INTERNATIONAL MARITIME ORGANIZATION

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MEPC.1/Circ.770
10 October 2011

INFORMATION ON AN APPROVED METHOD UNDER MARPOL ANNEX VI

Communication received from the Administration of Denmark

1 In accordance with the provisions of regulation 13.7.1 of MARPOL Annex VI, a communication has been received from the Administration of Denmark concerning certification of an approved method for marine diesel engine MAN B&W S60MC. The details are annexed hereto, and hereby circulated to Parties to MARPOL Annex VI and Member States of the Organization for information and appropriate action.

2 It should be noted that, for marine diesel engines with a power output of more than 5,000 kW and a per cylinder displacement at or above 90 litres, installed on a ship constructed on or after 1 January 1990 but prior to 1 January 2000, installation of an approved method is required if the approved method for that engine has been certified by an Administration of a Party or, alternatively, certification as provided for under regulation 13.7.1.2 of MARPOL Annex VI.

3 As the Administration of Denmark notified the certification of the approved method for engines specified in the annex to this circular on 5 October 2011, installation of the method for such engines will be mandatory no later than the first renewal survey for the International Air Pollution Prevention Certificate, which occurs on or after 6 October 2012, subject to commercial availability.

4 Member Governments are invited to bring this circular to the attention of their Administrations, relevant shipping organizations, recognized organizations, shipping companies and other stakeholders, and encourage them to take action as appropriate.

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ANNEX

APPROVED METHOD FOR MAN B&W S60MC

Specification of the Engine Type				Type of Approved Method	Approved Method Number	Date of notification
Engine type	Manufacturer	MCR per cylinder (kW/cyl)	Rated speed (rpm)			
S60MC	MAN B&W	1,650 – 2,040*	94-105*	Fuel nozzle	29085-11 HH	5 October 2011

* See attached Notice of Compliance for further details.

SØFARTSSTYRELSEN

International Maritime organization
4 Albert Embankment
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October 5, 2011
Our reference:
Case 201010593/13
File 30.80.01

Centre for Maritime Regulation/PK

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MINISTRY OF ECONOMIC AND BUSINESS AFFAIRS

Certification of an approved method under the revised marpol AnnexVI regulation 13.7.5. Engine type MAN BW S60MC

Dear Sirs,

In accordance with the revised MARPOL Annex VI, the Danish Maritime Authority hereby informs that Denmark has certified the enclosed approved method.

The certification of the approved method for the NOx reduction for engine type MAN B&W S60MC is attached for circulation in accordance with the revised MARPOL Annex VI, regulation 13.7.1.

The certification is based on the attached *Notice of compliance* Revised MARPOL 73/78, Annex VI Regulation 13 "Approved Method" for the Reduction of NOx Engine Type MAN B&W S60MC AM no. 29085-11 HH by Germanischer Lloyds Issued at Hamburg, 2011-08-31/Rev.1.

An example of the approved method file and the On-board Survey Procedure is attached together with Enclosure 3 which include more detailed information's by the manufacturer on the lay-out areas of the engines for which the Approved Method AM no. 29085-11 HH is applicable.

The approved method file required to accompany the specific engine will be issued based on the on board verification carried out after installation of the approved method.

The approved method complies with the requirements in the revised MARPOL Annex VI regulation 13.7.5.1 and 13.7.5.2.

Yours sincerely,

Palle Kristensen
Ship Surveyor
E-mail pk@dma.dk

Notice of Compliance

Revised MARPOL 73/78, Annex VI Regulation 13

"Approved Method" for the Reduction of NO_x

Engine Type MAN B&W S60MC

AM no. 29085-11 HH

This is to State

That a.-m. "Approved Method" (AM) has been verified under the provisions of the IMO Revised MARPOL Annex VI, Regulation 13, Paragraph 7.1, whereby a marine diesel engine with a power output of more than 5,000 kW and a per cylinder displacement at or above 90 litres installed on a ship constructed on or after 1 January 1990 but prior to 1 January 2000 shall comply with the emission limits set forth in subparagraph 7.4 of this regulation, provided that an "Approved Method" for that engine has been certified by an Administration of a Party and notification of such certification has been submitted to the Organization by the certifying Administration.

This is to Note

1. That this Revised Notice of Compliance is valid only for the combination of engine type, fuel valve nozzles and lay-out area mentioned below.
2. That this Revised Notice of Compliance does not replace the Approved Method File of the individual engine.
3. That this Revised Notice of Compliance includes a specification of allowed 'existing' fuel nozzles with IMO marking numbers, engine rating and max. performance values. The performance values should be taken from the test-bed report, or similar documentation.
4. That this Revised Notice of Compliance includes a Lay-out area graph for which the Approved Method with AM no. 29085-11 HH is applicable.

Specification of "Approved Method"

Manufacturer	:	MAN Diesel & Turbo
GL approval no.	**:**	**29085-11 HH**
Date of primary issue	:	2011-06-22

AM	Specification of engine type [iv]			Specification of performance [iv]			
	'Existing' fuel nozzles drawing number/ IMO ID number [i]	MCR per cylinder (kW/cyl) [ii]	Rated speed (rpm) [ii]	Pmax at max tolerance (barabs) [iii]		Pmax-Pcomp at max tolerance (bar) [iii]	
				100%	75%	100%	75%
MD-C-S60-1#1 5116821-1 (AM-1)	1756126-6 or M5-1 1268760-2, 3187610-9 or M6-7 1268787-8 or M6-8	1840-2040	100-105	143	132	16	31
MD-C-S60-2#1 5116799-5 (AM-2)	as AM-1	1650-2040	94-105	143	132	19	33
MD-C-S60-2#2 5116799-5 (AM-2)	as AM-1	1840-2040	100-105	143	132	18	33

Germanischer Lloyd
Issued at Hamburg, 2011-08-31 / Rev. 1

Hans- Joachim Götze

Dr. Fabian Kock

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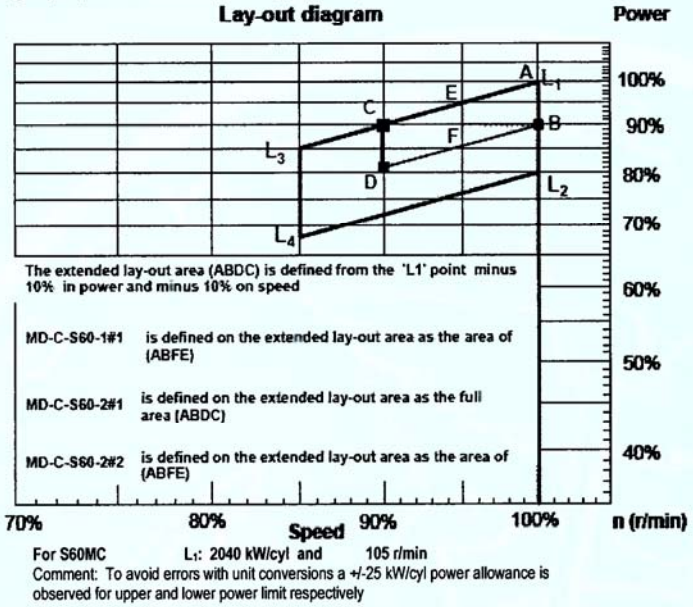
"Approved Method" for the Reduction of NO_x

Engine Type MAN B&W S60MC, AM no. 29085-11 HH

i not all fuel nozzles are marked, but if drawings are referenced to original MAN B&W (drilling) drawings (i.e. identical nozzles) these engines are also included in the AM
ii within the range bounded by MCR per cylinder and rated speed as defined in attached lay-out graph (a +/- 25 kW tolerance shall be allowed on the power limits, respectively, to allow for minor conversion errors)
iii at ISO ambient conditions based on original test-bed data at 75 & 100% loads (or interpolated from adjacent loads, if not available)
iv exemptions may be introduced on approval by the Administration

Lay-out area graph *(with AM-#'s indicated, if appropriate)*



The extended lay-out area (ABDC) is defined from the 'L1' point minus 10% in power and minus 10% on speed

MD-C-S60-1#1 is defined on the extended lay-out area as the area of (ABFE)

MD-C-S60-2#1 is defined on the extended lay-out area as the full area (ABDC)

MD-C-S60-2#2 is defined on the extended lay-out area as the area of (ABFE)

For S60MC L_1: 2040 kW/cyl and 105 r/min

Comment: To avoid errors with unit conversions a +/-25 kW/cyl power allowance is observed for upper and lower power limit respectively

This is to Confirm

1. That the a.-m. "Approved Method" has been verified and approved in accordance with all provisions and requirements as applicable.

2. In particular the a.-m. "Approved Method" fulfils the following requirements:

   - The cost of the Approved Method does not exceed 375 Special Drawing Rights per metric tonne NO_x.
   - The power of the engine is not reduced by more than 1.0%.
   - The specific fuel consumption (SFOC) as calculated following ISO standard conditions for the appropriate E3 or E2 cycle is not increased by more than 2.0%.

Germanischer Lloyd
Issued at Hamburg, 2011-08-31 / Rev. 1

Hans- Joachim Götze

Dr. Fabian Kock

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MAN Diesel & Turbo

Approved Method File

('Existing' engine emission document)

issued under the provisions of the Protocol of 2008 to amend the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 related thereto (MARPOL 73/78 Annex VI.)

for

MAN B&W – S70MC

MD-C-S70-2#2

Engine group .....

Engine type	Test cycle	Rated power (kW/cyl)	Rated speed (r/min)
S70MC	**E3**	**2250-2810***	**81-91**

*) a +- 25 kW/cyl allowance is given on both upper and lower power limits

THIS IS TO CERTIFY that engines specified in this engine group, when complying with the given description in Table 1 and 2 (requirements for design and performance,) fully satisfies the requirements as amended in the Revised MARPOL Annex VI and the NOx Technical Code 2008.

Applicable NOx emission limit (IMO Tier I) (g/kWh)		17.0
Estimated NOx emission value:	at reference conditions (g/kWh):	14.6
	at maximum tolerances (g/kWh):	16.7

MAN Diesel, PrimeServ dept. DR-CPH

prepared by .....

(full designation of the competent person or organization authorized under the provisions of the Convention)

place and date of issue .....Copenhagen, 21 Jan. 2011.....

1

MAN Diesel & Turbo

Engine Description – Design and Performance Values

Engine type: **MAN B&W – S70MC** Engine group: **MD-C-S70-2#2**

Table 1 – NOx Components*)

Component (parameter)	Specification	MAN B&W IMO ID	Other IMO ID
Fuel valve nozzle	2 fuel valves pr. cylinder	3062364-9	
Fuel pump plunger (diameter)	ø73 mm	not applicable (N/A)	
Fuel cam (rise)	1.953 mm/deg	not applicable (N/A)	

*) *A cross reference table for all 'IMO' components of less importance for the NOx emission has been submitted to the Administration to define the engine group*

Table 2 – Reference and maximum allowed operating values

	Parameter *(ISO ambient conditions)*	Reference value				Maximum allowed			
	Power – %	100	75	50	25	100	75	50	25
Engine parameters	Maximum combustion pressure – barabs	141	132	98	68	144	135	99	71
	Cylinder pressure rise – bar (Pmax - Pcomp)	4	24	20	21	12	32	28	29
	Scavenging-air temperature – °C	48	43	39	44	54	46	42	47
	Turbine back pressure – mmWC	300	179	86	25	450	340	225	115
	VIT load break point *(if applicable)*:	85 %				Reference value			
Ambient conditions *(ISO ambient conditions)*	Ambient pressure – mbar					1000			
	Ambient temperature – °C					25			
	Humidity – rel.%					30			
	Sea-water (inlet) temperature – °C					25			
	Central sea-water-cooler fresh-water-outlet temperature (for central-cooling system) – °C *)					36			

*) *Based on 25°C sea-water temperature (but depending on cooling strategy, (see also Instruction book 'Operation'.)*

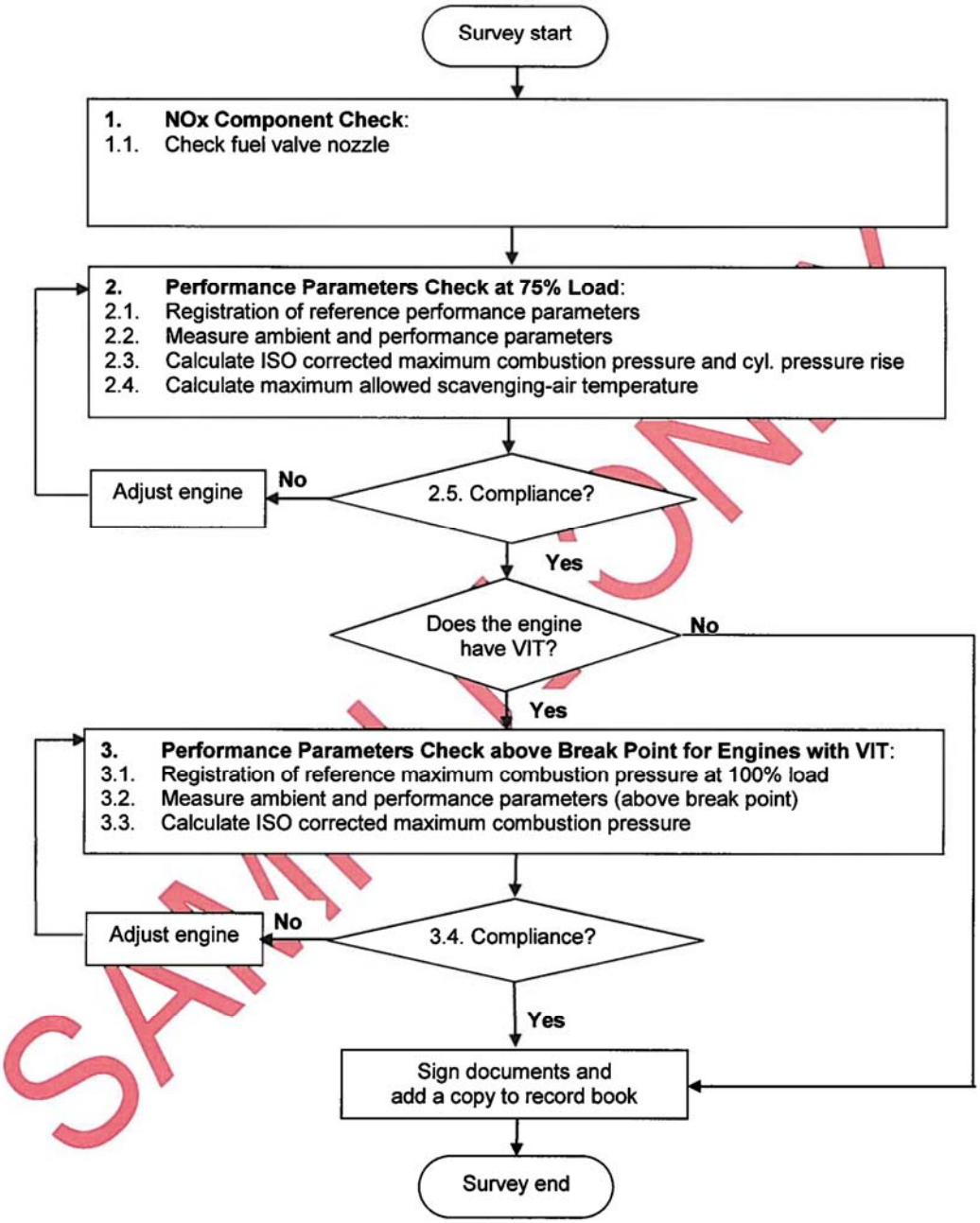
On-board survey

In order to ensure compliance, the following must be checked:

1. The design must correspond with the above description (Table 1 – NOx components.)
2. A standard performance check must provide performance data (corrected to ISO ambient conditions) within the tolerances as specified in Table 2 – Reference and maximum allowed operating values.

The attached flow chart describes the on-board survey and Appendix A provides a complete (manually handled) on-board survey. *(A dedicated survey code for the group can be used to demonstrate compliance.)*

MAN Diesel & Turbo



3

Engine group:	MD-C-S70-2
Engine No.:	5623
Date:	2011-02-18

Appendix A: On-board Survey Procedure

For onboard survey, fill out and print the following form (yellow fields)

1. NOx Component check *(AMF Table 1)*

	check	IMO ID#
Fuel valve nozzle		3062364-9

2. Performance parameter check at 75% load

2.1 Registration of reference performance parameters *(AMF Table 2)*

Performance parameters	Reference			Max. allowed		
	Units	Symbol	Values	Units	Symbol	Values
Max. combustion pressure	barabs	A	132	barabs	E	135
Cylinder pressure rise	bar	B	24	bar	F	32
Turbine back pressure	mmWC	C	179	mmWC	G	340
Scavenging-air temperature	°C	D	43	°C	H	46

2.2 Measure ambient and performance parameters *(at 75% load ± 5%)*

Performance parameters	Measured			ISO Corrected *(see 2.3-2.4)*		
	Units	Symbol	Values	Units	Symbol	Values
Max. combustion pressure	bar	I	130,8	barabs	Q	132,92
Max. cyl. compr. pressure	bar	J	105,3	barabs	R	107,54
Turbine back pressure	mmWC	K	194	mmWC		
Scavenging-air temperature	°C	L	42,3	°C		
Ambient pressure	mbar	M	1012	mbar		
T/C inlet temperature	°C	N	29,1	°C		
Sea-water inlet temperature	°C	O	32,5	°C		
Set point coolant outlet temp.	°C	P	36	°C		

2.3 Calculate ISO corrected max. combustion pressure and max. cyl. compression pressure

Q=(I+M/1000)*(1+0.002198*(N-25)-0.00081*(L-D)-0.00022*(M-1000)*0.75+0.00005278*(K-C)) (1)

R=(J+M/1000)*(1+0.002954*(N-25)-0.00153*(L-D)-0.000301*(M-1000)*0.75+0.00007021*(K-C)) (2)

2.4 Calculate maximum allowed scavenging-air temperature

Sea Water (SW) or Central fresh-water Cooling system (CC):

S=H+(O-25) (3)

Central fresh water Cooling system with Fixed outlet temperature (CC-F):

If O <= P-2 S=H (4a)

Else S=H+(O-(P-2)) (4b)

Where P is the central cooler set point for outlet coolant temperature

2.5 Compliance check

Performance parameters	Engine performance			Max. allowed		Compliance
Max. combustion pressure	Q	132,9	≤	135	E	yes
Cylinder pressure rise	Q - R	25,4	≤	32	F	yes
Turbine back pressure	K	194	≤	340	G	yes
Scavenging-air temperature *1)*	L	42,3	≤	46	S	yes

Engine group:	MD-C-S70-2
Engine No.:	5623
Date:	2011-02-18

75% Pres Rise (ISO corr) Q - R 25,38

Only for engines with VIT:

3. Performance parameter check above break point for engines with VIT *(if appropriate)*

3.1 Registration of reference performance parameters at 100% *(AMF Table 2)*

Performance parameters	Reference			Max. allowed		
	Units	Symbol	Values	Units	Symbol	Values
Max. combustion pressure	barabs	*A*	141	barabs	*E*	144
Turbine back pressure	mmWC	*C*	300	mmWC	*G*	450
Scavenging-air temperature	°C	*D*	48	°C	*H*	54
Break point	%	*T*	85			

3.2 Measure ambient and performance parameters *(above the break point)*

Performance parameters	Measured			ISO Corrected *(see 3.3)*		
	Units	Symbol	Values	Units	Symbol	Values
Max. combustion pressure	bar	*I*	140	barabs	*Q*	142,80
Turbine back pressure	mmWC	*K*	286	mmWC		
Scavenging-air temperature	°C	*L*	48	°C		
Ambient pressure	mbar	*M*	1012	mbar		
T/C inlet temperature	°C	*N*	32	°C		
Measured load	%	*U*	100			

3.3 Calculate ISO corrected maximum combustion pressure

Use equation (1)

3.4 Compliance check

Performance parameters	Engine performance			Max./Min. allowed		Compliance
Max. combustion pressure	*Q*	142,8	≤	144	*E*	yes
Measured load	*U*	100	≥	85	*T*	yes

MAN Diesel & Turbo

Enclosure 3
APPROVED METHOD(s) FOR MAN B&W S60MC

Date of notification: 05 October 2011
The AMs complies with the following requirements: Reg. 13.7.5.1 and Reg. 13.7.5.2

AM	Specification of engine type [iv]			Specification of performance [iv]			
	'Existing' fuel nozzles drawing number/ IMO ID number [i]	MCR per cylinder (kW/cyl) [ii]	Rated speed (rpm) [ii]	Pmax at max tolerance (barabs) [iii]		Pmax-Pcomp at max tolerance (bar) [iii]	
				100%	75%	100%	75%
MD-C-S60-1#1 5116821-1 (AM-1)	1756126-6 or M5-1 1268760-2, 3187610-9 or M6-7 1268787-8 or M6-8	1840-2040	100-105	143	132	16	31
MD-C-S60-2#1 5116799-5 (AM-2)	as AM-1	1650-2040	94-105	143	132	19	33
MD-C-S60-2#2 5116799-5 (AM-2)	as AM-1	1840-2040	100-105	143	132	18	33

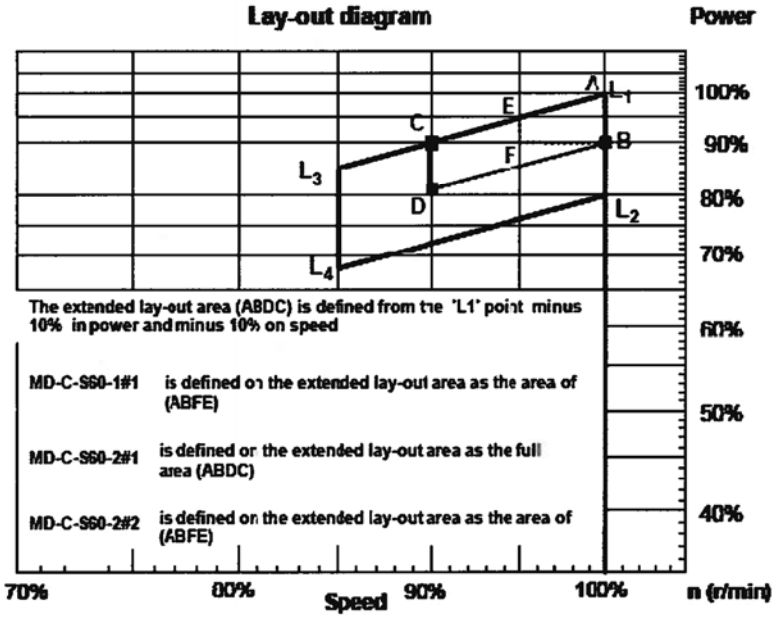
[i] not all fuel nozzles are marked, but if drawings are referenced to original MAN B&W (drilling) drawings (i.e. identical nozzles) these engines are also included in the AM

[ii] within the range bounded by MCR per cylinder and rated speed as defined in attached lay-out graph (a +/- 25 kW tolerance shall be allowed on the power limits, respectively, to allow for minor conversion errors)

[iii] at ISO ambient conditions based on original test-bed data at 75 & 100% loads (or interpolated from adjacent loads, if not available)

[iv] exemptions may be introduced on approval by the Administration

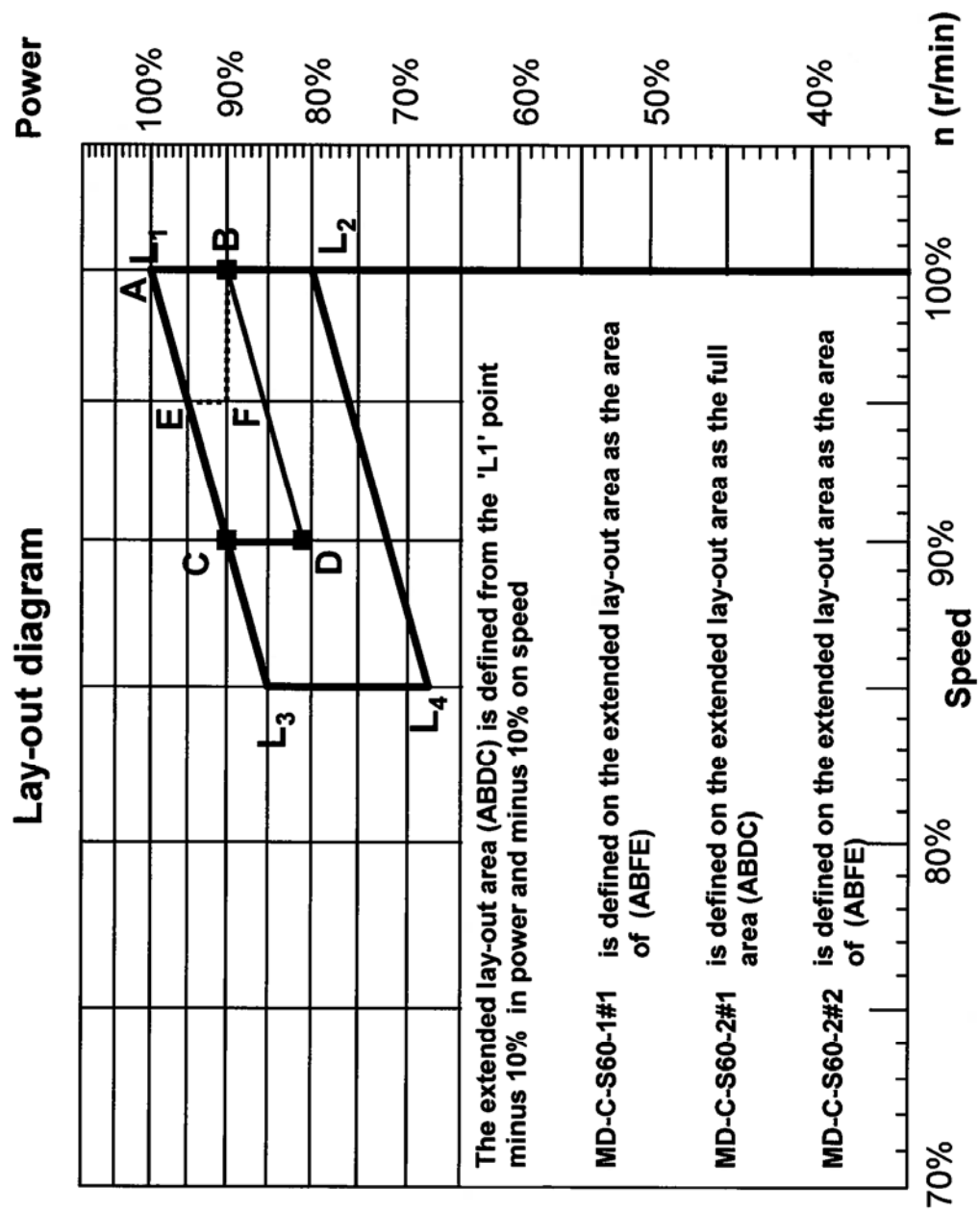
Lay-out area graph *(with AM-#'s indicated, if appropriate)*



For S60MC L_1: **2040 kW/cyl and 105 r/min**

Comment: To avoid errors with unit conversions a +/-25 kW/cyl power allowance is observed for upper and lower power limit respectively

Enclosure 3


Lay-out diagram
Power
100%
90%
80%
70%
60%
50%
40%
n (r/min)
70%
80%
90%
100%
Speed
A
B
C
D
E
F
L1
L2
L3
L4
The extended lay-out area (ABDC) is defined from the 'L1' point minus 10% in power and minus 10% on speed
MD-C-S60-1#1 is defined on the extended lay-out area as the area of (ABFE)
MD-C-S60-2#1 is defined on the extended lay-out area as the full area (ABDC)
MD-C-S60-2#2 is defined on the extended lay-out area as the area of (ABFE)