

Service Manual

WAUKESHA SCANIA

D317D

F475D

F476D

F673D

F674D

Series

Waukesha

DRESSER

INTRODUCTION

Waukesha Engine Division supplies this publication for use with Waukesha—Scania diesel engines. Scania and Waukesha identify these Waukesha marketed diesel engine models as follows:

Scania Basic Designations

D5 and DS5
D8 and DS8
D11, DS11, and DSI11

Waukesha Basic Designations

D317D and D317DS
F475D, F475DS, F476D, and F476DS
F673D, F673DS, F673DSI,
F674D, F674DS, and F674DSI

The Scania basic designation indicated D for diesel, S for turbocharged, I for intercooled, and the numerical designation, (5, 8, or 11) is the approximate displacement in litres. The Waukesha basic designation indicates the number of cylinders (D is 4 and F is 6), the approximate displacement in cubic inches (317, 475, 476, 673, and 674), D for diesel, S for turbocharged, and I for intercooled. When a U is added to the basic designation it indicates an industrial unit. When an M is added to the basic designation it indicates a marine application. When an F is added to the basic designation it indicates a Fire Underwriters' unit.

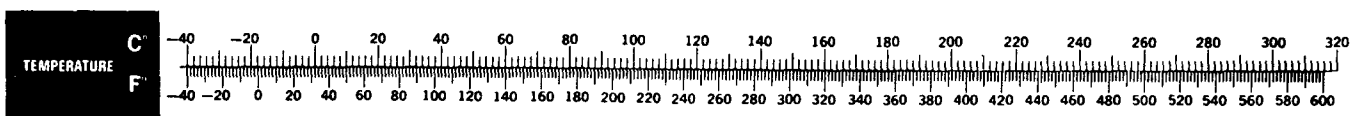
CAUTION

This manual includes three separate Tables of Contents and Indexes. As indicated at the tops of these pages, they each apply to only specific model series and designations. They are also color coded, as are the manual pages themselves. The white pages apply to model series D317D, F475D, and F673D; however, many of the white pages also apply to model series F476D and F674D and are listed in those Tables of Contents and Indexes when applicable. The yellow pages apply to only model series F476D. The blue pages apply to only model series F674D. Be careful to use the proper information for the engine being serviced. The first page of each section of yellow and blue pages also lists applicability by model, designation, and serial number.

CONVERSION FACTORS

In order to convert the metric data provided in these publications, use the following conversion factors.

TO CONVERT:	TO:	MULTIPLY BY:	TO CONVERT:	TO:	MULTIPLY BY:
mm	inches	.03937	litres	gallons	.2642
m	feet	3.281	kg	pounds	2.2046
mm ²	sq. inches	.00155	kgm	foot-pounds	7.233
dm ²	sq. inches	15.5	Nm	foot-pounds	.738
cm ³	fluid oz.	.0338	kp/cm ²	psi	14.22
m ³	cu. ft.	35.31	bar	psi	14.5
kcal	BTU	3.968			



For direct conversion of .1 to 25.4 millimeters (mm) into inches, use the following chart:

CONVERSION CHART SHOWING MILLIMETER SIZES, FRACTIONAL AND DECIMAL INCH SIZES AND NUMBER DRILL SIZES

Milli-Meter	Dec. Equiv.	Frac-tional	Num-ber	Milli-Meter	Dec. Equiv.	Frac-tional	Num-ber	Milli-Meter	Dec. Equiv.	Frac-tional	Num-ber	Milli-Meter	Dec. Equiv.	Frac-tional	Num-ber	Milli-Meter	Dec. Equiv.	Frac-tional
.1	.0039			1.75	.0689			....	.1570		22	6.8	.2677			10.72	.4219	$\frac{27}{64}$
.15	.0059			....	.0700		50	4.0	.1575			6.9	.2716			11.0	.4330	
.2	.0079			1.8	.0709			....	.1590		21	....	.2720		I	11.11	.4375	$\frac{7}{16}$
.25	.0098			1.85	.0728			....	.1610		20	7.0	.2756			11.5	.4528	
.3	.0118			....	.0730		49	4.1	.1614			....	.2770		J	11.51	.4531	$\frac{29}{64}$
....	.0135		80	1.9	.0748			4.2	.1654			7.1	.2795			11.91	.4687	$\frac{15}{32}$
.35	.0138			....	.0760		48	....	.1660		19	....	.2811		K	12.0	.4724	
....	.0145		79	1.95	.0767			4.25	.1673			7.14	.2812		....	12.30	.4843	$\frac{31}{64}$
.39	.0156	$\frac{1}{64}$	....	1.98	.0781	$\frac{5}{64}$	....	4.3	.1693			7.2	.2835	$\frac{9}{32}$		12.5	.4921	
.4	.0157			....	.0785		47	....	.1695			7.25	.2854			12.7	.5000	$\frac{1}{2}$
....	.0160		78	2.0	.0787			4.37	.1719	$\frac{11}{64}$	....	7.3	.2874			13.0	.5118	
.45	.0177			2.05	.0807			....	.1730		17	....	.2900		L	13.10	.5156	$\frac{33}{64}$
....	.0180		77	....	.0810		46	4.4	.1732			7.4	.2913			13.49	.5312	$\frac{17}{32}$
.5	.0197			....	.0820		45	....	.1770		16	....	.2950		M	13.5	.5315	
....	.0200		76	2.1	.0827			4.5	.1771			7.5	.2953			13.89	.5469	$\frac{35}{64}$
....	.0210		75	2.15	.0846			....	.1800		15	7.54	.2968	$\frac{19}{64}$	....	14.0	.5512	
.55	.0217			....	.0860		44	4.6	.1811			7.6	.2992			14.29	.5625	$\frac{9}{16}$
....	.0225		74	2.2	.0866			....	.1820		14	....	.3020		N	14.5	.5709	
.6	.0236			2.25	.0885			4.7	.1850		13	7.7	.3031			14.68	.5781	$\frac{37}{64}$
....	.0240		73	....	.0890		43	4.75	.1870			7.75	.3051			15.0	.5906	
....	.0250		72	2.3	.0905			4.76	.1875	$\frac{3}{16}$	....	7.8	.3071			15.08	.5937	$\frac{19}{32}$
.65	.0256			2.35	.0925			4.8	.1890		12	7.9	.3110			15.48	.6094	$\frac{39}{64}$
....	.0260		71	....	.0935		42	....	.1910		11	7.94	.3125	$\frac{5}{16}$	....	15.5	.6102	
....	.0280		70	2.38	.0937	$\frac{3}{32}$	....	4.9	.1929			8.0	.3150			15.88	.6250	$\frac{5}{8}$
.7	.0276			2.4	.0945			....	.1935		10	....	.3160		O	16.0	.6299	
....	.0292		69	....	.0960		41	....	.1960		9	8.1	.3189			16.27	.6406	$\frac{41}{64}$
.75	.0295			2.45	.0964			5.0	.1968			8.2	.3228			16.5	.6496	
....	.0310		68	....	.0980		40	....	.1990		8	....	.3230		P	16.67	.6562	$\frac{21}{32}$
.79	.0312	$\frac{1}{32}$	....	2.5	.0984			5.1	.2008			8.25	.3248			17.0	.6693	
.8	.0315			....	.0995		39	....	.2010		7	8.3	.3268			17.06	.6719	$\frac{43}{64}$
....	.0320		67	....	.1015		38	5.16	.2031	$\frac{13}{64}$	....	8.33	.3281	$\frac{21}{64}$	....	17.46	.6875	$\frac{11}{16}$
....	.0330		66	2.6	.1024			....	.2040		6	8.4	.3307			17.5	.6890	
.85	.0335			....	.1040		37	5.2	.2047			....	.3320		Q	17.86	.7031	$\frac{45}{64}$
....	.0350		65	2.7	.1063			....	.2055		5	8.5	.3346			18.0	.7087	
.9	.0354			....	.1065		36	5.25	.2067			8.6	.3386			18.26	.7187	$\frac{23}{32}$
....	.0360		64	2.75	.1082			5.3	.2086			....	.3390		R	18.5	.7283	
....	.0370		63	2.78	.1094	$\frac{7}{64}$	....	....	.2090		4	8.7	.3425			18.65	.7344	$\frac{47}{64}$
.95	.0374			....	.1100		35	5.4	.2126			8.73	.3437	$\frac{11}{32}$	....	19.0	.7480	
....	.0380		62	2.8	.1102			....	.2130		3	8.75	.3445			19.05	.7500	$\frac{3}{4}$
....	.0390		61	....	.1110		34	5.5	.2165			8.8	.3465			19.45	.7656	$\frac{49}{64}$
1.0	.0394			....	.1130		33	5.56	.2187	$\frac{7}{32}$	....	....	.3480		S	19.5	.7677	
....	.0400		60	2.9	.1141			5.6	.2205			8.9	.3504			19.84	.7812	$\frac{25}{32}$
....	.0410		59	....	.1160		32	....	.2210		2	9.0	.3543			20.0	.7874	
1.05	.0413			3.0	.1181			5.7	.2244			....	.3580		T	20.24	.7969	$\frac{51}{64}$
....	.0420		58	....	.1200		31	5.75	.2263			9.1	.3583			20.5	.8071	
....	.0430		57	3.1	.1220			....	.2280		1	9.13	.3594	$\frac{23}{64}$	....	20.64	.8125	$\frac{13}{16}$
1.1	.0433			3.18	.1250	$\frac{1}{8}$	....	5.8	.2283			9.2	.3622			21.0	.8268	
1.15	.0452			3.2	.1260			5.9	.2323			9.25	.3641			21.03	.8281	$\frac{53}{64}$
....	.0465		56	3.25	.1279			....	.2340		A	9.3	.3661			21.43	.8437	$\frac{27}{32}$
1.19	.0469	$\frac{3}{64}$	....	....	.1285		30	5.95	.2344	$\frac{15}{64}$	....	....	.3680		U	21.5	.8465	
1.2	.0472			3.3	.1299			6.0	.2362			9.4	.3701			21.83	.8594	$\frac{55}{64}$
1.25	.0492			3.4	.1338			....	.2380		B	9.5	.3740			22.0	.8661	
1.3	.0512			....	.1360		29	6.1	.2401			9.53	.3750	$\frac{3}{8}$	....	22.23	.8750	$\frac{7}{8}$
....	.0520		55	3.5	.1378			....	.2420		C	....	.3770		V	22.5	.8858	
1.35	.0531			....	.1405		28	6.2	.2441			9.6	.3780			22.62	.8906	$\frac{57}{64}$
....	.0550		54	3.57	.1406	$\frac{9}{64}$	....	6.25	.2460		D	9.7	.3819			23.0	.9055	
1.4	.0551			3.6	.1417			6.3	.2480			9.75	.3838			23.02	.9062	$\frac{29}{32}$
1.45	.0570			....	.1440		27	6.35	.2500	$\frac{1}{4}$		9.8	.3858			23.42	.9219	$\frac{59}{64}$
1.5	.0591			3.7	.1457			6.4	.2520			....	.3860		W	23.5	.9252	
....	.0595		53	....	.1470		26	6.5	.2559			9.9	.3898			23.81	.9375	$\frac{15}{16}$
1.55	.0610			3.75	.1476			....	.2570		F	9.92	.3906	$\frac{25}{64}$	....	24.0	.9449	
1.59	.0625	$\frac{1}{16}$	....	....	.1495		25	6.6	.2598			10.0	.3937			24.21	.9531	$\frac{61}{64}$
1.6	.0629			3.8	.1496			....	.2610		G	....	.3970		X	24.5	.9646	
....	.0635		52	....	.1520		24	6.7	.2638			....	.4040		Y	24.61	.9687	$\frac{31}{32}$
1.65	.0649			3.9	.1535			6.75	.2657	$\frac{17}{64}$	....	10.32	.4062	$\frac{13}{32}$	....	25.0	.9843	
1.7	.0669			....	.1540		23	6.75	.2657			....	.4130		Z	25.03	.9844	$\frac{63}{64}$
....	.0670		51	3.97	.1562	$\frac{5}{32}$	....	....	.2660		H	10.5	.4134			25.4	1.0000	1

For U. S. equivalents of valve clearance, crankshaft end play, and torque values, use the following listing and the following torque conversion chart:

	D317D	F475D	(1) F476D	F673D	(2) 674D
Valve—Int.	.014"	.014"	.014"	.014"	.014"
Clearance—Exh.	*.018"	*.018"	.028"	.028"	.031"
*.028" for D317DS and F475DS					
Crankshaft	.002"—	.002"—	.0035"—	.0035"—	.0035"
End Play	.010"	.010"	.0115"	.0115"	.0115"
Torque Values—					(3) 174 ft. lbs.
Cylinder Head	137 ft. lbs.	137 ft. lbs.	137 ft. lbs.	174 ft. lbs.	(3) 217 ft. lbs.
Main Bearings	152 ft. lbs.	152 ft. lbs.	152 ft. lbs.	210 ft. lbs.	210 ft. lbs.
Main Bearing					
Transverse Bolts					
Rod Bearings	80 ft. lbs.	80 ft. lbs.	80 ft. lbs.	80 ft. lbs.	80 ft. lbs.
Flywheel	137 ft. lbs.	137 ft. lbs.	137 ft. lbs.	137 ft. lbs.	137 ft. lbs.
Vibration Damper		80 ft. lbs.	80 ft. lbs.	80 ft. lbs.	80 ft. lbs.
Vibration Damper Hub	542 ft. lbs.	542 ft. lbs.	542 ft. lbs.	542 ft. lbs.	542 ft. lbs.
Oil Pan	36 ft. lbs.	36 ft. lbs.	36 ft. lbs.	36 ft. lbs.	36 ft. lbs.
Flywheel Housing	43 ft. lbs.	43 ft. lbs.	40 ft. lbs.	62 ft. lbs.	62 ft. lbs.
Injectors	7 ft. lbs.	7 ft. lbs.	7 ft. lbs.	7 ft. lbs.	7 ft. lbs.
Injection Tubing Nuts	11—14 ft. lbs.	11—14 ft. lbs.	11—14 ft. lbs.	11—14 ft. lbs.	11—14 ft. lbs.
Rocker Arm Shaft Retaining Screws	34 ft. lbs.	34 ft. lbs.	34 ft. lbs.	61 ft. lbs.	61 ft. lbs.
Stop Screw in End of Rocker Shaft			36 ft. lbs.		36 ft. lbs.

- (1) F476 engine 761785 and up
(2) F674 engine 888806 and up
(3) M16 bolt torque to 174 ft. lbs.
M18 bolt torque to 217 ft. lbs.

TORQUE CONVERSION CHART

kgm	ft. lbs. equiv.	kgm	ft. lbs. equiv.	kgm	ft. lbs. equiv.
.7	5	4.1	30	15	108
.8	6	4.7	34	19	137
1	7	5	36	20	145
1.4	10	6	43	21	152
1.5	11	6.2	45	22	159
1.6	12	6.7	48	24	174
2	14	8.4	61	26	188
2.1	15	8.5	62	29	210
2.4	17	11	80	30	217
2.5	18	13	94	42	304
2.8	20	14	101	75	542

Waukesha

DRESSER

Waukesha Engine Division Dresser Industries, Inc.

WARRANTY AND LIMITATION OF REMEDY AND LIABILITY

Effective September 1, 1976

A. Seller warrants only that its products and parts, when shipped, and its work (including start-up), when performed, will meet all applicable specifications and other specific product and work requirements, including those of performance, if any, of this agreement, and will be free from defects in material and workmanship. With respect to products, parts and work not manufactured or performed by Seller, Seller's only obligation shall be to assign to Buyer, to the extent possible, whatever warranty Seller receives from the Manufacturer. All claims for defective products or parts under this warranty must be made in writing immediately upon discovery and, in any event, within eighteen (18) months after shipment, but not to exceed twelve (12) months of service or 4000 operating hours after initial startup, whichever occurs first, and all claims for defective work must be made in writing immediately upon discovery and in any event within one (1) year of completion thereof by Seller. Defective items must be held for Seller's inspection and if requested by Seller returned to the original f.o.b. point, transportation prepaid. THE FOREGOING IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES WHATSOEVER, EXPRESS, IMPLIED AND STATUTORY INCLUDING WITHOUT LIMITATION THE IMPLIED WARRANTIES TO MERCHANTABILITY AND FITNESS. It is understood that Seller's warranty shall not apply to products or parts, which in Seller's opinion, have been damaged as a result of overloading, overspeeding, overheating, inadequate maintenance, accident or improper installation or storage.

B. Upon Buyer's submission of a claim as provided above and its substantiation Seller shall at its option either (i) repair or replace its product, part or work at the business establishment of a Waukesha Distributor or other location authorized by Waukesha, during said Distributor normal business hours. This Warranty does not include reimbursement of any costs for transporting the product or part to such establishment, or for removal or reinstallation of a product when necessary in connection with a Warranty repair, or (ii) refund an equitable portion of the purchase price. In no event shall Seller be liable for the cost of labor in connection with replacement or repair of defective parts when the engine or power unit has been in the possession of the using owner or rental operator for a period of six (6) months or longer.

C. THE FOREGOING IS SELLER'S ONLY OBLIGATION AND BUYER'S EXCLUSIVE REMEDY FOR BREACH OF WARRANTY AND, EXCEPT FOR GROSS NEGLIGENCE WILLFUL MISCONDUCT AND REMEDIES PERMITTED UNDER THE PERFORMANCE, INSPECTION AND ACCEPTANCE AND THE PATENTS CLAUSES HEREOF, THE FOREGOING IS BUYER'S EXCLUSIVE REMEDY AGAINST SELLER FOR ALL CLAIMS ARISING HEREUNDER OR RELATING HERETO WHETHER SUCH CLAIMS ARE BASED ON BREACH OF CONTRACT, TORT (INCLUDING NEGLIGENCE AND STRICT LIABILITY) OR OTHER THEORIES; BUYER'S FAILURE TO SUBMIT A CLAIM AS PROVIDED ABOVE SHALL SPECIFICALLY WAIVE ALL CLAIMS FOR DAMAGES OR OTHER RELIEF, INCLUDING BUT NOT LIMITED TO CLAIMS BASED ON LATENT DEFECTS. IN NO EVENT SHALL BUYER BE ENTITLED TO INCIDENTAL OR CONSEQUENTIAL DAMAGES. ANY ACTION ARISING HEREUNDER OR RELATING HERETO WHETHER BASED ON BREACH OF CONTRACT, TORT (INCLUDING NEGLIGENCE AND STRICT LIABILITY) OR OTHER THEORIES, MUST BE COMMENCED WITHIN ONE (1) YEAR AFTER THE CAUSE OF ACTION ACCRUES OR IT SHALL BE BARRED.

DISTRIBUTORS AND SERVICE

The Waukesha Engine Division has established a system of reputable distributors with trained mechanics and full facilities for maintenance and rebuilding, and to carry an adequate parts stock in all areas of major engine population all over the world. Their sales engineers are available for installation consultation. If you cannot locate a Waukesha distributor in your area, contact the Waukesha Service Division, 1000 West St. Paul Avenue, Waukesha, Wisconsin 53186, or call (414) 547-3311.

Authorized distributors can respond to your service needs more quickly if the following procedures are observed:

1. Give engine model, serial number and specification number which are stamped on the nameplate attached to the crankcase. The serial number is also stamped on the crankcase at either the gear cover or flywheel housing end.
2. When ordering parts, always furnish the complete description and part number, where known, of the parts wanted. Do not use the words "complete" or "sets"—state the quantity of each item required.
3. Tell the distributor how and where to ship parts—state whether to ship by freight, express or parcel post—furnish shipping point and post office address. Without specific shipping instructions the distributor will use his own discretion and will not be responsible for any charges by doing so. Be sure to mark your name, address, and where you can be reached on any order for parts as well as on any correspondence.
4. Terms on repair—to avoid delay, all repairs will be C.O.D. unless prior arrangements are made with the distributor.

In situations which may fall within the parameter of the Waukesha Engine Division standard warranty obligations, proceed as follows:

1. When placing a request for service, specifically state that the repair is believed to be within the

terms of warranty (this may be indicated on the purchase order if desired). Produce documentation showing the date of start up or installation of the engine and the engine model, serial number and specification number.

2. Once the service or repair is completed, pay for the service and/or parts in accordance with whatever terms were previously arranged, but indicate with the payment that a claim is pending under the provisions of warranty.
3. Confirmation of the submission of a warranty claim can be requested from the Waukesha distributor handling the repair. This is usually done by a notation on the distributor's invoice to the end user.
4. The Waukesha distributor will notify you via letter or credit on an invoice of the decision of the Waukesha Engine Division as to the request for warranty on a particular repair.
5. Any parts replaced in the repair which may be subject to warranty should be left with the distributor for proper handling.
6. Any part replaced under warranty assumes the identity of the part which it replaces in regard to warranty. That is to say, if the engine is six months old the new part placed in that engine for a failed part is six months old in regard to any future warranty determination.

Remember—you own the best. If repairs are needed use only Genuine Waukesha Parts purchased from Authorized Waukesha Distributors.

Distributor Directory

UNITED STATES

ALABAMA

BIRMINGHAM, 35233
Carlross Well Supply Company
Branch Office
2901 - 3rd Avenue, South
Phone: (205) 324-0689
Main Office - See Tennessee

ALASKA

ANCHORAGE, 99502
Waukesha-Alaska Corporation
239 E. International Airport Road
Phone: (907) 278-9651

ARIZONA

PHOENIX, 85005
Arizona Engine & Pump Co.
407 South 17th Avenue
P.O. Box 6159, Capital Station
Phone: (602) 252-1731

CASA GRANDE, 85222 - Branch Office
896 West Gila Bend Highway
Phone: (602) 836-8731

TUCSON, 85705 - Branch Office
4260 N. Sullinger
Phone: (602) 888-1690

ARKANSAS

FT. SMITH, 72901 - Branch Office
Waukesha-Pearce Industries, Inc.
6006 Hwy. 71 South
P.O. Box 6312
Phone: (501) 646-4396

CALIFORNIA

EMERYVILLE, 94608
King-Knight Company
6202 Christie Avenue
Phone: (415) 658-9400

COMPTON, 90221
Waukesha Engine Servicer, Inc.
17803 S. Santa Fe Avenue
Phone: (213) 774-5700

BAKERSFIELD, 93301 - Branch Office
1221 - 33rd Street
Phone: (805) 327-7571

VENTURA, 93001 - Branch Office
1636 N. Ventura Avenue
Phone: (805) 648-1865

EMERYVILLE, 94608
Waukesha Engine Division
(Western Regional Office)
1900 Powell St., Suite 455
Phone: (415) 653-1824

COLORADO

DENVER, 80239
PAMCO
P.O. Box 39088
10777 East 45th Avenue
Phone: (303) 371-0330

FLORIDA

JACKSONVILLE, 32205
Gator Service & Supply, Inc.
2535 St. Clair St.
P.O. Box 37446
Phone: (904) 783-1280

POMPANO BEACH, 33061
Melley Energy Systems, Inc.
P.O. Box 999
941 S.W. 12th Avenue
Phone: (305) 941-0200

GEORGIA

ATLANTA, 30325
Demco Division
Division of Auto Electric & Diesels
810 Lambert Dr. N.E.
Phone: (404) 876-3622

DECATUR, 30035
Waukesha Engine Division
(Southeastern Regional Office)
4336 Covington Highway
Suite 204C
Phone: (404) 289-0960

HAWAII

HONOLULU, 96820
Waukesha Engine Servicer Co. - Hawaii
P.O. Box 30525
Phone: (808) 833-3664

ILLINOIS

VILLA PARK, 60181
Charles Equipment Company
P.O. Box 368
187 East North Avenue
Phone: (312) 834-6000

GRAYVILLE, 62844
Oil Field Motor Service, Inc.
P.O. Box 98
Phone: (618) 375-2151

DEERFIELD, 60015
Waukesha Engine Division
(Central Regional Office)
108 Wilmet Rd., Suite 203
Phone: (312) 948-5210

INDIANA

INDIANAPOLIS, 46202
Eagle Machine Company, Inc.
P.O. Box 88
635 East Market Street
Phone: (317) 637-2521

IOWA

WATERLOO, 50704
Lewis Motor Supply Inc.
1801 Washington Street
P.O. Box 328
Phone: (319) 235-1481

KANSAS

KANSAS CITY, 66103
Sam Brown Company
275 Southwest Blvd.
P.O. Box 3248
Phone: (913) 831-9770

GREAT BEND, 67530
PAMCO - Branch Office
714 Patton Road
Phone: (316) 793-3553
Main Office - See Colorado

LIBERAL, 67901
PAMCO - Branch Office
210 Country Estates Road
Phone: (316) 624-5674
Main Office - See Colorado

KENTUCKY

LOUISVILLE, 40203
Atlas Machine & Supply Inc.
1328 West Jefferson
Phone: (502) 584-7262

LOUISIANA

HARVEY, 70058
Reagan Equipment Company
P.O. Drawer 628 (Zip 70059)
2230 Peters Road
Phone: (504) 367-1870

MORGAN CITY, 70380 - Branch Office
P.O. Drawer 2487
Highway 90 East
Phone: (504) 831-0321

VIDALIA, 71373 - Branch Office
P.O. Box 914
Highway 84 West
Phone: (318) 336-7161

NEW IBERIA, 70560
Waukesha-Pearce Industries, Inc.
Branch Office
P.O. Box 938
939 Jane Street
Phone: (318) 369-3741

Main Office - See Texas

SHREVEPORT, 71107
Waukesha-Pearce Industries, Inc.
Branch Office
P.O. Box 7066
1815 Barton Drive
Phone: (318) 221-4075
Main Office - See Texas

MARYLAND

BALTIMORE, 21230
Tate Engineering, Inc.
601 W. West Street
Phone: (301) 539-0787

MASSACHUSETTS

ALLSTON, BOSTON, 02134
W. A. Kraft Corporation
308 North Harvard Street
Phone: (617) 782-0076

MICHIGAN

NOVI, 48050
Engine Supply of Novi, Inc.
P.O. Box 437
44455 Grand River
Phone: (313) 349-3330

MINNESOTA

SOUTH ST. LOUIS PARK, 55426
Jeffco Power Systems
2238 Florida Avenue S.
Phone: (612) 546-5566

MISSISSIPPI

HEIDELBERG, 39439
Reagan Equipment Co. - Branch Office
P.O. Box 285
Highway 28 West
Phone: (601) 787-2221
Main Office - See Louisiana

JACKSON, 39208
Reagan Equipment Co. - Branch Office
P.O. Drawer 5700
Highway 80 East
Phone: (601) 939-4512
Main Office - See Louisiana

MISSOURI

ST. LOUIS, 63118
Charles Equipment Company
3100 Gravois Avenue
Phone: (314) 771-4700

NEW JERSEY

CARLSTADT, 07072
W. A. Kraft Corporation - Branch Office
485 Washington Avenue
Phone: (201) 933-5151
(212) 868-0135
Main Office - See Massachusetts

RIDGEWOOD, 07451
Waukesha Engine Division
(Northeastern Regional Office)
1156 East Ridgewood Avenue
Phone: (201) 652-4808

NEW MEXICO

FARMINGTON, 87401
PAMCO - Branch Office
P.O. Box 1558
218 Airport Drive
Phone: (505) 325-7529
Main Office - See Colorado

HOBBS, 88240
Waukesha-Pearce Industries, Inc.
Branch Office
P.O. Box 488
2601 West Marland
Phone: (505) 393-9155
Main Office - See Texas

NEW YORK

SYRACUSE, 13202
Power Plant Equipment Corp.
929 S. Salina Street
Phone: (315) 475-7251

LATHAM, 12110
Power Plant Equip. Corp. - Branch Office
6 Northway Lane
Phone: (518) 783-1991

TONAWANDA, 14150
Ronco Power Systems
595 Sheridan Drive
Phone: (716) 873-0760

NORTH DAKOTA

WILLISTON, 58801
PAMCO - Branch Office
P.O. Box 1147
Highway 2 North
Phone: (701) 572-6343

Main Office - See Colorado

OHIO

YOUNGSTOWN, 44509
Power Equipment, Inc.
168 South Meridian Road
Phone: (216) 782-1475

COLUMBUS, 43219 - Branch Office
P.O. Box 19085
889 N. 22nd Street
Phone: (614) 253-2711

NORTH ROYALTON, 44133 - Branch Office
10156 Royalton Road
Phone: (216) 237-1818

OKLAHOMA

WOODWARD, 73801
Waukesha-Pearce Industries, Inc.
Branch Office
P.O. Box 1086
Martia Road
Phone: (405) 256-7421

Main Office - See Texas

OKLAHOMA CITY, 73124
Waukesha-Pearce Industries, Inc.
Branch Office
1128 S.E. 25th
P.O. Box 24003
Phone: (405) 670-1381

Main Office - See Texas

OREGON

PORTLAND, 97210
I-D, Inc.
P.O. Box 10124
2355 N. W. Quimby Avenue
Phone: (503) 226-7966

PENNSYLVANIA

PITTSBURGH, 15234
P.C. McKenzie Company
3561 Valley Drive
Phone: (412) 833-2100

SOUTH CAROLINA

CHARLESTON, 29405
Diesel Engineers, Inc.
2025 Austin Avenue
P.O. Box 4398
Phone: (803) 554-5151

TENNESSEE

MEMPHIS, 38105
Carlson Well Supply Company
111 North Parkway Avenue
Phone: (901) 526-1141

NASHVILLE, 37213 - Branch Office
101 South First Street
Phone: (615) 254-1669

TEXAS

HOUSTON, 77035
Waukesha-Pearce Industries, Inc.
P.O. Box 35068
12320 South Main Street
Phone: (713) 723-1050

ARILENE, 79604 - Branch Office
P.O. Box 1562
3542 S. Treadway
Phone: (915) 692-4045

CORPUS CHRISTI, 78408 - Branch Office
P.O. Box 9267
5226 Frontage Road I-37
Phone: (512) 884-8275

IRVING, 75060 - Branch Office
P.O. Box 365
525 North Loop 12
Phone: (214) 259-1581

KILGORE, 75662 - Branch Office
P.O. Box 1185
Industrial Blvd.
Phone: (214) 984-2011

ODESSA, 79760 - Branch Office
P.O. Box 3549
1000 West 2nd Street
Phone: (915) 332-9106

PAMPA, 79066 - Branch Office
P.O. Box 1976
201 N. Price Road
Phone: (806) 668-3251

SAN ANTONIO, 78222 - Branch Office
P.O. Box 20163
J. Frank Dobie Station
3740 S.E. Loop 410
Phone: (512) 824-7256

SAN JUAN, 78589 - Branch Office
P.O. Box 246
Phone: (512) 787-4231

WICHITA FALLS, 76307 - Branch Office
P.O. Box 2185
4725 Jacksboro Highway
Phone: (817) 767-9234

HOUSTON, 77027
Waukesha Engine Division
(Mid-Continent Regional Office)
1835 West Loop South
410 Honeywell Building
Phone: (713) 626-0255

UTAH

SALT LAKE CITY, 84115
Diesel Electric Service & Supply
P.O. Box 15858
652 W. 17th Street, South
Phone: (801) 972-1836

VERNAL, 84078
PAMCO - Branch Office
P.O. Box 400
Highway 40 East
Phone: (801) 789-3383

Main Office - See Colorado

WASHINGTON

SEATTLE, 98107
Kem Equipment, Inc.
4301 Leary Way, N.W.
Phone: (206) 784-2372

WISCONSIN

APPLETON, 54911
Arthur G. Dietrich Co., Inc. - Branch Office
641 Hickory Farm Lane
Phone: (414) 731-6666

MILWAUKEE, 53217
Arthur G. Dietrich Co., Inc.
8635 N. Port Washington Road
Phone: (414) 352-7452

WAUKESHA, 53187
Waukesha Engine Division
Main Office
P.O. Box 379
1000 West St. Paul Avenue
Phone: (414) 547-3311

WYOMING

CASPER, 82601
PAMCO - Branch Office
P.O. Drawer 2795
3400 West Yellowstone Road
Phone: (307) 234-1548

Main Office - See Colorado

CANADA

ALBERTA

CALGARY - T2C 1H9
PAMCO, Ltd.
8241 - 31st St., S.E.
Phone: (403) 279-5561

CALGARY X-T2P OM2
Waukesha Engine Division
(Western Canada Regional Office)
Aquitaine Tower, Suite 540
540 - 5th Avenue, S.W.
Phone: (403) 266-8666

EDMONTON 82 - T6E 4N6 - Branch Office
P.O. Box 5798 Postal Station L
8235 Wagner Road
Phone: (403) 466-5371

REDCLIFFE - T1A 7N4 - Branch Office
P.O. Box 870
No. 2 1001 Highway Avenue, N.
Phone: (403) 546-3935

BRITISH COLUMBIA

RICHMOND V7C 4R9
PAMCO, Ltd. - Branch Office
5920-F No. 2 Road
Phone: (604) 278-7956

MANITOBA

WINNIPEG R3A 0X8
KeeWatn Electric & Diesels, Ltd.
1040 Coulter Avenue
Phone: (204) 772-0443

NEW BRUNSWICK

MONCTON - E1C 8N6
Consolidated Engines & Machinery
Co., Ltd. - Branch Office
146 Albert Street
P.O. Box 848
Phone: (506) 854-0982

Main Office - See Quebec

ONTARIO

TORONTO 16 - M4A 2N3
Atlas Polar Company, Ltd.
60 Northline Road
Station "O", P.O. Box 160
Phone: (416) 751-7740

QUEBEC

MONTREAL H4T 1L7
Consolidated Engines & Machinery
Co., Ltd.
8550 Delmeade Road
Phone: (514) 342-9233

LORETTEVILLE G2A AT2
Consolidated Engines & Machinery
Co., Ltd.
38, Louis Hebert
Phone: (418) 842-8531

TABLE OF CONTENTS

This table of contents is applicable to only Waukesha models D317D and DS, F475D and DS, and F673D, DS and DSI. These models are designated by Scania as D and DS5R40, R41, R80, A01, and M01; D and DS8R40, R41, R80, A01, and M01; and D, DS, and DSI11R40, R40A, R41, R80, R81, R82A, A01, and A02, respectively.

SUBJECT	PAGE NO.
Scania Manual—Explanation of Use.	III
General Engine:	
Description	3
Trouble Shooting and Repair	19
Specifications	79
Special Bulletins	101
Installation	165
Separate Engine Modifications	179
Cooling System:	
Description	189
Trouble Shooting and Repair	195
Specifications	201
Special Bulletins	207
Fuel System:	
Description	223
Trouble Shooting and Repair	229
Specifications	261
Special Bulletins	289
Miscellaneous:	
Compressors	311
Hydraulic Pumps.	330b
Batteries	331
Conversion Factors	337
Bolt Strength Classes.	341
Bolt Tightening Torques	343
Safety Precautions	

INDEX

CAUTION

This index is applicable to only Waukesha models D317D and DS, F475D and DS, and F673D, DS, and DSI. These models are designated by Scania as D and DS5R40, R41, R80, A01, and M01; D and DS8R40, R41, R80, A01, and M01; and D, DS, and DSI11R40, R40A, R41, R80, R81, R82A, A01, and A02, respectively.

Subject	Page	Subject	Page
Battery--Requirements	331	Installation Checks	165
Battery--Storage	334a	Installation Instructions	174a
Bearings--Replacement	152b		
	186-93	Lubricating Oil Cleaner--Maintenance	159
Bushings, Camshaft--Replacement.	65	Lubricating Oil Recommendations	112a
Camshaft--Installation	66	Lubricating Oil System--Description	13
Camshaft Nut Torque.	154b	Modifications--D/DS11 Marine.	179
Camshaft--Removal	63	Oil Cleaner--Description	14
Cold Start--Bosch Pump & RQV Gov.	297	Oil Cleaner--Repair	74
Cold Start Device--Operation	291	Oil Cooler--Repair	77
Cold Weather Starting	103	Oil Pan--Removal and Replacement.	71
Compressor Leakage Prevention	327	Oil Pressure Reduction Valve--Adjustment	76
Compressor TU FLO 500--Repair & Replacement	311	Oil Pressure Valve for D/DS8 and D/DS11	160a
Compressor Piston TU FLO 500.	330a	Oil Pump--Description	14
Connecting Rods--Removal & Insp	55	Oil Pump--Removal & Replacement	71
Conversion Factors	337	Oil Pump--Repair.	72
Coolant Leakage on D5 & D8 Series	123	Piston & Ring--Installation	57
Coolant Requirements	209	Piston & Ring Replacement Combinations	141
Cooling System--Description	189	Reduction Valve Modification on D/DS11	157
Cooling System--Fan Belt Tension	199	Reduction Valve on D/DS11	139
Cooling System--Temp. Gauge Check	199	Rings--Compression for D/DS11.	149
Cooling System--Thermostat Check.	199	Specifications-- Compressor	325
Crankcase Ventilation--Description	17	and Cooling System.	203
Crankshaft--Description	9	Tightening Crankshaft & Torques Pistons	93
Crankshaft For D/DS11	152a	Cylinder Block	91
Crankshaft--Removal & Replacement	49	Cylinder Head.	81
Cylinder Block--Machining Upper face on DS8	133	Engine General	79
Cylinder Block-- Replacement D/DS11	137	Fuel System	261
Cylinder Head--Gasket for D/DS8.	186-89	Injectors	287
Cylinder Head--Inspection.	21	Lubricating System	99
Cylinder Head--Installation	29	Timing Gears	97
Cylinder Head--Leakage Prevention.	115	Turbocharger	85
Cylinder Head--Removing	19	Water Pump	201
Cylinder Sleeves--Removal & Replacement	43	Strength Classes for Bolts & Nuts	341
Drain Plug Leakage	131	Thermostat Housing Gasket.	121
Engine Designation	3	Thermostat--Opening Temp.	215
Engine Mounting Rubber D/DS11	161	Thermostat--Sealing	216a
Flywheel--Housing for DS8	151	Timing Gears--Description.	11
Flywheel--Removal	51	Timing Gears--Forged Design for D/DS8	154a
Flywheel Housing Sealing Ring Removal & Replacement.	52	Timing Gears--Removal & Replacement	61
Fuel Filters--Maintenance	257	Tightening Torques--Bolt Classes	343
Fuel System--Description	223	Turbocharger--Charging Pressure.	175
Fuel System--Trouble Shooting	229	Turbocharger--Compressor Wheel Damage	129
Governor--Bosch EP/RSV Adjustment.	303	Turbocharger--Description.	7
Governors--Maintenance & Adjustment	244	Turbocharger--Oil Filter	155
Hydraulic Pump	330b	Turbocharger--Fitting Oil Pipes DS11 Marine	185
Injection Equipment Usage	301	Turbocharger--Repair & Replacement	33
Injection Pump Coupling--Bosch.	295	Valve Clearance--Procedure	30
Injection Pump Coupling--CAV	293	Valves & Mechanism--Repair & Replacement	20
Injection Pump--Description	225	Valves--Removing	20
Injection Pump--Maintenance.	233	Valve Seats--Oversize	119
Injection Pump Shelf for DS8 and D/DS11.	153	Vibration Damper--Description	9
Injector--Description	227	Vibration Damper--Installation.	69
Injector--Maintenance.	249	Vibration Damper--Removal	61
		Water Pump--Installation Check Marine Type	219
		Water Pump Modification D/DS8 and D/DS11	213
		Water Pump--Overhaul	195

TABLE OF CONTENTS

This table of contents is applicable to only Waukesha models F476D and DS, which are designated by Scania as D and DS8A02, A04, A05, and A06. Engine serial numbers for these models are from 761785 (Sweden) and 133869 (Netherlands).

SUBJECT	PAGE NO.
Scania Manual—Explanation of Use.	III
General Engine:	
Description	186-1
Trouble Shooting and Repair	186-13
Specifications	186-67
Special Bulletins	186-83
Installation	165
Cooling System:	
Description	189
Trouble Shooting and Repair	198-1
Specifications	204-1
Special Bulletins	207
Fuel System:	
Description	223
Trouble Shooting and Repair	242-1
Specifications	261
Special Bulletins	289
Miscellaneous:	
Compressor	311
Hydraulic Pump	330b
Batteries	331
Conversion Factors	337
Bolt Strength Classes	341
Bolt Tightening Torques	343
Safety Precautions	

INDEX

CAUTION

This index is applicable to only Waukesha models F476D and DS, which are designated by Scania as D and DS8A02, A04, A05, and A06. Engine serial numbers for these models are from 761785 (Sweden) and 133869 (Netherlands).

Subject	Page	Subject	Page
Battery--Requirements	331	Lubricating Oil Cleaner--Maintenance	159
Battery--Storage	334a	Lubricating Oil Recommendations	186-83
Bearings--Replacement	186-93	Lubricating Oil System--Description	186-9
Bushings, Camshaft--Replacement.	186-56	Modifications	186-85
Camshaft--Removal and Fitting	186-56	Oil Cleaner--Description	186-10
Cold Start--Bosch Pump & RQV Gov.	297	Oil Cleaner--Repair	186-64
Cold Start Device--Operation	291	Oil Cooler--Repair	186-65
Cold Weather Starting	103	Oil Pressure Reduction Valve--Adjustment	186-62
Compressor Leakage Prevention	327	Oil Pressure Valve	106a
Compressor TU FLO 500--Repair & Replacement	311	Oil Pump--Description	186-10
Compressor Piston TU FLO 500.	330a	Oil Pump--Removal & Replacement	186-61
Connecting Rods--Removal & Insp	186-45	Piston & Ring--Installation	186-46
Conversion Factors	337	Piston & Ring Replacement Combinations	141
Coolant Leakage	123	Specifications-- Compressor	325
Coolant Requirements	209	and Cooling System.	204-1
Cooling System--Description	189	Tightening Crankshaft & Torques Pistons	186-75
Cooling System--Fan Belt Tension	199	Cylinder Block	186-73
Cooling System--Temp. Gauge Check	199	Cylinder Head.	186-69
Cooling System--Thermostat Check.	200-1	Engine General	186-67
Crankcase Ventilation--Description	186-11	Fuel System	261
Crankshaft--Description	186-5	Injectors	287
Crankshaft--Removal & Replacement	186-51	Lubricating System	186-81
Cylinder Head--Gasket	186-25	Timing Gears	186-79
Cylinder Head--Inspection.	186-20	Turbocharger	186-72
Cylinder Head--Installation	186-25	Water Pump	204-1
Cylinder Head--Leakage Prevention.	115	Strength Classes for Bolts & Nuts	341
Cylinder Head--Removing	186-18	Thermostat--Opening Temp.	206-1
Cylinder Sleeves--Removal & Replacement	186-38	Timing Gears--Description.	186-7
Drain Plug Leakage	131	Timing Gears--Removal & Replacement.	186-49
Engine Designation	186-1	Timing Gear Housing and Seal Removal and Replacement	186-55
Flywheel--Removal and Replacement	186-48	Tightening Torques--Bolt Classes	343
Flywheel Housing Sealing Ring Removal and Replacement	186-41	Turbocharger--Charging Pressure.	186-71
Fuel Filters--Maintenance	257	Turbocharger--Compressor Wheel Damage	129
Fuel System--Description	223	Turbocharger--Description.	186-3
Fuel System--Trouble Shooting	229	Turbocharger Oil Filter --Changing	186-65
Governor--Bosch EP/RSV Adjustment.	303	Turbocharger--Oil Filter Warning	155
Governors--Maintenance & Adjustment	243	Turbocharger-Reconditioning	186-91
Hydraulic Pump	330b	Turbocharger--Repair & Replacement	186-27
Injection Equipment Usage	301	Valve Clearance--Procedure	186-26
Injection Pump Coupling--Bosch.	295	Valves & Mechanism--Repair & Replacement	186-21
Injection Pump Coupling--CAV	293	Valves--Removal	186-18
Injection Pump--Description	225	Valve Seats--Oversize	119
Injection Pump--Maintenance.	242-1	Vibration Damper--Description	186-5
Injector--Description	227	Vibration Damper--Installation.	186-50
Injector--Maintenance.	249	Vibration Damper--Removal	186-49
Injector Sleeve Replacement	186-19	Water Pump--Installation Check Marine Type	219
Installation Checks	165	Water Pump Modification	213
Installation Instructions	174a	Water Pump--Overhaul	198-1

TABLE OF CONTENTS

This table of contents is applicable to only Waukesha models F674D, DS, and DSI, which are designated by Scania as D, DS, and DSI11A04, A05, A06, and A07. Engine serial numbers for these models are from 888806 (Sweden) and 156300 (Netherland).

SUBJECT	PAGE NO.
Scania Manual—Explanation of Use.	III
General Engine:	
Description	18-1
Trouble Shooting and Repair	78-1
Specifications	100-1
Special Bulletins	101
Installation	165
Cooling System:	
Description	189
Trouble Shooting and Repair	198-1
Specifications	204-1
Special Bulletins	207
Fuel System:	
Description	223
Trouble Shooting and Repair	242-1
Specifications	264-1
Special Bulletins	289
Miscellaneous:	
Compressor	311
Hydraulic Pump	330b
Batteries	331
Conversion Factors	337
Bolt Strength Classes.	341
Bolt Tightening Torques	343
Safety Precautions	

INDEX

CAUTION

This index is applicable to only Waukesha models F674D, DS, and DSI, which are designated by Scania as D, DS, and DSI11A04, A05, A06, and A07. Engine serial numbers for these models are from 888806 (Sweden) and 156300 (Netherlands).

Subject	Page	Subject	Page
Battery--Requirements	331	Oil Cleaner--Repair	78-52
Battery--Storage	334a	Oil Cooler--Repair	78-53
Bearings--Replacement	152b	Oil Pressure Reduction Valve--Adjustment	78-50
Bushings, Camshaft--Replacement.	78-44	Oil Pressure Valve	106a
Camshaft Nut Torque.	154b	Oil Pump--Description	18-10
Camshaft--Removal and Fitting	78-44	Oil Pump--Removal & Replacement	78-49
Cold Start--Bosch Pump & RQV Gov.	297	Piston & Ring--Installation	78-34
Cold Start Device--Operation	291	Piston & Ring Replacement Combinations	141
Cold Weather Starting	103	Reduction Valve Modification	157
Compressor Leakage Prevention	327	Reduction Valve	139
Compressor TU FLO 500--Repair & Replacement	311	Rings--Compression	149
Compressor Piston TU FLO 500.	330a	Specifications-- Compressor	325
Connecting Rods--Removal & Insp	78-33	and Cooling System	204-1
Conversion Factors	337	Tightening Crankshaft & Torques Pistons	100-11
Coolant Requirements	209	Cylinder Block	100-9
Cooling System--Description	189	Cylinder Head.	100-3
Cooling System--Fan Belt Tension	199	Engine General	100-1
Cooling System--Temp. Gauge Check	199	Fuel System	264-1
Cooling System--Thermostat Check.	200-1	Injectors	287
Crankcase Ventilation--Description	18-11	Lubricating System	100-17
Crankshaft--Description	18-5	Timing Gears	100-15
Crankshaft--Removal & Replacement	78-39	Turbocharger	100-7
Cylinder Block--Replacement.	137	Water Pump	204-1
Cylinder Head--Inspection.	78-7	Strength Classes for Bolts & Nuts	341
Cylinder Head--Installation	78-12	Thermostat Housing Gasket.	121
Cylinder Head--Removing	78-6	Thermostat--Opening Temp.	206-1
Cylinder Sleeves--Removal & Replacement	78-26	Thermostat--Sealing	216a
Drain Plug Leakage	131	Timing Gears--Description.	18-7
Engine Designation	18-1	Timing Gears--Removal & Replacement	78-43
Engine Mounting Rubber	161	Timing Gear Housing and Seal Removal and Replacement	78-30
Flywheel--Removal and Replacement	78-36	Tightening Torques--Bolt Classes	343
Flywheel Housing Sealing Ring Removal and Replacement	78-29	Turbocharger--Charging Pressure.	100-5
Fuel Filters--Maintenance	257	Turbocharger--Compressor Wheel Damage	129
Fuel System--Description	223	Turbocharger--Description.	18-3
Fuel System--Trouble Shooting	229	Turbocharger Oil Filter--Warning	155
Governor--Bosch EP/RSV Adjustment.	303	Turbocharger--Oil Filter --Changing	78-53
Governors--Maintenance & Adjustment	243	Turbocharger--Fitting Oil Pipes DS11 Marine	185
Hydraulic Pump	330b	Turbocharger--Reconditioning	130-1
Injection Equipment Usage	301	Turbocharger--Repair & Replacement	78-15
Injection Pump Coupling--Bosch.	295	Valve Clearance--Procedure	78-13
Injection Pump--Description	225	Valves & Mechanism--Repair & Replacement	78-8
Injection Pump--Maintenance.	242-1	Valves--Removal	78-6
Injector--Description	227	Valve Seats--Oversize	119
Injector--Maintenance.	249	Vibration Damper--Description	18-5
Installation Checks	165	Vibration Damper--Installation.	78-38
Installation Instructions	174a	Vibration Damper--Removal	78-37
Lubricating Oil Cleaner--Maintenance	159	Water Pump--Installation Check Marine Type	219
Lubricating Oil Recommendations	112a	Water Pump Modification	213
Lubricating Oil System--Description	18-9	Water Pump--Overhaul	198-1
Modifications	112a-1		
Oil Cleaner--Description	18-10		

SCANIA

Service Handbook

SCANIA

Marketing Section
Service
151 87 Södertälje

0	General
1	Engines
2	Cooling System
3	Fuel and Exhaust System
4	
5	
6	
7	
8	
9	
10	Air Pressure Systems
11	
12	
13	Steering Gears
14	
15	
16	Electrical Equipment
17	
18	
19	
20	

SEKTIONERNAS MARKERING
MARKING OF THE SECTIONS
SEKTIONSMARKIERUNG
LA MARCA DE LAS SECCIONES

Funktionsbeskrivningar har ett mörkt fält med bokstäverna "FU" enl. denna placering

Function Descriptions have a dark setting with the letters "FU" on this level

Funktionsbeschreibungen haben ein dunkles Feld mit den Buchstaben "FU" laut dieser Plazierung

Las Descripciones de Funcionamiento llevan un rectángulo negro con las letras "FU" a esta altura



Arbetsbeskrivningar har ett mörkt fält med bokstäverna "AR" enl. denna placering

Work Descriptions have a dark setting with the letters "AR" on this level

Arbeitsbeschreibungen haben ein dunkles Feld mit den Buchstaben "AR" laut dieser Plazierung

Las Descripciones de Trabajo llevan un rectángulo negro con las letras "AR" a esta altura



Specifikationer har ett mörkt fält med bokstäverna "SP" enl. denna placering

Specifications have a dark setting with the letters "SP" on this level

Spezifikationen haben ein dunkles Feld mit den Buchstaben "SP" laut dieser Plazierung

Las Especificaciones llevan un rectángulo negro con las letras "SP" a esta altura



Speciella informationer har ett mörkt fält med bokstäverna "SI" enl. denna placering

Special Information have a dark setting with the letters "SI" on this level

Spezielle Informationen haben ein dunkles Feld mit den Buchstaben "SI" laut dieser Plazierung

Las Informaciones Especiales llevan un rectángulo negro con las letras "SI" a esta altura



0.

Allmänt

General

Allgemeines

Generalidades

SCANIA

SERVICEHANDBOK
SERVICE HANDBOOK
SERVICEHANDBUCH
MANUAL DE SERVICIO

a	Allmänna anvisningar för servicehandboken General Instructions for the Service Handbook Allgemeine Anweisungen für das Service Handbuch Instrucciones generales por el manual de servicio
b	Innehållsförteckning List of Contents Inhaltsverzeichnis Indice
c	Komponentförteckningar List of Assemblies Komponentenverzeichnisse Listos de los componentes
d	Allmänna data och normer General Data and Standards Allgemeine Daten und Normen Datos generales y normas
e	Smörjmedel, bränsle, kylvätska, kemikalier Lubricants, Fuel, Coolant, Chemicals Schmiermittel, Kraftstoff, Kühlflüssigkeit, Chemikalien Lubricante, combustible, liquido refrigerante, artículos químicos
f	Verktygsförteckning Tool List Werkzeugverzeichnis Lista de las herramientas
g	
h	
i	
k	

SERVICE SCANIA

PRODUCTS

grupp/group	General	
0a	number/number	sida/page
	1	1
datum/date	best. nr/order nr	
1.9.71	500a E	

COMPLETING THE SERVICE HANDBOOK

When the Service Handbook is to be completed with new pages or bulletins the following should be heeded:

When making out a new order always indicate the order number. This number is quoted in the form heading on the first page of each section.

Furthermore, as each Service Handbook is available in four different designs, each page has been provided with a code, that indicates which binder the page is to be inserted in.

The code is located at the bottom of the page to the right and has the following importance:

SE Service Handbook Scania Products
SF Service Handbook Scania Trucks
SG Service Handbook Scania Buses
SH Service Handbook Scania Engines

When inserting new pages the following procedure is carried out:

- 1 Main Group:** This is indicated in the form heading. The main groups are located under tabs 0–19 and the classification is to be found on the first page in the binder.

VIA	grupp/group	Work Description	
	11a	number/number	sida/page
		1	1
	datum/date	best. nr/order nr	
	1-12-01	511a E	

ND REAR AXLE POSITION

SERVICE SCANIA	grupp/group	number/number	sida/page
	11a	1	3.

Working of Rear Axle Position Measureme

ments see that the

- 2 Sub-Group:** This is also indicated in the form heading. The sub-groups lie under tabs a-k and the classification is to be found on each separate fly-leaf in each main group.

VIA	grupp/group	Work Description	
	11a	number/number	sida/page
		2	1
	datum/date	best. nr/order nr	
	71-12-01	511a E	

OF CHASSIS FRAMES

SCANIA	grupp/group	number/number	sida/page
	11a	2	3.

the above mentioned difficulties we have decided

some cross-members in sections. This appli

support bearing mounting (4th cr

the rear spring brack

SE, SF, SG, SH

SCANIA PRODUCTS	grupp/group	Function Description	
	14b	nummer/number	sida/page
	1	1	
datum/date		best. nr/order nr	
71-10-01		514b E	

- 3 **Section:** This is indicated in clear text in the form heading on the first page in each section. The section has also been marked with a thumb index, which has different positions for each section. These positions are again to be found on the first page in the binder.

BUSES AND BUS CHASSIS

Throttle cylinder (5) is a magnetic engaged.

SERVICE SCANIA	grupp/group	nummer/number	sida/page
	14b	1	3

piston (1) upwards. The piston (1) activates the piston (3) which then moves the throttle lever arm to position 1.

Magnetic valve for increased idling (6) is used in order to raise the idling speed to a more suitable value, when the selector has been turned to position "F" or "B".

Disrupted by the magnetic valve (6) disrupting the air suspension tank (7) and the charging the air existing in the

- 4 **Assembly Number:** Finally, look up the right number according to the assembly classification. This number is shown in the form heading and the classification is again to be found in the list of contents for each section.

Special Information 3-1 518a 31 E	Special Information 4-3 511a 4 31	Special Information 9-1 511a 11
---	---	---------------------------------------

Insert the pages under the current assembly number. Special information is inserted in numerical order and remaining information inserted in page numerical order.

SCANIA PRODUCT	grupp/group	Work Description	
	11a	nummer/number	sida/page
	1	1	
datum/date		best. nr/order nr	
71-12-01		511a E	

CHASSIS FRAME AND REAR AXLE POSITION

from the horizontal level is measured at the front ruler, and is corrected for the frame width of 900 mm according to illustration 2.

The distortion can be distributed over a long part of the frame, but it can also be due to the fact that one frame side member has become bent vertically, e.g. in conjunction with a collision.

2. Vertical bending can easily be determined by sighting being made on the lower edge of the frame. In order to localize the deformation it is advisable to make use of a ruler with approximately 1/2 m length according to Fig. 3.

3. The amount of deformation as well as its size can be determined by stretching a thread or wire across the frame. However, it is not recommended to stretch the thread or wire across the frame as it may damage the paint.

For Axle Position Measurements

measurements are taken that the unloaded wheel is perpendicular to the frame. Before measuring, there is no abnormal play in wheel bearings, hub, in balance arms as well. Check that the same is true on rear and the same to prevent wheel movements (hand-brake).

1. Flange and, in applicable cases, the castor hubs. Clean the contact surfaces of the flange and attach the ball with at least three Tool No. of the dummy shaft is 81427 for tool No. 81750 for series 75 and 38.

2. Fix the flange with the help of a plumb line.

3. Before measuring the dummy shaft, it is preferable with one measuring tool No. 81427. Drawing axle wheel center must be made in order to measure for trailing.

SERVICE SCANIA

PRODUCTS

grupp/group

0a

General

nummer/number

2

sida/page

1

datum/date
1.9.71

best. nr/order nr
500a E

CLASSIFICATION OF SERVICE HANDBOOK

- 1 Main Group Classification:** Here the products have been divided up into different units and functions.

Ex. 0 General, 1 Engines, 2 Cooling System and so on.

The main groups are numbered 0–19 and the classification for the variants E, F and G correspond to the classification in the Spare Parts Lists.

In order to obtain the same classification in all four variants in the Service Handbook, the classification, however, in the variant G, Service Handbook Scania Engines, will deviate from corresponding spare parts lists.

Some of the main groups are not included in this variant for the same reason.

The first page in the binder shows how this main group classification is drawn up and, on each page, the number of the main group is indicated in the form heading.

Service Handbook SCANIA Products

Function Description

Work Description

Specifications, Setting Values, Tests

Special Information

AB SCANIA-VABIS
Bilddivisionen - Automotive Group
Marknadsavdelningen - Marketing Division
Service
S-151 87 Sodertälje
Sweden

0	General Instructions List of Contents List of Abbreviations
1	Engines
2	Cooling System Engine Heater
3	Fuel and Exhaust System
4	Clutches
5	Transmissions
6	Propeller Shafts
7	Front Axles
8	Rear Axles
9	Hubs and Wheels
10	Brakes and Compressed Air Systems
11	Frames
12	Steering Systems
13	Steering Gears and Hydraulic Systems
14	Engine Control
15	Sheet-metal Engine Cover Plate
16	Electrical Equipment
17	Instruments
18	Cabs Bodies
19	Miscellaneous

18c Function Description

70 - 110

6

1

- 2 Sub-Group Classification:** The object with this classification is to combine together the same type units and models, which from the service view-point should be conveniently dealt with in the same section.

The Sub-Group Classification re-occurs within each main group and is made effective with aid of tabs a-k. Ex. Main Group 18 Cabs, Bodies divided up into a. L-trucks, b. LB-trucks and c. buses.

How the classification functions is shown by a fly-leaf under each main tab. The sub-group is also included in the form heading.

**18 Cabs
Bodies**

**18 Fahrerrhäuser
Karosserien**

**18 Cabines
Carrocerias**

a	L-Trucks L-Fahrzeugen Camiones L
b	LB-Trucks LB-Fahrzeugen Camiones LB
c	Buses Busse Autobuses

18c Work Description

70 - 110

6

1

On the first page of each section or bulletin there is indicated in clear text, in the form heading, to which section this belongs. The four sections are separated in addition by a thumb index, which is imprinted on each right-hand side. This thumb index has various positions for the different sections and the location is shown by the page in the binder.

Service Handbook		General Instructions List of Contents List of Assemblies		1		3		1		1	
Function Description		1 Engines		2 Cooling System Engine Heater		3 Fuel and Exhaust System		4 Clutches		5 Transmissions	
Work Description		6 Propeller Shafts		7 Front Axles		8 Rear Axles		9 Hubs and Wheel		10 Brakes and Com- pressed Air Systems	
Specifications, Setting Values, Tools		11 Frames		12 Suspension Systems		13 Steering Gears and Hydraulic Systems		14 Engine Control		15 Sheet Metal Engine Cover Plate	
Special Information		16 Electrical Equipment		17 Instruments		18 Cabs Bodies		19 Miscellaneous			

4 Assembly Classification: Within each section the units are then divided up into smaller units. This is achieved by numbering from 0-9. Thus for instance, Group 18a Cabs and Bodies L-Trucks, are divided up into 1 Cab Frame, 2 Cab Fitting, 3 Doors etc.

This assembly is also indicated in the form heading on each page respectively and the classification is to be found again in the list of contents for each section. Otherwise, this classification is indicated by reason of each section being prefaced on a new page with a squared form heading.

Within each similar section there is a following consecutive page number. This does not, however, apply to the section "Special Information". In this section the number follows for assembly classification of a running serial number, on account of the fact that several bulletins may arrive for each similar assembly. Within each bulletin of this kind there is also a consecutive page number.

SERVICE SCANIA

PRODUCTS

180

Special Information

0-0 0

18 CABS, BODIES

4 L Vehicles

List of Contents

General
Cab Frames
Cab Framing
Doors
Cab Sheet Metal
Cab parts
Cab Equipment
Miscellaneous

Number

0
1
2
3
4
5
6
7
8
9

180

Special Information

3-1

10/00/01

5184.21 E

ON HL-CABS

1. Door handle on the neutral position and door is that it locks out to the frame and door lock shall be adjusted accordingly.

2. The complete lock from the door opening 1 from support 2 plate for door lock in shape of a lug 3 for figure 4. No distortion of the lock plate 1 on lug 3.

3. In the door and check to be correct position mechanism for the side window caught up in the door lock mechanism.

1-11-1988

Approved by: L. Verheijen

SE SF

SE SF

SERVICE SCANIA

PRODUCTS

grupp/group

List of contents

0b

nummer/number

0

sida/page

1

datum/date

74-08-15

~~74-03-30~~

best. nr/order nr

E 500b

GRP	NO	Page Number	Applies to: All products	SI
0b	1	1	Instructions for List of Contents Current Interest, Classification, Ordering of Service Handbooks Shortening Section Descriptions Text Alterations Dating Distribution of Supplements Sorting out of Service Information	Concerning the contents reference is made to section "SPECIAL INFORMATION"
	2	1	List of Contents Current List of Contents, October 1973	
	3	1	Operation Card Paper edition for all Service Handbook subscribers. Plastic covered card to be ordered separately	

3200-712

XI

SE, SF, SG, SH

SERVICE SCANIA

PRODUCTS

grupp/group	Instructions for the list of contents	
	nummer/number	sida/page
Ob	1	1
datum/date	73-09-30	best. nr/order nr
74-08-15		E 500b

THE CURRENCY OF THE LIST OF CONTENTS

The list of contents which is issued in April and October each year always supersedes the previous issue.

The object of this being to give the service handbook holders the opportunity to bring their books up-to-date on these occasions, i. e.

- to check that the contents in the binders conform with the list
- also to sort out the bulletins that are no longer current

Note well too that the list of contents Ob:2 is arranged in the order that the pages are to be inserted in the binders.

SCANIA SERVICE HANDBOOK

The service handbook is divided up into two main parts:

- PRODUCTS
- WORKSHOPS (only intended for dealers)

The part SCANIA PRODUCTS contains the entire product programme and has **distribution code SA**.

From this main part it is possible to obtain an extract applicable for:

SF = TRUCKS

SG = BUSES

SH = SEPARATE ENGINES

There is only one list of contents for all four volumes SE, SF, SG and SH. The column before the last therefore indicates what is included in these.

ORDERING

The order numbers that are indicated in the last column of the list of contents show in which small parts you can order the contents in the SERVICE HANDBOOK:

- e. g. 6201b refers to all pages that are included under 1b and the sections FU, AR and SP.
- Special Information on the other hand can be ordered separately which is clearly shown also in the last column.

ALL ORDERING OF SERVICE LITERATURE SHALL TAKE PLACE THROUGH SCANIA DEALERS IN ACCORDANCE WITH SPECIAL PROCEDURES ALREADY ESTABLISHED (SEE 92:1 IN SERVICE HANDBOOK, WORKSHOPS).

ABBREVIATION OF SECTIONAL DESCRIPTIONS

- FU = Function description
- AR = Work description
- SP = Specifications, setting values, tools
- SI = Special Information

TEXT AMENDMENTS

On replacement pages

Shorter, **important** amendments that may be difficult to notice are marked with a line to **the left-hand side of the text column**.

Larger amendments that are clearly delineated are not marked.

On revised reprints

In respect of revision reprints as from 1974 the amendments are not even marked in complete sections.

THE DATING OF SPECIAL INFORMATION AND OTHER BULLETINS

Since January 1972 the dating of SI and other bulletins in the Service Handbook has been done on the very day the author has finally completed the bulletin. That means in effect that all information right up to the date of the bulletin is taken into consideration. Bulletins in the Swedish, English, German and Spanish languages with identical information are therefore given the same dating.

Beginning successively from October/November 1972 we will date the bulletins with the next nearest distribution day date, i. e. either on the 15th or 30th day in each month (February 28th).

The date applying for the Swedish issue will also apply for the corresponding bulletin in the foreign languages concerned.

From December 1972 work/print numbers have been applied. These numbers are indicated in the left-hand bottom corner and always begin with 3200 — plus one consecutive number. The same bulletin or pages with comparable numbers in the different languages have the same information, provided of course the print numbers conform.

DISTRIBUTION OF ADDITIONS

In order to meet the wishes from the field and to ensure that the distribution during the interim periods of April/October shall increase, we will, as soon as convenient, number the additions and, on a separate page, indicate which section, page, Special Information etc. is sent out. The date of distribution and the distribution code will also be shown there.

SORTING OUT OF THE BULLETINS

The numbers indicated below of Special Information are no longer applicable or have been processed in during revision of corresponding section.

What shall I do with them?

Since the conditions vary within different dealer areas we think it best for those responsible to decide whether the bulletins sorted out shall be thrown away or kept for a further period in a special binder.

3200-712

SE, SF, SG, SH

SERVICE SCANIA

PRODUCTS

grupp/group	Scrapping of bulletins	
	number, number	side, page
Ob	1	3
datum/date	77-03-31	best nr. order
78-04-15		E500b

SCRAPPING OF BULLETINS

The special information bulletins listed below are no longer valid or have been re-worked in connection with revision of the corresponding section.

Bulletin	Waukesha Page Number	Book	Bulletin
	293,294	5445C	8e SI 1-2
	295, 296	5445C	8f SI 2-4
			2-5
3a SI 1-4			
1-5			
4a SI 1-4			
1-5			
2-11			
5d SI 1-7			
1-14			
9-1			
5e SI 1-2			12a SI 1-1
1-3			1-2
6a SI 1-1			15a SI 0-2
1-2			
1-4			17a SI 1-4
1-5			
8a SI 1-8			18a SI 3-2
1-10			
4-2			18b SI 2-3
			2-4

grupp/group	List of contents	
	nummer/number	side/page
Ob	2	1
datum/date	27-03-93	best. nr./order nr.
78-04-15		E500h

This list comprises up to distribution No. 88

3200-1284

grupp	sekt	nr	sida
0b		2	2

	No. of leaves		No. of leaves		No. of leaves
2c Cooling system separate engines				5b Gear boxes, GR860	
Work descriptions, specifications	3	No. 4 Dual-disc clutch K3641 for DS11		List of contents, function- and work descriptions, specifications	42
SI 502c: 0-0		No. 5 Replacing bearings in the flywheel		SI 505b: 1-6	
1-1		No. 6 Single-disc clutches with diaphragm spring (K4223, -24, -25)		1-7	
1-2				2-11	
9-2				2-12	
9-3				2-13	
		SI 504a: 0-0		2-14	
		1-6		2-15	
		1-8		2-16	
		1-9		5-4	
Group 03 Fuel and exhaust system		2-12			
		2-13		5d Gear boxes, H/HR501	
3a Fuel and exhaust system D5, DS5, D8, DS8, D11, DS11				List of contents, function- and work descriptions, specifications	44
List of contents, function- and work descriptions, specifications	91	4b Clutch controls, vehicles		SI 505d: 0-0	
SI 503a: 0-0		List of contents, function- and work descriptions, specifications	27	0-1	
0-1		No. 1 Clutch servo		1-3	
1-7		LB81/86/111/141-trucks		1-6	
1-8		No. 2 Clutch servo		1-8	
5-3		L, LS, LT111-trucks		1-10	
5-5		No. 3 Clutch servo		1-11	
6-1		L, LS141, LT146-trucks		1-12	
6-2		No. 4 Clutch servo LK-trucks		1-13	
6-4		No. 5 Clutch operation		1-15	
		L81/86/111-trucks		1-16	
3b Fuel and exhaust system D14, DS14		No. 6 Clutch servo BR, CR86/145 and B, BF 86/111-buses		1-17	
List of contents, function- and work descriptions, specifications	18			1-18	
SI 503b: 0-0		SI 504b: 0-0		1-19	
1-5		1-2		1-20	
		1-3		9-3	
3c Fuel and exhaust system separate engines		4c Disc clutches, industrial engines		5e Gear boxes, GA651/652	
List of contents, specifications	27	Work description	1	Function- and work descrip- tions, specifications	7
SI 503c: 0-0		SI504c: 1-1		SI 505e: 0-0	
2-2				5h Gears for separate engines	
				SI 505h: 0-0	
				1-1	
				1-2	
Group 04 Clutches					
4a Disc clutches, vehicles					
List of contents, work descrip- tions, specifications	22				
No. 1 Single disc clutches with helical springs					
No. 3 Dual-disc clutch K3841 for DS14					

datum	
78-04-15	77-03-31

SERVICE SCANIA

grupp	sekt	nr	sida
0b		2	3

3200-1284

grupp	sekt	nr	sida
0b		2	4

	No. of leaves		No. of leaves
Group 13 Steering gears		SI 516a: 0-0	
		0-1	
13a Power steering gear 8065		0-2	
List of contents, function- and		0-3	
work descriptions, specifications	15	0-4	
		0-5	
SI 513a: 0-0		0-10—0-140	
1-1		1-2	
1-3		1-3	
		4-1	
13c Hydraulic pump with tank		4-6	
Function- and work descriptions	3	4-9	
		4-10	
SI 513c 0-0		4-11	
1-1			
1-3			
		16b Electrical equipment, separate engines	
		SI 516b: 4-2	
		4-3	
Group 14 Engine control			
14b Engine control, buses		Group 17 Instruments	
List of contents, function- and			
work descriptions	4	17a Instruments, vehicles	
SI 514b: 1-1		SI 517a: 1-3	
		1-6	
Group 15 Sheet-metal engine cover plate			
15a Vehicles		17b Instruments, separate engines	
Work descriptions	5	List of contents, function- and	
		work descriptions, specifications	41
SI 515a: 0-1			
1-1			
Group 16 Electrical equipment			
16a Electrical equipment, vehicles			
List of contents, work descrip- tions	3		

(Note: Pages XXI — XXIV have been obsoleted)

SERVICE SCANIA

PRODUCTS

grupp/group

List of contents

0c

nummer/number

0

sida/page

1

datum/date
74-03-30

best. nr/order nr
E 500c

GRP	NO	Page Number	Applies to: All products	SI
0c	0	1	Key to Component Designations General Principles, Engines Clutches, Gearboxes, Power take-offs Transmission Shafts, Final Gears, Vehicle Axles, Cabs, Steering Gears	Concerning the contents reference is made to section "SPECIAL INFORMATION"
	1	1	Component List – Trucks Diesel Engine, Gearbox, Clutch, Power take-off, Transmission Shafts Final Gear, Vehicle Axles, Steering Gears, Cabs	
	2	1	Component List – Buses Diesel Engine, Gearbox, Clutch, Transmission Shafts, Final Gear, Vehicle Axles, Steering Gears	

3200 656

SERVICE SCANIA

PRODUCTS

Key to component designations	
nummer/number	side/page
0	1

Supersedes bulletin 19a:1-1 dated August 13, 1971

KEY TO COMPONENT DESIGNATIONS

GENERAL

In conjunction with the new product range, Saab-Scania has introduced a standard for designating more important components. Consistent designations have therefore been introduced for some components which did not earlier have a designation other than the part number. The objective of this new system is to simplify the identification of components and thus facilitate the work of the service and spare parts departments.

The new system of designations includes components in production on June 1, 1971.

PRINCIPLES

The basic arrangement of the designations can be described as follows:

1. Main assembly. One letter.
2. Sub-assemblies (location, principle of design or operation). One or two letters.
3. Size designation. One or two digits.
4. Application (inclusion in vehicles, etc.). One digit or letter. This designation is employed in all cases.
5. Development/variant. One or two digits.

The letter designations generally refer to the English descriptions, although it has been necessary to make some exceptions in order to avoid a clash of designations.

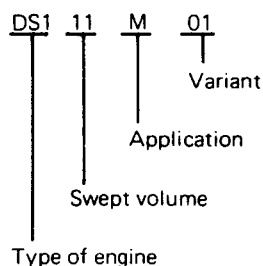
The components which have a significant need for a designation have been included as main assemblies in the system.

Designation

Diesel engines	D
Clutches	K
Gearboxes	G
Power take-offs	E
Transmission shafts	T
Final reduction gears	R
Vehicle axles	A
Cabs	H
Steering gear	S

ENGINES

Typical application



Type of engine

- D diesel engine without turbocharging (normally aspirated engine)
- DS diesel engine with turbocharging
- DSI diesel engine with turbocharging and intercooling (air cooler between the turbocharger and the induction manifold).

Swept volume

The swept volume is designated to the nearest integer corresponding to the swept volume in dm^3 (litres) of the engine.

Application

- A general applications which do not require a marine cooling system (built-in engines).
- B bus chassis
- C complete bus
- L truck, bonnet type or semi-cab-over-engine.
- LB cab-over-engine truck.
- M engine requiring a marine cooling system.

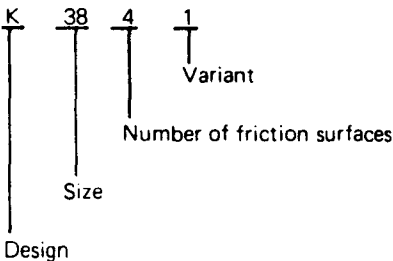
grupp	nr	sekt.	side
0c	0		2

Variant

Designated with a number in sequential order. The characteristics which necessitate a new variant number should be differences in the basic design of the engine for a given field of application. As an example, the differences may lie in the output, special design for some major customer or market.

CLUTCHES

Typical applications



Design

- K dry plate
- KV wet plate

Size

Specified by two digits which indicate the diameter of the plates in centimeters.

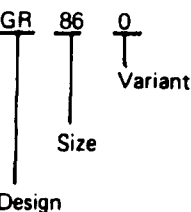
Number of friction surfaces

Variant

Specified from case to case and designated with the digits 1—9.

GEARBOXES

Typical applications



Design

- G mechanical gear changing, a series of gearwheels
- GS mechanical gear changing, a diviable series of gearwheels
- GR mechanical gear changing one low ratio and one high ratio series
- GA fully automatic or semi-automatic gear changing
- GA can be followed by V (bevel gears), S (Split), R (Range), A (Automatic).

Size

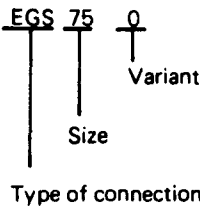
Specified by one digit between 1 and 9, referring to the relative strength in relation to other gearboxes and one digit between 0 and 9, referring to the relative size of the fly-wheel housing to which the gearbox is to be connected.

Variant

Specified from case to case and designated by one digit between 0 and 9.

POWER TAKE-OFF

Typical application



Type of connection

- ED diesel engine
- EK clutch
- EG mechanical gearbox, main unit
- EGS mechanical gearbox, auxiliary unit
- EGA automatic gearbox

Size

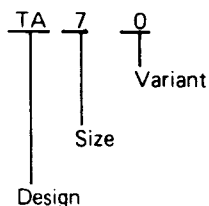
Specified by means of the size designation applicable for the main component to which the power take-off is connected.

Variant

Specified from case to case and designated with one digit between 0 and 9.

TRANSMISSION SHAFTS

Typical application



Design

T propeller shafts (including that between the axles of a tandem bogie)

TA intermediate shaft

Size

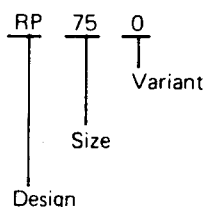
Specified with one digit for the relative size.

Variant

Specified from case to case and designated with one digit between 0 and 9.

FINAL REDUCTION UNITS

Typical applications



Design

R single reduction unit for connection to the front axle, single rear axle or rear bogie axle

RB single reduction unit for the front bogie axle on tandem operation

RP single reduction unit and hub reduction units for single rear axle or rear bogie axle

RT single reduction unit with two speeds

RBP single reduction unit with hub reductions for the front bogie axle on tandem operation.

The letter V may be added after the above designations to indicate a bevel gear design.

Size

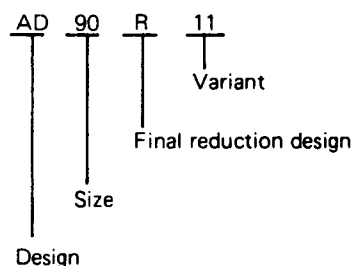
Specified with two digits. The first digit between 1 and 9 specifies the relative strength and the second digit between 0 and 9 specifies the banjo pitch circle diameter.

Variant

Specified from case to case and designated with one digit between 0 and 9.

VEHICLE AXLES

Typical applications



Design

AD with driving wheels

AM with steered wheels

AS trailing axle

AT trailer axle

Size

Axle diameter in mm at the inner bearing.

Final reduction design

R with single reduction unit

P with single reduction unit and hub reductions

T with two speeds

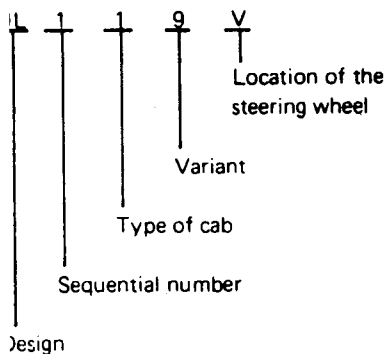
Variant

Specified from case to case and designated with two digits between 01 and 99.

rupp	nr	sekt.	side
0c	0		4

ABS

typical applications



Design

- 4L for cab designed for bonnet type truck
- 4B for cab designed for cab-over-engine trucks

Sequential number

Coded with 1 digit between 1 and 9 in sequential order in the same sequence as new designs of HB and HL cabs or whenever the cab is subjected to extensive modifications.

Type of cab

- 1. Specifies a normal cab
- 2. Specifies a bunk cab.
- 3. Specifies a sleeper cab.

The digits 4–9 are reserved for possible future requirements.

Variant

- 0 specifies that the cab has one window at the rear and one at each of the rear corners.
- 1 specifies that the cab has one window in the rear, one window in each of the rear corners and a roof hatch.
- 2 specifies that the cab has a roof hatch (has no windows in the rear or in the rear corners).
- 3 specifies that the cab has a window at the rear and one window on each side.

4-8 are reserved for possible future requirements

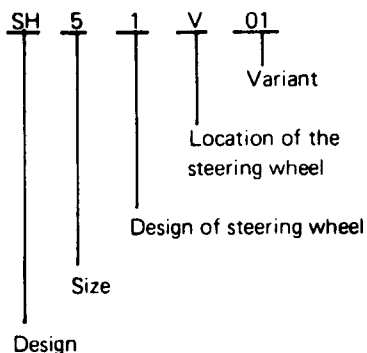
- 9 specifies that the cab is of special design to suit certain specific customers or a specific application (whenever necessary, the design should be specified).

Location of the steering wheel

- H for right-hand
- V for left-hand

STEERING GEAR

Typical applications



1. Design

- S mechanical
- SH hydraulic

2. Size

Specified with a digit between 1 and 9 with regard to the relative strength.

3. Steering gear design

- 0 without bevel gears
- 1 with bevel gears

4. Location of the steering wheel

- V left-hand
- H right-hand

5. Variant

Variant with two digits. The implication should be specified from case to case.

SERVICE SCANIA

PRODUKTER—PRODUCTS—PRODUKTE—PRODUCTOS

grupp/group	Specifications, setting values, tools	
	nummer/number	sida/page
Od	1	1
datum/date	best. nr/order nr	
77-09-15	ETS500d	

HÅLLFASTHETSKLASSER FÖR SKRUVAR OCH MUTTRAR

ISO (International Organization for Standardization) har utarbetat rekommendationer för hållfasthetsfordringar, hållfasthetsmärkning och provning beträffande skruvar och muttrar. Dessa rekommendationer har antagits av de flesta länders standardiseringsorgan.

Detta innebär att vi ändrar hållfasthetsklasserna till den nya standarden.

Hållfasthetsbeteckningen för skruvar enligt de nya hållfasthetsklasserna består av två tal åtskilda av en punkt t.ex. 8.8, 2.9. Talet före punkten i beteckningen 8.8 anger en tiondel av materialets min. brottgräns i kp/mm^2 . Talet efter punkten i beteckningen anger en tiondel av det procentuella förhållandet mellan sträckgräns och brottgräns. Multiplicering av de två talen ger alltså materialets min. sträckgräns i kp/mm^2 .

En skruv med beteckningen 8.8 har alltså brottgränsen 80 kp/mm^2 och sträckgränsen 64 kp/mm^2 .

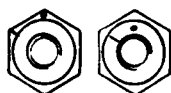
Det kan förekomma att punkten utelämnas. En skruv av hållfasthetsklass 8.8 märks alltså med 8.8 eller 88.

Beteckningen för muttrar i de nya hållfasthetsklasserna består av ett tal. Detta tal anger att muttern är jämnstark med en skruv vars beteckning inleds med samma tal. En mutter i hållfasthetsklass 8 är alltså jämnstark med en skruv i hållfasthetsklass 8.8.

Muttrarna märks med siffror, angivande hållfasthetsklass, eller med kodsymboler, s.k. klockmärkning enligt figur.



Hållfasthetsklass 8
Strength class 8



Hållfasthetsklass 10.
Strength class 10



Hållfasthetsklass 12
Strength class 12

STRENGTH CLASSES FOR BOLTS AND NUTS

ISO (International Organization for Standardization) has drawn up recommendations for strength requirements, strength marking and testing as regards bolts and nuts. These recommendations have been adopted by the standardization associations in most countries.

This means that we alter the strength classes to the new standard.

The strength designation for bolts according to the new strength classes consists of two numbers separated by a dot e.g. 8.8, 2.9. The figure before the dot 8.8 indicates one tenth of the material yield point in kp/mm^2 . The figure after the dot in the designation indicates one tenth of the percentage ratio between yield point and tensile strength. Consequently, multiplication of the two numbers gives the min. material yield point in kp/mm^2 .

Thus a bolt with designation 8.8 has a tensile strength of 80 kp/mm^2 and a yield point of 64 kp/mm^2 .

It can occur that the dot is omitted. Consequently, a bolt of strength class 8.8 is marked with 8.8 or 88.

The designation for nuts in the new strength classes consists of one number. This number indicates that the nut is of equal strength with a bolt the designation of which begins with the same number. A nut in strength class 8 is thus of equal strength with a bolt in strength class 8.8.

The nuts are marked with figures, indicating strength class or with code symbols, so-called clock marking according to the figure.

grupp	sekt	nr	sida
0d	SP	1	2

FESTIGKEITSKLASSEN FÜR SCHRAUBEN UND MUTTERN

ISO (International Organization for Standardisation) hat Empfehlungen für Festigkeitsforderungen, Festigkeitsmarkierung und Prüfung von Schrauben und Muttern ausgearbeitet. Diese Empfehlungen wurden von dem Standardisierungsamt der meisten Länder übernommen.

Dies bedeutet, daß wir die Festigkeitsklassen für den neuen Standard ändern.

Die Festigkeitsbezeichnung für Schrauben nach den neuen Festigkeitsklassen besteht aus zwei durch einen Punkt getrennte Zahlen z.B. 8.8, 2.9. Die Zahl vor dem Punkt 8.8 gibt ein Zehntel von der Mindestbruchgrenze des Materials in kg/mm^2 an. Die Zahl hinter dem Punkt, 8.8, gibt ein Zehntel von dem prozentualen Verhältnis zwischen der Streckgrenze und der Bruchgrenze an. Die Multiplikation der zwei Zahlen ergibt demnach die Mindeststreckgrenze des Materials in kg/mm^2 .

Eine Schraube mit der Bezeichnung 8.8 hat also die Bruchgrenze 80 kg/mm^2 und die Streckgrenze 64 kg/mm^2 .

Es kann vorkommen, daß der Punkt fortfällt. Eine Schraube der Festigkeitsklasse 8.8 wird also mit 8.8 oder 88 markiert.

Die Bezeichnung für Muttern in den neuen Festigkeitsklassen besteht aus einer Zahl. Diese Zahl bezeichnet, daß die Mutter ebenso stark ist wie eine Schraube, deren Bezeichnung mit derselben Zahl anfängt. Eine Mutter in der Festigkeitsklasse 8 ist also ebenso stark wie eine Schraube in der Festigkeitsklasse 8.8.

Die Muttern werden mit Ziffern, welche die Festigkeitsklasse angeben, oder mit Codesymbolen, sog. Uhrzeigersinnmarkierung nach Figur markiert.



Festigkeitsklasse 8
Clase de resistencia 8



Festigkeitsklasse 10
Clase de resistencia 10



Festigkeitsklasse 12
Clase de resistencia 12

CLASES DE RESISTENCIA PARA TORNILLOS Y TUERCAS

La ISO (Organización Internacional de Estandarización) elaboró recomendaciones para exigencias, marcación y ensayos en cuanto a la resistencia de los tornillos y las tuercas. Estas recomendaciones han sido adoptadas por las organizaciones de estandarización de la mayoría de los países.

Esto implica que cambiamos las clases de resistencia al nuevo estandard.

La designación de resistencia según las nuevas clases de resistencia consta de dos números separados por un punto, p. ej. 8.8, 2.9. El número delante del punto 8.8 indica una décima parte de la resistencia mínima a la rotura del material, expresada en kgf/mm^2 . El número después del punto, 8.8, indica una décima parte de la relación percentual entre el límite de elasticidad y la resistencia a la rotura. Por consiguiente, la multiplicación de los dos números da el límite mínimo de elasticidad, expresado en kgf/mm^2 .

Un tornillo con la designación 8.8 tiene por lo tanto un punto de rotura de 80 kgf/mm^2 y un límite de elasticidad de 64 kgf/mm^2 .

También ocurrir que se omita el punto. En tal caso un tornillo de la clase de resistencia 8.8 lleva la referencia 8.8 o 88.

La referencia para tuercas en las nuevas clases de resistencia consta de un número. Este número indica que la fuerza de la tuerca equivale a la de un tornillo cuya referencia empieza con el mismo número. Por lo tanto, una tuerca de la clase de resistencia 8 tiene la misma fuerza que un tornillo en la clase de resistencia 8.8.

Las tuercas estan marcadas con cifras que indican la clase de resistencia, o con claves, llamadas marcación-reloj según la figura

SERVICE SCANIA

PRODUCTS

grupp/group

Od

Specifications, setting values,
tools

nummer/number

2

sida/page

1

datum/date
77-09-15

best. nr/order nr
E 500d

GENERAL TIGHTENING TORQUES FOR SCANIA PRODUCTS

The list below applies to bolts with internal hexagon and external hexagon bolt and hexagon nut of steel in strength class 8 and 10 respectively when they have normal external width across the flats and cross-slotted bolt of steel in strength class 4.8 RX and 5.8 FX, KFX. The engagement length shall be minimum 0.8 d (d = external thread diameter) in material of corresponding strength class or higher.

The tightening torques indicated in this information apply for tools with $\pm 30\%$ permissible torque spread, the values imply the following friction conditions.

Surface treatment				Lubricating conditions
Bolt	Nut	Material	Washer BRB, FBB	
base	untreated	—	untreated	slightly oiled
zinc coated	zinc coated	—	zinc coated	ungreased
zinc coated	—	cast iron or steel untreated	zinc coated	ungreased
phosphated	zinc coated untreated	—	untreated (HRB 400 min)	ungreased

Metrical fine thread

Strength class 8 (even D80)			Strength class 10 (even D100, D120)		
Thread	Tightening Torque		Thread	Tightening Torque	
	Nm	kgm		Nm	kgm
M8 x 1	21	2,1	M8 x 1	27	2,7
M10x1,25	42	4,2	M10x1,25	52	5,2
M12x1,25	77	7,7	M12x1,25	96	9,6
M14x1,5	120	12	M14x1,5	150	15
M16x1,5	190	19	M16x1,5	240	24
M18x1,5	270	27	M18x1,5	340	34
M20x1,5	390	39	M20x1,5	490	49
M22x1,5	530	53	M22x1,5	670	67
M24x1,5	700	70	M24x1,5	870	87

Hexagon bolt and nut

Metrical coarse thread

Strength class 8 (even D80)			Strength class 10 (even D100, D120)		
Thread	Tightening torque		Thread	Tightening Torque	
	Nm	kgm		Nm	kgm
M4	2,4	0,24	M4	3	0,3
M5	5	0,5	M5	6,2	0,62
M6	8	0,8	M6	10	1
M8	20	2	M8	25	2,5
M10	39	3,9	M10	49	4,9
M12	70	7	M12	87	8,7
M14	112	11,2	M14	140	14
M16	180	18	M16	220	22
M18	240	24	M18	300	30
M20	350	35	M20	440	44
M22	490	49	M22	610	61
M24	600	60	M24	760	76

Cross-slotted bolt, metrical coarse threads and UNC-threads

Strength class 4.8 RX, URX; 5.8, FX, UFX, KFX, UKFX (D60)

Thread			Tightening Torques				Remarks
			4,8		5,8		
			Nm	kgm	Nm	kgm	
M	UNC						
3			0,4	0,04	0,7	0,07	The values indicated in this table are adapted for tool with ± 30% spreading
3,5	Nr 6		0,6	0,06	1	0,1	
4	Nr 8		1,5	0,15	2	0,2	
5	Nr 10		2	0,2	3	0,3	
	Nr 12		3	0,3	5	0,5	
6	1/4		4	0,4	7	0,7	
8	5/16		9	0,9	15	1,5	
10	3/8		18	1,8	30	3	
12	7/16		30	3	50	5	

3200-1227

XXXIII

12/10/77

SP

SERVICE SCANIA

PRODUKTER—PRODUCTS—PRODUKTE—PRODUCTOS

grupp/group

Oe

Special Information
Información especial

nummer/number

3 - 1

sida page

1

datum/date

77-09-15

best. nr/order nr

ETS500e:3-1

KORROSIONSSKYDD FÖR KYLSYSTEM

Bakgrund

Vi kommer att införa aluminiumdetaljer i kontakt med kylvätska. Nuvarande korrosionsskydd ger otillfredsställande skydd för aluminium. Därför har vi infört ett nytt korrosionsskydd som passar alla kylsystem.

Aktuell information

Det nya korrosionsskyddet har erhållit gulgrön färg genom tillsats av ett färgämne som är fluorescerande vid belysning med UV-lampa (UV = ultraviolett). Genom att lysa med en UV-lampa kan man hitta eventuella läckor i kylsystemet.

Att iaktta

Korrosionsskyddet följer samma doseringsregler som det tidigare.

Observera att aluminium kan korrodera kraftigt om inte våra rekommendationer beträffande korrosionsskydd följs.

Benämning	Utgår	Tillkommer
Korrosionsskydd	561186	584001

ANTI-CORROSION LIQUID FOR THE COOLING SYSTEM

Background

Parts coming into contact with the coolant will shortly be of aluminium. The present anti-corrosion liquid gives inadequate protection for aluminium. Therefore we have introduced a new anti-corrosion liquid which is suitable for all cooling systems.

Current Information

The new anti-corrosion liquid has a yellow-green colour by addition of a dye, which becomes fluorescent when illuminated with a UV-lamp (UV = ultra-violet). By lighting up with a UV-lamp it is possible to locate any leaks in the cooling system.

Attention

The same dosage liquid apply for the anti-corrosion liquid as previously.

Note! Aluminium can be exposed to considerable corrosion unless our recommendations regarding anti-corrosion liquid are followed.

Description	Discontinued	Added
Anti-corrosion liquid	561186	584001

KORROSIONSSCHUTZ FÜR KÜHLSYSTEM

Anlaß

Für Teile, die mit der Kühlflüssigkeit in Berührung kommen, werden wir Aluminiumteile einführen. Die bisherige Korrosionsschutz gibt ungenügend Schutz bei Aluminium. Deshalb haben wir einen neuen Korrosionsschutz eingeführt, der für alle Kühlsysteme paßt.

Aktuelle Information

Der neue Korrosionsschutz hat jetzt eine gelbgrüne Farbe durch Zusatz eines Farbstoffs, der bei Beleuchtung mit einer UV-Lampe (UV = ultraviolett) schillert. Durch Beleuchtung mit einer UV-Lampe kann man eventuelle Leckagen im Kühlsystem feststellen.

Zu beachten

Für den Korrosionsschutz gelten dieselben Dosierungsregeln wie bisher.

Bitte beachten, daß Aluminium stark korrodieren kann, wenn unsere Empfehlungen bezüglich Korrosionsschutz nicht beachtet werden.

Benennung	Fällt fort	Kommt hinzu
Korrosionsschutz	561186	584001

NUEVO ANTOCORROSIVO PARA SISTEMA DE REFRIGERACION

Antecedentes

Se van a introducir piezas de aluminio que estarán en contacto con el líquido refrigerante. El anticorrosivo empleado actualmente no ofrece a este metal una protección satisfactoria. Por lo tanto se ha introducido un nuevo producto anticorrosivo que conviene a todos los sistemas de refrigeración.

Información actual

El nuevo producto anticorrosivo es de color verde-amarillo por añadidura de un colorante que es fluorescente cuando se ilumina con lámpara ultravioleta. Alumbrando con una lámpara U.V. se pueden localizar eventuales fugas en el sistema de refrigeración.

Se observará

El nuevo producto anticorrosivo sigue la misma dosificación que el antiguo.

Es de observar que el aluminio puede corroerse gravemente si no se observan nuestras recomendaciones de protección anticorrosiva.

Denominación	Saliente	Entrante
Producto anticorrosivo	561186	584001

3200-1233

SERVICE SCANIA

PRODUCTS

grupp/group	Special Information	
	nummer/number	sida/page
0e	3 - 2	1
datum/date	best. nr/order nr	
77-11-15	E500e:3-2	

COOLANT

Brief summary

1. Add Scania anti-corrosion liquid (part No. 584001) to all coolants.

Trucks	First addition	Every 30 000 km (450 h)
81/86/111 series	1 1/2 dm ³ (litres)	1 dm ³ (litre)
141/146 series	2 1/2 dm ³ (litres)	1 1/2 dm ³ (litres)

2. At low outdoor temperatures and consequent risk of freezing, use glycol (preferably glycol without nitrites). Add Scania anti-corrosion liquid in accordance with 1. above. On delivery from the works, the coolant contains anti-corrosion liquid. Add Scania anti-corrosion liquid at intervals of 30 000 km (450 h).

3. If Scania anti-corrosion liquid is added at regular intervals as described above, the coolant can be used as long as it is reasonably clean.

General

Where there is a risk of freezing use as coolant a water-glycol mixture and when there is no risk of freezing water only. These liquids may cause corrosion of certain components in the cooling system, and the coolant should therefore contain suitable protective additives. The additives contain constituents such as pH adjustment agents, lime precipitation preventive agents, and agents which counteract corrosion and cavitation damage.

Water

The water must be free from solid impurities and, as far as possible, free from salts, lime and other dissolved substances. The pH value should be neutral or slightly alkaline (pH of 6-9).

Glycol

Glycol (ethylene glycol) sold for use in coolants usually contains corrosion inhibitors. However, these substances must be adjusted to suit the type of engine and the metals employed in the cooling system. Glycol which does not contain nitrites but which contains Scania anti-corrosion liquid, has been found to provide good protection against damage to the cooling system.

In certain cases, low contents of nitrites may cause accelerated corrosion of aluminium, unless the coolant simultaneously contains a sufficient proportion of Scania anti-corrosion liquid.

The corrosion inhibiting substances are gradually consumed and must therefore be renewed. Scania anti-corrosion liquid must therefore be added to all coolants at the intervals specified above (every 30 000 km or 450 h).

On the other hand, the anti-freeze action of glycol is not impaired, and the glycol as such can be used for several years.

Glycol content

The glycol content can be checked by means of an areometer (see Fig. 1) or by means of an optical instrument (see Fig. 2). The reading indicates the temperature at which minor quantities of ice will begin to form (curve A in Fig. 3).

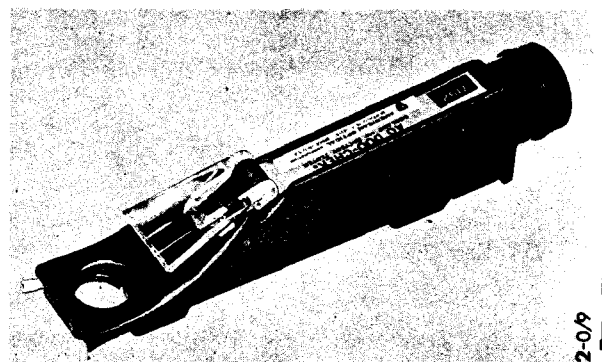
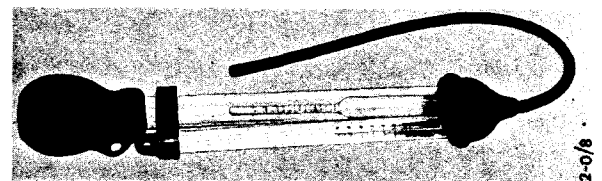


Fig. 2. Optical instrument for measuring the glycol content

3200-1232

grupp	sekt *	nr	sida
0e	SI	3-2	2

However, there is no risk of damage due to freezing, even at appreciably lower temperatures. Down to the "Critical freezing temperature" (curve B in Fig. 3), there is normally no risk of damage. On the other hand, it may take some time after starting (1/2-1 hour) before the cab heater begins to deliver heat. Under such conditions, the engine must not be run under heavy load immediately after starting.

Curve A should thus correspond to the normal winter temperature and curve B to the absolute minimum conceivable temperature.

If the temperature should fall below the "Critical freezing temperature", damage may occur, primarily to the cab heater element.

Example: A coolant contains 30 percent of glycol. Minor ice formation will start at -18°C . At -31°C , there is a risk of damage.

Quantity of glycol necessary at various temperatures

Truck or integrally built bus*	Percent glycol	15	20	25	30	35	40	45	50
	Freezing temperature, read $^{\circ}\text{C}$	-7	-10	-14	-18	-24	-30	-38	-46
	Critical freezing temp., $^{\circ}\text{C}$	-12	-17	-24	-31	-38	-46	-50	-50
	Litres of coolant	Litres of glycol							
L80/85, L81/86	30	5	6	8	9	11	12	14	15
LB80/85, LB81/86	35	6	7	9	11	13	14	16	18
L110, L111	40	6	8	10	12	14	16	18	20
LB110, LB111	45	7	9	12	14	16	18	21	23
	50	8	10	13	15	18	20	23	25
	55	9	11	14	17	20	22	25	28
	60	9	12	15	18	21	24	27	30
	65	10	13	17	20	23	26	30	33
	70	11	14	18	21	25	28	32	35
	75	12	15	19	23	27	30	34	38
L, LB141/146	80	12	16	20	24	28	32	36	40
CR85	85	13	17	22	26	30	34	39	43
	90	14	18	23	27	32	36	41	45
CR145	95	15	19	24	29	34	38	43	48
	100	15	20	25	30	35	40	45	50
CR111M	105	16	21	27	31	37	42	48	53
	110	17	22	28	32	40	44	50	55
	115	18	23	29	34	41	46	52	58
	120	18	24	30	35	42	48	54	60
	125	19	25	32	37	44	50	57	63

* The coolant volumes specified for trucks and buses are approximate. More accurate values will be found in the appropriate Driver's Manual.

Example: An LB111 is to be protected against freezing at temperatures down to -18°C . The coolant must then contain 30 percent of glycol. In the case of the LB111, this corresponds to 14 litres of glycol and the remainder of water. This mixture will normally eliminate the risk of damage down to -31°C .

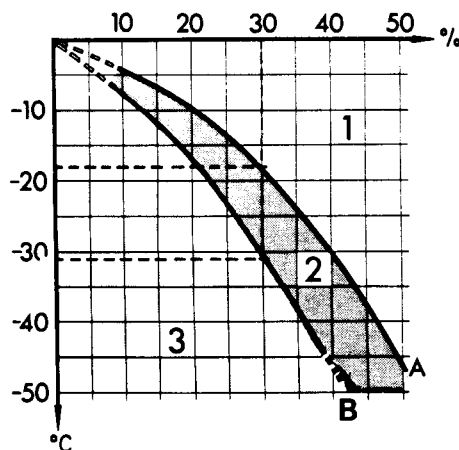


Fig. 3 Curve A: Freezing starts
Curve B: Critical freezing temperature
1: Safe zone
2: Disturbances may occur
3: Risk of damage

Changing the coolant

If Scania anti-corrosion liquid is added as specified, the coolant need not be changed as long as it is clear and thus does not contain appreciable quantities of solids and sludge. If the coolant is cloudy, it must be drained and the cooling system must be flushed with water.

New trucks

On delivery from the works, the cooling system contains glycol, anti-corrosion liquid and water.

If there is no risk of freezing where the truck is to be used, this coolant should be drained and the cooling system should be filled with a mixture of water and anti-corrosion liquid only.

Scania anti-corrosion liquid (part No. 584001)

Scania anti-corrosion liquid should be added at regular intervals (every 30 000 km or 450 h). Higher concentration of anti-corrosion than recommended will cause no damage.

	First * addition, dm ³ (litres)	Every 30 000 km (450 h) dm ³ (litres)
Trucks		
81/86/111	1 1/2	1
141/146	2 1/2	1 1/2
Integrally built buses		
CR85	2 1/2	1 1/2
CR110, 111	3 1/2	2
CR145	3	1 1/2
Others, dm³ (litres) of coolant		
16-30	1	1/2
30-50	1 1/2	1
50-65	2	1
65-80	2 1/2	1 1/2
80-100	3	1 1/2
100-115	3 1/2	2
115-130	4	2

* On delivery from the factory, the cooling system contains pure glycol and Scania anti-corrosion liquid, in addition to water. It is therefore sufficient to make up the anti-corrosion protection at intervals of 30 000 km (450 h). Otherwise, make the "first addition" when filling the system with new coolant.

Other anti-corrosion additives

Other types and makes of anti-corrosion agents are obviously available on the market in the form of chemical additives, possibly combined with coolant filters.

Many different additives are available, but tests on their properties are extremely expensive and time-consuming. We are therefore unable to offer advice on their performance in the cooling systems of our engines. An additional factor is that the various manufactures often modify the compositions of their additives without prior notice.

SERVICE SCANIA

PRODUCTS

grupp/group

1 a

List of contents

nummer/number

0

sida/page

1

datum/date

74-02-28

best. nr/order nr

E6201a

GRP	NO	Page Number			Applies to:	SI
		FU	AR	SP	D5, D8, D11, DS5, DS8, DS11	
1a	0	—	—	1	General	Concerning the contents reference is made to section "SPECIAL INFORMATION"
		1	—	—	Engine Type Designations	
	1	—	—	1	Cylinder Head	
		—	1	—	Removing the Cylinder Head	
		—	2	—	Reconditioning the Cylinder Head	
		—	9	—	Fitting the Cylinder Head	
		—	10	—	Adjusting the Valve Clearance	
		—	11	—	Retightening the Cylinder Head Nuts	
	2	—	—	—	Intake and Exhaust Systems	
		1	—	1	Turbocharger 3 LD, 4LE, T-04B	
		—	1	—	Turbocharger Checks	
		—	3	—	Model 3LD, Repair Instructions	
		—	6	—	Model 4LE, Repair Instructions	
		—	9	—	Model T-04B, Repair Instructions	
	3	—	—	1	Cylinder Block	
		—	1	—	Measuring Cylinder Wear	
		—	1	—	Changing Cylinder Liners	
	4	—	—	1	Crankshaft and reciprocating parts	
		1	1	—	Crankshaft	
		1	3	—	Vibration Damper	
		—	3	—	Flywheel	
		—	6	—	Connecting Rods	
		1	8	—	Pistons and Piston Rings	
	5	1	—	1	Timing Gears	
		—	1	—	Dismantling the Timing Gears	
		—	4	—	Changing the Camshaft Bushings	
		—	5	—	Assembling the Timing Gears	
	6	1	—	1	Lubricating system	
		4	1	—	Oil Sump	
		1	1	—	Lubricating Oil Pump	
		2	3	—	Cleaning the Centrifugal Cleaner with divided Rotor Housing	
		2	4	—	Cleaning the Centrifugal Cleaner with undivided Rotor Housing	
		3	4	—	Reduction Valve	
		—	5	—	Oil Cooler	

75.17265/3200-10.340

SERVICE SCANIA

PRODUCTS

grupp/group	Function description	
	nummer/number	sida/page
1 a	0	1
datum/date	best. nr/order nr	
74-02-28	E6201a	

GENERAL

The engines described here have in general the same kind of build-up and, in the majority of cases, their corresponding assemblies are of the same design. Thus, as a rule it is possible to apply the same methods for maintenance work. On account of this the different engine types and variants are dealt with jointly in this section of the Workshop Handbook.

When it concerns identification or the procurement of spare parts reference is made to the Spare Parts List for the engine type in question.

Engine Type Designations

The engine type designation indicates the engine type, size and field of application etc. in code form.

Two somewhat different designation systems exist at present, one system which is outgoing and one system for future use. The transition from the former to the latter system will take place successively.

Example:

DS11R40	D8M01
According to outgoing designation system	According to future designation system

Common for both systems is the code for:

Engine Type

D =	Diesel engine
DS =	Diesel engine equipped with turbocharger
DSI =	Diesel engine equipped with turbocharger and intercooler

Cylinder Displacement

The numbers 11 and 8 respectively indicate the displacement of the engine in litres. Then the nearest integral number corresponding to the cylinder displacement in litres of the engine is given.

Differences of Symbols between the Systems

OUTGOING SYSTEM

Location of injection pump

R =	Engine with the injection pump on right-hand side
L =	Engine with the injection pump on left-hand side

TYPE OF BUILD-IN AND VARIANT NUMBER SERIES

01-19	engines for trucks
20-39	engines for buses
40-59	separate engines, general application
60-79	engines for power packs and generating sets
80-99	engines for marine applications

FUTURE SYSTEM

Field of application

- A for general application and not requiring a marine cooling system, the basic design of which deviates from the engines intended for our trucks.
- B for bus in chassis design.
- C for integrally-built bus.
- G for generator and power packs (not engines with a marine cooling system).
- L for truck with conventional or semiforward control cab.
- LB for truck with forward control cab.
- M for general application which requires a marine cooling system.

VARIANT

A number in order of sequence is indicated for a variant. The characteristics which occasion new variant numbers are the fields of application. For instance, differences in output, special designs for certain customers or sales market.

Classified Marine Engines

To ensure as far as possible that classified engines are fitted with classified spare parts, the engine type reference, carried on the engine name plate, is extended by two letters indicating the classification society in which the engine is classified. The classification societies are denoted as follows:

LR =	Lloyd's Register of shipping
NV =	Det Norske Veritas
BV =	Bureau Veritas
GL =	Germanischer Lloyd
SF =	Statens Fartygsinspektion (The National Swedish Ship's Inspectorate), Stockholm

SE, SF, SG, SH

grupp	sekt	nr	sida
1a	FU	0	2

Thus the references DS11R80-LR and D8M01-LR respectively denote a marine engine with a turbocharger certified by Lloyd's Register of Shipping.

Besides the engine number the complete engine type reference should always be stated, i.e. including the letters indicating the classification society.

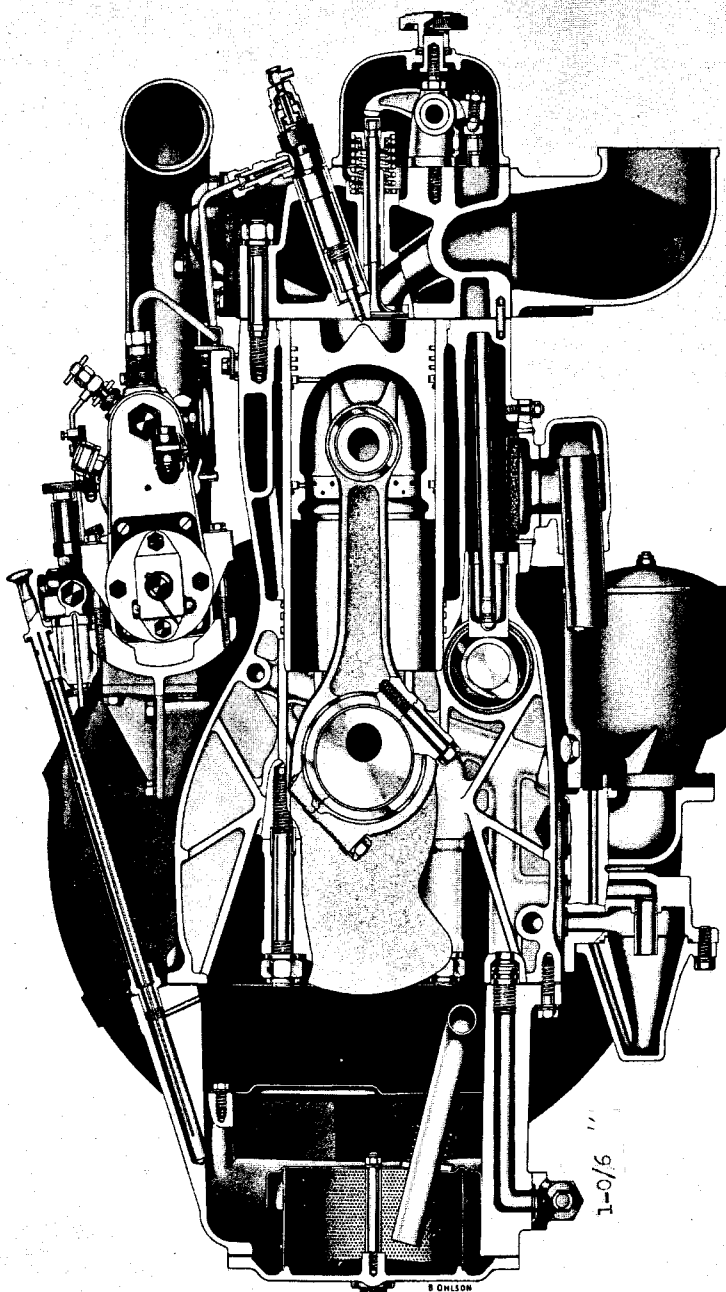


Fig. 1

Diesel engine without turbocharger
Cross-section

75.17265/3200-10.340

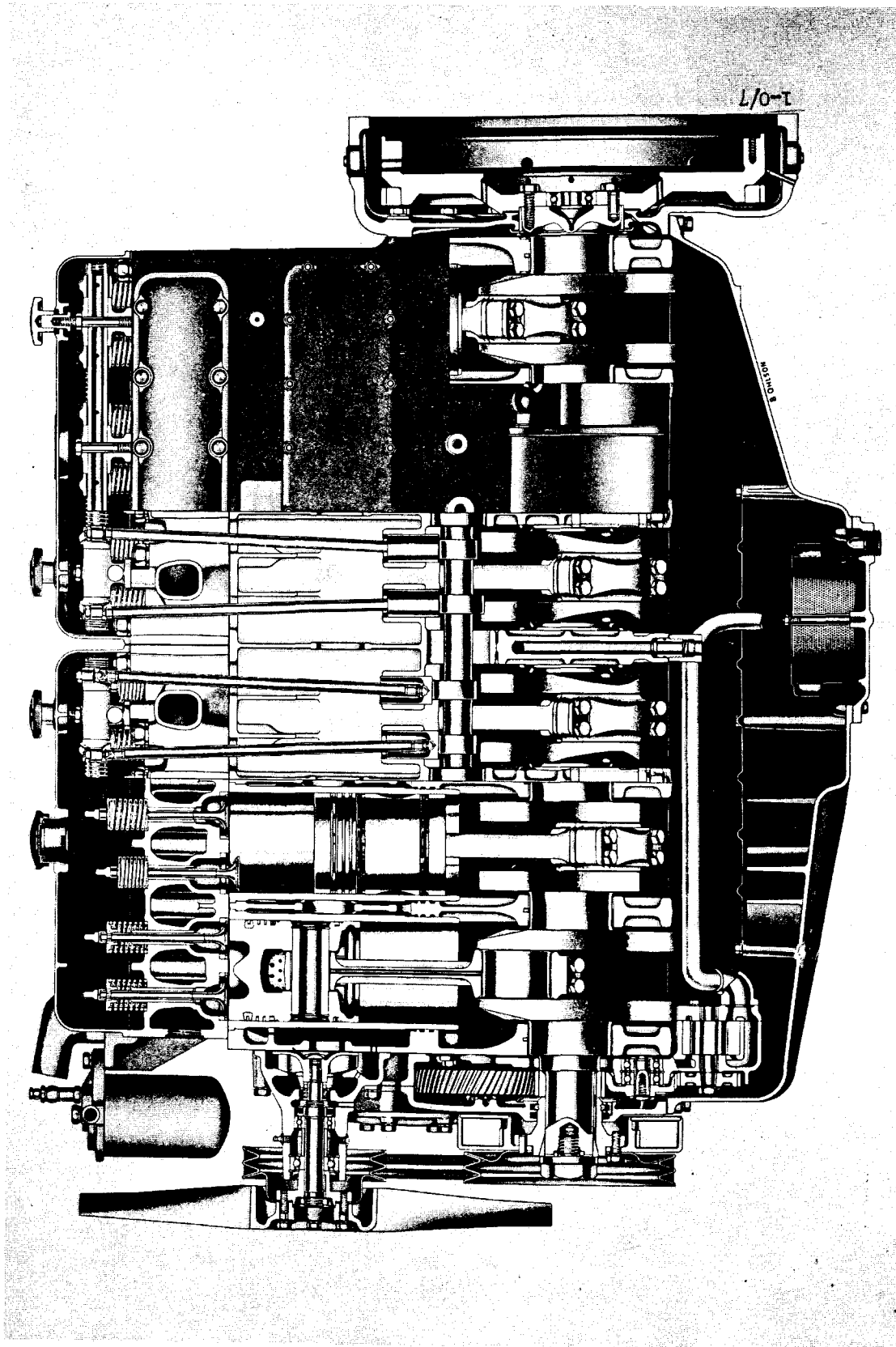


Fig. 2

Diesel engine
Longitudinal section

FU

SERVICE SCANIA

PRODUCTS

grupp/group

1 a

datum/date
75-03-15

Function description

nummer/number

2

sida/page

1

best. nr/order nr
E6201a:2

TURBOCHARGER

General

The task of the turbocharger is to increase the air supply to the cylinders of the engine. This increase in the supply of air enables the engine to burn more fuel per piston stroke than a naturally aspirated engine, so that a greater power output becomes possible.

The turbocharger consists of the following main subassemblies. Exhaust turbine, bearing housing and compressor. The turbine and the compressor are mounted one on each side of the bearing housing, the turbine wheel and compressor wheel being united by a common shaft. The shaft runs in the bearing housing in "floating" sliding bearings.

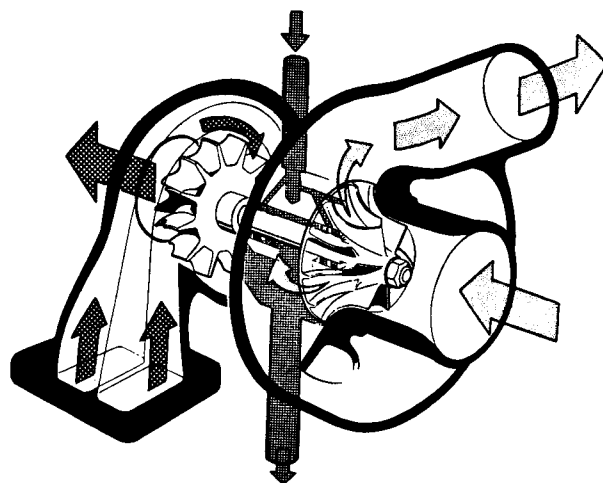
The turbine makes use of some of the energy contained in the hot exhaust gas. The exhaust gas goes straight from the exhaust manifold of the engine into the turbine housing. Inside the housing the gas first passes a nozzle ring to give it a greater velocity before it reaches the turbine wheel. The energy of the exhaust gas is converted by the turbine wheel into kinetic energy. The turbine wheel drives the compressor wheel, which is of the centrifugal type.

The air is drawn in at the centre of the compressor wheel and is forced out radially into the compressor housing through a diffuser. From the outlet of the compressor cover it is then forced into the engine intake manifold.

Since the turbine is driven by the engine exhaust gas, the speed of the turbocharger will automatically adjust itself to the load and speed of the engine.

The turbocharger is mounted directly on the exhaust manifold of the engine with a screwed fastening in the intake flange of the turbine. It is extremely important that this fastening alone should take the weight of the turbocharger and that no pipe connections or joints are too stiff, or they are liable to exert constraining forces on the unit and in such a condition could soon lead to trouble. For this reason, the exhaust pipe from the turbine is fitted with a special connection which takes up the movements that occur.

The lubrication of the bearings and the cooling of the bearing housing is effected by oil from the engine lubricating system. Before entering the bearing housing the oil first passes through a separate filter.



To seal between the shaft and the bearing housing use is made of sealing rings of piston ring type. This type of sealing ring does not seal properly as while in operation a certain amount of exhaust gas flows into the bearing housing, passes through the oil return pipe down to the oil sump and goes out through the crankcase ventilation. In some operating conditions, e.g. when braking with the engine or driving at high speed and with very little load there will be hardly any exhaust gas flow. Instead, it may happen that a small quantity of oil mist will force its way out. Oil is condensated from the oil mist, which will be seen on the inside of the intake and exhaust lines as a coating of grease. The oil mist does not disturb the function of the engine, but has rather a positive effect on for instance the intake valves.

On all current production turbochargers there is only one sealing ring on the turbine side. On account of the manufacturing tolerances the ring must be worn into its correct position. This mainly takes place during the engine's running-in period.

Start and Stop

The engine should if possible be allowed to run at idling speed for a few minutes after start and stop. This saves both the turbocharger and the engine in general, as the various parts are then cooled off by the lubricating oil.

grupp	sekt	nr	sida
1a	FU	2	2

Types

Several turbochargers look very much alike in appearance. However, there may be considerable differences inside. Therefore, when carrying out repair work or changing the turbocharger the part number which is indicated on the unit must be checked so that the correct parts are ordered.

For certain turbochargers, which have been purchased as spare parts, it may be necessary to turn the compressor and turbine housings in relation to the bearing housing, in order that the turbocharger shall fit the engine.

A list covering all turbochargers is to be found in 1a SP 2.

Classified Engines

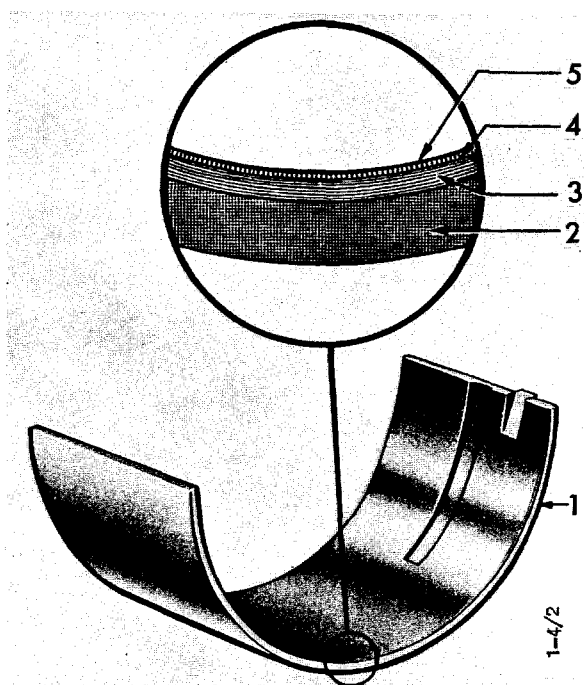
For classified engines (see 1a FU 0) turbochargers which have been specially checked must be used. A list covering these is to be found in 1a SP 2.

Some turbochargers for separate engines are identical to those used for truck engines besides the fact that the compressor and turbine housings are differently turned in relation to each other in the bearing housing. A corresponding turbocharger of standard design (for truck) can consequently be altered to fit certain separate engines.

grupp/group	Function description	
1 a	nummer/number	sida/page
	4	1
datum/date	best. nr/order nr	
74-02-28	E6201a	

CRANKSHAFT AND RECIPROCATING COMPONENTS

The **crankshaft** is drop-forged of alloy steel and is statically and dynamically balanced. It is carried in force-lubricated main bearings with renewable bearing shells. The bearing shells are built up with lead-bronze on a steel body. On the friction surface there is a thin layer of lead and indium.



Cross-section of bearing shell

- 1. Bearing shell
- 2. Steel body
- 3. Lead-bronze
- 4. Lead
- 5. Indium

The lead-indium layer is softer than the actual bearing metal, and is therefore the purpose of assisting running-in. No risk is therefore entailed if, after a period in service, this layer is worn away. The bearing-surfaces of the crankshaft are hardened and fine-polished, giving long life. The axial thrust is taken up by washers at the rearmost main bearing.

The rear end of the crankshaft is in the form of a flange to which the flywheel is bolted. The ring gear for the starting motor is shrunk onto the flywheel.

The connecting rod bearings are of the same type as the main bearings, having renewable bearing shells of lead-bronze.

The pistons are made of an aluminium-silicon alloy. Each piston has three compression rings and two oil rings alternatively one oil ring. The top compression ring usually has a chromium-plated wearing surface.

The piston pins are made of case-hardened chromium steel. At normal working temperature they are fully floating, i.e. free to move in both piston and connecting rod.

The piston pin bushing is made of lead-bronze on a steel body like the other bearings, but has no lead indium layer.

The **vibration damper** consists of a hermetically sealed housing. The housing encloses a steel damper ring of rectangular cross-section. The space between the damper ring and the housing forms a narrow gap which is filled with liquid. The liquid has a high viscosity (viscous liquid) and a high viscosity index, the latter indicating that the viscosity is relatively unaffected by temperature changes. The housing, which is fixed to the crankshaft. The damper ring, which is not directly secured to the housing, attempts, by its inertia, to go on rotating at the same speed. The occurrence of torsional vibration in the crankshaft will give rise to a difference in speed, of alternating direction, between the damper ring and the housing. The resistance offered by the liquid serves to equalize the speeds of the damper ring and the housing. Since the housing is fixed to the crankshaft, this speed equalization means that the vibration of the crankshaft will be damped down. The damper requires no adjustment, oil replenishment or other maintenance.

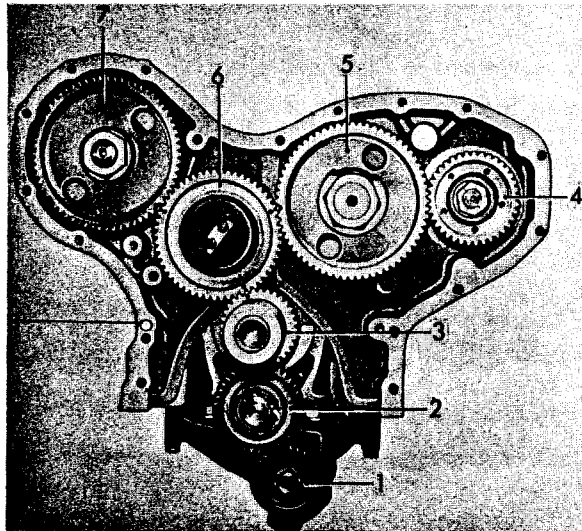
grupp/group	Function description	
	nummer/number	sida/page
1 a	5	1
datum/date	best. nr/order nr	
74-02-28	E6201a	

TIMING GEARS

General

The timing gears comprise cylindrical gearwheel with helical teeth.

The drive is taken from the crankshaft.



Timing gears.

1. Driving wheel of lubricating-oil pump
2. Idler gear for lubricating-oil pump
3. Crankshaft with gearwheel
4. Compressor gearwheel
5. Camshaft gearwheel
6. Idler gear
7. Driving wheel of injection pump
8. Dowel

The injection pump and camshaft are driven through an idler gear.

The compressor is driven through the camshaft gearwheel.

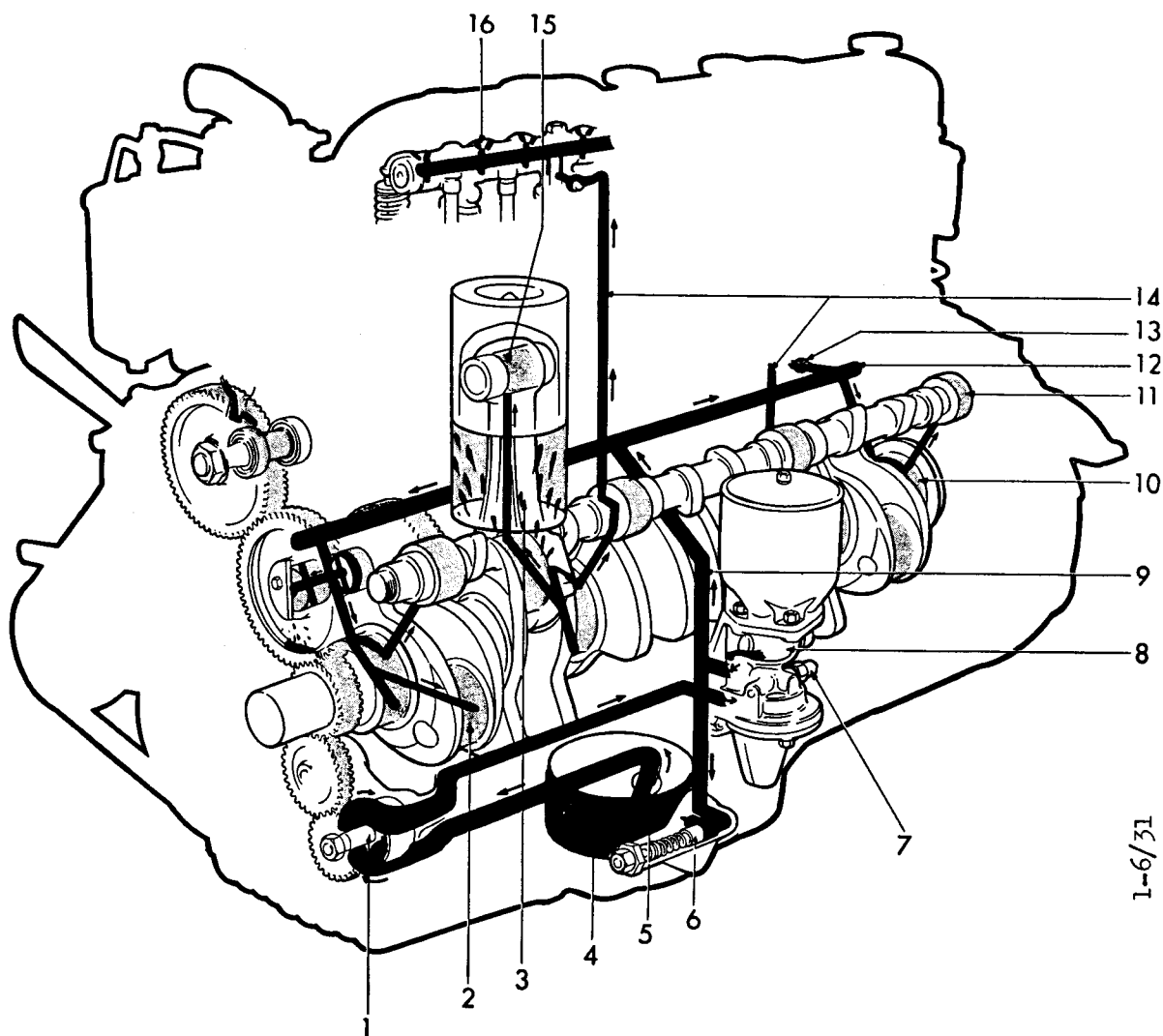
The hydraulic pump is driven through a rubber coupling direct from the compressor gearwheel.

The lubricating-oil pump is driven by the crankshaft through an idler gear.

The timing gears are protected by a housing and a casing. The housing is bolted to the cylinder block, while the casing is bolted to the casing.

The lubricating-oil pump with its idler gear is sited partly down in the oil sump. The sump is bolted to the timing gear casing, cylinder block and flywheel housing.

LUBRICATING SYSTEM



Lubricating system

- | | |
|---|--|
| 1. Oil pump | 9. Oilway between cyclone and distribution oilway |
| 2. Big-end bearing | 10. Main bearing |
| 3. Splash lubrication for cylinder bores | 11. Camshaft bearing |
| 4. Oil strainer mounted in sump | 12. Distribution oilway |
| 5. Suction pipe for oil from sump to pump | 13. Connection for oil-pressure gauge |
| 6. Reduction valve for oil pressure | 14. Oilway for lubricating oil to rocker arm mechanism |
| 7. Oil-pressure monitor | 15. Piston pin |
| 8. Lubricating-oil cleaner | 16. Rocker arm mechanism |

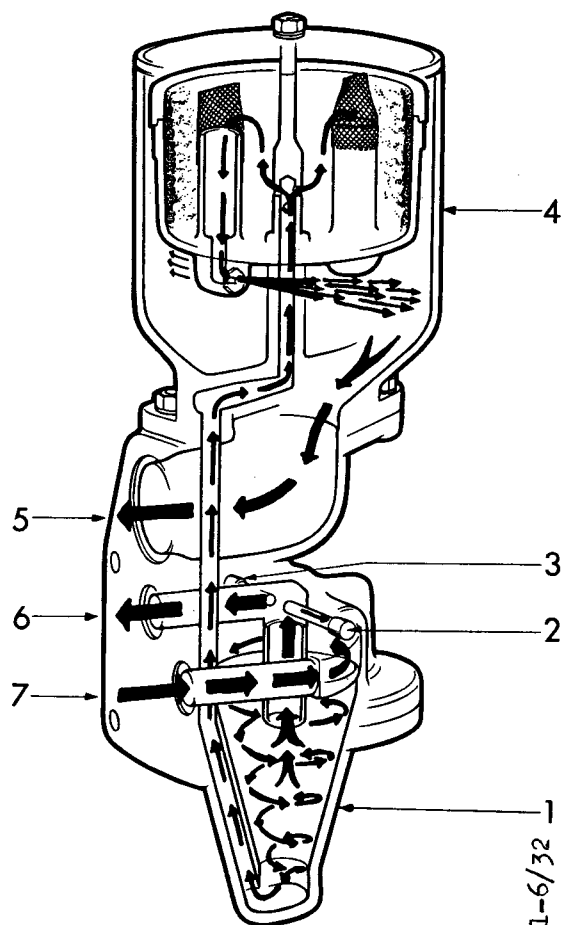
In addition the lubricating oil is distributed to the injection pump and oil cooler (which does not occur on all engine types)

grupp	sekt	nr	sida
1a	FU	6	2

The engine has a force-lubricating system, which means that the oil is forced round to the various lubricating points by an oil pump.

The oil pump, which is located at the front end of the oil pan, draws oil from the pan via an oil strainer. The oil strainer removes any coarse particles which may be present in the oil before it is drawn up out of the pan. The oil pump then feeds the oil under pressure into a lubricating-oil cleaner in which it is cleaned.

The lubricating-oil cleaner consists of a cyclone (1) and a centrifugal cleaner (4). The oil is first forced into the cyclone, where the impurities, by reason of their greater weight, are thrown out against the walls and are then driven downwards by the current of following oil.

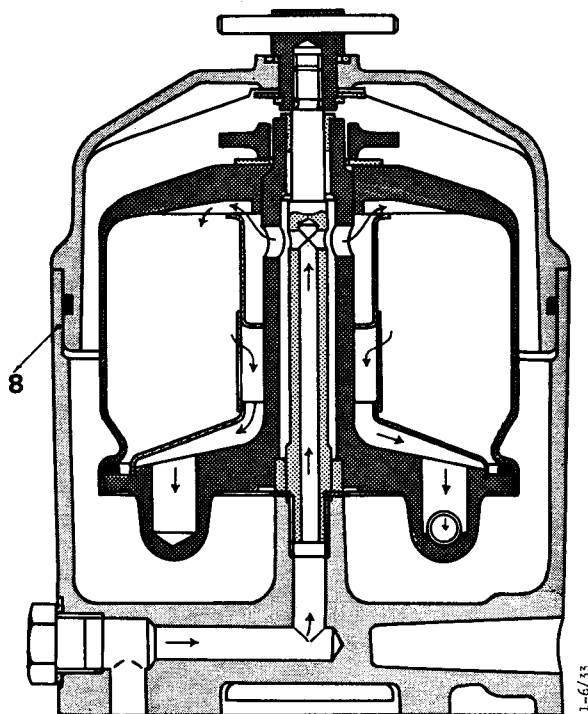


Lubricating-oil cleaner (without connection for oil cooler)

1. Cyclone
2. Outlet for lubricating oil to compressor
3. Outlet for oil-pressure monitor
4. Centrifugal-cleaner housing for rotor with divided rotor housing
5. Return line to oil sump
6. Oilway from cyclone to distribution oilway
7. Oilway from oil sump

On D/DS11 beginning from engine No. 880840 the cyclone section is turned so that the impure oil is forced upwards by the current of following oil.

The dirty oil is next forced through the oilway in the housing of the oil cleaner up into the rotor section of the centrifugal cleaner. This is made to rotate at high speed by the reaction of the oil squirting out of the two nozzles.



8. The centrifugal-cleaner housing for rotor with undivided rotor housing (The bottom part of the cleaner corresponds in principle to the design shown on the left-hand side)

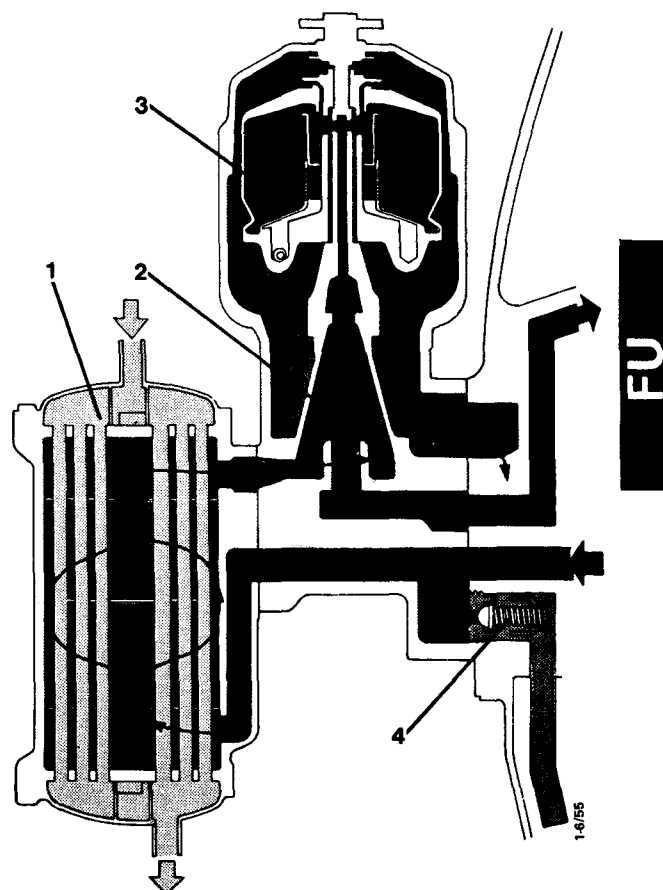
The centrifugal force throws foreign particles in the oil out towards the walls of the rotor, where they are deposited in the form of a black rubbery mass. The clean oil flows through line (5) back down into the oil sump.

Lubricating oil cleaners with two different designs of centrifugal cleaner are available. They differ from each other by reason of the fact that on one cleaner the rotor is mounted on the rotor housing cover and rotor housing respectively in comparison with the other where the mounting is located in the rotor hub.

The oil in the centre of the cyclone is free from impurities and is taken through the oilway (6) to the distribution oilway (12) from which the oil is taken by oilways in the block to the main bearings (10), the camshaft bearings (11) and the timing gears. From the main bearings the oil goes through oilways in the crankshaft to the big-end bearings (2) and from there by oilways in the connecting rods to the piston pins (15).

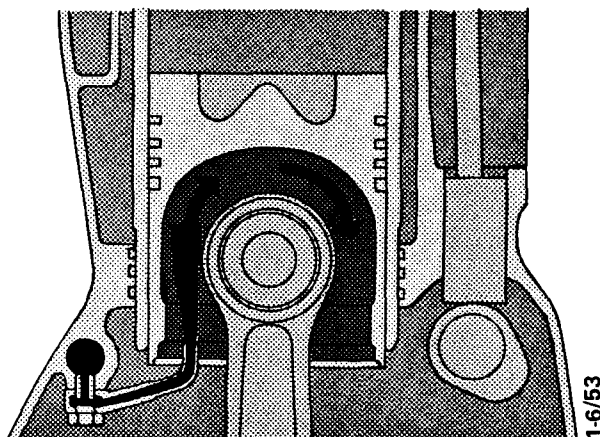
Through oilways in the camshaft the oil is forced intermittently to the rocker arm mechanism (16). The oil running back from the rocker arm mechanism lubricates the valves.

On D/DS11 beginning from engine No. 880840 the injection nozzles for oil cooling of pistons are mounted in the longitudinal distribution oilway. Via the nozzles oil is injected up under the pistons.



The lubricating oil cleaner with flange-mounted oil cooler, applies to D/DS11 beginning from engine No. 880840.

1. Oil cooler
2. Cyclone cleaner
3. Centrifugal cleaner
4. Reduction valve



Injection nozzles for oil cooling of pistons.

The injection pump camshaft housing and governor are lubricated from the engine lubricating system. The feed oil is led to the pump housing via a pump element lifter, the radial clearance of which regulates the quantity of oil supplied to the pump housing. The level of the oil in the pump housing is determined by the outlet hole for return oil, which leads to the engine oil sump.

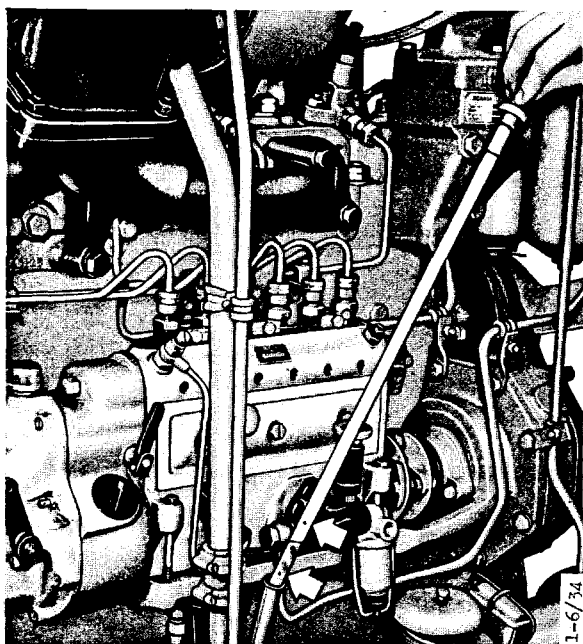
Pistons, cylinder bores and camshaft cams are lubricated by oil, which is splashed about by the crankshaft.

grupp	sekt	nr	side
1a	FU	6	4

The lubricating oil cooler is used in some operations for limiting the oil temperature. The inlet and outlet sides are connected to passages in the lubricating oil cleaner support.

The oil pressure is controlled by a reduction valve (6) of piston type that is accessible from the outside and located on the lubricating oil pump. On D/DS11 beginning from engine No. 880840 the reduction valve is mounted on the engine block behind the intermediate piece of the lubricating oil cleaner.

The oil-pressure gauge, which is sited on the instrument panel, is connected by a pipeline (13) to the distribution oilway of the engine. The lubricating system is also provided with an electric unit (7) connected to a warning lamp. The lamp, which is sited on the instrument panel, lights when the oil pressure gets too low.



Check the oil level

1. Oil dip stick

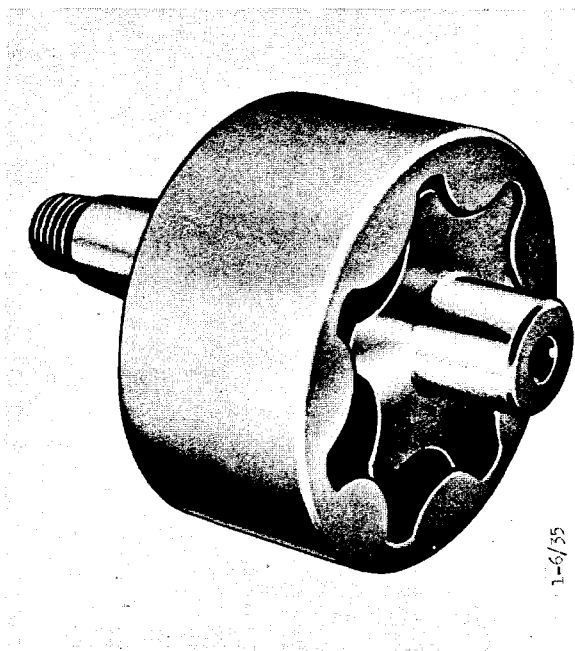
Lubricating Oil Pump

The lubricating oil pump, now fitted, is of gearwheel type. Previously, a rotor pump of Eaton type was fitted. Both the pumps are mounted on the cylinder block on the front main bearing and are driven by the crankshaft gearwheel.

Rotor Pump

The moving parts consist of an inner and outer rotor. The outer rotor, which has internal arc-shaped teeth, runs eccentrically in relation to the inner rotor. The outer rotor rotates freely in the pump housing.

The number of teeth on the inner rotor is one less than the number of tooth spaces in the outer rotor. The shape of the inner rotor is such that it is in constant contact with the outer rotor.



Rotor set

The inner rotor is made in one piece with the driving shaft, which is carried in the housing and the cover of the pump with easily replaceable bearing bushings. The pump is driven by the crankshaft gearwheel through an idler gear.

In the pump housing the bearing journal for the idler gear is also pressed in. On this journal the idler gear is mounted with two ball-bearings.

The oil is taken in via the oil strainer and suction pipe through passages in the bottom part of the housing and inbetween the rotors. These then force the oil up in the passage to the lubricating oil cleaner.

The oil pan is a silumin casting and is provided with a cylindrical oil strainer. The pan is so shaped that the return oil from the lubricating points of the engine runs down on the outside of the strainer. The suction line of the oil pump is therefore located inside the strainer. The drain plug for the engine oil is fitted with a magnetic plug. The magnetic plug collects all particles of magnetic material out of the oil. Round it there is a sludge pocket.

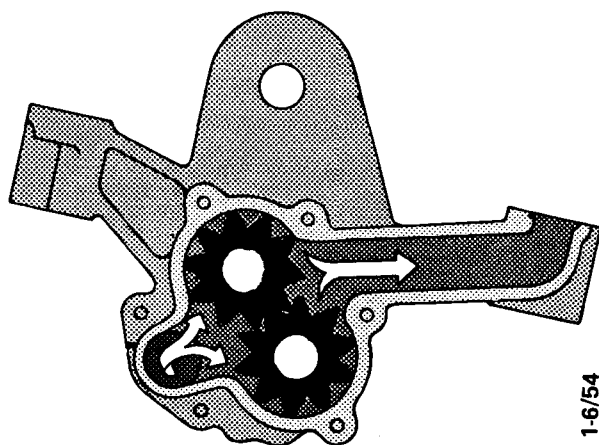
Gearwheel Pump

The pump consists of two pump gearwheels which are driven by the crankshaft gearwheel via an idler gear.

The pump gearwheels are mounted in the pump housing and the cover of the lock with replaceable bearing bushings.

The idler gear is mounted with two ball-bearings in the pump housing cover.

Oil is sucked via the oil strainer and suction pipe inbetween the teeth of the pump gearwheel. These then force the oil up in the passage to the lubricating oil cleaner.



Lubricating oil pump of gearwheel type

Crankcase Ventilation

To prevent the occurrence of overpressure in the crankcase the engine is provided with a special breather pipe mounted on a side cover. Inside the side cover is a filter which extracts the oil from the crankcase gases before they leave the engine.

SERVICE SCANIA

PRODUCTS

grupp/group	Function description	
	nummer/number	sida/page
1a	0	1
datum/date 77-02-28		best. nr/order nr E501a

CAUTION

This section is applicable to only Waukesha models F674D, DS, and DSI, which are designated by Scania as D, DS, and DS11A04, A05, A06, and A07. Engine serial numbers for these models are from 888806 (Sweden) and 156300 (Netherlands).

EU

General

The engines described here of type D11 and DS11 have in general the same kind of build-up and, in the majority of cases, their corresponding assemblies are of the same design. Thus, as a rule it is possible to apply the same methods for maintenance work. On account of this the different engine types and variants are dealt with jointly in this section

When it concerns identification or the procurement of spare parts reference is made to the Spare Parts List for the engine type in question.

Engine type designations

The engine type designation indicates the engine type, size and field of application etc. in code form.

Example:

DS11A06

Engine type

- D = Diesel engine
- DS = Diesel engine equipped with turbocharger
- DSI = Diesel engine equipped with turbocharger and intercooler

Cylinder displacement

The number 11 indicates, the displacement of the engine in litres. Then the nearest integral number corresponding to the cylinder displacement in litres of the engine is given.

Field of application

- A for general application and not requiring a marine cooling system, the basic design of which deviates from the engines intended for our trucks.
- B for bus with longitudinal engine.
- C for bus with transverse engine.
- L for truck with conventional or semiforward control cab.
- LB for truck with forward control cab.
- M for general application which requires a marine cooling system.

Variant

A number in order of sequence is indicated for a variant. The characteristics which occasion new variant numbers are the differences in the designs of the engines for certain fields of application. For instance, differences in output, special designs for certain customers or sales market.

Classified marine engines

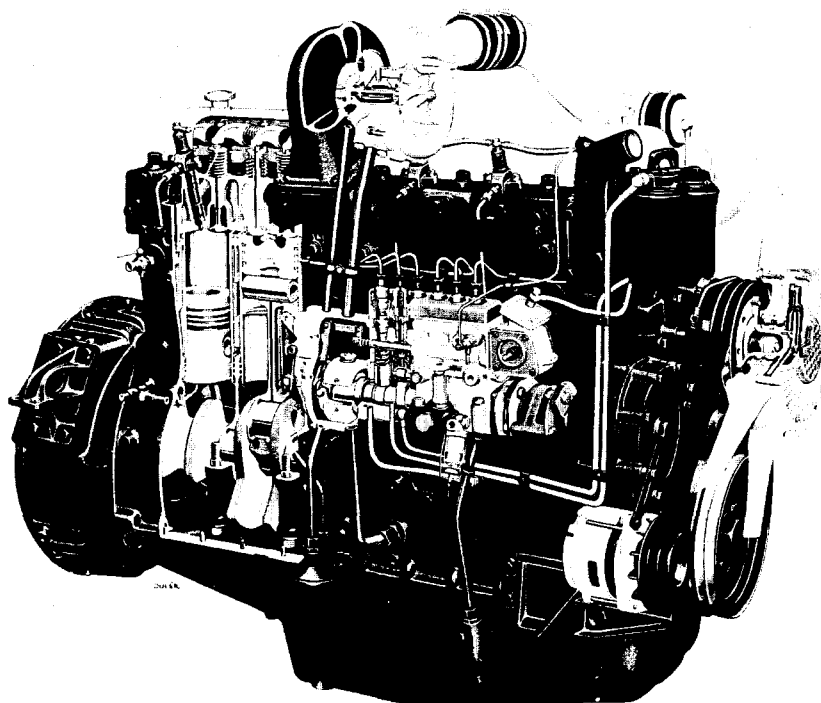
To ensure as far as possible that classified engines are fitted with classified spare parts, the engine type reference, carried on the engine name plate, is extended by two letters indicating the classification society in which the engine is classified. The classification societies are denoted as follows:

- LR = Lloyd's Register of shipping
- NV = Det Norske Veritas
- BV = Bureau Veritas
- GL = Germanischer Lloyd
- SF = Statens Fartygsinspektion (The National Swedish Ship's Inspectorate), Stockholm

grupp	sekt	nr	sida
1a	FU	0	2

Thus the reference DSI11M01-LR denotes a marine engine with a turbocharger certified by Lloyd's Register of Shipping.

Besides the engine number the complete engine type reference should always be stated, i.e. including the letters indicating the classification society, e.g. when ordering spare parts.



1-0/19

Fig. 1 Diesel engine with turbocharger

gruppgroup		Function description	
datum/date	nummer/number	sida/page	
77-02-28	1 a	2	1
		best. nr/order nr	
		E501a2	

TURBOCHARGER

General

The task of the turbocharger is to increase the air supply to the cylinders of the engine. This increase in the supply of air enables the engine to burn more fuel per piston stroke than a naturally aspirated engine, so that a greater power output becomes possible.

The turbocharger consists of the following main sub-assemblies. Exhaust turbine, bearing housing and compressor. The turbine and the compressor are mounted one on each side of the bearing housing, the turbine wheel and compressor wheel being united by a common shaft. The shaft runs in the bearing housing in "floating" sliding bearings.

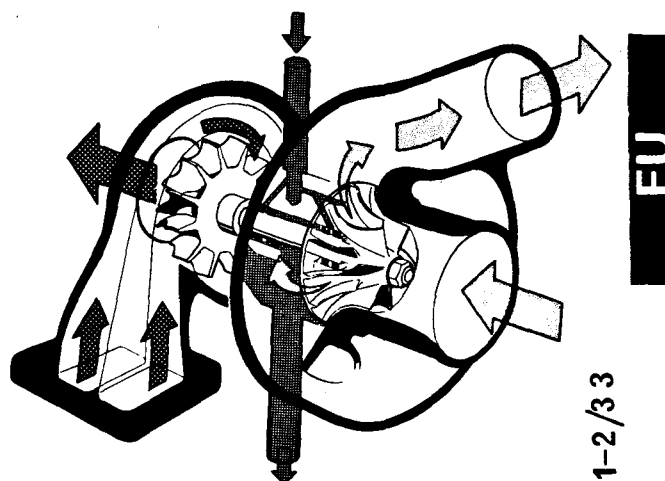
The turbine makes use of some of the energy contained in the hot exhaust gas. The exhaust gas goes straight from the exhaust manifold of the engine into the turbine housing. Inside the housing the gas first passes a nozzle ring to give it a greater velocity before it reaches the turbine wheel. The energy of the exhaust gas is converted by the turbine wheel into kinetic energy. The turbine wheel drives the compressor wheel, which is of the centrifugal type.

The air is drawn in at the centre of the compressor wheel and is forced out radially into the compressor housing through a diffuser. From the outlet of the compressor cover it is then forced into the engine intake manifold.

Since the turbine is driven by the engine exhaust gas, the speed of the turbocharger will automatically adjust itself to the load and speed of the engine.

The turbocharger is mounted directly on the exhaust manifold of the engine with a screwed fastening in the intake flange of the turbine. It is extremely important that this fastening alone should take the weight of the turbocharger and that no pipe connections or joints are too stiff, or they are liable to exert constraining forces on the unit and in such a condition could soon lead to trouble. For this reason, the exhaust pipe from the turbine is fitted with a special connection which takes up the movements that occur.

The lubrication of the bearings and the cooling of the bearing housing is effected by oil from the engine lubricating system. Before entering the bearing housing the oil first passes through a separate filter.



To seal between the shaft and the bearing housing use is made of sealing rings of piston ring type. This type of sealing ring does not seal properly as while in operation a certain amount of exhaust gas flows into the bearing housing, passes through the oil return pipe down to the oil sump and goes out through the crankcase ventilation. In some operating conditions, e.g. when braking with the engine or driving at high speed and with very little load there will be hardly any exhaust gas flow. Instead, it may happen that a small quantity of oil mist will force its way out. Oil is condensed from the oil mist, which will be seen on the inside of the intake and exhaust lines as a coating of grease. The oil mist does not disturb the function of the engine.

Start and stop

The engine should if possible be allowed to run at idling speed for a few minutes after start and stop. This saves both the turbocharger and the engine in general, as the various parts are then cooled off by the lubricating oil.

Types

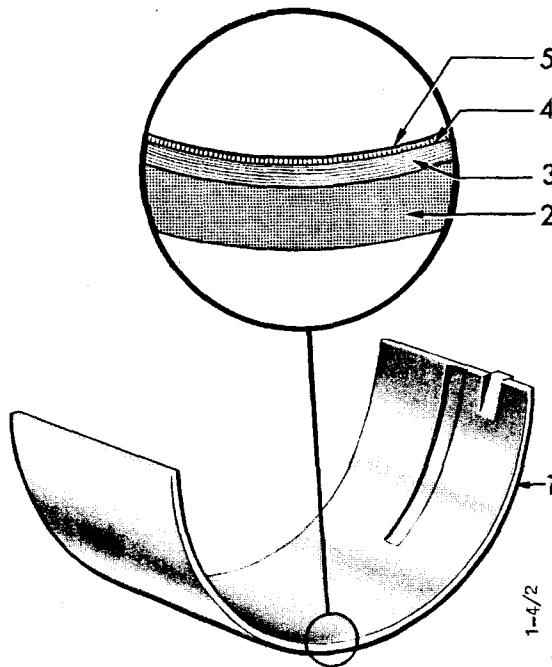
Several turbochargers look very much alike in appearance. However, there may be considerable differences inside. Therefore, when carrying out repair work or changing the turbocharger the part number which is indicated on the unit must be checked so that the correct parts are ordered.

For classified engines turbochargers which have been specially checked must be used.

For certain turbochargers, which have been purchased as spare parts, it may be necessary to turn the compressor and turbine housings in relation to the bearing housing, in order that the turbocharger shall fit the engine.

CRANKSHAFT AND RECIPROCATING COMPONENTS

The crankshaft is drop-forged of alloy steel and is statically and dynamically balanced. It is carried in force-lubricated main bearings with renewable bearing shells. The bearing shells are built up with lead-bronze on a steel body. On the friction surface there is a thin layer of lead and indium.



Cross-section of bearing shell

- | | |
|------------------|-----------|
| 1. Bearing shell | 4. Lead |
| 2. Steel body | 5. Indium |
| 3. Lead-bronze | |

The lead-indium layer is softer than the actual bearing metal, and is therefore the purpose of assisting running-in. No risk is therefore entailed if, after a period in service, this layer is worn away. The bearing-surfaces of the crankshaft are hardened and fine-polished, giving long life. The axial thrust is taken up by washers at the rearmost main bearing.

The rear end of the crankshaft is in the form of a flange to which the flywheel is bolted. The ring gear for the starting motor is shrunk onto the flywheel.

The connecting rod bearings are of the same type as the main bearings, having renewable bearing shells of lead-bronze.

The pistons are made of an aluminum-silicon alloy. Each piston is provided with three compression rings and one or two oil rings. The top compression ring wear surface is hard chromium-plated, or molybdenum coated.

The piston pins are made of case-hardened chromium steel. At normal working temperature they are fully floating, i.e. free to move in both piston and connecting rod.

The piston pin bushing is made of lead-bronze on a steel body like the other bearings, but has no lead indium layer.

The vibration damper consists of a hermetically sealed housing. The housing encloses a steel damper ring of rectangular cross-section. The space between the damper ring and the housing forms a narrow gap which is filled with liquid. The liquid has a high viscosity (viscous liquid) and a high viscosity index, the latter indicating that the viscosity is relatively unaffected by temperature changes.

The housing, which is fixed to the crankshaft, always accompanies the movements of the crankshaft. The damper ring, which is not directly secured to the housing, attempts, by its inertia, to go on rotating at the same speed. The occurrence of torsional vibration in the crankshaft will give rise to a difference in speed, of alternating direction, between the damper ring and the housing. The resistance offered by the liquid serves to equalize the speeds of the damper ring and the housing. Since the housing is fixed to the crankshaft, this speed equalization means that the vibration of the crankshaft will be damped down.

The damper requires no adjustment, oil replenishment or other maintenance.

grupp/group	Function description	
	nummer/number	sida/page
1a	5	1
datum/date	best. nr/order nr	
77-02-28	E501a5	

TIMING GEARS

The timing gears comprise cylindrical gearwheel with helical teeth.

The drive is taken from the crankshaft.

The injection pump and camshaft are driven through an idler gear.

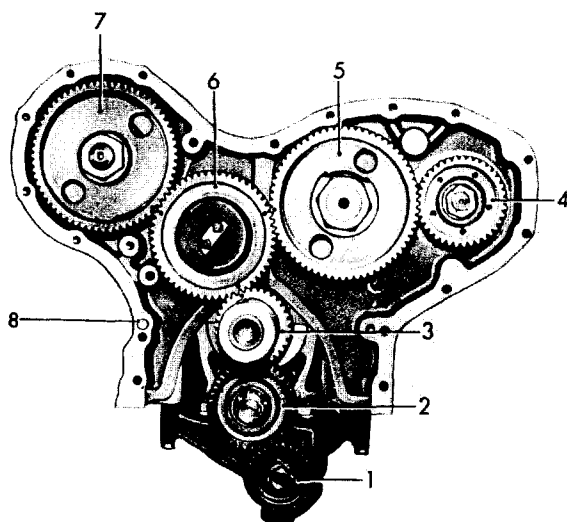
The compressor is driven through the camshaft gearwheel.

The hydraulic pump is driven through a rubber coupling direct from the compressor gearwheel.

The lubricating-oil pump is driven by the crankshaft through an idler gear.

The timing gears are protected by a housing and a casing. The housing is bolted to the cylinder block, while the casing is bolted to the casing.

The lubricating-oil pump with its idler gear is sited partly down in the oil sump. The sump is bolted to the timing gear casing, cylinder block and flywheel housing.



Timing gears

- | | |
|--|------------------------------------|
| 1. Driving wheel of lubricating-oil pump | 5. Camshaft gearwheel |
| 2. Idler gear for lubricating-oil pump | 6. Idler gear |
| 3. Crankshaft with gearwheel | 7. Driving wheel of injection pump |
| 4. Compressor gearwheel | 8. Dowel |

LUBRICATING SYSTEM

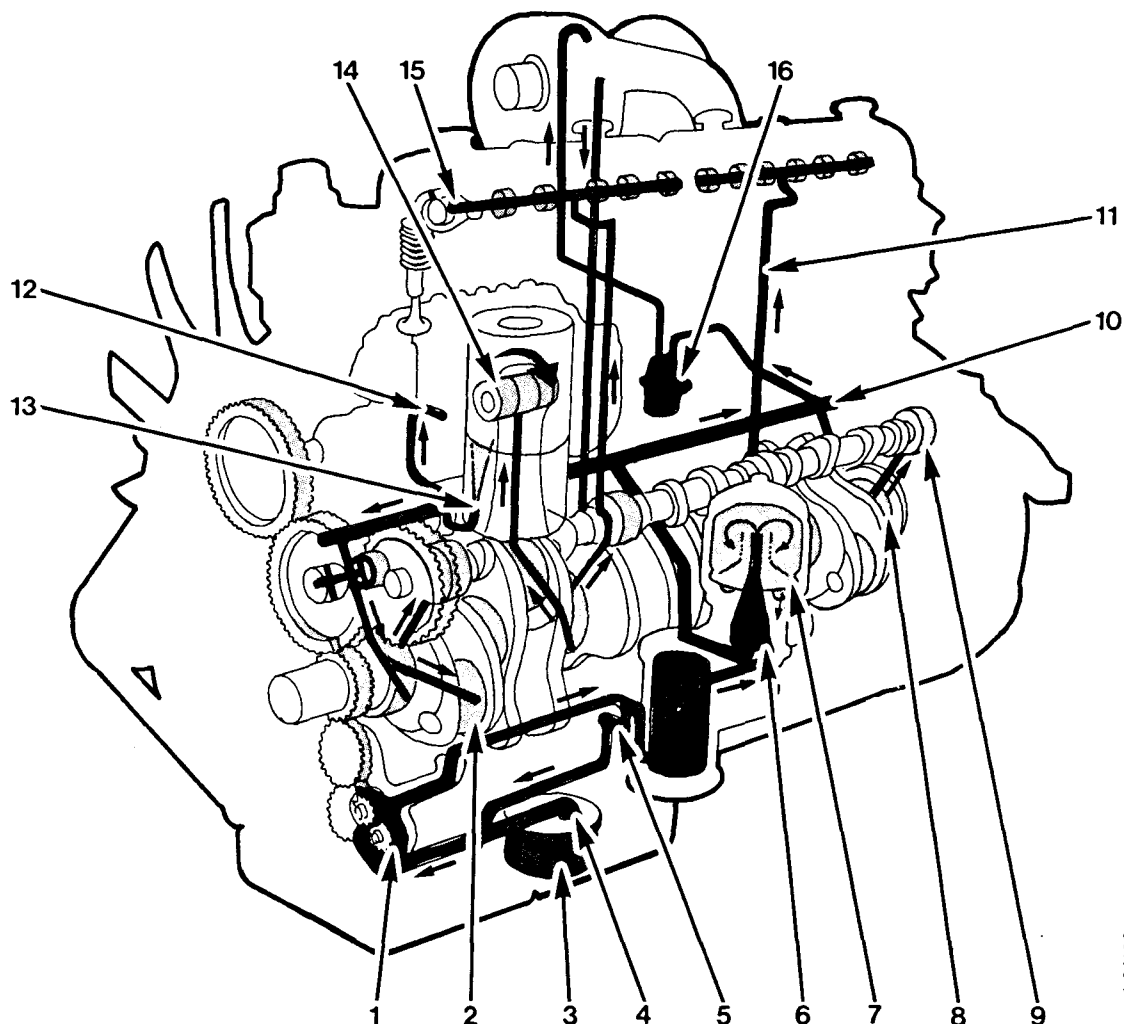


Fig. 1 Lubricating system

1. Oil pump
2. Crankpin
3. Oil strainer
4. Suction pipe for oil from sump to pump
5. Reduction valve
6. Cyclone cleaner
7. Centrifugal cleaner
8. Main bearing journal

9. Camshaft bearing journal
10. Distribution oilway
11. Oilway for lubricating oil to rocker arm mechanism
12. Oil pipe to injection pump
13. Injection nozzle for piston cooling
14. Piston pin
15. Rocker arm mechanism
16. Oil filter for turbocharger

grupp	sekt	nr	sida
1a	FU	6	2

The engine has a force-lubricating system, which means that the oil is forced round to the various lubricating points by an oil pump.

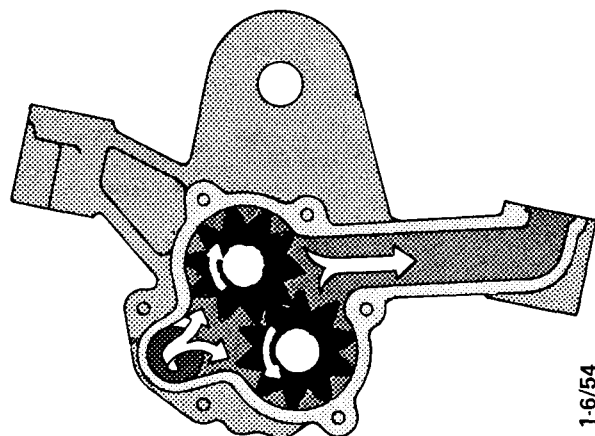
Oil pump

The oil pump, which is located at the front end of the oil pan, draws oil from the pan via an oil strainer. The oil strainer removes any coarse particles which may be present in the oil before it is drawn up out of the pan. The oil pump then feeds the oil under pressure into a lubricating-oil cleaner in which it is cleaned.

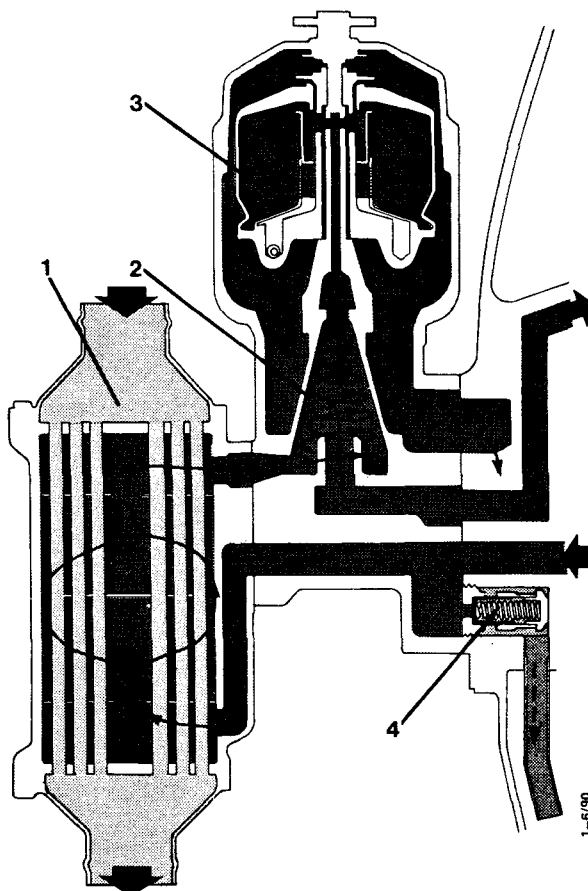
The pump consists of two pump gear wheels which are driven by the crankshaft gearwheel via an idler gear.

The pump gearwheels are mounted in the pump housing and the pump housing cover with replaceable bearing bushings.

The idler gear is mounted with two ball-bearings in the pump housing cover.



Lubricating-oil pump of gearwheel type



Lubricating oil cleaner with flange-mounted oil cooler

1. Oil cooler
2. Cyclone cleaner
3. Centrifugal cleaner
4. Reduction valve

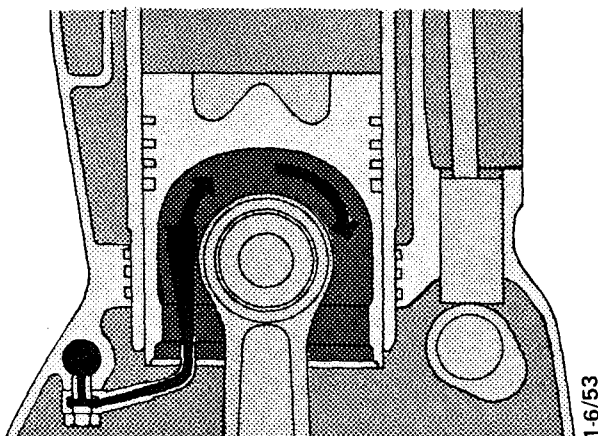
Lubricating oil cleaner

The lubricating cleaner consists of a cyclone and a centrifugal cleaner. The oil is first forced into the cyclone, where the impurities, by reason of their greater weight, are thrown out against the walls and there then forced up to the rotor section of the centrifugal cleaner by the current of following oil. This is made to rotate at high speed by the reaction of the oil squirting out of the two nozzles.

The centrifugal force throws foreign particles in the oil out towards the wall of the rotor, where they are deposited in the form of a black rubbery mass. The clean oil flows through a line back down into the oil sump.

The oil in the centre of the cyclone is free from impurities and is taken through the distribution oilway and other oilways in the block to the main bearings, the camshaft bearings and the timing gears. From the main bearings the oil goes through oilways in the crankshaft to the big-end bearings and from there by oilways in the connecting rods to the piston pins. Through oilways in the camshaft the oil is forced intermittently to the rocker arm mechanism. The oil running back from the rocker arm mechanism lubricates the valve tappets.

The injection nozzles for oil cooling of pistons are mounted in the longitudinal distribution oilway. Via the nozzles oil is injected up under the pistons.



Injection nozzles for oil cooling of pistons

The injection pump camshaft housing and governor are lubricated from the engine lubricating system. The feed oil is led to the pump housing via a pump element lifter, the radial clearance of which regulates the quantity of oil supplied to the pump housing. The level of the oil in the pump housing is determined by the outlet hole for return oil, which leads to the engine oil sump.

Pistons, cylinder bores and camshaft cams are lubricated by oil, which is splashed about by the crankshaft.

Oil cooler

The lubricating oil cooler is used for limiting the oil temperature. The inlet and outlet sides are connected to passages in the lubricating oil cleaner support.

Reduction valve

The oil pressure is controlled by a reduction valve of piston type that is accessible after the oil cleaner support has been removed.

Oil pressure gauge

The oil pressure gauge, which is sited on the instrument panel, is connected by a pipeline to the distribution oilway of the engine. The lubricating system is also provided with an electric unit connected to a warning lamp. The lamp, which is sited on the instrument panel, lights when the oil pressure gets too low.

Crankcase ventilation

To prevent the occurrence of overpressure in the crankcase, the engine is provided with a special breather pipe mounted on a side cover. Inside the side cover is a filter which extracts the oil from the crankcase gases before they leave the engine.

Oil pan

The oil pan is a silumin casting and is provided with a cylindrical oil strainer. The pan is so shaped that the return oil from the lubricating points of the engine runs down on the outside of the strainer. The drain plug for the engine oil is fitted with a magnetic plug. The magnetic plug collects oil particles of magnetic material out of the oil. Round it there is a sludge pocket.

The oil level in the engine is checked by using an oil dipstick put in the oil pan on the right-hand side of the engine. The oil level must be between the markings on the dipstick. It is only necessary to fill up with oil when the oil level has dropped to the bottom marking.

SERVICE SCANIA

PRODUCTS

grupp/group

1 a

Work Description

nummer/number

1

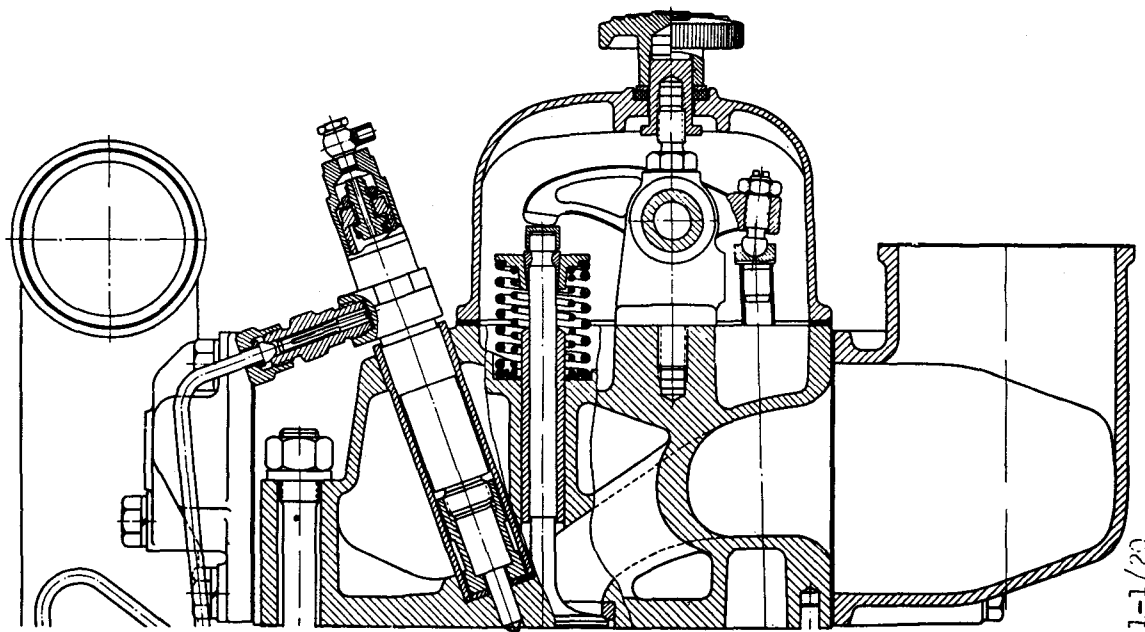
sida/page

1

datum/date
74-02-28

best. nr/order nr
E6201a

CYLINDER HEADS



Cross-section of cylinder head

AR

The cylinder heads are fitted with pressed-in valve seat inserts made of a special alloy. In each cylinder head there are also pressed-in stainless steel sleeves in which the injectors are mounted. These steel sleeves are in direct contact with the circulating coolant, which thus cools the injectors effectively.

The intake and exhaust valves are made of heat-resistant steel with a satellite coating on the valve heads and with hard-chromium-plated valve stems. The valves are fitted with renewable hardened steel caps, against which the rocker arms bear. This keeps wear on the top end of the valve stems down to negligible proportions. The valve stems run in valve guides made of cast-iron.

On engines that are not turbocharged there is a sealing between the top valve stem ends and the valve spring heads on certain engine series. Applies only to intake valves.

Removing Cylinder Heads

1. Drain off the coolant.
2. Remove the air cleaner and the vacuum pipes, undo the link rod of the throttle control at the throttle housing and remove the intake manifold.
3. Remove the exhaust manifold from the cylinder heads.
4. Carefully unscrew the metal sleeve of the coolant thermometer and remove the water-passage flange.
5. Disconnect the leak-off tube at the injectors. Fit protective plugs.

grupp	sekt	nr	sida
1a	AR	1	2

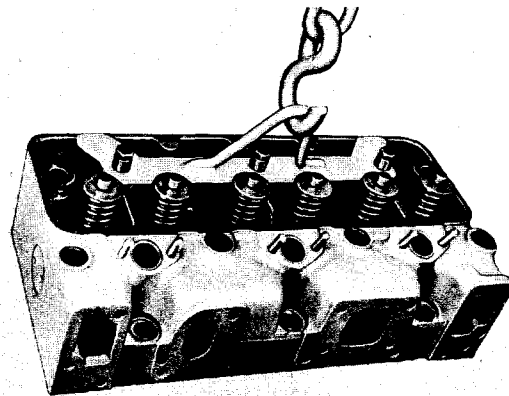


Take up the sealing washer of the injector

6. Remove the pressure pipes. Fit protective plugs at both ends of the pressure pipes and protective caps on the injection pump and injectors.
7. Remove the injectors. If the sealing washers do not come up with them, remove these washers using the extractor.
8. Remove the valve covers.
9. On engines with a lubricating-oil pipe running to the rocker-arm mechanism, disconnect the banjo connection of this pipe at the bearing bracket.
10. Undo the screws of the bearing brackets of the valve mechanism. Check that the gaskets beneath the bearing brackets do not fall down into the holes for the pushrods while the valve mechanism is being lifted clear.
11. Remove the pushrods carefully so that the valve lifters do not come with them.

12. Screw off the cylinder-head nuts. See that none of the nuts fall into the holes for the pushrods. Should this happen, the nut can be recovered by taking off the corresponding side cover. On some later type engines hexagon-headed screws are fitted instead of studs and nuts.

13. Lift off the cylinder head with the lifting tool.



Lift off the cylinder heads

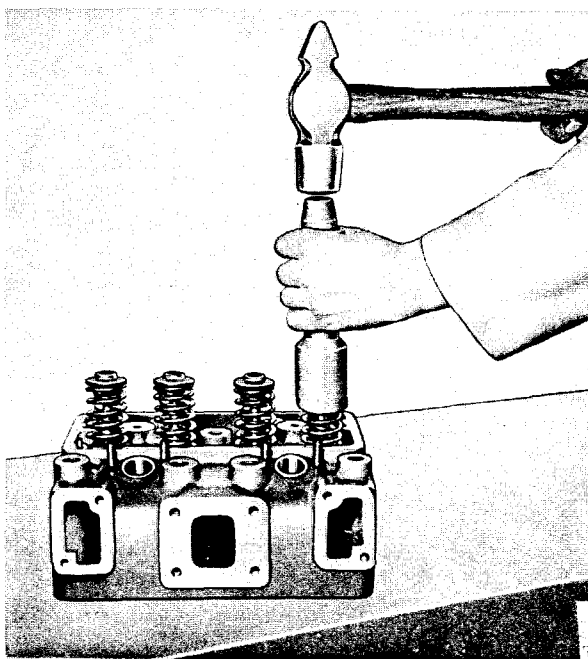
Reconditioning Cylinder Heads

Removing the Valves

Remove in cases occurring the rubber sealings, valve caps and then the valves.

The valve-stem keys can be removed with aid of the drift, which is placed on the upper guide washer of the valve. A heavy blow on the drift will compress the springs and release the keys.

N.B. Do not strike too hard so that the spring heads come in contact with the valve guide in which case this can be damaged (upset).



Remove the valve-stem keys

The valve-spring compressor, which is actually designed for use in fitting the valve stem keys, can also be used to remove them.

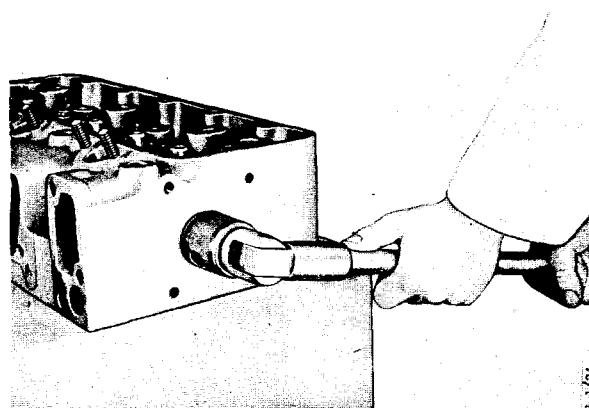
Put the valves into a valve stand in their correct order, which will make it easier to put them back into their original places during reassembly.

Inspecting Cylinder Heads

Examining each cylinder head for cracks and other defects. The underside of the cylinder head must be absolutely plane. The easiest and best way to check this is to use a surface plate smeared with marking blue. Marking blue adhering to the cylinder head indicates the points of unevenness. Small unevennesses can be corrected with a scraper. The cylinder head must then be checked again with the surface plate. The correction of greater unevennesses calls for machining.

While the cylinder head is out of the engine the coolant passages should be scraped clean and then blown through with compressed air.

Examine the sealing plugs in the cylinder heads for damages. Check that the threads of the sealing plugs and cylinder heads are clean. If required, replace the sealing plugs by new ones with oversize threads. Fit new sealing rings. Smear self-hardening plastic on the threads. Tighten the sealing plugs using the stud wrench.

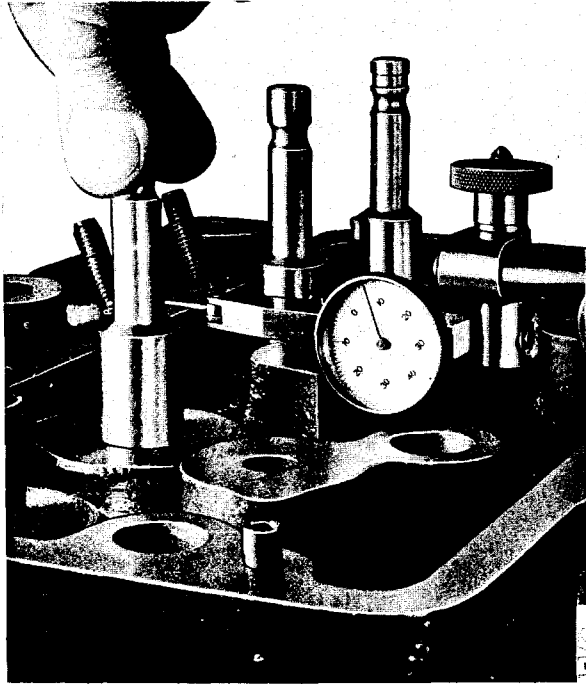


Fit the sealing plugs

If the clearance between valve stems and valve guides is excessive, the guides should be replaced by new ones. Excessive clearance between valve and guide results in poor valve sealing and increases the oil consumption, since more oil passes through the guides of the intake valves than is needed for lubrication.

The clearance is best checked by using a dial gauge.

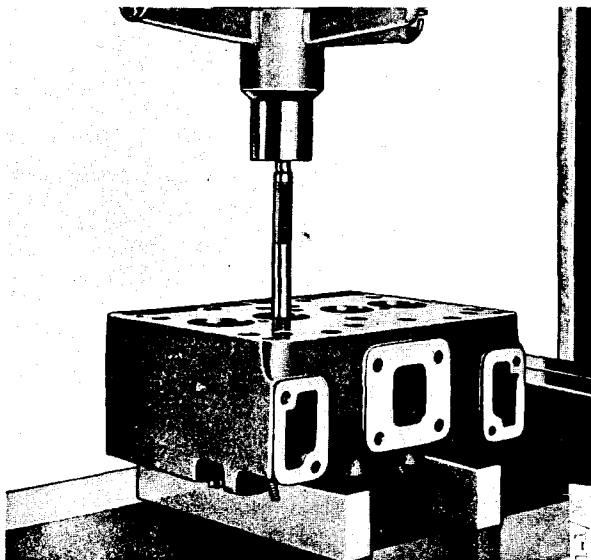
grupp	sekt	nr	sida
1a	AR	1	4



Check the clearance between the valve stem and valve guide

Removing a Valve Guide

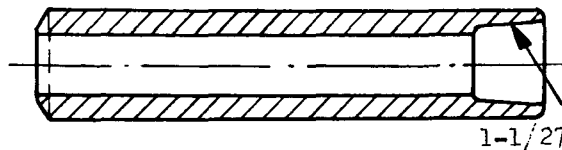
The old valve guides are removed with a drift, by means of which they are pressed out towards the top of the cylinder head.



Press out the valve guides

Fitting a Valve Guide

Oil the valve guides before fitting them. The guides of the intake and exhaust valves differ in design. It is therefore important to fit them into the right holes. The lower end of the exhaust valve guide has a recess intended to prevent deposits of coke which would make the valve stick. If this guide is not renewed, the recess should be scraped clear from soot using the cleaning tool.

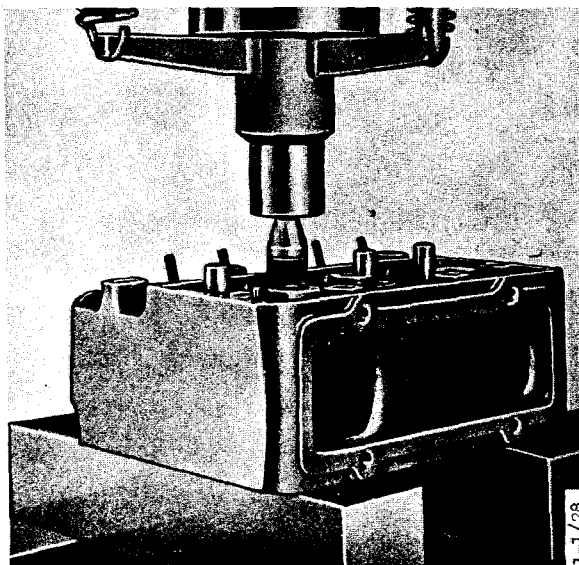


Exhaust Valve Guide

The guide is on certain engine designs provided with a recess which shall be turned towards the valve head. On certain other engine designs this recess and the upper edge of the guide are slightly chamfered.

To ensure that the valve guide is correctly positioned and is not damaged while being pressed in, the appropriate drift should be used.

This automatically gives the correct distance from the upper edge of the guide to the seating plane of the springs when the drift is pressed down against the cylinder head. After the guide has been pressed in, its inside diameter will be correct and will not need any subsequent treatment. The guide should, however, be checked with a gauge or a new valve.



Press in the valve guides

Always use a press in fitting a guide. If the guide is driven in with a hammer it can easily be upset, which may result in damage to the valve stem making additional treatment necessary.

The upper guide ends can also be damaged if the cylinder head is displaced on a level basis with the upper side of the cylinder head turned towards this (applies to the D11 Series).

Changing Valve Seat Inserts and Injector Sleeves

Valve seat inserts whose seating surface, as a result of repeated grinding, has acquired an outer diameter (dimension D) greater than the stated figures must be changed.

Also, of course, damaged and loose valve seat inserts must be renewed. Pay particular attention to the seats of the exhaust valves.

Proceed as follows in removing valve seat inserts.

1. If no suitable puller is available, a mounted grinding wheel can be used to grind two diametrically opposite grooves in the insert, after which the two halves can be levered out.
2. Wash the cylinder head.

3. Give the cylinder head a pressure test if water leaks are suspected, and change the injector sleeves if necessary. If the sleeves are leaky the injectors will usually be found to be corroded.

4. Proceed as follows in replacing sleeves:

Removing

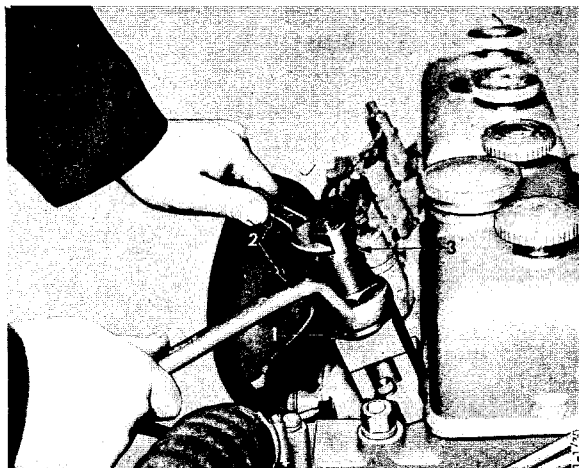
(On fitted cylinder head, seal the bottom end of the injector sleeve with a well greased dry cloth, which prevents shavings from dropping down into the combustion chamber.)

Tighten up properly the puller body of special tool on the injector place with two nuts and cut a thread (M28x1.5) inside the injector sleeve. Then straighten up the thread tap with the guide bushing, see fig. Fit the puller screw in the thread and pull out the sleeve with aid of the nut, see fig.



The thread tap is straightened up with guide bushing

1. Puller body
2. Thread tap
3. Guide bushing



Pulling out the sleeve

1. Washer
2. Wrenches
3. Puller screw

Fitting

Clean and inspect the contact surfaces of the injector sleeve in the cylinder head and grind off all possible burrs and irregularities, which can cause scratches on the injector sleeve.

Degrease the new injector sleeve and apply a thin layer of "Loctite thread sealing" on the contact surfaces. Then drive it in the cylinder head with aid of assembly drift 87056.

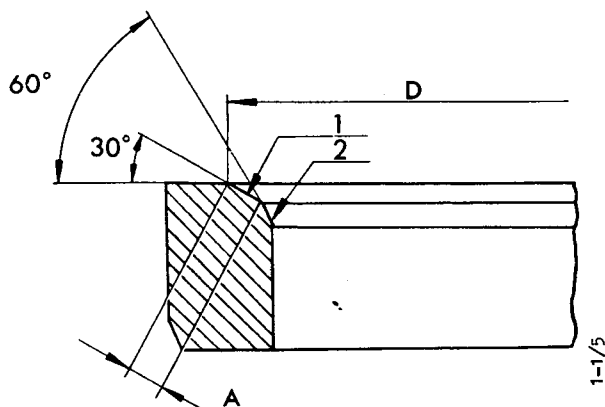
1. Smear the valve seat recesses with a suitable carbon solvent. The cylinder heads can also be laid with the recesses downwards in a container holding enough solvent to ensure that the recesses come into contact with the liquid.
2. Clean the valve-seat recesses.
3. Before being pressed in, the valve seats, and also the drifts, must be chilled to the stated temperature, for example using carbon dioxide snow in a heat-insulated container. Inserts to be cooled should be in close contact with the snow for at least 15 minutes. The pressing in of the valve seat inserts must be done very quickly,

since the insert warms up almost at once when it comes into contact with the recess in the cylinder head. To prevent excessive heat transfer from the drift to the insert the drift must also be chilled. If liquid air is available we recommend it as a cooling agent. In this case, however, the drift need not be chilled.

N.B. Take care in handling the above-mentioned cooling agents and items chilled with them, since frostbite is a very real hazard.

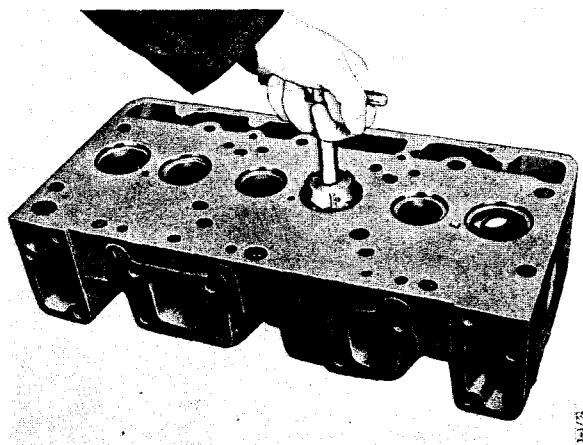
Machining Valve Seats

1. After the inserts have been pressed in, the seats must be very carefully adjusted in relation to the valve guides. Use for this purpose the appropriate milling tool with a locating spindle screwed with moderate force into the valve guide.
2. Turn the milling head with the 30° milling angle side facing the valve seat and put the milling head over the locating spindle, using the T-wrench. Turn with as much uniform force and speed as possible until the sealing surface attains the width A. If the sealing surface should become broader, which can easily occur in regrinding a valve seat insert, the inner edge of the seat should be bevelled to an angle of 60° until the width of the sealing surface does not exceed the maximum permissible.



Valve seat insert

1. Sealing surface
2. Bevel



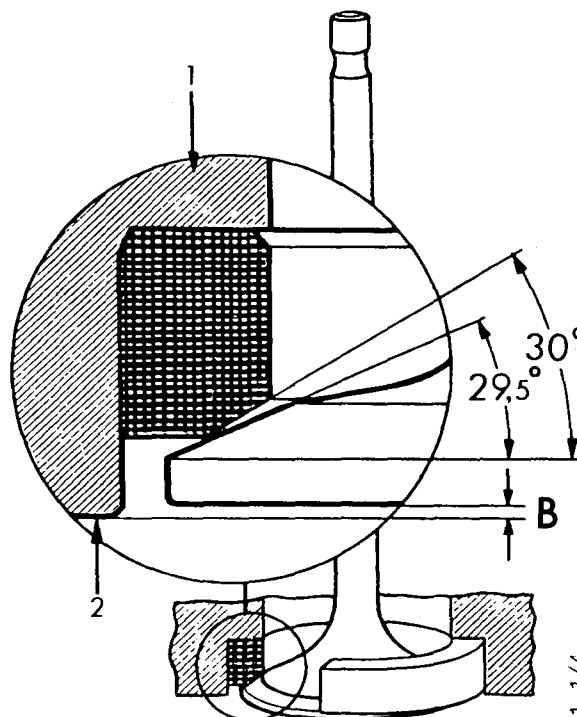
Grinding the valve seats



Checking the sealing surface of the valve seat

Grinding Valves

In order to make the sealing between valve and seat as effective as possible the sealing surfaces have been given a special shape. Thus the valve seat has an angle of 30° , while the corresponding angle on the valve is 29.5° . This arrangement produces a very narrow sealing surface, which during the bedding-in period gives better sealing than a broader surface would.



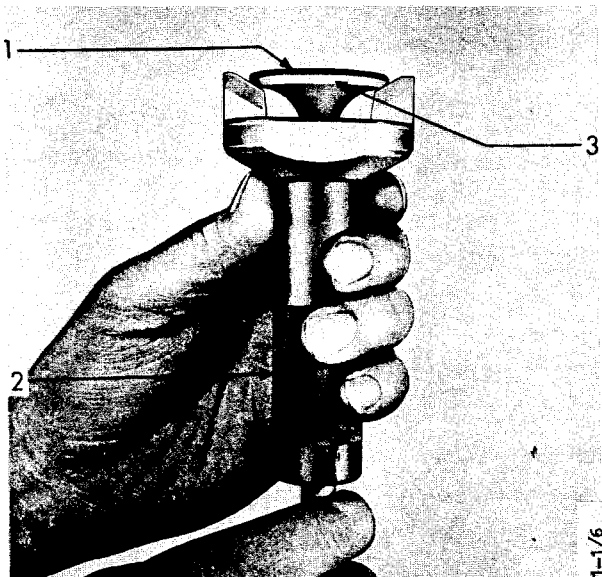
Valve and valve seat

1. Cylinder head
2. Underside of cylinder head

3. After carefully grinding the valve seats, smear the sealing surfaces with a thin film of marking blue. Then put a valve-seat gauge into the valve guide, press it lightly against the seat and twist it to and fro. The marking blue left of the gauge will indicate whether the grinding wheel, and with it the valve seat, has the correct angle. Failing this, the angle of the grinding wheel must be corrected and the grinding of the seat and its checking with the gauge must be repeated.

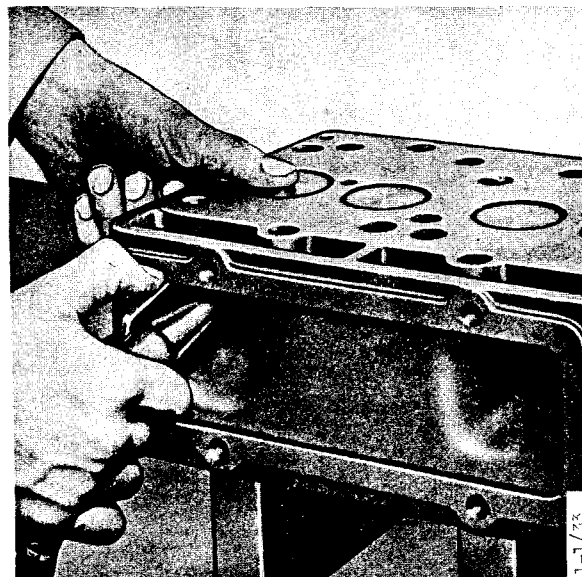
1. If the sealing surfaces of the valve heads are defective the valves must be reground by machine to 29.5° . The grinding wheel should be of vitrified aluminium oxide with a fineness of grain 70 or possibly 80 and a hardness grade of M-N at a structure of 8.

Check the angle of the wheel before grinding and adjust if necessary with a diamond. Do not grind away more stock than is absolutely necessary to give a clean contact surface. After grinding, check the angle of the contact surface with the appropriate valve gauge.



Checking the contact surface of the valve

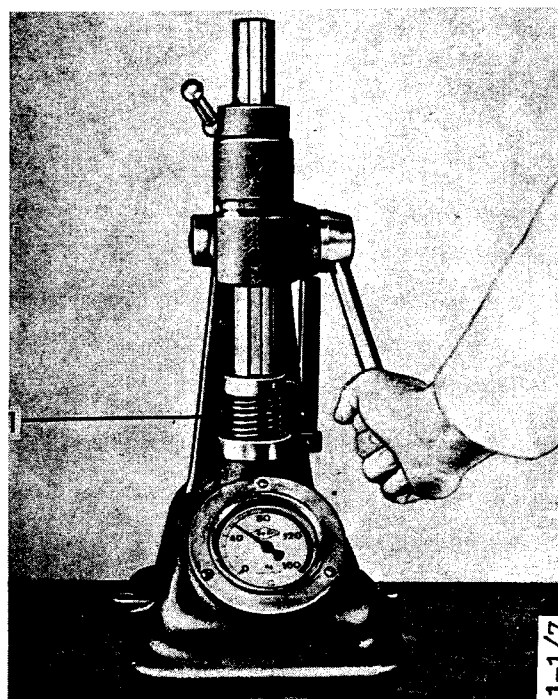
1. Valve
2. Valve gauge
3. Sealing surface



Checking the sealing of the valve

Examining Valve Springs and Fitting Valves

1. Before the valve springs are fitted they should be checked individually in a special testing device both in respect of free length and length at a given load.



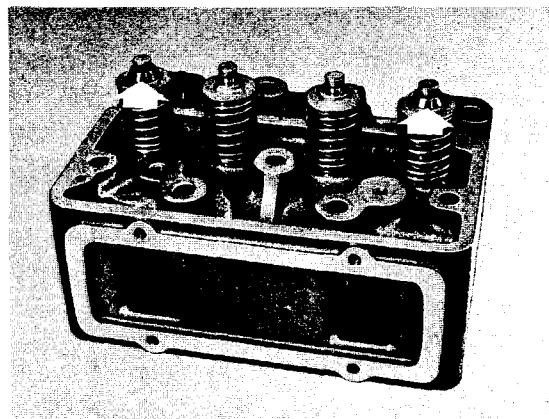
Testing the valve springs

1. Valve spring

2. Check the sealing of the valve as follows: Fit the valve into the cylinder head and pour a little liquid onto the valve head. Press the valve against the seat and blow compressed air in from below. If the valve is leaky, air bubbles will appear around the valve head. But the blast of compressed air must not be so powerful that the valve is lifted by the air pressure. If the valve does not seal, grind the seat — not the valve — once more using the grinder. Then clean the seat and test it afresh with the valve.
3. To clean the valve head and seat use compressed air and then check the measurement B.

2. Check also that there are no cracks or other defects in the springs.
3. Oil the valve stems with engine oil and fit the valves.
4. In fitting the valve springs, first put the guide washers into place and then fit, in the following order, the inner spring, the outer spring, and the washer above the springs. The valve springs are made with a pitch increasing towards one end.

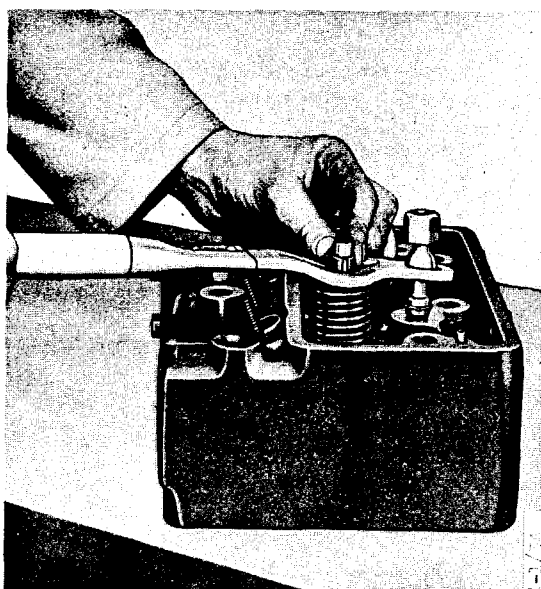
Using a valve-spring compressor, compress the springs and fit the valve-stem keys.



On certain type engines of a later design there is rubber sealing, which reduces the flow of oil to the valve stem.

5. Fit the valve caps. These caps must be free to rotate easily on the valve stems.
6. Fit in cases occurring rubber sealing on the valve stem ends.

AR

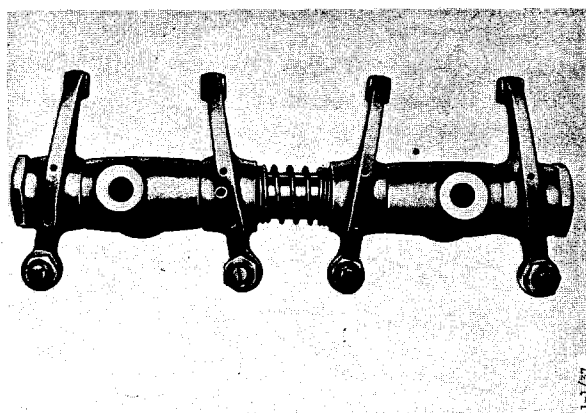
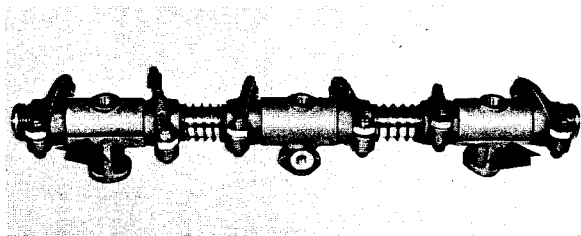


Fitting the valve-stem keys

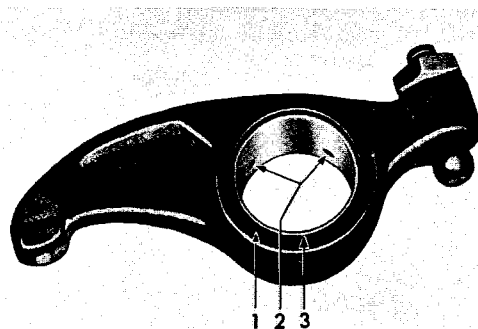
Renovating the valve mechanism

1. In engine renovation, the whole of the valve mechanism should be stripped down and checked. First examine the valve lifters. The surface at which the valve lifters contact the camshaft must not show any depressions or other damage. Defective valve lifters must be renewed at once.
2. Check that the pushrods are straight by rolling them on a surface plate. Against a light background it is very easy to see whether they are straight or not. If the deviations are not excessive the pushrods can be straightened out using a rubber mallet. The length of the pushrods should also be checked. Do not forget to examine the balls and ball cups. Remember that the ball cups are also subject to wear. The simplest method is to make comparison with a new pushrod.

3. Strip the rocker arm mechanism.
4. Wash all parts.
5. Check that all oil passages in the rocker arm shaft are clean, and that the shaft is undamaged.



Rocker arm mechanisms



1-1/10

Rocker arm with bushing

1. Rocker arm
2. Lubricating hole
3. Bushing

N.B. Two holes for the oil passages must be drilled in the bushing.

The bushing must then be reamed to bring the clearance to the correct figure.

Clean thoroughly

6. Check that the ball stud on the rocker arms has not worked loose or become damaged.
7. Check that the surface at which the rocker arms contact the valve caps is not worn. In mild cases the surface can be corrected in a grinding machine.
8. A rocker arm bushing which has become worn oval must be changed if the greatest diameter exceeds 25.04 mm. It should be pressed in and out using a drift. The bushing must be pressed in so that the slit comes in the position shown in Fig. C20. The bushing must be flush with that side of the rocker arm that bears against the bearing bracket.
9. Clean the oil passages in the rocker arms.
10. In assembling the rocker arm mechanism, first oil the shaft and then fit the various components in order. Note that the rocker arms are different in design, being arranged in pairs.

In fitting the rocker arm mechanism onto the cylinder head see points 5 and 6 under "Fitting Cylinder Heads".

Fitting Cylinder Heads

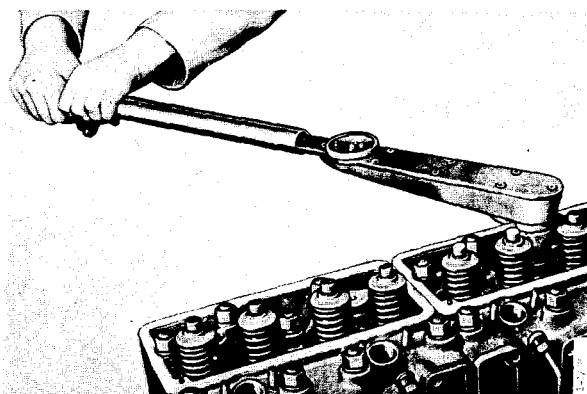
The order of assembly of the cylinder head and its various components is the reverse of that of removal.

Check in the cases where the studs for cylinder head nuts are fitted, that they are properly tightened and that the lining height is correct before the cylinder heads are put on.

1. Before putting on the cylinder heads, make quite sure that the sealing surfaces on the cylinder block, liners, cylinder heads and gasket are undamaged and absolutely free from coke deposits and other impurities. Clean the studs holes as well in the cylinder head.

The reason for this is that the high working pressures in the engine make it imperative that the various components seal perfectly against each other. The cylinder-head gasket must always be renewed. The sealing surfaces must not be smeared with sealing compound of any kind. Be careful not to damage the gasket in threading it over the studs.

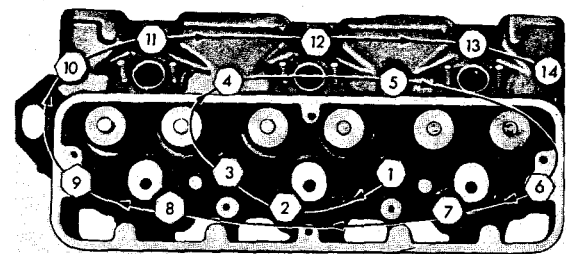
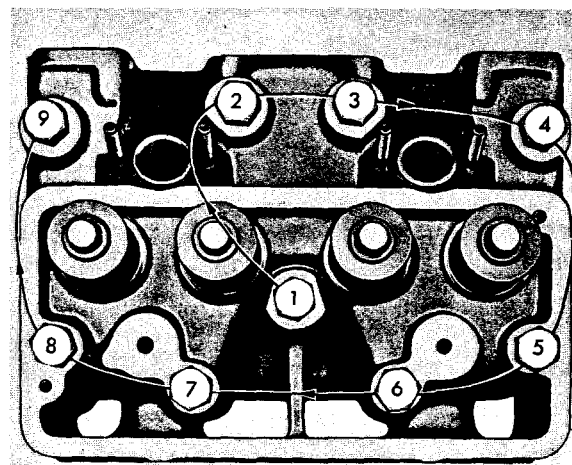
2. Lift the cylinder head into place and check that it enters properly on the studs. Make certain that these are well knocked down and with the end chamfer turned downwards.
3. Well lubricate the washers for the cylinder head nuts and the stud threads with engine oil.



Always tighten the cylinder nuts with torque wrench

4. Tighten the cylinder head nuts in the order as shown in the fig. and in three stages according to the following:

First of all tighten up all nuts to 50 % of max. torque, then once again to 75 % of max. torque and finally once more to max. torque.



Consecutive order for tightening the cylinder head nuts.

75.17265/3200.10.340

AR

SE, SF, SG, SH

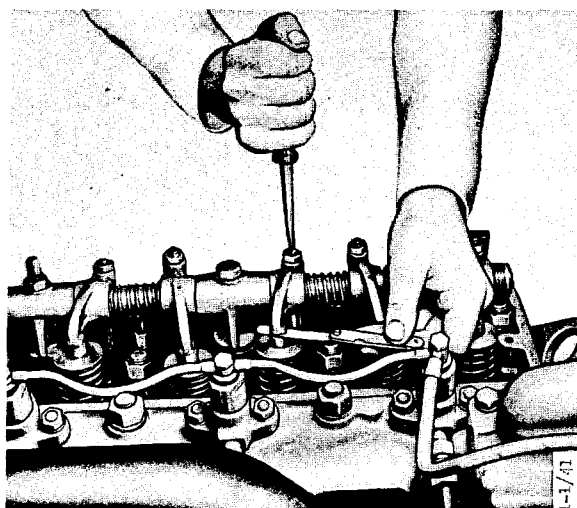
- On fitting the rocker arm mechanism on the cylinder head a gasket shall be placed under each bearing bracket. These gaskets have the task of sealing against the oil pressure in the lubricating oil passages in the rocker arm mechanism and it is therefore important not to forget them.

When the brackets for the rocker arm shaft are finally tightened it is necessary to check that both the outer-most rocker arms are easy to turn on the shaft.

- On engines with lubricating oil pipe to rocker arm mechanism this is connected.
- Check that there is no sealing washer remaining down in the injector sleeves. Always put in new washers.
- Tighten the injector nuts to the torque specified. This torque is automatically obtained if the torque wrench intended for this purpose is used.

Adjusting the Valve Clearance

After the cylinder heads have been fitted, the valve clearance must be adjusted. The valves to be adjusted must be in closed position.



Adjust the valve clearance

The clearance is adjusted by using the adjusting screw in one end of the rocker arm. When the clearance is correct the adjusting screw is secured in place with the lock nut. It is necessary for the engine to be completely cold when adjusting the valves. However, do not carry out adjustment immediately after driving, but allow the engine to stand and cool down at least half an hour before making adjustment. Lubricate the valve mechanism immediately after starting until the existing shot lubrication comes into function.

The simplest way to adjust the valves is by using the method below. In the description, the valves are numbered from in front and back.

- Turn the engine in its direction of rotation until the 1st cylinder piston is in the T.D.C position after the compression stroke. The intake and exhaust valves are now for this cylinder in closed position and the flywheel is in "T.D.C" according to the flywheel graduation. The following valves can now be adjusted:

Engine	Valve No
D/DS5	1*, 2**, 3**, 5*
D/DS8	1*, 2**, 4*, 6**, 8*, 10**
D/DS11	1*, 2**, 4*, 5**, 7*, 9**

* Intake valve

** Exhaust valve

- Turn the engine once more in its direction of rotation exactly one revolution from the adjustment mark according to above.

The flywheel is now once again in "T.D.C.", but with the camshaft in another position. The remaining valves can now be adjusted.

Engine	Valve No.
D/DS5	4*, 6**, 7**, 8*
D/DS8	3**, 5*, 7**, 9*, 11**, 12*
D/DS11	3**, 6*, 8**, 10*, 11**, 12*

* Intake valve

** Exhaust valve

Advancing the Cylinder-head Nuts (bolts)

After running the engine up to its working temperature, the cylinder-head nuts must be advanced while the engine is warm.

After the engine has been tested under load, advancement shall also be undertaken at once. (See table)

4. Follow the points 5 and 6 under the heading "Fitting Cylinder Heads".

1. Follow points 8–10 under the heading "Removing Cylinder Heads".

Let the engine cool and check the valve clearance according to the instructions given under "Adjusting the Valve Clearance."

On engines with cylinder-head nuts beneath the pressure pipes, these pipes must be detached from the injectors to enable the cylinder-head nuts to be tightened with the appropriate wrench.

When the engine has done about 50 hours or 2,500 km the cylinder head nuts (the bolts) must be advanced again.

Follow the instructions under "Advancement of Cylinder Head Nuts" except point 2 for which the following applies:

2. Slacken off each cylinder head nut separately a fourth of a turn and pull it immediately to the max. torque specified. Tighten all the nuts in this way in consecutive order according to the fig.
3. Check once again the advancement torque of all nuts.

Undo each cylinder head nut separately four turns, lubricate the washer and thread of stud with engine oil and then tighten up immediately to the max. specified torque. Tighten all the nuts in this manner consecutively according to the fig.

On engines with cylinder head bolts, it will first be necessary to remove the injectors. After which the bolts can be removed **one at a time**. Each bolt is taken out, lubricated with engine oil, refitted and tightened to max. torque.

Tightening the Cylinder Head Bolts (nuts)

	Engine Typ		
	D8	DS8	D/DS11
Driving assembly	X	X	X
After running the engine warm without load	—	X 1)	—
After test running with load (approx. 1/2 h)	X	X	X
After 2500 km (50 h) (lubricate the threads)	X	X	X

1) Does not apply to DS8 as from engine No. 761785 (i.e. with ten cylinder head bolts).