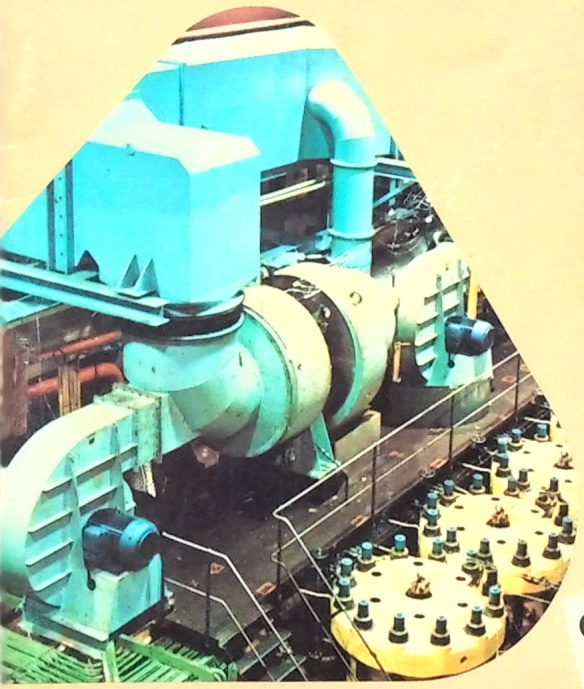
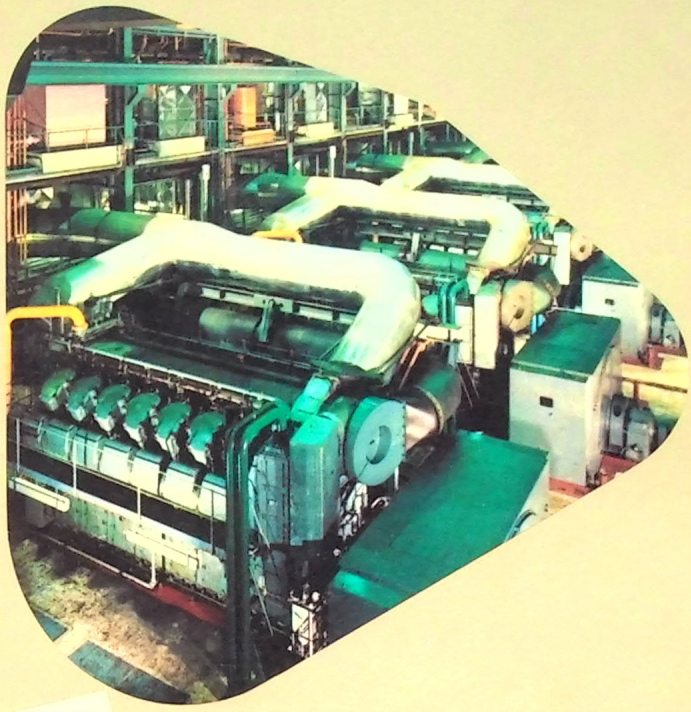
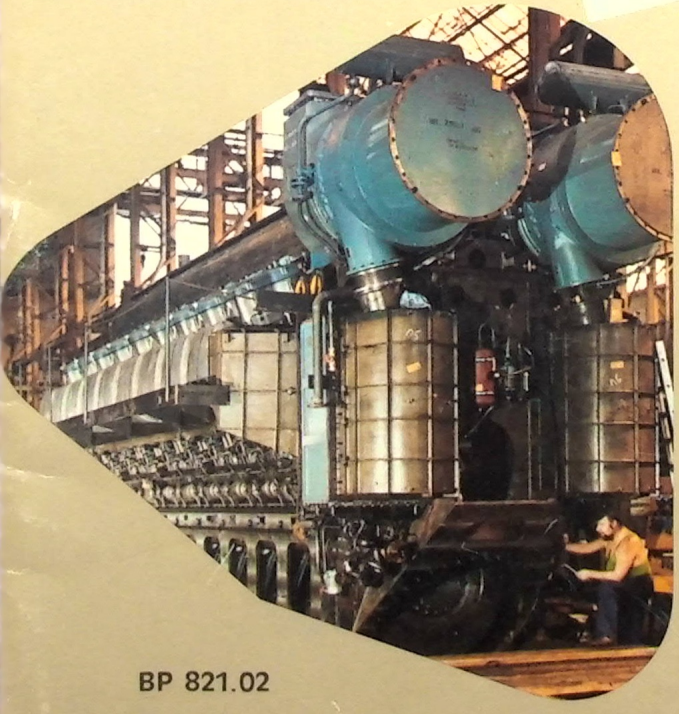
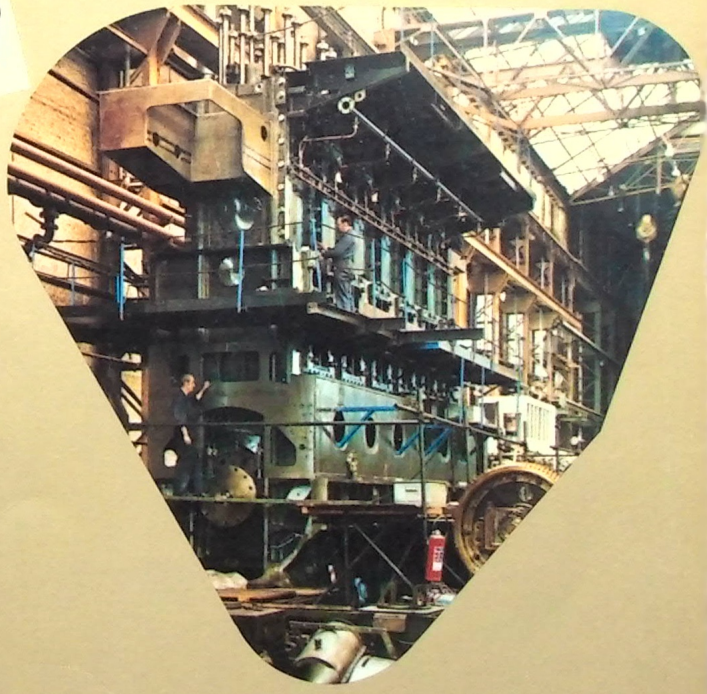
ACEC DIESEL ENGINES



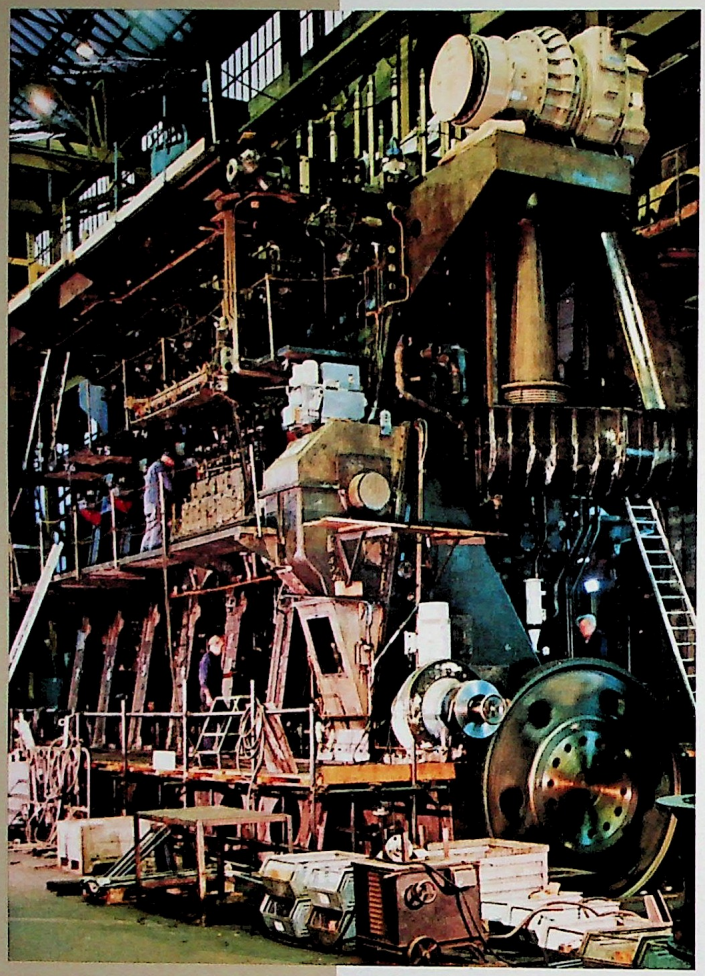






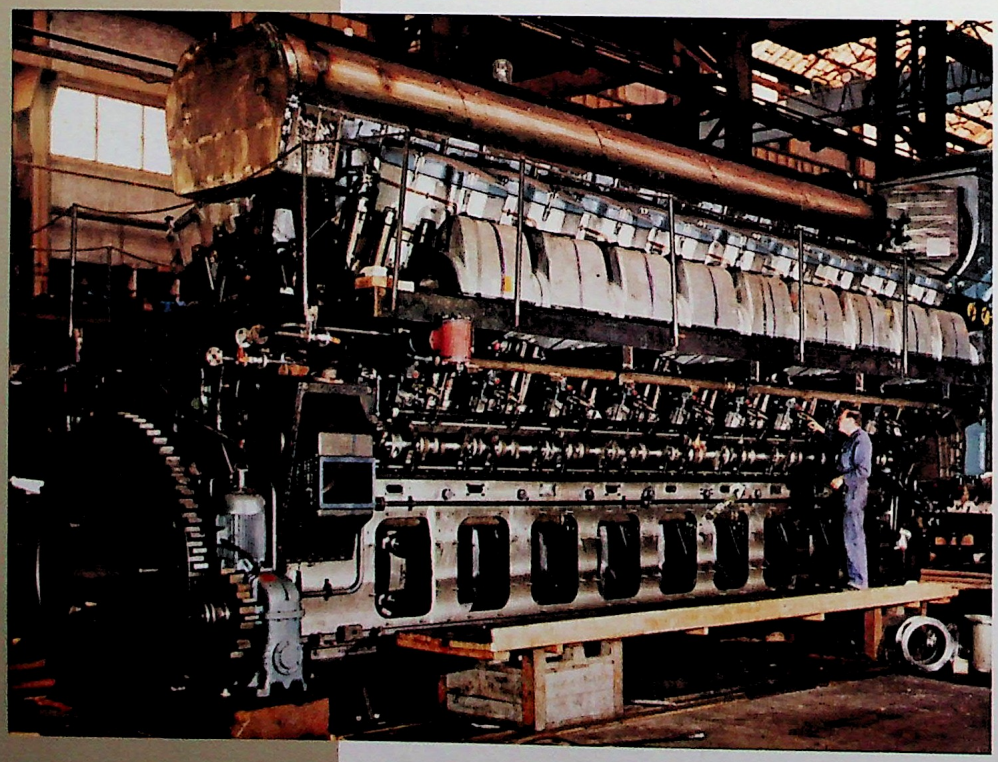
BP 821.02

ACEC BP4 B-6000 Charleroi-Belgium
Telex 51.227 acec b Tel. 071/44 21 11

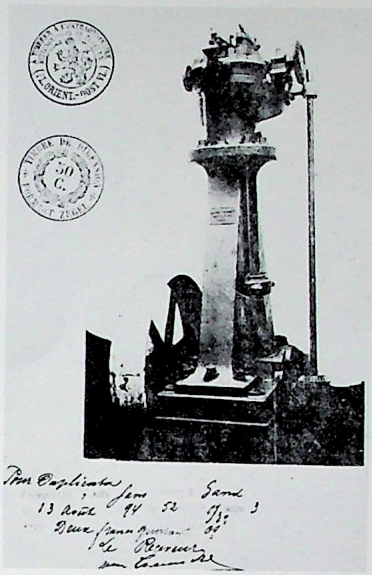


A two-stroke diesel engine type ACEC-M.A.N. K6SZ90/160A at test bed (19 200 H.P. — 122 rpm). This engine is sold to the shipyard Boelwerf for installation in the bulk carrier "EEKLO".

An 18 cyl. four-stroke diesel engine type ACEC-M.A.N. 52/55A during erection.



THE CONSTRUCTION OF DIESEL ENGINES



First Carels-Diesel engine built in 1894.

HISTORICAL NOTE

It is more than 75 years since the Ghent works of ACEC began building diesel engines. In 1894 Ateliers Carels signed a licence contract with Dr. Diesel, even before his invention had taken practical form and, the same year, the first engine was built. The construction in 1902 of a single-cylinder diesel engine of industrial type marked the outcome of persistent research and repeated tests. From that time, Carels engines enjoyed increasing renown and, in 1912, the firm was constituted as a limited company under the name of "Usines Carels Frères".

It is no exaggeration to say that Carels Frères played the part of pioneers in the construction and development of the diesel engine. Here is the evidence of this :

1902 : first industrial type diesel engine;

1905 : production of a 500 hp 3-cylinder unit, the most powerful of its time;

1908 : production of a direct-reversing, 2-stroke, 8-cylinder marine engine developing 1000 hp;

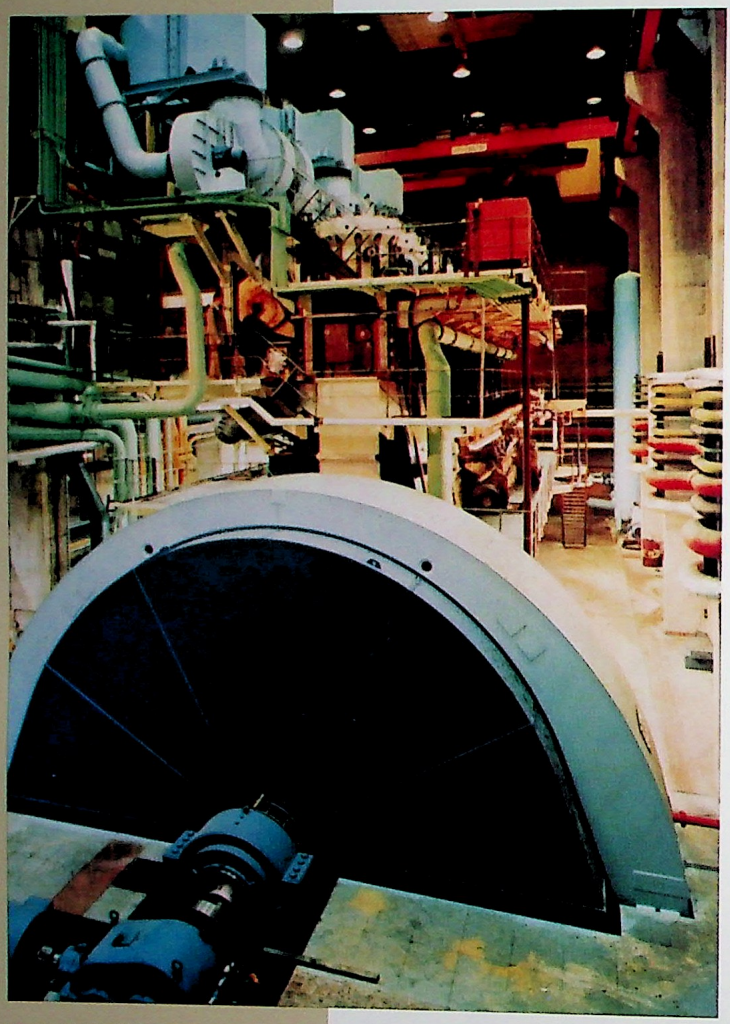
1910 : construction of a single-cylinder, 2-stroke diesel of 1000 hp, which was the forerunner of the great marine and stationary engines of the present time;

1913 : the largest engine running in the U.S.A. was a Carels.

After the interruption due to the First World War, this firm's remarkable career was quickly resumed and, in 1920, the company took the style of "Société d'Electricité et de Mécanique (S.E.M.), Procédés Thomson-Houston & Carels".

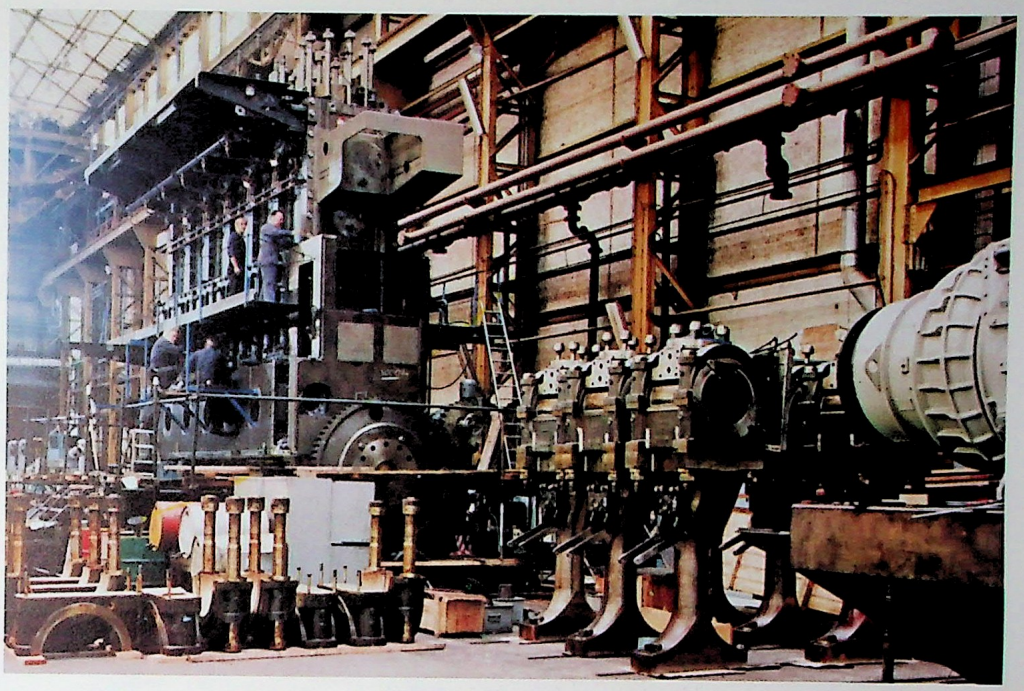
In 1960 the company became the mechanical division of ACEC. In these different companies and throughout the years the diesel engine activity continued with increasing success.

In 1956 a licence contract was made with Maschinenfabrik Augsburg-Nürnberg (M.A.N.) for the construction of large two-stroke engines (KSZ). Similar contracts were made in 1964 and 1969 for the building of medium-speed four-stroke diesel engines.



General view of a diesel generator set of 39.1 MVA equipped with a 40 000 H.P. two-stroke diesel engine.

Bulk carrier "MINERAL BELGE» owned by CMB, propulsed by an ACEC-M.A.N. two-stroke diesel engine, type K7Z 86/106E (16 000 H.P. — 118 rpm).



A two-stroke diesel engine type ACEC-M.A.N. K6SZ 70/125B (12 400 H.P. – 145 rpm) at test bed. This engine is foreseen for a fruit carrier owned by Ahlers & Partners.

SOME OF OUR RECENT ACHIEVEMENTS AND ORDERS OF ACEC-M.A.N.-DIESEL ENGINES

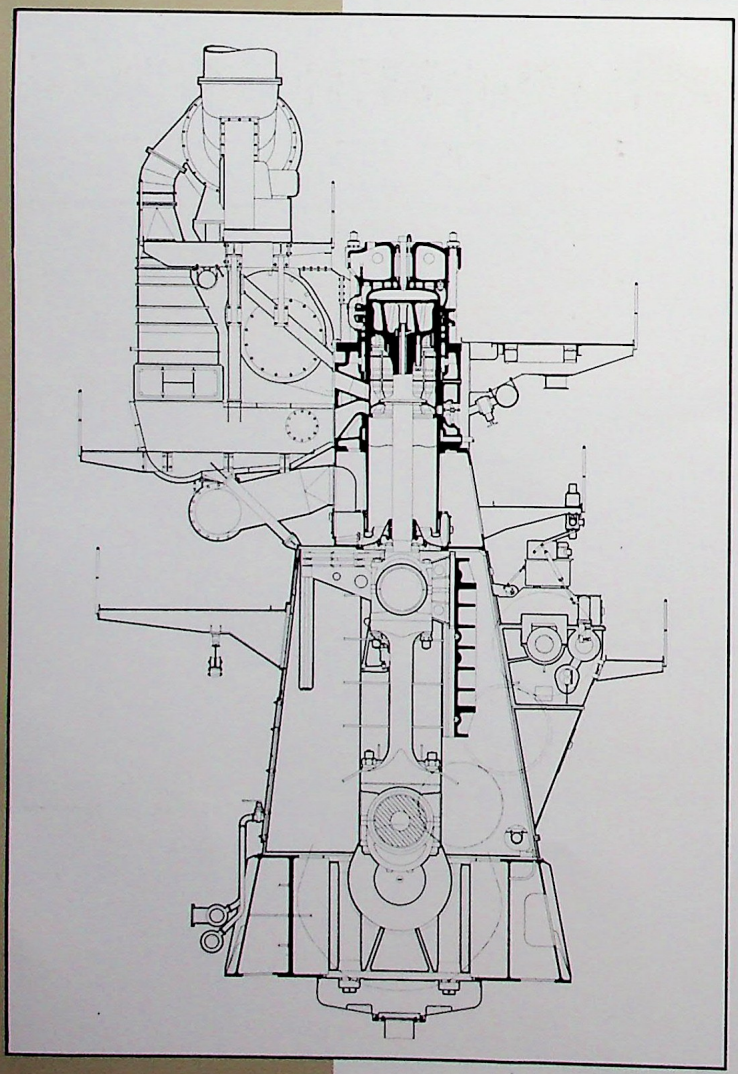
MARINE INSTALLATIONS

Engine type	HP	Ship type	Shipping C°	Commissioning
K 8 Z 86/160 F	20 000	Tanker –82 000 T	AHLERS & C°	4/74
K 8 Z 86/160 F	20 000	Tanker –82 000 T	AHLERS & C°	10/74
K 8 Z 86/160 F	20 000	Tanker –82 000 T	AHLERS & C°	4/77
K 8 Z 70/120 E	11 200	Bulkcarrier	BOLTON SHIPPING C°	5/73
K 8 Z 70/120 E	11 200	Bulkcarrier	BOLTON SHIPPING C°	12/73
K 8 Z 70/120 E	11 200	Bulkcarrier	BOLTON SHIPPING C°	10/76
K 7 Z 86/160 E	16 100	Bulkcarrier 66 500 T	C.M.B.	11/73
K 7 Z 86/160 E	16 100	Bulkcarrier 66 500 T	C.M.B.	6/76
K 6 SZ 90/160 A	19 200	Bulkcarrier 75 700 T	BOCIMAR	4/78
K 6 SZ 90/160 A	19 200	Bulkcarrier 75 700 T	BOCIMAR	12/78
K 6 SZ 70/125 B	12 400	Bulkcarrier	AHLERS & C°	10/78
K 6 SZ 70/125 B	12 400	Bulkcarrier	AHLERS & C°	5/79
K 8 SZ 70/125 B	16 540	Fruitcarrier	AHLERS & C°	6/79
K 8 SZ 70/125 B	16 540	Fruitcarrier	AHLERS & C°	9/79
K 8 SZ 70/125 B	16 540	Fruitcarrier	AHLERS & C°	2/80

STATIONARY INSTALLATIONS

1 x K 12 Z 93/170	30 000	Base-load group	ELEC. COMP. GHENT	12/67
1 x K 10 SZ 105/180	40 000	Base-load group	ELEC. COMP. GHENT	11/72
1 x K 12 SZ 90/160 A	40 000	Base-load group	ELEC. COMP. GHENT	End 79
7 x 14 V 52/55	7 x 14 000	Base-load group	W.V.E.M.	6/76
1 x 18 V 52/55 A	18 000	Base-load group	W.V.E.M.	11/78

Bulk carrier "MS EEKLO" during sea trials, owned by BOCIMAR and propulsed by an ACEC-M.A.N. K6 SZ 90/160A engine (19 200 H.P. — 122 rpm).

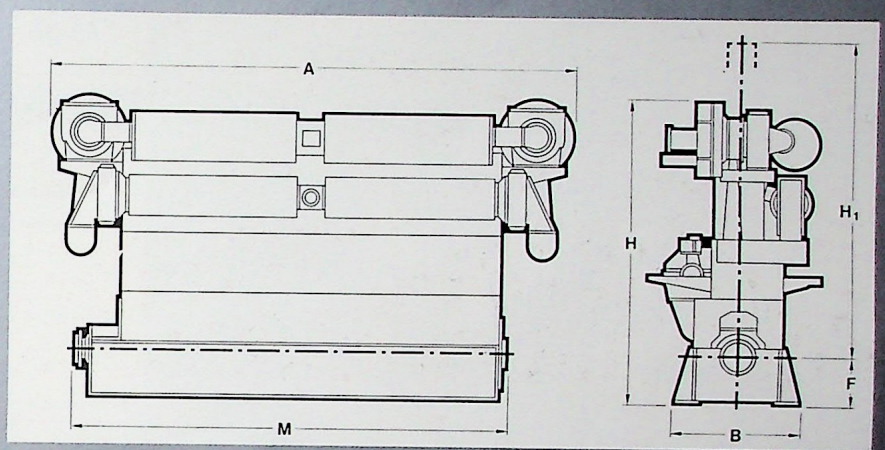


Cross-section of a two-stroke diesel engine type ACEC-M.A.N. K10 SZ 105/180 (40 000 H.P. — 107 rpm).

ACEC-M.A.N. - TWO-STROKE DIESEL ENGINES

OUTPUT — WEIGHT — DIMENSIONS

KSZ 70/125 B/BL
KSZ 78/155 B/BL
KSZ 90/160 B/BL



KSZ 70/125 — 1520 kW/cyl. — 145 rpm — Cm = 6.04 m/s — pe = 13.1 bar.

Engine	No. of cyls.	P kW	A mm	M** mm	B mm	F mm	H mm	Ho mm	H_1 mm	a mm	b mm	h mm	Weight t
K 5SZ 70/125 B/BL	5*	7 600	9 300	8 406	3 240	1 250	8 200	7 900	9 600	7 850	3 800	3 050	300
K 6SZ 70/125 B/BL	6*	9 120	12 100	9 706	3 240	1 250	8 000	7 900	9 600	5 050	1 950	2 500	345
K 7SZ 70/125 B/BL	7	10 640	14 100	11 758	3 240	1 250	8 000	7 900	9 600	5 050	2 100	2 500	400
K 8SZ 70/125 B/BL	8	12 160	15 400	13 058	3 240	1 250	8 000	7 900	9 600	5 050	2 100	2 500	450
K 9SZ 70/125 B/BL	9	13 680	17 200	14 358	3 240	1 250	8 200	7 900	9 600	6 400	2 050	3 000	495
K10SZ 70/125 B/BL	10	15 200	18 500	15 658	3 240	1 250	8 200	7 900	9 600	6 400	2 200	3 000	540

* Camshaft drive at coupling end; thrust bearing integrated in camshaft drive. ** Crankshaft length.

KSZ 78/155 — 1960 kW/cyl. — 122 rpm — Cm = 6.3 m/s — pe = 13.0 bar.

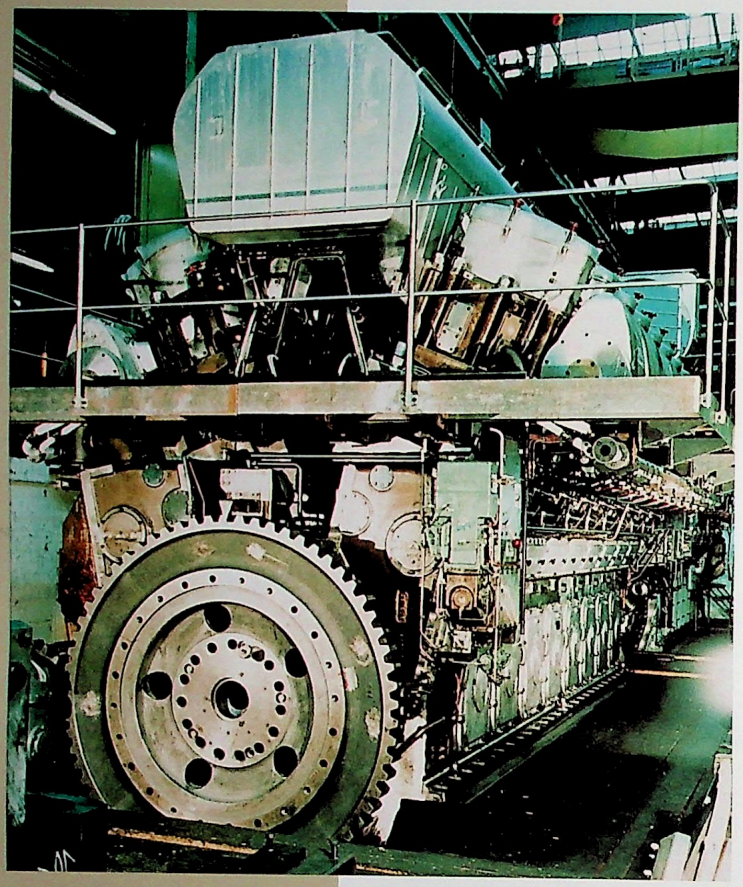
K 6SZ 78/155 B/BL	6*	11 760	13 200	10 745	3 900	1 550	9 600	9 600	11 700	5 050	2 100	2 500	500
K 7SZ 78/155 B/BL	7	13 720	15 800	13 225	3 900	1 550	9 800	9 600	11 700	6 400	2 050	3 000	595
K 8SZ 78/155 B/BL	8	15 680	17 300	14 675	3 900	1 550	9 800	9 600	11 700	6 400	2 200	3 000	665
K 9SZ 78/155 B/BL	9	17 640	18 700	16 125	3 900	1 550	9 800	9 600	11 700	6 400	2 200	3 000	735

* Camshaft drive at coupling end; thrust bearing integrated in camshaft drive. ** Crankshaft length.

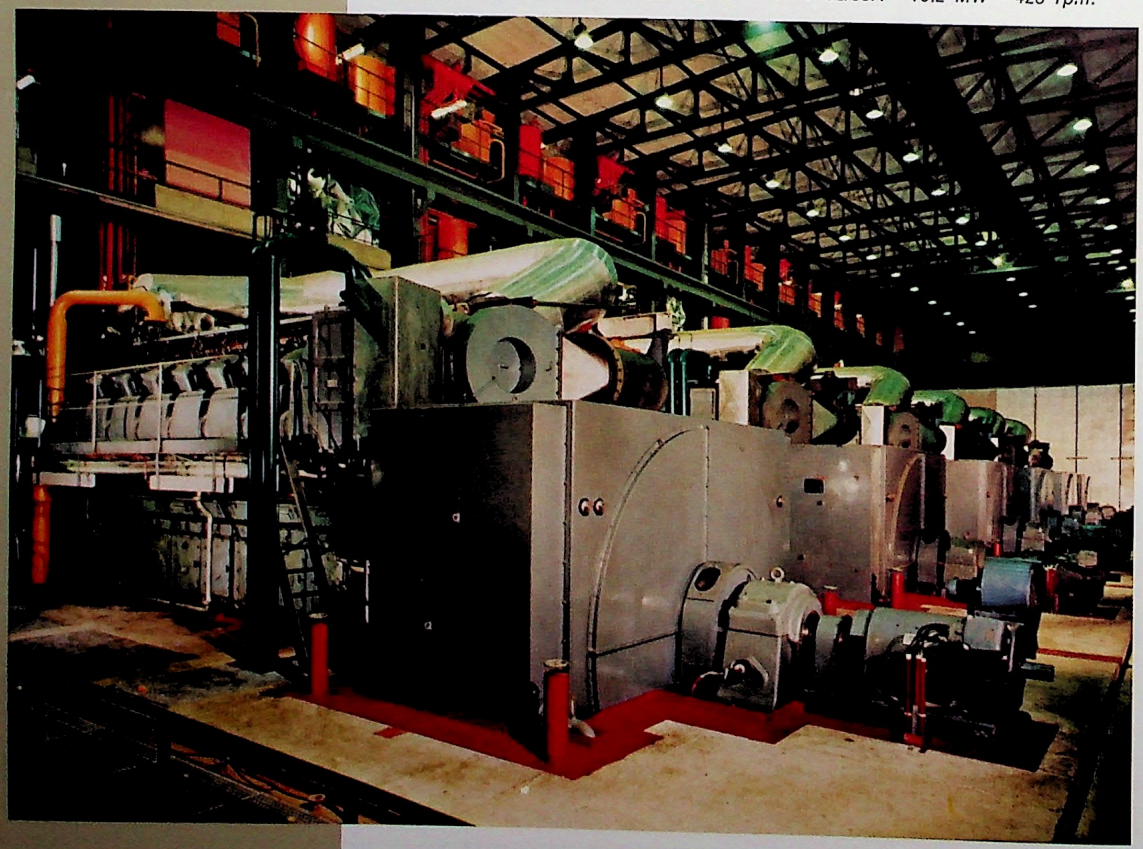
KSZ 90/160 — 2700 kW/cyl. — 122 rpm — Cm = 6.5 m/s — pe = 13.0 bar.

K 6SZ 90/160 B/BL	6*	16 200	14 100	12 023	4 460	1 600	10 500	10 100	12 300	6 400	2 200	3 000	615
K 7SZ 90/160 B/BL	7	18 900	16 700	14 493	4 460	1 600	10 500	10 100	12 300	6 400	2 200	3 000	730
K 8SZ 90/160 B/BL	8	21 600	19 800	16 093	4 460	1 600	10 900	10 100	12 300	7 650	2 400	3 500	820
K 9SZ 90/160 B/BL	9	24 300	21 400	17 693	4 460	1 600	10 900	10 100	12 300	7 650	2 400	3 500	895
K10SZ 90/160 B/BL	10	27 000	23 000	19 293	4 460	1 600	10 900	10 100	12 300	7 650	2 800	3 500	980
K12SZ 90/160 B/BL	12	32 400	26 700	22 493	4 460	1 600	10 800	10 100	12 300	8 400	2 800	4 050	1 150

* Camshaft drive at coupling end; thrust bearing integrated in camshaft drive. ** Crankshaft length.



General view of a four-stroke diesel engine type V52/55A (450 rpm - 775 kW/cyl.).

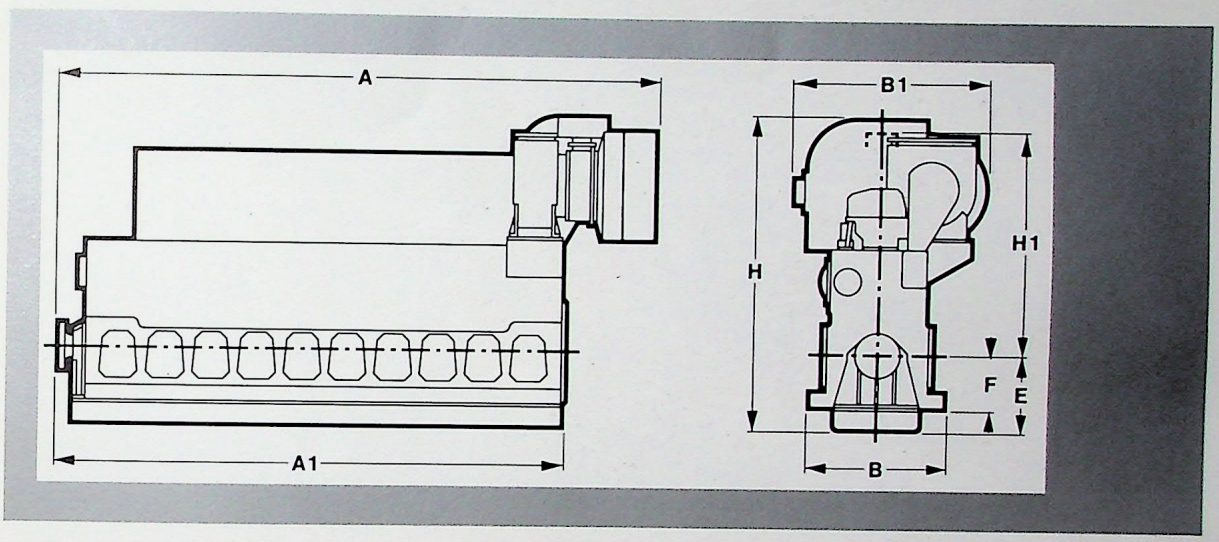


General view of the WVEM power station equipped with 7 medium-speed ACEC-M.A.N. diesel generating sets type 14 V 52/55A - 10.2 MW - 428 rpm.

ACEC-M.A.N. - MEDIUM-SPEED DIESEL ENGINES

OUTPUT — WEIGHT — DIMENSIONS

L-V 32/36
L-V 40/45
L-V 52/52
V 65/65



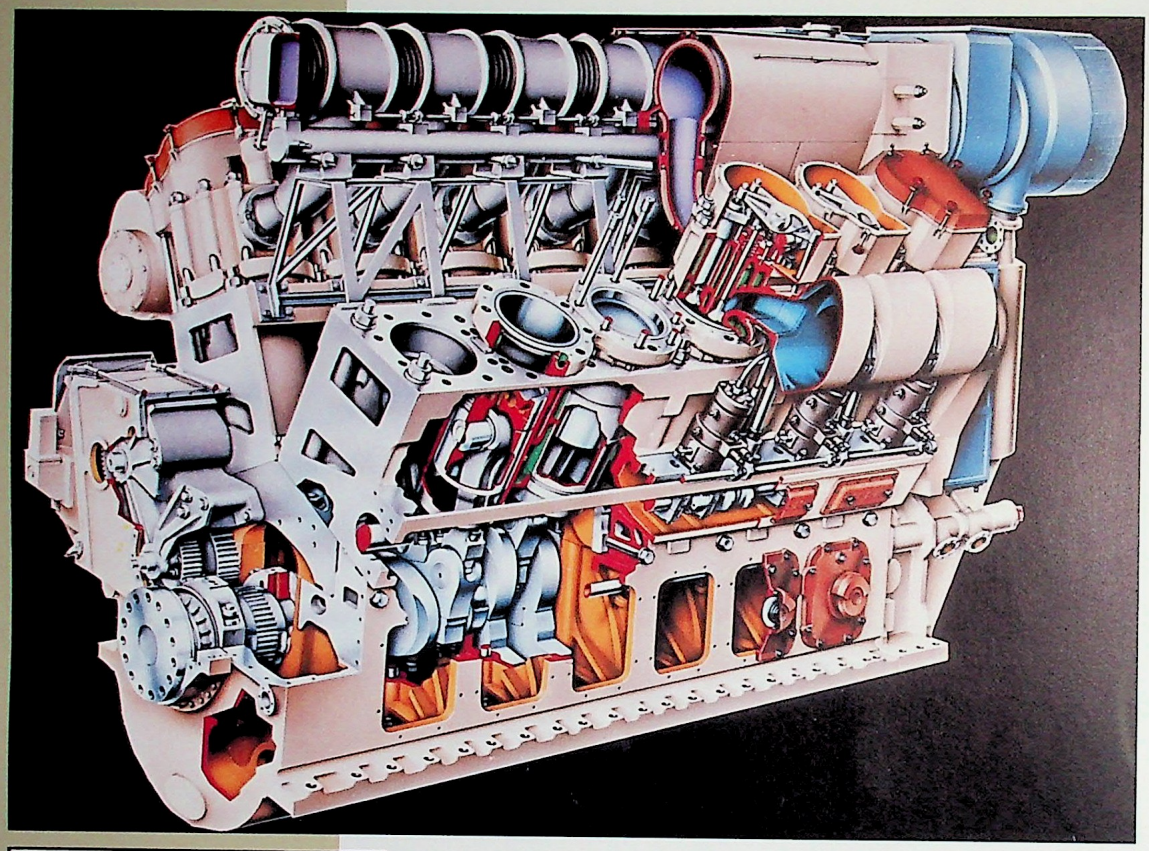
L-V 32/36 — 370 kW/cyl. — 750 rpm — Cm = 9.0 m/s — pe = 20.4 bar.

Engine	No of cyls.	P kW	A mm	A_1 mm	B mm	B_1 mm	H mm	E mm	F mm	H_1 mm	Weight t
6L 32/36	6	2 200	5 600	4 800	1 600	2 250	3 550	850	600	2 600	27
7L 32/36	7	2 590	6 140	5 340	1 600	2 250	3 550	850	600	2 600	32
8L 32/36	8	2 960	6 900	5 880	1 600	2 350	3 650	850	600	2 600	37
9L 32/36	9	3 330	7 400	6 420	1 600	2 350	3 650	850	600	2 600	42
12V 32/36	12	4 440	6 350	4 980	1 600	3 300	3 650	850	600	2 300	44
14V 32/36	14	5 180	6 900	5 550	1 600	3 300	3 750	850	600	2 300	50
16V 32/36	16	5 920	7 500	6 120	1 600	3 300	3 750	850	600	2 300	58
18V 32/36	18	6 660	8 050	6 690	1 600	3 300	3 750	850	600	2 300	65

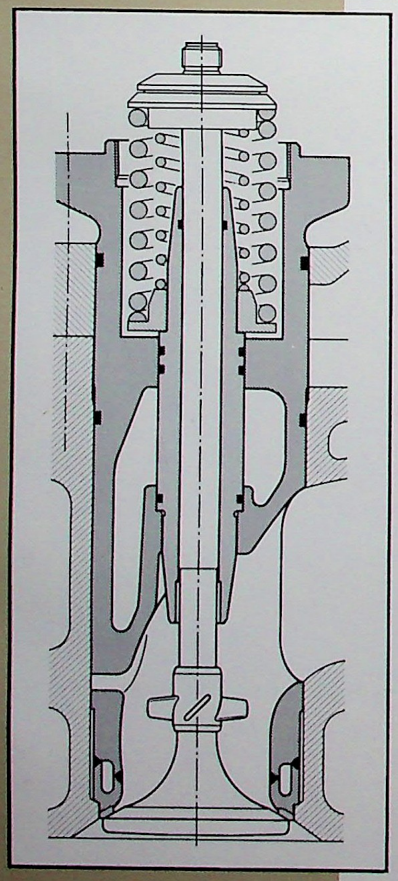
L-V 40/45 — 550 kW/cyl. — 600 rpm — Cm = 9.0 m/s — pe = 19.5 bar.

6L 40/45	6	3 300	7 100	5 440	2 000	2 400	4 550	1 145	750	3 380	50
7L 40/45	7	3 850	7 780	6 120	2 000	2 400	4 550	1 145	750	3 380	58
8L 40/45	8	4 400	8 600	6 800	2 000	2 400	4 700	1 145	750	3 380	64
9L 40/45	9	4 950	9 300	7 480	2 000	2 400	4 700	1 145	750	3 380	72
12V 40/45	12	6 600	7 650	6 040	2 000	3 050	4 600	1 168	750	3 170	79
14V 40/45	14	7 700	8 600	6 820	2 000	3 100	4 750	1 168	750	3 170	92
16V 40/45	16	8 800	9 350	7 600	2 000	3 100	4 750	1 168	750	3 170	102
18V 40/45	18	9 900	10 150	8 380	2 000	3 100	4 750	1 168	750	3 170	115

H_1 = Height required for removing cylinder liner and piston.

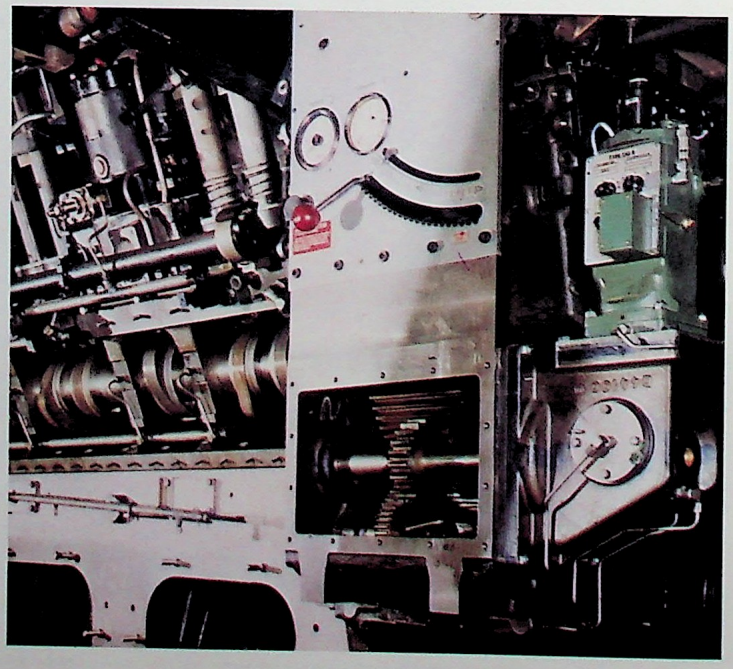


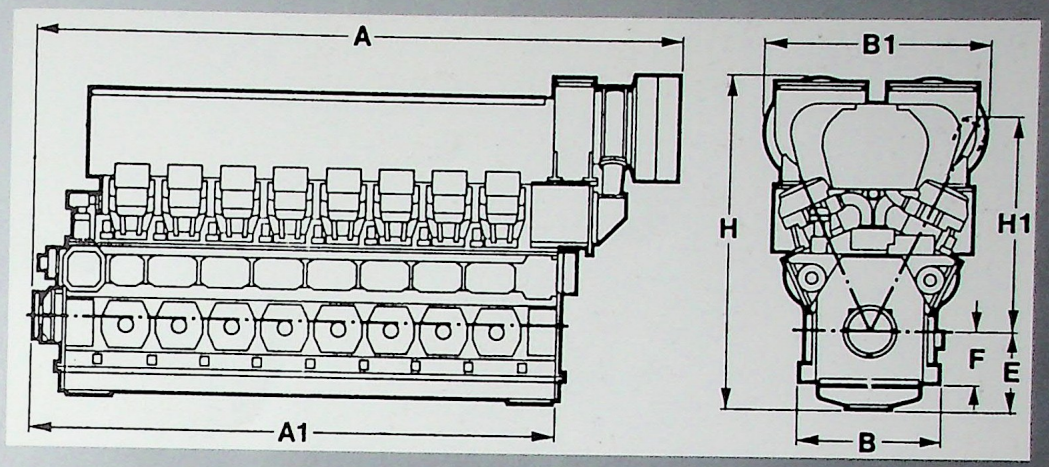
Artist's impression of a medium-speed diesel engine type 12 V 52/55A.



Exhaust valve of a V52/55A four-stroke engine.

Detail of the cam-shaft and governor of a V52/55A engine.





L-V 52/52 — 885 kW/cyl. — 514 rpm — Cm — 8.91 m/s — pe = 18.7 bar.

Engine	No of cyls.	P kW	A mm	A_1 mm	B mm	B_1 mm	H mm	E mm	F mm	H_1 mm	Weight t
6L 52/52	6	5 310	8 050	6 235	2 000	2 460	4 650	1 122	400	3 800	93
7L 52/52	7	6 195	8 900	7 035	2 000	2 720	4 650	1 122	400	3 300	105
8L 52/52	8	7 080	9 700	7 835	2 000	2 720	4 650	1 122	400	3 800	118
9L 52/52	9	7 965	10 500	8 635	2 000	2 720	4 650	1 122	400	3 800	129
10V 52/52	10	8 850	7 700	5 440	2 100	4 000	5 200	1 140	550	3 600	126
12V 52/52	12	10 620	8 500	6 240	2 100	4 000	5 200	1 140	550	3 600	145
14V 52/52	14	12 390	9 350	7 040	2 100	4 000	5 200	1 140	550	3 600	171
16V 52/52	16	14 160	10 150	7 840	2 100	4 000	5 300	1 140	550	3 600	188
18V 52/52	18	15 930	10 950	8 640	2 100	4 000	5 300	1 140	550	3 600	208

H_1 = Height required for removing cylinder liner and piston.

V 65/65 — 1325 kW/cyl. — 400 rpm — Cm = 8.67 m/s — pe = 18.4 bar.

12V 65/65	12	15 900	11 900	9 150	3 000	4 800	7 600	1 920	1 200	4 650	255
14V 65/65	14	18 550	13 050	10 300	3 000	4 800	7 600	1 920	1 200	4 650	294
16V 65/65	16	21 200	14 200	11 450	3 000	4 800	7 600	1 920	1 200	4 650	340
18V 65/65	18	23 850	15 350	12 600	3 000	4 800	7 600	1 920	1 200	4 650	382

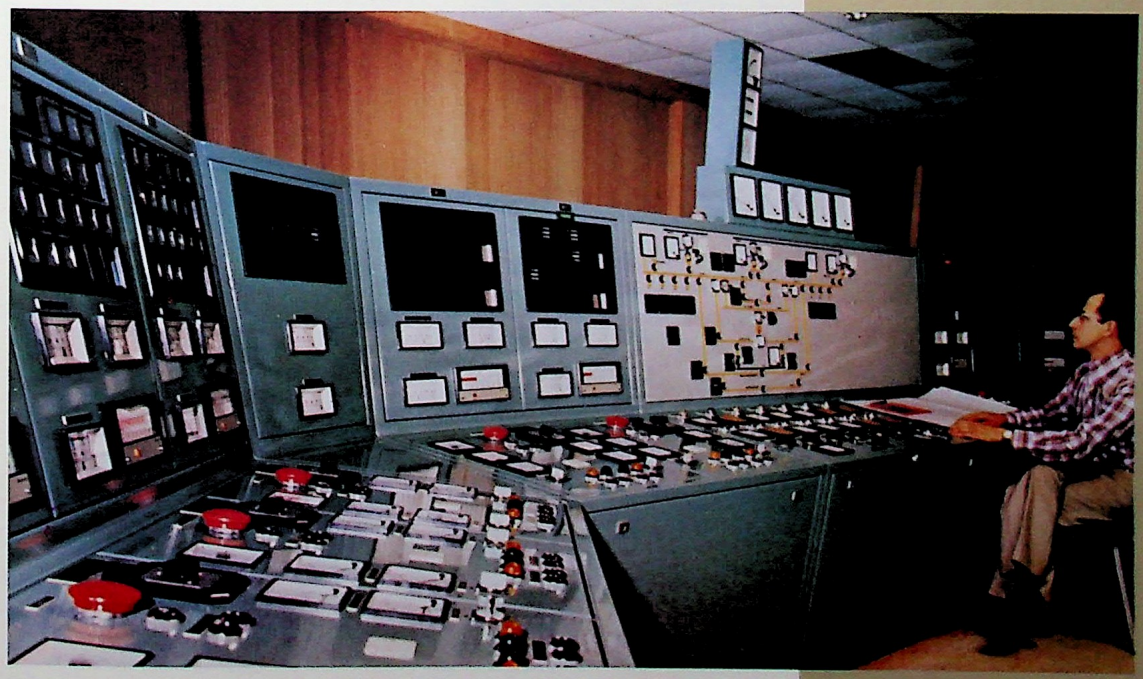
OUTPUT OF MEDIUM-SPEED DIESELS FOR POWER GENERATION

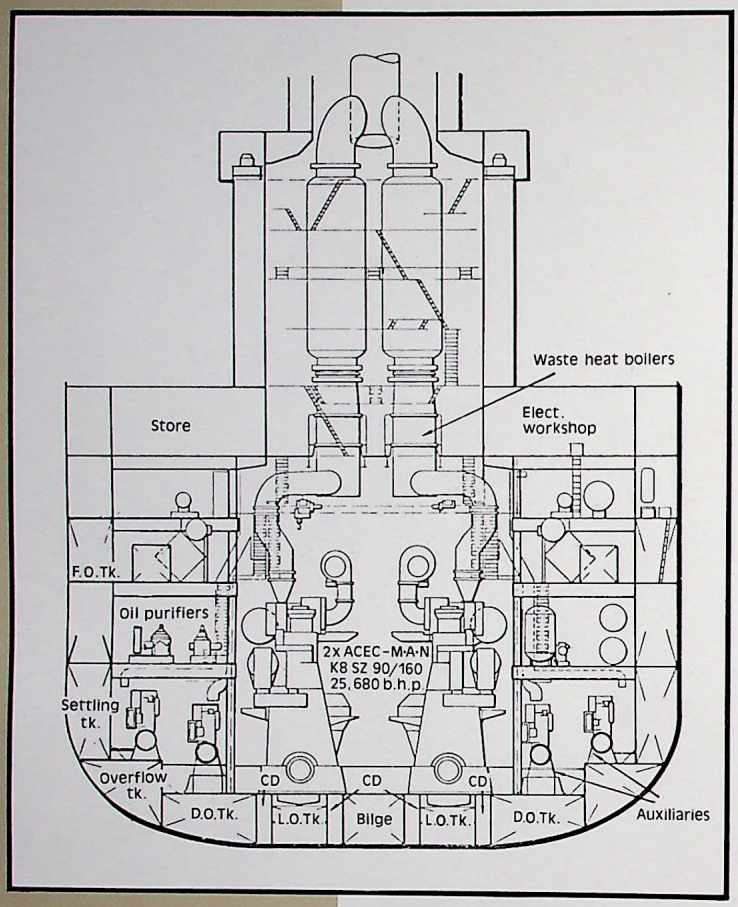
Engine type	PS/ Cyl.	η_g	50 Hz					60 Hz				
			P (Diesel)		n	N_N Generator		P (Diesel)		n	N_N Generator	
			kW	Ps	rpm	kVA	kW	kW	Ps	rpm	kVA	kW
6L 32/36			2 220	3 000		2 635	2 110	2 130	2 880		2 530	2 025
8L 32/36			2 960	4 000		3 515	2 810	2 840	3 040		3 375	2 700
9L 32/36			3 330	4 500		3 955	3 165	3 195	4 320		3 795	3 035
12V 32/36	500	95	4 440	6 000	750	5 275	4 220	4 260	5 760	720	5 060	4 045
14V 32/36			5 180	7 000		6 150	4 920	4 970	6 720		5 900	4 720
16V 32/36			5 920	8 000		7 030	5 625	5 680	7 680		6 745	5 395
18V 32/36			6 660	9 000		7 910	6 325	6 390	8 640		7 590	6 070
6L 40/45			3 300	4 500		3 960	3 170	3 300	4 500		3 960	3 170
8L 40/45			4 400	6 000		5 280	4 225	4 400	6 000		5 280	4 225
9L 40/45			4 950	6 750		5 940	4 750	4 950	6 750		5 940	4 750
12V 40/45	750	96	6 600	9 000	600	7 920	6 335	6 600	9 000	600	7 920	6 335
14V 40/45			7 700	10 500		9 240	7 390	7 700	10 500		9 240	7 390
16V 40/45			8 800	12 000		10 560	8 450	8 800	12 000		10 560	8 450
18V 40/45			9 900	13 500		11 880	9 505	9 900	13 500		11 880	9 505
6L 52/52			5 160	7 020		6 255	5 005	5 310	7 200		6 440	5 150
7L 52/52			6 020	8 190		7 300	5 840	6 195	8 400		7 510	6 010
8L 52/52			6 880	9 360		8 340	6 675	7 080	9 600		8 585	6 870
9L 52/52			7 740	10 530		9 385	7 510	7 965	10 800		9 660	7 725
10V 52/52	1200	97	8 600	11 700	500	10 430	8 340	8 850	12 000	514	10 730	8 585
12V 52/52			10 320	14 040		12 515	10 010	10 620	14 400		12 875	10 300
14V 52/52			12 040	16 380		14 600	11 680	12 390	16 800		15 025	12 020
16V 52/52			13 760	18 720		16 685	13 345	14 160	19 200		17 170	13 735
18V 52/52			15 480	21 060		18 770	15 015	15 930	21 600		19 315	15 450
6L 52/55 A			4 440	6 030		5 380	4 305	4 650	6 330		5 640	4 510
7L 52/55 A			5 180	7 035		6 280	5 025	5 425	7 385		6 575	5 260
8L 52/55 A			5 920	8 040		7 180	5 740	6 200	8 440		7 515	6 015
9L 52/55 A			6 660	9 045		8 075	6 460	6 975	9 495		8 445	6 765
10V 52/55 A	1055	97	7 400	10 050	428	8 975	7 180	7 750	10 550	450	9 400	7 520
12V 52/55 A			8 880	12 060		10 765	8 615	9 300	12 660		11 275	9 020
14V 52/55 A			10 360	14 070		12 560	10 050	10 850	14 770		13 155	10 525
16V 52/55 A			11 840	16 080		14 355	11 485	12 400	16 880		15 035	12 030
18V 52/55 A			13 320	18 090		16 150	12 920	13 950	18 990		16 915	13 530

Output according to ISO 3046/I.
Air temp. 300 K° (27°C) Air pressure 1 bar.
Cooling water temp. before inter. cooler 300°K (27°C)
Power factor cos. $\varphi = 0.8$.

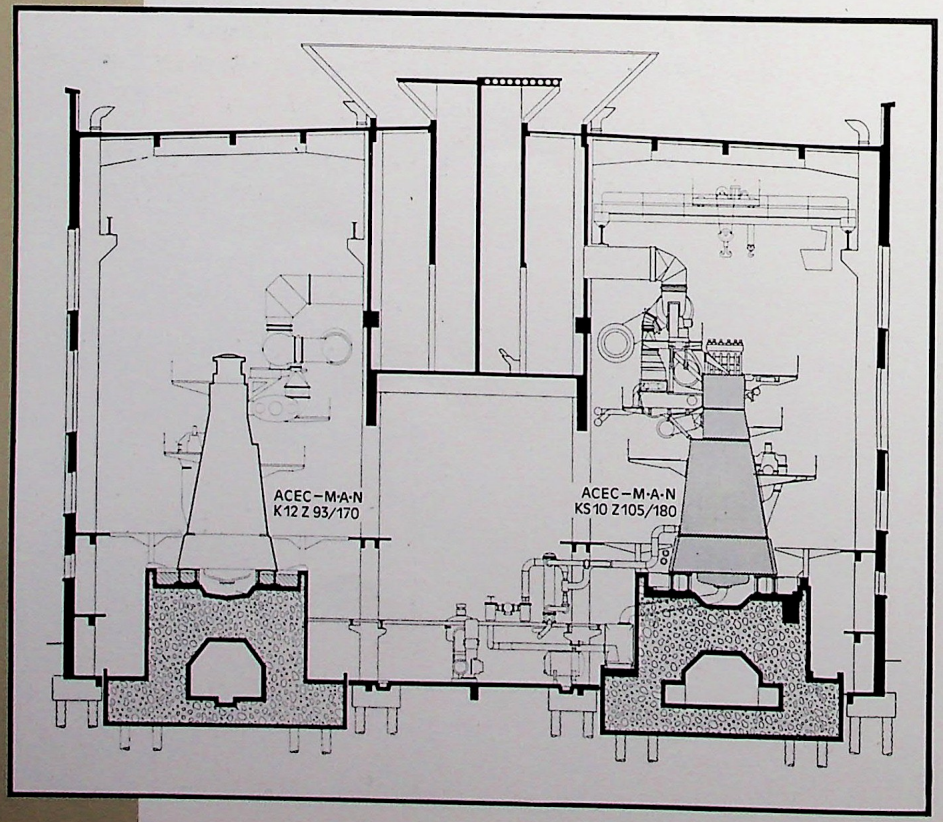
Aerial view of WVEM diesel power station in Harelbeke (7 x 10.2 MW + 1 x 13 MW)

General view of the main control desk of a diesel power plant.

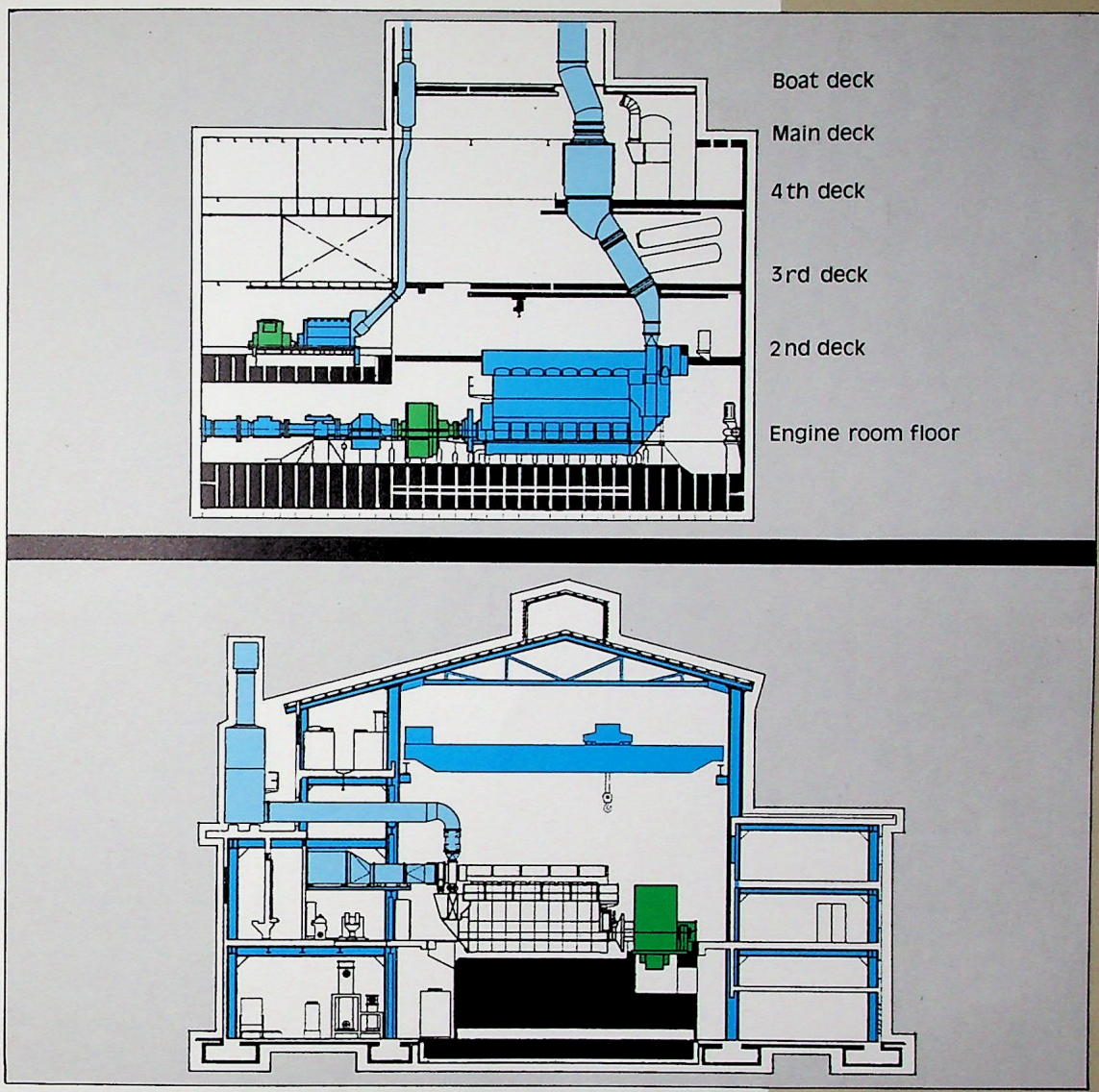




Lay-out of a motor ship propulsed by 2 M.A.N. K8 SZ90/160A engines.

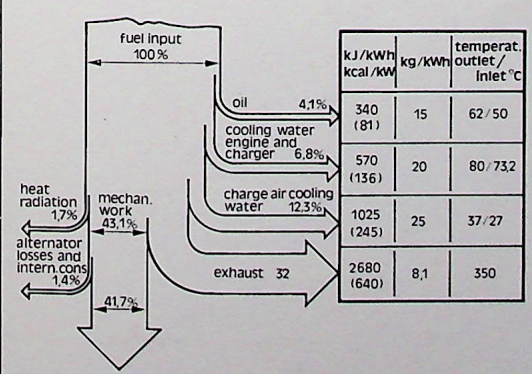


Cross-section of a two-stroke diesel plant.



Application examples of four-stroke engines for marine and stationary installations.

Heat diagram L/V 52/55 A — HFO oil operation, ISO conditions.



	kJ/kWh kcal/kW	kg/kWh	temperat. outlet/inlet °C
oil 4,1%	340 (81)	15	62/50
cooling water engine and charger 6,8%	570 (136)	20	80/73,2
charge air cooling water 12,3%	1025 (245)	25	37/27
exhaust 32	2680 (640)	8,1	350

Diesel power plant with heat recovery system for heating services.