

H系列柴油机使用保养说明书

Operation and Maintenance Manual H Series Diesel Engine

S00013037+01



上海柴油机股份有限公司
SHANGHAI DIESEL ENGINE CO.,LTD.

H 系列柴油机 使用保养说明书

Operation and Maintenance Manual H Series Diesel Engine

上海柴油机股份有限公司

Shanghai Diesel Engine Co., Ltd.

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告诫

为降低人员受伤和财产损失的可能性，降低柴油机性能恶化及柴油机早期磨损或损坏的可能性，请务必认真遵守本手册中所给出的安全须知和操作规程，尤其是操作警告和注意事项。

本手册中给出的警告部分内容是必须严格遵循，否则会引起烧伤、截肢、致残、窒息、其他人身伤害或死亡的可能；注意部分内容是提醒操作者必须按正确的方法操作，以避免柴油机零部件损坏或柴油机性能恶化。这些“警告”和“注意”并不周全，上海柴油机股份有限公司不可能，也不能给出违反这些安全须知和操作规程而产生的所有潜在的危险后果。

未经上海柴油机股份有限公司书面许可，不得复制本出版物的任何部分，也不得将其存储在检索系统中或以任何形式（无论是电子方式、机械方式还是复印方式）传递。

产品报修、技术咨询、投诉与建议

产品报修、技术咨询、投诉与建议，请与上柴“易+人”呼叫中心联系，365×24小时为您提供快捷、专业、真情的服务。全国免费服务热线 400-820-5656。

产品报修，请务必提供如下信息：

柴油机型号

柴油机订货号

柴油机机号

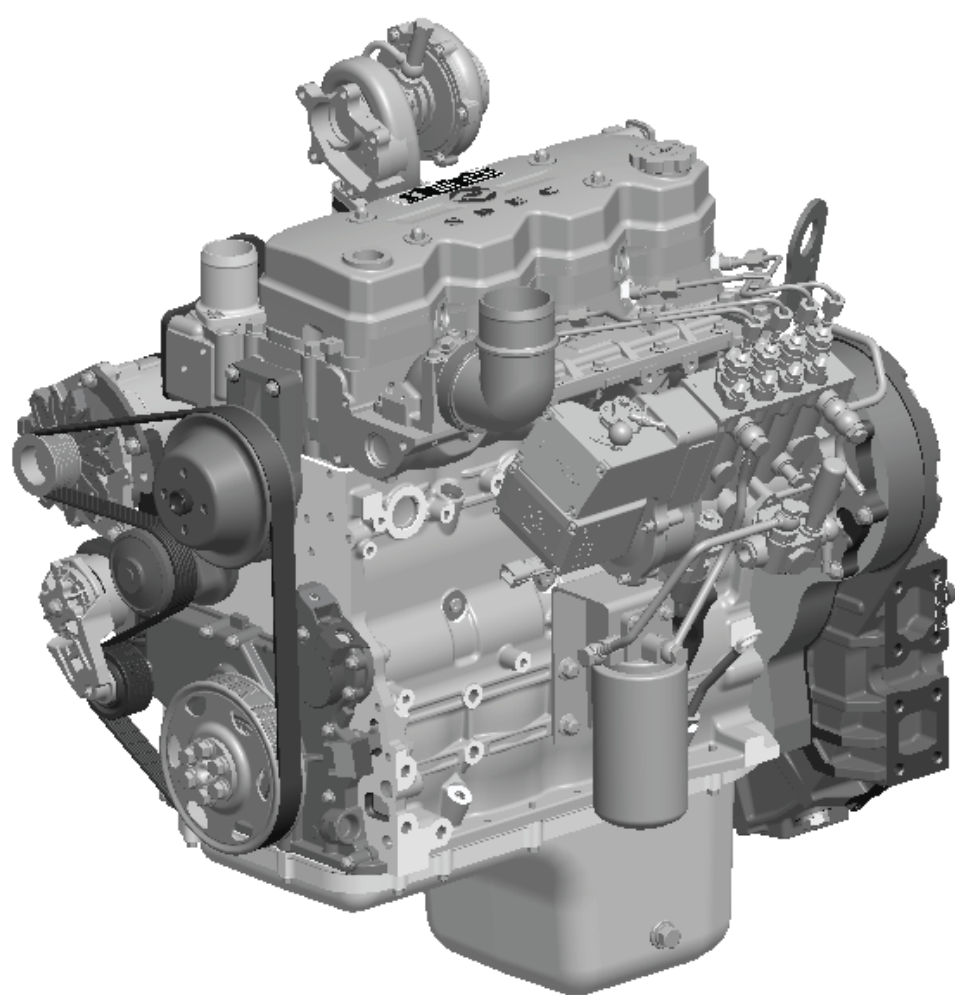
设备采购日期

较详细的故障描述

联系人地址与电话

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1 引言

1.1 致用户和操作者

感谢您选择使用上海柴油机股份有限公司的柴油机产品！

H 系列柴油机分为 4L 和 7L 两种机型，是我公司新开发的 4、6 缸中等功率四气门柴油机。H 系列柴油机动力强劲、油耗低，排放符合国家相关法规标准，是中高端汽车和设备等的理想配套动力。

本手册主要叙述该系列柴油机基本型的技术规格、使用操作和保养注意事项，以帮助用户熟悉本产品并正确使用和保养本产品。用户在柴油机使用前应认真阅读本手册中的有关内容和要求。由于产品性能和结构在不断改进，本手册中所列技术规格和图例说明与您在使用的实物可能略有不同，我公司在今后再版时会不断予以补充完善，不再专门通知用户，谨请注意。在本产品的使用保养中，如有任何疑问请随时联系上柴“易+人”呼叫中心（400-820-5656），以获得技术咨询或技术指导。

上海柴油机股份有限公司（上柴公司）的产品采用最新技术和高质量零部件。维修保养时，建议使用上柴公司品牌的服务备件。上柴公司授权的维修站遍布全国各地，提供维修服务和备件供应，维修人员经过专业培训。

1.2 用户反映产品质量情况须知

为便于我公司了解和分析产品质量问题及其产生故障的原因，及时改进产品质量，更好地为用户服务，谨请用户在反映产品质量时说明下列事项：

- 1) 发生故障的时间和地点；
- 2) 柴油机出厂编号（机号）、型号、订货号、发货日期、收货者确切地址；
- 3) 柴油机使用条件、工作累计时间（小时数或公里数）、工作状态（功率、转速）、使用的燃油和机油牌号；
- 4) 被驱动设备的特性（型号、消耗功率、结构特点等）；
- 5) 故障现象描述；
- 6) 要求赔偿或检修的零件或部件，应随同损坏过程记录或说明寄到或带到本公司，以便进行分析。如用户发现问题较多或问题特别严重时，应保持现场，并及时告知，我公司派员共同分析之。

对柴油机质量问题的处理按照质量保修手册有关规定。

1.3 产品售后服务承诺

为搞好产品售后的服务工作，减小因产品出现质量问题给用户造成的损失，上柴公司建立了 24 小时报修处理制度。用户在全国范围内拨打 400-820-5656 电话，均可得到上柴公司及时、专业的咨询和售后服务。

1.4 安全须知

- 在柴油机或其驱动装置周围工作时不要穿着肥大的衣服并摘掉所有饰物。必要时，戴上防护眼镜，穿工作服，戴安全帽或其他保护用品。
- 为防止人身事故，所有外露的旋转部件都要有防护装置，并安装牢固。
- 柴油机工作室应通风良好，柴油机废气应排到室外。
- 不得将易燃液体存放在柴油机附近。
- 起动前，从柴油机上拿走所有的工具、电线及其他零星物品。
- 在调整柴油机及其驱动装置之前务必停止柴油机运转。
- 在加注燃油时不准吸烟，燃油蒸汽容易燃烧。
- 在检查电池电解液液面时不准吸烟，蓄电池会放出易燃气体。
- 电解液是一种酸。在补充蓄电池电解液时，必须防止电解液与皮肤或眼睛接触。一旦接触皮肤，应尽快用肥皂和清水冲皮肤，如进入眼睛，应立即用大量清水冲洗眼睛 15 分钟，并且立即到医院就诊。
- 柴油机在加注冷却液时应小心防止蒸汽伤人。应先冷却柴油机，只有在冷却液温度低于 50℃时才慢慢拧松压力盖使冷却系统卸压，然后进行添加。
- 把溢出的润滑油、燃油、冷却液或其它液体擦干净。将有油的抹布存放在防火容器中，不得将有油的抹布放在

柴油机上。

●在起动刚修复的柴油机时，要作好切断空气供给的准备。一旦在柴油机起动后发生飞车现象时，立即断气停止柴油机。

●不得利用风扇部位盘动柴油机曲轴，否则会造成严重的人身伤害或风扇叶片损坏。

●柴油机排气系统温度较高，不可用手触摸排气管等高温零部件。

●在拆卸或松开任何管路、固定接头、接口或有关零部件之前，要先释放这些零部件所属系统的压力，如空气系统、冷却系统、润滑系统或燃油系统中的压力。不可用手检查泄漏。高压高温燃油或润滑油会伤害人体。

●当柴油机长期停车不用或维修时，应拆除柴油机与蓄电池的连接导线，以防止柴油机意外起动。

●使用过的柴油机机油可能含有致癌成分，且能引起再生毒性。要避免吸入机油蒸汽或长时间与其接触。用适当的、安全的、可靠的方法处理废油。

●为防止窒息或冻伤，在拆除空调制冷剂（氟利昂）管路时，一定要穿戴防护衣并且必须在通风良好的环境中进行。为保护环境，制冷系统必须使用专门的设备进行倒空或灌装，以防止氟利昂扩散到大气中。应回收和循环使用制冷剂。

1.5 柴油机使用注意事项

●认真阅读本手册，严格遵守本手册中规定的操作步骤及保养规程。

●应严格遵守本手册规定，进行日常维护和四级保养，并做好定期保养记录。

●应按本手册规定，使用恰当的燃油、润滑油和冷却液。

●对新机或大修后的柴油机，使用前须经 60 小时磨合运行。磨合要求见 3.7 节。

●不允许在不带空气滤清器情况下运行柴油机，以免柴油机发生早期磨损。

●柴油机的冷却系统在任何气候下都应采用规定的冷却液。

●在加注机油时，不同规格的润滑油不得混用。

●起动柴油机前，应做好“起动前的准备”工作，切记柴油机必须空载起动。

●起动柴油机前，必须检查冷却液、机油、燃油是否足够。严禁燃油箱内柴油很少的情况下运行柴油机，应及时补充燃油箱内柴油，否则，容易造成喷油泵损坏。

●柴油机运行时，应经常观察其运行状态 and 所有仪表的显示值。如遇紧急情况应采取紧急停车措施，防止因缺水过热或机油压力过低而导致柴油机运动件咬合。

●检查胶带张力及其它驱动装置时，柴油机应处于停车状态。

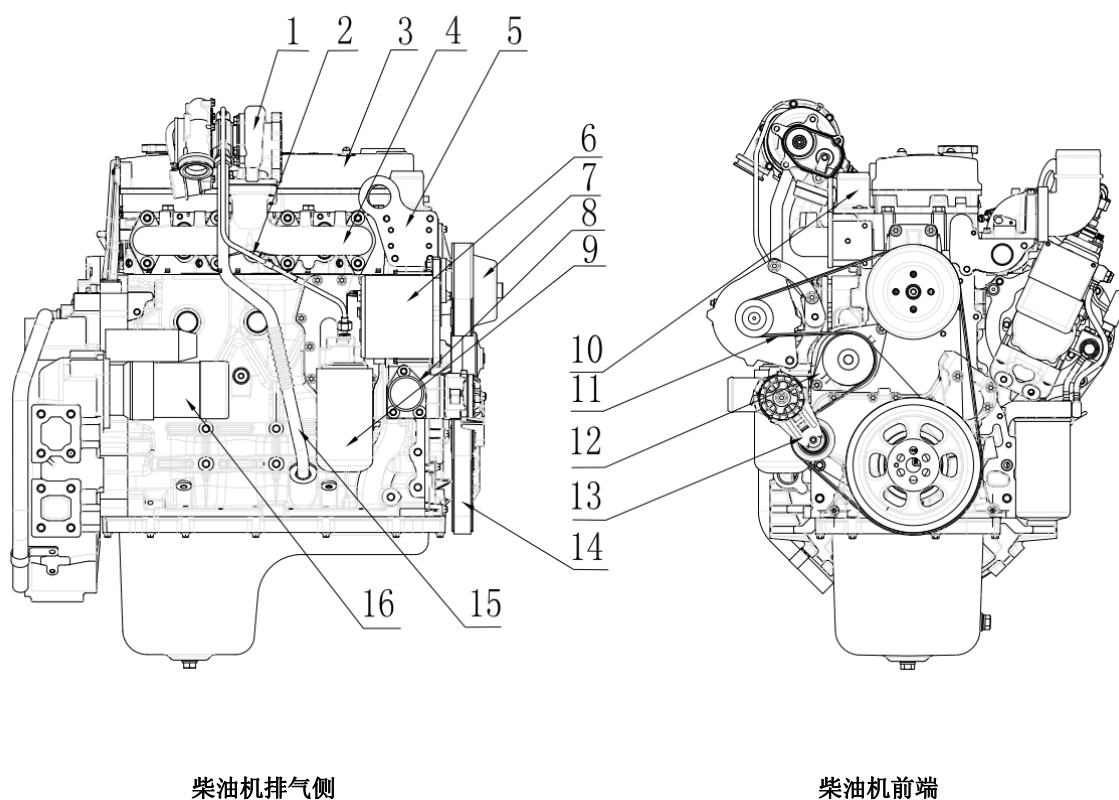
●如调温器失灵应及时更换，不得随意拆除不用。

●禁止私自拆下喷油泵上的铅封进行调整，否则极易引起柴油机损坏、动力不足等故障。

2 柴油机概况

2.1 柴油机外形图

2.1.1 SC4H 柴油机（4L）外形图



1 增压器

2 增压器进油管

3 气缸盖罩壳

4 排气管

5 柴油机前吊环

6 发电机

7 传动胶带轮

8 柴油机进水管

9 机油滤清器

10 柴油机出水管

11 风扇皮带

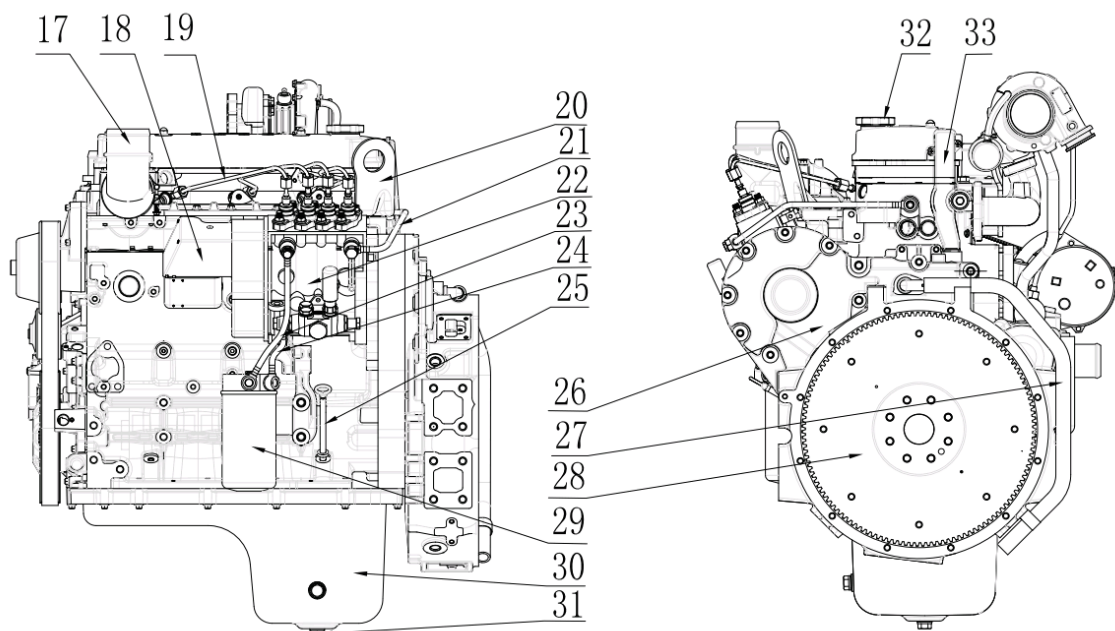
12 水泵

13 张紧轮

14 曲轴前端带轮

15 增压器回油管

16 起动电机

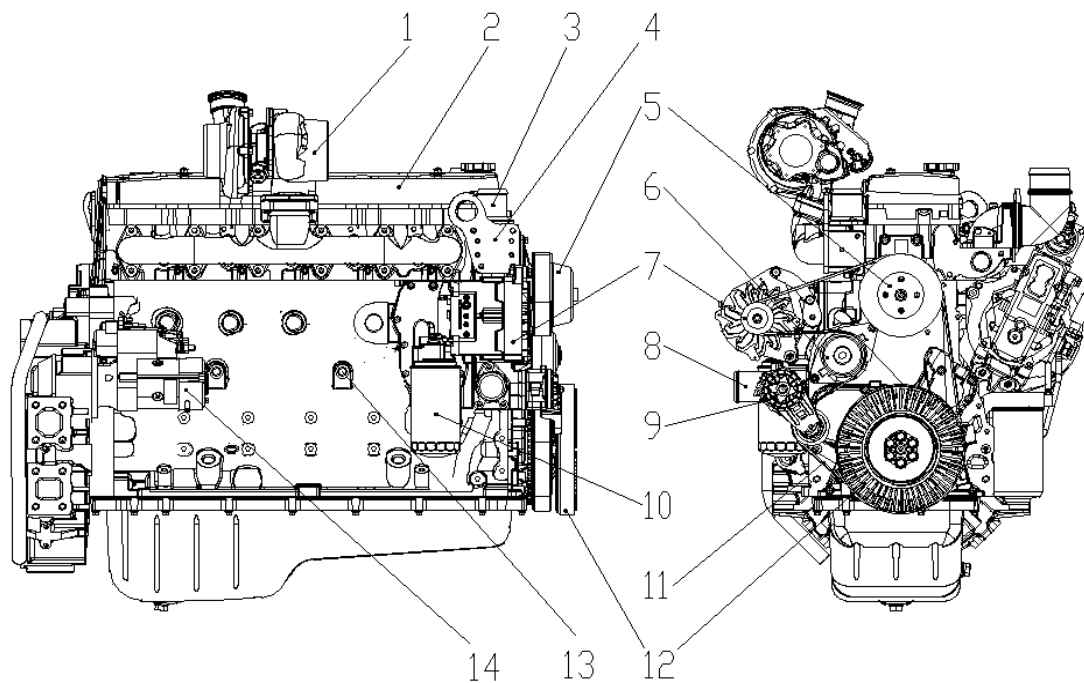


柴油机进气侧

柴油机后端

- | | | |
|-----------|---------------|------------|
| 17 进气接管 | 18 机械式或电子式调速器 | 19 高压油管 |
| 20 柴油机后吊环 | 21 燃油回油管 | 22 喷油泵 |
| 23 喷油泵进油管 | 24 燃油滤清器进油管 | 25 油尺 |
| 26 飞轮壳 | 27 油气分离器出气管 | 28 飞轮 |
| 29 燃油滤清器 | 30 油底壳 | 31 油底壳放油螺塞 |
| 32 加油盖 | 33 气缸盖罩壳通气管 | |

2.2.2 SC7H 柴油机（7L）外形图



柴油机排气侧

柴油机前端

1 增压器

2 气缸盖罩壳

3 柴油机出水管

4 柴油机前吊环

5 风扇轴承座

6 水泵

7 发电机

8 柴油机进水管

9 张紧轮

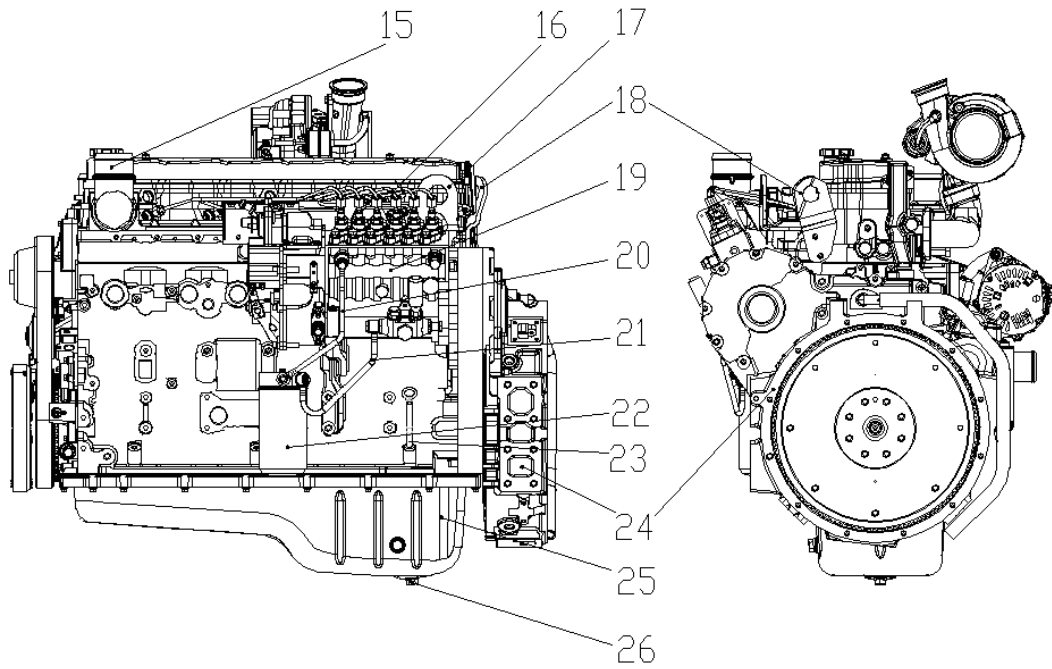
10 机油滤清器

11 风扇胶带

12 减振器

13 柴油机放水螺塞

14 起动机



柴油机进气侧

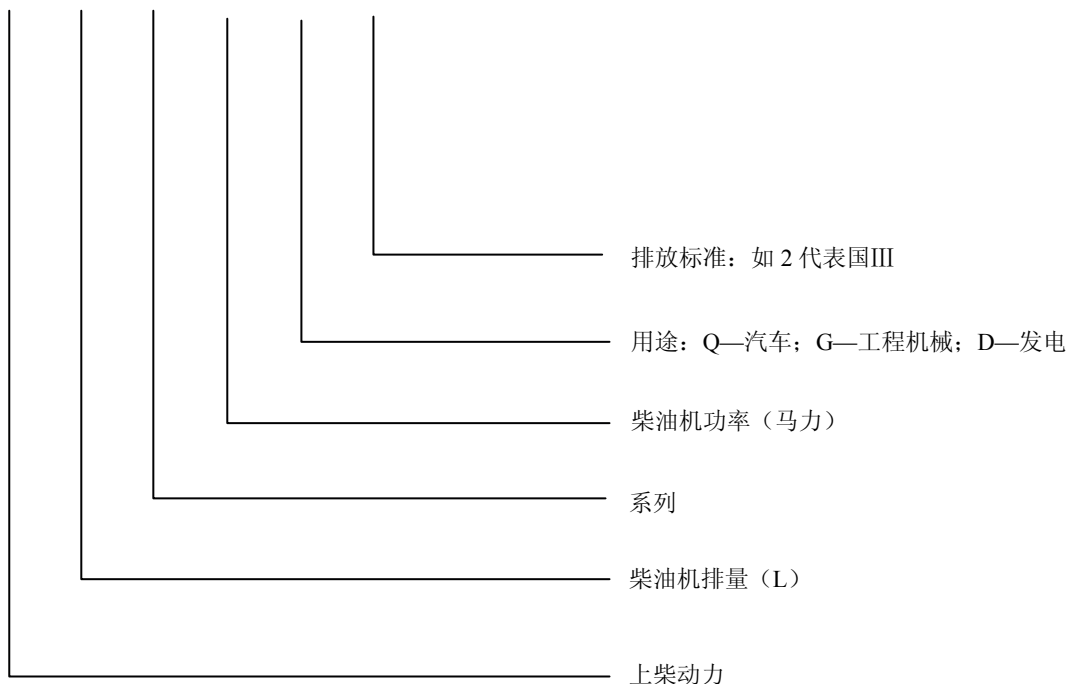
柴油机后端

- | | | |
|-------------|-------------------|-----------|
| 15 进气接管 | 16 高压油管 | 17 柴油机后吊环 |
| 18 后吊环（选装） | 19 喷油泵（机械式或电子调速器） | 20 喷油泵进油管 |
| 21 燃油滤清器进油管 | 22 燃油滤清器 | 23 油尺 |
| 24 飞轮壳 | 25 油底壳 | 26 放油螺塞 |

2.2 柴油机型号识别

柴油机型号表示下列含义：

SC X H □ □ □



例：SC4H160Q3 代表上柴 H 系列 4 升四气门 160 马力国Ⅲ（道路）车用柴油机

SC7H200G2 代表上柴 H 系列 7 升四气门 200 马力国Ⅱ（非道路）工程机械用柴油机

2.3 柴油机铭牌

柴油机铭牌标明了您所购买的柴油机的主要技术数据和信息：型号、订货号、机号、出厂日期、标定功率、标定转速，是用户购买维修零件和我公司进行售后技术服务的主要依据。希望用户将这些信息和数据记录到您的柴油机或所配设备的工作日志中。在日后联系维修和反映质量问题时，及时提供这些信息，有助于正确解决您所反映的问题。请保护好标牌不受损坏。铭牌位于柴油机缸盖罩壳顶面。

 上柴动力 柴油机 DIESEL ENGINE	型号 MODEL	机号 SER.NO.	出厂日期 DATE
	许可证号 LICENCE NO.	额定功率/转速 RATED POWER/SPEED kW/r/min	
	型式核准号 TYPE-APPROVAL NO.	排放阶段 EMISSION LIM.	净质量 NET WT. kg
	执行标准 EXECUTED STANDARD	订货号 ORD.NO.	
中国上海柴油机股份有限公司 SHANGHAI DIESEL ENGINE CO.,LTD.CHINA			

电站柴油机铭牌：

 上柴动力 柴油机 DIESEL ENGINE	型号 MODEL	机号 SER.NO.	出厂日期 DATE
	许可证号 LICENCE NO.	额定功率/转速 RATED POWER/SPEED kW/r/min	
	最大功率/转速 MAX POWER/SPEED kW/r/min	排放阶段 EMISSION LIM.	净质量 NET WT. kg
	执行标准 EXECUTED STANDARD	订货号 ORD.NO.	
中国上海柴油机股份有限公司 SHANGHAI DIESEL ENGINE CO.,LTD.CHINA			

△注意：未经我公司许可，用户不得随意更换柴油机铭牌！

2.4 柴油机技术规格

2.4.1 基本参数

柴油机		SC4H	SC7H
活塞总排量/L		4.3	6.5
形 式		直列、四冲程、水冷	
缸径/mm		105	
行程/mm		124	124
缸 数		4	6
每缸气门数		4	
发火次序 (从自由端数起)		1-3-4-2	1-5-3-6-2-4
进气方式		增压，中冷	
燃油系统		机械式喷油泵	
曲轴旋转方向（面向飞轮端）		逆时针	
起动方式		电起动	
净重/kg（干重） [*]		423	560
外形尺寸 (基本型) ^{**}	长/mm	807	1048
	宽/mm	722	722
	高/mm	968	995

*干重量按 DIN70020 定义为不含起动机、发电机、空压机、转向泵、离合器及柴油机内的油水的重量，但包含飞轮和飞轮壳重量。

** 外形尺寸仅为柴油机基本型尺寸，不同机型外形略有差异。

2.4.2 主要技术参数

柴油机	SC4H	SC7H
润滑系统		
机油压力/kPa		
怠速时(允许最低)	70	
标定转速时(允许最低)	207	
标定转速时(允许最高)	600	
油底壳容量/L		
(油尺“高一低”)	11.4-9.4	18-15
系统容量/L	13.4	20.5
冷却系统		
冷却液容量/L [*]	6.8	9.6
进排气系统		
允许最大进气阻力/kPa		
(标定工况，干式空气滤清器)	4（新滤芯）	
最大允许的排气阻力/kPa ^{**}		
（涡轮出口压力）	10	
（标定工况）		
电器系统		
最小推荐的蓄电池容量/Ah ^{***}	120	150
24V 系统	24 V	
－18℃ 蓄电池冷起动电流/CCA	600	750
起动电机		
电压/V	24	
功率/kW	4.5	6
发电机		
电压/V	28	
电流/A	55、70 可选	
额度功率/kW	1.5、2 可选	

* 该值仅指本柴油机系统容积。

** 不包括制动蝶阀的阻力。

*** 对起动要求较高的应用, 应适当加大蓄电池的容量。

3 柴油机使用

正确使用柴油机，不仅能保持柴油机工作正常、性能良好，而且会延长柴油机的寿命、降低使用成本。按本章节的要求采用正确的燃油、机油和冷却液，采用正确的操作步骤。

3.1 燃油

柴油机使用的柴油应根据环境温度来确定牌号。在冬季气温低的环境下，应使用低凝固点的柴油，夏季则反之。本柴油机采用的燃油规格应符合 GB 19147-2009 标准规定，燃油牌号使用地区按 GB 19147-2009 标准推荐。用户也可按下表推荐来选用：例如，环境温度为-27℃时，应选用-35 号柴油。

柴油牌号与适用最低气温的关系

柴油牌号	0 号	-10 号	-20 号	-35 号
十六烷值	≥49	≥49	≥46	≥45
凝固点 (°C)	≤0	≤-5	-20	-35
适用最低气温 (柴油机工作环境温度 °C)	4°C 以上	-5°C 以上	-14°C 以上	-29°C 以上

△注意：柴油必须保持高度的清洁，不被灰尘杂质或水所污染。

3.2 机油

为确保柴油机的正常运行和使用寿命、改善柴油机的排放，请使用上柴公司专用的 CF-4 级及以上等级的润滑油。在无法购买到上柴专用机油的情况下，可使用满足美国石油协会（API）要求的 CF-4 级及以上等级的润滑油。

合适的机油粘度等级是根据柴油机冷态时最低的外界温度和柴油机运转时最高的外界温度来确定的。

使用下表中最低温度栏的数据，以确定起动一台“冷透”的柴油机所需的润滑油粘度。使用下表中最高温度栏的数据，以选择预期最高运转温度的润滑油粘度。

润滑油适用于工作温度范围（GB 11122-2006）

上柴牌 CF-4 级机油粘度等级	环境温度	
	最低	最高
0W-20	-40°C	10°C
0W-40	-40°C	40°C
5W-40	-35°C	40°C
10W-30	-30°C	40°C
15W-40	-25°C	40°C
20W-50	-20°C	50°C

△注意：机油必须保持清洁，不被灰尘杂质或水所污染。

上柴公司用专用的 CF-4 级润滑油件号：

Y/1511000001 ((3.5kg))	Y/1511000002 (16 kg)	Y/AG0105 (3.5 kg)	Y/AG0106 (16 kg)
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3.3 冷却液

为确保柴油机的正常运行和使用寿命，请在任何气候条件下都使用上柴公司专用的有机型（防冻）冷却液。该冷却液具有防冻、防腐、导热性好、稳定性好、环保等特点。

名称	件号	冰点/°C	沸点/°C
上柴有机型（防冻）冷却液	F/LQY-45	-45	108

3.4 柴油机起动

在使用柴油机之前，应根据具体的使用环境和条件，选用适当规格的机油、燃油和冷却液。起动前应做好如下工作：

- 对柴油机及起动系统作一次环视检查，发现问题，及时解决。
- 检查机油压力表、温度压力表、警示灯、以及其他仪表是否处于正常状态。
- 检查空滤器保养指示器是否出现红色柱塞。

△注意：绝不允许不带空滤器起动柴油机（船用柴油机除外），以防柴油机早期磨损。

- 检查燃油粗滤器保养指示器是否变红色。
- 检查机油油面高度是否在规定的范围内。
- 检查冷却液液面高度是否在规定的范围内。
- 检查电解液液面高度是否在规定的范围内。
- 如果柴油机已有多日停止工作，或者刚刚更换过燃油滤清器，燃油系统内可能有空气。必要时对燃油系统泵油排气，具体操作见 4.3 节中燃油系统泵油排气。
- 检查电起动线路是否处于正常状态。
- 所有安全防护装置必须安装就位。
- 检查油门踏板或油门操作杆动作是否灵活。

3.4.1 常规起动步骤

- 使柴油机与传动装置脱离或将变速箱置于空挡位置。
- 机械操纵装置等处于运转位置。
- 插入电钥匙，将开关从 OFF 位置转到 ON 位置，接通电子控制器和其他电器。
- 待进气预热器指示灯熄灭后将开关从 ON 位置转到 START 位置。如有进气预热，指示灯亮；如没有进气预热，指示灯不亮。对车用柴油机，起动时需要踏油门。

△注意：为防止损坏起动电机，起动时间不得超过 15 秒，两次起动之间应间隔 2 分钟。

每次起动时间一般为 2 至 3 秒，如果 3 次起动都不成功，联系上柴“易+人”（400-820-5656）。

- 柴油机成功起动后，开关自动从 START 位置回位到 ON 位置。

△注意：起动成功后 15 秒内柴油机油压表必须显示读数。如果 15 秒内不能指示机油压力，应立即停车，以防损坏柴油机。然后按第 5 章“故障排除指南”查明原因，排除故障。

- 热态柴油机起动后，在怠速运转 1~3 分钟后，然后逐步加速加载运行。
- 冷态柴油机起动后，在怠速运转 3~5 分钟后，逐步增加转速，确保各轴承得到充分润滑，并使机油压力稳定。待油压稳定后方可逐步加载运行。
- 柴油机在怠速工况下运转时，检查所有仪表工作是否正常。

△注意：严禁柴油机起动后立即加速加载运转。

△注意：柴油机怠速运转时间不许太长，否则会损害柴油机。因为怠速运转燃烧室温度低，燃油不能完全燃烧，造成缸内结碳，引起喷油器喷孔堵塞、使活塞环和气门卡滞、柴油机性能下降。

△注意：当使用一个跨接电缆起动柴油机时，一定要将电缆并联：正极连正极，负极连负极。当使用外部电源起动柴油机时，将断路开关置到“OFF”位，连接跨接电缆之前，为了防止意外起动，将钥匙拔出。

3.4.2 低温起动

柴油机具有在-15℃以上不采用任何预热措施顺利起动的能力。但为在冬季气温较低的情况下能快速顺利起动柴油机并使起动后的柴油机转速保持稳定，烟度得到改善，建议采用进气加热装置—电阻丝加热装置）。

电阻丝加热装置：由电加器，电子控制器、温度传感器、指示灯等元件组成，其工作由电子控制器控制。

电子控制器根据环境温度决定是否启动进气加热。进气加热分为 2 个阶段：起动前的进气预热和起动后的进气加热。在预热过程中一般不允许起动柴油机，若起动则预热停止，待预热完成后方可起动。

- 启动前先插入电钥匙并从 OFF 位置转到 ON 位置，接通预热辅助装置电路，此时指示灯亮，进气预热开始；进气预热结束，预热灯闪烁，告知柴油机可以启动。
- 待预热灯熄灭后，将电钥匙从 ON 位置转到 START 位置启动柴油机。启动成功后，开关自动回位到 ON 位置。
- 启动后的进气加热（第 2 阶段加热）开始，时间由电子控制器控制，期间预热灯不亮。

启动后的其他事项按 3.4.1 节“常规启动步骤”规定。

注：若指示灯开始闪烁后 30S 未进行启动操作或启动不成功，电子控制器将自动切断预热回路、电磁阀回路和指示灯回路，进入延时保护。若再要启动，需将电钥匙退回到 OFF 位置，停留 5 秒后重复上述过程。

3.4.3 长时间停车或更换机油后的启动

每当更换机油后或停车时间大于 30 天时，启动柴油机前，必须先检查机油液面是否在油尺刻线范围之内，给燃油系统泵油排气，具体操作见第 4.3 节，然后按常规启动或低温启动程序启动柴油机。

3.5 柴油机运行

柴油机运行时注意事项：

- 经常关注油压、冷却液温度是否正常，若见异常，应该停车检查。
- 当柴油机开始出现过热时(水温报警器报警)，应降低转速或降低负荷或二者同时进行，直到柴油机冷却液温度恢复到正常工作范围，否则，按第 5 章“故障排除指南”查明原因，排除故障；如需要联系上柴“易+人”呼叫中心（400-820-5656）。
- 在汽车下陡坡时，须利用变速箱档位和制动器同时控制车辆速度和柴油机转速；在汽车上坡时，必须选择适当的变速箱档位，以防汽车冲坡。

△注意：柴油机超速运行会导致其严重损坏。

- 柴油机在非常寒冷的环境下运行，必须使用正确的润滑油、燃油和冷却液。

大多数柴油机故障出现前有明显的征兆，通过听柴油机声音变化、看柴油机性能变化和外观变化可以预先知道柴油机需要保养或维修，应及时进行保养或维修，否则会酿成严重故障。必要时，应及时联系上柴“易+人”呼叫中心，以获得技术指导或专业的维修服务。

柴油机故障前典型征兆

柴油机异常熄火
柴油机异常振动
柴油机声音异常
柴油机冷却液温度、机油压力突然发生变化
柴油机冒黑烟
功率不足
机油耗增加
燃油耗增加
三漏（机油、燃油、冷却液泄漏）

3.6 柴油机停车

3.6.1 正常停车

柴油机长时间高速高负载运转后，停机前应逐步卸去负荷、降低转速，并在怠速运行 3-5 分钟，使增压器转速大幅下降，然后再停机，以保护柴油机和增压器。严禁采用“加速—熄火—空档滑行”的方法停车。柴油机停止运转后将开关从 ON 位置转到 OFF 位置，并取出电钥匙。

柴油机如需停用一段时间，需要做好保存工作，具体见第 6 章柴油机停运后保存。

3.6.2 紧急停车

在紧急或特殊情况下，为避免柴油机发生严重事故可采取紧急停车。此时用手拨动紧急停车手柄，即可达到目的。

3.7 新柴油机或大修后柴油机的磨合

新的或大修后的柴油机，在正式使用前须经 60 小时磨合并更换机油后，方可投入全负荷使用，以改善柴油机各运动部件的工作状况，提高柴油机的运行可靠性和使用寿命。磨合应视柴油机用途和拖载方式的不同，考虑具体磨合方案。原则上随着磨合时间的增加分阶段逐步提高柴油机的转速和负载。在整个磨合期内负荷应是标定功率的 50~80%，转速应不大于标定转速的 80%。

柴油机在磨合期及磨合后的正常工作期，均不宜长时间处于怠速运行或低负荷运行。柴油机怠速连续运行时间一般不宜超过 5 分钟，以避免因积碳而引起早期磨损或影响柴油机性能。

4 柴油机保养

4.1 柴油机保养表

下表给出了本系列柴油机保养周期及保养内容。用户应根据本表规定进行定保养。若柴油机经常在环境温度低于-18℃或高于 38℃情况下运行，或者在多尘环境或频繁停车情况下运行，须适当缩短保养周期。

保养内容	日常 保养	每 10 000 公里 或每 250 小时 或每 3 个月	每 20 000 公里 或每 500 小时或 每 6 个月	每 40 000 公里 或每 1000 小时 或每 12 个月	每 80 000 公里 每 2000 小时或 每 2 年或
检查柴油机外围	●	●	●	●	●
检查燃油箱	●	●	●	●	●
检查空滤器保养指示器	●	●	●	●	●
检查燃油粗滤保养指示器	●	●	●	●	●
检查机油油面	●	●	●	●	●
检查冷却液液面	●	●	●	●	●
检查电解液液面	●	●	●	●	●
检查传动胶带 [*]	●	●	●	●	●
检查冷却风扇	●	●	●	●	●
检查进气系统		●	●	●	●
更换机油和机油滤清器 ^{**}		●	●	●	●
更换柴油滤清器（精、粗） ^{***}			●	●	●
燃油系统泵油排气			●	●	●
检查和调整气门间隙			●	●	●
检查空气滤清器滤芯			●	●	●
检查中冷器			●	●	●
检查胶带张紧轮 ^{****}				●	●
检查风扇轴承					●
检查增压器					●
检查减振器					●
检查空气压缩机					●
更换冷却液					●
[*] 当传动胶带表面出现裂痕或其他影响使用的缺陷时，必须更换。 ^{**} 采用等级为 CH-4 及以上等级的机油，机油和机油滤清器更换周期可以延长至每 6 个月或每 500 小时或每 2000 公里（以先到为准）。 ^{***} 当燃油含杂质较多时，应适当缩短燃油粗滤的更换时间。 ^{****} 当张紧轮带轮出现卡滞，转动不灵活时需要更换。					

注：本表中以月、小时或公里为单位规定保养间隔，是以先到为准。

4.3 柴油机保养内容及方法

检查柴油机外围

每天在柴油机起动前进行柴油机外围检查，内容如下：

- 检查柴油机及散热器上有无搭布、废电线、管夹、螺钉等杂物堆积，保持柴油机清洁、整齐。
- 检查燃油系统、冷却系统、润滑系统各处接头、密封面有无泄漏。
- 检查风扇连接和安全护罩是否安全可靠到位。
- 检查附件紧固情况。
- 检查电气线路接头是否松动，导线是否完好。
- 检查传动胶带是否完好。

检查燃油箱

每天检查燃油箱油面。

检查空气滤清器保养指示器

每天检查空气滤清器上的保养指示器，如果检视窗口显示红色，表示空滤器进气阻力超过规定值，需要更换滤芯。滤芯更换后，必须按下保养指示器端部上的按钮，使其复位。



△注意：更换空气滤清器滤芯后，确保空气滤清器两端面可靠密封，不得漏气。

△注意：绝不允许不带空气滤清器情况下起动柴油机。否则极易造成柴油机早期磨损。

检查燃油粗滤器保养指示器

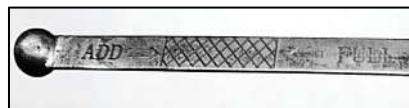
每天检查燃油粗滤器保养指示器。当粗滤器杂质累计已达到一定程度，造成输油泵泵油困难，此时滤清器上的保养指示器显示红色，提醒用户需要更换燃油粗滤器。如果粗滤器使用 500 小时后，指示器未出现红色，根据保养规定，也必须更换。燃油粗滤器也是旋入式的，更换步骤与燃油精滤器，参见燃油精滤更换。



检查机油油面

每天在柴油机起动前或停车状态时（停车后至少 15 分钟）检查机油油面，以使机油有充分的时间流回油底壳。机油油面高度应在油尺上的“ADD”和“FULL”两刻线之间。如果机油量不足，应添加机油。油尺低位“ADD”至高位“FULL”的油量差，4L 机约为 2 升，7L 机约为 2.5 升。

△注意：决不能在机油液面低于“ADD”刻线的情况下运行柴油机，否则会导致柴油机性能变差，甚至损坏柴油机。



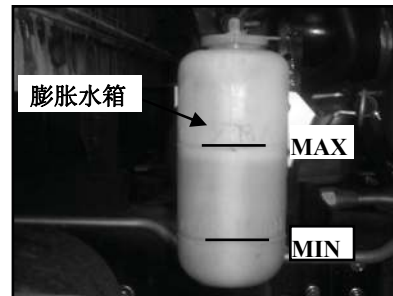
检查冷却液液面

▲警告：柴油机工作时，其冷却液温度较高且有压力，容易引起烫伤。待柴油机停车并且冷却液冷却到 50℃ 以下，慢慢旋松压力盖释放压力后才能进行冷却液液面检查或添加。

▲警告：冷却液中的防锈剂含碱，应避免其与皮肤和眼睛接触，以防伤害。

车用柴油机

每天在柴油机起动前或停车状态检查膨胀水箱内冷却液液面高度。冷却液液面应保持在刻线上限 (MAX) 和下限 (MIN) 液面之间，必要时添加，添加至接近上刻线。

**非车用柴油机**

(1) 在柴油机起动前或停车后冷却液温度下降至 50℃ 以下后，慢慢旋开散热器或膨胀水箱上的冷却液加液盖以释放压力。

(2) 从加液口或液面检查口检查冷却液液面高度，应在上下刻线内或满足车辆或设备制造商的规定。

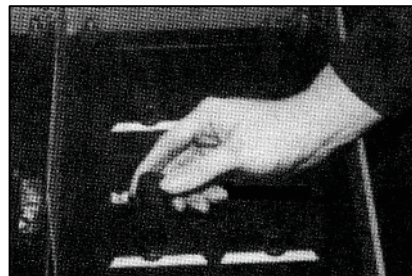
(3) 必要时添加。添加至接近上刻线或满足车辆或设备制造商的规定。

△注意：添加冷却液时应慢慢注入，以防产生气阻。

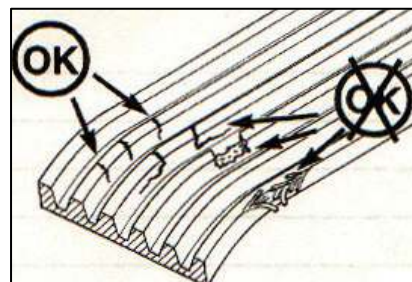
检查电解液液面

(1) 每天卸下加液盖，查看电解液液面。卸下加液盖，电解液液面应在加注口底部。如果液面不足，应按要求补充。

(2) 装上加液盖。

**检查传动胶带**

每天目视检查传动胶带。检查胶带是否有纵横交叉的裂纹。沿胶带宽度方向的横向裂纹是允许的。但不允许出现纵向(沿胶带长度方向)和横向贯穿的裂纹。若胶带磨损或出现材料剥落也应予更换。

**检查冷却风扇**

每天用肉眼检查风扇有无裂纹等缺陷。应确保风扇安装可靠。必要时应拧紧紧固螺栓(55-65 N·m)，或更换损坏的风扇。

▲警告：风扇叶片损坏会造成伤人的严重事故。绝不允许拖拉和撬动风扇，更不能借风扇转动柴油机曲轴。

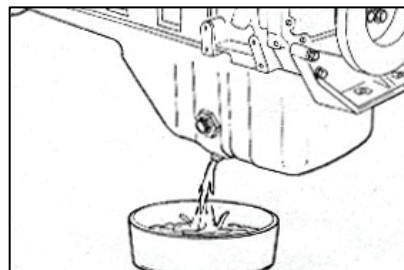
检查进气系统

检查进气胶管是否有裂缝或穿孔，夹箍是否松动。如有发现进气胶管失效应予以更换，发现夹箍松动应拧紧夹箍螺钉，确保进气系统不漏气。

更换机油和机油滤清器

▲警告：在更换机油和机油滤清器时要注意安全，与热机油和柴油机表面接触会引起皮肤烫伤。

(1) 待柴油机运转至冷却液温度达到 60°C 时停车，拆下油底壳放油螺塞，报废垫片，放尽机油。



△注意：不要在柴油机冷态时泄放机油。因为在冷态时，悬浮在机油中的杂质颗粒已沉积到油底壳底部并粘附在油底壳内表面，不能随机油一起排出。机油温热时杂质颗粒悬浮在机油中，此时泄放机油，杂质颗粒易排出。

(2) 清洁放油螺塞安装面，更换新垫片，然后装上放油螺塞，拧紧力矩为 56-64 N·m。

(3) 清洁机油滤清器外表面，用工具拆下机油滤清器并报废。

(4) 清洁滤清器座密封面，不得有旧的 O 型密封圈残留。



(5) 安装新的机油滤清器前，应从滤清器周边 8 个小孔注入干净的机油，注满滤清器内腔，油面离螺纹孔下端 3-15 mm。并在密封圈密封表面上涂一薄层干净的机油，用以形成润滑膜。

△注意：不得从滤清器中心的孔注入机油。



(6) 手旋滤清器直到密封圈接触到安装面，再用工具再拧紧 3/4 圈至 1 圈。

(7) 打开加油口盖，用清洁的机油注入柴油机至接近“FULL”刻线（高油面记号）。

本柴油机系统机油容量	
13.4 L (SC4H)	20.5 L (SC7H)

(8) 起动柴油机并怠速运转，检查机油滤清器和放油螺塞是否漏油。

(9) 停车，约等 5 分钟让机油有充分的时间流回油底壳，然后检查机油液面高度。如需要添加，添加至接近油尺

“FULL”刻线（高油面记号）。

（10）安装加油口盖，手感拧紧即可。

更换燃油滤清器（精滤）

（1）清洁燃油滤清器外表面，用工具拆下燃油滤清器并报废。

（2）清洁燃油滤清器座周围及滤清器座密封面，不得有旧的 O 型密封圈残留。



（3）安装新的燃油滤清器前，应从滤清器周边 8 个小孔注入清洁的燃油，注满滤清器内腔，油面离螺纹孔下端 3-15mm。并在密封圈密封表面上涂一薄层干净的机油，用以形成润滑膜。

△注意：不得从滤清器中心的孔注入燃油。



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（3）安装新的燃油滤清器前，应从滤清器周边 8 个小孔注入清洁的燃油，注满滤清器内腔，油面离螺纹孔下端 3-15mm。并在密封圈密封表面上涂一薄层干净的机油，用以形成润滑膜。

△注意：不得从滤清器中心的孔注入燃油。



(4) 手旋滤清器直到密封圈接触到安装面，再用工具再拧紧 3/4 圈至 1 圈。

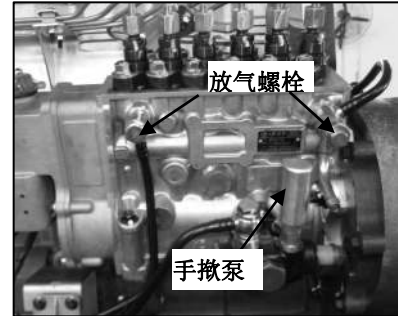
更换燃油滤清器（粗滤）

燃油粗滤器也是旋入式的，其更换步骤与更换燃油精滤器步骤一样。

燃油系统泵油排气

柴油机更换燃油滤清器（精滤、粗滤）后或已有多日停止工作，空气会进入燃油系统，需要按以下步骤排气：

- (1) 松开燃油粗滤器上的排气螺栓。
- (2) 反复按输油泵上手撇泵进行泵油排气，直到从排气螺栓处流出的柴油中没有气泡为止。
- (3) 拧紧排气螺栓。



△注意：没有及时加燃油，导致空气进入燃油系统，或者其它因素导致燃油系统有空气，均需要排除空气。

燃油粗滤器放水

粗滤器有油水分离功能。当粗滤器上水储存罐中的水位达到一定高度时，水位传感器将信号提供给装在驾驶室的水位指示灯，提醒驾驶员及时排水。旋松放水阀门，排除水和沉淀物，直到清洁的燃油流出为止，然后再关紧阀门。不要用力拧紧，手感紧即可。



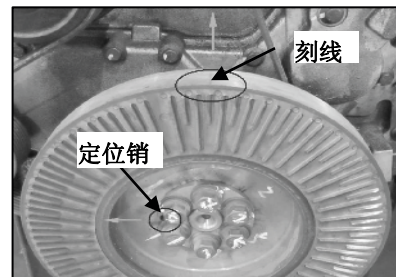
检查和调整气门间隙

新柴油机和大修后投入使用的柴油机，在首保时，进行第一次气门间隙检查，以便及时调整和纠正气门间隙的初期变化。在其后的正常运转期间，按保养计划检查和调整。

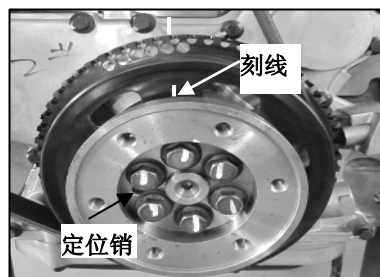
气门间隙检查在柴油机停止运转且冷却液冷却至 60℃ 以下后进行。

- (1) 拆下气缸盖罩壳上加油口盖。
- (2) 用盘车工具逆时针转动曲轴，使柴油机第 1 缸活塞或第 4 缸活塞（SC4H）或第 6 缸活塞（SC7H）处于上止点位置。

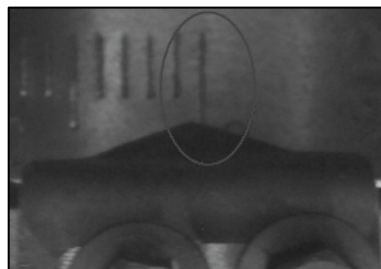
注：减振器上的定位销在左边，或其上的刻线朝上与齿轮室盖板上的刻线对齐时，第 1 缸或第 4 缸（SC4H）或第 6 缸（SC7H）的活塞处于上止点。



注：曲轴皮带盘上的定位销在左边，或其上的刻线朝上与齿轮室盖板上的刻线对齐时，第 1 缸或第 4 缸（SC4H）或第 6 缸（SC7H）的活塞处于上止点。



注：飞轮壳上的指针对准飞轮上“0”刻线时，第 1 缸或 4 缸（SC4H）或第 6 缸（SC7H）的活塞处于上止点。



（3）寻找压缩上止点：

SC4H（4 缸）：加油口在第 1 缸时，从加油口摇摆第 1 缸的摇臂，如摇臂能摆动，则第 1 缸活塞处于压缩上止点，如不能，则第 4 缸活塞处于压缩上止点；加油口在第 4 缸时，从加油口摇摆第 4 缸的摇臂，摇臂能摆动，则第 4 缸活塞处于压缩上止点，如不能，则第 1 缸活塞处于压缩上止点。

SC7H（6 缸）：加油口在第 1 缸时，与 SC4H 做法一样；加油口在第 6 缸时，从加油口摇摆第 6 缸的摇臂，摇臂能摆动，则第 6 缸活塞处于压缩上止点，如不能，则第 1 缸活塞处于压缩上止点。

（4）当第 1 缸活塞处于压缩上止点时，用塞片检查如下气门间隙：SC4H（4 缸）柴油机为第 1 和第 2 缸进气门，第 1 和第 3 缸排气门；SC7H（6 缸）柴油机为第 1、第 2 和第 4 缸进气门，第 1、第 3 和第 5 缸排气门。

当 SC4H（4 缸）柴油机第 4 缸活塞处于压缩上止点时，用塞片检查第 3 和第 4 缸进气门的气门间隙，第 2 和第 4 缸排气门的气门间隙。

当 SC7H（6 缸）柴油机第 6 缸活塞处于压缩上止点时，用塞片检查第 3、第 5 和第 6 缸进气门的气门间隙，第 2、第 4 和第 6 缸排气门的气门间隙。

注：用间隙塞片检查间隙时，塞片在气门桥杆顶面与摇臂之间移动时手感有点阻力，即为正确的气门间隙。



（5）如间隙不符合要求，拧松该摇臂上的气门间隙锁紧螺母，调节至规定值。然后拧紧锁紧螺母，拧紧力矩为 39-47 N·m，复查该气门间隙，间隙数值不应有变化。

气门间隙：进气门间隙为 0.25 ± 0.08 mm；排气门间隙为 0.50 ± 0.08 mm

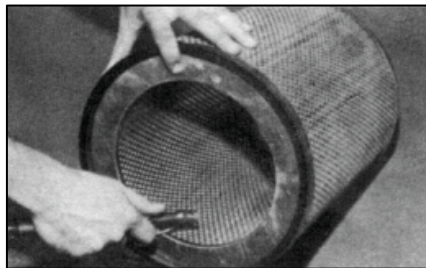
（6）在减振器或风扇过渡盘上做上标志，然后旋转曲轴一周（ 360° ），以同样的步骤调整其余的进排气门间隙。

检查气滤清器滤芯

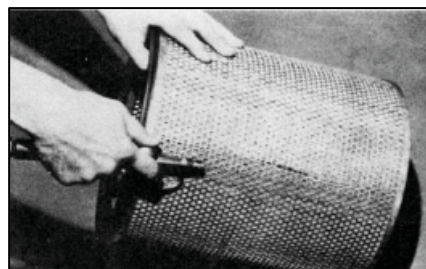
检查空滤器滤芯是否破损。检查前先清洁滤芯。

▲警告：在使用压缩空气时，应做好防护。压缩空气最高压力应不超过 205 kPa。不要用硬物碰撞或敲击的办法来清洁滤芯。清洁后应检查滤芯。不得使用有褶皱、密封垫或密封圈损坏的滤芯。

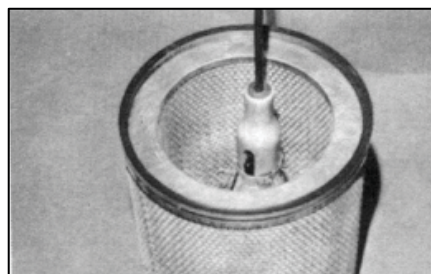
(1) 用压缩空气沿着褶纹长度方向吹洗内部。



(2) 用压缩空气沿着滤芯褶纹长度方向吹洗外部，再沿着滤芯褶纹长度方向吹洗内部。



(3) 在清洁后的滤芯内放置检查灯进行检查。根据透光情况来判断滤芯是否有破洞或撕裂。如有则更换新的滤芯。



检查中冷器

用肉眼检查中冷器进出气室是否有裂缝、穿孔或其他损坏，检查进出气管是否有裂缝、脱焊及其他损坏。如有，应予以更换。

检查胶带张紧轮

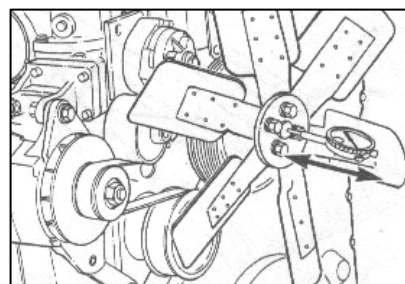
(1) 逆时针旋转张紧轮，拆下传动胶带。转动张紧轮带轮，检查张紧轮是否有卡滞或径向/轴向窜动，以此来确定张紧轮轴承是否表面划伤或磨损；摆动张紧轮张臂，检查其弹簧工作性能是否良好。

(2) 安装传动胶带，然后目测和调整，确保胶带中心处于各胶带轮中央。



检查风扇轴承

逆时针旋转胶带张紧轮，拆下传动胶带。手动转动风扇皮带轮检查转动轴轴承是否有异常。转动风扇时不得有振动和过大的轴向窜动现象。



检查增压器

目视检查增压器涡轮叶片和压缩机叶片是否损坏或有裂纹，手指轻压叶片，叶片是否会与涡轮壳或压气机壳接触，增压器转轴转动是否不灵活自如。如发现上述问题，需要更换增压器。

检查减振器

硅油减振器：检查减振器是否有减振液（硅油）泄漏、减振器表面是否塌陷，检查减振器厚度以确定减振器是否变形。如发生上述问题，需要更换减振器。

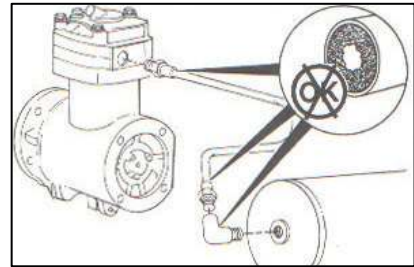
橡胶减振器：检查减振器隔振橡胶圈是否有老化或脱圈，减振器内外圈是否有周向错位。如发生上述问题，需要更换减振器。

检查空气压缩机

▲警告：空气系统内的空气有一定的压力。在拆卸空气压缩机上零部件前，必须先释放空气系统内的压力，以免人员受伤。

检查空气压缩机出气管

检查管路及管接头的积碳情况，视积碳程度的轻重分别采取清洗或更换的措施。

**更换冷却液**

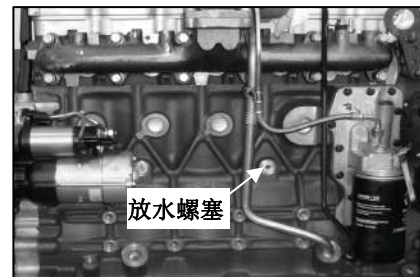
为确保柴油机冷却液的冷却和防蚀效果，必须每 80 000 公里或、每 2000 小时、或每 2 年（先到为准）更换冷却液。更换冷却液时须清洗冷却系统。

▲警告：在工作温度下，柴油机冷却液温度较高且有压力。蒸汽能引起人身伤害。只有在柴油机停止工作后，待冷却液温度降至 50℃ 以下，才可慢慢拧开散热器上压力盖释放压力。

▲警告：冷却液内防锈剂含碱，应避免皮肤和眼睛与其接触，以防人身伤害。

(1) 待柴油机停车冷却液温度下降至 50℃ 以下，慢慢旋松散热器上压力盖以释放压力，然后卸下压力盖。旋开散热器的放水阀，放尽散热器中的冷却液。

(2) 拆下柴油机上的放水螺塞，报废 O 形密封圈，放尽冷却系统中所有冷却液。



(3) 按下列步骤清洗冷却系统。

(a) 装上并拧紧所有放水阀和放水螺塞，从散热器加水口处将碳酸钠水溶液（或在市场上能买到的碳酸钠与水的混合物）加入冷却系统。

△注意：每 23 L 水用 0.5 kg 碳酸钠混合。不得用含腐蚀剂的清洗剂，否则会损坏铝制零件。

△注意：在灌注清洗液过程中必须将冷却水腔中空气排出，且慢慢注入，以防止产生气阻，清洗液需加至散热器加水口底面，等待 3-5 分钟，让空气充分排出。

(b) 起动柴油机，等清洗液温度升到 80℃ 以上后运转 5 分钟，然后停车并放尽冷却系统中的清洗液。

△注意：在冷却系统清洗整个过程中，不安装散热器加水压力盖，并在不加水盖的情况下运行柴油机。

(c) 将清水注入冷却系统。

△注意：灌注清水时，须慢慢注入，以防止产生气阻，清水需加至散热器加水口底面，等待 3-5 分钟，让空气充分排出。

(d) 起动柴油机，等水温升到 80℃ 以上后运转 5 分钟，然后停车并放尽冷却系统中的清水。

△注意：若排出水仍是脏的，必须按上述步骤再次清洗冷却系统，直到流出的水是干净的为止。

(4) 清洗完毕后，拧紧散热器上的放水阀。柴油机放水螺塞上安装新的 O 形密封圈，拧紧放水螺塞，拧紧力矩为 45 N·m。

(5) 加注冷却液，冷却液总量见下表：

本柴油机冷却液容量	
6.8 L (SC4H)	9.6 L (SC7H)

△注意：表中容积值仅指本柴油机系统容积。实际添加量以整车数据或设备数据为准。

△注意：加注冷却液时，须慢慢注入，以防止产生气阻，冷却液需加至散热器加水口底面或符合车辆或设备制造商的要求，等待 3-5 分钟，让空气充分排出。

(6) 安装压力盖，起动柴油机，直至水温到达 80℃，然后停车检查冷却系统是否泄漏。

(7) 停车后待冷却液温度降至 50℃ 以下，打开散热器加水口压力盖，复查冷却液液面，如有必要，再补注适量冷却液。

5 柴油机故障排除指南

5.1 故障排除指南

下表列出了柴油机使用中一些简单典型的失效故障模式、可能原因及故障排除步骤。柴油机在运行中若出现其中任何一个征兆，用户都应采取适当方法予以排除，否则有可能酿成柴油机的大事故。用户可按照可能原因的排列顺序（即查找步骤）查找原因，自行排除简单的故障，复杂故障需要联系上柴“易+人”呼叫中心（400-820-5656），以获得技术指导或专业的维修服务。

序号	故障模式	序号	故障模式
1	发电机不充电或充电不足	16	柴油机敲缸
2	起动系统故障	17	柴油机噪声过大
3	柴油机不能起动或起动困难	18	柴油机冒黑烟
4	柴油机能起动，但不能保持运转	19	柴油机冒白烟
5	柴油机在低转速下易熄火	20	柴油机冒蓝烟
6	柴油机发火不良或转速不稳定	21	燃油消耗量过高
7	柴油机功率不足	22	冷却液温度高于正常情况—柴油机逐步过热
8	负荷情况下不能达到额定转速	23	冷却液温度高于正常情况—柴油机突然过热
9	柴油机工作粗暴或缺火	24	冷却液温度低于正常情况
10	柴油机意外停机或减速时熄火	25	冷却液污染
11	柴油机加速性能差	26	机油压力过高
12	柴油机无法停机	27	机油压力过低
13	柴油机怠速时运行粗暴	28	机油污染
14	柴油机怠速不稳、游车	29	机油消耗量过高
15	柴油机振动过大		

故障模式 1：发电机不充电或充电不足

可能原因	排除方法
仪表或指示灯失效	检查/更换仪表或指示灯
蓄电池的接头松动或腐蚀	清洗/拧紧电池接头
传动胶带打滑或张紧轮失效	检查胶带张紧轮工作是否正常
交流发电机或发电机电压调节器上的接头接触不良	拧紧交流发电机或电压调节器上的全部接头
联系上柴“易+人”呼叫中心	

故障模式 2：起动系统故障

可能原因	排除方法
起动电路接头松动或锈蚀，蓄电池接线或接头松动、断开或腐蚀	检查清洁接线和接头，并紧固接头
蓄电池电力不足	用电力充足的蓄电池或增加蓄电池并联使用
起动电机故障	检查起动系统线路，必要时联系上柴“易+人”呼叫中心
联系上柴“易+人”呼叫中心	

故障模式 3：柴油机不能起动或起动困难

可能原因	排除方法
起动方法错误	参看车辆或设备使用说明书
起动时间约2-3秒	属于正常情况，不用调整
驱动装置合上	脱开驱动装置
起动速度太低（最低起动速度 100 转/分）	检查蓄电池电压，检查起动电机接头是否松动或腐蚀
燃油箱内燃油不足	添加燃油
燃油系统中有空气	检查泄漏源，必要时拧紧燃油接头、油管夹箍，或更换燃油接头、油管，然后给燃油系统泵油排气
燃油低压管路接头松动	检查燃油低压管路，拧紧所有低压管路接头
燃油滤清器或燃油吸油管堵塞	更换燃油滤清器或燃油吸油管
天冷燃油结蜡	根据使用环境，选择本手册规定的适合燃油
燃油泵中没有燃油	检查输油泵，必要时，联系上柴“易+人”呼叫中心
进气系统阻力超过规定值	检查进气系统，必要时更换空滤器滤芯
排气系统阻力不符合要求	检查排气系统
曲轴旋转受阻	柴油机盘车，检查曲轴受阻情况，必要时联系上柴“易+人”呼叫中心
喷油泵静态供油提前角不正确	按5.2节给出的步骤检查并调整静态供油提前角
进排气门间隙调整错误	调整进排气门间隙
联系上柴“易+人”呼叫中心	

故障模式 4：柴油机能起动，但不能保持运转

可能原因	排除方法
柴油机与被驱动未脱开	将柴油机与被驱动脱开
天冷燃油结蜡	根据使用环境，选择本手册规定的适合燃油
燃油系统中有空气	检查泄漏源，必要时拧紧燃油接头、油管夹箍，或更换燃油接头、油管，然后给燃油系统泵油排气
燃油滤清器或燃油吸油管路堵塞	更换燃油滤清器或燃油吸油管路
进气系统阻力超过规定值	检查进气系统，必要时更换空滤器滤芯
排气系统阻力不符合要求	检查排气系统，必要时联系上柴“易+人”呼叫中心
燃油油品差	使用本手册规定的燃油，用临时油箱盛放品质好的燃油开车验证
联系上柴“易+人”呼叫中心	

故障模式 5：柴油机在低转速下易熄火

可能的原因	排除方法
油箱中柴油偏少	添加加油
低压油路中有空气	检查燃油箱燃油液面、检查燃油箱与燃油输油泵的之间的连接是否有泄漏、油管是否变形、弯曲，排除泄漏源，然后给燃油系统泵油排气
联系上柴“易+人”呼叫中心	

故障模式 6：柴油机发火不良或转速不稳定

可能的原因	排除方法
燃油箱中燃油偏少	添加燃油
燃油系统内进入空气	检查泄漏源，必要时拧紧燃油接头、油管夹箍，或更换燃油接头、油管，然后给燃油系统泵油排气
燃油压力低	检查油箱内是否有油，检查油箱至输油泵之间油管有无漏油、严重变型、弯曲或有脏污引起阻塞，管内是否有气泡。必要时，联系上柴“易+人”呼叫中心
高压油管接头处漏油	拧紧接头，如果接头螺纹已损坏，应更换相关零件
喷油泵供油提前角不正确	按 5.2 节给出的步骤检查并调整喷油泵供油提前角
气门间隙不正确	检查并调整气门间隙
联系上柴“易+人”呼叫中心	

故障模式 7：柴油机功率不足

可能的原因	排除方法
询问驾驶员	获得所有与问题相关的信息
超载运行	减少载荷至许用范围
车辆或柴油机在超过规定的高原上行驶或运行	在规定的高原上行驶或运行，随着海拔升高，功率会相应变小
柴油机驱动系统若已更换，与柴油机不匹配	检查驱动系统齿轮传动与柴油机是否匹配
机油油位超过规定值	检查并调整至规定的油位范围内
油门踏板或油门操作杆没有到底	检查油门踏板或油门操作杆运动是否受阻
驱动附件负荷过大	检查柴油机冷却风扇运行情况，车辆制动是否有摩擦
燃油系统中有空气	检查泄漏源，必要时拧紧燃油接头、油管夹箍，或更换燃油接头、油管，然后给燃油系统泵油排气
燃油进油温度高	向燃油箱中添加燃油，必要时联系上柴“易+人”呼叫中心
燃油供应受阻	检查进油阻力，如必要，更换燃油粗滤器和燃油精滤器
排气支管或增压器排气泄漏	检查排气管和增压压力，排除泄漏源
排气系统阻力不符合规定	检查排气系统阻力，必要时联系上柴“易+人”呼叫中心
进气系统阻力超过规定值	检查进气系统阻力，必要时更换空滤器滤芯
进气系统泄漏	检查进气管、中冷器及其管路连接是否松动、泄漏
增压器故障	检查增压器，必要时联系上柴“易+人”呼叫中心
燃油规格不符合使用要求或油品差	使用本手册规定的燃油，用临时油箱盛放品质好的燃油开车验证
进气门或排气门调整错误	检查调整气门间隙
联系上柴“易+人”呼叫中心	

故障模式 8：负荷情况下不能达到额定转速

可能的原因	排除方法
负荷过大	降低车辆或设备负荷，或换成低档
车辆驱动系统更改，导致其与柴油机不匹配	检查驱动系统与柴油机匹配情况
转速表故障或转速传感器故障	检查转速表和转速传感器，必要时更换
燃油进油阻力大	检查燃油滤清器及燃油吸油管路，必要时更换滤清器
增压器故障	检查增压器，必要时联系上柴“易+人”呼叫中心
进气系统泄漏	检查进气管、中冷器及其管路连接是否松动、泄漏
进气系统阻力超过规定值	检查进气系统阻力，必要时更换空滤器滤芯
燃油规格不符使用要求或油品差	使用本手册规定的燃油，用临时油箱盛放品质好的燃油开车验证
联系上柴“易+人”呼叫中心	

故障模式 9：柴油机工作粗暴或缺火

可能的原因	排除方法
仅发生在怠速时	参见故障诊断“冷却液温度低于正常情况”
柴油机运行温度低	参见故障诊断“冷却液温度低于正常情况”
气门调整错误	调整气门间隙
联系上柴“易+人”呼叫中心	

故障模式 10：柴油机意外停机或减速时熄火

可能的原因	排除方法
车辆或设备的保护系统原因	与车辆或设备制造厂商联系
燃油系统有空气进入	检查泄漏源，必要时拧紧燃油接头、油管夹箍，或更换燃油接头、油管，然后给燃油系统泵油排气
燃油污染	更换清洁合格的燃油
联系上柴“易+人”呼叫中心	

故障模式 11：柴油机加速性能差

可能的原因	排除方法
询问驾驶员或操作员	获得所有关于问题的细节
车辆驱动系统更改，导致其与柴油机不匹配	检查驱动系统与柴油机匹配情况
附件负荷过大	检查冷却风扇、空调以及车辆制动系统阻力是否过大，降低驱动附件负荷
油门踏板或油门操作杆运动受阻	检查油门踏板或油门操作杆受阻情况
进气系统漏气	检查进气管、中冷器及其管路是否漏气
进气或排气系统受阻	检查进、排气系统阻力，必要时联系上柴“易+人”呼叫中心
喷油泵供油提前角不正确	按5.2节给出的步骤检查并调整喷油泵供油提前角
气门调整错误	调整气门间隙
联系上柴“易+人”呼叫中心	

故障模式 12: 柴油机无法停机

可能的原因	排除方法
柴油机吸入油雾	检查柴油机进气管, 隔离油雾源
外部供电电压	检查并确认没有外部电压电路连接到车辆或设备的电源电路上
增压器机油密封不良, 漏油	检查压气机出气口、空气接管是否有机油痕迹
联系上柴“易+人”呼叫中心	

故障模式 13: 柴油机怠速时工作粗暴

可能的原因	排除方法
柴油机温度过低	让柴油机升温
怠速负荷过大 (大于50马力)	降低怠速负荷
中冷器或中冷器管路有泄漏	检查中冷器及管路
进气管漏气	检查进气管
柴油机支撑问题	检查柴油机支架和缓冲垫
发电机故障	临时断开发电机, 测试柴油机
气门间隙不对	调整气门间隙
联系上柴“易+人”呼叫中心	

故障模式 14: 柴油机怠速不稳、游车

可能的原因	排除方法
燃油系统中有空气	检查低压管路, 排除泄漏源, 必要时拧紧或更换接头和低压油管, 然后给燃油系统泵油排气
联系上柴“易+人”呼叫中心	

故障模式 15: 柴油机振动过大

可能的原因	排除方法
柴油机运转不稳定	参见“柴油机工作粗暴或失火”
传动胶带轮或减振器的固定螺栓或螺帽松动	拧紧螺栓或螺帽
风扇转动不平衡	放松或卸下风扇胶带, 并使柴油机以当时出现振动时的转速短时运转。如果这样就不振动, 说明需要更换风扇和风扇传动轴承
风扇损坏或附件故障	检查/更换故障零件
减振器损坏	检查/更换减振器
柴油机支撑问题	检查柴油机支架和缓冲垫, 必要时更换相关零件
联系上柴“易+人”呼叫中心	

故障模式 16: 柴油机敲缸

可能的原因	排除方法
空气进入燃油系统	燃油系统排气和检查燃油吸油管是否泄漏
燃油质量差	使用本手册规定的燃油, 用临时油箱盛放品质好的燃油开车验证
喷油泵供油提前角不正确	按5.2节给出的步骤检查并调整喷油泵供油提前角
联系上柴“易+人”呼叫中心	

故障模式 17: 柴油机噪声过大

可能的原因	排除方法
传动胶带张力不足或负荷过大	检查张紧轮工作情况,必要时更换;检查各带轮是否转动自如
进气和排气泄漏	检查进排系统泄漏情况,拧紧已松动的零部件,必要时更换相关零部件
增压器噪声	检查叶轮和涡轮是否与壳体相碰
喷油泵供油提前角不正确	按5.2节给出的步骤检查并调整喷油泵供油提前角
气门间隙太大	检查并调整气门间隙
联系上柴“易+人”呼叫中心	

故障模式 18: 柴油机冒黑烟

可能的原因	排除方法
柴油机过载	使用低速排挡或减低设备负荷
进气系统阻力超过规定	检查进气系统阻力,必要时更换空滤器滤芯
喷油泵供油提前角不正确	按5.2节给出的步骤检查并调整喷油泵供油提前角
进气门或排气门间隙错误	调整气门间隙
燃油不符合使用要求或油品差	使用本手册规定的燃油,用临时油箱盛放品质好的燃油开车验证
联系上柴“易+人”呼叫中心	

故障模式 19: 柴油机冒白烟

可能的原因	排除方法
柴油机处于冷态	让柴油机暖车
燃油系统中有水	检查油水分离器,必要时更换,同时排尽燃油系统中的水分
喷油泵供油提前角不正确	按5.2节给出的步骤检查并调整喷油泵供油提前角
燃油不符合使用要求或油品差	使用本手册规定的燃油,用临时油箱盛放品质好的燃油开车验证
联系上柴“易+人”呼叫中心	

故障模式 20: 柴油机冒蓝烟

可能的原因	排除方法
长期低负荷(标定功率的40%以下)运转,活塞与缸套之间间隙较大,使机油易窜入燃烧室	适当提高负荷;配套时选用功率要适当
油底壳内机油加入过多	按机油标尺刻线加注机油
涡轮增压器油封损坏,机油进入进气支管	检查进气支管有无机油,必要修时检查或更换涡轮增压器
联系上柴“易+人”呼叫中心	

故障模式 21：燃油消耗量过高

可能的原因	排除方法
驾驶员操作技术	检查驾驶员换挡、减速和怠速操作
里程表显示错误	调整里程表
驱动系统与柴油机匹配不正确	检查车辆齿轮，确认柴油机及驱动系统零件无误
燃油泄漏	检查燃油系统的管路密封性，如有松动则拧紧
进气或排气阻力过大	检查进排气系统，特别是空滤器、排气消声器，必要时联系上柴“易+人”呼叫中心
机油油位过高	检查机油油面，调整机油油量
喷油泵供油提前角不正确	按5.2节给出的步骤检查并调整喷油泵供油提前角
进气或排气门密封不良	检查并调整气门间隙
燃油品质差	使用本手册规定的燃油，用临时油箱盛放品质好的燃油开车验证
联系上柴“易+人”呼叫中心	

故障模式 22：冷却液温度高于正常情况—柴油机逐步过热

可能的原因	排除方法
柴油机过载运行	减少负载运行
冷却液液位过低	检查冷却液液面和泄漏情况，排除泄漏，添加冷却液至规定范围
机油油面过高或过低	检查机油油面，调整至规定范围
散热器叶片堵塞或损坏	检查散热器叶片，必要时修理或更换
冷却液管路软管瘪塌、泄漏	检查软管，必要时更换软管
传动胶带松弛	检查胶带，必要时更换
散热器压力盖故障，压力标定低	检查压力盖功能，必要时联系上柴“易+人”呼叫中心
温度表故障或温度传感器故障	检查温度表和传感器，必要时更换
空气进入冷却系统	检查水泵吸入端接头泄漏情况
联系上柴“易+人”呼叫中心	

故障模式 23：冷却液温度高于正常情况—柴油机突然过热

可能的原因	排除方法
冷却液液位过低	检查冷却液泄漏情况，排除泄漏源，然后添加冷却液至规定范围
冷却系统软管瘪塌、泄漏	拧紧已松动夹箍，必要时更换软管
传动驱动胶带断裂	检查胶带，必要时更换
冷却液温度表故障	检查温度表，必要时更换
联系上柴“易+人”呼叫中心	

故障模式 24: 冷却液温度低于正常情况

可能的原因	排除方法
散热器百叶窗卡死在最大开度	检查百叶窗，必要时更换
流过散热器的冷风过多	目视检查风扇和风扇离合器（如配置）运行情况，必要时联系联系上柴“易+人”呼叫中心
柴油机在低温环境下工作	采取提高进气温度措施
冷却液温度表故障或温度传感器故障	检查温度表和传感器，必要时更换
联系上柴“易+人”呼叫中心	

故障模式 25: 冷却液污染

可能的原因	排除方法
冷却介质选用不当	选用本手册规定的冷却液
冷却液更换周期太长	按更换周期要求更换冷却液
联系上柴“易+人”呼叫中心	

故障模式 26: 机油压力过高

可能的原因	排除方法
柴油机运转温度过低，机油黏度大	参见故障诊断“冷却液温度低于正常情况”
机油压力表故障或压力传感器故障	检查压力表和传感器，必要时更换
润滑油规格不符合要求	更换成本手册规定的润滑油，并更换机油滤清器
联系上柴“易+人”呼叫中心	

故障模式 27: 机油压力过低

可能的原因	排除方法
机油油面过低	检查机油油面，调整至规定范围
机油管路泄漏	检查机油管路，排除泄漏源
机油温度高于规定值	参见故障诊断“冷却液温度高于正常情况”
机油压力表故障或压力传感器故障	检查压力表和传感器，必要时更换
机油中有水	检查加油盖或油尺是否丢失，更换机油和机油滤清器
机油滤清器阻塞	更换机油和机油滤清器
机油规格不符合要求，粘度过低	检查机油规格，必要时更换机油和机油滤清器
机油中有液压油	检查液压油泄漏，更换机油和机油滤清器
联系上柴“易+人”呼叫中心	

故障模式 28: 机油污染

可能的原因	排除方法
柴油机运转过冷，使柴油机在正常温度以下运行，导致柴油冷凝进入油底壳	检查柴油机的怠速运行时间是否过久，缩短怠速运行时间
联系上柴“易+人”呼叫中心	

故障模式 29：机油消耗量过高

可能的原因	排除方法
怠速时间过长	缩短怠速时间
机油油面过高	检查机油油面，必要时调整
柴油机外部漏油	检查柴油机外部的管路、密封垫片、油封等是否有泄漏，更换损坏的零部件
增压器机油泄漏到进气或排气系统	检查压气机出气口、空气接管是否有机油痕迹
曲轴箱内压力将机油压到油气分离器	检查油气分离器周围是否有机油痕迹，必要时联系上柴“易+人”呼叫中心
空气压缩机泵油	检查空气压缩机出气口是否有机油痕迹，必要时更换空气压缩机
油品规格不符合要求	检查机油规格。采用正确规格的机油，并更换机油和机油滤清器
联系上柴“易+人”呼叫中心	

5.2 喷油泵静态供油提前角检查和调整

要排除与喷油泵静态供油提前角有关的故障，需要按下面步骤检查和调整静态供油提前角。

在检查和调整喷油泵静态供油提前角时，规定曲轴转向以面对飞轮端逆时针方向为柴油机工作转向，以确保消除齿轮系统的齿侧间隙。

检查和调整喷油泵供油提前角前需确定第 1 缸活塞压缩上止点。

确定第 1 缸活塞压缩上止点（方法 1）

（1）拆下飞轮壳观察监视窗盖板。

（2）逆时针转动曲轴，使飞轮壳上的指针对准飞轮上 0 刻线。

（3）拆下气缸盖罩壳上的加油盖。

（4）加油口在第 1 缸时，从加油口摇摆第 1 缸的摇臂，摇臂能摆动，则第 1 缸活塞处于压缩上止点；如不能，则逆时针转动曲轴一周（ 360° ），使第 1 缸活塞处于活塞上止点；加油口在第 4 缸（SC4H）或第 6 缸（SC7H）时，从加油口摇摆第 4 缸（SC4H）或第 6 缸（SC7H）的摇臂，摇臂能摆动，则第 4 缸或第 6 缸活塞处于压缩上止点，再将曲轴逆时针转动一周（ 360° ），使第 1 缸活塞处于压缩上止点。

注：此方法用于实际喷油泵静态供油提前角与规格值相差较大情况。

（5）安装加油口盖，手感拧紧即可。

确定第 1 缸活塞压缩上止点（方法 2）即确定理论静态供油提前角

（1）拆下飞轮壳观察监视窗盖板。

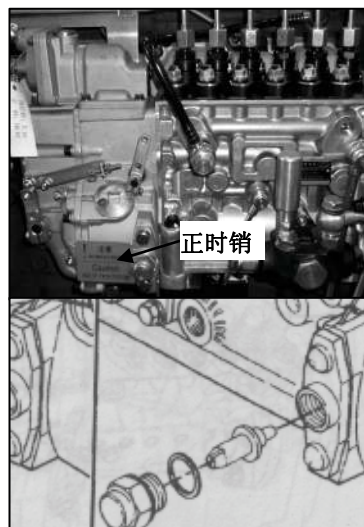
（2）逆时针转动曲轴，使飞轮壳上的指针对准飞轮上 0 刻线。

（3）从喷油泵调速器壳体上拆下定时销安装螺塞，取出定时销，反向将定时销插入凸轮轴定时齿或定时槽。如不能插入，稍稍来回盘动曲轴，边盘边插；如还是不能插入，须再逆时针转动 360° CA，插入定时销。定时销插入说明喷油泵处于理论静态供油提前角，而第 1 缸活塞处于压缩上止点。

注：此方法用于实际喷油泵静态供油提前角与规定值相差较小情况。

（4）拔出定时销，掉头装入定时销孔内，并安装定时销螺塞和垫片，拧紧力矩为 $15\text{ N}\cdot\text{m}$ 。

△注意：在进行喷油泵供油提前角检查和调整前必须将定时销拔出，以免损坏定时销。



静态供油提前角

（1）顺时针转动曲轴 40° CA，使曲轴处于上止点前 40° CA。

（2）松开喷油泵端的第 1 缸的高压油管螺母，并移开高压油管。

（3）将调速器手柄置于高怠速位置，用手揪泵向燃油系统供油。

（4）逆时针慢慢转动至喷油泵第 1 缸出油阀接头内燃油刚刚出现轻微波动的瞬时为止，检查飞轮壳上指针所对应的刻线角度，该角度就是当前实际喷油泵静态供油提前角。如该角度与规定的静态供油提前角（见柴油机铭牌）不符合，则需要进行调整。

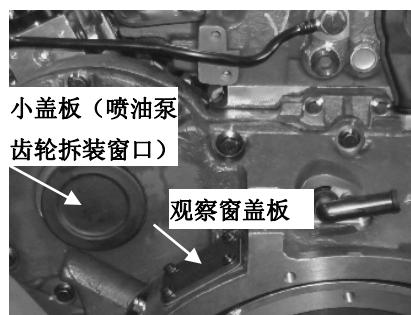
调整静态供油提前角

(1) 拆下飞轮壳上小盖板（喷油泵齿轮拆装窗口），报废 O 形密封圈。

(2) 拆下喷油泵齿轮紧固螺母。

△注意：拆除时要小心，紧固螺母和弹簧垫圈不可掉入齿轮室内。

(3) 用齿轮拆卸工具（拉模）将齿轮脱离喷油泵凸轮轴。



(4) 根据检查结果逆时针或顺时针转动曲轴，使检视窗上的指针对准飞轮上规定的供油提前角刻线。

(5) 安装齿轮，使喷油泵齿轮与凸轮轴齿轮啮合。

(6) 安装喷油泵齿轮紧固螺母和垫圈并拧紧，拧紧力矩 172-188 N·m (M20)，112-128 N·m (M18)。

(7) 复查喷油泵静态供油提前角。如不符合，再重新调整，直至正确为止。

(8) 拧紧高压油管螺母，拧紧力矩 32-38 N·m。

(9) 安装喷油泵齿轮拆装盖板，采用新的 O 形密封圈。

(10) 安装观察监视窗盖板。

(11) 将调速器手柄置于正常位置。

6 柴油机停运后保存

柴油机如需停用一段时间（最长至 6 个月），需要做好清洁工作和必要的油封措施，防止生锈。

△注意：附件驱动带轮表面需采取一定防锈措施。

Caution

Be sure to read this instruction manual carefully and strictly observe the safety and operation instructions herein, especially the warnings and cautions, so as to reduce the possibilities of personnel injury, property loss, engine performance deterioration, premature wear or damage.

Warnings in this manual must be observed strictly. Failure to observe them can cause burns, amputation, mutilation, asphyxiation and other personal injury or death. Cautions are provided for the user to operate the engine in a proper way, so as to avoid damage to engine parts and engine performance deterioration. Warnings and cautions in this manual are not complete since Shanghai Diesel Engine Co., Ltd. (SDEC) has no possibility and is not able to foresee all potential risks resulted from failure to follow the safety cautions and operation instructions.

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Repair, Technical Consultation, Complaint and Suggestion

For engine repair, technical consultation, complaints or suggestions, please contact SDEC's after-sale service center: spare@sdecie.com.

Please provide the following information for product repair:

The model of diesel engine

The order number of diesel engine

The serial number of diesel engine

The date of equipment procurement

The detailed description of fault

The address and phone number of contact person

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1 Introduction

1.1 To User and Operator

Thank you for purchasing a diesel product of Shanghai Diesel Engine Co., Ltd!

The H series diesel engine, available in two displacements of 4L and 7L, is a medium-power four-valve diesel engine with four or six cylinders that is newly developed by SDEC. Featuring strong power and low fuel consumption and with the emissions conforming to relevant national regulations, The H series diesel engine is a perfect power for middle- and high-end vehicles and industrial equipment.

This manual mainly covers the technical specifications, operation and maintenance instruction, with an aim to familiarize you with the engine, as well as the proper operation and maintenance thereof. Before using the engine, read carefully the relevant contents and requirements in this manual. Due to the continuous improvement of performance and structure of the engine, the technical specifications and illustrations in this manual may be slightly different from the engine you have, please note that we will provide the supplement and perfection in the later editions without notice. In case of any question during your engine operation and maintenance, please never hesitate to contact SDEC's after-sale service center spare@sdecie.com for technical advice or guidance.

SDEC adopted the latest technology and high-quality parts for the engine. The genuine SDEC service parts are recommended to be used for repair and maintenance. Please contact SDEC's after-sale service center spare@sdecie.com for service parts.

1.2 Notices for Engine Quality Feedback

To better our service, please fill in your engine quality feedback items as follows, whereby, we can understand and analyze quality issue(s) and the root cause(s) thereof, and make the improvement in time:

- 1) When and where fault occurred;
- 2) Engine serial number, model, order number, delivery date and the detailed address of consignee;
- 3) Service conditions, cumulative operation time (in hours or kilometers), operating conditions (power, speed) and the grade of fuel and engine oil that were used;
- 4) The characteristics of the driven equipment (model, power consumption and structural feature, etc.)
- 5) The description of faults;
- 6) Parts or components claimed for compensation or repair should be mailed or sent in person to SDEC headquarter with the damage process record or description for facilitating analysis. If there are several problems or a very serious problem, please leave the site as it was and inform us promptly, and then SDEC will send staff for joint analysis.

Quality issues should be settled based on the relevant provisions in the quality warranty manual.

1.3 Safety Instructions

- Do not wear a loose garment or any jewelry when working around the engine or its driven equipment. If necessary, wear the safety goggles, work clothes, safety helmet or other protective items.
- All the exposed rotating parts should be provided with guards with firm installation to prevent personal injury.
- The workroom of the engine should be well ventilated with waste gas exhausted outside.
- No flammable liquid is allowed to be around the engine.
- Take all tools, wires, other odds and ends away from the engine prior to starting.
- Make sure to shutdown the engine before any adjustment is performed to it and its driven equipment.
- Smoking is not allowed during fuel filling, otherwise, fuel steam can cause fire easily.
- Smoking is also not allowed when checking electrolyte level because electrolyte will release flammable gas.
- Contact between electrolyte and skin or eyes must be prevented when replenishing electrolyte for the battery, since it is an acid. In case of skin contact, please flush the contacted part with soap and clean water; in case of eyes contact, flush

your eye(s) for 15 minutes with clean water and seek for medical treatment immediately.

- Cool the engine first to avoid being hurt by the steam when filling coolant. Open the pressure cap only when the coolant is lower than 50°C, and then slowly loosen the cap to release the pressure of coolant.
- Wipe up lubricating oil, fuel, Coolant or other liquids overflowed. Put oily rags into a fire-protection container, but not leave it on the engine.
- Before starting a repaired engine, make sure to be ready to cut ECU power supply. In case of any abnormal, switch off the power supply immediately.
- Do not rotate the engine with the fan, otherwise severe personal injury or damage to fan blades can be caused.
- Do not touch the parts of the exhaust system such as the exhaust manifold for its high temperature.
- Release the pressure in the air system, lubricating system, cooling system or fuel system prior to dismantling or loosening any pipelines, permanent joints, connectors or relevant parts. Do not use your hand to check for leakage, otherwise the high pressure and high temperature fuel or lubricating oil can cause personal injury.
- If the engine will not be used for a long time or is under repair, separate it from the battery to prevent an unexpected start-up.
- Used engine oil may contain carcinogenic substance which can result in reproductive toxicity, therefore, inhalation of or longtime exposure to oil steam should be avoided. Waste oil should be disposed in proper, safe and reliable manner.
- To prevent choke or cold injury, removal of air-conditioning refrigerant (Freon) pipeline should be conducted in well ventilated environment with protective clothing worn. For environment protection, the refrigerating system should be emptied or filled using dedicated equipment so as to prevent diffusion of Freon into atmosphere. Refrigerant should be recovered and recycled.

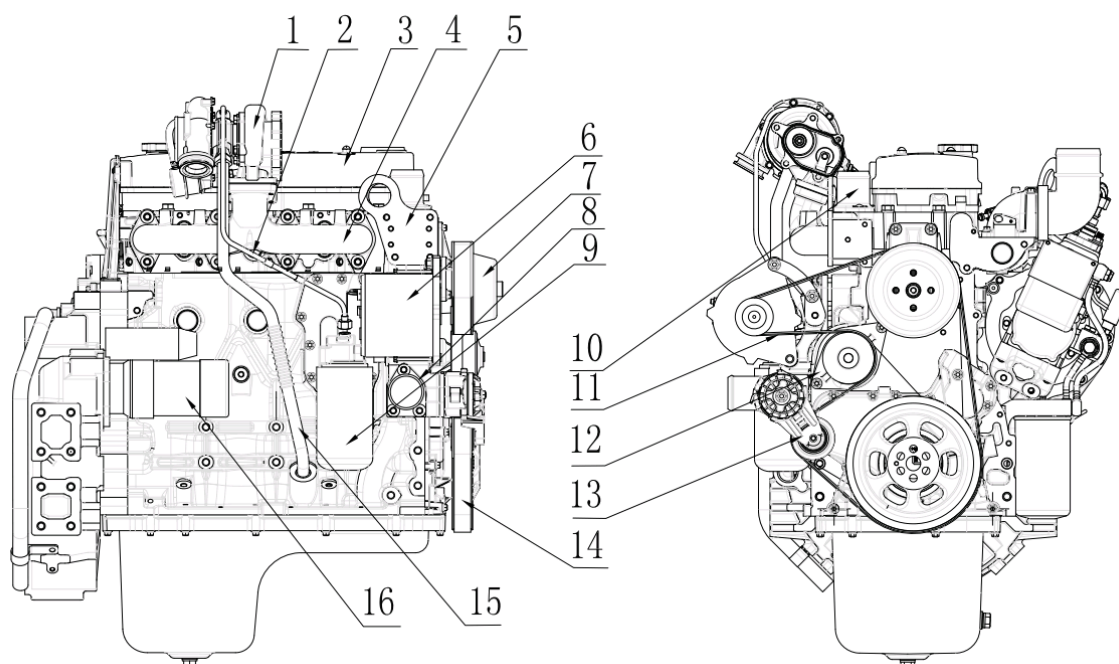
1.4 Engine Operation Instructions

- Read this manual carefully, and be in strict accordance with operation instructions and maintenance procedure specified in this manual.
- Conduct daily and 4-level maintenance as specified in this manual, and keep the records of scheduled maintenance.
- Use the proper fuel, lubricating oil and coolant specified in this manual.
- 60 hours' running-in must be conducted for a new or overhauled engine. Please refer to Section 3.7 for the running-in requirements.
- Do not run the engine without air filter, otherwise, early engine wear will be caused.
- The cooling system of the engine should adopt a specified coolant at any kind of climate.
- When filling engine oil, it is not allowed to use the mixture of different-graded oil.
- Preparations should be well done before starting the engine. Be sure to remember that the engine must be started without any load.
- Check if coolant, engine oil and fuel are enough before starting the engine. It is not allowed to start the engine with lack of diesel fuel in the fuel tank. The fuel tank should be replenished; or it will cause damage to the high pressure fuel pump.
- Observe the engine operation and all the instrument readings. In case of critical situation, an emergency stop should be performed to prevent the seizure of moving parts caused by low engine oil pressure or overheating due to lack of coolant.
- The belt tension and the other drive devices can only be inspected when the engine is in stop.
- Malfunction thermostat should be replaced in time but the use of thermostat cannot be omitted.
- Never remove the lead seal on the fuel injection pump to make adjustment without permission, or it will cause engine damage or insufficient engine power output.

2 About the Engine

2.1 Engine Outline Diagrams

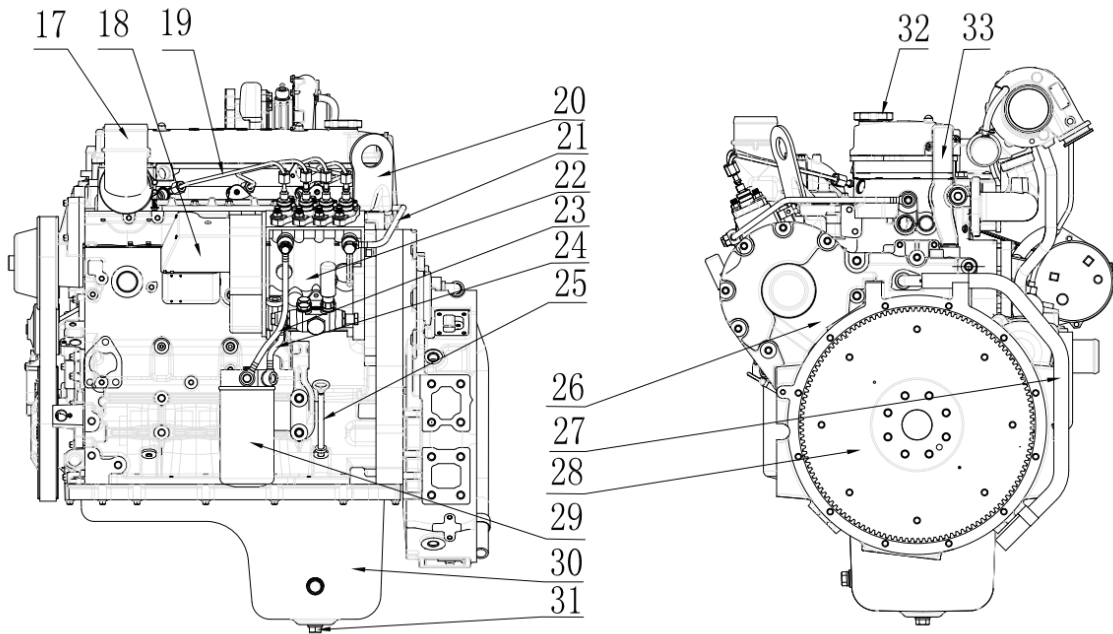
2.1.1 SC4H diesel engine (4L)



Exhaust Side View

Front End View

1 Turbocharger	2 Turbocharger oil inlet pipe	3 Valve cover
4 Exhaust manifold	5 Front engine lifting plate	6 Alternator
7 Fan pulley	8 Engine coolant inlet pipe	9 Oil filter
10 Engine coolant outlet pipe	11 Fan Belt	12 Water pump
13 Belt tensioner	14 Crankshaft pulley	15 Turbocharger oil return pipe
16 Starting Motor		

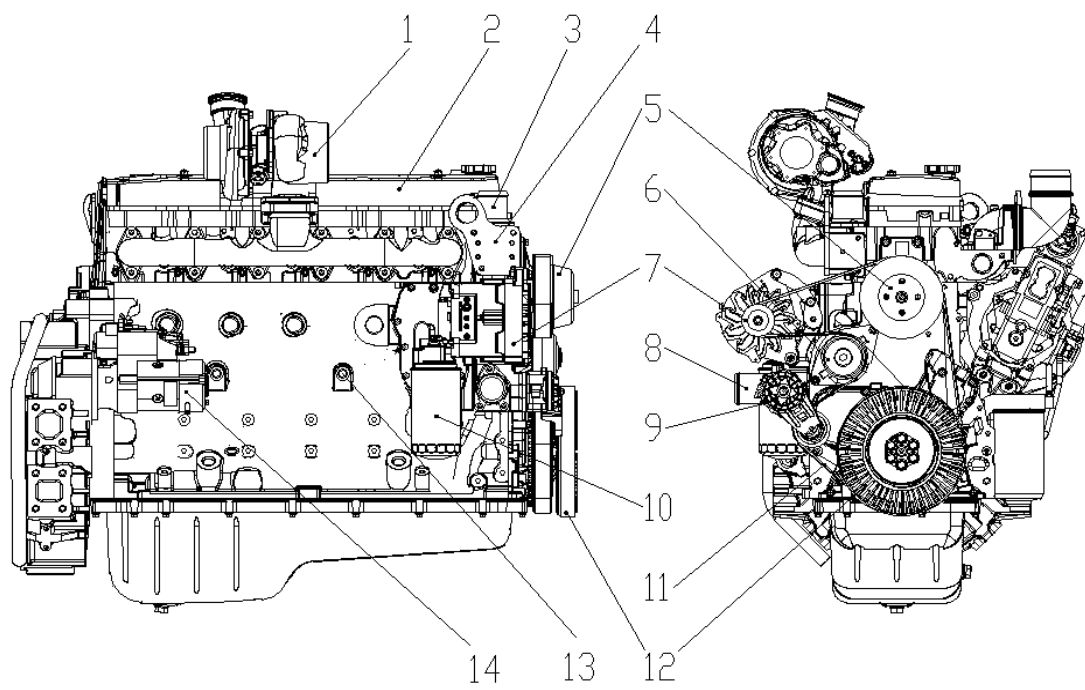


Intake Side View

Rear End View

- | | | |
|--|---|----------------------------|
| 17 Air inlet elbow | 18 Governor (mechanical or electronic) | 19 High-pressure fuel pipe |
| 20 Rear engine lifting plate | 21 Fuel return pipe | 22 Fuel injection pump |
| 23 Fuel injection pump fuel inlet pipe | 24 Fuel filter inlet pipe | 25 Oil dipstick |
| 26 Flywheel housing | 27 Outlet pipe of crankcase ventilation | 28 Flywheel |

2.2.2 SC7H diesel engine (7L)



Exhaust Side View

Front End View

1 Turbocharger

2 Valve cover

3 Engine coolant outlet pipe

4 Front engine lifting plate

5 Fan bearing housing

6 Water pump

7 Alternator

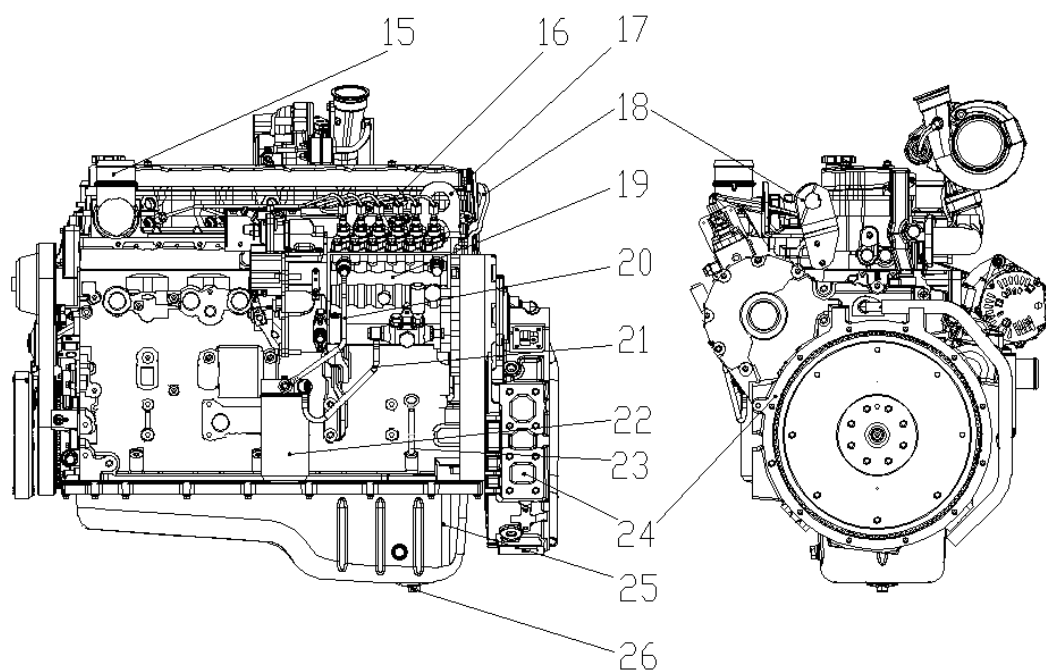
8 Engine coolant inlet pipe

9 Tensioner

10 Oil filter

11 Fan belt

12 Vibration damper



Intake Side View

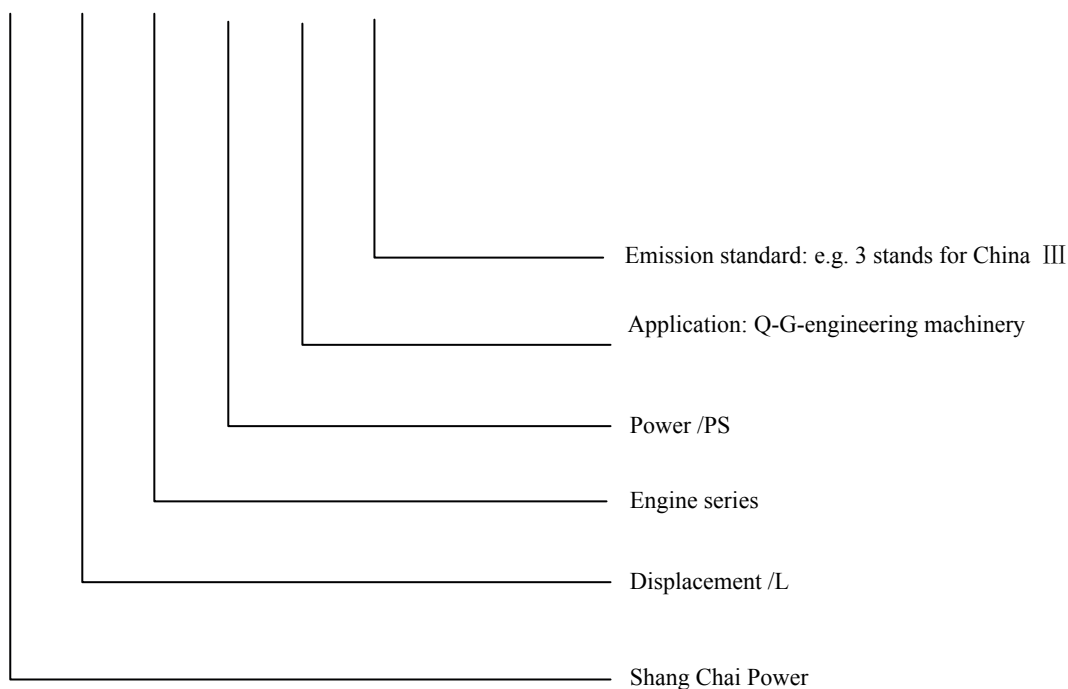
Rear End View

- | | | |
|---|--|-------------------------------|
| 15 Intake pipe | 16 High pressure fuel pipe | 17 Right engine lifting plate |
| 18 Rear engine lifting plate (optional) | 19 Fuel injection pump (mechanical or electronic governor) | |
| 20 Fuel injection pump fuel inlet pipe | 21 Fuel filter inlet pipe | 22 Fuel filter |
| 23 Oil dipstick | 24 Flywheel housing | 25 Oil pan |
| 26 Oil drain plug | | |

2.2 Engine Model Name Identification

The model name represents the meanings as follows:

SC X H □ □ □



For example: SC4H160Q3 stands for Shang Chai Power H series four-valve vehicle diesel engine of 4 liters with power of 120 PS and compliant with China III

SC7H200G2 stands for Shang Chai Power H series four-valve diesel engine of 7 liters with power of 200 PS and compliant with China Stage II for construction equipment

2.3 Diesel Engine Nameplate

The diesel engine nameplate indicates the main technical data and information: model, order no., serial no., date of production, rated power and rated speed, which are the major basis for you to purchase service parts and for SDEC to conduct after-sale technical service. We hope you to put the information and data into the daily record of work of your diesel engine or the matched equipment for later repair and reflection of quality problems, which are helpful to the correct settlement of your problems. The nameplate locates at the top of the cylinder head cover. Protect it from being damaged.

	型号 MODEL	机号 SERIAL NO.		出厂日期 DATE	
	许可证号 LICENCE NO.	额定功率/转速 RATED POWER/SPEED		kW/r/min	
	型式核准号 TYPE-APPROVAL NO.	排放阶段 EMISSION LVL.	净质量 NET WT.	kg	
	执行标准 EXECUTED STANDARD	订货号 ORD. NO.			
柴油发动机 DIESEL ENGINE 中国上海柴油机股份有限公司 SHANGHAI DIESEL ENGINE CO., LTD. CHINA					

For generator set

	型号 MODEL	机号 SERIAL NO.		出厂日期 DATE	
	许可证号 LICENCE NO.	额定功率/转速 RATED POWER/SPEED		kW/r/min	
	最大功率/转速 MAX POWER/SPEED	kW/r/min	排放阶段 EMISSION LVL.	净质量 NET WT.	kg
	执行标准 EXECUTED STANDARD	订货号 ORD. NO.			
柴油发动机 DIESEL ENGINE 中国上海柴油机股份有限公司 SHANGHAI DIESEL ENGINE CO., LTD. CHINA					

Notice: Do not change the nameplate without our permission!

2.4 Specifications and Parameters

2.4.1 Specifications

Diesel engine		SC4H	SC7H
Total piston displacement/L		4.3	6.5
Type		In-line, four-stroke, water-cooled	
Bore/mm		105	
Stroke/mm		124	124
Number of Cylinders		4	6
Number of valves of each cylinder		4	
Firing order (Viewed from the free end)		1-3-4-2	1-5-3-6-2-4
Aspiration		Turbocharged with intercooler	
Fuel system		Mechanical fuel injection pump with mechanical or electronic governor	
Crankshaft rotation (facing flywheel)		Counterclockwise	
Starting mode		Electric	
Net weight/kg *		423	560
Dimensions ** (basic model)	Length/mm	807	1048
	Width/mm	722	722
	Height/mm	968	995

* This net weight does not include the weight of starting motor, alternator, air compressor, power steering pump, clutch, coolant and oil but includes the weight of flywheel and flywheel housing according to DIN 70020.

** Outline dimensions listed above refer only to the basic engine model and those of other models are slightly different.

2.4.2 Parameters

Diesel engine	SC4H	SC7H
Lubricating System		
Oil pressure/kPa		
@ Idle speed (minimum allowable)	70	
@ Rated speed (minimum allowable)	207	
@ Rated speed (maximum allowable)	600	
Oil pan capacity/L		
(Oil dipstick “high-low”)	11.4-9.4	18-15
Total system capacity/L	13.4	20.5
Cooling system		
Coolant capacity/L *	6.8	9.6
Intake-exhaust system		
Max. allowable intake resistance/kPa		
(@ rated condition, with dry-type air filter)	4 (with new element)	
Max. allowable exhaust resistance/kPa **		
(Turbine outlet pressure	10	
@ rated condition)		
Electrical system		
Min. recommended battery capacity/Ah ***	120	150
24V system	24V	
Battery current of at -18℃ for cold starting /CCA	600	750
Starting motor		
Voltage/V	24V	
Power/kW	4.5	6
Alternator		
Voltage/V	28	
Current/A	55, 70 (optional)	
Rated power/kW	1.5, 2 (optional)	

* Coolant capacity only refers to the coolant volume in the engine cooling system.

** The value does not include the resistance of exhaust butterfly valve.

*** The capacity of a battery should be properly increased for a starting with higher requirement.

3 Engine Operation

Proper use of your engine can not only keep it in normal working order and good performance, but also can extend its service life and reduce its use cost. Adopt proper fuel, oil and coolant, as well as the correct operation steps stipulated in this section.

3.1 Fuel

The grade of diesel fuel should be determined based on the ambient temperature. In cold winter, fuel with low-freezing-point should be adopted, while in the contrary in summer. The fuel used should be in accordance with the GB 19147-2009, and the grade of fuel as per recommendations of GB 19147-2009. You may take the recommendations in the table below: e.g. the -35# fuel should be used at the ambient temperature of -27°C.

Relationship between diesel fuel grades and applicable minimum temperatures

Grades of fuel	0#	-10#	-20#	-35#
Cetane value	≥49	≥49	≥46	≥45
Solid point/°C	≤0	≤-5	-20	-35
Minimum applicable temperature (engine working temperature)/°C	Above 4°C	Above -5°C	Above -14°C	Above -29°C

△Caution: Fuel must be kept at the highest level of cleanness and not polluted by dust, impurities or water.

3.2 Engine Oil

SDEC-designated special lubricating oil of grade CF-4 and above is strongly recommended for this engine in order to ensure its normal operation and long service life and improve its emissions. If the above engine oil is not available, oil of CF-4 grade or above meeting the requirements of American Petroleum Institute (API) can serve as an alternative.

Proper oil viscosity grade is determined according to the minimum external temperature when the diesel engine is in stop and the maximum external temperature when the diesel engine is in operation.

Determine the oil viscosity required for starting a “thoroughly cold” engine by using the data in the column of minimum ambient temperature in the table below.

Choose the oil viscosity under the expected highest working temperature by using the data in the column of maximum ambient temperature in the table below.

Operating temperature range for engine oil (GB 11122-2006)

Viscosity grades of SDEC-designated engine oil of CF-4	Ambient temperature	
	Minimum	Maximum
0W-20	-40°C	10°C
0W-40	-40°C	40°C
5W-40	-35°C	40°C
10W-30	-30°C	40°C
15W-40	-25°C	40°C
20W-50	-20°C	50°C

△Caution: Engine oil must be kept clean and free from dust, impurities or water.

Part numbers of SDEC-designated special lubricating oil of grade CF-4 are as follows:

Y/1511000001 (3.5 kg)	Y/1511000002 (16 kg)	Y/AG0105 (3.5 kg)	Y/AG0106 (16 kg)
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3.3 Coolant

In order to ensure the normal operation and long service life of the engines, use SDEC- designated special organic coolant (anti-freezing type) for any climate. The coolant proves antifreeze, anticorrosion, good thermal conductivity, performance stability, and environmental friendliness.

Name	Part No.	Freezing point/°C	Boiling point/°C
SDEC-designated special organic coolant	F/LQY-45	-45	108

3.4 Engine Start

Before using the engine, choose proper engine oil, fuel and coolant according to actual ambient conditions. Besides, the following work should be done before starting:

- Make a surround inspection of the engine and its starting system, and solve problems in time if any.
- Check oil pressure and temperature gauges, warning lights and other instruments for normality.
- Check the service indicator of the air filter for appearance of red piston.

△Caution: Do not to start the engine without an air filter to avoid early engine wear.

- Check the service indicator of the first stage fuel filter for appearance in red.
- Check the oil level for being within the specified range.
- Check the coolant level for being within the specified range.
- Check the electrolyte level for being within the specified range.
- If the engine has not been in operation for a long time, or its fuel filter has just been replaced, there may be air in the fuel system. Prime the fuel system with priming pump if necessary. Refer to Section 4.3 for specific priming operation.
- Check the electric starting wires for normality.
- All the safety devices must be installed in place.
- Check the accelerator pedal or throttle lever for free movement.

3.4.1 Normal starting procedure

- Disengage the engine from the drive system, or put transmission into the “neutral” position if equipped.
- Put the mechanical operating devices into the “running” position.
- Insert electric key and turn the switch from the position OFF to the position ON to electrify intake air heating device and other electrical devices. For vehicle application, it is required to step on the accelerator pedal when starting.
- Wait until the pre-heating indicator light goes out (the light flashes on when intake air pre-heating proceeds and it doesn't flash when no pre-heating happens). Then turn the switch from the position ON to the position START to start the engine.

△Caution: Starting time should be no more than 15 seconds and there should be a 2-minute interval before the next starting so as to prevent the damage to starting motor.

Each starting usually lasts 2 -3 seconds.

- The switch goes back to the position ON from the position START automatically after starting up.

△Caution: The oil pressure gauge should show reading within 15 seconds after the engine has successfully been started; otherwise, stop the engine immediately to prevent damage to the engine and find the causes and remove the fault according to Section 5 Troubleshooting Guidelines.

- Started up from a hot state, the engine should run at idle for 1-3 minutes before being accelerated and loaded gradually.
- Started up from a cold state, the engine should run at idle for 3-5 minutes. Increase the engine speed slowly to have every bearing adequately lubricated and oil pressure stable. Gradually accelerate and load the engine after oil pressure is stable.
- Check the instruments for operational conditions in engine idle running.

△Caution: Do not accelerate and load the engine immediately after it is started up.

△Caution: Do not idle the engine for a long period of time or it can cause problems to the engine. When an engine idles, the temperature in combustion chamber is low and combustion is not complete. It can cause carbon deposit in cylinder that results in blocking of orifice of fuel injector, as well as the seizures of piston rings and valve, thus leading to engine performance deterioration.

△Caution: If the engine is start by a jumper cable, parallel connection of the cable should be adopted by connecting the positive pole to the positive terminal and the negative pole to the negative terminal. If the engine is start by external power supply, the circuit breaker should be set to the position OFF. Take out the key to prevent accidental activation before connection of jumper cable.

3.4.2 Cold starting

The engine has the ability to start successfully without any pre-warming aid if the temperature is above -15°C. The engine is equipped with an intake air heating device for fast and smooth start, as well as for keeping speed stable and improving the smoke after starting up.

Electric heating device consists of electric heater, electronic controller, temperature sensor and indicator light. Its work is governed by the electronic controller.

The electronic controller governs intake air heating action according to ambient temperature. The heating is divided into two stages: heating intake air before engine start (pre-heating) and heating intake air after engine start (after-heating). Generally, it is not allowed to start engine during the first stage of heating (pre-heating). Once the engine is started, the pre-heating will automatically stop. Start the engine after the pre-heating is over.

- Insert the electric key and turn the switch from the position OFF to the position ON to electrify the electronic controller. Pre-heating intake air starts and the indicator light flashes on. Intake air heating ends and the indicator light flickers. The engine is ready to start.

- Turn the switch from the position ON to the position START to start the engine after the indicator light goes out. The switch turns back to the position ON automatically after the engine has started up.

- After-heating begins and its duration is governed by the electronic controller. The indicator light does not flash in the process.

Refer to Normal Starting Procedure for other engine starting instructions.

Note: If startup does not happen or the engine has not been started up within 30 seconds after the indicator light starts flickering, the electronic controller will automatically disconnect the circuits of glow plug, solenoid and indicator light, entering delay protection. If another startup is initiated, turn the electric key back to the position OFF, and wait for 5 seconds before repeating the above process.

3.4.3 Starting after a long-time stop or engine oil replacement

If the engine hasn't been used for more than 30 days or its engine oil has just been replaced, it is necessary to check the oil level for being within the range of the level marks in the dipstick before starting, and prime the fuel system. Refer to Section 4.3 Priming Fuel System for specific operation.

3.5 Engine Operation

Cautions for operation of the engine:

- Pay frequent attention to oil pressure and coolant temperature. In case of any abnormality, stop the engine immediately for inspection.

- When engine overheating starts to happen that is indicated by the coolant temperature alarming, reduce engine speed or reduce load or take the both actions until the coolant temperature falls down into the normal range; otherwise, find the

cause and remove the fault as per Section 5 Troubleshooting Guidelines.

- When driving down a steep slope, the transmission gear and brake should be used simultaneously to control the vehicle speed and engine speed; when driving up a steep slope, a proper gear must be chosen to prevent the vehicle from rushing on the slope.

△Caution: Over-speed running will cause serious damage to the engine.

- Proper lubricating oil, fuel and coolant must be used for the engine when it runs in an extremely cold area.

There are significant signs before the faults of an engine occur, such as changes in performance, sound, or engine appearance. Listening and observing will help to detect in advance or predict some problems of the engine that will occur later, with which the proper measures can be taken in time to eliminate such problems that would lead to a serious engine failure.

Typical engine fault signs:

- Engine misfires abnormally
- Engine vibrates abnormally
- Engine sounds abnormal
- Engine coolant temperature and oil pressure change abruptly
- Engine produces black smoke
- Engine power output is insufficient
- Engine oil consumption is too much
- Fuel consumption is too much
- There is leakage of oil, fuel or/and coolant

3.6 Engine Shutdown

3.6.1 Normal shutdown

If the engine has just worked at a high speed and heavy load for a long time, reduce its load and speed gradually and run it at idle for 3-5 minutes before stopping it to let turbocharger speed fall considerably so as to protect the engine and turbocharger. Turn the switch from the position ON to the position OFF and take out the electric key after the engine has been stopped.

If the engine will not be used for a period of time (6 months at most), keep it properly. Refer to Section 6 for engine storage.

3.6.2 Emergency shutdown

Under an emergency or special condition, make an emergency stop to avoid serious engine failure. Manually pulling of the emergency stop handle can achieve an emergency shutdown.

3.7 Running-In of A New or Overhauled Engine

Before running a new or overhauled engine in full load condition, run it for 60 hours in running-in condition and change its oil thereafter to improve its moving parts working condition and its reliability and service life.

The way of running-in varies from one engine application and loading manner to another. In principle, engine speed and load in running-in process will be increased gradually with the running-in going on. Load should be 50%-80% of its full load, and speed should not exceed 80% of its rated speed.

Do not run an engine at idle or with low load for a long-time either in running-in period or normal working period thereafter. Continuous running at idle is usually not longer than 5 minutes to avoid early wear due to carbon deposit or engine performance being affected.

4 Engine Maintenance

4.1 Maintenance Schedule

The following table gives maintenance period and tasks. Make regular maintenance based on this table. If the engine frequently operates at the ambient temperature below -18°C or above 38°C, or in dusty environment or under a stop-and-go condition, the maintenance period should be shortened properly.

Maintenance tasks	Daily	Every 10,000 km or 250 h or 3 months	Every 20,000 km or 500 h or 6 months	Every 40,000 km or 1,000 h or 12 months	Every 80,000 km or 2,000 h or 2 years
Checking engine periphery	●	●	●	●	●
Checking fuel tank	●	●	●	●	●
Checking air filter service indicator	●	●	●	●	●
Checking first stage fuel filter service indicator	●	●	●	●	●
Checking oil level	●	●	●	●	●
Checking coolant level	●	●	●	●	●
Checking electrolyte level	●	●	●	●	●
Checking drive belt *	●	●	●	●	●
Checking cooling fan	●	●	●	●	●
Checking intake system		●	●	●	●
Replacing engine oil and oil filter **		●	●	●	●
Replacing fuel filter (first/second stages) ***			●	●	●
Priming fuel system			●	●	●
Checking/Adjusting valve clearance			●	●	●
Checking air filter element			●	●	●
Checking intercooler			●	●	●
Checking belt tensioner ****				●	●
Checking fan bearing					●
Checking turbocharger					●
Checking vibration damper					●
Checking air compressor					●
Replacing coolant					●
* The Belt must be replaced when it has crack or defect(s) that affects its use. ** If oil of grade CH-4 or above is used, the interval of replacement of oil and oil filter can be extended to every 6 months or every 500 hours or every 2 000 km, whichever comes first. *** The replacement period of the first stage fuel filter should be shorten properly when it contains a certain amount of foreign particulates and causes difficulty to pump fuel. **** The belt tensioner must be replaced when its pulley doesn't spin freely.					

Note: The maintenance interval in this table is in months, hours or kilometers, whichever comes first.

4.3 Tasks and Methods of Engine Maintenance

Checking engine periphery

Check the periphery of the engine each time before starting:

- Check if the engine is in clean state and free from useless things on it.
- Check the connectors and sealed faces of the fuel system, cooling system and lubricating system for leakage.
- Check if the fan and its safety guard are fastened in place.
- Check the fastenings of the accessories.
- Check the electrical circuits for looseness and the lead for intact.
- Check the drive belt for intact.

Checking fuel tank

Check the fuel level in the fuel tank daily.

Checking air filter service indicator

Check the maintenance indicator of the air filter every day. If the viewing window shows red piston, it represents that the intake resistance of the air filter exceeds the specified value, and the filter element requires to be replaced. Press the button on the top of the service indicator for reposition after the replacement.

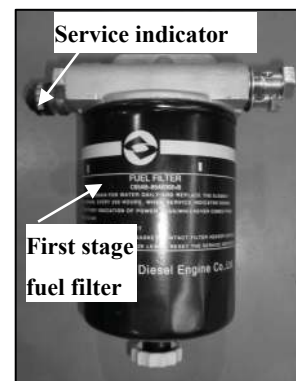


△Caution: Be sure that both end faces of the air filter are reliably sealed without leakage after the air filter element is changed.

△Caution: Do not start the engine without an air filter, and failure to do so would easily cause early engine wear.

Checking first stage fuel filter service indicator

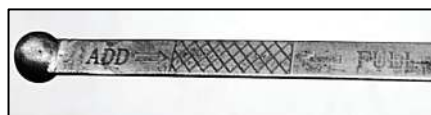
Check the service indicator daily. When the first stage fuel filter contains a certain amount of foreign particulates and causes difficulty for the fuel transfer pump to pump fuel, the indicator on the filter appears in red, reminding you that the fuel filter must be replaced. The filter must be replaced too even the indicator does not appear red after being used for 500 hours. The filter is a spin-on type one like the second stage fuel filter. Refer to “Replacing fuel filter (second stage)” for the replacement procedure.



Checking oil level

Check the oil level daily before starting the engine or the engine is in stop (at least 15 minutes after being stopped) to provide enough time for oil to flow back to the oil pan. The oil level should be between the marks ADD and FULL. If oil is not enough, supplement it. The oil volume difference between the low level ADD and the high level FULL is about 2 L for 4L engine and 2.5 L for 7L engine.

△Caution: Do not run the engine when the oil level is below the mark ADD, otherwise it can result in poor engine performance, or even damage to the engine.



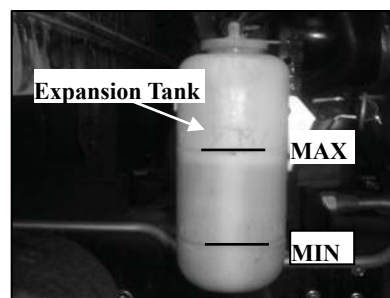
Checking coolant level

▲ **Warning:** Avoid skin or eye contact with coolant to prevent personal injury.

▲ **Warning:** At operating temperature, engine coolant is hot and under pressure, and the steam can cause personal injury. Do not remove the pressure cap on the radiator until the engine has been stopped and coolant temperature has dropped below 50°C. Slowly loosen the cap to relieve pressure before checking coolant level or making supplement.

For vehicle application

Check coolant level daily. It should remain between the marks MAX (high level) and MIN (low level) in the expansion tank, and add it if necessary. Coolant should be added near the upper mark (MAX).

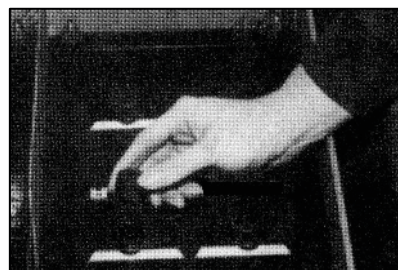
**For non- vehicle application**

- (1) Slowly loosen the pressure cap on the radiator to release pressure before starting the engine or until coolant temperature goes below 50°C after stopping the engine.
- (2) Remove the pressure cap and check coolant level daily, check from inspection port. The coolant level should remain between the marks in the radiator or expansion tank, or meet the requirement of equipment manufacturer.
- (3) Add if necessary. Coolant should be added near the upper mark or meet the requirement of equipment manufacturer.

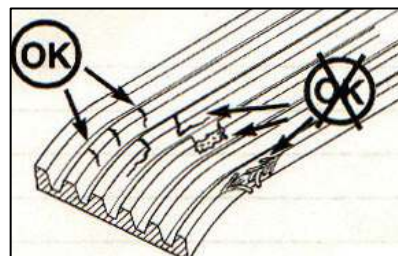
△**Caution:** Coolant should be added slowly to avoid air block.

Checking electrolyte level

- (1) Check the electrolyte level before starting the engine. Remove the filler cap and check the electrolyte level. It should be at the bottom of filler port. Add it as required.
- (2) Install the cap.

**Checking drive belt**

Perform visual check on the drive belt everyday for any intersecting cracks. Transverse cracks along the width direction of the belt are acceptable, while longitudinal cracks (along the length direction) that intersect with transverse cracks are not allowed. If any wear or abrasion occurs on the belt, replace it.

**Checking cooling fan**

Perform visual check on the cooling fan for flaw or any other defect. The fan should be installed reliably. Tighten the fastening bolts (55–65 N·m) or replace the damaged fan if necessary.

▲ **Warning:** Damaged fan blades can cause serious personal injury. Do not pull or pry the fan, and never rotate the engine crankshaft with the fan.

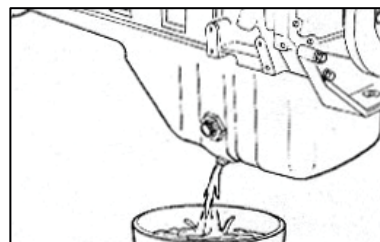
Checking intake system

Check the intake hoses for any crack, as well as perforation, and clamps for looseness. Replace the hose(s) if any fault is found, and tighten clamp screw(s) if looseness is found to ensure leak-proof of the intake system.

Replacing engine oil and oil filter

▲ Warning: Be careful when replacing engine oil and oil filter because skin contact with the hot engine oil or hot engine surface can cause scald.

- (1) Don't stop the engine until the temperature of coolant reaches 60°C, then remove the oil drain plug, scrap the gasket and drain the engine oil.



△Caution: Do not drain engine oil when the engine is in cold-state at which foreign particles has deposited and attached to the bottom of an oil pan, and will not drain with oil. When engine oil is warm, foreign particles suspend in it and can easily drain with engine oil.

- (2) Clean the installation surface of the oil drain plug on the oil pan. Fit the drain plug with a new gasket and tighten it by 56-64 N·m.

- (3) Clean the periphery of the oil filter head. Remove the oil filter with tool and scrap it.

- (4) Clean the sealed face of the filter head, and there should be no old O-ring left.



- (5) Before installing a new oil filter, fill it with clean oil from 8 peripheral holes. The oil level should be 3-15mm below the threaded hole. Apply a light film of clean engine oil to the O-ring on the new filter to form a lubricating film.

△Caution: Do not add oil from the central hole of the filter.



- (6) Turn the filter by hand until the O-ring touches the sealed surface of the filter head, and further tighten it by 3/4 to one turn with tool.

- (7) Open the filler cap, and fill the engine with clean engine oil until the oil level is near the mark FULL in the oil dipstick.

Lubricating system capacity	
13.4 L (SC4H)	20.5 L (SC7H)

- (8) Start the engine and keep it running at idle, and then check the oil filter and drain plug for oil leaks.
- (9) Shut off the engine, wait for about 5 minutes to provide enough time for the oil to flow into the oil pan, and check the oil level. If required, add engine oil until it is near the mark FULL (high level) in the oil dipstick.
- (10) Install the filler cap and tighten it until you feel suitable.

Replacing second stage fuel filter

- (1) Clean the periphery of the fuel filter. Remove the filter with tool and scrap it.
- (2) Clean the filter head and its sealed face. There should be no old O-ring left.



- (3) Before installing a new fuel filter, fill it with clean fuel from 8 peripheral holes. The fuel level should be 3-15 mm below the threaded hole. Apply a light film of clean engine to the O-ring on the new fuel filter to form a lubricant film.

△Caution: Do not add fuel from the central hole of the filter.



- (4) Screw the filter by hand until the O-ring touches the sealed surface of the filter head, and further tighten it by 3/4 to one turn with tool.

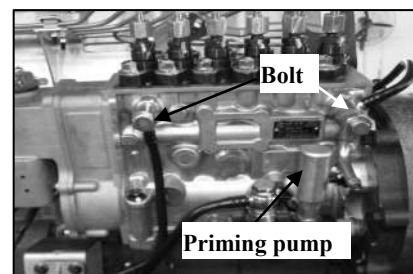
Replacing first stage fuel filter

The first stage fuel filter is also spin-on type, and the steps for its replacement are the same as that for the second stage fuel filter.

Priming fuel system

If the engine has not been used for a long time or fuel filter (first- or/and second- stage) is changed, air will enter the fuel system. It is required to prime the fuel system as per following steps:

- (1) Loosen the bolt of the fuel return pipe.
- (2) Prime the priming pump until there is no bubble visible in the fuel that outflows from the bolt.
- (3) Tighten the bolt.



△Caution: Priming the fuel system is required if air enters the fuel pipeline due to untimely fuel supplement or there is air in the fuel system due to other reasons.

Drain water

The first stage fuel filter has a function of water and fuel separation. When water level in the water container of the first stage fuel filter reaches a certain level, the water-level sensor will send a signal to the water-level indicator light in cab, reminding the driver to drain the water timely. Loosen the water drain valve about three and half turn to drain the water and sediment until clean fuel outflows. Then tighten the valve until you feel suitable. Don't over-tighten it.

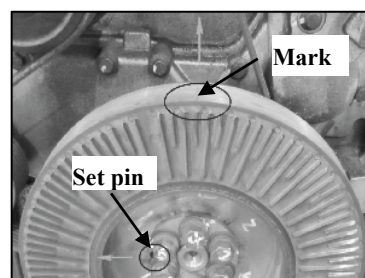
**Checking/adjusting valve clearance**

When doing the first maintenance for a new or overhauled engine, conduct valve-clearance checking to timely regulate and correct the initial changes of the valve clearances. Later valve clearance checking and regulating should be based on the maintenance plan if the engine operates normally.

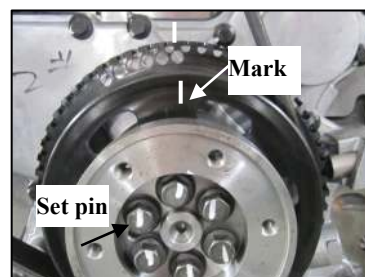
Valve clearance checking should be conducted after the engine has been stopped and the coolant temperature falls to below 60°C.

- (1) Remove the cover of oil filler.
- (2) Rotate the engine anticlockwise with barring tool and make the piston of No. 1 cylinder or No. 4 cylinder (SC4H) or No. 6 cylinder (SC7H) position at the top dead center on the compression stroke.

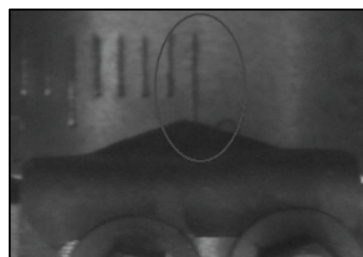
Note: When the set pin is on the left side or the mark in the vibration damper is in alignment with the mark in the gear housing cover, the piston of No 1 cylinder or No. 4 cylinder (SC4H) or No. 6 cylinder (SC7H) is at the top dead center.



Note: When the set pin is on the left side or the mark in the pulley is in alignment with the mark in the gear housing cover, the piston of No 1 cylinder or No. 4 cylinder (SC4H) or No. 6 cylinder (SC7H) is at the top dead center.



Note: When the point indicator on the flywheel housing points at the mark 0 in the flywheel, the piston of No 1 cylinder or No. 4 cylinder (SC4H) or No. 6 cylinder (SC7H) is at the top dead center.



(3) Looking for TDC on compression stroke:

SC4H: When the oil filler is located at No. 1 cylinder, sway the rocker arm of No. 1 cylinder from the oil filler. If the rocker arm can be swayed, the piston of No. 1 cylinder is at the top dead center on compression stroke. If not, the piston of No. 4 cylinder is at the top dead center on compression stroke. When the oil filler is located at No. 4 cylinder, sway the rocker arm of No. 4 cylinder from the oil filler. If the rocker arm can be swayed, the piston of No. 4 cylinder is at the top dead center on compression stroke. If not, the piston of No. 1 cylinder is at the top dead center on compression stroke.

SC7H: When the oil filler is located at No. 1 cylinder, do in the same way as SC4H. When the oil filler is located at No 6 cylinder, sway the rocker arm of No 6 cylinder from the oil filler. If the rocker arm can be swayed, the piston of No 6 cylinder is at the top dead center on compression stroke. If not, the piston of No. 1 cylinder is at the top dead center on compression stroke.

(4) When the piston of No. 1 cylinder is at the top dead center on compression stroke, check the following valve clearances with feeler gauge. for the SC4H engine (4- cylinder): check the intake valve clearances of No. 1 and No. 2 cylinders as well as the exhaust valve clearances of No. 1 and No. 3 cylinders; for the SC7H engine (6- cylinder): check the intake valve clearances of No. 1, No. 2 and No. 4 cylinders as well as the exhaust valve clearances of No. 1, No. 3 and No. 5 cylinders.

When the piston of No. 4 cylinder (SC4H) is at the top dead center on compression stroke, check with feeler gauge the intake valve clearances of No. 3 and 4 cylinders, as well as the exhaust valve clearances of No. 2 and 4 cylinders.

When the piston of No. 6 cylinder (SC7H) is at the top dead center on compression stroke, check with feeler gauge the intake valve clearances of No. 3, No. 5 and No. 6 cylinders as well as the exhaust valve clearances of No. 2, No. 4 and No. 6 cylinders.

Note: The clearance is correct when some resistance is felt when the feeler gauge is slipped between the valve bridge and the rocker arm.



(5) If a valve clearance fails to meet the requirement, loosen the valve clearance locknut on the corresponding rocker arm, adjust the clearance to specified value and tighten the locknut by 39-47 N·m. Check the valve clearance again and it should not change.

Valve clearance

Intake: 0.25 ± 0.08 mm; exhaust: 0.50 ± 0.08 mm.

(6) Mark a sign on the damper or fan adaptor plate, and rotate the crankshaft for a circle (360°). Follow the same steps to adjust the other intake and exhaust valve clearances.

(7) Install the oil filler and tighten it.

Checking air filter element

Check the air filter element for damage. Clean the element before checking. Use compressed air to clean the element.

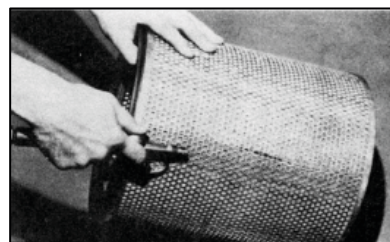
▲Warning: The protective work should be done well before using the compressed air. The highest pressure of compressed air should be no more than 205 kPa. Do not clean the filter element through the collision or strike of hard objects, and check the element after cleaning. Do not use a filter element with damaged pleats, sealing gaskets

or rings.

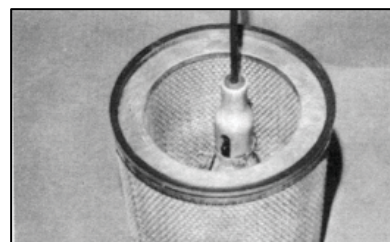
(1) Direct compressed air along the length of pleats inside of the element for cleaning.



(2) Direct compressed air along the length of pleats outside and then inside of the element for cleaning.



(3) Put an inspection lamp into the cleaned element to check it for broken holes or tears based on transmittance, and replace the element with a new one if any problem is found.



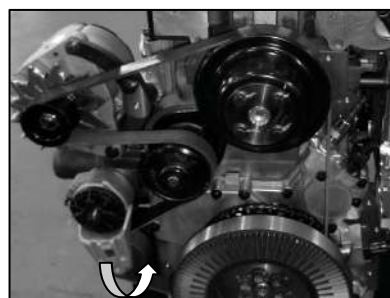
Checking intercooler

Perform visual check on the air inlet and outlet chambers of the intercooler for crack, perforation or other damages, and of the air inlet and outlet pipes for sealing-off and other damages. Replace the intercooler if necessary.

Checking belt tensioner

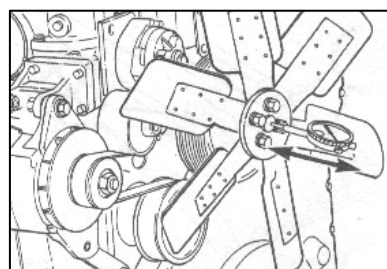
(1) Rotate the belt tensioner anticlockwise, and remove the drive belt. Turn the tensioner pulley to check it for seizure or radial/axial movement, by which to determine if there is scratch or wear on the bearing surface of the tensioner pulley. Swing the tensioner arm to check if the spring performs well.

(2) Install the drive belt and make a visual inspection after the installation to make sure that the belt center line is in alignment with the center lines of the pulleys.



Checking fan bearing

Rotate the belt tensioner anticlockwise and remove the drive belt. Turn the fan to check the fan bearing for normality. When rotating the fan, there should be no vibration or excessive axial movement.



Checking turbocharger

Perform visual check on turbine and compressor blades of the turbocharger for damage, crack, or contact between the turbine or compressor housings when a light finger pressure applied on them. And check the turbocharger shaft for free spinning. In case that any of the above problems occur, the turbocharger should be replaced.

Checking vibration damper**Viscous damper**

Check the vibration damper for damping fluid (silicon fluid) leak and surface dents. Also examine the thickness of damper to confirm if the damper has become deformed. In case that any of the above problems occur, the damper should be replaced.

Rubber damper

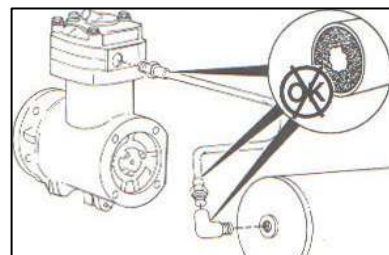
Check the vibration damper for rubber ring aging problem or movement between of inner and outer rings. In case that any of the above problems occur, the damper should be replaced.

Checking air compressor

▲Warning: Air pressure should be released from the air system before removing parts from the air compressor to avoid personal injury.

Air outlet pipe

Check the air outlet pipe and joints for carbon deposit.
Clean or replace relevant parts based on the deposit.

**Replacing coolant**

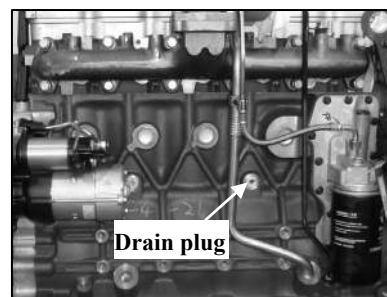
In order to ensure the engine coolant to be good in cooling and anticorrosion, the replacement of coolant is required every 80,000 km, 2,000 hours or 2 years, whichever comes. The cooling system must be cleaned before the replacement.

▲Warning: At operating temperature, engine coolant is hot and under pressure, and the steam can cause personal injury. Do not remove the pressure cap on the radiator until the engine has been stopped and coolant temperature goes below 50°C. Slowly unscrew the pressure cap to release pressure. The anti-rust additive in the coolant contains alkali. Avoid skin and eye contact to prevent personal injury.

▲Warning: Avoid skin or eyes contact with coolant to prevent personal injury.

(1) Stop the engine and wait until the temperature of coolant falls to below 50°C. Slowly unscrew the pressure cap to release pressure and remove it. Loosen the drain cock on the radiator to completely drain the coolant in the radiator.

(2) Remove the water drain plug on the engine, scrap the O- ring and completely drain the coolant in the cooling system.



(3) Clean the cooling system according to the following steps.

(a) Install and screw up all the drain cocks and plug, and add the sodium carbonate solution (or the mixture of sodium carbonate and water that is available in market) into the cooling system from the coolant filler.

△Caution: Each 23 L of water should be mixed with 0.5 kg sodium carbonate. Do not use caustic cleaner, or it will do harm to aluminum parts.

△Purge the air in the coolant system while adding the cleaning fluid. Pour the cleaning fluid slowly to avoid air block. Cleaning fluid should be added up to the bottom of the filler in the radiator and wait for about 3-5 minutes for a full purge of air.

(b) Start the engine and keep it running for 5 minutes after the cleaning fluid temperature goes up to above 80°C, then stop the engine and completely drain the cleaning fluid in the cooling system.

△Caution: During the whole cleaning process the pressure cap should not be on and the engine runs without the cap on.

(c) Add clean water into the cooling system

△Caution: Pour clean water slowly to avoid air block. Clean water should be added up to the bottom of the filler in the radiator and wait for about 3-5 minutes for a full purge of air.

(d) Start the engine and keep it running for 5 minutes after the water temperature goes up to above 80°C, then stop the engine and completely drain the clean water in the cooling system.

△Caution: If the discharged water is still dirty, clean the cooling system again according to the above steps until discharged water becomes clean.

(4) Tighten all water drain cock on the radiator after cleaning. Use a new O-ring and tighten the plug on the engine by 45 N·m.

(5) Add coolant. Fill the cooling system with the specified coolant, and the total volume is as follows.

Engine coolant capacity	
6.8 L (SC4H)	9.6 L (SC7H)

△Caution: Engine coolant capacity listed above refers to the coolant volume in the engine cooling system. The actual amount should refer to to the vehicle or equipment data.

△Caution: Add coolant slowly to avoid air block. Coolant should be added up to the bottom of the filler in the radiator or meet the requirement of vehicle or equipment manufacturer. Wait for about 3-5 minutes for a full purge of air.

(6) Install the pressure cap on the radiator, start and run the engine until coolant temperature goes up to 80°C, then stop the engine and check the cooling system for leakage.

(7) Stop the engine and wait until the coolant temperature falls to below 50°C. Then open the pressure cap and recheck the coolant level. Supplement properly, if necessary.

5 Troubleshooting Guidelines

5.1 Troubleshooting Guidelines

Some simple typical diesel engine fault modes, possible causes and troubleshooting steps are listed in the table below. If any one of modes occurs in engine operation, it is required to eliminate it by taking appropriate measures. Otherwise, it would lead to severe engine failure. For simple engine faults, you can locate and eliminate them on your own according to the sequence of possible causes (namely the steps of locating problems). For complex faults, contact SDEC's after-sale service center (spare@sdecie.com) for technical guidance.

No	Fault mode	No	Fault mode
1	Alternator refuses to charge or fails to charge enough	16	Diesel knock
2	Starting motor fault	17	Excessive noise
3	Engine is difficult to start or will not start	18	Black smoke
4	Engine starts, but will not keep running	19	White smoke
5	Liable misfire or unsteady speed	20	Blue smoke
6	Liable misfire at low speed	21	Fuel consumption too much
7	Engine cannot reach rated speed under load	22	Coolant temperature above normal -- gradual overheat
8	Engine power output low	23	Coolant temperature above normal—sudden overheat
9	Rough running and misfiring	24	Coolant temperature below normal
10	Unexpected engine halt or misfire in deceleration	25	Coolant contamination
11	Poor acceleration	26	Oil consumption too much
12	Engine will not stop	27	Oil pressure too high
13	Unsteady idle speed and engine hunting	28	Oil pressure too low
14	Rough running at idle speed	29	Oil contamination
15	Excessive vibration		

Fault mode 1: Alternator refuses to charge or fails to charge enough

Possible cause	Correction
The instrument or indicator light failure	Check and replace the instrument or indicator light
The battery connector(s) is loose or eroded	Clean and tighten the battery connector(s)
The drive belt slip or failure of the belt tensioner	Check and replace the belt and check the spring performance of the tensioner
Poor terminal contact of the alternator	Tighten all terminal connects of the alternator

Fault mode 2: Starting system fault

Possible cause	Correction
The terminals and connectors of the starting circuit and/or the battery are loose, open or eroded	Clean and tighten all the terminals and the connectors
Insufficient battery output	Adopt a battery with sufficient output or add some more batteries in parallel
Starting motor fault	Check the starting motor

Fault mode 3: Engine is difficult to start or will not start

Possible cause	Correction
Improper starting method	Refer to the operating instruction manual of the vehicle or the equipment for proper starting method
The time for engine start up is 2-3 seconds	It is normal and needs no adjustment
The drive system is engaged	Disengage the drive system
Too low starting speed (minimum starting speed is 100 rpm)	Check battery for voltage and check starting motor for looseness or eroded connection
Insufficient fuel in the tank	Add fuel
Air in the fuel system	Check for air in the system. Tighten or replace the fuel joints, fuel pipes and relevant parts if necessary and then prime the system
The connectors of low-pressure fuel pipeline is loose	Check the low-pressure fuel pipeline and tighten all the connectors
The fuel filter or fuel suction pipe is blocked	Replace the fuel filter or fuel suction pipe
Fuel arises solidification because of cold weather	Choose proper fuel specified in this manual based on the ambient condition
There is no fuel in the fuel injection pump	Check the fuel transfer pump
The resistance of the intake system exceeds the specified value	Check the intake system and replace the air filter element if necessary
The resistance of the exhaust system fails to meet the requirements	Check the exhaust system
The crankshaft rotation is restricted	Barring the crankshaft and check for restriction.
Injection pump timing is not correct	Check and adjust injection pump timing. Refer to 5.2 for the procedure
Intake/exhaust valve clearance error (s)	Check and adjust valve clearance

Fault mode 4: Engine starts, but will not keep running

Possible cause	Correction
The engine is engaged with the drive system	Disengage the engine with the drive system
Fuel arises solidification because of cold weather	Choose proper fuel specified in this manual based on the ambient condition
Air in the fuel system	Check for air in the system. Tighten or replace the fuel joints, fuel pipes and relevant parts if necessary and then prime the system
The fuel filter or fuel suction pipe is blocked	Replace the fuel filter or fuel suction pipe
The resistance of intake system exceeds the specified value	Check the intake system and replace the air filter element if necessary
The resistance of exhaust system fails to meet the requirements	Check the exhaust system
Fuel fails to meet required specification or its quality is poor	Use the fuel specified in this manual and fill a temporary tank with right high-quality one, with which to run the engine and verify the fuel issue

Fault mode 5: Liable misfire or unsteady speed

Possible cause	Correction
Fuel level in the fuel tank too low	Add fuel
Air in fuel system	Check for air in the system. Tighten or replace the fuel joints, fuel pipes if necessary and then prime the system
Fuel pressure too low	Check the fuel tank for fuel level, check the pipe between the tank and the fuel transfer pump for leakage, serious deformation, bent or plug and for air
Leakage at high-pressure fuel pipe connectors	Tighten the connectors and make replacement if required
Injection pump timing is not correct	Check and adjust injection timing. Refer to 5.2 for the procedure
Intake/exhaust valve clearance error (s)	Check and adjust valve clearance

Fault mode 6: Liable misfire at low speed

Possible cause	Correction
Fuel level is low in the tank	Add fuel
Air in the low-pressure fuel pipeline	Check the low-pressure fuel pipeline for air source. Tighten or replace joints or pipes if necessary and then prime the system

Fault mode 7: Engine cannot reach rated speed with load

Possible cause	Correction
The load is too heavy	Reduce the load or shift to lower gear
The drive system has been changed and cannot match the engine	Check the transmission gears for mismatch of the engine
Fault of the tachometer or speed sensor	Check the tachometer and speed sensor, and make replacement when necessary
The resistance of fuel inlet is great	Check the fuel filter and fuel suction pipe and replace the fuel filter if necessary
Fault of the turbocharger	Check the boost pressure
Leakage in the intake system	Check the connection of intake manifold, intake pipe, intercooler, its pipeline for looseness or leakage
The resistance of intake system exceeds the specified value	Check the intake system resistance and replace the air filter element if necessary
Fuel fails to meet required specification or its quality is poor	Use the fuel specified in this manual and fill a temporary tank with right high-quality one, with which to run the engine and verify the fuel issue

Fault mode 8: Engine power output low

Possible cause	Correction
Inquire the driver or operator	Obtain all the information related to the problem
Overloaded operation	Reduce the load to allowed range
The engine runs on the plateau beyond the specification	Run the engine on the specified plateau. Engine power decreases with increase of altitude
The drive system has been changed and cannot match the engine	Check the transmission gears for mismatch of the engine
Oil level is too high	Check and lower oil level to the specified range
The accelerator pedal or throttle lever doesn't arrive at the full position	Check accelerator pedal or throttle lever for restriction
Accessories load is too big	Check the cooling fan for abnormal operation and vehicle braking for friction
Air in the fuel system	Check for air in the system. Tighten or replace the fuel joints, fuel pipes if necessary and then prime the system
Fuel inlet temperature is high	Add fuel into the fuel tank
The fuel supply is blocked	Check the fuel inlet resistance and replace the fuel filter (first stage) and fuel filter (second state) if necessary
Leakage of the exhaust manifold or turbocharger	Check the exhaust manifold and boost pressure to find and eliminate the source of leakage
The resistance of exhaust system fails to meet the requirements	Check the exhaust system resistance
The resistance of intake system exceeds the specified value	Check the intake system resistance and replace the air filter element if necessary
Leakage in the intake system	Check the connection of intake manifold, intake pipe, intercooler, its pipeline for looseness or leakage
Fault of the turbocharger	Check the boost pressure
Fuel is not proper or its quality is poor	Use the fuel specified in this manual and fill a temporary tank with right high-quality one, with which to run the engine and verify the fuel issue
Incorrect injection pump timing	Check and adjust injection timing. Refer to 5.2 for the procedure
Intake/exhaust valve clearance error (s)	Check and adjust valve clearance

Fault mode 9: Rough running and misfiring

Possible cause	Correction
Only happens at idle speed	Refer to the fault mode "Rough running at idle" for correction
Low running temperature	Refer to the fault mode "Coolant temperature below normal"
Intake/exhaust valve clearance error (s)	Check and adjust valve clearance

Fault mode 10: Unexpected engine halt or misfire in deceleration

Possible cause	Correction
Causes related to the protective system of the vehicle or equipment	Contact the manufacturer of the vehicle or equipment
Air in the fuel system	Check for air in the system. Tighten or replace the fuel joints, fuel pipes if necessary and then prime the system
The fuel has been contaminated	Replace it with clean and qualified fuel

Fault mode 11: Poor acceleration

Possible cause	Correction
Inquire the driver or operator	Obtain all the information relevant to the problem
The drive system has been changed and cannot match the engine	Check the transmission gears for mismatch of the engine
Overload of accessories	Check the cooling fan, air conditioner and the vehicle braking system for too much resistance and reduce the load of the accessories
The accelerator pedal or throttle lever movement is restricted	Check the pedal or throttle lever or restriction
Leakage of the intake system	Check the intake manifold, intake pipe, intercooler and its pipelines for leakage
The intake system or exhaust system is blocked	Check the resistances of intake and exhaust systems.
Injection pump timing is not correct	Check and adjust injection pump timing. Refer to 5.2 for the procedure
Intake/exhaust valve clearance error (s)	Check and adjust valve clearance

Fault mode 12: Engine will not stop

Possible cause	Correction
Electric key switch fault	Refer to the manual of vehicle or equipment manufacturer for instruction
The engine inhales fuel mist	Check the intake manifold and separate the source of fuel mist
External power supply	Check and make sure there is no external power supply being connected to the power supply circuit of the vehicle or equipment
Oil leak in the turbocharger due to poor seal	Check the compressor outlet and intake pipe for oil trace

Fault mode 13: Unsteady idle speed and engine hunting

Possible cause	Correction
Air in the fuel system	Check for air in the system. Tighten or replace the fuel joints, fuel pipes if necessary and then prime the system

Fault mode 14: Rough running at idle speed

Possible cause	Correction
Engine temperature is too low	Warm up the engine
The load at idle speed is too heavy (more than 50 horsepower)	Reduce the load at idle speed
Leakage of the intercooler or its pipeline	Check intercooler and its pipeline for leaks
Leakage of the intake manifold or pipeline	Check the intake manifold or pipeline for leaks
Engine support problem	Check the engine support and cushion
Alternator fault	Disconnect the alternator to check the problem
Valve clearance error (s)	Check and adjust valve clearance
Engine support problem	Check the supporter and cushion pad of the engine

Fault mode 15: Excessive vibration

Possible cause	Correction
The engine runs unsteadily	Refer to fault mode “Rough running or misfire”
Pulley or vibrator bolts or nuts loose	Check and tighten loose bolts or nuts
Fan blade not in balance	Loosen or remove fan belts and operate engine for a short time at the r/min that the vibration was present. If vibration is not present any more, make a replacement of the fan assembly
Damage of fan or accessories	Check, and replace relevant parts if required
The vibration damper is broken	Check/replace the damper
Engine support problem	Check the supporter and cushion pad of the engine for problem. Make replacement if necessary

Fault mode 16: Diesel knock

Possible cause	Correction
Air in the fuel system	Check for air in the system. Tighten or replace the fuel joints, fuel pipes if necessary and then prime the system
Poor quality fuel	Use the fuel specified in this manual and fill a temporary tank with right high-quality one, with which to run the engine and verify the fuel issue
Injection pump timing is not correct	Check and adjust injection timing. Refer to 5.2 for the procedure

Fault mode 17: Excessive noise

Possible cause	Correction
Noise from drive belt due to poor tension or heavy load	Check the belt drive system and ensure all pulleys running
Leakage of intake system and exhaust system	Check the intake and exhaust systems for leakage. Tighten the loose components and replace the related parts if necessary
Noise from the turbocharger	Check the blades of compressor or turbine for their contact with their housings
Incorrect injection pump timing	Check and adjust injection timing. Refer to 5.2 for the procedure
Too big valve clearance	Check and adjust valve clearance

Fault mode18: Black smoke

Possible cause	Correction
The engine is overloaded	Set to lower gear or reduce equipment load
Intake system resistance exceeds the specified value	Check the intake system for resistance and replace the air filter element if necessary
Incorrect injection pump timing	Check and adjust injection timing. Refer to 5.2 for the procedure
Intake/exhaust valve clearance error	Check and adjust the valve clearance
Fuel is not proper or its quality is poor	Use the fuel specified in this manual and fill a temporary tank with right high-quality one, with which to run the engine and verify the fuel issue

Fault mode 19: White smoke

Possible cause	Correction
The engine is in cold state	Warm the diesel engine
Water in fuel	Check the first stage fuel filter for fuel and water separate function. Replace it if required
Injection pump timing is not correct	Check and adjust injection timing. Refer to 5.2 for the procedure
Fuel is not correct or its quality is poor	Use the fuel specified in this manual and fill a temporary tank with right high-quality one, with which to run the engine and verify the fuel issue

Fault mode 20: Blue smoke

Possible cause	Correction
A big gap between piston and liner channeling oil into the combustion chamber due to the engine running long time at low load (below 40% of full load)	Increase engine load and make proper engine load match
Too much oil in the oil pan	Adjust oil level to be within the specified range
Oil leak in the turbocharger due to poor seal	Check the compressor outlet and intake pipe for oil trace

Fault mode 21: Fuel consumption too much

Possible cause	Correction
Something related to driving technique	Check driver's operation for gear shift, deceleration and idle speed
Display error of the odometer	Adjust or replace the odometer
The drive system cannot match the engine	Check the transmission gears and make sure that the components of the engine and drive system are correct
Leakage of fuel	Check the fuel system pipeline for leakage and tighten connectors if loosened
The resistance of intake or exhaust is too great	Check the intake and exhaust systems, especially the air filter and exhaust muffler.
Oil level is too high	Check and adjust the oil level
Injection pump timing is not correct	Check and adjust injection timing. Refer to 5.2 for the procedure
Poor seal of intake valve or exhaust valve	Check and adjust valve clearance
Fuel is not correct or its quality is poor	Use the fuel specified in this manual and fill a temporary tank with right high-quality one, with which to run the engine and verify the fuel issue

Fault mode 22: Coolant temperature above normal -- gradual overheat

Possible cause	Correction
Overload operation	Reduce the load
Coolant level is too low	Check the coolant level and engine external for leakage, eliminating the leakage and adding the coolant to be within the specified range
Oil level is too high or too low	Check oil level and adjust it to be within the specified range
The radiator core is broken or blocked	Check the radiator core and repair or replace it if necessary
The coolant pipe is collapsed and there is leakage	Check the pipe and replace it if necessary
The drive belt is loose	Check the drive belt and replace it if necessary
Fault of the pressure cap of radiator and pressure calibration is too low	Check the function of the pressure cap
Fault of the thermometer or temperature sensor	Check the thermometer and sensor, and make replacement when necessary
Air in the cooling system	Check the connector at water pump inlet for leakage

Fault mode 23: Coolant temperature above normal—sudden overheat

Possible cause	Correction
Coolant level is too low	Check coolant level and engine external for leakage, eliminating the leakage and adding the coolant to be within the specified range
Coolant system hose(s) is collapsed and there is leakage	Check the hose(s) and replace it if necessary
The drive belt is broken	Check the drive belt and replace it if necessary
Fault of the coolant thermometer	Check the coolant thermometer and replace it if necessary

Fault mode 24: Coolant temperature below normal

Possible cause	Correction
The radiator shutter is blocked at the maximum opening	Check the radiator shutter and replace it if necessary
Too much cold air flows though the radiator	Visually check the fan and fan clutch (if equipped) for operation
Running in low ambient temperature	Take measures to increase intake air temperature
Fault of the coolant thermometer	Check the coolant thermometer and replace it if necessary

Fault mode 25: Coolant contamination

Possible cause	Correction
Improper coolant	Choose the coolant specified in this manual
Coolant change interval too long	Change coolant at the specified time

Fault mode 26: Oil consumption too much

Possible cause	Correction
The engine runs at idle speed for too long time	Shorten the time of the engine running at idle
The oil level is too high	Check the oil level and make adjustment if necessary
External oil leakage of the engine	Check the external pipeline, sealing gasket and crankshaft seals for leakage and replace the damaged components
The oil in the turbocharger leaks into the intake system or exhaust system	Check the compressor inlet, air intake pipe and turbine outlet for oil trace
Big blow-by push oil in crankcase to the crankcase ventilation device	Check the crankcase ventilation device for oil trace on its periphery
Air compressor pumps oil	Check the air compressor outlet for oil trace
Oil is not correct	Check the oil for its specification. Use correct oil and change the oil and oil filter

Fault mode 27: Oil pressure too high

Possible cause	Correction
The operating temperature of the engine is too low and the oil viscosity is high	Refer to the fault mode "Coolant temperature below normal"
Fault of the oil pressure meter or pressure sensor	Check the pressure meter and sensor, and make replacement when necessary
The lubricating oil fails to meet the requirements	Use the lubricating oil specified in this manual and replace the oil filter

Fault mode 28: Oil pressure too low

Possible cause	Correction
Oil level is too low	Check oil level and adjust it to the specified range
Leakage of the oil pipeline	Check the oil pipeline and eliminate the leakage
Oil temperature is higher than the specified value	Refer to the fault mode "Coolant temperature above normal"
Fault of the oil pressure meter or pressure sensor	Check the pressure meter and sensor, and make replacement when necessary
Water in engine oil	Check the oil filler cover or the oil dipstick for their missing. Replace the oil if required
The oil filter is blocked	Replace the oil and oil filter
The engine oil fails to meet the requirements and the oil viscosity is too low	Check the oil specification and replace the oil and oil filter if necessary
Hydraulic oil in the engine oil	Check for hydraulic oil leak, replace the oil and oil filter if required

Fault mode 29: Oil contamination

Possible cause	Correction
Cold running of the engine leads to fuel in engine oil	Check if the engine runs at idle for a too long time. Shorten idle running time

5.2 Static Fuel Injection Pump Timing Check and Adjustment

To remove the faults related to static injection pump timing, check and adjust the static pump timing as per following steps.

In order to eliminate gear backlashes, it is required to rotate the crankshaft counterclockwise viewed from the flywheel end, which is defined as the working rotation, in checking and adjusting of the injection pump timing.

The No.1 piston at TDC on the compression stroke is the starting point of the timing check and adjustment procedures.

Locating top dead center (TDC) on the compression position for No. 1 piston (method 1)

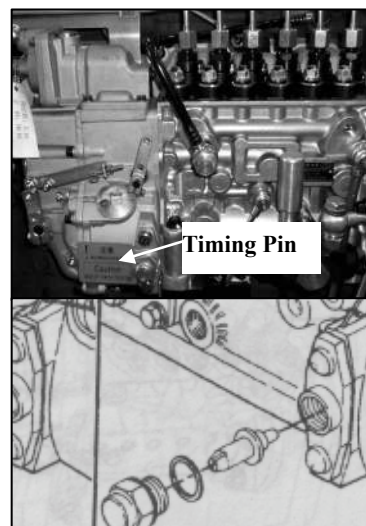
- (1) Remove the cover of the observing window.
- (2) Rotate the crankshaft counterclockwise to make the indicator on the flywheel housing point at the mark 0 in the flywheel.
- (3) Remove the cover of oil filler.
- (4) When the oil filler is located at No. 1 cylinder, sway the rocker arm of No. 1 cylinder from the oil filler. If the rocker arm can be swayed, the piston of No. 1 cylinder is at the top dead center on compression stroke. If not, rotate the crankshaft 360 degrees counterclockwise to let the piston of No. 1 cylinder be at the top dead center on compression stroke. When the oil filler is located at No. 4 cylinder (SC4H) or at No. 6 cylinder (SC7H), sway the rocker arm of No. 4 cylinder or No. 6 cylinder from the oil filler. If the rocker arm can be swayed, the piston of No. 4 cylinder or No. 6 cylinder is at the top dead center on compression stroke. Rotate the crankshaft 360 degrees counterclockwise to let the piston of No. 1 cylinder be at the top dead center on compression stroke.

Note: The method is applicable for a big difference between the actual timing and required one.

- (5) Install and tighten the oil filler cover.

Locating top dead center (TDC) on the compression position for No. 1 piston (method 2) or locating theoretical static pump timing

- (1) Remove the cover of the observing window.
- (2) Rotate the crankshaft counterclockwise to make the indicator points at the mark 0 in the flywheel.
- (3) Remove the timing pin plug from the governor housing of the fuel injection pump, take the timing pin out and insert the other end of the pin into the timing gear or timing slot in the pump camshaft (rotating the crankshaft clockwise and anticlockwise slowly and slightly when inserting the pin). If the pin cannot be inserted, rotate the crankshaft 360 degrees and insert the pin again. When the pin can be inserted, the theoretical static pump timing is achieved and the piston of No. 1 cylinder is at TDC on the compression stroke.



Note: The method is applicable for a small difference between the actual timing and required one.

- (4) Take the pin out. Reinstall it with the other end in and install the plug and washer. Tighten the plug by 15 N·m.

△Caution: The pin must be taken out before checking and adjusting the injection timing to avoid it being damaged.

Checking procedure

- (1) Rotate the crankshaft clockwise 40 degrees to make the 0 mark in flywheel 40 degrees before DTC.
- (2) Loosen the nut of the high pressure fuel pipe of No. 1 cylinder at the fuel pump end and move the pipe away.
- (3) Put the hand lever of the governor in high idle speed position and use the priming pump to pump fuel to the fuel system.
- (4) Rotate the crankshaft counterclockwise slowly until the fuel at the fuel delivery valve joint just starts to move and check the number mark at which the indicator points. The pointed number represents the actual injection pump timing. It is required to make the adjustment if the actual timing is out of the specified range (see the engine nameplate)

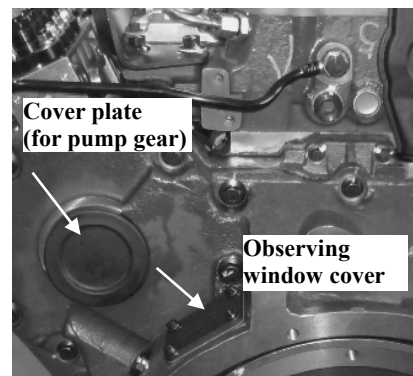
Adjusting procedure

- (1) Remove the cover on the flywheel housing for the removal and installation of the injection pump gear and scrap the O-ring.

- (2) Remove the injection pump gear nut.

△Caution: Be careful not to let the nut and spring washer fall into the gear housing.

- (3) Pull the injection pump gear from the pump camshaft with a special tool (pulling tool).



- (4) Rotate the crankshaft counterclockwise or clockwise according to the checking result until the indicator points at the required fuel injection pump timing.
- (5) Install the injection pump gear and making it engage with the camshaft gear.
- (6) Install the gear nut and washer. Tighten the nut by 172-188 N·m (M20), 112-128 N·m (M18).
- (7) Recheck the static injection pump timing. If it is not correct, adjust it over until the correct one is attained.
- (8) Install the high pressure fuel pipe and tighten the nut by 32-38 N·m.
- (9) Install the cover with a new O-ring.
- (10) Install the observing cover.
- (11) Put the hand lever of the governor back to the normal position.

6 Engine Storage

If the diesel engine is to be shutdown for a period of time (6 months at most), measures of cleaning and necessary oil seal should be taken for rust protection.

△Caution: Rustproof measures should be taken on the surface of the accessory driving pulleys.