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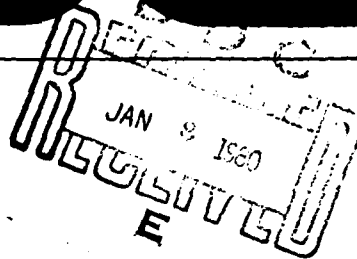
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AIRBORNE NOISE LEVELS ON MERCHANT SHIPS

A compilation of data

DR Lambert

30 April 1979

Prepared for
US Coast Guard
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ADMINISTRATIVE INFORMATION

This document has been prepared for the US Coast Guard, Office of Research and Development, for general guidance in the development of noise standards for US merchant ships. It is one of several dealing with various aspects of noise as related to the safety of personnel and habitability aboard merchant ships.

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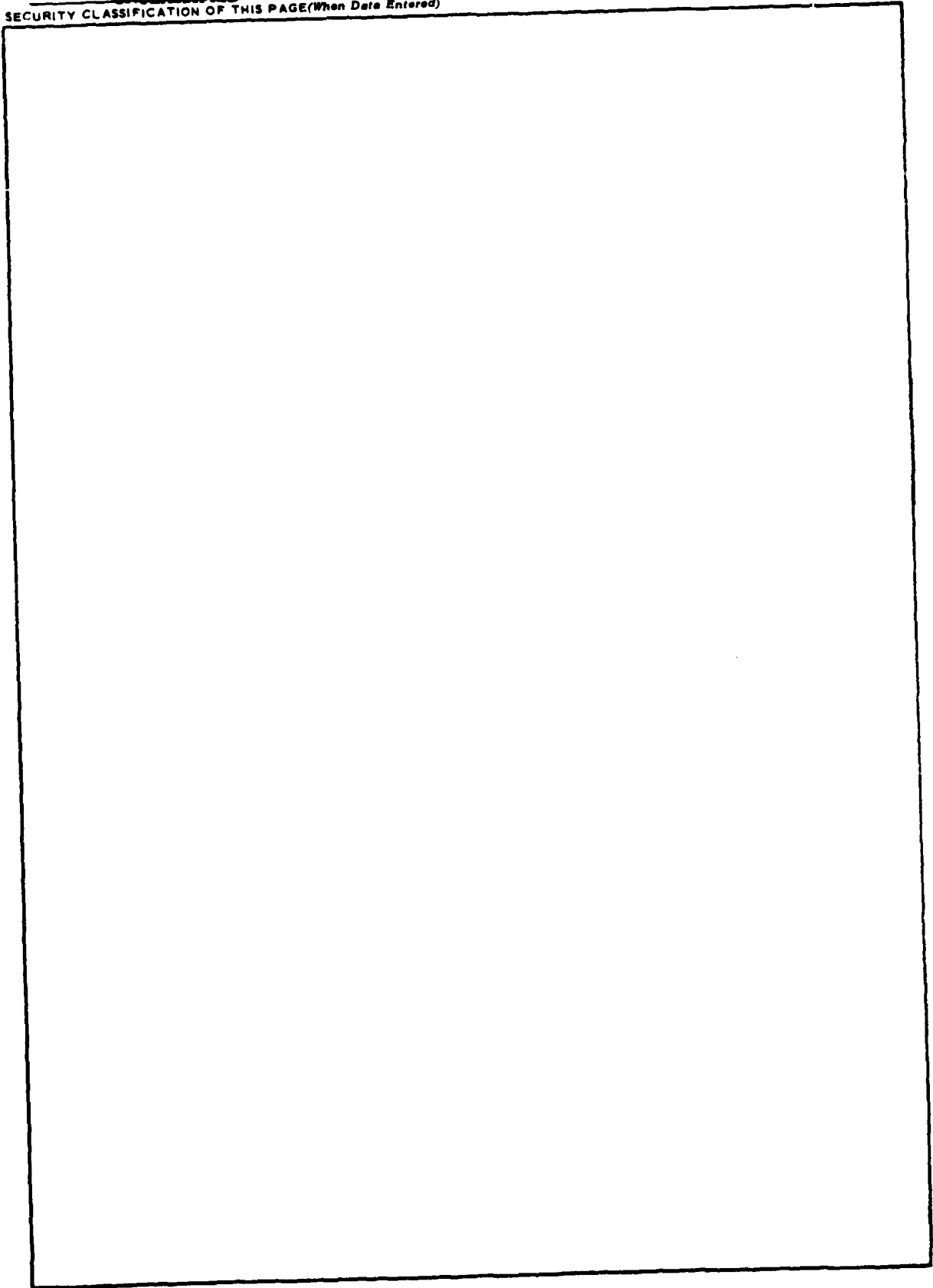
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INTRODUCTION

This document summarizes selected A- and C-weighted sound pressure level (SPL) data for each major type of space aboard merchant ships of US flag and non-US flag (tables 1-27). The data were extracted or derived from available literature and from recent measurements made by NOSC. The NOSC ships were all of US registration (US flag). The flags of the non-US flag ships were presumed to be the same as the nationality of the author of the reference.

One may estimate the number of individual ship compartments of a given type which comply with a specified sound level criterion by using means and standard deviations derived from a large number of such compartments. However, the statistics reported in the literature are often difficult to use for this purpose because the format in which data are being reported is not yet uniform. This is especially true for reporting information on the variability among compartments, which is sometimes omitted altogether. Furthermore, even when such statistics are reported, the compartments of similar function are often so small in number and diverse in sound level that the summary statistics cannot adequately represent the true data points. For more detail concerning sound levels on the ships measured by NOSC, see NOSC TR 405 (ref 1), in which data are reported for each compartment on each ship.

A- AND C-WEIGHTED SOUND PRESSURE LEVELS

A-weighted sound pressure levels are (1) as reported by the literature source, (2) as calculated from octave band spectra, or (3) as calculated from noise rating (NR) values by adding 5 dB.

C-weighted sound pressure levels are (1) as reported by the literature source, (2) as calculated from octave band spectra, or (3) those reported as "flat" or unweighted values in the literature. Often, an average, mean or median value is given along with a standard deviation, a percentile, or a range of values. The A- and C-weighted SPL reported may be that for a single measurement position or the average for many spaces or ships. Note that when means are reported, they do not provide information about either the maximum values or the variability of the individual measurements.

C MINUS A

To provide an indication of the low-frequency content of the noise, the difference, C-weighted SPL minus A-weighted SPL, or C - A, has been calculated where possible. Large C - A values indicate high amplitude at low frequencies. Strictly, the C - A values should be calculated from the C and A levels for an individual measurement location and condition. Here, however, those C - A values which are enclosed in parentheses have been calculated from average A and C levels. Note that, like average A and C levels, the C - A calculated from average A and C levels will not reflect the variability of the individual data.

NOTES ON THE DATA

Except where noted, the data for the five "MARAD, 1963-64" ships refer to "absolute" (ABS) power; that is, the maximum speed possible without the minor

¹ NOSC TR 405, Noise Levels and Crew Noise Exposure Aboard US Merchant Vessels, by DR Schmidt, 30 April 1979.

engine modification necessary to obtain "national defense" (NDF) power. For one vessel, the sound level at ABS power was often estimated by averaging the levels measured at normal (N) and NDF powers.

Except where noted, the NOSC data apply to merchant ships steaming at their usual (maximum) cruising speeds. Ships measured by NOSC are designated as follows:

Ship	Type	Power	Tonnage Range	Period Built
CS-1	Cargo	Steam turbine	10 000-15 000 GRT	1960-1965
CS-2	"	" "	15 000-20 000 GRT	1965-1970
TS-1	Tanker	" "	15 000-20 000 GRT	1955-1960
TS-2	"	" "	35 000-40 000 GRT	1970-1975
TG-1	"	Gas turbine	15 000-20 000 GRT	1975-present
OD-1	Ore carrier	Diesel	15 000-20 000 DWT	1970-1975
OD-2	" "	"	5 000-10 000 GRT	1920-1925

When data were not reported for a particular location, they were sometimes substituted from a nearby location. For example, some "typical" or general engine-room levels are included under the heading "Main Engineering Control Station."

LIST OF NOTES

The following notes apply to the superscript numbers in the tables that follow.

- 1 - At normal (N) power
- 2 - At national defense (NDF) power
- 3 - Arithmetic average of sound levels measured at N and NDF powers
- 4 - Data substituted from a nearby location
- 5 - Octave band data reported through 2 kHz only. To calculate an A level, it was assumed that the SPL decreased above 2 kHz at a rate of 3 dB per octave.

Table 1. STATEROOM A- and C-weighted sound pressure levels (US flag; ⁺US flag presumed).

SHIP(S) AND REFERENCE	SOUND PRESSURE LEVEL			
	A wt. (dBA)	C wt. (dBC)	C wt.-A wt. (dB)	
10 Ships @ ABS Power; (ref 2).	Mean	48	61	13
	90th %	59	70	11
5 Steam Turbine Ships @ ABS Power; (ref 3).		53 ³		
	officers'	47		
		51		
		44		
		55	67	12
		49 ²		
	crews'	48 ²		
		-		
		58	68	10
Container ⁺ , "B DK, Living Spaces"; (ref 4).		66	90	24
7 Ships @ max power; (ref 1).				
officers':				
	CS-1	54	79	25
	CS-2	53	85	32
(amidships)	TS-1	49	65	16
(aft)	"	64	91	27
	TS-2	62(59-67)	88(86-91)	26(20-32)
	TG-1	51-57	78-90	21-40
	OD-1	61-65	82-85	18-23
	OD-2	56,65	79,81	23,16
crews':				
	CS-1	52	76	24
	CS-2	53	82	29
crews'	TS-1	49,59	65,87	16,28
	TS-2	66(62-70)	88(85-92)	22(18-26)
	TG-1	56	84	28
(calc from passageway levels)	OD-1	66		
	OD-2	60,64	83,79	23,15
2 Tugs ⁺ ; (ref 5);				
	EDITH before treat.	77-84		
	EDITH after treatment	69-76		
	ANNE before treatment	67-73		
	ANNE after treatment	67-73		

² Shipboard Noise and Vibration from a Habitability Viewpoint, by A Hagen and NO Hammer, presented to the Chesapeake Section of SNAME, 30 November 1966; also published in Marine Technology, vol 6 no 1, p 1-29, 1969.

³ MARAD, 1963-64 - five in-house reports of noise and vibration measurements during official sea trials of five ships, prepared by Division of Engineering, Office of Ship Construction, Maritime Administration, 1963-1964.

⁴ NKF Report 7205, Vibration and Noise Survey on Container Ships, by WH Knopfle, NKF Engineering Associates Inc, Silver Spring MD, 25 February 1972.

⁵ Noise Control on Diesel Tugs, by TR Dyer and B Lundgaard; paper prepared for presentation to Pacific Northwest Section of the Society of Naval Architects and Marine Engineers, 11 January 1973.

Table 2. MESS (M), LOUNGE (L), and RECREATION (R)
ROOM A- and C-weighted sound pressure levels
(US flag; †US flag presumed).

SHIP(S) AND REFERENCE	SOUND PRESSURE LEVEL			
	A wt. (dBA)	C wt. (dBC)	C wt. - A wt. (dB)	
10 Ships @ ABS Power; (ref 2).	Mean	51	62	11
	90th %	61	68	7
5 Steam Turbine Ships @ ABS Power; (ref 3).		50 ³		
	officers'	45		
		54		
		53 ¹		
		63	70	7
		53 ³		
	crews'	-		
		66 ¹		
		-		
		66	73	7
7 Ships @ max power; (ref 1).				
	officers':			
		CS-1 59(M)	81(M)	22
		CS-2 58(M)	87(M)	29
		" 55(R)	87(R)	32
		TS-1 70(M)	99(M)	29
		" 49(L)	74(L)	25
		TS-2 66(M)	84(M)	18
		" 60(L)	85(L)	25
		TG-1 57(M&L)	85(M&L)	28
		OD-1 68(M)	88(M)	20
		OD-2 64(M)	80(M)	16
	crews':			
		CS-1 69(M&L)	81(M&L)	12
		CS-2 62(M)	76(M)	14
		" 60(R)	-	-
		TS-1 70(M)	96(M)	26
		" 68(R)	97(R)	29
		" 64(L)	84(L)	20
		TS-2 63(M)	87(M)	24
		" 64(L)	88(L)	24
		TG-1 -	-	-
		OD-1 69(M)	89(M)	20
		OD-2 70(M)	84(M)	14
	data from secondary source @ 80% power; off			
		TD-0 63(M)	80(M)	17
		TD-0 60(R)	82(R)	22
2 Tugs [†] ; (ref 5)				
	EDITH before treat.	80		
	EDITH after treatment	74		
	ANNE before treatment	74		
	ANNE after treatment	73		

Table 3. OFFICE and DAY CABIN A- and C-weighted sound pressure levels (US flag).

<u>SHIP(S) AND REFERENCE</u>		<u>SOUND PRESSURE LEVEL</u>		
		<u>A wt.</u> <u>(dBA)</u>	<u>C wt.</u> <u>(dBC)</u>	<u>C wt.-A wt.</u> <u>(dB)</u>
10 Ships @ ABS Power; (ref 2).	Mean	49	62	13
	90th %	61	71	10
5 Steam Turbine Ships @ ABS Power; (ref 3).		50 ³		
		52		
		55		
		-		
7 Ships @ max power; (ref 1). (offices:)	CS-1	54		
	CS-2	55		
	TS-1	50		
	TS-2	62	84-88	24 est.
	TG-1	57	87	30
	OD-1	-	-	
	OD-2	65	81	16
	data from secondary source; 80% power: TD-0 (master's office)	56	80	24

Table 4. PASSAGEWAY A- and C-weighted sound pressure levels (US flag; †US flag presumed).

<u>SHIP(S) AND REFERENCE</u>	<u>SOUND PRESSURE LEVEL</u>			
	<u>A wt.</u> <u>(dBA)</u>	<u>C wt.</u> <u>(dBC)</u>	<u>C wt.-A wt.</u> <u>(dB)</u>	
10 Ships @ ABS Power; (ref 2).	Mean	57	67	-
	90th %	67	75	-
5 Steam Turbine Ships @ ABS Power; (ref 3).		57-66	66-74	6-9
		59-72	68-76	4-9
		56-58,74	68-70,78	11-14,4
		49-69	59-78	9-12
		52-59	63-70	7-11
7 Ships @ max power; (ref 1).	CS-1	63-65	77-83	12-18
	CS-2	64		
same location/casing door open to engineering:	"	90		
forward:	TS-1	50		
aft:	"	74	96	22
	TS-2	64-77	-	
	TG-1	57-76	84-92	14-29
	OD-1	73-78	90-94	14-17
	OD-2	79,82	91,92	12,10
data from secondary source @ 80% power; TD-0:				
	(bridge deck)	65	81	16
	(boat deck)	68	89	21
2 Tugs [†] ; (ref 5);	EDITH before treat.	86		
	EDITH after treat.	85		
	ANNE before treat.	81		
	ANNE after treat.	79		

Table 5. WHEELHOUSE/ENCLOSED BRIDGE A- and C-weighted sound pressure levels (US flag; +US flag presumed).

<u>SHIP(S) AND REFERENCE</u>	<u>SOUND PRESSURE LEVEL</u>		
	<u>A wt.</u> <u>(dBA)</u>	<u>C wt.</u> <u>(dBC)</u>	<u>C wt.-A wt.</u> <u>(dB)</u>
5 Steam Turbine Ships @ ABS Power; (ref 3).	61 ²		
	56 ²		
	54 ¹		
	51 ³		
	56	66	10
7 Ships @ max power; (ref 1).	CS-1 60	78	18
	door closed: CS-2 58	-	
	door open: " 66	84	18
	TS-1 61	77	16
	TS-2 64	95	31
	TG-1 56	84	28
	OD-1 63	92	29
	OD-2 -	-	
data from secondary source @ 80% power: TD-0	59	84	25
2 Tugs ⁺ ; (ref 5);	EDITH before treat.	72	
	EDITH after treat.	67	
	ANNE before treat.	66	
	ANNE after treat.	66	

Table 6. **RADIO ROOM, BRIDGE WING, and LOOKOUT/LISTENING POST** A- and C-weighted sound pressure levels (US flag).

<u>SHIP(S) AND REFERENCE</u>	<u>SOUND PRESSURE LEVEL</u>		
	<u>A wt.</u> <u>(dBA)</u>	<u>C wt.</u> <u>(dBC)</u>	<u>C wt. - A wt.</u> <u>(dB)</u>
<u>RADIO ROOM</u>			
4 of 7 Ships @ max power; (ref 1).			
	CS-1 61	71	10
	TS-1 64	73	9
	TS-2 63	93	30
	TG-1 58	86	28
<u>BRIDGE WINGS</u>			
<u>SHIP(S) AND REFERENCE</u>	<u>SOUND PRESSURE LEVEL</u>		
	<u>dB(A)</u>	<u>dB(C)</u>	
2 of 7 Ships @ max power; (ref 1).			
Open bridge wings (vent low):	TS-2 68	89	21
" " " (vent high):	" 75	89	14
" " " Bridge deck, near stack:	CS-2 73(68-78)	--(87)	--(11)
	" 90	96	6
<u>LOOKOUT/LISTENING POST</u>			
<u>SHIP(S) AND REFERENCE</u>	<u>SOUND PRESSURE LEVEL</u>		
	<u>dB(A)</u>	<u>dB(C)</u>	
1 of 7 Ships @ max power; (ref 1).			
(bow):	CS-1 73	92	19

Table 7. **ISOLATED MAIN MACHINERY CONTROL ROOM**
 A- and C-weighted sound pressure levels
 (US flag; ⁺US flag presumed).

<u>SHIP(S) AND REFERENCE</u>	<u>SOUND PRESSURE LEVEL</u>		
	<u>A wt.</u> <u>(dBA)</u>	<u>C wt.</u> <u>(dBC)</u>	<u>C wt.-A wt.</u> <u>(dB)</u>
7 Ships @ max power; (ref 1).	CS-1 NONE		
	CS-2 NONE		
	TS-1 NONE		
	TS-2 NONE		
(remote:)	TG-1 56	82	26
	OD-1 86	99	13
	OD-2 NONE		
data from secondary source; full power:	TD-0 73	89	16
Container ⁺ , steam; 2 rooms; (ref 4).	70	88	18

Table 8. MAIN MACHINERY CONTROL STATION (control panel or gauge board A- and C-weighted sound pressure levels (US flag)

<u>SHIP(S) AND REFERENCE</u>	<u>SOUND PRESSURE LEVEL</u>			
	<u>A wt.</u> <u>(dBA)</u>	<u>C wt.</u> <u>(dBC)</u>	<u>C wt.-A wt.</u> <u>(dB)</u>	
10 Ships @ ABS Power; (ref 2).	Mean	84	89	5
	90th %	87	91	4
5 Steam Turbine Ships @ ABS Power; (ref 3).	officers'	85 ³	88 ³	3
		86	90	4
		87	90	3
		86	89	3
		84 ⁴	89 ⁴	5
7 Ships @ max power; (ref 1).	CS-1	92	96	4
	CS-2	86	93	7
	TS-1	94	100	6
	TS-2	91	101	10
	Turbine room; has isolated control room:	TG-1 (102)	(107)	5
	Ship has isolated machinery control room:	OD-1 (108)	(111)	3
		OD-2 89	95	6
data from secondary source; 80% power; outside isolated control room:	TD-0 (100)	(104)		
Cargo; steam turbine; (ref 6)	G	90		

⁶ US Coast Guard ltr 16710/3/Galloway dtd 11 January 1978; Officer in Charge, US Coast Guard Marine Inspection Office, New York.

Table 9. MACHINERY SPACE MAXIMUM REPORTED A- and C-weighted sound pressure levels (US flag).

<u>SHIP(S) AND REFERENCE</u>	<u>SOUND PRESSURE LEVEL</u>		
	<u>A wt.</u> <u>(dBA)</u>	<u>C wt.</u> <u>(dBC)</u>	<u>C wt.-A wt.</u> <u>(dB)</u>
5 Steam Turbine Ships @ ABS Power; (ref 3).			
Machinery casing; 2 nd deck:	94	97	3
Forced-draft blower @ 0.5 ft.:	98 ³	102 ³	4
Forced-draft blower @ 1 ft.:	93	97	4
Forced-draft blower @ 1 ft.:	99	100	1
Prom deck casing:	96	99	3
7 Ships @ max power; (ref 1).			
Main thrust bearing, reduction gear:	CS-1 102	-	-
Turbine area:	CS-2 99	100	1
Stbd generator reduction gear:	TS-1 106	108	2
Main thrust bearing, reduction gear:	TS-2 104	-	-
Turbine room:	TG-1 104	105	1
Aux turbine room:	" 115	115	0
Platform above engines:	OD-1 108	111	3
Diesel generator:	OD-2 102	106	4
data from secondary source;			
Between main engines @ full power:	TD-0 106	108	2
" " " @ 80% power:	" 106	108	2
Cargo; steam turbine; (ref 6)	G 105	-	-

Note that this is the maximum level reported; frequently the true maximum level in the machinery spaces is not measured.

Table 10. **FIREROOM WATCH STATION COMBUSTION CONTROL**
A- and C-weighted sound pressure levels (US flag).

<u>SHIP(S) AND REFERENCE</u>	<u>SOUND PRESSURE LEVEL</u>		
	<u>A wt.</u> <u>(dBA)</u>	<u>C wt.</u> <u>(dBC)</u>	<u>C wt.-A wt.</u> <u>(dB)</u>
5 Steam Turbine Ships @ ABS Power; (ref 3).	90 ³	92 ³	2
	88	91	3
	88	93	5
	88	91	3
	88 ²	91 ²	3
	81 ⁴	89 ⁴	8
2 of 7 Ships @ max power; (ref 1).	CS-1 89	98	9
	CS-2 -		
	TS-1 87 ⁴	96 ⁴	9
	TS-2 -		
	TG-1 -		
	OD-1 -		
OD-2 -			

Table 11. MACHINERY SPACE WORKSHOP A- and C-weighted sound pressure levels (US flag).

<u>SHIP(S) AND REFERENCE</u>	<u>SOUND PRESSURE LEVEL</u>		
	<u>A wt.</u> <u>(dBA)</u>	<u>C wt.</u> <u>(dBC)</u>	<u>C wt.-A wt.</u> <u>(dB)</u>
7 Ships @ max power; (ref 1).	CS-1	91	3
	CS-2	90	8
	TS-1	92	100
	TS-2	-	-
	TG-1	-	-
	OD-1	95	6
	OD-2	-	-
Cargo; steam turbine; (ref 6)	G	80	-

Table 12. TURBINE AREA A- and C-weighted sound pressure levels (US flag).

<u>SHIP(S) AND REFERENCE</u>	<u>SOUND PRESSURE LEVEL</u>		
	<u>A wt.</u> <u>(dBA)</u>	<u>C wt.</u> <u>(dBC)</u>	<u>C wt.-A wt.</u> <u>(dB)</u>
1 of 5 Steam Turbine Ships @ ABS Power; (ref 3).	87	94	7
3 of 7 Ships @ max power; (ref 1).	CS-1 91	98	7
	CS-2 99	100	1
	(gas turbine:) TG-1 (102)	(107)	5

Table 13. MAIN REDUCTION GEAR AREA A- and C-weighted sound pressure levels (US flag).

<u>SHIP(S) AND REFERENCE</u>	<u>SOUND PRESSURE LEVEL</u>		
	<u>A wt.</u> <u>(dBA)</u>	<u>C wt.</u> <u>(dBC)</u>	<u>C wt.-A wt.</u> <u>(dB)</u>
5 Steam Turbine Ships @ ABS Power; (ref 3):	90	96	6
	95 ³	98 ³	3
	93	96	3
	91	94	3
	90	93	3
3 of 7 Ships @ max power; (ref 1).	CS-1 102		
	TS-1 98	105	
	(main thrust bearing): TS-2 104		
data from secondary source; full power: TD-0	100	105	

Table 14. SHAFT ALLEY A- and C-weighted sound pressure levels (US flag).

<u>SHIP(S) AND REFERENCE</u>	<u>SOUND PRESSURE LEVEL</u>		
	<u>A wt.</u> <u>(dBA)</u>	<u>C wt.</u> <u>(dBC)</u>	<u>C wt.-A wt.</u> <u>(dB)</u>
5 Steam Turbine Ships @ ABS Power; (ref 3).	-	-	-
	-	-	-
	-	-	-
	-	-	-
fwd end:	87	93	6
7 Ships @ max power; (ref 1).			
in alley:	CS-1 81	95	14
at entrance:	CS-2 95	99	4
" " :	TS-1 98	105	7
	TS-2 95	108	13
	TG-1		
	OD-1		
	OD-2 93	98	5
Cargo; steam turbine; (ref 6)			
at entrance:	G 80-85		
at aft end:	G 84-86		

Table 15. **STATEROOM A-** and C-weighted sound pressure levels (flag presumed: British, Norwegian, Swedish, Spanish, German, Dutch).
(Continued)

<u>SHIP(S) AND REFERENCE</u>	<u>SOUND PRESSURE LEVEL</u>			<u>Flag</u>
	<u>A wt.</u> <u>(dBA)</u>	<u>C wt.</u> <u>(dBC)</u>	<u>C wt.-A wt.</u> <u>(dB)</u>	
6 Diesel; "PD,HD,BD"&"kammern" (ref 14).	55	84(81-89)	(29)	Ge
	68	94(90-100)	(26)	
	66	91(89-95)	(25)	
	59	86(82-92)	(27)	
	65	88(86-88)	23	
	69	91(91)	22	
Various types diesel; 82 "cabins"; (ref 15). Ship 8: 8000T cargo-pass.; 23 crew cabins; (ref 15).	58(42-84)			Du
	63(54-68)			Du
6 Large (turbine) tankers; "cabins"; (ref 16).	55	71	16	Du
	50	67	17	
	53	72	19	
	61	79	18	
	58	76	18	
	64	81	17	
	59	81	22	
	62	75	13	
	69	81	12	
	64	81	17	
69	82	13		

¹⁴ Zur Schallpegelsenkung auf Schiffen durch rekonstruktive Massnahmen an den Aufbauten und durch Verwendung schnelllaufender Hauptmaschinen, by G Schmidt and H Schmidt; Schiff & Hafen/ Kommandobruecke, Heft 7, 29. Jahrgang, p 655-659, 1977.

¹⁵ Report 125S, A Proposal on Noise Criteria for Seagoing Ships, by J Buiten; Netherland Ship Research Center TNO, 1969.

¹⁶ Reports 44S and 45S, Some Acoustical Properties of Ships with Respect to Noise Control, Parts I and II, by JH Janssen; Netherland Ship Research Center, 1962.

Table 16. MESS (M), LOUNGE (L) and RECREATION (R)
 ROOM A- and C-weighted sound pressure levels
 (flag presumed: British, Swedish, Dutch).

SHIP(S) AND REFERENCE	SOUND PRESSURE LEVEL			Flag
	A wt. (dBA)	C wt. (dBC)	C wt.-A wt. (dB)	
6 Tankers; "accommodations overall". (ref 7).	(* = NR+5dB)			
200,000 Ton: crews' mess	71(M)	95(M)	24	Br
" PO Smokerroom	61(L)	91(L)	30	
" "	75*			
" salon	68(L)	102(L)	34	
70,000 Ton: "	66(L)			
67,000 Ton: "	71*			
53,000 Ton: "	60*			
18,000 Ton: "	68*			
18,000 Ton: "	65*			
2 ships (Diesel); (ref 10). crews' mess	62(M),75(M)			Sw
1 ship; 50000WT(1973)(ref 17). officers' mess:	72(M)	88(M)	16	Du

¹⁷ Prediction of Noise Levels in Ships, by T Kihlman and J Plunt, in International Symposium on Shipboard Acoustics 1976, JH Janssen, ed, p 297-317, 1977; Elsevier Scientific Publishing Co, New York.

Table 17. OFFICE and DAY CABIN A- and C-weighted sound pressure levels (flags presumed: Swedish, Norwegian).

<u>SHIP(S) AND REFERENCE</u>	<u>SOUND PRESSURE LEVEL</u>			<u>Flag</u>	
	<u>A wt.</u> <u>(dBA)</u>	<u>C wt.</u> <u>(dBC)</u>	<u>C wt.-A wt.</u> <u>(dB)</u>		
1 ships (Diesel); (ref 10). ship C	67			Sw	
Various examples (ref 18):	57-60	-		No	
	73	93	20		
	59	88	29		
	75	104	29		
	crews' before treat.	75	82		7
	" after "	61	78		17
		77	86		9
		65	80		15
		59	80		21

Table 18. PASSAGEWAY A- and C-weighted sound pressure levels.

<u>SHIP(S) AND REFERENCE</u>	<u>SOUND PRESSURE LEVEL</u>			<u>Flag</u>
	<u>A wt.</u> <u>(dBA)</u>	<u>C wt.</u> <u>(dBC)</u>	<u>C wt.-A wt.</u> <u>(dB)</u>	

No data retrieved.

¹⁸ NTNF Report B0930.4502.1, Noise Control in Ships, by JWE Peterson and JF Storm (ed), p 17, 180-197, 234-242, 1975; Norwegian Council for Technical and Scientific Research, Det Norske Veritas.

Table 19. WHEELHOUSE/ENCLOSED BRIDGE A- and C-weighted sound pressure levels (flag presumed: British, Norwegian, Dutch, Spanish).

SHIP(S) AND REFERENCE	SOUND PRESSURE LEVEL			Flag
	A wt. (dBA)	C wt. (dBC)	C wt.-A wt. (dB)	
6 Tankers; "accommodations overall". (ref 7).	(* = NR+5dB)			
200,000 Ton:	63*			Br
70,000 Ton:	62*			
67,000 Ton:	69*			
53,000 Ton:	61*			
18,000 Ton:	64*			
18,000 Ton:	62*			
40 merchant (same as below) (ref 19). mean & range:	68(52-78)	89(77-105)		
11 Steam (ref 19)	60	81	(21)	Br
29 Diesel (ref 19)	68	92	(24)	
39 Diesel Merchant (Storm, cit in ref 8).	66	91	(25)	No
Various examples (ref 18):	71	96	25	No
a ship with a solidly mounted superstructure:	76	98	22	
same ship with resiliently mounted " :	61	87	25	
diesel exhaust noise:	76	110	34	
radar on:	71	84	13	
radar off:	56	81	15	
10 ships (ref 15). (* = NR+5dB)	1 75*			Du
	2 -			
	3 65*			
	4 89*			
	4a 81*			
	5 78*			
	6 71*			
	7 -			
	8 87*			
	8a 82*			
14 Bulk Cargo; (ref 12)	68			Sp

¹⁹ A Survey of Noise in Merchant Ships, by RB Conn; Trans of North East Coast Institution of Engineers and Shipbuilders, vol 85 no 4, p 61-71, 20 January 1969.

Table 20. **RADIO ROOM, BRIDGE WING, and LOOKOUT/LISTENING POST** A- and C-weighted sound pressure levels (flag presumed: British, Dutch).

RADIO ROOM

<u>SHIP(S) AND REFERENCE</u>		<u>SOUND PRESSURE LEVEL</u>			<u>Flag</u>
		<u>A wt.</u> <u>(dBA)</u>	<u>C wt.</u> <u>(dBC)</u>	<u>C wt.-A wt.</u> <u>(dB)</u>	
40 merchant (same as below) (ref 19).	mean & range:	60(50-75)	83(70-93)	(23)	Br
11 Steam (ref 19)		58	77	(19)	
29 Diesel (ref 19)		62	88	(26)	

BRIDGE WINGS

<u>SHIP(S) AND REFERENCE</u>		<u>SOUND PRESSURE LEVEL</u>			<u>Flag</u>
		<u>A wt.</u> <u>(dBA)</u>	<u>C wt.</u> <u>(dBC)</u>	<u>C wt.-A wt.</u> <u>(dB)</u>	
40 merchant (same as below) (ref 19).	mn&rng port:	67(55-82)	91(74-110)	(24)	Br
	stbd:	71(55-80)	99(72-110)	(28)	
11 Steam (ref 19)		63	83	(20)	
29 Diesel (ref 19)		70(67-73)	100	(30)	
10 ships (ref 15).	(* = NR+5dB)	1	82*		Du
		2	79*		
		3	74*		
	propulsion stopped:	"	58	88 (30)	
		4	94*		
	propulsion stopped:	"	65	99 (34)	
		4a	81*		
		5	96*		
		6	87*		
		7	90*		
		8	85*		
	propulsion stopped:	"	54	73 (19)	
		8a	74*		
	Diesel exhaust:	before silencing (NR=86)	79		
	<u>NOTE: higher dBA after</u>	"	(NR=76)	80	

LOOKOUT/LISTENING POST

<u>SHIP(S) AND REFERENCE</u>	<u>SOUND PRESSURE LEVEL</u>			<u>Flag</u>
	<u>A wt.</u> <u>(dBA)</u>	<u>C wt.</u> <u>(dBC)</u>	<u>C wt.-A wt.</u> <u>(dB)</u>	

No data retrieved.

Table 21. **ISOLATED MAIN MACHINERY CONTROL ROOM A- and C-weighted sound pressure levels (foreign flag presumed; British, Norwegian, Swedish, Spanish, Japanese).**

SHIP(S) AND REFERENCE	SOUND PRESSURE LEVEL			Flag
	A wt. (dBA)	C wt. (dBC)	C wt.-A wt. (dB)	
"Typical values" (ref 20).	75			Br
29 Diesel (ref 19); control room; mean & range (*=NR+5dB)	73(68-78)	84(75-92)	(72*-82*)	Br
Various examples (ref 18):	72	83	11	No
	65	87	22	
	71	90	19	
4 ships; (ref 10)	Dry Car. 1600GRT; b1t 1972	71		Sw
	Prot tanker 5000 GRT; 1972	93		
	Dry Car. 10000 GRT; 1969	83		
	Tanker, 75000 GRT; 1973	73		
1 ship (ref 11) 5000DWT (1973):	73	87	14	Sw
14 Bulk Cargo; (ref 12):	79			Sp
Diesel ferries (ref 21):				Ja
Calm water ferries	"semi" control room:	79-81		
		-		
Channel ferries		-		
		-		
Ocean going ferries		76		
		78		
Island ferries	"semi" control room:	80		
	"semi" control room:	80		
Other diesel vessels (ref 21):				Ja
Bulk carrier		74		
"		80		
Tanker		76		
"		74		
Cargo		75		

²⁰ Noise in Ships' Engine Rooms and Other Machinery Spaces, by J McNaught and AH Middleton; report sponsored by the Chamber of Shipping of the United Kingdom (c 1974).

²¹ Present State of Engine-Room Noise and Crew's Hearing Impairment, by H Kanda; Maritime Labour Research Institute, Tokyo, Japan, p 3-1-1 to 3-1-10 (c 1974).

Table 22. MAIN MACHINERY CONTROL STATION A- and C-weighted sound pressure levels (flag presumed: British, Norwegian, Spanish, German, Dutch, Japanese).

SHIP(S) AND REFERENCE	SOUND PRESSURE LEVEL			Flag
	A wt. (dBA)	C wt. (dBC)	C wt.-A wt. (dB)	
6 Tankers; "accommodations overall". (ref 7).	(* = NR+5dB)			
200,000 Ton: eng rm overall:	63-109	81-117		Br
" typical(contr stn?):	98*			
70,000 Ton: eng rm overall	86-100	94-107		
" typical(contr stn?):	97*			
67,000 Ton (diesel):	"	99*		
53,000 Ton:	"	92*		
18,000 Ton:	"	101*		
18,000 Ton:	"	91*		
40 merchant (same as below) (ref 19).	mean & range: 95(77-110)	103(88-112)		
11 Steam (ref 19)	93	100		Br
29 Diesel (ref 19). (* = NR+5dB);	96(98*)	103		
Various examples (ref 13):	102	106	4	No
	91	105	14	
	113	114	1	
39 Diesel Merchant. (Storm, cit in ref 3).	100	107	(7)	No
14 Bulk Car.; (ref 12) "engine top"	103			Sp
183(?) Slow rotor diesel ships (ref 13).				Ge
"working floor"; 1957-65:	97			
(yr built):1966-70:	96			
1971-74:	98(95-100)			
"cylinder station"; 1957-65:	100			
1966-70:	102			
1971-74:	104(100-108)			
Med-Fast rotor diesel ships (ref 13).				
1957-65:	100			
1966-70:	102			
1971-74:	106(103-109)			
17 ships (1500-6000 GRT) with same diesel engine,				
8-cyl, 4000hp, 375rpm: port & stbd sides:	106(105-109)			
cylinder station:	104(100-106)			
turbocharger:	108(104-111)			

Table 22. **MAIN MACHINERY CONTROL STATION** A- and C-weighted sound pressure levels (flag presumed: British, Norwegian, Spanish, German, Dutch, Japanese).
(Continued)

<u>SHIP(S) AND REFERENCE</u>	<u>SOUND PRESSURE LEVEL</u>			<u>Flag</u>
	<u>A wt.</u> <u>(dBA)</u>	<u>C wt.</u> <u>(dBC)</u>	<u>C wt.-A wt.</u> <u>(dB)</u>	
Three coastal motor vessels (ref 13); (999 GRT)				Ge
2000hp, 1000rpm	115			
2250hp, 800rpm	108			
2000hp, 269rpm	104			
Coastal vessel (ref 13); (999 GRT); 2300 hp; 900 rpm:				Ge
w/turbocharger	112			
w/silencer	106			
6 Diesel; (watch station?); (ref 14).	109	113	4	Ge
	103	105	2	
	111	113	2	
	105	110	5	
	107	109	2	
	104	107	3	
2 Large (turbine) tankers; (ref 16); (in engineroom casing of an untreated ship):	102	108	4	Du
	95	105	10	
	92	101	9	
	90	101	11	
(in engineroom casing of a treated ship):	105	111	6	
	96	104	8	
	86	98	8	
Typical of diesel enginerooms (Janssen, cit in ref 22)	104	109	5	Du
2 ships (Janssen, cit in ref 22)	101	110	9	Du
Diesel ferries (ref 21).				Ja
Calm water ferries	103-110			
	101-104			
	103-107			
Channel ferries	106-110			
	107-111			
Ocean going ferries	102-109			
	102-109			
Island ferries	104-109			
	101-106			
Other diesel vessels (ref 21).				Ja
Bulk carrier	94-101			
" "	95-103			
Tanker	96-104			
"	92-100			
Cargo	91-101			

²² State of the Art for Shipboard Vibration and Noise Control, by EF Noonan and S Feldman; in Ship Vibration Symposium, published by the Society of Naval Architects and Marine Engineers, New York, p A-1 to A-38, 1978.

Table 26. **MAIN REDUCTION GEAR and TURBOGENERATOR REDUCTION GEAR AREA A- and C-weighted sound pressure levels (non-US flag).**

MAIN REDUCTION GEAR AREA

<u>SHIP(S) AND REFERENCE</u>	<u>SOUND PRESSURE LEVEL</u>			<u>Flag</u>
	<u>A wt.</u> <u>(dBA)</u>	<u>C wt.</u> <u>(dBC)</u>	<u>C wt.-A wt.</u> <u>(dB)</u>	
6 large tankers, (ref 16).				
MRG (@ 1 meter)	104	107	3	Du
	99	102	3	
	97	101	4	
	97	100	3	
	95	96	i	
	110	113	3	

TURBOGENERATOR REDUCTION GEAR AREA

<u>SHIP(S) AND REFERENCE</u>	<u>SOUND PRESSURE LEVEL</u>			<u>Flag</u>
	<u>A wt.</u> <u>(dBA)</u>	<u>C wt.</u> <u>(dBC)</u>	<u>C wt.-A wt.</u> <u>(dB)</u>	
6 large tankers, (ref 16).				
(@ 0.7 meter above turbogenerator RG)	100	102	2	
"	105	104	-1	
"	94	96	2	
"	97	96	-1	

Table 27. **DIESEL and STEAM ENGINE A-weighted sound pressure levels.** Noise level is determined by the speed of a diesel engine, not by its power. (Adapted from ref 20. An example from ref 18 is also included.)

<u>TYPE OF ENGINE</u>	<u>SOUND PRESSURE LEVELS AT 1 METER</u> <u>AVERAGE & RANGE</u> (dBA)
-----------------------	--

Slow speed (0-175 RPM) DIESEL	104(90-118)
Med speed (300-800 RPM) DIESEL	107(98-115)
Med speed (800-1500 RPM) DIESEL	114(102-122)

<u>TYPE OF ENGINE</u>	<u>MANEUVERING PLATFORM OR AVERAGE ENGINEER ROOM LEVELS</u> <u>AVERAGE & RANGE</u> (dBA)
-----------------------	--

Slow speed DIESEL	94(89-99)
Med speed DIESEL	105(94-102)
A 500 RPM DIESEL (ref 18):	109(110 dBC)
STEAM: close to power unit:	99(91-123) (median & range)
average engineer room level:	93(82-101)(median of avg & range of avg)

<u>AUXILIARY MACHINERY</u>	
<u>AVERAGE & RANGE</u> (dBA)	

Diesel powered aux. generators	102(87-110)
Turbo-generators	97(89-108)
Auxiliary boilers	97(89-103)
Main boilers	91(86-103)
Compressors	87(83-96)

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