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FILE NO.

DIRECT DIAL NO. 202-955

January 30, 1985

BY HAND

Honorable Lawrence J. Brenner
 Honorable Peter A. Morris
 Administrative Judges
 Atomic Safety and Licensing Board
 U.S. Nuclear Regulatory Commission
 4350 East-West Highway
 Fourth Floor (North Tower)
 Washington, D.C. 20814

Honorable George A. Ferguson
 Administrative Judge
 School of Engineering
 Howard University
 2300 - 6th Street, N.W.
 Room 1114
 Washington, D.C. 20059

Long Island Lighting Company
Docket No. 50-322-1 (OL)

Dear Administrative Judges:

I am enclosing the list of witnesses, exhibits and sequence of testimony requested in your Memorandum of December 24, 1984.

Very truly yours,



John Jay Range

Enclosures

cc: Secretary of the Commission (w/enc.)
 Fabian C. Palomino, Esq. (w/enc.)
 Douglas J. Scheidt, Esq. (w/enc.)
 Robert G. Perlis, Esq. (w/enc.)

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WITNESSES IN ALPHABETICAL ORDER

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<u>Anderson, Robert N.</u>	23,826
"Joint Direct Testimony of Dr. Robert N. Anderson, Professor Stanley G. Christensen, G. Dennis Eley, Dale G. Bridenbaugh and Richard B. Hubbard regarding Suffolk County's Emergency Diesel Generator Contentions" (section pertaining to crankshafts)	
"Supplemental Testimony of Dr. Robert N. Anderson, Professor Stanley G. Christensen, G. Dennis Eley, and Richard B. Hubbard Regarding Suffolk County's Emergency Diesel Generator Contention Concerning Cylinder Blocks"	25,564
"Revised Joint Direct Testimony of Dr. Robert N. Anderson, Professor Stanley G. Christensen, G. Dennis Eley, Dale G. Bridenbaugh and Richard B. Hubbard Regarding Suffolk County Emergency Diesel Generator Contentions Concerning Cylinder Blocks"	25,564
"Rebuttal Testimony of Dr. Robert N. Anderson, Professor Stanley G. Christensen, and G. Dennis Eley"	26,326
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Witness

TDI Emergency Diesel Generators at the Shoreham Nuclear Power Station, Volume 1. Henriksen was deleted from the portion of this testimony pertaining to cylinder blocks (see page 25,175)

Bridenbaugh, Dale G.

23,826

"Joint Direct Testimony of Dr. Robert N. Anderson, Professor Stanley G. Christensen, G. Dennis Eley, Dale G. Bridenbaugh and Richard B. Hubbard regarding Suffolk County's Emergency Diesel Generator Contentions" (section pertaining to crankshafts)

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25,564

Burrell, N. Ken

23,122

"Testimony of Clifford H. Wells, Duane P. Johnson, Harry F. Wachob, Craig K. Seaman, Dominic Cimino and N. Ken Burrell on behalf of Long Island Lighting Company Concerning Shotpeening of the Replacement Crankshafts"

Bush, Spencer H.

23,126

"Joint Testimony of Carl H. Berlinger, Spencer H. Bush, Adam J. Henriksen, Walter W. Laity and Professor Arthur Sarsten on Contentions Concerning TDI Emergency Diesel

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Generators at the Shoreham Nuclear Power Station."
Henriksen was deleted from the portion of this testimony pertaining to cylinder blocks (see page 25,175)

"Supplemental Testimony of Spencer H. Bush and Adam J. Henriksen Concerning Cylinder Blocks of the TDI Emergency Diesel Generators at the Shoreham Nuclear Power Station"

25,775

Chen, Simon K.

22,610

"Testimony of Roger L. McCarthy, Paul R. Johnston, Eugene F. Montgomery and Simon K. Chen on behalf of Long Island Lighting Company on Suffolk County's Contention Regarding Replacement Crankshafts on Diesel Generators at Shoreham"

Christensen, Stanley G.

23,826

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25,564

"Rebuttal Testimony of Dr. Robert
N. Anderson, Professor Stanley G.
Christensen, and G. Dennis Eley"

26,326

Cimino, Dominic

23,122

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and N. Ken Burrell on behalf of
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Eley, G. Dennis

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<u>Henriksen, Adam J.</u>	23,126
"Joint Testimony of Carl H. Berlinger, Spencer H. Bush, Adam J. Henriksen, Walter W. Laity and Professor Arthur Sarsten on Contentions Concerning TDI Emergency Diesel Generators at the Shoreham Nuclear Power Station." Henriksen was deleted from the portion of this testimony pertaining to cylinder heads (see page 25,175)	
"Supplemental Testimony of Spencer H. Bush and Adam J. Henriksen Concerning Cylinder Blocks of the TDI Emergency Diesel Generators at the Shoreham Nuclear Power Station"	25,775
<u>Hubbard, Richard B.</u>	23,826
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Diesel Generator Contention
Concerning Cylinder Blocks" 25,564

Johnson, Duane P. 23,122

"Testimony of Clifford H. Wells,
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Craig K. Seaman, Dominic Cimino
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"Testimony of Roger L. McCarthy,
Charles A. Rau, Clifford H. Wells,
Harry F. Wachob, Duane Johnson,
Craig K. Seaman, Edward J. Youngling
and Milford H. Schuster On Behalf of
Long Island Lighting Company on
Suffolk County Contention Regarding
Cylinder Blocks" 24,372

"Supplemental Testimony of Roger
L. McCarthy, Charles A. Rau,
Clifford H. Wells, Harry F. Wachob,
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Edward J. Youngling and Milford H.
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Johnston, Paul R.

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"Testimony of Roger L. McCarthy,
Paul R. Johnston, Eugene F.
Montgomery and Simon K. Chen on
behalf of Long Island Lighting
Company on Suffolk County's
Contention Regarding Replacement
Crankshafts on Diesel Generators
at Shoreham"

Laity, Walter W.

23,126

"Joint Testimony of Carl H.
Berlinger, Spencer H. Bush,
Adam J. Henriksen, Walter W.
Laity, and Professor Arthur
Sarsten on Contentions
Concerning TDI Emergency
Diesel Generators at the
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of this testimony pertaining
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McCarthy, Roger L.

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and Milford H. Schuster On Behalf of
Long Island Lighting Company on
Suffolk County Contention Regarding
Cylinder Blocks"

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"Supplemental Testimony of Roger L. McCarthy, Charles A. Rau, Clifford H. Wells, Harry F. Wachob, Duane P. Johnson, Craig K. Seaman, Edward J. Youngling and Milford H. Schuster on Behalf of Long Island Lighting Company on Suffolk County Contention Regarding Cylinder Blocks"

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Montgomery, Eugene F.

22,610

"Testimony of Roger L. McCarthy, Paul R. Johnston, Eugene F. Montgomery and Simon K. Chen on behalf of Long Island Lighting Company on Suffolk County's Contention Regarding Replacement Crankshafts on Diesel Generators at Shoreham"

Pischinger, Franz F.

22,610

"Testimony of Edward J. Youngling and Franz F. Pischinger on behalf of Long Island Lighting Company on Suffolk County's Contention Regarding Replacement Crankshafts on Diesel Generators at Shoreham"

Rau, Charles A.

"Testimony of Roger L. McCarthy, Charles A. Rau, Clifford H. Wells, Harry F. Wachob, Duane Johnson, Craig K. Seaman, Edward J. Youngling and Milford H. Schuster On Behalf of Long Island Lighting Company on Suffolk County Contention Regarding Cylinder Blocks"

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Witness

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Sarsten, Arthur

23,126

"Joint Testimony of Carl H. Berlinger, Spencer H. Bush, Adam J. Henriksen, Walter W. Laity, and Professor Arthur Sarsten on Contentions Concerning TDI Emergency Diesel Generators at the Shoreham Nuclear Power Station."
Henriksen was deleted from the portion of this testimony pertaining to cylinder blocks (see page 25,175)

Schuster, Milford H.

"Testimony of Roger L. McCarthy, Charles A. Rau, Clifford H. Wells, Harry F. Wachob, Duane Johnson, Craig K. Seaman, Edward J. Youngling and Milford H. Schuster On Behalf of Long Island Lighting Company on Suffolk County Contention Regarding Cylinder Blocks"

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"Supplemental Testimony of Roger L. McCarthy, Charles A. Rau, Clifford H. Wells, Harry F. Wachob, Duane P. Johnson, Craig K. Seaman, Edward J. Youngling and Milford H. Schuster On Behalf of Long Island Lighting Company On Suffolk County Contention Regarding Cylinder Blocks"

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Seaman, Craig

23,122

"Testimony of Clifford H. Wells,
Duane P. Johnson, Harry F. Wachob,
Craig K. Seaman, Dominic Cimino
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Long Island Lighting Company
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Harry F. Wachob, Duane P. Johnson,
Craig K. Seaman, Edward J. Youngling
and Milford H. Schuster On Behalf of
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"Supplemental Testimony of Roger L.
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H. Wells, Harry F. Wachob, Duane
P. Johnson, Craig K. Seaman, Edward
J. Youngling and Milford H. Schuster
On Behalf of Long Island Lighting
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Wachob, Harry F.

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"Testimony of Clifford H. Wells,
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Cylinder Blocks"

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Wells, Clifford H. 23,122

"Testimony of Clifford H. Wells, Duane P. Johnson, Harry F. Wachob, Craig K. Seaman, Dominic Cimino and N. Ken Burrell on behalf of Long Island Lighting Company Concerning Shotpeening of the Replacement Crankshafts"

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"Supplemental Testimony of Roger L. McCarthy, Charles A. Rau, Clifford H. Wells, Harry F. Wachob, Duane P. Johnson, Craig K. Seaman, Edward J. Youngling and Milford H. Schuster On Behalf of Long Island Lighting Company On Suffolk County Contention Regarding Cylinder Blocks" 24,372

Youngling, Edward J.

"Testimony of Edward J. Youngling and Franz F. Pischinger on behalf of Long Island Lighting 22,610

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Company on Suffolk County's
Contention Regarding Replacement
Crankshafts on Diesel Generators
at Shoreham"

"Testimony of Roger L. McCarthy,
Charles A. Rau, Clifford H. Wells,
Harry F. Wachob, Duane P. Johnson,
Craig K. Seaman, Edward J. Youngling
and Milford H. Schuster On Behalf of
Long Island Company On Suffolk County
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"Supplemental Testimony of Roger L.
McCarthy, Charles A. Rau, Clifford
H. Wells, Harry F. Wachob, Duane P.
Johnson, Craig K. Seaman, Edward J.
Youngling and Milford H. Schuster
On Behalf of Long Island Lighting
Company On Suffolk County Contention
Regarding Cylinder Blocks"

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EXHIBITS BY PARTY AND NUMBER

<u>Exhibit Number</u>	<u>Description</u>	<u>Identified at Transcript Page</u>	<u>Admitted at Transcript Page</u>
LILCO Ex. B-7	Typical configuration of the cylinder block, cylinder head, cylinder liner and cylinder head studs	24,372	24,372
LILCO Ex. B-8	Plan view of block top, cylinder bore, cylinder head studs and cylinder head	24,372	24,372
LILCO Ex. B-9	Section view of a cylinder head stud	24,372	24,372
LILCO Ex. B-10	Section view of a non-stud region	24,372	24,372
LILCO Ex. B-11	Section view of a cylinder liner	24,372	24,372
LILCO Ex. B-12	Graph depicting the effect of section thickness on tensile strength of gray cast iron	24,372	24,372
LILCO Ex. B-13	Table depicting load history of EDG 101	24,372	24,372

<u>Exhibit Number</u>	<u>Description</u>	<u>Identified at Transcript Page</u>	<u>Admitted at Transcript Page</u>
LILCO Ex. B-14	Table depicting load history of EDG 102	24,372	24,372
LILCO Ex. B-15	Table depicting load history of original EDG 103	24,372	24,372
LILCO Ex. B-16	EDG 101 crack map	24,372	24,372
LILCO Ex. B-17	EDG 102 crack map	24,372	24,372
LILCO Ex. B-18	Original EDG 103 crack map	24,372	24,372
LILCO Ex. B-19	Diagram: typical example of a ligament crack	24,372	24,372
LILCO Ex. B-20	Figure depicting stud-to-stud cracking in original EDG 103	24,372	24,372
LILCO Ex. B-21	Component task evaluation report Q-410	24,372	24,372
LILCO Ex. B-22	Figure depicting strain gage placement on original EDG 103	24,372	24,372
LILCO Ex. B-23	Figure depicting strain gage placement on original EDG 103	24,372	24,372

<u>Exhibit Number</u>	<u>Description</u>	<u>Identified at Transcript Page</u>	<u>Admitted at Transcript Page</u>
LILCO Ex. B-24	Drawing showing crack-mouth opening displacement	24,372	24,372
LILCO Ex. B-25	Original EDG 103 crack map as of 4/23/84	24,372	24,372
LILCO Ex. B-26	Graph showing strain v. load for gages 8, 9, 10	24,372	24,372
LILCO Ex. B-27	Graph showing strain v. load for gages 11, 12, 13	24,372	24,372
LILCO Ex. B-28	Graph showing strain v. load for gage no. 3	24,372	24,372
LILCO Ex. B-29	Graph showing principal stresses v. load for gages 8, 9, 10	24,372	24,372
LILCO Ex. B-30	Graph showing principal stresses v. load for gages 11, 12, 13	24,372	24,372
LILCO Ex. B-31	Graph showing principal stresses v. load for gage no. 3	24,372	24,372
LILCO Ex. B-33	Photograph of the Widmanstaetten microstructure in original EDG 103	24,372	24,372

<u>Exhibit Number</u>	<u>Description</u>	<u>Identified at Transcript Page</u>	<u>Admitted at Transcript Page</u>
LILCO Ex. B-34	Microscopy comparison of original EDG 103 sample	24,372	24,372
LILCO Ex. B-35	Details of Widmanstaetten graphite in original EDG 103	24,372	24,372
LILCO Ex. B-36	Photomicrographs of microstructure of EDG 101	24,372	24,372
LILCO Ex. B-37	Photomicrographs of microstructure of EDG 102	24,372	24,372
LILCO Ex. B-38	Photomicrographs showing comparison of eutectic cell boundaries in EDG 101, EDG 102 and original EDG 103	24,372	24,372
LILCO Ex. B-39	Schematic drawing of specimen location from original EDG 103 segment removed from between cylinders 6 and 7	24,372	24,372
LILCO Ex. B-40	Table summarizing tensile tests on original and new EDG 103 block material	24,372	24,372
LILCO Ex. B-42	Graph of strain-life data for TDI gray cast iron	24,372	24,372

<u>Exhibit Number</u>	<u>Description</u>	<u>Identified at Transcript Page</u>	<u>Admitted at Transcript Page</u>
LILCO Ex. B-43	Graph of strain life data from literature sources	24,372	24,372
LILCO Ex. B-44	Graph of fatigue crack growth rates of original EDG 103 gray cast iron	24,372	24,372
LILCO Ex. B-45	Planar two-dimensional model	24,372	24,372
LILCO Ex. B-46	Perspective view of three-dimensional block top model	24,372	24,372
LILCO Ex. B-47	Two-dimensional block top model depicting loads	24,372	24,372
LILCO Ex. B-48	Table showing stress measured at strain gage 13 to block top crack sites	24,372	24,372
LILCO Ex. B-49	Goodman-Smith curve for low cycle fatigue at 100% load for Shoreham EDG 101 and EDG 102	24,372	24,372
LILCO Ex. B-50	Goodman-Smith curve for high cycle fatigue at 100% load for Shoreham engines EDG 101 and EDG 102	24,372	24,372

<u>Exhibit Number</u>	<u>Description</u>	<u>Identified at Transcript Page</u>	<u>Admitted at Transcript Page</u>
LILCO Ex. B-51	FSAR 8.3.1-1 and letter from Stone and Webster depicting load levels for Shoreham	24,372	24,372
LILCO Ex. B-59	"Supplemental Testimony of Roger L. McCarthy, Charles A. Rau, Clifford H. Wells, Harry F. Wachob, Duane P. Johnson, Craig K. Seaman, Edward J. Youngling and Milford H. Schuster On Behalf of Long Island Lighting Company on Suffolk County Contention Regarding Cylinder Blocks," with attached exhibit	25,082	
LILCO Ex. B-60	Preliminary cam gallery strain gage data	26,336	
LILCO Ex. B-61	Drawings depicting the cam gallery region of the original EDG 103 block, after casting, after grinding and after weld repairs	26,464	26,757
LILCO Ex. B-62	Drawings depicting the cam gallery regions of EDG 101 and 102 blocks, after casting, after grinding and after weld repairs	26,464	26,757

<u>Exhibit Number</u>	<u>Description</u>	<u>Identified at Transcript Page</u>	<u>Admitted at Transcript Page</u>
LILCO Ex. B-63	Photographs [at 100X and 500X] showing the tip of casting shrinkage crack	26,519	26,741
LILCO Ex. B-64	Photograph showing the liquid penetrant test for circumferential crack of cross-section through cylinder no. 5 on original EDG 103 block	26,686	26,...
LILCO Ex. C-1	Evaluation of Emergency Diesel Generator Crankshafts at Shoreham and Grand Gulf Nuclear Power Stations prepared for TDI Diesel Generator Owners Group dated May 22, 1984 (hereinafter "Owners Group Crankshaft Report"), Figure 3-4	22,610	22,610
LILCO Ex. C-2	Specification for Diesel Generator Sets, Shoreham Nuclear Power Station - Unit 1, Spec. No. SH1-89, Revision 2, January 26, 1983, pages 1-20	22,610	22,610
LILCO Ex. C-3	U.S. Nuclear Regulatory Commission Regulatory Guide 1.9, Revision 2, December 1979.	22,610	22,610

<u>Exhibit Number</u>	<u>Description</u>	<u>Identified at Transcript Page</u>	<u>Admitted at Transcript Page</u>
LILCO Ex. C-4	IEEE Standard Criteria for Diesel Generator Units Applied as Standby Power Supplies for Nuclear Power Generating Stations, Std. 387-1977	22,610	22,610
LILCO Ex. C-5	Transcript of July 11, 1984 meeting of the TDI Diesel Generator Owners Group, pages 124-25	22,610	22,610
LILCO Ex. C-6	Available Logged Hours of Operation of DSR-48, Rated 3500 KW at 450 RPM	22,610	
LILCO Ex. C-7	TDI Diesel Generator Run History - Shoreham Nuclear Power Station - Unit 1 - August 6, 1984	22,610	22,610
LILCO Ex. C-8	Results of non-destructive examinations of replacement crankshafts at Shoreham after 100 hours of operation at full load or greater	22,610	22,610
LILCO Ex. C-9	American Bureau of Shipping, Rules for Building and Classing Steel Vessels (1983) § 37.17.1	22,610	22,610

<u>Exhibit Number</u>	<u>Description</u>	<u>Identified at Transcript Page</u>	<u>Admitted at Transcript Page</u>
LILCO Ex. C-10	American Bureau of Shipping, Rules for Building and Classing Steel Vessels (1983), Table 34.3	22,610	22,610
LILCO Ex. C-12	American Bureau of Shipping Reports on Castings or Forgings of Replacement Crankshafts	22,610	22,610
LILCO Ex. C-13	American Bureau of Shipping letter to TDI dated May 3, 1984	22,610	22,610
LILCO Ex. C-14	Diesel Engine Manufacturers Association Standard Practices for Low and Medium Speed Stationary Diesel and Gas Engines (1972 ed.), pages 53-56	22,610	22,610
LILCO Ex. C-15	TDI Proposed Torsional and Lateral Critical Speed Analysis, August 22, 1983	22,610	22,610
LILCO Ex. C-16	Field Test of Emergency Diesel Generator 103 with 13 x 12 Crankshaft, April, 1984	22,610	22,610
LILCO Ex. C-17	Owners Group Crankshaft Report	22,610	22,610

<u>Exhibit Number</u>	<u>Description</u>	<u>Identified at Transcript Page</u>	<u>Admitted at Transcript Page</u>
LILCO Ex. C-18	Crankshaft Torsional Stress Calculations for 8L 17 x 21 Engine-Generator Set, July 19, 1984	22,610	22,610
LILCO Ex. C-19	Table 2.2 from Owners Group Crankshaft Report showing natural frequencies from TDI analysis	22,610	22,610
LILCO Ex. C-20	Table 2.4 from Owners Group Crankshaft Report showing single order nominal stresses from TDI analysis	22,610	22,610
LILCO Ex. C-21	Table 2.5 from Owners Group Crankshaft Report showing nominal stresses calculated from torsigraph	22,610	22,610
LILCO Ex. C-22	Crankshaft Torsional Stress Calculations for 8L 17 x 21 Engine-Generator Set, July 19, 1984, page 11	22,610	22,610
LILCO Ex. C-23	Figure 3-3 from Owners Group Report showing comparison of measured and calculated torque	22,610	22,610

<u>Exhibit Number</u>	<u>Description</u>	<u>Identified at Transcript Page</u>	<u>Admitted at Transcript Page</u>
LILCO Ex. C-24	Tables 3.6 and 3.7 from Owners Group Crankshaft Report showing comparison between analytical and test results	22,610	22,610
LILCO Ex. C-25	Figure 3-13 from Owners Group Crankshaft Report showing fatigue endurance limit of replacement crankshafts on Goodman diagram	22,610	22,610
LILCO Ex. C-26	Oberg and Jones, <u>Machinery's Handbook</u> (18th Ed.) pages 352-53; Shigley, <u>Mechanical Engineering Design</u> (Mcgraw-Hill) pages 212-13; Rothbart (editor), <u>Mechanical Design and Systems Handbook</u> (McGraw-Hill) page 18-4	22,610	22,610
LILCO Ex. C-27	Engineering and Design Coordination Report No. F-46109G	23,121	23,122
LILCO Ex. C-28	Military Specification No. 13165B, Amendment 2, June 25, 1979	23,121	23,122

<u>Exhibit Number</u>	<u>Description</u>	<u>Identified at Transcript Page</u>	<u>Admitted at Transcript Page</u>
LILCO Ex. C-29	LILCO Operational Quality Assurance Reports (EDG 102 and 103 Crankshafts)	23,121	23,122
LILCO Ex. C-30	Metal Improvement Company Certificate of Shot Peening (EDG 102 and 103 Crankshafts)	23,121	23,122
LILCO Ex. C-31	Certificate of Non-Destructive Testing Issued by Krupp Stahl AG (EDG 102 and 103 Crankshafts)	23,121	23,122
LILCO Ex. C-32	LILCO Magnetic Particle Testing and Liquid Penetrant Testing Records (EDG 102 and 103 Crankshafts)	23,121	23,122
LILCO Ex. C-33	LILCO Ultra Sonic Testing Records (EDG 102 and 103 Crankshafts)	23,121	23,122
LILCO Ex. C-34	H. Fuchs and R. Stevens, <u>Metal Fatigue in Engineering</u> (1980) at pages 226-227; H. Uhlig, <u>Corrosion and Corrosion Control</u> at pages 132-133	23,121	23,122

<u>Exhibit Number</u>	<u>Description</u>	<u>Identified at Transcript Page</u>	<u>Admitted at Transcript Page</u>
LILCO Ex. C-35	Metal Improvement Company Certificate of Shot Peening (EDG 101 Crankshaft)	23,121	23,122
LILCO Ex. C-36	LILCO Operational Quality Assurance Reports (EDG 101 Crankshaft)	23,121	23,122
LILCO Ex. C-37	Certificates of Non-Destructive Testing Issued by Krupp Stahl AG (EDG 101 Crankshaft)	23,121	23,122
LILCO Ex. C-38	LILCO Magnetic Particle Testing, Liquid Penetrant Testing and Ultra Sonic Testing Records (EDG 101 Crankshaft)	23,121	23,122
LILCO Ex. C-39	Kirk, <u>Behavior of</u> <u>Peen-Formed Steel Strip on</u> <u>Isochronal Annealing,</u> Proceedings of the Second International Conference on Shot Peening at page 231, (May, 1984)	23,121	23,122
LILCO Ex. C-40	Deposition testimony of Dr. Robert N. Anderson, dated May 10, 1984, pages 70-71	23,881	24,333

<u>Exhibit Number</u>	<u>Description</u>	<u>Identified at Transcript Page</u>	<u>Admitted at Transcript Page</u>
LILCO Ex. C-41	Rules and Regulations for the Classification of Ships, Lloyd's Register of Shipping, Part 5, Chapter 2 (July, 1982) and Part 5, Chapter 1 (January, 1983)	24,010	24,333
LILCO Ex. C-42	Deposition testimony of Woytowich Blanding and Guiffra (ABS), dated July 18, 1984, pages 129-130	24,143	24,333
LILCO Ex. P-1	Photograph of piston skirt with mounted crown and rings	21,949	21,949
LILCO Ex. P-2	Photograph of a piston from a Shoreham EDG showing skirt and crown	21,949	21,949
LILCO Ex. P-3	Cross section of crown and skirt indicating the two areas of load transfer from the crown to the skirt	21,949	21,949
LILCO Ex. P-4	Piston reassembly guidelines showing measurements of cold gap	21,949	21,949
LILCO Ex. P-5	Gas pressure versus crank angle diagram	21,949	21,949

<u>Exhibit Number</u>	<u>Description</u>	<u>Identified at Transcript Page</u>	<u>Admitted at Transcript Page</u>
LILCO Ex. P-6	Comparison of all AE and AF piston skirts in the region of the stud attachment bosses	21,949	21,949
LILCO Ex. P-7	Representative dimension checks on Task Evaluation Reports Q-338, 310, 194, 203 and 182	21,949	21,949
LILCO Ex. P-8	Trip report on non-destructive examination of AE piston skirt and a copy of AE piston skirt inspection, requirements, certificates of compliance and receipt inspection documentation	21,949	21,949
LILCO Ex. P-9	A sample preoperational test procedure and Appendix F showing peak firing pressures taken before the crankshaft failure and after the crankshaft replacement	21,949	21,949
LILCO Ex. P-10	Strains and sigma III stress from strain gage rosette measurements	21,949	21,949

<u>Exhibit Number</u>	<u>Description</u>	<u>Identified at Transcript Page</u>	<u>Admitted at Transcript Page</u>
LILCO Ex. P-11	Results of templug measurements of peak temperature as a function of position on crown	21,949	21,949
LILCO Ex. P-12	Location of strain gage rosettes on instrumented AE skirt	21,949	21,949
LILCO Ex. P-13	Summary of experimental observations related to crown/skirt interaction	21,949	21,949
LILCO Ex. P-14	Strain readings and calculated stresses for AE piston skirt for the complete stud boss rosettes at 1600 psig with a conventional crown	21,949	21,949
LILCO Ex. P-15	Comparison of experimental and numerical values of cyclic stresses for the AE piston skirt	21,949	21,949
LILCO Ex. P-16	Comparison of experimental observations of peak stress at 1627 psig for AE piston skirt with corresponding finite element results using extremes of wrist pin behavior	21,949	21,949

<u>Exhibit Number</u>	<u>Description</u>	<u>Identified at Transcript Page</u>	<u>Admitted at Transcript Page</u>
LILCO Ex. P-17	Cyclic stresses in AE piston skirts under isothermal and steady-state conditions	21,949	21,949
LILCO Ex. P-18	Comparison of peak stress in stud boss region of AE piston skirt for loads applied on inner and outer contact rings	21,949	21,949
LILCO Ex. P-19	Comparison of experimental and numerical gap closure and load split	21,949	21,949
LILCO Ex. P-20	Comparison of skirt stiffnesses as evaluated from experimental observation and crown/skirt interaction model with corresponding finite element values	21,949	21,949
LILCO Ex. P-21	Mean and cyclic stresses for infinite fatigue life	21,949	21,949
LILCO Ex. P-22	Stress states for isothermal AE piston skirt for various gap sizes plotted on graph of allowable stress amplitude as a function of mean stress	21,949	21,949

<u>Exhibit Number</u>	<u>Description</u>	<u>Identified at Transcript Page</u>	<u>Admitted at Transcript Page</u>
LILCO Ex. P-23	Stress states for AE piston skirt for various conditions plotted on a graph of allowable stress amplitude as a function of mean stress for various gap sizes and for isothermal and steady-state temperature conditions	21,949	21,949
LILCO Ex. P-24	Summary of fracture toughness data from the literature for nodular cast iron with strength levels similar to 100-70-03	21,949	21,949
LILCO Ex. P-25	Applied values of Delta K and R as a function of crack depth and corresponding values of Delta K-th	21,949	21,949
LILCO Ex. P-26	Liquid dye penetrant inspection results after 100 hours of operation for EDGs 101, 102 and 103	21,949	21,949
LILCO Ex. P-27	Eddy current test results after 100 hours operation for EDGs 101, 102, 103; FaAA Procedure NDE 11.5, Rev. 0 and Rev. 1	21,949	21,949

<u>Exhibit Number</u>	<u>Description</u>	<u>Identified at Transcript Page</u>	<u>Admitted at Transcript Page</u>
LILCO Ex. P-28	<u>Iron Castings Handbook</u> , page 34	21,949	21,949
LILCO Ex. P-29	Results of inspection of AE pistons on the Kodiak Electric Association engine and the TDI R-5 prototype engine	21,949	21,949
LILCO Ex. P-30	Volume I, TDI Owners Manual (sections discussing engine lubrication)	21,949	21,949
LILCO Ex. P-31	Excerpts from <u>Diesel Engine Design</u> by T.D. Walshaw and <u>Internal Combustion Engines</u> by V.L. Maleev	21,949	21,949
LILCO Ex. P-32	Task evaluation reports and LILCO deficiency reports which discuss the DRQR's visual inspections of AE piston skirts	21,949	21,949
LILCO Ex. P-33	Liquid dye penetrant test results for AF piston skirts	21,949	21,949

<u>Exhibit Number</u>	<u>Description</u>	<u>Identified at Transcript Page</u>	<u>Admitted at Transcript Page</u>
LILCO Ex. P-34	Minimum and maximum stresses in AE piston skirt for various peak firing pressures for isothermal and steady state operating conditions; applied values of Delta K and R as a function of crack depth and corresponding values of Delta K-th (2,200 psig)	21,949	21,949
LILCO Ex. P-35	LILCO EDG 103 cylinder 7 pressure data	22,532	22,535
LILCO Ex. P-36	Influence of Thermal Distortion on Fatigue Performance of AF and AE Piston Skirts, June 1984	23,713	
County Ex. 7	Design Review of TDI R-4 and RV-4 Series Emergency Diesel Generator Cylinder Blocks and Liners, June 1984	23,827	

<u>Exhibit Number</u>	<u>Description</u>	<u>Identified at Transcript Page</u>	<u>Admitted at Transcript Page</u>
County Ex. 7 (Revised)	"Design Review of TDI R-4 and RV-4 Series Emergency Diesel Generator Cylinder Blocks and Liners, June 1984," pages i, ii, iii, 1-1, 1-2, 1-3, 3-5, 3-6, 3-9, 4-1, 4-5, 4-6, 4-8, 5-1, 5-2; Figures 1-1, 1-2, 1-3, 1-4, 1-5, 1-6, 1-7, 1-8, 3-1, 3-6, 3-7, 3-13, 3-14, 4-2, A-1, A-2, A-3	25,550	25,566
County Ex. 9	Page 8-3, TDI Instruction Manual for DSR 48 engine	26,556	26,557
County Ex. 10	Deposition of Gerald E. Trussell, dated May 7, 1984, pages 62, 45-48, 74-87, 107, 111-113, 128-129	23,827	23,827
	Pages 128-129	26,556	26,557
County Ex. 24	Deposition of Maurice H. Lowrey, dated May 10, 1984, pages 1, 15-16, 62, 85	23,827	23,827
County Ex. 24 (Revised)	Deposition of Maurice H. Lowrey, dated May 10, 1984, pages 1, 14-16	25,550	25,566

<u>Exhibit Number</u>	<u>Description</u>	<u>Identified at Transcript Page</u>	<u>Admitted at Transcript Page</u>
County Ex. 32	Deposition of Clinton S. Mathews, dated May 8, 1984, pages 106, 107	25,550	25,566
County Ex. 35	Board Notification 84-101; Evaluation of Diesel Generator Failure at Shoreham Unit 1, Franklin Research Center, pages 1-6, 33-34, 59-62, 63-68	23,827	23,827
County Ex. 36	Calculations for 12" x 13" Crankshafts under Lloyd's Register Rules by Professor Christensen	23,827	23,827
County Ex. 37	Calculations for 12" x 13" Crankshafts under Lloyd's Register Rules by Mr. Eley	23,827	23,827
County Ex. 38	IACS-CIMAC Rules for the Calculation of Crankshafts for Diesel Engines	23,827	23,827
County Ex. 39	TDI Calculations under IACS-CIMAC Rules on R-48 Crankshaft	23,827	23,827
County Ex. 40	Calculations under ABS Rules for Crankshafts with Solid Webs, by Profesora Christensen	23,827	23,827

<u>Exhibit Number</u>	<u>Description</u>	<u>Identified at Transcript Page</u>	<u>Admitted at Transcript Page</u>
County Ex. 41	Deposition testimony of Franz F. Pischinger, dated June 21, 1984, pages 1, 94, 97-98, 100-101, 108, 110, 185-187	23,827	23,827
County Ex. 43	Deposition testimony of Messrs. Woytowich, Blanding and Giuffra (ABS), dated July 18, 1984, pages 1, 80-81, 93, 98-99, 112, 163-165, 167-168 and exhibit 3 to the Deposition	23,827	23,827
County Ex. 44	May 3, 1984 letter from ABS to TDI	23,827	23,827
County Ex. 45	TDI submission to ABS entitled "Report on Crankshaft Torsional Stresses, Transamerica Delaval Model DRS-48, Serial No. 74010/12 for Long Island Lighting Company, by Roland Yang, April 4, 1984	23,827	23,827

<u>Exhibit Number</u>	<u>Description</u>	<u>Identified at Transcript Page</u>	<u>Admitted at Transcript Page</u>
County Ex. 46	July 25, 1984 letter to Howard C. Blanding (ABS) from Alan Roy Dynner, and documents 1-12 attached	23,827	23,827
	Attachments 5 through 9 to July 25, 1984 Dynner letter to Blanding, American Bureau of Shipping	26,556	26,557
County Ex. 47	ABS Check Calculations (Exhibit 3 to ABS deposition) dated July 18, 1984	23,827	23,827
County Ex. 48	Letter dated February 17, 1984 to Gregory M. Beshouri (TDI) from Shinpei Denoh (Kobe Steel Ltd.)	23,827	23,827
County Ex. 49	Field Test of Emergency Diesel Generator 103 With 13 x 12 Crankshaft, April 1984, pages 1 and 7-3	23,827	23,827
County Ex. 50	Field Test of Emergency Diesel Generator 101, October 1984, pages 1 and 7-2	23,827	23,827

<u>Exhibit Number</u>	<u>Description</u>	<u>Identified at Transcript Page</u>	<u>Admitted at Transcript Page</u>
County Ex. 51	Stone & Webster Engineering Corporation Engineering and Design Coordination Report No. F-46109G	23,827	23,827
County Ex. 52	Deposition testimony of Paul R. Johnston, May 9, 1984, pages 1, 39-40	23,827	23,827
County Ex. 53	Stone & Webster Engineering Corporation Interoffice Memorandum dated September 20, 1983	23,827	23,827
County Ex. 54	April 17, 1984 letter from Reis to the Administrative Judges Concerning Morning Report of April 16, 1984	25,550	25,566
County Ex. 55	March 20, 1984 Morning Report Concerning Con Rod Bearing Cracks and Eddy Current Examinations of the Cylinder Block Cracks	25,550	25,566
County Ex. 56	TDI Owners Group DRQR review of SNPS cylinder blocks	25,550	25,566
County Ex. 57	Deposition of William J. Museler, dated May 22, 1984, pages 1, 7-8, 14-17, 43-46, 98-99	25,550	25,566

<u>Exhibit Number</u>	<u>Description</u>	<u>Identified at Transcript Page</u>	<u>Admitted at Transcript Page</u>
County Ex. 58	Deposition of Robert K. Taylor, dated May 10, 1984, page 1 and exhibit no. 1	25,550	25,566
County Ex. 59	Deposition of Robert K. Taylor, dated May 10, 1984, pages 1, 39-41, 67, 69-70	25,550	25,566
County Ex. 66	Deposition of Simon K. Chen, dated May 15, 1984, pages 1, 29	25,550	25,566
County Ex. 67	Handwritten memo to Pratt from Lowrey on cylinder block castings	25,550	25,566
County Ex. 69	Article from <u>Motor Ship Technical Magazine</u> , February 1978, entitled "Sulzer's Four-stroke High and Medium Speed Engine Range"	22,365	
County Ex. 70	Article from <u>The Institute of Marine Engineers Transactions</u> , January 1966, entitled "The Development of a Highly Rated Medium Speed Diesel Engine of 7,000 to 9,000 Horsepower for Marine Propulsion"	22,384	

<u>Exhibit Number</u>	<u>Description</u>	<u>Identified at Transcript Page</u>	<u>Admitted at Transcript Page</u>
County Ex. 71	Photograph of piston removed from EDG 103 taken by Aneesh Bakshi at SNPS of scuffing, June 1984	22,421	
County Ex. 72	Deposition testimony of Woytowich, Blanding and Guiffra (ABS) dated July 18, 1984, pages 114-130	24,274	24,333
County Ex. 73	Liquid Penetrant Examination Report, Cylinder Liner Landing, Cylinder No. 7 EDG 102, February 10, 1984	24,398	
County Ex. 74	TER Q-329 Liquid Penetrant Examination Report, Cylinder Block Liner Landing. Cylinders 2, 3, 4, 5	24,445	
County Ex. 75	FaAA Eddy Current Examination Report, pages 11, 12, 21, 23, 27, 39	24,598	24,600
County Ex. 76	EDX analysis of EDG 103 Cam Gallery crack sample	25,387	25,479
County Ex. 77	Schematic of upper cam saddle area	25,455	25,479

<u>Exhibit Number</u>	<u>Description</u>	<u>Identified at Transcript Page</u>	<u>Admitted at Transcript Page</u>
County Ex. 78	Circilli trip report re: EDGs at Kansas and Delaval, April 13, 1983	25,463	25,479
County Ex. 79	Eddy Current Examination Report with attachments, dated September 12, 1984	25,503	25,539
County Ex. 80	SNPS-1 FSAR, page 8.3-5 (Rev. 26, April 1982)	26,157	26,164
County Ex. 81	Photographs HFW-4, dated September 13, 1984 and CB-1, dated September 11, 1984	26,808	26,875
County Ex. 82	FaAA photographs DP-1, DP-2, DP-3, dated September 12, 1984	26,817	26,875
County Ex. S-1	FaAA Liquid Penetrant Examination Report, dated August 24, 1984	25,550	25,566
County Ex. S-2	FaAA Crack Depth Measurements, dated September 21, 1984	25,550	25,566
County Ex. S-3	Photographs of Cam Gallery Bearing Saddles Nos. 5, 7 and 8, Original Block, EDG 103	25,550	25,566

<u>Exhibit Number</u>	<u>Description</u>	<u>Identified at Transcript Page</u>	<u>Admitted at Transcript Page</u>
County Ex. S-4	Photographs at 50 and 100X, of section of cam saddle No. 7, Original Block, EDG 103	25,550	25,566
County Ex. S-5	LILCO Magnetic Particle Examination Report, EDG 101, dated September 20, 1984	25,550	25,566
County Ex. S-6	LILCO Liquid Penetrant Examination Report, EDG 101, dated September 21, 1984	25,550	25,566
County Ex. S-7	LILCO Deficiency Report 2507 and attachments, dated October 1, 1984	25,550	25,566
County Ex. S-8	Inspection Report of C.R. Islieb, dated May 17, 1984	25,550	25,566
County Ex. S-9	Drawings of location of cracks	25,550	25,566
County Ex. S-10	LILCO Magnetic Particle Examination Report, dated September 19, 1984	25,550	25,566
Staff Ex. 1	PNL Evaluation of Crankshaft Dimensions	23,236	24,236

<u>Exhibit Number</u>	<u>Description</u>	<u>Identified at Transcript Page</u>	<u>Admitted at Transcript Page</u>
Staff Ex. 2	PNL Analysis of Torsional Stresses for Sum of 24 Orders of Vibration	23,236	23,236
Staff Ex. 3	PNL Analysis of Stress Levels for Single Orders	23,236	23,236
Staff Ex. 4	American Bureau of Shipping letter to TDI dated May 3, 1984	23,236	23,236
Staff Ex. 5	Kohls, et al., <u>Effects of Multiple Shot- Peening/Cadmium-Plating Cycles on High-Strength Steel</u>	23,124	23,128
Staff Ex. 7	Pages 6 and 7 of Ricardo Report with tabulation of seven piston skirts, August 10, 1984	23,579	23,579
Staff Ex. 8	Eisenhut letter to George, dated August 13, 1984, with attachments	23,704	
Staff Ex. 9	Dr. Wells drawing to illustrate potential leak path between block and liner	25,208	25,213

Exhibit
Number

Description

Identified at
Transcript Page

Admitted at
Transcript Page

Staff Ex.
10

Drawing of "Section Through
Cylinder Head Stud"
(originally Ex. B-9) with
additional markings

26,186

26,187

Board Ex.
1

Resolution of Suffolk
County Diesel Generator
Contention re: Cylinder
Heads, dated September 21,
1984

25,204

SEQUENCE OF CRANKSHAFT TESTIMONY

<u>Witness (Party)</u>	<u>Date</u>	<u>Transcript Page Where Witness Sworn</u>
Chen (LILCO)	9/17/84	22,664
Johnston (LILCO)	9/17/84	22,605
Montgomery (LILCO)	9/17/84	22,605
McCarthy (LILCO)	9/17/84	22,605
Pischinger (LILCO)	9/17/84	22,605
Youngling (LILCO)	9/17/84	22,605
Burrell (LILCO)	9/20/84	23,118
Cimino (LILCO)	9/20/84	23,118
Johnson (LILCO)	9/20/84	23,118
Seaman (LILCO)	9/20/84	23,118
Wachob (LILCO)	9/20/84	23,118
Wells (LILCO)	9/20/84	23,118
Bush (NRC)	9/20/84	23,118
Henriksen (NRC)	9/24/84	23,234
Sarsten (NRC)	9/24/84	23,234
Anderson (SC)	10/1/84	23,812
Bridenbaugh (SC)	10/1/84	23,812
Christensen (SC)	10/1/84	23,812
Eley (SC)	10/1/84	23,812
Hubbard (SC)	10/1/84	23,812

SEQUENCE OF CYLINDER BLOCK TESTIMONY

<u>Witness (Party)</u>	<u>Date</u>	<u>Transcript Page Where Witness Sworn</u>
McCarthy (LILCO)	10/22/84	24,368
Wachob (LILCO)	10/22/84	24,368
Wells (LILCO)	10/22/84	24,368
Youngling (LILCO)	10/22/84	24,368
Seaman (LILCO)	10/22/84	24,368
Johnson (LILCO)	10/22/84	24,368
Rau (LILCO)	10/22/84	24,368
Schuster (LILCO)	10/22/84	24,368
Anderson (SC)	11/1/84	25,541
Anderson (SC)	11/13/84	26,324
Christensen (SC)	11/1/84	25,541
Christensen (SC)	11/13/84	26,324
Eley (SC)	11/1/84	25,541
Eley (SC)	11/13/84	26,324
Bridenbaugh (SC)	11/1/84	25,541
Hubbard (SC)	11/1/84	25,541
Bush (NRC)	11/7/84	25,771
Henriksen (NRC)	11/7/84	25,771
Berlinger (NRC)	11/7/84	25,771