

**Betriebsanleitung  
Operation Manual**

STAND-BY GEN.

234

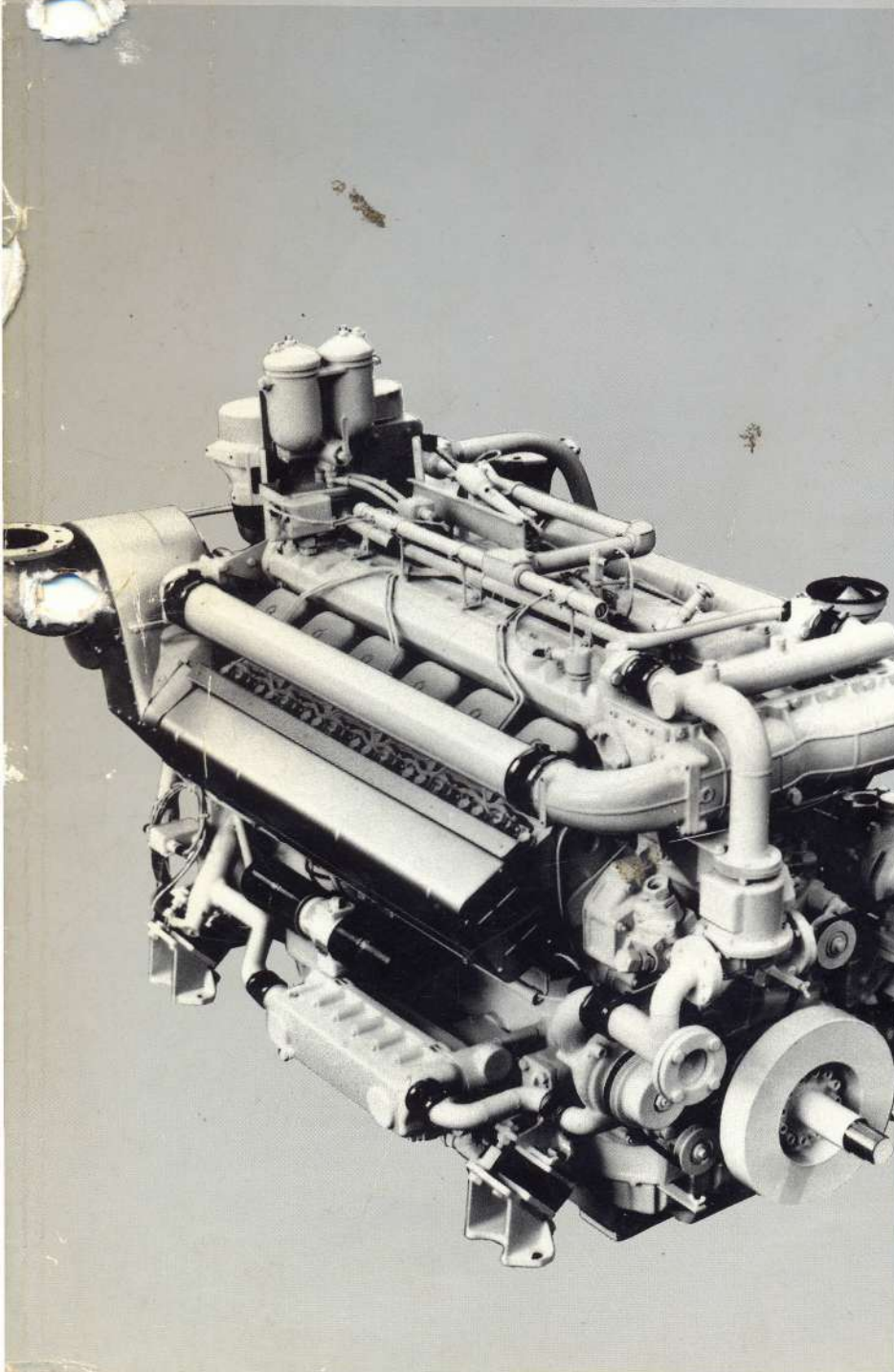
234



**AE.03.**

**8A**

All





## Hinweise

- Lesen und beachten Sie die Informationen dieser Betriebsanleitung. Sie vermeiden Unfälle, erhalten sich die Garantie des Herstellers und verfügen über einen funktionstüchtigen und einsatzbereiten Motor.
- Dieser Motor ist ausschließlich für den dem Lieferumfang entsprechenden Verwendungszweck - definiert durch den Gerätehersteller - gebaut (bestimmungsgemäßer Gebrauch). Jeder darüber hinausgehende Gebrauch gilt als nicht bestimmungsgemäß. Für hieraus resultierende Schäden haftet der Hersteller nicht. Das Risiko hierfür trägt allein der Benutzer.
- Zur bestimmungsgemäßen Verwendung gehören auch die Einhaltung der vom Hersteller vorgeschriebenen Betriebs-, Wartungs- und Instandsetzungsbedingungen. Der Motor darf nur von Personen genutzt, gewartet und instandgesetzt werden, die hiermit vertraut und über die Gefahren unterrichtet sind.
- Stellen Sie sicher, daß diese Betriebsanleitung jedem am Betrieb, Wartung und Instandsetzung Beteiligten zur Verfügung steht und der Inhalt verstanden wird.
- Die Nichtbeachtung dieser Betriebsanleitung kann zu Funktionsstörungen und Motorschäden sowie Verletzungen von Personen führen, für die vom Hersteller keine Haftung übernommen wird.
- Voraussetzung für die fachgerechte Wartung und Instandsetzung ist die Verfügbarkeit aller erforderlichen Ausrüstungen, Hand- und Spezialwerkzeuge, sowie deren einwandfreier Zustand.
- Motorteile wie Federn, Klammern, elastische Halteringe etc. beinhalten bei unsachgemäßer Behandlung erhöhte Verletzungsgefahr.
- Die einschlägigen Unfallverhütungsvorschriften sowie sonstige allgemein anerkannte sicherheitstechnische und arbeitsmedizinische Regeln sind einzuhalten.
- Höchste Wirtschaftlichkeit, Zuverlässigkeit und lange Lebensdauer ist nur bei Verwendung von Original Teilen der Marke DEUTZ MWM sichergestellt.
- Die Instandsetzung des Motors muß der bestimmungsgemäßen Verwendung entsprechen. Bei Umbauarbeiten dürfen nur vom Hersteller für den jeweiligen Verwendungszweck freigegebene Teile eingesetzt werden. Eigenmächtige Veränderungen am Motor schließen eine Haftung des Herstellers für daraus resultierende Schäden aus.

## Note

- Read and pay attention to the information given in these operating instructions. You will avoid accidents, will maintain the manufacturer's guarantee and will have a fully functional and operable engine.
- This engine was constructed exclusively for the purpose conforming to its scope of delivery as defined by the equipment manufacturer (operation in accordance with the intended purpose). Any use exceeding the above scope will be deemed to constitute operation which is not in accordance with the intended purpose. The manufacturer will not be liable for resulting damages. The risk will be borne solely by the user.
- Operation in accordance with the intended purpose also includes conformity with the operating, servicing and maintenance conditions specified by the manufacturer. The engine must only be used, serviced and repaired by persons who are entrusted with it and have been informed about the risks involved.
- Make sure that these operating instructions are available to all persons involved in operation, servicing and maintenance and that their contents are understood.
- Failure to observe these operating instructions may lead to malfunctions and engine damage as well as personal injury. The manufacturer assumes no liability for such occurrences.
- As an essential prerequisite for expert servicing and repair, all necessary equipment, handiend and special tools must be available and must be in perfect condition.
- If handled improperly, parts of the engine such as springs, clips and flexible retaining rings etc. may involve an increased risk of injury.
- The relevant Accident Prevention Regulations and all other generally recognized safety and industrial hygiene regulations must be obeyed.
- Maximum economic operation, reliability and a long useful life will be guaranteed only if original spare parts are used.
- Repair of the engine must conform to its use in accordance with its intended purpose. If conversions are carried out, use must be made only of the parts approved by the manufacturer for the intended purpose. Any changes carried out on the engine by the user without the manufacturer's permission will exclude any liability on the part of the manufacturer for resulting damage.

# Betriebsanleitung Operation Manual 234



8A

0297 4800

Motornummer:  
Engine Serial Number:

0 8 0 2 8 3 9

Bitte tragen Sie hier die Motornummer ein. Sie erleichtern hierdurch die Abwicklung bei Kundendienst-, Reparatur- und Ersatzteilfragen.

Please enter engine serial number here. In this way, questions concerning Customer Service, Repairs and Spare Parts can be more easily dealt with.

Gegenüber Darstellungen und Angaben dieser Betriebsanleitung sind technische Änderungen, die zur Verbesserung der Motoren notwendig werden, vorbehalten. Nachdruck und Vervielfältigung jeglicher Art, auch auszugsweise, bedarf unserer schriftlichen Genehmigung.

In view of continuous design improvements or changes, the technical specifications and the illustrations shown in this Operation Manual are subject to alteration. Reprinting and reproduction, in part or in whole, are subject to our written approval.

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## Vorwort

Sehr geehrter Kunde,  
die Motoren der Marke DEUTZ MWM sind für ein breites Anwendungsspektrum entwickelt. Dabei wird durch ein umfangreiches Angebot von Varianten sichergestellt, daß die jeweiligen speziellen Anforderungen erfüllt werden.

Ihr Motor ist dem Einbaufall entsprechend ausgerüstet, das heißt, nicht alle in dieser Betriebsanleitung beschriebenen Bauteile und Komponenten sind an Ihrem Motor angebaut.

Wir haben uns bemüht, die Unterschiede deutlich herauszustellen, so daß Sie die für Ihren Motor relevanten Betriebs- und Wartungshinweise leicht finden können.

Bitte lesen Sie diese Betriebsanleitung bevor Sie Ihren Motor in Betrieb setzen und beachten Sie die Betriebs- und Wartungshinweise.

Für Rückfragen stehen wir Ihnen gerne beratend zur Verfügung.

Ihre

DEUTZ SERVICE INTERNATIONAL GmbH

## Allgemeines

### DEUTZ MWM Motoren

sind das Produkt jahrelanger Forschung und Entwicklung. Das dadurch gewonnene fundierte know how in Verbindung mit hohen Qualitätsanforderungen ist die Garantie für die Herstellung von Motoren mit langer Lebensdauer, hoher Zuverlässigkeit und geringem Kraftstoffverbrauch. Es ist selbstverständlich, daß auch die hohen Anforderungen zum Schutz der Umwelt erfüllt werden.

### Wartung und Pflege

sind mit entscheidend, ob der Motor die an ihn gestellten Forderungen zufriedenstellend erfüllt. Die Einhaltung der vorgeschriebenen Wartungszeiten und die sorgfältige Durchführung der Wartungs- und Pflegearbeiten sind daher unbedingt notwendig. Insbesondere sind vom normalen Betrieb abweichende, erschwerende Betriebsbedingungen zu beachten.

### DEUTZ SERVICE INTERNATIONAL GmbH

Wenden Sie sich bei Betriebsstörungen und Ersatzteilfragen an eine unserer zuständigen Service-Vertretungen. Unser geschultes Fachpersonal sorgt im Schadensfall für eine schnelle und fachgerechte Instandsetzung unter Verwendung von Original Teilen.

Original Teile der DEUTZ SERVICE INTERNATIONAL GmbH sind stets nach dem neuesten Stand der Technik gefertigt.

Hinweise zu unserem SERVICE finden Sie am Ende dieser Betriebsanleitung.

### Vorsicht bei laufendem Motor

Wartungsarbeiten oder Reparaturen nur bei stillgesetztem Motor durchführen. Evtl. entfernte Schutzvorrichtungen nach Abschluß der Arbeiten wieder montieren. Bei Arbeiten am laufenden Motor muß die Arbeitskleidung fest anliegen. Nur bei stillgesetztem Motor tanken. Motor nie in geschlossenen Räumen laufen lassen - Vergiftungsgefahr.



### Sicherheit

Dieses Symbol finden Sie bei allen Sicherheitshinweisen. Beachten Sie diese sorgfältig. Geben Sie Sicherheitsanweisungen auch an Ihr Bedienungspersonal weiter. Darüber hinaus sind die "Allgemeinen Sicherheits- und Unfallverhütungsvorschriften" des Gesetzgebers zu beachten.



### Hinweis

Dieses Symbol finden Sie bei Hinweisen allgemeiner Art. Beachten Sie diese sorgfältig.



### Asbest

Bei diesem Motor verwendete Dichtungen können Asbest enthalten. Bitte achten Sie bei Reparaturarbeiten aufentsprechend gekennzeichnete Ersatzteile ("a").

## Foreword

Dear Customer,

The liquid-cooled engines of the trademark DEUTZ MWM have been developed for a wide range of applications. Consequently, a large spectrum of variants is available to meet the specific requirements of each individual case.

Your engine is appropriately equipped for the installation concerned, which means that not all of the components described in this Operation Manual are necessarily mounted to your engine.

We have taken pains to point out the differences, so that you can easily find the operating and maintenance instructions relevant to your engine.

Please read these instructions before commissioning your engine and give due consideration to the operating and maintenance instructions.

Should you have any further queries, please do not hesitate to contact us.

Yours sincerely,

DEUTZ SERVICE INTERNATIONAL GmbH

## General

### DEUTZ MWM Diesel Engines

are the product of research and development invested over many years. The knowhow thereby gained, coupled with high demands with regard to quality, forms the guarantee for the manufacture of engines featuring long service life, high reliability and low fuel consumption.

### Service and Maintenance

will also play a decisive role as to whether the engine fulfills to your satisfaction the demands you make on it. Observance of the specified maintenance intervals and careful performance of the service and maintenance jobs are therefore essential.

Particular attention is required if the applications involve different and harder operating conditions as compared to normal operation.

### DEUTZ SERVICE INTERNATIONAL GmbH

In case of engine malfunctions and queries concerning spare parts, please contact one of our relevant service agencies. Where necessary, our trained specialists will ensure a quick and professional repair, using genuine spare parts. Genuine spare parts of DEUTZ SERVICE INTERNATIONAL GmbH are always manufactured according to the latest state of the art.

More information on our SERVICE is to be found at the end of this Operation Manual.

### Beware of Running Engine

Be sure to stop the engine before performing maintenance and repair work. Upon completing the work, refit any guards which had to be removed. Working clothes should fit tightly when doing work on the running engine.

Always stop the engine before refuelling.

Never run the engine in an enclosed space - danger of poisoning.



### Safety

When reading through this Manual, you will find this symbol marking all safety instructions. Observe them carefully. Also inform your operating personnel in detail about all safety instructions.

In addition, observe the "General Safety and Accident Prevention Regulations" imposed by legislation.



### Attention

This symbol appears when we give you general tips. Observe them carefully.



### Asbestos

Gaskets used in this engine may contain asbestos. When carrying out repair work, pay special attention to spare parts which are marked "a".

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- 01.5 Maßsystem

## 1. Teil: Motordaten u. Beschreibung

- 1.1 Motordaten
- 1.2 Hauptabmessungen
- 1.3 Beschreibung des Motors

## 2. Teil: Betrieb u. Betriebsmittel

- 2.1 Vorbereitungen zur ersten Inbetriebnahme
- 2.2 Bedienung des Motors
- 2.3 Betriebsstoffvorschriften

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  - 3.1.1 Sonstige Hilfsstoffe
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## 01 Hinweise

**01.1 Allgemeine Kenntnisse** von der Wirkungsweise des Viertakt-Verbrennungsmotors und ein gewisses Verständnis für technische Zeichnungen sind beim Leser und Benutzer dieser Betriebsanleitung vorausgesetzt. Der Text ist daher zugunsten der Übersichtlichkeit entsprechend gestrafft. Der Informationsgehalt ist durch Fotos, Schnittbilder und schematische Darstellungen ergänzt.

### 01.2 Baugruppenaufteilung

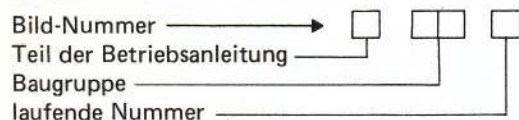
Teil 1 dieser Betriebsanleitung ist - soweit möglich - in folgende Baugruppen eingeteilt:

- 00 Gruppenfreie Teile
- 01 Zylinderkurbelgehäuse und Ölwanne
- 02 Zylinderköpfe
- 03 Triebwerk
- 04 Rädertrieb und Nockenwelle
- 05 Kraftstoffsystem
- 06 Drehzahlregelung
- 07 Schmiersystem
- 08 Kühlsystem
- 09 Aufladung
- 10 Anlaßsystem
- 11 Bedienung und Überwachung

Diese Baugruppen sind aus den Motorschnittbildern ersichtlich.

Die Bilder sind nach den zugehörigen Abschnitten und - in Teil 1 - nach den Baugruppen benummert.

#### Beispiel



**01.3 Der technische Stand** dieser Betriebsanleitung gilt für die serienmäßige Ausführung z.Zt. der Drucklegung. Nachträgliche Änderungen können Abweichungen gegenüber der gelieferten Ausführung verursachen.

Bei idiomatisch bedingten Abweichungen zwischen den deutschen und fremdsprachlichen Texten ist der deutsche Text maßgebend.

Rechtliche oder alle sonstigen Ansprüche sind daher ausgeschlossen.

### 01.4 Garantieansprüche

im Rahmen unserer Lieferbedingungen setzen voraus, daß alle Vorschriften für Kraftstoffe, Schmiermittel, Kühlmittel sowie die Wartungsvorschriften beachtet und befolgt werden.

## Directions

### General remarks

It is assumed that the reader and user of these Operating Instructions is familiar with the basic mode of operation of a fourstroke combustion engine and is able to follow technical drawings reasonably well.

The text has been kept, therefore, as short as possible for the sake of clarity. The information content is backed by photographs and sectional drawings.

### Assembly breakdown

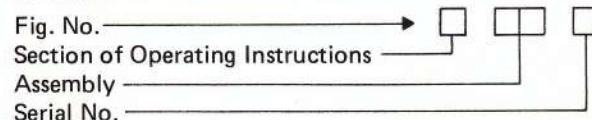
Part 1 of these Operating instructions are broken down in the following assemblies where this is possible:

- 00 Separate parts
- 01 Crankcase and Oilpan
- 02 Cylinderheads
- 03 Crank assembly
- 04 Gear drive, camshaft
- 05 Fuel system
- 06 Governor
- 07 Lubricating system
- 08 Cooling system
- 09 Turbocharger
- 10 Starting system
- 11 Control and monitoring

These assemblies are shown in the engine sectional drawings.

The figures are numbered according to the corresponding sections and - in part 1 - according to the assemblies.

#### Example



**Technical status** of these Operating Instructions applies to standard design at the time of going to print. Subsequent changes can result in deviations regarding the type made available.

Where differences result from idiomatic usage in German and foreign language texts, the German text shall govern. Any legal or other claims are thus excluded.

### Warranty claims

within the scope of our conditions require that all requirements as to fuels, lubricants, cooling agents and servicing instructions have been duly observed and carried out.

## 01.5 Maß-Einheiten

Die in dieser Betriebsanleitung verwendeten Maßeinheiten entsprechen dem Internationalen Einheitensystem (SI)

Formelzeichen	Größe	Einheit	Benennung	weitere Einheiten	Bemerkungen Umrechnungen
l A V	Länge Fläche Volumen	m m <sup>2</sup> m <sup>3</sup>	Meter		$\mu\text{m} = 0,001 \text{ mm}$
$\alpha$	ebener Winkel	rad	Radian	° Grad ' Minute " Sekunde	$1 \text{ rad} = 1 \text{ m/m} = \frac{360^\circ}{2\pi}$
m J	Masse (Gewicht) Drehmasse	kg kgm <sup>2</sup>	Kilogramm	g (Gramm)	Massenträgheitsmoment $J = GD^2 \cdot 0,25$
t v a n f $\omega$	Zeit Geschwindigkeit Beschleunigung Drehzahl Frequenz Winkelgeschwindigkeit	s m/s m/s <sup>2</sup> 1/s Hz rad/s	Sekunde Meter je Sekunde Meter je Sekundenquadrat Umdrehungen je Sekunde Hertz	min (Minute) h (Stunde) m/min (Meter je Minute) 1/min (Umdrehungen je Minute) °/s (Grad je Sekunde)	Wegänderung je Zeiteinheit Geschwindigkeitsänderung je Zeiteinheit Normfallbeschleunigung $g_n = 9,80665 \text{ m/s}^2$ 1 Hz = 1/s Schwingungen je Sekunde Umfangsgeschwindigkeit am Radius 1 $\omega = 2\pi n$ bei u 1/min gilt $\omega = n \times \frac{u}{30} \text{ 1/s}$
F G M	Kraft Gewichtskraft Drehmoment	N Nm	Newton		$1 \text{ N} = 1 \text{ kgm/s}^2 = 1 \text{ Ws/m}$ $1 \text{ N} = 0,10197 \text{ kp}$ $G = m \cdot g$ Moment einer Kraft am Hebelarm $1 \text{ Nm} = 0,10197 \text{ kpm}$
p	Druck von Flüssigkeiten und Gasen	bar		Pa (Pascal) mm WS (Millimeter Wassersäule)	$1 \text{ Pa} = 1 \text{ N/m}^2$ $1 \text{ bar} = 10^5 \text{ Pa} = 10 \text{ N/cm}^2 = 1,0197 \text{ kp/cm}^2$
E W Q	Energie Arbeit Wärmemenge	J	Joule	Ws (Wattsekunde) kWh (Kilowattstd.)	$1 \text{ J} = 1 \text{ Ws} = 1 \text{ Nm}$ $1 \text{ kWh} = 3600 \text{ KJ}$
P	Leistung	W	Watt		$1 \text{ W} = 1 \text{ J/s} = 1 \text{ Nm/s} = 1 \text{ kgm}^2/\text{s}^3$
T	Temperatur	K	Kelvin	°C (Grad Celsius)	$0^\circ \text{C} = 273,15 \text{ K}$ $1^\circ \text{C} = 1 \text{ K}$ (als Temperaturdifferenz $\Delta t$ )



## Vorsätze

Die vorgenannten Einheiten können mit Vorsätzen versehen sein, die ein dezimales Vielfaches oder einen dezimalen Teil der Grundeinheit ausdrücken.

Einheiten für Temperaturen, Winkel und Zeit (Ausnahme ist Sekunde) sind ohne Vorsatz zu verwenden.

Folgende Tabelle gibt einige Vorsätze mit Abkürzungen und Wert an.

Vorsatz Prefix		Abkürzung Abbreviation	Wert Value		
Mega	Mega	M	$10^6$	=	1000000
Kilo	Kilo	k	$10^3$	=	1000
Hekto	Hecto	h	$10^2$	=	100
Deka	Deca	da	$10^1$	=	10
Dezi	Deci	d	$10^{-1}$	=	0,1
Zenti	Centi	c	$10^{-2}$	=	0,01
Milli	Milli	m	$10^{-3}$	=	0,001
Mikro	Micro	$\mu$	$10^{-6}$	=	0,000001

## Prefixes

The units stated overleaf may be provided with prefixes expressing a decimal multiple or a decimal part of the basic unit.

Units for temperatures, angles and time (except for seconds) should be applied without a prefix.

The following table is giving some prefixes with abbreviations and value.

### Berechnungsformeln für Motor-Kennwerte:

#### 1. Mittlere Kolbengeschwindigkeit

$$c_m = \frac{s \cdot n}{30000} \quad \text{m/s}$$

#### 2. Drehmoment

$$M_D = \frac{9550 \cdot P_e}{n} \quad \text{Nm}$$

#### 3. Mittlerer effektiver Druck

$$p_e = \frac{1200 \cdot P_e}{n \cdot V_H} \quad \text{bar}$$

#### 4. Spezifischer Kraftstoffverbrauch

$$b_e = \frac{B}{P_e} \quad \text{g/kWh}$$

#### 5. Nutzwirkungsgrad

$$\eta_e = \frac{8431}{b_e} \quad \%$$

(gerechnet mit  $H_U = 42,7 \text{ kJ/g}$ )

### Equations for engine characteristic values:

#### 1. Mean piston speed

$$c_m = \frac{s \cdot n}{30000} \quad \text{m/s}$$

#### 2. Torque

$$M_D = \frac{9550 \cdot P_e}{n} \quad \text{Nm}$$

#### 3. Mean effective pressure

$$p_e = \frac{1200 \cdot P_e}{n \cdot V_H} \quad \text{bar}$$

#### 4. Specific fuel consumption

$$b_e = \frac{B}{P_e} \quad \text{g/kWh}$$

#### 5. Efficiency

$$\eta_e = \frac{8431}{b_e} \quad \%$$

(calculated with a lower cal. value of  $42.7 \text{ kJ/g}$ )

S	mm	Kolbenhub
n	1/min	Drehzahl pro Minute
$P_e$	kW	effektive Leistung
$V_H$	$\text{dm}^3$	Gesamt-Hubvolumen
B	g/h	Kraftstoffverbrauch pro Stunde.

s	mm	Piston stroke
n	1/min	Revolutions per minute
$P_e$	kW	Effective power
$V_H$	$\text{dm}^3$	Total swept volume
B	g/h	Fuel consumption per hour.



## 01.5 Measuring units

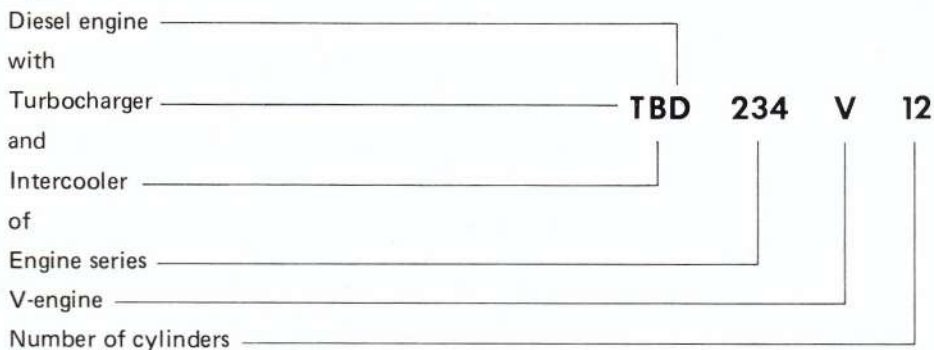
The measuring units applied in this operation instructions manual are complying with the International Unit System (SI).

Symbol	Value	Unit	Denomination	Further units	Remarks / Conversions
l	Length	m	Metre		$\mu\text{m} = 0.001 \text{ mm}$
A	Area	$\text{m}^2$			
V	Volume	$\text{m}^3$			
$\alpha$	Plane angle	rad	Radian	° Degree ' Minute " Second	$1 \text{ rad} = 1 \text{ m/m} = \frac{360^\circ}{2\pi}$
m	Mass (Weight)	kg	Kilogramme	g (Gramme)	
J	Rotary mass	$\text{kgm}^2$			Moment of inertia $J = GD^2 \cdot 0.25$
t	Time	s	Second	min (Minute) h (Hour)	
v	Velocity	m/s	Metre per second	m/min (Metre per minute)	Distance change per unit of time
a	Acceleration	$\text{m/s}^2$	Metre per square second		Change of speed per unit of time Standard acceleration due to gravity $g_n = 9.80665 \text{ m/s}^2$
n	Speed	1/s	Revolutions per second	1/min (Revolutions per minute)	
f	Frequency	Hz	Hertz		1 Hz = 1/s Vibrations per second
$\omega$	Angular velocity	rad/s		°/s (degree per second)	Peripheral speed at radius 1 $\omega = 2\pi n$ u 1/min applies to $\omega = n \times \frac{u}{30} \text{ 1/s}$
F	Force	N	Newton		1 N = $1 \text{ kgm/s}^2 = 1 \text{ Ws/m}$ 1 N = 0.10197 kp
G	Weight				$G = m \cdot g$
M	Torque	Nm			Moment of a force on lever arm 1 Nm = 0.10197 kpm
p	Force of liquids and gases	bar		Pa (Pascal) mm WS (Millimeter water gauge)	1 Pa = $1 \text{ N/m}^2$ 1 bar = $10^5 \text{ Pa} = 10 \text{ N/cm}^2 = 1.0197 \text{ kp/cm}^2$
E	Energy	J	Joule	Ws (Wattsecond)	1 J = 1 Ws = 1 Nm
W	Work			kWh (Kilowatt hour)	1 kWh = 3600 KJ
Q	Quantity of heat				
P	Power	W	Watt		1 W = 1 J/s = 1 Nm/s = $1 \text{ kgm}^2/\text{s}^3$
T	Temperature	K	Kelvin	° C (Degrees Celsius)	0° C = 273.15 K 1° C = 1 K (as difference in temperature of $\Delta t$ )

1. Engine data and description

1.1 Engine data

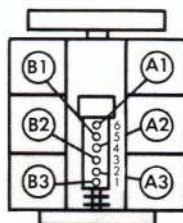
1.1.1 Type code



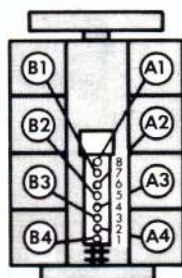
1.1.2 Numbering of cylinders

Flywheel end

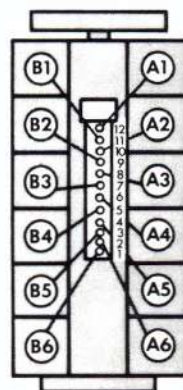
6-cylinder engine



8-cylinder engine



12-cylinder engine



1.1.3 Construction

	D 234 V 6	TBD 234 V 6	D 234 V 8	TBD 234 V 8	D 234 V 12	TBD 234 V 12
Operating method	4 - stroke, direct injection					
Pos. of cylinders/no. of cylinders	60° V/6	60° V/6	60° V/8	60° V/8	60° V/12	60° V/12
Cylinder bore Ø mm	128	128	128	128	128	128
Stroke mm	140	140	140	140	140	140
Cylinder piston displacement dm <sup>3</sup>	1,8	1,8	1,8	1,8	1,8	1,8
Total swept volume dm <sup>3</sup>	10,8	10,8	14,4	14,4	21,6	21,6
Number of inlet and exhaust valves	1/1	1/1	1/1	1/1	1/1	1/1
Compression ratio ε	16,5 : 1	15 : 1	16,5 : 1	15 : 1	16,5 : 1	15 : 1
<b>Valve timing</b>						
Inlet valve opens	2° after T.D.C.	10° bef. T.D.C.	2° after T.D.C.	10° bef. T.D.C.	2° after T.D.C.	10° bef. T.D.C.
Inlet valve closes	35° after B.D.C.	29° after B.D.C.	35° after B.D.C.	29° after B.D.C.	35° after B.D.C.	29° after B.D.C.
Exhaust valve opens	34° bef. B.D.C.	41° bef. B.D.C.	34° bef. B.D.C.	41° bef. B.D.C.	34° bef. B.D.C.	41° bef. B.D.C.
Exhaust valve closes	at T.D.C.	7° after T.D.C.	at T.D.C.	7° after T.D.C.	at T.D.C.	7° after T.D.C.
<b>Order of ignition</b>						
Cylinder row A	A1 A3 A2	A1 A3 A4 A2	A1 A3 A4 A2	A1 A5 A3 A6 A2 A4	A1 A5 A3 A6 A2 A4	A1 A5 A3 A6 A2 A4
Cylinder row B	B2 B1 B3	B2 B1 B3 B4	B2 B1 B3 B4	B5 B3 B6 B2 B4 B1	B5 B3 B6 B2 B4 B1	B5 B3 B6 B2 B4 B1



## Construction data (cont.)

	D + TBD 234 V 6		D + TBD 234 V 8		D + TBD 234 V 12	
	longitudinal	transversal	longitudinal	transversal	longitudinal	transversal
<b>Engine inclination</b>						
<b>Standard execution</b>						
Installed inclination (max.)	8°	-	8°	-	6°	-
Max. total inclination (max. 2 hours)	10°	10°	18°	22,5°	15°	22,5°
During operation (max. 3 min.)	14°	14°	22,5°	22,5°	18°	22,5°
<b>Special design</b>						
Installed inclination (max.)	10°	-	10°	-	8°	-
Max. total inclination (max. 2 hours)	14°	22,5°	22,5°	22,5°	18°	22,5°
During operation (max. 3 min.)	18°	26°	22,5°	22,5°	22,5°	22,5°
<b>Dry sump lubrication</b>						
Installed inclination (max.)	12°	-	12°	-	10°	-
Max. total inclination (max. 2 hours)	45°	30°	45°	30°	45°	30°
During operation						

## 1.1.4 Adjusting data

	D 234 V 6	TBD 234 V 6	D 234 V 8	TBD 234 V 8	D 234 V 12	TBD 234 V 12
Inlet valve clearance mm	0,2	0,3	0,2	0,3	0,2	0,3
Exhaust valve clearance mm	0,3	0,5	0,3	0,5	0,3	0,5
Inj. valve opening pressure (bar)	180 bis 188	210 bis 218	180 bis 188	210 bis 218	180 bis 188	210 bis 218
Nominal speed (min <sup>-1</sup> )	Start of delivery in ° crank angle bef. TDC ± 0.5			Start of delivery in mm before TDC		
	D 234	TBD 234 with injection pump S 1000   S 7100		D 234	TBD 234 with injection pump S 1000   S 7100	
1200 - 1600	20	-	-	5,35	-	-
1601 - 2000	22	-	-	6,45	-	-
2001 - 2300	24	-	-	7,65	-	-
1200 - 1800	-	22	18,5	-	6,48	4,63
1801 - 2300	-	25	22,5	-	8,30	6,75
<b>Pollutant - optimized adjustment</b>						
1500 - 1800	-	18	-	-	4,37	-

## 1.1.5 Operating data

<b>Rotational speed in min<sup>-1</sup></b>	*	*	*	*	*	*
Nominal speed						
Ignition speed	115	115	115	115	115	115
Lowest idling speed	650	650	650	650	650	650
Nominal output kW	*	*	*	*	*	*
<b>Presures in bar</b>						
Compression, min.	26	23	26	23	26	23
Ignition pressure	90	150	90	150	90	150
Lube oil pressure, max.	3...6	3...6	3...6	3...6	3...6	3...6
Lube oil pressure at n = 750 min <sup>-1</sup>	0,8...3	0,8...3	0,8...3	0,8...3	0,8...3	0,8...3
<b>Temperatures in °C</b>						
Cooling water, max.	90	85	90	85	90	85
Exhaust gas	650	650	650	650	650	650
Lube oil, max. (in oil pan)	110	120	110	120	110	120
Oil consumption, max. g/kWh	1,4	1,4	1,4	1,4	1,4	1,4

\* see rating plate

1.1.6 Füllmengen in dm<sup>3</sup>

	D + TBD 234 V6	D + TBD 234 V8	D + TBD 234 V12
Kühlwasserinhalt ohne Kühler	20	24	35
Schmierölinhalt obere Peilstabmarke	22	28	35 (39)*
Schmierölinhalt untere Peilstabmarke	16	16	20 (26)*
Ölmenge in Einspritzpumpe mit Bosch-Regler, nur bei Erstfüllung	0,4	0,7	2,0
Ölmenge in Schmierölfilter	2,0	3,5	3,5

\* Sonderausführung ohne Trockensumpf

1.1.6 Filling quantities in dm<sup>3</sup>

	D + TBD 234 V6	D + TBD 234 V8	D + TBD 234 V12
Cooling water capacity (without radiator)	20	24	35
Lube oil capacity, to top notch on dipstick	22	28	35 (39)*
Lube oil capacity, to bottom notch on dipstick	16	16	20 (26)*
Oil capacity in injection pump using Bosch governor (first-time filling only)	0,4	0,7	2,0
Lube oil filter oil capacity	2,0	3,5	3,5

\* special design, without dry sump

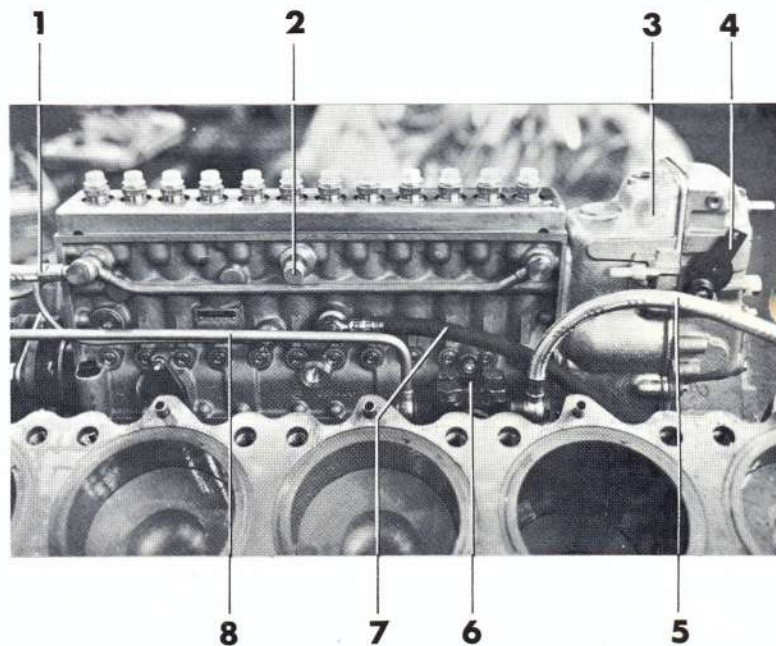
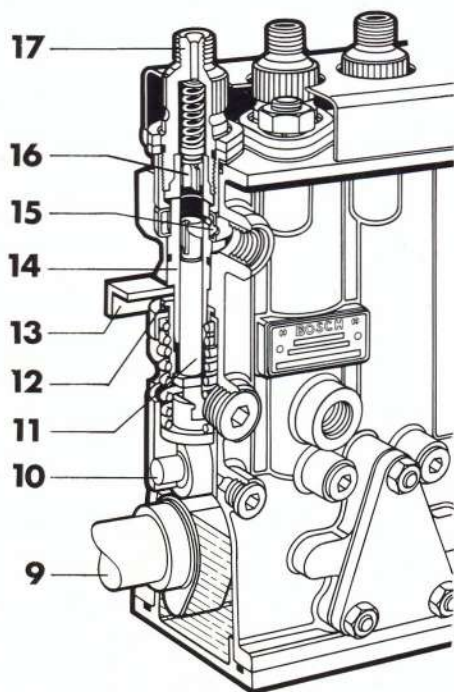
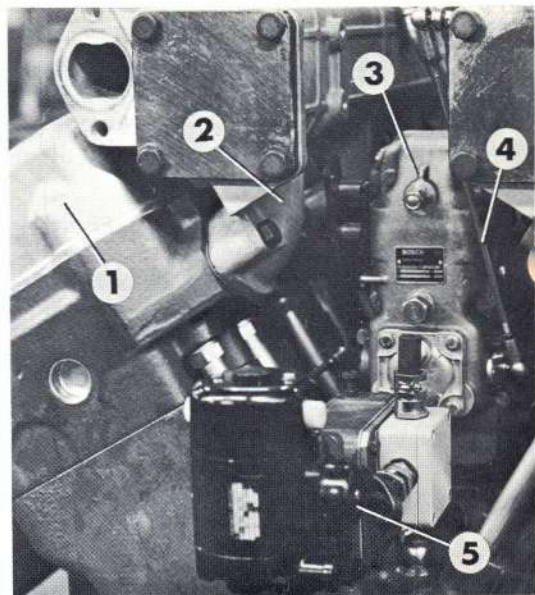


**Bild 1052** Einspritzpumpe am Motor

- 1 Zylinderkopf
- 2 Ansaugrohr
- 3 Einspritzpumpe mit Regler
- 4 Abstellgestänge
- 5 Elektrische Drehzahlverstellung

**Fig. 1052** Injection pump on engine

- 1 Cylinder head
- 2 Intake pipe
- 3 Injection pump with governor
- 4 Stop linkage
- 5 Elektric speed adjustment device

**Bild 1053** Einspritzpumpe

- 1 Kraftstoffzulauf vom Filter
- 2 Überströmventil (Bild 1051, Pos. 7)
- 3 Regler
- 4 Drehzahlverstellhebel
- 5 Kraftstoffzulauf
- 6 Kraftstoffförderpumpe (siehe auch Bild 1055)
- 7 Schmierölrücklauf
- 8 Leitung zum Filter
- 9 Nockenwelle für Einspritzpumpe
- 10 Rollenstößel
- 11 Kolben
- 12 Regelhülse
- 13 Regelstange
- 14 Pumpenzylinder
- 15 Zulaufbohrung
- 16 Druckhalteventil
- 17 Druckanschluß zum Einspritzventil

**Fig. 1053** Injection pump

- 1 Fuel supply from filter
- 2 Overflow valve (Fig. 1051, pos. 7)
- 3 Governor
- 4 Speed adjustment lever
- 5 Fuel supply
- 6 Fuel feed pump (see also fig. 1055)
- 7 Lubricating oil return
- 8 Pipe to filter
- 9 Camshaft for injection pump
- 10 Roller tappet
- 11 Piston
- 12 Control sleeve
- 13 Control rod
- 14 Pump cylinder
- 15 Inlet drilling
- 16 Delivery valve
- 17 Pressure connection to the injection valve

### 1.3.07 Schmiersystem

Um die Reibung zu vermindern und Wärme abzuführen werden die Lagerstellen und Zylinderlaufbuchsen mit Schmieröl versorgt.

Die Schmierölpumpe 9 saugt das Schmieröl aus der Ölwanne an und befördert es durch den Ölkühler 12 und das Schmierölfilter 11 zu den Schmierstellen. Um zu vermeiden, daß bei verstopftem Ölkühler der Ölfluß unterbrochen wird, ist das Umgehungsventil 13 eingebaut. Das Überdruckventil 14 öffnet, wenn der Öldruck 6 bar übersteigt und läßt das zuviel geförderte Öl in die Ölwanne zurückfließen.

### Lube oil system

In order to reduce friction and to dissipate heat, the bearings and the cylinder liners are lubricated.

The lube oil pump 9 draws the lube oil off the oil pan. It is then pumped to the points of lubrication through the oil cooler 12 and the lube oil filter 11. A by-pass valve 13 prevents the interruption of the oil flow when the oil cooler is clogged. The excess pressure valve 14 opens as soon as the oil pressure exceeds 6 bar and the surplus oil flows back into the oil pan.

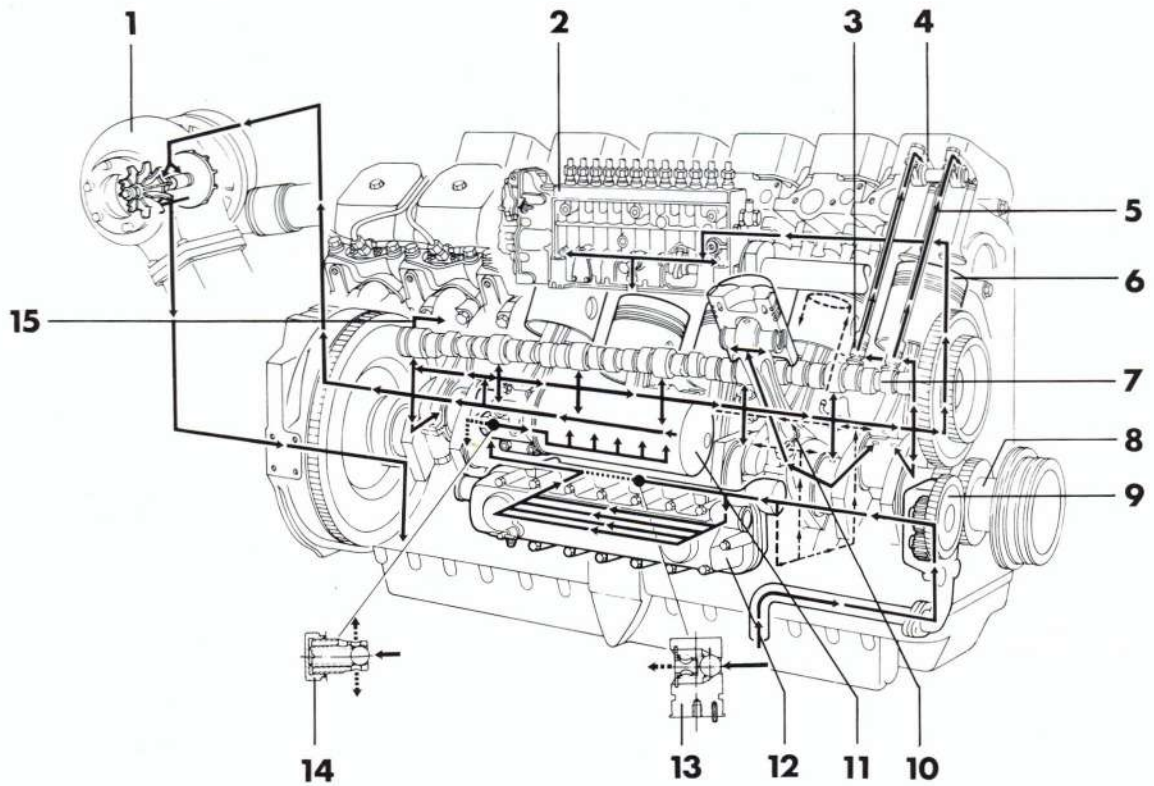


Bild 1071 Schmierölschema

- 1 Turbolader
- 2 Einspritzpumpe
- 3 Stößel
- 4 Kipphebel
- 5 Stoßstange
- 6 Kolben
- 7 Nockenwelle
- 8 Kurbelwelle
- 9 Schmierölpumpe
- 10 Spritzdüsen für Kolbenkühlung
- 11 Ölfilter
- 12 Ölkühler
- 13 Umgehungsventil, Öffnungsdruck 6 bar
- 14 Überdruckventil, Öffnungsdruck 6 bar
- 15 Zur Stößelschmierung

Fig. 1071 Schematic diagram of lube oil system

- 1 Turbo charger
- 2 Injection pump
- 3 Mushroom tappet
- 4 Rocker arm
- 5 Push rod
- 6 Piston
- 7 Camshaft
- 8 Crankshaft
- 9 Lube oil pump
- 10 Cooling nozzle for piston cooling
- 11 Oil filter
- 12 Oil cooler
- 13 By-pass valve, opening pressure 6 bars
- 14 Excess pressure valve, opening pressure 6 bars
- 15 To mushroom tappet lubrication



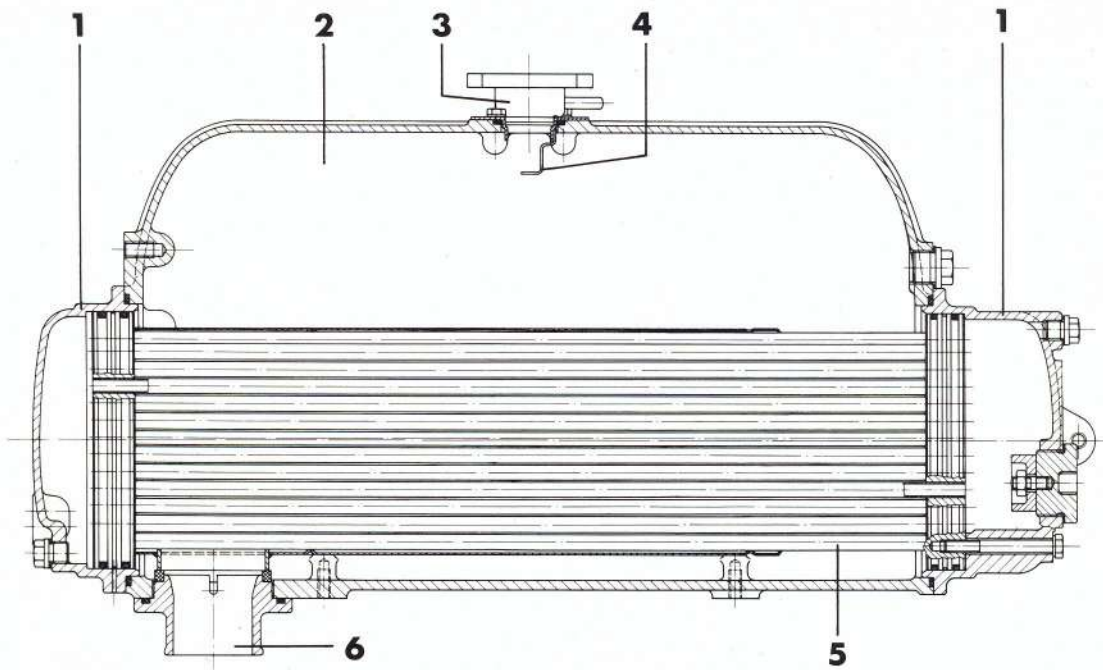


Bild 1082 Wärmetauscher

- 1 Kopfstück
- 2 Ausgleichsraum
- 3 Kühlwasser-Einfüllstutzen
- 4 Wasserstandsmarke
- 5 Rohrbündel
- 6 Kühlwasserausgang zum Motor

Fig. 1082 Heat exchanger

- 1 Header
- 2 Expansion space
- 3 Cooling water filler neck
- 4 Water level mark
- 5 Tube bundle
- 6 Cooling water outlet to engine

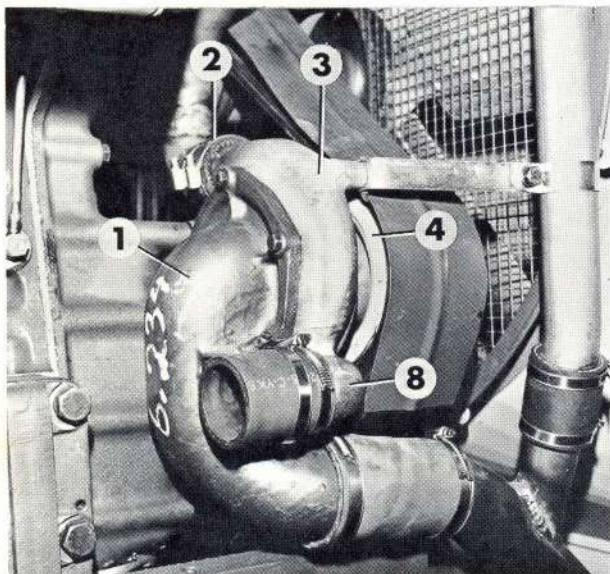


Bild 1083 Reinwasserpumpe

- 1 Ansaugkrümmer
- 2 Kühlwasseraustritt zur A-Seite
- 3 Pumpengehäuse
- 4 Keilriemenscheibe
- 5 Kugellager
- 6 Axialdichtung
- 7 Schaufelrad
- 8 Kühlwasseraustritt zum Ölkühler (B-Seite)

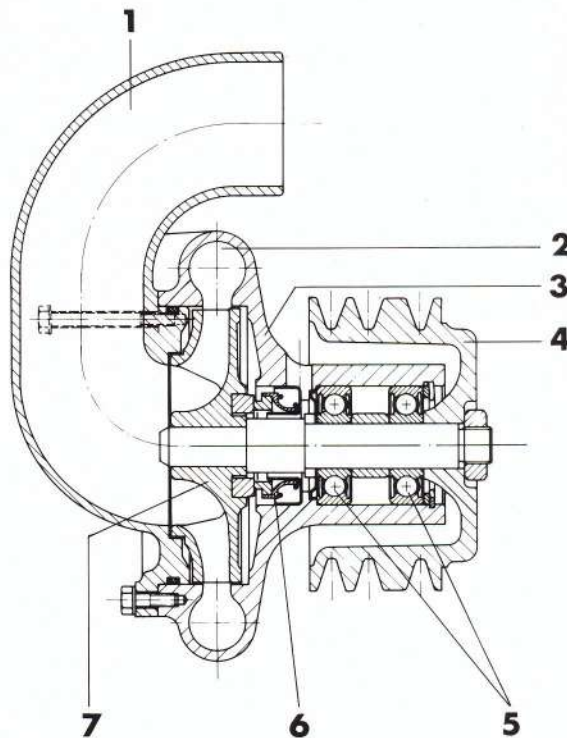
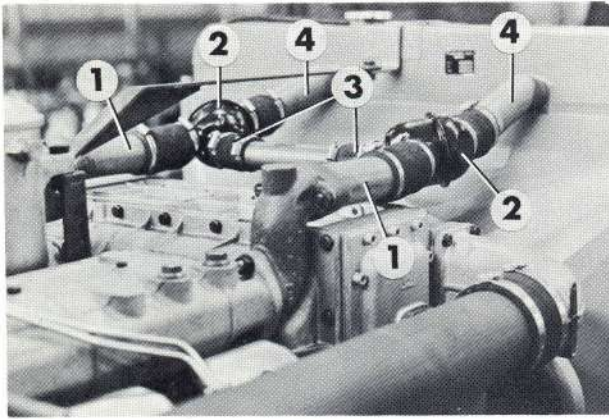


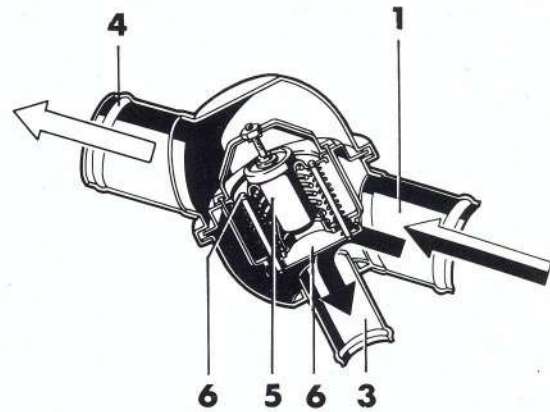
Fig. 1083 Fresh water pump

- 1 Intake bend
- 2 Cooling water outlet to A-side
- 3 Pump housing
- 4 V-belt pulley
- 5 Ball bearings
- 6 Axial sealing ring
- 7 Impeller
- 8 Cooling water outlet to oil cooler (B-side)



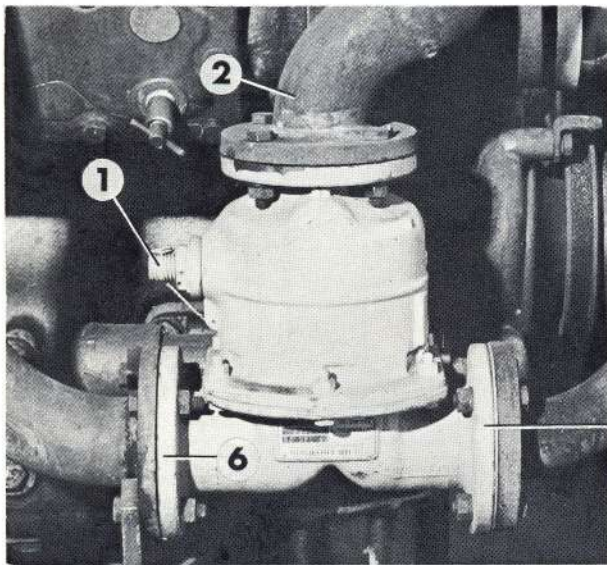
**Bild 1085a** Thermostat

- 1 Kühlwasserzulauf
- 2 Thermostat
- 3 Kurzschluß zur Wasserpumpe
- 4 Zum Kühler
- 5 Thermoelement
- 6 Ventilteller



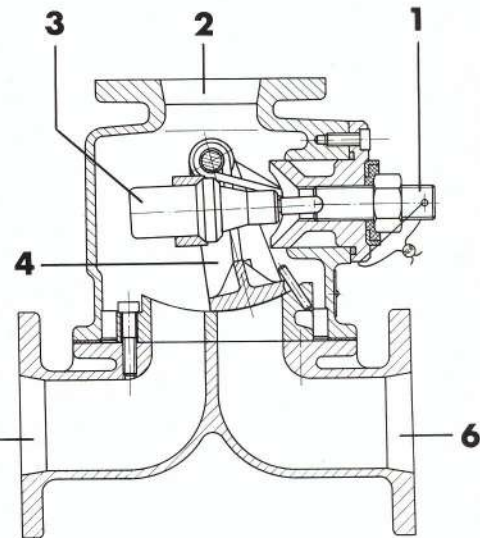
**Fig. 1085a** Thermostat

- 1 Cooling water feed
- 2 Thermostat
- 3 Short circuit to water pump
- 4 To cooler
- 5 Thermoelement
- 6 Valve disc



**Bild 1085b** Thermostat

- 1 Not-Verstellung
- 2 Kühlwasserzulauf
- 3 Thermoelement
- 4 Steuerschieber
- 5 Kurzschluß zur Wasserpumpe
- 6 Zum Kühler



**Fig. 1085b** Thermostat

- 1 Emergency adjusting device
- 2 Cooling water feed
- 3 Thermoelement
- 4 Regulating slide
- 5 Short circuit to water pump
- 6 To cooler



## 2.2 Bedienung des Motors

### 2.2.1 Vor dem Anlassen

- Entwässerungsventil am Anlaßluftbehälter kurzzeitig öffnen (Druckluftanlaß)
- Motorabstellung auf Leichtgängigkeit prüfen
- Falls vorhanden, Raumbelüftung einschalten



**Achtung!** Auf dem Motor abgelegte Gegenstände entfernen, besonders im Kurbelgehäusesattel abgelegte Gegenstände können zu schweren Unfällen oder Schäden führen.

#### 2.2.1.1 Vorrat der Betriebsstoffe prüfen

Um Betriebsstörungen und Unterbrechungen zu vermeiden ist es notwendig, alle Betriebsstoffe in ausreichenden Mengen bereitzuhalten. Da durch Verbrauch, Verdunsten oder Undichtheit der Bestand dieser Stoffe abnimmt, ist täglich eine Kontrolle der entsprechenden Füllungen vorzunehmen.

Es ist darauf zu achten, daß nur einwandfreie, saubere, den Qualitätsansprüchen in Abs. 2.3. entsprechende Betriebsstoffe aufgefüllt werden.

##### • Kraftstoffvorrat prüfen

Kraftstoffstand im Tagestank prüfen und gegebenenfalls ergänzen. Je nach Größe des Tanks und Motorbelastung Tagestank mehrmals täglich auffüllen.



**Achtung!** Rauchen und jeglicher Umgang mit offener Flamme ist beim Auftanken streng verboten. Ebenso das Ein- und Ausschalten elektrischer Geräte aller Art. Explosionsgefahr!

- **Kühlwasserventile öffnen (Rohwasserkreislauf)** wenn vorhanden
- **Kühlmittelstand prüfen**

Kühlmittelstand in Kühler 1 durch Öffnen des Kühlerdeckels 2 prüfen. Der Kühlmittelstand soll bei kaltem Motor bis zur unteren Sichtmarke (Pfeil) reichen. Bei Kühlmittelmangel bis zur entsprechenden Marke ergänzen.

**Hinweis:** Wird bei betriebswarmem Motor Kühlmittel nachgefüllt, Motor laufen lassen, um plötzlichen Temperatursturz im Motor zu vermeiden. Bei häufigem Kühlwassermangel Kühlsystem auf Dichtheit prüfen. Verdunstungsverluste durch kalkfreies Wasser ersetzen. Wird eine größere Menge Kühlwasser nachgefüllt, Korrosionsschutzmittelanteil (0,5 % bis 1,5 %) oder Frostschutzmittelanteil (mindestens 33 %) überprüfen.

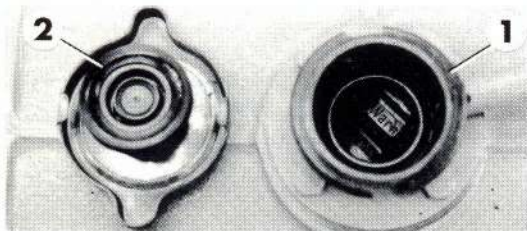


Bild 2009 Kühler

- 1 Einfüllstutzen
- 2 Kühlerdeckel

Fig. 2009 Cooler

- 1 Filler neck
- 2 Cooler cap

## Engine control

### Prior to starting

- Briefly open drain valve of the starting air compressor (air starting)
- Check engine stopping device for easy movement
- Switch on engine room ventilation, if available



**Caution!** Remove any objects that have been put down on the engine. It is particularly dangerous to leave anything in the crankcase saddle it may result in serious accidents and damages.

### Checking supply of POL products

In order to prevent operational failures and stoppages, it is necessary to ensure that all POL products are available in sufficient quantities. Since the level of these products decreases as a result of consumption, evaporation or leaks, their level should be checked daily.

It should be ensured that use is made only of correct, clean POL products, meeting the requirements of section 2.3.

##### • Checking the fuel supply

Check the fuel level in the service tank and replenish if necessary. Depending on the size of the tank and the engine load, the service tank must be replenished several times per day.



**Caution!** When refuel, smoking and all any naked flames are strictly forbidden due to the explosion hazard. The same applies to the switching on and off of electric appliances of all types.

- **Open cooling water valves (raw water circuit)** if attached
- **Checking the coolant level**

Check coolant level in radiator 1 by opening radiator cover 2. When the engine is cold the coolant should reach the under mark (arrow).

When coolant is lacking, fill in coolant up to the corresponding mark.

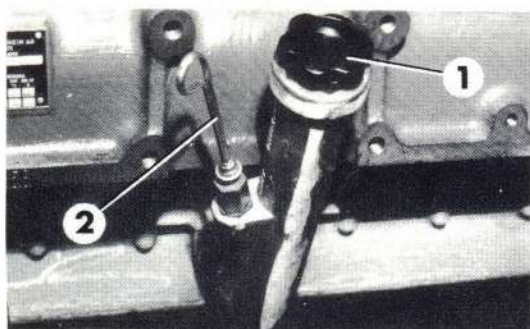
**Note:** When refilling coolant at normal running temperature, let the engine run in order to prevent a sudden drop in temperature in the engine. In the event of a frequent cooling water shortage check the cooling system for leakage. Compensate losses due to evaporation by means of water that is free of lime. In case a considerable amount of cooling water is filled in, check the percentage of the corrosion agent (0.5 % up to 1.5 %) and of the anti-freezing agent (at least 33 %).



- **Schmierölstand prüfen**

Peilstab 2 ziehen und mit sauberem Lappen trocken wischen. Peilstab 2 wieder zurückstecken und kurze Zeit warten, bis das Öl den Peilstab benetzt hat, dann Peilstab erneut herausziehen und Ölstand kontrollieren.

**Achtung!** Peilstab nicht nach oben halten, da das herunterlaufende Öl das Meßergebnis verfälschen würde. Wenn untere Peilstabmarke erreicht ist, Öl nachfüllen.



- **Checking the lube oil level**

Pull out dipstick 2 and wipe dry with a clean rag. Reintroduce dipstick 2 and wait for a short time until dipstick is wetted with oil. Pull out dipstick again and check lube oil level.

**Caution!** Do not keep dipstick upwards, as otherwise the oil running down would falsify the measuring result. When the lower dipstick mark is reached, top up oil.

**Bild 2010**  
Einfüllstutzen

- 1 Verschlußschraube
- 2 Peilstab

**Fig. 2010**  
Oil filter

- 1 Plug
- 2 Dipstick

### 2.2.1.2 Batterie prüfen

Verschlußstopfen (Pos. 1) abschrauben und mit Säureprüfer Säuredichte der Batterie messen. Säuredichte 1,23 bis 1,28 kg/l normal. Säuredichte unter 1,21 kg/l nachladen. Der Wasserspiegel soll ca. 15 mm über dem Plattenrand liegen, wenn nicht, destilliertes Wasser nachfüllen.

Falls notwendig, Ladegerät an Batterie anklemmen (Pluspol an Pluspol und Minuspol an Minuspol) und Batterie nachladen. Der Nachladestrom beträgt 1/10 des Zahlenwertes der Batteriekapazität, z.B. 145 Ah = Ladestrom 14,5 Ampere.



**Achtung!** Beim Nachladen wird Wasserstoff-Sauerstoffgemisch (Knallgas) frei. Offenes Feuer und Rauchen vermeiden. Die Verschlußstopfen (Pos. 1) unbedingt öffnen! Nach dem Laden Verschlußstopfen schließen, Batteriepole reinigen und mit säurebeständigem Fett einfetten.

**Hinweis:** Stillgesetzte Batterien sind alle 4 bis 6 Wochen nachzuladen.

- **Check battery**

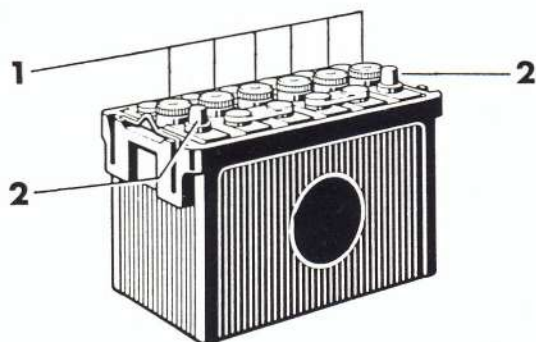
Remove plugs (Item 1) and measure density of electrolyte with hydrometer. Electrolyte density 1.23 to 1.28 kg/l normal. Electrolyte density less than 1.21 kg/l recharge. The water level should be approx. 15 mm above the plate edge, if not, top up using distilled water.

If necessary, connect battery charger to battery (positive to positive and negative to negative) and recharge battery. The recharging current is equal to 1/10 of battery capacity "number" e.g. 145 Ah = recharging current 14.5 ampere.



**Caution!** Hydrogen-oxygen mixture (oxyhydrogen gas) is released during recharging. No naked flames, no smoking. The plugs (Item 1) must be open. After recharging, replace plugs, clean battery terminals and grease with anti-acid grease.

**Note:** Unused batteries must be recharged every 4 to 6 weeks.



**Bild 2011**  
Batterie

- 1 Verschlußstopfen
- 2 Batteriepole

**Fig. 2011**  
Battery

- 1 Plugs
- 2 Battery terminals

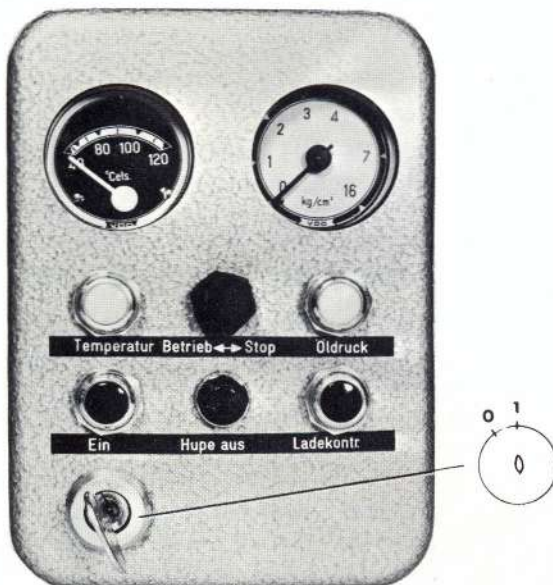


## 2.2.2 Motor anlassen

- Drehzahlregler auf kleine Drehzahl stellen
- Überwachung einschalten (bei Schlüsselschalter: Stellung I).
- Falls vorhanden, Schalter „Betrieb-Stop“ auf „Betrieb“ stellen.
- Motor mit Anlaßschalter starten (bei Schlüsselschalter: Schlüssel eindrücken und bis zum Endanschlag nach rechts drehen).
- Nach dem Anspringen des Motors Anlaßschalter loslassen. Der Schalter geht selbsttätig in Stellung „Betrieb“ zurück.

**Achtung!** Geht der Motor durch (Drehzahl steigt immer weiter an) oder wird kein Öldruck aufgebaut, Motor sofort abstellen und Kraftstoffhähne schließen.

Während des Betriebs Schlüsselschalter auf Stellung I stehen lassen. Bei Stellung 0 ist die Überwachung ausgeschaltet.



## Starting the engine

- Set speed governor to low engine speed
- Switch on monitoring device (in case of a key-operated switch: position I)
- If fitted, position switch "Betrieb – Stop" (Operation – Stop) to "Betrieb" (Operation)
- Start engine by means of starter switch (in case of a key-operated switch: press key inwards and turn it to the right as far as it will go)
- As soon as engine starts release switch. The starter switch automatically returns to position "Betrieb" (Operation)

**Caution!** Should the engine race (ever increasing speed) or the oil pressure not develop adequately, stop engine immediately and close fuel cocks.

During operation maintain key-operated switch on position I, otherwise (= position 0) the monitoring facility will be out of circuit.

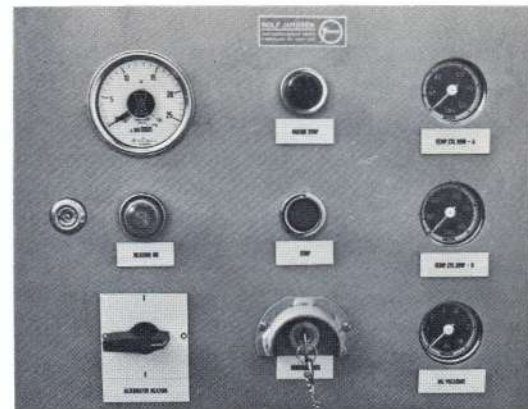


Bild 2012 (Beispiele)

Schalt - und überwachungstafel

Fig. 2012 (Examples)

Switch - and control board

### 2.2.2.1 Motor anlassen mit Flammstartanlage

- Schlüsselschalter in Stellung I schalten.
- Zugschalter bis zur 1. Raste ziehen (Vorheizen der Flammglühkerze).
- Bei Erreichen der entsprechenden Glühstifttemperatur (Kontrolllampe leuchtet auf) Zugschalter bis zum Anschlag herausziehen (Anlaßstellung).
- Nach dem Anspringen des Motors Zugschalter bis zum Anschlag eindrücken.

### Engine start with flame starting system

- Turn key-operated switch to position I
- Draw out push-pull switch up to first notch (Preheating of the flame glow plug)
- When the corresponding temperature (pilot lamp flashes up) has been reached draw out push-pull switch as far as possible (starting position)
- when engine starts press push-pull switch inwards to stop limit.





**Operating media instructions for small to medium-sized engines**

Issue 11.89

0297 5242 en

<b>Lube oil qualities</b>	<b>API-CC</b> A = MIL-L-46152A MIL-L-2104B		<b>API-CD</b> B = MIL-L-2104C MIL-L-2104D		<b>Remarks:</b> <b>GENERAL DATA</b>	
<b>Fuel</b>	Distillate fuels as per DIN 51601 BS 2869 Class A 1 or A 2 ASTM-D 975 No. 1 D and/or 2 D		MDF as per BS 2869 Class B 1	MDF as per BS 2869 Class B2 or BS MA 100 Class M2		Standard and heavy-duty application in vehicles, equipment and generating sets. <b>Total energy plants/heat pumps</b> Use in total energy plants <b>Emergency power supply</b> Use in emergency generating sets. Consult manufacturers at operating times of less than 20 h/month. Oil to be changed at least once every 6 months.
<b>Sulfur concentration in % by wgt</b>	up to 0.5	up to 1		up to 1.5		
<b>Application</b>	GENERAL		emer- gency power supply	total energy plant/ heat pumps	GENERAL	
<b>engine type</b>	Lube oil quality (see overleaf)					
<b>Naturally aspirated engines</b>	D 327, 302, 916, 932	A	B	B	-	-
	D 226/226B	A	B	B	B	-
	D 232	A	B	B	B	B
	D 234	B	B	B	B	B
	D 601 to 604B 1)	B	B	B	B	B
	S/AM 816 1)	B	B	B	B	B
<b>Oil change interval in hours 2)</b>	500	500	500	500 or after analysis	250	250
<b>Turbocharged engines</b>	TD 226, TD/TBD 226B	B	B	B	B	-
	TD/TBD 232	B	B	B	B	B
	TBD 234	B	B	B	B	B
	TD/TBD 601 to 604B	B	B	B	B	B
	S/B AM 816	B	B	B	B	B
<b>Oil change interval in hours 2)</b>	250	250	250	250 or after analysis	125	125
1) The use of lube oil centrifuges or of superfine bypass filters may permit an extension of the oil change intervals specified. 2) The above operating periods are merely guidelines. They may be subject to marked changes as a result of different operating conditions, engine maintenance and lube oil servicing.						

**Lube oil viscosity**  
The viscosity category of the lube oil is governed by the prevailing ambient temperature

ambient temperature	viscosity category
above 30°C	SAE 40 and/or 15 W-40
0-30°C	SAE 30 and/or 10 W-40
below 0°C	SAE 10W
-10°C bis +10°C	20W-20

Special instructions may apply to manually started engines. Please consult the relevant operating instructions for more details.

Multigrade oils are intended solely for use in vehicle engines. However, only multigrade oils are permitted that fully meet the requirements of specification MIL-L-2104C/D and of classifications API-CD to -CE.

**A combined use of MDF fuels and multigrade oils is not permitted.**

**Lube oil change intervals**  
The lube oil level shall be checked regularly and topped up to the topmost dipstick marking. Provided the optimum oil change interval has been determined by a series of used-oil analyses, the oil change interval may be extended in cases of predominantly constant motor load. Orders for lube oil testing can be placed with the oil companies, specified institutions or DEUTZ MWM. The cost involved will be invoiced at actuals to the ordering party. The lubricating oil will at any rate have to be changed if the results of lube-oil testing show that one or several of the limiting values given in the table to the right have been exceeded.

1) Value given in brackets permissible only in exceptional cases  
2) The total base number of the lube oil should be approximately equal to 10-times the sulfur content (in %) in the fuel.

Analytical values	min.	max.	
Viscosity at 100°C sq.mm/s(cSt)			DIN 51562
SAE 20W-20	7.0	11.0	
SAE 10W	3.9	-	
SAE 30	9.5	14.0	
SAE 40	11.0	17.0	
Flash point °C	200	-	DIN 51376
Fuel content % by volume	-	3	
Total fouling % by weight	-	1.5(2) <sup>1)</sup>	DIN 51365
Water content % by weight	-	0.2	DIN 51582
Total base number %	50% of value as new		pREN 55 <sup>2)</sup>

**Coolant**  
Fresh water of the analytical limiting values given below shall be used as cooling water. It shall be mixed with a corrosion inhibitor approved of by Deutz MWM. Admixing, proportioning and topping up of the corrosion inhibitor, as well as regular concentration checks shall be done as per instructions of the suppliers. Insufficient concentration of the corrosion inhibitor

Water quality	min.	max.	
pH value	6.5	8.5	only water meeting these quality requirements shall be mixed with the additives listed overleaf
Chloride ion concentr. mg/cu.dm	-	100	
Sulfate ion concentr. mg/cu.dm	-	100	
Total anion concentr. mg/cu.dm	-	150	
<b>when using antifreeze agents:</b>			
total (German) hardness dGH°	3	12	
(German) carbonate hardness dKH°	3	-	
<b>when using chemical corrosion inhibitors:</b>			
total (German) hardness dGH°	suppliers' instructions to be observed, otherwise		
	0	10	

has detrimental effects on engines of type 226B, 234, 601...604B and 816. Internally galvanized pipes do not agree with corrosion inhibitors and shall therefore not be used for cooling systems.

**Corrosion inhibitors**  
Chemical corrosion inhibitors can also be used with water from desalination and evaporation facilities. The restrictions as to engines of series 226B, 234, 601...604B and 816 shall be duly considered.

**Antifreeze agents**  
Antifreeze agents to be used down to -20°C. at a minimum. An antifreeze concentration of at least 33% shall be maintained the year over for preventing corrosion. It shall be exchanged every two years.

Chemical corrosion inhibitors can be used jointly with pure ethylene glycol that is free of inhibitors.

Concentration checks and verification of the cooling water quality shall be made at intervals of 1000 h of operation but not less frequently than every 3 months.

Particulars of the water quality to be inquired at the local water-works or to be determined with the Deutz MWM laboratory test kit 1213 0382. When in doubt, the water should be analyzed by an outside chemical laboratory. Never use non-analyzed water.

Warranty claims concerning damage caused by POL products can only be met if the above regulations are carefully observed and adhered to.

See overleaf for cooling-water additives.



According to information received from the suppliers, all operating media meet our requirements. Due to the large number of products available we are not able to test all suitable pro-

ducts and to name them. This means that also other products not included in the following list can be used on the condition that they will come up to our requirements.

The supplier of the operating media has sole responsibility for the consistent quality of the products supplied by him.

supplier	API-CC MIL-L-46152A MIL-L-2104B		API-CD MIL-L-2104C MIL-L-2104D		antifreeze agent des	chemical corrosion inhibitor supplier   designation	
	A engine oil des		B engine oil des			for Series: 226, 232, 916 and 932	
Agip	Agip Diesel Gamma Agip Cladium 70		Agip Diesel Sigma S, Agip Sigma Multi, Agip Superdiesel Multigrade, Agip Cladium 120		Agip Antifreeze Agip Antifreeze Plus	Drew Ameroid	Ameroid Dewt-NC Ameroid CWT 110
Aral	Aral Super Kowal		Aral Multi Turboral, Aral Multi Turboral DL Aral Turboral M, Aral Disola M, Aral Turboral BM		Aral radiator antifreeze	Perolin	Formet 326
Avia	Avia engine oil HD Avilub Special HD	Avia Multigrade CFE Plus 10W-40* Avia Multigrade HDC Plus 15W-40*	Avia Special engine oil HDC Avia Multigrade HDC 15W-40 Tractavia HF Super 10W-30	Avia Super 365 15W-40 Avia Multigrade CFE 10W-40 Avia Turbo CFE 10W-40	Avia antifreeze	Vecom	CWT Diesel/QC-2
Bay Wa	HD-Extra		Super 2000 CD Super 2000 CD-MC HDC 1540 HD Superior	Universal HD 1040 MC Turbo 2000* Super Truck*	Fricofin	Nalfloc	Nalfleet 9-131 C Nalfleet 9-121
BP	BP Vanellus-T, BP Energol HD-S		BP Vanellus Multigrad, BP Terrac, BP Vanellus C3 BP Vanellus C3 extra, BP Vanellus FE*		BP Anti-Freeze	Perry	Perry Filter
Castrol	Castrol Deusel CRD-DB Castrol CRX		Castrol CRD-DB Castrol RX Super Castrol Turbomax*		Castrol Anti-Freeze	Bedia	Bedia-Filter BS/BT Bedia Liquid BL1
Chevron/ Caltex	Delo 100 engine oil, Delo 200 engine oil		Delo 300 engine oil, Delo 400 engine oil			for series: 226 B, 234, 601 + 604 B, 816	
Deutzer Oel KG	Deutz Oel SGHD-B		Deutz Oel SGHD-C, Deutz Oel HD-C 15W-40, Deutz Oel TAD (15W-40)*, Deutz Oel TLL 10W-40		Gylsantin™	Perry	Perry Filter
Elf	Elf Performance 2B		Elf Performance 3C, Elf Multiperformance 3C Tractorelf ST3, Elf Disola M3015, Elf Superperformance Elf Multiperformance 4D *		Glacelf	Nalfloc	Nalcoool 2000
Esso	Essolube HDX Essolube HDX Plus +		Essolube XD-3+ Multigrade 15W-40, engine oil MHC15W-40 Diesel engine oil Super TD 15W-40*, Esso engine oil LDX 10W-40* Esso engine oil CSX 10W-40, engine oil Turbo FE 10W-40		Esso antifreeze agent	Bedia	Bedia-Filter BS/BT Bedia Liquid BL1
Fina	Purflina engine oil, Fina Dilano		Fina Kappa Plus engine oil, Fina Kappa TD engine oil Fina Kappa TD Multigrade Motor Oil Fina Kappa LDO* Fina Caprano		Fina Termidor P 100		
Fuchs	Renopur HD Renolin HD Titan HD Super		Renolin HD Superior Titan Universal HD Titan Hydromat 1030 MC	Tital Unic 1040 MC*) Titan Truck 1540*) Titan Universal 1040 MC	Fricofin		
Mobil	Mobil Delvac 1200		Mobil Delvac 1300, Mobil Delvac 1300 Super Mobil Delvac 1*, Mobil Delvac 1400 Super *		antifreeze 500		
RHG	HG engine oil HD HG engine oil Extra HD		HG engine oil HD 20W-30 HG engine oil CS3 HD Spezial 1540 HG Super 2000 CD engine oil		Fricofin		
Shell	Shell Rotella X, Shell Rotella TX Shell Melina Öl		Shell Rimula X Multigrad, Shell Rimula X Shell Öl Diesel M 1540, Shell Öl Diesel R 1540 Shell Öl Diesel R, Shell Gadinia Öl Shell Myrina TX*, Shell Myrina *		Glycoshell		
Texaco	Ursatex Multigrade SAE 15W-40		Ursa Super LA Multigrade SAE 15W-40 Ursa Super TD SAE 15W-40		Texaco antifreeze Texaco antifreeze NF		
Total	Total Rubia H, Total GTE 15W-40		Total Rubia S, Total Rubia X, Total Diesel 2001 Total Rubia TIR XLD*		Total antifreeze		
Veedol	Veedol Diesel HD B		Veedol Diesel HD C, Veedol Dieselstar, Veedol Turbostar*		Veedol Antifreeze		
Wintershall	Wiolamit Magnum Spezial		Rekord, Multi-Rekord, Magnum Rekord, Magnum Super, TFE 10W-40, Magnum Turbo FE 10W-40, Turbo-Rekord 15W-40*, Magnum Turbo D3 15W-40*		radiator antifreeze		
ICI					ICI 007/400F		

\* „SHPD“ oils

### 3.1.2 Fault-Tracing Table

The fault-tracing table lists faults in engine operation with a description of how they may occur and their causes. The potential causes are given in the order in which the true cause is likely to be localized with the least effort. The sections given under "Remedy" contain information on how to remedy the fault. The causes of deviations in lube oil pressure, lube oil temperature and coolant temperature as well as information on how to remedy them are given in section 2.2.3.1 checking operating values!

Faults	Engine does not turn when started	Engine does not ignite or stops after a few ignitions	Engine does not achieve specified output/speed	Engine running irregularly	Engine knocking	Engine overheats	Engine stops operating	Abnormal exhaust gas colouring	Engine overspeeds	Water in lube oil	Causes	Remedy see section
	→	→					→					
	→	→									Starting air pressure deficiency Battery discharged	2.1.4 2.2.1.1
		→					→				Fuel cock closed	—
		→									Stop lever in Stop position	—
					→			→			Engine too cold	—
								→			Wrong lube oil viscosity	—
		→	→	→				→			Air in fuel system	2.1.2
								→			Air filter fouled	3.2.002 3.3.004
		→	→	→							Fuel filter fouled	3.2.053
	→	→									Starting system defective	Workshop
						→		→			Injector defective	Workshop
		→	→					→			Compression too low	Workshop
	→	→					→				Monitor has tripped	Workshop
		→	→	→							Fuel delivery pump defective	Workshop
										→	Oil cooler leaking	Workshop
			→					→	→		Injection pump defective	Workshop
		→	→	→					→		Governor defective or governor linkage sticking	Workshop
					→			→			Defect in valve drive	Workshop
			→		→	→	→	→			Defect in crank assembly	Workshop
										→	Cylinder liner in crankcase leaking	Workshop

When in doubt call in servicing



### 3.1.3 Servicing schedule

The following table shows the servicing tasks subdivided according to servicing intervals. The servicing work has to be carried out at the latest as soon as the intervals given in the column on the right expire, irrespective of the actual number of operating hours run (see column on the left side).

The servicing tasks must be repeated according to the given number of operating hours and periods of time respectively.

only once after 60 operating hours			Engine oil change Checking V-belt drive/Lubricating raw water pump Replacement of engine oil filter cartridges	3.2.001 3.2.003 3.2.025			
for continuous operation				for emergency and standby operation			
500 h	1000 h	2000 h	Servicing tasks	No. of Job Sheet	monthy	1 year	2 years
			Trial run	3.1.4.1	x		
⊗			Engine oil change ◆ Cleaning air filter (note maintenance indicator on dry-type air filters) Checking V-belt drive/Lubricating raw water pump Checking zinc protective coating Replacing engine oil filter cartridges	3.2.001 3.2.002 3.2.003 3.2.005 3.2.025		1/2 x x x	x
			Checking and resetting valve clearance	3.2.028			x
			Renewing fuel filter cartridges or fuel filter element Checking monitoring and engine stopping device Cleaning the intercooler Lubricating the bearings (generator type T1)	3.2.053 3.2.055 3.2.057 3.2.060			x
according to requirements			★ Tightening torques of main screw connections in Nm Engine preservation ▲ Cleaning fresh water re cooler (natural water side)	3.3.001 3.3.003 3.3.007	according to requirements		

⊗ for turbocharged engines every 250 h

★ **Caution:** Cylinder-head screws, bearing cover and connecting-rod bolts should never be retightened!

▲ In case of higher cooling-water temperature, check head pieces visually and clean, if necessary.

◆ clean wet-type air filters every 100 h

### 3.1.3.1 Overhauls

The reliability of the engine is affected over long periods of time by wear and corrosion. In order to avoid engine failures, we suggest to carry out the overhauls indicated in the following table. The first overhaul operations must be performed after 2,000/6,000 operating hours or, if not reached, after 2 years. The work sequence is described in the Workshop Manual, which can be obtained at our Spare Parts Department.

Rating symbol *) as per DIN 6271, part 2	MC15N	IC15N	MCXN	ICXN	MXN	MCXN *)	SCXN
			IFN	MOFN	IOFN		
			ION	F	MON	ICXN *)	MCFN
			IXN	SFN			
						SCFN	ICFN
<b>Inspection</b>	<b>1,000 h or 2 years</b>	<b>2,000 h</b>	<b>6,000 h</b>				
Check injection nozzles	X	X	X	X	X	X	X
Check compression pressure	X	X	X	X	X	X	X
Check turbocharger bearing clearance	—	—	—	—	—	—	—
<b>Partial overhaul</b>	<b>3,000 h or 6 years</b>	<b>6,000 h</b>	<b>12,000 h</b>				
Check turbocharger bearing clearance	X	X	X	X	X	X	X
Overhaul cylinder heads	X	X	X	X	X	X	X
Check cylinder liners	X	X	X	X	X	X	X
Clean and check exhaust-gas pipes (water-end) for corrosion	X	X	X	X	X	X	X
Renew injection pipes	X	X	X	X	X	X	X
<b>Major overhaul</b>	<b>9,000 h or 18 years</b>	<b>18,000 h</b>	<b>24,000 h</b>				
Renew connecting-rod and main bearings	X	X	X	X	X	X	X
Check pistons	X	X	X	X	X	X	X
Check crankshaft	X	X	X	X	X	X	X
Check camshaft	X	X	X	X	X	X	X
Check camshaft bearings	X	X	X	X	X	X	X
Renew bearings of mass-balancing device	X	X	X	X	X	X	X
Check gear drive	X	X	X	X	X	X	X
Replace lubricating oil pump	X	X	X	X	X	X	X
Clean lubricating oil cooler	X	X	X	X	X	X	X
Overhaul injection pump, injection pump drive and coupling	X	X	X	X	X	X	X
Replace water pump	X	X	X	X	X	X	X
Replace crankshaft seals	X	X	X	X	X	X	X
Replace vibration dampers	■)	X	X	X	X	X	X
Clean cooling system	X	X	X	X	X	X	X
Renew thermostats	X	X	X	X	X	X	X
Renew hose connections	X	X	X	X	X	X	X
Renew crankcase breather	X	X	X	X	X	X	X
Renew turbocharger	X	X	X	X	X	X	X

\*) stamped in rating plate

•) in plant application

■) 18,000 h

#### Notes:

1. Cleaning should be done more frequently if increased contamination prevails.
2. The instruction "Checking" means that following a visual inspection or dimensional check, adjustment, reconditioning or replacement may be necessary.

The execution of the repairs (maintenance and overhauls) requires skill and special knowledge. Should you have no skilled staff at your disposal, our After-Sales Service Department will be pleased to give you information about maintenance contracts involving various work scopes.



Replacing engine oil filter cartridges

read thoroughly  
prior to beginning

Page 1 of 1 page

Necessary tools

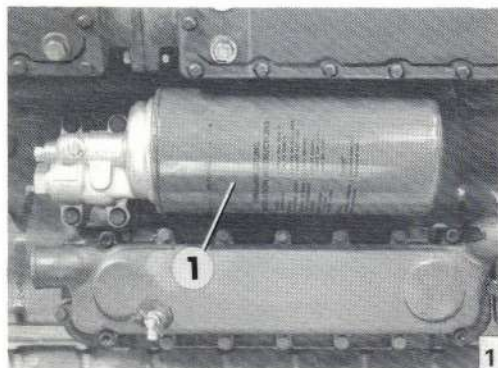
Tool set  
Oil pan  
For reversible filter:  
Cock wrench SW 17

Necessary materials and auxiliaries

Filter cartridge 6.0541.29.7.0048 = 6 Cyl.  
Filter cartridge 6.0541.29.7.0039 = 8+12 Cyl.  
or (in case of a reversible duplex filter):  
2 filter cartridges 6.0541.18.8.0008

Spares Table No.

47 - ...

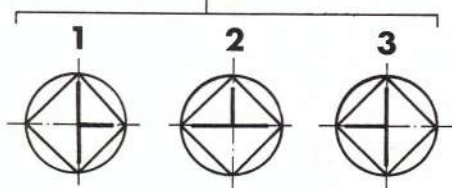
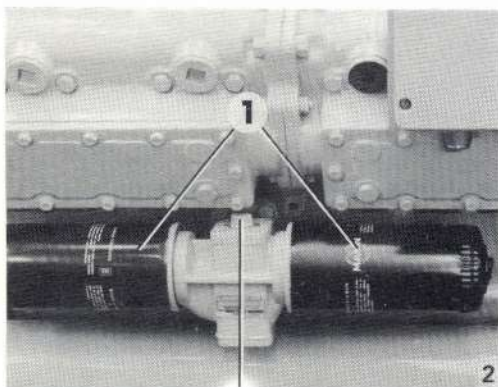


Within the lube oil circuit, the oil filter is installed in such a way that all particles of dirt are kept away from the bearings. These particles clog the filter. As a result the oil pressure decreases. Therefore, the filter cartridges have to be replaced from time to time.

If a reversible duplex fuel filter is mounted, the filter cartridges can be replaced while the engine is in operation, provided that the corresponding filter chamber has been switched off (see Fig. 3). During normal operation, both filters must be in operation.

Replacing filter cartridges

1. Loosen filter cartridge 1 with strap wrench and unscrew it.
2. Clean seal seat and oil seat of new filter cartridge slightly.
3. Screw new filter cartridge into filter head until seal contacts, then tighten by 1/2 a turn manually. Do not use tools!
4. Check filter for leakage with engine running.



3

Cock position 1 : left filter closed  
Cock position 2 : both filters open  
Cock position 3 : right filter closed







**Renewing fuel filter cartridges of fuel filter element**

 read thoroughly  
prior to beginning

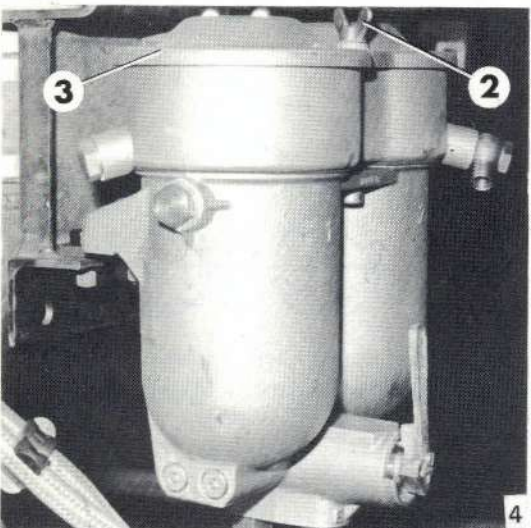
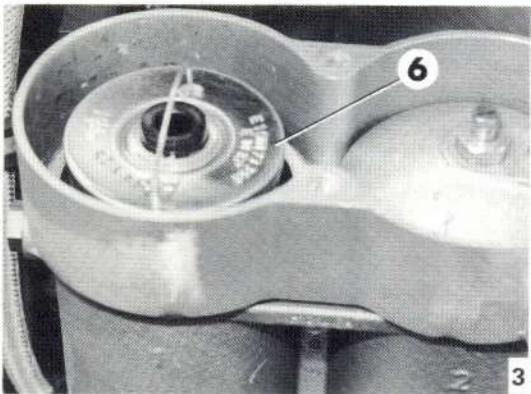
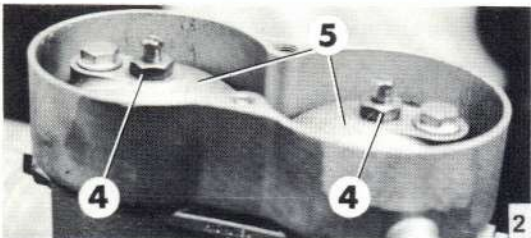
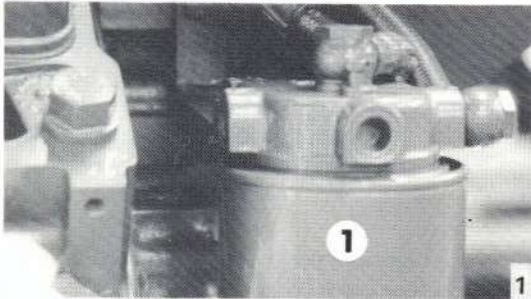
Page 1 of 2 pages

**Necessary tools**
**Necessary materials and auxiliaries**
**Spares Table No.**

Set of tools

Fuel filter Fig. 1	
Filter cartridge	6.0541.18.8.0004
Fuel filter Fig. 4	
Filter element	6.0541.14.0.0003
For single-stage filter	1 each
For duplex filter	2 each

29 - ...



In order to protect the ignition pumps and injectors, a fuel filter is incorporated in the fuel system upstream of the pumps and injectors. A contaminated filter element reduces the flow of fuel and must therefore be replaced after the above-mentioned operating hours.

If a reversible fuel filter is provided, the filter cartridges may also be renewed while the engine is running.

**Caution!**

Only when the filter elements are changed must the corresponding filter be shut down. During normal operation leave both filter in circuit!

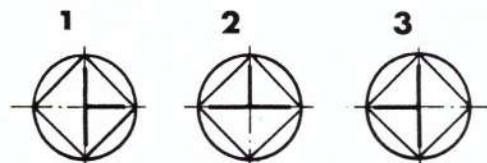
Filter switching diagram, see figure 5.

**Renewing fuel filter cartridge (Filter Fig. 1)**

1. Close fuel cocks
2. Loosen filter cartridge 1 with strap wrench and remove it.
3. Coat seal of the new filter cartridge with fuel.
4. Screw filter cartridge into filter head down to the seal, then tighten by 1/2 a turn. Do not use tools.
5. Bleed the fuel filter (see last paragraph).

**Renewing the fuel filter element (Filter Fig. 2 ... 4)**

1. Close fuel cocks.
2. Unscrew wing screws, item 2, and take down cover, item 3, taking care of gasket.
3. Slacken centre screws, item 4, and take down cover, item 5.
4. Take filter elements, item 6, out of filter housing and clean inside of filter housing.
5. Insert new filter elements into housing and reattach cover in the reverse sequence, taking care of gaskets.
6. Vent fuel filter (see last paragraph).


 Right-hand  
filter  
in operation

 Both filters  
in operation

 Left-hand  
filter  
in operation 5



Renewing fuel filter cartridges of fuel filter element

read thoroughly  
prior to beginning

Page 2 of 2 pages

Necessary tools

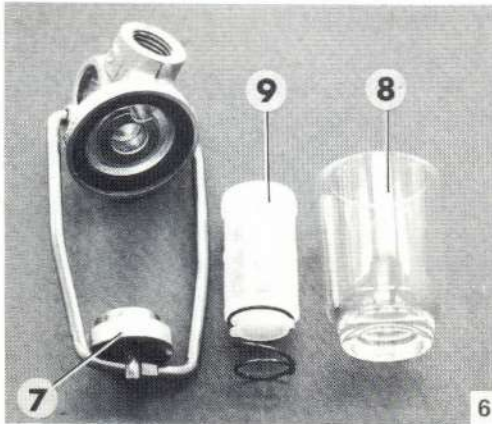
Set of tools

Necessary materials and auxiliaries

Fuel filter Fig. 1  
Filter cartridge 6.0541.18.8.0004  
Fuel filter Fig. 4  
Filter element 6.0541.14.0.0003  
For single-stage filter 1 each  
For duplex filter 2 each

Spares Table No.

29 - ...

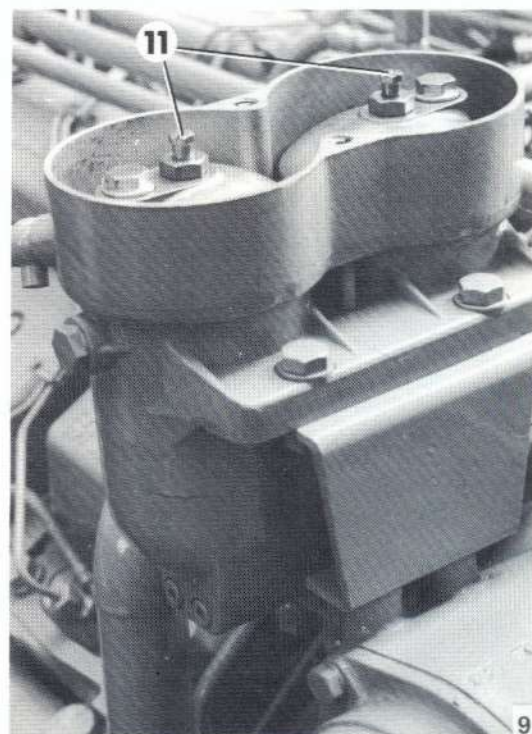
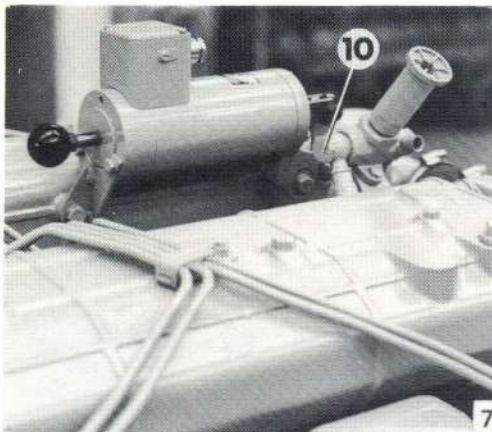


Cleaning fuel prefilter (Fig. 6)

1. Close fuel cocks
2. Loosen knurled nut 7 and put strap aside. Remove sight-glass 8 and filter element 9.
3. Clean all parts with fuel, use a soft brush in order to remove strong dirt.
4. Reassembly in reverse sequence. For bleeding open fuel cocks, loosen banjo bolt 10 and operate hand fuel pump until fuel emerges free of bubbles. Continue pumping while tightening banjo bolt again.

Bleeding the fuel filter

1. Open bleeding screws 11 and operate hand fuel pump until fuel emerges free of bubbles. Continue pumping while tightening bleeding screws 11 again.
2. Check filter for leakage during operation.





**Checking monitoring and engine stopping device**

 read thoroughly  
prior to beginning

Page 1 of 1 page

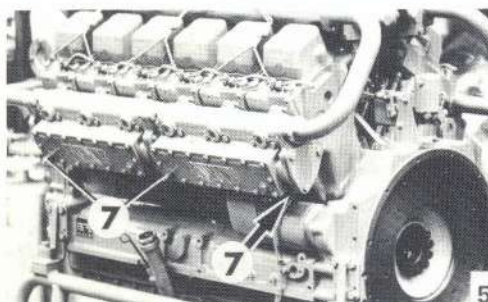
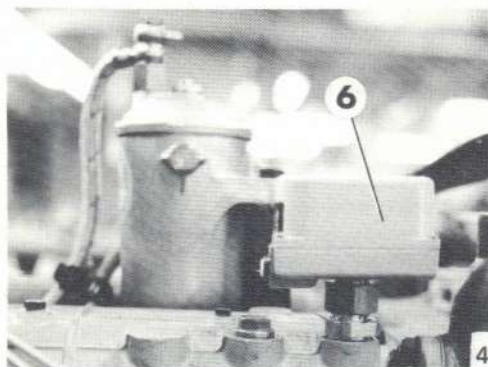
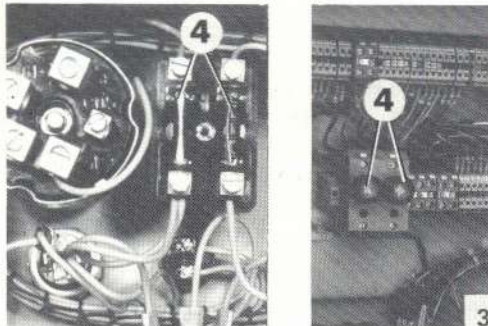
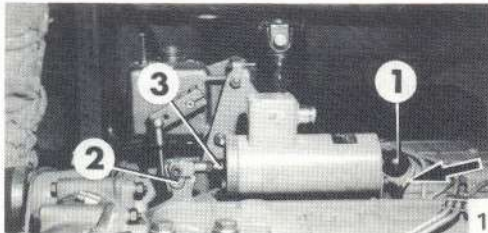
**Necessary tools**

 Heatable container  
Thermometer (up to 100°C)  
Tool set  
Wrench SW 27

**Necessary materials and auxiliaries**

 Molybdenum sulfide spray  
or  
Lithium saponified grease  
Lube oil

**Spares Table No.**

 41 - ...  
89 - ...


In order to avoid damages resulting from the malfunction of lubrication or cooling, monitoring devices were mounted to the engine. In case of an excessive cooling water temperature or a too low oil pressure, warning devices (pilot lamp, siren) are switched on or the engine is shut down via the shutdown solenoid.

**Checking and lubricating manual shutdown device**

Press shutdown button 1 in direction of arrow and release again. The shutdown device automatically returns to starting position. If this is not the case, check rods for smooth working. Lubricate joints 2 and tie rod 3 of the solenoid with molybdenum sulfide or oil.

**Checking oil pressure monitoring device**

**Note:** If a timing relay is installed the reactions of the monitoring device may delay for 15 sec. (maximum). Switch on monitoring device (in case of key-operated switch: pos. I) and put switch "Operation-Stop" ("Betrieb-Stop") to "Operation" ("Betrieb"). The pilot lamp "oil pressure" ("Öldruck") flashes up and the siren sounds. Operate switch "Siren off" ("Hupe aus") and the siren is shut off.

If the pilot lamp does not light up, check fuses 4 in the instrument panel or change the bulb. If this is of no use, short circuit connections 5 on the oil pressure switch or – if it is a unipolar connection – ground them. If the pilot lamp lights up, renew oil pressure switch. If not, check cable connections. After checking, switch off monitoring device.

**Checking cooling water monitoring device**

Switch on monitoring device (in case of key-operated switch: pos. I) and position switch "Operation-Stop" ("Betrieb-Stop") to "Operation" ("Betrieb"). Short-circuit connection on temperature sensor or – if it is a unipolar connection – ground it. Pilot lamp "cooling water temperature" lights up, siren sounds. If this is not the case, renew fuses 4 in the instrument panel or change the bulb. If still not illuminating, check cable connections.

Drain off cooling water (drain cocks 7), pinch off cable connections on temperature sensor 6 and dismantle temperature sensor. Repinch temperature sensor, suspend in a water bath and heat it. At approx. 95°C pilot lamp must light up and siren sound. If this is not the case, renew temperature sensor.

**Checking shutdown solenoid**

Short-circuit connection on oil pressure switch or temperature sensor 6. The shutdown solenoid is in "Stop" position. If this is not the case, operate switch "Engine-Stop" ("Motor-Stop"). If the shutdown solenoid passes to position "Stop", check cable connections. If this is of no use, renew shutdown solenoid.



Job Sheet

Date  
5.85

first time after

after and every  
2000 h

Engine type  
TBD 234

Job Sheet No.  
3.2.060

read thoroughly  
prior to beginning

Page  
1 of  
1 Side

Necessary tools

Necessary materials and auxiliaries

Spares Table No.

as required  
Ball bearing grease Ft 1 v 34 (Msrs. Bosch)

89 - ....



A generator is required for supplying power to the electric loads on the engine, such as starter, indicator and operating systems. Since the battery has a limited capacity, it is re-charged by the generator which is driven by the engine through a V-belt.

The rotor of the generator runs in ball bearings at both ends. These bearings must be lubricated again at the intervals given in the servicing schedule.

#### Lubricating bearings

Screw in the grease cups 2 turns. If the grease cups have already been screwed in as far as they will go, unscrew and re-pack with ball bearing grease.

Screw in Stauffer boxes until you strike an obstacle, then screw in by two further rotations.

#### Caution!

Only use Bosch No. Ft 1 v 34 ball bearing grease.





Job Sheet

Date  
11.89

first time after  
—

after and every  
—

Engine type  
D  
TBD 234

Job Sheet No.  
3.3.001

Tightening torques of main screw connections in Nm

read thoroughly  
prior to beginning

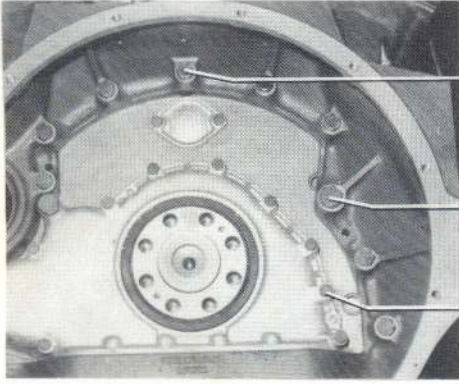
Page of  
1 3 pages

Necessary tools

Necessary materials and auxiliaries

Spares Table No.

- ★ Tightening torque specifications for cylinder head bolts:
- Lubricate screw thread and contact surface (do not use Molykote). Tighten the bolts crosswise to 20 Nm, then tighten further in three stages (100 Nm, 200 Nm, 400 Nm).
- with washer
- ▲ with lock washer



M12 - 8.8  
75 - 80

M12 - 12.9  
140 - 145

370 - 380

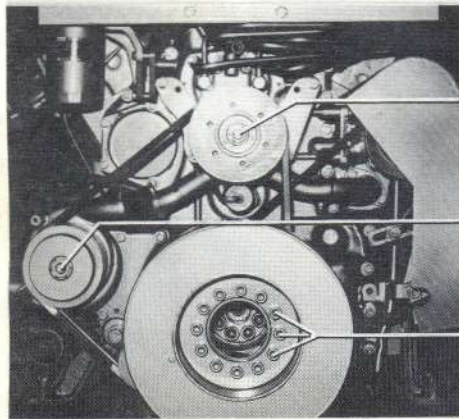
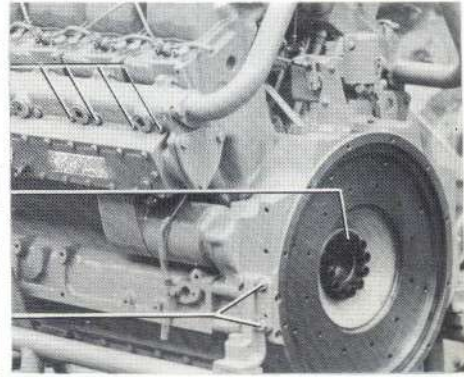
M8 - 12.9  
40 - 45

45 - 50

380 - 390

M12 - 12.9  
140 - 145

M14 - 12.9  
220 - 230



M 16x10.9  
300 - 310

M 20 - 8.8  
415 - 425

140 - 150

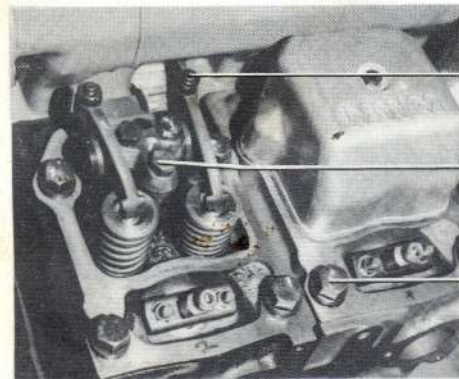
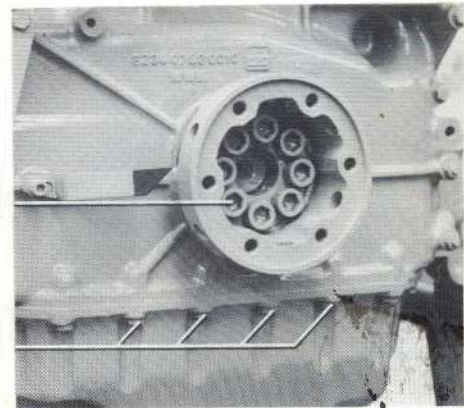
M10 - 8.8  
45 - 50

M12 - 8.8  
82 - 87

M12 - 10.9  
115 - 120

380 - 390

20 - 25

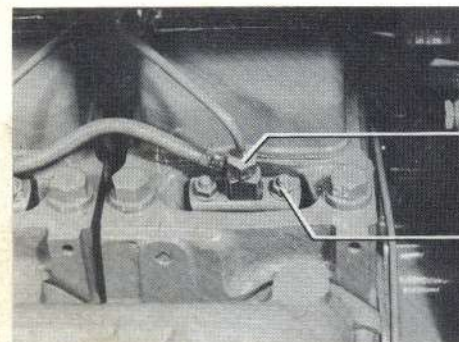
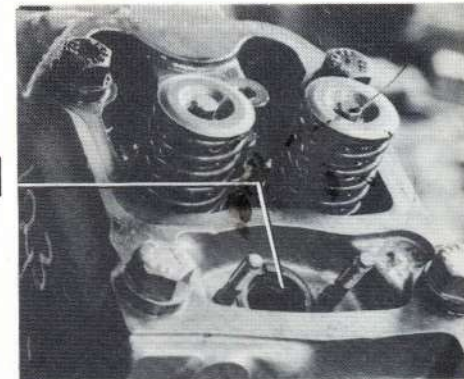


30 - 33

65 - 70 ●  
75 - 80 ▲

★

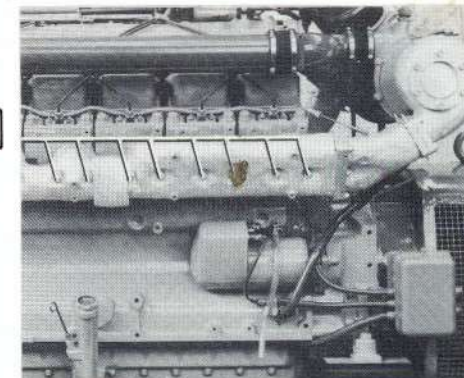
30 - 40



20 - 25

15 - 20

50 - 55







**Job Sheet**

Date  
11.89

first time after  
—

after and every  
—

Engine type  
D  
TBD 234

Job Sheet No.  
3.3.001

**Tightening torques of main screw connections in Nm**

read thoroughly  
prior to beginning

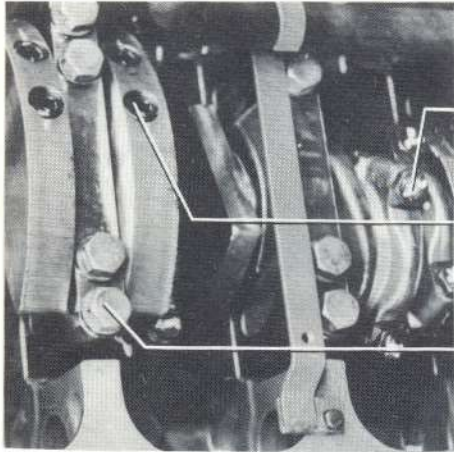
Page 2 of 3 pages

**Necessary tools**

**Necessary materials and auxiliaries**

**Spares Table No.**

◆ 60° (1 hexagon)



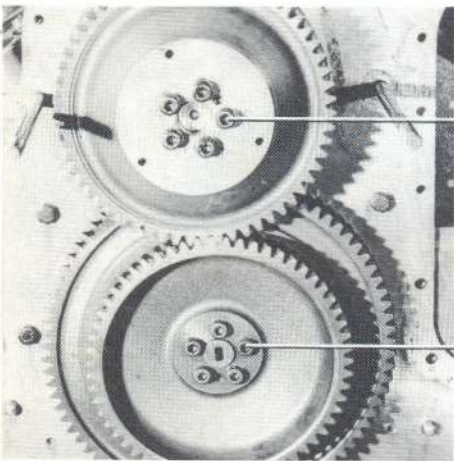
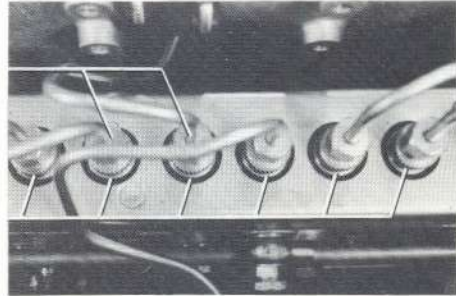
90 + ◆

260 - 270

200+ ◆ 11/2

20 - 25

40 - 45



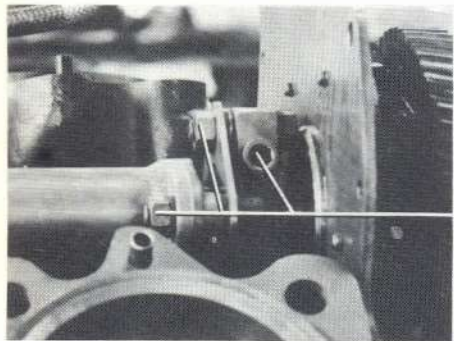
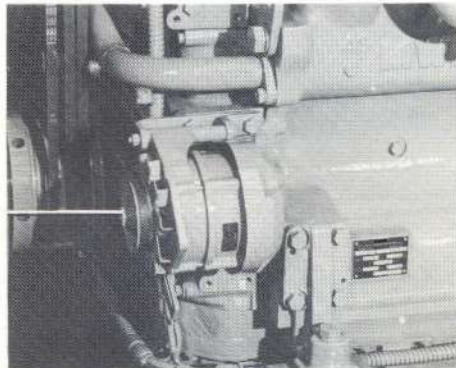
M8 - 12.9  
40 - 45

M10 - 12.9  
85 - 90

M8 - 12.9  
50 - 55

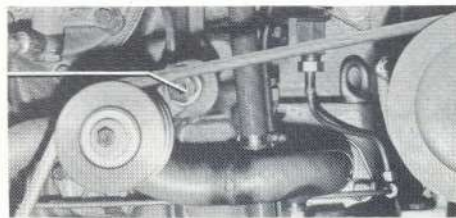
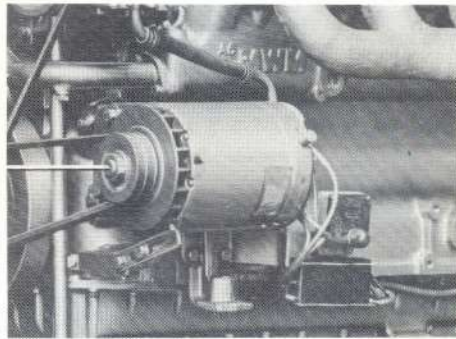
M10 - 12.9  
90 - 95

35 - 50

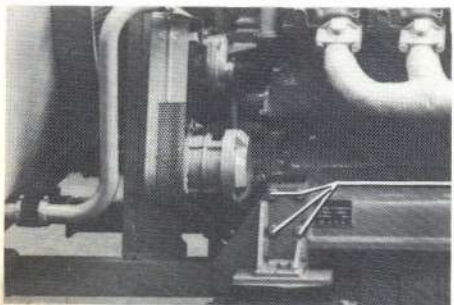


100 - 110

120 - 150



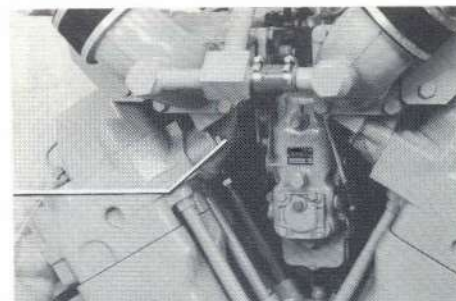
100 - 110



M12 - 8.8  
75 - 80

M14 - 10.9  
180 - 190

50 - 55



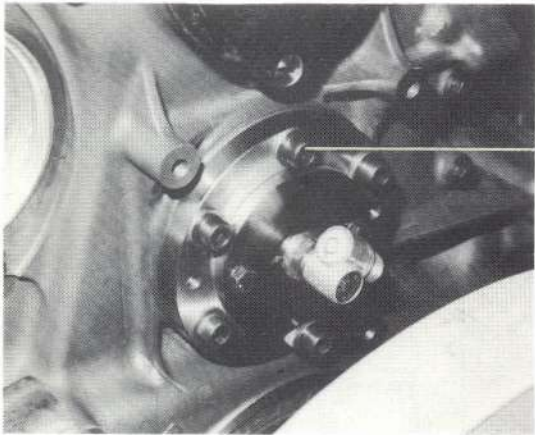


Tightening torques of main screw connections in Nm

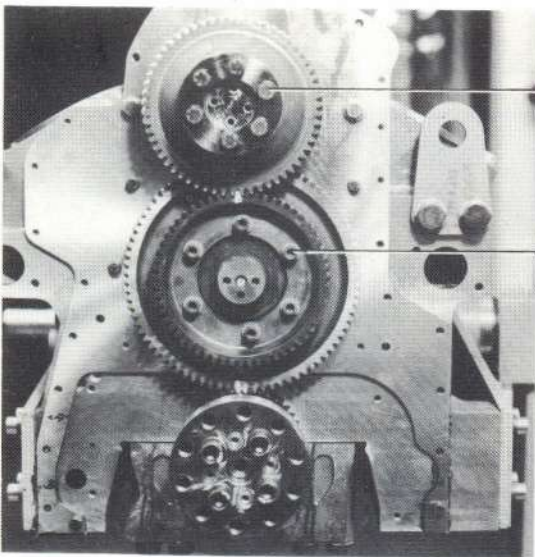
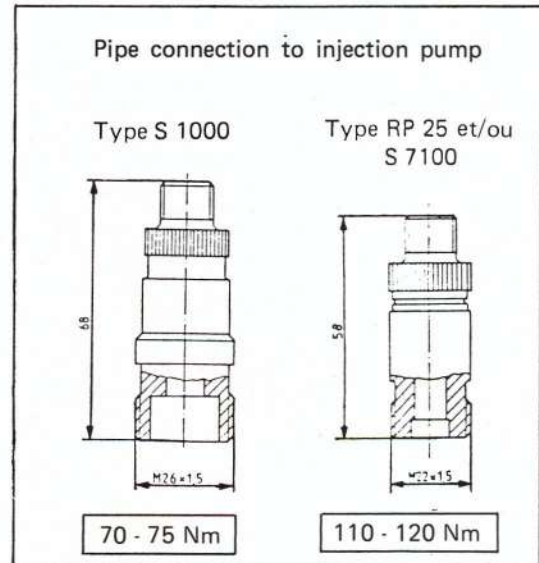
read thoroughly  
prior to beginning

Page 3 of 3 pages

Necessary tools	Necessary materials and auxiliaries	Spares Table No.
Set of tools		

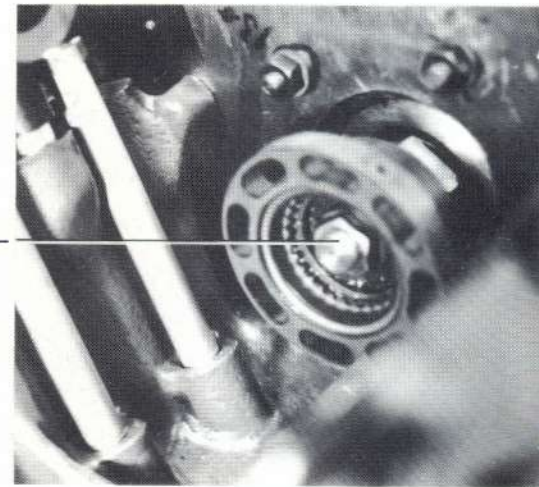


65 - 70

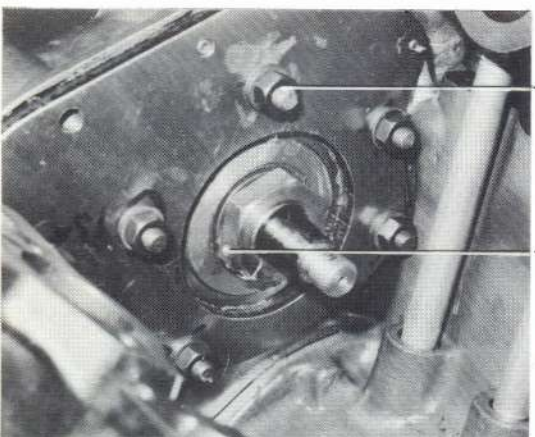


65 - 70

65 - 70



240 - 250



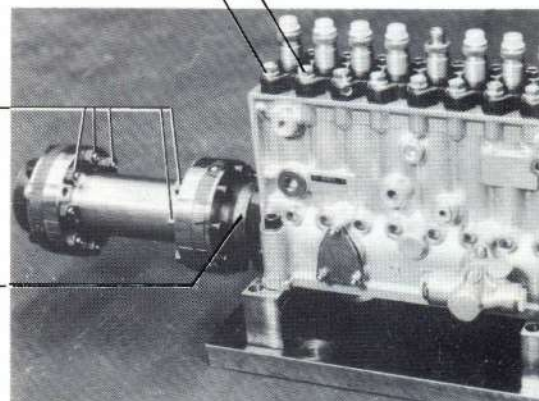
110 - 120

10 - 14

40 - 45

35 - 40

100 - 110





Anti-corrosion treatment of engines not yet installed

read thoroughly  
prior to beginning

Page 1 of 2 Pages

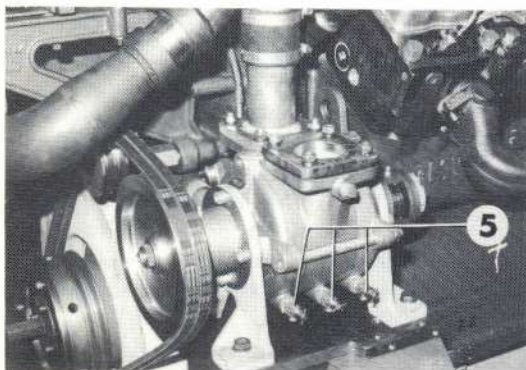
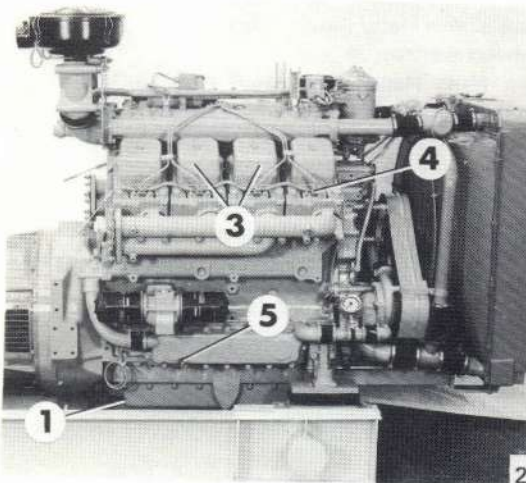
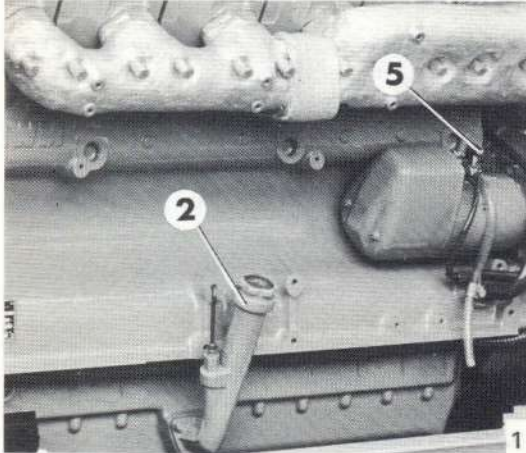
Necessary tools

Set of tools  
Spray gun  
Tilt (waterproof)

Necessary materials and auxiliaries

Protective grease e.g. Messrs. Fuchs KG; Antikorit-MV  
Anti-corrosion oil for lubricating oil system, e.g. Messrs. Fina; Rusan 20 W 20  
Anti-corrosion oil for fuel system, e.g. Messrs. Castrol: Rustillo DWX 32  
Anti-corrosion agent for cooling water, e.g. Messrs. Kuhbier-Chemie: Puriton 4110  
Talcum powder

Spares Table No.



Should the engine not be installed and commissioned within a period of 3 months, an anti-corrosion treatment is to be carried out to prevent corrosion.

Anti-corrosion treatment of the engine

1. Mark position of the flywheel or of the crankshaft flange. There right be first beginnings on the cylinder liners in the height of the piston rings, therefore the position of the piston should be changed after each anti-corrosion treatment.
2. Fill fuel mixture consisting of 9 parts Diesel fuel and 1 part anti-corrosion oil in fuel filter.
3. Wash and/or tins out oil sump and additional devices with own oil filling with Diesel fuel. Screw-in oil discharging screw No. 1 and tighten it.
4. Fill anti-corrosion oil in the engine (inlet connection 2) and/or spray it in the additional devices.
5. Should the engines be equipped with a hand pump, pump the filled in anti-corrosion oil through the engine by means of a hand pump and race the crankshaft by hand so that all bearings and liners are slightly wet. Should the engines not be equipped with a hand pump, the anti-corrosion oil has to be pressed through the oil system by means of the mounted lubricating oil pump. That can happen as described in the following:  
Remove blind flange on intake- and exhaust pipe.  
Should the starter be mounted and a battery be available, turn the crankshaft by the starter.  
**Attention:** Ignition of the engine is allowed, but only with minimal speed until the oil pressure is built up.  
Should the engine not be equipped with a starter, race the crankshaft several times by turning. In case of super-charged engines the turbine wheel must be raced several times by hand.
6. Remove cylinder head cover 3, spray in valve springs and rocker arms with anti-corrosion oil, install cylinder head cover.
7. Remove injection nozzles 4 and bring the corresponding piston to BDC. Spray anti-corrosion oil in the combustion rooms through the opening on the cylinder head. Reinstall injection nozzles.
8. Should the engines be equipped with a compressed-air start, remove starting star and starting line on the cylinder head. Spray in starting star and openings of the starting line in the cylinder head with anti-corrosion oil. Reinstall de-mounted parts.
9. Unscrew oil discharging screws 1 and drain anti-corrosion oil, rescrew oil discharging screws 1. The fuel mixture can remain in the system.
10. Fill cooling water mixture consisting of 20 parts cooling water and 1 part anti-corrosion agent in the engine and circulate the cooling water mixture in the engine by a separate pump. Then drain the cooling water mixture and let the draining cocks 5 opened.
11. The intake- and exhaust openings are to be closed that external weather influences are kept away from the engine inside.





**Job Sheet**

Date

5.85

first time after

—

after and every

—

Engine type

TBD 234

Job Sheet No.

3.3.003 A

Anti-corrosion treatment of engines not yet installed

read thoroughly  
prior to beginning

Page 2 of 2 Pages

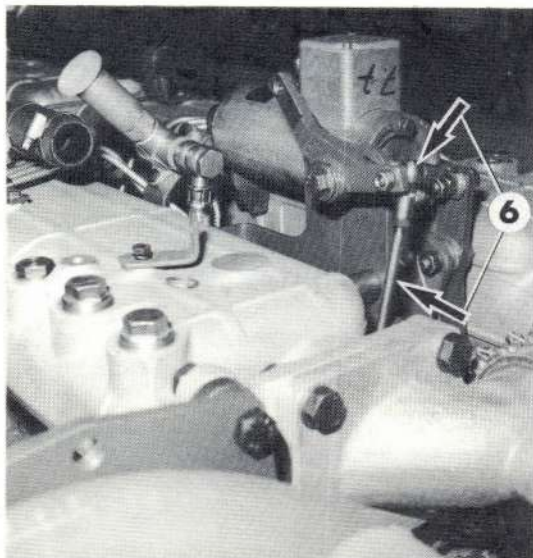
**Necessary tools**

Set of tools  
Spray gun  
Tilt (waterproof)

**Necessary materials and auxiliaries**

Protective grease e.g. Messrs. Fuchs KG; Antikorit-MV  
Anti-corrosion oil for lubricating oil system,  
e.g. Messrs. Fina; Rusan 20 W 20  
Anti-corrosion oil for fuel system, e.g.  
Messrs. Castrol: Rustillo DWX 32  
Anti-corrosion agent for cooling water, e.g.  
Messrs. Kuhbier-Chemie: Puriton 4110  
Talcum powder

**Spares Table No.**



**Represerving the outer parts of engine**

1. Degrease all bright outer parts of engine and clean with fuel.
2. Coat the bright items, e.g. linkage 6 with protecting grease.
3. Dust all rubber items (hoses, anti-vibration mounting pads) with talcum powder.
4. Check paintwork for damage and, if necessary, repair.
5. If possible locate engine in storage area, spray with preserving oil (spray gun) and cover with tarpaulin.
6. Note date of preservation and fix message "do not turn crankshaft" at a prominent point on the engine.

Treating the installed engines against corrosion for lengthy standstill periods

 read thoroughly  
prior to beginning

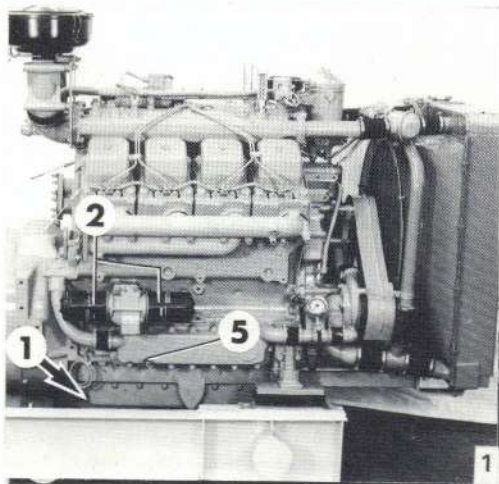
 Page of  
1 2 Pages

**Necessary tools**

 Set of tools  
Spray gun  
Tilt (waterproof)

**Necessary materials and auxiliaries**

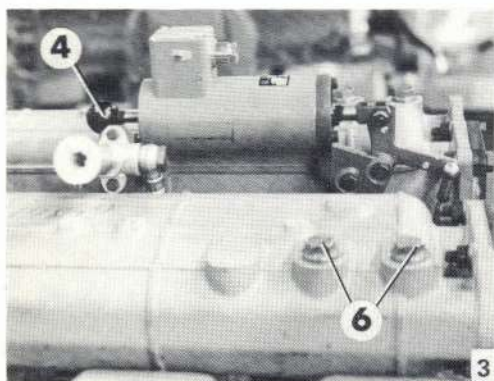
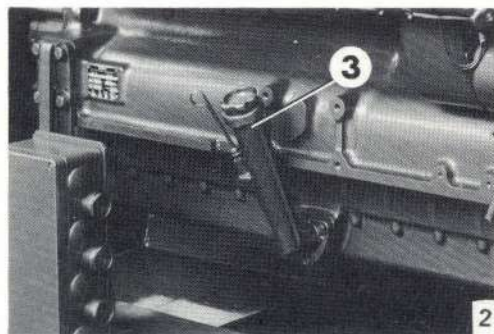
 Protective grease e.g. Fuchs KG; Antikorit-MV  
Anti-corrosion oil for lubricating oil system,  
e.g. Messrs. Fina; Rusan 20 W 20  
Anti-corrosion oil for fuel system, e.g.  
Messrs. Castrol: Rustillo DWX 32  
Anti-corrosion agent for cooling water, e.g.  
Messrs. Kuhbier-Chemie: Puriton 4110  
Talcum powder

**Spares Table No.**


Should the engine be put out of operation for a fairly long period of time, an appropriate treatment against corrosion should be performed.

**Treating the engine against corrosion**

1. Drain engine oil (drain plugs 1), then screw in and tighten drain plugs again.
2. Unscrew, drain and reattach oil-filter cartridge 2. Tightening prescriptions for filter cartridge: screw in filter cartridge until gasket touches slightly, then, tighten, turning by approx. half a turn manually and using no tool.
3. Fill engine with anticorrosion oil (filling neck 3).
4. Drain cooling water (drain cock 5) and fill engine with mixture composed of 20 parts of cooling water and 1 part of anticorrosion agent. Vent at venting screws 6 and fill in with mixture through filling neck up to lower mark.
5. Drain fuel out of tank, make a mixture composed of 9 parts of fuel and 1 part of anticorrosion oil and pour it into tank.
6. Start engine, wait until oil pressure gauge indicates pressure and then, increase speed to approx. 2/3 of nominal speed. Allow engine to run for about 15 minutes without load.
7. Stop engine.
8. Remove air filter.
9. Should the engine be equipped with Nova starting appliances, close starting-air receiver, remove starting-air line upstream of main valve and pour approx. 0.25 dm<sup>3</sup> of anti-corrosion oil into starting line. Connect starting line again.
10. Crank engine using starting appliances while holding stop lever 4 on stop position. Spray anticorrosion oil into open air-intake pipes, using a spraying gun, during the starting process.
11. Attach air filter.
12. Drain anticorrosion agent out of fuel tank, oil pan and cooling system.
13. The intake and exhaust line being already laid must be closed so as to keep external atmospheric influences away from the engine interior.







# Job Sheet

Date  
5.85

first time after  
—

after and every  
—

Engine type  
TBD 234

Job Sheet No.  
3.3.003 B

Treating the installed engines against corrosion for lengthy standstill periods

read thoroughly  
prior to beginning

Page 2 of 2 Pages

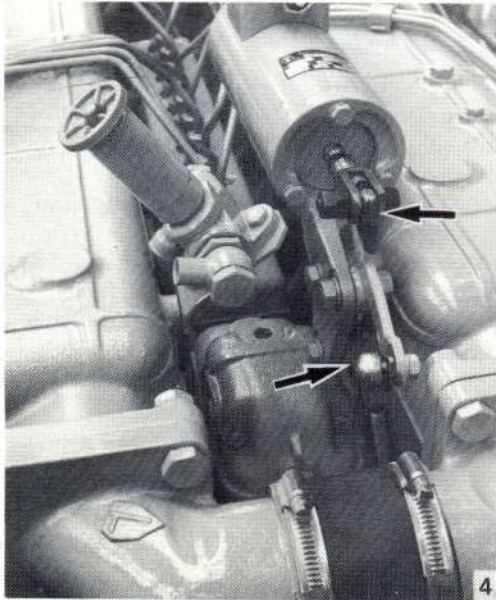
### Necessary tools

Set of tools  
Spray gun  
Tilt (waterproof)

### Necessary materials and auxiliaries

Protective grease e.g. Fuchs KG; Antikorit-MV  
Anti-corrosion oil for lubricating oil system,  
e.g. Messrs. Fina; Rusan 20 W 20  
Anti-corrosion oil for fuel system, e.g.  
Messrs. Castrol: Rustillo DWX 32  
Anti-corrosion agent for cooling water, e.g.  
Messrs. Kuhbier-Chemie: Puriton 4110  
Talcum powder

### Spares Table No.



### Preserving the outer parts

1. Coat all bright items, e.g. control linkages (Fig. 4) with protecting grease.
2. Dust all rubber items (hoses, anti-vibration mounting pads) with talcum powder.
3. Check paintwork for damage and, if necessary, repair.
4. Locate engine in storage area, spray with preserving oil (spray gun) and cover with tarpaulin.
5. Note date of preservation and fix message "do not turn crankshaft" at a prominent point on the engine.

**Caution!** Repeat preservation after at least 3 months.