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SUBJECT: Forwards response to NRC Question 022.54,provided in connection w/SER Open Item 27,subcompartment nodalization. Info will be incorporated as part of Amend 23 to FSAR.

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APP 4

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February 4, 1981

Director, Office of Nuclear Reactor Regulation
Attention: Mr. Frank Miraglia, Branch Chief
Licensing Branch No. 3
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Gentlemen:

Subject: Docket Nos. 50-361 and 50-362
San Onofre Nuclear Generating Station
Units 2 and 3

Enclosed are sixty-three (63) copies of the response to NRC Question 022.65. This information is provided in connection with SER Open Item No. 27, Subcompartment Nodalization. The results provided are consistent with the predictions made during the January 16, 1981 meeting with the NRC in Bethesda, Maryland and resolve the NRC information requirements for SER Open Item 27.

The enclosed information will be incorporated in the San Onofre Units 2 and 3 FSAR as part of Amendment No. 23 to the FSAR which is scheduled for submittal to the NRC on February 27, 1981.

If you have any questions or comments concerning this matter, please contact me.

Very truly yours,

KPB

Enclosures

B001
S
1/63

A

Question 022.65

The response to 022.59 is not complete.

Discuss the acceptability of the subcompartment nodalization used to determine the transient loads on the major components due to asymmetric subcompartment pressurization following a LOCA. Provide the transient loads ($f_x(t)$, $f_y(t)$, $f_z(t)$) and moments ($M_x(t)$, $M_y(t)$, $M_z(t)$) for the component support design basis model and the expanded subcompartment nodalization model (refer to Figures 022.21-1 and 022.36-1), resolved at the appropriate elevations for the component supports design evaluation. In doing so provide the transient loads resulting from subcompartment pressurization for two cases, namely, the design basis case from which transient loading data were obtained for use in the component supports evaluation and the case based on the expanded subcompartment nodalization model.

Response

Based on telephone conversations between Combustion Engineering and the Containment Systems Branch of NRC, we are providing the time history summations of forces at each level of, and the overturning and torsional moments on, the major components in the base (19 node) and expanded (40 node) steam generator (SG) subcompartment nodalization models. Loads on the steam generator due to a 600 in.^{2} SG inlet nozzle guillotine break and a 592 in.^{2} SG outlet nozzle guillotine break and loads on a reactor coolant pump due to a 480 in.^{2} RCP outlet nozzle guillotine break are transmitted herein.

Figures 022.65-1 through 022.65-4 show the orientation of the forces and moments and the location of the break nodes for each specific case analyzed. Figures 022.65-5 through 022.65-66 are time history plots of the forces and moments on the reactor coolant system components. These forces and moments were calculated by multiplying the nodal pressures by the project component cross-sectional area in each direction required. The forces in each direction at each level of the model were summed on a time history basis to produce the plots. In the case of moments, these PXA terms were multiplied by the indicated lever arms to produce moments about the centerlines of the component. The effect of the SG or RCP nozzles and intact piping within the cavity was accounted for in the calculations.

Consistent with the agreement reached in the meeting with the containment systems and mechanical engineering branches of the NRC on 1/16/81, SCE is providing time history forces and moments on the reactor vessel (RV) using the base (17 node) and expanded (28 node) RV cavity models for a 350 in^2 RV inlet nozzle guillotine break.

Figures 022.65-67 through 70 show the orientation of the forces and moments and the location of the break nodes for each case analyzed. Figure 022.65-71 compares the maximum forces and moments on the reactor vessel for the base and expanded nodalization models. Figures 022.65-72 through 91 are time history plots of the forces and moments on the reactor vessel. These forces and moments were calculated by **multiplying** the nodal pressures, by the component cross-sectional area in each direction required. The forces in each direction at each level of the model were summed on a time history basis to produce the plots in the enclosures. In the case of moments, these forces were multiplied by the indicated lever arms to produce moments about the centerlines of the component. The presence of the reactor vessel nozzles and intact piping within the cavity was accounted for in the calculations. 23

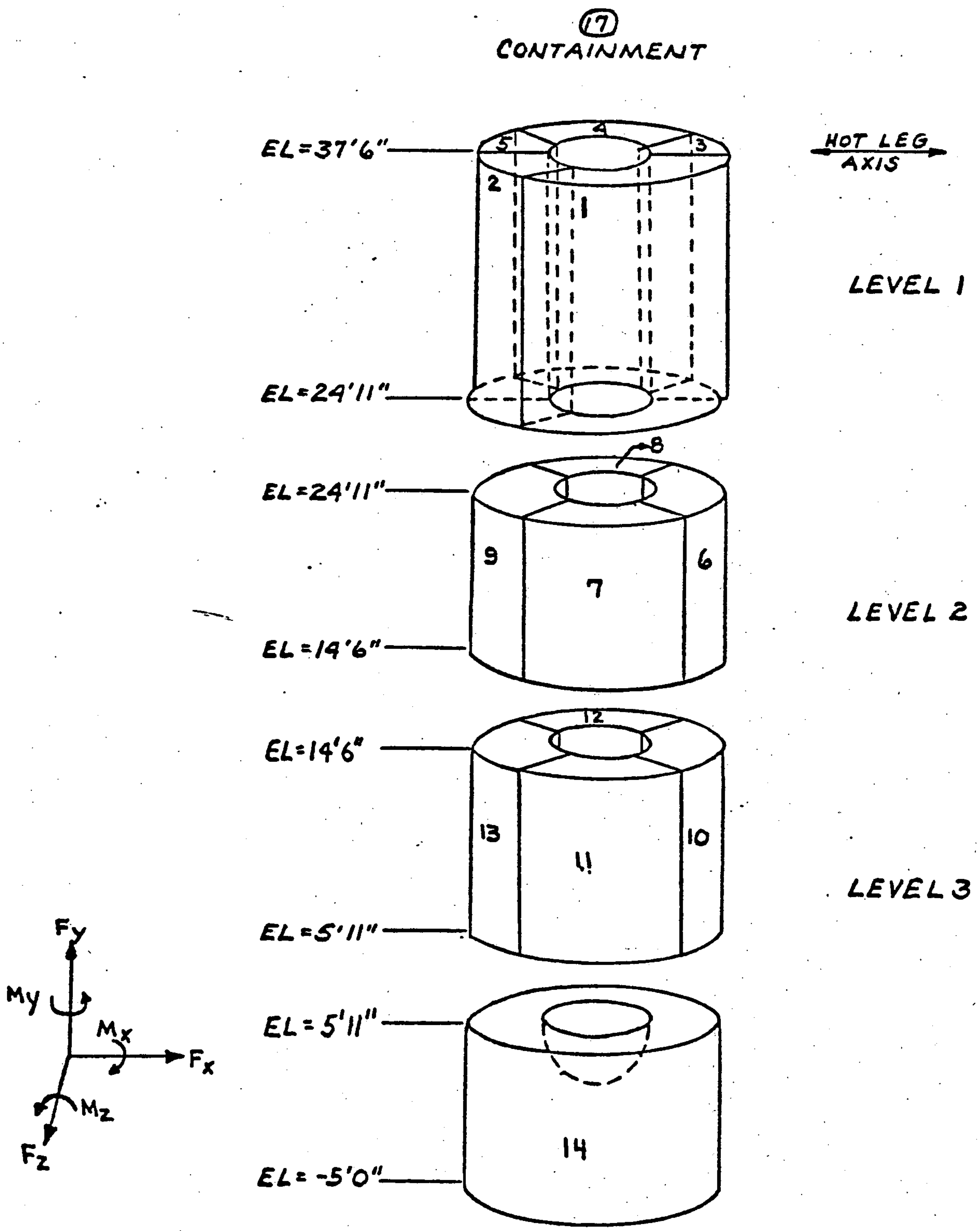
The results are consistent with the predictions made at the January 16, 1981 meeting with the NRC. Increases in moment are below 10%, and although the expanded case horizontal forces at levels 2 and 3 are 23% greater, these forces account for less than 3% of the total horizontal force.

<u>Reference</u>

FSAR paragraph 6.2.1.2, figure 6.2-14, and response to NRC Question 022.36.
No change was made to the FSAR.

FIGURE 022.65-67
REACTOR CAVITY

BASE MODEL NODALIZATION



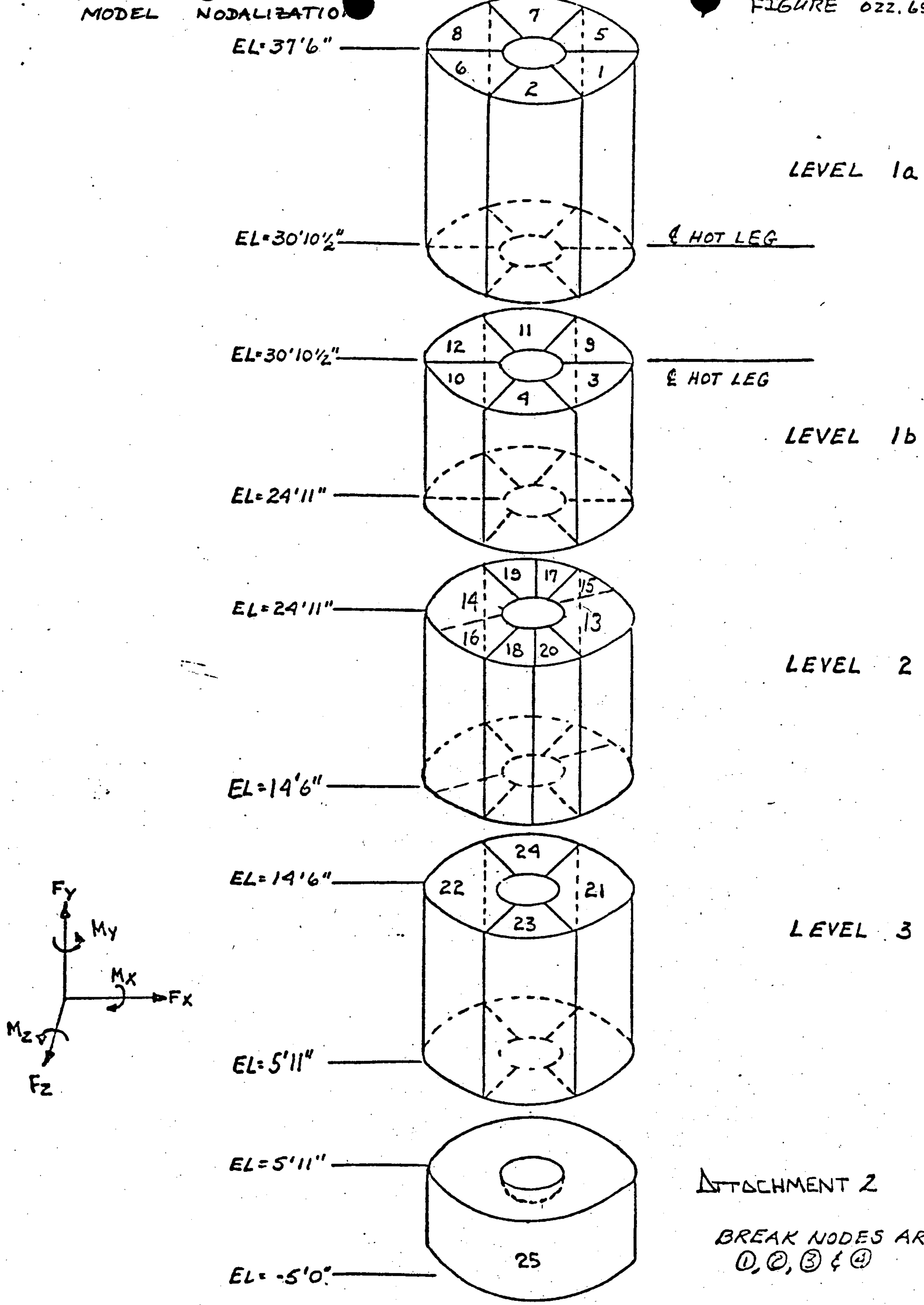
BREAK NODE IS 1

ATTACHMENT I

REACTOR CAVITY EXPANDED MODEL NODALIZATION

(28) CONTAINMENT

FIGURE 022.65-68

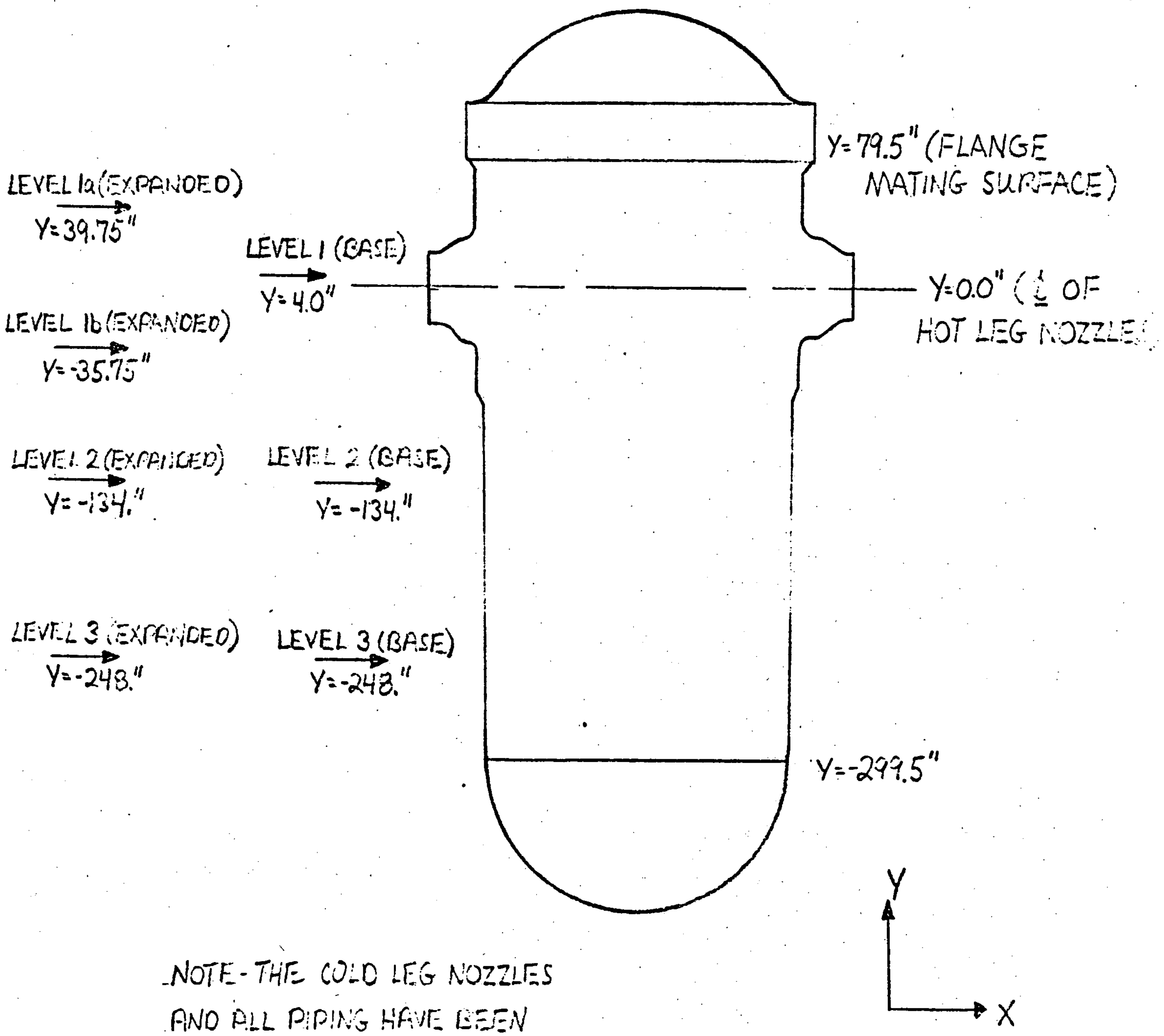


ATTACHMENT 2

BREAK NODES ARE
1, 2, 3 & 4

FIGURE 022.65-69

REACTOR VESSEL - LOCATIONS OF CENTERS OF PRESSURE FOR BASE AND EXPANDED MODELS



NOTE - THE COLD LEG NOZZLES AND ALL PIPING HAVE BEEN OMITTED FOR CLARITY

ATTACHMENT 3

MAXIMUM FORCES AND MOMENTS DUE TO CAVITY PRESSURIZATION

FIGURE 022-65-70

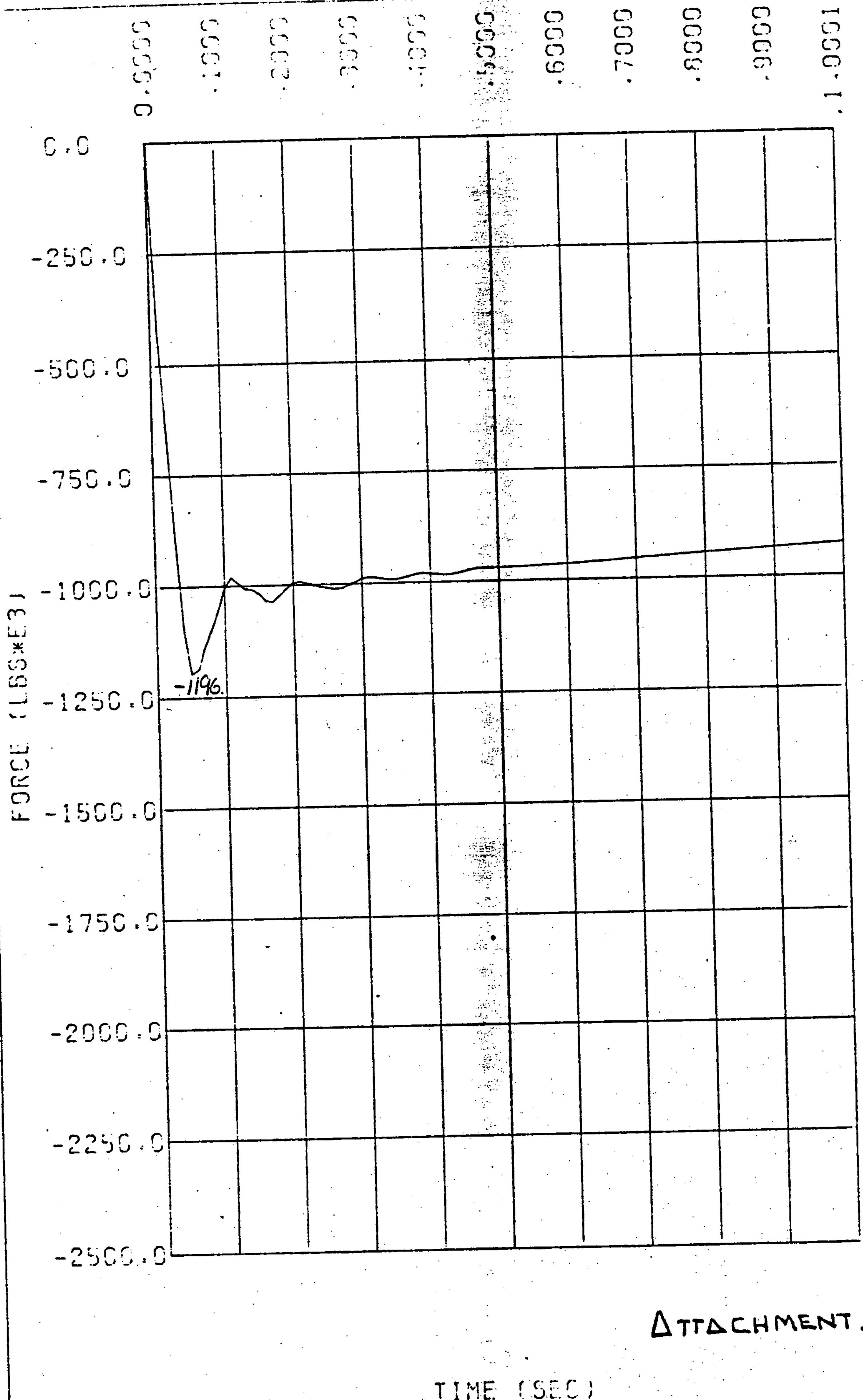
LOCATION	TYPE OF FORCE OR MOMENT	NODALIZATION USED: BASE MODEL MAX. LOAD (KIPS OR IN·KIPS)	BASE MODEL TIME (SEC)	EXPANDED MODEL MAX. LOAD (KIPS OR IN·KIPS)	EXPANDED MODEL TIME (SEC)	% INCREASE IN SRSS OF FORCE OR MOMENT
LEVEL 1 OR 1a (DEPENDING ON NODALIZATION USED)	FX	-1,196.	.050	-605.	.050	
	FZ	-2320.	.050	-1,183.	.050	
	SRSS	2610.		1,329.		0.9*
LEVEL 1b	FX	——		-597.	.050	
	FZ	——		-1,159.	.050	
	SRSS	——		1,304.		
LEVEL 2	FX	-35.7	.070	-41.9	.060	
	FZ	-34.7	.060	-49.3	.060	
	SRSS	49.8		64.7		23.
LEVEL 3	FX	-10.7	.170	-13.6	.170	
	FZ	-6.3	.170	-8.7	.090	
	SRSS	12.4		16.1		23.
VERTICAL FORCE	FY	562.	.680	549.	.680	-2.4
TORSIONAL MOMENT	MY	12,044.	.050	12,873.	.050	6.4
OVERTURNING MOMENT	MX	-10,607.	.050	-10,304.	.050	
	MZ	5,913.	.050	7,096.	.050	
	SRSS	12,144.		12,511.		2.9

* BASED ON THE COMPARISON OF THE LEVEL 1 SRSS WITH THE ABS SUM OF THE SRSS OF LEVELS 1a AND 1b

ATTACHMENT 4

FIGURE 02265-71

350 SQ IN [illegible] V INLET QUILL - BASE M[illegible]EL
HORIZONTAL FORCE X - LEVEL 1

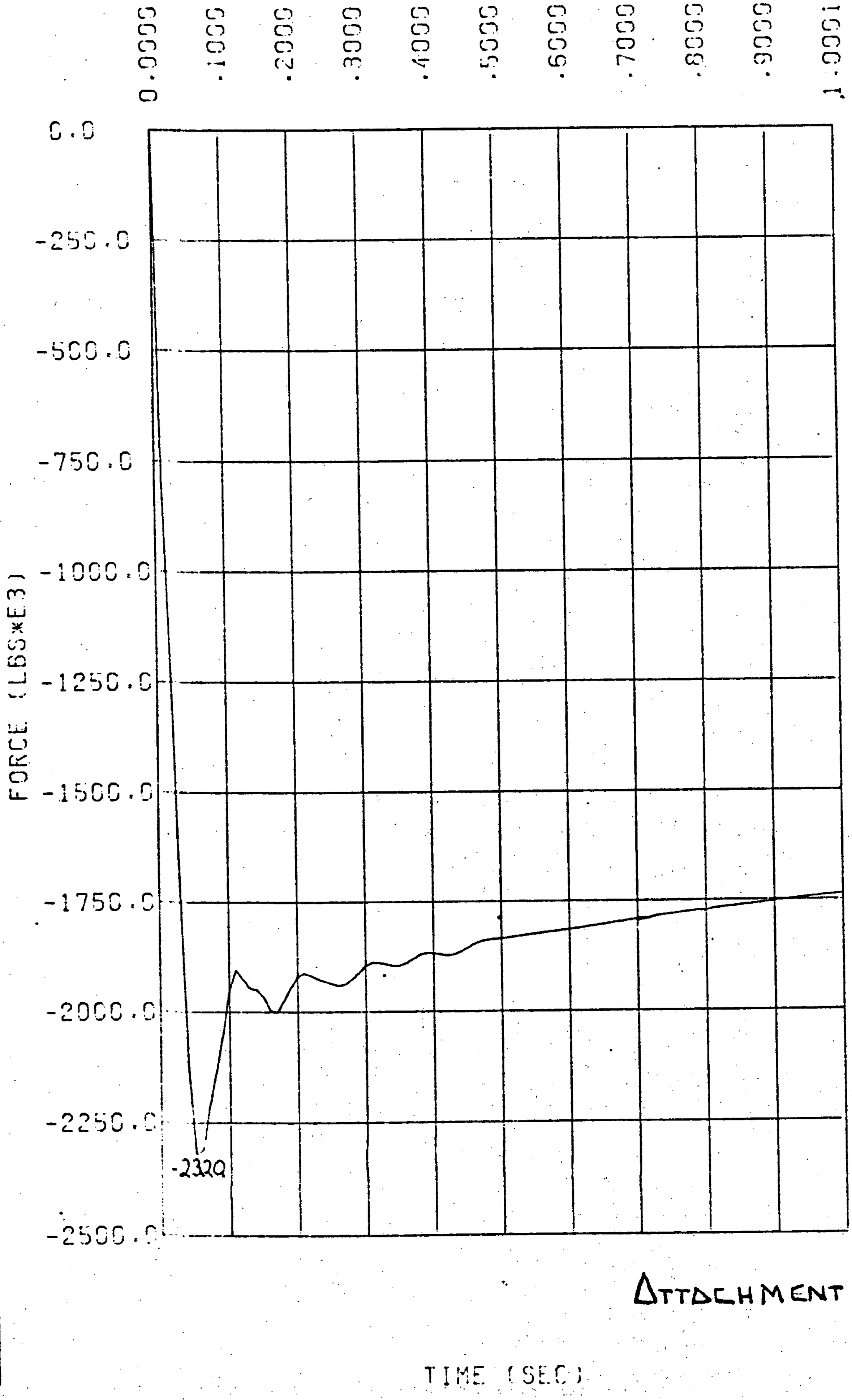


ATTACHMENT 5

FIGURE 022.65-72

350 SQ IN RV INLET QUILL - BASE MODEL

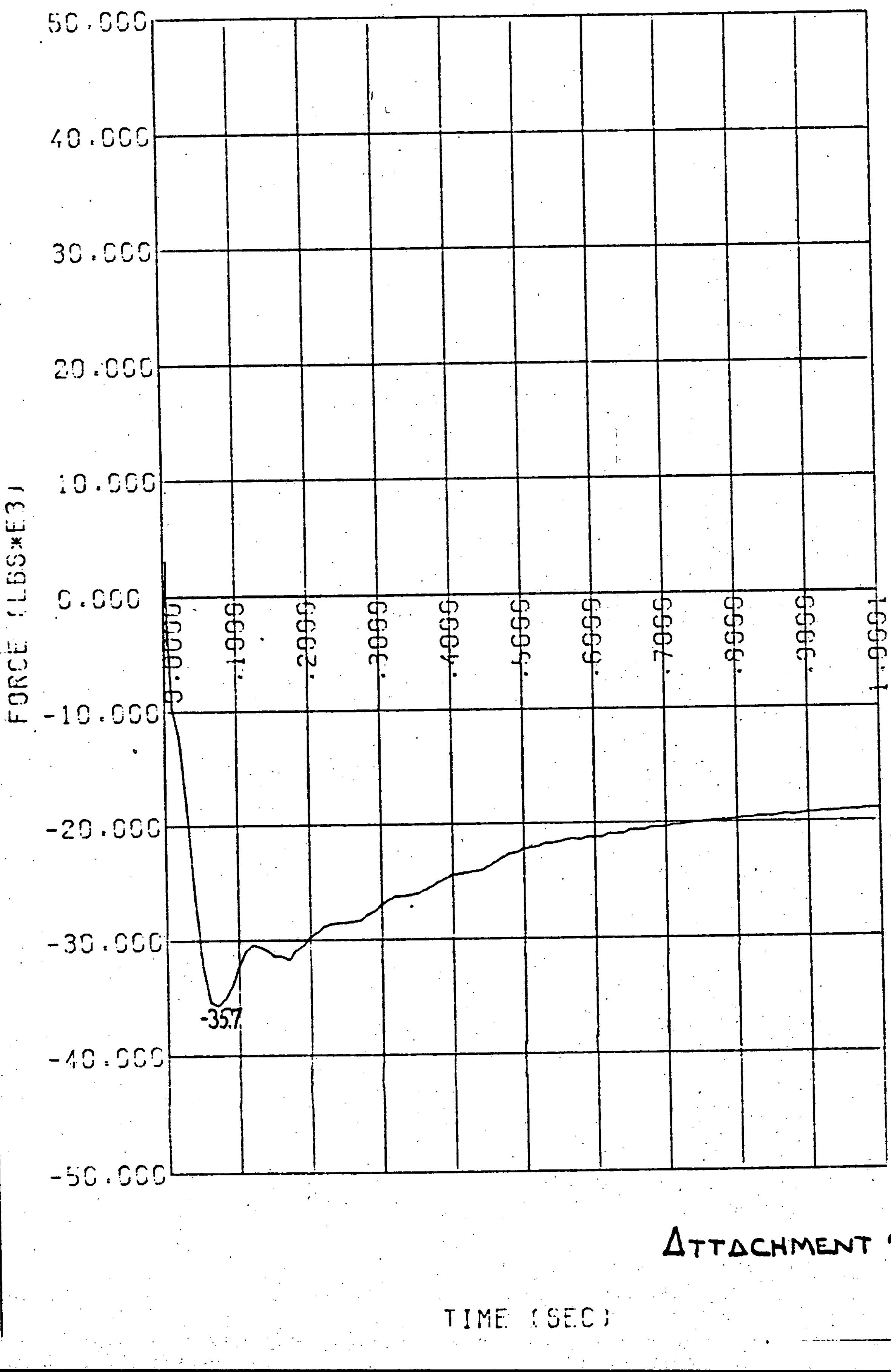
HORIZONTAL FORCE Z - LEVEL 1



ATTACHMENT 6

FIGURE 022.65-73

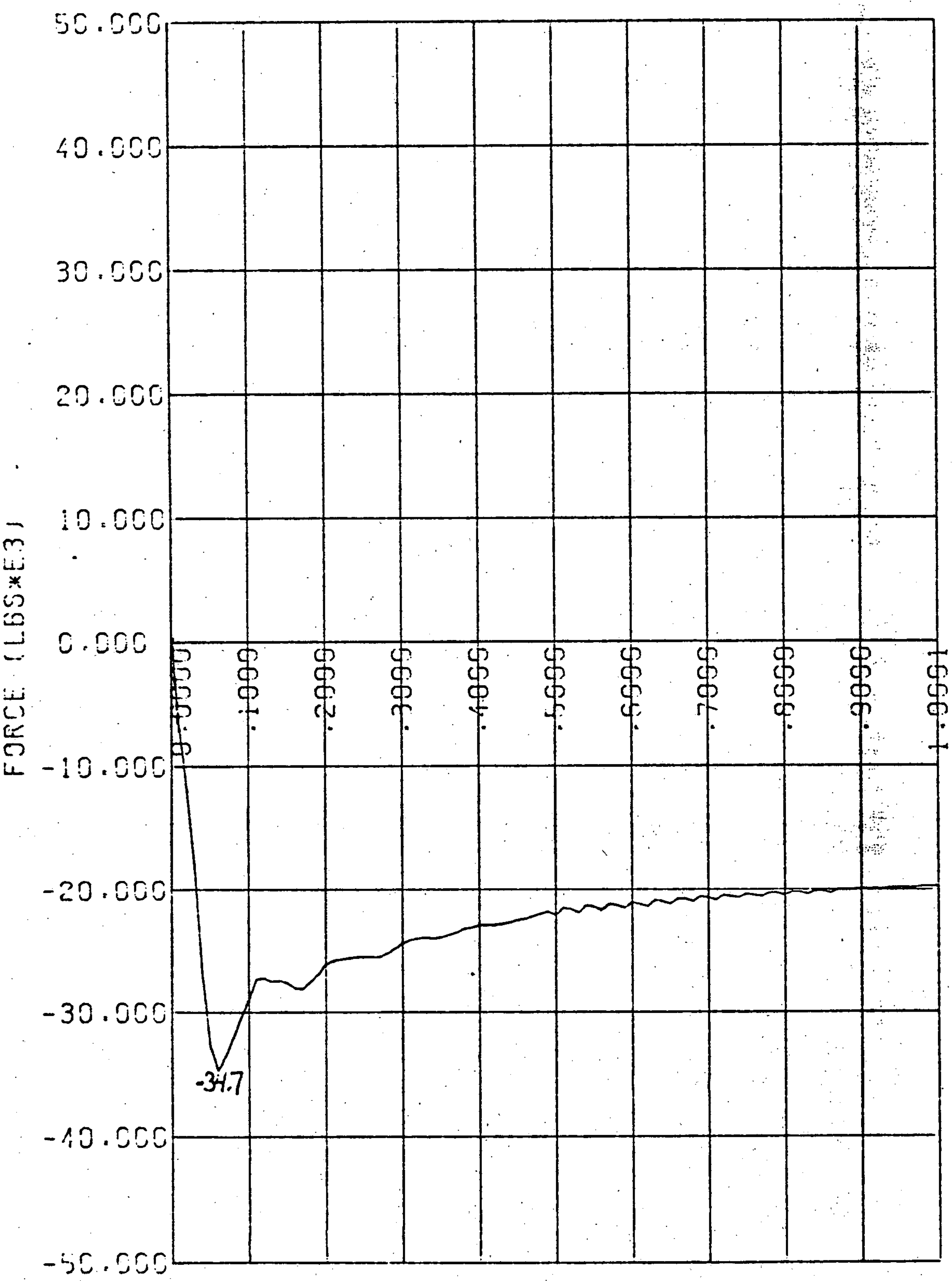
350 SQ IN RV INLET QUILL - BASE MODEL
HORIZONTAL FORCE X - LEVEL 2



ATTACHMENT 7

FIGURE 022.65-74

350 SQ IN RV INLET CUILL - BASE MODEL
HORIZONTAL FORCE Z - LEVEL 2

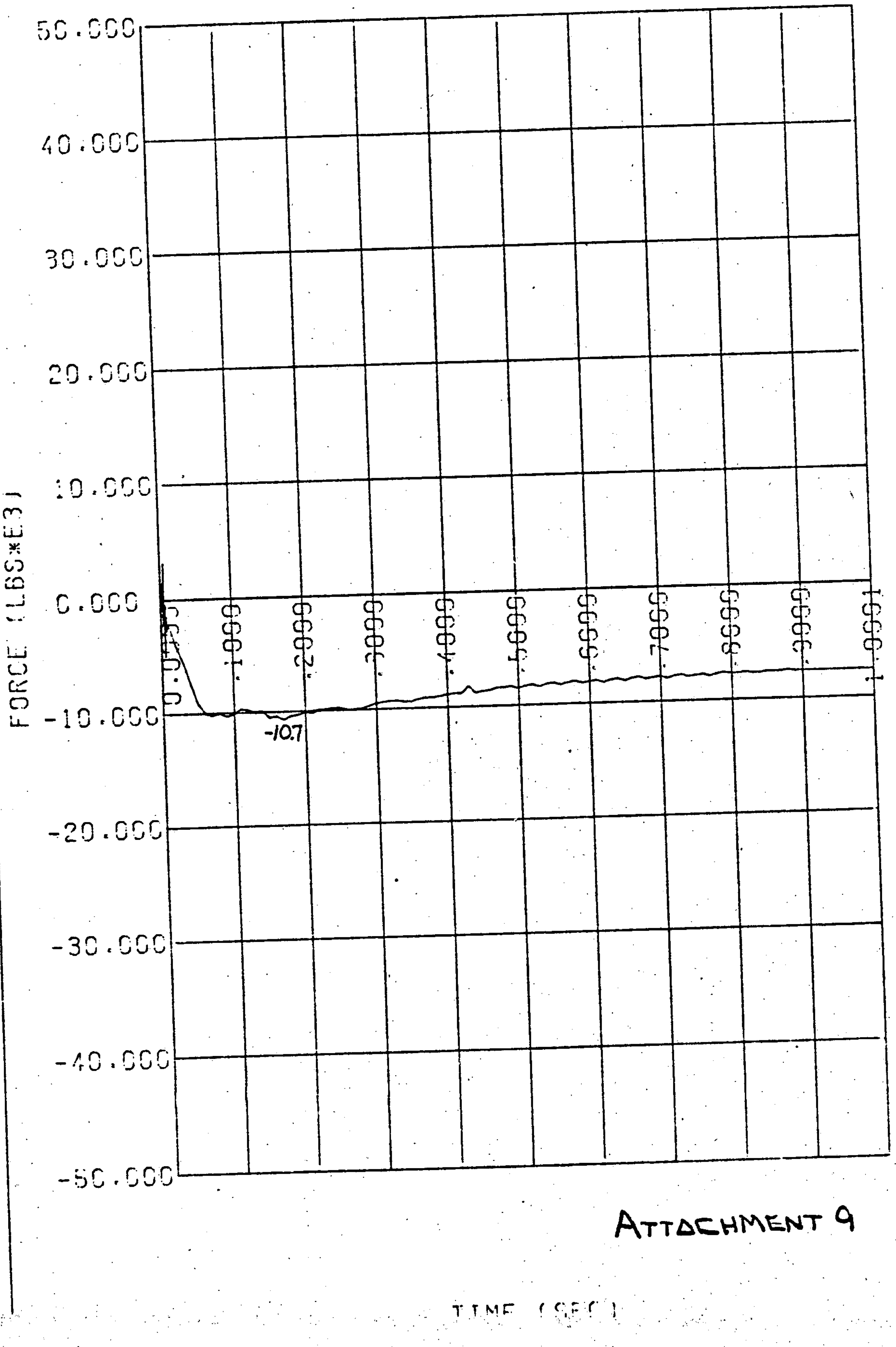


ATTACHMENT 8

TIME (SEC)

FIGURE 022.65-75

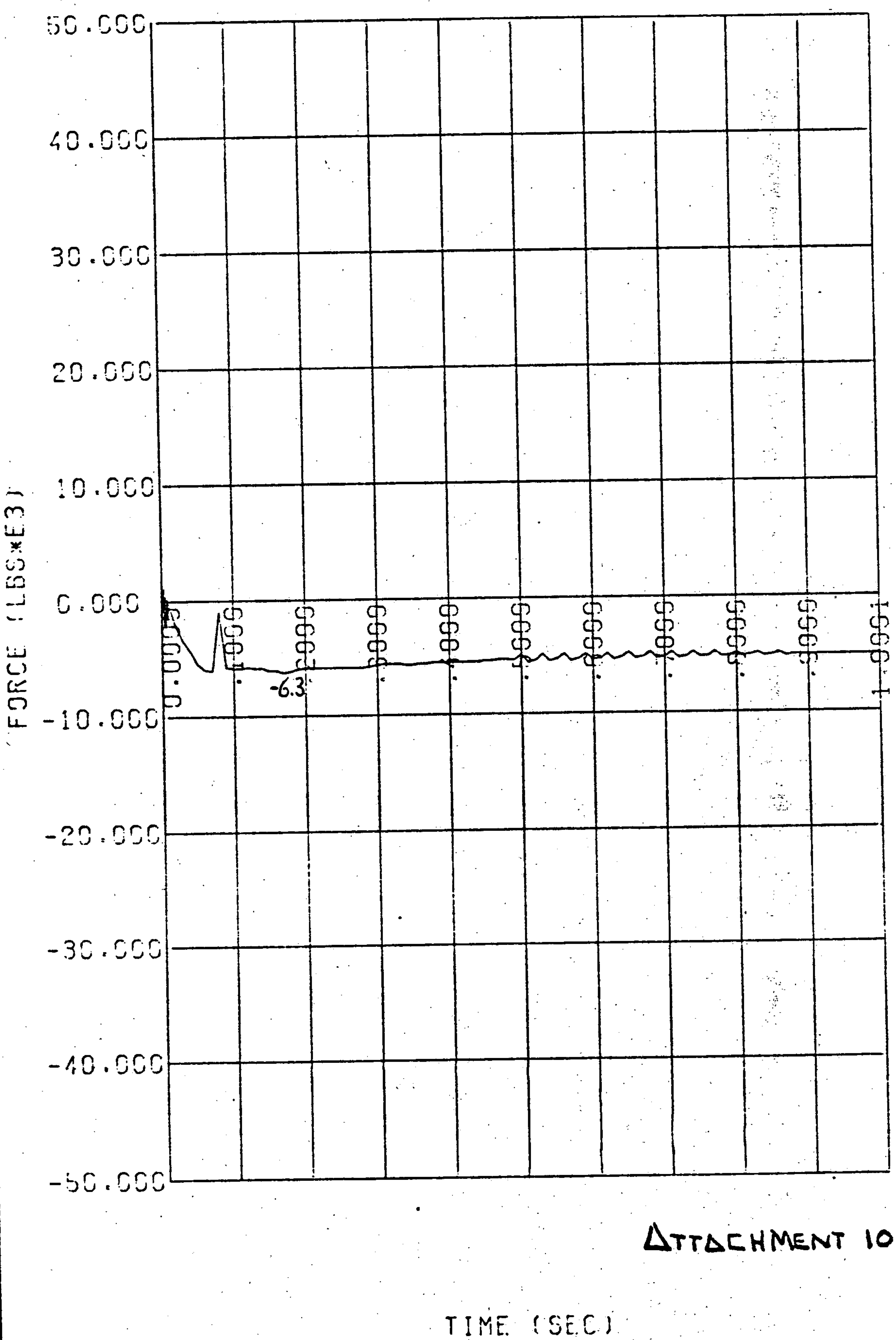
350 SQ IN RV INLET QUILL - BASE MODEL
HORIZONTAL FORCE X - LEVEL 3



ATTACHMENT 9

350 SQ IN RV INLET QUILL - BASE MODEL
HORIZONTAL FORCE Z - LEVEL 3

FIGURE 022.65-76

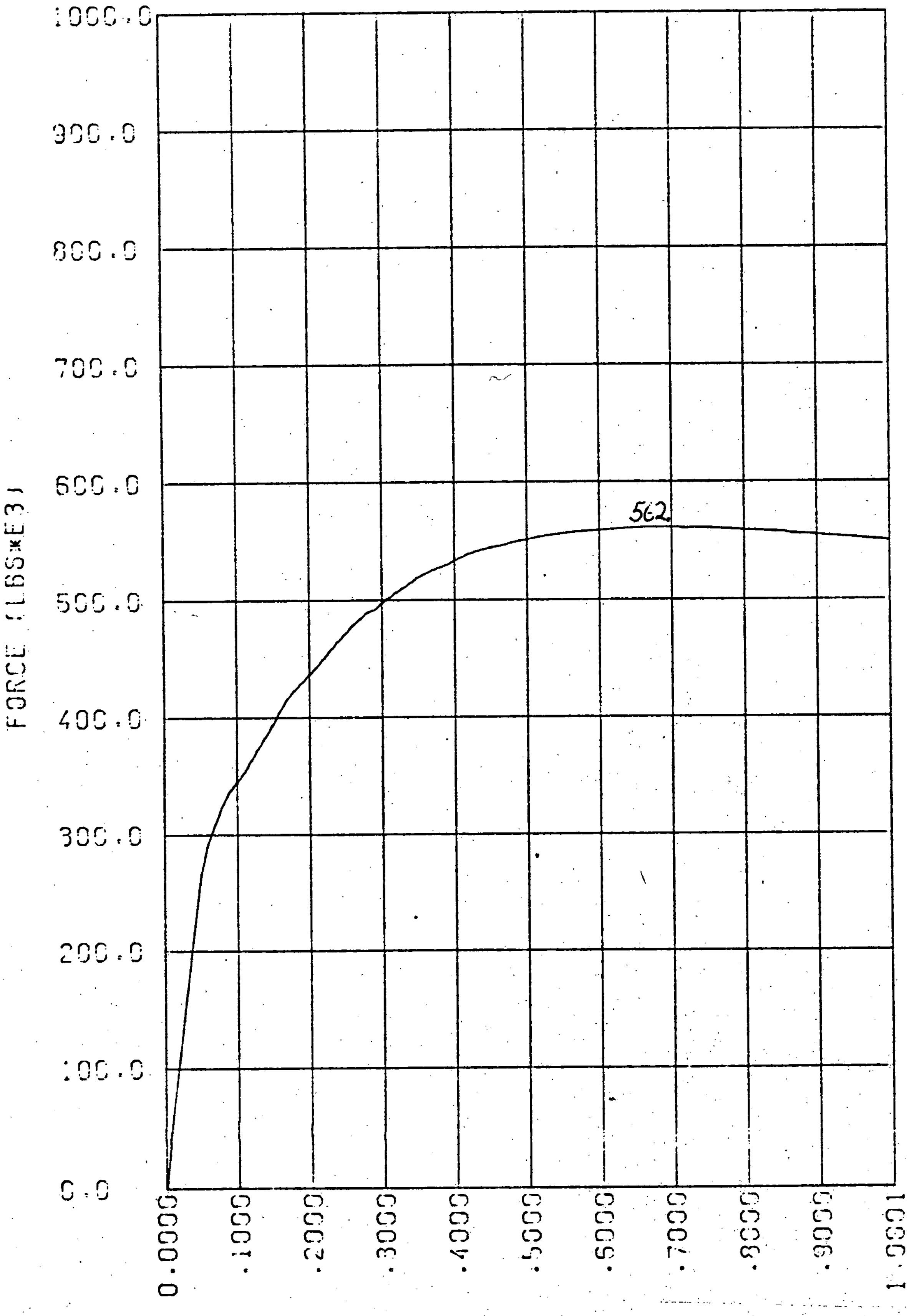


ATTACHMENT 10

FIGURE 022.65-77

350 SQ IN [illegible]V INLET QUILL - BASE M[illegible]EL

VERTICAL FORCE Y

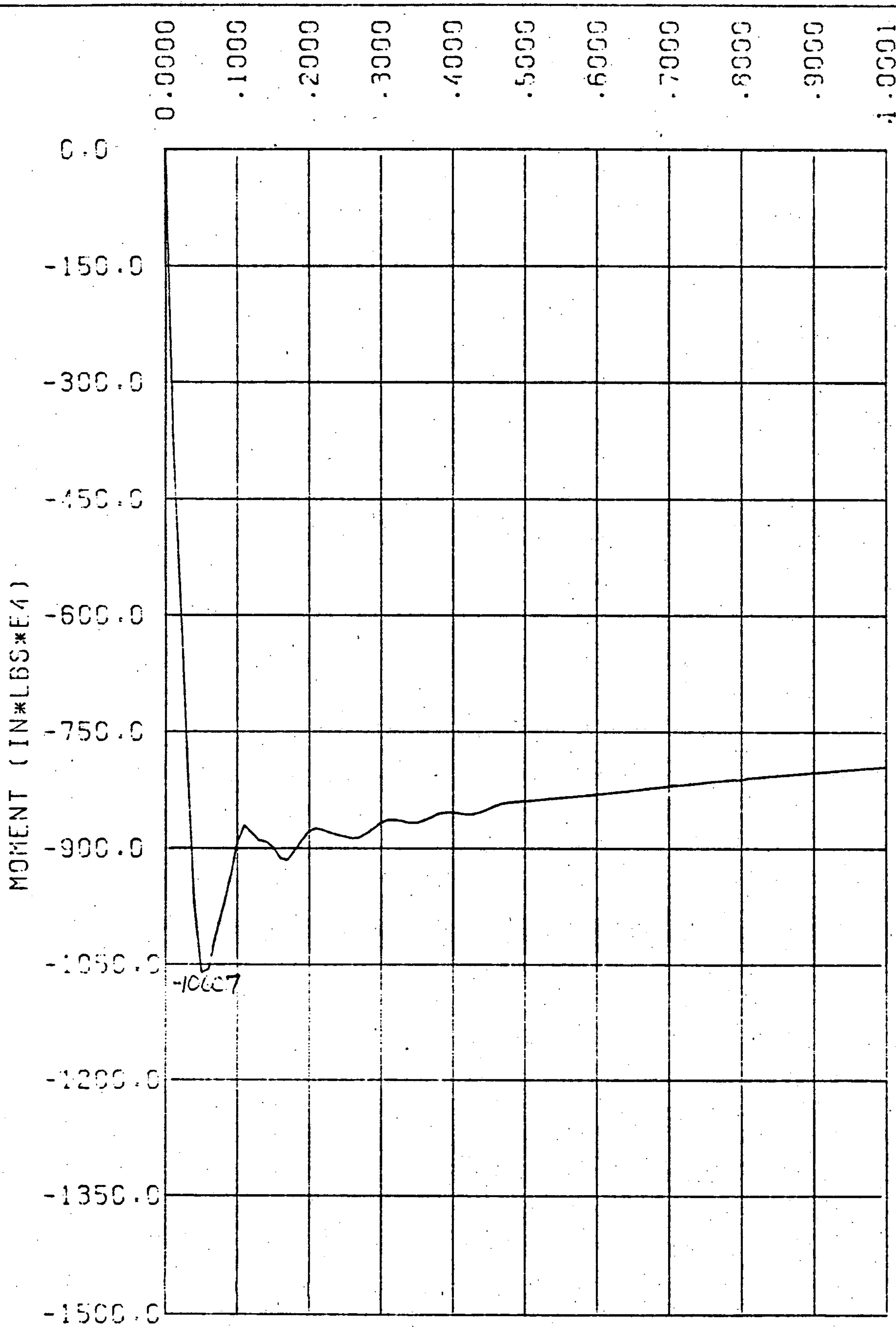


ATTACHMENT 11

FIGURE 022.65-78

350 SQ IN SRV INLET QUILL - BASE MODEL

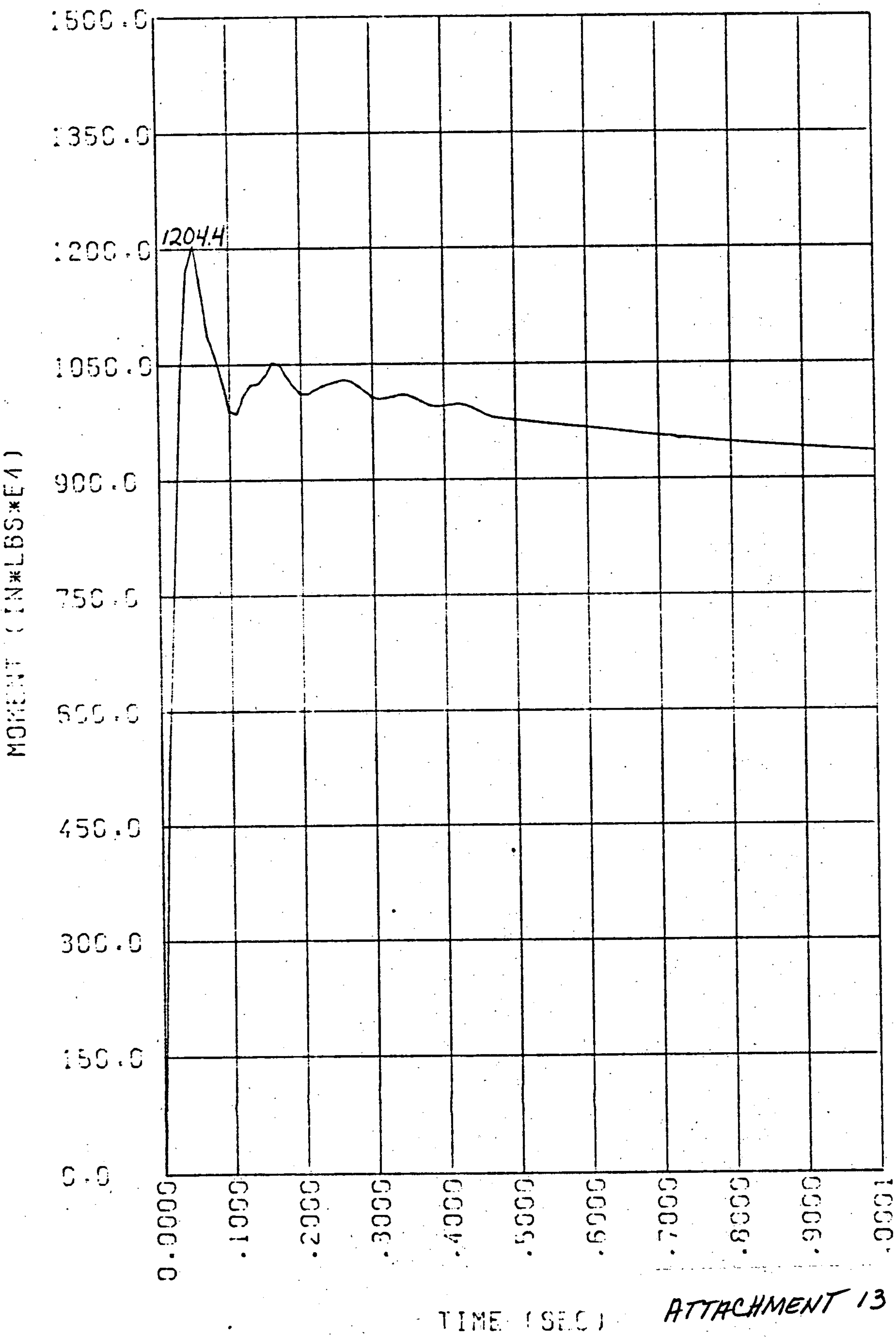
OVERTURNING MOMENT X



ATTACHMENT 12

FIGURE 022.65-79

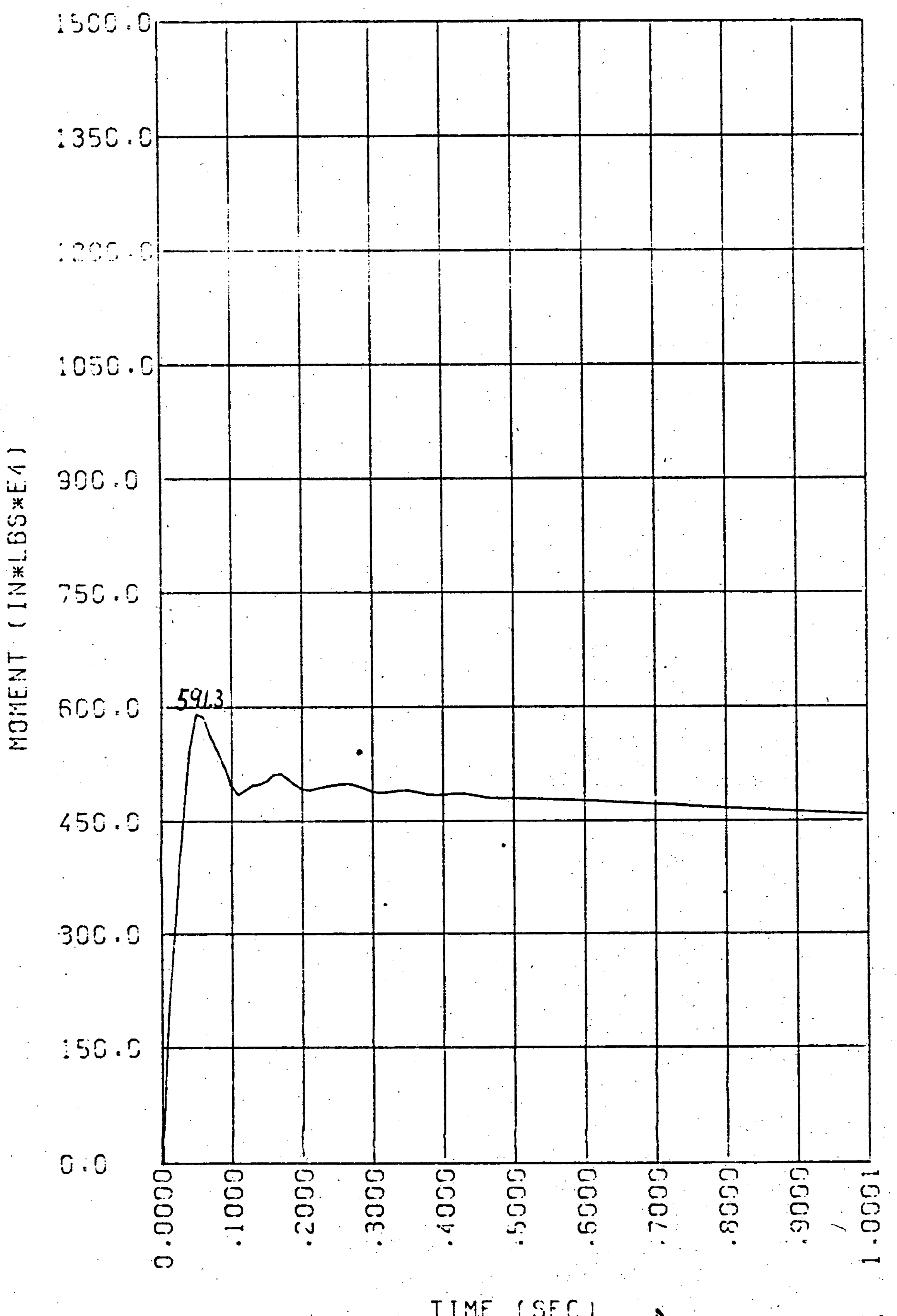
350 SQ IN RV INLET QUILL - BASE MODEL
TORSIONAL MOMENT Y



ATTACHMENT 13

FIGURE 022.65-80

350 SQ IN RV INLET QUILL - BASE MODEL
OVERTURNING MOMENT Z

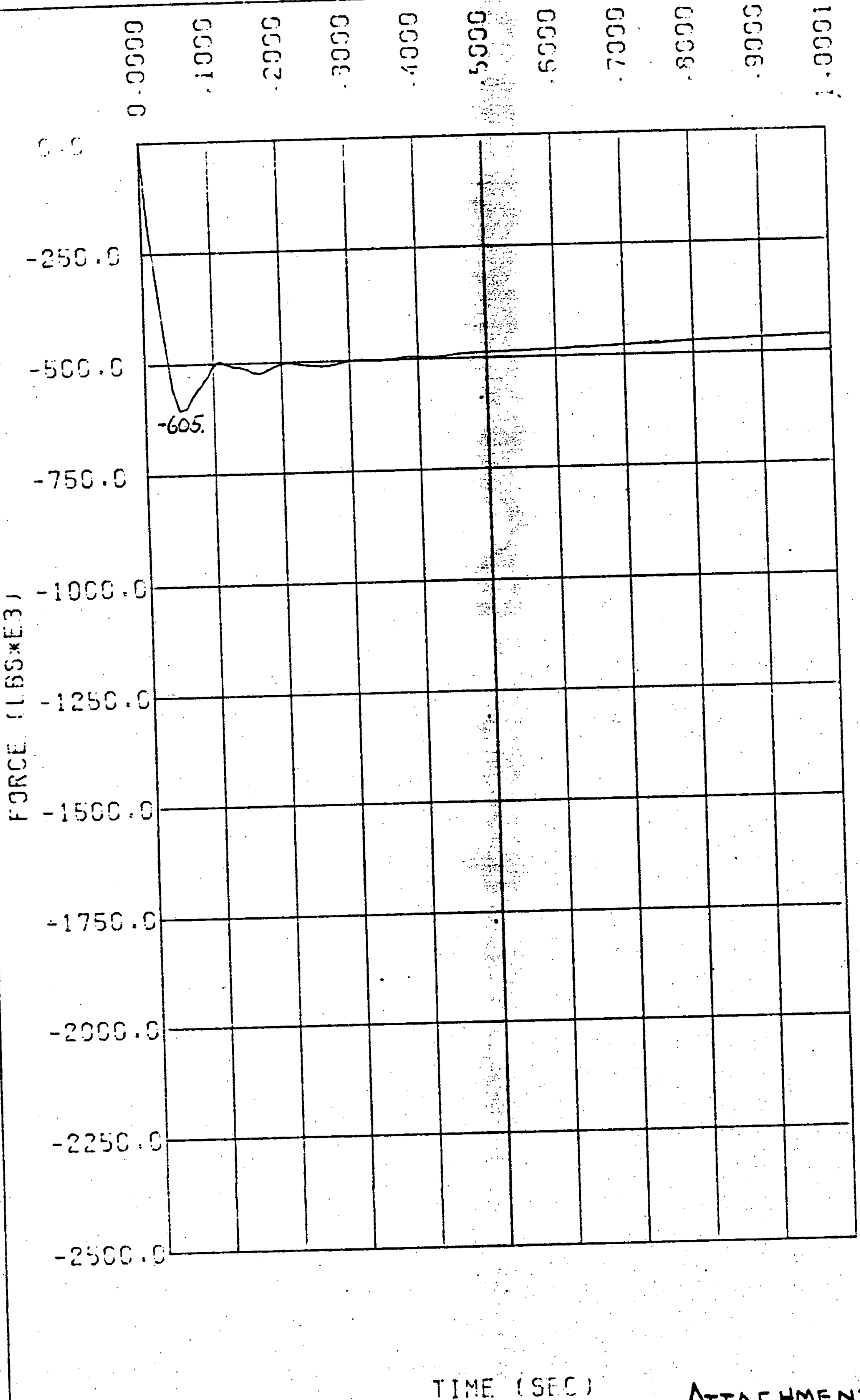


ATTACHMENT 14

FIGURE 022.65-81

350 SQ IN RV INLET QUILL - EXP M EL

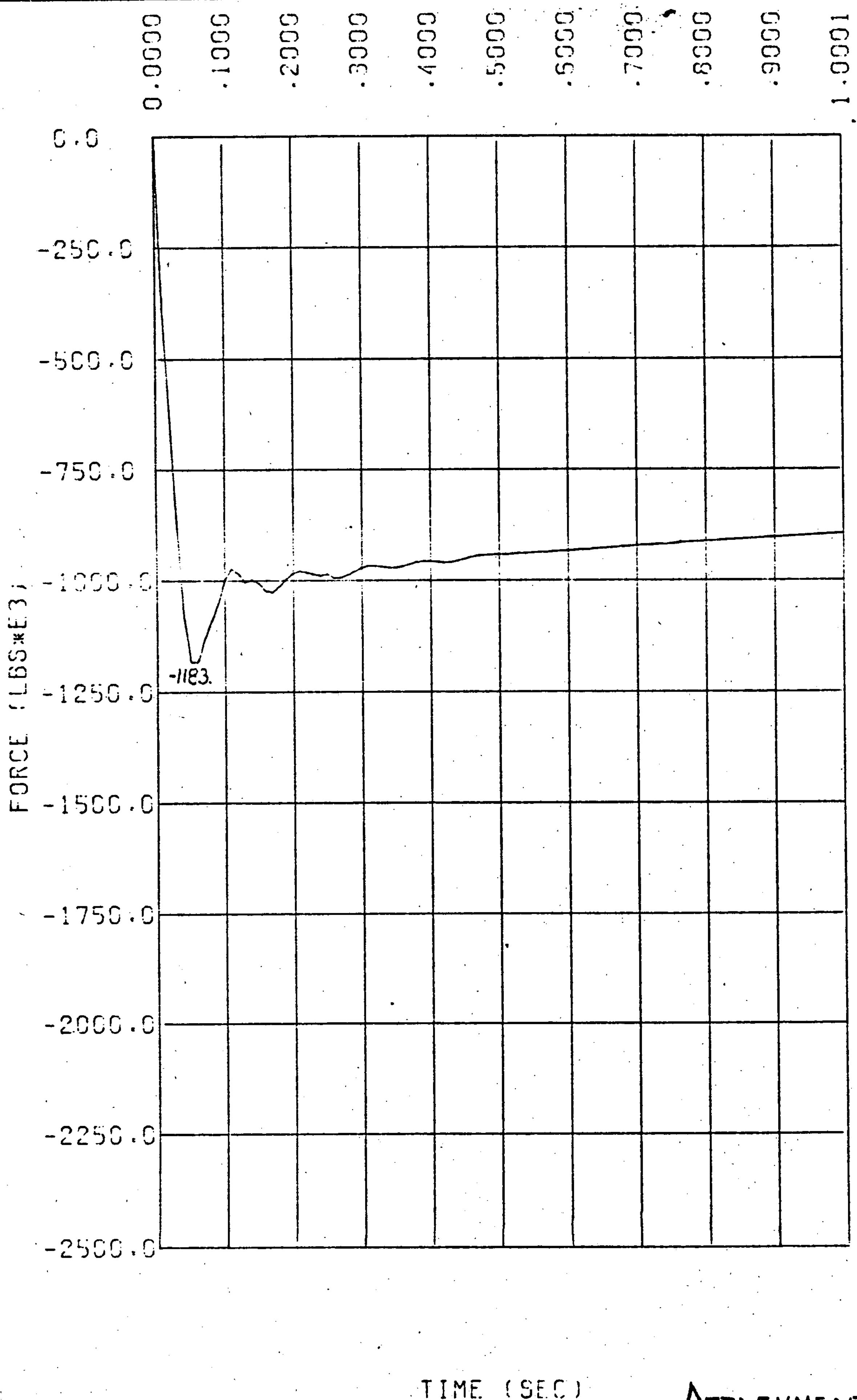
HORIZONTAL FORCE X - LEVEL 1a



ATTACHMENT 15

FIGURE 022.65-82

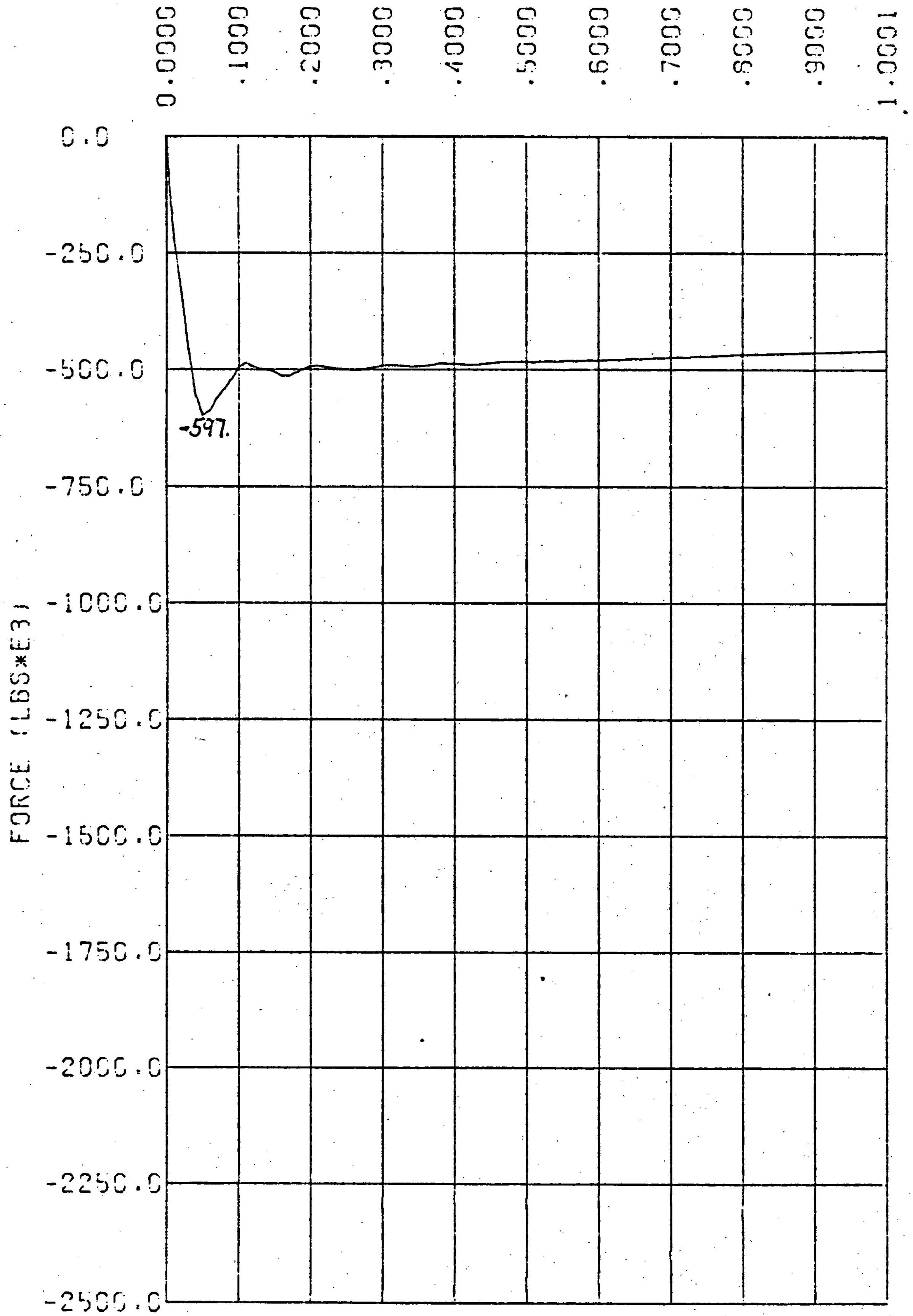
350 SQ IN V INLET QUILL - EXP MO EL
HORIZONTAL FORCE Z - LEVEL 1a



ATTACHMENT 16

FIGURE 022.65-83

350 SQ IN RV INLET QUILL - EXP MODEL
HORIZONTAL FORCE X - LEVEL 1b

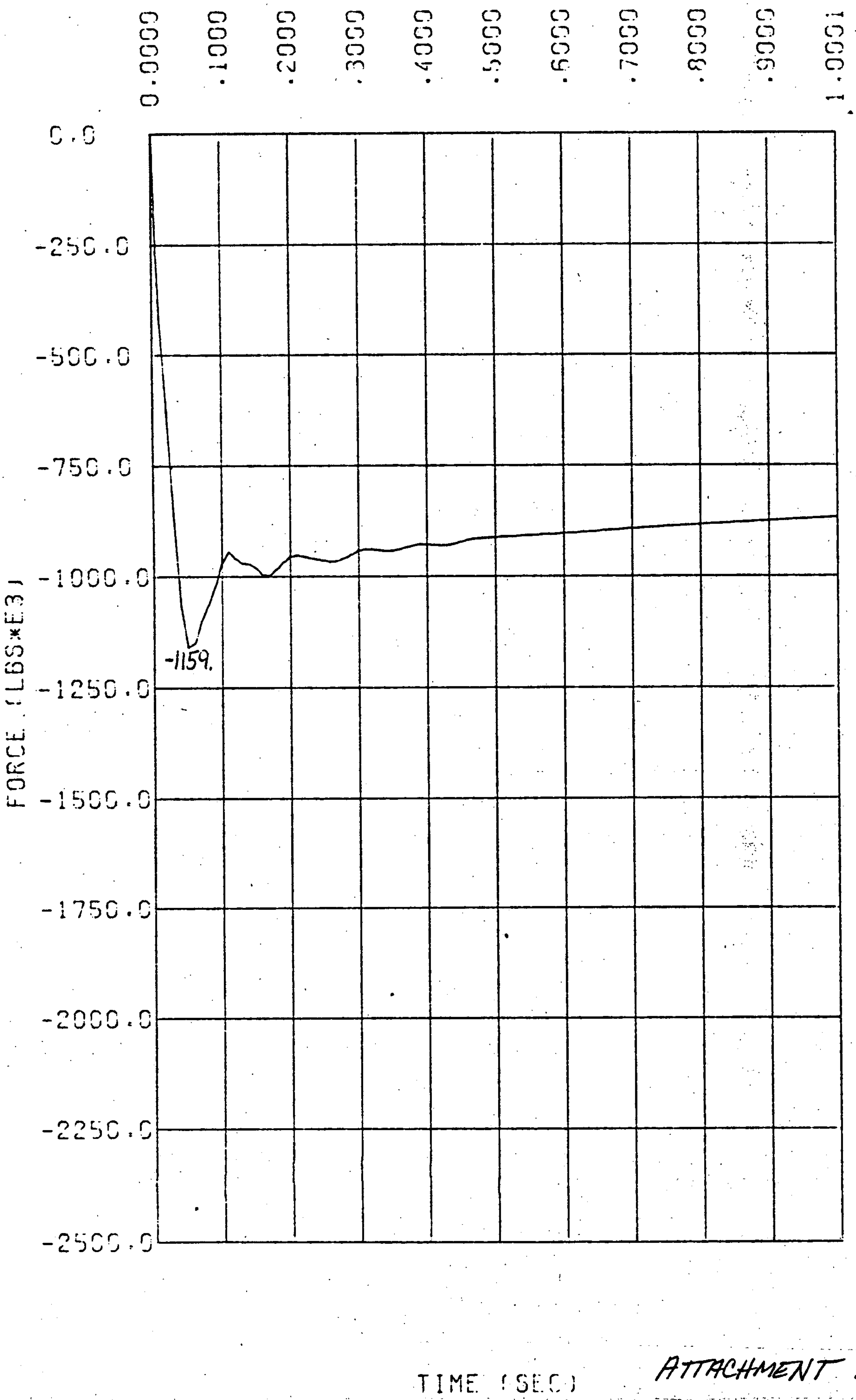


ATTACHMENT 17

FIGURE 022.65-84

350 SQ IN RV INLET QUILL - EXP MODEL

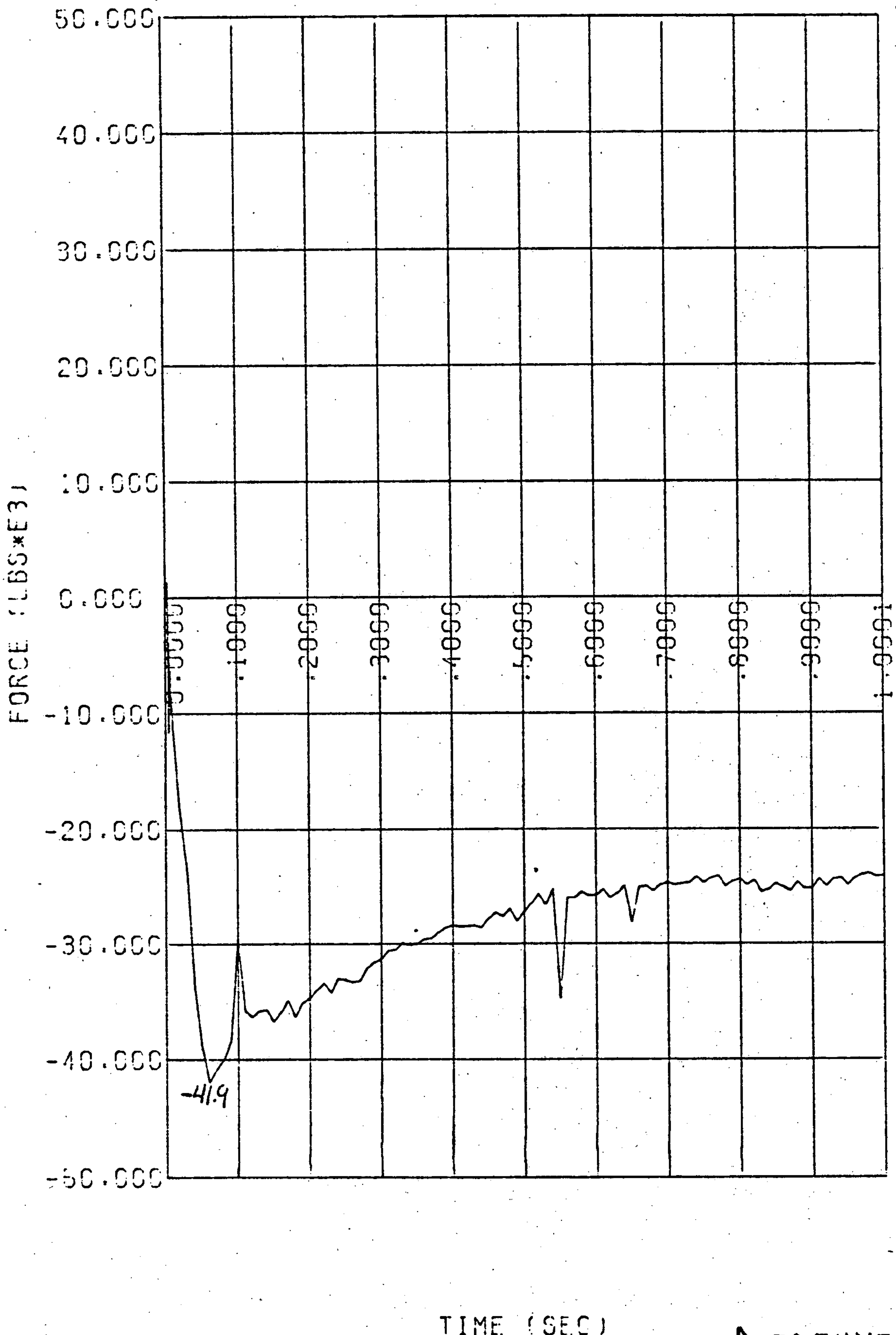
HORIZONTAL FORCE Z - LEVEL 1b



ATTACHMENT 18

350 SQ IN[illegible]V INLET QUILL - EXP MO[illegible]L
HORIZO[illegible]TAL FORCE X - LEVEL 2

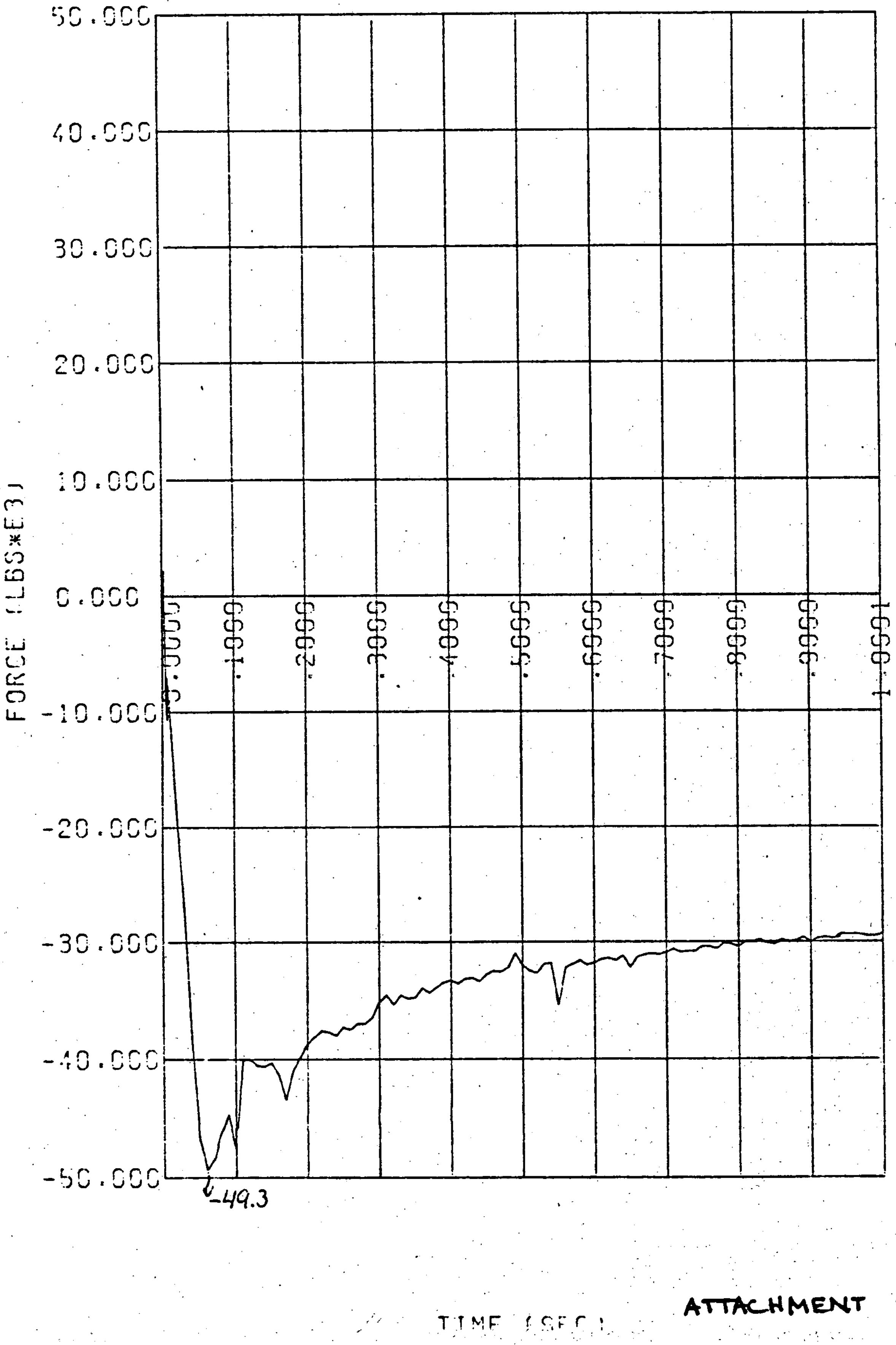
FIGURE 022.65-85



ATTACHMENT 19

FIGURE 022.65-86

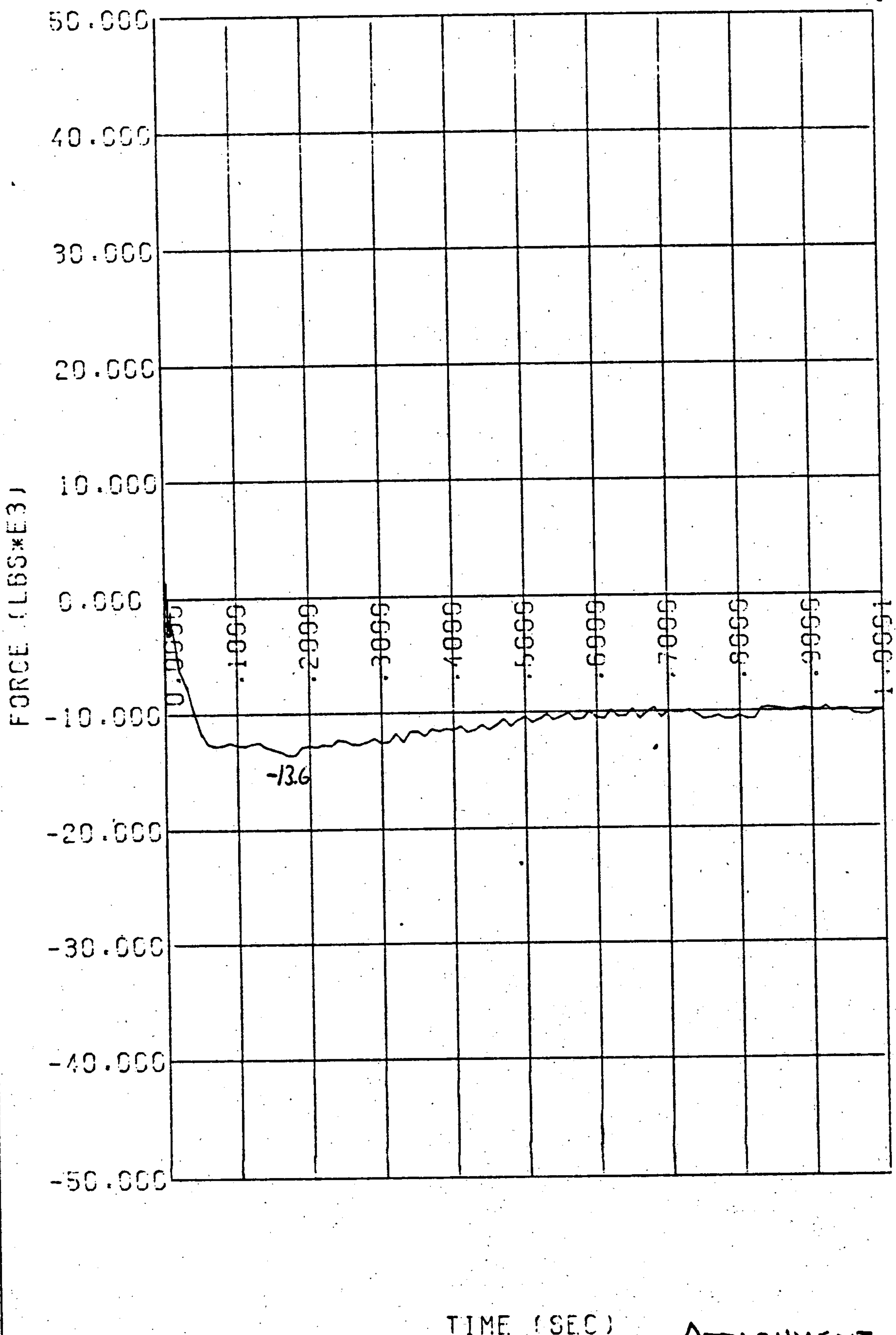
350 SQ IN RV INLET QUILL - EXP MODEL
HORIZONTAL FORCE Z - LEVEL 2



ATTACHMENT 20

FIGURE 022.65-87

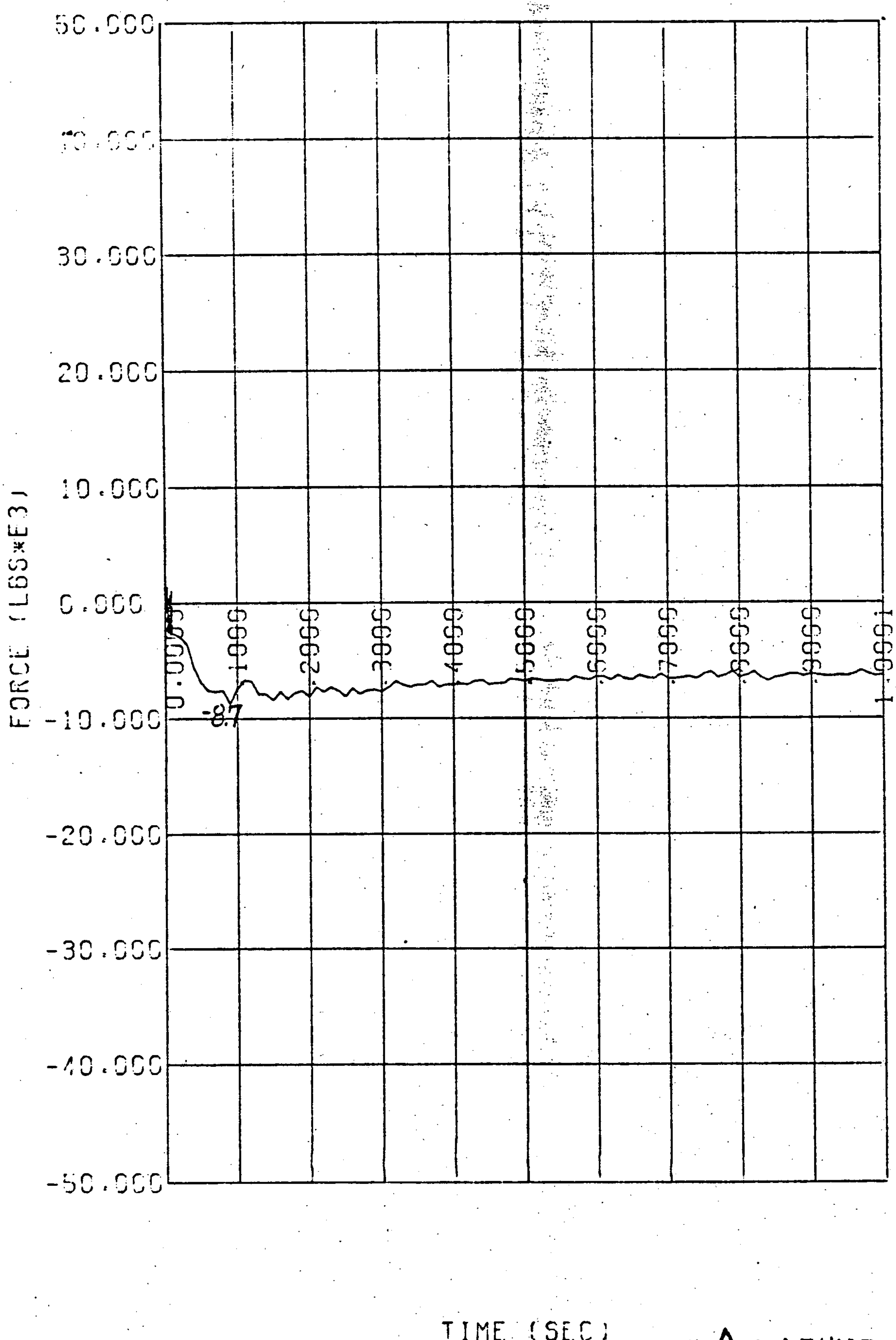
350 SG IN RV INLET QUILL - EXP MODEL
HORIZONTAL FORCE X - LEVEL 3



ATTACHMENT 21

350 SQ I[illegible]RV INLET QUILL - EXP M[illegible]EL
HORIZONTAL FORCE Z - LEVEL 3

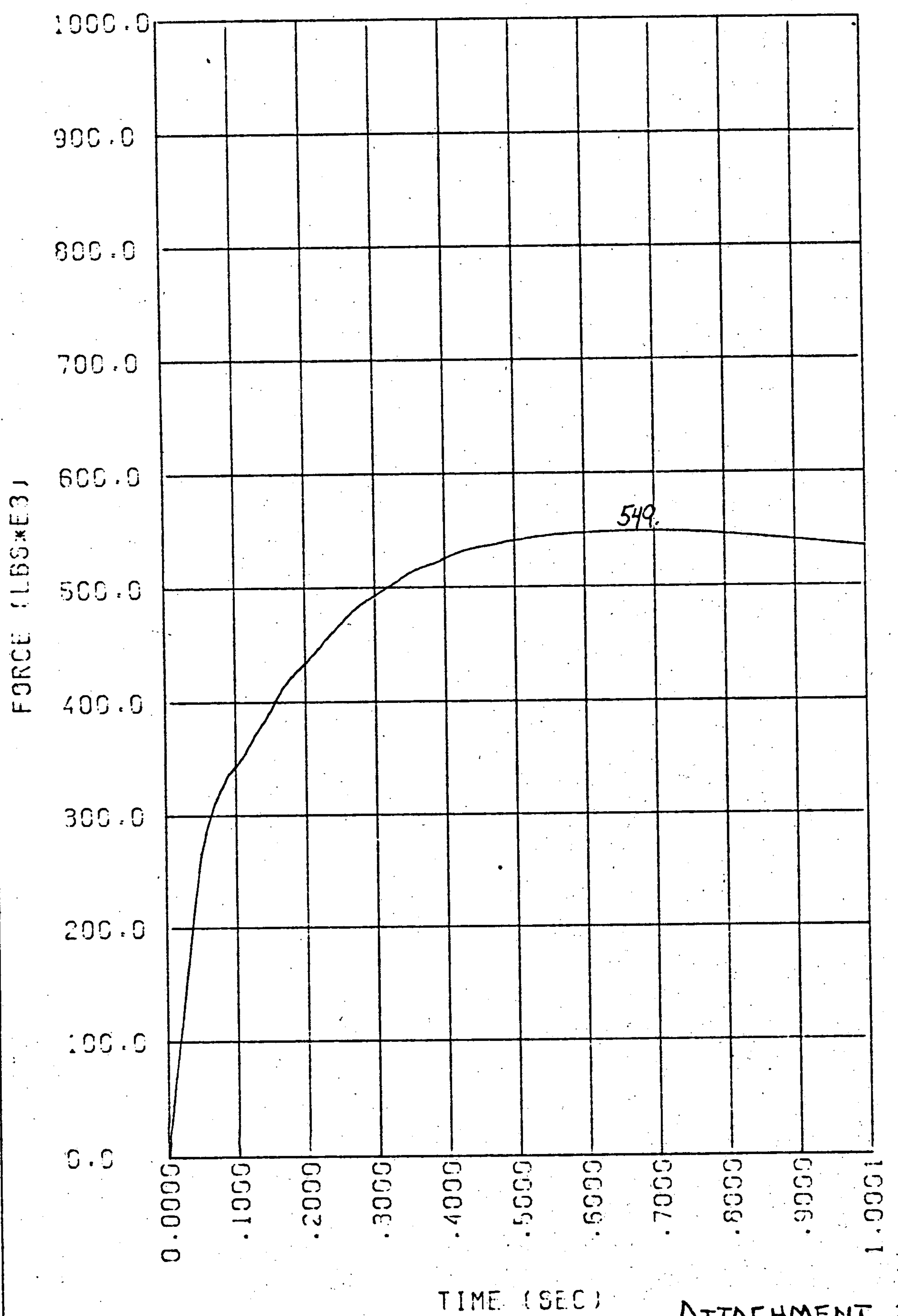
FIGURE 022.65-88



ATTACHMENT 22

350 SQ IN RV INLET QUILL - EXP MODEL
VERTICAL FORCE Y

FIGURE 022.65-89

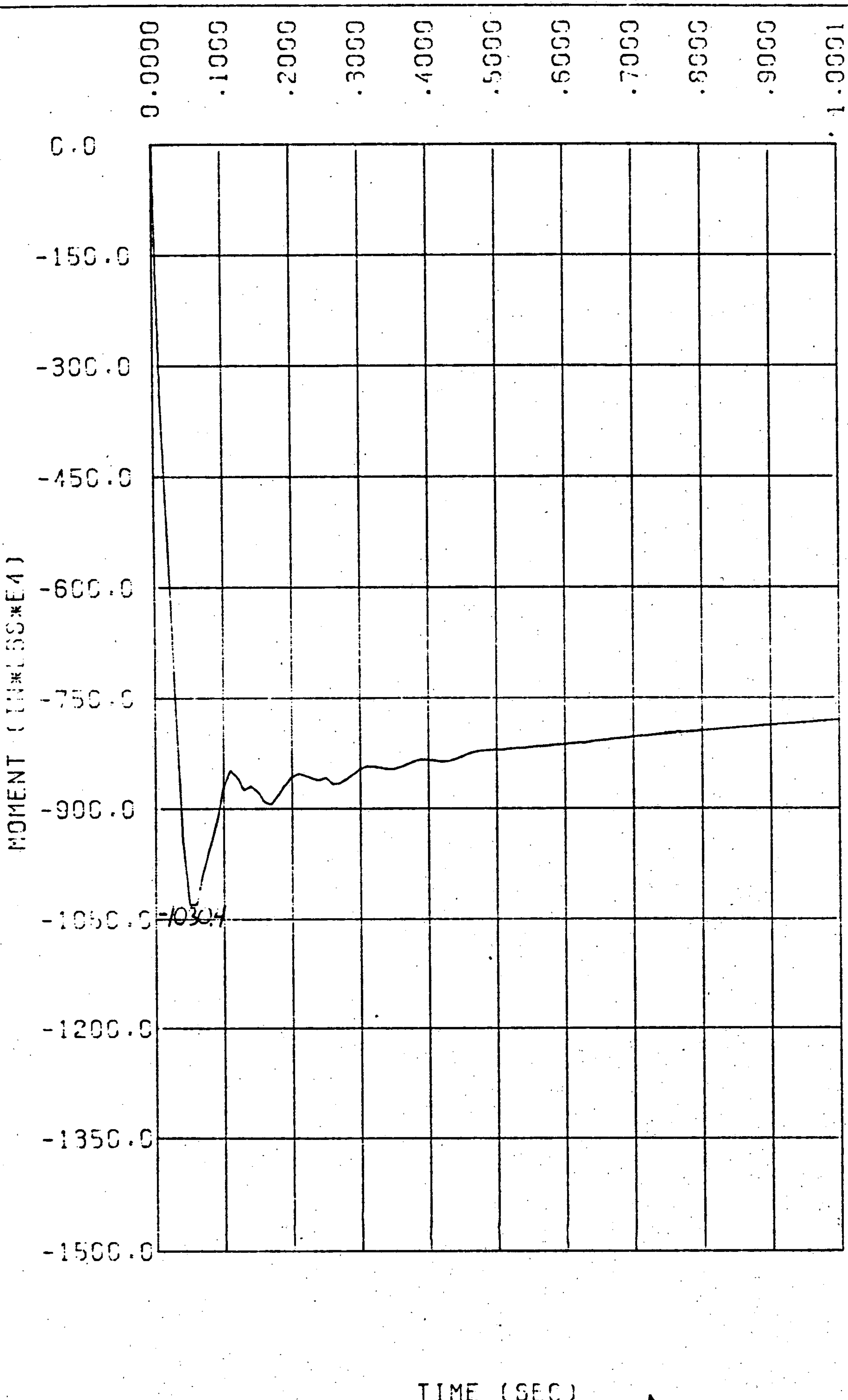


ATTACHMENT 23

FIGURE 022.65-90

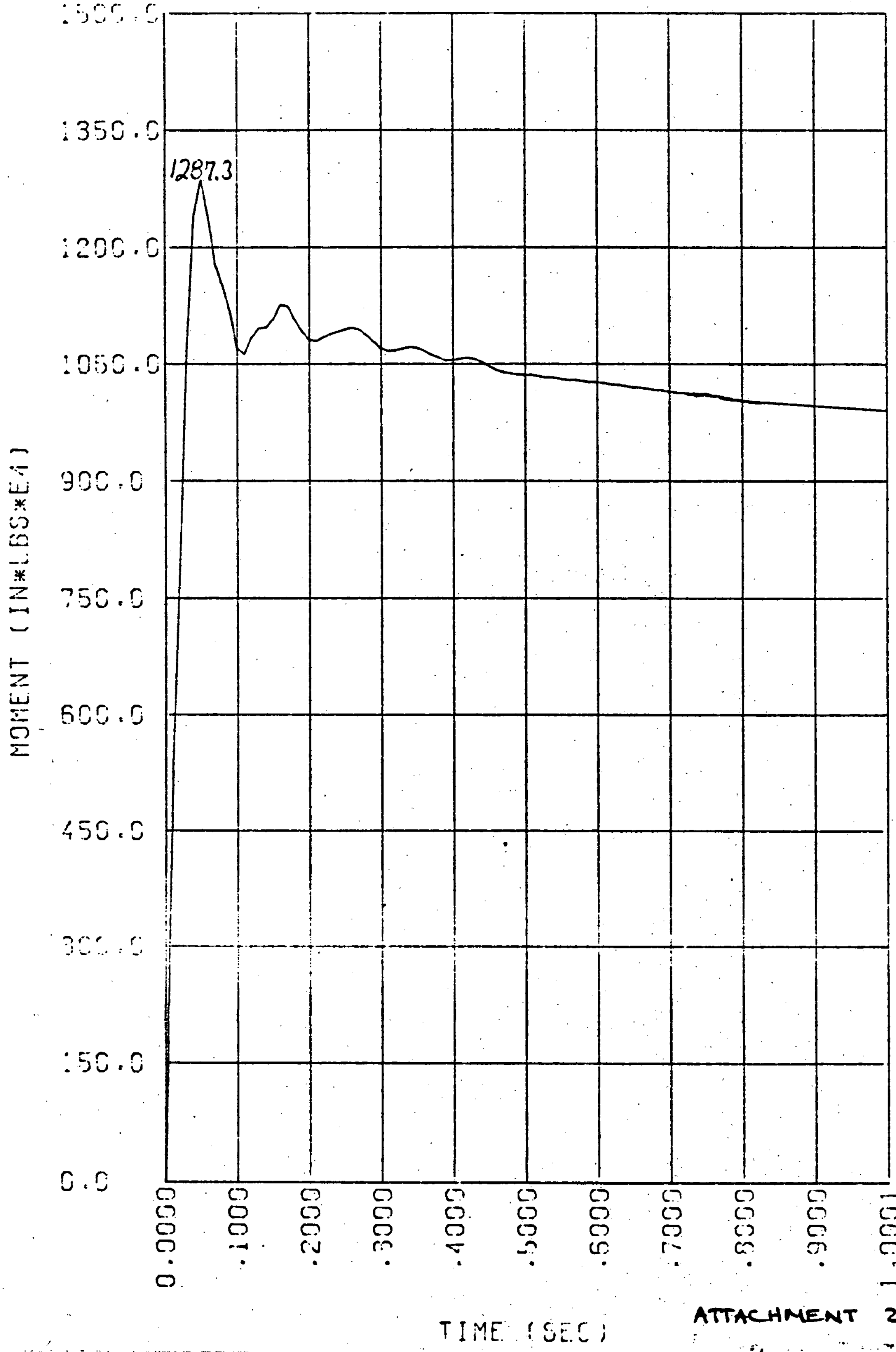
350 SQ I[illegible]RV INLET CUILL - EXP [illegible]DEL

OVERTURNING MOMENT X



ATTACHMENT 24

FIGURE 022.65-91
350 SQ IN RV INLET QUILL - EXP MODEL
TORSIONAL MOMENT Y

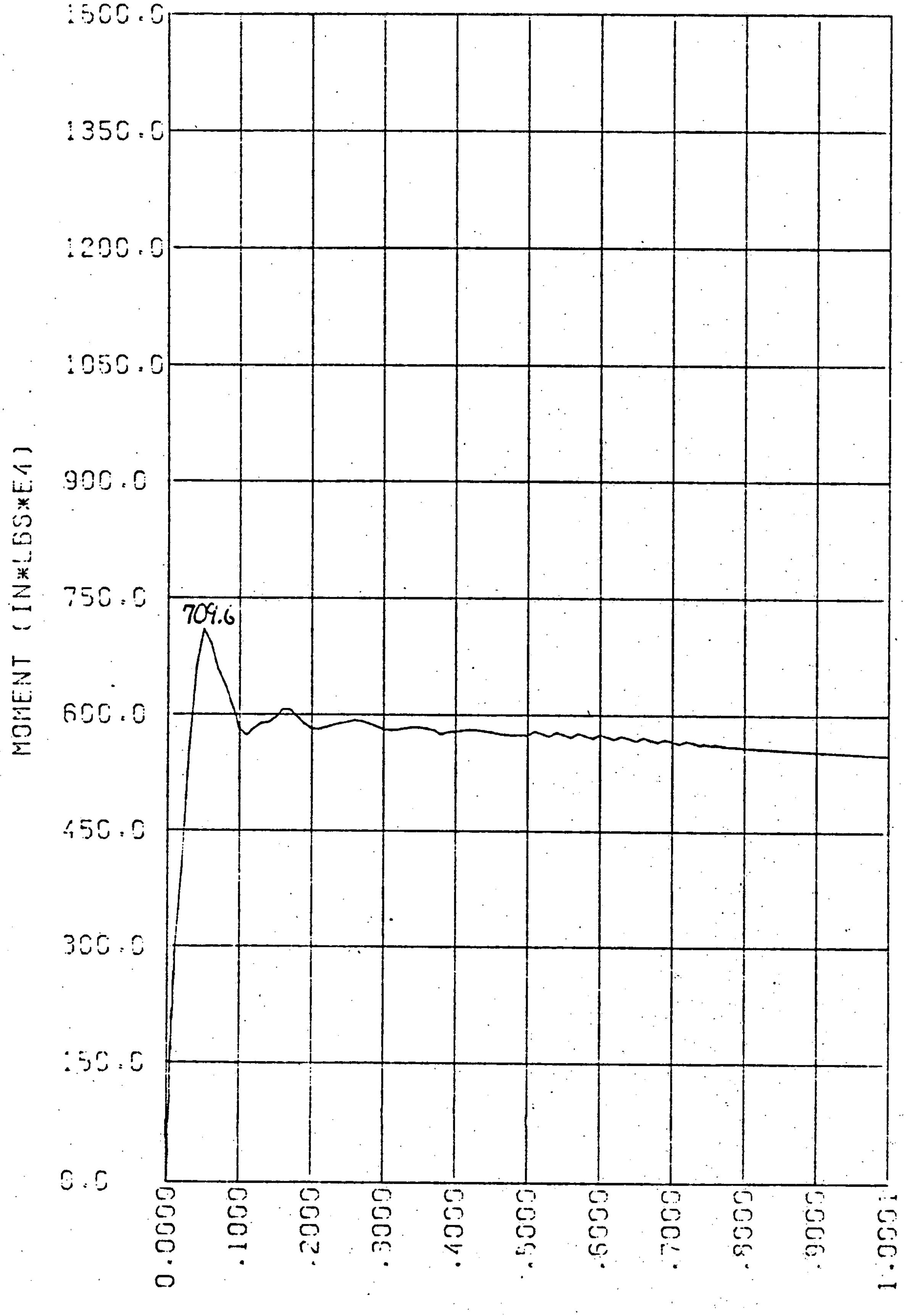


ATTACHMENT 25

FIGURE 022.65-92

350 SG IN RV INLET QUILL - EXP MODEL

OVERTURNING MOMENT Z



ATTACHMENT 26