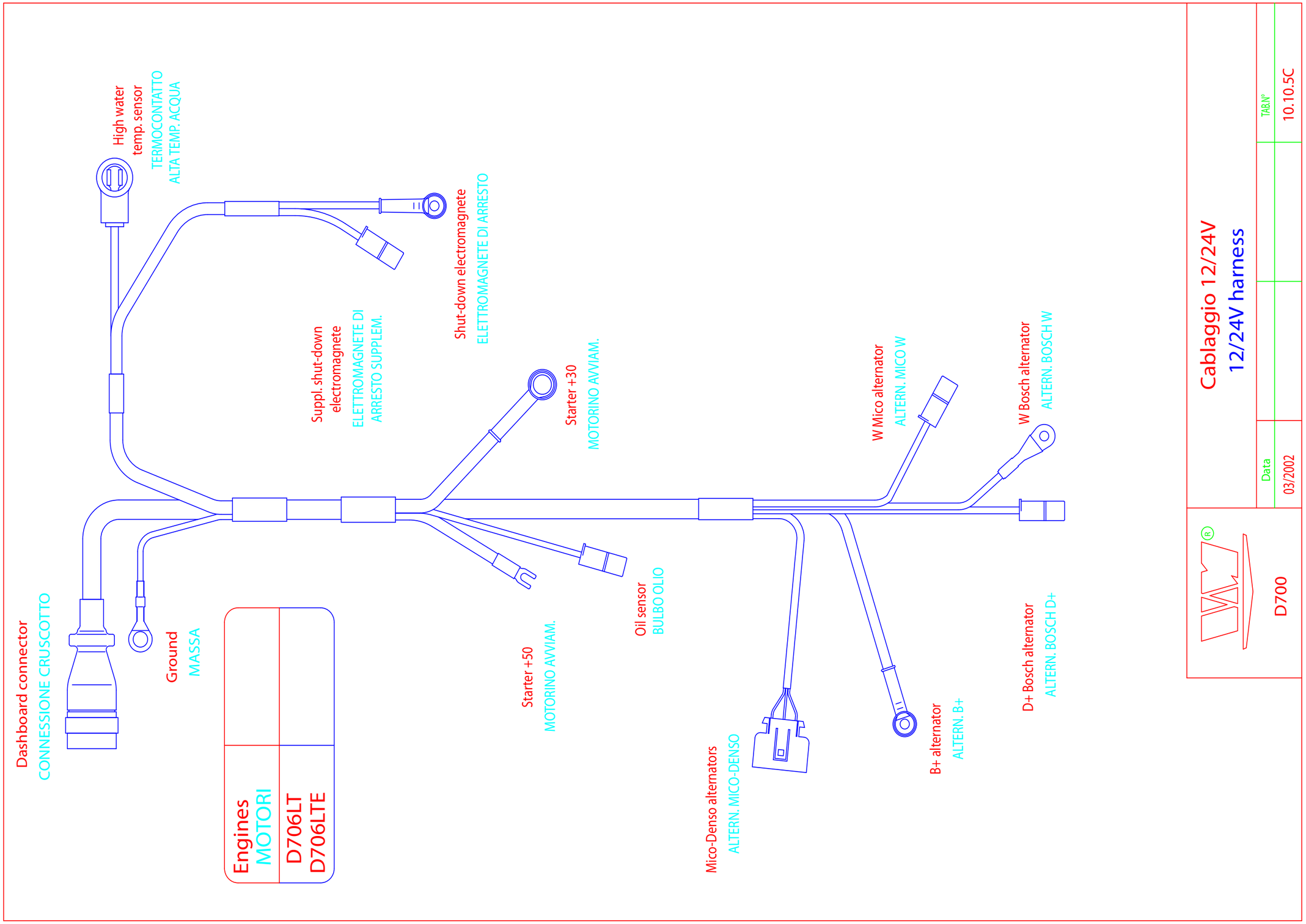


4.4.3 KSB / Glow plugs harness 12-24 V D704L/LE/LT/LTE - D706LT/LTE

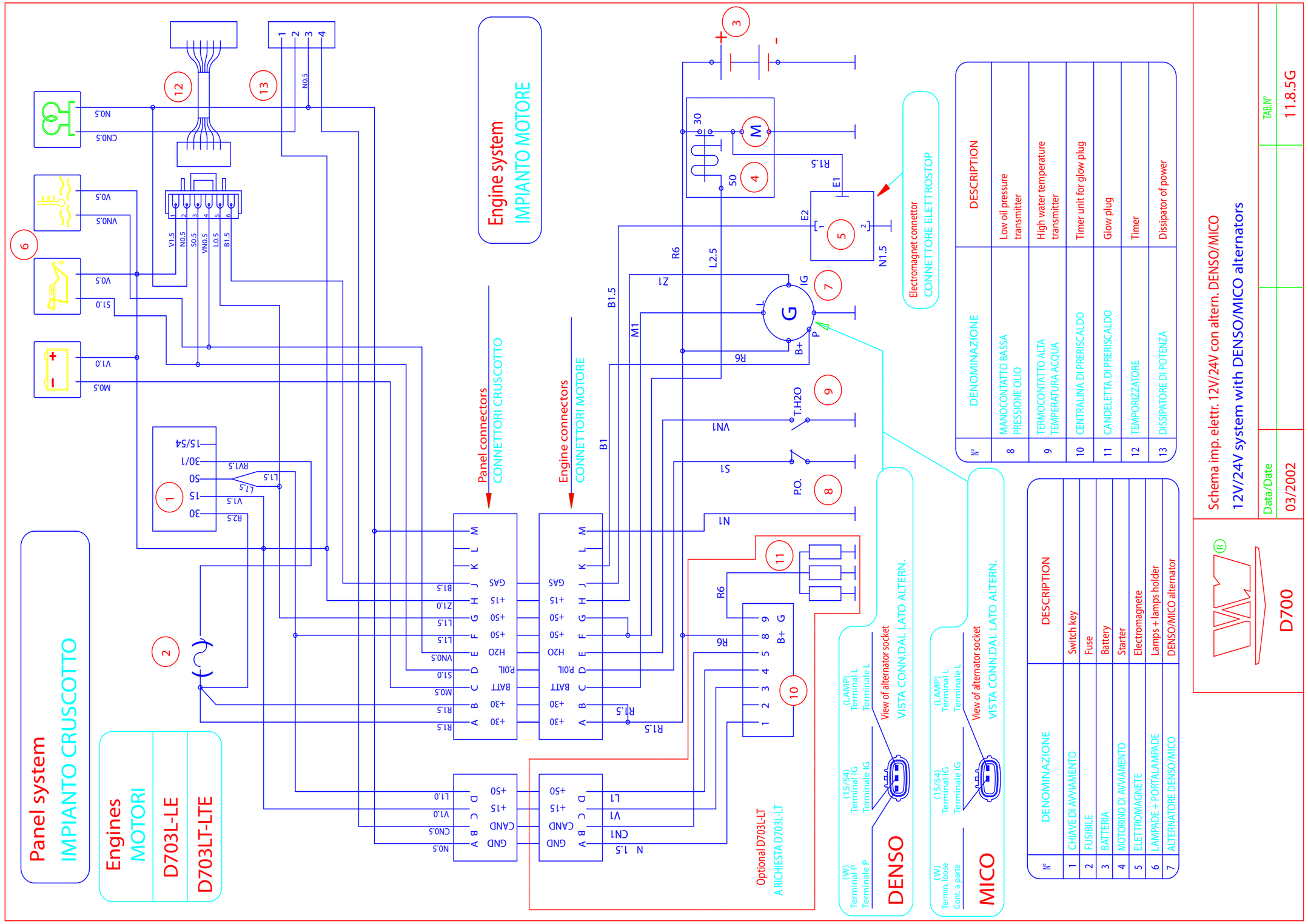


4.4.4 Engine harness 12-24 V D704L/LE/LT/LTE




High water temp. sensor
TERMOCONTATTO ALTA TEMP. ACQUA
Suppl. shut-down electromagnete
ELETTROMAGNETE DI ARRESTO SUPPLEM.
Shut-down electromagnete
ELETTROMAGNETE DI ARRESTO
Starter +30
MOTORINO AVVIAM.
W Mico alternator
ALTERN. MICO W
W Bosch alternator
ALTERN. BOSCH W
Dashboard connector
CONNESSIONE CRUSCOTTO
Ground
MASSA
Engines
MOTORI
D706LT
D706LTE
Starter +50
MOTORINO AVVIAM.
Oil sensor
BULBO OLIO
Mico-Denso alternators
ALTERN. MICO-DENSO
B+ alternator
ALTERN. B+
D+ Bosch alternator
ALTERN. BOSCH D+
Cablaggio 12/24V
12/24V harness
TAB.N°
10.10.5C
Data
03/2002
D700

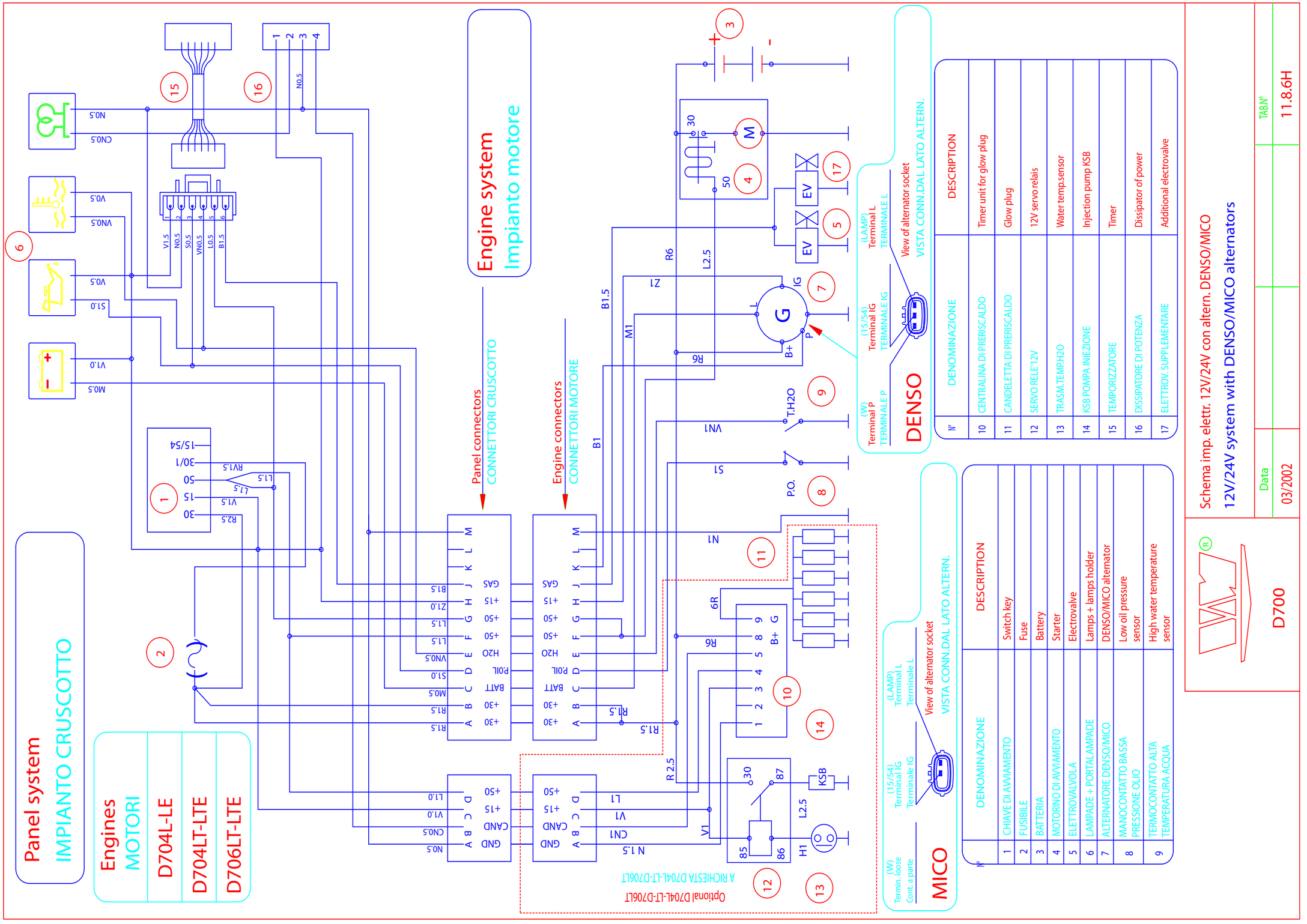
4.4.6 Electrical diagram D703L/LE - LT/LTE with alternator Denso-Mico 12-24V



N°	DENOMINAZIONE	DESCRIPTION
1	CHIAVE DI AVVIAMENTO	Switch key
2	FUSIBILE	Fuse
3	BATTERIA	Battery
4	MOTORINO DI AVVIAMENTO	Starter
5	ELETTROMAGNETE	Electromagnete
6	LAMPADE + PORTALAMPADE	Lamps + lamps holder
7	ALTERNATORE DENSO/MICO	DENSO/MICO alternator

N°	DENOMINAZIONE	DESCRIPTION
8	MANOCONTATTO BASSA PRESSIONE OLIO	Low oil pressure transmitter
9	TERMOCONTATTO ALTA TEMPERATURA ACQUA	High water temperature transmitter
10	CENTRALINA DI PRERISCALDO	Timer unit for glow plug
11	CANDELETTA DI PRERISCALDO	Glow plug
12	TEMPORIZZATORE	Timer
13	DISSIPATORE DI POTENZA	Dissipator of power

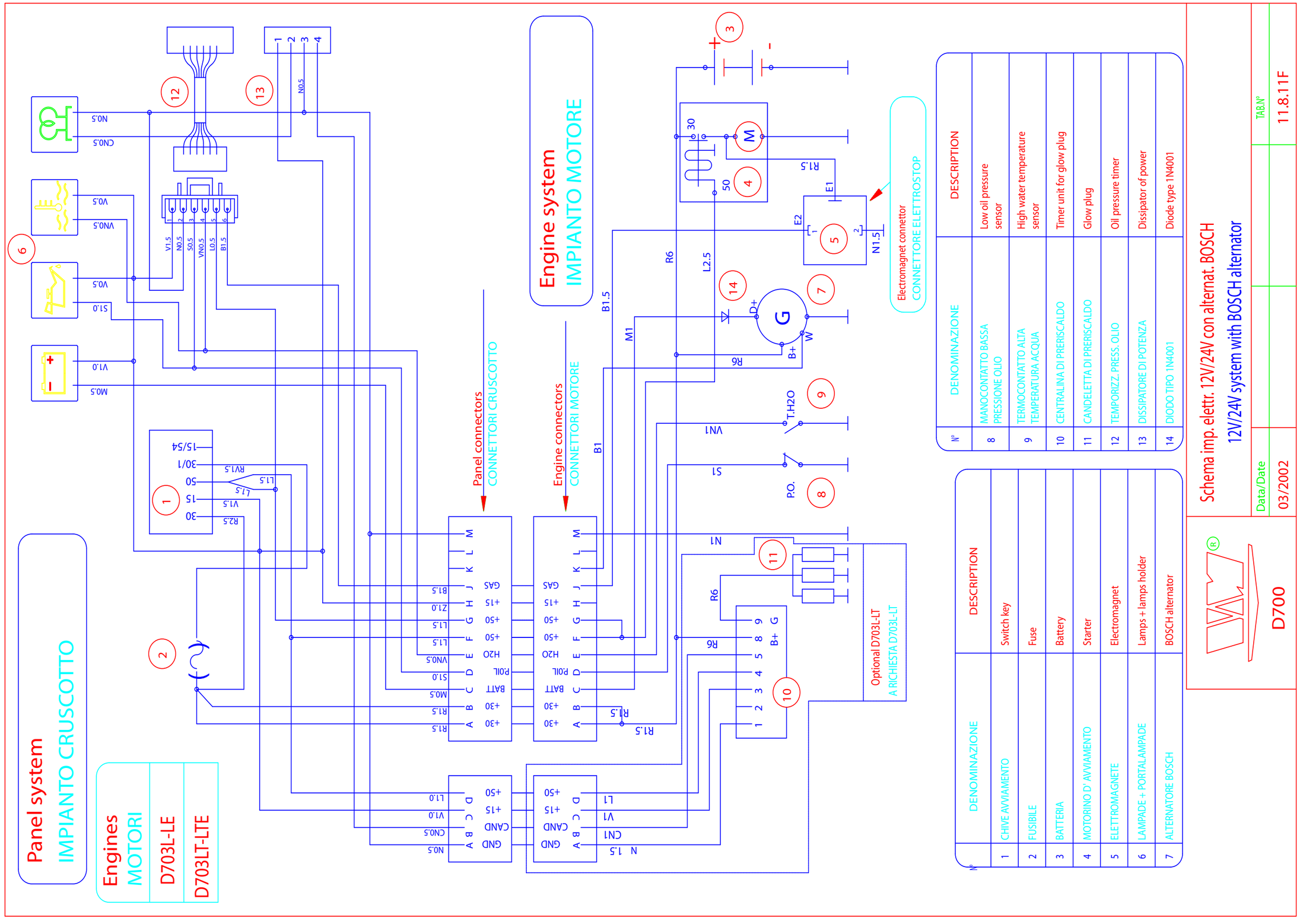
4.4.7 Electrical diagram D704L/LE /LT/LTE - D706LT/LTE with alternator Denso-Mico 12-24V



N°	DENOMINAZIONE	DESCRIPTION
10	CENTRALINA DI PRERISCALDO	Timer unit for glow plug
11	CANDELETTA DI PRERISCALDO	Glow plug
12	SERVO RELE'12V	12V servo relais
13	TRASM.TEMP.H2O	Water temp.sensor
14	KSB POMPA INIEZIONE	Injection pump KSB
15	TEMPORIZZATORE	Timer
16	DISSIPATORE DI POTENZA	Dissipator of power
17	ELETTROV.SUPPLEMENTARE	Additional electrovalve

N°	DENOMINAZIONE	DESCRIPTION
1	CHIAVE DI AVVIAMENTO	Switch key
2	FUSIBILE	Fuse
3	BATTERIA	Battery
4	MOTORINO DI AVVIAMENTO	Starter
5	ELETTROVALVOLA	Electrovalve
6	LAMPADE + PORTALAMPADE	Lamps + lamps holder
7	ALTERNATORE DENSO/MICO	DENSO/MICO alternator
8	MANOCONTATTO BASSA PRESSIONE OLIO	Low oil pressure sensor
9	TERMOCONTATTO ALTA TEMPERATURA ACQUA	High water temperature sensor

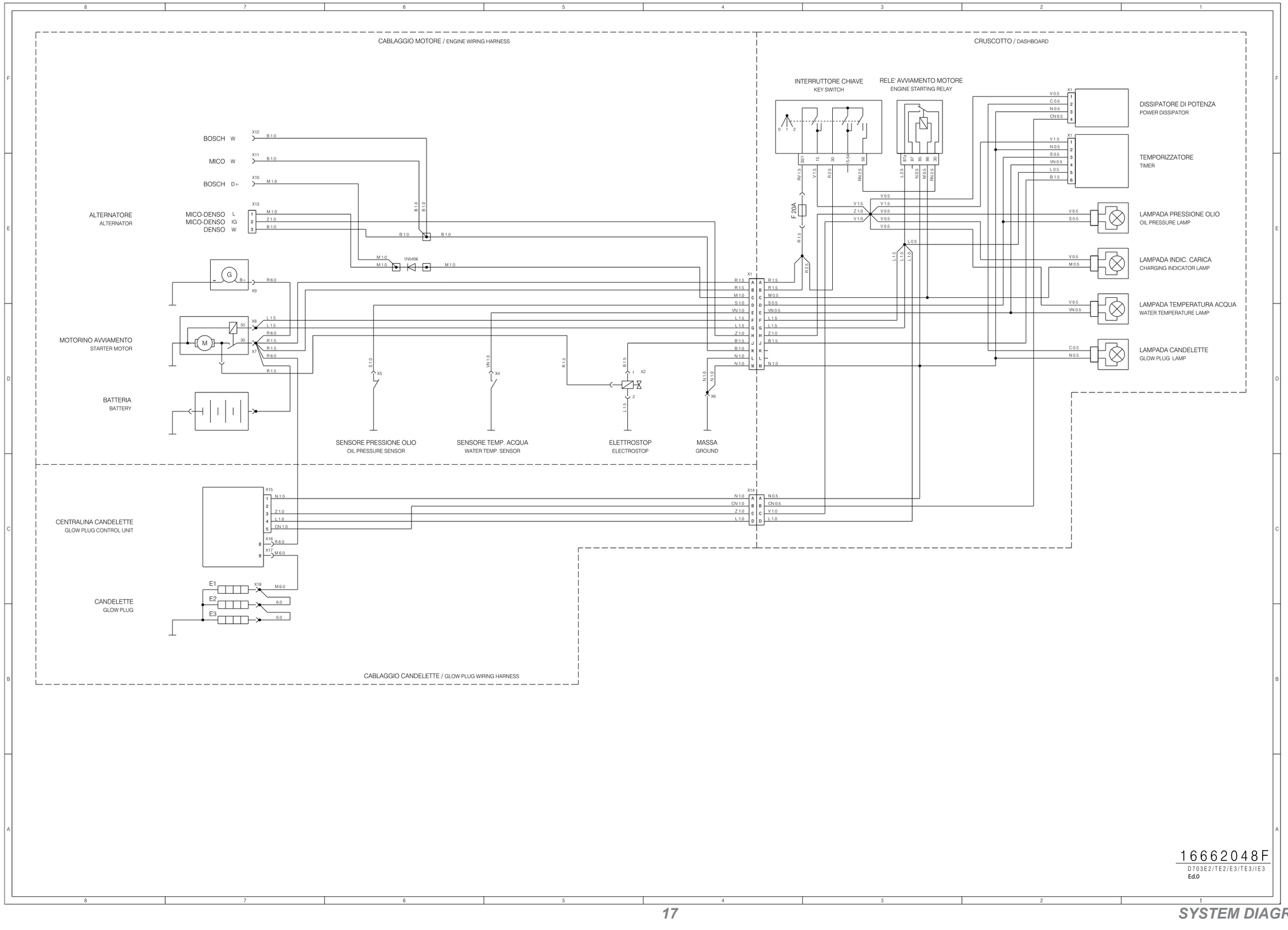
4.4.8 Electrical diagram D703L/LE /LT/LTE with alternator Bosch 12-24V



N°	DENOMINAZIONE	DESCRIPTION
8	MANOCONTATTO BASSA PRESSIONE OLIO	Low oil pressure sensor
9	TERMOCONTATTO ALTA TEMPERATURA ACQUA	High water temperature sensor
10	CENTRALINA DI PRERISCALDO	Timer unit for glow plug
11	CANDELETTA DI PRERISCALDO	Glow plug
12	TEMPORIZZ. PRESS. OLIO	Oil pressure timer
13	DISSIPATORE DI POTENZA	Dissipator of power
14	DIODO TIPO 1N4001	Diode type 1N4001

N°	DENOMINAZIONE	DESCRIPTION
1	CHIVE AVVIAMENTO	Switch key
2	FUSIBILE	Fuse
3	BATTERIA	Battery
4	MOTORINO D' AVVIAMENTO	Starter
5	ELETTROMAGNETE	Electromagnet
6	LAMPADE + PORTALAMPADE	Lamps + lamps holder
7	ALTERNATORE BOSCH	BOSCH alternator

4.4.8a Electrical diagram D703E2_TE2_E3_TE3_IE3 / 12-24V

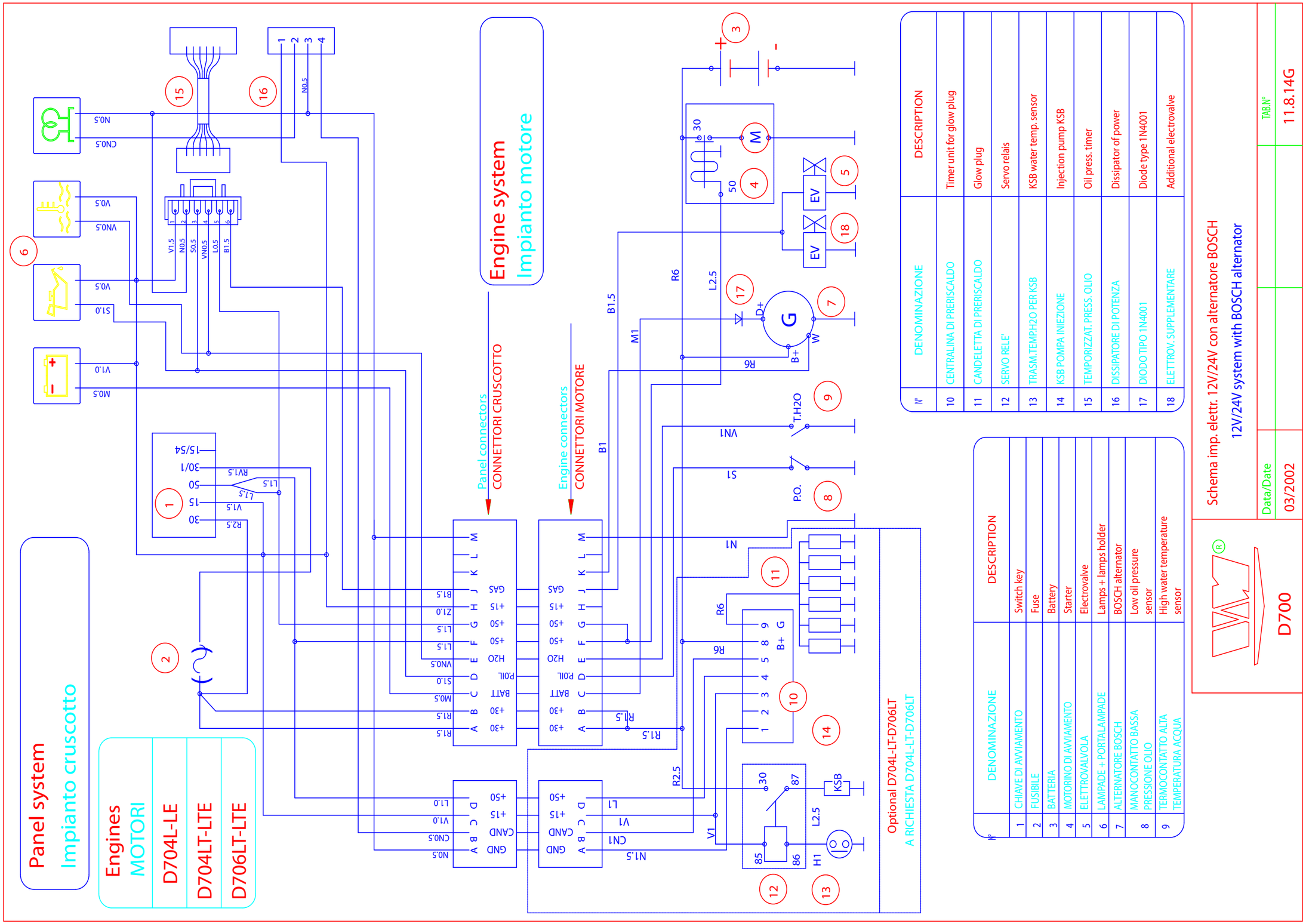


16662048F

D703E2/TE2/E3/TE3/IE3

Ed.0

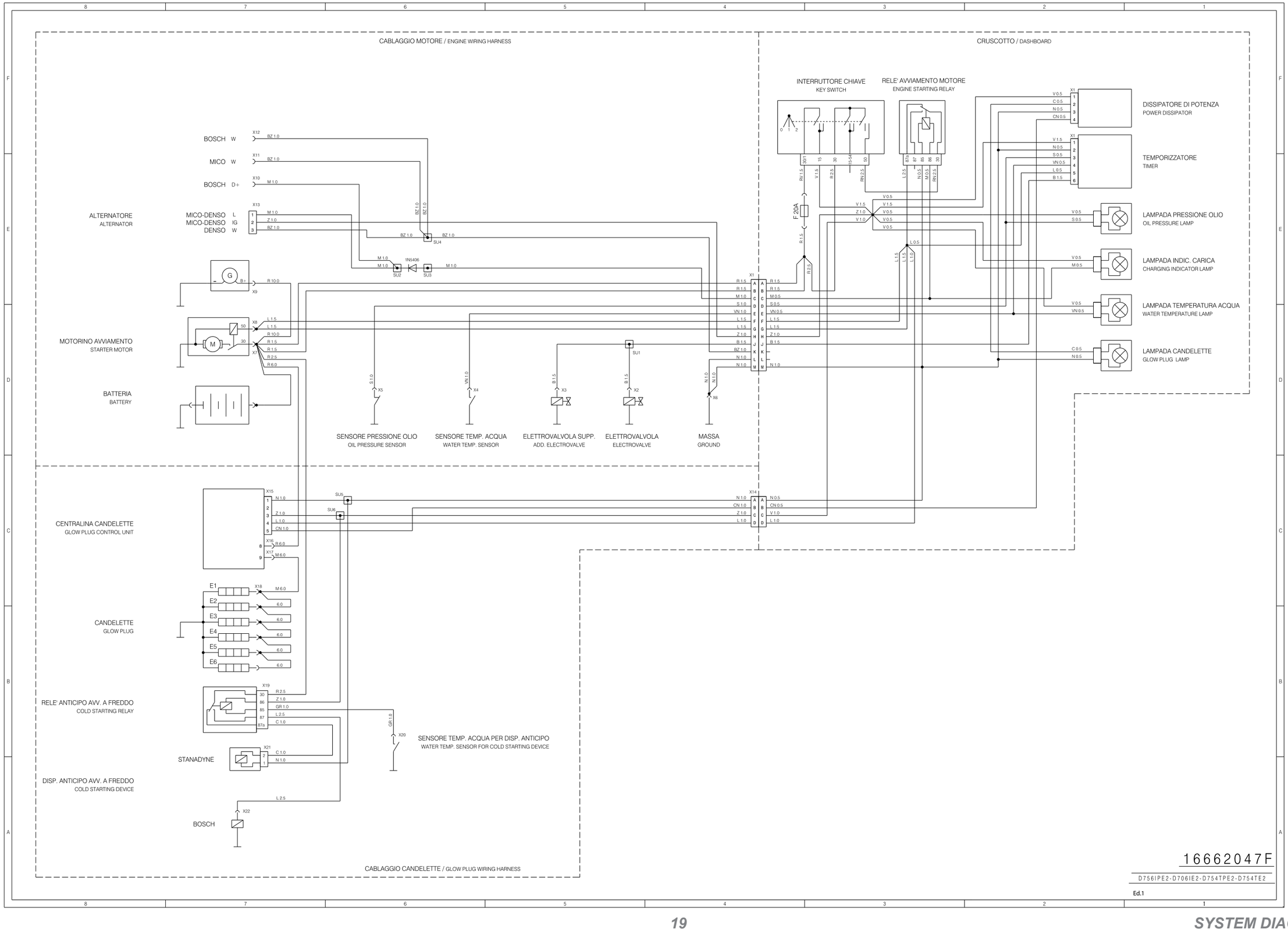
4.4.9 Electrical diagram D704L/LE /LT/LTE - D706LT/LTE with alternator Bosch 12-24V



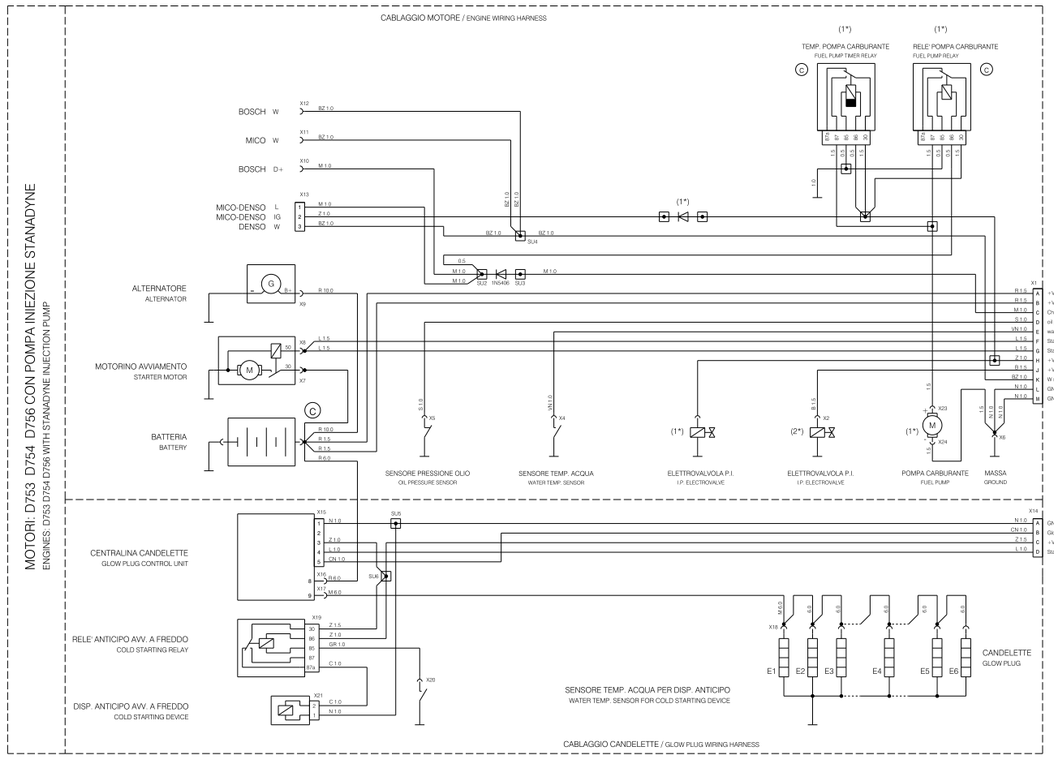
N°	DENOMINAZIONE	DESCRIPTION
10	CENTRALINA DI PRERISCALDO	Timer unit for glow plug
11	CANDELETTA DI PRERISCALDO	Glow plug
12	SERVO RELE'	Servo relais
13	TRASM.TEMP.H2O PER KSB	KSB water temp. sensor
14	KSB POMPA INIEZIONE	Injection pump KSB
15	TEMPORIZZAT. PRESS. OLIO	Oil press. timer
16	DISSIPATORE DI POTENZA	Dissipator of power
17	DIODO TIPO 1N4001	Diode type 1N4001
18	ELETTROV. SUPPLEMENTARE	Additional electrovalve

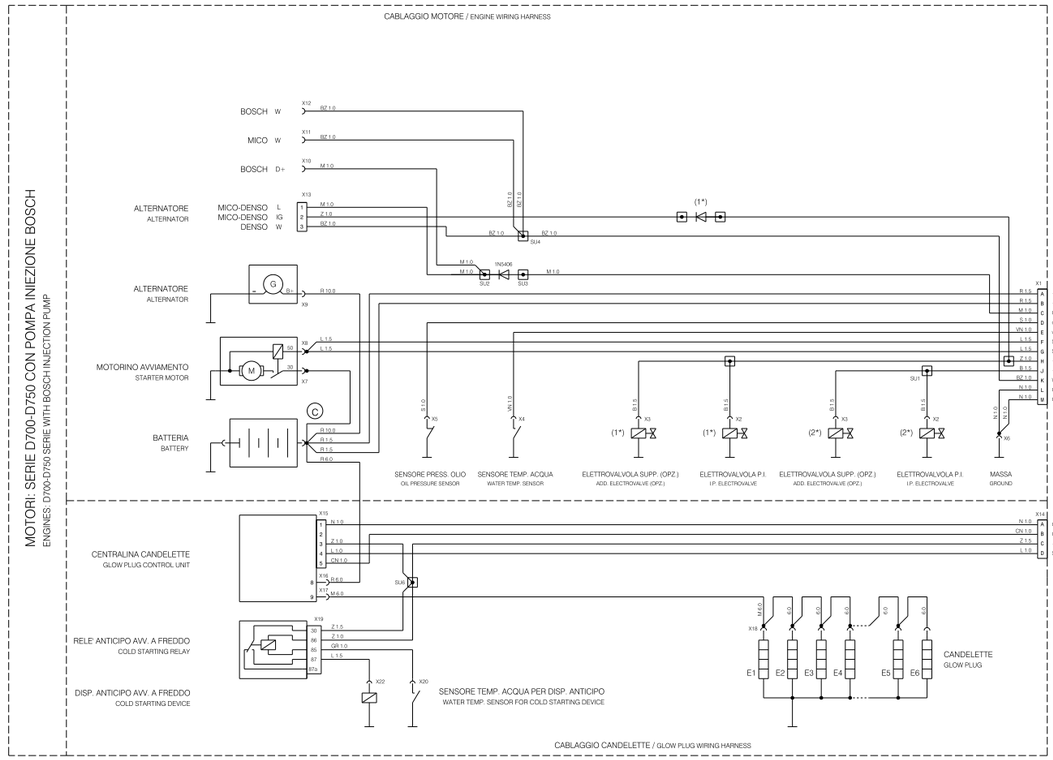
N°	DENOMINAZIONE	DESCRIPTION
1	CHIAVE DI AVVIAMENTO	Switch key
2	FUSIBILE	Fuse
3	BATTERIA	Battery
4	MOTORINO DI AVVIAMENTO	Starter
5	ELETTROVALVOLA	Electrovalve
6	LAMPADE + PORTALAMPADE	Lamps + lamps holder
7	ALTERNATORE BOSCH	BOSCH alternator
8	MANOCONTATTO BASSA PRESSIONE OLIO	Low oil pressure sensor
9	TERMOCONTATTO ALTA TEMPERATURA ACQUA	High water temperature sensor

4.4.9 Electrical Diagram D756IE2_706IE2_754TPE2_754TE2 / 12-24V - VM code 16662047_01_2008



4.4.9b Electrical Diagram D753 E3 - TE3 - IE3 / 12-24V - VM code 16662047_03_2009





NOTE/NOTES

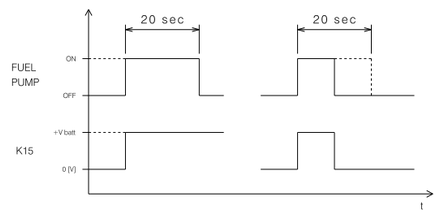
(1*) SOLO PER APPLICAZIONI INDUSTRIALI
FOR INDUSTRIAL APPLICATIONS ONLY

(2*) SOLO PER APPLICAZIONI STAZIONARIE O.P.U.
FOR OPEN POWER UNITS ONLY

LA POMPA ELETTRICA CARBURANTE E' PREVISTA SUI MOTORI D753 CON MOTORINO DI AVVIAMENTO SUL LATO POMPA INIEZIONE.

THE ELECTRIC FUEL PUMP IS PROVIDED ON D753 PUMP INJECTION SIDE STARTER MOTOR VERSION.

TEMPORIZZAZIONE POMPA ELETTRICA CARBURANTE
ELECTRIC FUEL PUMP TIMER



CODICE COLORI
COLOR CODE

A	AZZURRO LIGHT BLUE
B	BIANCO WHITE
C	ARANCIO ORANGE
G	GIALLO YELLOW
H	GRIGIO GREY
L	BLU BLUE
M	MARRONE BROWN
N	NERO BLACK
R	ROSSO RED
S	ROSA PINK
V	VERDE GREEN
Z	VIOLA PURPLE

Data Date 10/03/09 | Esponente Index No. 03 | Disegno Nr. Part No. 16662047F | VM MOTORI S.p.A.

Tabella eseguita con CAD / Computerized table

TIPO TERMINALE *Terminals chart*	Bosch	Denso	Mico	Funzione *Use*
B+	X	X	X	+30 OUTPUT CORRENTE ALLA BATTERIA *+30 Battery charge*
W	X		X	OUTPUT PER CONTAGIRI OPPURE PER ALTRE UTENZE *Hour-speed meter signal or further uses*
P		X		OUTPUT PER CONTAGIRI *Hour-speed meter signal*
IG		X	X	+15 DA CHIAVE PRIMO SCATTO DELLA CHIAVE (NORMALMENTE VIENE COLLEGATO NELL'IMPIANTO) *+15 Key switch First switch of the key (usually wired on diagram)*
L		X	X	CONTOLLO ROTAZIONE ALTERNATORE OPPURE PER ALTRE UTENZE (ES. SENSORE CINGHIA ROTTA) *Alternator corret operation or further uses (ex.vee belt failure)*
D+	X			CONTOLLO ROTAZIONE ALTERNATORE OPPURE PER ALTRE UTENZE (ES. SENSORE CINGHIA ROTTA) *Alternator corret operation or further uses (ex.vee belt failure)*

D700E

Connessioni elettriche alternatore.
Alternator electric connections.

Data/Date	Disegn./Drawn.	Control./Ckd	TAB.N°
01/03	Cotti	Paris	11.8.16A

Legend of the colors
LEGENDA DEI COLORI

Identification letter LETTERA DI IDENTIFIC.	*Color* COLORE	*Wire section mm'2* SEZIONE CAVI mm'2	*Use* UTENZA
A	Azzurro-***Light blu***		
B	Bianco-***White***	1	Terminale P dell'alternatore DENSO-Terminale W alt.BOSCH
			Terminal P of the alternator DENSO-W terminal BOSCH alt.
		1.5	Terminale E2 dell'elettrostop(D703)
			E2 terminal of the shut-down magnete(D703)
		1.5	E. valvola sulla p.i. per stop mot.(D704-D706)
			Electrovalve on the inj.pump for eng.shut-down (D704-D706)
C	Arancio-***Orange***		
G	Giallo-***Yellow***		
H	Grigio-***Grey***	1	Sensore KSB al terminale 86 del rele'
			Water KSB sensor to 86 terminal of the relais
L	Blu- ***Blu***	1	Terminale +50 della centralina (pin4)
			Terminal +50 of the glow plug control unit(pin 4)
		2.5	Terminale +50 del motorino
			Terminal +50 of the starter
		2.5	Dal KSB al terminale 87 del rele'
			KSB terminal to 87 of the relais
M	Marrone-***Brown***	1	Terminale L dell'alternatore(lampada)DENSO-Terminale D+ alt.BOSCH
			Terminal L of the alternator(lamp)DENSO-D+terminal BOSCH alt.
N	Nero-***Black***	1	Connettore a 12 vie(messa a terra)
			12 ways connector(ground terminal)
		1.5	Connettore a 4 vie messa a terra della centralina (pin1)
			4 ways connector(ground terminal of the glow plug control unit)(pin1)
		1.5	Terminale messa a terra dell' elettrostop(D703)
			Ground terminal of the shut-down magnete(D703)
P	Nocciola-***Light brown***		
R	Rosso-***Red***	1.5	Terminale E1 dell' elettrostop(D703)
			E1 terminal of the shut-down magnete(D703)
		2.5	Dal +30 del motorino al 30 del rele' del KSB
			From +30 terminal of the starter to 30 of the KSB relais
		6	Terminale B+ del motorino
			B+ terminal of the starter
		6	Terminale B+ dell' alternatore
			B+ terminal of the alternator
		6	Terminale B+ della centralina
			B+ terminal of the glow plug control unit
		6	Terminale G delle candelette
			G terminal for glow plugs on the control unit
S	Rosa - ***Pink***	1	Sensore pressione olio
			Oil pressure sensor
V	Verde - ***Green***	1	Terminale 15 del connettore a 4 vie al pin3 della centralina(D703)
			Terminal 15 of the 4 ways connector to pin3 of the control unit(D703)
		1	Terminale 15 del connettore a 4 vie al pin3 della centralina e al terminale 85 del rele'KSB (D704-D706)
			Terminal 15 of the 4 ways connector to pin3 of the control unit and to terminal 85 of the KSB relais (D704-D706)
Z	Viola -***Violet***	1	Terminale IG dell' alternatore(15/54)
			Terminal IG of the alternator(15/54)
GN	Giallo/Nero - ***Yellow/Black***		
CN	Arancio/Nero -***Orange/Black***	1	Term.CAND del conn.4 vie al pin 5 della centralina
			CAND. terminal of the 4 ways connector to pin5 of the control unit
VN	Verde/Nero - ***Green/Black***	1	Sensore temperatura acqua
			Water temperature sensor

Tabella eseguita con CAD / Computerized table

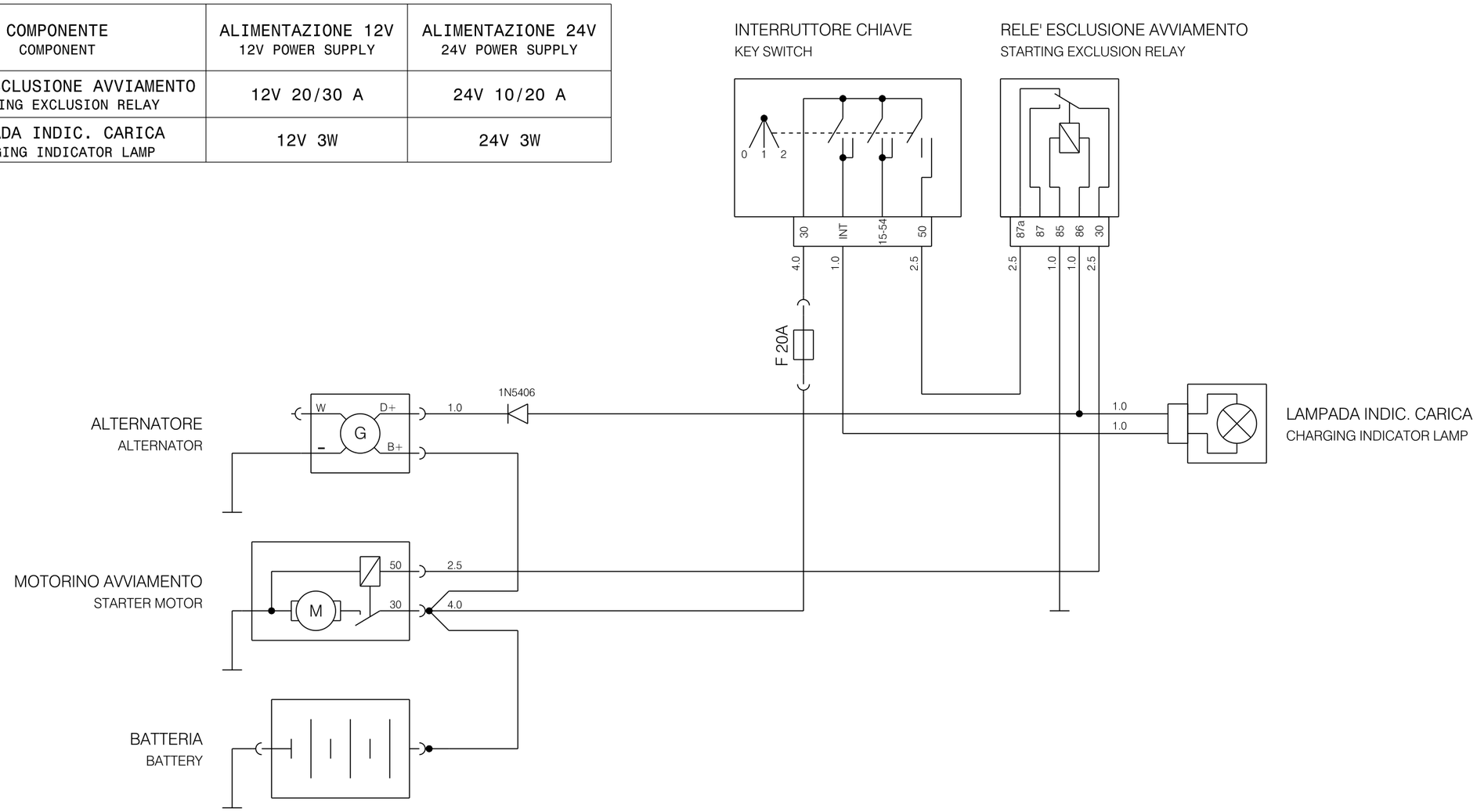
D700

Legenda dei colori
Legend of the colors

Data/Date	Disegn./Drawn.	Control./Ckd	TAB.N°
06/2001	Maniezzi	Paris	11.8.22A

4.6 STARTER MOTOR EXCLUSION WITH OPERATING ENGINE

COMPONENTE COMPONENT	ALIMENTAZIONE 12V 12V POWER SUPPLY	ALIMENTAZIONE 24V 24V POWER SUPPLY
RELE' ESCLUSIONE AVVIAMENTO STARTING EXCLUSION RELAY	12V 20/30 A	24V 10/20 A
LAMPADA INDIC. CARICA CHARGING INDICATOR LAMP	12V 3W	24V 3W



SCHEMA ELETTRICO ESCLUSIONE AVVIAMENTO A MOTORE IN MOTO
STARTER EXCLUSION WITH ENGINE IN MOTION ELECTRIC DIAGRAM

16662043F

18/05/07

VM MOTORI S.p.A.

5 DISASSEMBLY

INTRODUCTION

The following instructions refer to engine models available at the time of publication of this manual.

Before proceeding with the complete or partial disassembling of the engine, check that the problem is not due to some external cause.

WHERE VM SPECIAL TOOLS ARE NOT SPECIFIED IN THE DISASSEMBLY PROCEDURES, USE STANDARD COMMERCIAL TOOLS OF THE TYPE ILLUSTRATED.

Mounting the engine on the stand

Mount the engine on a commercial stand as shown in figure 5.0.

Secure the engine by means of the assembling arms and bolts provided with the stand (or using mounting bolts of the same type).

_WARNING: THE STAND MUST BE EQUIPPED WITH A REDUCTION GEAR AS SHOWN IN THE FIGURE TO SLOW DOWN ENGINE ROTATION AND CONTROL ROCKING.

_WARNING: REMEMBER TO INSERT THE LOCK PIN (A) AND CHECK THAT IT EFFECTIVELY LOCKS T HE ENGINE IN POSITION.

_WARNING: RISK OF CRUSHING AND/OR SHEARING OF LIMBS DURING ROTATION OF ENGINE ON STAND.

NEVER INTRODUCE PARTS OF THE BODY OR FOREIGN OBJECTS IN THE AREA SHADED GREY IN FIGURE 5.0.

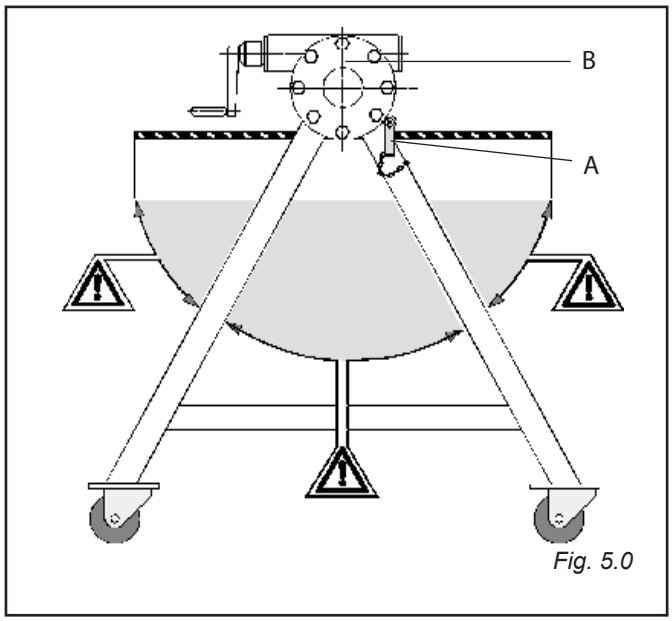


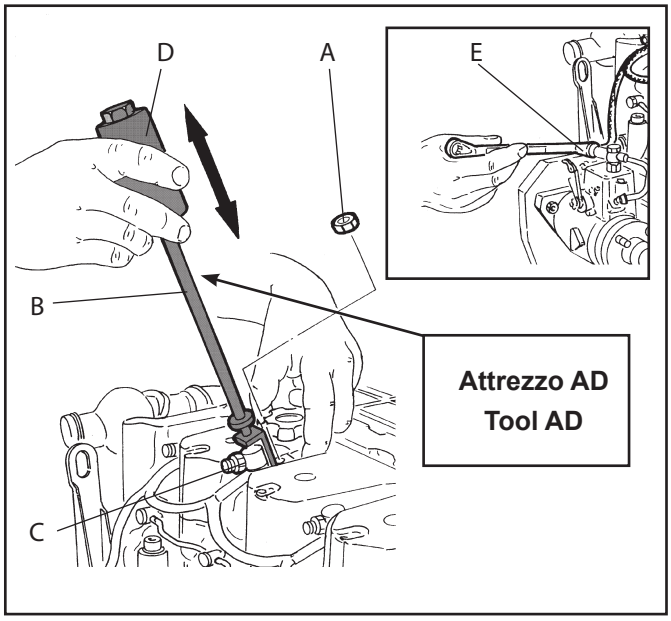
Fig. 5.0

INJECTORS

Unscrew union **E** on the injection pump.

Unscrew securing nut **A**. Fit special tool **B** **(TAB. 11.1 ref. B and/or AD)** on injector **C** as shown. Remove the injector by operating the percussion slide **D** as shown in the figure.

TO FACILITATE REMOVAL, ROTATE THE INJECTOR CLOCKWISE/ COUNTER-CLOCKWISE TO BREAK ANY SEAL FORMED BY EXCESS PAINT. REPEAT THE OPERATION FOR EACH INJECTOR.



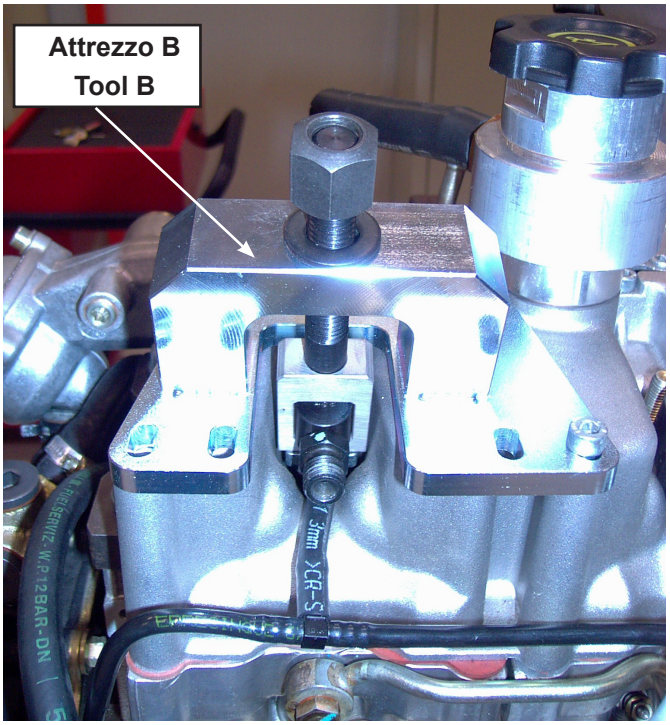
Withdraw the injector together with its mounting, keeping them parallel to each other.

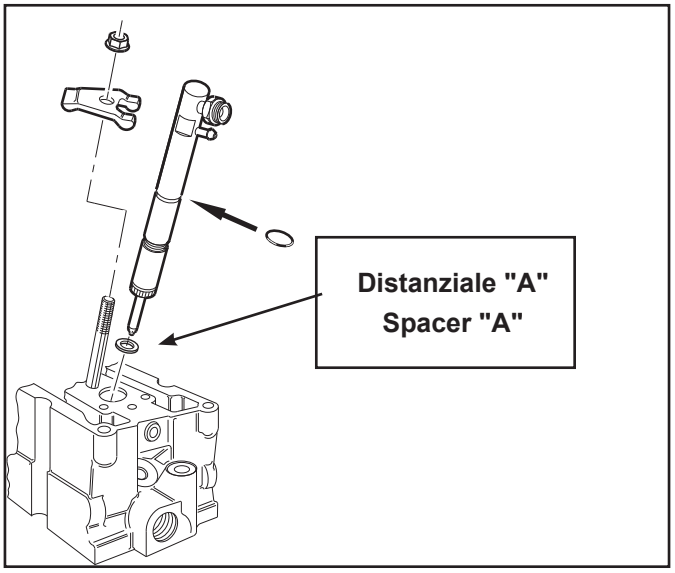
Remove the entire injector assembly with the relative fuel return pipes.

FOR EACH ENGINE MODEL IS INSTALLED A SPECIFIC SPACER "A".

EVERY ENGINE MODEL HAS A SPACER WITH A SPECIFIC THICKNESS VALUE.

DO NOT INSTALL SPACER OF OTHER ENGINE MODELS.

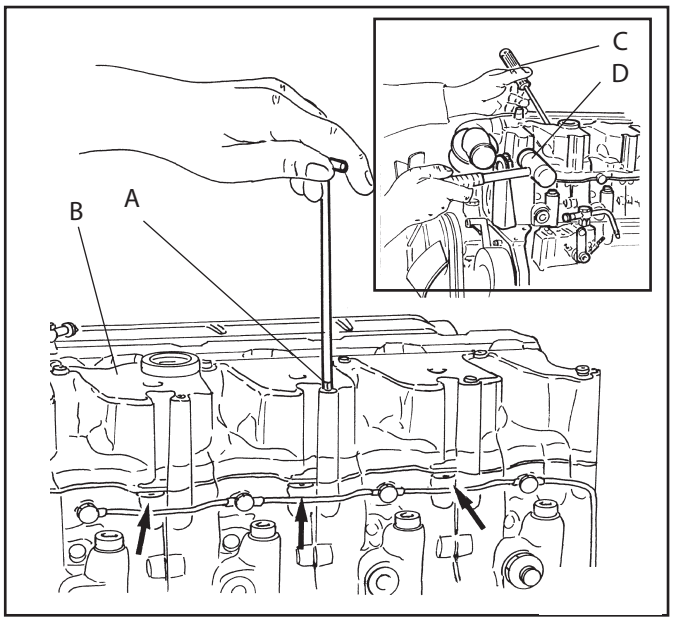




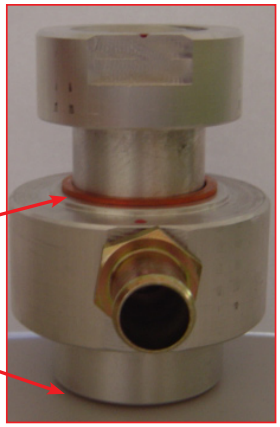
ROCKER ARMS COVER

Unscrew bolts **A** securing the rocker arm cover **B**.
Remove the cover.

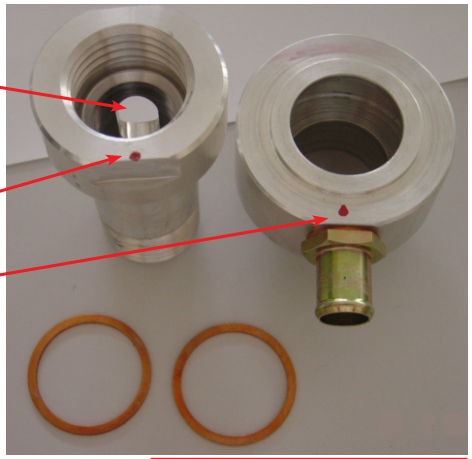
IF NECESSARY, INSERT A SCREWDRIVER (C) IN THE SLOTS AND TAP THE COVER WITH A RUBBER MALLET (D) TO BREAK THE HEAD/ ROCKER COVER GASKET SEAL.



OIL SEPARATOR KIT



GUARNIZIONE
WASHER



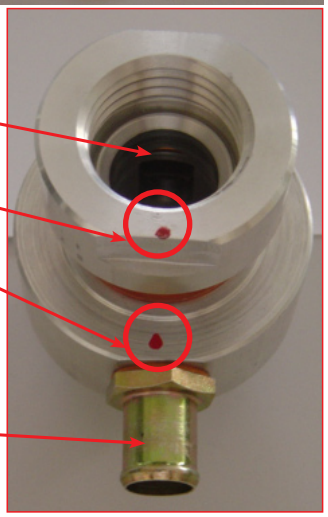
ASOLA "A"
SLOT "A"

PUNTI ROSSI VERNICIATI
RED DOTS

ALLINEARE I 2 PUNTI ROSSI VERNICIATI IN MODO CHE L'ASOLA "A" SIA OPPOSTA AL BOCCHETTONE "B"

ALIGN 2 RED DOTS EACH OTHER SO THAT THE SLOT "A" IS OPPOSITE TO HOSE CONNECTION "B"

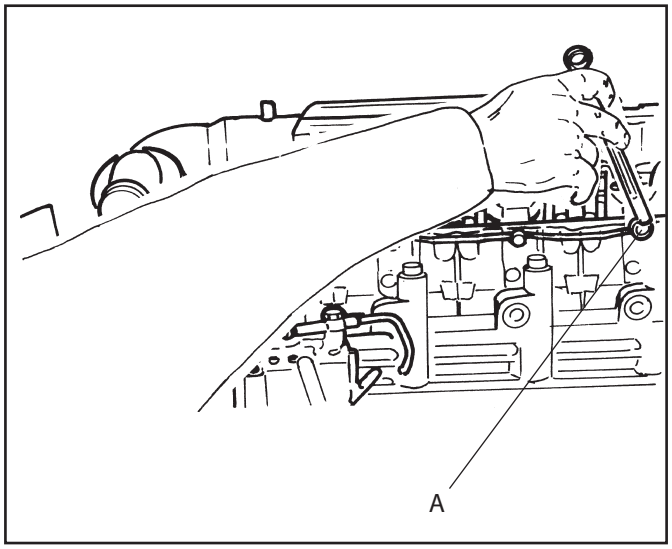
ASOLA "A"
SLOT "A"



BOCCHETTONE "B"
HOSE CONNECTION "B"

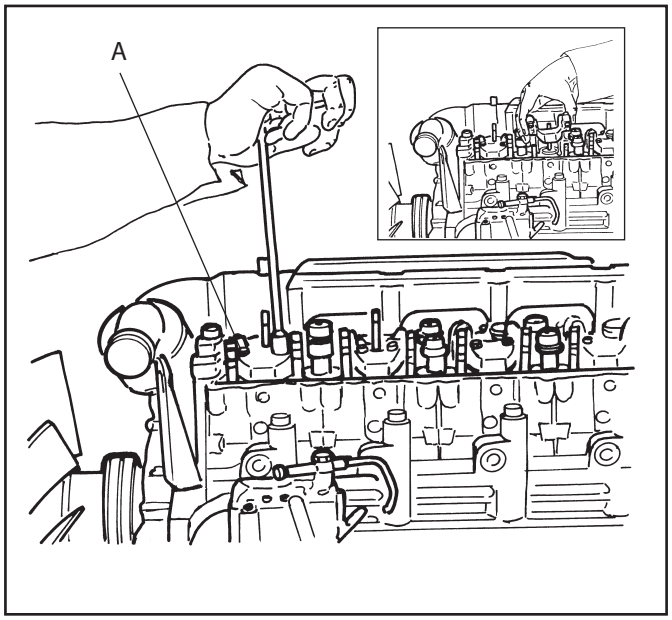
ROCKER ARM OIL FEED PIPE

Unscrew unions **A**.
Make sure do not loose the washers of the unions.



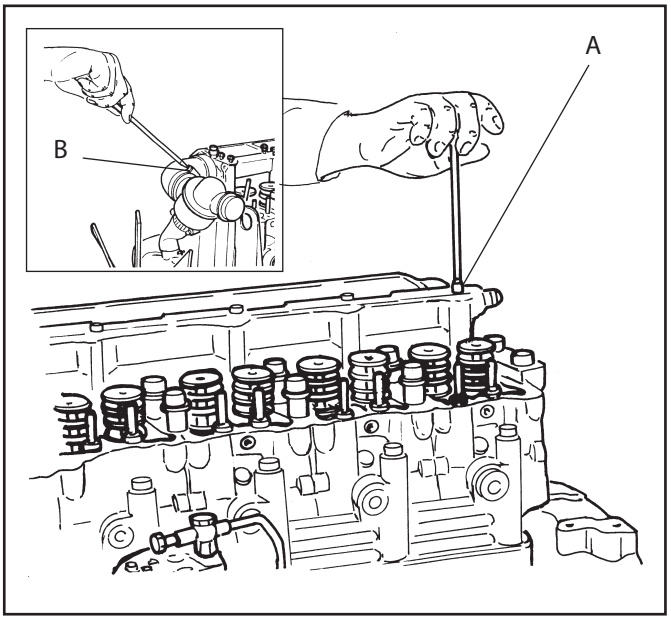
ROCKER ARMS

Unscrew nuts **A** to release the rocker arms.
Remove the rocker arms by lifting them upwards.



CYLINDER HEAD COOLANT MANIFOLD

Unscrew screws **A**, loosen clamp **B** and remove the manifold.

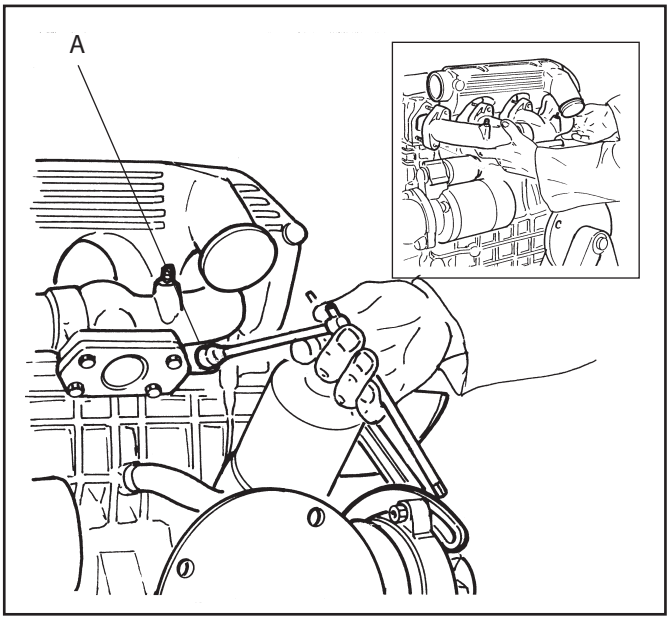


EXHAUST MANIFOLD

Unscrew securing nuts **A**.

Remove the manifold.

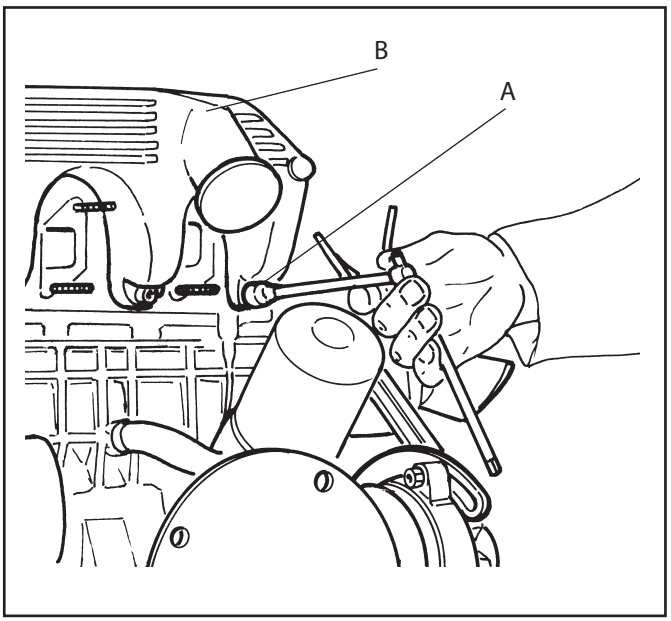
Renew the gaskets.



INLET MANIFOLD

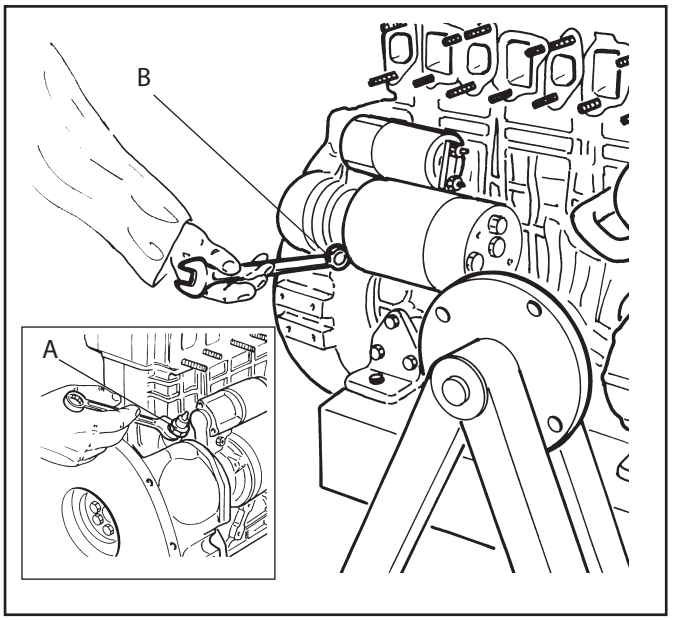
It is advisable to remove the inlet manifold **B** after having removed the exhaust manifold. Unscrew the nuts **A** and remove the inlet manifold.

Renew the gaskets.



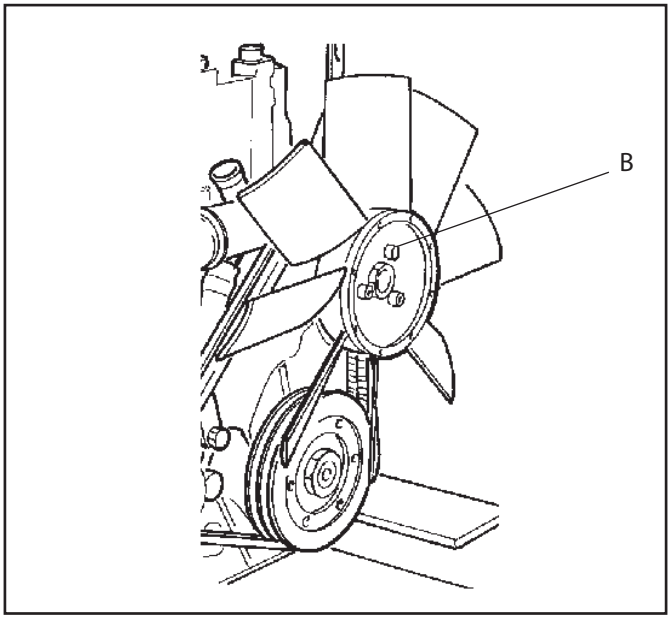
STARTER MOTOR

To facilitate removal of the starter motor, first remove the oil pressure sensor **A** (this operation is not necessary on 6-cylinder engines). Then unscrew retaining nuts **B**.



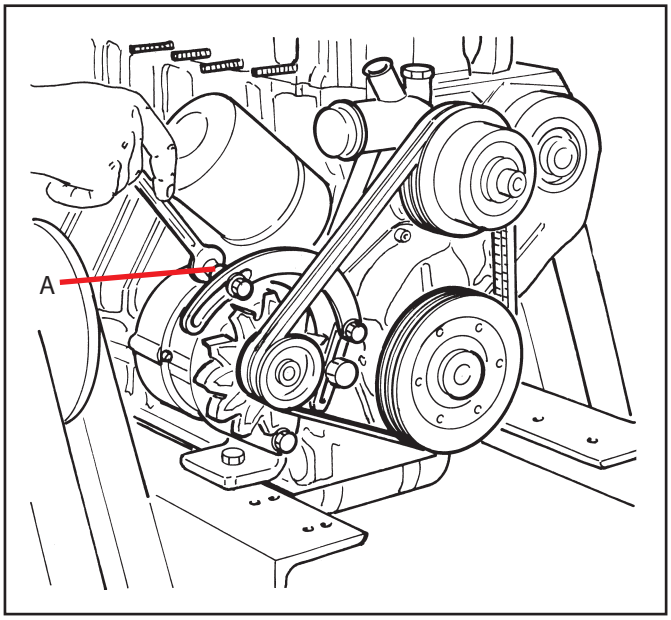
FAN

Unscrew bolts **B** and remove the fan.



ALTERNATOR BELT

Slacken the alternator adjustment nut **A** and push the alternator towards the engine to slacken the belts. Slip the drive belts from the pulleys being careful not to damage them.

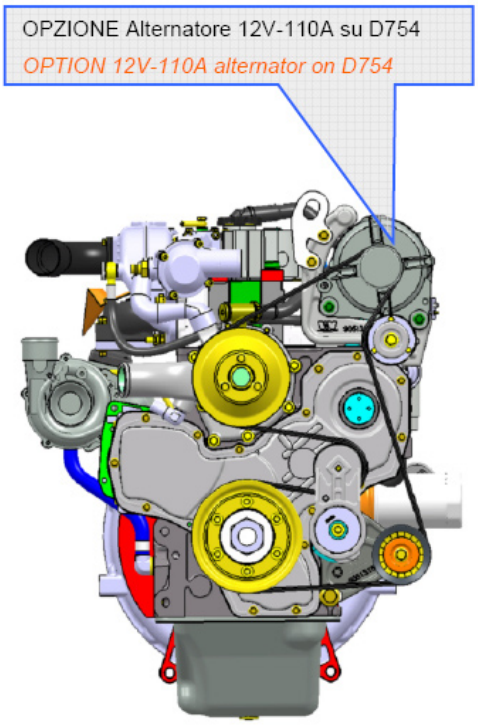


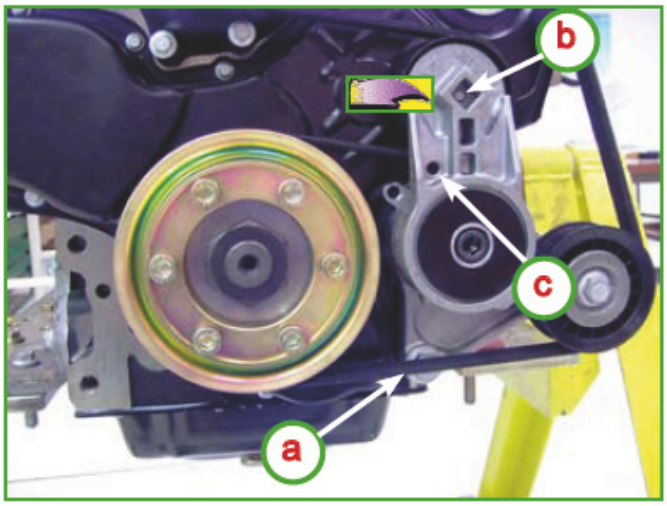
ALTERNATOR POLY - V BELT

1. Position a suitable tool in the automatic tensioner release slot.
2. Rotate the automatic tensioner, in the direction of the arrow, to remove the tension on the serpentine belt.

a - Serpentine belt
b - Tensioner release slot
c - Hole
d - pin

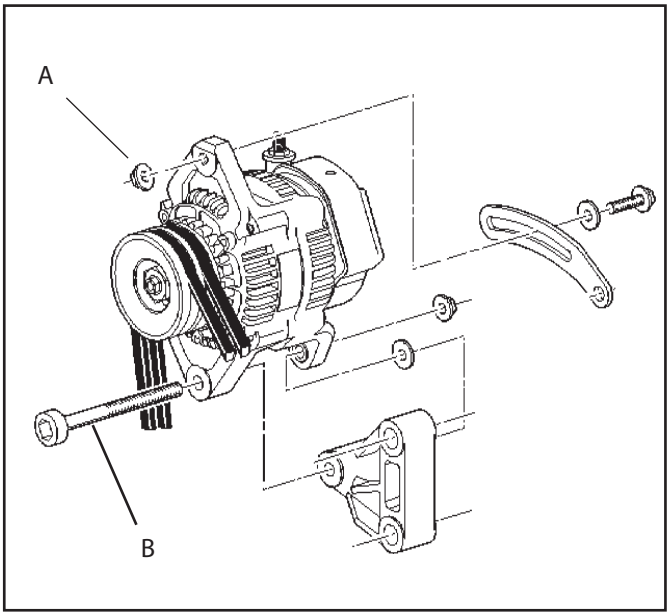
3. Install a pin into the tensioner hole to block the tensioner rotation.
4. Before removing the serpentine belt note its position on the alternator, and idler pulleys.
5. Remove the serpentine belt.





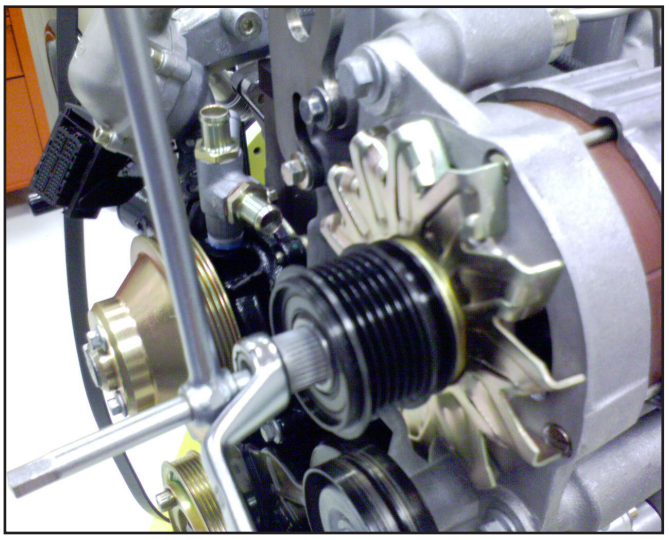
ALTERNATOR

Fully unscrew nut **A**, that was previously loosened, and also remove the lower pin **B** so the alternator can be removed.



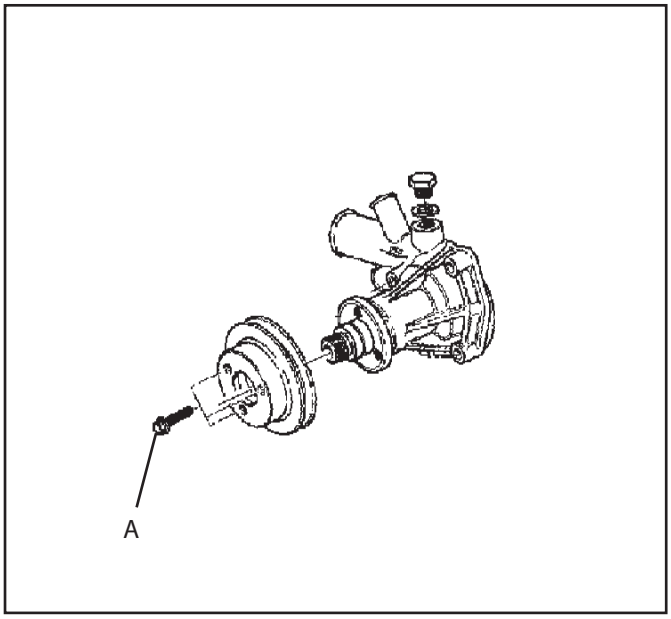
On specific engine models is install an alternator with a clutch.

To remove the pulley, remove the plastic cover from the pulley and insert the specif socket. Refer to Chapter 11 Special Tools - AK



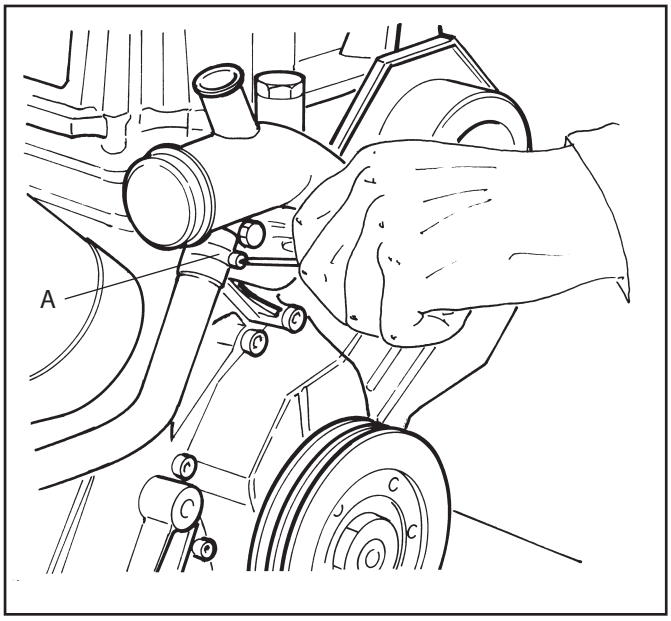
COOLANT PUMP PULLEY

Unscrew the screws **A** and remove the pulley.

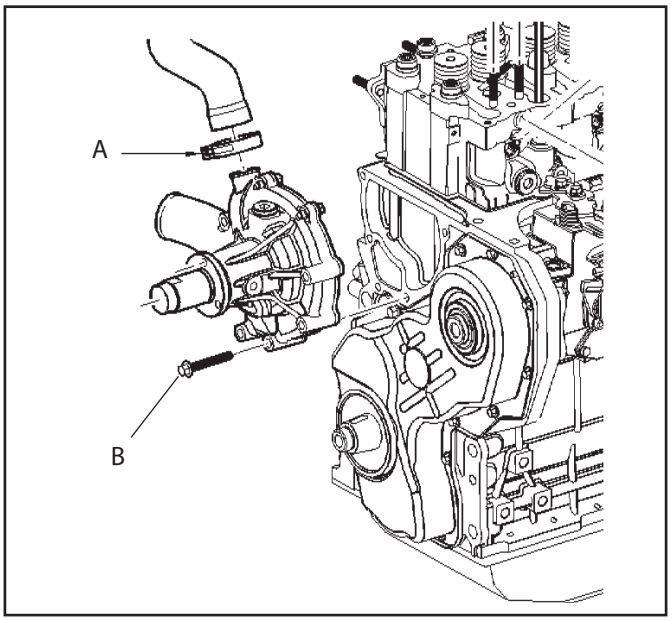


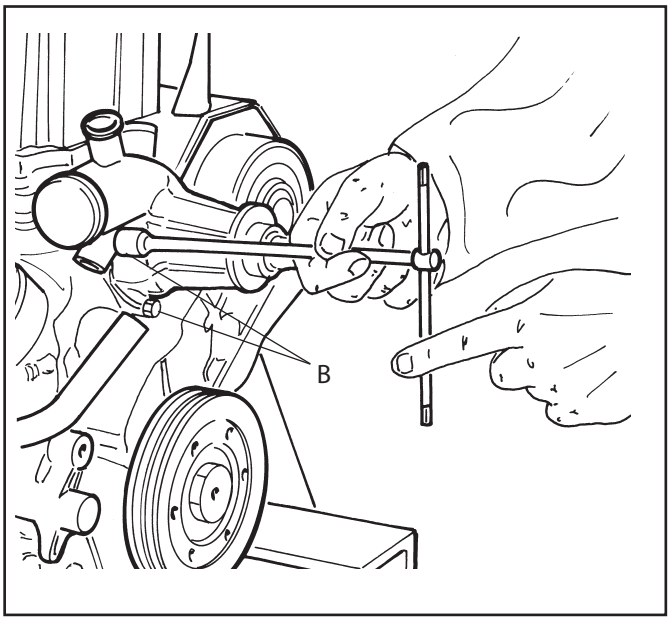
COOLANT PUMP

Loosen clamp **A** and remove the connected pipe.



Unscrew the pump retaining bolts **B**.



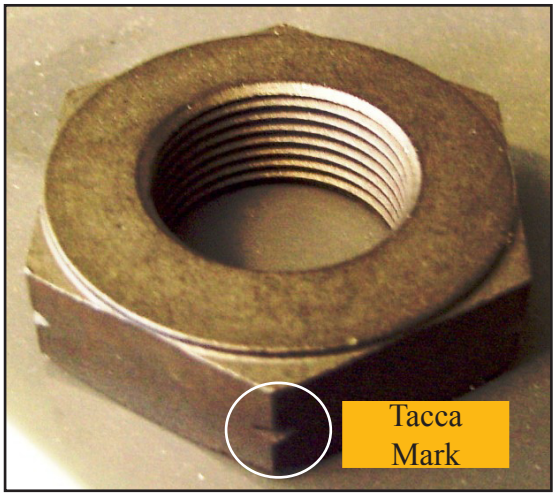


CRANKSHAFT PULLEY / HUB

A crankshaft with front cone shape end and right-hand thread pulley nut were installed on D703 and D706 engine models.

D704 - D754 engine models can also have a crankshaft front end cone shape type

Starting from D704TE2 and D754E2/TE2 a new crankshaft and pulley nut have been introduced: crankshaft with front cylindrical shape end and left-hand threaed pulley nut. Therefore in order to recognize if the engine has a crankshaft with front cylindrical shape end it is necessary to look at the mark present on the pulley fixing nut (see picture).



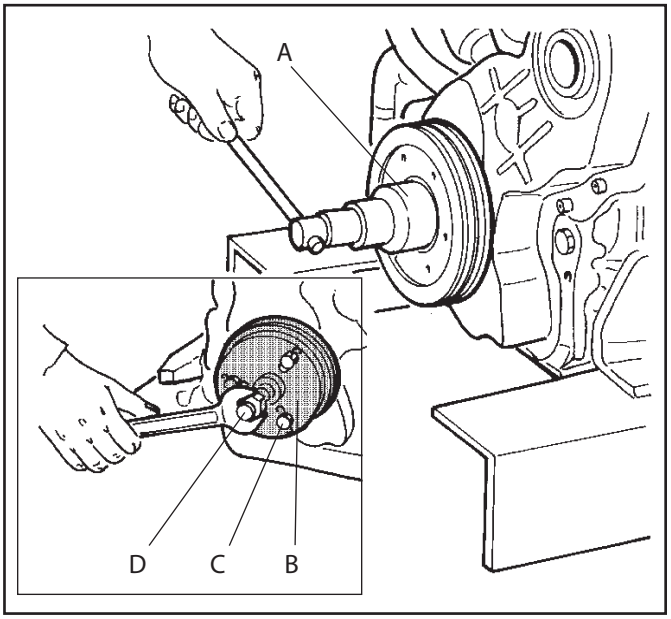
In order to remove the front pulley on engines with crankshaft with front cone shape end install the special tool **(TAB. 11.1 ref. A)**, attaching part **B** to the pulley with standard commercial bolts **C**. Screw in bolt **D** until the pulley comes free.

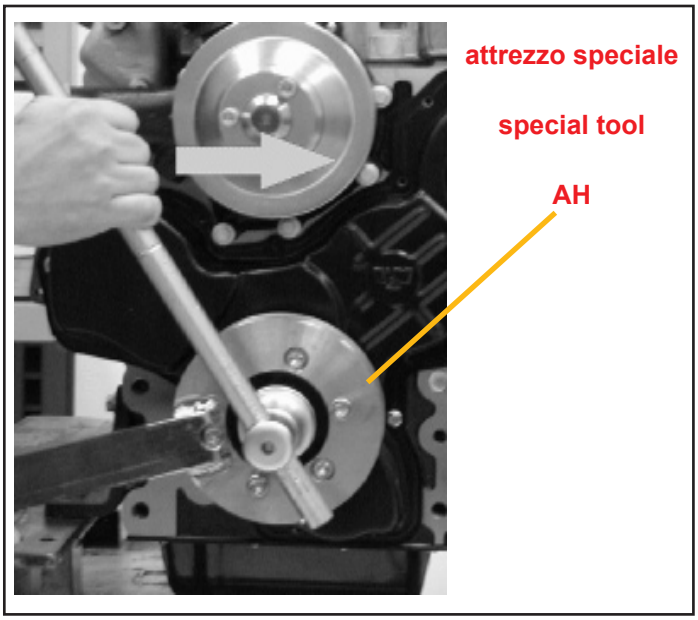
TO PREVENT THE CRANKSHAFT ROTATING DURING REMOVAL OF THE CRANKSHAFT PULLEY, FIT SPECIAL TOOL IN PLACE OF STARTER MOTOR (TAB. 11.1 REF. T).

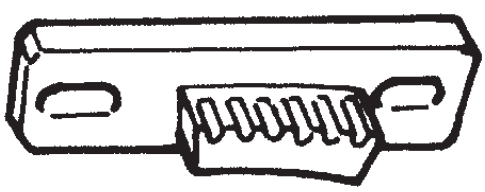
WHEN IT IS NOT POSSIBLE TO BLOCK THE ROTATION OF THE ENGINE SHAFT WITH THE FLYWHEEL, THE OPERATION CAN BE CARRIED OUT USING THE SPECIAL TOOL (TAB. 11.1 REF. AH).

The operation is carried out screwing the tool onto the front pulley using the M10 screws. Then, using a socket spanner, loosen the pulley-blocking nut.

Unscrew retaining nuts **A**.



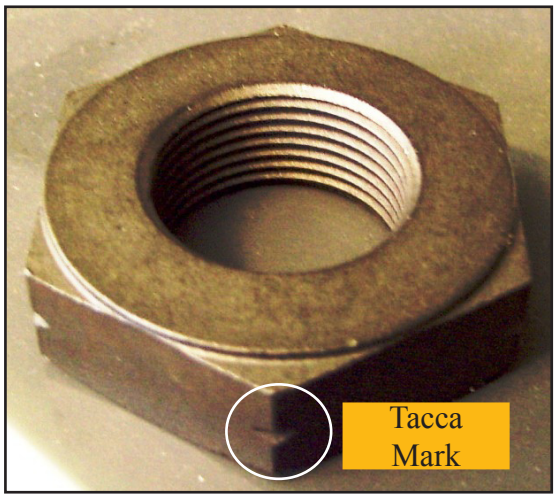




(TAB. 11.1 RIF. T)

(TAB. 11.1 RIF. AH)

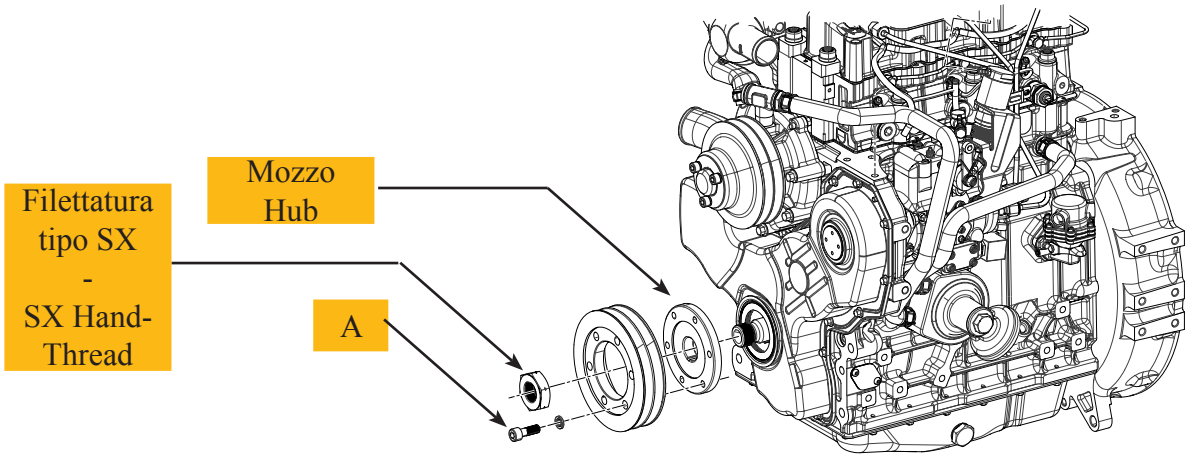
On D753, D704TE2 and D754E2/TE2 a new crankshaft and pulley nut have been introduced: crankshaft with front cylindrical shape end and left-hand threaed pulley nut. Therefore in order to recognize if the engine has a crankshaft with front cylindrical shape end it is necessary to look at the mark present on the pulley fixing nut (see picture).



Remove screws A.

Install in place of starter motor the special tool T.

Loosen the crankshaft hub nut clockwise.



(TAB. 11.1 RIF. T)

TIMING COVER

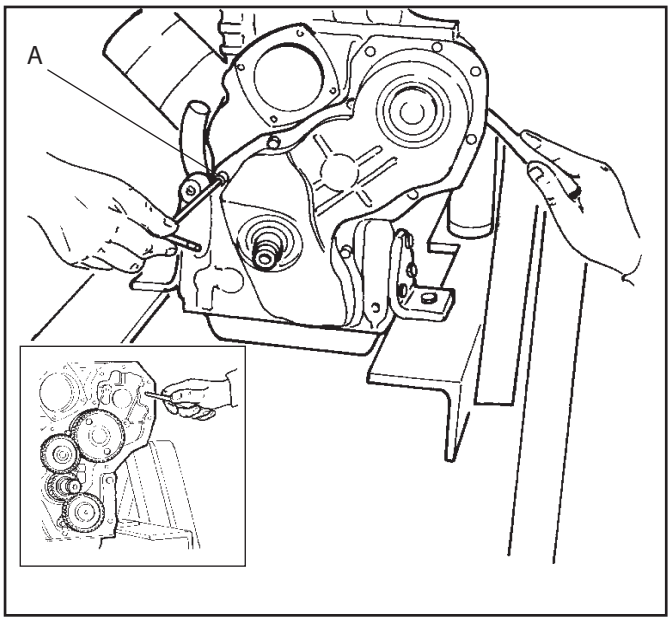
Remove bolts **A** around the perimeter of the timing cover.

Carefully remove the timing cover.

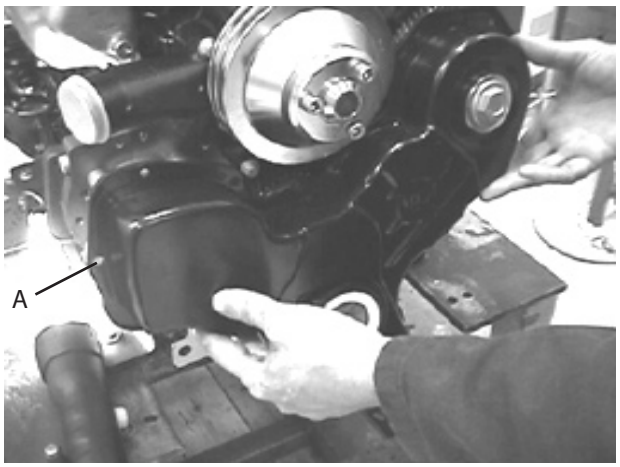
Clean all traces of sealant or gasket from the timing cover/crankcase.

Antifon covers have silicon sealant.

Casting covers have gasket.

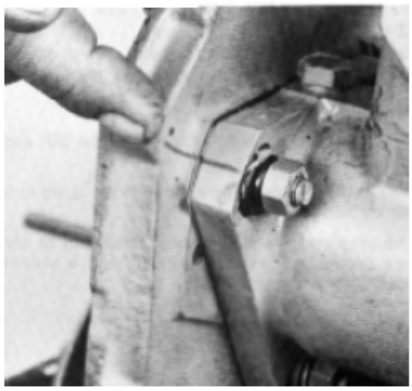


Metal sheet cover



INJECTION PUMP

BOSCH INJECTION PUMP REMOVAL WITHOUT REMOVING THE TIMING COVER



Before removing the injection pump, mark the injection pump flange and crankcase (see picture), in order to reassemble the pump in the same position by obtaining the previous injection timing advance.

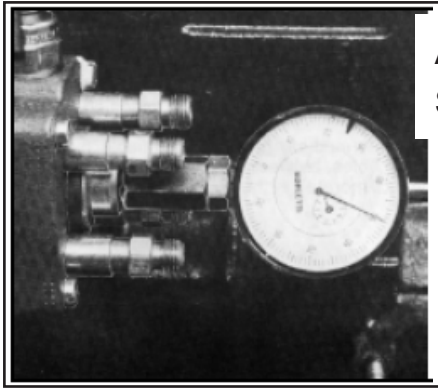
Install the **special tool AG** and dial gauge in place of 1st injector (timing side). Bring the cylinder number 1 piston top dead center (TDC) of compression stroke. Set the dial indicator to zero "0"

Install the **special tool X** and dial gauge on the injection pump.

Rotate the engine counterclockwise 15° - 20° before cylinder number 1 piston top dead center (BTDC) of compression stroke. While rotating the crankshaft look at the dial indicator needle on injection pump: when the needle stops moving, stop the rotation of the engine. Set the dial indicator to zero "0".

Bring again the engine at TDC: note the value red on the injection pump dial gauge indicator. **This value is the static injection pump timing advance in mm. Refer to also Chapter 6 paragraph 6.34 about static injection pump timing advance values**

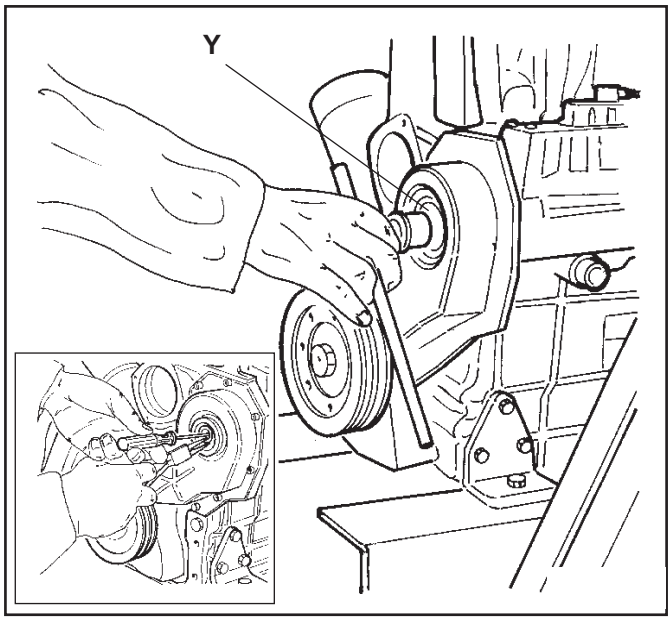
Attrezzo AG
Special Tool AG



Attrezzo X
Special Tool X

Unscrew threaded plug **Y on timing cover**.

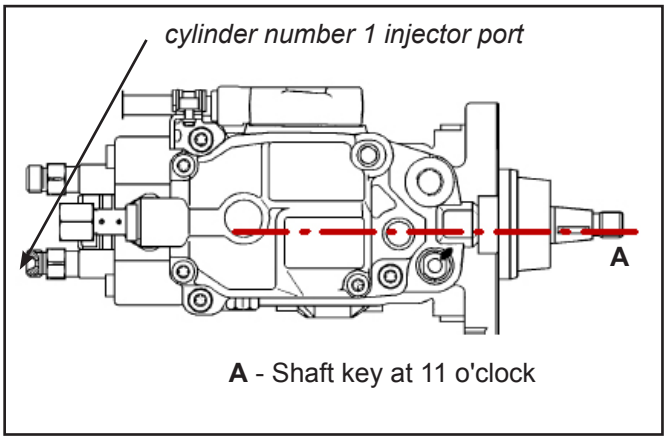
Unscrew the nut fixing injection pump gear, and using long-nosed pliers, remove the washer from the injection pump shaft. Use a screwdriver to prevent the washer falling inside the engine if partially dismantled.



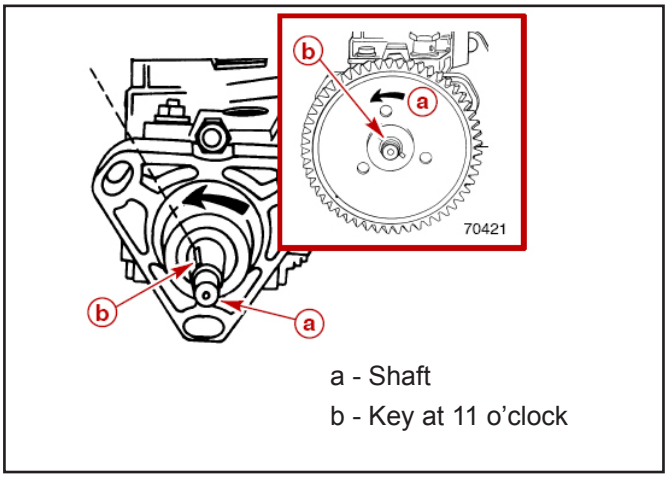
Verify the injection pump key position: if the key is approximately at 11 o'clock, as viewed from the injection pump gear looking toward the flywheel, the key is aligned with the cylinder number 1 injector port.

In this condition the cylinder number 1 piston is at TDC on its compression stroke.

If the key is not at 11 o'clock position, turn the crankshaft for a complete revolution.



A - Shaft key at 11 o'clock



a - Shaft

b - Key at 11 o'clock

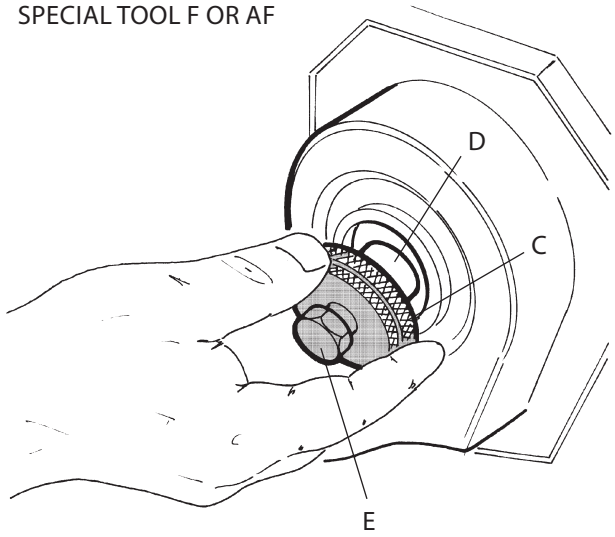
Before applying the special tool F or AF (refer to chapter 11 - Special Tools), to extract the pump, rotate the engine **counterclockwise** 15° - 20° before cylinder number 1 piston top dead center (BTDC) of compression stroke.

While rotating the engine observe the dial indicator installed on injection pump: stop the engine rotation when the dial gauge needle indicates "0". .

Fit the special tool **(TAB. 11.1 ref. F or AF as for depth of the front cover)** as follows:

- screw ringnut **C** up to the timing cover
- screw part **D** up to the pump gear
- remove 3 retaining pump flange nuts to crankcase
- screw in nut **E** until the pump gear is separated from the tapered shaft of the pump.

ATTREZZO SPECIALE F O AF
SPECIAL TOOL F OR AF



DB4427 AND DB4627 STANADYNE INJECTION PUMP MODEL REMOVAL - WITHOUT REMOVING THE TIMING COVER

Install the special tool AG and the dial gauge in place of 1st injector, timing side

Bring the **cylinder number 1 piston top dead center (TDC) of its compression stroke piston** and set the indicator to "0".

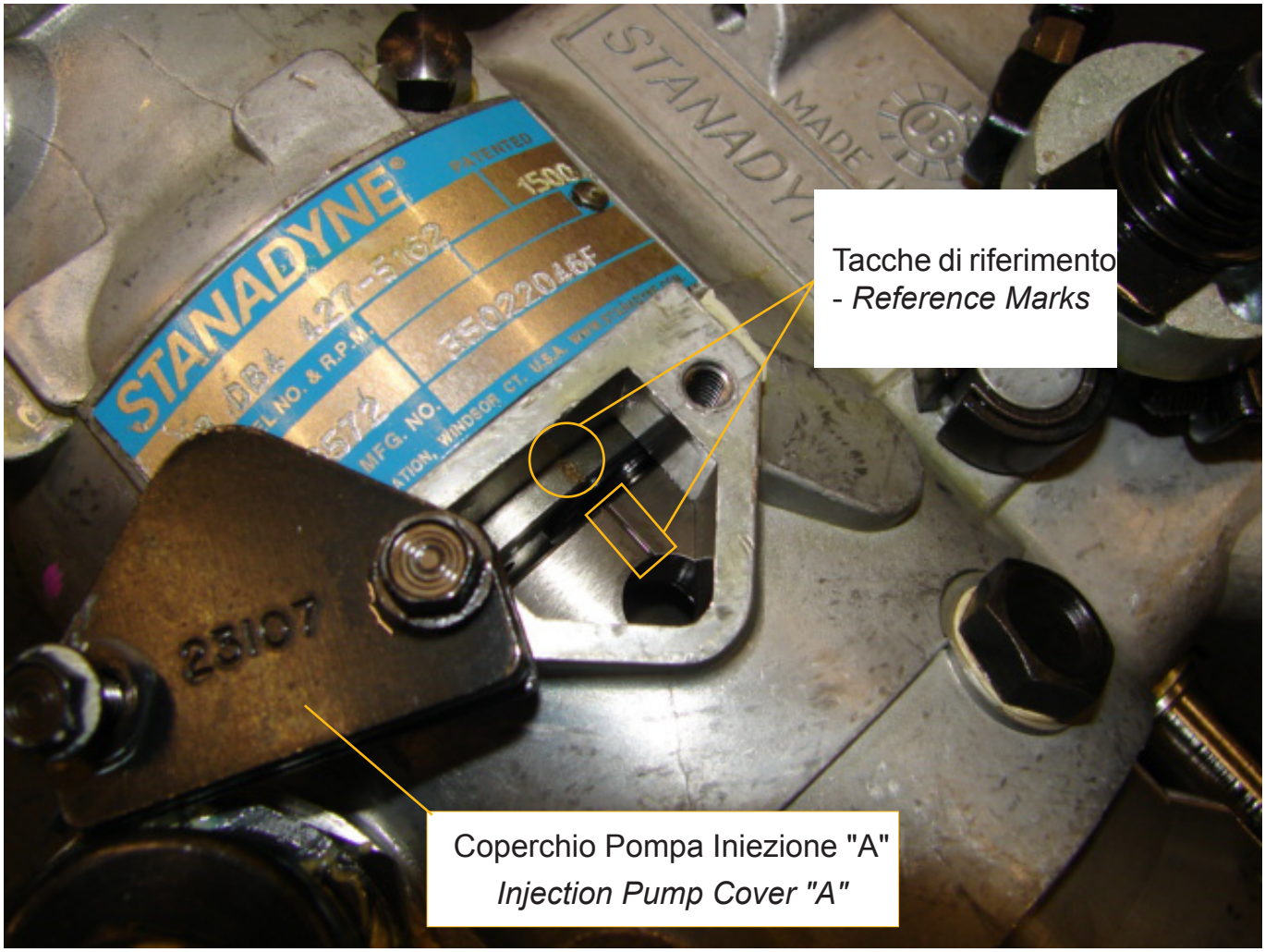
Rotate the engine, as viewed from the front of the engine, 20° - 30° counterclockwise to remove any injection pump backlash.

Use the **special tool R, VM code 68450003A, graduated disc to determine the degrees.**

Rotate the engine clockwise toward TDC: stop the engine rotation once obtained the injection pump timing advance degrees. **(REFER TO CHAPTER 6 "CHECK & REPAIRS" paragraph 6.34)**

Loosen the cover **A** on injection pump.

Verify no.2 reference marks are aligned as shown in the picture. If they are not aligned anticipate o retard the engine



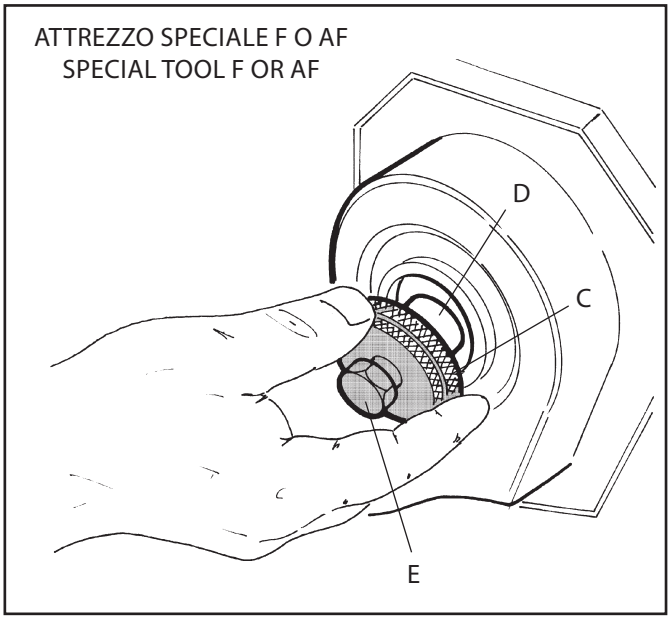
Loosen the plug on timing cover.

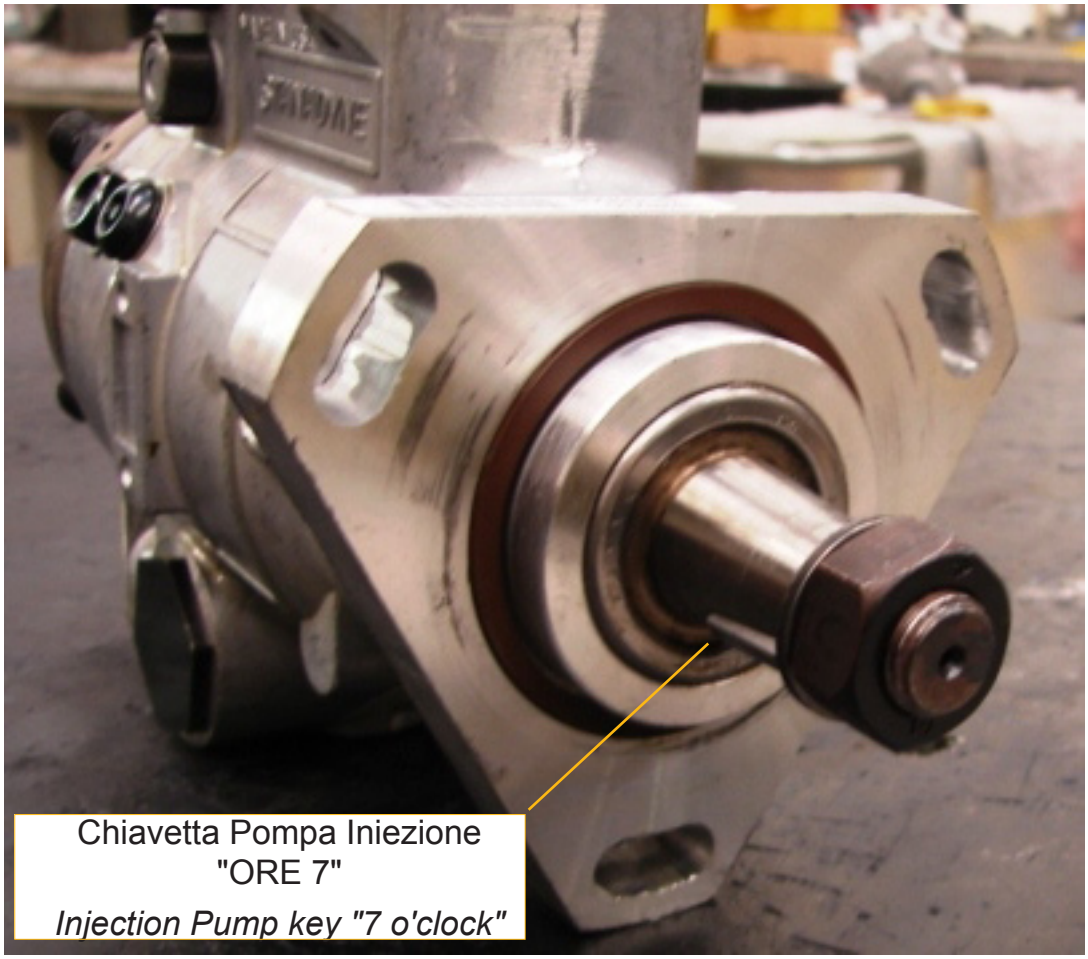
Loosen the nut fixing the injection pump gear and using long-nosed pliers, remove the washer from the injection pump shaft. Use a screwdriver to prevent the washer falling inside the engine if partially dismantled.

Before extracting the injection pump verify the injection pump key position: if the key is approximately at 7 o'clock, as viewed from the injection pump gear looking toward the flywheel, the key is aligned with the cylinder number 1 injector port. SEE PICTURE

Apply the special tool **F or AF** (**refer to chapter 11 - Special Tools**) to extract the pump.

- Install the ringnut **C** against the timing cover .
- Screw part **D** up to the pump gear
- Remove 3 retaining pump flange nuts to crankcase
- Screw in nut **E** until the pump gear is separated from the tapered shaft of the pump.





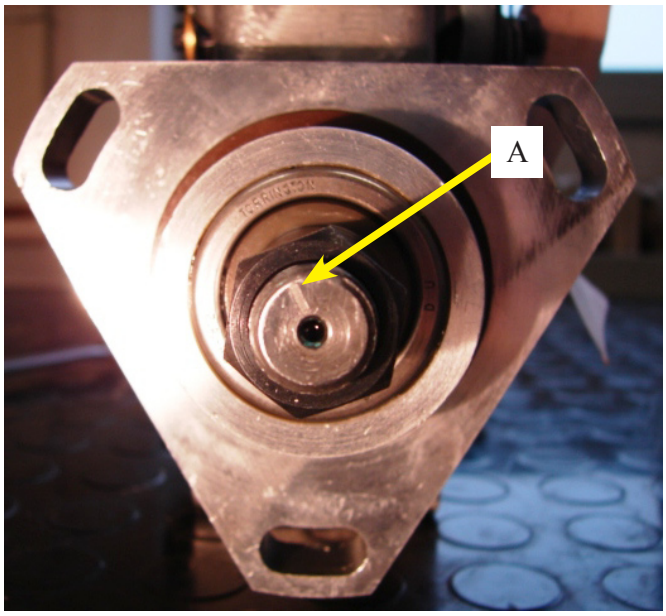
D753 E3/TE3/IE3, D754TPE2/IPE2, D756TPE2/IPE2 STANADYNE INJECTION PUMP DB 4329, DB4429, DB4629 MODEL - REMOVAL

Install the special tool AG and dial gauge in place of 1st injector, timing side.

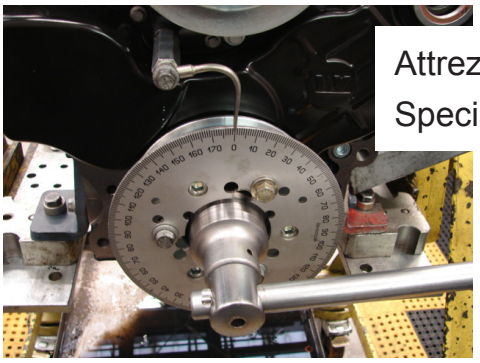
Bring the **cylinder number 1 PISTON TOP DEAD CENTER (TDC) OF ITS COMPRESSION STROKE** and set the indicator to "0".

Loosen the plug on timing cover.

Verify that mark **"A"** on injection pump shaft is aligned with the cylinder number 1 injector port, approx 11 o'clock (see picture). In this condition the **cylinder number 1 PISTON TOP DEAD CENTER (TDC) IS OF ITS COMPRESSION STROKE**



Install the **special tool R, VM code 68450003A, graduated disc in order to determine the injection timing advance. Bring the crankshaft to TDC and** set to "0" the needle on graduated disc.



Attrezzo R
Special Tool R

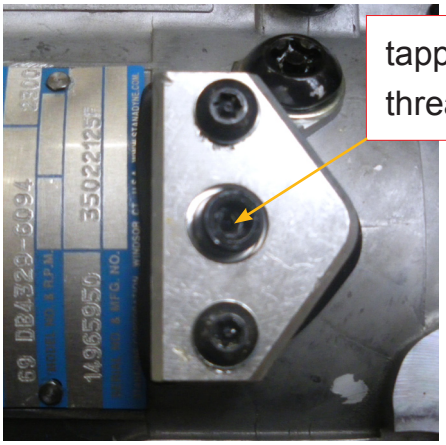
ONLY FOR D753TE3/IE3 TURBO and TURBO INTERCOOLED ENGINES

Using the pin, **special tool VM 68480019F** it is possible to block the pump to engine TDC.

Remove the plug A on injection pump cover and insert the **special tool 68480019F**.

Verify that the dial gauge indicator on the cylinder head and the needle on graduated disc indicate "0" . If the indication is not correct ("0") set both indicators to "0".

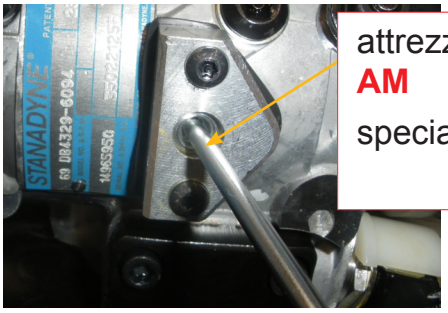
Remove the **special tool AM** from injection pump cover and install the thread plug A.



tappo A
thread plug A

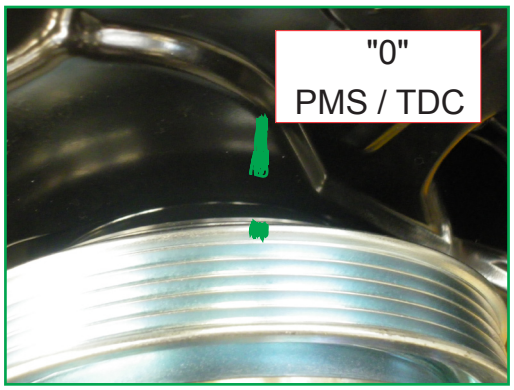
Make a reference mark on crankshaft pulley and timing cover. This reference mark is the TDC - "0"

Anticipate the engine 20° - 30° before cylinder number 1 piston top dead center (BTDC) of compression stroke, rotating the engine counterclockwise, looking at the engine from the timing: **in this way any injection pump backlash is removed.**



attrezzo speciale **AM**
special tool **AM**

Rotate the engine clockwise, towards TDC up to specific degrees values of injection timing advance. (REFER TO TABLE OF CHAPTER 6 "CHECKS AND REPAIRS")



"0"
PMS / TDC

Model	Injection Timing Advance Degrees
D753TE3	8°
D753IE3	8°
D753E3	14°
D756IPE2	version fire pump "FRP" max 3000 rpm: 10° version GENSET max rpm 2300: 7°
D754TPE2	version fire pump "FRP" max 3000 rpm: 9° version GENSET max giri/min 2300: 4°

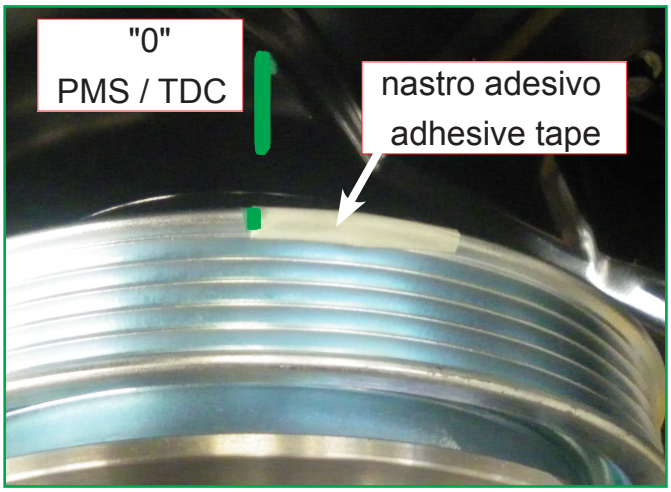
IN CASE OF GRADUATED DISC NOT INSTALLED

If the graduated disc has been not installed in order to determine the injection timing advance it is needed to follow this task:

- measure the diameter of crankshaft pulley (example Ø 200 mm)
- calculate the circumference (200 x π = 628 mm)
- divide the circumference in degrees (628 / 360 = 1.75 mm)
- Every 1,75 mm coincides with 1° degree

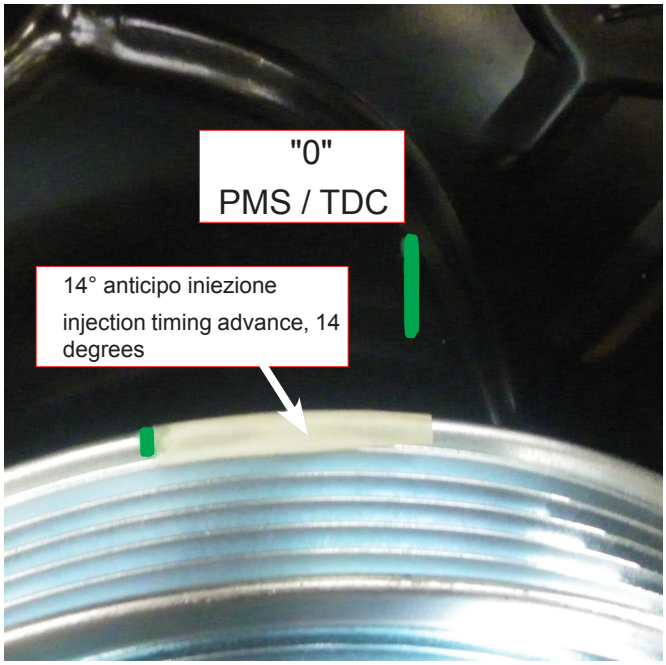
After calculating how many circumference millimeters of crankshaft pulley coincide with 1° degree (example: 1,75 mm coincides with 1° degree), 14°degrees of injection timing advance correspond to 1,75 x 14= 24.5 mm , 2.45 cm (about 2,5 cm).

Apply on crankshaft pulley a piece of adhesive tape as long as the value calculate (example 2,5 cm). Refer to picture .

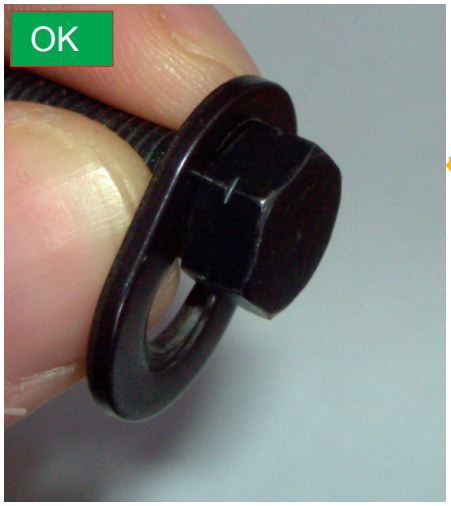


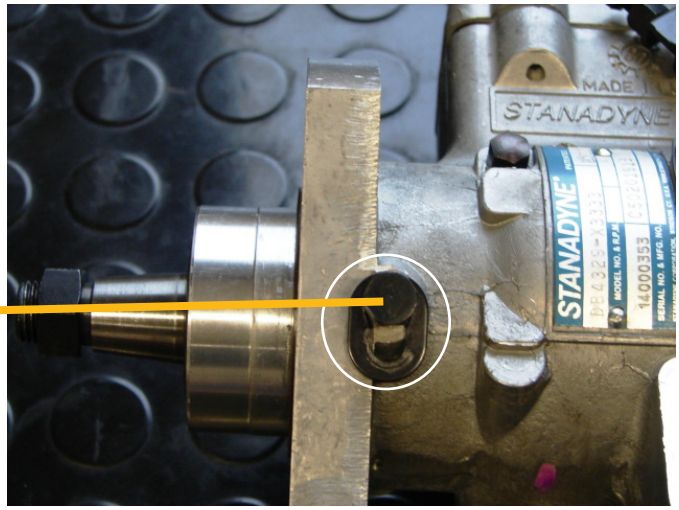
Anticipate the engine 20° - 30° before cylinder number 1 piston top dead center (BTDC) of compression stroke, rotating the engine counterclockwise, looking at the engine from the timing: **in this way any injection pump backlash is removed.**

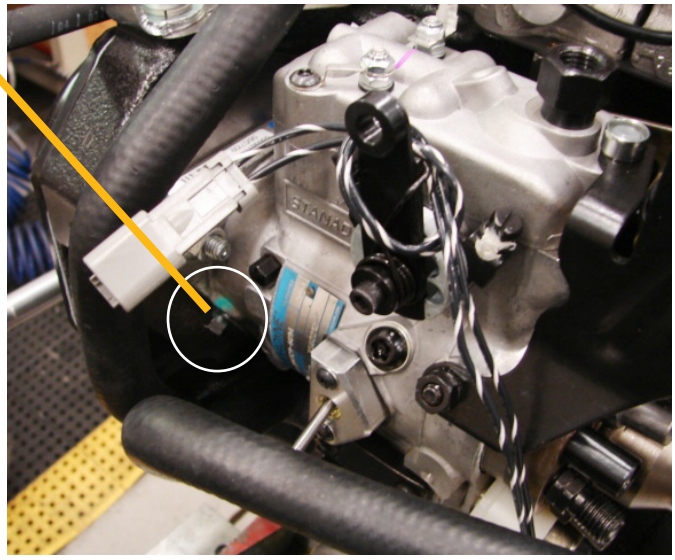
Rotate the engine counter clockwise, up to align the adhsive tape end with reference mark TDC "0".



Install the special bolt and related washer so that the pump rotation is blocked. Verify the special washer position on the bolt.



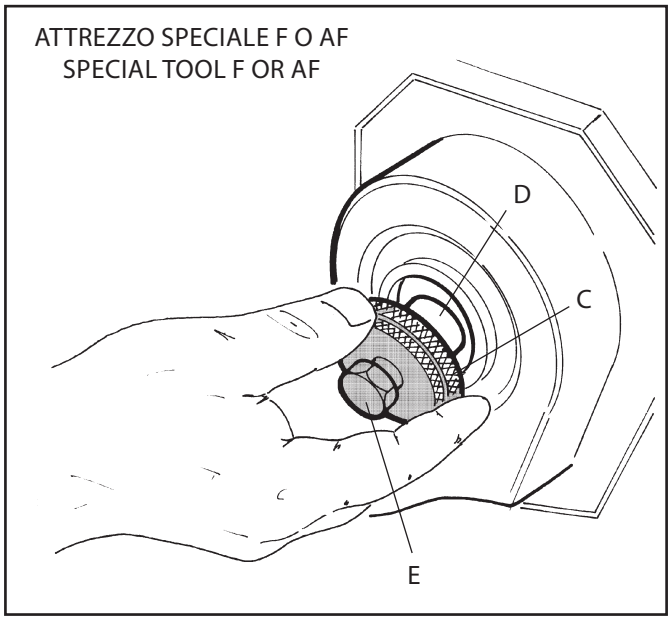




Remove the threaded plug on timing cover.

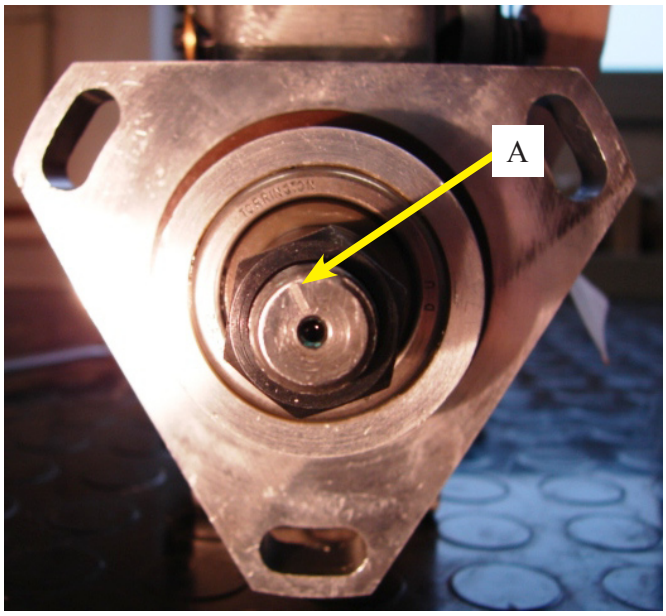
Remove the injection pump gear fixing nut and and using long-nosed pliers, remove the washer from the injection pump shaft. Use a screwdriver to prevent the washer falling inside the engine if partially dismantled.

Before removing the injection pump verify that mark **"A"** on injection pump shaft is aligned with the cylinder number 1 injector port. (see picture). This is the condition the **cylinder number 1 PISTON TOP DEAD CENTER (TDC) OF ITS COMPRESSION STROKE**



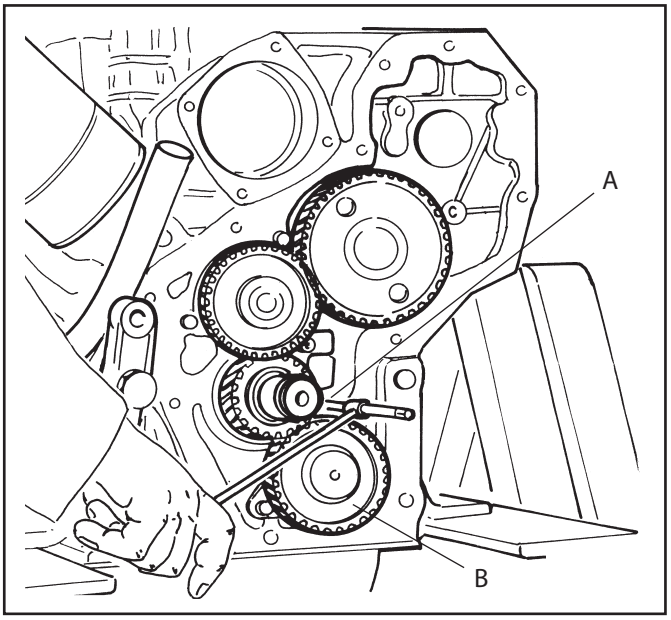
Apply the special tool **F o AF (refer to chapter 11 - Special Tools)** to extract the injection pump.

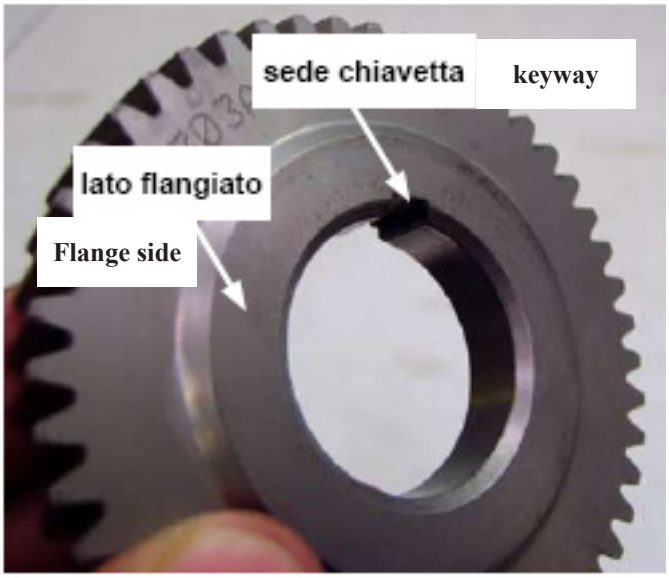
- Install the ringnut **C** on the timing cover .
- Screw part **D** on pump gear
- Remove 3 retaining pump flange nuts to crankcase
- Screw in nut **E** until the pump gear is separated from the tapered shaft of the pump.

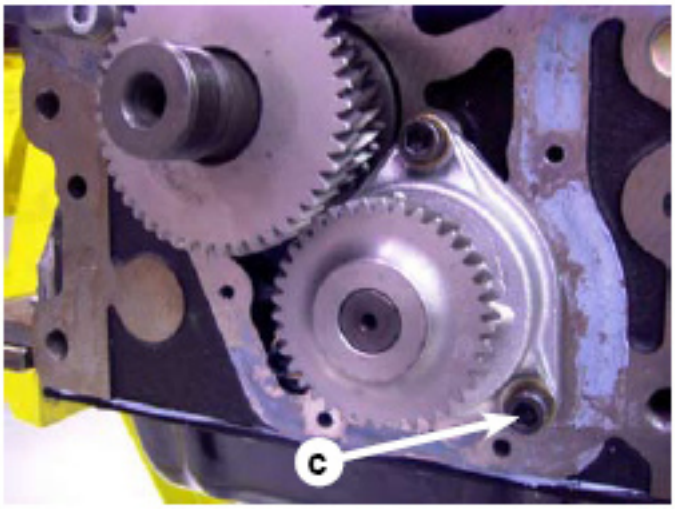


OIL PUMP

Unscrew retaining bolts **A** and withdraw oil pump **B**.





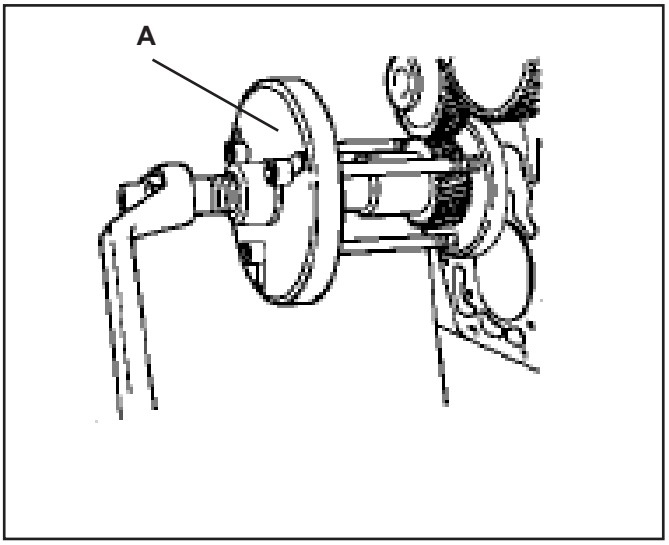


CRANKSHAFT GEAR AND INTERMEDIATE GEAR

Crankshaft gear

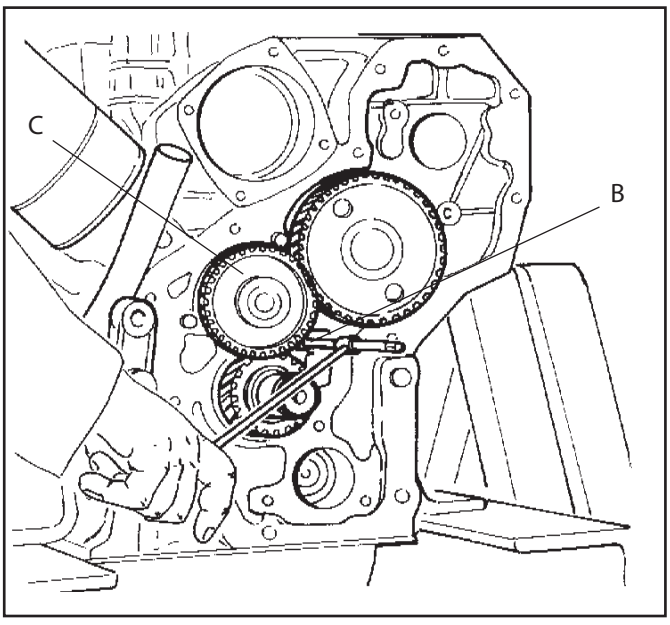
To remove crankshaft gear, use special tool **A** **(TAB. 11.1 rif. G) for crankshaft having a** front cone shape end.

For crankshaft with cylindrical front end use the special tool (TAB 11.1 Al)



Idler gear

Unscrew retaining bolts **B** and withdraw gear **C**.

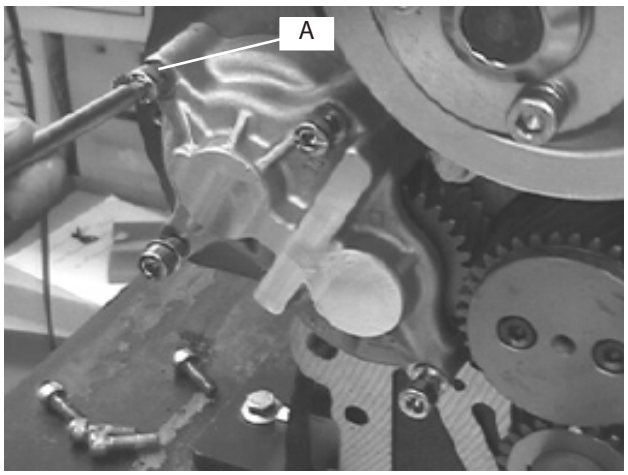


IMPORTANT

Before removing the crankshaft, idler and camshaft gears , it is needed to mark the teeth of these gears or align them as indicated in the Chapter 7 paragraph "TIMING GEARS".

Hydraulic pump Gears

Unscrew the fixing screws **(A)** and remove the support, extracting it from the gears.

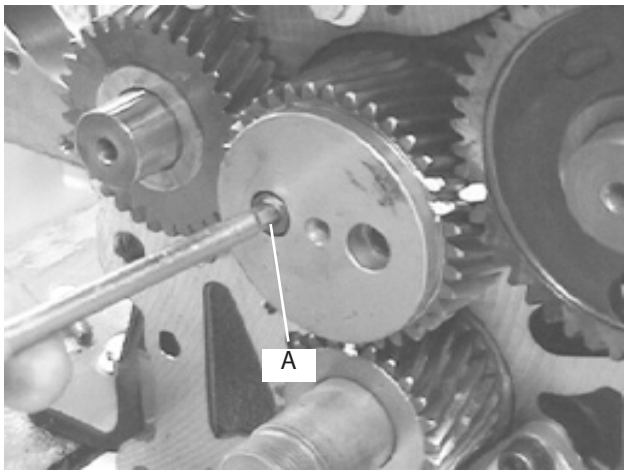


Idler gear

Remove the fixing screws **(A)** and extract the gear.

IMPORTANT

Before removing the crankshaft, idler and camshaft gears , it is needed to mark the teeth of these gears or align them as indicated in the Chapter 7 paragraph 7.16 "TIMING GEARS".



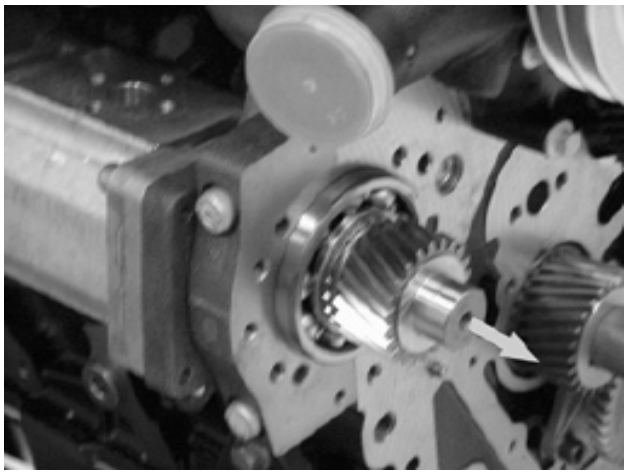
Hydraulic pump intermediate gear

Extract the gear from its seat on the crankshaft.

Hydraulic pump control gear

Remove the gear, extracting it as indicated in the figure.

It does not need excessive force as it is not placed with interference.

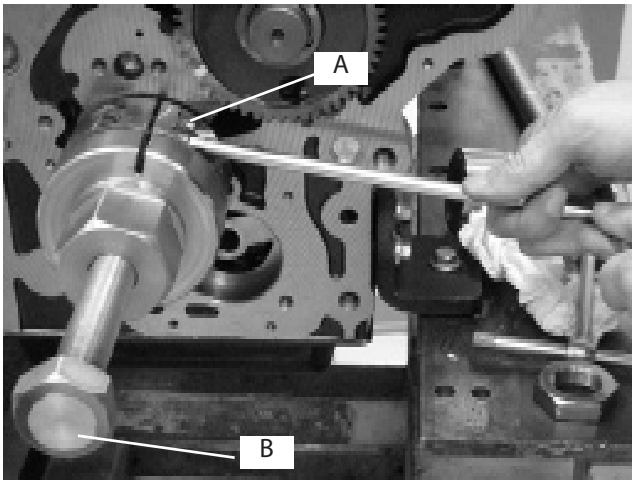


Crankshaft gear (crankshaft with front cylindrical end)

To remove the gear from the engine shaft it is necessary to use the specific tool **(TAB.11.1 ref. AI)** that must be inserted onto the gear. Tighten screws **B** that block it onto the gear and rotate the reaction screws **C** until it is totally extracted.

IMPORTANT

Before removing the crankshaft, idler and camshaft gears , it is needed to mark the teeth of these gears or align them as indicated in the Chapter 7 paragraph 7.16 "TIMING GEARS".



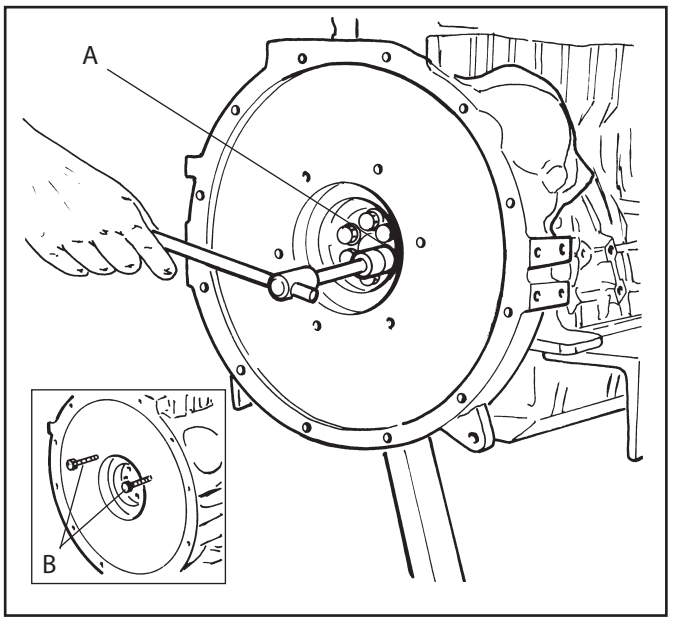
(TAB. 11.1 RIF. AI)

FLYWHEEL

Install the special tool **(TAB. 11.1 ref. T)** in place of starter motor in order to prevent flywheel from turning.

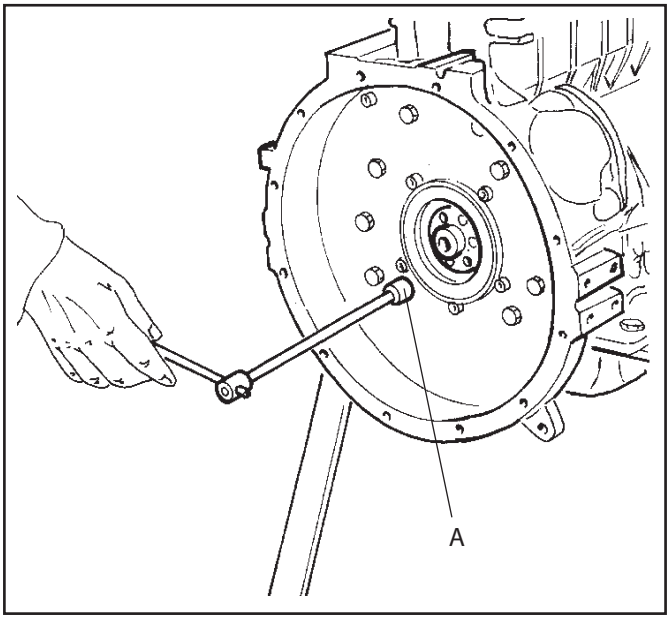
Unscrew flywheel bolts **A**.

To facilitate flywheel removal, use two standard commercial bolts **B** as shown in the figure.



FLYWHEEL BELL HOUSING

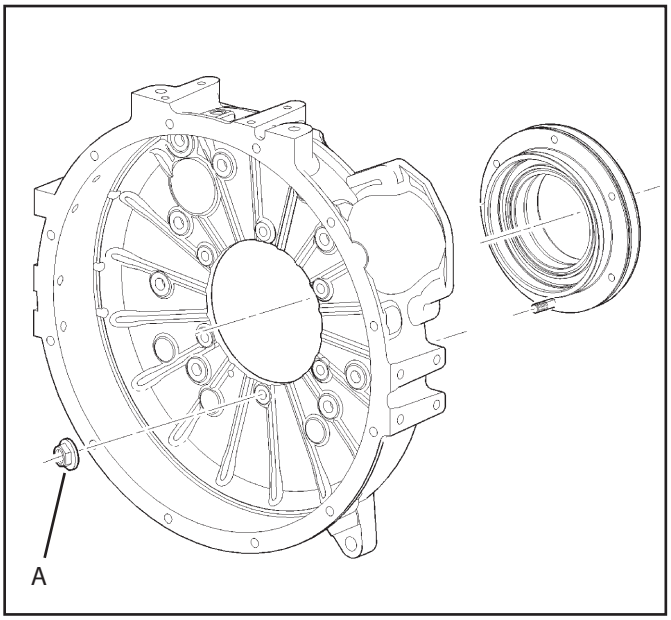
Remove bolts and flange nuts **A**.



REAR MAIN BEARING CARRIER

Unscrew nuts **A** and remove the bearing carrier taking care not to exert any radial force.

THE REAR MAIN BEARING CARRIER MAY BE REMOVED TOGETHER WITH THE FLYWHEEL BELL HOUSING.

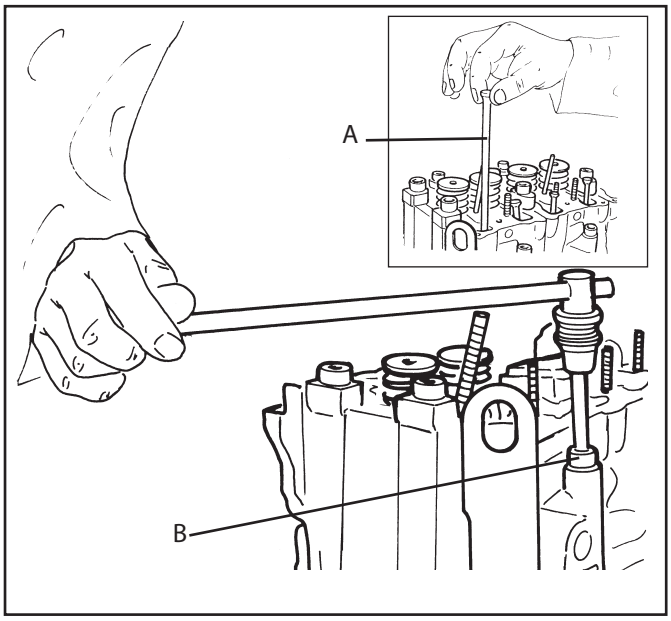


CYLINDER HEAD

Withdraw the push rods A and rocker arms assembly.

Unscrew the cylinder head bolts **B**.

IT IS ADVISABLE TO MARK THE CYLINDER HEADS AS TO THEIR POSITION.



HYDRAULIC TAPPETS

Remove retainers **A** .

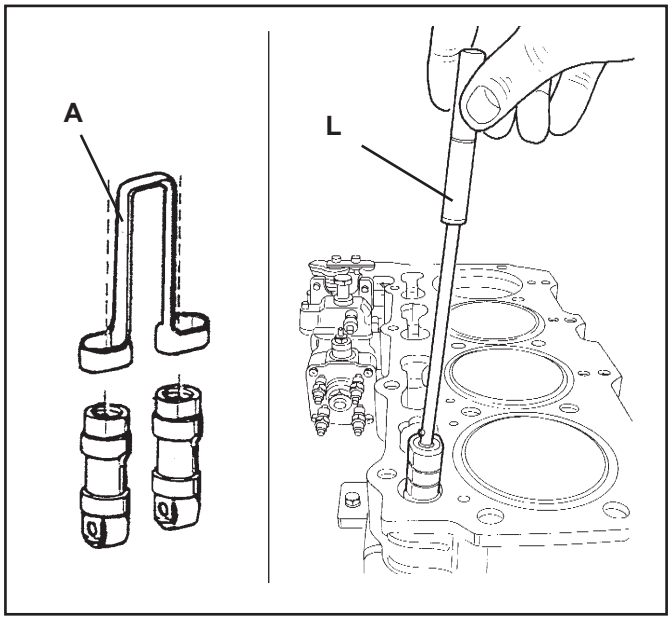
Install VM special tool **L** **(TAB. 11.1 ref. L)** through openings in the block and fit the tool firmly in the head of the tappet. Push down and twist the tool of 90°.

At this point the hydraulic tappet is hooked.

Pull the tappet out of the bore with a twisting motion.

If all the tappets have to be removed, identify them to ensure installation in the original location.

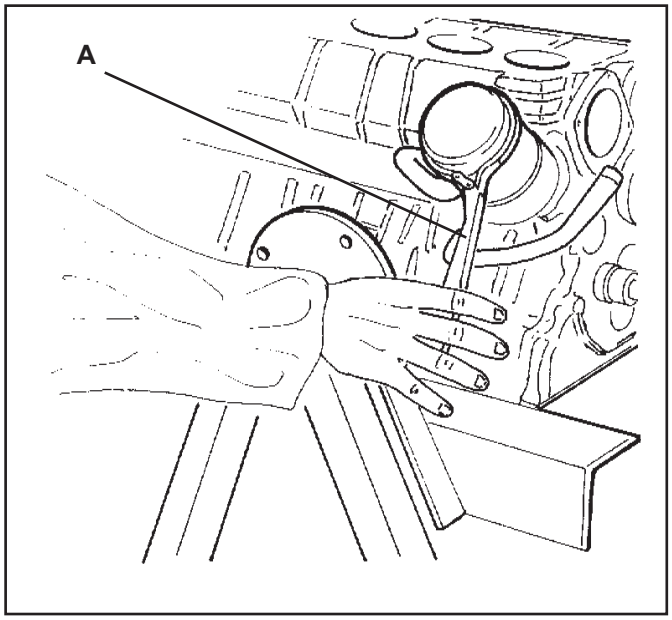
NOTE: IF THE ENGINE IS EQUIPPED WITH MECHANICAL TAPPETS, REMOVAL IS PERFORMED IN A LATER STEP



OIL FILTER CARTRIDGE

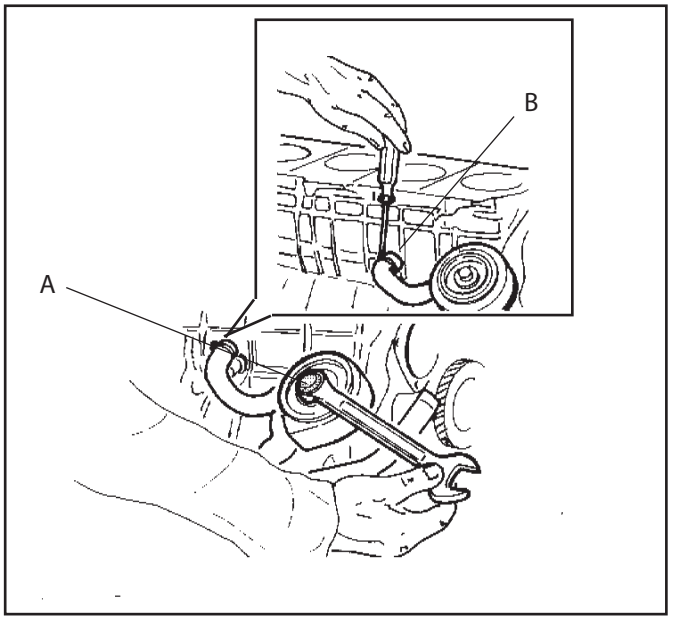
Unscrew and remove the oil filter cartridge using a commercial oil filter wrench **A**.

BE CAREFUL NOT TO DEFORM THE CARTRIDGE MOUNTING.



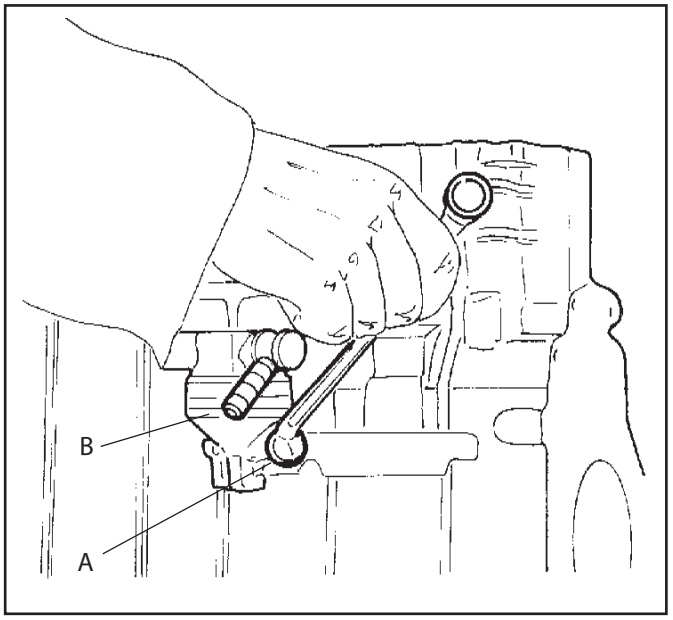
OIL HEAT EXCHANGER

Unscrew the internal union **A**.
Slacken off the water hose clamps **B**.
Remove the oil cooler complete with the water hoses.



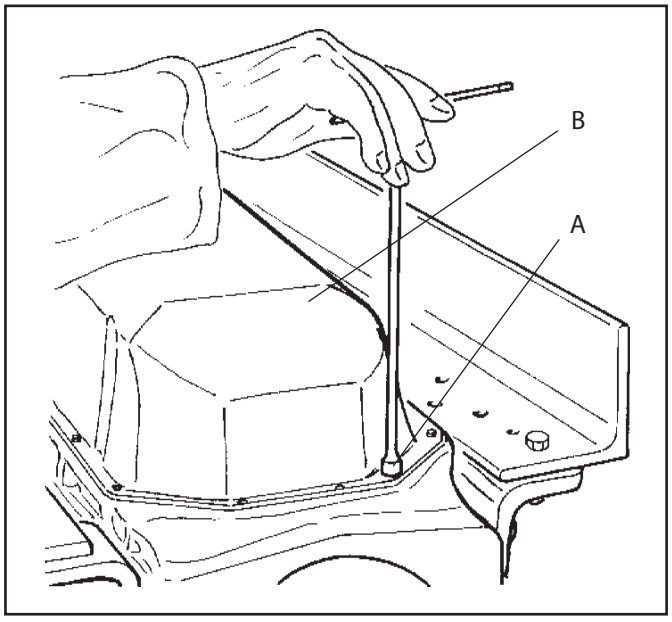
FEED FUEL PUMP

Unscrew bolts **A**.
Remove pump **B**.



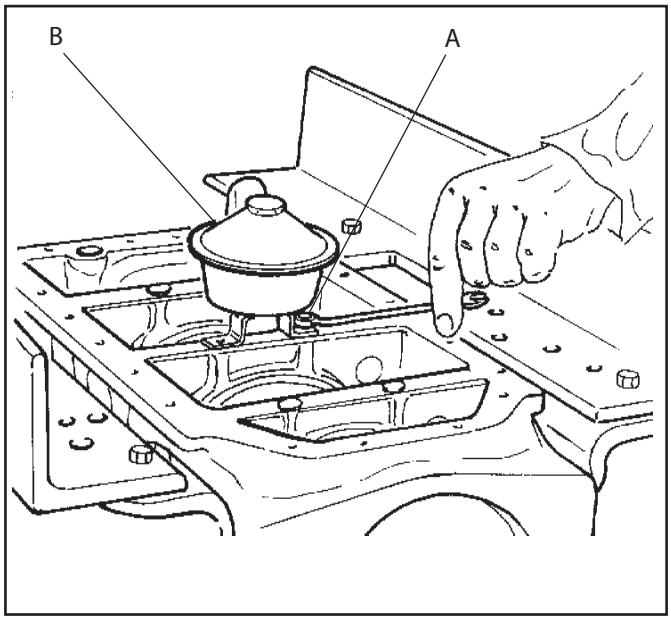
OIL PAN

Turn the engine upside down.
Unscrew bolts **A** and remove the sump pan **B**.



OIL PICK-UP PIPE

Unscrew bolts **A** and remove pipe **B**.



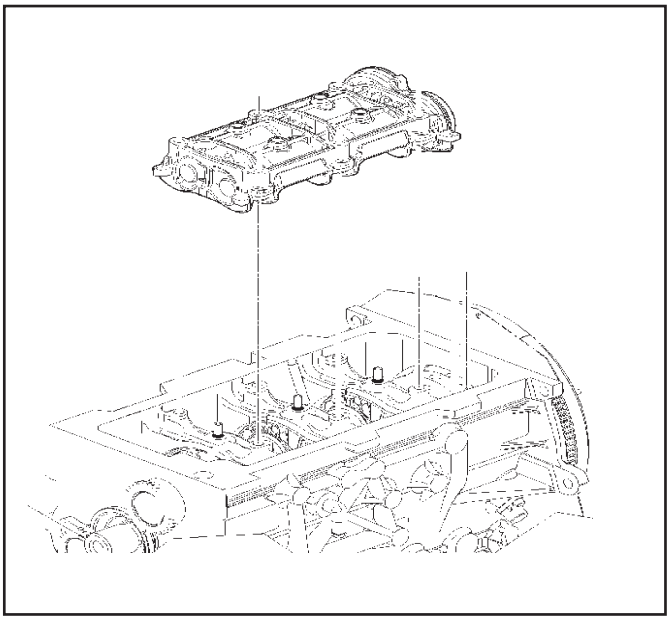
BALANCE SHAFT

IMPORTANT: before removing the counter balance shaft it is necessary to bring the cylinder piston no.1 at its TDC: use special tool AG to determine the TDC.

Remove the bolts tightening the balance shaft assembly to the blok.

Push with a lever under the balance shaft assembly in different positions in order to make it free from the centering pins, if these are still keeping it in position.

Remove the balance shaft assembly.

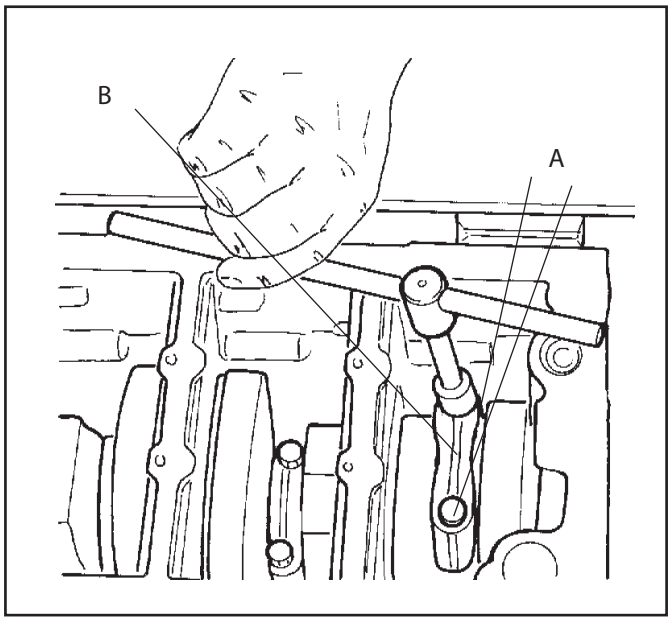


CONNECTING ROD - PISTON COMPLETE WITH RINGS

Turn the crankshaft so that the connecting rod to be removed when is at bottom dead center.

Unscrew bolts **A** and remove big-end bearing cap **B**. Using a suitable implement of soft material (wood or rubber), push the connecting rod/piston assembly up the bore and out of the cylinder block. Repeat this operation for each piston.

IT I S GOOD PRACTICE TO REASSEMBLE THE CAPS AND CONNECTING RODS AFTER REMOVAL AND NUMBER THEM CONSECUTIVELY ACCORDING TO THEIR POSITION.
ONLY REMOVE THE PISTONS FROM THE CONNECTING RODS IF ABSOLUTELY NECESSARY. TO DO THIS, REMOVE THE CIRCLIPS AND GUDGEON PINS.
PISTON RINGS MUST BE REMOVED USING A COMMERCIAL PISTON RING REMOVAL TOOL.



CENTER MAIN BEARING CARRIER

1. Remove the main bearing locating screws and special locating screws that hold the main bearing carriers in cylinder block and supply lubricating engine oil to main bearings carriers and front / rear main bearings.

a - Locating screw - standard

b - Special locating screw (for oil supply hose to turbocharger)

c - Oil supply pipe - rocker arms

2. Install the Crankshaft Installer Tool over the timing gear to protect front main bearing.

d - Crankshaft Installer Tool

e - Crankshaft gear

IMPORTANT: Before removing the crankshaft from the block, number or mark the bearing carriers according to the journal upon which they are fitted. Also make matching marks on both bearing carrier halves for correct reassembly.

IMPORTANT: When removing the crankshaft do not damage the piston cooling jet. Ensure to remove the oil piston cooling jet. (Refer to Oil Piston cooling Jets Section)

x - matching marks on both bearing carrier halves

y - matching marks on all main bearing carriers (between carrier and block)

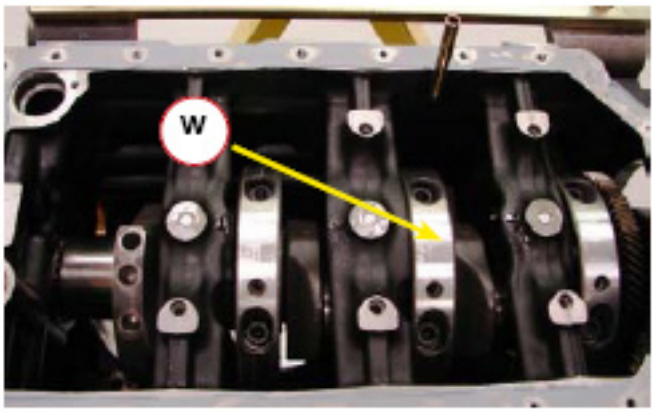
z - number all main center bearing carrier according to the journal upon which they are fitted

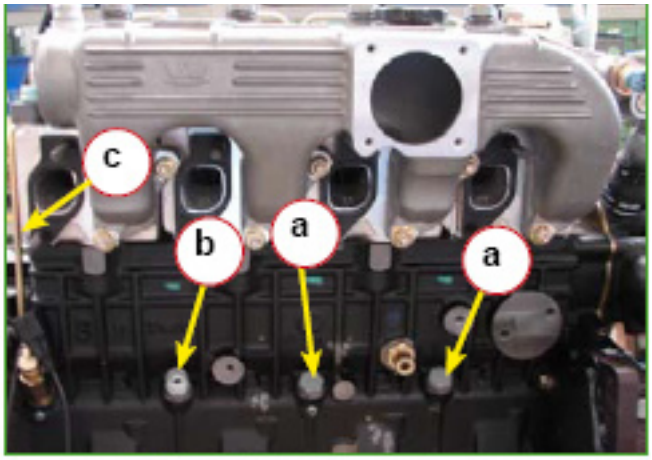
3. Withdraw the crankshaft so that the main bearing carries can be disassembled.

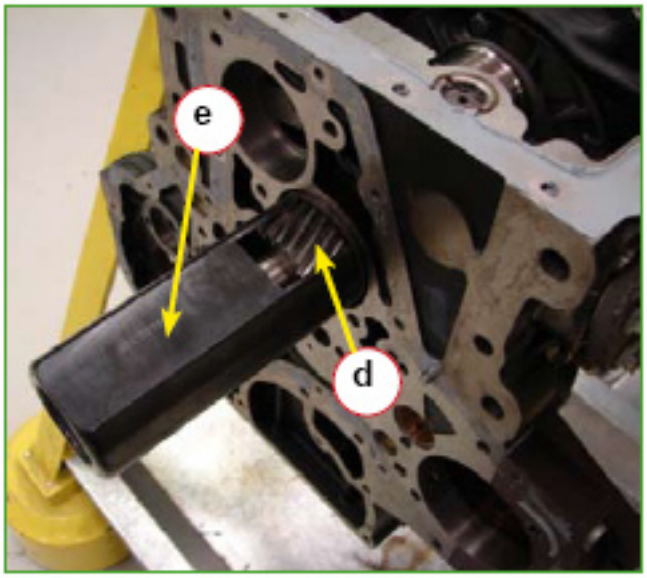
Disassemble all main bearing carriers.

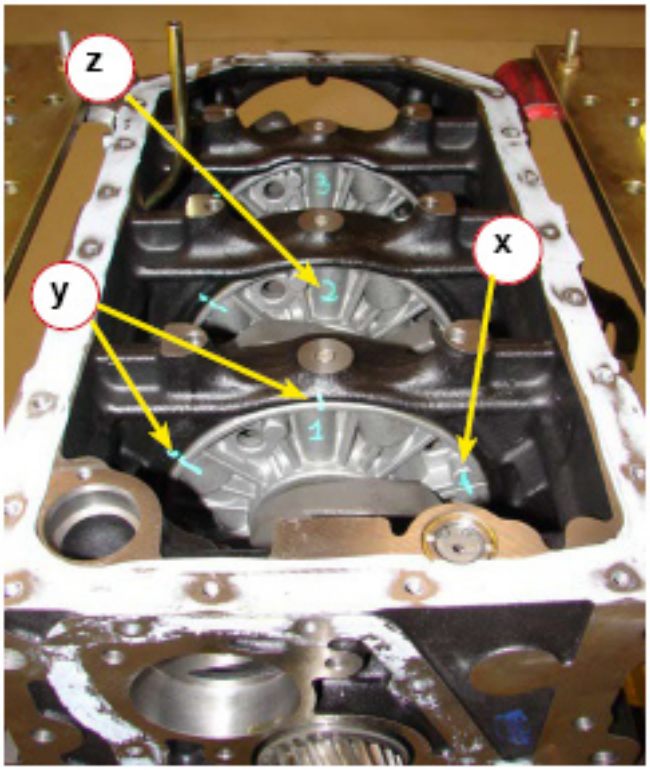
Take crankshaft off from the cylinder block.

w - main bearing carriers removed proper block bore



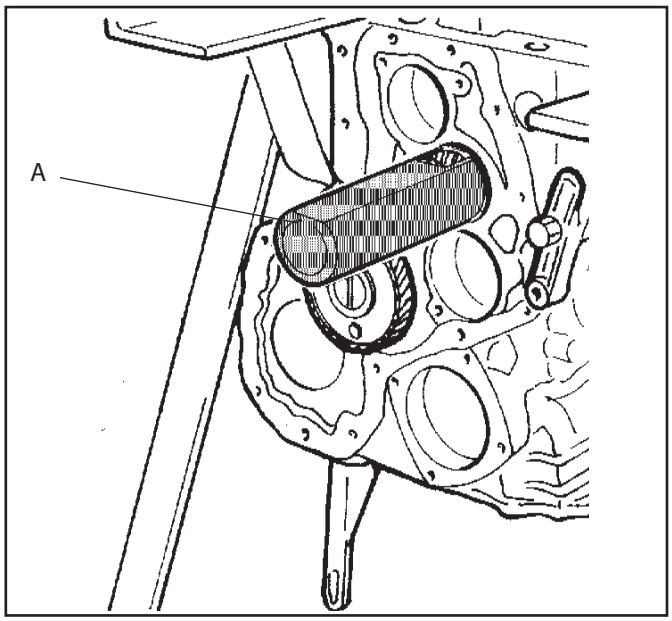






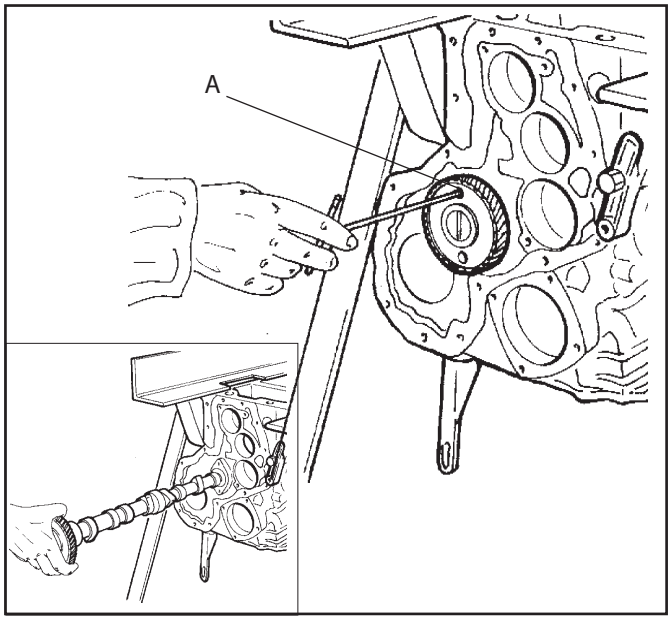
CRANKSHAFT

Using special tool **A** **(TAB. 11.1 ref. H)**, withdraw the crankshaft.



CAMSHAFT

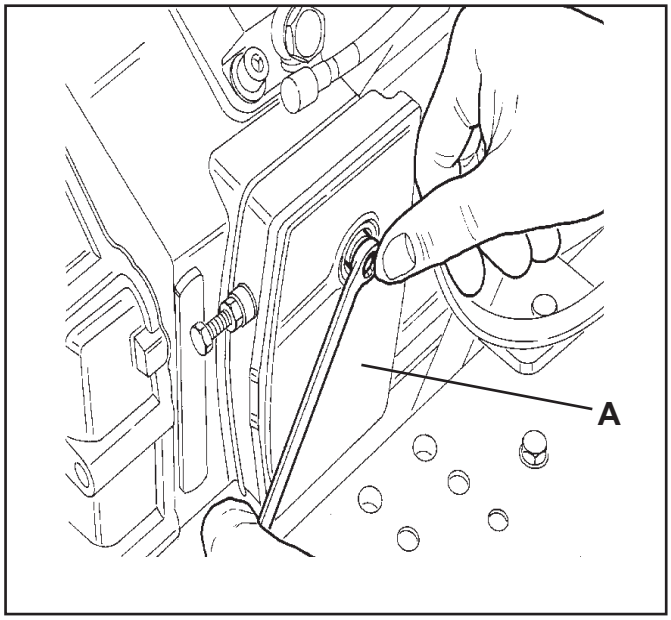
With the engine inverted, unscrew bolts A.
Withdraw the camshaft very gently taking care not to damage the camshaft bearings.



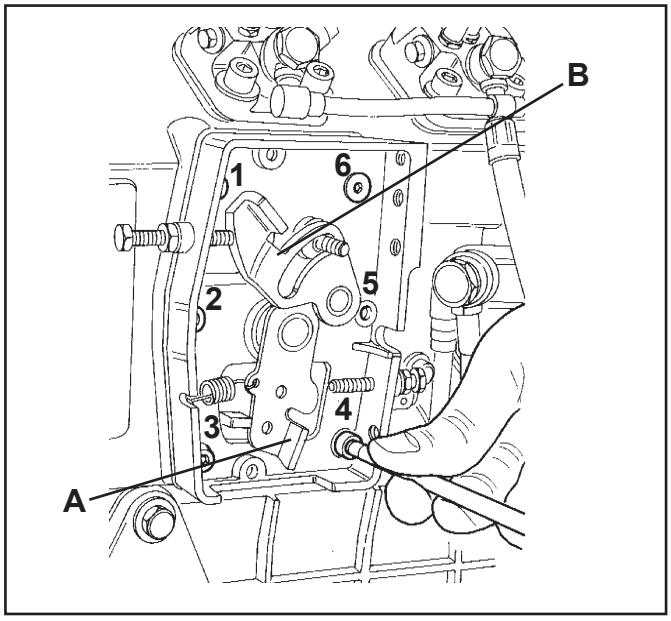
ENGINE WITH SINGLE PUMPS (D703)

REGULATOR (D703)

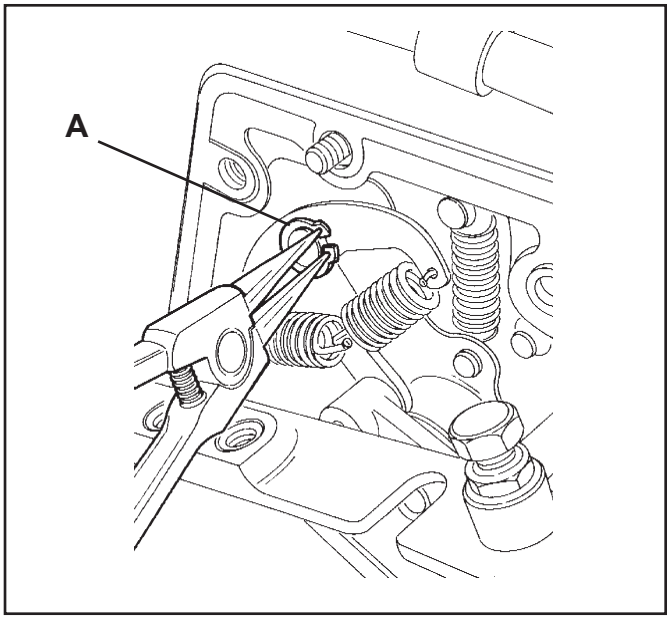
Remove the regulator cover **A**



Remove the internal leverages (stop **A** and accelerator **B**) housing bolts (**1,2,3,4,5,6**).

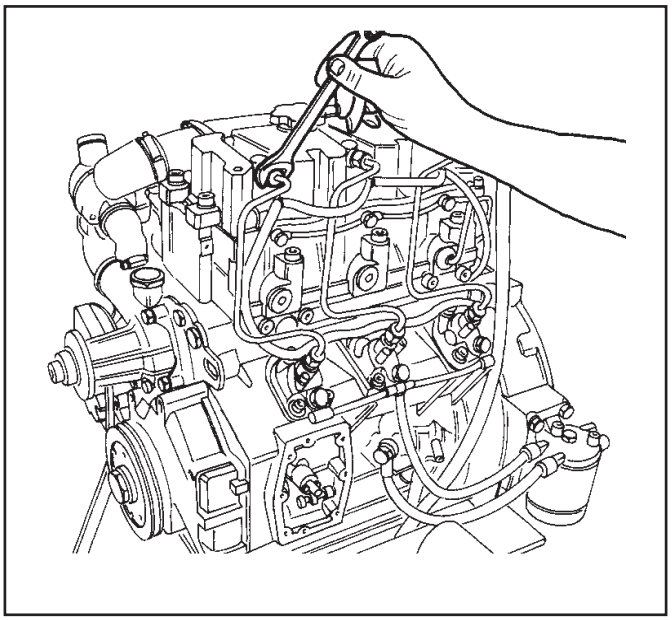


Remove the governor spring circlip **A**

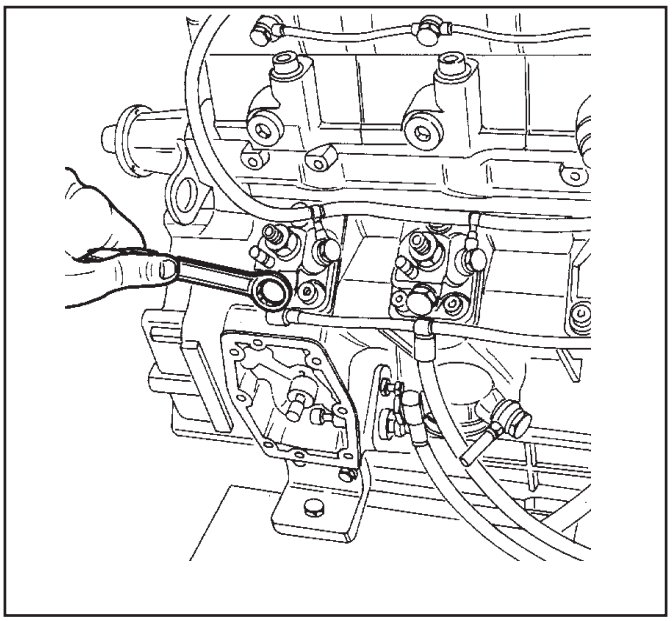


FUEL LINES

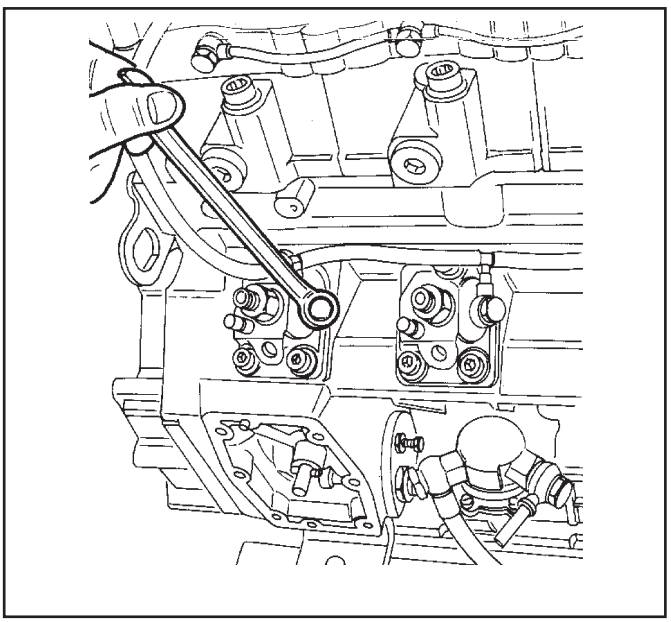
Remove the high pressure fuel line



Remove the fuel line supply from the filter to the pumps



Remove the fuel return line

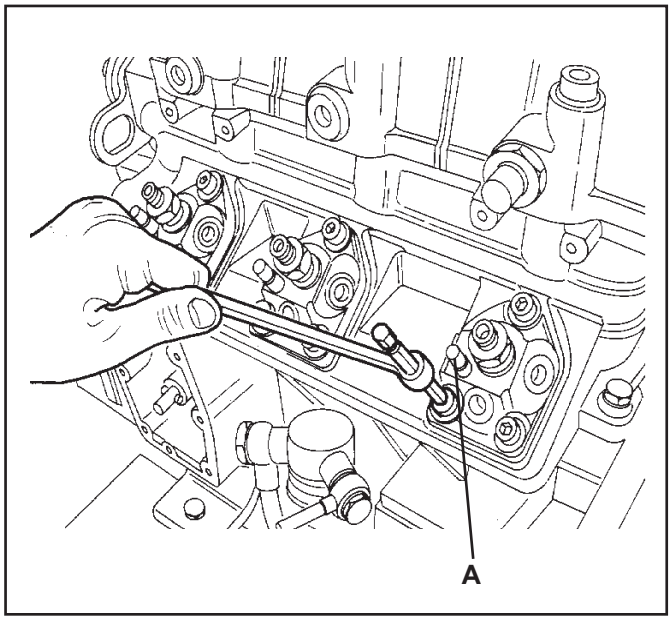


INJECTION PUMP (OLD MODEL)

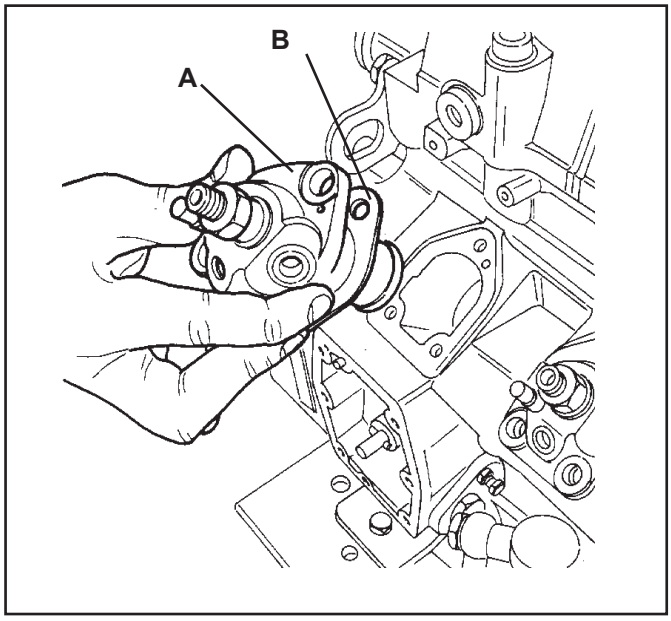
Remove the #3 inblock pump bolts

NOTE: before removing the pump from the block, it is strongly suggested to block them seting over the blocking device (A) located on the STANADYNE pump.

For BOSCH pump type, use the special tool p/n 68480012F **(Tab.11.1 ref. V)**.

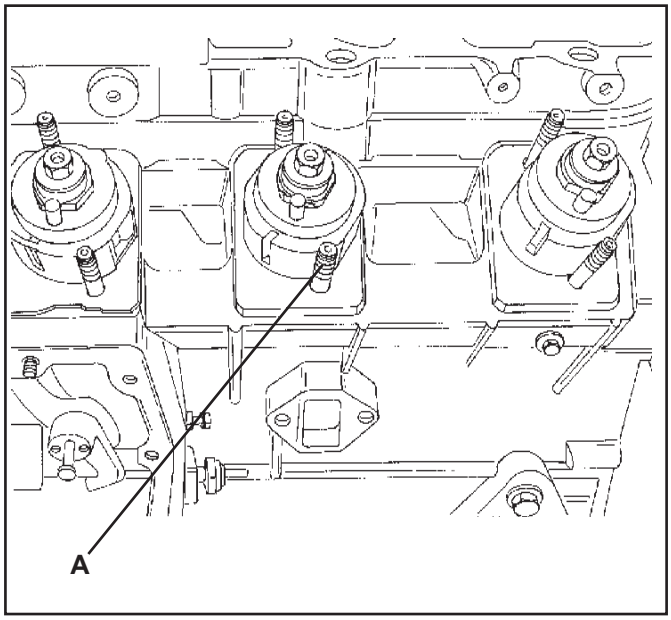


Remove the # 3 inblock pump (**A**) and gasket (**B**)



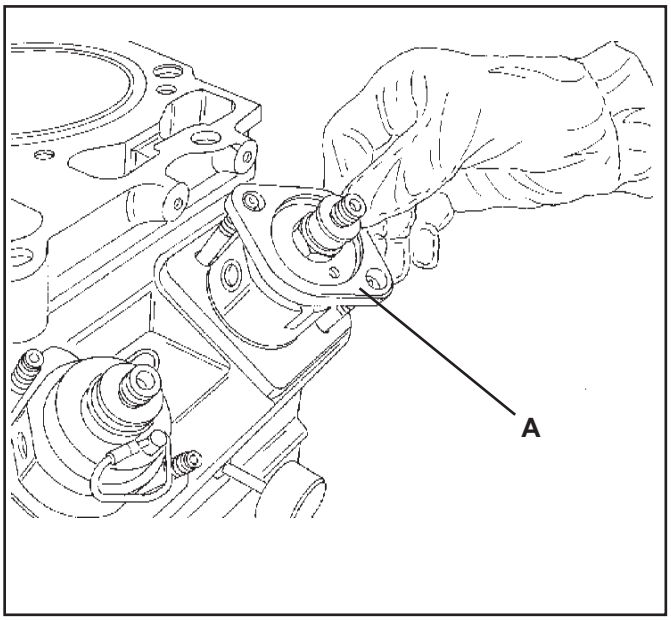
INJECTION PUMP HIGH PRESSURE (NEW MODEL)

Remove the nuts inblock pump **(A)**

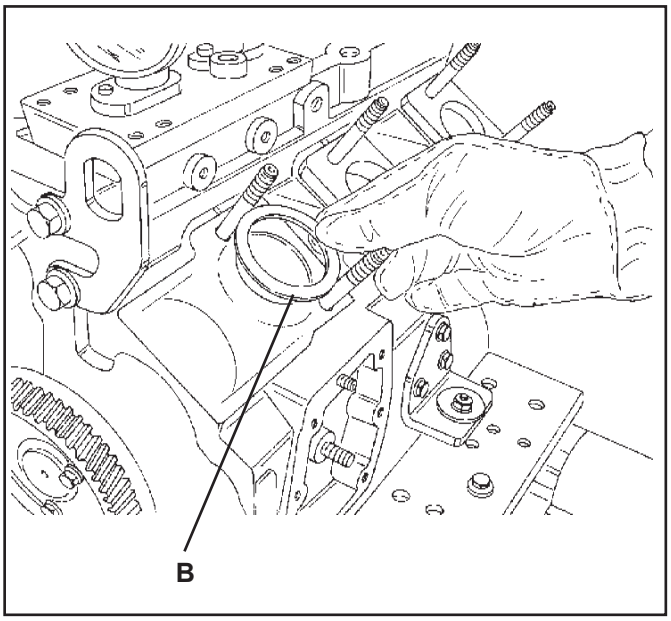


Remove the fixing flange (**A**) and take the pump out of its seat.

If it is to be used again, we advise marking its position with a crayon in order to remount it in its original position.
If it is to be substituted, this operation is not necessary.



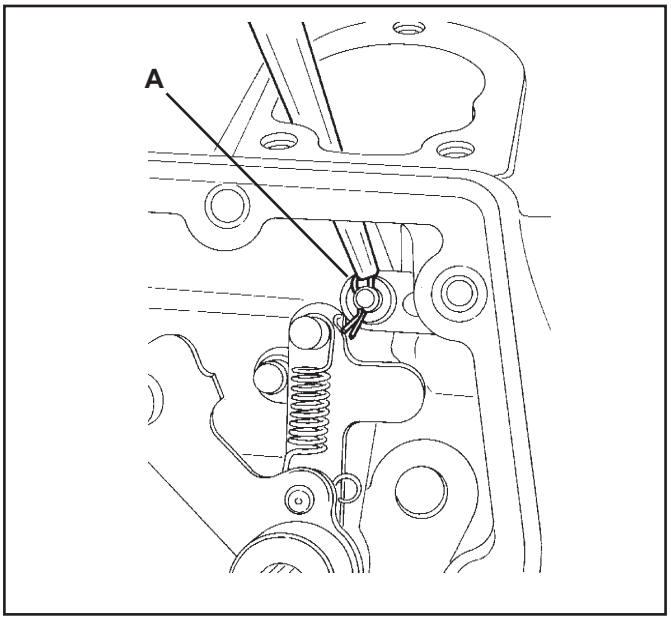
Remove the gasket (**B**), marking its position as well.



PUMP CONNECTING RACK

OLD MODEL

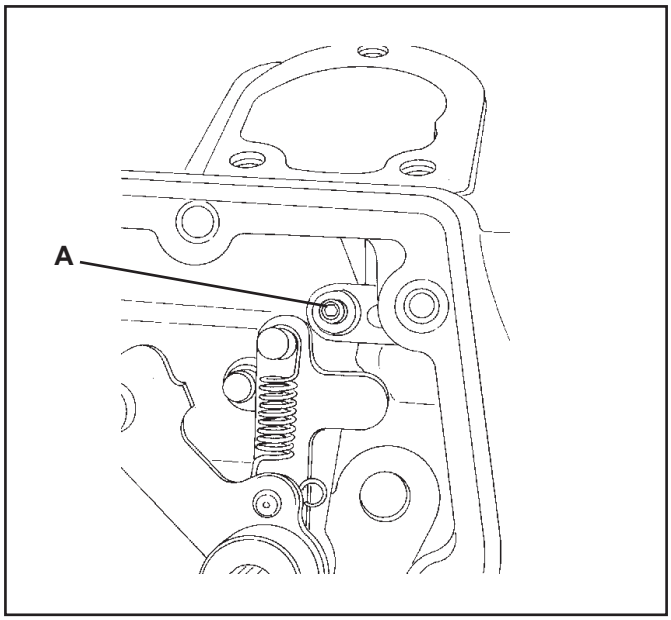
Remove the rack spit pin (**A**).



PUMP CONNECTING RACK

(HIGH PRESSURE PUMP - NEW MODEL)

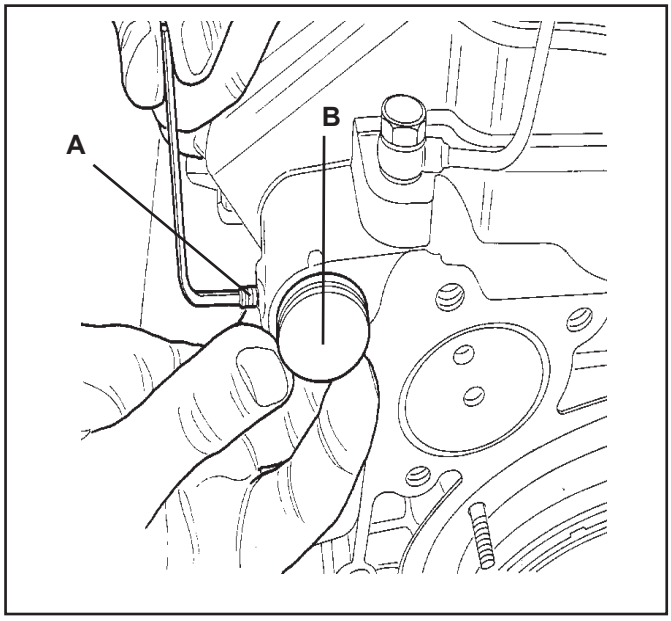
Unscrew and remove the pump connecting rack bolt (**A**)



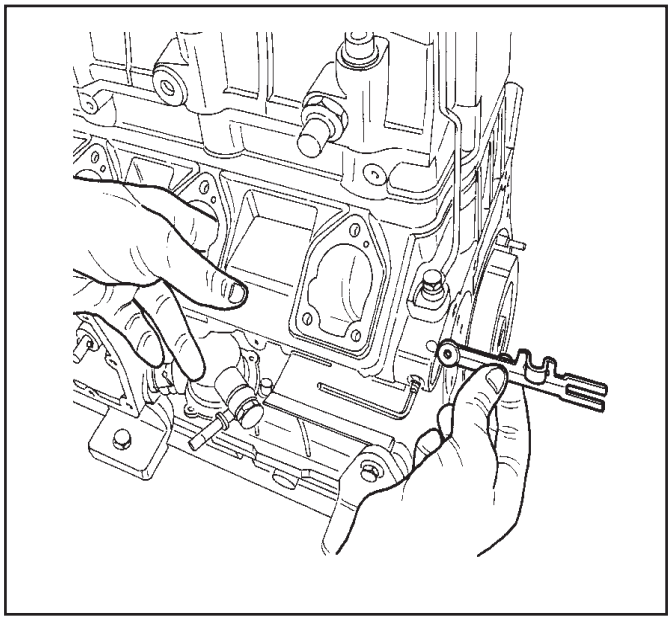
VALID FOR BOTH TYPE OF INJECTION PUMPS (OLD AND NEW MODEL)

Unscrew the dowel (**A**) and remove the pumps connecting rack support (**B**)

N.B. THE FLYWHEEL AND THE FLYWHEEL DOME COVER MUST BE REMOVED IN ORDER TO DO THIS.

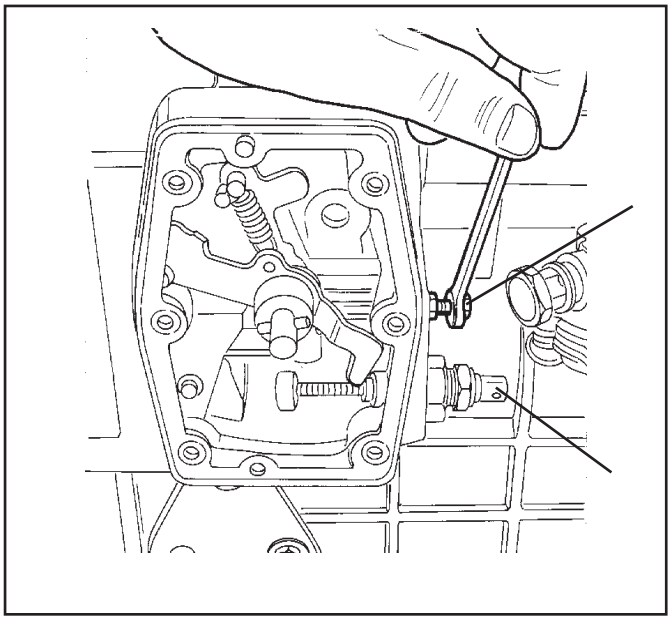


Remove the pump connecting rack

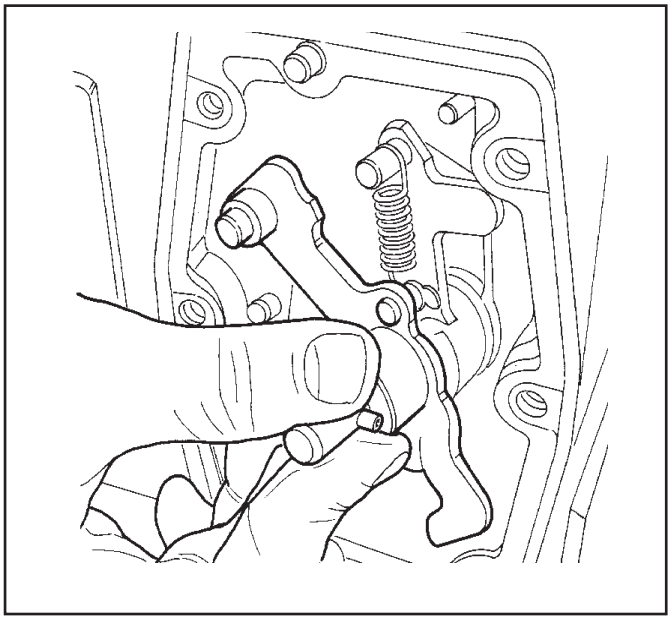


Remove the regulator travel stop screw (**A**)
Remove the fuel delivery screw (**B**)

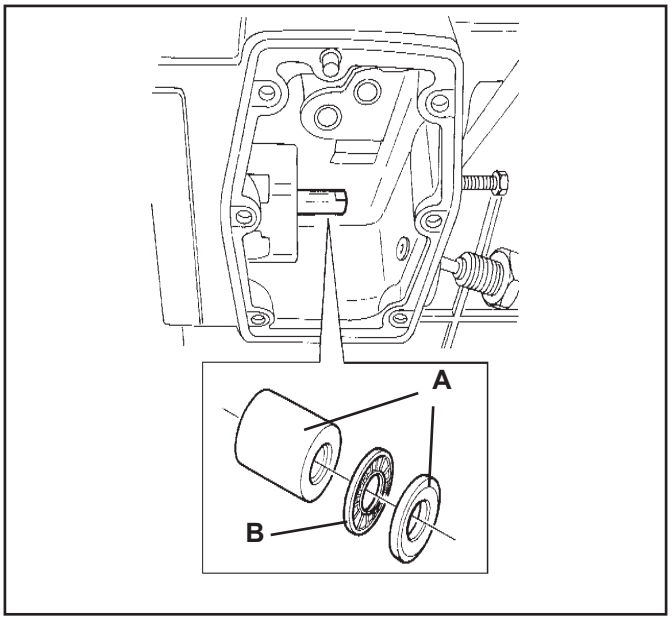
Note:
Before removing the fuel delivery screw (**B**) mark with paint the screw thread the nut and the block in order to have a continuos line.



Remove the governor assembly

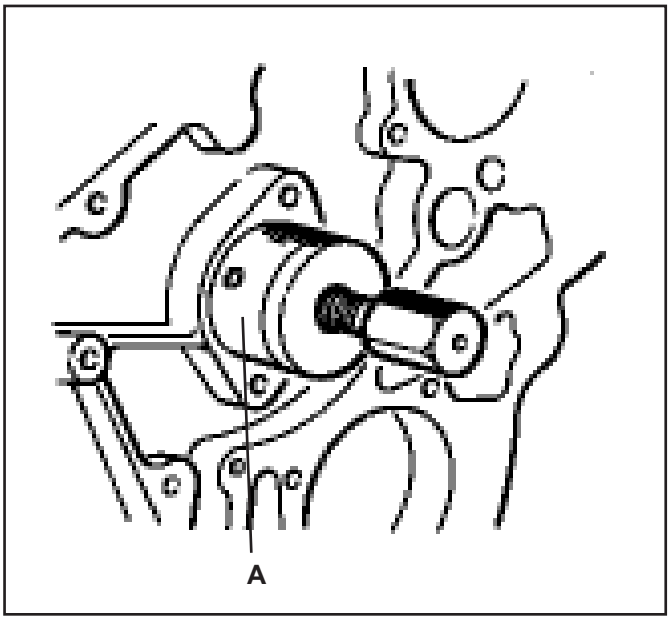


Remove governor spacers (**A**) and bearing (**B**)

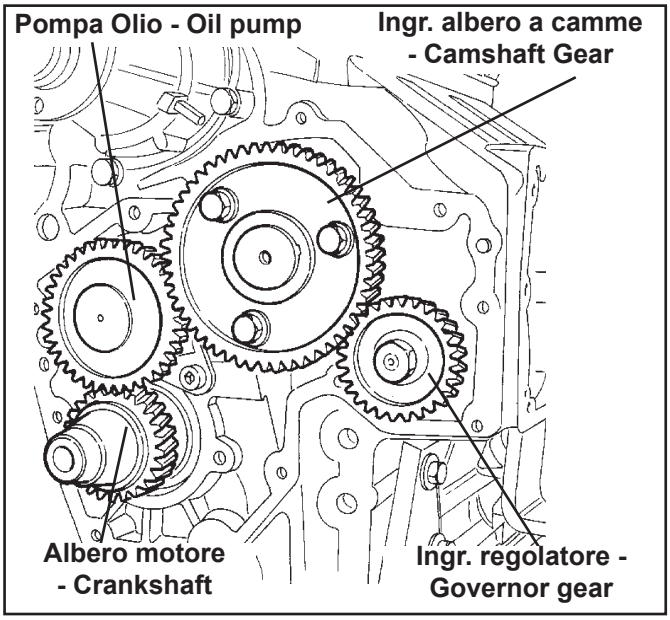


CRANKSHAFT AND CAMSHAFT BEARINGS

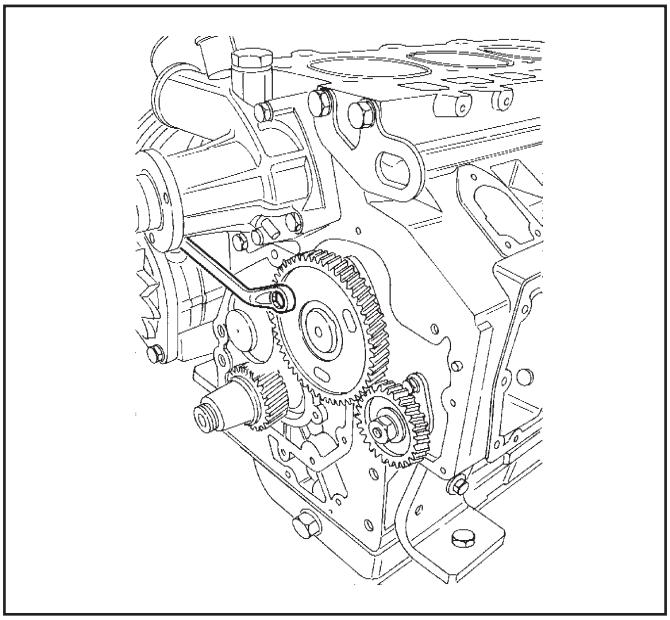
To remove crankshaft and\or camshaft bearing use the special tool **A** **(TAB. 11.1 rif. E)**.



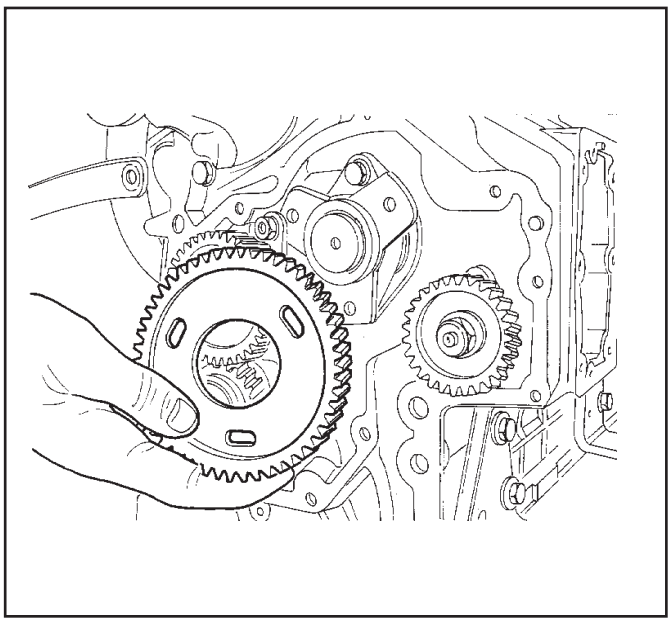
DISTRIBUTION LAYOUT D703



Unscrew the #3 camshaft gear bolts

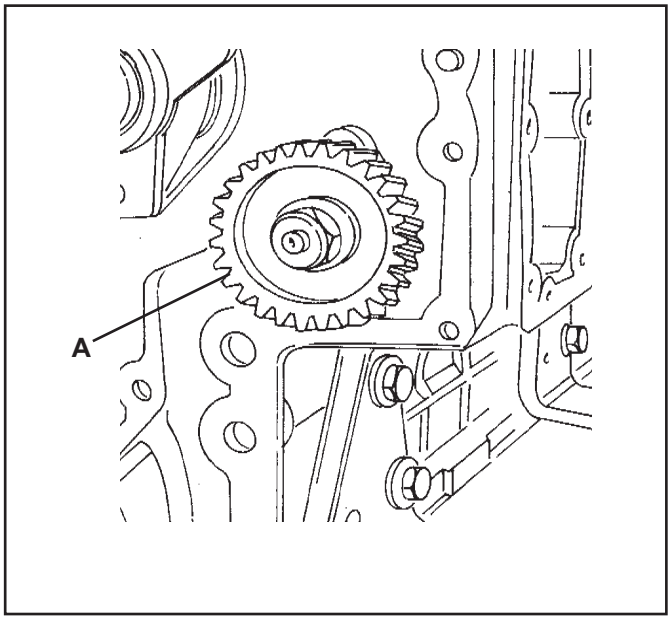


Remove the camshaft gear

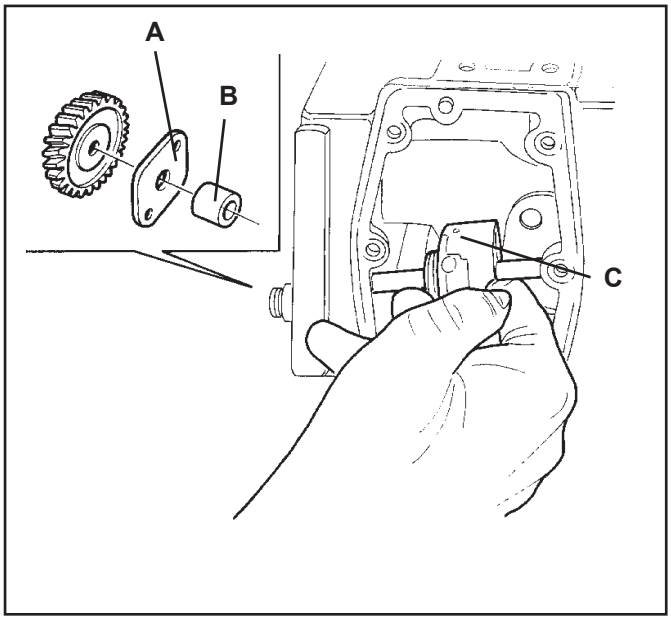


Remove the governor gear (**A**).

NOTE: THE GOVERNOR GEAR NUT IS LEFT HAND THREAD



Remove flange (**A**) fixed into the block with #2 screw, spacer (**B**) and counter weight (**C**)

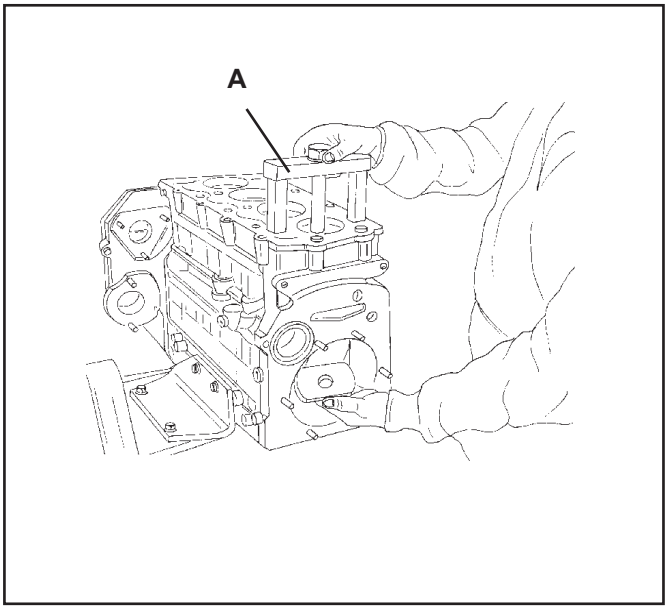


CYLINDER LINERS

To remove the liners use the specific tool **A** **(TAB. 11.1 rif. C)**.

Verifiy the presence of shims under the liner neck. These shims will be used during the liner installation so that the liner can protrude from crankcase.

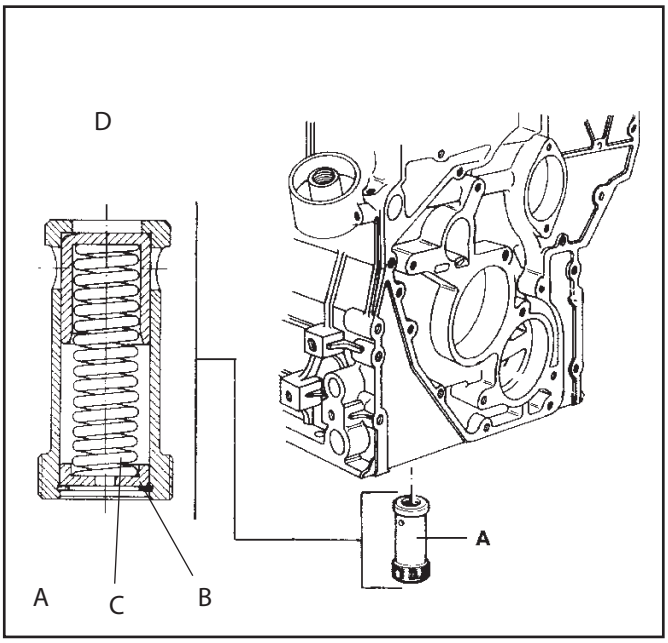
If these shims are present refer to liner installation procedure with shims, because the limit protrusion of the liner from crankcase is different than liner installation without shims.

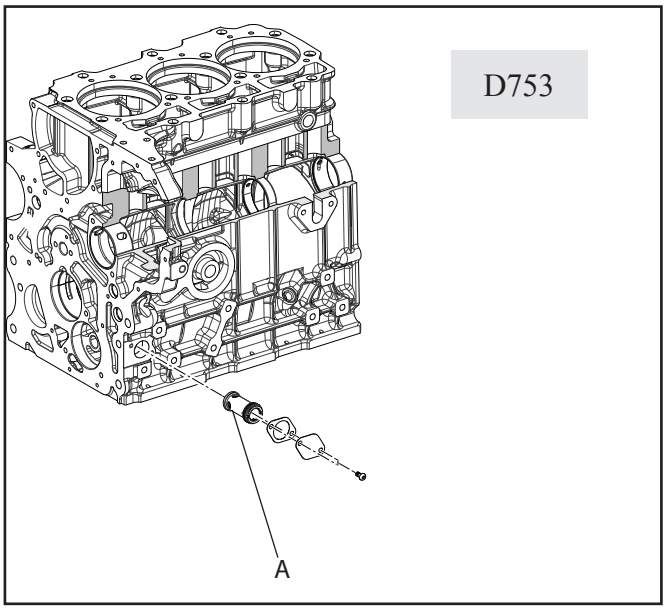


OIL PRESSURE REGULATING VALVE

To dismantle of the complete valve, we recommend heating the seat, but not too much, because the valve is assembled with LOCTITE, you can use various normal tools to unscrew it.

If you have to check the plunger or its seat, we recommend only dismantling the internal part, removing the snap ring **(A)**, removing washer **(B)**, spring **(C)** and plunger **(D)**.





D753

PISTON COOLING JETS (OIL SPRAY NOZZLES)

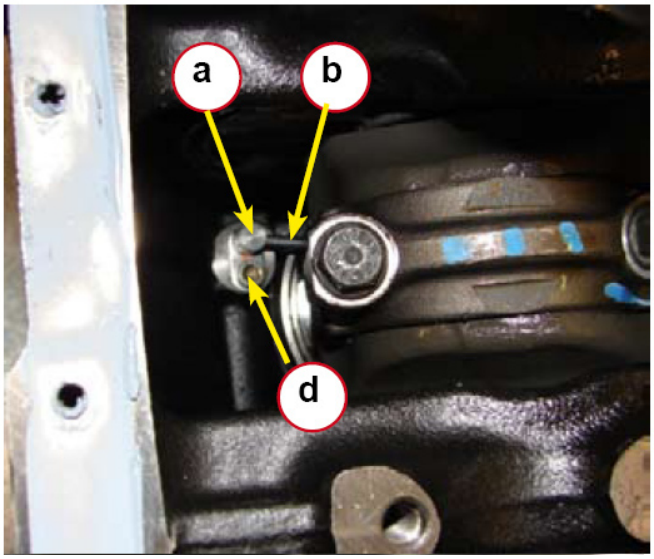
Oil spray from the piston cooling jet nozzles cools and lubricates the piston and other engine components.

Inadequate or improper oil spray could result in engine damage.

Ensure the oil spray nozzles are clean and the piston cooling jet assemblies are correctly installed to allow proper oil spray distribution.

Remove the piston cooling jet assembly from near the cylinder bore.

Remove and discard the O-ring seal on the piston cooling jet.



a - Cooling jet assembly

b - Nozzle

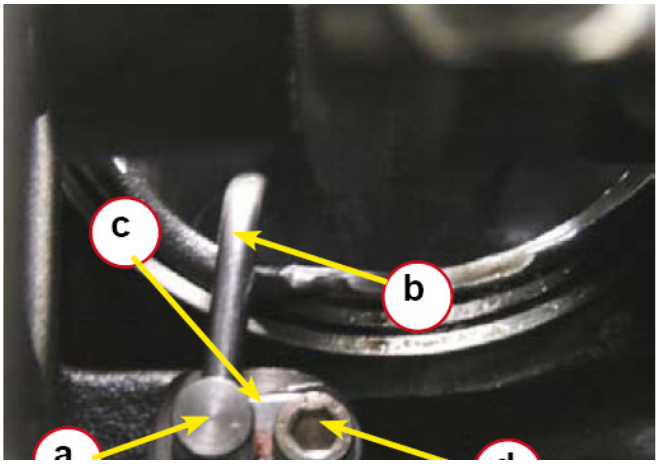
c - Plate

d - Bolt

Clean the passages of the piston cooling jet and cylinder block. Put on safety glasses.

Blow out any debris from cleaning, using compressed air.

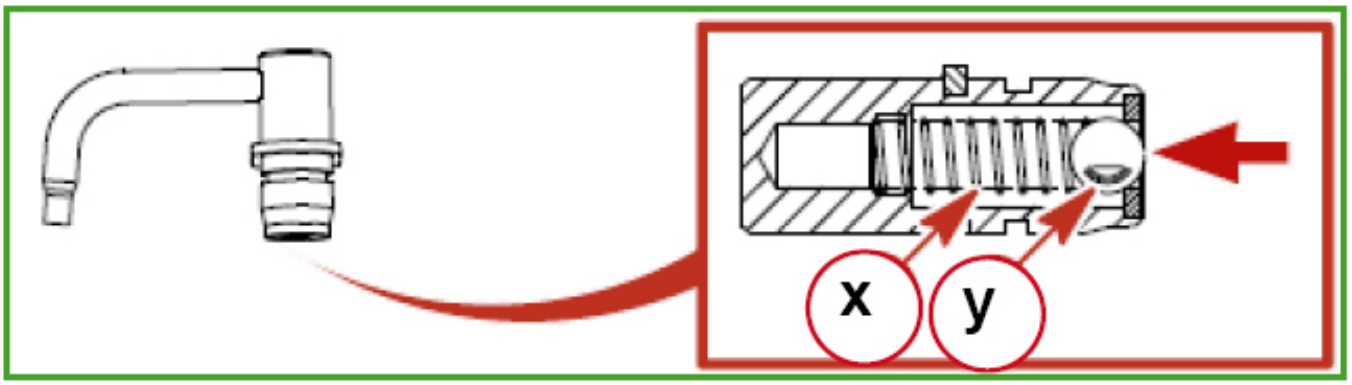
Ensure the check valve ball moves freely against the spring in the bore.



x - Spring

y - Check valve ball

2. Check for a cracked, bent or damaged tube or nozzle.



6 CHECKS AND REPAIRS

6.0 FINDING TOP DEAD CENTER (TDC)

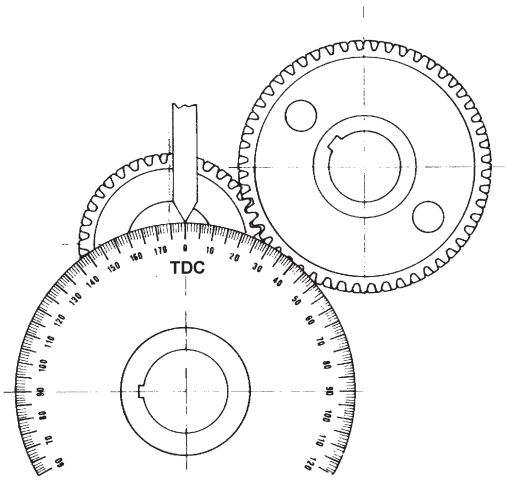
1) Fit the front pulley to the crankshaft temporarily
2) Fit special tool **(TAB. 11.1 ref. R)** and position a pointer next to the graduated scale.
3) Fit a dial gauge with 0.01 mm scale divisions on special tool **C (TAB. 11.1 ref. W)** on top of the crankcase.
4) Bring piston **A** of cylinder no. 1 (first from timing end) up to near TDC.
5) Place the contact point of dial gauge **B** on the piston crown.
6) Turn the crankshaft in the normal direction of engine rotation (clockwise as viewed from timing end) until the point where the needle of dial gauge **B** changes direction.
7) Position the pointer in correspondence with 0° TDC on special tool **(TAB. 11.1 ref. R)**, making sure that it does not touch the dial.

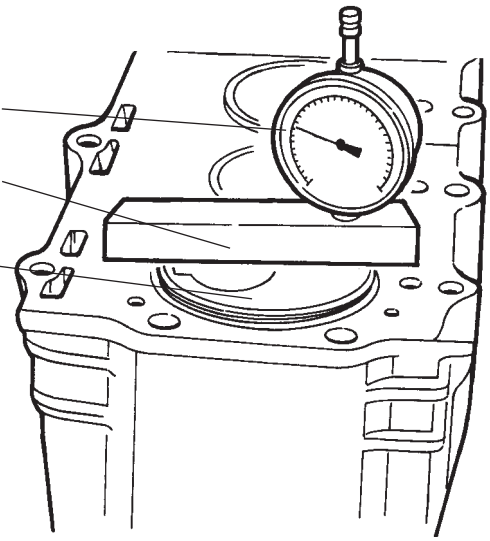
   Refer to this indicator each time it is necessary to find TDC.

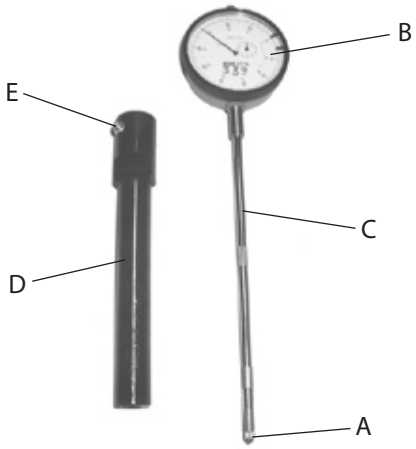
In case it is not possible to find the TDC, because it is not avilable the reffrence mark on the crankshaft pulley, it has to be used the specific special tool **(TAB. 11.1 ref. AG)** .This tool has to be installed instead of injector N° 1.

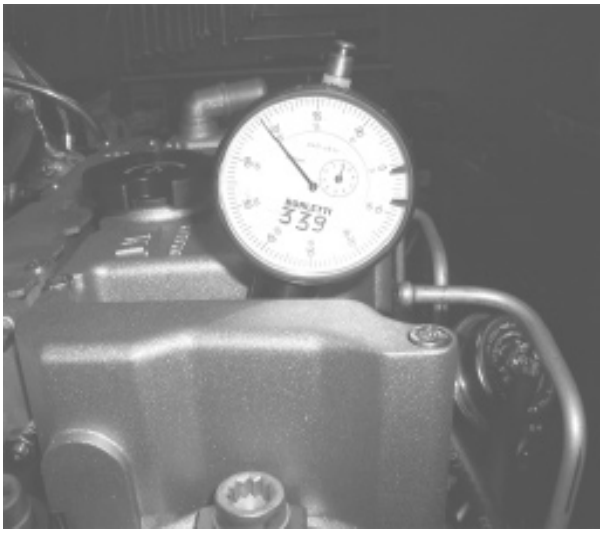
The TDC will be identify by looking at the piston movement.

Remove the spherical head **A** from the dial gauge and screw it into the special tool stem **C**.
Then screw the stem into the dial gauge **B.** At this point insert the dial gauge and stem into the special tool body.
Instal the special tool in the place of injector N° 1 and follow the procedure from point 4.
Use the screw **E** to fix the dial gauge in the right position to perform the TDC reading.

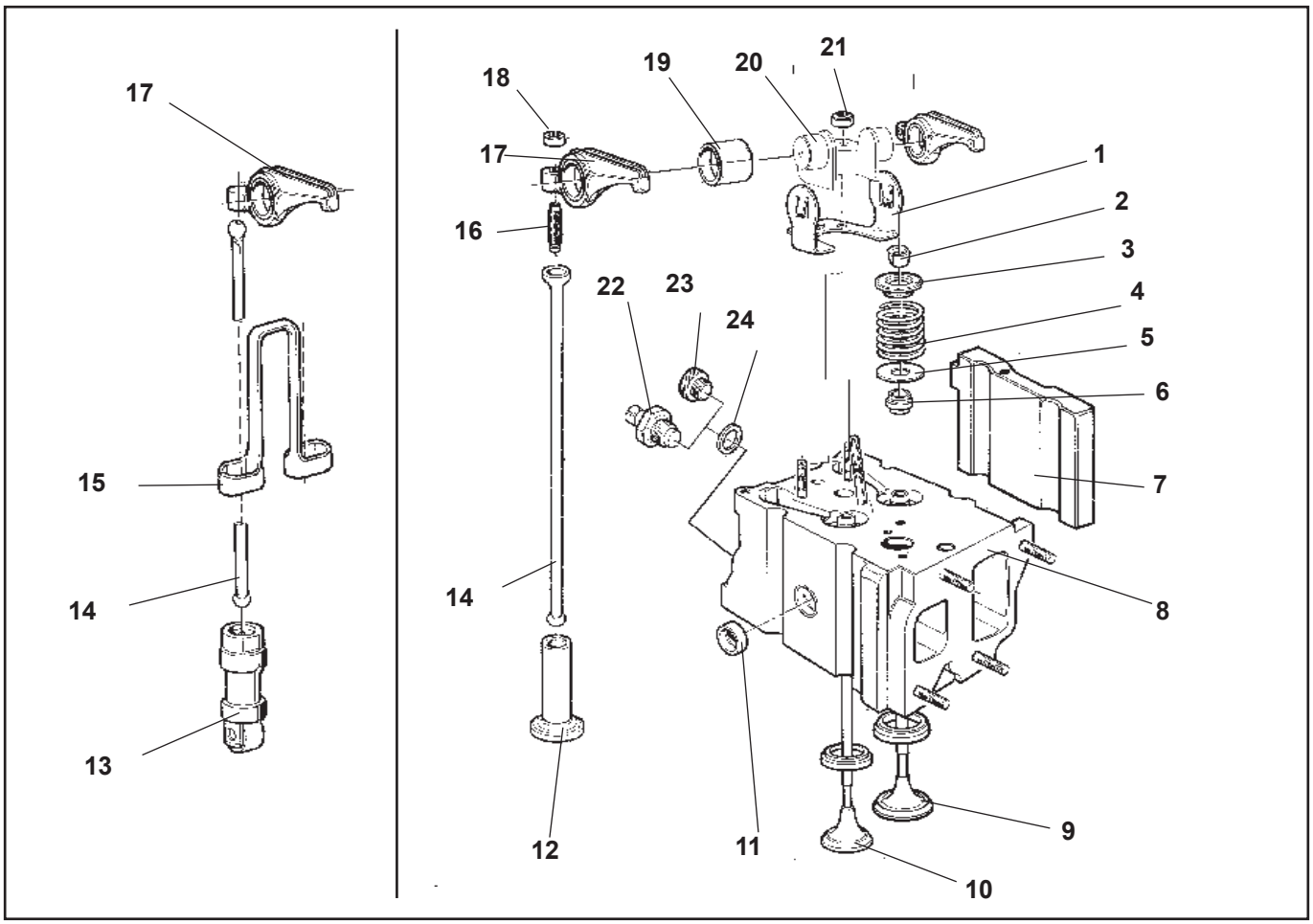








6.1 CYLINDER HEAD



KEY: **1)** Spring, **2)** Split collets, **3)** Spring cap, **4)** Valve spring, **5)** Spring seat, **6)** Valve guide seal, **7)** Cylinder head distance piece, **8)** Cylinder head, **9)**Valve, **10)** Valve seat, **11)** Plug, **12)** Mechanical tappet, **13)** Hydraulic tappet, **14)** Push rod, **15)** Aligning yokes, **16)** Adjuster screw, **17)** Rocker arm, **18)** Nut, **19)** Bearing, **20)** Rocker journal, **21)** Nut, **22)** Water temp. sensor, **23)** Plug, **24)** Copper washer

DO NOT REMOVE OR DISMANTLE CYLINDER HEADS WHEN HOT TO AVOID DISTORSION.

Remove the valves using a commercial valve spring compressor and number them.

Remove carbon deposits from the heads and inspect the gasket matching surfaces.

CYLINDER HEAD RESURFACING

IMPORTANT: The cylinder heads on these diesel engines are treated with a protective nickel coating to resist corrosion and should not be resurfaced. Resurfacing would remove the nickel coating. Do not resurface the cylinder heads.

Height of cylinder head 89.95 - 90.05 mm

Head fixing support plate 89.92 - 90 mm (item 7 into the picture)

6.2 VALVES - SEATS - GUIDES

If necessary clean the valves with a wire brush or replace them if the heads are bent, worn or cracked.
Check the diameter of the valve stem, value **A** (fig. 6.2), and if the valve stems are worn replace the valves.
Check that the guides are not grooved inside or show signs or seizing.
To check whether the valve guides are in the right position, check value **A** (fig. 6.3).
Check the internal diameter of the valve guides, value **B** (fig. 6.3).
If there is any difference in the values, replace the head.
If value **C** (fig. 6.3) is lower than normal, the valve has probably broken through the seat and you will have to replace the head.

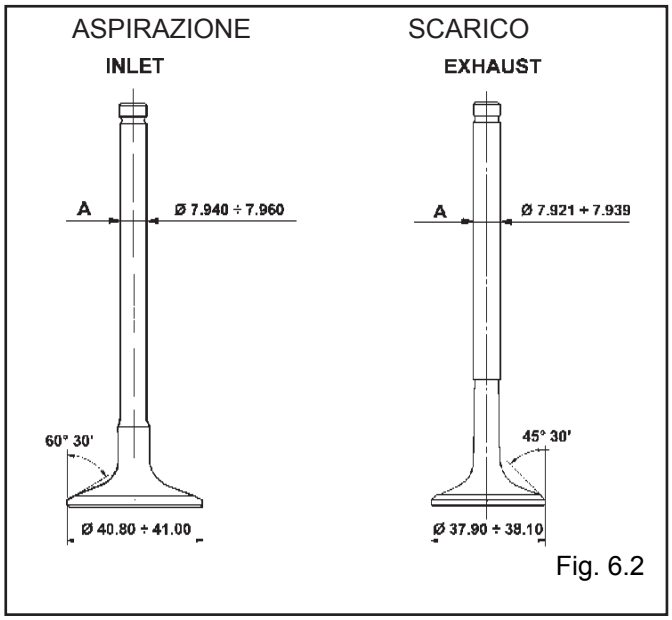
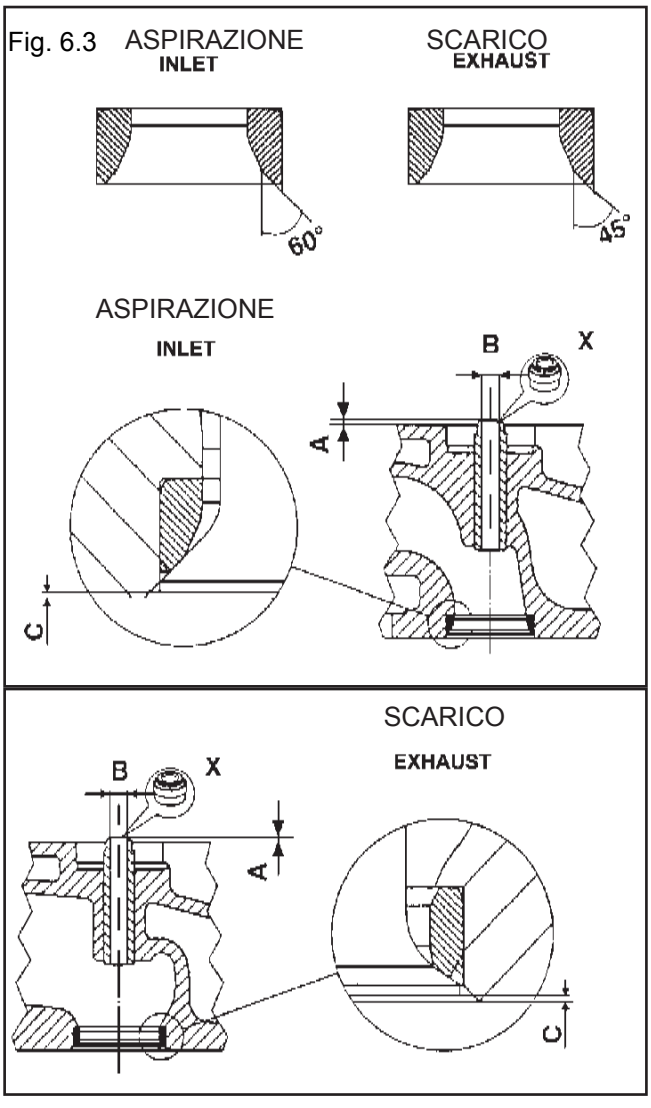


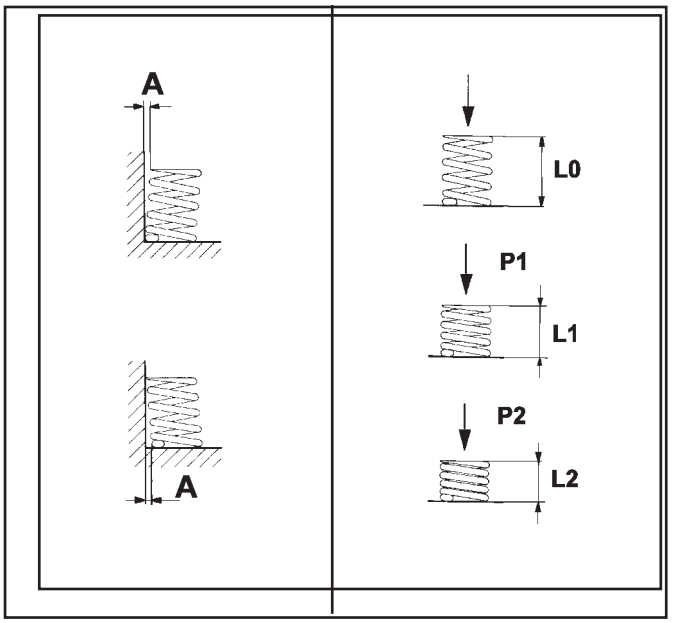
Fig. 6.2

Dimens.	At installation	
	Inlet mm	Exhaust mm
A - Fig. 6.3	2.00 ÷ 1.50	2.00 ÷ 1.50
B - Fig. 6.3	8.000 ÷ 8.015	8.000 ÷ 8.015
C - Fig. 6.3	0 ÷ 0.3	0 ÷ 0.3



X = RING SEAL

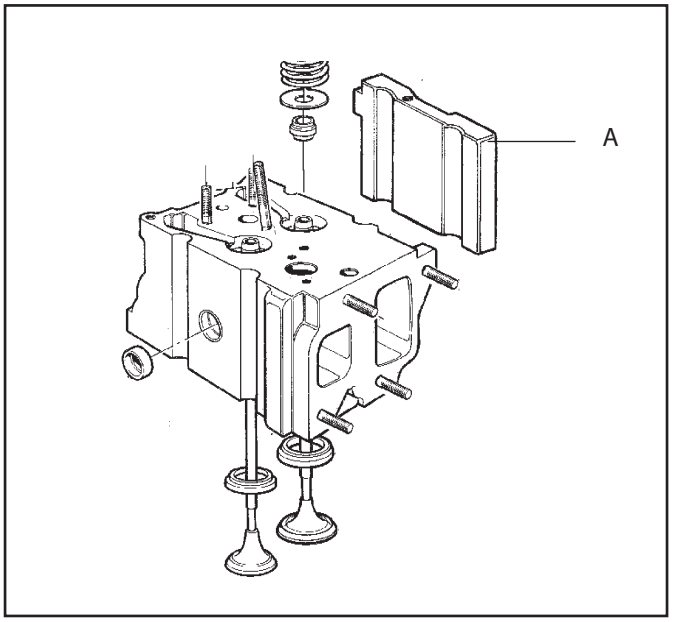
6.3 VALVE SPRING



Check that the valve springs are not cracked or have lost their resilience.
Check spring height under different load conditions.
Check that distortion **"A"** does not exceed **2** mm.

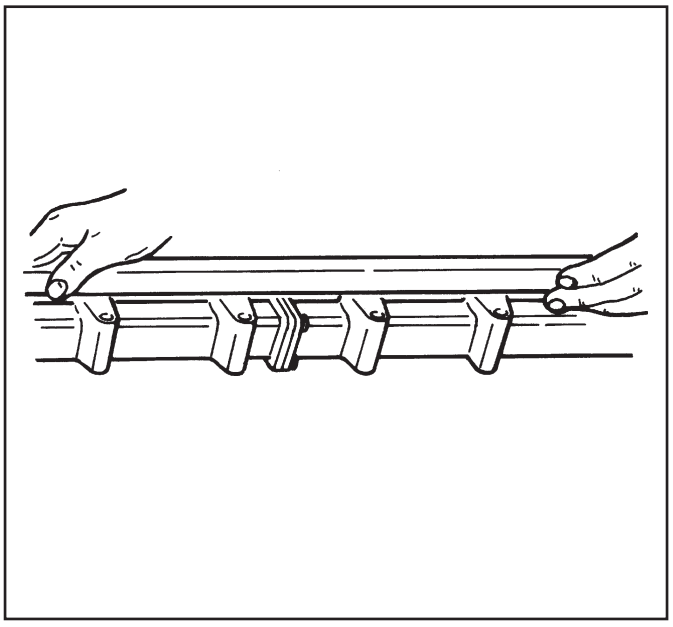
L 0 = 44 mm (free length)
L 1 = 37 mm **P 1** = 24 Kg
L 2 = 26,61 mm **P 2** = 59,6 Kg

6.4 CYLINDER HEAD DISTANCE PIECES



Check that the height of the distance piece **A** is 89.92 - 90.00 mm and that there is no deformation caused by incorrect fastening of the head clamps.

6.5 COOLANT MANIFOLD



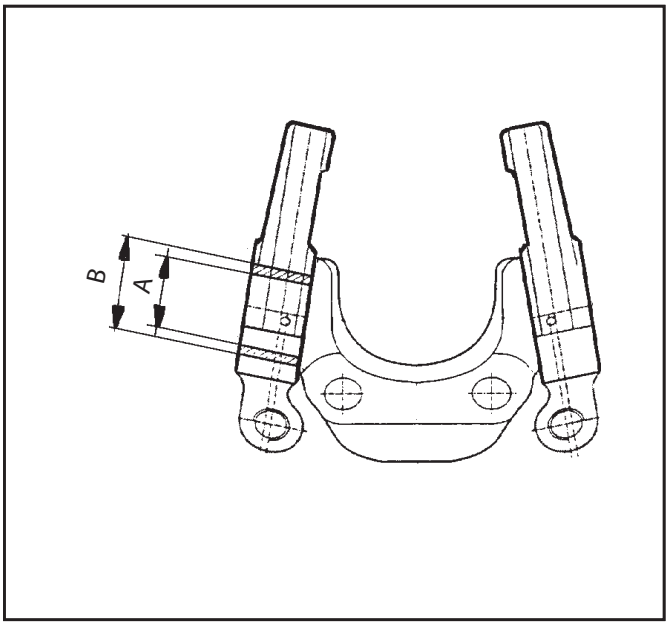
Inspect manifold for cracks or splits.
Check that the mating surfaces of the flanges are flat and aligned in the same plane; small discrepancies can be removed by careful regrinding.

6.6 ROCKER ARMS

Clean journals and rocker arms with solvent.

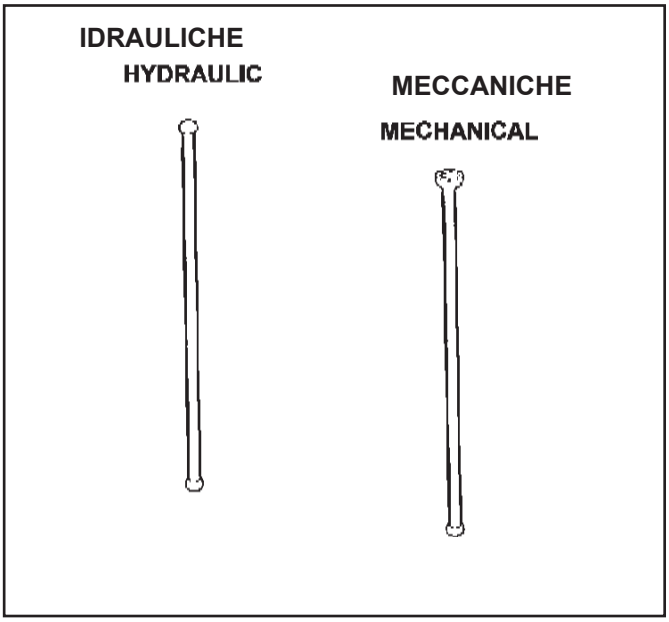
CLEAN OIL WAYS OF OIL AND SLUDGE

Check dimensions:
A = 24.979 - 25.000 mm
B = 25.020 - 25.041 mm
If the measured dimensions do not correspond with those specified, the rocker arms must be replaced.



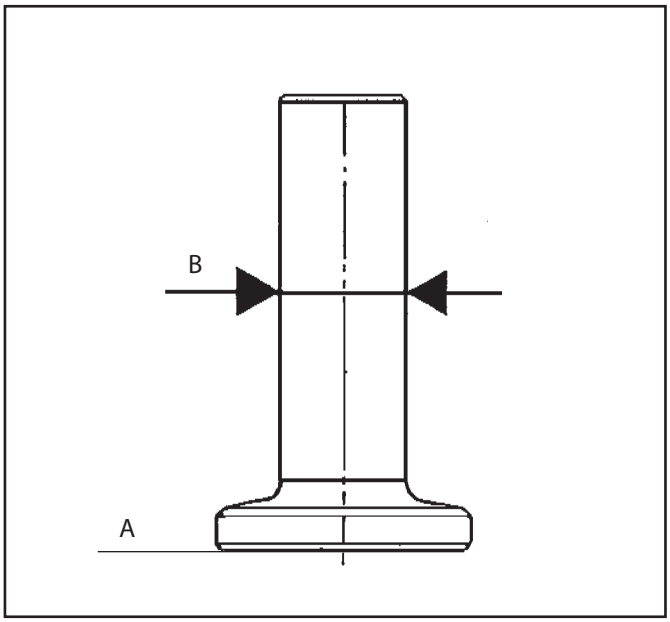
6.7 PUSH RODS

Check that the pushrods are straight and that the spherical tips are in good condition.



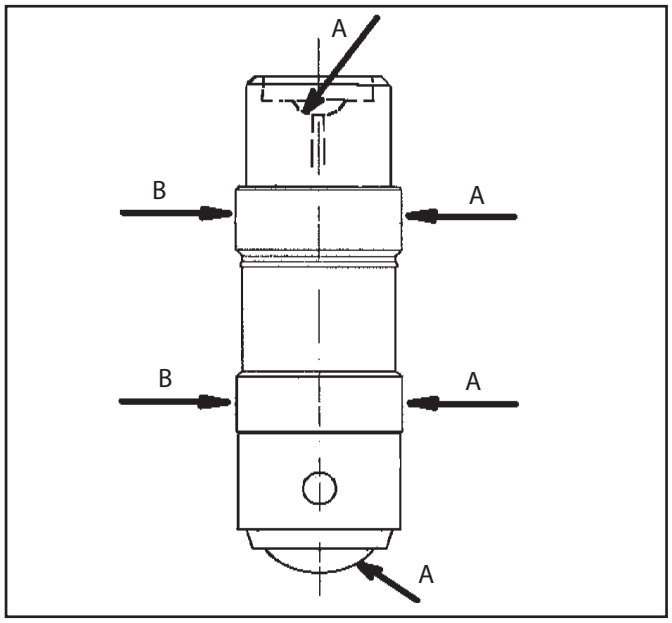
6.8 MECHANICAL TAPPETS

Check that the tappet contact faces **A** are smooth. Slight scoring can be removed with a carborundum stone.
Check dimensions **B** = 14.965 - 14.985 mm



6.9 HYDRAULIC TAPPETS

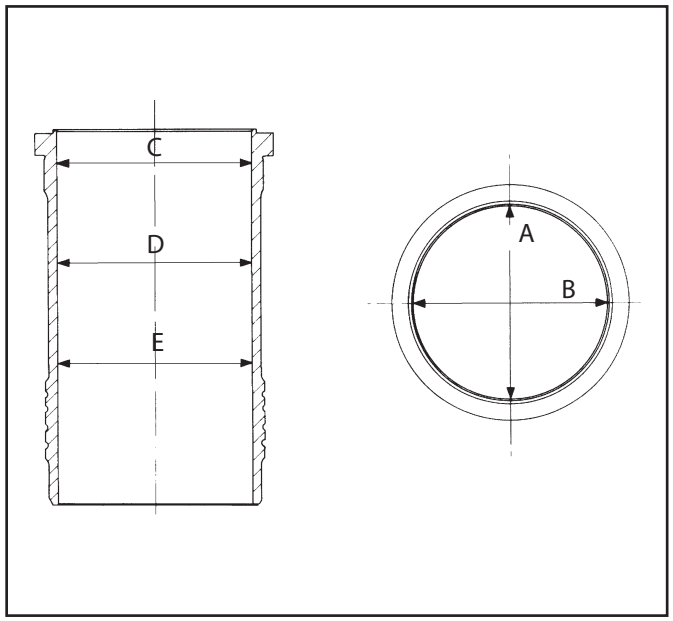
Inspect **A** surfaces wich are in touch with push rod, engine block and camshaft to be sure they are not score or scuffed.
Check dimensions **B** = 22.195 - 22.212 mm



6.10 CYLINDER LINERS

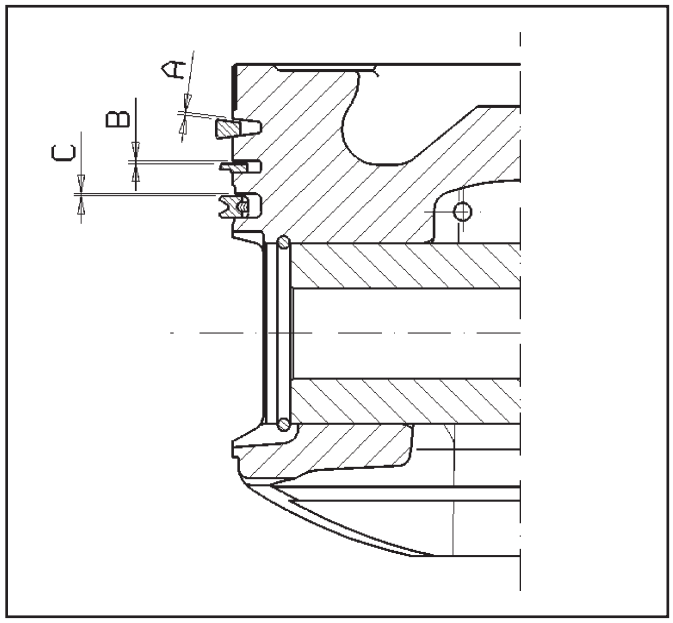
Liner internal diameter D = 93.995 - 94.015 mm
Maximum ovality **A - B**: 0.100 mm
Maximum taper **E - C**: 0.100 mm

When cylinder wear or scoring does not exceed the nominal dimensions **D** by more than 0.10 mm, surface roughness can be removed with fine grade emery cloth soaked in diesel fuel working in clockwise and counter-clockwise spiral directions.
Surface roughness must be between 0.8 ÷ 1.2 µ. If wear or scoring exceeds 0.10 mm, fit new liners.



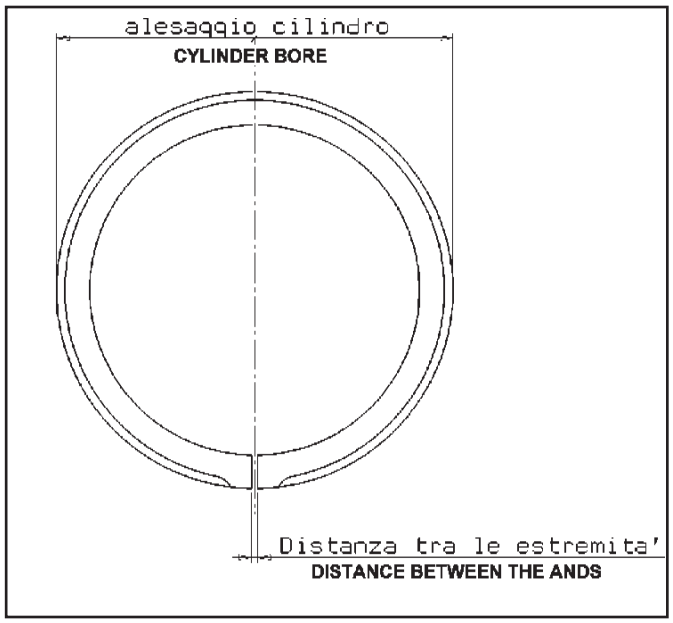
6.11 PISTONS

Check that the working surfaces are free of any anomalies, scratches, or signs of seizing, if you do find any of the above problems, replace the faulty part.
To check the play between the rings and their seats, use a precision feeler gauge and check that the play isn't over the following limits:
compression ring A**, cannot be measured**
piston ring B **max. 0.10 mm**
oil scraper ring C **max. 0.08 mm**



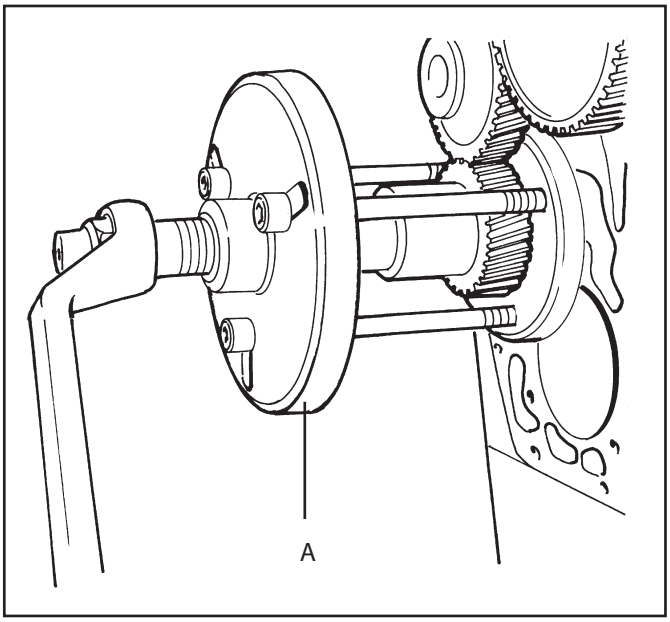
6.11A PISTON RINGS

Check that the piston rings are free to turn in their seats without any friction or blocking and that they show no signs of damage. If any anomalies are found, replace the rings.
To check the distance between the two ends of the rings, as shown in the figure, insert the ring in the cylinder, position it at a right angle to the working surface and use a precision feeler gauge.
The values measured should not exceed those indicated below:
compression ring **A**, max 0.5 mm
piston ring **B** max. 0.5 mm
oil scraper ring **C** max. 0.6 mm



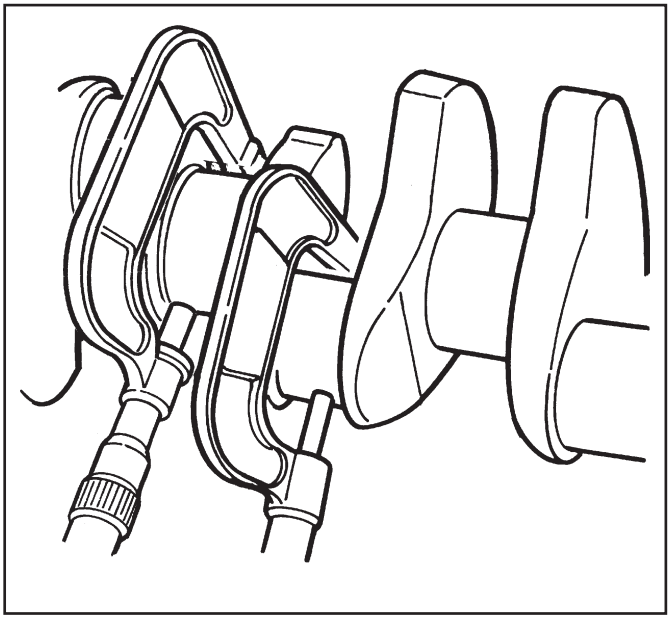
6.12 CRANKSHAFT

Immerse the crankshaft in a solvent bath and remove any sludge from the oil ways.
Inspect for cracks.
Check the spigots, mating surfaces and threads for wear, scoring and distortion.
Check that the timing gear teeth are not worn or damaged. Slight indentations can be removed using a very fine grade carborundum stone. If the timing gear needs replacing, remove using the special puller **A** **(TAB. 11.1 ref. G for engines with crankshaft front cone shape end, while for engines with cranshaft front cylindrical end use special tool TAB. 11. rif. AI).**



Heat the new gear (only for engines with crankshaft front cone shape end) in an oven to 180 ÷ 200 °C and install taking care to align the key correctly.

Heat the new gear (only for engines with crankshaft front cylindrical shape end) in an oven to 70 °C. Install it on crankshaft against the crankshaft shoulder and leave the gear in this position for at least 10 seconds.

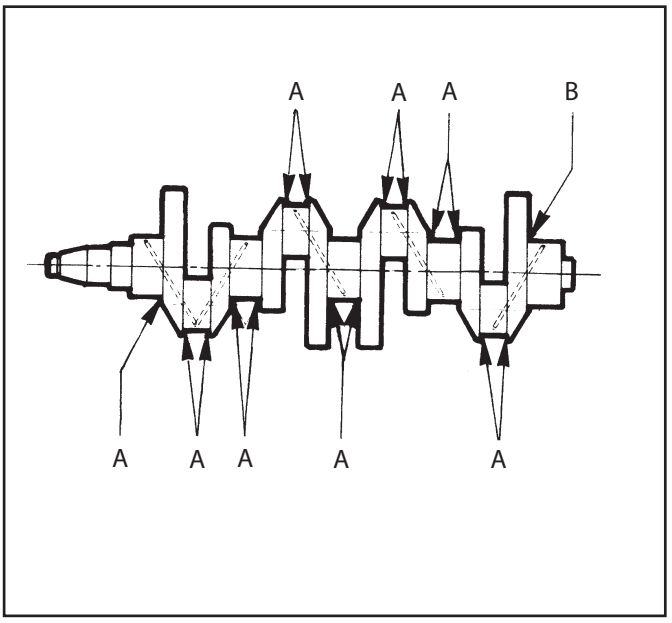


Remove the grooves caused by oil seal rings using very fine grade emery cloth to produce fine spirals in the opposite direction to crankshaft rotation. Always replace oil seals at each rebuild.
Check crankpins and journals for ovality and wear at different positions using a micrometer.
If wear exceeds **0.10** mm, the crankpins and journals will have to be reground and undersize bearings must be fitted **(TAB. 8.2.1)**.

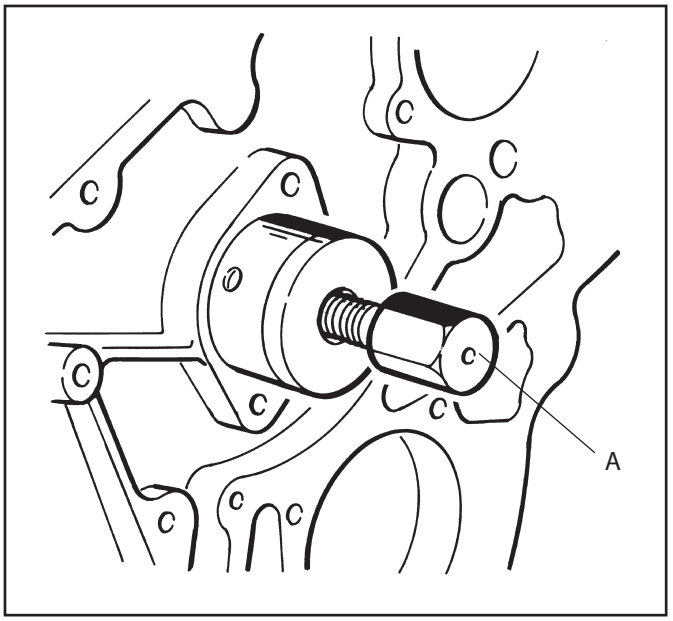
Before refitting a crankshaft that has been seized, overheated or reground, carry out a Magnaflux check for fine cracks. The surface roughness of the journals and crankpins should be **0.12 µ**. If the crankshaft needs regrinding, be careful not to remove material from the fillet radii **A-B**. After grinding, the crankshaft must be subjected to “SURSULF” surface hardening treatment (hardness HRC 53 - 57).

WHEN GRINDING THE CRANKSHAFT, DO NOT REMOVE MATERIAL FROM THRUST FACES.

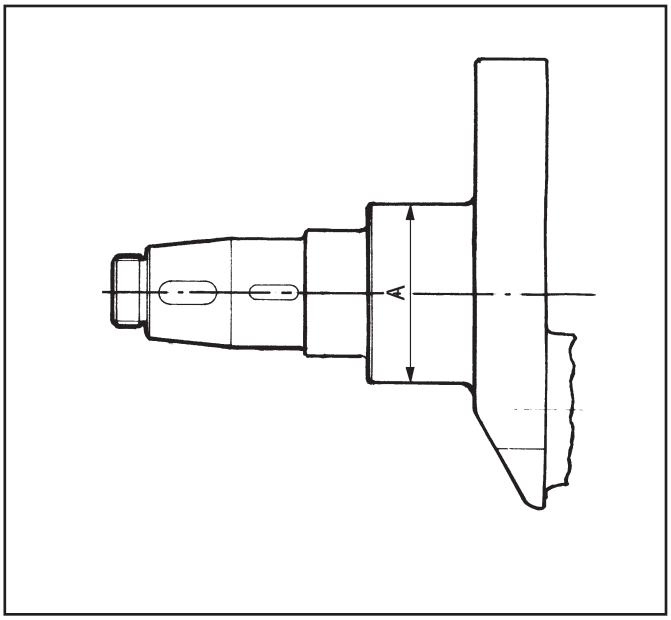
THE RADIUS A - B ON THE SHAFT MUST BE HOW SHOWED AT (TAB. 8.2.1).



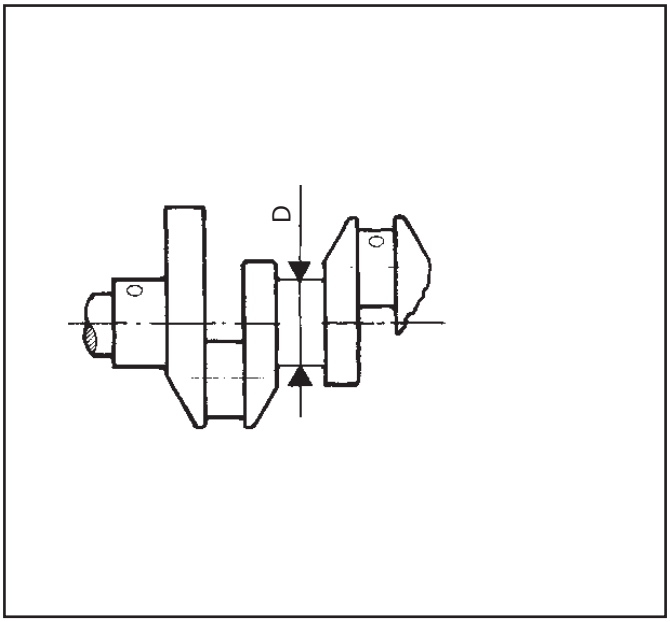
All main and big-end bearing shells, including undersize shells, are supplied in exact sizes as specified. To remove and install the front main bearing, use special tool **A** **(TAB. 11.1 ref. E).**



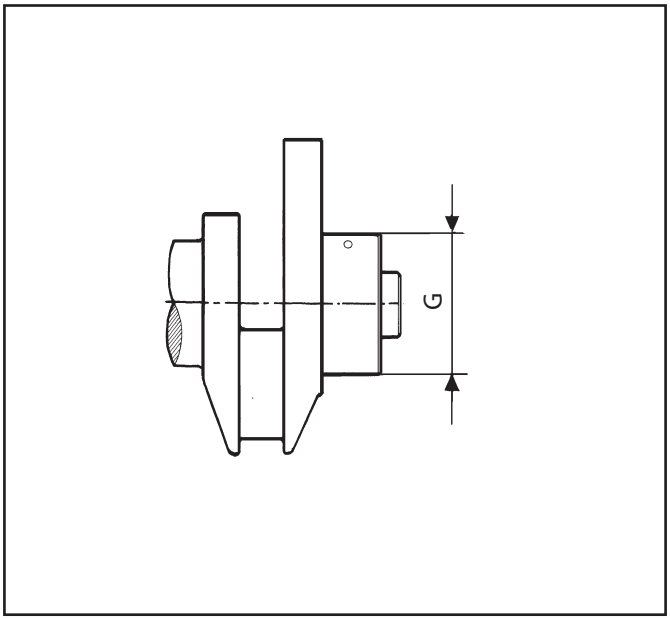
Front main bearing and journal see (TAB. 8.2.1).



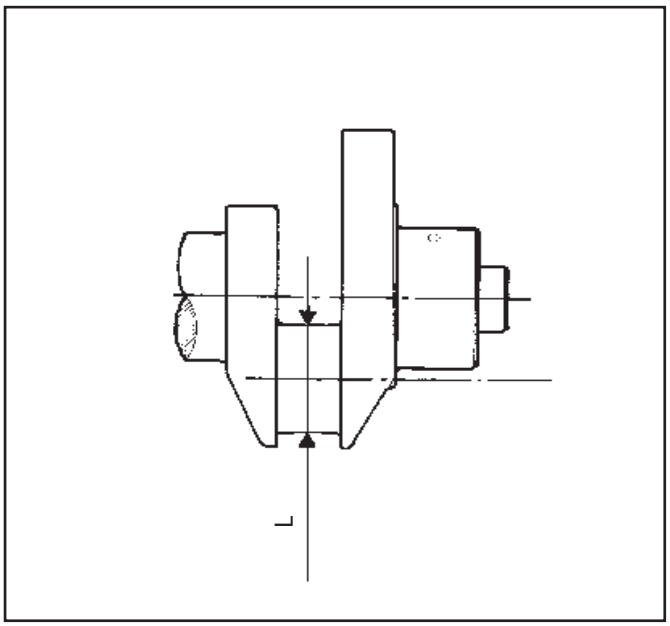
Center main bearing shells and journal see (TAB. 8.2.1).



Rear main bearing shells and journal see (TAB. 8.2.1).

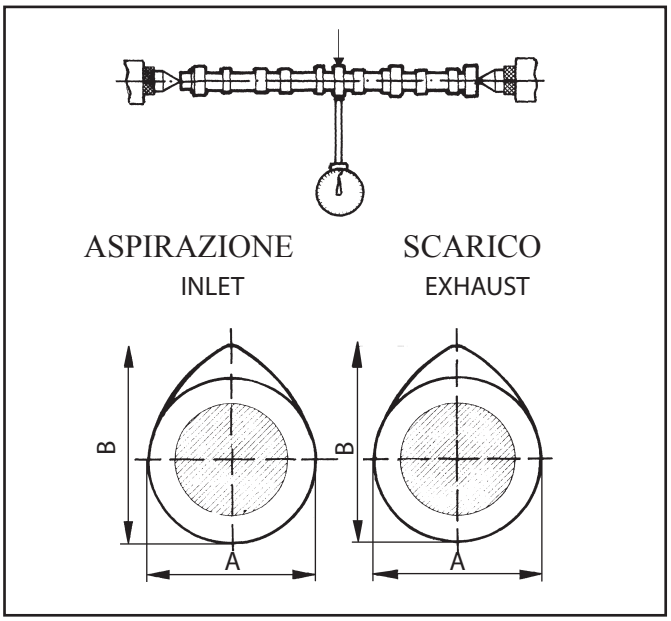


Crankpins and big-end bearing shells see **(TAB. 8.2.1)**.



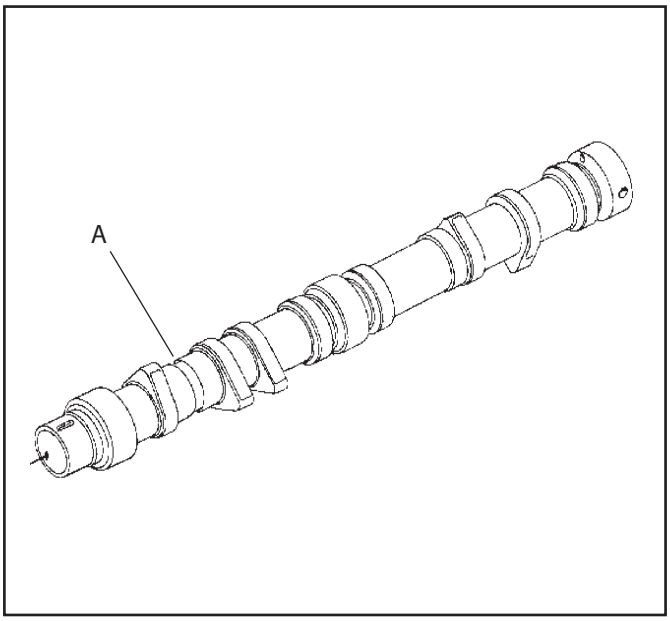
6.13 CAMSHAFT

Inspect for signs of wear or scoring on the journals and cam lobe surfaces. Check that cam dimensions are no more than 0.05 mm less than the dimensions given in **(TAB. 8.2.2)**.



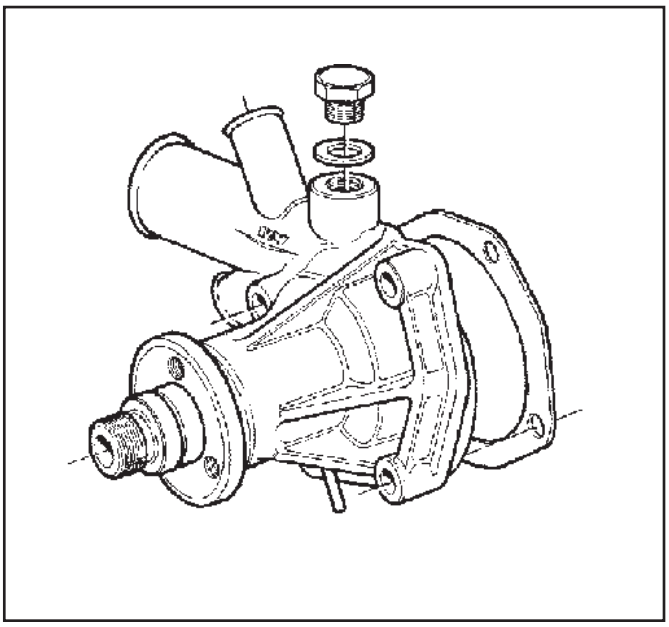
D754 CAMSHAFT IDENTIFICATION

D754 camshaft only, has got a groove between the intake and exhaust lobe of 1ST cylinder

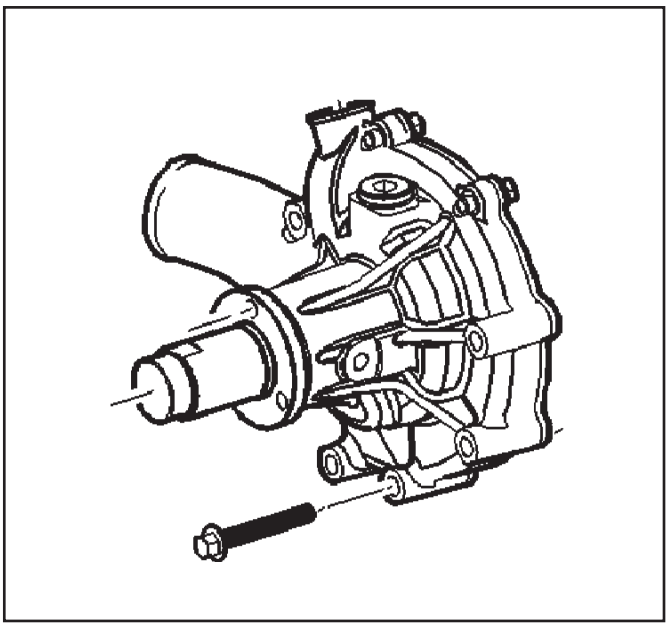


6.14 COOLANT PUMP

Check for leakage between the pump body and the crankcase. If leaks are found, renew gasket. If the pump body shows signs of blowing or if the impeller is broken, replace the pump with the correct model selected from the replacement parts catalogue.

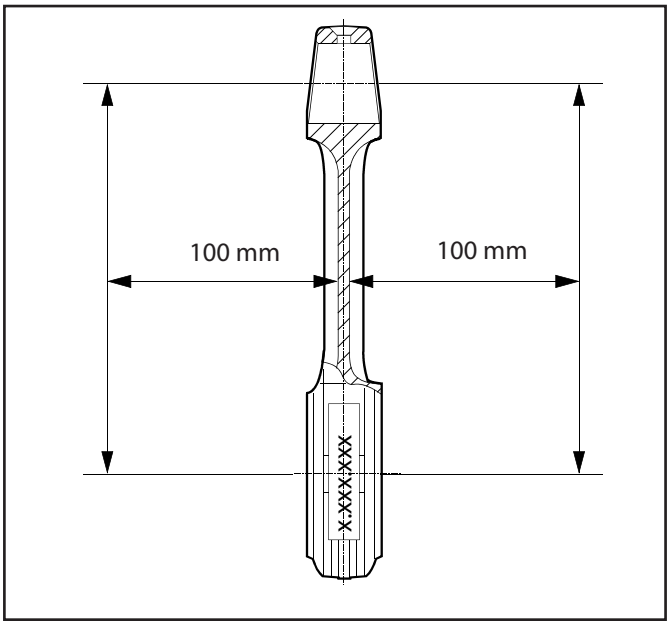


Bigger coolant pump, version (D754-E1-E2)



6.15 GUDGEON PINS AND CONNECTING RODS

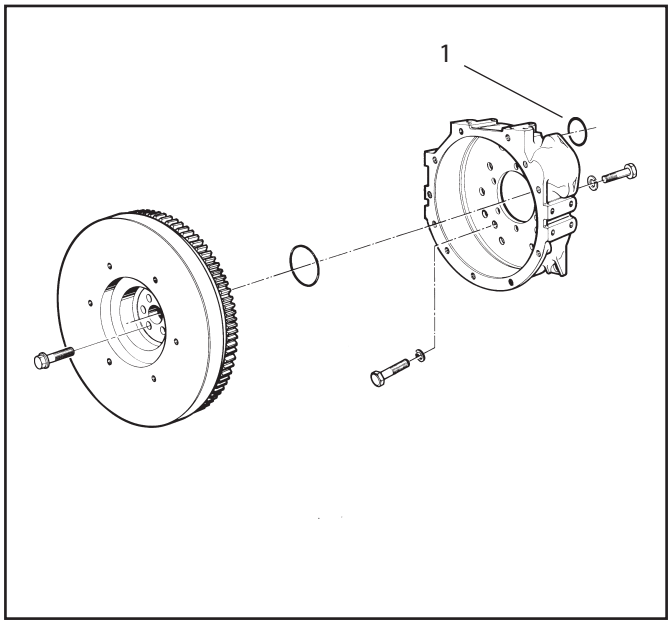
Inspect connecting rods for wear or cracks using Magnuflux if possible. Check that the gudgeon pin is free of grooves or seizure marks.
Check parallelism of the connecting rod axes.
Deviation must not exceed **± 0.05** mm in all directions outside the gudgeon pin at a distance of 100 mm from the centerline.
If the small-end bush is replaced, make sure that the oil ways in the bush and the connecting rod are correctly aligned.



NOTE:
THE AUTOMATIC CONNECTING ROD TIGHTENING SYSTEM LEAVES A GREEN APPEARS ON THE BIG-END CAPS. THIS MARK DOES NOT INDICATE THE WEIGHT OF THE CONNECTING ROD. ONLY ONE TYPE OF REPLACEMENT CONNECTING ROD IS AVAILABLE IN KITS FOR 3-4-6 CYLINDER ENGINES. CHECK THAT ALL THE CONNECTED RODS ARE STAMPED WITH THE SAME SELECTION CODE NUMBER.

6.17 FLYWHEEL BELL-HOUSING

Examine the condition of the mating surface, bolt holes and spigot. If internal threads are damaged, replace with Helicoil inserts. The camshaft oil seal ring **1** should be renewed each time the engine is overhauled.



6.18 REAR MAIN BEARING CARRIER

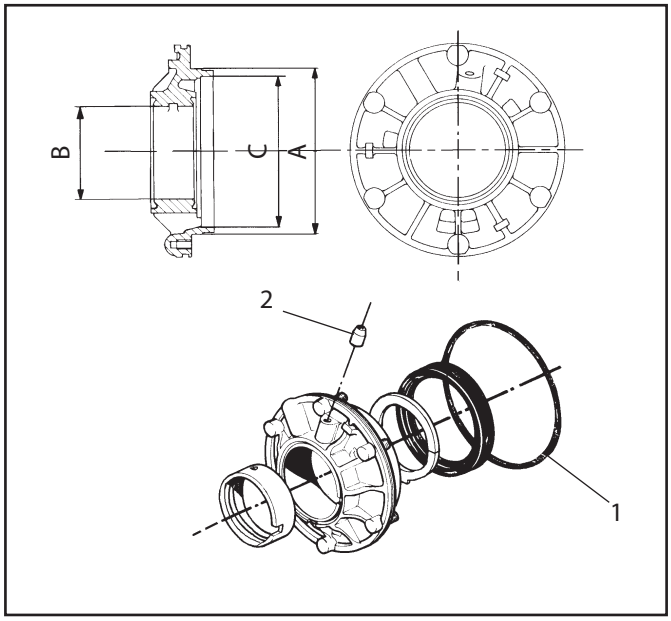
Inspect the surfaces of thrust washer seats for wear.
Check that the run-out of the main bearing seat relative to the center line does not exceed **0.03** mm.
Check the following dimensions:

A Spigot diameter **131.930 ÷ 131.970** mm
B Bearing shell seat diameter **75.05 ÷ 75.030** mm
C Oil seal seat diameter **120.000 ÷ 120.030** mm

After serial number:
28B/03997 (D703L), 29B/03884 (D703LT)
21B/06049 (D704L), 22B/06144 (D704LT)
27B/02422 (D706LT), 75B/01048 (D703LTE)
76B/01015 (D704LE), 77B/01160 (D704LTE)
78B/01016 (D706LTE)

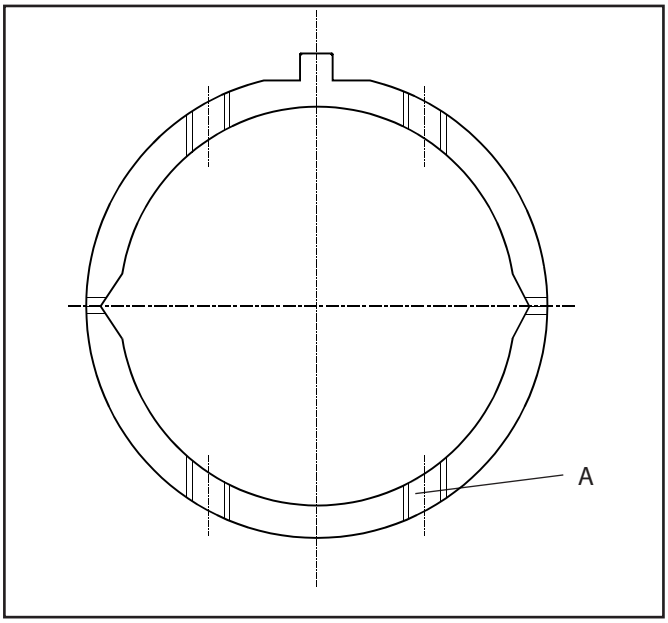
A Spigot diameter **131.930 ÷ 131.970** mm
B Bearing shell seat diameter **85.985 ÷ 86.005** mm
C Oil seal seat diameter **120.000 ÷ 120.050** mm

Seal ring **1** should be renewed each time the engine is overhauled.
Check that oil jet valve **2** functions correctly.
The opening pressure must be **150 ÷ 200 kPa (1.5 ÷ 2.0 bar)(21.7 ÷ 29 psi)**, if not, replace the jet valve.
Secure by staking at three points 120° apart.
N.B. Oil jet valves are made in two pieces. Reassemble by torquing parts to 1.5 ÷ 2.0 kgm (14.7 ÷ 19.6 Nm)(11 ÷ 14.5 lbf ft.)



6.19 THRUST WASHERS

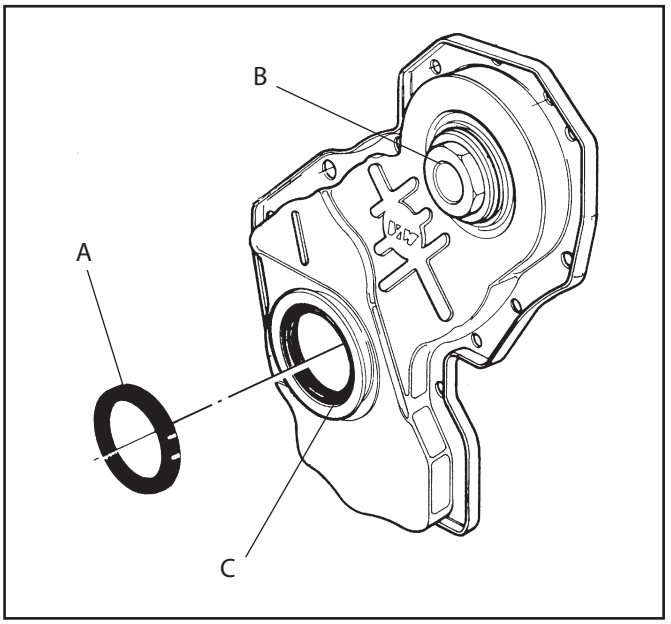
Thrust washers in various thicknesses are available for adjustment of crankshaft endfloat see **(TAB. 8.2.3)**.
The thickness of the thrust washer is stamped at **A**.



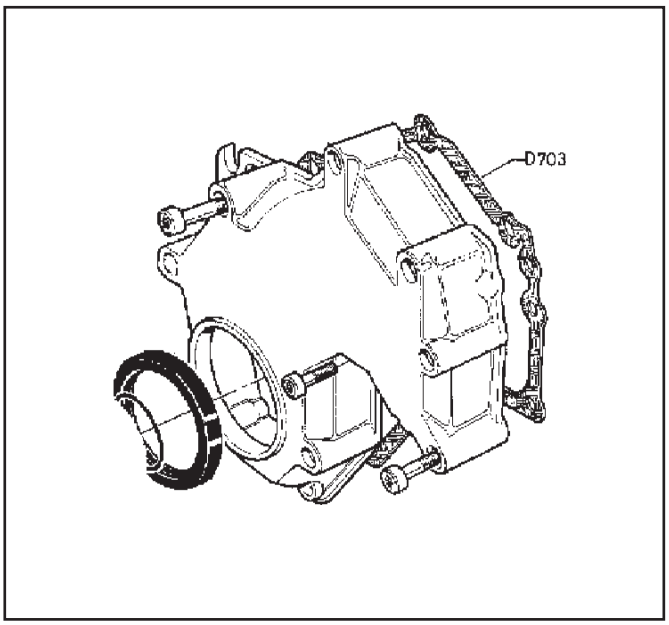
6.20 TIMING COVER

The timing cover is supplied complete with a oil seal **A** and a plug **B** closing the injection pump gear access hole.
Check that the sheet steel cover is not deformed such as to affect its tightness.
Check that the fused cover is not porous such as to affect its tightness or damaged such as to cause breakage.

IT IS IMPORTANT NOT TO TOUCH THE HOLDING LIP OF THE OIL SEAL THAT IS BEING REPLACED/MOUNTED, WITH BARE HANDS OR DIRTY GLOVES BECAUSE THEGREASE OF THE HANDS OR THE DIRT OF THE GLOVES WILL AFFECT ITS TIGHTNESS.

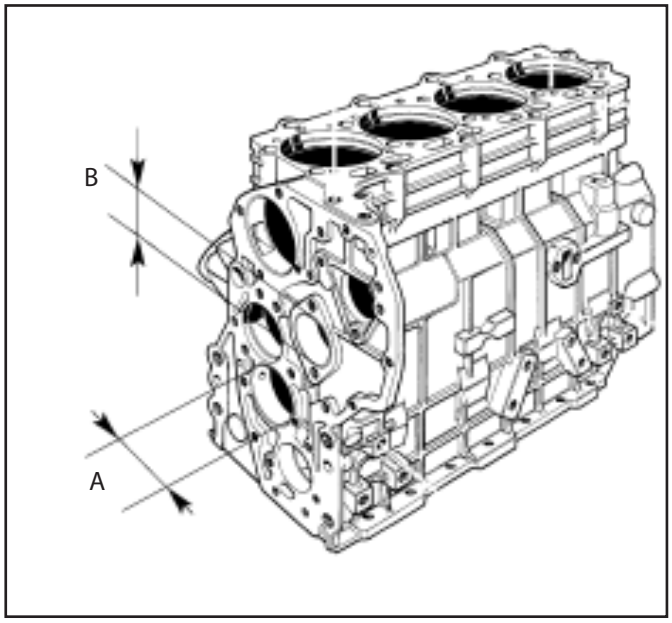


To replace the front oil seal **A** it has to be used the specific special tool **(TAB. 11.1 ref. AB)** to avoid bending on the cover.



6.21 CRANKCASE

- Clean the crankcase thoroughly using a solvent (para. 3.7).
- Check condition of the cylinder head matching surface.
- Check condition of the bore mating surfaces.
- Check that internal threads are clean and are in good condition.
- Check that the oil ways are free of obstructions.
- Check that the oil ways are free from cracks and casting flaws.
- Check on the block the inner diameter of the front journal crankshaft bearing seat **A** = Ø 67.025 - 67.050 mm
  and
  B = Ø 57.000 - 57.030 mm (crankcase inner diameter - front camshaft journal bushing)

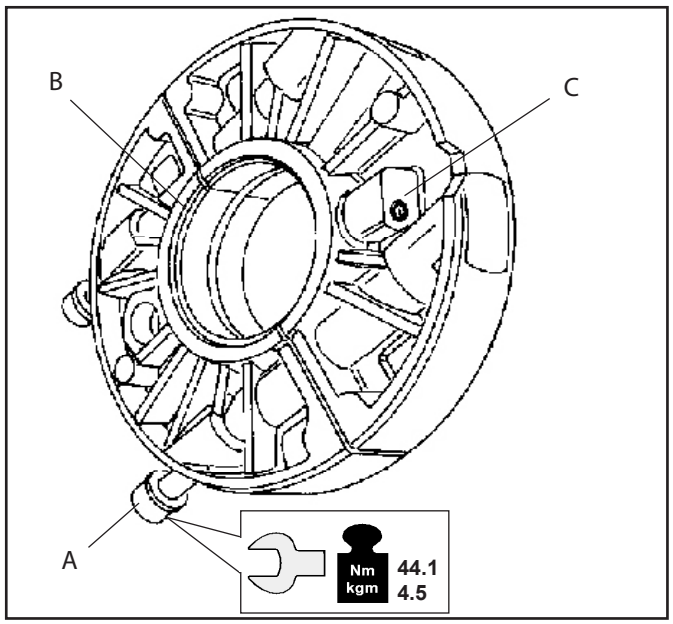


D704TE2, D754E2/TE2, D706IE2, D753 engine models front journal camshaft bushing (VM p/n (21712081G, 21712076F) must be bored, machined when is installed in the block:

- **inner bushing diameter, bored bushing:**
- **53.59 - 53.62 mm**
- **and the clearance between front camshaft journal and inner bushing diameter:**
- **0.08 - 0.135 mm**

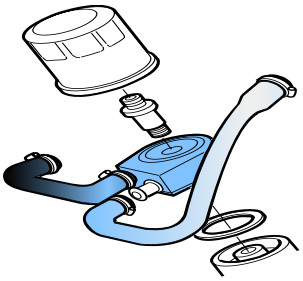
6.21.2 CENTER MAIN BEARING CARRIER

Tighten the carrier bolts **A** to the prescribed torque values.
Measure the bearing seat diameter **B** in two perpendicularly opposed positions.
Seat diameter (Ø 66.670 - 66.697 mm).
If the valve **C** needs replacing, remove the bearing half shell to gain access to the old valve.
Insert the new valve in its seat with jet directed towards the piston.
Insert the new bearing.

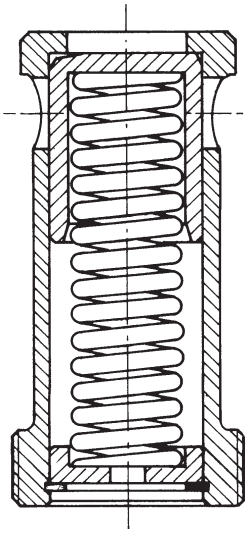


6.22 LUBRIFICATION CIRCUIT

Check the condition of the oil cooler housing and particularly the oil filter cartridge mounting. Check the condition of the coolant inlet/outlet pipes.

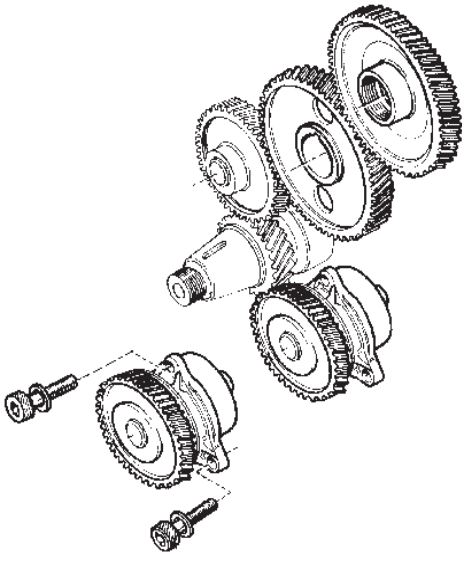


- Clean the oil pressure regulator valve using the prescribed solvent (para. 3.7).



6.23 OIL PUMP

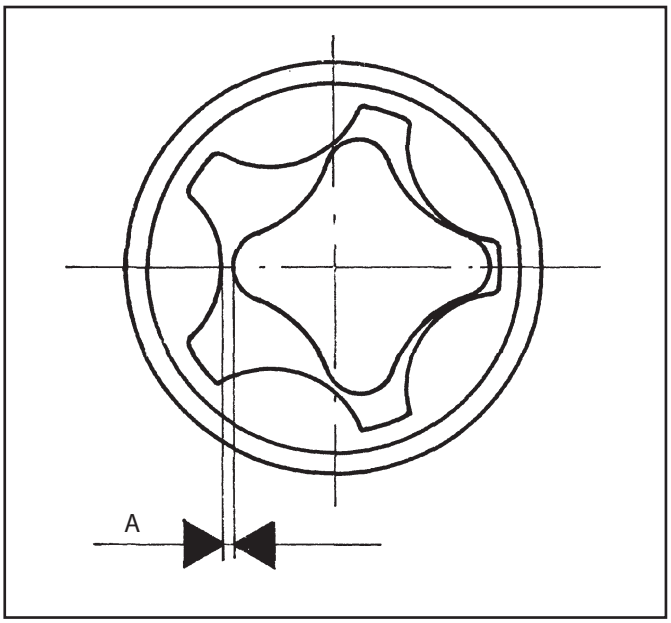
Dismantle the pump, clean the components and inspect for wear.

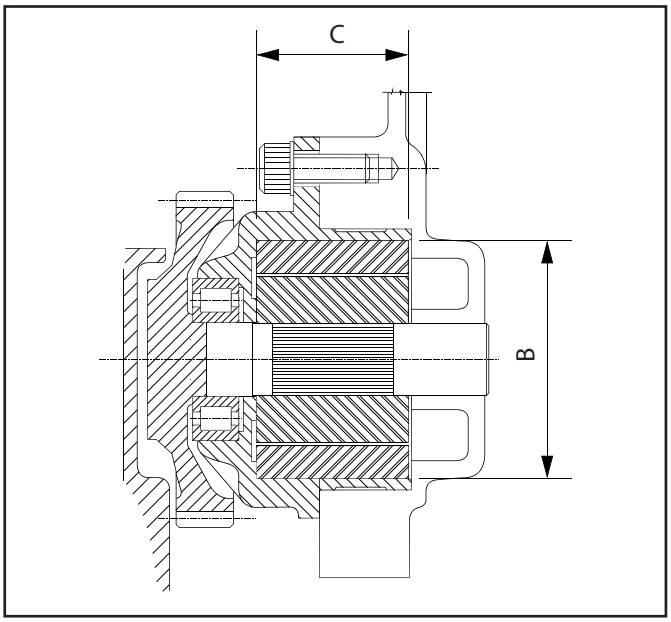


Dimensions and clearances

Rotor height: **32.487 ÷ 32.500** mm.
Max. clearance **(A)** between rotors: **0.152** mm
Clearance between rotor height and rotor housing: **0.081 ÷ 0.097** mm.
Axial clearance between pump gear and pump body: **0.050 ÷ 0.070** mm.
Diameter of rotor housing **(B)**: **58.105 ÷ 58.130**.
Depth of rotor housing **(C)**: **32.403 ÷ 32.406** mm.
Clearance between housing and outer rotor: **0.105 ÷ 0.106** mm, limit: **0.500** mm.

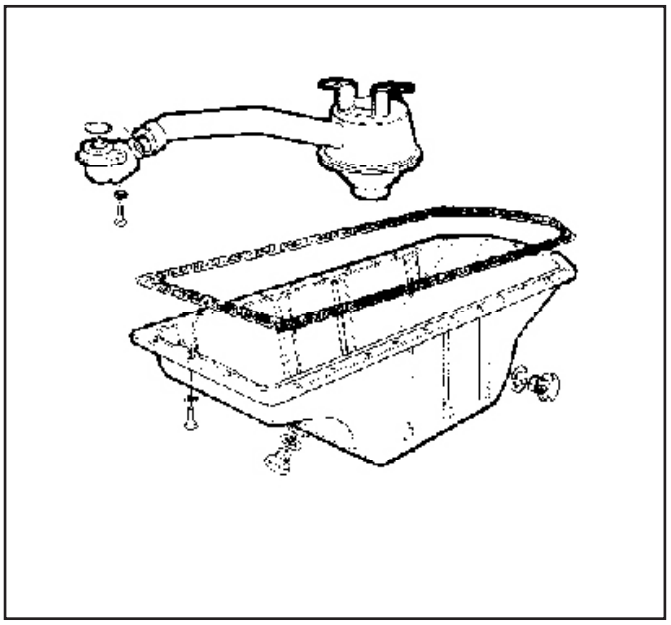
Reassemble with the bevelled end of the outer rotor towards the pump gear and check that the rotor and gear coupling resists a torque of 9 kgm.





6.24 SUMP PAN AND OIL PICK-UP

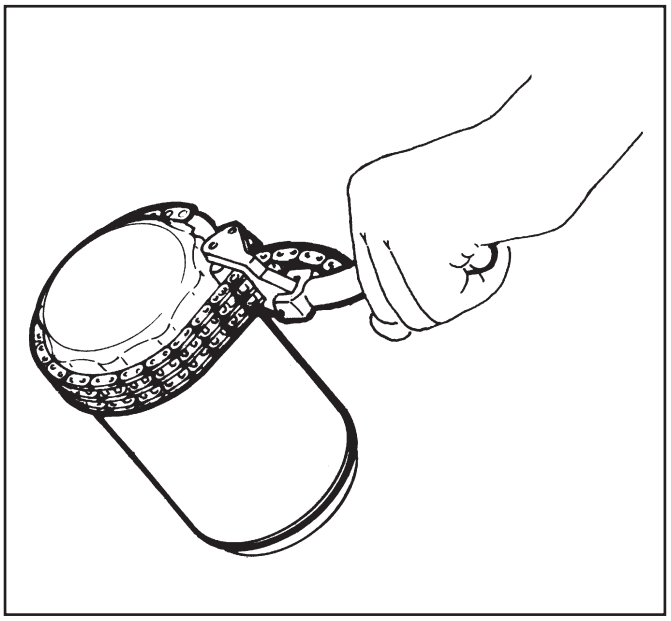
Inspect the sump pan for cracks.
Check all welds for leaks and check the condition of the seals on the oil pick-up pipe.



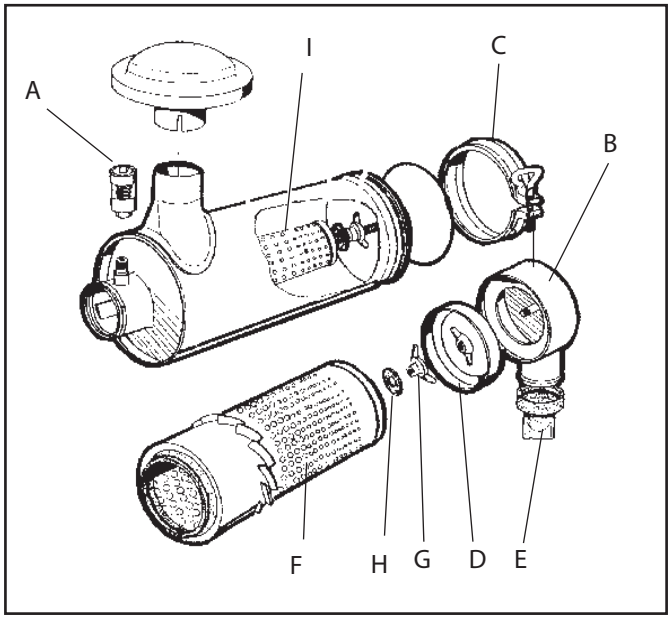
6.25 OIL FILTER

Renew the filter cartridge at the intervals specified in chapter 3 Maintenance.
Oil the gasket before fitting the cartridge.

Check that the oil cooler support union is firmly secured.



6.27 DRY AIR FILTERS



The filter is equipped with a clog indicator **A**.

Clean or change the cartridge when the indicator color is red.

Maintenance:

Unscrew wingnut **C** and remove the dust debris from prefilter **B**.

Remove cover **D** and empty the container.

On filters without expulsion valve **E** this operation should be performed daily.

Remove the cartridge **F** by unscrewing wingnut **G** and perform maintenance.

The safety cartridge **I** (if present) must only be removed when strictly necessary.

Replace the cartridge at the intervals shown in chapter 3 (Maintenance).

Do not impact the cartridge against hard surfaces

Check the air inlet ports and remove any debris.

Clean the internal cartridge with low pressure compressed air.

Use a worklight to check that there are no tears in the cartridge.

If the upper seal is torn and/or if the plastic fins are damaged, replace the cartridge.

After 3 services change the main cartridge and (if present) the safety cartridge.

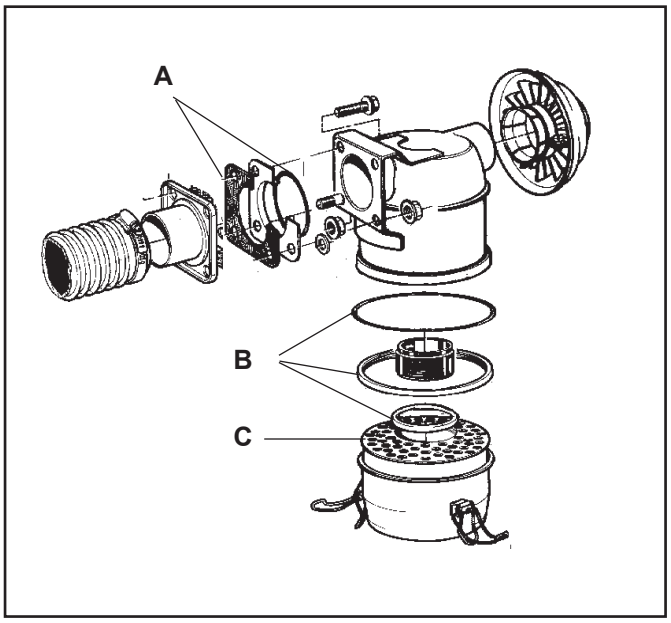
Refit the cartridge in the filter, placing seal **H** beneath the wingnut.

After servicing, press button **A** to reset the clog indicator.

In the event of replacement, specify the type of filter on which the indicator is fitted.

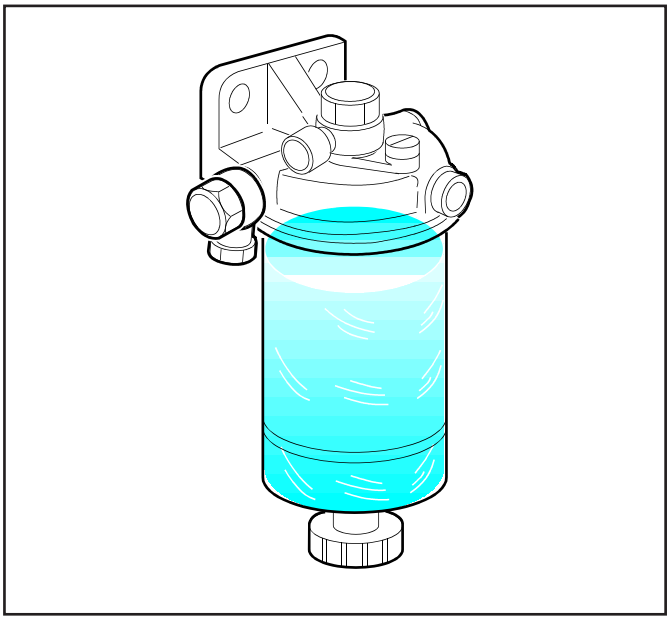
6.28 OIL-BATH AIR FILTER

- Check that the gaskets **A** between filter and sheat are in good condition. Replace if necessary.
- Remove the seal rings **B** and renew if damaged.
- Wash filter element **C** with paraffin or solvent (chapter 3, "Maintenance") and replace if the mesh is damaged. Check the air inlet ports.
- Dry the element with compressed air and refit only when perfectly dry.
- Clean the bowl and fill up to the level mark with new engine oil.
- Service the filter at the intervals specified in chapter 3.



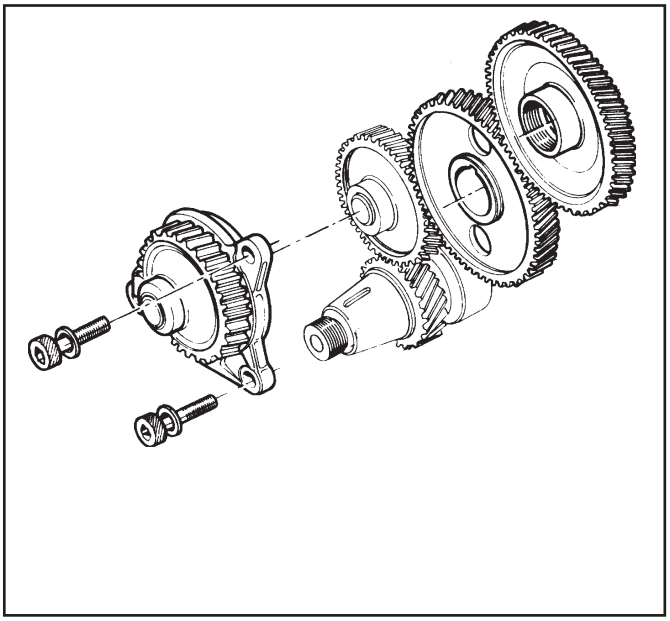
6.29 FUEL FILTER

Renew the cartridge at the intervals specified in chapter 3.
To replace the cartridge:
Disconnect the pipe connecting the filter to the injection pump at the pump.
Replace the cartridge.
Before reconnecting the cartridge to the filter, allow 2 ÷ 3
liters of diesel fuel to flow through the filter and the fuel pipe.
Bleed the fuel system in the manner described on chapter 9).



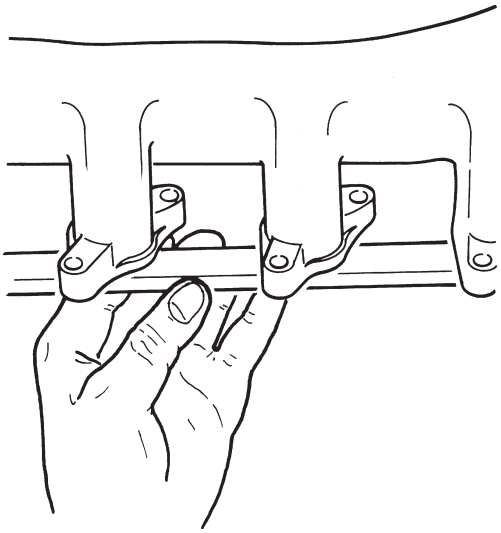
6.30 INTERMEDIATE TIMING GEAR

Inspect the gear for signs of damage or excessive wear. If the gear needs replacing, it is advisable to replace the entire assembly. When refitting, check that there is a clearance of **0.10 ÷ 0.20** mm between the gears.



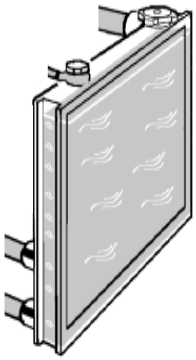
6.31 INLET AND EXHAUST MANIFOLDS

Inspect the manifolds for cracks and distortion and replace if necessary.
Check that the flange mating surfaces are all aligned in the same plane. Grind surfaces if necessary.



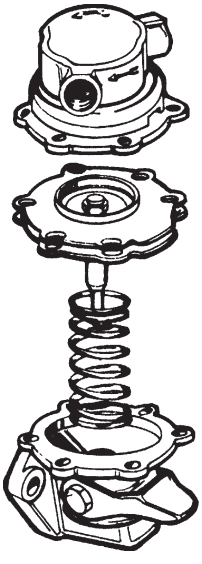
6.32 RADIATOR

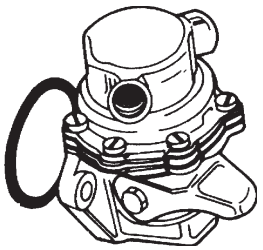
The radiator is an optional component supplied on request. It is mounted at the front of the engine. Check for leaks. Remove internal deposits using suitable solvents (see para. 3.7). Remove dirt and dust from the fins using a soft brush. Note that overheating of the coolant could be caused by obstructions in the coolant circuit, low coolant level, a slack fan-belt or malfunction of the thermostat valve.



6.33 FUEL SUPPLY PUMP

The diaphragm type fuel pump is mounted on the crankcase. The pump is operated by an eccentric cam on the camshaft and is to be primed manually.



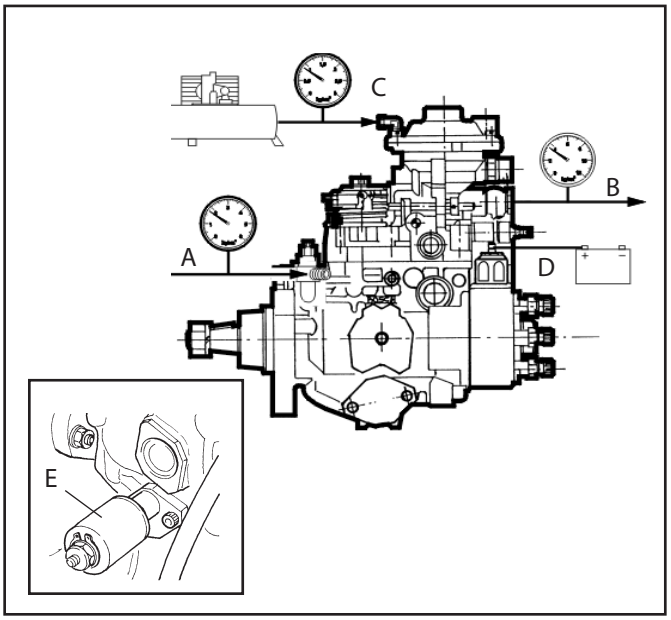


6.34 INJECTION PUMP

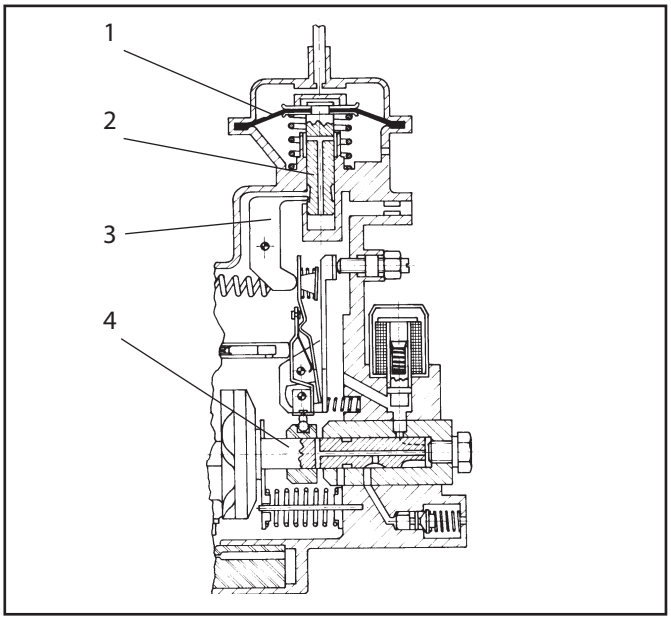
BOSCH INJECTION PUMP

BOSCH ROTARY PUMP TESTS

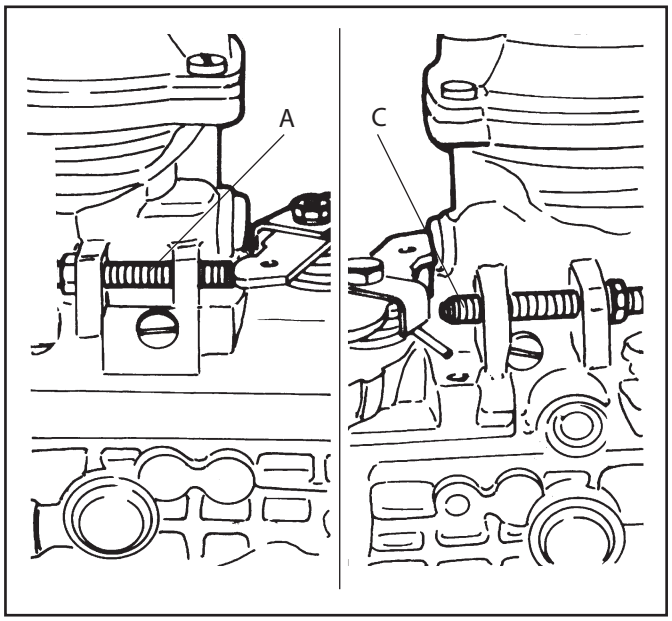
Connect the engine stop solenoid **D** to the positive terminal of a battery. Attach a pressure gauge **A** to the fuel inlet union: the fuel supply pressure must be **0.35** kg/cm^2.
Attach a second pressure gauge **B** to the fuel outlet union to measure the internal pressure.
To check the stroke of the automatic advance variator, install the device **E** (Bosch code 1688130139) on the opposite side to the variator spring.



To adjust the fuel flow rate, on a injection pump test bench, connect the limiter to a compressed air line with pressure **70** kPa.
The air pressure acts on the diaphragm **1** forcing the piston **2** down thus allowing lever **3** to disengage the slide **4**.
The prescribed test values for the pumps installed on D700 series engines may be obtained from all authorized **BOSCH** service centers for all the pumps.



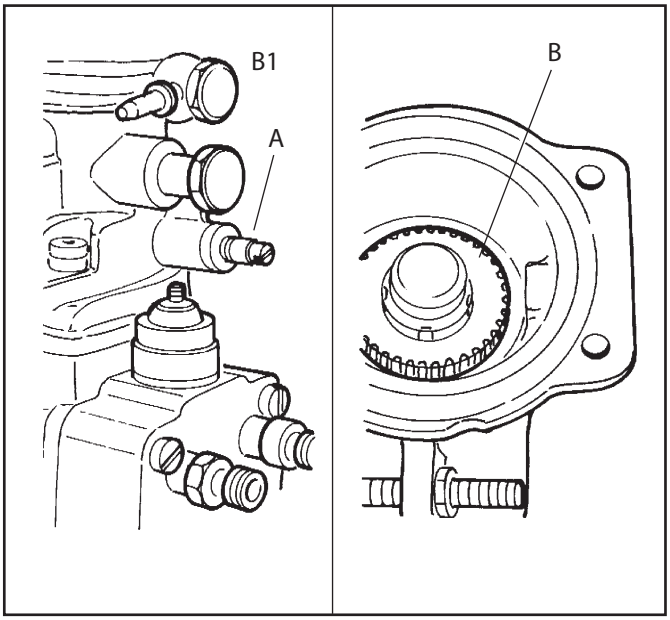
Fuel line no. 1 is always the top union on the right-hand side of the pump when viewed from the rear (opposite end to the mounting flange).
Idle speed adjustment
Turn screw **A** to obtain an engine speed of 750 ÷ 850 rpm.
Maximum speed adjustment
Turn screw **C** to obtain a no-load engine speed 400 ÷ 450 rpm greater than the full-load speed.



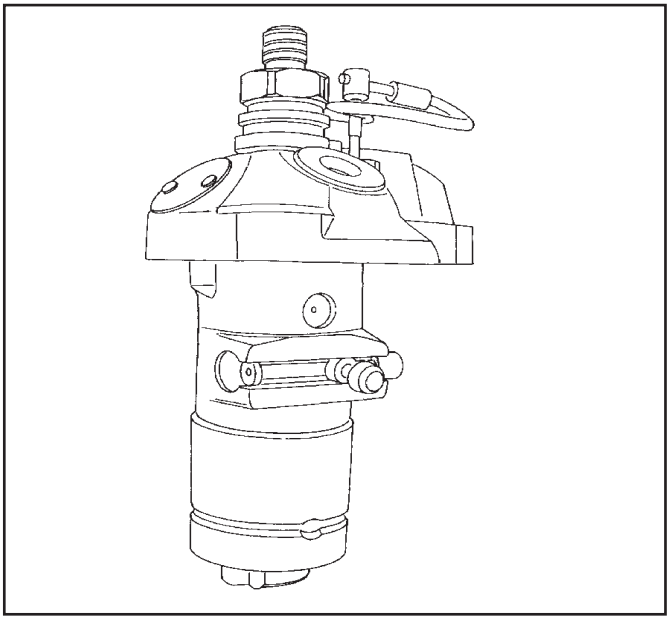
SETTINGS

ALL TESTS AND ADJUSTMENT OF INJECTION DELIVERY SETTINGS MUST BE PERFORMED ON THE INJECTION PUMP TEST BENCH OR WITH A DYNAMOMETER INSTALLED ON THE ENGINE.

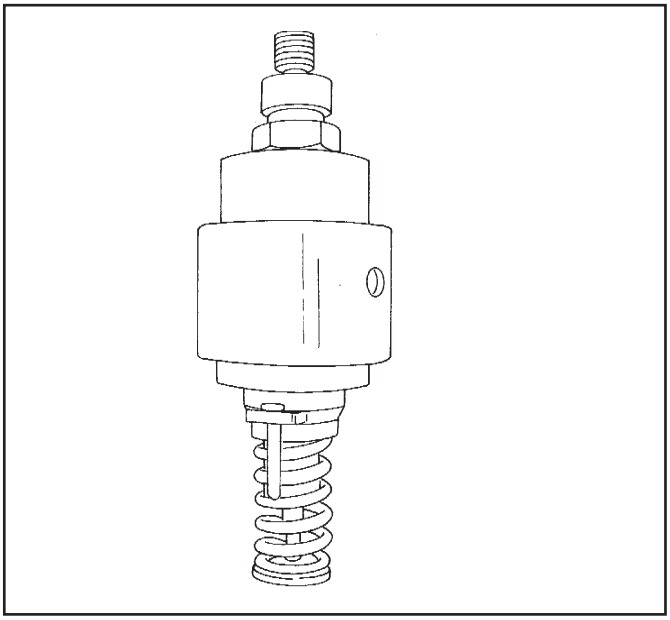
Pump fuel settings are carried out by acting on aneroid adjustment "B" to set smoke reducer up to 2000 RPM and by adjusting the screw "A" to set maximum fuel delivery.
Remove union B1 and act on aneroid B through a screw driver..
When acting on aneroid adjustment "B" insert a screw driver tip and turn toothed segment clockwise to increase low speed fuel and antoclockwise to decrease the fuel.
When setting maximum fuel delivery turn screw A clockwise to increase fuel and anticlockwise to decrease fuel.



BOSCH INJECTION PUMP (old model)
Check that the slide of the rack has not hardened.
For delivery checking, refer to a pump specialist.



BOSCH high pressure injection pump (new model), version (E1-E2-E3)

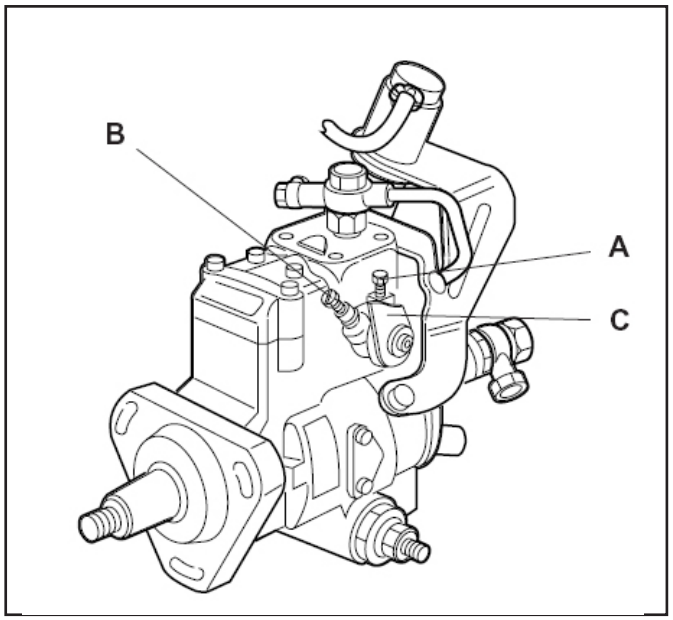


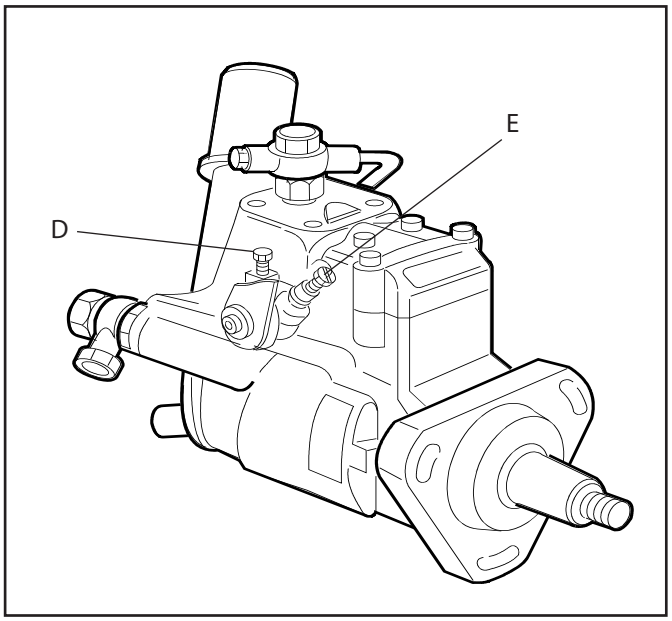
STANADYNE ROTARY PUMP

Idle speed and maximum no-load engine speed can be set on the Stanadyne pump:
A) maximum no-load speed adjuster screw;
B) idle speed adjuster screw.

Push lever **C** towards the flywheel and turn screws **A-B** to set the maximum and idle speeds.

THE FUEL DELIVERY IS PRE-SETTED. ON TURBOCHARGED ENGINES, ACCELERATION PICKUP AND SMOKE GRADE CAN BE ADJUSTED BY MEANS OF SCREWS D-E .





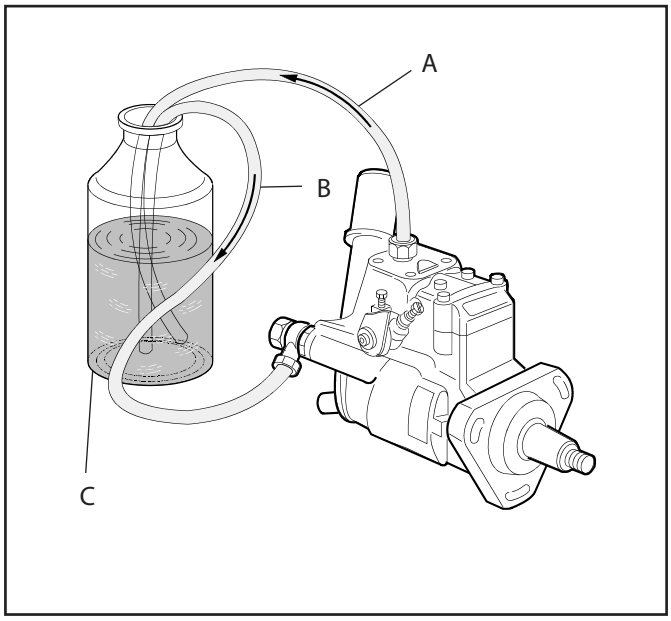
Stanadyne rotary pump test

-Dynamic timing test (with stroboscope and engine running).
Connect the Time Trac or an equivalent diagnostic instrument and run the engine at 1500 rpm under no-load conditions and check the pump timing with stroboscope.
Start the engine and bring the speed up to 1500 rpm under no-load conditions.
The timing is correct when the indicator on the timing cover and the TDC notch on the front pulley are aligned (with strobe lamp); the values in degrees will be shown on the display.

-Bleeding air from the fuel system
After having filled the fuel system using the fuel supply pump and bled the air from the fuel filter, operate the fuel pump until all air has been eliminated from the system.

-Bleeding air from the injector fuel lines
Slacken off the nuts on the injector fuel line unions.
Turn the engine over by operating the starter motor until fuel appears at the pipe unions.
Re-tighten the nuts.

N.B. Before carrying out the above operation make sure that the injection pump solenoid is electrically connected.



A = Return
B = Delivery
C = Uncontaminated diesel fuel.

STANADYNE INJECTION PUMP TIMING

STANADYNE INJECTION PUMP				
ENGINE TYPE	Max RPM	REF. STANADYNE	INJECTION ADVANCE	Note
703L	2300/2600/3000	PFR 1K90/32492/1	18° - 19°	
703LT	2300/2600/3000	PFR 1K90/32492	18° - 19°	
704L	2300/2600/3000	DB4427-5161	13.5°	
704LT	2300/2600/3000	DB4427-5160	12.5°	
704LT	1500/1800	DB4427-5162	12°	
706LT	1500/1800	DB4627-5178	14°	
753 E3	2300/2600/3000		14°	
753 TE3/IE3	2300/2600/3000		8°	FRP: fire pump GEN: genset MTP: motorpump
D756IPE2	"FRP" max 3000		10°	
D756IPE2	GEN max 2300		7°	

REGULATOR SPRINGS - D703 MODELS

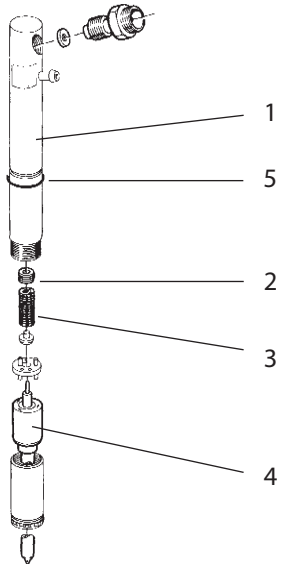
REGULATOR SPRINGS - D703 MODEL		
COLOUR	MODEL	APPLICATION
RED	D703 L-LT-LE-LTE	INDUSTRIAL 3000 RPM
WHITE-AZURE	D703 LE.G15-D703 LTE.G15	G.E. 1500 RPM
WHITE-RED	D703 LE.G18-D703 LTE.G18	G.E. 1800 RPM
YELLOW-GREEN	D703 L-LE	INDUSTRIAL 2300-2600 RPM
YELLOW-BLUE	D703 LT-LTE	INDUSTRIAL 2300 RPM
YELLOW-BROWN	D703 LT-LTE	INDUSTRIAL 2600 RPM

INJECTION PUMP BOSCH - TIMING ADVANCE

	Engine Model	D703 Injection Advance (Degrees)	D704-D706 Injection Advance (prestroke in mm with 1st piston at TDC in fire position)	MAX RPM
	703L	18° - 19°		2300/2600/3000
	703LE	18° - 19°		2300/2600/3000 - (GenSet 1500/1800)
	703LT	18° - 19°		2300/2600/3000
	703LTE	15° - 16°		2300/2600/3000 - (GenSet 1500/1800)
	703TSE	15° - 16°		2600
	703E2	7° +/- 30’		2300/2400/2600
703TE1-TE2		5° +/- 30’		2300/2600
	704L		1.29 - 1.31	2300/2600/3000/3600
	704LE		1.25 - 1.28	2300/2600/3000
	704LE		1.09 - 1.11	2000
	704LT		1.13 - 1.15	1650/1800/2300/2600/3000/3600
	704LTE		1.03 - 1.05	2300/2600/3000 - (GenSet 1500/1800)
	704LTE		1.20	2600 version 77B/8 & version 09A-14A-11A
	704TE2		1.03 - 1.05 **0.99 – 1.01***	2300/2600 *** solo per versione .44A** *** only for version .44A**
	754E1		1.09 - 1.11	2300/2600
	754E2		0.99 - 1.01	2300/2600
	754TE2		0.93 - 0.97	2300/2600
	706LT		1.70 - 1.72	2300/2600/3000/3600
	706LTE		1.23 - 1.25	2300/2600/3000 - (GenSet 1500/1800)
	706IE2		1.24 - 1.26	2300/2600/3000
	D703TE3-IE3	3° +/- 30’		2300/2600
	706LI		1.70 - 1.72	3000
	D754SE3-TE3		0.59 – 0.61	2300/2600
	D754IE3		0.99 – 1.01	2300/2600
	D703E0/TE0	8° +/- 30’		1500/1800/2300/3000

6.35 INJECTOR

Key to parts:
1) Body - **2)** Spacer - **3)** Spring - **4)** Nozzle - **5)** O-ring
To examine the spray produced by the injector, remove the injector from the cylinder head.
Connect the injector to the external delivery pipe and turn the engine over slowly by hand with pump set to maximum delivery.
If the nozzle drips during testing, it must be replaced.
Install the injector on the test bench, operate the hand pump and check that the injection pressure is that specified in chapter 2.



6.36 STARTING *(D700-D700E)*

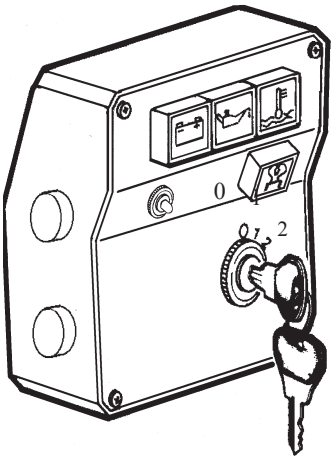
D700

When the ignition key is turned to **position 1**, the oil pressure control and battery charge circuits are energized. When the key is turned to **position 2**, the starter motor is energized. Do not operate the starter motor for more than 15 seconds at a time to avoid overheating the solenoid.
After each attempt at starting, wait a few moments before trying again in order to allow the battery to recover.
When the engine is stopped, always turn the key to position **0** so as not to discharge the battery or burn out the indicator lamps.

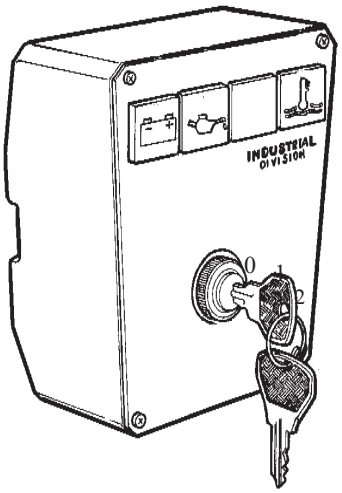
D700 E

When the ignition key is turned to **position 1**, the glowplugs, the oil pressure control and battery charge circuits are energized. When the key is turned to **position 2**, the starter motor is energized. Do not operate the starter motor for more than 15 seconds at a time to avoid overheating the solenoid.
After each attempt at starting, wait a few moments before trying again in order to allow the battery to recover.
When the engine is stopped, always turn the key to position **0** so as not to discharge the battery or burn out the indicator lamps.

D700



D700E



6.37 GENERAL ELECTRICAL SYSTEM CHECK

Examine the cables and the condition of the insulation.
If the system is not functioning correctly, investigate the following possible causes:
- battery-starter motor connection cables damaged;
- red wire from starter motor to alternator damaged;
- battery discharged and/or elements damaged;
- starter motor faulty;
- voltage regulator faulty;
- alternator diode/s faulty.

6.38 BATTERY

The battery is not supplied by DDC.
Minimum battery sizes are given in the VM installation manual

6.39 ALTERNATOR

The alternator is of the self-excited 3-phase type with integral diode rectifier.
Check:
- alternator connections.

For alternator overhaul or repair, contact your nearest authorized VM service center.

6.40 VOLTAGE REGULATOR

ENGINE TYPE	ALTERNATOR SPEC.
D703	BOSCH 14V - 85A
D704 - 754	BOSCH 28V - 55A
D706	*DENSO 12V - 50A
	DENSO 24V - 25A

*: VM COD.: 38522287G starting from 23/03/2000

The voltage regulator requires no maintenance or adjustment.
For replacement consult the Spare Parts Catalogue.

6.41 STARTER MOTOR

Check starter motor brushes at the prescribed intervals.
Inspect the commutator for scratches and excessive wear.
For repairs or overhaul contact your nearest authorized service center.

6.42 TURBOCHARGER

VM MOTORI DECLARES THAT ANY MODIFICATIONS TO THE TURBOCHARGER WILL AUTOMATICALLY INVALIDATE THE GUARANTEE.

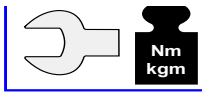
7 ASSEMBLY

7.0 GENERAL WARNINGS

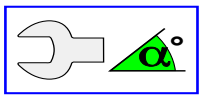
The following instructions refer to engine models available at the time of publication of this manual.

Assembly the engine components in the order indicated to save time and avoid damage.

Carefully check components before assembly following the instructions in chapter 6 “CHECKS AND REPAIRS”.



USE TORQUE WRENCH



USE ANGULAR TORQUE WRENCH

_WARNING: WHEN THE ABOVE SYMBOLS APPEAR TOGETHER, THE OPERATIONS ARE TO BE PERFORMED IN THE SEQUENCE INDICATED IN THE FIGURE.

_WARNING: PRIOR TO ASSEMBLY, CLEAN PARTS WITH A SUITABLE SOLVENT (SEE PARAGRAPH 3.7).

WARNING: IT IS STRICTLY FORBIDDEN TO CLEAN THE ENGINE WITH COMPRESSED AIR.

_WARNING: USE ALWAYS TORQUE WRENCHES

WHERE THE USE OF VM SPECIAL TOOLS IS NOT SPECIFIED IN THE ASSEMBLY PROCEDURES, USE STANDARD COMMERCIAL TOOLS OF THE TYPE ILLUSTRATED.

Mounting the engine on the stand

Mount the engine on a commercial stand as shown in figure.

Secure the engine by means of the assembling arms and bolts provided with the stand (or using mounting bolts of the same type).

_WARNING: REMEMBER TO INSERT THE LOCK PIN (A) AND CHECK THAT IT EFFECTIVELY LOCKS THE ENGINE IN POSITION.

_WARNING: ALWAYS USE THE REDUCTION GEAR (B) TO ROTATE THE ENGINE.

_WARNING: RISK OF CRUSHING AND/OR SHEARING OF LIMBS DURING ROTATION OF ENGINE ON STAND.

NEVER INTRODUCE PARTS OF THE BODY OR FOREIGN OBJECTS IN THE AREA SHADED GREY IN FIGURE 7.0.

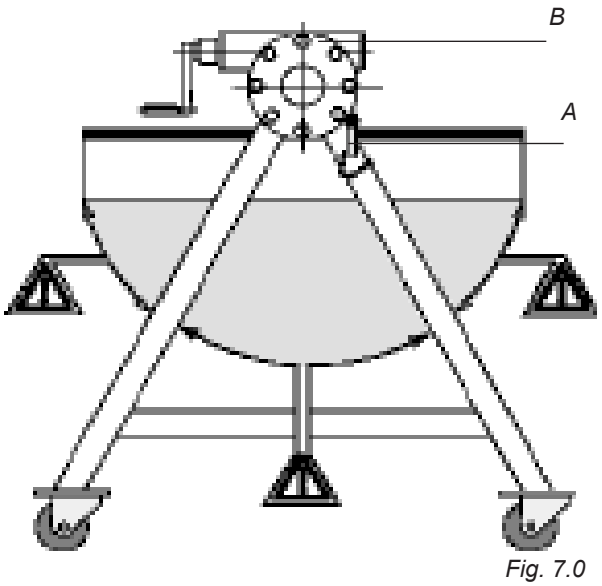


Fig. 7.0

7.1 FRONT MAIN BEARING AND CAMSHAFT BEARINGS

Apply Loctite 601 on outer surface of the new bearing.

Fit new bearing **D** on special tool **C** **(TAB. 11.1 ref. E)** as shown in the figure. Align the oil passage in the engine block with the hole of the new bearing.

NOTE: To aid installation retain bearing halves on tool with a rubber band or similar.

Turn bolt **of special tool** to withdraw the old bearing from the crankcase and simultaneously install the new bearing.

a - Oil passage

b - Bearing hole

c - Front Main Bearing and Camshaft Bearing Puller Tool

d - Bearing halves (on tool)

e - Bearing bore

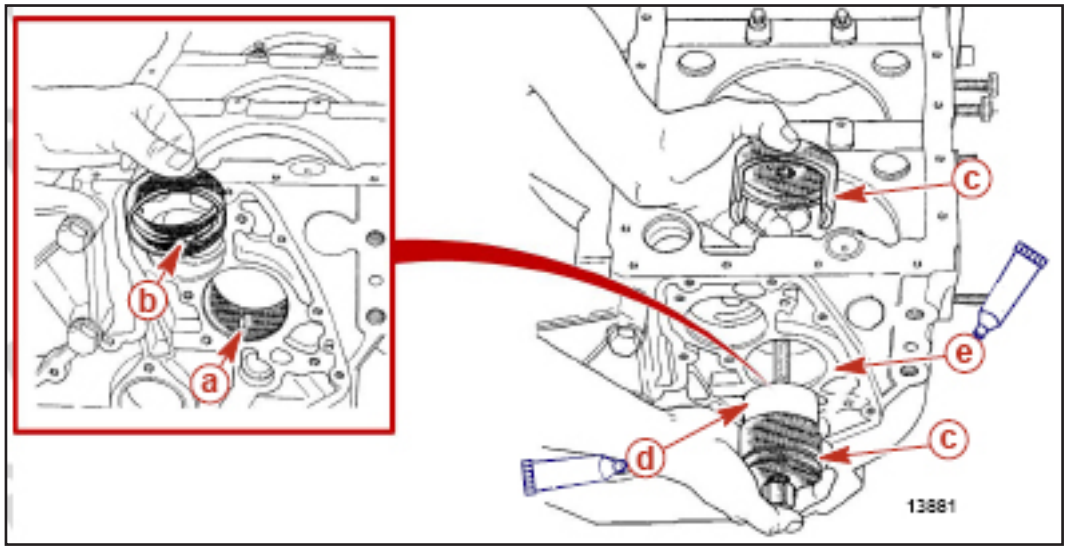


Fig. 7.1

D704TE2, D754E2/TE2, D706IE2, D753 engine models front journal camshaft bushing (VM p/n (21712081G, 21712076F) must be bored, machined when is installed in the block:

- **inner bushing diameter, bored bushing:**
- **53.59 - 53.62 mm**
- **and the clearance between front camshaft journal and inner bushing diameter:**
- **0.08 - 0.135 mm**

7.2 CYLINDER LINER

Insert liner **A** in the corresponding bore in the cylinder block **B**.

Fit a dial gauge with a 0.01 mm graduated scale on special tool **C** **(TAB. 11.1 ref W)**.

Zeroset the gauge on the surface of the cylinder block.

Then position the contact point on the liner neck surface. The height measured (**A** fig. 7.3) is then used to calculate the thickness of the shim to be interposed between the cylinder block and the liner to obtain the correct liner protrusion from the cylinder block face.

Liner protrusion values for disassembled liner with shims:

(0 ÷ +0.05 mm) or (+0.01 ÷ +0.06 mm).

Liner shims thicknesses 0.15, 0.17, 0.20, 0.23, 0.25 mm.

Liner protrusion values for disassembled liner WITHOUT shims:

(-0.01 ÷ +0.07 mm).

Remove the liner.

Fit the O-rings **D**: 2 rings with same colour **X** in the grooves near the neck of the liner and 1 ring **Y** with different colour than first two, at the bottom.

Apply a thin uniform layer of sealing compound (Loctite 986) to the upper sealing surface of the liner. Carefully remove any excess sealing compound.

Lubricate the lower centering spigot of the liner with graphite grease (Molyguard LMP-180).

Fit the shim of the correct size on the liner (ONLY FOR DISASSEMBLED LINERS WITH SHIMS).

FOR DISASSEMBLED LINERS WITHOUT SHIMS INSERT THE LINER WITHOUT SHIM.

Insert the liner in the bore.

Tap the liner gently home using a wooden or rubber block.

Fix the liner at two diametrically opposed points using standard M14 bolts and liner clamps **E**.

Tighten bolts to 3 kgm.

Zeroset a dial gauge on the cylinder block surface and measure liner protrusion (**B** fig. 7.3) at two opposite points on the transverse axis of the cylinder block.

Check that liner protrusion corresponds with the value earlier indicated:

REFER TO PROPER LINER PROTRUSION VALUES DEPENDENTLY ON THE PRESENCE OF THE SHIM DURING LINER DISASSEMBLING PROCEDURE.

Repeat the above procedure for each liner.

IF THE HEADS CANNOT BE INSTALLED AND TORQUED WITHIN 1 HOUR, THEN THE LINERS HAD TO BE CLAMPED DOWN FOR 8 HOURS TO LET THE LOCTITE DRY. THEN THE CLAMPS CAN BE REMOVED AND THE HEADS INSTALLED

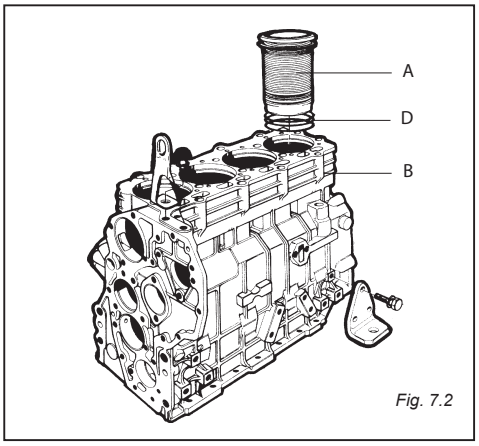


Fig. 7.2

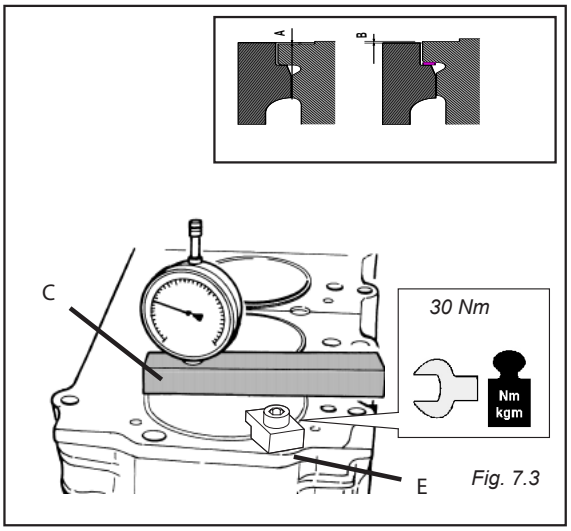
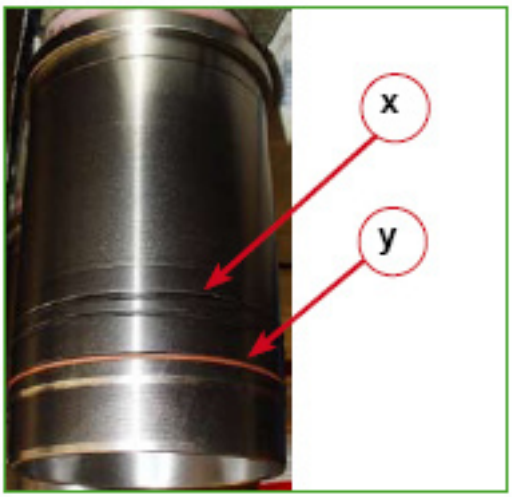
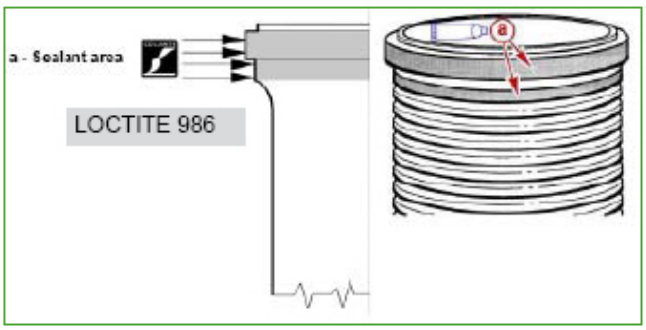


Fig. 7.3





7.3 MECHANICAL TAPPETS

Turn the engine block upside down.

Lubricate the tappet surface with engine oil.

Lubricate the tappet seat in the crankcase.

Repeat the procedure for each tappet.

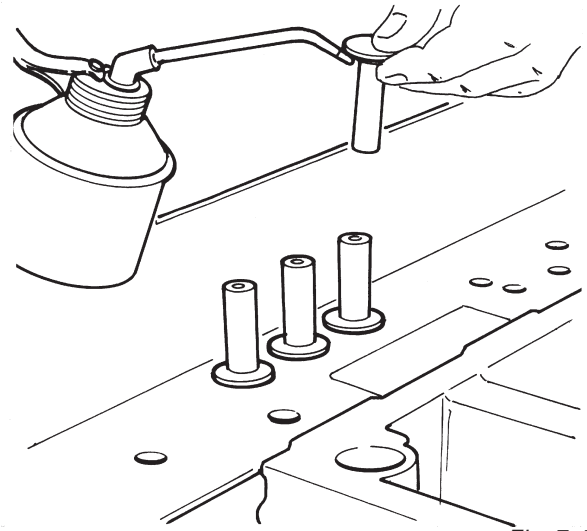


Fig. 7.4

7.4 CAMSHAFT

Lubricate the camshaft bearing contact surfaces.

Insert the camshaft, being careful not to damage the bearing surfaces with the sharp edges of the cam lobes.

Fit the camshaft thrust plate and the gear and tighten bolts **A** to torque values:

27.5 Nm - 2.8 Kgm (flange)

(30 Nm - 3.1 Kgm for D703) (camshaft gear)

D704TE2, D754E2/TE2, D706IE2, D753 engine models front journal camshaft bushing (VM p/n (21712081G, 21712076F) must be bored, machined when is installed in the block:

- **inner bushing diameter, bored bushing:**
- **53.59 - 53.62 mm**
- **and the clearance between front camshaft journal and inner bushing diameter:**
- **0.08 - 0.135 mm**

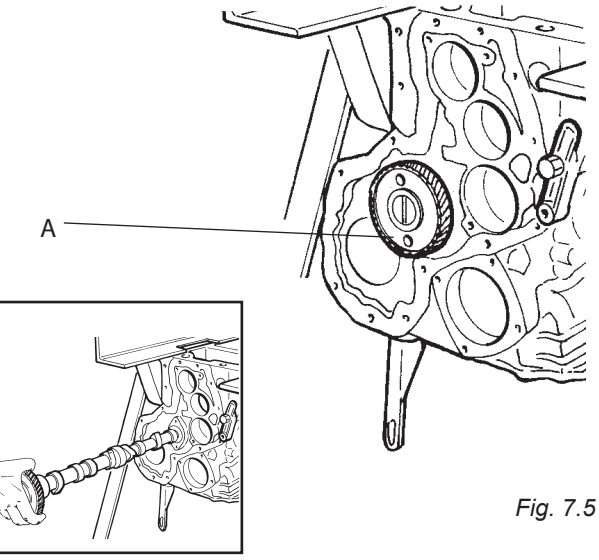


Fig. 7.5

7.5 CRANKSHAFT

Lubricate the main bearing and big-end bearing contact surfaces.

Insert the crankshaft complete with gear using the special tool **(TAB. 11.1 ref. H)** to avoid scoring or scratching the front bearing surface.

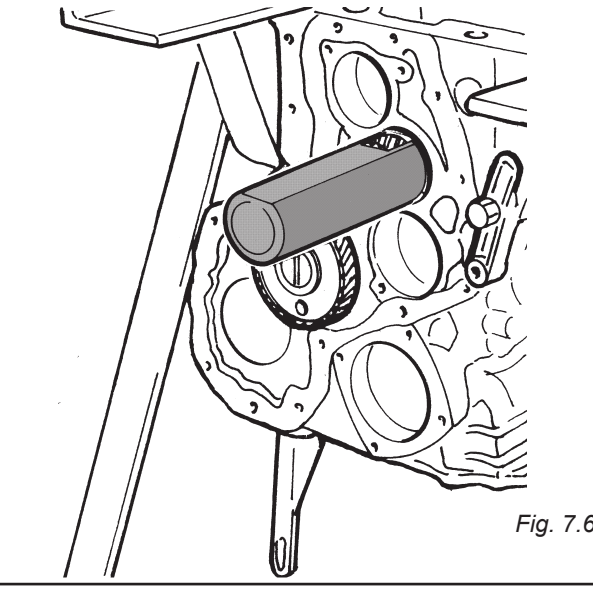


Fig. 7.6

7.6 CENTER MAIN BEARING CARRIER

Lubricate with grease the main bearing carrier bores in the cylinder block.

Install the matching main bearing carrier halves on crankshaft journals in their original locations (marked during disassembly) or by referencing the factory paint marks on the side.

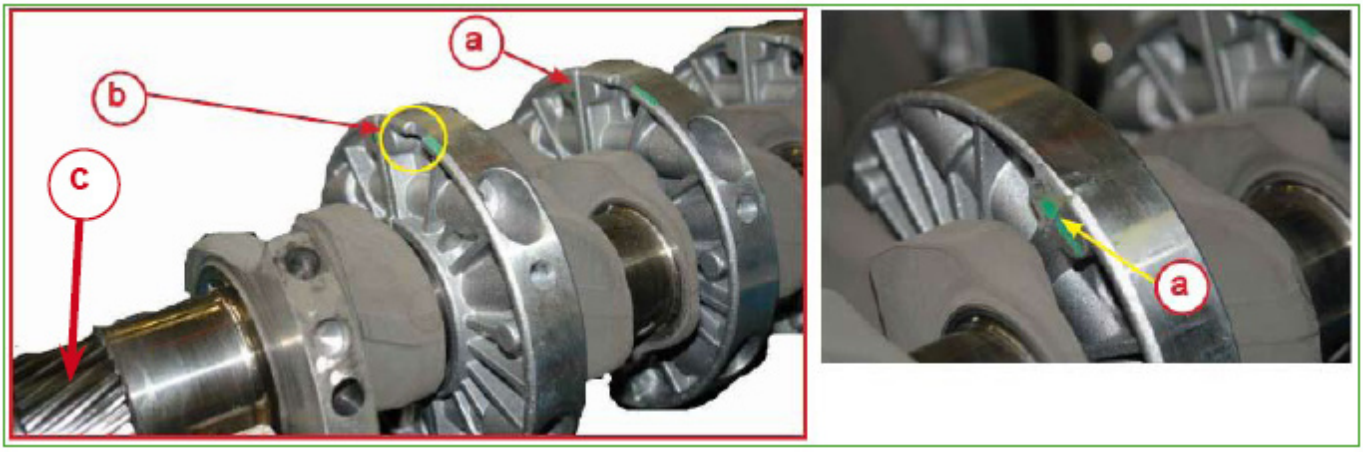
Ensure that all carriers were positioned so that the front of the carrier halve is toward the crankshaft gear after installing them on the journal.

Verify also that the piston lubrication oil jet is directed towards the front of the engine (timing end). If this oil jet is not present in main center bearing carriers, another type of piston oil jet is installed in the block, to ensure the lubrication and cooling of the piston. Refer to proper paragraph "piston cooling jet - oil spray nozzle".

Lubricate with MOLYguard LMP 180 grease the bearing carrier underside bolts and thread and torque them.

Fix the bearing carriers by tightening retaining bolts

Bearing carrier bolt 44.1 Nm.



a- Reference paint marks made by factory or operator during disassembly
b-- Reference that identifies the front of the carrier, it must be pointed toward the crankshaft gear.
c- crankshaft gear

Carefully insert the crankshaft with the main bearing carriers attached into the cylinder block.

Rotate the bearing carriers to align with marks made during disassembly. If no marks are present, position the bearing carriers with the round hole **Z** through the casting pointing toward the oil pan flange.

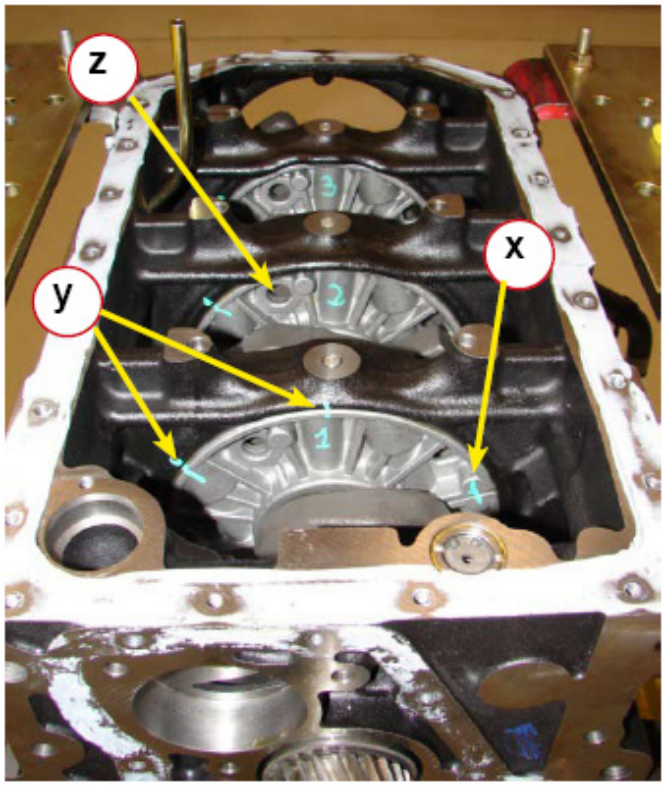
Then insert the crankshaft completed of the main bearing carriers in their seats in the crankcase.

Install new sealing washers on all main bearing locating screws and special locating screws.

To avoid damaging the threads,hand thread the main bearing locating screws and special locating screws into the bearing carriers.

Torque all main bearing locating screws and special locating screws..

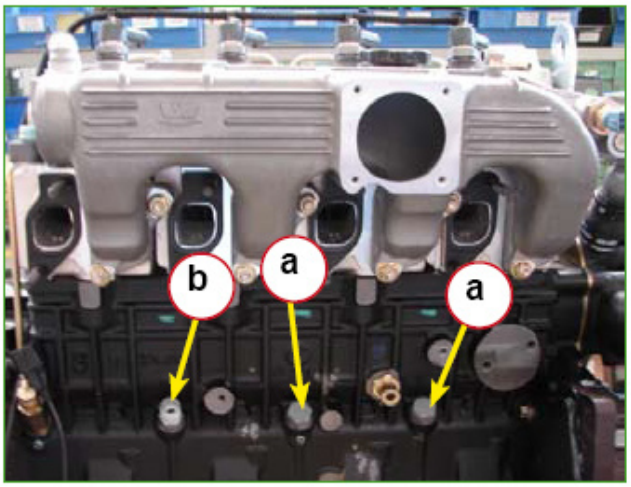
Locating screw	**53.9 Nm**



x - matching marks on both bearing carrier halves

y - matching marks on all main bearing carriers (between carrier and block)

z - Round holes through the castings



a - Locating screw - standard

b - Special locating screw (for oil supply hose to turbocharger)

7.7 REAR MAIN BEARING CARRIER

Fit rear oil seal **B on the rear main carrier** .

Fit standard size thrust washers.

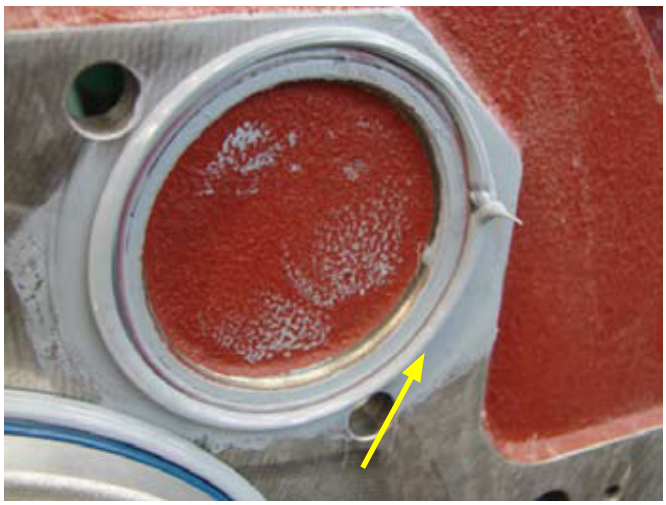
Fit rear main bearing carrier O-ring seal **C (and C1 on flywheel housing or crankcase) applying Dow Corning 7091 silicon in order to avoid oil leakage**.

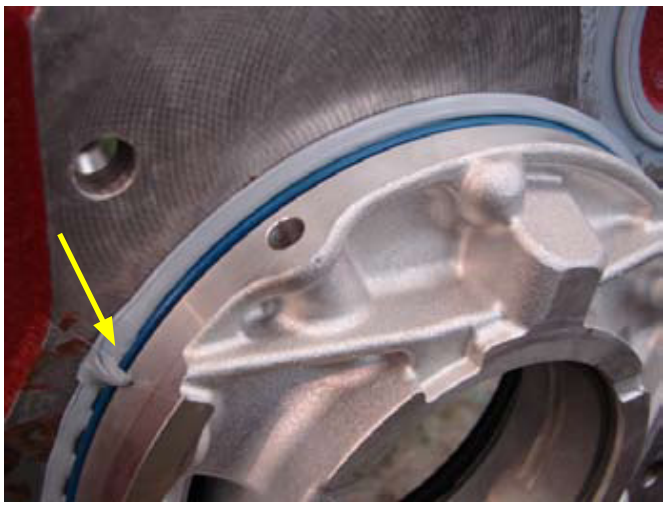
Install the rear carrier in its seat in the crankcase making sure the oil ways is aligned with oil passage in the block.

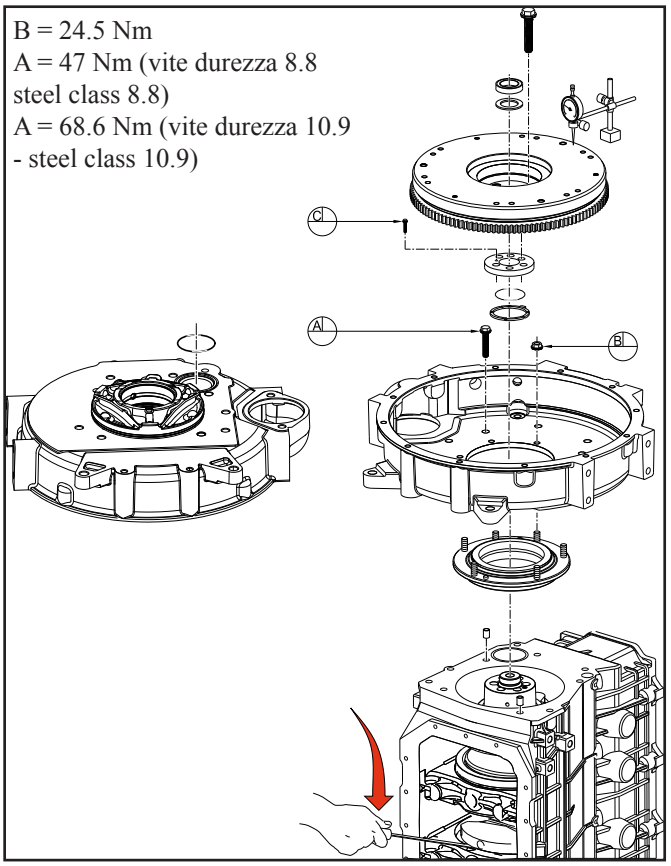
Install the flywheel housing on the rear main carrier aligning the rolled pin on the carrier with proper hole on flywheel housing.

Tighten the carrier nuts **D** to the specified torque.

DO NOT TOUCH AT ALL THE OIL SEAL INTERNAL LIP THIS TO REDUCE THE RISK OF OIL LEAKS.







7.8 FLYWHEEL BELL- HOUSING

Locate the flywheel housing on the spigot of the rear main bearing carrier.

Tighten bolts to specified torque:

Bolt steel class 8.8	**4.8 Kgm (47Nm)**
Bolt steel class 10.9	**7 Kgm (68.6 Nm)**

7.9 FLYWHEEL

Position the flywheel fixing holes in line with the holes on the crakshaft.

We recommend the use of support plugs **(TAB. 11.1 ref. AE)** to facilitate this operation.

Install the special tool **B (TAB. 11.1 Ref. T)**, to lock the flywheel, crankshaft rotation.

Follow the flywheel bolts tightening procedure as following described:

Lubricate with engine oil the screw head base and the thread.

Fit the 6 screws **A** and tighten to a **5.1 kgm (50 Nm)** torque with a ± **5%** tolerance, starting from screw 1 and then tightening the opposite one (cross pattern tightening sequence).

The tightening sequence is clockwise.

Check the crankshaft endfloat and consult the specifications indicate on the heading 7.10.

Using a torque wrench equipped with a goniometer, **(TAB. 11.1 Ref. R)**, loosen one screw at a time and then tighten all screws **A** to a **2.05 kgm (20 Nm) torque + 75°** with a ± **5%** tolerance, tightening the opposite one (cross pattern tightening sequence).

The tightening sequence is clockwise.

WHILE USING NEW SCREWS, DO NOT LUBRIFY THEM AT ALL, SINCE THEY ARE ALREADY COATED WITH AN ANTISEIZURE TREATMENT.
USUALLY THE BOLTS COME REUSED.
IF REUSED THEY MUST BE LUBRICATED.
DO NOT REUSE THE BOLT IF SHOW DAMAGE.

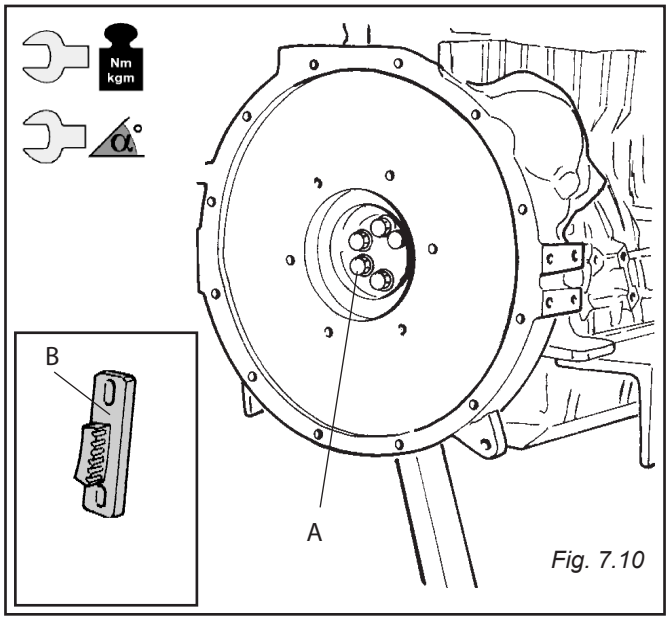
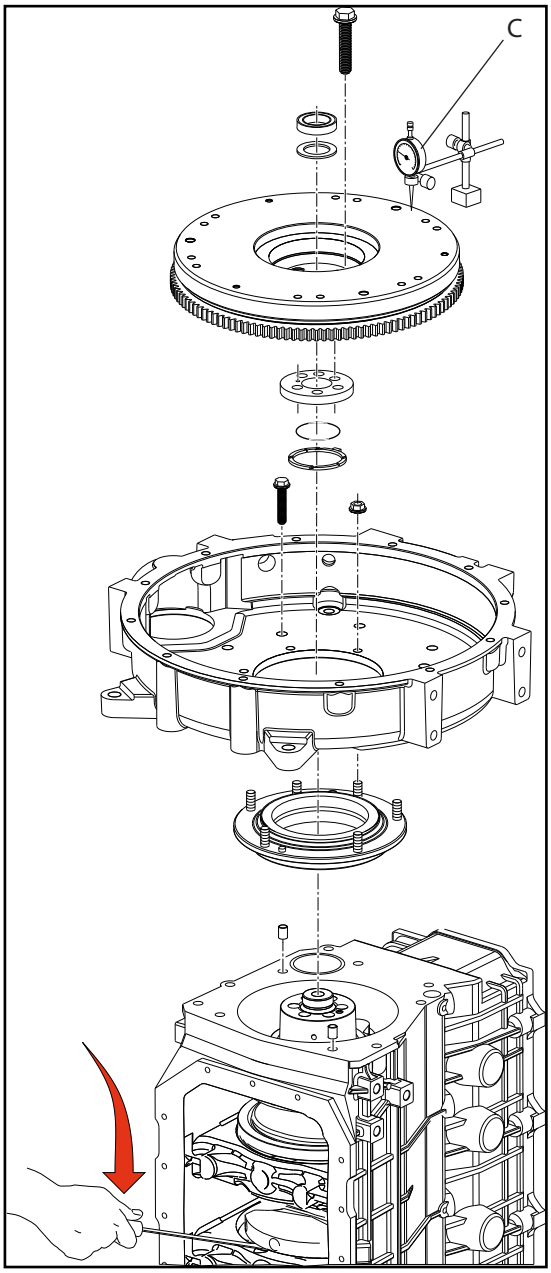


Fig. 7.10



7.10 CRANKSHAFT ENDFLOAT

Install the flywheel.

Use a dial gauge **C** mounted on a support.

Force the crankshaft back and for using a lever, the maximum axial play is specified:

(rear crankshaft end) diameter of rear main bearing STD.

Ø 70 = 0.153 - 0.304 mm

(rear crankshaft end) diameter of rear main bearing STD.

Ø 80 = 0.080 - 0.280 mm

(rear crankshaft end) diameter of rear main bearing CLARKE fire pumps version

Ø 80 = 0.155 - 0.356 mm

7.11 CONNECTING-ROAD AND PISTON

Assemble the piston on the shaft of connecting rod **B** aligning the explosion chamber with the side of the connecting rod where the coupling numbers are located and further for **fractured con-rods the casting node N must be positioned as view "C"**.

Insert pin and secure it with the seeger rings **D**.

Assemble the rings on the piston positioning them as shown in (Fig. 7.12a):

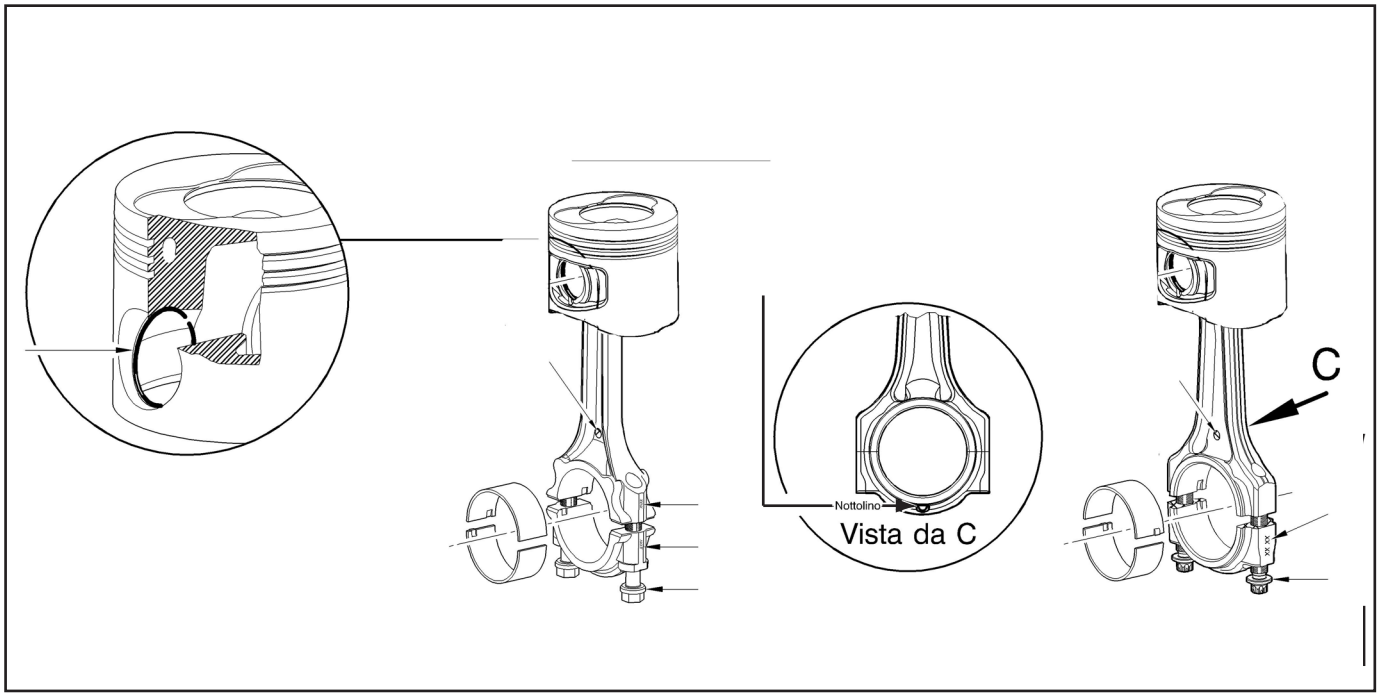
1st Compression ring with trapezoidal shape.

2nd Compression ring with step profile at the bottom.

3rd Oil rake ring.

Compress the rings using the commercial tool .

We advise against the use of wads in materials that are harder than the piston and that leave a residue.



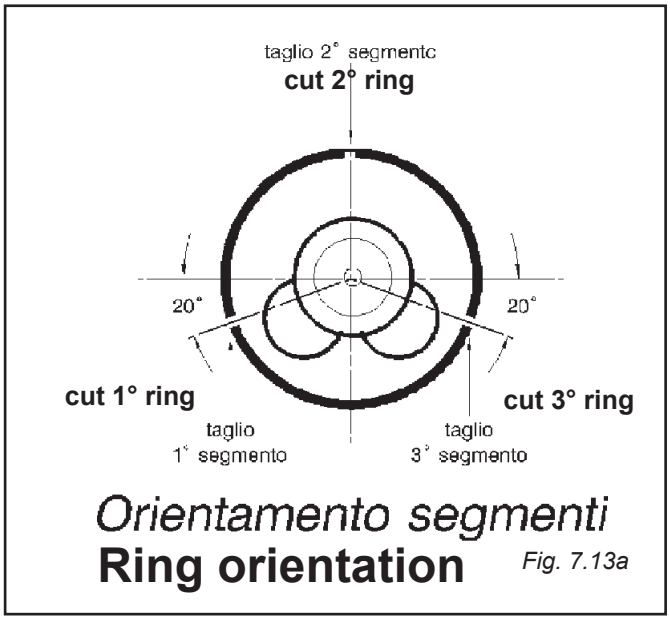
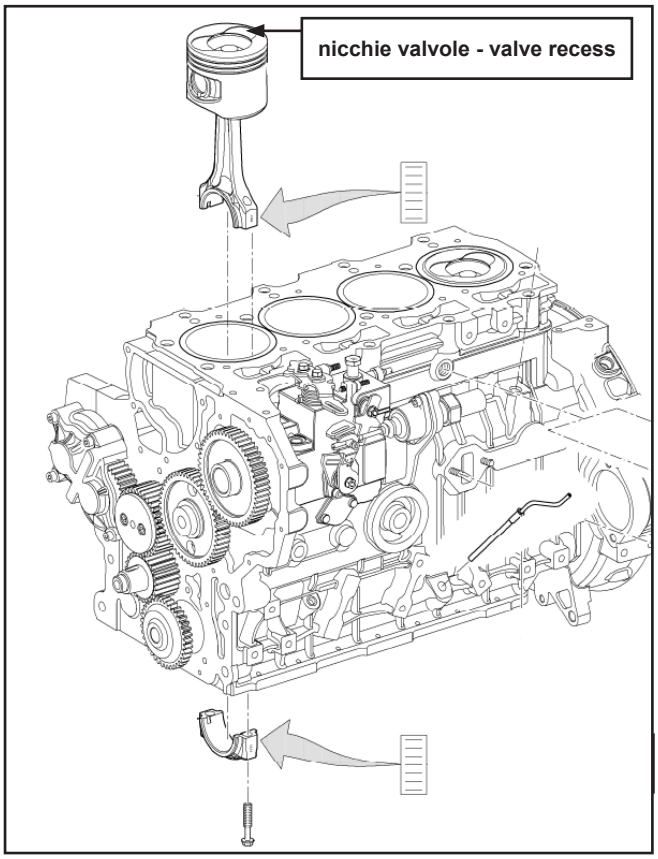


Fig. 7.13a



CONNECTING ROD

Assemble the shaft and caps, making sure that the numbers on the con rod shaft and cap correspond and are in line with the piston combustion chamber (same side).

Tighten cap bolts as follow indicate:

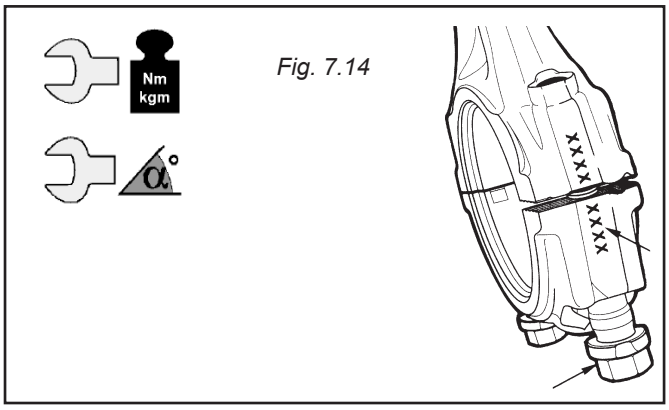
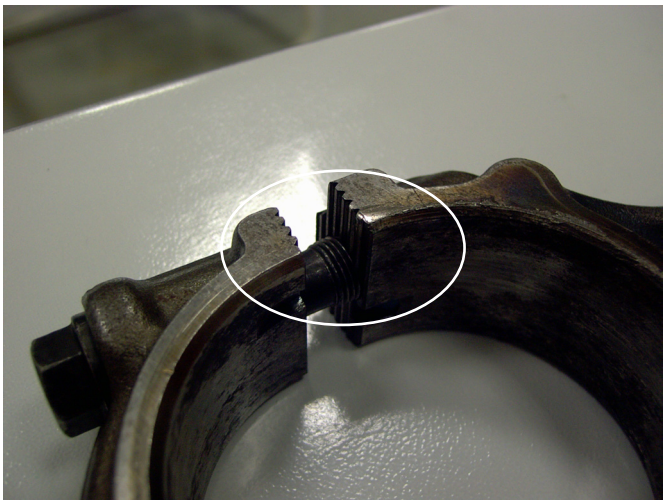


Fig. 7.14

TRADITIONAL - BROACHED CONNECTING ROD

- Lubricate with engine oil the screw head base and the thread.
- Fit the screws and using torque wrench equipped with a goniometer **(TAB. 11.1 Ref. R)**, tighten to a **3.06 kgm (30 Nm) + 60°**.

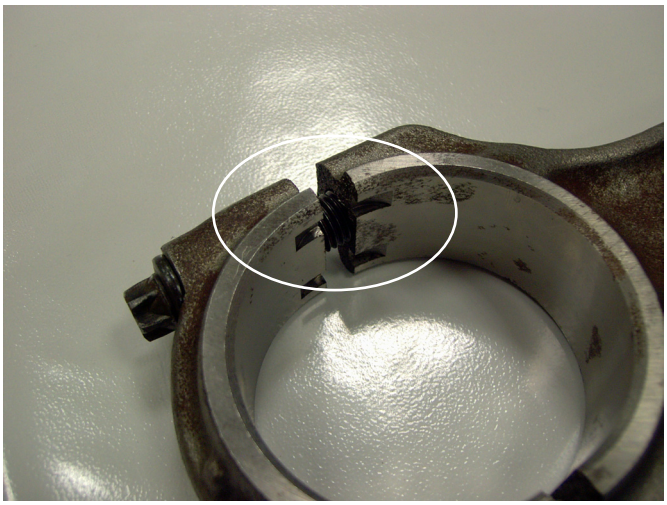
WHILE USING NEW SCREWS, DO NOT LUBRIFY THEM AT ALL, SINCE THEY ARE ALREADY COATED WITH AN ANTISEIZURE TREATMENT.
USUALLY REPLACE BOLT.
IF REUSED, LUBRICATE THEM WITH ENGINE OIL.



FRACTURED ED CONNECTING ROD

- Hand thread bolts and torque to10 Nm - 1Kgm.
- Torque to 30 Nm - 3.06 Kgm one bolt at the time.
- Perform a rotation of 40° for each bolts with torque wrench equipped with a goniometer.
- Final check with torque wrench setted to 88 Nm - 9 Kgm

WHILE USING NEW SCREWS, DO NOT LUBRIFY THEM AT ALL, SINCE THEY ARE ALREADY COATED WITH AN ANTISEIZURE TREATMENT.
USUALLY REPLACE BOLT.
IF REUSED, LUBRICATE THEM WITH ENGINE OIL.



7.12 OIL PRESSURE REGULATOR VALVE

Carefully clean the valve seat in the underside of the crankcase.

Assemble valve with Loctite 510.

Oil pressure relief valve	53.9 Nm

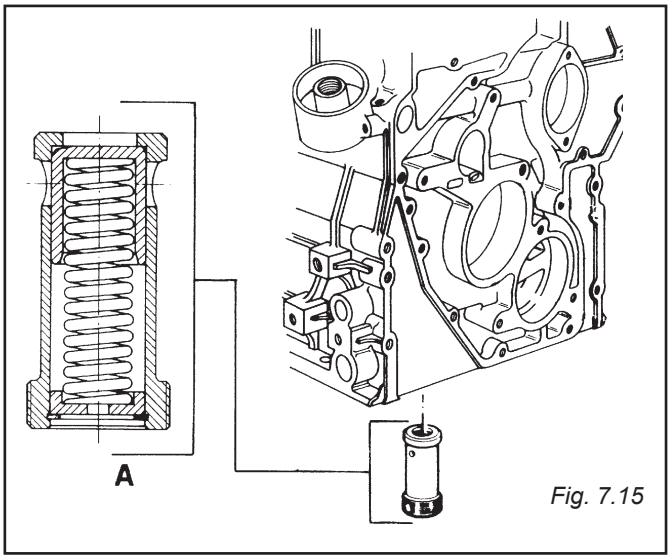
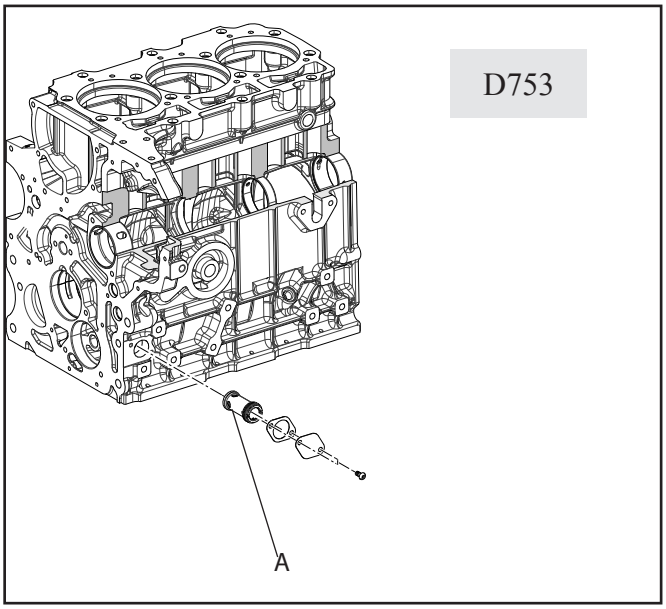


Fig. 7.15

Apply Loctite 510 on both gasket surfaces

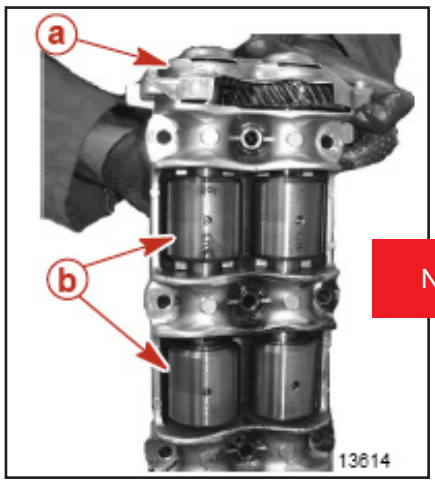
Oil pressure relief cover bolts	5.9 Nm



7.12.1 BALANCE SHAFT

Time the balance shaft using the special tool **(Tab. 11.1 ref. Z).** Insert the Tool into either the front or rear set of 2 holes in the balance shaft assembly housing, to keep the counterweights aligned during installation.

TIMING OF BALANCE SHAFT ASSEMBLY (COUNTERWEIGHTS)

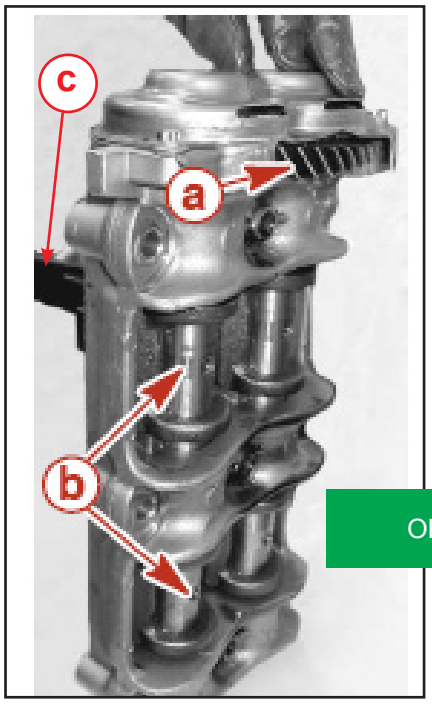


NOT OK

Improperly aligned counterweights
(visible counterweights)

a - Balance shaft assembly

b - Counterweights **VISIBLE** - improperly align



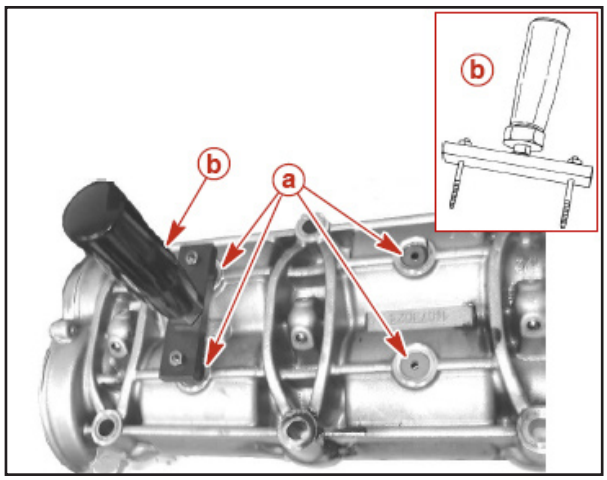
OK

Properly aligned counterweights
(not visible counterweights)

a - Balance shaft assembly gear

b - Counterweights **NOT VISIBLE** - properly aligned

c - Counterweight Alignment Tool



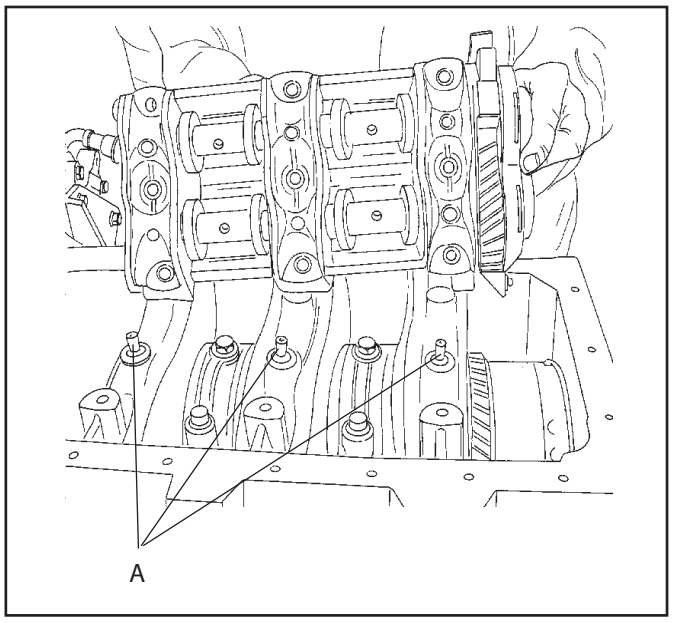
a - Front and rear set of 2 holes

b - Counterweight Alignment Tool

Set first piston at TDC.

Position the balance weights support on the crankcase, referring to the three locating pins in the support **A** and remember to insert the specific o-rings on the locating pins before positioning the balance shaft casing.

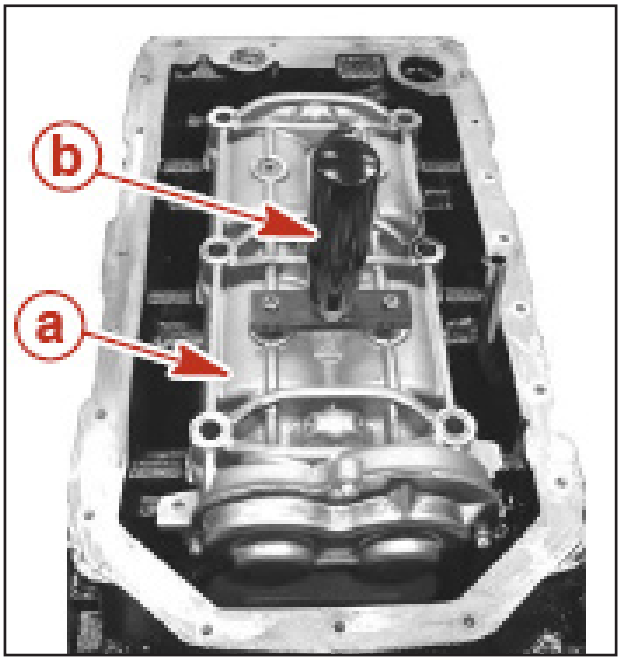
3 pins supply engine oil to Balance shaft assembly to lubricate it.

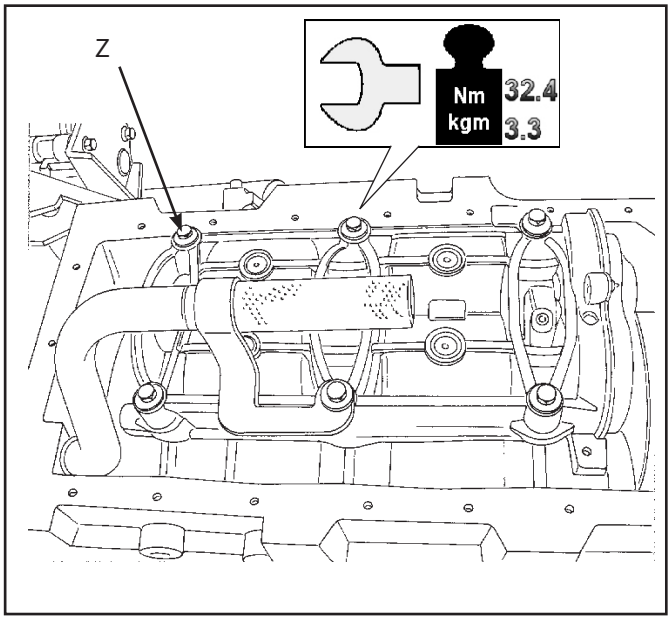


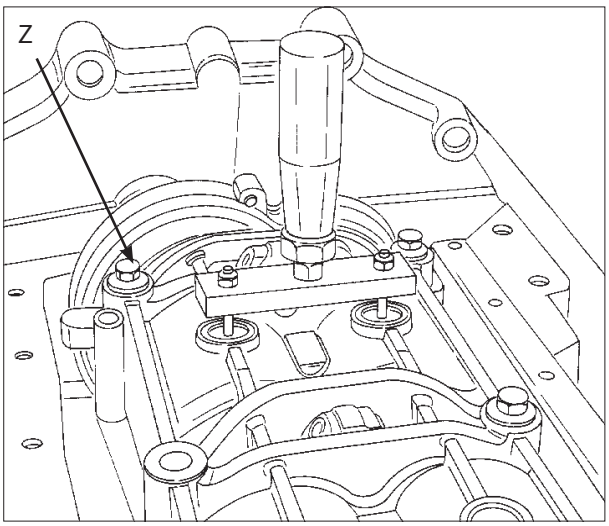
Remove the tool used to position the balance shaft, insert the fixing screws **Z** except for the screw that secures the oil suction pipeline and its screw and torque to the specified value.

a - Balance shaft assembly

b - Counterweight Alignment Tool







7.13 OIL PICK-UP PIPE

Position the O-ring in its seat in the pick-up union.

Clean the seat in the crankcase .

Fit the oil pick-up pipe **A**.

Screw in bolts **B** and then tighten to specified torque value.

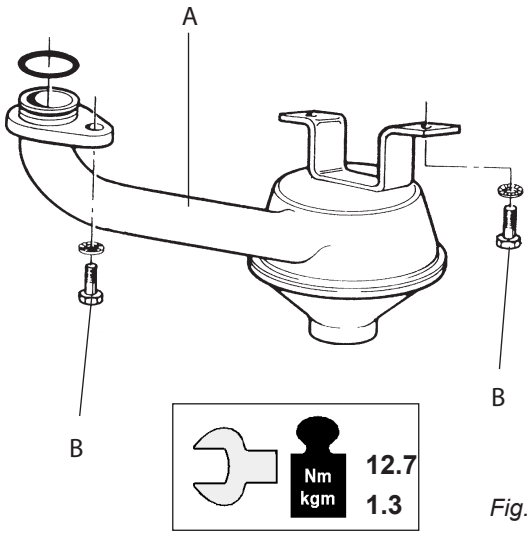


Fig. 7.16

7.14 OIL SUMP PAN

Clean the sump pan mating surface.

Locate gasket **A** on crankcase with Loctite 510 or apply a continuous and uniform bead of silicon sealant to oil pan. Please refer to the D700 parts catalog for the correct procedure for your specific oil pan.

Fit sump pan **B**.

Install the oil pan bolts. Torque bolts to specified torque value.

In case of an emergency repair, apply a continuous and uniform bead of silicon sealer **DOW CORNING 7091** to oil pan. Install within 10 minutes (see the fig. 7.17a - 7.17b).

TORQUE THE OIL DRAIN PLUG TO 78.5 Nm - 8 Kgm

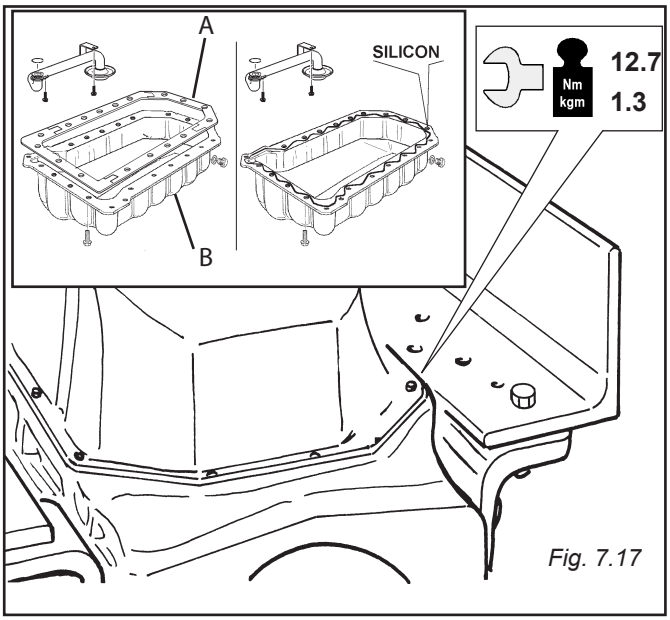


Fig. 7.17

COPPA 4-6 CIL.

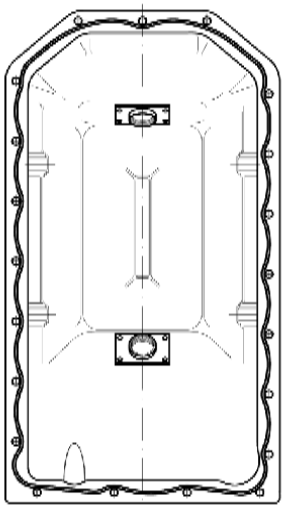


Fig. 7.17b

3 CYLINDER COPPA 3 CIL.

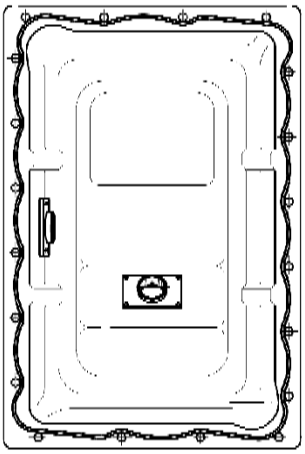


Fig. 7.17a

7.15 OIL PUMP

D703

Check that the oil pump components are assembled as shown in the figure, making sure that the internal rotor is installed with the bevelled end towards the seat in the pump housing **A**.

Fit the oil pump, meshing the pump gear with the crankshaft gear.

Tighten bolts **B** to specified torque value and check for teeth backlash.

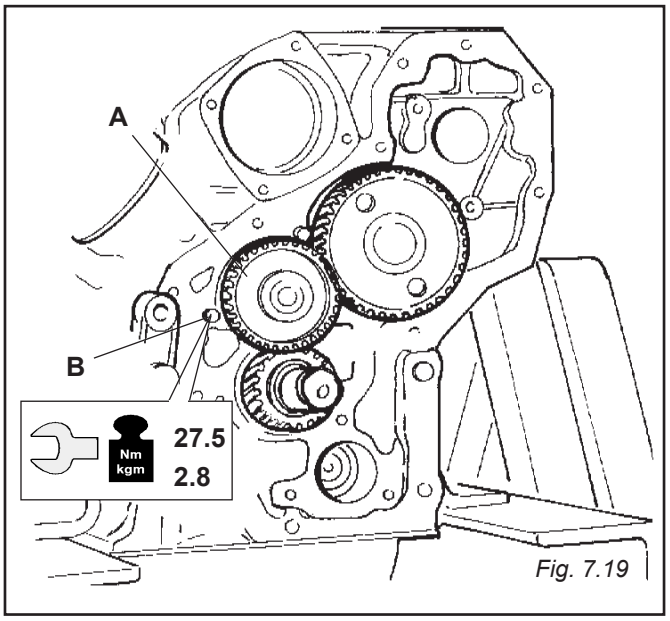
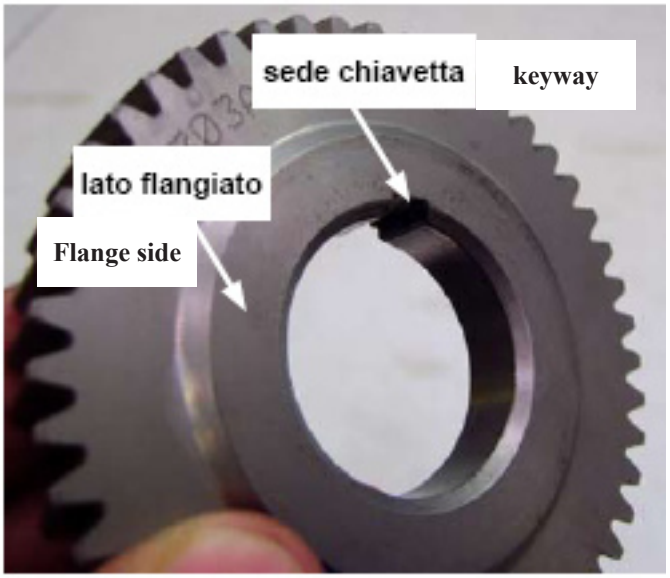
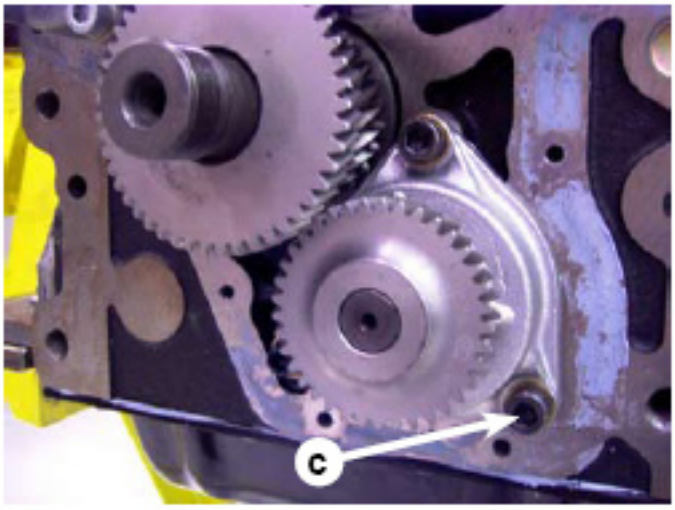
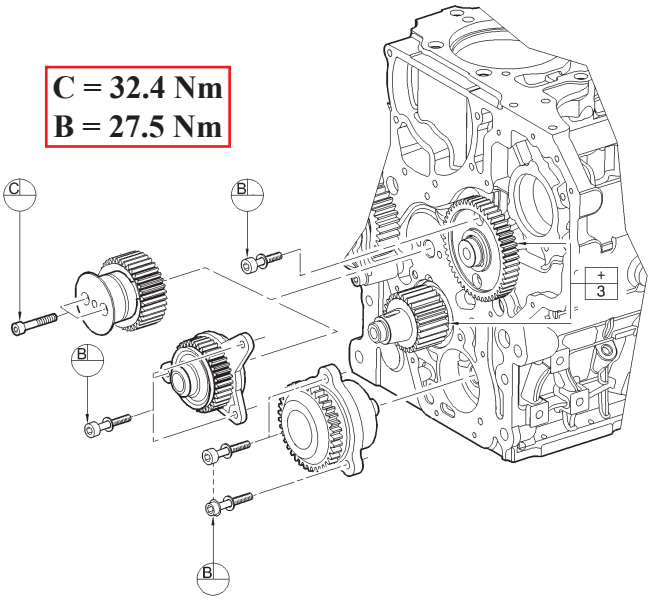


Fig. 7.19





D704 - D754 D753- D706



7.16 TIMING GEARS

7.16.0 Intermediate timing gear (standard timing version)

Fit the intermediate gear with the reference notch aligned with the notches on the crankshaft gear.

Screw in the bolts, using the flat-head bolt in the lower hole so that the gear can rotate freely.

Tighten bolts to **27.5 Nm - 2.8 Kgm**.

Bolt in **A** position has smaller head (M8x16).

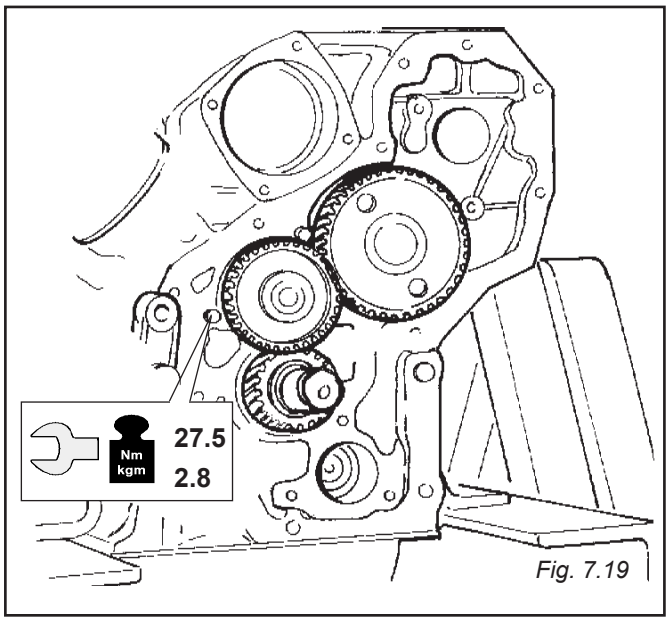


Fig. 7.19

7.16.1 Intermediate timing gear (for engine versions with hydraulic pump adapter)

Insert the transmission gear **A** in the relevant support **B** by paying attention to the insertion direction.

The two grooves **(1-2)** that the are present in the gear **A** as shown in (fig. 7.19.2) must be turned towards the base.

Insert the support with the gear into the relrvant base seat, by aligning the reference engravings for the engine timing (fig. 7.19.3), insert the relevant fixing screws and tighten them according to the indicate torque value.

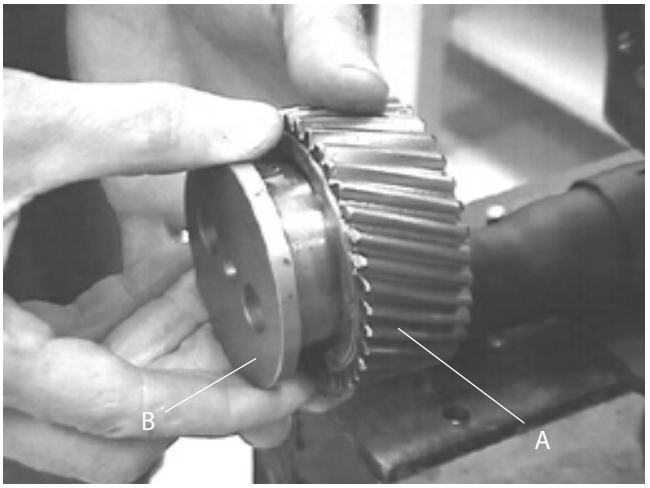


Fig. 7.19.1

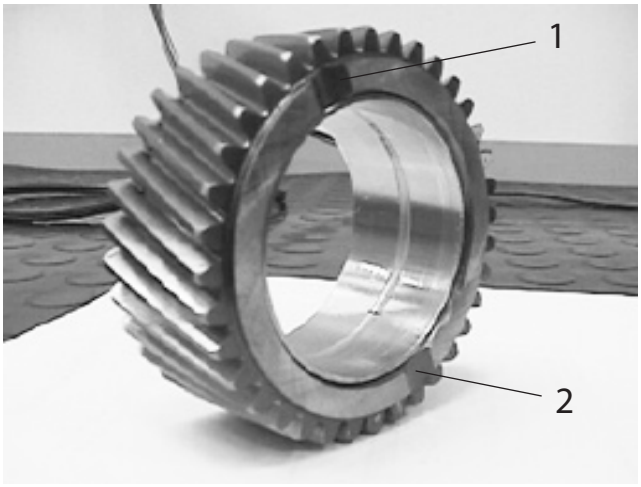


Fig. 7.19.2

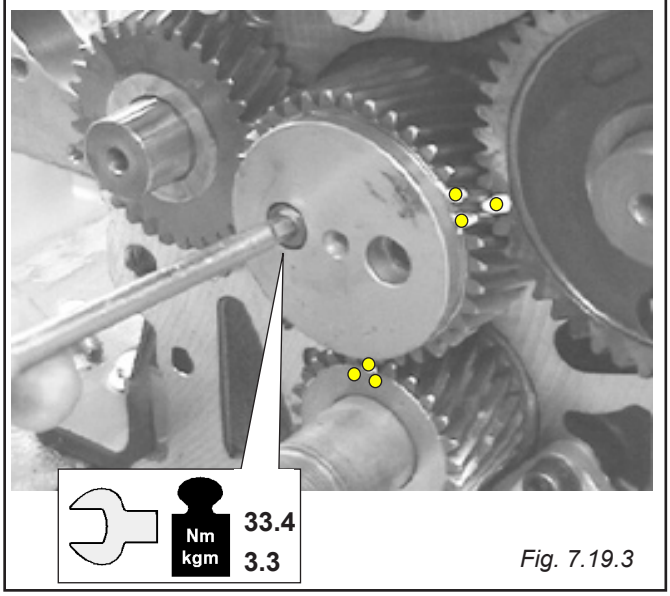
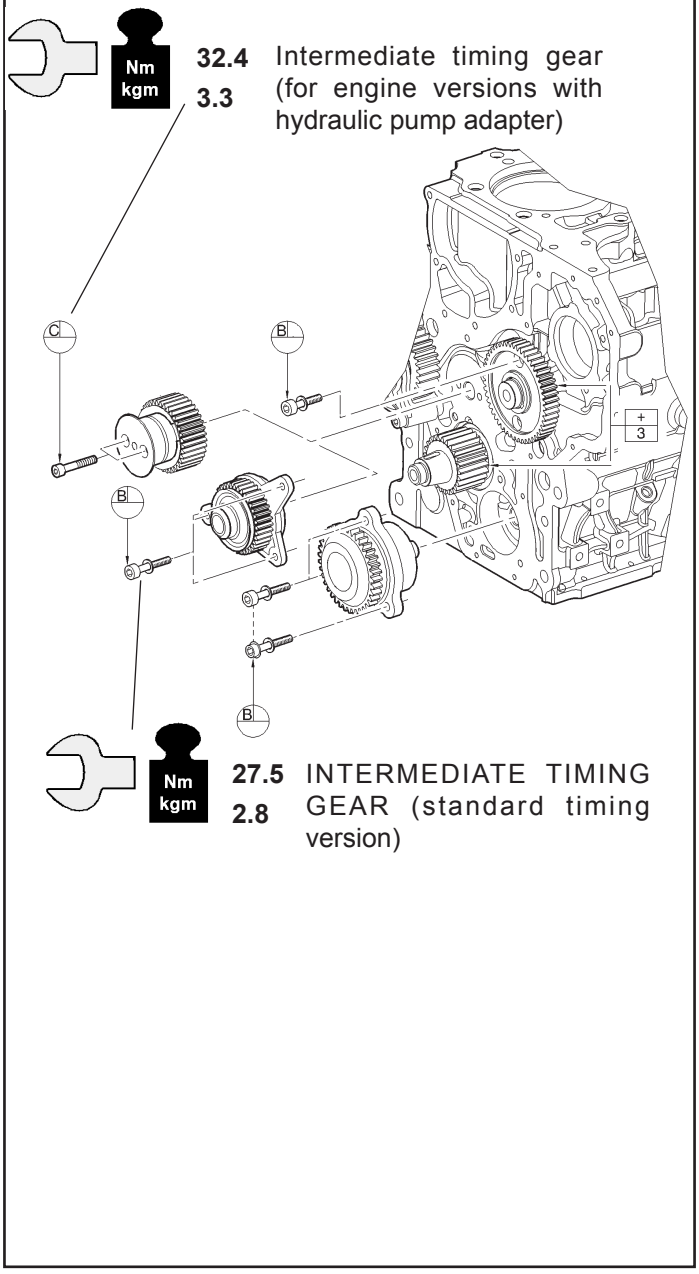


Fig. 7.19.3



7.16.2 Complete transmission gear (for engine versions with hydraulic pump adapter)

Insert the complete transmission gear **A** into its base seat (fig. 7.19.5) by paying attention to the insertion direction.

The two grooves that are present in the gear **A** as shown in (fig. 7.19.4) must be turned towards the base.

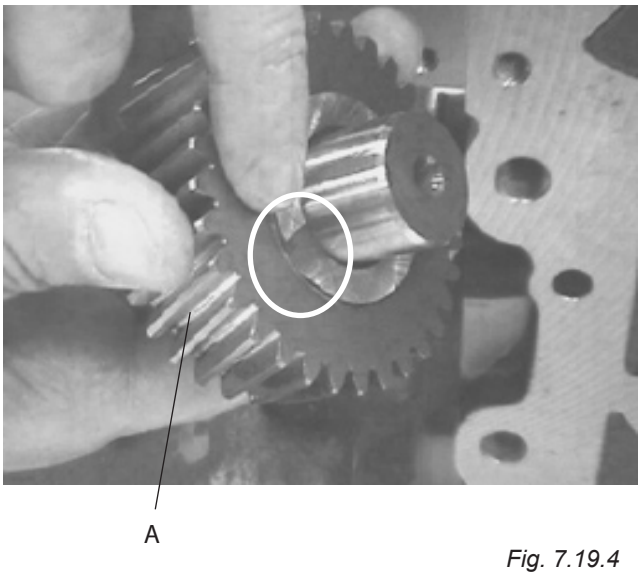


Fig. 7.19.4

Fig. 7.19.5

7.16.3 Pump controlling gear (for engine versions with hydraulic pump adapter)

Insert the hydraulic pump controlling gear with the relevant bearing into the supporting flange that is present on the rear side of the base as shown in (fig. 7.19.7) until the two bearings are at the same height, see (fig. 7.19.8).

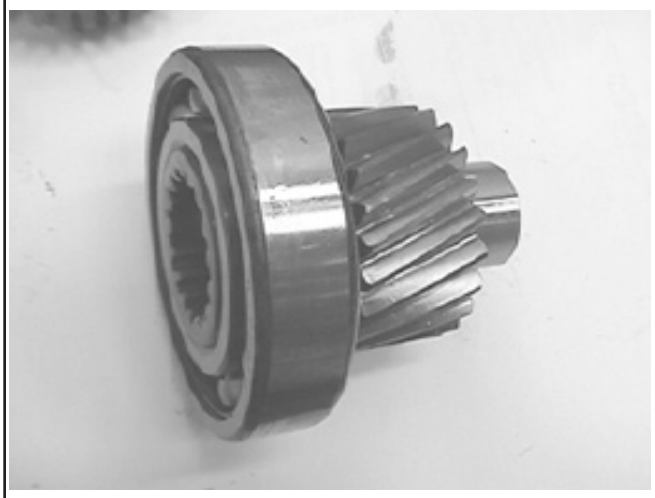


Fig. 7.19.6

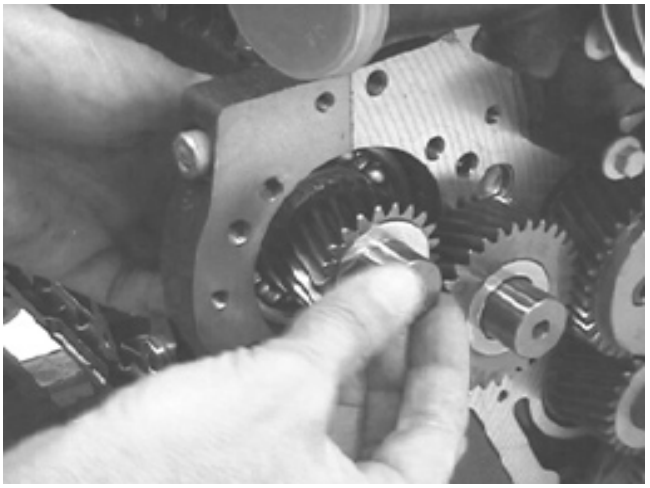


Fig. 7.19.7

Fig. 7.19.8

7.16.4 Gear support

Insert the support by centring the reference pin **A** in its seat on the base.

Before inserting the support into the gear pins **B**, it is necessary to grease them.

Insert the fizing screws and tighten them according to the relevant value as shown in (fig. 7.19.10). Apply Teflon liquid on thread screw.

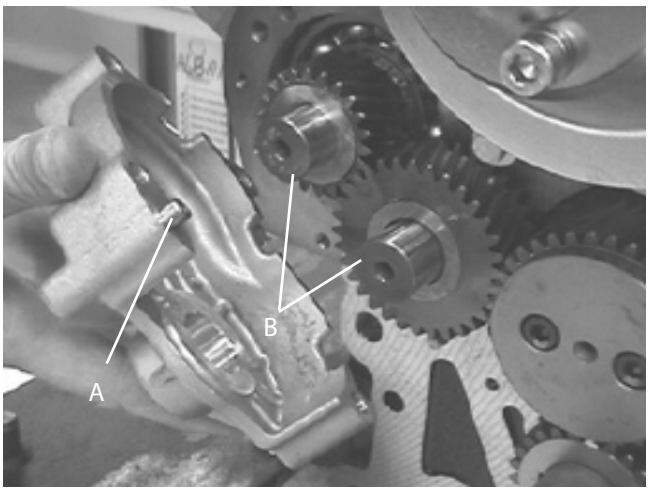


Fig. 7.19.9

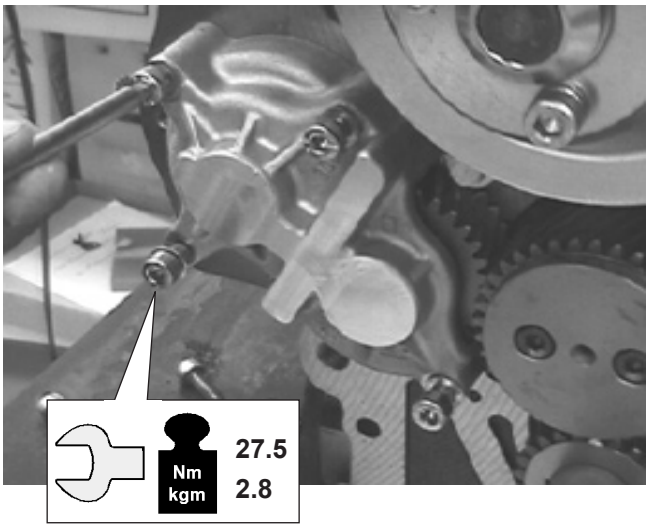


Fig. 7.19.10

7.16.5 Supporting bracket 2p hydraulic pump

Check that the sealing O-ring **A** (fig. 7.19.11) is in good state and correctly positioned in its seat.

Apply a slight layer of LOCTITE 510 on the perimeter in contact with the base (fig. 7.19.11).

Position the bracket as shown in (fig. 7.19.12) by centring the projecting part of the previously inserted bearing.

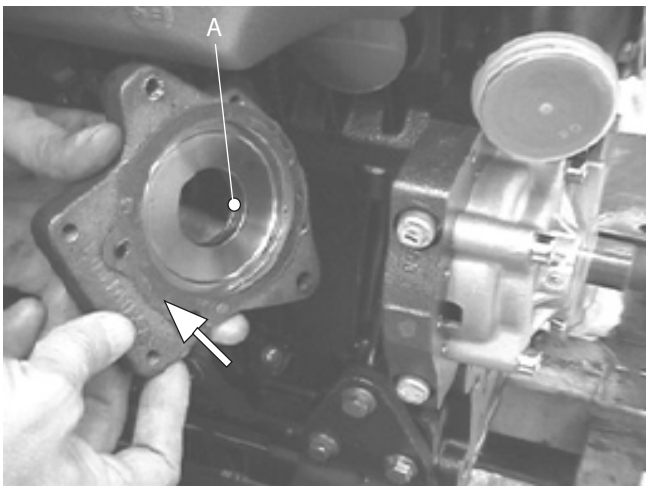


Fig. 7.19.11

Insert the fixing screws and tighten them at to the indicated torque value. Apply Teflon liquid on thread screw.

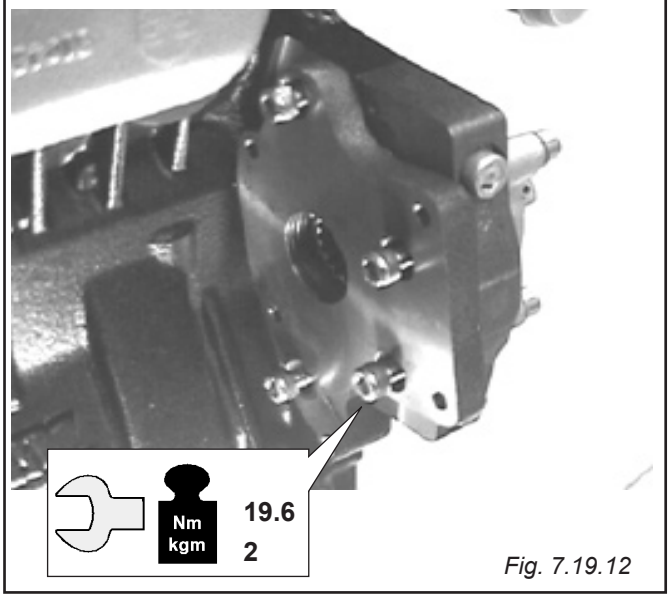
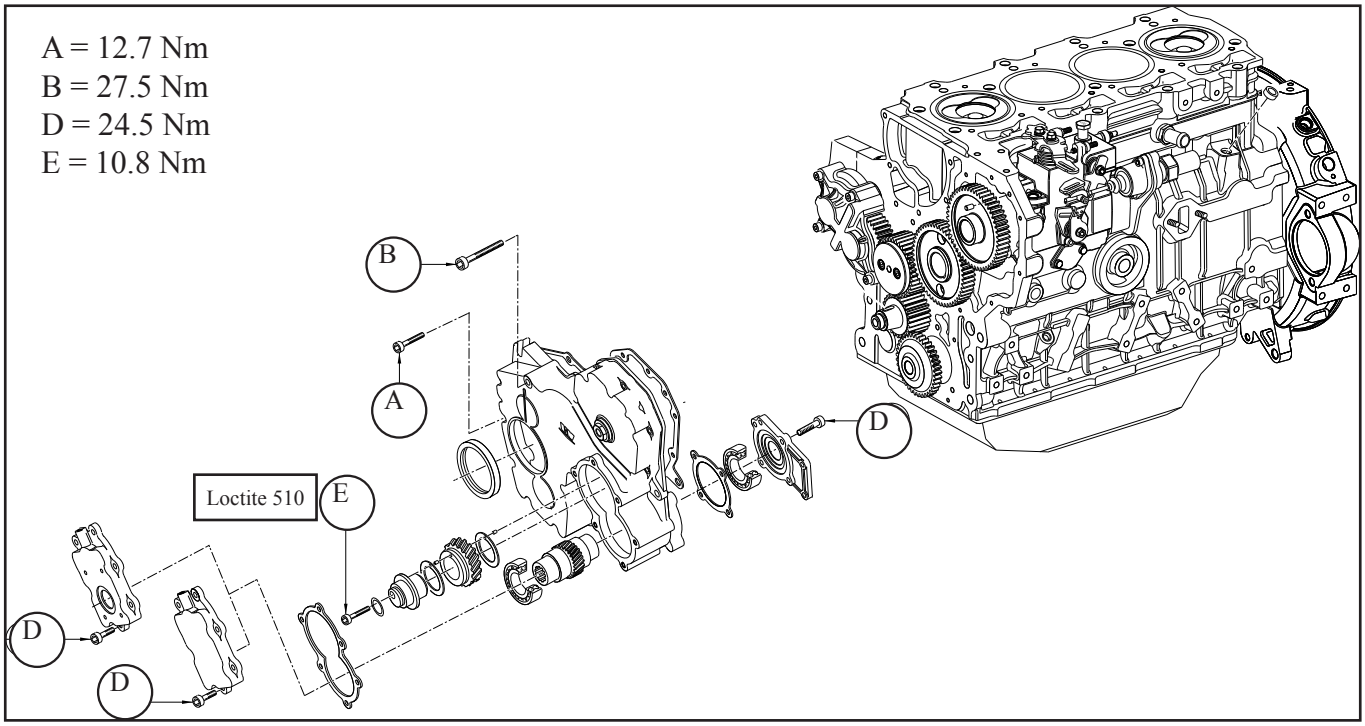
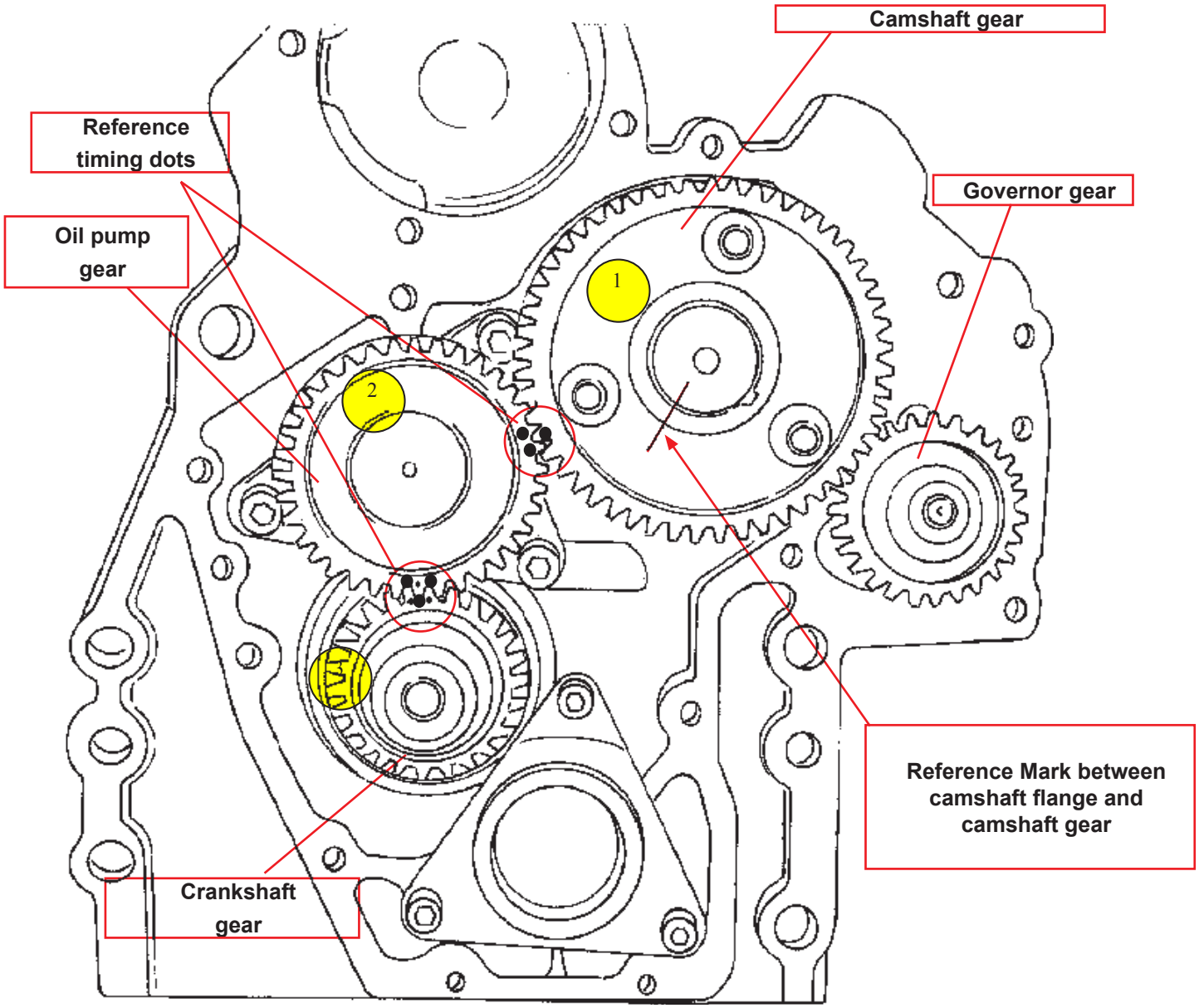


Fig. 7.19.12



TIMING LAYOUT 3 CYLINDERS D703 (STANDARD VERSION)

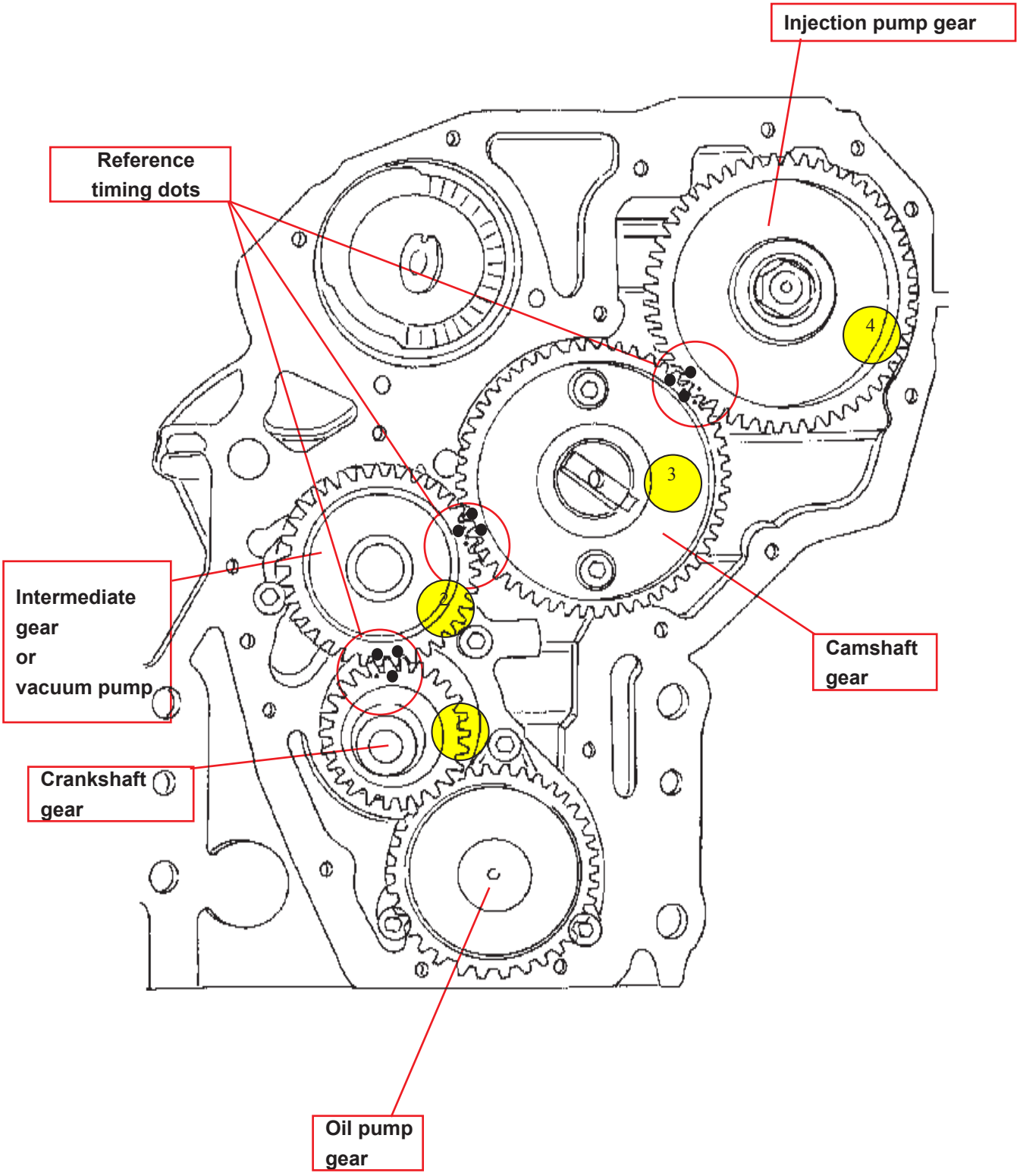
TIMING GEARS WITH CYLINDER NUMBER 1 PISTON IS AT COMPRESSION STROKE TDC



Before removing gears 1,2,3 for engines D703 and gears 1,2,3,4 for engines D704,D754,D706 perform a reference mark on teeth of gears or align the mentioned gears as shown in the above picture so that reference timing dots (punched on each gear) are properly aligned and timed.

TIMING LAYOUT 4-6 CYLINDERS (STANDARD VERSION) - 3 CYLINDERS D753

TIMING GEARS WITH CYLINDER NUMBER 1 PISTON IS AT COMPRESSION STROKE TDC



Before removing gears 1,2,3 for engines D703 and gears 1,2,3,4 for engines D704,D754,D706 perform a reference mark on teeth of gears or align the mentioned gears as shown in the above picture so that reference timing dots (punched on each gear) are properly aligned and timed.

TIMING LAYOUT (ENGINE VERSION WITH ADAPTER HYDRAULIC PUMP)

TIMING GEARS WITH CYLINDER NUMBER 1 PISTON IS AT COMPRESSION STROKE TDC

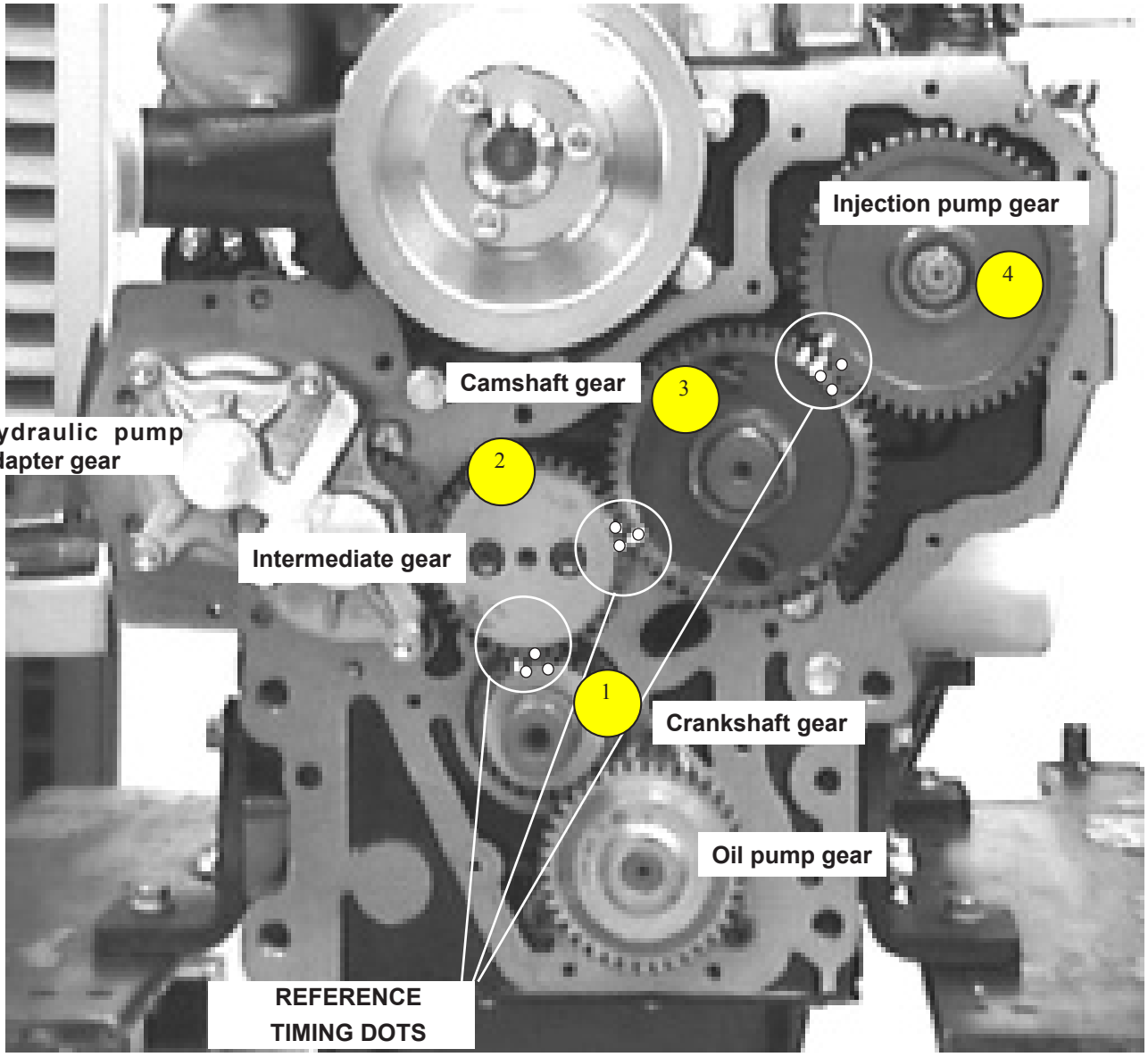


Fig. 7.19c

Before removing gears 1,2,3 for engines D703 and gears 1,2,3,4 for engines D704,D754,D706 perform a reference mark on teeth of gears or align the mentioned gears as shown in the above picture so that reference timing dots (punched on each gear) are properly aligned and timed.

7.18 PISTON-CYLINDER HEAD CLEARANCE

-Use special tool **(TAB. 11.1 ref. W)** and a dial gauge.

-Bring piston **C** (first piston on the front side) to TDC.

-Zeroset the dial gauge **A** on the cylinder block surface **B**.

-Position the gauge contact point **A** on the piston crown **C** and note the gauge reading.

- Repeat the procedure with the rest of the cylinders

- Take the average of the measuraments carried out.

- Select a suitable head gasket following the indications here below:

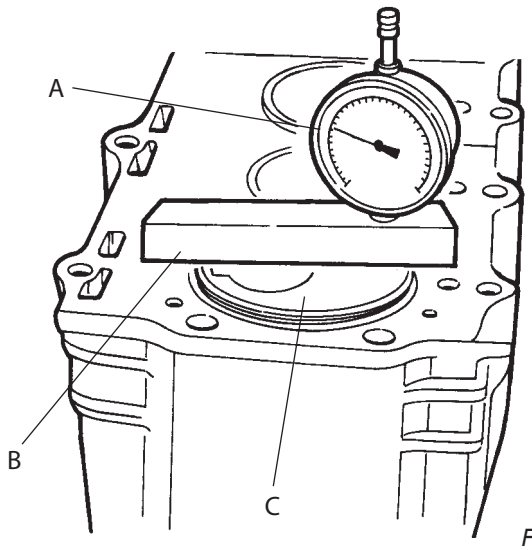


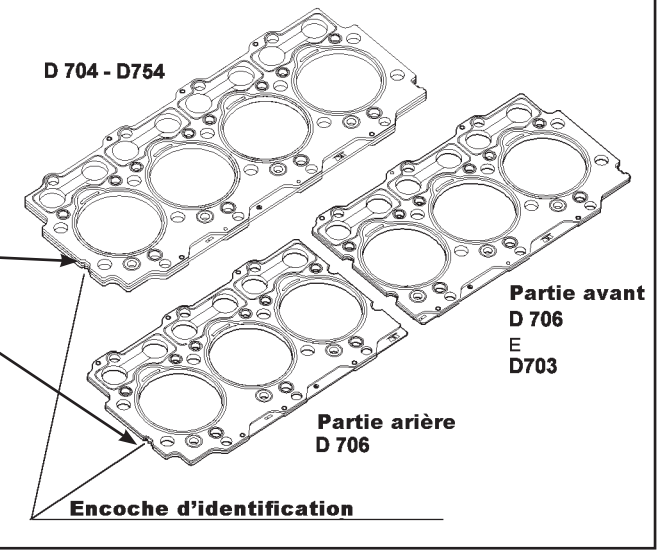
Fig. 7.22

Piston protrusion from crankcase	**Cyl. head gasket tickness**
0.60 - 0.72 mm	1.42 mm (without mark or hole)
0.73 - 0.82 mm	1.52 mm (2 marks o holes)
0.83 - 0.95 mm	1.62 mm (1 marks o holes)

ONLY ONE TYPE OF GASKET (SAME THICKNESS) MUST BE USED IN THE ENGINE TO ENSURE THAT THE CYLINDER HEADS ARE LEVEL (ONLY FOR SINGLE CYL.HEAD GASKETS).

- Intermediate thickness gaskets (identifiable by two notches along the edge) are included in the set of gaskets available at VM PARTS centers.

Example of entire or complete (not single) cylinder head gasket



notches for gasket thickness identification

7.19 HYDRAULIC TAPPETS

Starting from:

D703L	-	S/N: 28B*02700*
D703LT	-	S/N: 29B*02642*
D703LTS	-	S/N: 66B*01030*
D704L	-	S/N: 21B*03060*
D704LT	-	S/N: 22B*03029*
D706LT	-	S/N: 27B*01534*

In order to standardise and improve the production, hydraulic tappets have been introduced in place of mechanical tappets.

Using the special tool **(TA B. 11.1 ref. L)**, discharge the hydraulic tappet pushing down the internal spring few times. This operation has always to be carried out to avoid push road damaging.

Install tappet **A** and align yoke **B** retainers in the original positions. Ensure that the draining hole **C** on the tappet side faces the crankshaft.

Install cylinder heads, intake/exhaust manifolds, push roads and the rocker arms in the original positions.

Before tightening the rocker arms the pistons must be located far form TDC:

- Bring piston n°1 at TDC aligning the marks of front pulley and fornt cover.
- Turn crankshaft of 40°÷45° clockwise then tighten all rocker arms pedestals nuts.

Assemble the pushrods **A** taking care to fit them in the center of the cam followers **B**.

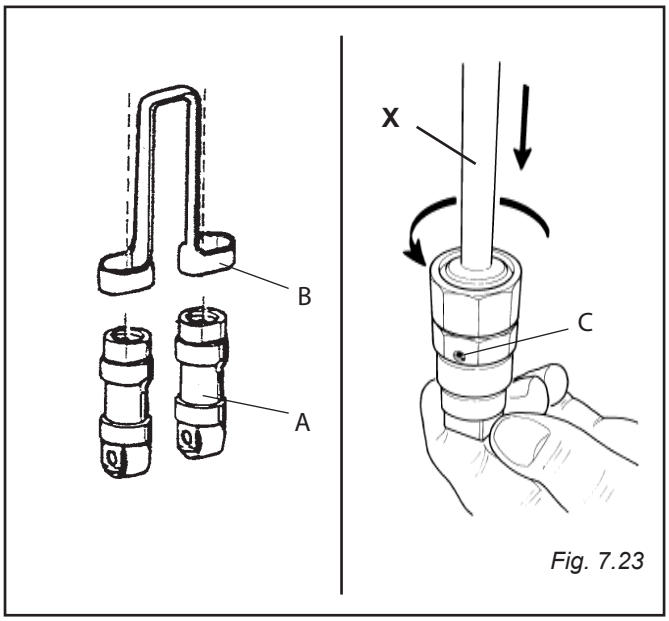


Fig. 7.23

Make some crankshaft turns by hands to besure that everything turns free.

Start the engine, run it above idle until all hydraulic tappets have filled with oil, and have become quiet.

EPA starting from:

D703LE	S/N	90B010001
D703LTE	S/N	75B010001
D704LE	S/N	76B010001
D704LTE	S/N	77B010001
D706LTE	S/N	78B010001

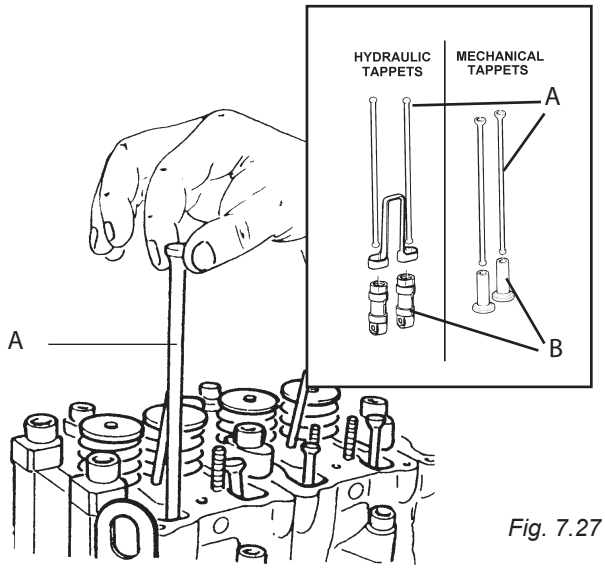


Fig. 7.27

7.20 CYLINDER HEAD ASSEMBLY

Insert gaskets **B** on the block floor and put heads **A** into position.

Use the dedicated tool **C** to ensure correct assembly of heads **A** and gasket **B** **(Tab. 11.1 ref S)**.

After inserting the heads, mount the intake manifold without gasket and loosely tighten the nuts, this is necessary in order to align the heads correctly.

Remove plugs **C** one at a time and replace them with the relative fixing screws.

IF THE SAME HEAD SCREWS ARE TO BE REUSED: Lubricate all the screws (thread and underside of head bolt) with molycote such as GRAPID PLUS.

Mount the side posts and then the terminals, aligning them correctly.

Now go ahead and tighten the heads as instructed in the specifications below.

Remove the intake manifold and replace it together with the exhaust manifold with the relative gaskets.

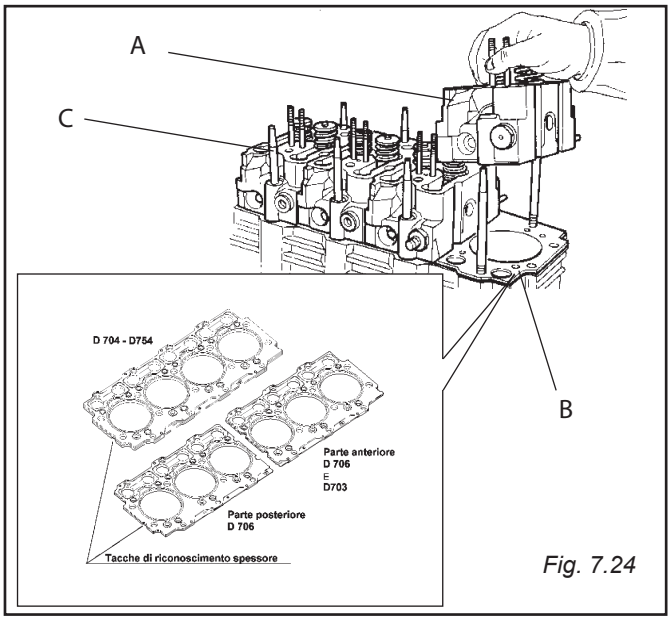


Fig. 7.24

TO TIGHTEN THE SCREWS USE THE SPECIAL TOOLS ***(TAB. 11.1 Ref. N-O-P-Q)***

1 Use the torque wrench to tighten the central screws as follows value **30 Nm (3 Kgm)**

Engine 3 cyl. 3-2-1-4-6-7-8-5

Engine 4 cyl. 3-2-1-4-5-8-9-10-7-6

Engine 6 cyl. 11-12-13-14-10-9-8-4-3-2-1-5-6-7

2 Use the special tool **(Table 11.1 ref. Q)** with angular value indication and tighten the central screws as follows value **65°**

Engine 3 cyl. from **1** to **8**

Engine 4 cyl. from **1** to **10**

Engine 6 cyl. from **1** to **14**

3 Repeat the operation **2** following the same way

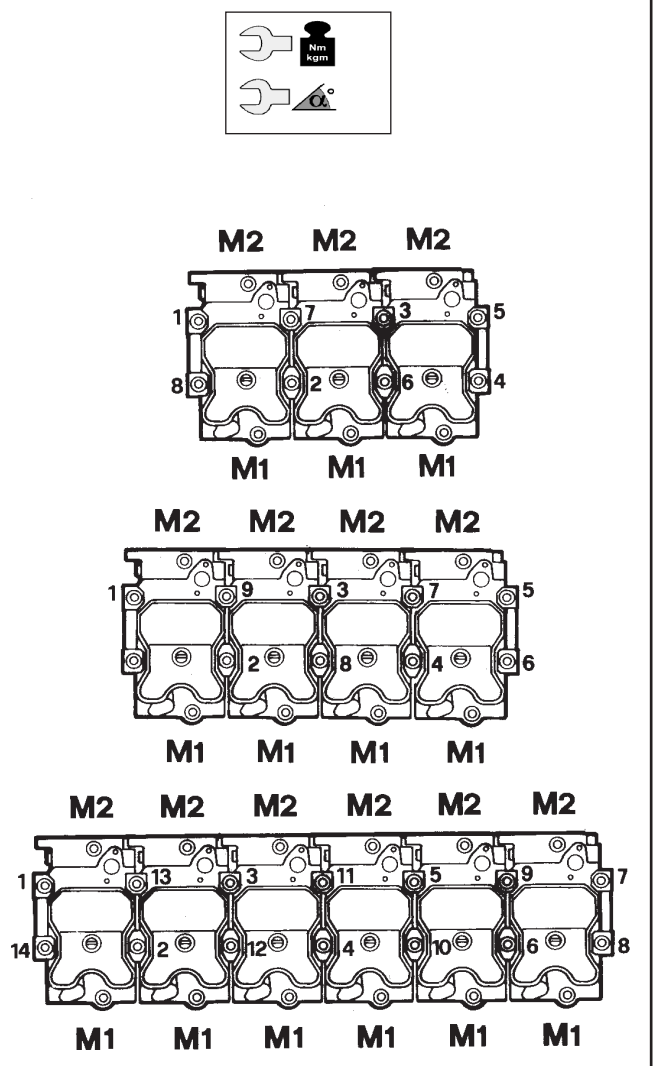


Fig. 7.25

4 Use the torque wrench and tighten the external screws **M1** as **30 Nm (3 Kgm)**

5 Using the relevant torquing tool with angular value indication and torque the external screws **M1** as **85°**

6 Use the torque wrench and tighten the external screws **M2** as **30 Nm (3 Kgm)**

7 Using the relevant torquing tool with angular value indication and torque the external screws **M2** as **85°**

_AFTER THE CYLINDER HEADS HAVE BEEN CORRECTLY ASSEMBLED AND TORQUED, RUN THE ENGINE AT SPEED FOR 20 MINUTES UP TO REACH NORMAL WORKING TEMPERATURE 80°-90°C AND THEN SWITCH OFF IT.

8 **RETIGHTEN AFTER RUNNING**:

_WARNING: PERFORM THIS OPERATION WITH ENGINE COLD (< 40°C)

9 Central screws: loosen one screw at a time, releasing it completely, then tighten with **30 Nm (3 Kgm)** torque plus rotation of **120°**

10 Side screws **(M1 and M2)** do not require re-tightening, use a dynamometrical wrench set at **90 Nm (9kgm)** for checking, if necessary.

11 Re-tightening during the life of the motor should be carried out after 150 ÷ 200 hours or 20,000 Km.

ATTENTION: THIS OPERATION IS ONLY FOR MOTORS WITH SINGLE HEAD GASKETS (NOT FOR ENTIRE GASKET

12 Central screws in sequence from

Engine 3 cyl. from **1** to **8**

Engine 4 cyl. from **1** to **10**

Engine 6 cyl. from **1** to **14**

rotate by **15°**

13 Side screws **(M1 and M2)** rotate by **15°**, first **M1** screws and then **M2** screws.

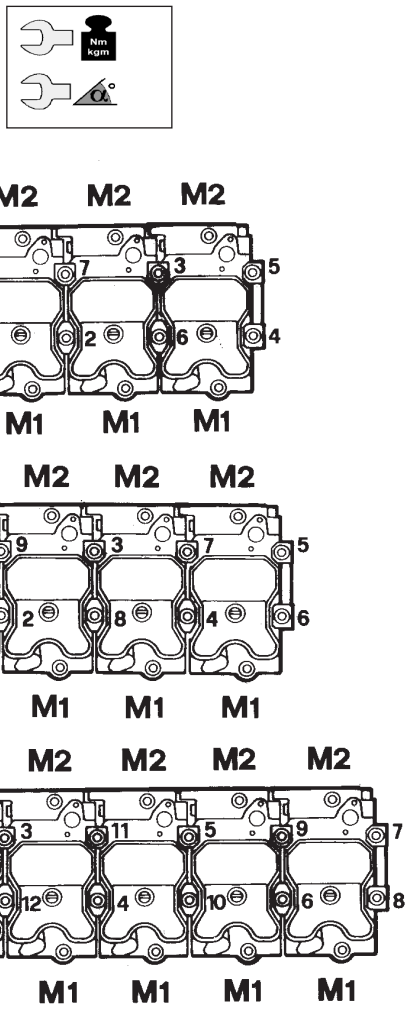


Fig. 7.26

Mounting 3 cylinder head with entire metal gasket

In mounting the head of this D703 engines, remember to insert insert (**A**) under the small column (**B**) at point (**C**), viewed from the driving wheel side.
This insert is needed to recover the thickness of the entire metal head gasket which does not protrude from the head as on the opposite side.
The entire gasket is used starting from the following numbers:

D703L-28B10753
D703LTS -66B01888
D703LE -90B01598
D703LTE -75B01752
D703TSE -92B01112
D703LT -29B10738

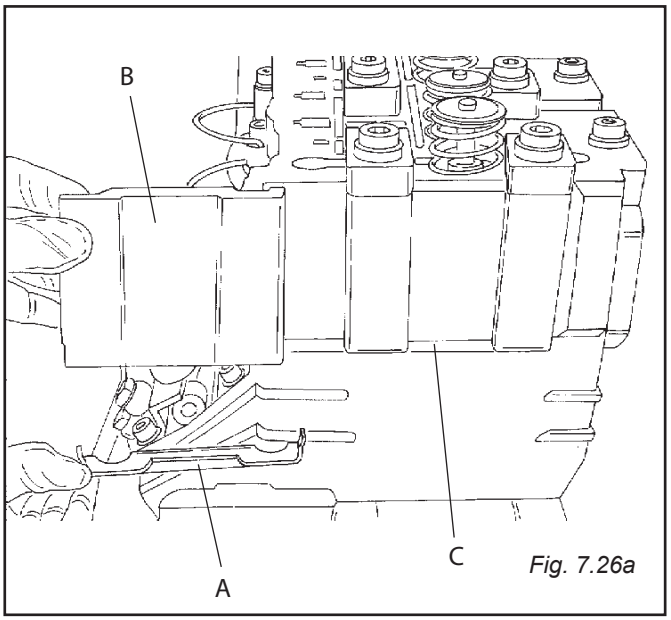
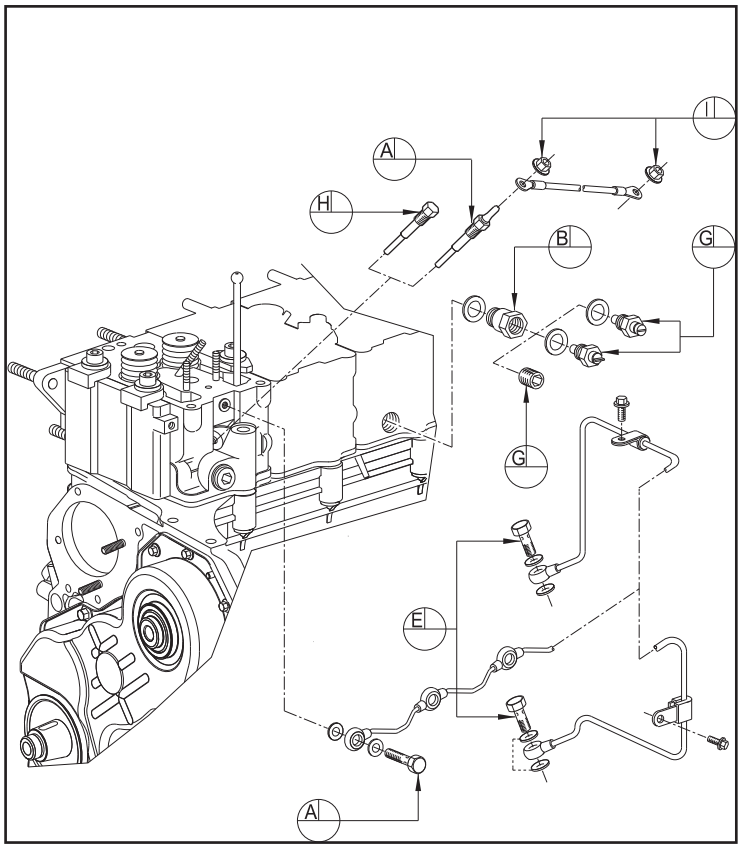


Fig. 7.26a

FAILURE TO APPLY WILL CAUSE THE LOSS OF THE HOLD OF THE LOCKING SCREWS OF THE HEAD

CONSEQUENTLY DAMAGING IT

Coolant temperature sensor - transmitter



B = 68.6 Nm - Loctite 510
G = 24.5 Nm - Loctite 510

7.21 INLET MANIFOLD

Fit the inlet manifold **A**, tightening bolts **B** to the specified torque.

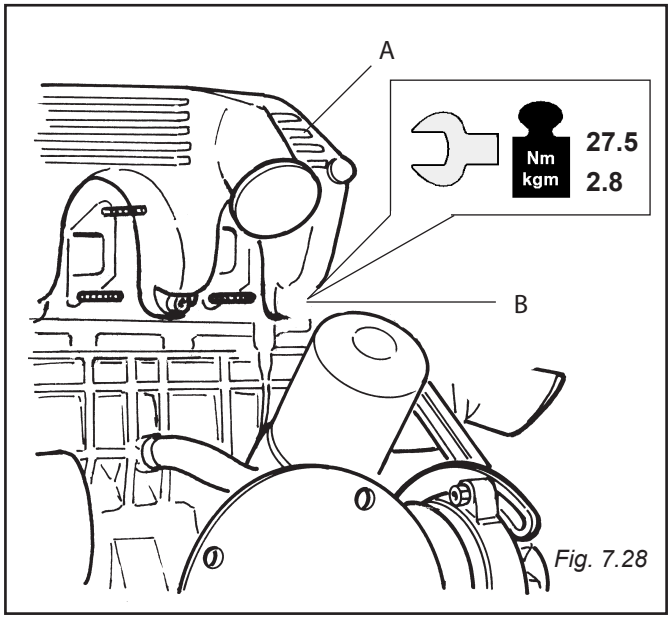


Fig. 7.28

7.22 EXHAUST MANIFOLD AND TURBOCHARGER

Mount the exhaust manifold on the studs and tighten bolts to the specified torque.

A = turbocharger fixing nut
32.4 Nm

E = turbocharger oil feed special fitting
27.5 Nm

F= turbocharger oil pipe
49 Nm

G = turbocharger oil pipe
39.2 Nm

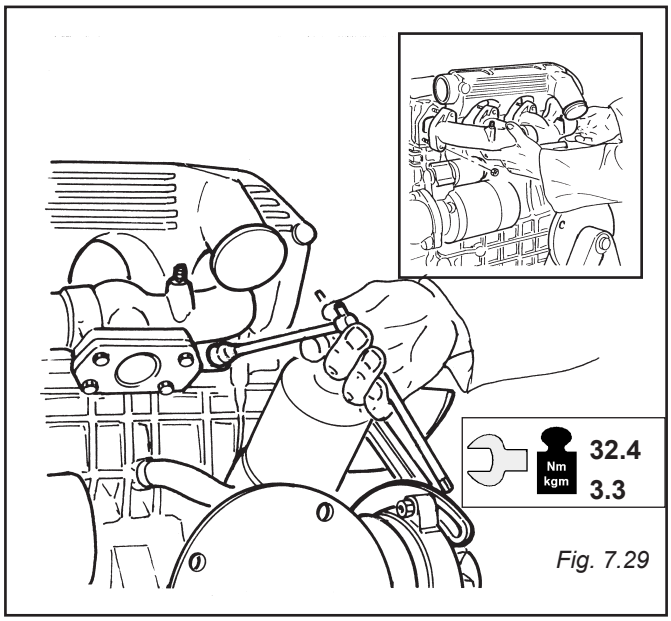
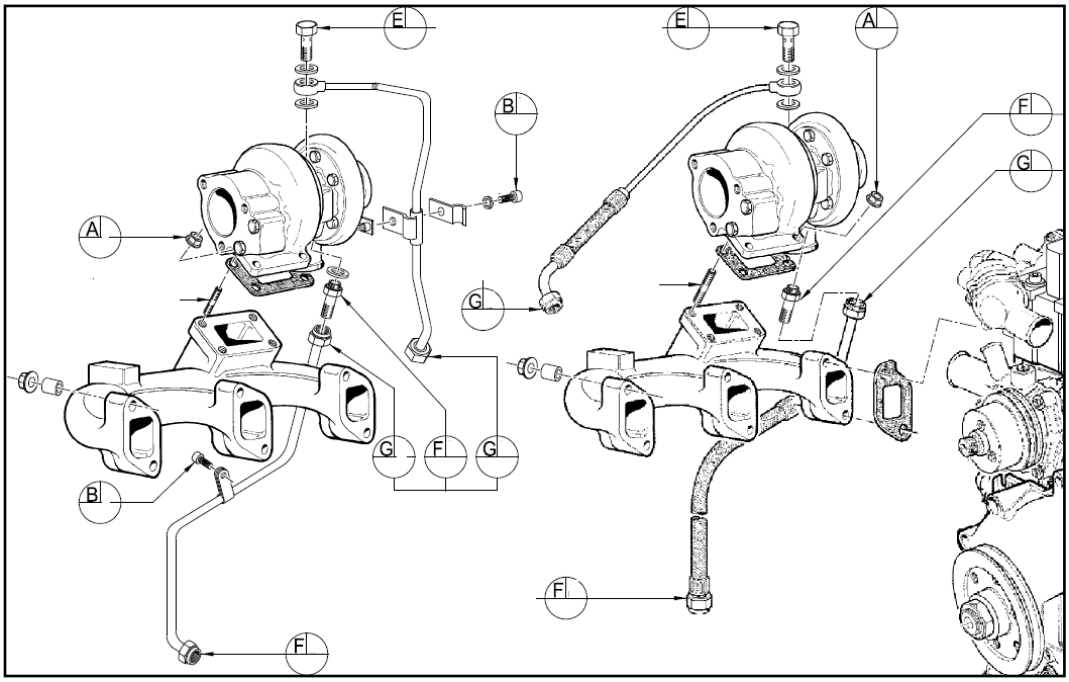


Fig. 7.29



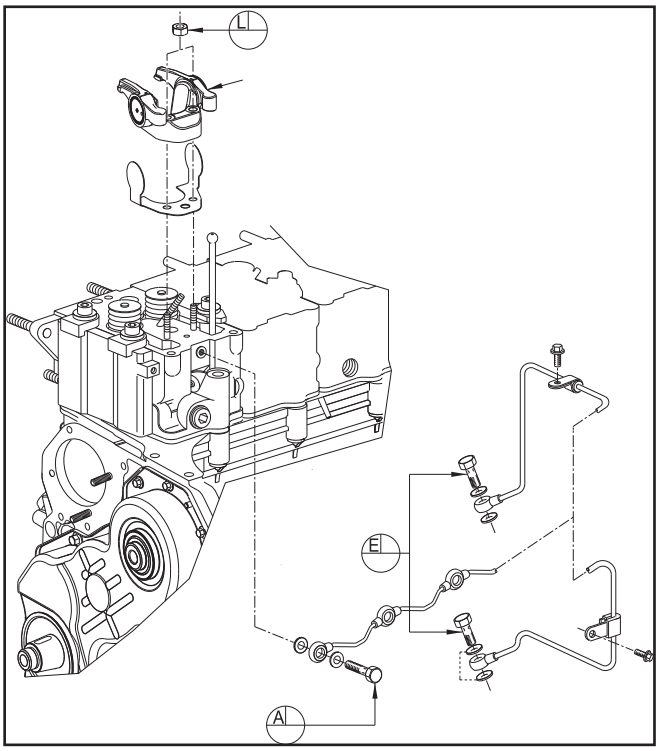
7.23 ROCKER ARMS AND OIL FED PIPE

Fit rocker arms on the studs.
Tighten retaining nuts to specified torque.

LUBRICATE WITH OIL AND SUITABLE ADDITIVES.

L = rocker arm fixing nut 29 Nm (hydraulic tappets)
L = rocker arm fixing nut 10.7 Nm - 1.1 kgm (mechanical tappets)

E = rocker arm oil feed pipe fitting 23.5 Nm
A = rocker arm oil feed pipe fitting 14 Nm



7.24 GLOW PLUGS

Fit glowplugs **A** into their seats and tighten to the specified torque.

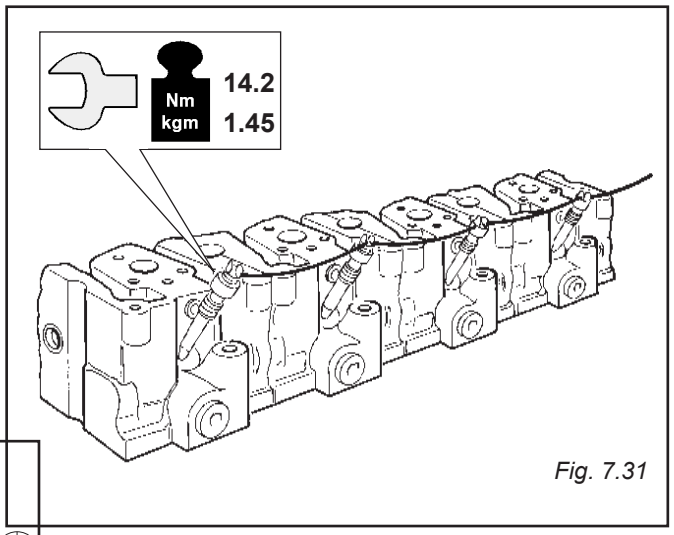
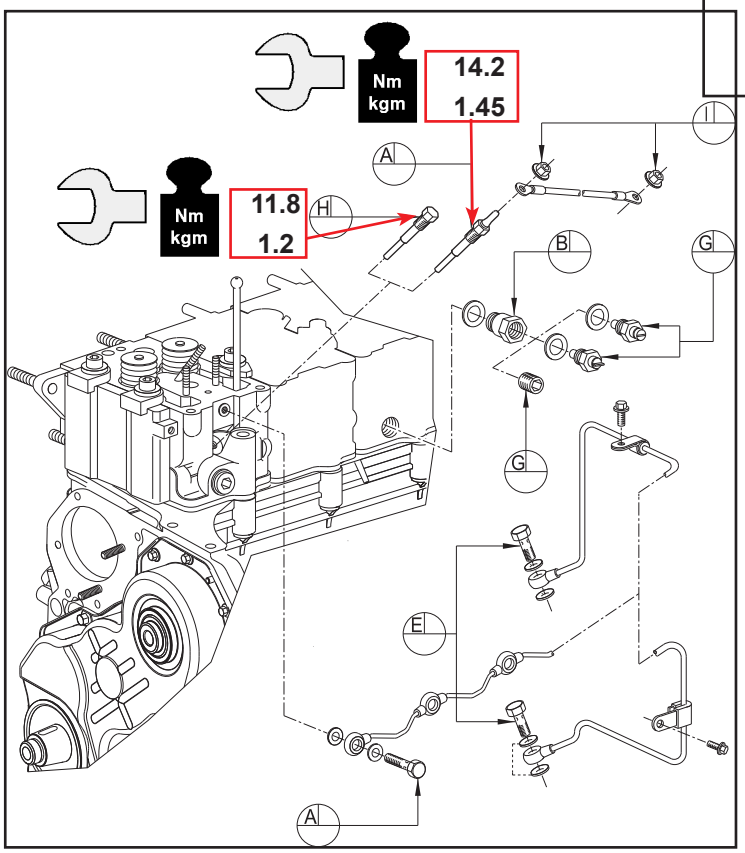


Fig. 7.31

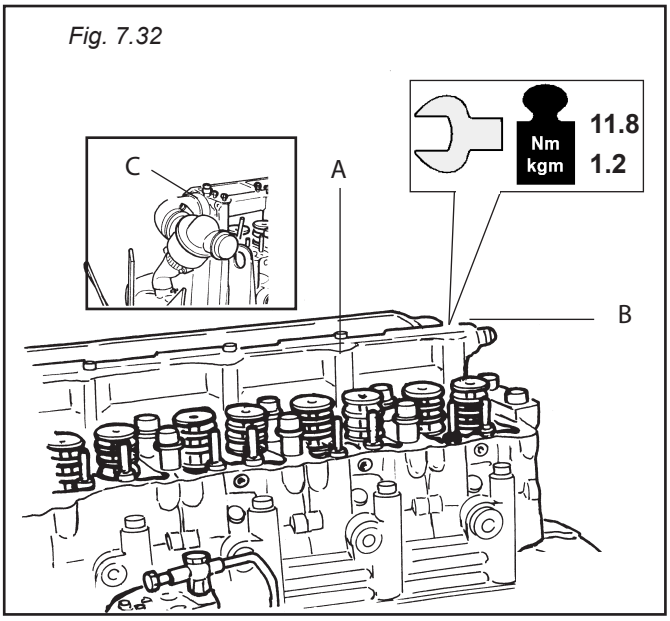


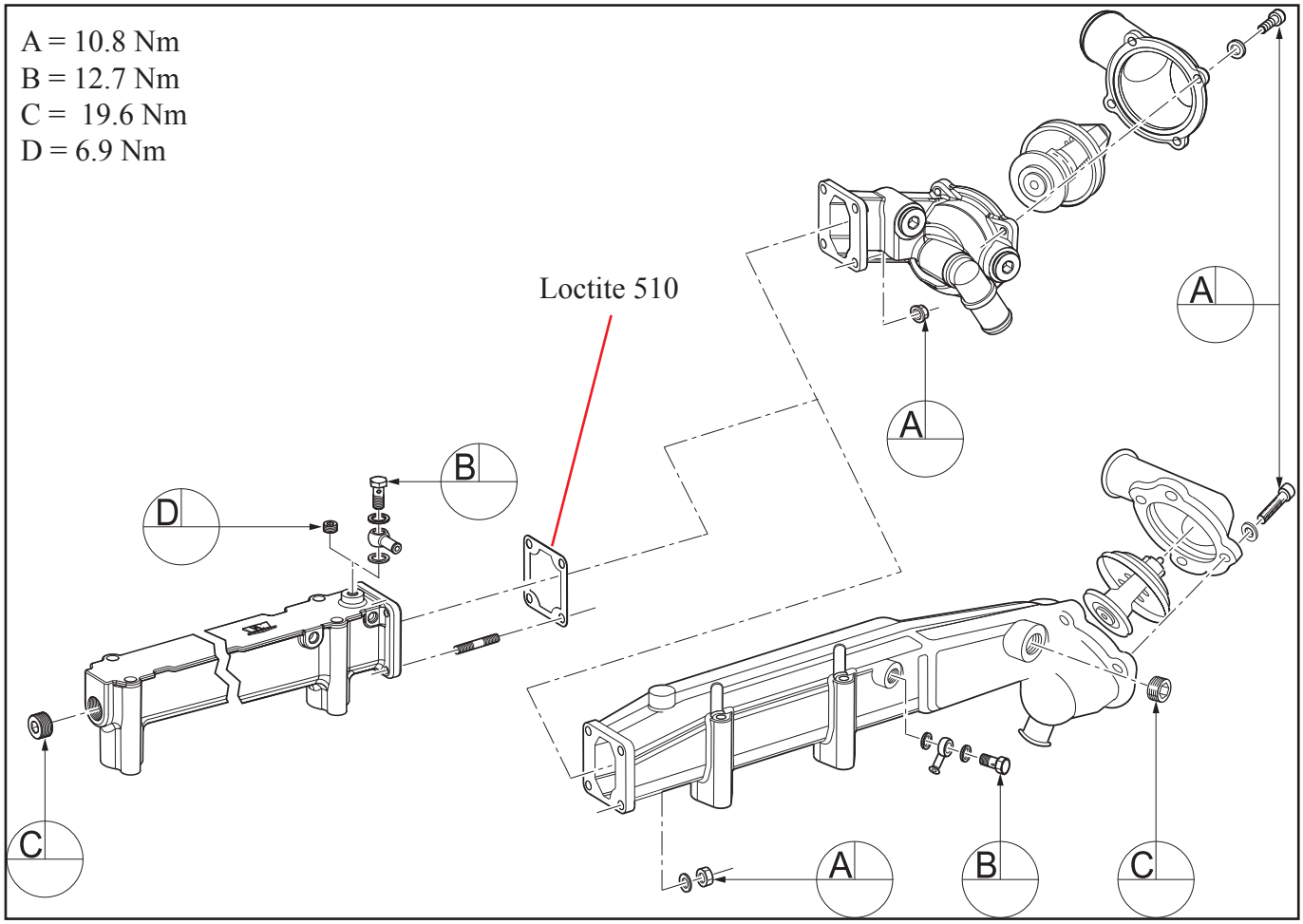
7.25 COOLANT MANIFOLD

Position coolant manifold **A** on cylinder head and tighten bolts **B** to the specified torque.

Connect the coolant hose and tighten clamp **C** to the specified torque.

Fig. 7.32





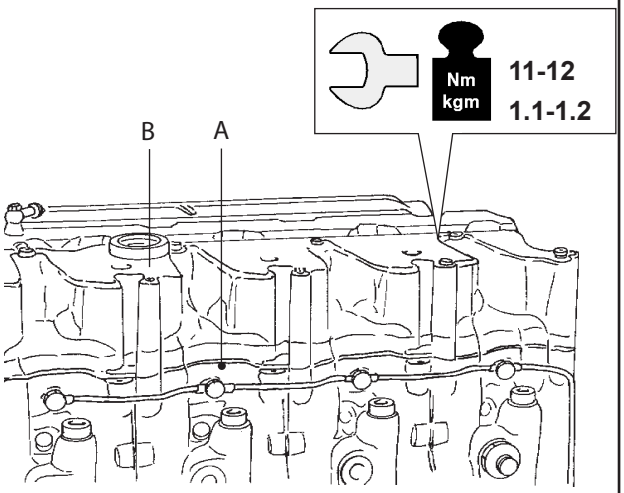
7.26 ROCKER ARMS COVER

Fit new gasket **A**, ensuring that it adheres to the cylinder head at all points.

Fit rocker cover **B** and tighten bolts to the specified torque.

_BE CAREFUL THAT THE INTERNAL RIBS OF THE ROCKER COVER ADJACENT TO THE ROCKER ARMS DO NOT DAMAGE THE GASKET.

Fig. 7.33b



7.27 INJECTORS

BEFORE INSTALLING THE INJECTORS (C), FIT THE O-RING (E) AND THE WASHER (A), USING A LITTLE GREASE TO HOLD THEM IN POSITION.

BEFORE INSTALLING INJECTOR PUT MOLIKOTE P 1500 GREASE BETWEEN X AND Y AREA IN ORDER TO AVOID INJECTOR BLOCKING

Fit bracket **B** on injector **C**.

Fit bracket and injector as shown in the figure.

Tighten nut **D** to the specified torque.

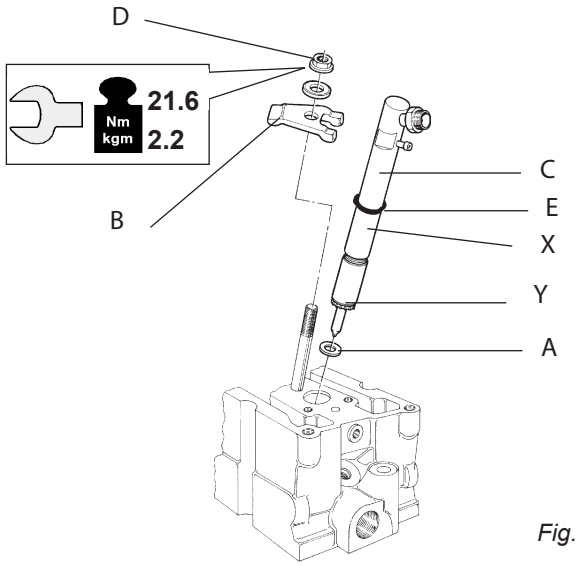


Fig. 7.34

INJECTOR TYPES INSTALLED ON ENGINE MODELS D700 AND D750 HAVE A SPACER (A) WITH A SPECIFIC THICKNESS .

INSTALL THE SPECIFIC SPACER IN RELATION TO INJECTOR TYPE AND ENGINE MODEL.

7.28 INJECTION PUMP

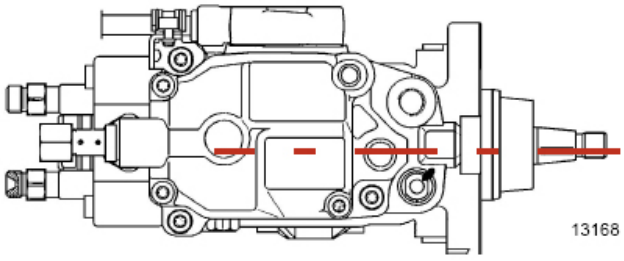
BOSCH

Ensure that the engine is in the same position when the pump was removed or that the crankshaft is 15° - 20° before cylinder number 1 piston top dead center (BTDC) of its compression stroke. If necessary refer to Establishing TDC and Chapter Disassembling. Use specific timing tools .

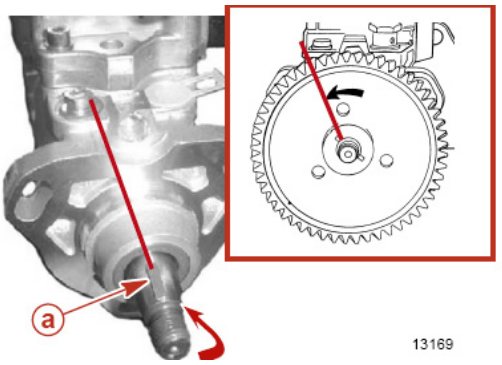
Rotate the injection pump shaft to align the key with the cylinder number 1 injector port: the injection pump key has to be at approximately 11 o'clock (see pictures).

NOTE: To rotate shaft, temporarily install original drive gear and a suitable jam nut. Do not damage pump shaft threads with improper nuts or overtightening.

inj. pump key at approximately 11 o'clock.



cylinder number 1 injector port



a - inj. pump key approximately at 11 o'clock.

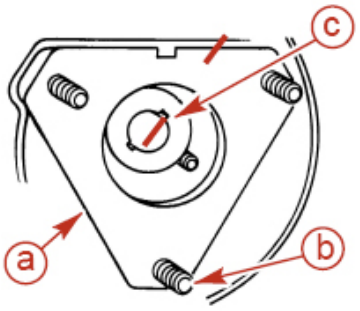
Install in the crankcase the injection pump gasket by aligning the gasket holes in the studs.

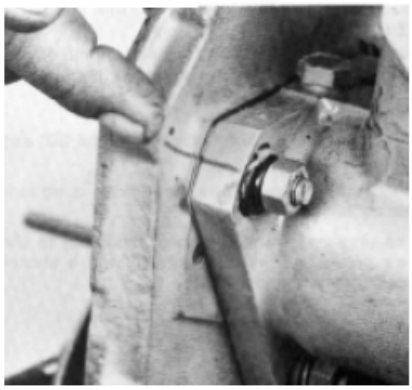
Insert the injection pump shaft into the injection pump gear, being careful not to dislodge key. Do not turn the injection pump shaft from 11 o'clock position. Rotate the injection pump body in the slotted adjustment holes to align the key with the injection pump gearkeyway.

Align the reference marks on injection pump flange and block: the reference marks were carried out during the injection pump removal.

Otherwise center injection pump slotted adjustment holes in relation to mounting studs.

a - Injection pump gasket
b - Injection pump mounting stud
c - Upper keyway position



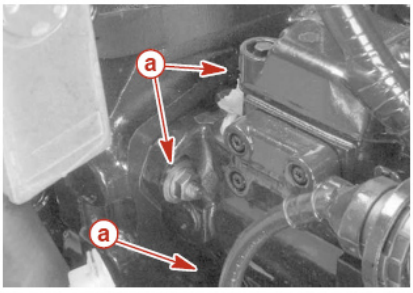


Install the injection pump mounting washers and flange nuts. Temporarily only finger-tighten the nuts.

Remove the Injection Pump Gear Puller Tool. Ensure the key is in position.

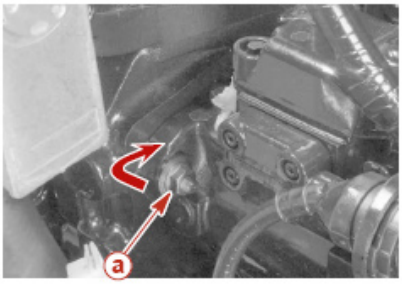
Using a new lockwasher, secure the injection pump gear to shaft with the hex nut.

Torque the injection pump gear nut at 88Nm.



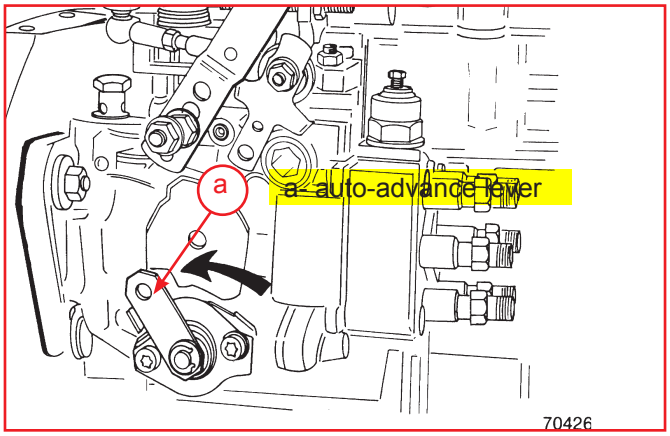
a- washers and flange nuts.

Rotate the pump to the center of the slotted adjustment holes in the direction shown and tighten the 3 flange nuts to **27.5 Nm**



a- slotted adjustment holes

Check that the auto-advance lever **A** is at the rest position and KSB is released. Refer to KSB adjustment here as follows:

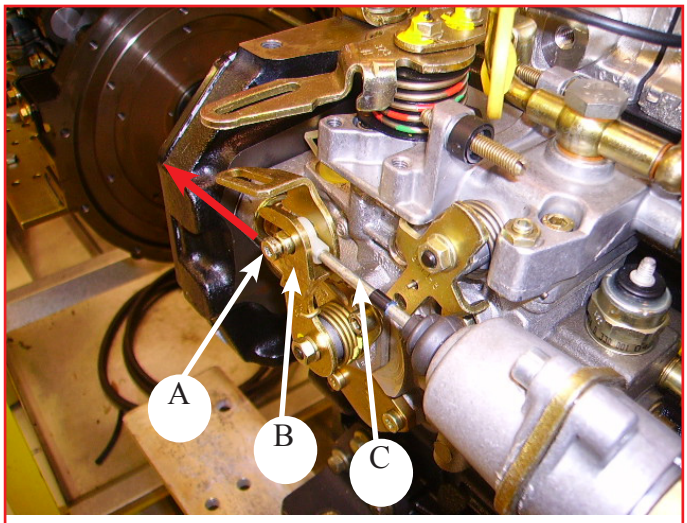


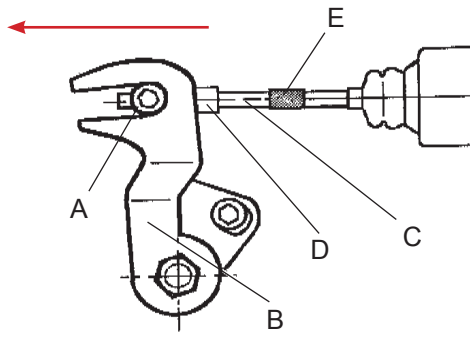
KSB adjustment engine while carring out the fuel injection pump timing procedure (REST POSITION)

- Loosen the lock screw **A** and slide lever **B** and rod **C** on a rest position **(RED ARROW DIRECTION)**.

This will release the pump advance lever and must be performed before carrying out the fuel injection pump timing procedure.

- Make sure that the cold start device is in the rest position (inactive) (lever **B completely at rest).**





KSB setting for correct operation (WORKING POSITION)

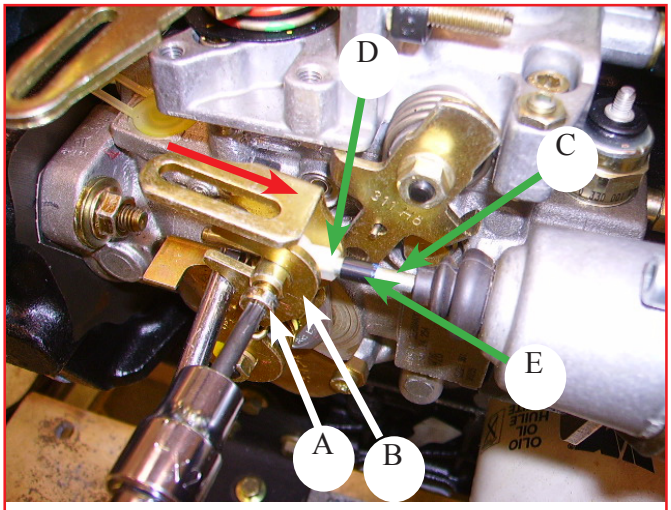
Loosen the adjusting collar assembly lock screw **A.**

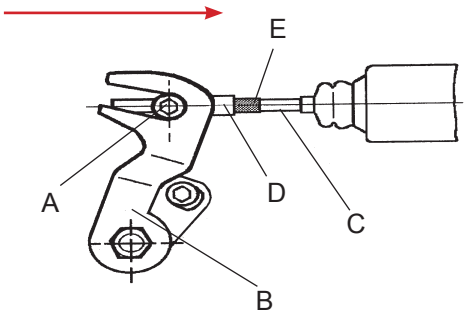
Rotate the lever **B** in a clockwise direction (**RED ARROW DIRECTION)**, until the collar assembly **D** stops against the black plastic coating **E** on rod **C.** A screw driver or pry tool may be used in the slot on the top of the lever to help overcome the mechanical force of the internal spring in the pump to properly position the lever.

Tighten the lock screw **A**.

The KSB device is now in the working position and will function in the smoke control mode upon initial start-up (electrical contact off), until araund 30 °C (86 °F) (electrical contact on).

The KSB device is controlled/activated by a water temperature switch in the cylinder head. It should be noted that the movement of the KSB upon engine warm-up is gradual and not instantaneous.





Remove vent screw and sealing washer from rear of injection pump.

Install the Dial Indicator Adapter tool and dial gauge as shown.

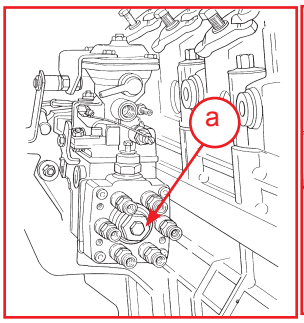
Look at dial indicator needle and slowly rotate the crankshaft counterclockwise (as viewed from water pump end looking toward flywheel) until the dial indicator stops moving.

Set the dial indicator to zero ("0").

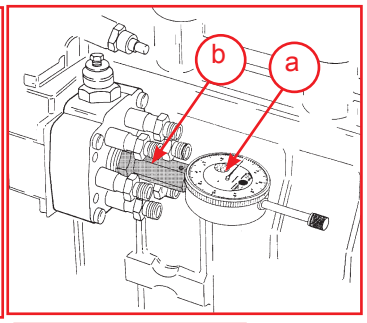
Slowly rotate the engine clockwise until the Cylinder TDC Tool indicates that cylinder number 1 piston is at TDC (Top Dead Center).

At this moment, the cylinder number 1 piston is at TDC on its compression stroke.

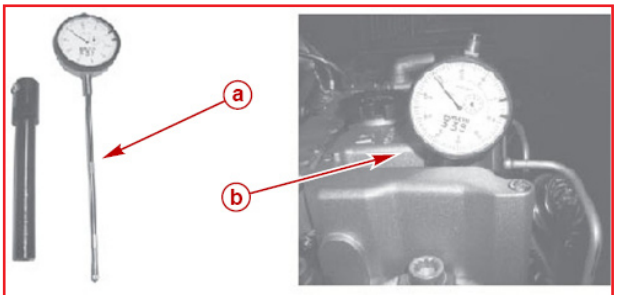
The dial indicator should show the specified timing setting. **(Refer to chapter 6 to identify the timing setting)**



a- vent screw



a- dial indicator
b -adapter



a - Cylinder TDC Tool with dial gauge
b - Cylinder TDC Tool installed

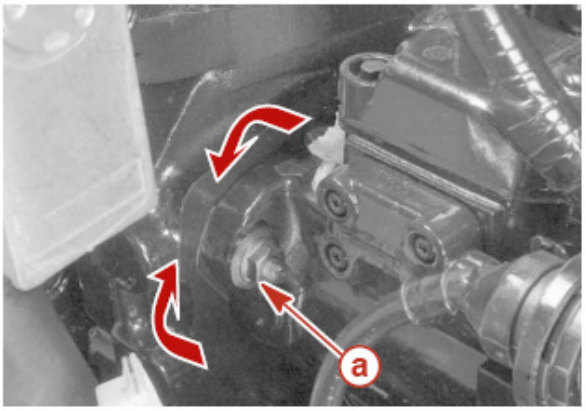
If the dial indicator does not show the specified timing setting, loosen the injection pump mounting flange nuts "A". Slightly rotate the injection pump in the appropriate direction to obtain the specified timing setting.If the pump is rotated forward the value decreases. If the rotating is backward the value increases. Retorque the flange nuts "A".

Rotate the crankshaft counterclockwise until the dial indicator sets zero ("0").

Slowly rotate the engine clockwise by bringing to TDC.

The dial indicator should show the specified timing setting. If so, **torque the three injection pump mounting flange nuts "A" at 27.5 Nm**.

Remove the dial gauge and Dial Indicator Adapter tool. Install the fuel injection pump vent screw using a new sealing washer. Tighten securely.



injection pump mounting flange nuts "A"

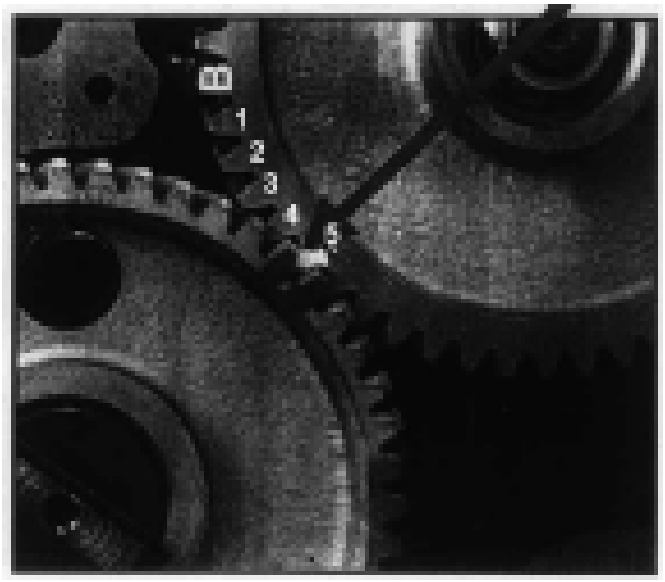
If the timing cover and injection pump gear are removed, fit the pump drive gear, making sure that the tooth marked with a punch mark and/or the number of cylinders or letter in the pump is positioned between the two punch-marked teeth on the camshaft gear.

ENGINE	GEAR PUMP CODE	TOOTH MARKED
D704L/LE	20662098F	3 TEETH BEFORE A IN CLOCKWISE
D704LT	"	4 TEETH BEFORE B IN CLOCKWISE
D704LTE/TE2	"	5 TEETH BEFORE B IN CLOCKWISE
D706LT/LI	"	A
D706LTE/IE2	"	1 TOOTH BEFORE B IN ANTICLOCKWISE
D754E1/E2	"	3 TEETH BEFORE A IN CLOCKWISE

ENGINE	GEAR PUMP CODE	TOOTH MARKED
D754TE2	20662122F	1 TOOTH BEFORE B IN CLOCKWISE
D754E2	"	1 TOOTH AFTER A IN CLOCKWISE
D704TE2	"	1 TOOTH BEFORE B IN CLOCKWISE

ENGINE	GEAR PUMP CODE	TOOTH MARKED
D704LT.01G	20660471G	4 A
D704LT.01G	"	4 A
D706LT.01G	"	1 TOOTH AFTER 4 B IN CLOCKWISE

Example
D704LTE/TE2
5 TEETH BEFORE B IN CLOCKWISE



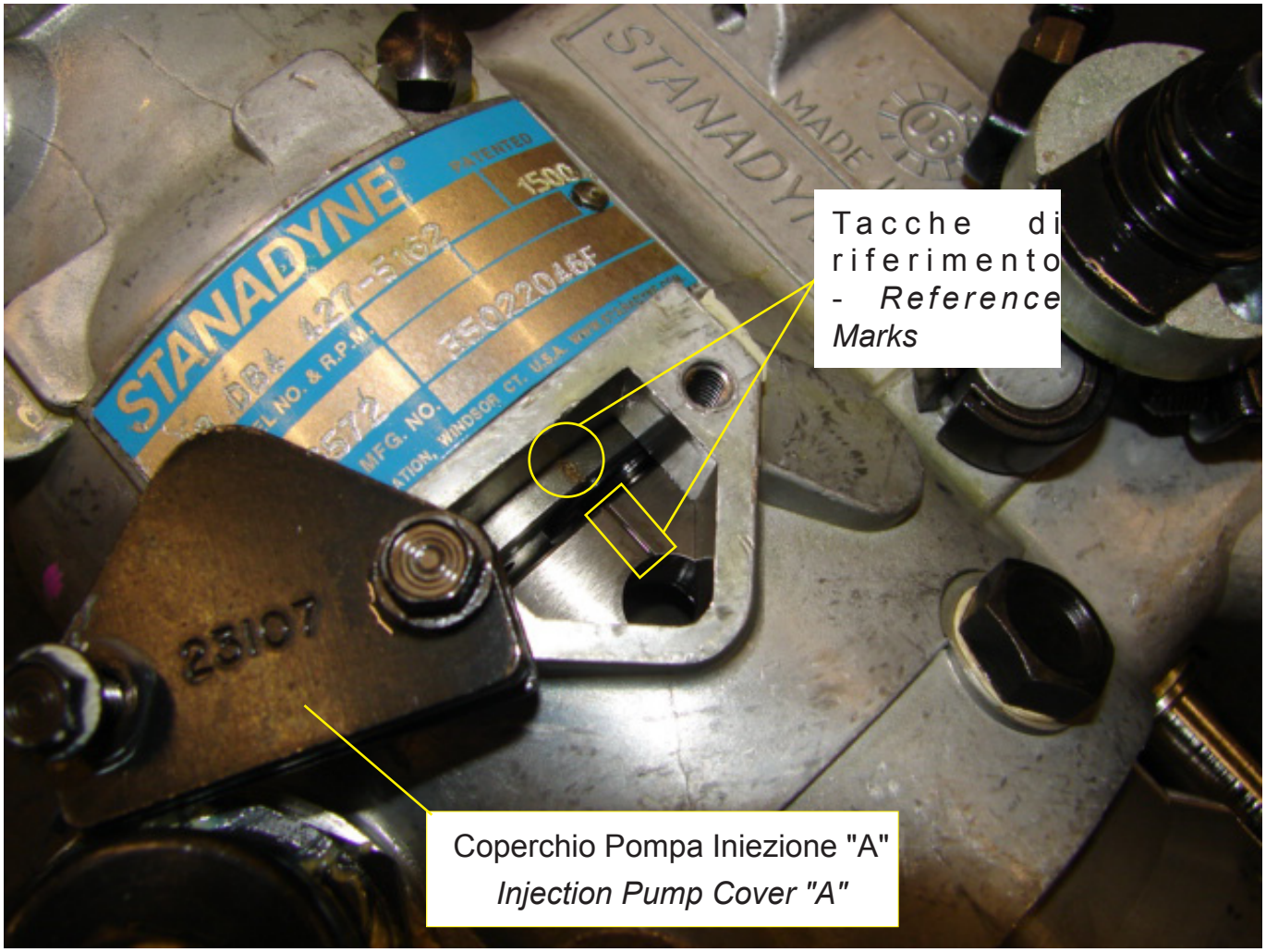
STANADYNE

Static Phase - pump type DB4427, DB4627

Refer to **no 5 DISASSEMBLY Chapter** to remove the **TIMED** injection pump, injection pump is on 1st cylinder fuel delivery positioned.

Loosen the cover **A** on injection pump.

Verify no.2 reference marks are aligned as shown in the picture (injection pump is on 1st cylinder fuel delivery positioned, as from disassembly). **If they are not aligned rotate pump shaft.**



Verify the injection pump key is oriented to "7 o'clock" l(see picture), so that the keyway is aligned with the cylinder number 1 injector port. In this condition **the** injection pump is on 1st cylinder fuel delivery positioned, as by disassembly.

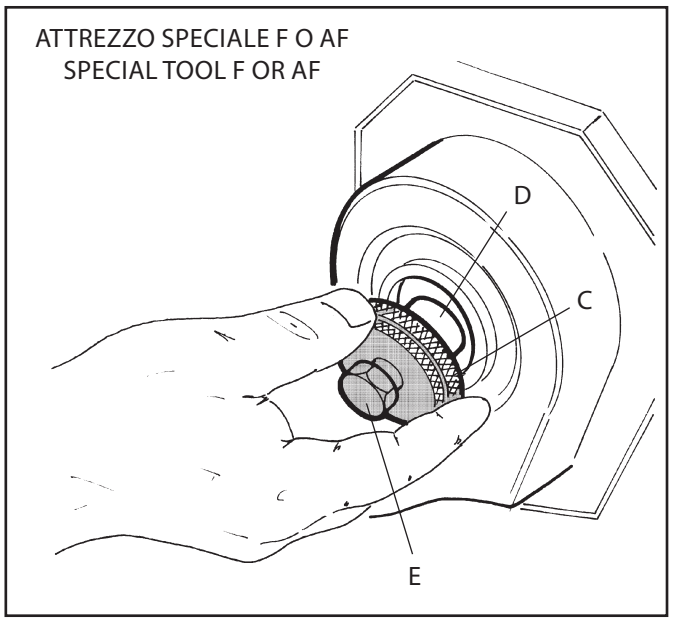
Install the injection pump on crankcase taking care to align the key on proper seat on gear.

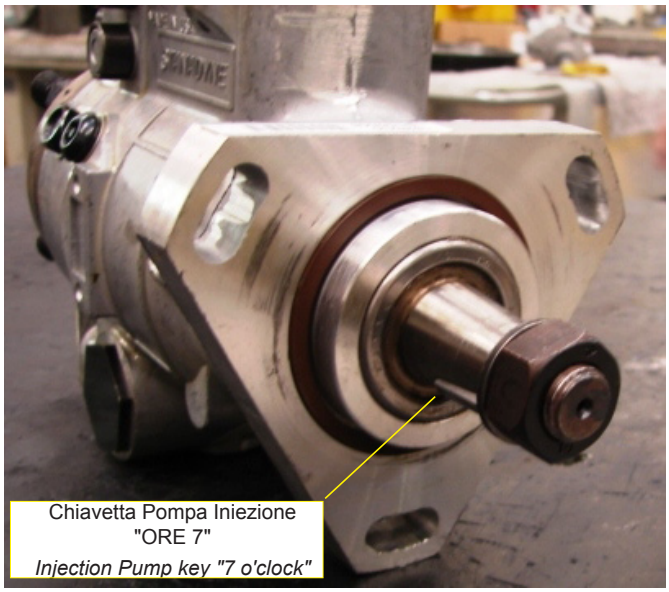
Torque no. 3 nut fixing the pump to block.

Remove the special tool to extract the pump, ***special tool F or AF (refer to Chapter 11, Special Tools).***

Install lock washer and injection pump gera fixing nut and torque to **86.3 Nm**

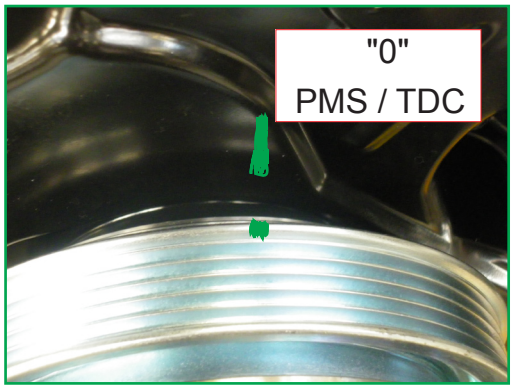
Install the plug on timing cover.





Dynamic timing test (with stroboscope and engine running)

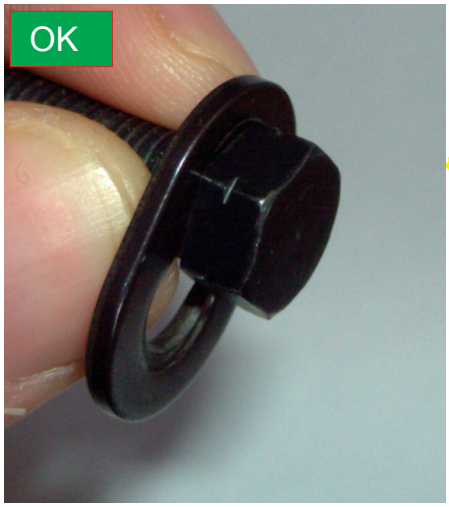
Connect the Time Trac or an equivalent stroboscope diagnostic instrument and run the engine at 1500 rpm under no-load conditions and check the injection pump timing advance with stroboscope.
Start the engine and bring the speed up to 1500 rpm under no-load conditions.
The timing is correct when the reference marks on the timing cover and the crankshaft pulley ("0" TDC" are aligned (with strobe lamp); the values in degrees will be shown on the display.

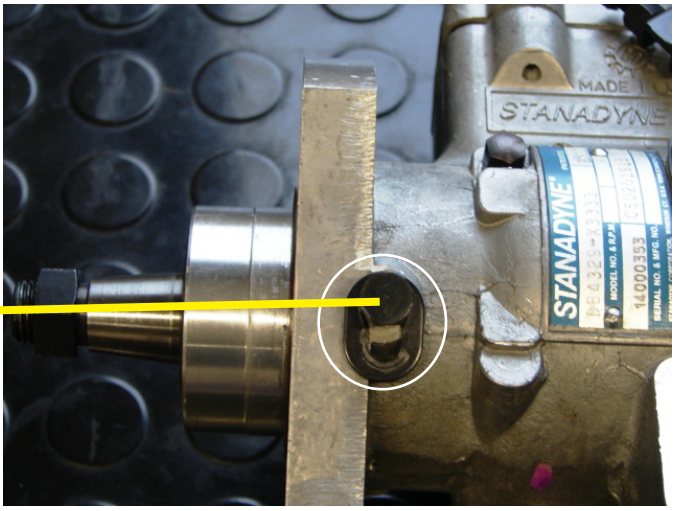


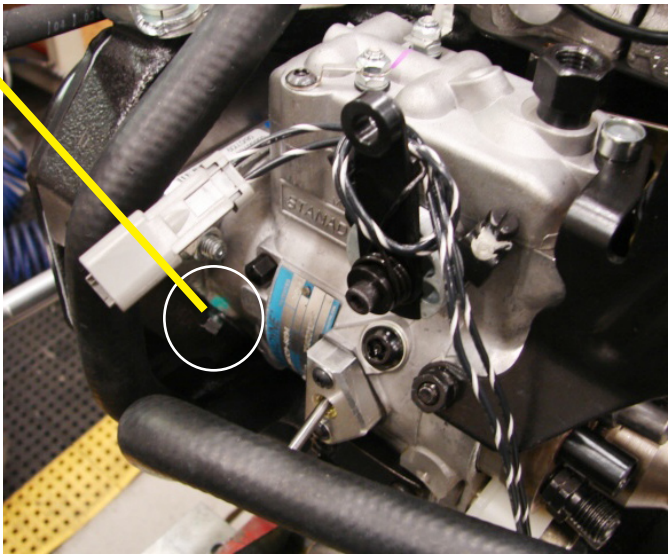
Static phase - pump type: DB4329, DB4429, DB4629, engine models D753 E3/TE3/IE3, D754TPE2/IPE2, D756TPE2/IPE2

Refer to no. 5 DISASSEMBLY Chapter to remove the TIMED injection pump, injection pump is on 1st cylinder fuel delivery positioned.

During Disassembling ensure that the special screw locks the injection pump shaft rotation. In this way the injection pump is locked and TIMED: 1st cylinder fuel delivery position.
Verify the special washer position in relation to proper bolt.

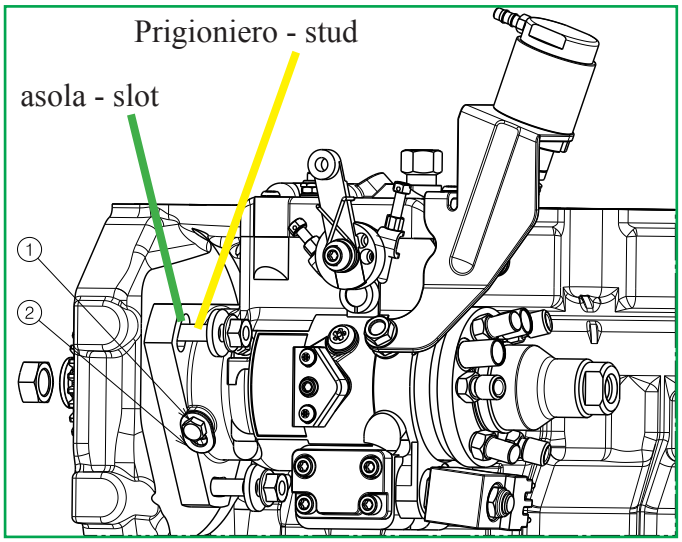






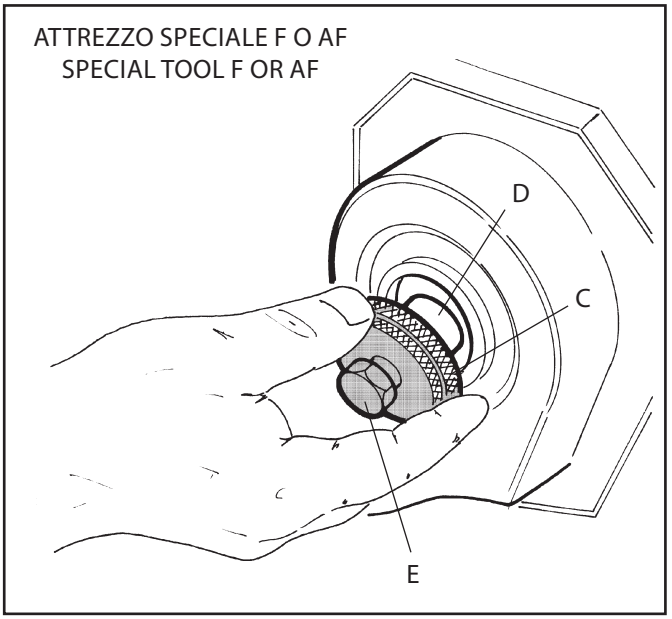
Install the injection pump on no. 3 studs: center the injection pump flange slot in relation to the stud.

Torque no. 3 injection pump fixing nuts by **27.5 Nm**

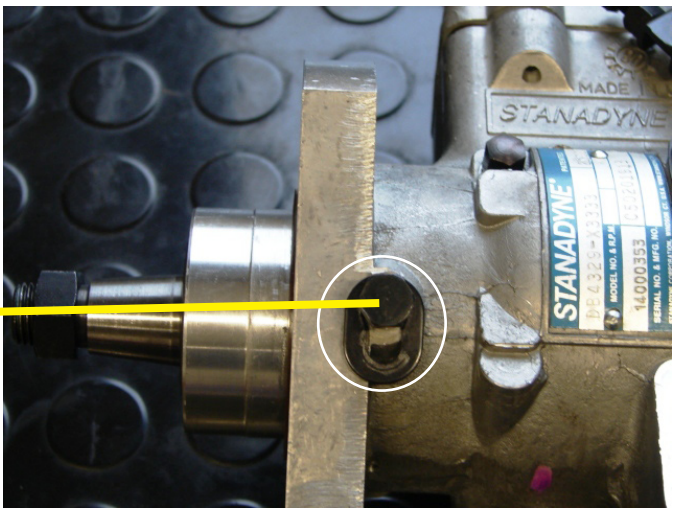


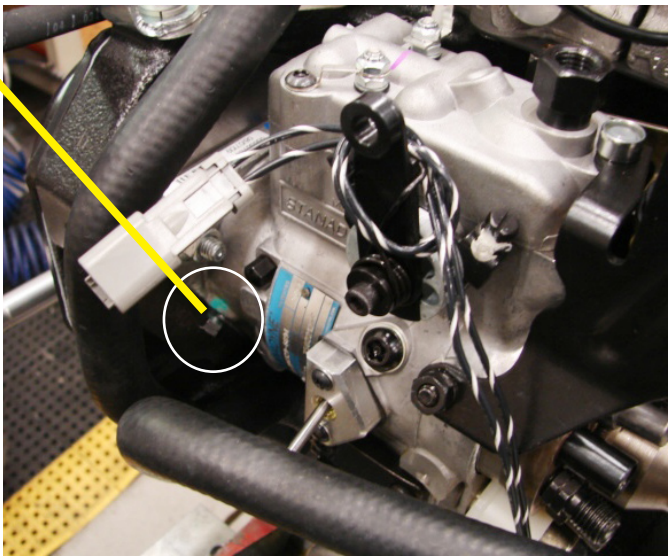
Torque the injection pump gear by **86.3 Nm**

Remove the ring nut C and install the plung on timing cover



Loosen the special screw on injection pump body that lock the injection pump shaft rotation: the special washer must be free, not locked





Dynamic timing test (with stroboscope and engine running)

Connect the Time Trac or an equivalent diagnostic instrument and run the engine at 1500 rpm under no-load conditions and check the injection pump timing advance with stroboscope.
Start the engine and bring the speed up to 1500 rpm under no-load conditions.
The timing is correct when the reference marks on the timing cover and the crankshaft pulley ("0" TDC" are aligned (with strobe lamp); the values in degrees will be shown on the display.

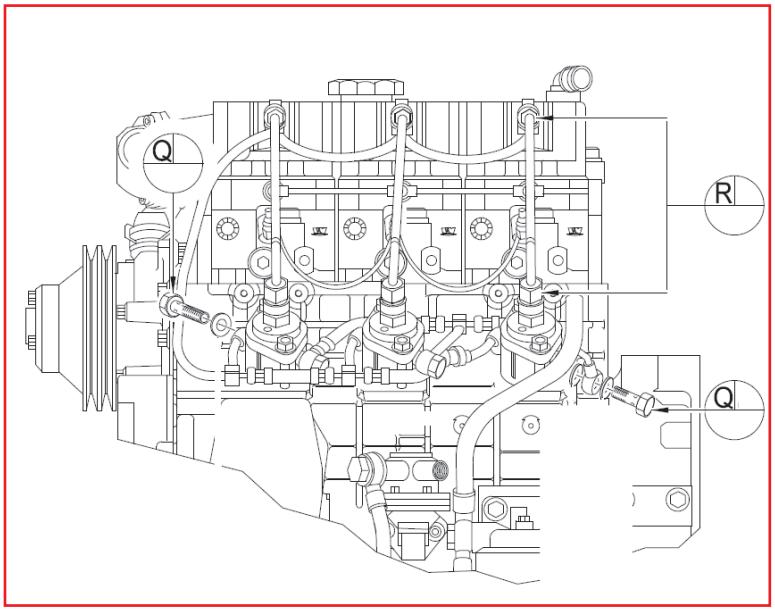
About engine models D753 in order to check injection pumo timing it is necessary to use a specific special tool stroboscope device.
See chapter "Special Tools" - Tool no. AN

7.29 INJECTION PIPES

D703 INJECTION PUMP (HIGH PRESSURE)

(R)
D703 pipe from inj.pump to injector = 20 Nm

(Q)
D703 Fuel return & feed fitting =30 Nm

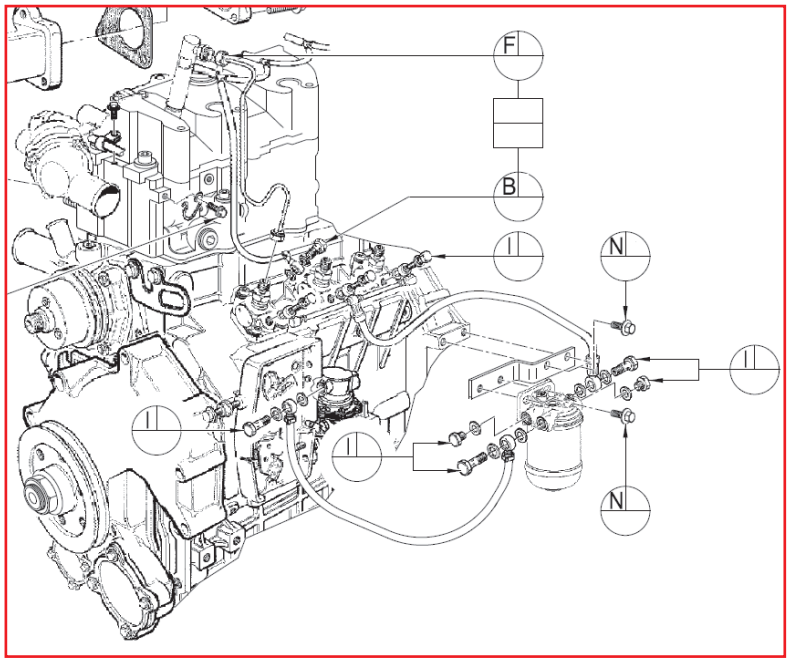


D703 INJECTION PUMP (LOW PRESSURE)

(F)
D703 pipe from inj.pump to injector = 22 Nm

(B)
D703 Fuel return fitting = 25.5 Nm

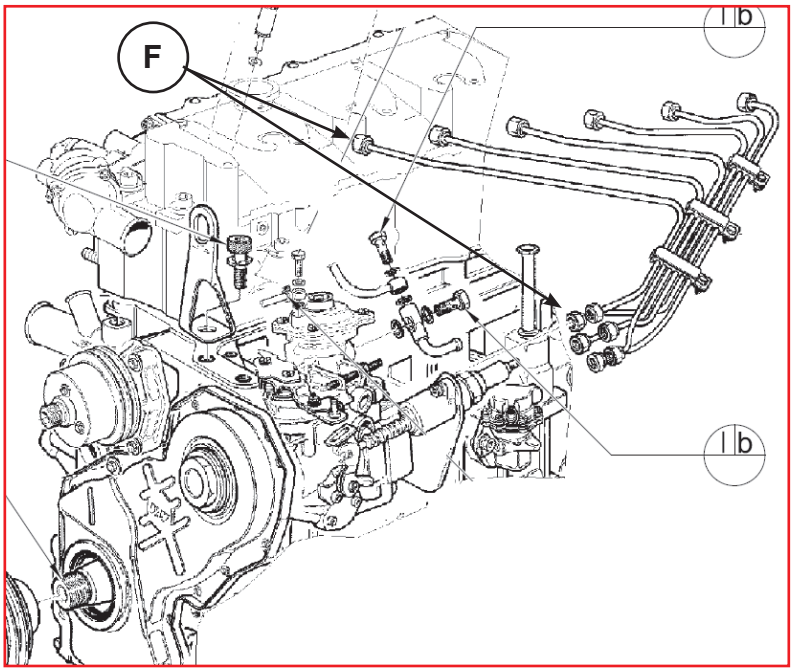
(I)
D703 Fuel feed fitting = 16.7 Nm



D704-D754-D706 INJECTION PUMP

(I)
Fuel return fitting = 16.7 Nm

(F)
Pipe from inj.pump to injector = 22 Nm



7.30 TIMING COVER

ANTIFON SHEET COVER

Carefully clean and degrease the cylinder block matching surface.

Apply a film of sylicon along the cover perimeter (**A**): make sure to apply the film of sylicon without interruption, turn aroun the holes on the external side.

Position the cover on the cylinder block, centering the dowel pins.

Screw in the bolts at the requested torque.

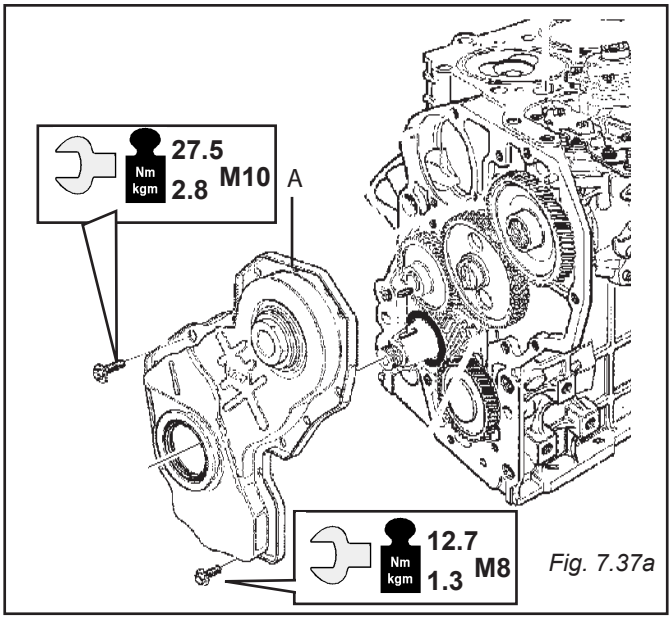


Fig. 7.37a

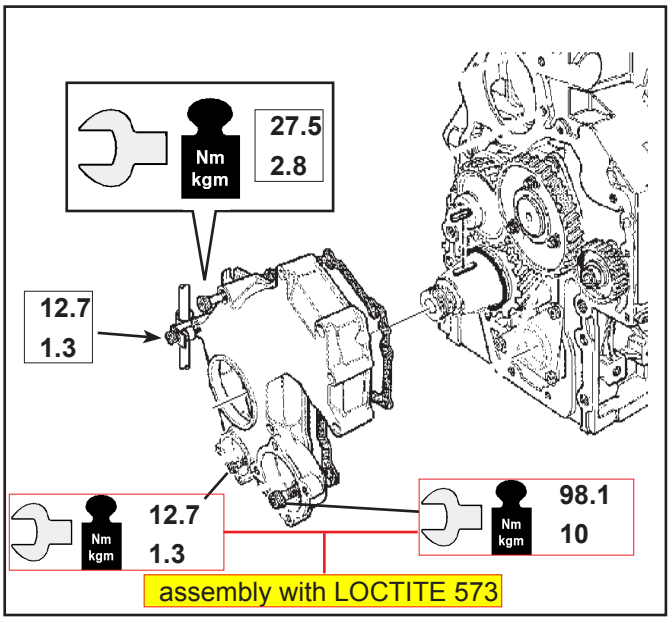
DROP-FORGED COVER

Carefully clean and degrease the cylinder block matching surface.

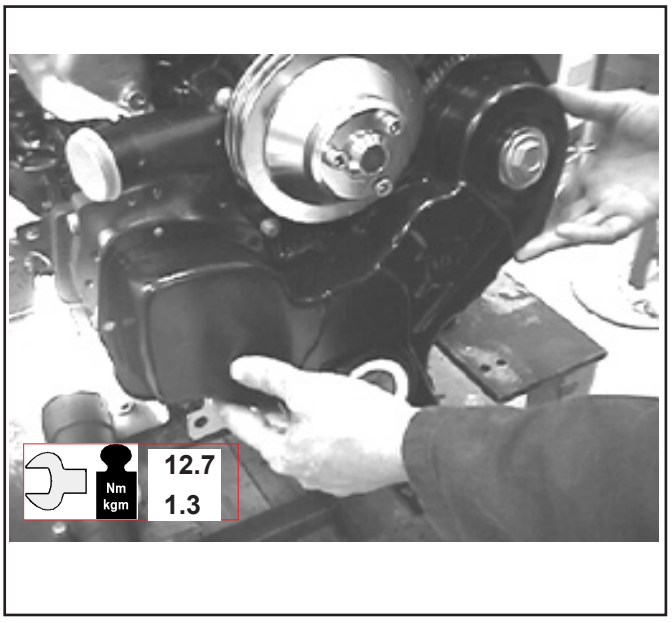
Position the sealing gasket on the block, centering the dowel pins.

Assembly the cover, centering the dowel pins.

Screw in the bolts, making sure to center the gasket holes, torque the bolts at the requested.



ANTIFON SHEET COVER FOR ENGINE VERSION WITH HYDRAULIC PUMP ADAPTER



7.31 COOLANT PUMP

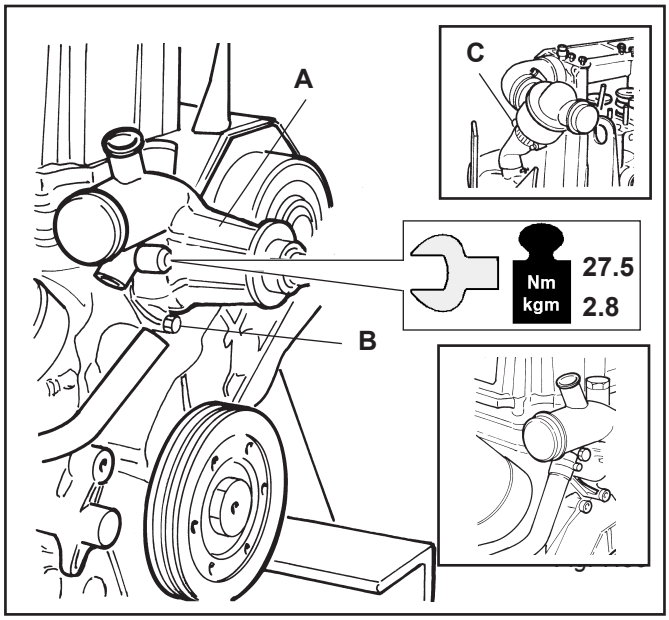
Old type

Fit coolant pump **A** as shown in the figure.

Tighten bolts **B** to the specified torque.

Connect hose between pump **A** and thermostat valve **C**.

Tighten hose clamps to the specified torque.



New type with majored flow rate

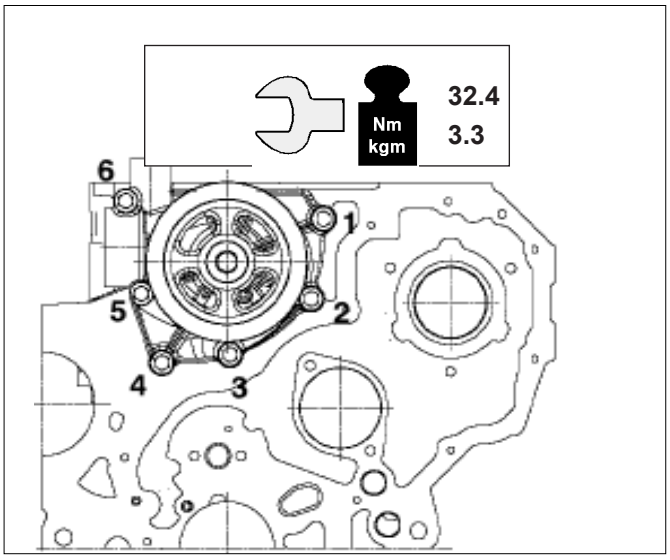
Insert the screws into holes 1-2-3-6.

Approach the pump to crankcase torquing the screw 2 by hands.

Approach the other screws (1-3-6) and torque them at indicated value in picture with sequence 6-3-1.

Torque other screws with sequence 4-2-5.

Retorque all screws with sequence 6-3-1-4-2-5.



7.36B COOLANT PUMP PULLEY

Fit pulley into coolant pump and tighten the screws to specified torque.

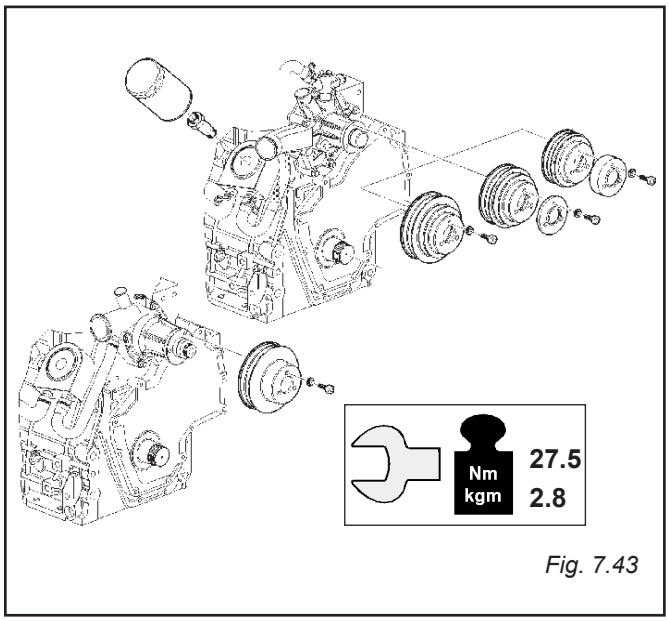


Fig. 7.43

7.32 TIMING COVER OIL SEAL

ANTIFON TIMING COVER

Fit together the two half rings **A** of special tool **(TAB 11.1 ref. I)** on timing cover **B**.

Fit the outer ring **C** of the tool as shown.

Gradually tighten bolts **D** to force the oil seal into its seat.

TIGHTEN BOLTS (D) EVENLY SO THAT THE OIL SEAL IS INSERTED STRAIGHT.
DO NOT TOUCH AT ALL THE OIL SEAL INTERNAL LIP. THIS TO REDUCE THE OF OIL LEAKS.

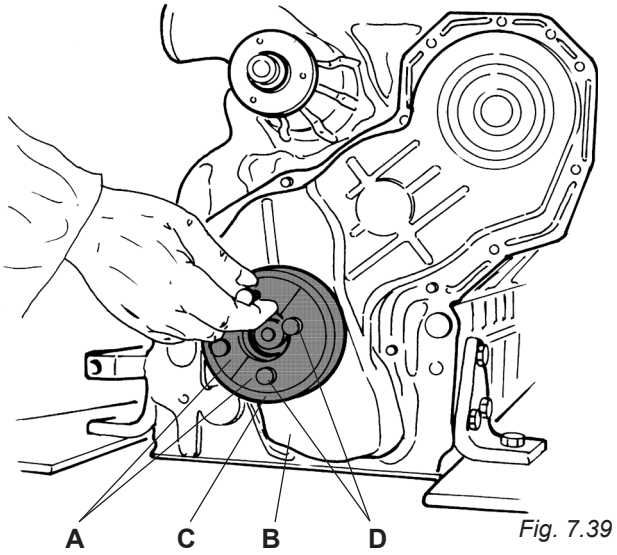


Fig. 7.39

TIMING OIL SEAL FUSION COVER

To replace holding ring (**A**), you must use the tool **(TAB11.1 ref. AB)** (fig.7.39b) that avoids the cover being irremediable deformed.

Clean the seat (**B**) on the cover accurately, insert the (**C**) insert (fig.7.39b), screwing it to the engine shaft until they contact each other.

Insert the new oil seal into support (**D**).

Insert the support with the oil seal into the insert until the oil seal contacts the cover.

Then, place an M10x40 screw (**E**) into the back hole of the support and screw it up in the insert until the two pieces meet.

At this point the oil seal is correctly inserted.

IT IS IMPORTANT NOT TO TOUCH THE HOLDING LIP OF THE OIL SEAL THAT IS BEING REPLACED/ MOUNTED, WITH BARE HANDS OR DIRTY GLOVES BECAUSE THEGREASE OF THE HANDS OR THE DIRT OF THE GLOVES WILL AFFECT ITS TIGHTNESS.

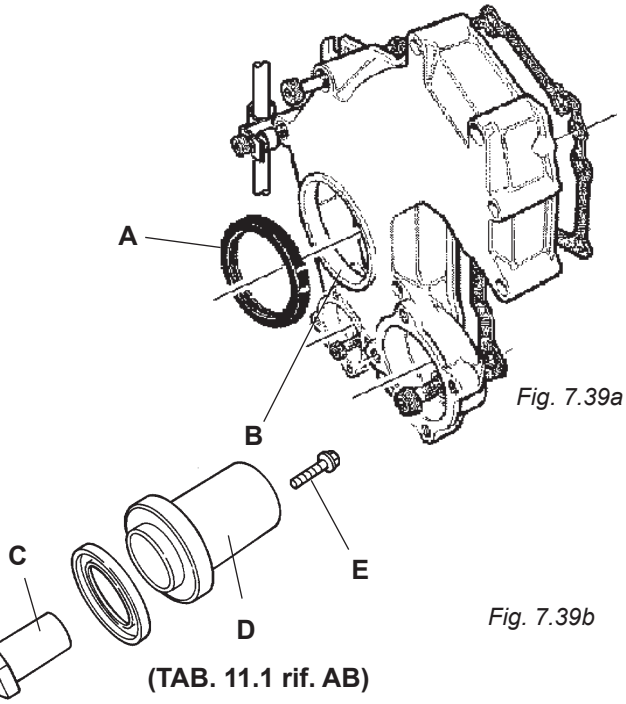


Fig. 7.39a

Fig. 7.39b

(TAB. 11.1 rif. AB)

7.33 CRANKSHAFT PULLEY

CRANKSHAFT FRONT CONE SHAPE END WITH RIGHT HAND THREAD - D703-D704-D754-D706

Nut torque 235.4 Nm (24 Kgm)

Loctite 222 on nut thread

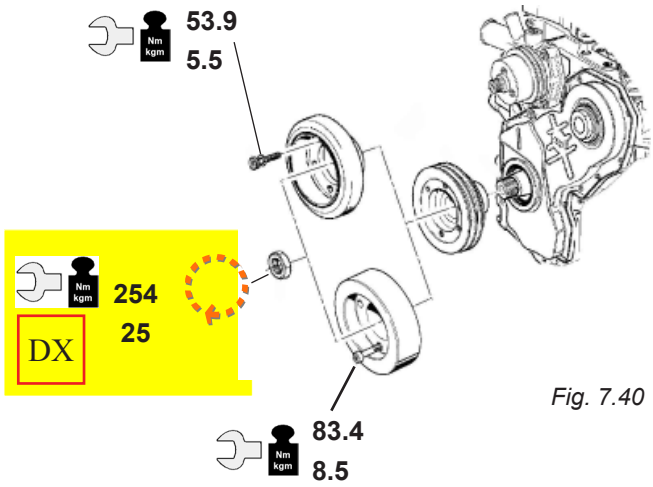


Fig. 7.40

CRANKSHAFT FRONT CYLINDRICAL END WITH LEFT HAND THREAD - D704-D754

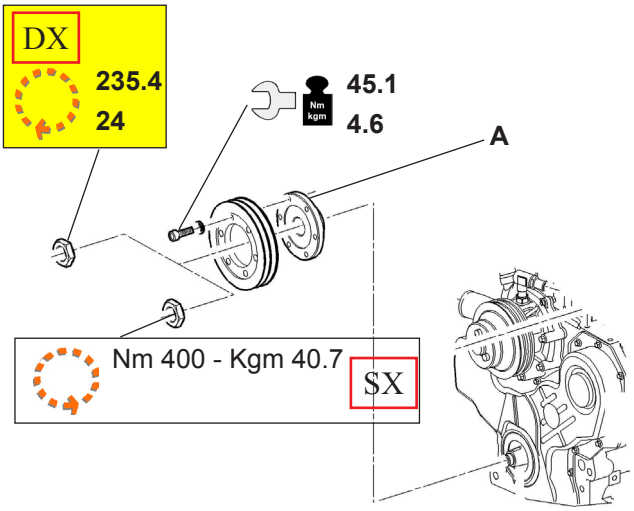
Check the cleaning of the crankshaft thread, crankshaft gear surface in contact with crankshaft pulley **A** and pulley surface in contact with the nut.

Apply “Molykote G Rapid Plus Paste” on the nut thread and on the nut surface in contact with pulley **A**.

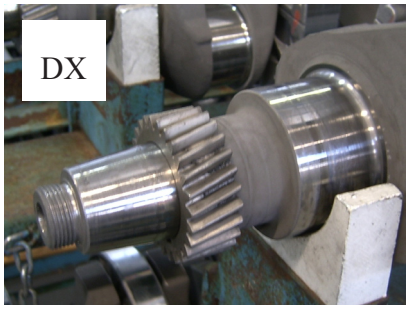
Torque nut "A" at 400 Nm - 41 Kgm.

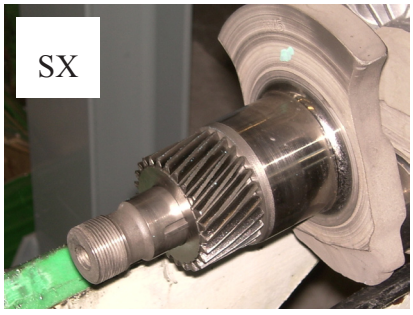
Slacken the nut.

Torque again the nut at 400 Nm - 41 Kgm.



CRANKSHAFT FRONT CONE SHAPE END WITH RIGHT HAND THREAD - D703-D704-D754-D706

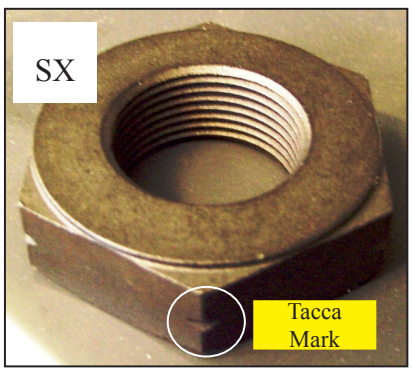




CRANKSHAFT FRONT CYLINDRICAL END WITH LEFT HAND THREAD - D704-D754-D753

IMPORTANT: ON ENGINE MODELS D704 AND D754 COULD BE INSTALLED TWO TYPES OF CRANKSHAFT WITH DIFFERENT FRONT SHAPE END AND THREAD.

IN ORDER TO RECOGNIZE IF AN ENGINE HAS A LEFT HAND THREAD NUT OR RIGHT HAND THREAD NUT IT IS NECESSARY TO LOOK AT THE NUT: IF THE NUT SHOWS UNI ISO MARKS AROUND THE PERIMETER THE CRANKSHAFT NUT IS LETF HAND THREAD



7.34 OIL COOLER

Fit oil cooler **A** as shown in the figure.

Tighten the internal union **B** to the specified torque.

Connect the pipes and tighten clamps **C** to the specified torque.

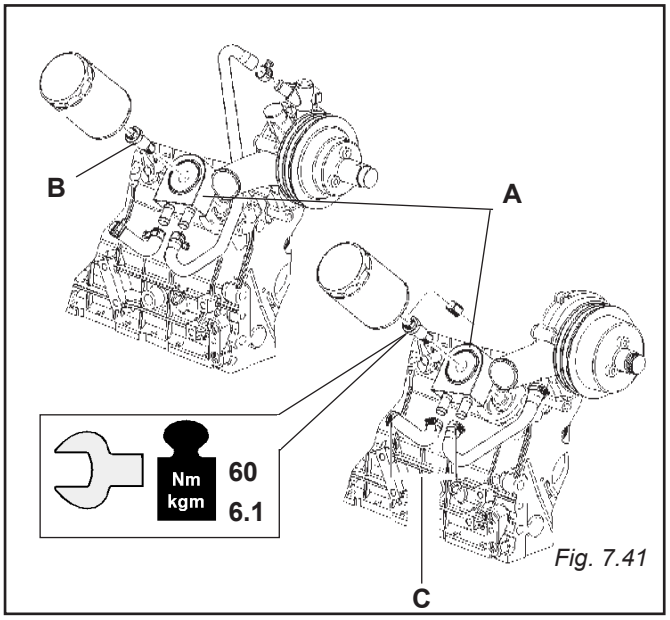
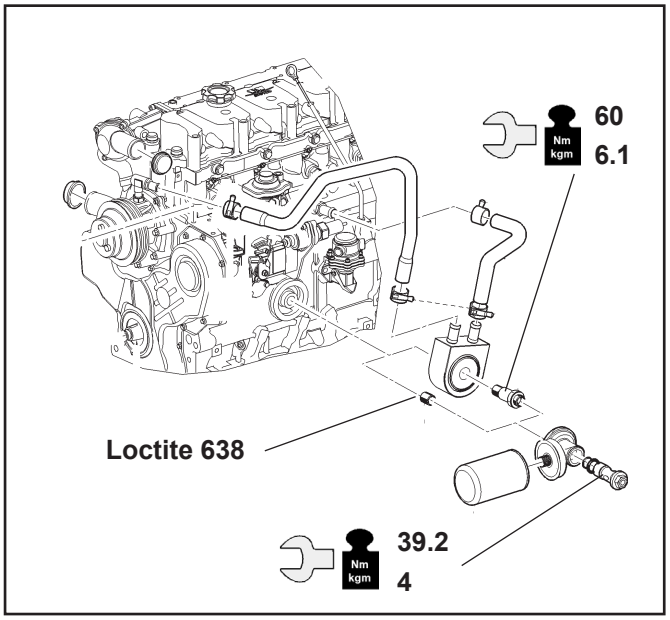


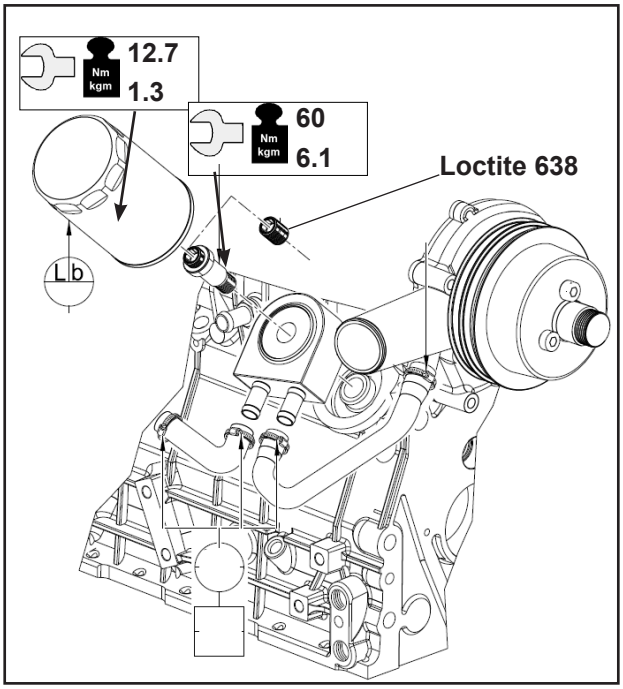
Fig. 7.41



7.35 OIL FILTER

Lubricate the oil filter mounting and screw filter **A** on to oil cooler **B** using a standard commercial strap or chain wrench to the specified torque.

(L) Oil filter cartridge 12.7 Nm



7.37 ALTERNATOR

Fit the adjustment bracket **A** to the crankcase with nut **B** and tighten to specified torque.

Fit alternator **C** and tighten nut **D** to specified torque.

B =54 Nm - 5.5 Kgm

D =27.5 Nm - 2.8 Kgm

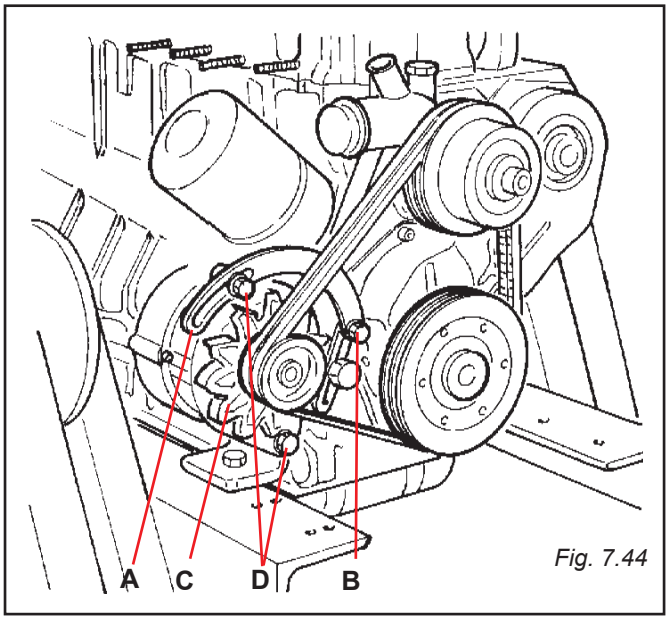
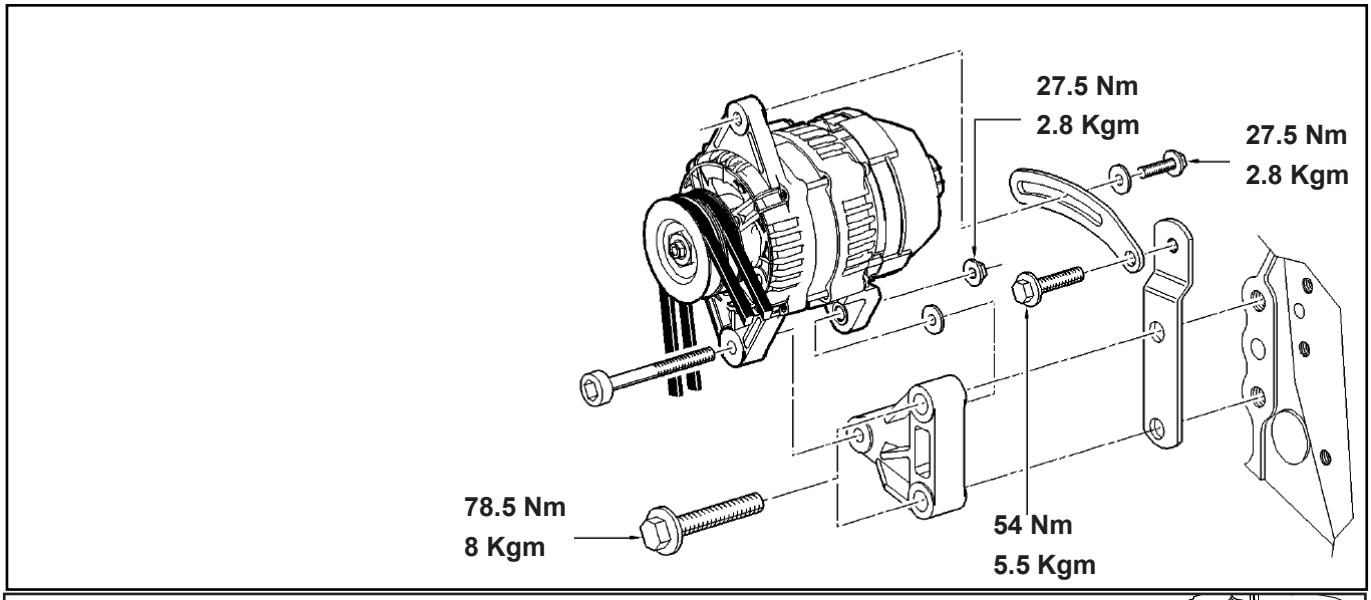
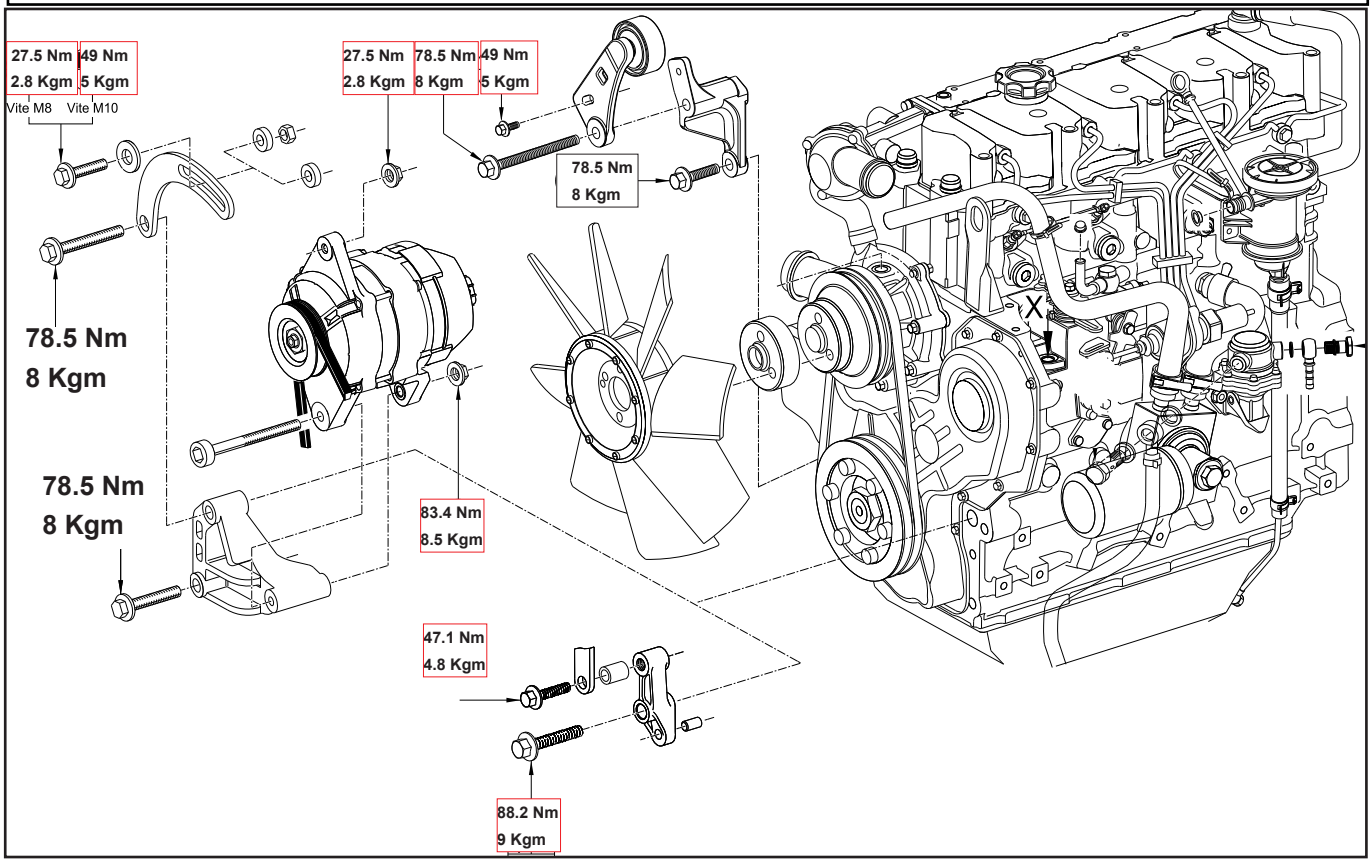
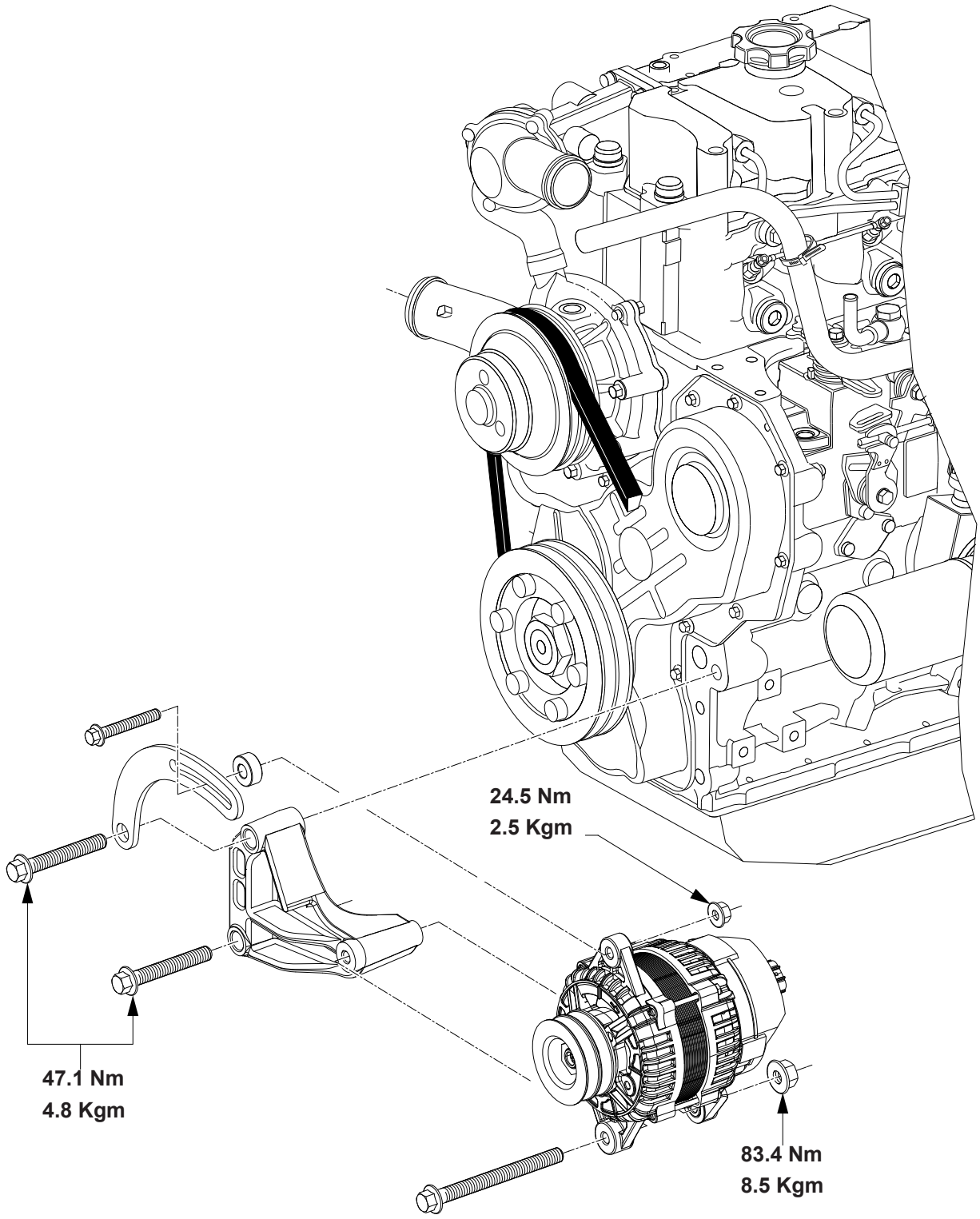


Fig. 7.44






24.5 Nm
2.5 Kgm
47.1 Nm
4.8 Kgm
83.4 Nm
8.5 Kgm

7.38 ALTERNATOR - BELT - TENSIONING

It is possible to check **at cold engine** the belts are suitably tight in two ways as described below:

A) by applying pressure of about 7 ÷ 8 kg on the longest side of the belt (see Fig. 7.45): the resulting flexion should be approximately 10 mm.

B) by using an electronic tester (frequency analyser). This must be positioned on side L (Fig. 7.45.1) and a blow imparted on the belt in order to read the oscillation frequency.

The correct frequency must be within the values shown below.

F1 = INITIAL TIGHTENING

F2 = AMOUNT WHEN OPERATING (AFTER HALF HOUR OF OPERATING AND AT COLD ENGINE)

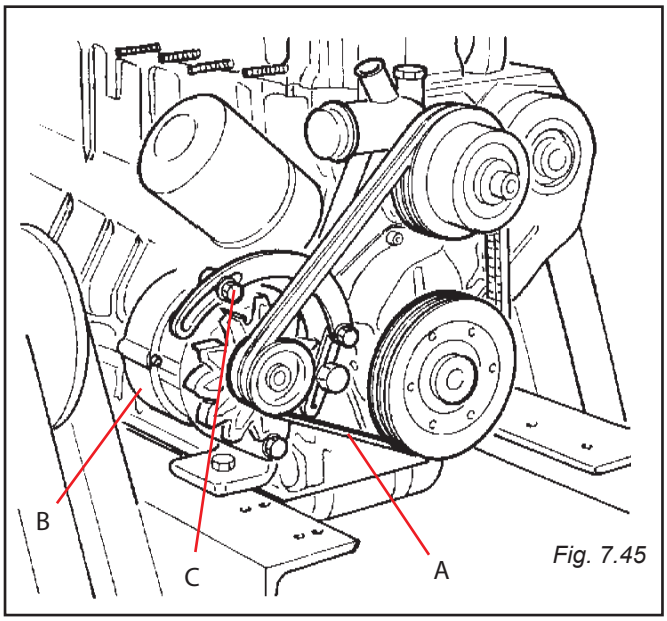


Fig. 7.45

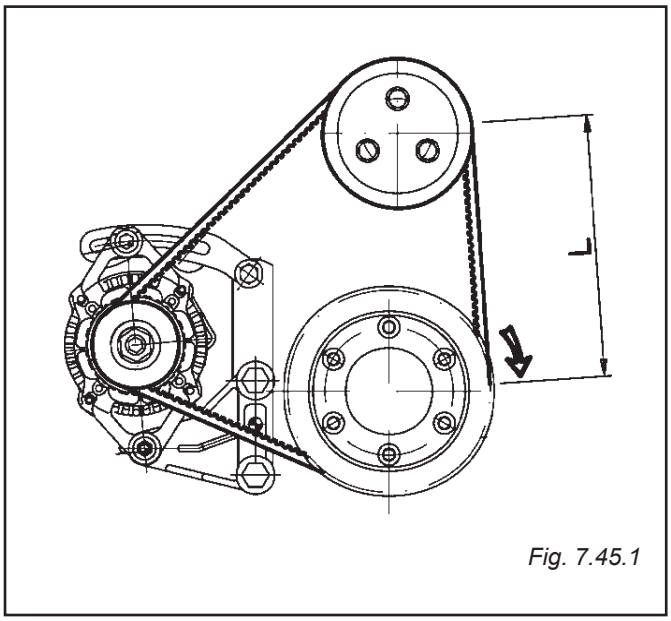
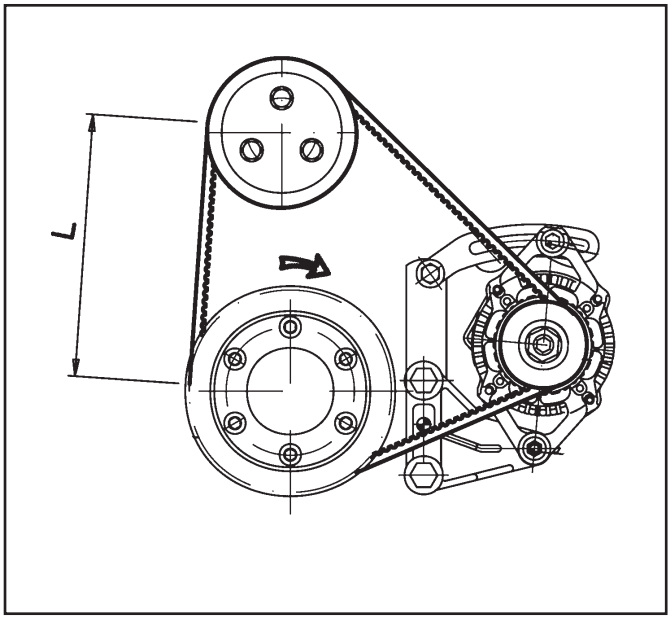


Fig. 7.45.1



STANDARD VERSIONS

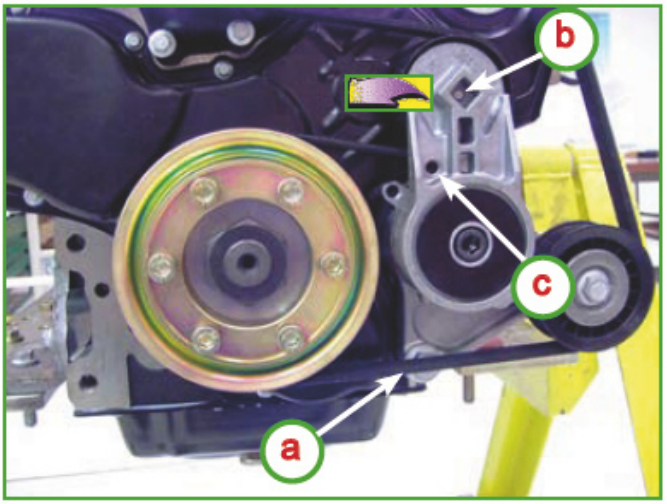
ENGINE	F1	F2
D754E1 D703TE1 D703E2	165 ± 4	139 ± 4
D706LTE D704LTE	188 ± 4	158 ± 4
D704LE D703LTE D703LE	184 ± 4	155 ± 4
D704TE2 D754E2	168 ± 4	141 ± 4
D706IE2	166 ± 4	140 ± 4

UPPOSITIONED WATER PUMP VERSIONS

D706IE2	107± 4	90± 4
D704TE2	109± 3	91± 3
D754TE2	109± 3	91± 3

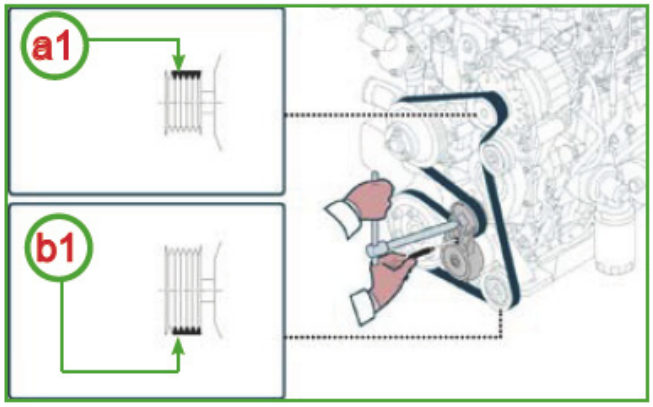
POLY - V / SERPENTINE BELT

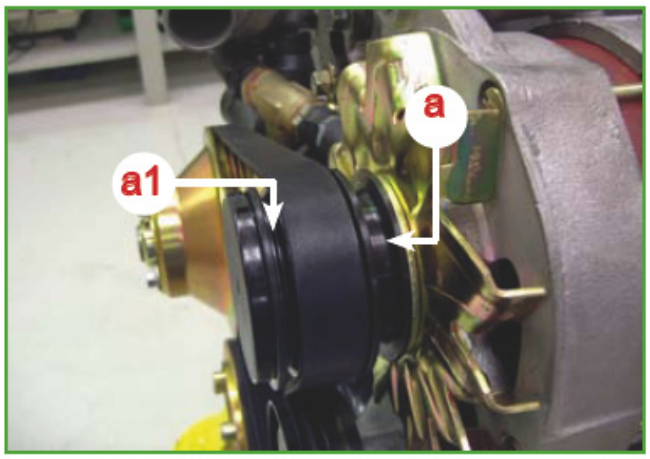
1. Position a suitable tool in the automatic tensioner release slot.
2. Rotate the automatic tensioner, in the direction of the arrow, to remove the tension on the serpentine belt.



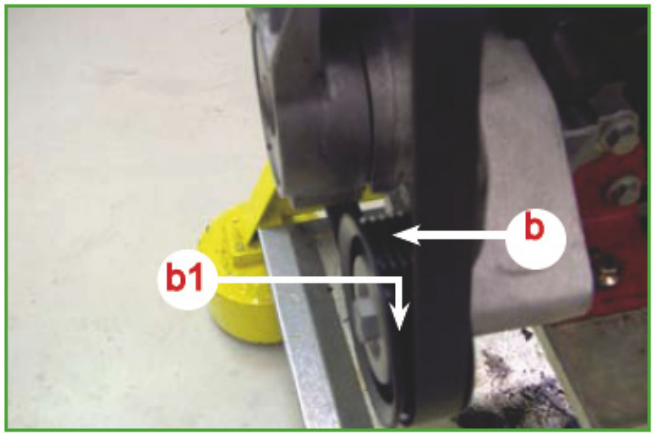
a - Serpentine belt
b - Tensioner release slot
c - Hole
d - pin

3. Install a pin into the tensioner hole to block the tensioner rotation.
4. Before removing the serpentine belt note its position on the alternator, and idler pulleys.
5. Replace the serpentine belt.
6. Install a new belt if required.





IMPORTANT: For a correct alignment of the serpentine belt it must be stay positioned on the inner races of the alternator and idler pulleys



a - alternator pulley
b - idler pulley
a1 - alternator pulley outer races remaining
b1 - idler pulley outer race remaining

7.39 FAN

Mount the fan **A** on the crankshaft pulley and screw **B** tighten it to specified torque.

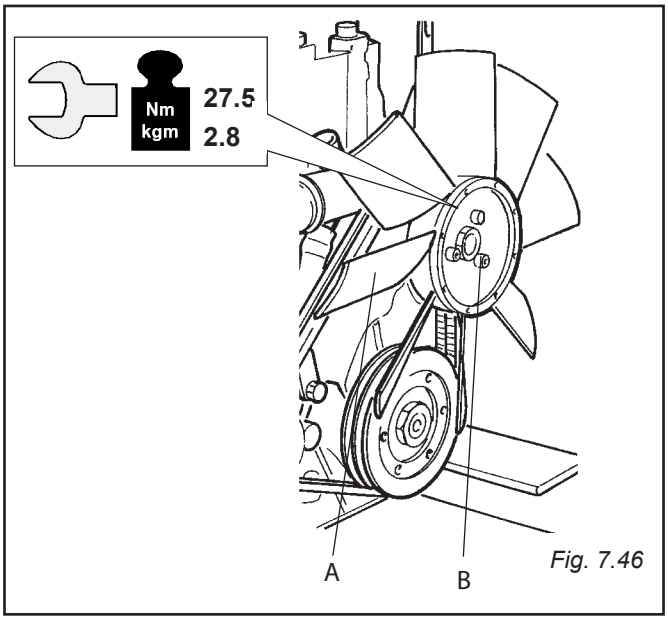


Fig. 7.46

7.40 STARTER MOTOR

Mount starter motor **A** on crankcase.

Tighten the srews of fastening.

_WARNING: AFTER FITTING THE STARTER MOTOR (A), REMEMBER TO REFIT THE OIL PRESSURE SENSOR (C) IF PREVIOUSLY REMOVED.

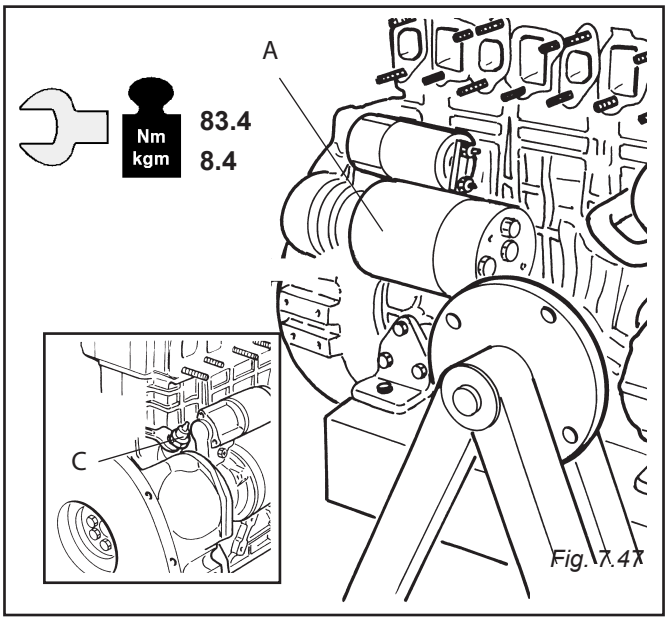


Fig. 7.47

7.41 FUEL SUPPLY PUMP

Fit pump **A** to the crankcase as shown in the figure, taking care not to damage the O-ring **B** oil seal.

Tighten the self-locking nuts **C** to specified torque.

_WARNING: BEFORE FITTING THE FUEL PUMP (A), CHECK CONDITION OF THE O-RING AND REPLACE IF NECESSARY.

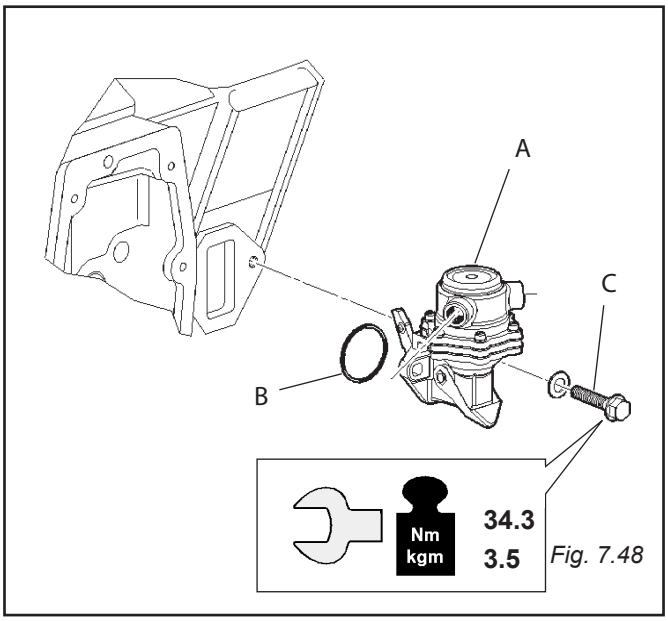


Fig. 7.48

7.43 REGULATOR AND INJECTION PUMPS ASSEMBLY FOR D703

Install : Counter weight (A)
Spacer (B)
Flange (C)

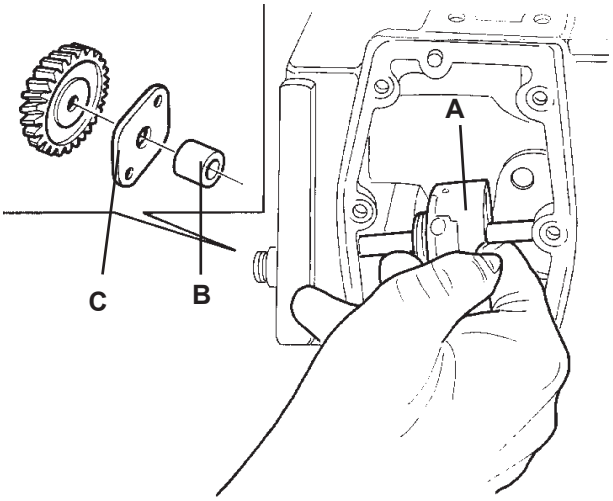


Fig. 7.55

(Fig. 7.56)
Note: Flange groves have to face the crankcase.

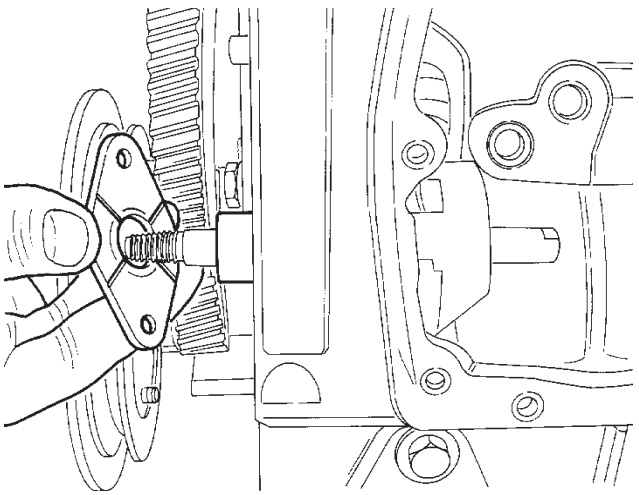


Fig. 7.56

(Fig. 7.57)
Tight # 2 flange bolts **Nm 12.7 - 1.3 Kgm**

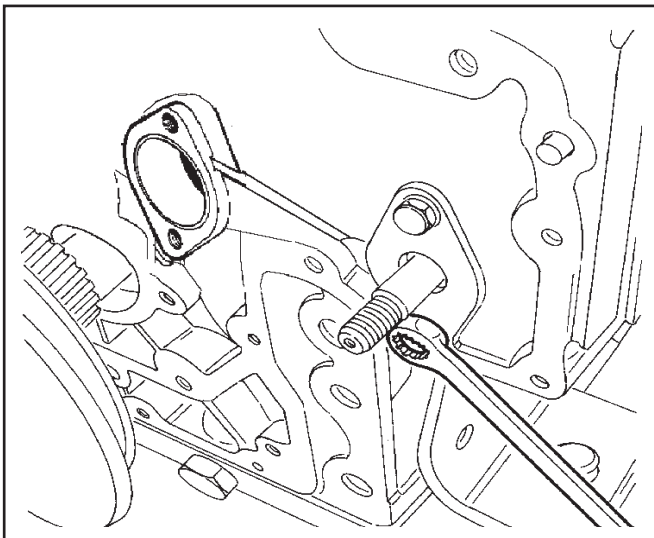


Fig. 7.57

(Fig. 7.58)
Tight governor gear nut to the specified value.
Note: The governor gear nut is left hand thread.

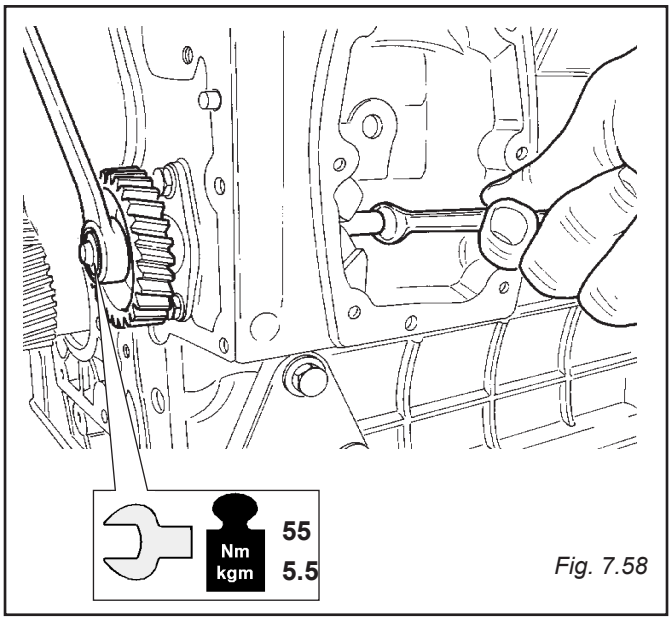


Fig. 7.58

(Fig. 7.59)
Install the camshaft

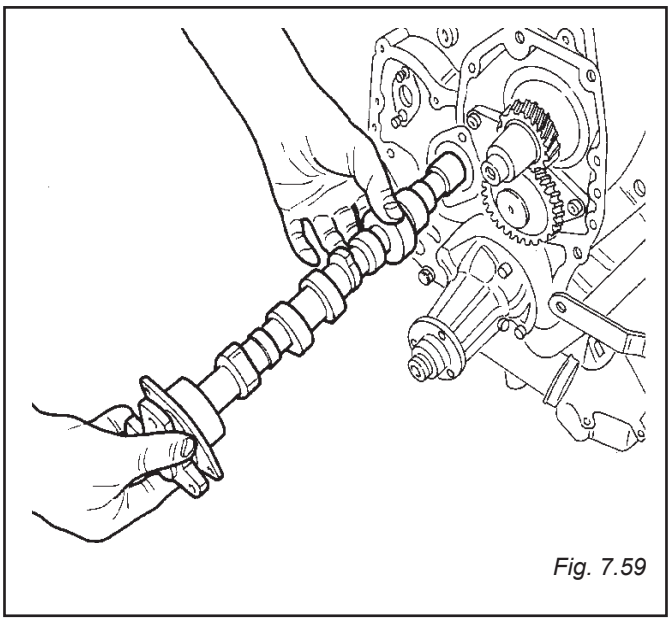


Fig. 7.59

(Fig. 7.60)
Tight the # 2 camshaft flange bolts to the specified value.

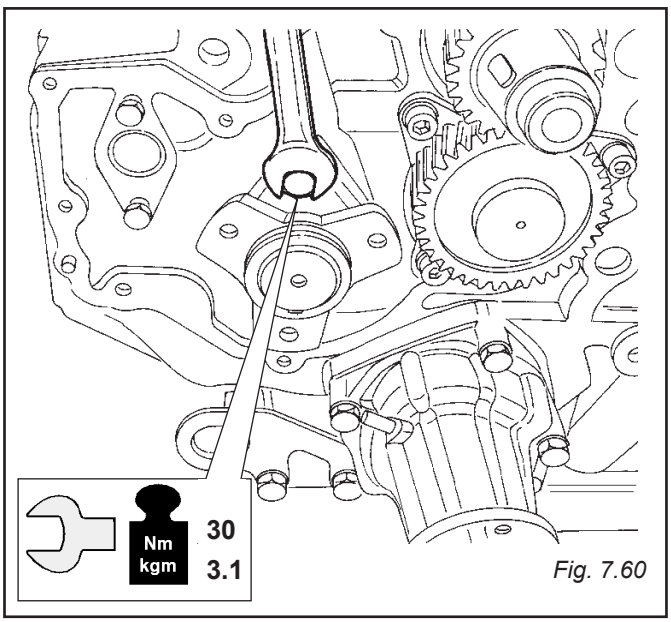


Fig. 7.60

(Fig. 7.61)
Determine # 1 piston T.D.C. usig special tool
(TAB 11.1. ref. R)

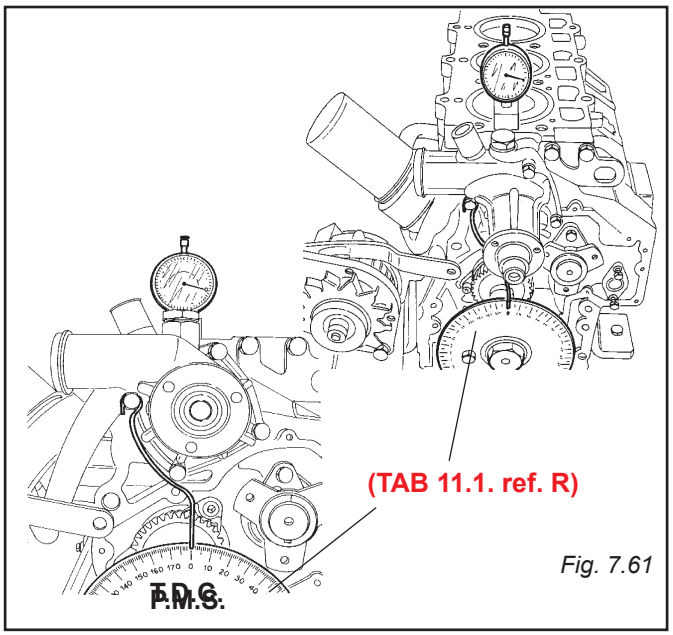


Fig. 7.61

(Fig. 7.62)
Introduce # 2 cam followers
Introduce # 2 push rods.
Turn the camshaft and identify the balance or rocking position (exaust valve finishes closing and intake valve starts opening) referred to piston # 1.
This is commonly referred to as the valve overlap position.

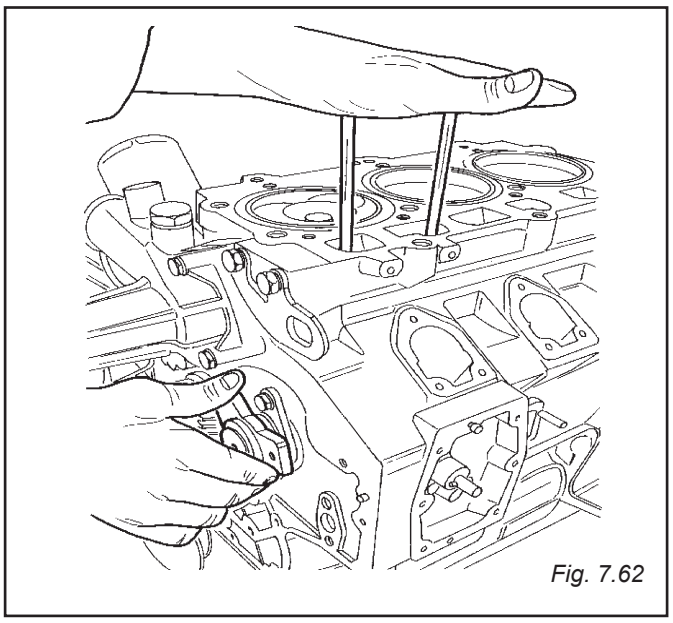


Fig. 7.62

(Fig. 7.63)
Position the camshaft gear.
The holes on the camshaft flange have to be in the center of the gear slot.
The governor gear has not to be timed.

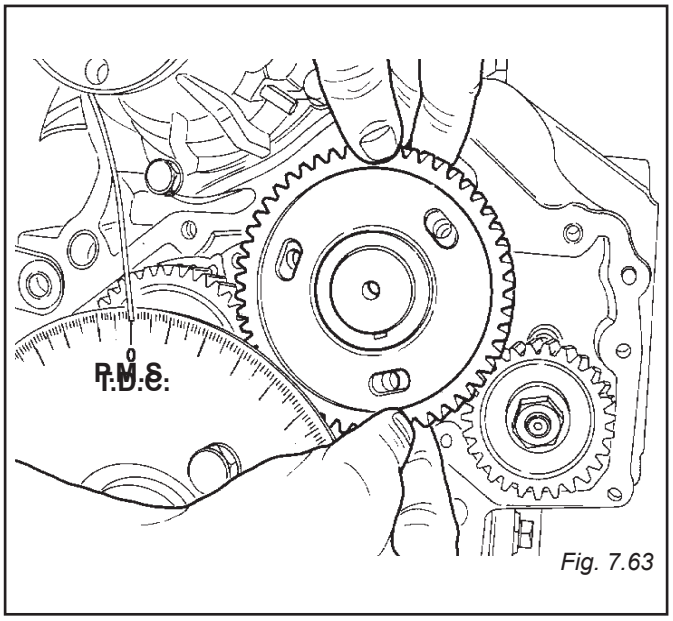


Fig. 7.63

(Fig. 7.64)
Install # 3 camshaft gear bolts but tigh only one bolt.
At this point make complete crankshaft turn (360°) to bring the piston # 1 on compression stroke.

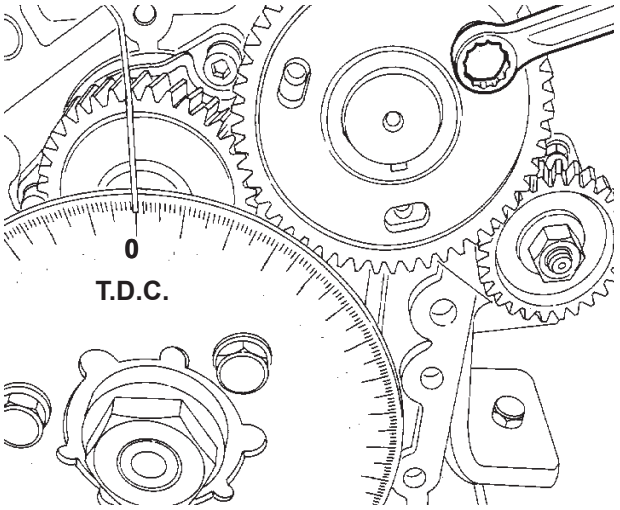


Fig. 7.64

(Fig. 7.65)
Install governor spacers **(A)** and bearing **(B)**

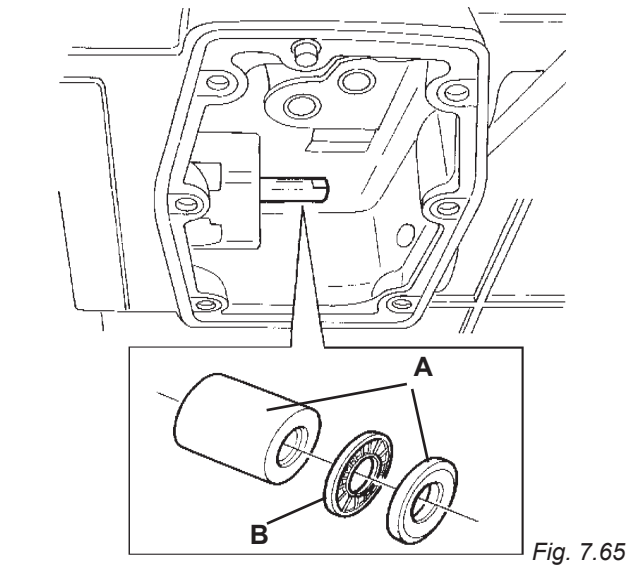


Fig. 7.65

(Fig. 7.66)
Install the governor assy.

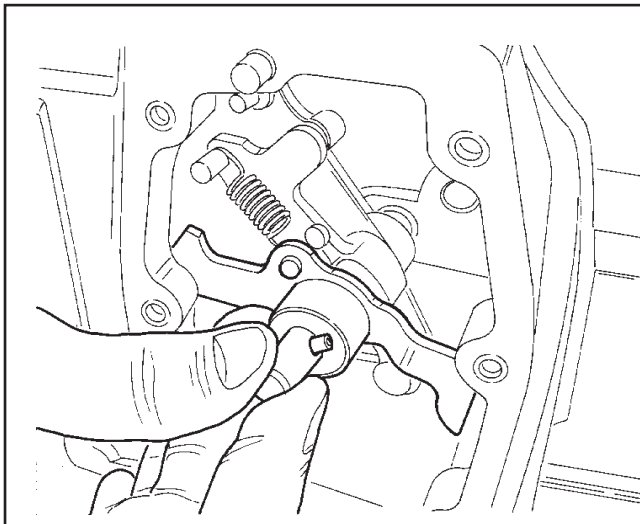


Fig. 7.66

(Fig. 7.67)

Install the bushing **A** on the injection pump connecting rack B.

Grease the o-ring **C**.

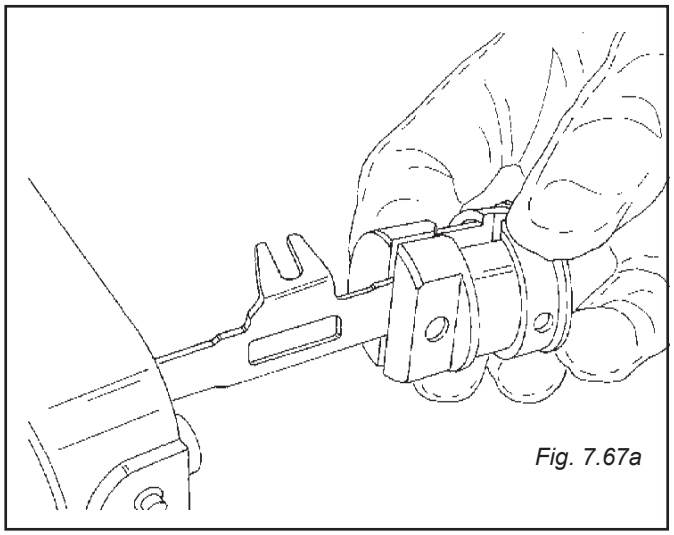


Fig. 7.67a

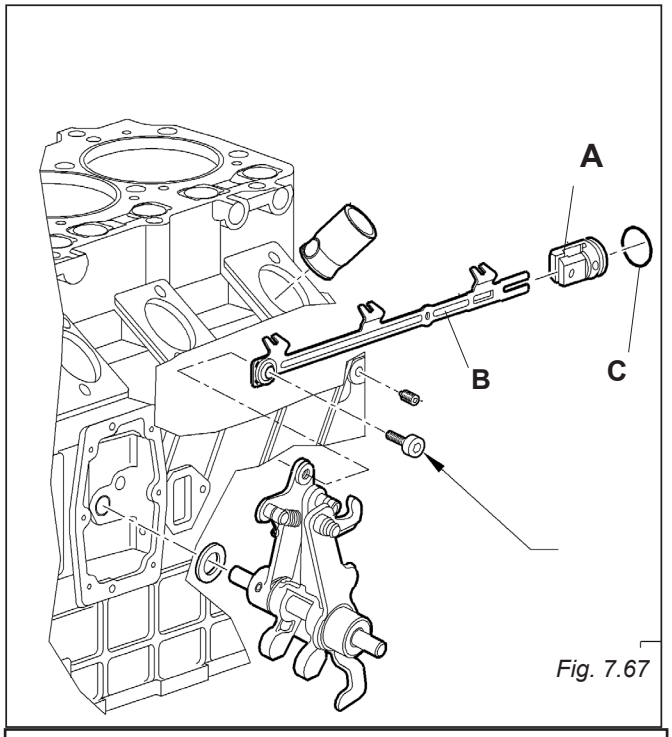


Fig. 7.67

(Fig. 7.68)

Position the connecting rack on the governor assy.

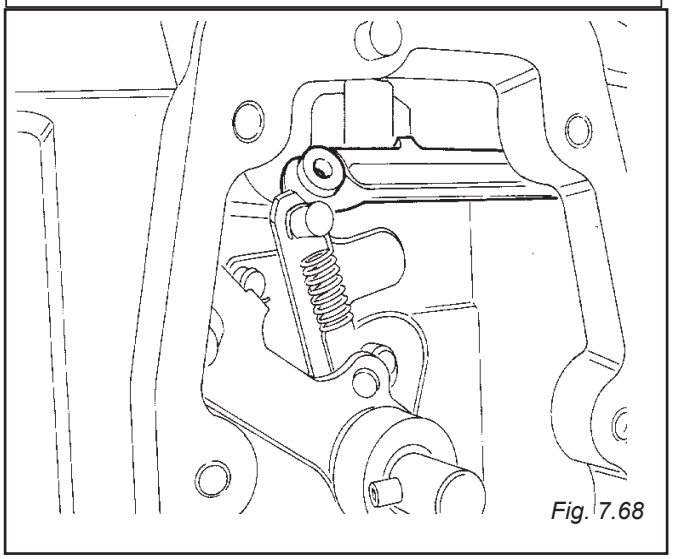


Fig. 7.68

(Fig. 7.69)

Install the rack spit pin **A for injection pump old model or** tighten fixing screw **B for new model of high pressure injection pump.**

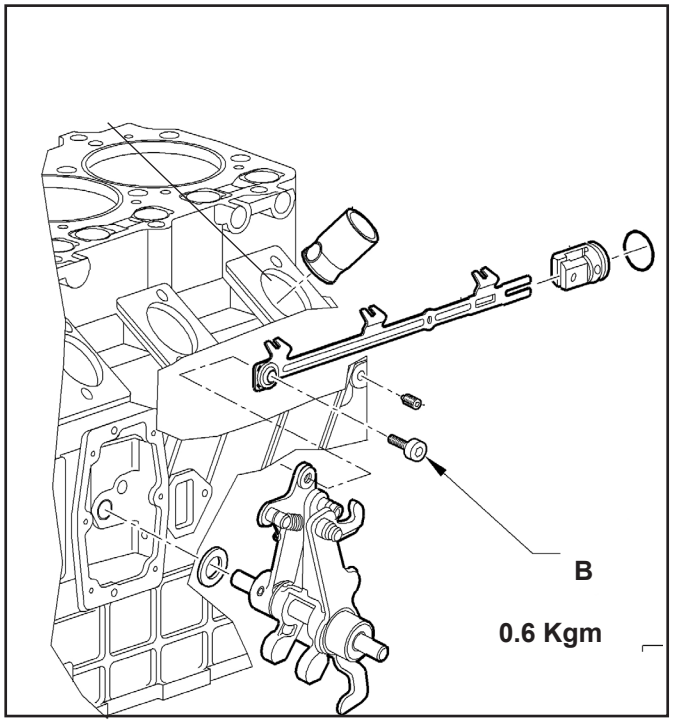
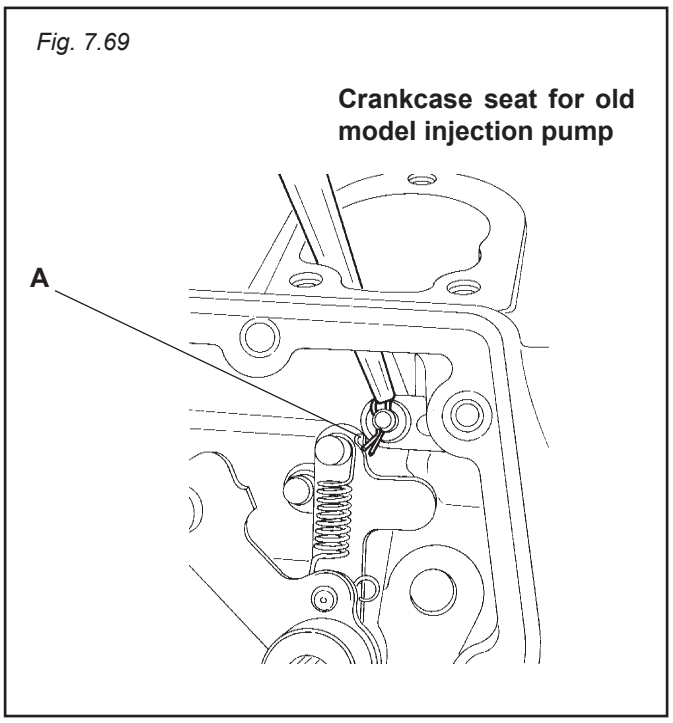


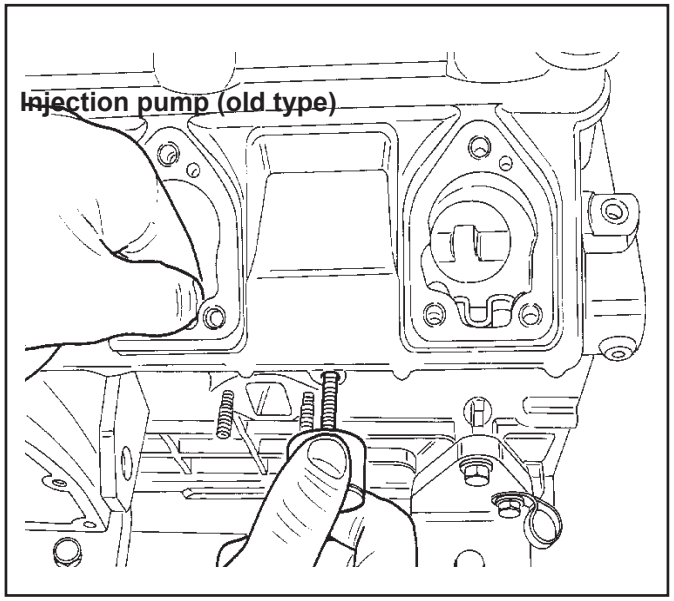
Fig. 7.69

Crankcase seat for old model injection pump



Install special tool **(tab. 11-8 ref. U)** to lock the pump connecting rack in the center position.

Screw the tool into the specific rack hole.



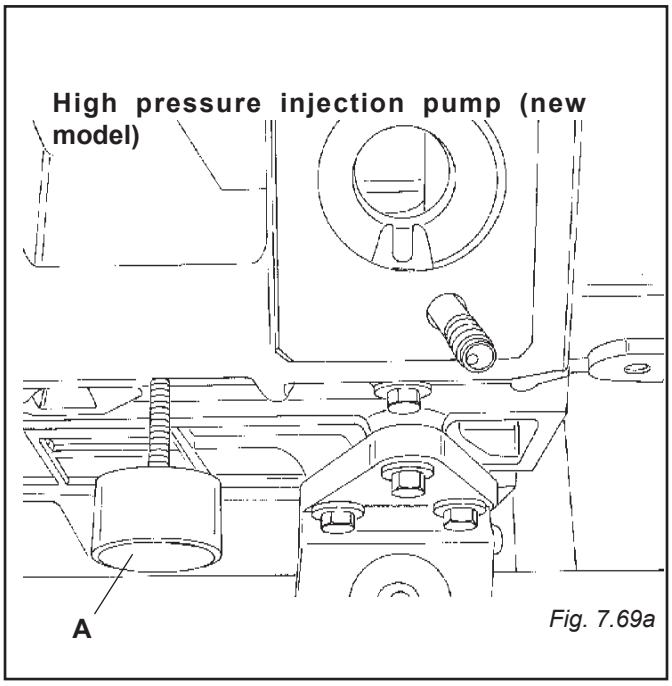


Fig. 7.69a

(Fig. 7.70)

Introduce the connecting rack support **(B)** and tight the dowel **(A).**

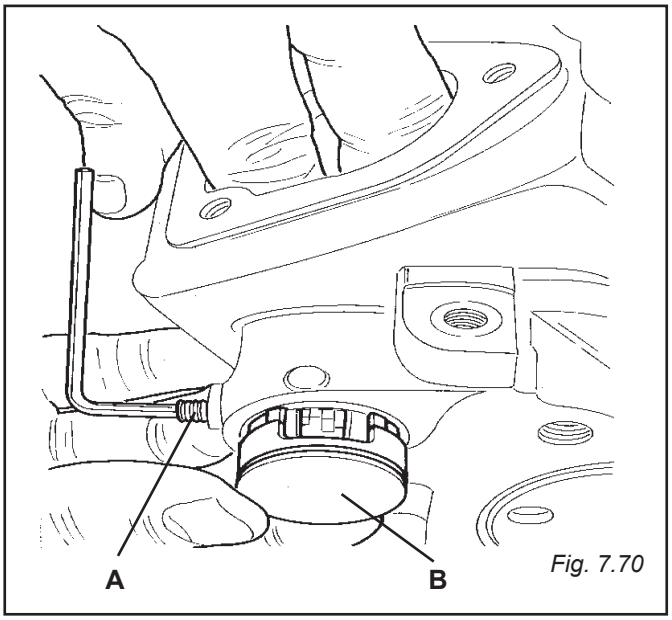


Fig. 7.70

INJECTION PUMP SHIMMING

Old injection pump

(Fig. 7.72)

Position the camshaft so that the injection pump cam is in rest position (pointing downwards) (**B**)

Using a depth gauge **(A)**, measure the distance between the pump mounting surface and the cam.

At the quota shown, add thicknesses until obtaining the correct height, which should be 82.8 mm.

For example:

Measure on depth gauge = 82.1mm

Injection pump height = 82.8 mm

Difference: 82.8 - 82.1 = 0.7 mm

Available spare parts thicknesses:

0.10 mm

0.30 mm

Thicknesses to add = 0.30+0.30+0.10 = 0.7 mm

82.1 + (0.30 + 0.30 + 0.10) = 82.8 mm.

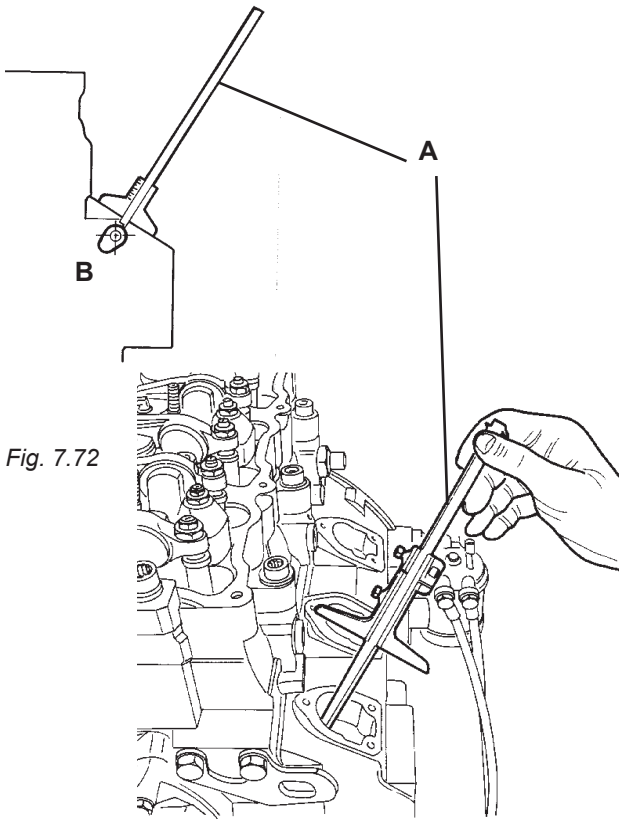
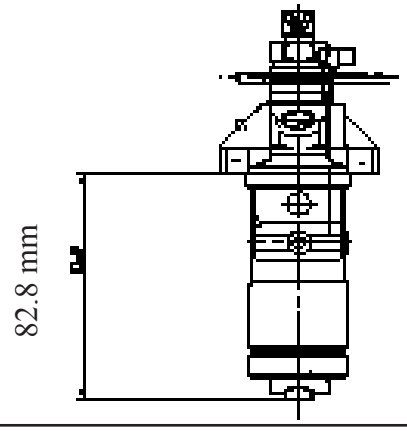


Fig. 7.72

Height of old type injection pump



ONLY FOR BOSCH INJECTION PUMP

Whenever a value other than “zero” is indicated (see **A** in fig. 7.73) on the flange of the pump, a further thickness equal to the value indicated must be added to those already inserted. This operation is necessary to recuperate the movement of the pump itself.

The marked value corresponds to:

+ 1 = 0.1 mm

+ 2 = 0.2 mm

+ 3 = 0.3 mm

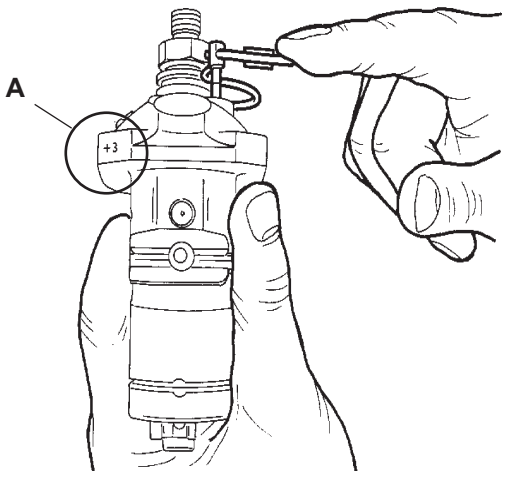


Fig. 7.73

ASSEMBLY PUMP (BOSCH/STANADYNE OLD TYPE)

ONLY FOR BOSCH PUMP

Place the pin (**C**) of the rack at the centre of the pump and block it with the apposite stop (**A**), See special tool **(Tab. 11-1 ref. V)**.

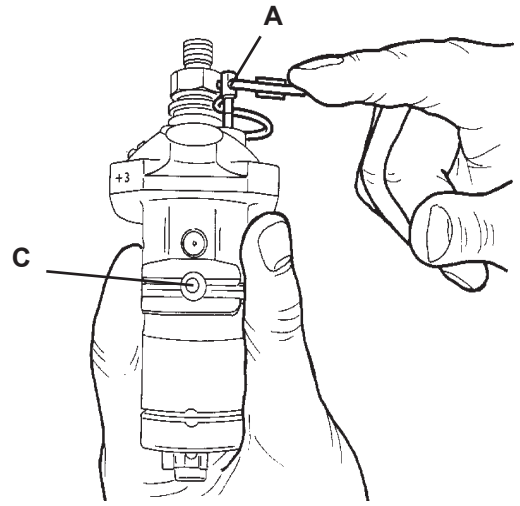


Fig. 7.75

ONLY FOR STANADYNE PUMP

Position the delivery lever (**C**) rack in the middle of the pump and lock it by rotating the lock pin **(B)** through a rotation of 180°.

The lock pin (**B**) identifies Stanadyne pumps

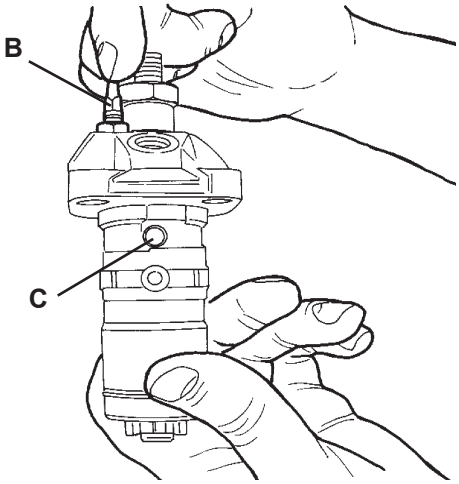


Fig. 7.74

(Fig. 7.76)

Apply Loctite 573 on the pump shim (both sides).

Position the shim on the block.

Assembly the pump.

On the silk-screened steel shim does not apply loctite 573

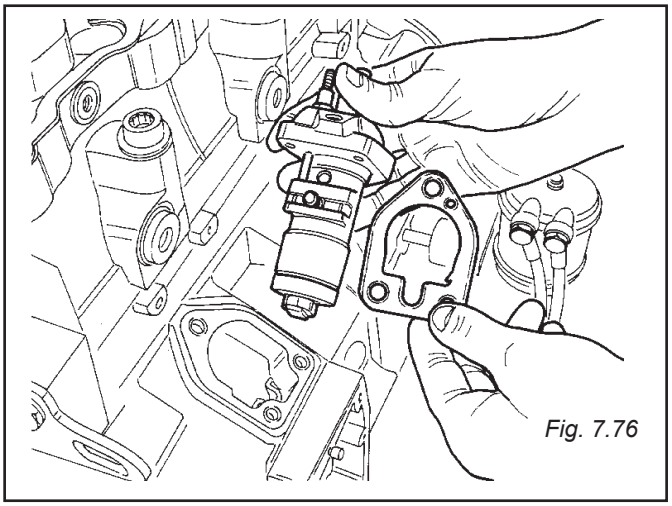


Fig. 7.76

(Fig. 7.77)

Tight the # 3 inblock pump bolts to **27.8 Nm - 2.8 kgm.**

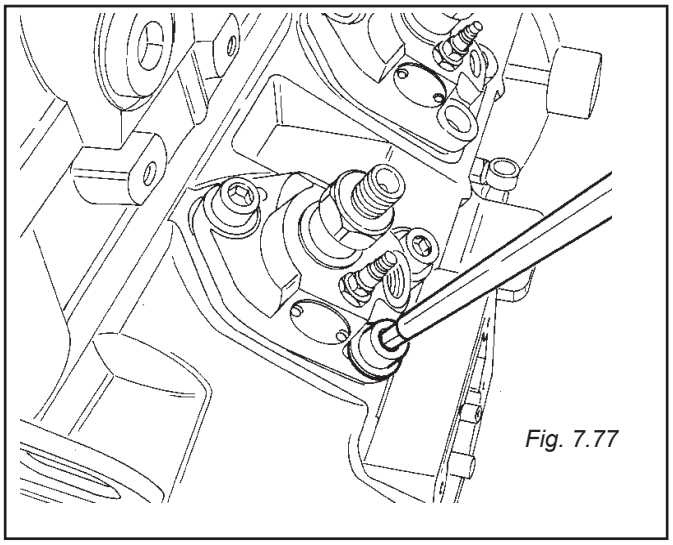


Fig. 7.77

Insert tappets (**A**) into their seat as in the illustration until they rest on the camshaft.

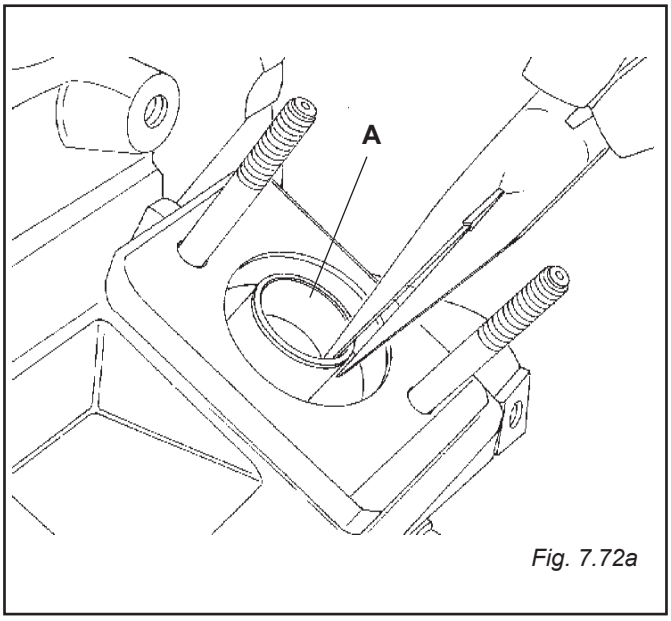


Fig. 7.72a

With the help of a good depth gauge measure the distance between the pump support and the interior of the tappet.
With the measured value, calculate the thickness needed to put beneath the injection pump to reach the predetermined quote

56± 0.05 mm (55.95 - 56.05 mm) (see figure 7.72.f)

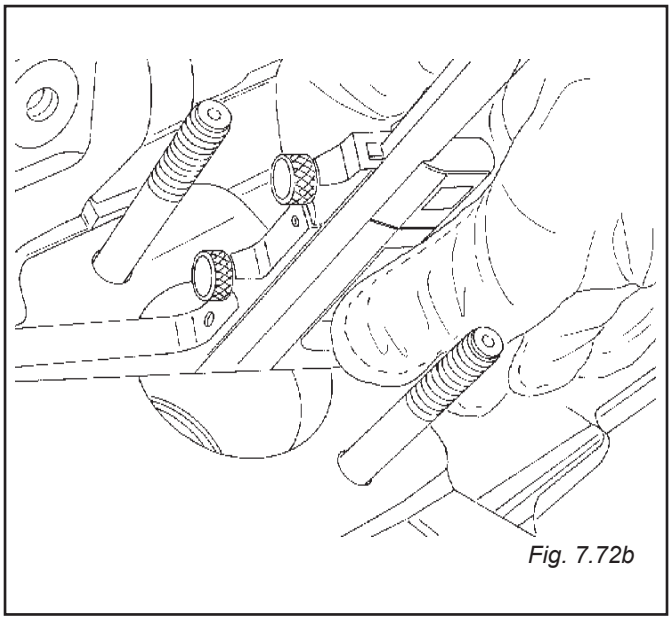


Fig. 7.72b

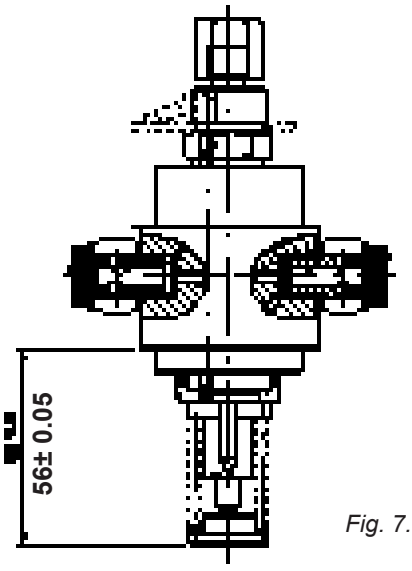


Fig. 7.72f

¡APPET

OLD THICKNESS (without sealing)

Insert the pump into its proper seat, remembering to interpose eventual thicknesses and to insert the pin of the rack rod into the apposite niche of the previously blocked pump connecting rod.
N.B. apply Loctite 573 onto both faces of the thicknesses before putting them in position.

**THE USE OF LOCTITE IS BOUND ONLY TO THE USE OF METAL THICKNESSES WITHOUT ANY SEALING.
IN THE NEW THICKNESS VERSION, THE USE OF LOCTITE IS NO LONGER NECESSARY AS IT IS ALREADY PROVIDED WITH A SEALING.
(SEE FIG. 7.73.2C)**

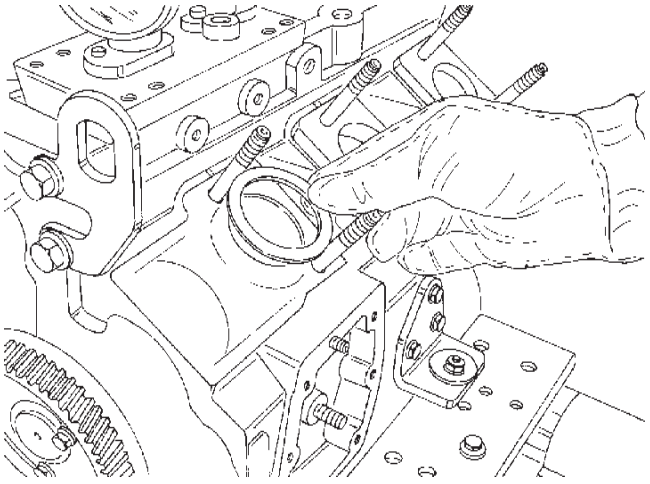


Fig. 7.72c

NEW THICKNESS (with sealing)

(Fig.7.73.2c)

When 2 thicknesses are used, as a result of the addition of the thicknesses of the seal, a further 0.05 mm has to be added to the quota,

e.g.:

Value measured with depth gauge: **55.40 mm**

Predetermined quote of inj. pump: **55.95 - 56.05 mm**

Difference "a" (see chart): **0.65 - 0.55 mm**

Available thicknesses at spare parts:

0.10, 0.20, 0.30, 0.40, 0.50 mm.

Thicknesses to add: **0.30 + 0.30 + (0.05)= 0.65mm oppure 0.30 + 0.20 + (0.05) = 0.55mm.**

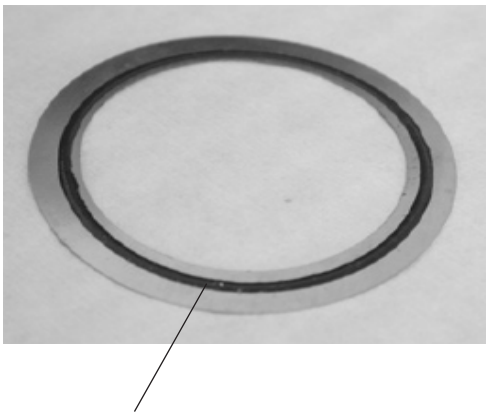


Fig. 7.73.2c

The new silk-screened gaskets have been inserted into the following numbers:

D703E2 number 15C-02583
D703TE1 " 16C-02782
D703TE2 " 16C-30001

D700 E2_E3 injection pump shimming chart

a = difference

SPESSORAZIONE POMPA INIEZIONE MOTORI D703TE2/E2/E3 ⓐ Injection pump shimming engine D703TE2/E2/E3		
LETTURA COMPARAT. a Compare reading	SPESSORAZIONE Shimming	CODICE Code
0.070 - 0.170	0.1	22022135
0.171 - 0.270	0.2	22022136
0.271 - 0.370	0.3	22022137
0.371 - 0.470	0.4	22022138
0.471 - 0.570	0.5	22022139
0.571 - 0.670	N°2 GUARNIZIONI DA 0.3 N°2 gasket thk.0.3	N°2 Pz. 22022137

(Fig.7.73a / 7.73b)

Equip yourself with a pump and a stop **(Tab.11-1 ref. AC)**.
Compress the spring of the pump until obtaining the free rotation of the rack rod (**A**), insert stop (**B**) into the apposite hole on the upper part of the pump and make it penetrate into the corresponding hole on rack rod (**A**), see Fig.7.73b.
Release the spring and check that the rack rod is well blocked.
If this is not so, repeat the operation.

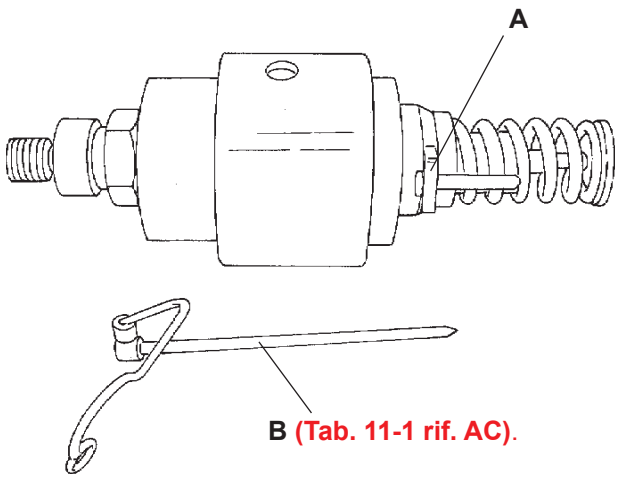


Fig. 7.73a

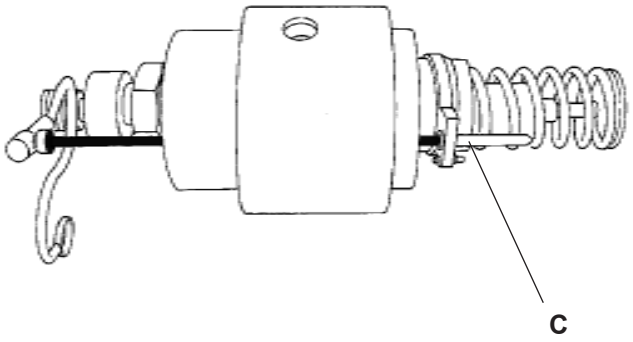


Fig. 7.73b

Insert the pump into its proper seat, remembering to interpose eventual thicknesses and to insert the pin of the rack **C** (fig. 7.73.b) rod into the apposite niche of the previously blocked pump connecting rod.Insert blocking flange (**A**) and then the respective nuts.

The procedure for screwing the blocking nuts is as follows:
- tighten both nuts to a 1 kgm couple (Nm 9.8) on all the pumps
- close the nuts again with a 1.5 kgm couple (Nm 14.7) on all the pumps
- complete the operation applying a couple equal to 1.8 kgm (Nm 17.6)

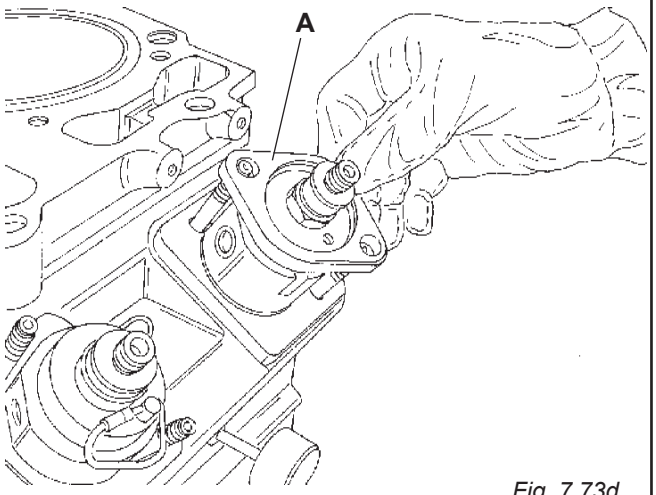


Fig. 7.73d

(Fig. 7.82)

Install the regulator travel stop screw **(A).**

Bring the delivery rack on stop position.

Screw in the screw untill it touch the regulator lever.

At this point screw in a further 1/4 of a turn and tight the nut.

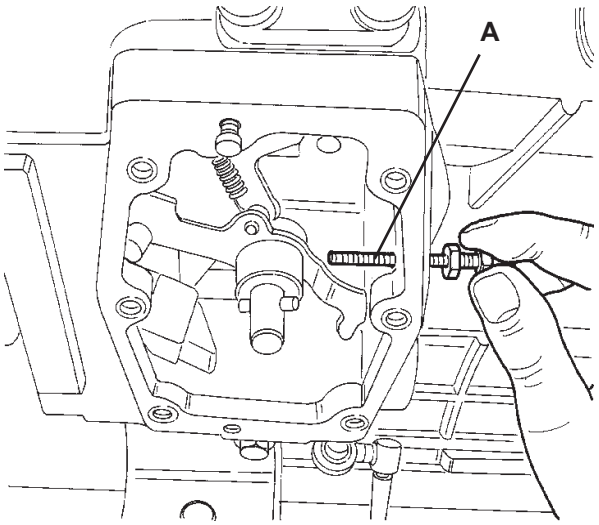


Fig. 7.82

(Fig. 7.83)

Install the fuel delivery screw **(B)** make sure that the painted mark **(performed during the disassembly)** are perfectly in line.

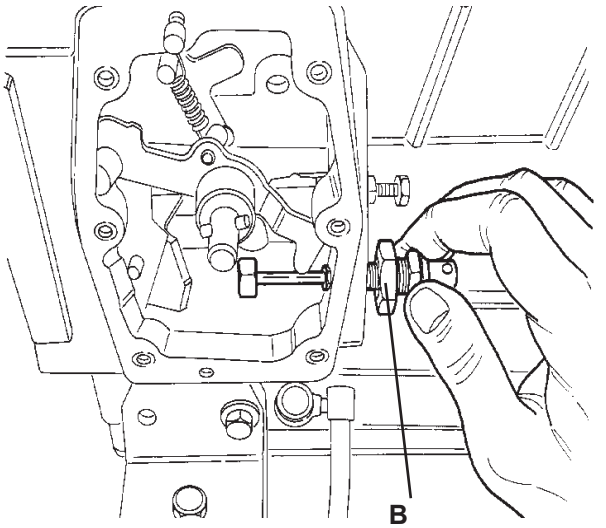


Fig. 7.83

(Fig. 7.84)

Position the regulator gasket **(A)**

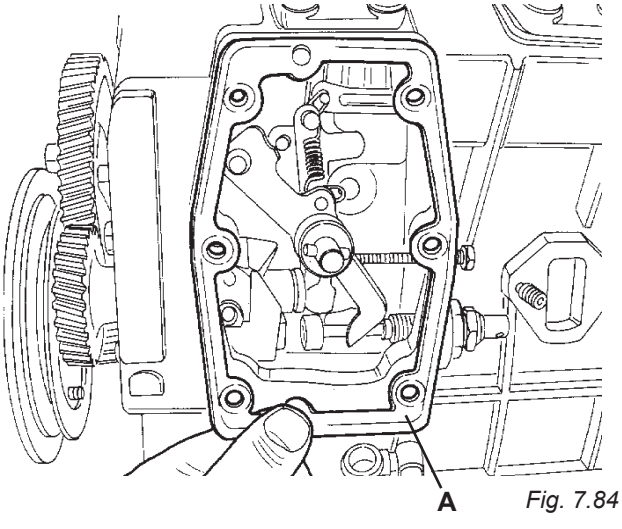


Fig. 7.84

(Fig. 7.85)
Assemble the governor spring circlip **(A)**

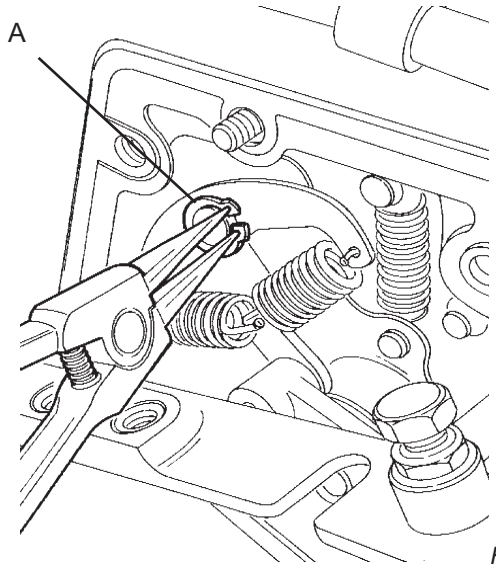


Fig. 7.85

(Fig. 7.86)
Tight the internal leverages (stop **B** and accelerator **A**) housing bolts (1-2-3-4-5-6).

NOTE: make sure that a spacer is correctly located in side (**C**) before install cover.

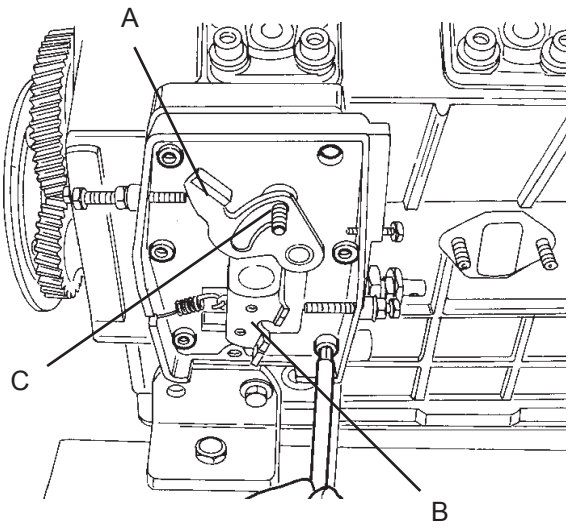


Fig. 7.86

(Fig. 7.87)
Install the cover guard

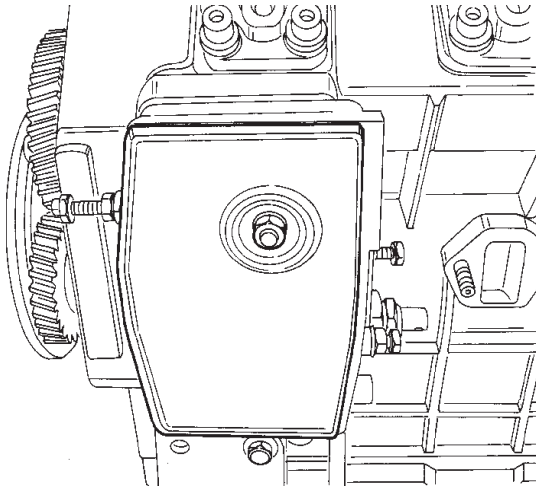
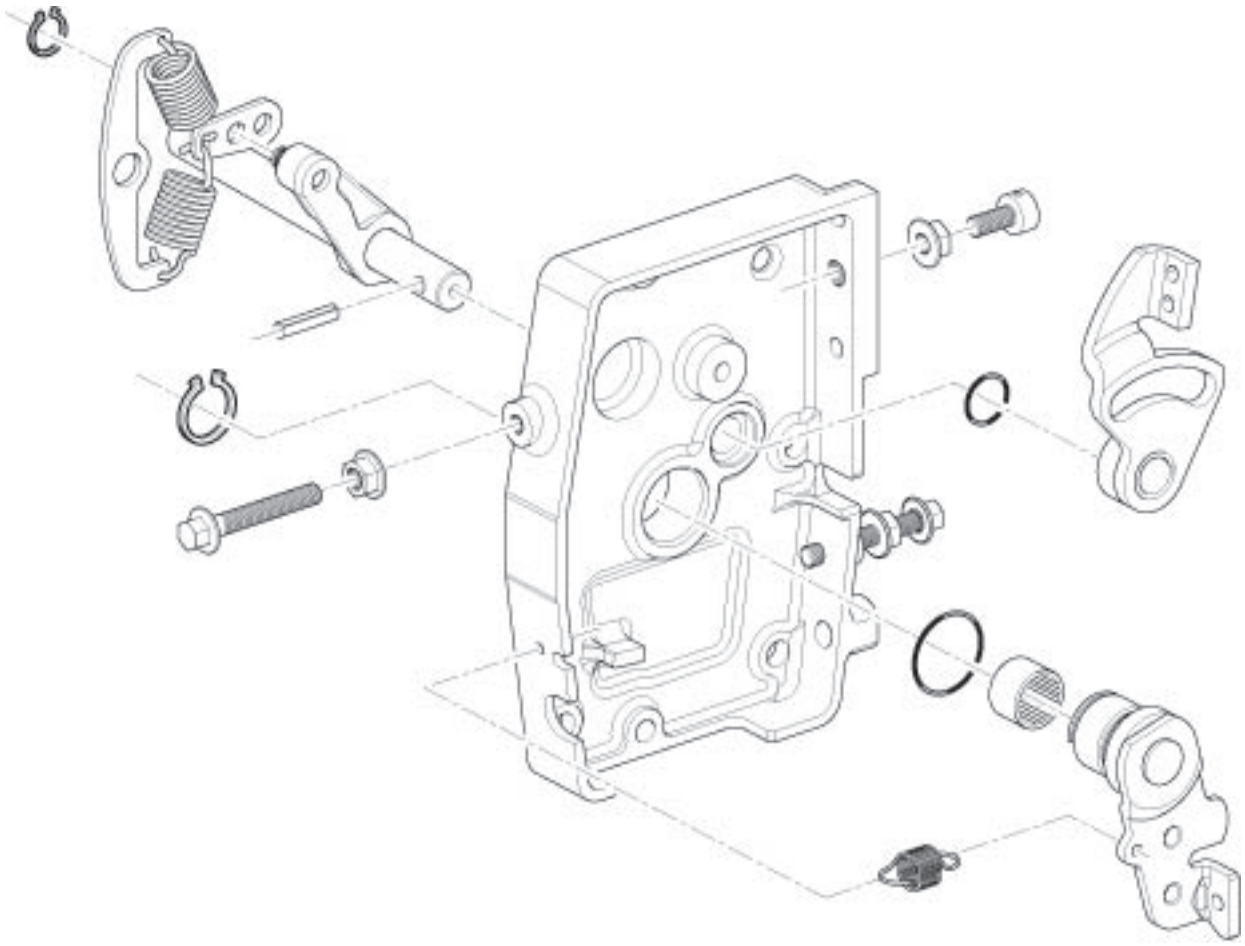


Fig. 7.87

Governor Cover - Exploded View



(Fig. 7.79b)

With a pipe (**A**) and a banjo connect the intake side of the lift pump with the external plastic tank (**C**).

Put the fuel return pipe (**B**) into the plastic tank.

Now we have a "closed fuel circuit, start pumping on the lift pump, pump till you see fuel coming out from the return line (**B**).

Now the circuit is full and without air into the circuit.

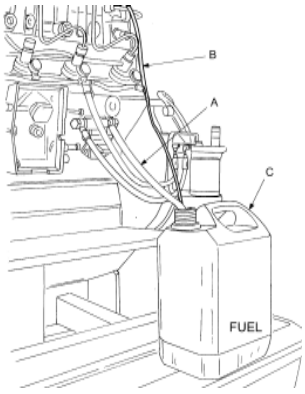


Fig. 7.79b

FUEL

Stanadyne pump

Release the pump delivery lever rack.

Pull up the lock pin **(A)** and rotate it through 180°.

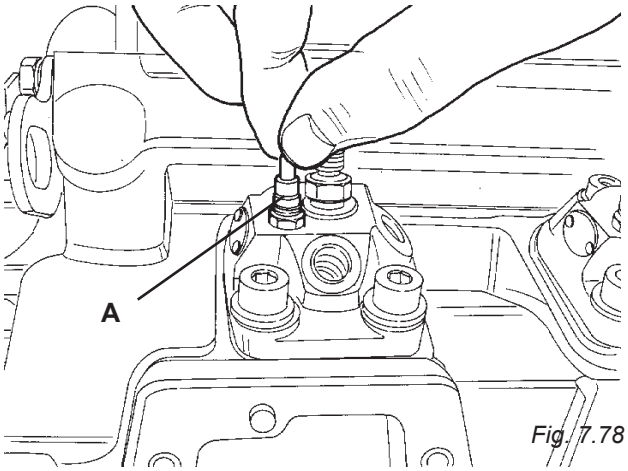


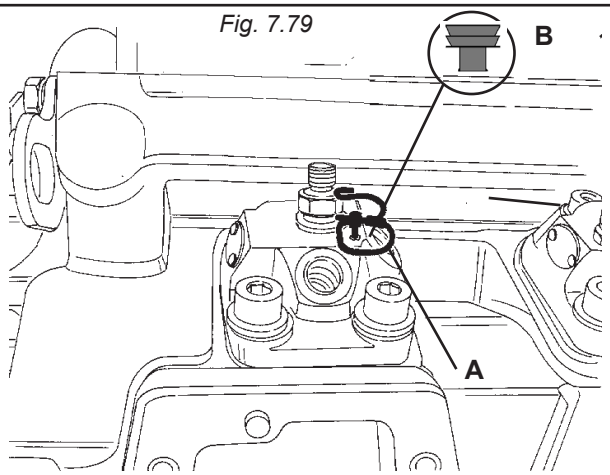
Fig. 7.78

Bosch pump

Release the pump delivery lever rack by removing the hook **(A).**

Close the hole with the plastic cap **(B)** VM P/N 41772088F

Fig. 7.79



HIGH PRESSURE INJECTION PUMP NEW TYPE

Release the pump delivery lever rack by removing the hook **(A).**

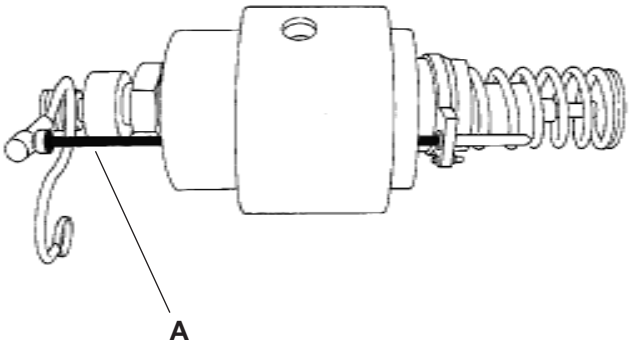


Fig. 7.73b

Turn the cranckshaft 45° ÷ 50° clockwise and anti clockwise until you see that the fuel moves on top of the injection pump plunger; at this point blow the fuel away, with your mouth.

Be sure that the injection pumps rack lever is free.

(Fig. 7.79a)

To fix the connecting rack in the middle position, fitting there are two way.

Fitting the special tool (**A**) **(TAB. 11.1 ref. V)** ,the stop blocking rack rod or special tool (**A**) **(TAB. 11.1 ref. U)** fig. 7.81.

While introducing the special tool, into the pumps connecting rack or into the pump, work on the stop lever: it has to be in the middle position fig. 7.79a.

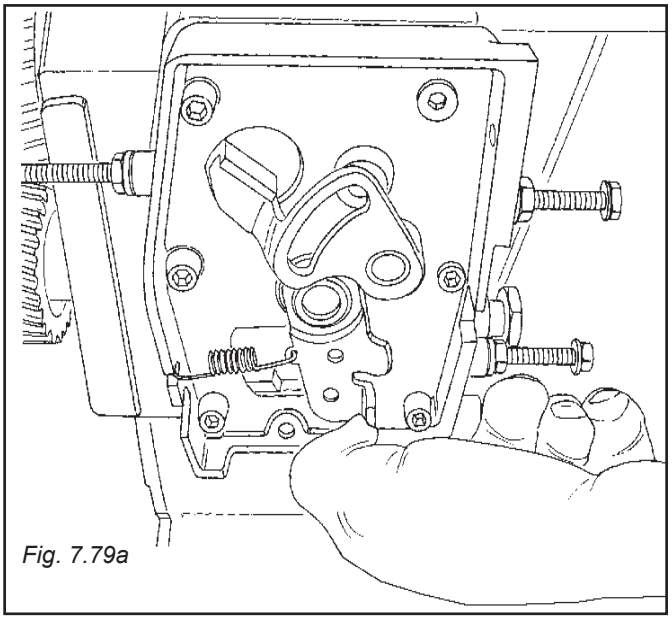


Fig. 7.79a

(Fig. 7.80)

Assembly special tool (**A**) **(TAB. 11.1 ref. Y)** on the pump delivery union.

Turns crankshaft till fuel is into the special tool (**A**).

Verify that piston # 1 is at TDC on compression stroke

Bring the crankshaft 50° ÷ 60° before TDC, turning it in a counter clockwise direction.

Slowly turn the crankshaft clockwise (use a commercial tool of 41 mm) as soon as fuel starts to move on the trasparant gauge tip (**A**) stop turning the crankshaft. That is the start point of the injection.

To be sure repeat the operation a couple of times.

On the crankshaft timing disk read the pump delivery value which must correspond with the injection advance value; see table at chapter 6 pages 6-26 and 6-27.

Note: If the point of injection beginning is retarded or advanced, proceed as follows:

- Loosen camshaft gear screws and turn camshaft flange left to advance, or right to retard until correct timing is obtained.

- Tighten # 3 camshaft gear screws to 30 Nm - 3.1 Kgm

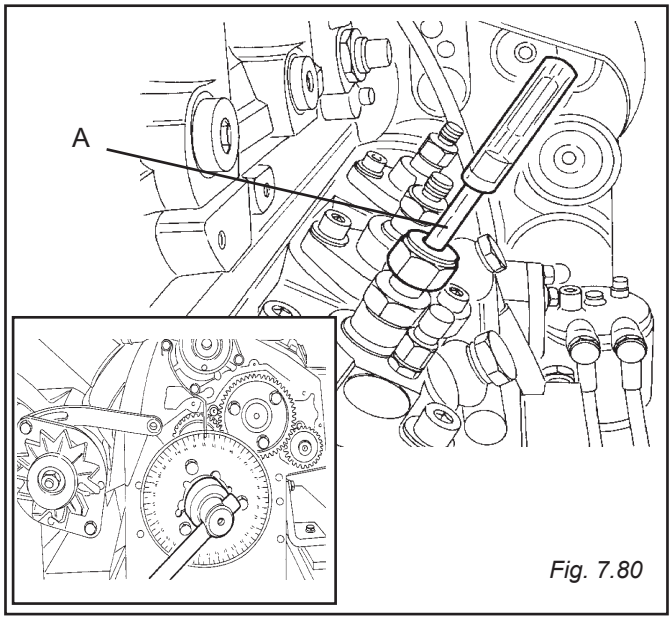


Fig. 7.80

(Fig. 7.81)

Relase the rack by removing the lock pin tool **(A)** **(TAB.11.1 ref. U)**.

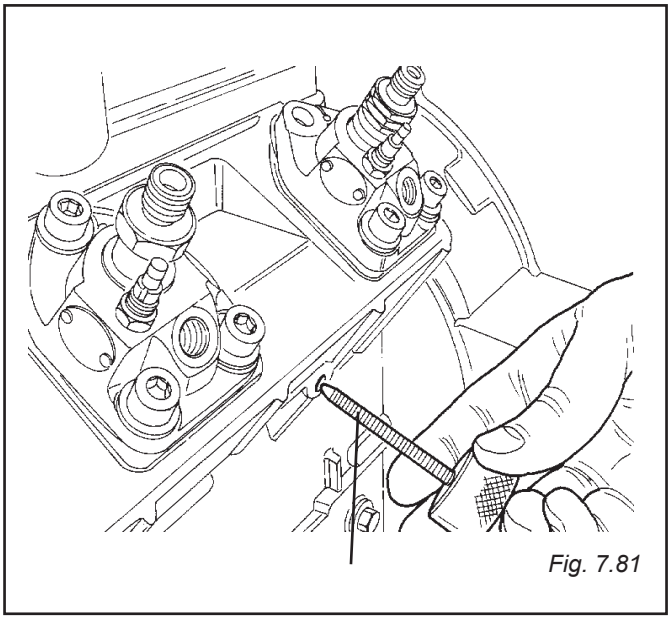


Fig. 7.81

(Fig. 7.81a)

Note: in case you do not have the graduated disck available, for istance you are out in the field, proceed as follow.

With a calibre measure the distance between the TDC mark and advance mark.

Pulley diameter x 3.14 / _____360°

e.g.: pulley diameter = 151.5 mm

151.5 x 3.14 = 1.32 mm

1° = 1.32 mm

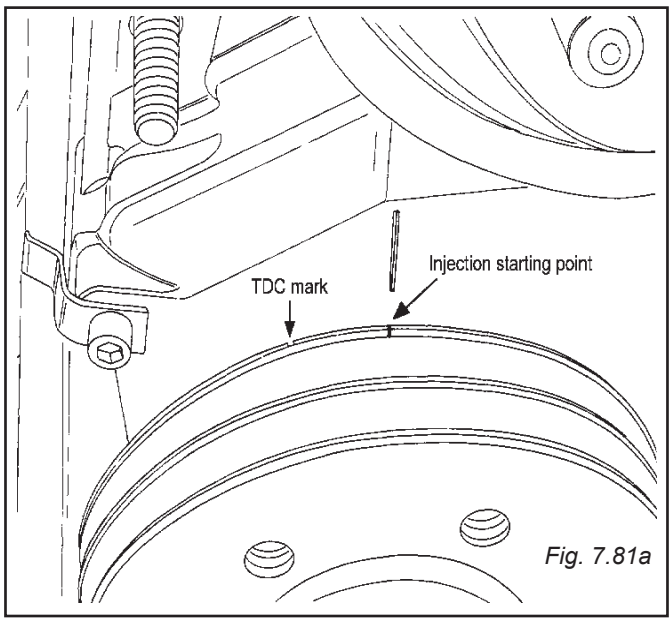


Fig. 7.81a

7.44 D703 PUMPS BALANCE PROCEDURE

(Fig. 7.88 - 7.89)

1. Remove #3 threaded caps on the top of the exhaust manifold (one for each cylinder).
2. Introduce #3 thermocouples. Be sure to introduce the thermocouples into the exhaust manifold at the same depth (Fig. 7-88).
3. Start the engine.
4. Let the engine runs until it reaches the operating temperature.
5. Measure the temperature of the exhaust gas at each cylinder at **1800 rpm**.
6. If you have correctly followed the pump timing procedure you should have the measurement at each cylinder with a tolerance no more than **5°C**.
7. If the measurement at each cylinder is higher that **5°C** proceed as follow:

a) Take in consideration one pump at a time

b) Loose the three pump bolts

c) Adjust the fuel pump delivery by slightly rotating the body of the pump:

- To increase the fuel pump delivery, or exhaust temperature, rotate the pump clockwise.
- To decrease the fuel pump delivery, or exhaust temperature, rotate the body pump counterclockwise (Fig. 7.89).

Note: this step has to be carried out until the tolerance at each cylinder is no more than **5°C**

8. Tight #3 pumpe bolts.
9. Remove #3 thermocouples.
10. Screw in #3 caps on the exhaust manifold.

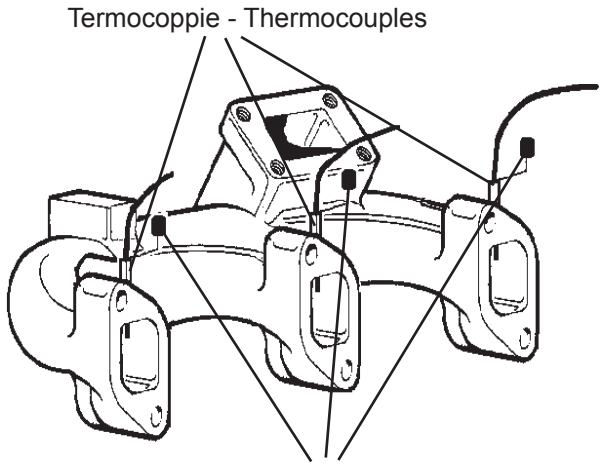


Fig. 7.88

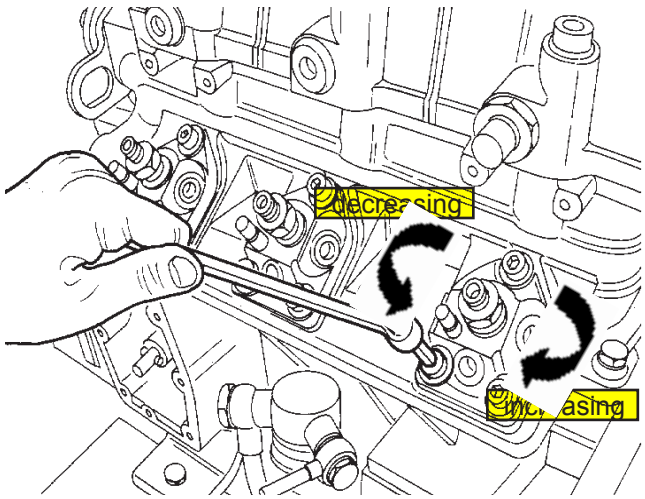
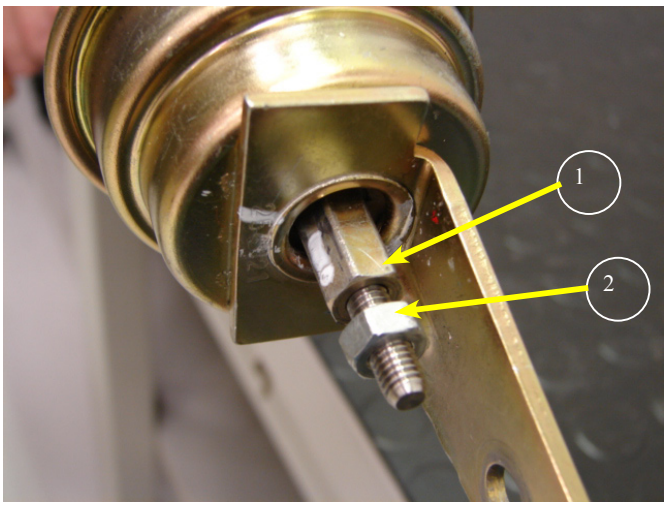


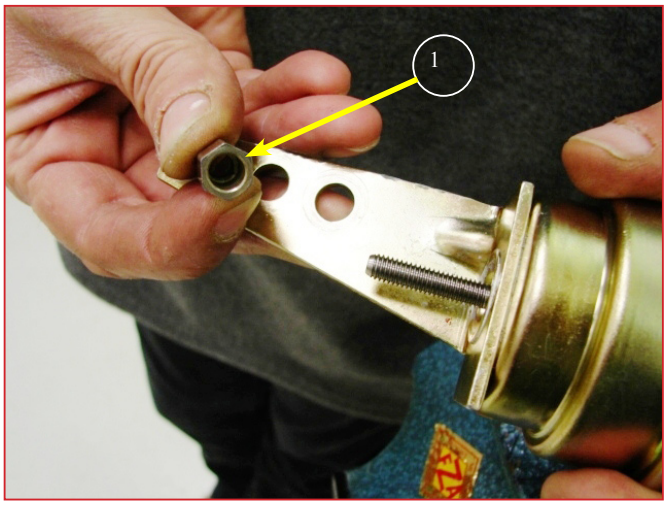
Fig. 7.89

7.45 LDA VALVE

Install special screw 1 on LDA threaded stem valve and screw it by 3 turns and half in order to pre-load the internal spring of LDA valve.

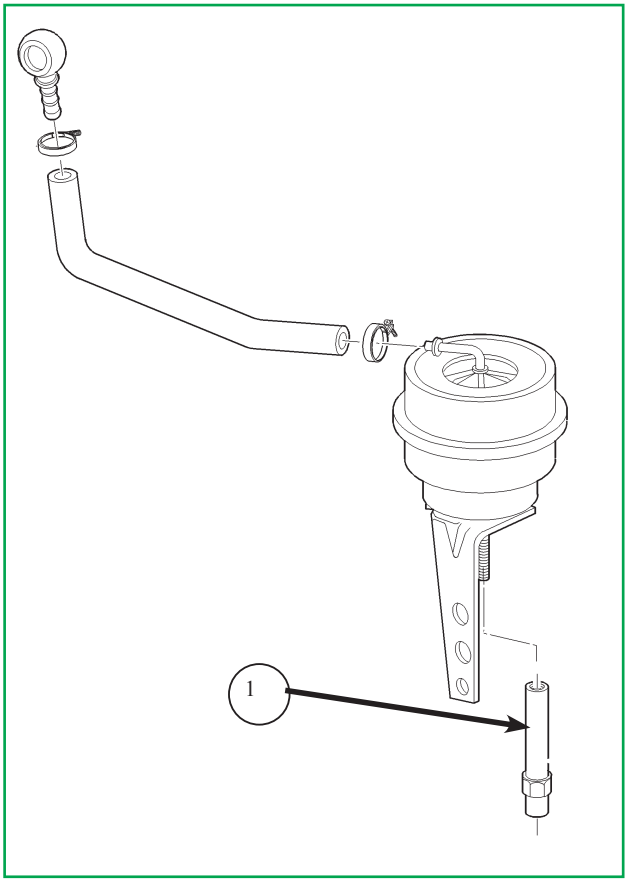


Make reference marks on LDA valve bracket and on special screw 1 in order to facilitate 3 turn and half .

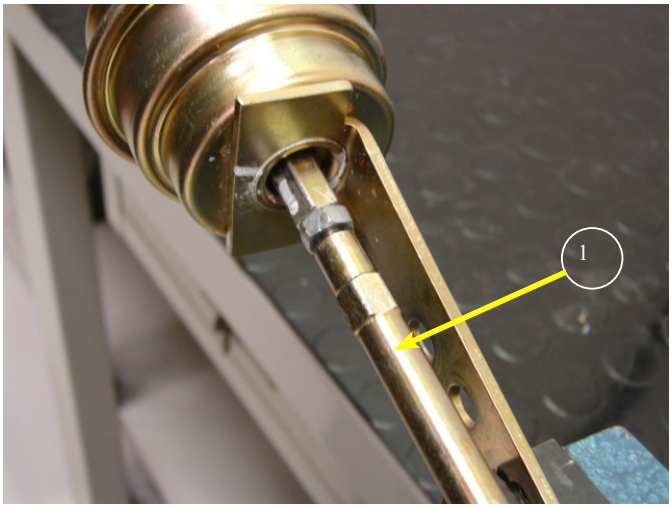


The special screw shows a side not threaded (1): install this side towards LDA threaded stem valve so that the threaded side is towards the bottom.

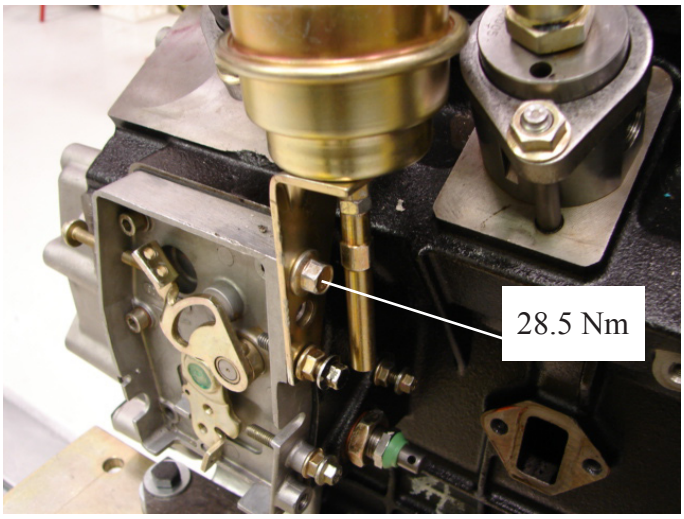
Once that the special screw is installed, secure it through the fixing nut 2



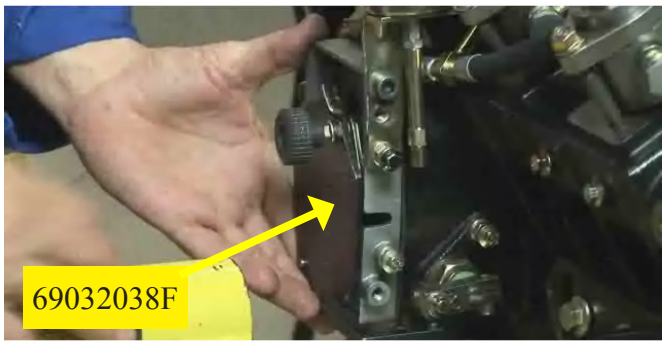
Install the special fitting 1 as shown in the picture and torque at 1,1 kgm



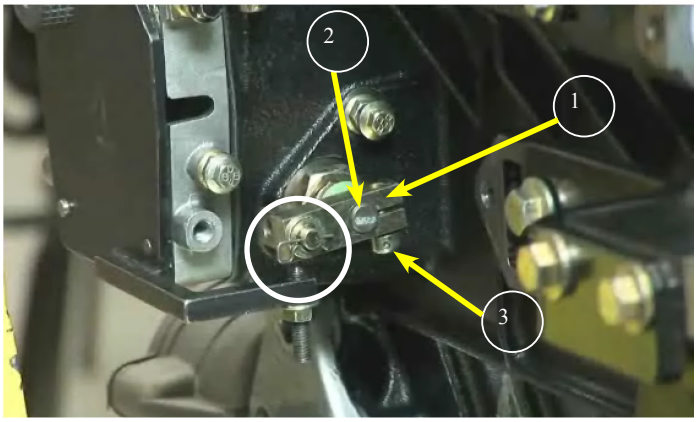
Install the LDA valve assembly on governor cover



Install lever 1 on pin 2.
Install **special tool 69032038F, chapter 11 Special tools - AL**

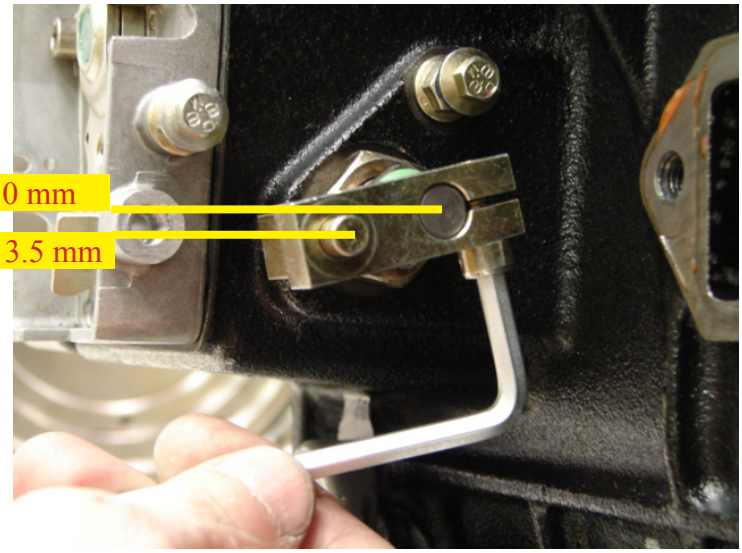


Bring into contact the lever 1 with pin 2.
Torque the screw 3.



If the special tool 69032038F is not available install the lever on the pin as shown in the picture:
the lever has to be lower than pin by 3,5 mm.
Torque the screw.

Position with pressure 0.9 bar

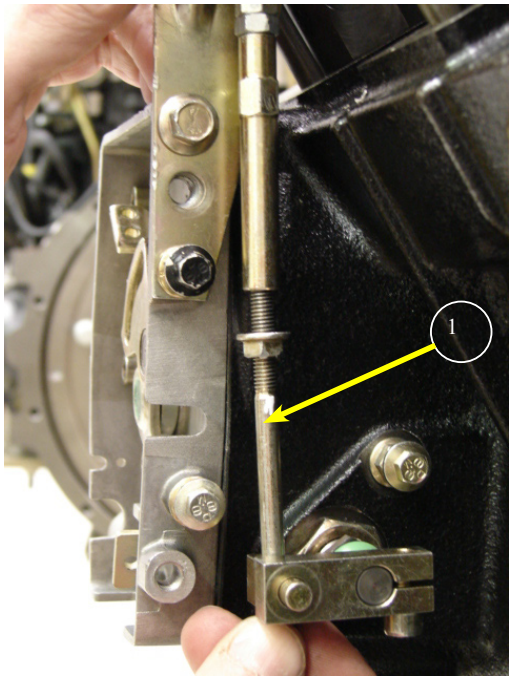


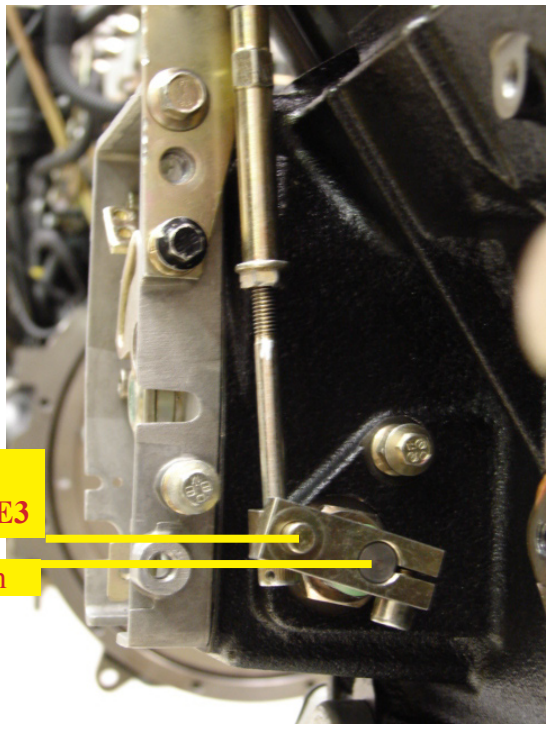
Screw the allen screw 1 by:

D703TE1 -
5 turns (like at 1.5 mm above "0")

D703LTE/LT/TE2/TE3/IE3
7 turns (like at 3.5 mm above "0")

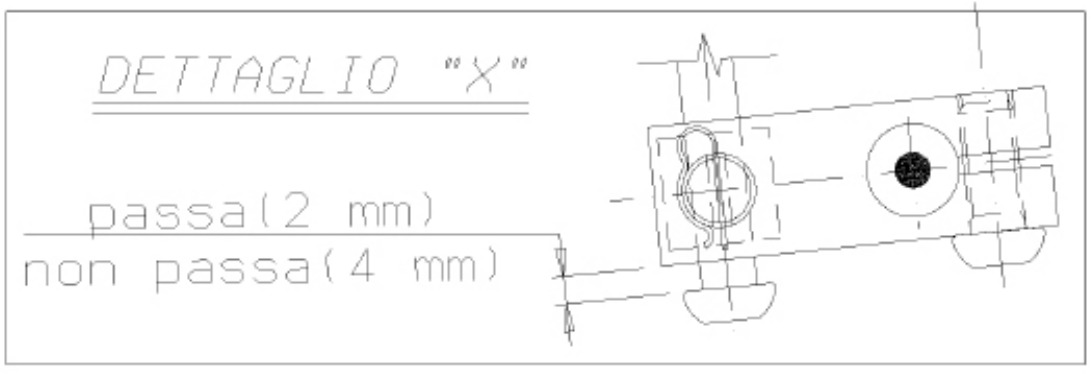
Secure the allen screw through the nut.





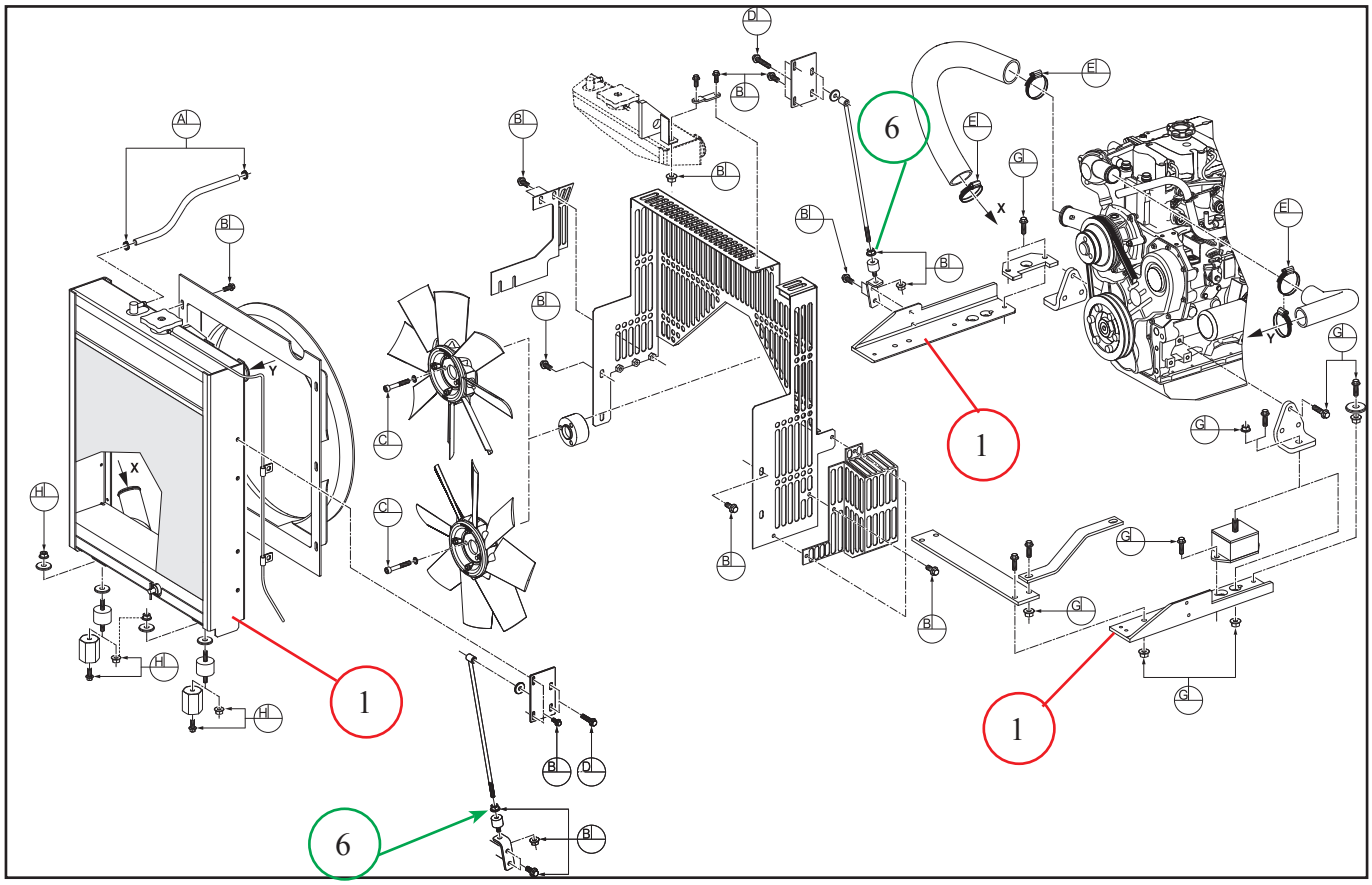
LDA SETTING FINAL CHECK

Apply air pressure at LDA valve inlet: apply air pressure 0,9 bar for engine models D703LT-LTE-TE1-TE2 and 1,1 bar for engine model D703TE3-IE3.
Check with go-not-go gauge (go 2mm) (not go 4 mm) the screw clearance in relation to the lever.



7.46 RADIATOR

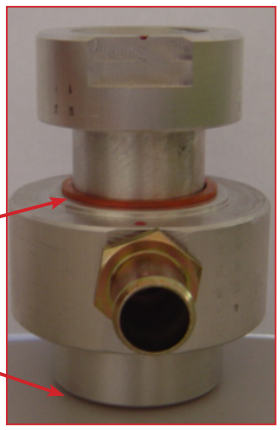
B = 10.8 Nm
C = 27.5 Nm
H = 35 Nm
D = 24.5 Nm
G = 47.1 Nm



1 Chek the perpendicularity of the brackets in relation to block and the perpendicularity of the radiator in relation to the brackets.

6 Install the vibration damper, position the rod and tighten the vibration damper nut.
Torque the nut indicated by the arrow.

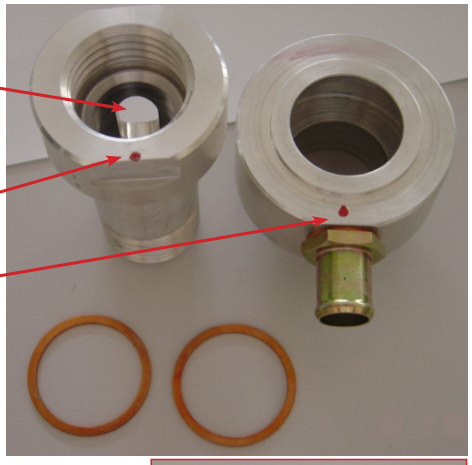
7.47 OIL SEPARATOR KIT INSTALLED ON ROCKER ARM COVER



GUARNIZIONE
WASHER

ASOLA "A"
SLOT "A"

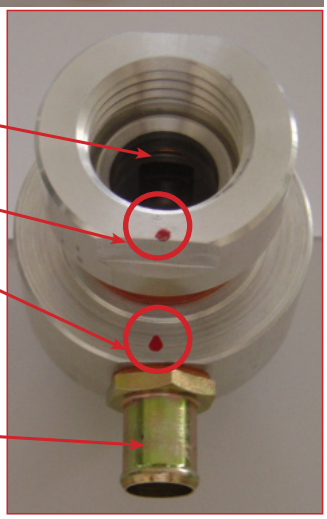
PUNTI ROSSI VERNICIATI
RED DOTS



ALLINEARE I 2 PUNTI ROSSI VERNICIATI IN MODO CHE L'ASOLA "A" SIA OPPOSTA AL BOCCHETTONE "B"

ALIGN 2 RED DOTS EACH OTHER SO THAT THE SLOT "A" IS OPPOSITE TO HOSE CONNECTION "B"

ASOLA "A"
SLOT "A"



BOCCHETTONE "B"
HOSE CONNECTION "B"

8.2 DIMENSIONS

8.2.1 Crankshaft

REF.	DESCRIPTION	DIMENSIONS
A	Diameter of front main bearing journal	62.985 ÷ 63.005 mm
B	Diameter of center main bearing journal	63.005 ÷ 63.020 mm
C	Diameter of rear main bearing journal	before the modification 69.985 ÷ 70.000 mm after the modification 79.985 ÷ 80.000 mm from serial number: 28B/03997 29B/03884 21B/06049 22B/06144 27B/02422
	Conicity of rear main bearing journal	-0.015 ÷ -0.030 mm
D	Diameter of crankpin con-rod	53.955 ÷ 53.940 mm
	Undersizer **A-B-C-D**	0.250 mm
A-B-C	Roughness	0.22 µm
D	Roughness	0.18 µm

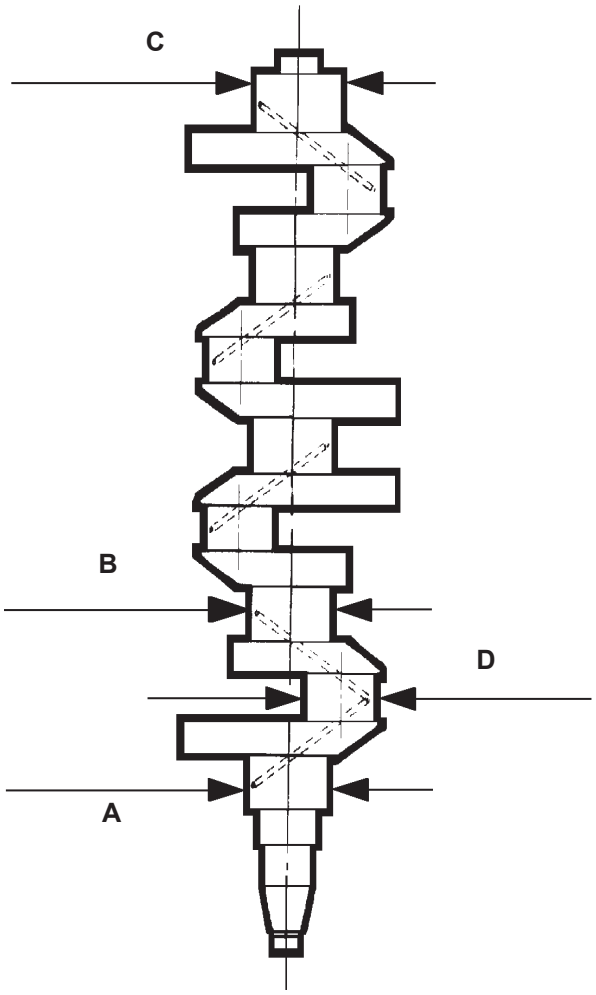


Fig. 8.2.1a

REF.	DESCRIPTION	DIMENSIONS
A	Radius	R = 3 0 /- 0.3 mm
B	Radius	R = 2.5 +/- 0.15 mm

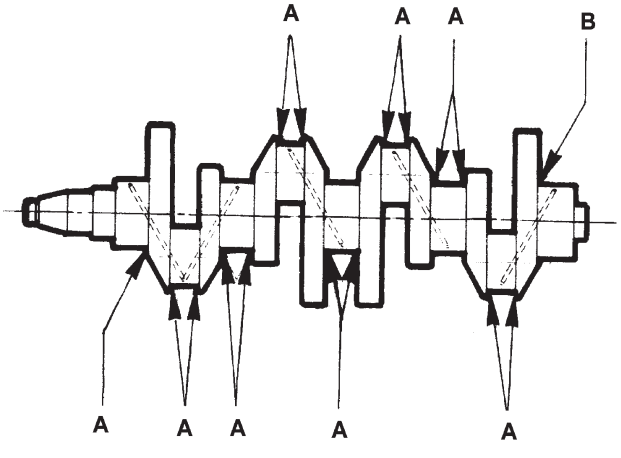


Fig. 8.2.1b

8.2.2 Camshaft

RIF.	DESCRIZIONE	DIMENSIONE
A	Diameter inlet - D703	38.550 ÷ 38.650 mm
A	Diameter inlet - D704/706	39.450 ÷ 39.550 mm
A1	Diameter exhaust	38.550 ÷ 38.650 mm
B	Lift inlet - D703	7.30 mm
B	Lift inlet - D704/D706	6.85 mm
B1	Lift exhaust	7.30 mm
C	Diameter front journal	53.495 ÷ 53.510 mm
D	Diameter central main journal	53.450 ÷ 53.470 mm
E	Diameter rear main journal	53.480 ÷ 53.500 mm
	Undersizer C-D-E	0.250 mm
	C-D-E Roughness	0.8 µm

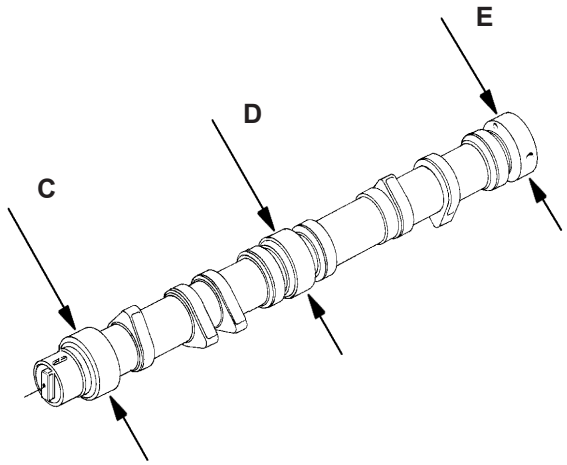


Fig. 8.2.2a

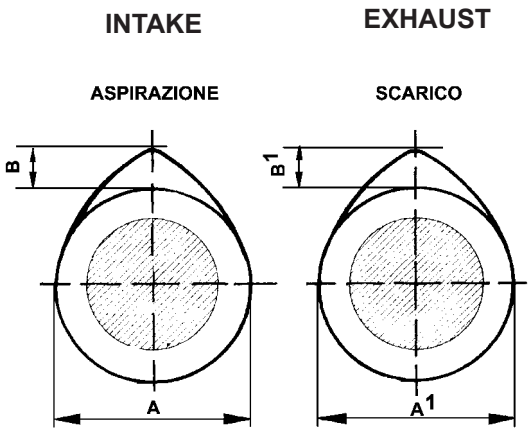


Fig. 8.2.2b

8.2.3 THRUSTWASHER

REF.	DESCRIPTION	DIMENSIONS
	Standard	2.310 ÷ 2.360 mm
	1st oversizer + 0.10	2.410 ÷ 2.460 mm
	2nd oversizer + 0.20	2.510 ÷ 2.560 mm

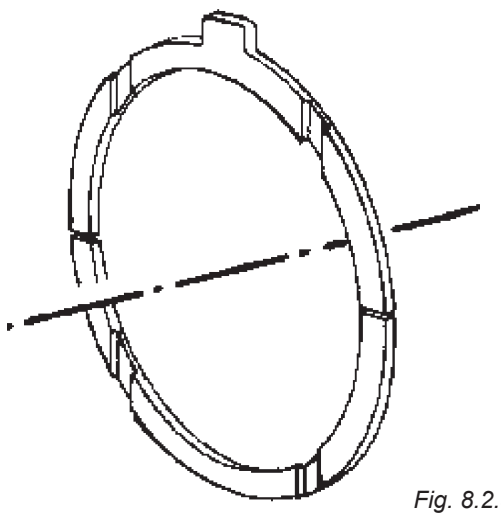
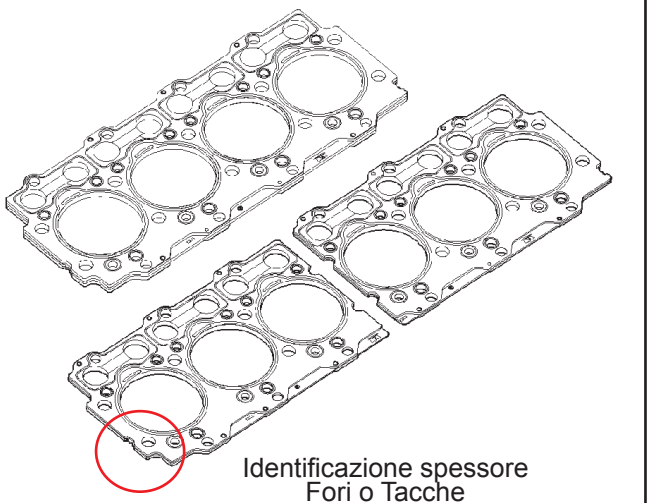


Fig. 8.2.3

8.2.4 Cylinder head gasket

DESCRIPTION	mm
Piston protrusion from crankcase	0.60 ÷ 0.72
Cylinder head gasket Spess.	1.42
Dead volume assembled	0.70 ÷ 0.82
Piston protrusion from crankcase	0.73 ÷ 0.82
Cylinder head gasket Spess.	1.52
Dead volume assembled	0.70 ÷ 0.79
Piston protrusion from crankcase	0.83 ÷ 0.95
Cylinder head gasket Spess.	1.62
Dead volume assembled	0.67 ÷ 0.79

MAX PISTONS PROTRUSION DISALIGNIMENT
3-4 cil. = 0.11
6 cil. = 0.12



Identificazione spessore
Fori o Tacche
Thickness identification
Notches or marks *Fig. 8.2.5a*

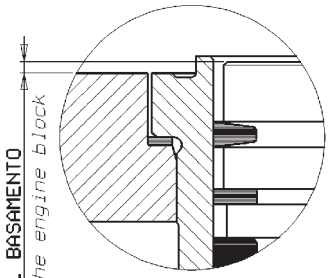


Fig. 8.2.5b

8.2.6 Oil jet valve into the main bearing carrier

The oil jet valve (installed in main bearing carriers) opening at a pressure of:
150 ÷ 200 kPa (1.5 ÷ 2.0 bar) (fig. 8.2.6)

The oil jet valve (installed on crankcase) opening at a pressure of:
1.8 ÷ 2.0 bar (fig. 8.2.6a)

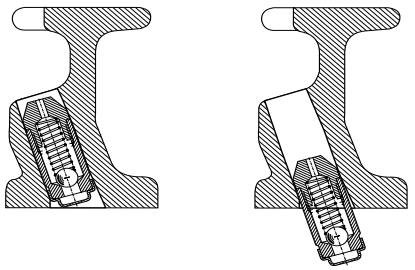


Fig. 8.2.6

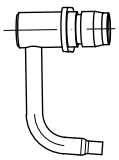


Fig. 8.2.6a

8.2.7 Shims for cylinder liners

Are available the following shims **A**:
0.15 - 0.17 - 0.20 - 0.23 - 0.25 mm.

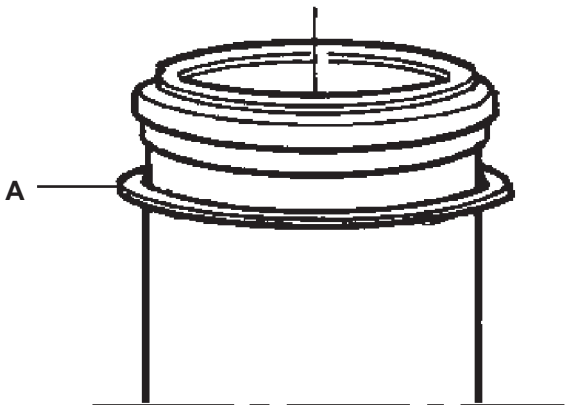


Fig. 8.2.7

8.2.8 PRINCIPAL TECHNICAL DATA TABLES

DISTRIBUCTION:
ENGINES EQUIPPED WITH MECHANICAL TAPPET
α = **12°** (Opens before TDC inlet valve)
β = **12°** (Closes after BDC exhaust valve)

ENGINES EQUIPPED WITH HIDRAULIC TAPPET (Fig. 8.2.8b)
Check with a dial gauge the cam lift is 1 mm. with the following angle position.

Engines (D703-L - LT - LTS)
α = **4° ± 2°** (After TDC inlet valve)
β = **24° ± 2°** (Before TDC exhaust valve)

Engines (D703-LE)
α = **6° ± 2°** (After TDC inlet valve)
β = **22° ± 2°** (Before TDC exhaust valve)

Engines (D703-LTE - TSE)
α = **9° ± 2°** (After TDC inlet valve)
β = **19° ± 2°** (Before TDC exhaust valve)

Engines (D704 - D706 - D706IE2 (3000 rpm))
α = **8° ± 2°** (After TDC inlet valve)
β = **16°± 2°** (Before TDC exhaust valve)

Engines D754 E1-E2-TE2 - D704TE2 - D706IE2 (2300/2600 rpm)
α = **10° ± 2°**(After TDC inlet valve)
β = **10° ± 2°**(Before TDC exhaust valve)

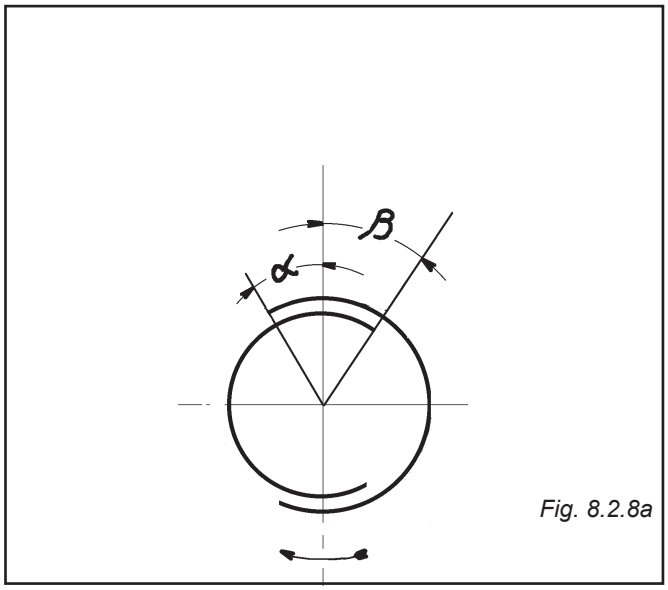


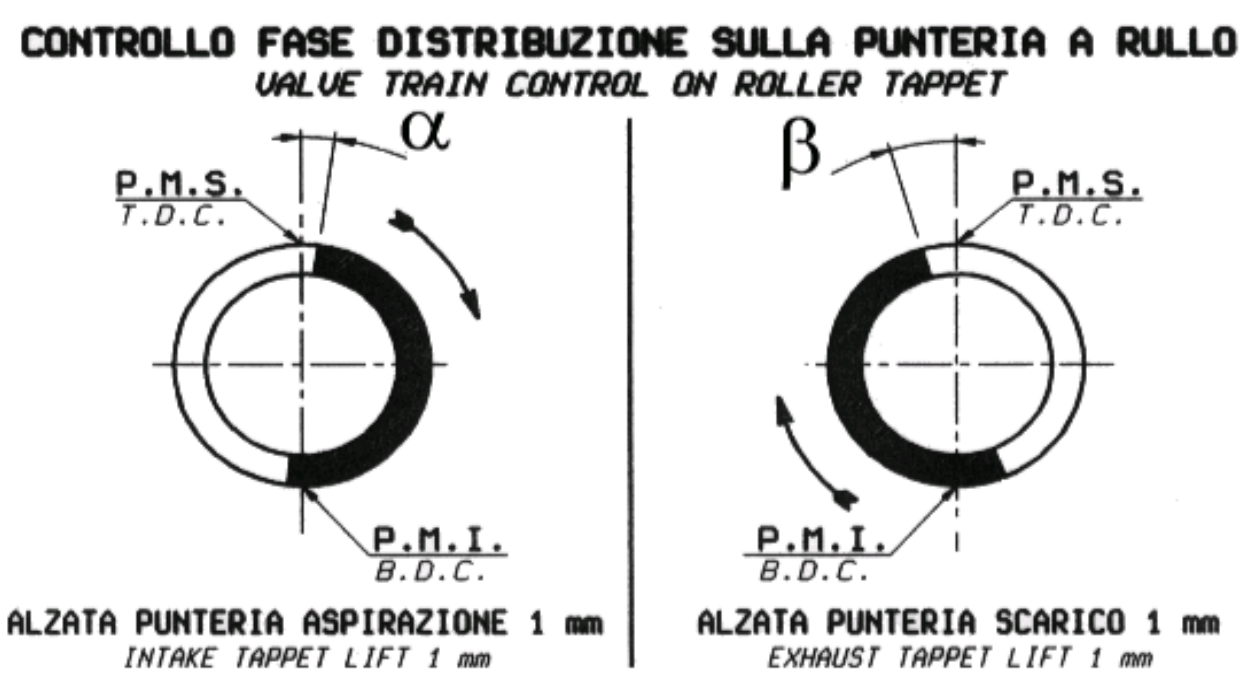
Fig. 8.2.8a

Engines (D703-E2 camshaft 20182068F)
α = **11°± 2°** (After TDC inlet valve)
β = **9°± 2°** (Before TDC exhaust valve)

Engines (D703-E2 camshaft 20182070F after engine s/n 15C02913)
α = **11°± 2°** (After TDC inlet valve)
β = **11°± 2°** (Before TDC exhaust valve)

Engines (D703-TE1)
α = **13°± 2°** (After TDC inlet valve)
β = **7°± 2°** (Before TDC exhaust valve)

Engines (D703-TE2)
α = **13°± 2°** (After TDC inlet valve)
β = **9° ± 2°** (Before TDC exhaust valve)



8.2.9 VALVE CLEARANCE:

Intake and exhaust **mm 0.30**
Cecked with thickness gauge.
(This procedure has to be carried out for engine equipped with mechanical tappets)

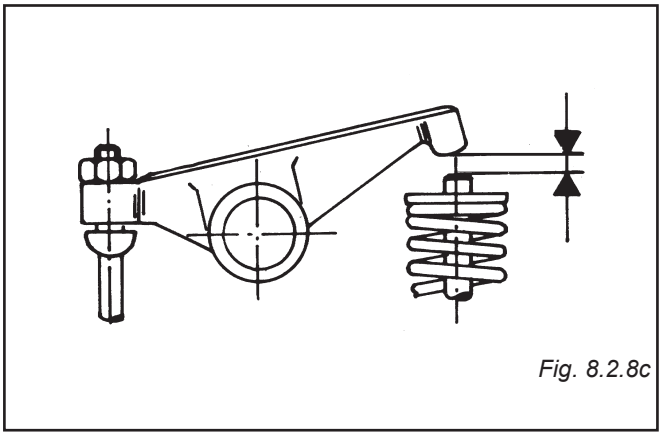


Fig. 8.2.8c

8.2.10 FIRING ORDER:

D703:	1 - 3 - 2
D704 - 754:	1 - 3 - 4 - 2
D706:	1 - 5 - 3 - 6 - 2 - 4

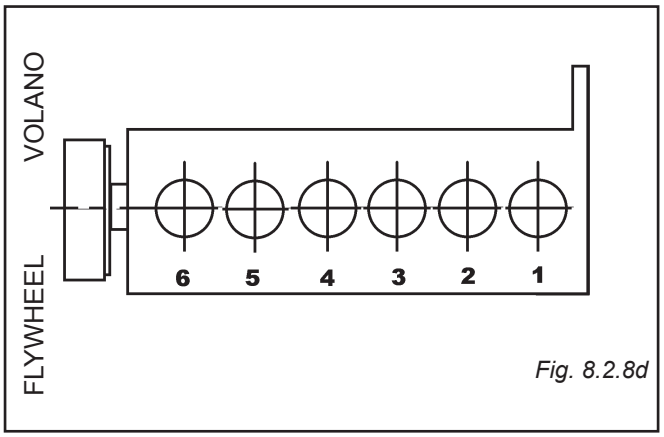


Fig. 8.2.8d

RUNNING TESTS AND ADJUSTMENTS 9

9.0 RUNNING TESTS AND ADJUSTMENTS

The instructions in the following chapter “Running tests and adjustments” apply to all D700 series engines.

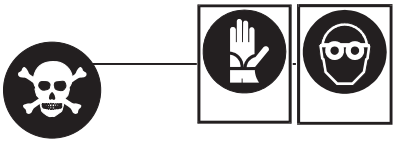
9.1 PRE-STARTING CHECK

On completion of engine assembly, proceed as follows:

- Mount the engine on a suitable base or dynamometer, or install in the vehicle.
- Check level of oil in sump.
- On engines fitted with oil-bath air filters, also check oil level in filter.
- Connect the starter motor and the injection pump solenoid valve (Bosch or Stanadyne) to the battery.

9.2 FILLING THE COOLING CIRCUIT AND LUBRICATING CIRCUIT

Fill the circuit with a coolant mixture including 50% fresh demineralised water and 50% antioxidant antifreeze (inibited ethilene glicol) that meets the ASTM D 3306 requirements.(available from specialized sales outlets).



WARNING: TAKE CARE WHEN HANDLING ANTIOXIDANT ANTIFREEZE AVOID CONTACT WITH EYES AND SKIN.

WARNING:
DO NOT INGEST ANY OF THE LIQUIDS USED IN THE ENGINE.

Run the engine for a few minutes until all parts of the system are full of coolant and free from air bubbles.

Check the level and top up if necessary.

COOLANT SYSTEM CAPACITY

D703=	**3.7l** (without radiator)
D704 - 754=	**5l** (without radiator)
D706=	**7.5l** (without radiator)

RADIATOR CAPACITY

D703= 4l -	**D703E= 6l**
D704= 4l -	**D704E/754E= 6l**
D706= 6.2l	

WARNING:
THE COOLANT LEVEL MUST BE CHECKED OUT EVERY DAY AND IF NECESSARY IT MUST BE TOPPED UP WITH IDENTICAL MIXTURE.
AVOID TO REFILL WITH DIFFERENT REFRIGERANT MIXTURE DIFFERENT FROM THE ONE WHICH IS ALREADY IN THE CIRCUIT.
THE COOLANT MIXTURE MUST BE TOTALLY DRAINED AND REPLACED AT LEAST EVERY 24 MONTHS.
FOR COOLING SYSTEM CAPACITY, SEE CHAP. 2.

WARNING:
THE USE OF A COOLANT WHICH DOES NOT COMPLY WITH THE ABOVE SPECIFICATIONS COULD CAUSE DAMAGE TO ENGINE COMPONENTS AND WILL INVALIDATE THE WARRANTY.

ENGINE OIL PAN CAPACITY

Standard Oil Pan

D703 = MIN 4.5 - MAX 5.5 Kg
D704 - 754 = MIN 4.8 - MAX 5.8 Kg
D706 = MIN 4.5 - MAX 7.5 Kg

Oil pan customized for OEM

_WARNING:
FOR SOME CUSTOMIZED ENGINES THE OIL PAN CAPACITY CAN BE DIFFERENT IN RELATION TO ENGINE VERSION.

THE MAXIMUM OIL PAN CAPACITY CAN VARY FROM:

D703 = 4.5 - 6 KG
D704 - 754 = 6 - 9 KG

FILL THE LUBRICATING CIRCUIT BY USING ABOVE LOWER VALUE .
FILL 100-200 ML AT THE TIME TO REACH THE MAXIMUM LEVEL ON OIL DIPSTICK.

_WARNING:
THE USE OF A LUBE ENGINE OIL WHICH DOES NOT COMPLY WITH THE SPECIFICATIONS STATED IN CHAPTER 2 TECHINICAL SPECIFICATIONS COULD CAUSE DAMAGE TO ENGINE COMPONENTS AND WILL INVALIDATE THE WARRANTY.

9.3 BLEEDING AIR FROM THE FUEL SYSTEM

(fig. 9.2 - 9.3)

- Bleed air from the fuel filter by loosening off the bleed screw **B** and operating the lever **A** until a continuous flow of fuel is obtained at the bleed screw.

The injection pump is self-purging.

- Loosen off the unions of the injector fuel feed pipes.
- Turn the engine over by means of the starter motor until the fuel flowing from the injector feed pipe unions is completely free of air.
- Re-tighten the injector fuel feed pipe unions and start the engine.

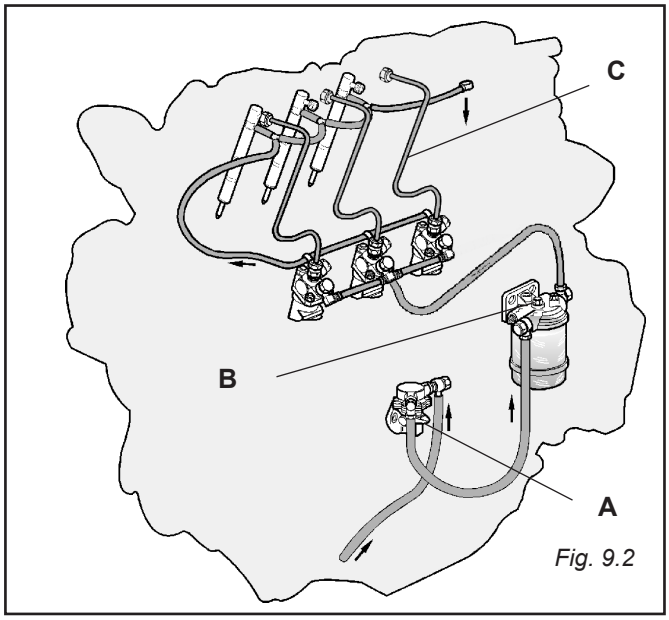


Fig. 9.2


_WEAR SAFETY GOGGLES TO PROTECT AGAINST RISK OF FUEL SPRAYING OUT UNDER PRESSURE.


_WEAR GLOVES TO PROTECT SKIN FROM CONTACT WITH FUEL.

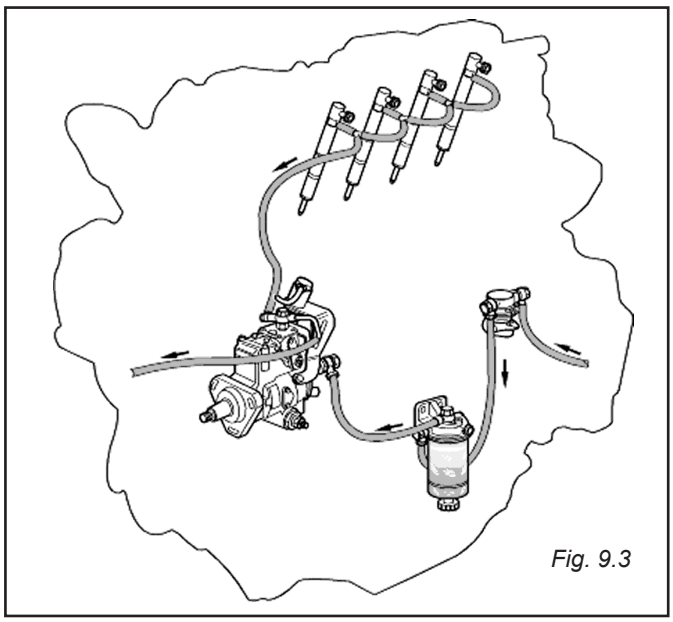


Fig. 9.3

9.4 IDLE RUNNING TEST

All adjustments are to be made with the engine hot and with the aid of a tachometer.

- Run the engine at low speed to warm it up to normal operating temperature.
- Connect a 10 kPa pressure gauge to the last main bearing carrier oil line on the crankcase and check the oil pressure while the engine is running.
- Check for possible oil or water leaks, abnormal noise or vibration.
- Check the electrical system.

9.5 ENGINE SPEED ADJUSTMENT

(fig. 9.4 - 9.5)

Idle speed and maximum no-load engine speed are to be set on the test bench.

- Check that the engine idle speed is a specified in the table technical data chapter 2. Adjust if necessary by way of screw **A** (Bosch injection pump) or screw **B** (Stanadyne injection pump).

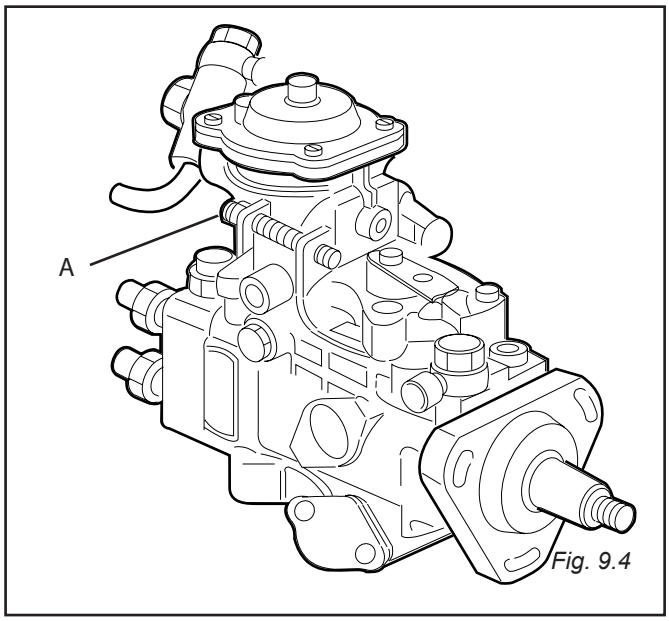


Fig. 9.4

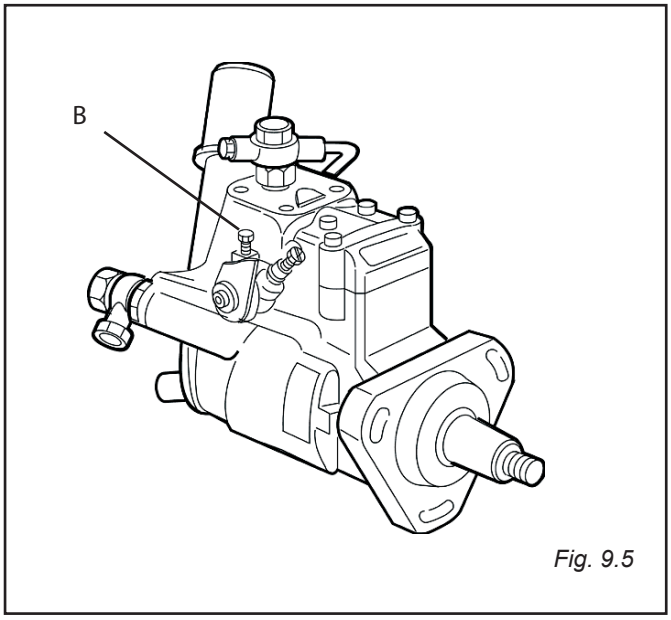


Fig. 9.5

9.6 RUNNING-IN

After replacing parts requiring running-in or after a full engine overhaul, do not exceed 70% of the maximum power rating for the first 50 operating hours.

9.7 EXHAUST BACK PRESSURE

(fig. 9.6)

Attach a liquid U-tube pressure gauge to the exhaust (after the turbocharger on turbocharged models). The optimum back pressure values at max rpm are:

normally aspirated engines

8 ÷ 9 kPa (0.08 ÷ 0.09 bar)
(1.16 ÷ 1.3 psi)

turbocharged models

7 ÷ 8 kPa (0.07 ÷ 0.08 bar)
(1.01 ÷ 1.16 psi)

If the back pressure is over **10** kPa (0.01 bar) (0.145 psi) check the exhaust pipe or muffler.

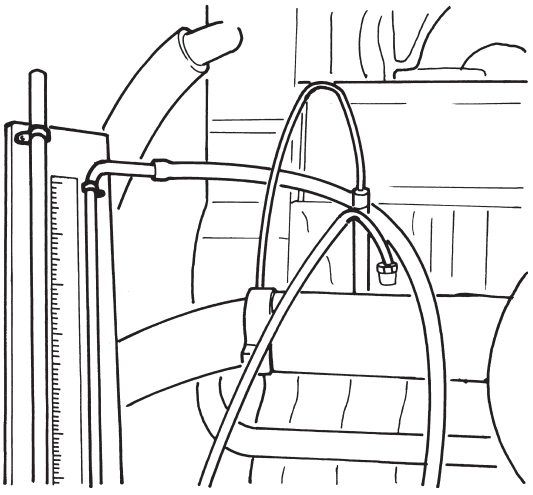


Fig. 9.6

9.8 ADJUSTING FUEL FLOW RATE

Fuel flow rate is normally set on the engine test bench. Due to the difficulties involved in testing the fuel flow rate when the engine is installed in the vehicle, we recommend that, before proceeding with any adjustments, you make sure that the problem is in fact due to an insufficient or excessive fuel supply.

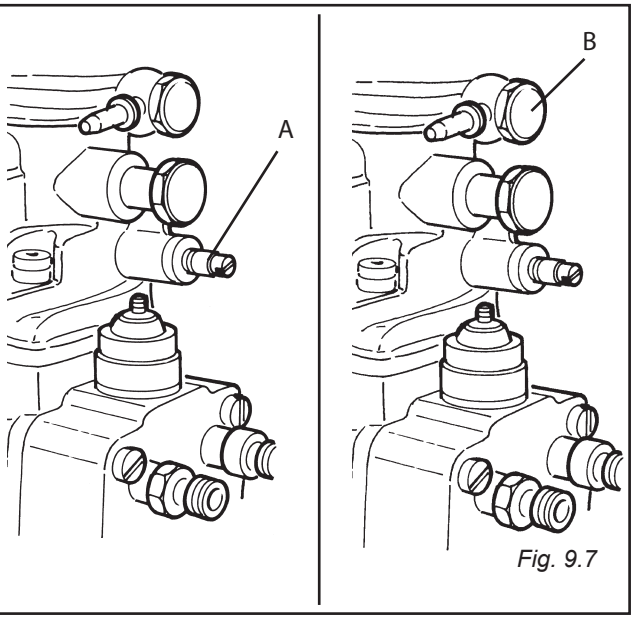


Fig. 9.7

turn screw **A** to adjust the quantity of fuel delivered at maximum engine speed (screw in to increase flow, screw out to reduce flow).

TURBOCHARGED ENGINES ONLY:

To adjust the quantity of fuel delivered up to 2000 rpm, unscrew ringnut **B,** and using a screw driver tip turn the toothed segment on the aneroid adjustment (clockwise to increase flow, counter-clockwise to reduce flow).

9.9 MAXIMUM PERMISSIBLE EXHAUST FUME INDEX UNDER-LOAD

(Bosch scale).

Engine	Fume index	RPM
704 L - LE	4.5	1500 rpm
704 LT - LTE	3.5	"
706 LT - LTE	3.0	"
703L - LE - LTE	4.5	"
703 E2/TE2	4.0	"
703 TE1	4.5	"
754 E1	4.0	"
754 E2/TE2	3.5	"
704 TE2	3.5	"
706 IE2	3	"

9.10 STANADYNE ROTARY PUMP

(FIG. 9.8)

Fuel flow at maximum engine speed and idle speed is adjusted by way of screws **A-B** (screw in to increase flow, screw out to reduce flow):

A) Maximum engine speed

B) Idle speed

Turn lever **C** towards the flywheel then adjust screws **A-B.**

THE FUEL DELIVERY IS PRE-SETTED. ON TURBOCHARGED MODELS ACCELERATION PICK-UP AND EXHAUST FUMES CAN BE ADJUSTED BY MEANS OF THE SCREWS ON THE REAR OF THE INJECTION PUMP.

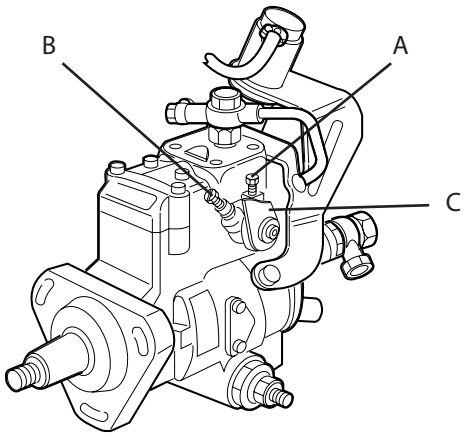


Fig. 9.8

Stabilising the inconstant regime for GEN SET

(Fig. 9.8 A)

Using a screwdriver, turn screw **A**

clockwise/counter-clockwise to obtain an even idle speed.

THE IDLE SPEED ADJUSTER SCREW CAN BE TURNED THROUGH A MAXIMUM OF 360° CLOCKWISE AND COUNTER-CLOCKWISE.

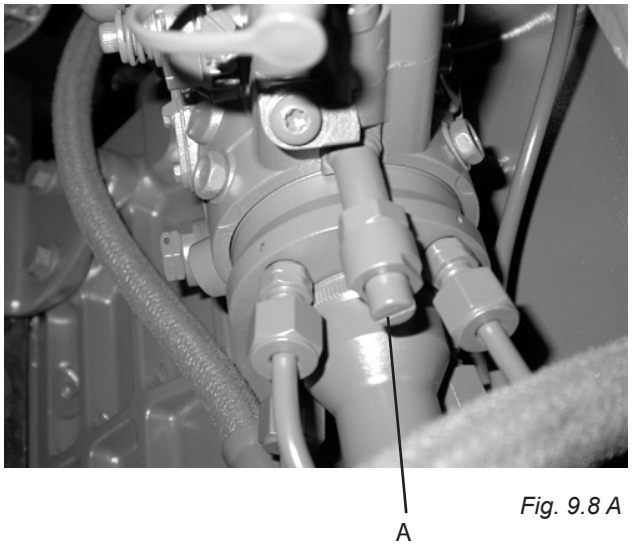


Fig. 9.8 A

9.11 FUEL SUPPLY PUMP PRESSURE

(fig. 9.9)

Install a pressure gauge before the injection pump inlet and check that the supply pressure is no less than **20** kPa (0.2 bar)(2.9 psi).

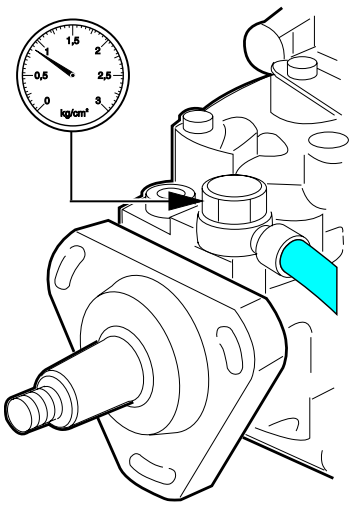


Fig. 9.9

9.12 ENGINE SUCTION PRESSURE

Check the suction pressure after the filter, before the inlet manifold. Maximum permissible suction pressure see chapter 2 technical data

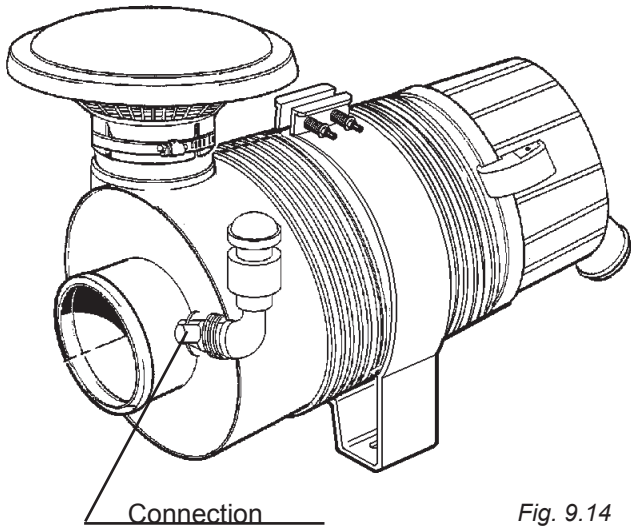


Fig. 9.14

9.13 OIL PRESSURE TEST

(fig. 9.10)

Test the oil pressure at the union provided on the crankcase. The oil should be at a temperature of 80° ÷ 90°C (176 ÷ 194°F).

Idle speed 800 rpm = 100 ÷ 160 kPa
(1 ÷ 1.6 bar)
(17.4 ÷ 23.2 psi)

Max speed 2600 rpm = 400 ÷ 450 kPa
(4 ÷ 4.5 bar)
(50.7 ÷ 58 psi)

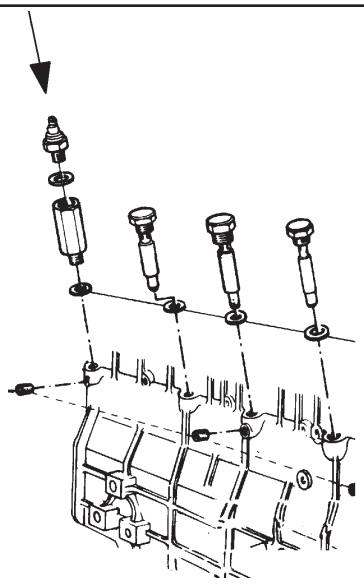


Fig. 9.10

9.14 COMPRESSION TEST

(fig. 9.11)

Check the pressure developed in each cylinder. Insufficient compression will cause power loss, increased fuel and oil consumption, exhaust fumes, difficult starting and partial seizure.

Test procedure

- To take away all the injctors.
- Clean the injector seat and install the compression tester **(A)** **(TAB. 11.1 ref. AA)**.
- Zeroset the dial and crank the engine with the starter motor .
- Repeat the operation with the other pistons.
- Check the battery conditions.
  During the test the battery must be in the optimal condition, because in different case there are several possibility to do a wrong test.
- If low readings are obtained or if the difference among different cylinders exceeds **500** kPa (5 bar)(72.5 psi), check piston rings, valves, cylinder liners and pistons.

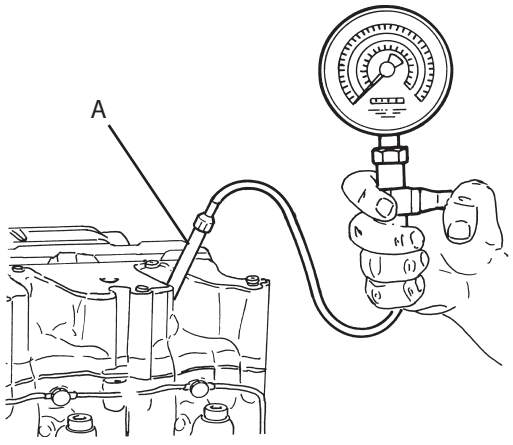


Fig. 9.11

9.15 TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSES
FAILS TO START	A1 - A2 - A3 - A4 - A5 - A6 - A7 - A8 - C1 - C2 - C3 - C4 - D4 - E1 - E3
STARTS THEN STOPS	A1 - A2 - A3 - A5 - D5 - E4 - E6 - E7
POOR ACCELERATION	A1 - A2 - A3 - A4 - A5 - A7 - D1 - D2 - D4
RUNS UNEVENLY	A4- A7 - B2 - E4
BLACK SMOKE	A6 - A9 - D1 - D2 - D4 - E1 - E2
WHITE SMOKE	B2 - D5 - E1 - E2 - E7
OVERHEATS	B1 - B4 - B5 - B9 - D2 - D4 - D6 - E5
LOW OIL PRESSURE	B1 - B3 - B4 - B5 - B6 - B7 - B9 - E6
EXCESSIVE NOISE	A6 - E3 - E5 - E6 - E8 - D4
OIL PRESSURE TOO HIGH	B3 - B6
LACK OF POWER	A6 - A8 - D1 - E2 - E7
OIL CONSUMPTION	E1 - E2 - E7

	PROBLEM	POSSIBLE CAUSES
FUEL SYSTEM	FAULTY OR CLOGGED FUEL PUMP	A1
	OBSTRUCTED FUEL LINES	A2
	FUEL FILTER CLOGGED	A3
	FAULTY INJECTION PUMP	A4
	AIR IN FUEL SYSTEM	A5
	INJECTORS NOT SET CORRECTLY OR SEIZED	A6
	HARDENED CONTROL ROD RACK	A7
	INJECTION PUMP NOT SET CORRECTLY	A8
	BLOCKED STOP SOLENOID VALVE	A9
	EXCESS FUEL DEVICE SEIZED	A10
	INJECTION PUMP VALVE BLOCKED	A11
LUBRICATION SYSTEM	FAUTLY OIL PUMP	B1
	OIL LEVEL TOO HIGH	B2
	OIL PRESSURE RELIEF VALVE STICKING	B3
	OIL VISCOSITY TOO HIGH	B4
	OIL LEVEL TOO LOW	B5
	FAULTY PRESSURE GAUGE OR SWITCH	B7
	OIL SUCTION LINES CLOGGED OR UNIONS LOOSE	B8
	OIL COOLER CLOGGED	B9
	HIGH OIL CONSUMPTION	B10
ELECTRICAL SYSTEM	BATTERY DISCHARGED	C1
	LOOSE CABLE CONNECTION	C2
	FAULTY STARTING SWITCH	C3
	FAULTY STARTER MOTOR	C4
	PICK-UP BROKEN OR NOT CONNECTED	C5
	FUSE BROKEN	C6
	POTENTIOMETER DON'T GO TO END STROKE	C7
MAINTENANCE	CLOGGED AIR CLEANER	D1
	ENGINE OVER LOAD	D2
	TIMING NOT SET CORRECTLY	D4
	IDLE SPEED NOT SET CORRECTLY	D5
	RADIATOR/INTERCOOLER STOPPED	D6
	CLOGGED COOLING CIRCUIT FINS	D7
	SEA WATER PUMP FAULTY	D8
	SEA WATER FILTER OBSTRUCTED	D9
	BELTS LOOSE	D10
REPAIRS	WORN OR STUCK RINGS	E1
	POOR VALVE SEALING	E2
	STUCK VALVE	E3
	GOVERNOR SPRING BROKEN OR WRONG SPRING	E4
	FAN FAILURE	E5
	WORN CON. RODS/OR MAIN BEARINGS	E6
	WORN CYLINDERS	E7
	WRONG VALVE CLEARANCE	E8

APPLICATIONS 10

10.1 ADDITIONAL CUT-OFF SOLENOID VALVE APPLICATIONS

(fig. 10.1 - 10.2)

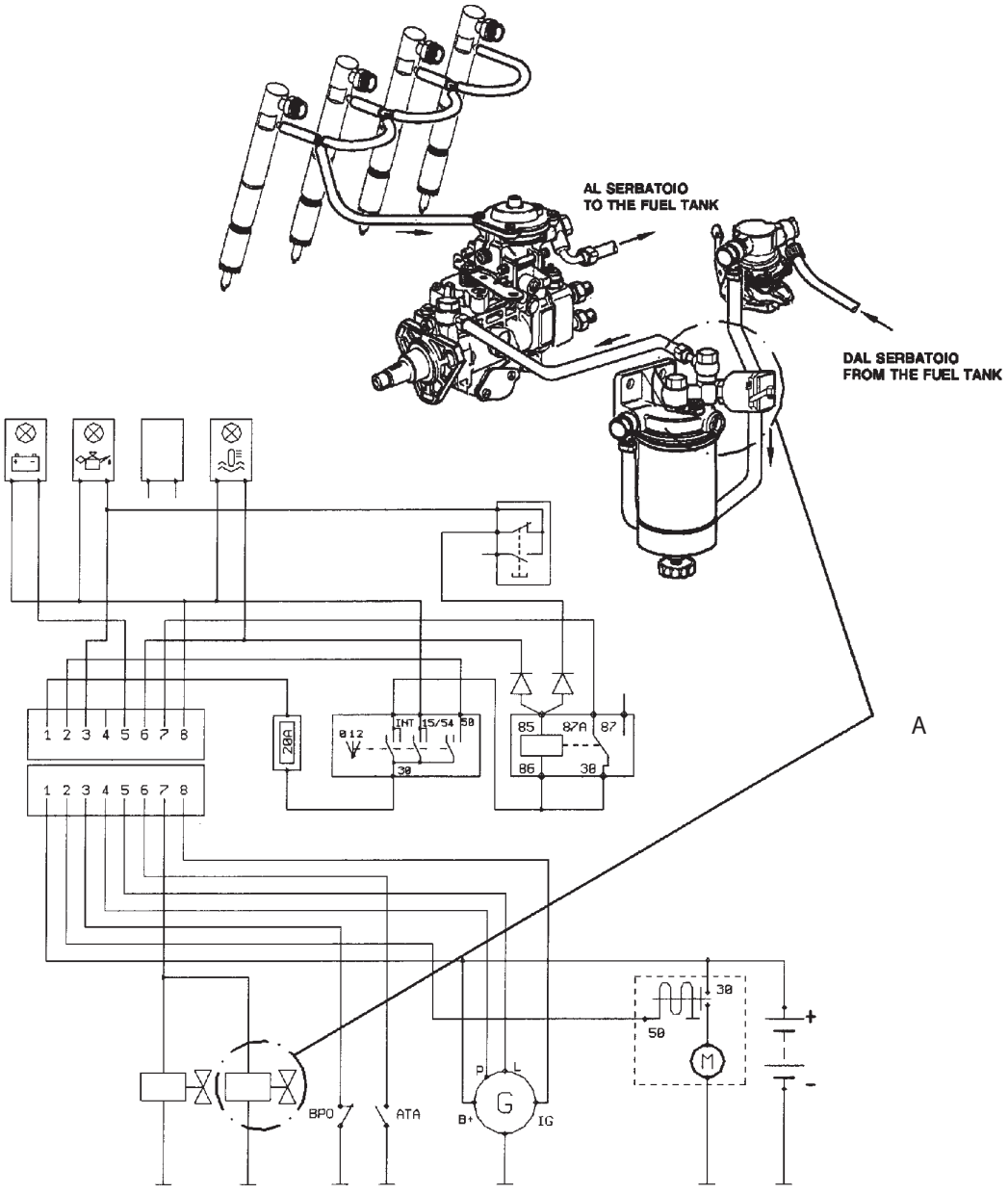
In some applications, it may be necessary to use a supplementary cut-off system in addition to the standard one.

As can be seen in figures 10.1 – 10.2, there are two types of applications: one on the diesel filter (fig. 10.1) and one directly on the injection pump (fig. 10.2).

To stop an industrial engine quickly (tractor, etc.), solenoid valve (A) is fixed to the body of the oil filter (fig. 10.1) and is a NC type (normally closed).

In the industrial engines of fire fighting vehicles and equipment to stop the engine quickly a cut-off system has been established which envisages the use of an additional solenoid valve (A) (fig. 10.2), which acts in a complimentaryway to the solenoid valve on the body of the injection pump.

The NC type solenoid valve is fixed to the injection pump as can be seen in the picture below.



CARATTERISTICHE TECNICHE *Technical features*	
ASSORBIMENTO *Absorption*	7W-12V 3.5W-24V
CONTATTO N.C. *N.C. Contact*	

Fig. 10.1

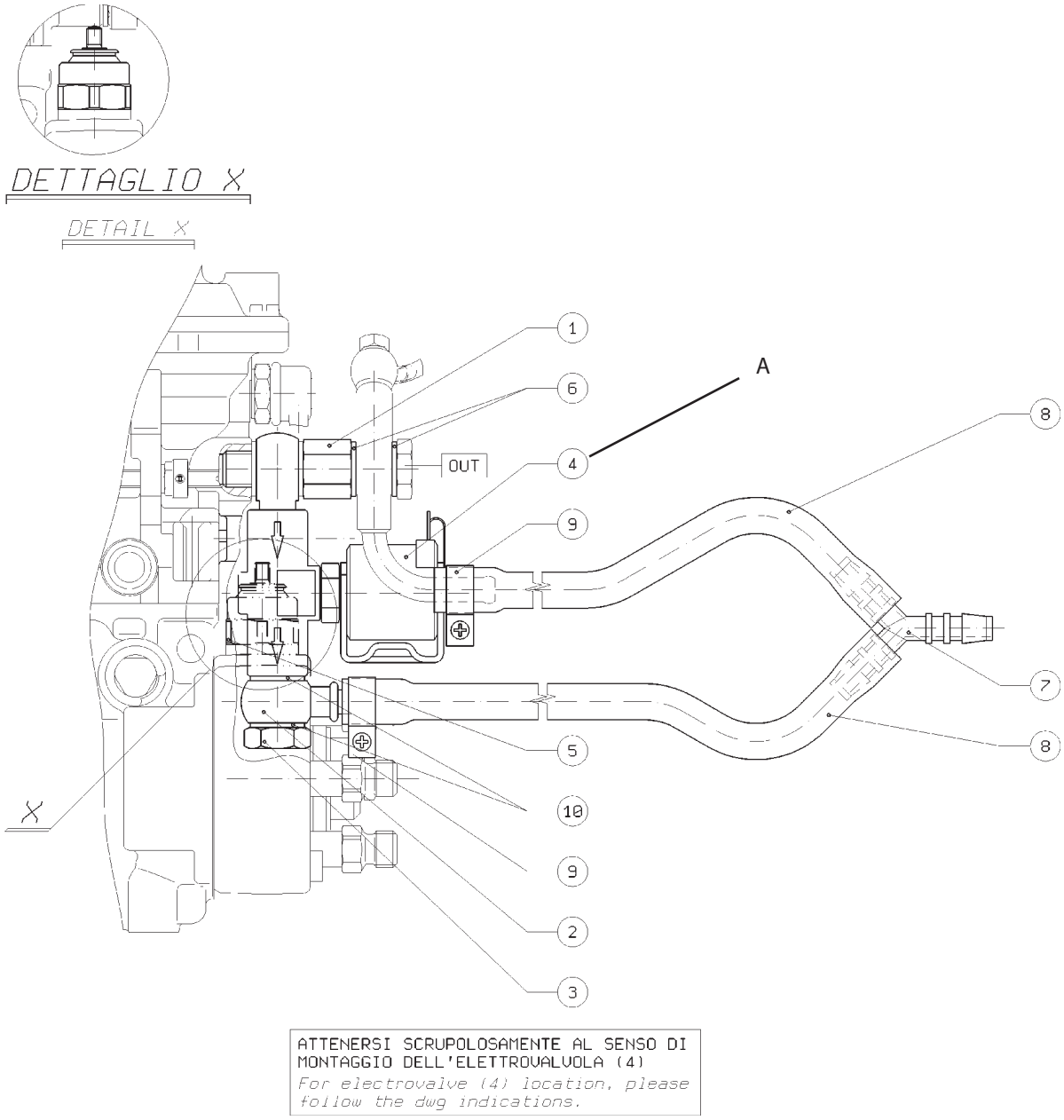

DETTAGLIO X
DETAIL X
OUT
A
X
1
6
4
9
8
7
8
5
10
9
2
3
ATTENERSI SCRUPOLOSAMENTE AL SENSO DI MONTAGGIO DELL'ELETTROVALVOLA (4)
For electrovalve (4) location, please follow the dwg indications.

Fig. 10.2

D700 (FIG. 10.3 - 10.4)

For ambient temperature from -10 °C (- 14°F) up to -20 °C (-4 °F):It is racommendable to use the pre-heater glowplugs and pre-post heater glow plug with relative control unit.

For ambient temperatures below -20 °C (- 4°F):

It is recommendable the 24V system with starter motor alternator, pre-heater glow plug and pre-post heater glow plug control unit at 24V.

It is available a fuel filter with heater.

For different requirements consult VM Motori.

Fig. 10.3

1 Control unit
2 Glowplugs
3 Washer
4 Nut
5 Conductor
G1 Battery
S Ignition keyswitch
H Glowplug indicator lamp
F Fuse
R Glowplug

D700 EPA (FIG. 10.3 - 10.4)

The engine are equipped with pre-post heater glow plug control unit that doesn't work starting from 25°C (77°F) ± 7 °C (45°F).

For ambient temperatures below -20 °C (- 4°F):

24V system with starter motor alternator, pre-heater glow plug and pre-post heater glow plug control unit at 24V.

It is available a fuel filter with heater

For different requirements consult VM Motori.

Fig. 10.4

1 Heater
G1 Battery
S Ignition keyswitch
F1 Fuse
F2 Fuse
CT Thermostat
R Resistor

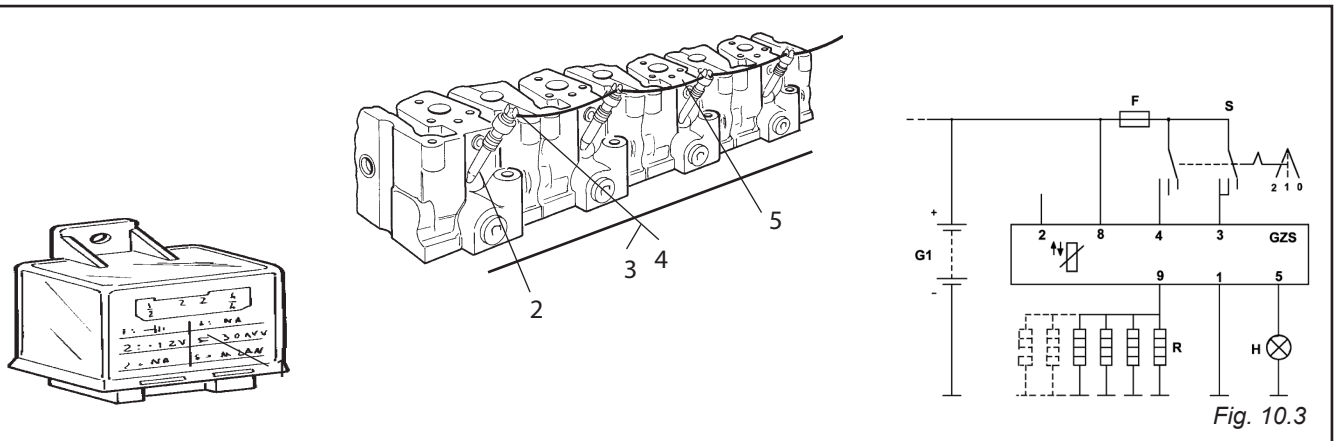


Fig. 10.3

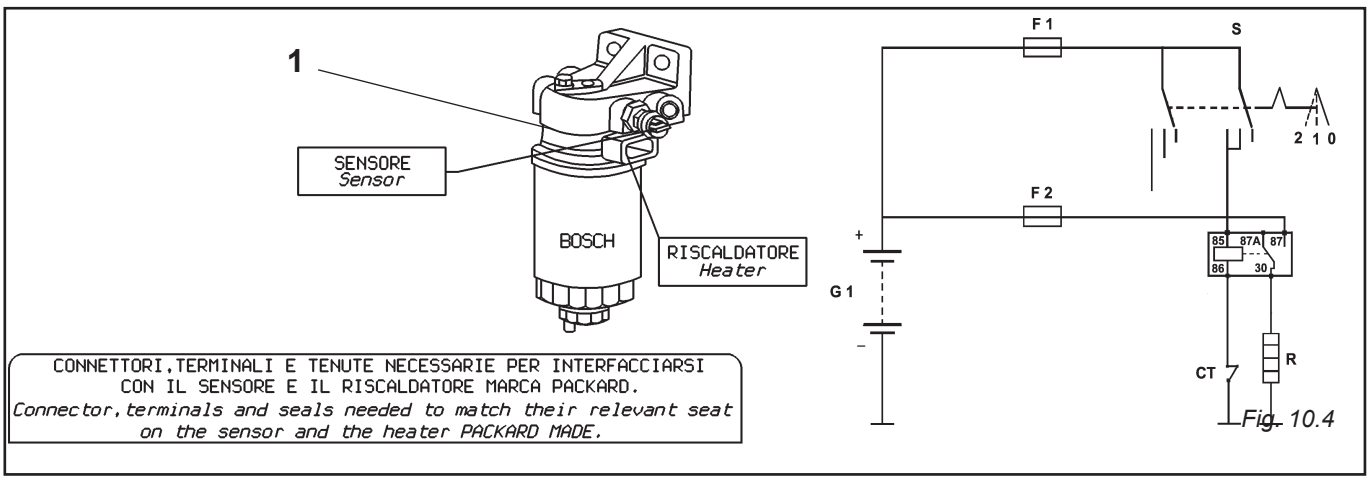
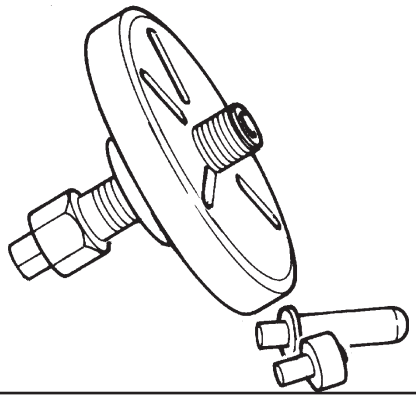
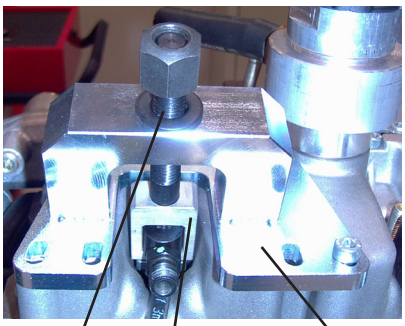
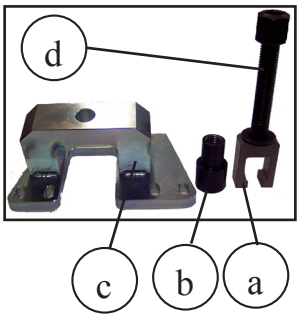
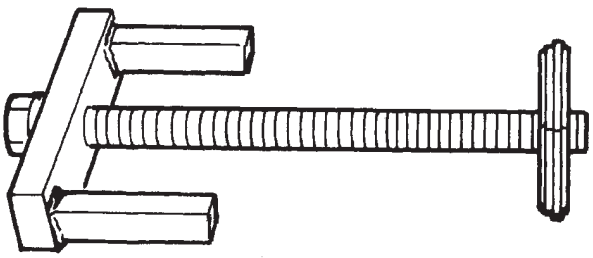
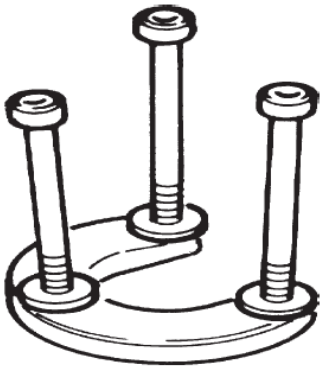
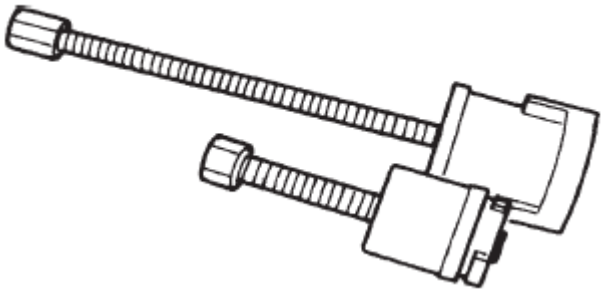
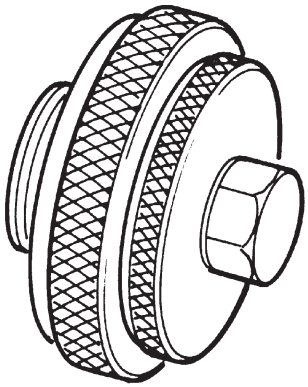
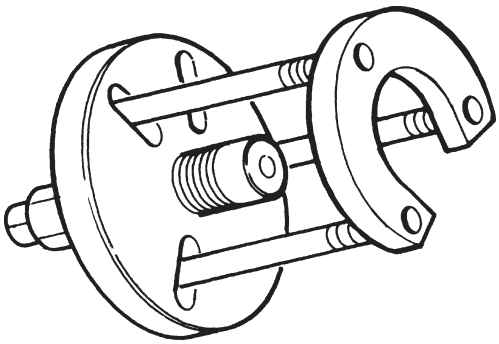
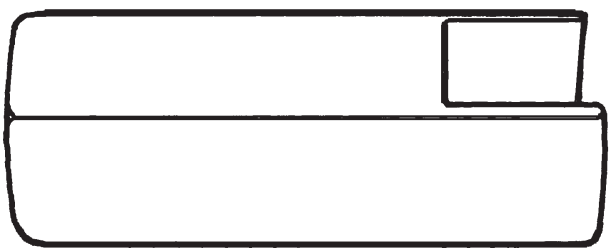


Fig. 10.4

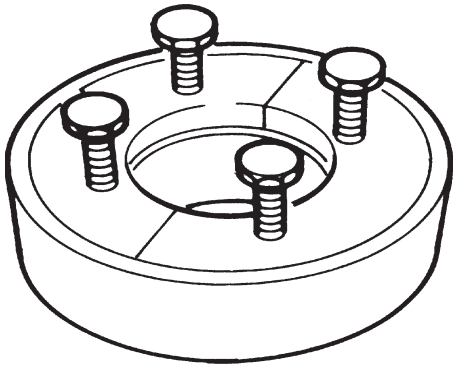
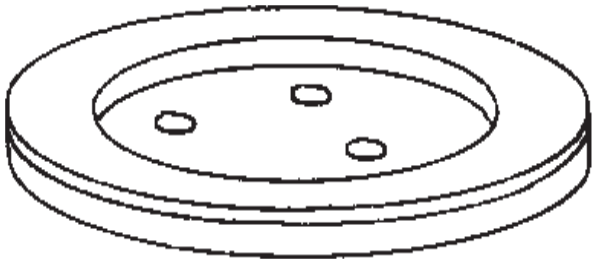
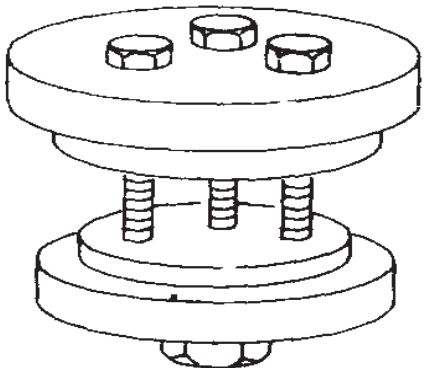
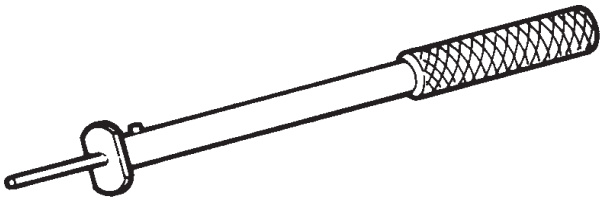
SPECIAL TOOLS

SPARE P.N.	USA CODE	DESIGNATION	TOOL
68400001B **A**	see "G"	Pulley Remover	
68400042F (The tool is composed by a - 68400041F - Fork for D700 b - 68400036F - adaptor for MD 700 c - 68400043F - body d - 68400044F - screw **B**		Injector extractor	 
68400012A **C**	J-42779	Cylinder liner extractor	
68400013B **D**		Crankshaft gear puller See also tool "G"	

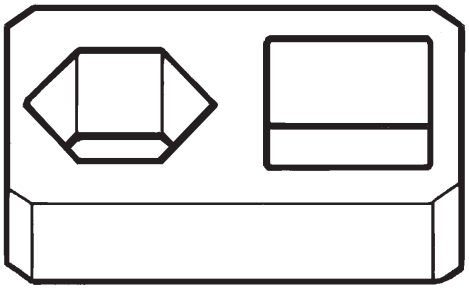
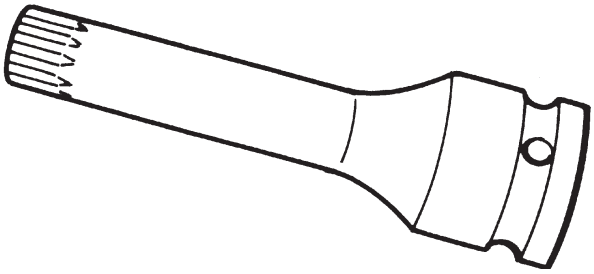
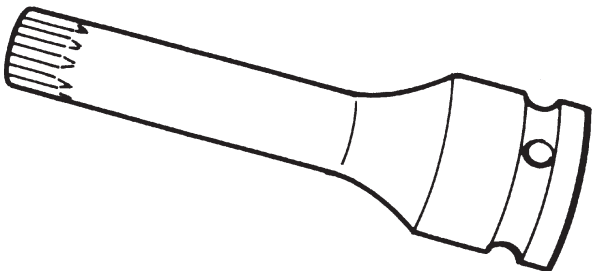
✱ U.S. tools are supplied by Kent Moore and may be slightly different in appearance than tools shown

68400015A **E**		Crankshaft and camshaft bearing remover/installer	
68400025A **F**	J-42671	Injection pump extractor	
68400028A **G**	J-42511	Crankshaft gear pulley complete with pulley extractor (This tool comprises tools **A+D**)	
68410006A **H**	J-42778	Crankshaft/gear cover assembly tool	

U.S. tools are supplied by Kent Moore and may be slightly different in appearance than tools shown

68410009F I	J-43454	Timing cover oil seal assembling	
68410011F J	J-43455	Rear seal assembling tool (with rear and bearing assembled on the engine), diameter of rear main bearing journal 70 mm	
68410010F K	J-43456	Rear seal assembling tool (with rear end bearing removed from the engine), diameter of rear main bearing journal 70 mm	
68410012F L	J-45349	Assembly/disassembly Hydraulic tappets tool	

❋ U.S. tools are supplied by Kent Moore and may be slightly different in appearance than tools shown

68420012A **M**	J-43458	Offset tool for cylinder head tightening (This tool comprise M+O)	
68420016F **N**	J-42514	XZN wrench for cylinder head bolt (12 mm)	
68420017F **O**	See "M"	XZN wrench for cylinder head bolt	
68420015F **P**	J-42437	XZN wrench for cylinder head bolt (14 mm)	

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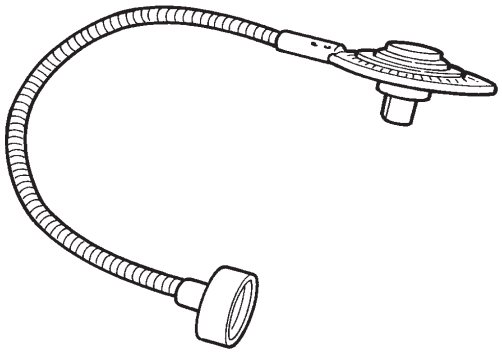
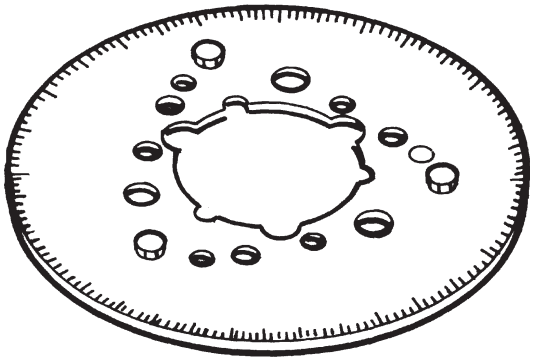
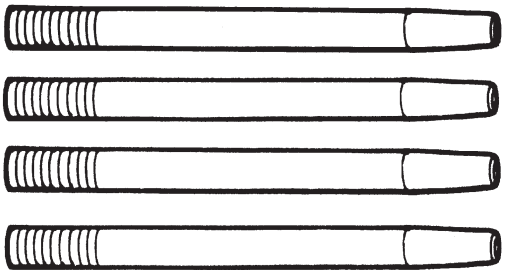
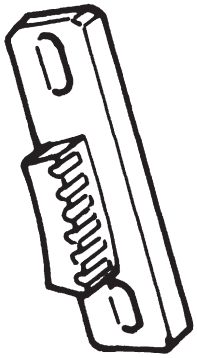
68420019F Q	J-91104	Angular torque wrench	
68450003A R	N/A	Graduated disc (timing check)	
68460003A S	J-42699 dowels	Cylinder head assembly	
68480003A T	J-44968	Flywheel ring gear clamp This tool blocks the crankshaft rotation during the front crankshaft pulley and flywheel removal	

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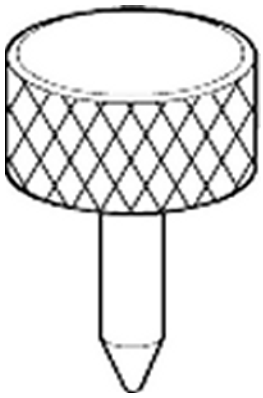
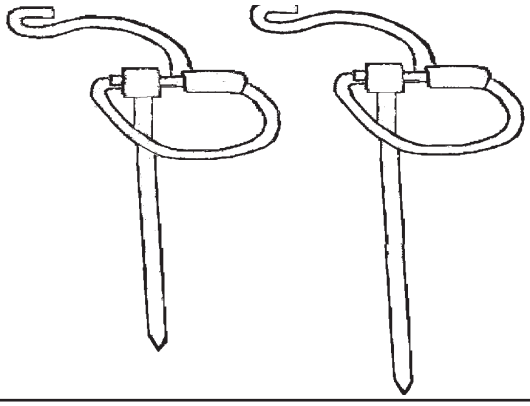
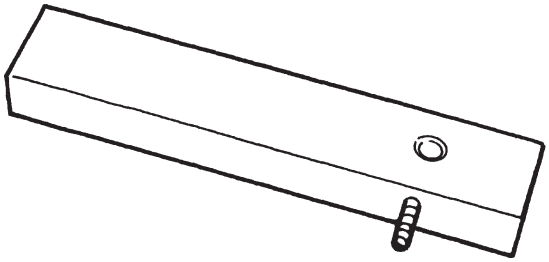
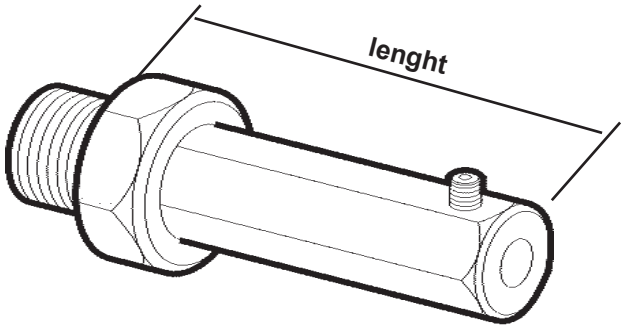
68480006A **U**	J-43464	Control rod lock pin	
68480012F **V**	J-45351	**BOSCH** injection pump hooks (INJECTION PUMPS OLD TYPE)	
68490007A **W**	J-44805	Cylinder liner protusion gauge	
68490014F (KIT 4 pieces) 68490027F 68490026F 68490025F 68490024F **X**	J-42670 (8 mm) J-44560 (10 mm)	Dial gauge mounting for Bosch injection pump timing lenght 50mm (M10x1) lenght 50mm (M8x1) lenght 90mm (M8x1) lenght 90mm (M10x1)	

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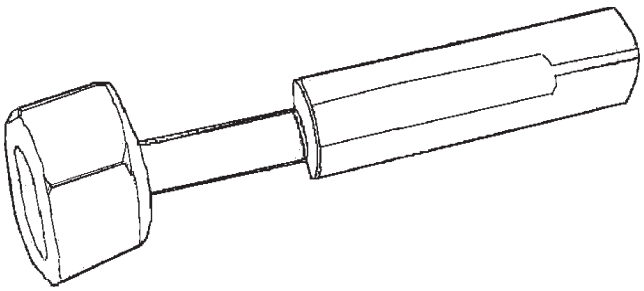
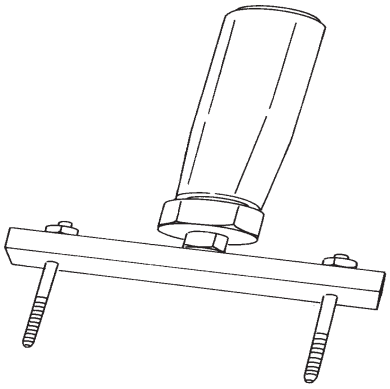
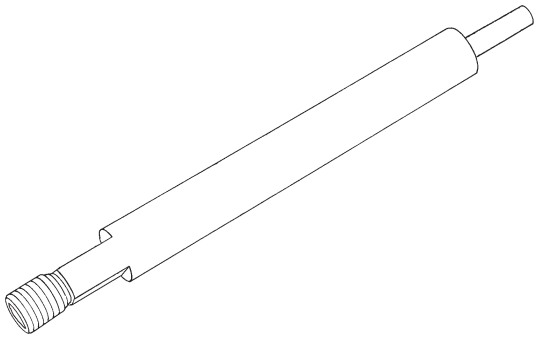
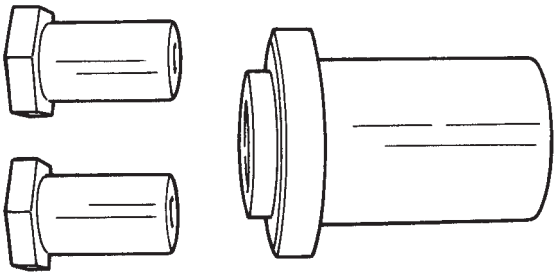
68490016F **Y**	J-44919 point	Fuel pump delivery start	
68480013F **Z**		Centering pins for balance shaft	
68490015F **AA**		Cilynder pressure check device	
68410013F **AB**		Tool for mounting front oil seal fusion cover. This tool is supplied with an insert with a right thread and a left thread.	

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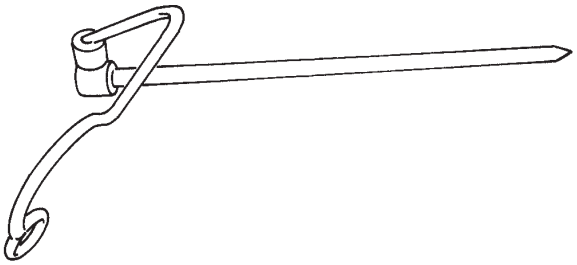
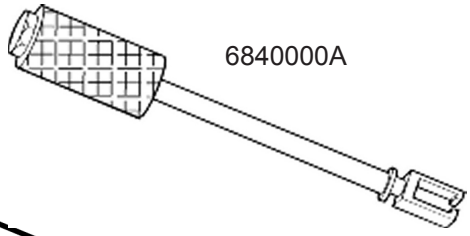
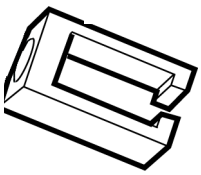
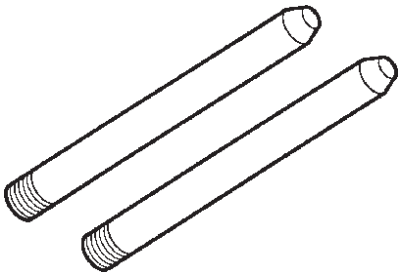
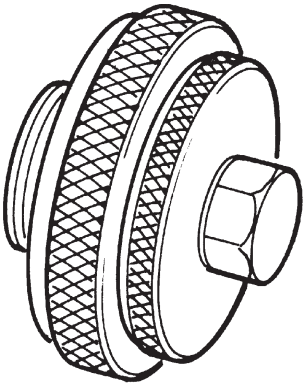
68480015F **AC**		Stop for **HIGH PRESSURE BOSCH** injection pump for D703E. (INJECTION PUMPS NEW MODEL)	
68400035F **AD**		Fork for injectors extractor for previous injector extractor 68400004A, **NO LONGER SUPLLIED.** **FORK NO LONGER SUPLLIED**	 
68460005F **AE**		Pins for flywheel assembly	
68400037F **AF**		Injection pump extractor for engine with deeper timig cover	

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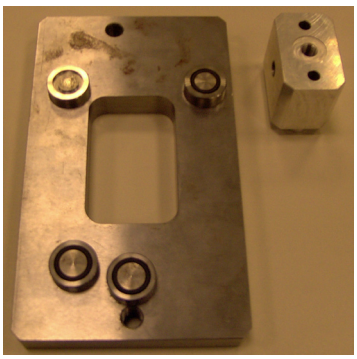
68490020F **AG**		Tool for T.D.C. from injector seat.	
68410014F **AH**		Tool for blocking the engine shaft pulley for engines with cylindrical crankshaft end	
68400038F **AI**		Crankshaft gear extractor for engines with cylindrical crankshaft end	
684400010F **AJ**		Device for cylinder head hydraulic pressure test	

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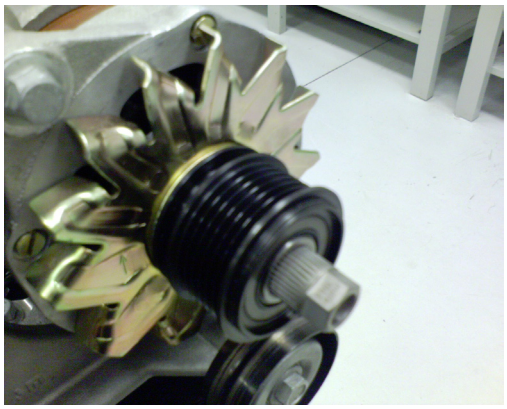
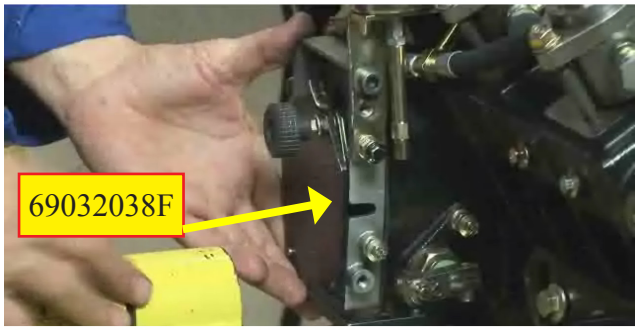
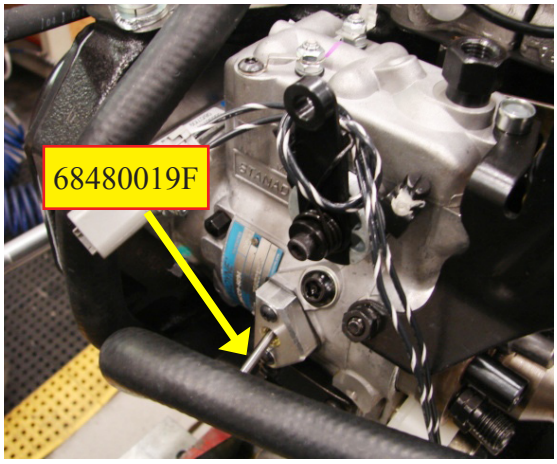
68420022F **AK**		Alternator pulley socket	
69032038F **AL**		Mask for adjstument LDA valve	
68480019F **AM**		injection pump timing pin only for D753TE3-IE3 engines with installed STANADYNE injection pump	
63050218F **AN**		Stroboscope device model DS88-VME to check dinamic timing, only for D753TE3-IE3 engine models with installed STANADYNE injcetion pump	

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LABOR TIME GUIDE 12

KEY TO DEFINITIONS

R/R = removal and re-installation
U.d.P. = unit of power

INTERPRETING THE CODE OF THE OPERATION

Cod. **3Z - EAA / 4**
The first code group identifies the operation performed (ex: **3Z** = replacement)
The second group separated by a dash, identifies the component (ex: **EAA** = camshaft)
The number after the slash, identifies the quality of components involved in the operation, this number can be omitted if there are no other similar components on the engine.

1°) exsample: **3Z - EAA**

replacement — camshaft

This type of code is used when there are no other similar components or multiple components on the engine.

2°) exsample: **10Z - OAA / 1** or **10Z - OAA / 6**

10Z - OAA / 1: test — function — on **1** injector
10Z - OAA / 6: test — function — on **6** injectors

this type of code is used when there are other similar components or multiple components on the engine.

OPER. NO.	ENGINE - REMOVE AND REINSTALL (R & R)	CYL. No.	P/U	IND.	MAR.
14Z-AAA	**Remove and Reinstall engine:** of the application.			4.0	
3Z-AAA	**Replace Short Block Assembly:** With new or reconditioned assembly; does not include reconditioning of parts. Includes retorque cylinder heads and reset tappets.	3 4 6		10.5 11.0 11.5	

OPER. NO.	ENGINE OVERHAUL	CYL. No.	P/U	IND.	MAR.
7Z-AAA	**Major Engine Overhaul:** – Steam clean and completely dismantle; clean all parts; flush all oil and water passages and replace plugs; check crankshaft for size and wear and inspect all parts. – Check the cylinder wear and if necessary replace them. – Replace, or renew where necessary, camshaft and auxiliary drive bushes, main and big end bearings and thrust washers. – Inspect and replace timing gears, as necessary. – Replace water pump, oil pump and turbocharger. – Overhaul turbocharge – Clean head and disassemble completely; inspect all parts and magnaflux head (Magnaflux crack detector); and Hydraulic test (pressure the cylinder head at ~ 2 bar (29 psi) dip it in a hot water +50-60°C (+122-140°F) for two minutes and check for air bubble.) Check longitudinal and horizontal warpage on head surface; replace valve guides or ream as needed. Grind valves and seats; replace valves and/or seats, as required. Check springs, keepers and retainers and replace as required. Lap valves and reassemble. – Test bench – Valve clerance adjustmente (this procedure has to be carried out for engine equipped with mechanical tappets.)	3 4 6		21.0 25.0 32.5	
8Z-AAA	**Partial engine overhaul:** – Steam clean parts and partial dismantle (cylinder heads and pistons). Clean the disassembled parts, replace plug (only if worn), check liners dimension and wear. – Hone cylinder liners and replace the compression rings. – Check or replace, valves, guide valves and seats grind – Inspect and replace timing gears, as necessary. Inspect and renew, as required water pump, oil pump and turbocharger. – Engine assembly following the procedure at chapter 7 (assembly) – Test bench – Valve clerance adjustmente (this procedure has to be carried out for engine equipped with mechanical tappets.)	3 4 6		9.0 10.0 12.0	
2I-AAA	**Oil consumption rectification:** – Remove cylinder head, lube oil pan and oil pump. – Remove all pistons and connecting rods. – Deglaze all cylinder bores. – Clean and check pistons for wear, renewing as necessary and replace all piston rings. – Check condition of oil pump and renew if necessary. – Reassemble all parts using new gaskets.	3 4 6		8.0 10.2 15.5	

OPER. NO.	ENGINE OVERHAUL	CYL. No.	P/U	IND.	MAR.
8Z-DAA	**Top overhaul (cylinder heads and/or gaskets):** – Remove cylinder head(s) and gasket(s). – Remove all traces of jointing compound and old gasket. – Check cylinder head(s) and reseat valves. – Fit new gasket and replace head(s), Check atomisers and service as necessary. – Torque head and set valve clearance. – Run engine and check for leaks. – Retorque head(s) and reset tappets.	3 4 6		7.5 8.5 10.5	
8Z-KDA	**Additonal time for turbocharged units.** For use on specific operations listed below:	3 4 6	1.0 1.0 1.0	- - -	- - -
3Z-ABA	**Cylinder Block - Replace:** – Steam clean complete engine, dismantle, clean and inspect all component parts. – Reassemble engine complete into new bare block with same or new pistons, using new rings main and big end bearings and thrust washers, gaskets and seals, and torque to specifications. – Run engine and check for leaks. – Retorque head and reset tappets.	3 4 6		8.5 11.0 16.5	
3Z-DAA	**Replace Cylinder Head/Gasket (Each):** – R&R and renew rocker arm assembly – R&R intake manifold – R&R exhaust manifold – R&R water manifold from heads – R&R rocker arm lubricating pipe – fit new gasket	3 4 6		3.7 4.5 6.0	
9Z-DAA	**Retorque cylinder head assembly and reset tappets (Mechanical tappets).**	3 4 6		1.0 1.0 1.2	
9Z-DAA	**Retorque cylinder head assembly - no reset tappets (Hydraulic tappets).**	3 4 6		0.7 0.6 0.8	
10Z.DGA	**Major Valve Job:** – Clean and disassemble head assembly. – Inspect all parts and renew or replace as necessary. – Reassemble head assembly.	3 4 6		0.9 1.1 1.5	

OPER. NO.	BASIC ENGINE	CYL. No.	P/U	IND.	MAR.
3Z-DGG 3Z-DGF	**R&R valve guides (all):** Includes: R&R cylinder head.	3 4 6		6.5 7.5 9.0	
3Z-BAA	**R&R Crankshaft:** – R&R rear crankshaft seal. – R&R flywheel housing. – R&R oil pan and strainer. – R&R oil pump. – R&R vibration damper. – R&R thrust washers. – R&R timing gear cover. – R&R head. – R&R main bearings. – R&R pistons and connecting rods.	3 4 6		12.0 13.0 15.0	
3Z-MCE	**Replace Front Crankshaft Oil Seal:**	3 4 6		0.5 0.5 0.7	
3Z-BIG	**R&R rear crankshaft seal:**	3 4 6		0.7 0.7 0.7	
3Z-BOA 3Z-BHA 3Z-BIA	**Replace Main Bearings: (Replace All including rear and front)** – R&R oil pan and strainer.	3 4 6		11.5 12.5 14.5	
3Z-BIA	**Replace main rear bearing:** – R&R Flywheel housing.	3 4 6		1.0 1.0 1.0	
3Z-BOA	**Replace main front bearing:** – R&R Replace timing gear housing and gasket.	3 4 6		12 13 15	
3Z-QBB	**Replace small end bushing:** – R&R connecting rod.	3 4 6		1.7 1.8 2.0	
3Z-GEA	**Replace oil heat exchanger (modine type).**	3 4 6		0.5 0.5 0.5	

OPER. NO.	BASIC ENGINE	CYL. No.	P/U	IND.	MAR.
3Z-QAA	**Replace main front bushing (one pair):** – R&R oil pan and strainer.	3 4 6		12.3 13.3 15.3	
3Z-QAD	**Replace main rear bushing:** – R&R flywheel housing.	3 4 6		0.9 0.9 0.9	
3Z-BLA	**Replace Crankshaft Pulley/Damper Assembly:**	3 4 6		0.3 0.3 0.3	
3Z-JAF	**Replace Fan Belt:**	3 4 6		0.3 0.3 0.3	
3Z-BFA	**Replace Flywheel Assembly:**	3 4 6		0.2 0.2 0.2	
3Z-BFE	**Replace starter ring gear:**	3 4 6		0.5 0.5 0.5	
3Z-MAA	**Replace Flywheel Housing:** – R&R flywheel assembly.	3 4 6		0.5 0.5 0.5	
3Z-BAF 3Z-BAG 3Z-EAC 3Z-BGL 3Z-PAC	**Replace timing gear assembly:** – R&R timing gear cover. (excluding camshaft on 4-6 cylinders).	3 4 6		1.7 1.7 1.7	
3Z-MCA	**Replace timing gear housing and gasket:** – R&R crankshaft pulley/damper.	3 4 6		0.7 0.7 0.7	
3Z-MCE	**Replace timing case cover oil seal:**	3 4 6		0.5 0.5 0.5	
3Z-HAA	**Replace Water Pump Assembly:**	3 4 6		0.5 0.5 0.5	
3Z-HAL	**Replace water pump pulley:**	3 4 6		0.2 0.2 0.2	

OPER. NO.	BASIC ENGINE	CYL. No.	P/U	IND.	MAR.
3Z-PAC	**Replace fuel pump drive gear:** – R&R timing gear cover and gasket.	3 4 6		1.2 1.2 1.2	
3Z-BAF	**Replace crankshaft gear:** – R&R timing gear cover and gasket.	3 4 6		1.8 1.8 1.9	
3Z-CAA/1	**Replace One Piston and Connecting Rod:** – R&R Cylinder head and gaskets. – R&R oil pan and strainer.	3 4 6		5.4 6.5 9.0	
3Z-CAA/3 3Z-CAA/4 3Z-CAA/6	**Replace all pistons and connecting rods:** – R&R cylinder heads and gaskets. – R&R oil pan and strainer.	3 4 6		6.4 7.5 10.0	
3Z-CAD	**Replace piston rings on all pistons:** – R&R all pistons and connecting rods.	3 4 6		6.5 7.6 10.1	
3Z-AIA/3 3Z-AIA/4 3Z-AIA/6	**Replace all liners:** – R&R one connecting rod.	3 4 6		6.7 7.8 10.3	
3Z-AIA/1	**Replace one liner:** – R&R one connecting rod.	3 4 6		5.7 6.8 9.3	
3Z-EAA	**Replace camshaft assembly:** – R&R all push rods. – R&R timing gear assembly. – R&R timing gear cover and gasket. – R&R rocker arms. – R&R oil pan. – adjust valve clearance.	3 4 6		5.5 6.5 8.5	
3Z-EAC	**Replace camshaft gear assembly:** – R&R timing cover and gasket.	3		0.6	
3Z-EAF	**Replace camshaft oil seal (rear):** – R&R Flywheel housing.	3 4 6		0.7 0.7 0.7	
3Z-DFA/3 3Z-DFA/4 3Z-DFA/6	**Replace Rocker Shaft Assembly:** – Adjust all tappets.	3 4 6		1.3 1.5 1.8	

OPER. NO.	BASIC ENGINE	CYL. No.	P/U	IND.	MAR.
3Z-DFA/1	**Replace Rocker arm assembly :(each)** – Adjust tappets.	3 4 6		0.5 0.5 0.5	
3Z-ECA	**Replace all pushrods:** – R&R rocker arm assemblies.	3 4 6		1.4 1.6 1.9	
3Z-EBB	**Replace all tappets (Mechanical tappets):** – R&R camshaft assembly.	3 4 6		5.6 6.6 8.7	
3Z-EBB	**Replace all tappets (Hydraulic tappets):** – Replace Cylinder Head/Gasket.	3 4 6		3.5 5.0 6.5	
3Z-DGH/1 3Z-DGI/1	**Replace One Valve Spring Assembly:** – R&R valve cover and gasket.	3 4 6		0.8 0.8 0.8	
3Z-DGH/3/4/6 3Z-DGI/3/4/6	**Replace all valve spring assemblies:** – R&R valve cover and gasket.	3 4 6		1.7 2.0 2.5	
3Z-MHA	**Replace Valve Cover and Gasket:**	3 4 6		0.2 0.3 0.4	
3Z-KAA	**Replace Air Intake Manifold:**	3 4 6		0.3 0.4 0.6	
3Z-KDA	**Replace Turbocharger:**	3 4 6		0.6 0.6 0.6	
3Z-MBA	**Replace Oil Pan and Gasket**	3 4 6		0.4 0.4 0.5	
3Z-KBA	**Replace Exhaust Manifold:**	3 4 6		0.2 0.3 0.5	
3Z-NAB	**Replace mechanical governor spring:**	3		1.0	

OPER. NO.	FUEL SYSTEM	CYL. No.	P/U	IND.	MAR.
3Z-OAA/1	**Replace One Injector Assembly:**	3 4 6		0.2 0.2 0.2	
3Z-OAA/3 **3Z-OAA/4** **3Z-OAA/6**	**Replace all injector assemblies:**	3 4 6		0.7 0.8 1.0	
3Z-OAB/1	**Replace one nozzle assembly:**	3 4 6		0.3 0.3 0.3	
3Z-OAB/3 **3Z-OAB/4** **3Z-OAB/6**	**Replace all nozzle assemblies:** – Test all nozzles.	3 4 6		0.3 0.4 0.6	
3Z-NAA	**Replace Governor Assembly:**	3		1.0	
10Z-OAA/1	**Remove and test atomiser: (each)** – R&R high pressure fuel lines.	3		1.0	
10Z-OAA/3 **10Z-OAA/4** **10Z-OAA/6**	**Remove and test all atomisers:** – R&R high pressure fuel lines.	3		2.0	
3Z-PAA	**Replace fuel injection pump assembly:** – Check fuel pump timing. – R&R high pressure lines.	3 4 6		2.5 2.0 2.0	
3Z-OFA	**Replace fuel lift pump:**	3 4 6		0.2 0.2 0.2	
10Z-PAA	**Check fuel pump timing:**	3 4 6		0.5 0.5 0.5	
12Z-OEL	**Bleed fuel system:**	3 4 6		0.1 0.1 0.1	
3Z-SGD	**Replace fuel pump stop solenoid:**	3 4 6		0.5 0.5 0.5	

OPER. NO.	FUEL SYSTEM	CYL. No.	P/U	IND.	MAR.
3Z-OEC	Replace Fuel Filter Element:	3 4 6		0.2 0.2 0.2	
3Z-OCA	Replace High Pressure Fuel Line: (Each)	3 4 6		0.2 0.2 0.2	
3Z-OCA	Replace high pressure fuel lines: (all)	3 4 6		0.5 0.5 0.5	

OPER. NO.	LUBRICATING SYSTEM	CYL. No.	P/U	IND.	MAR.
3Z-GAA	**Replace oil pump assembly:**	3 4 6		1.2 1.2 1.2	
3Z-GGA	**Replace oil pump relief valve:** – R&R oil pan and strainer.	3 4 6		0.6 0.6 0.7	
3Z-GAQ	**Replace rocker arm pipes assembly:**	3 4 6		0.4 0.5 0.6	
3Z-GID	**Replace oil breather assembly:**	3 4 6		0.2 0.2 0.2	
3Z-GBA	**Replace Oil Filter Element:**	3 4 6		0.2 0.2 0.2	
3Z-GAO	**Replace oil pickup tube and screen:**	3 4 6		0.6 0.6 0.7	

OPER. NO.	COOLING SYSTEM	CYL. No.	P/U	IND.	MAR.
3Z-IAA	Replace Radiator Fan:	3 4 6		0.5 0.5 0.5	
3Z-HDA	Replace Thermostat Assembly:	3 4 6		0.1 0.1 0.1	
3Z-HHA	Replace Radiator Assembly:	3 4 6		1.0 1.0 1.0	

OPER. NO.	ELECTRICAL AND INSTRUMENT	CYL. No.	P/U	IND.	MAR.
3Z-SEA	Replace Alternator:	3 4 6		0.3 0.3 0.3	
3Z-SEF	Replace Current Voltage Regulator:	3 4 6		0.4 0.4 0.4	
3Z-SGA	Replace Starter Motor Assembly:	3 4 6		0.3 0.3 0.3	
3Z-SGD	Replace starter solenoid assembly:	3 4 6		0.2 0.2 0.2	
3Z-SAA	Replace Wiring Harness:	3 4 6		1.0 1.0 1.0	

OPER. NO.	TUNE UP	CYL. No.	P/U	IND.	MAR.
11Z-DGA/1	**Adjust Valve Clearance: (Each Set)** – R&R valve cover and gasket (01.85-00).	3 4 6		0.2 0.2 0.2	
11Z-DGA/3 **11Z-DGA/4** **11Z-DGA/6**	**Adjust valve clearance: (all)** – R&R valve cover and gasket.	3 4 6		0.8 0.9 1.1	
10Z-DGA	**Valve timing check:** – R&R valve cover and gasket. (RE: service manual).	3 4 6		0.5 0.5 0.5	