Attachment 4
Test 001-08, 2/29/96

Materials contained in attachment 4

Test data tracking form

Test engineer's notes

Test sequence

Time-history data plots for:

- Conditions B1.39.0928.101-.102
- Condition B1.39.0928.103.1
- Conditions B1.39.0928.103.6-103.7
- Conditions B1.39.0928.105-.111
- Conditions B1.39.0928.107.2-107.3
- Condition B1.39.0928.108.1
- Conditions B1.39.0928.201-.203
- Condition B1.39.0928.201.1
- Conditions B1.39.0928.205-.210
- Condition B1.39.0928.209.1

737 FLIGHT CONTROLS DATA TRACKING FORM

(WRITE IN BLACK INK OR PHOTOCOPY BEFORE TRANSMITTING)

PRIORITY:

DESCRIPTION 737-200 RUDDER SYSTEM GROUND TESTING — SPS 20

TEST NO. 001-08 — PILOT/AIRPLANE ——— / PG3099 — PARAM. SET # ——— — WINDS ———

TEST DATE 2/29/96 — AIRPORT/RUNWAY ——— — PLOT FORMAT # ——— — GW/CG/I ———

MANEUVER CODE ——— — FC STAFF Ben Smith — PHONE 294-7923 — FLT TEST STAFF P. Nagel

DATA REQUEST NUMBER	EKS DATE	STAT. SOURCE	CONDITION NUMBER	SEQUENCE NUMBER	IRIG TIME START	IRIG TIME END	ALT MC	REMARKS
CCZM.B970			B1.39.092B.101		08:47:25	08:48:25		
			.102		08:49:05	08:50:10		
			.103.1		08:54:25	08:55:25		
			.103.6		09:07:25	09:08:25		
			.103.7		09:10:15	09:11:10		
			.105		09:14:10	09:15:05		
			.106		09:15:30	09:16:35		
			.107		09:17:00	09:17:55		
			.107.2		09:21:50	09:22:50		
			.107.3		09:22:55	09:24:05		
			.108		09:25:00	09:25:50		
			.108.1		09:34:15	09:35:00		
			.109		09:35:30	09:36:25		
			.110		09:38:10	09:39:10		
			B1.39.092B .111		09:41:55	09:42:40		
BXRN.8971			B1.39.092B.201		15:54:35	15:55:20		
			.201.1		15:57:05	15:58:00		
			.202		16:00:20	16:01:20		
			.203		16:02:00	16:03:20		
			.205		16:07:15	16:07:55		
			.206		16:09:00	16:10:00		
			.207		16:11:00	16:12:00		
			.208		16:14:05	16:14:45		
			.209		16:15:45	16:16:45		
			.209.1		16:17:25	16:18:20		
			.210		16:19:10	16:20:30		

CSHQ.9039

C41L.9049

FILE RECEIVED ——— FAST ——— ——— TINKER/FILTER ——— DATABASE PACK

ADDATA ——— ADDKEY ———

FLIGHT TEST DATA SHEET

IMPORTANT: DO NOT USE BLUE INK AS IT WILL NOT REPRODUCE FROM THE ORIGINAL

TAPE ON	08:01:29	TAPE ON	
	08:05:58	20° L Rudder, 58 pounds Force	
	08:06:40	20° R Rudder, 58 pounds Force	
	08:07:00	Neutral	
		Note: A 125 Kts pitot pressure is required on the rudder feel computer to simulate the same pedal force at a -300 model. There is a leak in the SAFT Vlv and they are fixing it now	
NOTE:	Since the main & Standby actuators have been removed so many times, Measurement Abs 3022.437 & 3022.434 (The Torque Tube Position) are very questionable.		
TAPE OFF	08:30:01		
TAPE ON	08:36:17		
NOTE:	We will run the test without the 125 Kts		
B1.39.0928.101	08:39:47	A&B ON	
	08:40:22	125 Kts	
	08:44:45	20° L R,	62.1 lbs force
	08:46:15	20° R R',	58 lbs force
B1.39.0928.101	08:47:30	Begin	Note: We don't have 125 Kts but we will press on anyway.
	08:48:11	End	
B1.39.0928.102	08:49:16	Begin, Dwell,	± 3° fa, 0.3 Hz
	50:00	End	
B1.39.0928.103	08:51:10	Begin Dwell	± 1° fa, 0.3 Hz
	51:45	Begin Manual Sweep of Pedals	
	08:52:43	End Manual Sweep of Pedals	
B1.39.0928.103.1	08:54:35	Input Dwell	; Note the dwell stopped halfway thru cond .103 so we repeated it for .103.1 ...
	08:54:48	Manual sweep	
		end	
B1.39.0928.103.2	08:57:00	Hardover	
	08:57:29	END (Invalid)	

SHEET 1 OF 4	TITLE 737-200 Rudder Sys	MODEL	
RECORDER D. Nugent	Ground Testing	AIRPLANE	
TEST NO. 001-08 S/N	BOEING	DOC. NO.	
DATE 2/29/96		PAGE	

X-21094 REV. 4/83

FLIGHT TEST DATA SHEET

IMPORTANT: DO NOT USE BLUE INK AS IT WILL NOT REPRODUCE FROM THE ORIGINAL

B1.39.0928.1073	08:59:15	Handover (Invalid)						
	08:59:40	End						
B1.39.0928.1084	———	Handover (Invalid)						
B1.39.0928.1035	09:01:45	Handover (Invalid)						
	09:02:25	End						
	09:02:30	Begin Pedal Sweep						
	09:02:05	End						
B1.39.0928.1036	09:07:35	R Handover / Rudder Sweep (- Hand)						
	09:08:11	End (Good one)						
B1.39.0928.1037	09:10:25	L Handover / Rudder Sweep (+ Hand)						
	09:10:59	End (Good one)						
B1.39.0928.104	09:11:25	Buggies are installed on Rudder T.E.						
B1.39.0928.105	09:14:03	B & Standby Rudder (Hyd) Pressures						
	1:14:30	Rudder Pedal Cycle						
	09:14:54	End						
B1.39.0928.106	09:15:45	Begin ±3° δR, 0.3Hz Dwell						
	09:16:20	End						
B1.39.0928.107	09:17:10	Begin ±1° δR, 0.3Hz Dwell / Manual Sweep)						
	09:17:45	End						
B1.39.0928.107.1	09:18:45	Handover L / Rudder Sweep (+ Hand)						
	09:19:35	End						
B1.39.0928.107.2	09:21:59	Handover L / Rudder Sweep (+ Hand)						
	09:22:40	End						
B1.39.0928.107.3	09:23:06	Handover R / Rudder Sweep (- Hand)						
	09:23:56	End						
B1.39.0928.108	09:24:45	A, B, & Standby						
	09:25:11	Begin Sweep						
	09:25:37	End						
B1.39.0928.108.1	09:34:35	Begin Sweep [redacted]						
	09:34:42	End						
B1.39.0928.109	09:35:40	Begin Dwell, 3.0° δR, 0.3Hz						
	09:36:15	End						
B1.39.0928.110	09:38:16	Begin Dwell, 1.0° δR, 0.3Hz						
	1:38:30	Manual Sweep						
	1:38:45	End Sweep						
	09:39:00	End Dwell						

SHEET 2 OF 4	TITLE 737-200 Rudder Sys Ground Test	MODEL
RECORDER R. Nagel		AIRPLANE
TEST NO. 001-08	BOEING	DOC. NO.
DATE 2/29/96		PAGE

X-21094 REV. 4/93

FLIGHT TEST DATA SHEET

IMPORTANT: DO NOT USE BLUE INK AS IT WILL NOT REPRODUCE FROM THE ORIGINAL

		09:39:51	Standby Sys Only						
B1.39.09[illegible].111		09:42:05	Begin Pedal Sweep						
		09:42:27	End						
		09:44:41	Cycle Rudder						
		09:45:45	Hyds OFF						
TAPE OFF		09:46:00							
TAPE ON		15:43:00							
		15:43:22	L Rudder (Standby Hyd Only)						
		15:43:30	R Rudder						
		15:43:45	Cycles of Rudder						
		15:46:[illegible]	A&B ON						
[redacted]									
		15:50:30	Input 20° dn & Hold						
		15:51:13	19.7° @ 77 pounds						
		15:52:20	-19.4° @ -66 pound						
B1.39.09[illegible].201		15:54:[illegible]	Begin Sweep						
		15:55:10	End						
B1.39.09[illegible].201.1		15:57:15	Slow Pedal Sweep						
		15:57:47	End						
	[redacted]		A&B Hyds ON						
		15:58:57	19.8° @ 68 lbs						
		15:59:26	-19.1° @ -52 lbs						
		15:59:36	Neutral						
B1.39.09[illegible].202		16:00:30	Begin Dwell ± 3° @	0.3 Hz					
		16:01:10	End						
B1.39.09[illegible].203		16:02:10	Begin Dwell ± 1° @	0.3 Hz					
		16:02:23	Manual Sweep						
		16:02:50	End Manual Sweep						
		16:03:10	End Dwell						

SHEET 3 OF 4	TITLE 737-200 Rudder Sys		MODEL
RECORDER D. Nagel	Ground Testing		AIRPLANE
TEST NO. 001-08 S.I.	BOEING		DOC. NO.
DATE 3/29/96			PAGE

X-21094 REV. 4/93

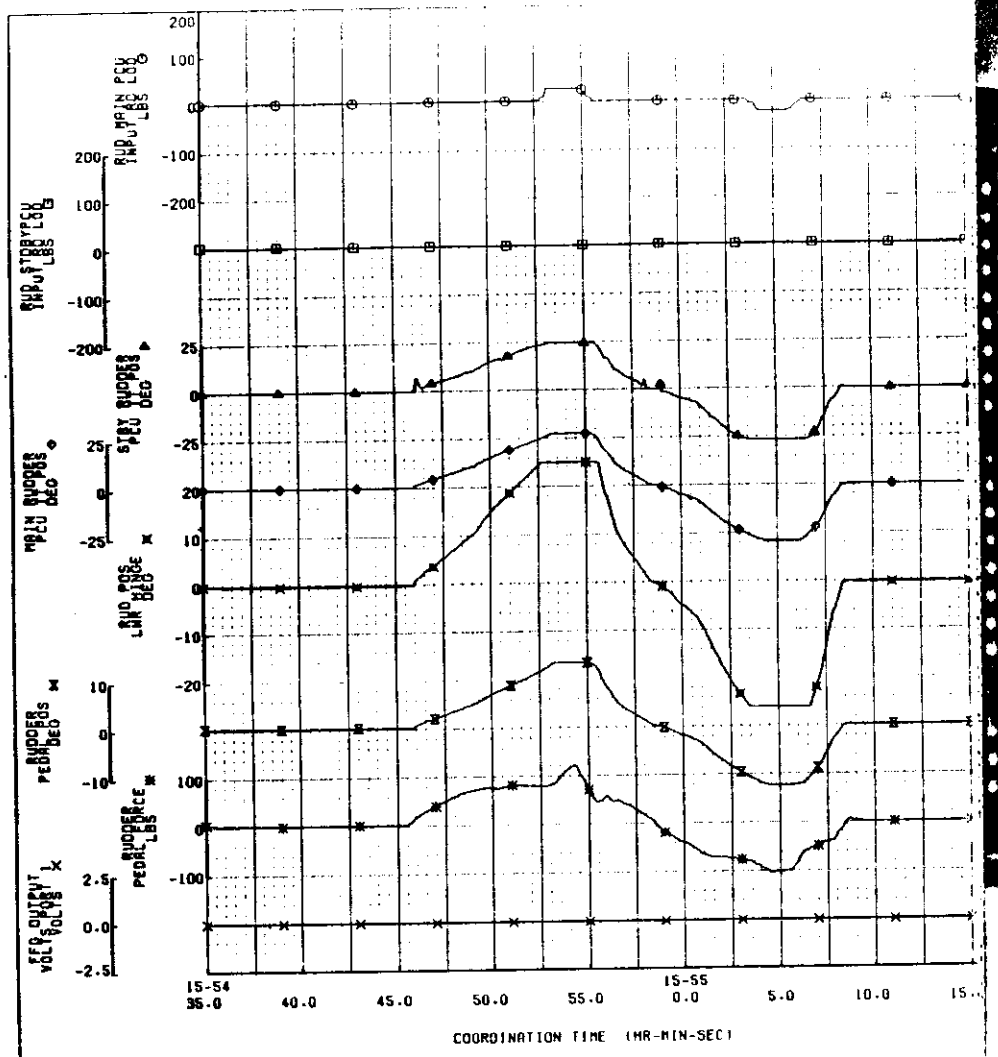
FLIGHT TEST DATA SHEET

IMPORTANT: DO NOT USE BLUE INK AS IT WILL NOT REPRODUCE FROM THE ORIGINAL

B1.39.0928.204		16:03:52		Air load (hinges) are applied					
B1.39.0928.205		16:05:33		A & B Standby					
		16:07:25		Begin Manual Sweep					
		16:07:42							
B1.39.0928.206		16:09:10		Begin 3° Dwell @ 0.3 Hz					
		16:09:50		End					
B1.39.0928.207		16:11:10		Begin 1° Dwell @ 0.3 Hz					
		16:11:18		Begin Manual Sweep					
		16:11:—		End Manual Sweep					
		16:11:50		End Dwell					
B1.39.0928.208		16:14:00		A & B Standby					
		16:14:15		Begin Manual Sweep					
		16:14:34		End Manual Sweep					
B1.39.0928.209		16:15:56		Begin 3° Dwell @ 0.3 Hz					
				End Dwell					
B1.39.0928.209.1		16:17:36		Begin 3° Dwell			3K – 3.1K		gauge pressu
		16:18:10		End Dwell					
B1.39.0928.210		16:19:20		Begin 1° Dwell @ 0.3 Hz					
		16:19:42		Begin Manual Sweep					
		16:20:03		End Manual Sweep					
		16:20:20		End Dwell					
TAPE OFF		16:24:00							

SHEET 4 OF 4	TITLE 737-200 Rudder Sys		MODEL
RECORDER [redacted] D. Nagel	Gamma Test		AIRPLANE
TEST NO. 001-08 S1.4	BOEING		DOC. NO.
DATE 2/29/96			PAGE

X-21094 REV. 4/93



03/05/96 1622			REQ C41L-9169		737-200 RUDDER GRND TEST TIME HISTORY PLOT	737-200 PG309
CALC			REVISED	DATE		
CHECK					CONDITION NO. B1-39-0928-201 TEST 001-08 TEST DATE 02/29/96	B1-39-0928
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APR						

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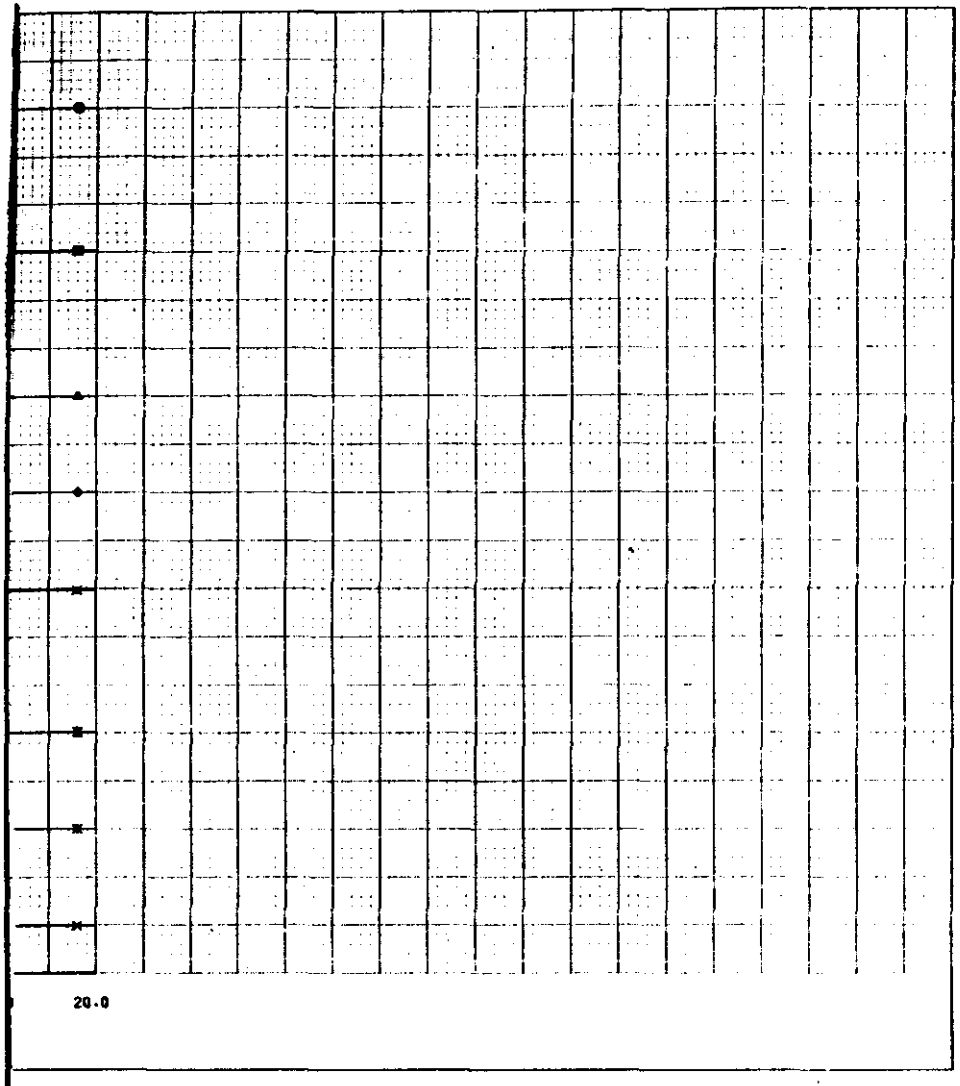
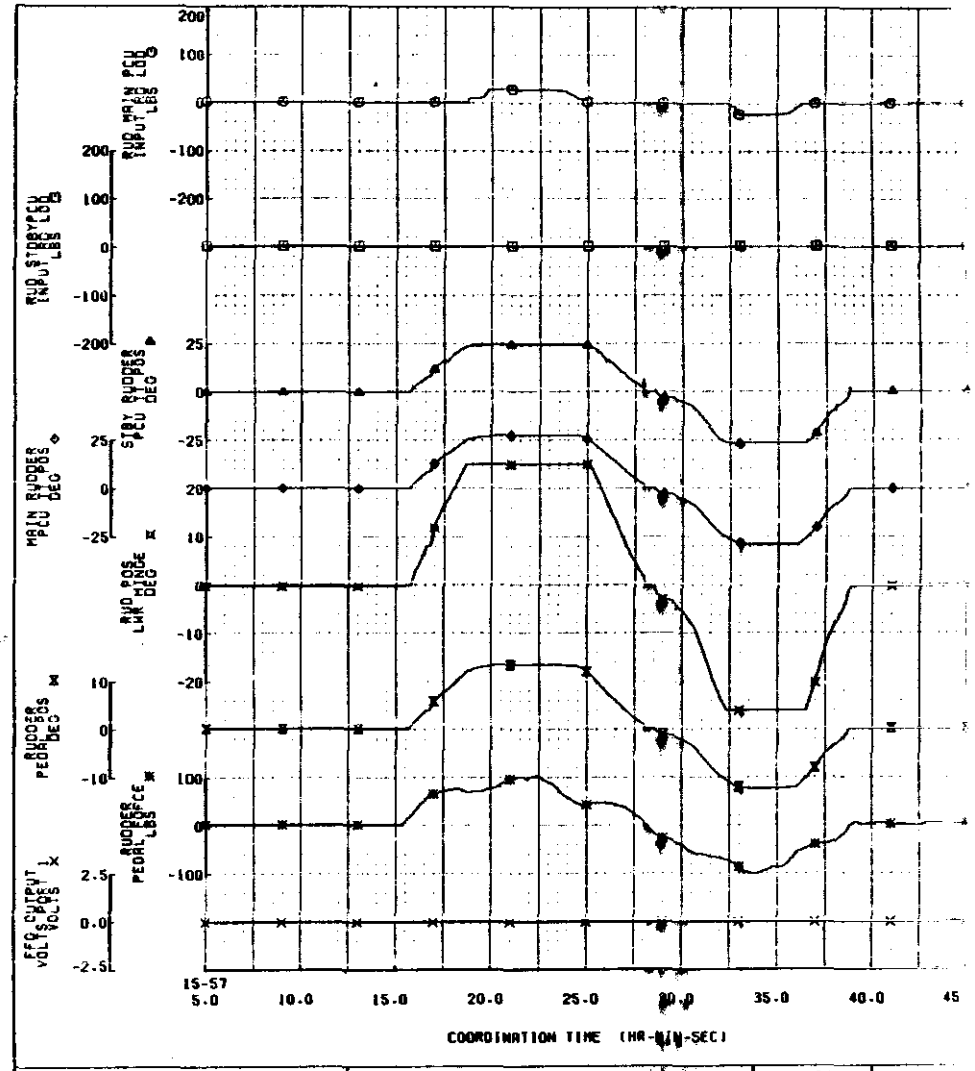
737-200, PG309, RUDDER SYSTEM GROUND TESTING





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CALC			REVISED	DATE		
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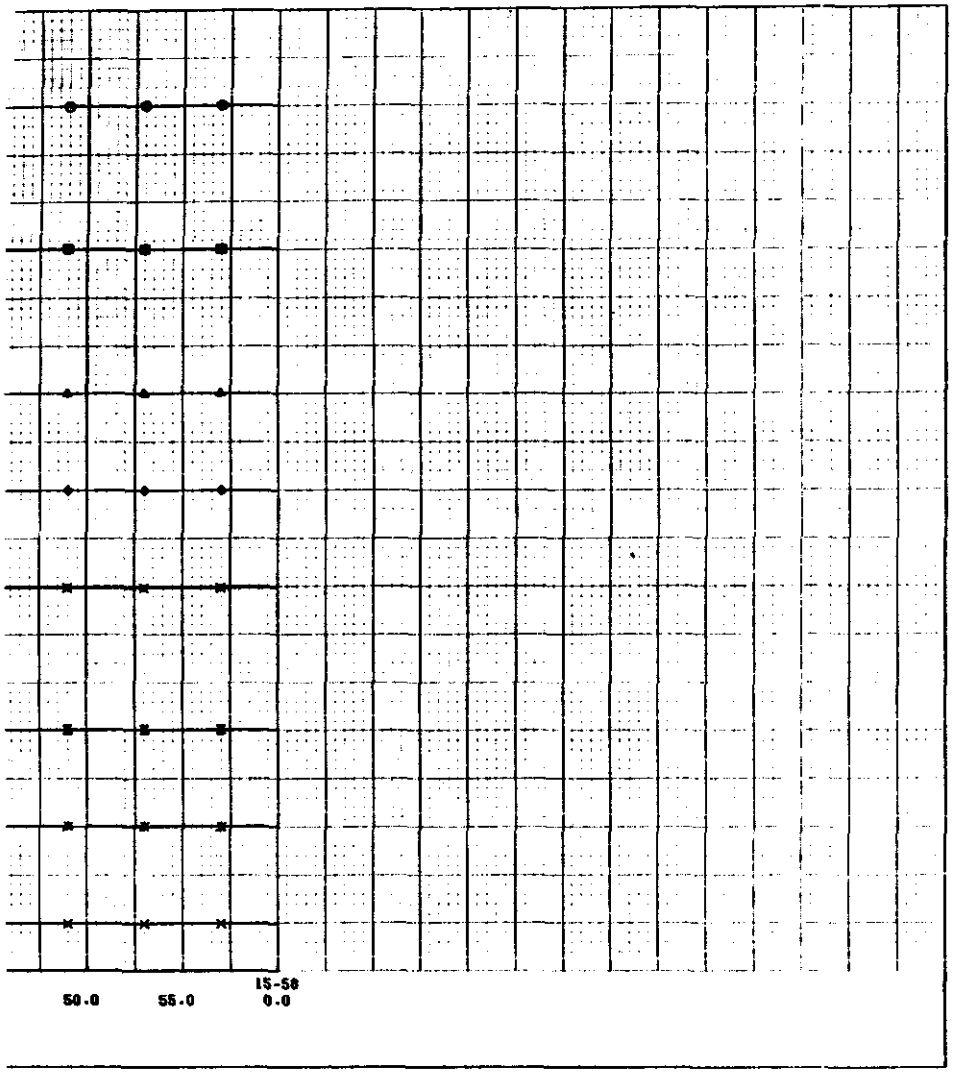

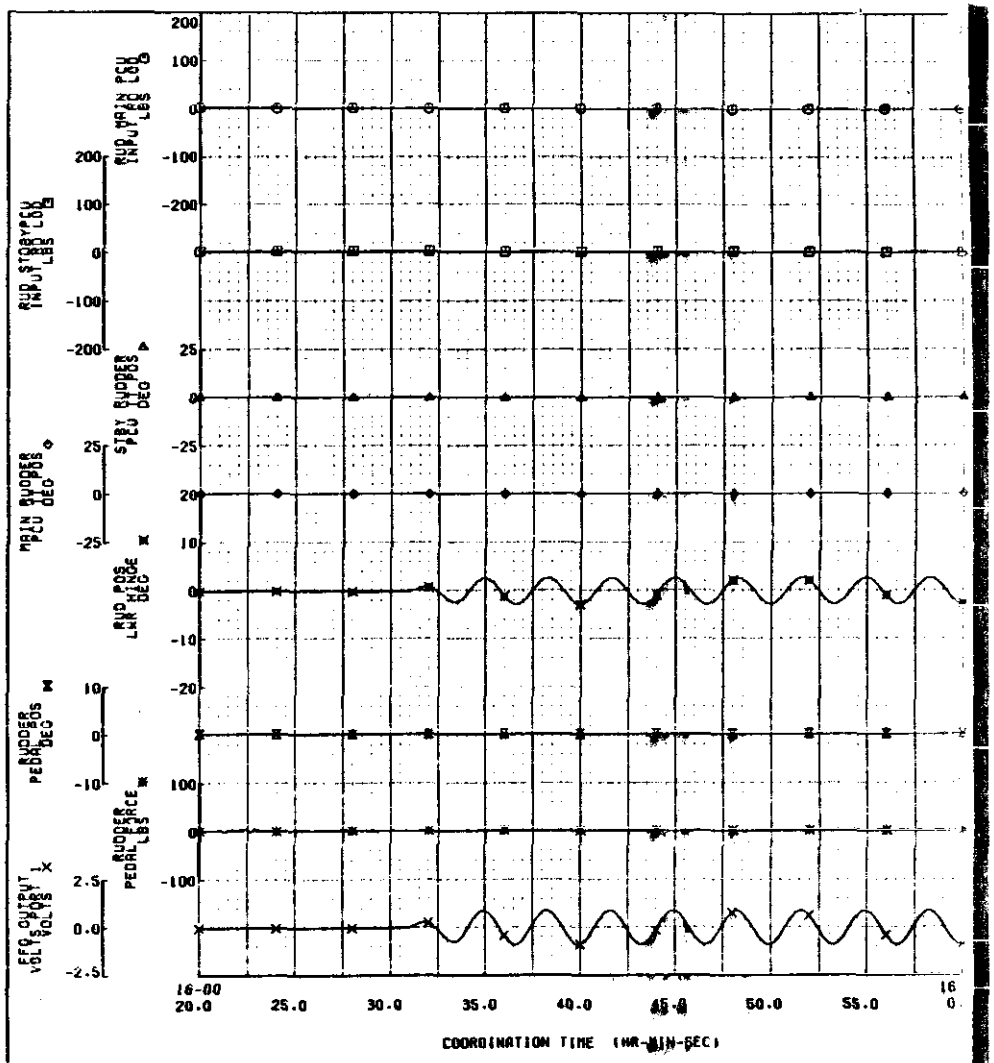

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CALC			REVISED	DATE		
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APR					TEST 001-08 TEST DATE 02/29/96	B1.39.0928
APR					THE BOEING COMPANY	PAGE

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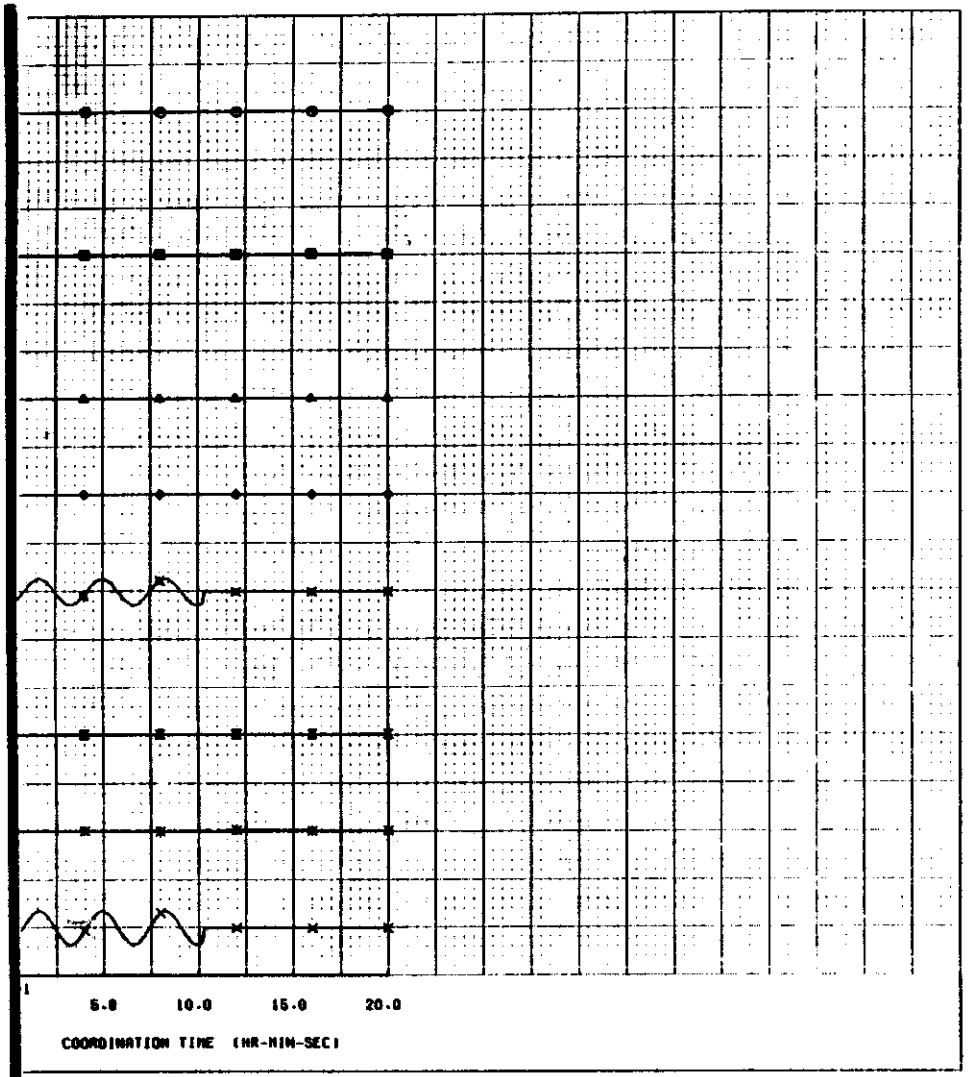
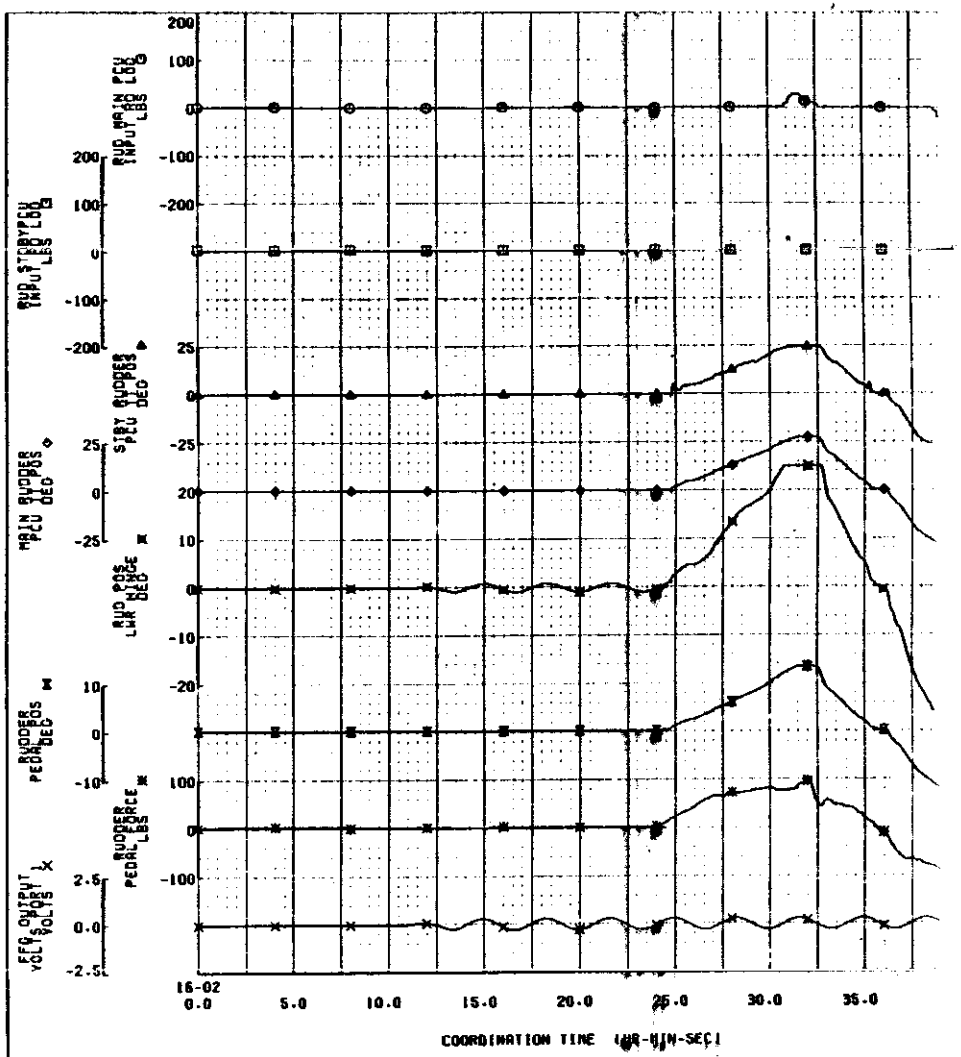
737-200, PG309, RUDDER SYSTEM GROUND TESTING





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CALC			REVISED	DATE		
CHECK					CONDITION NO. B1-39-0928.203	
APR					TEST 001-08 TEST DATE 02/29/96	B1-39-0928
APR					THE BOEING COMPANY	PAGE

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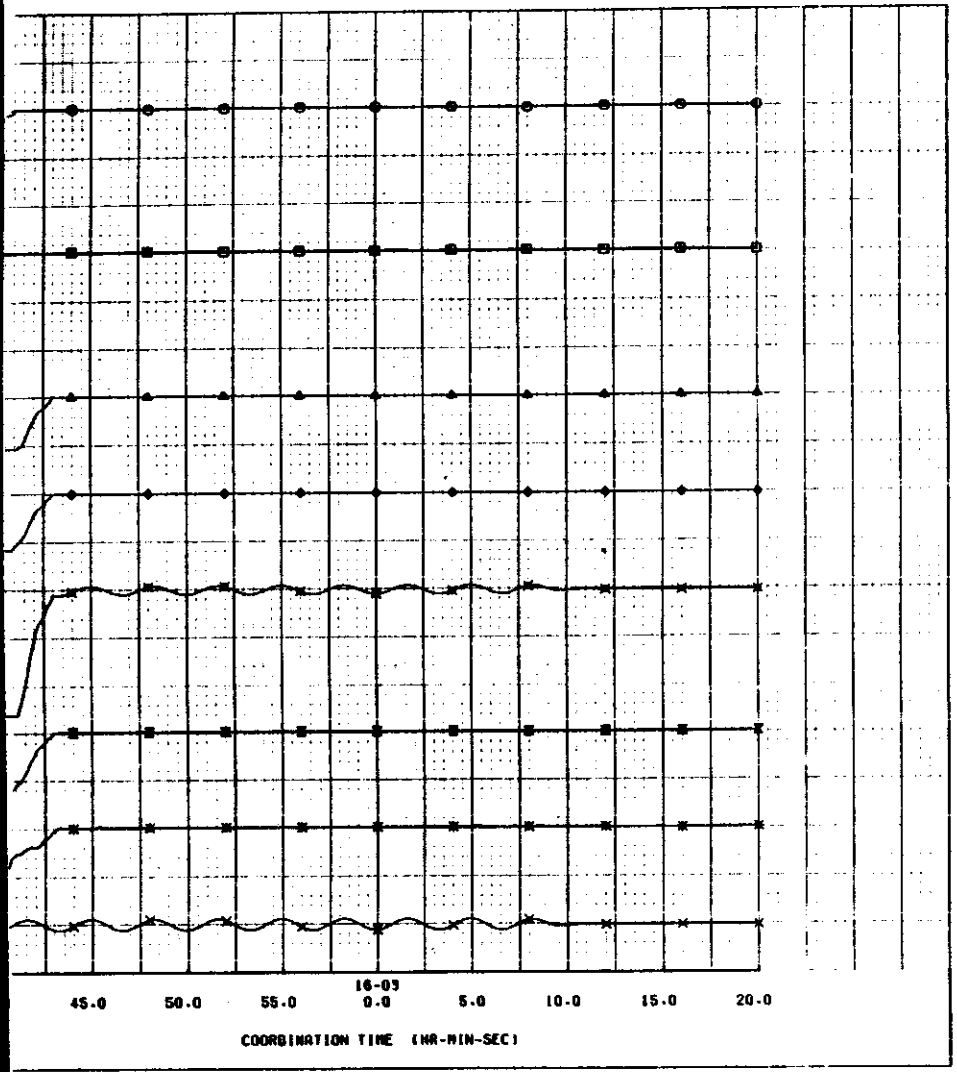

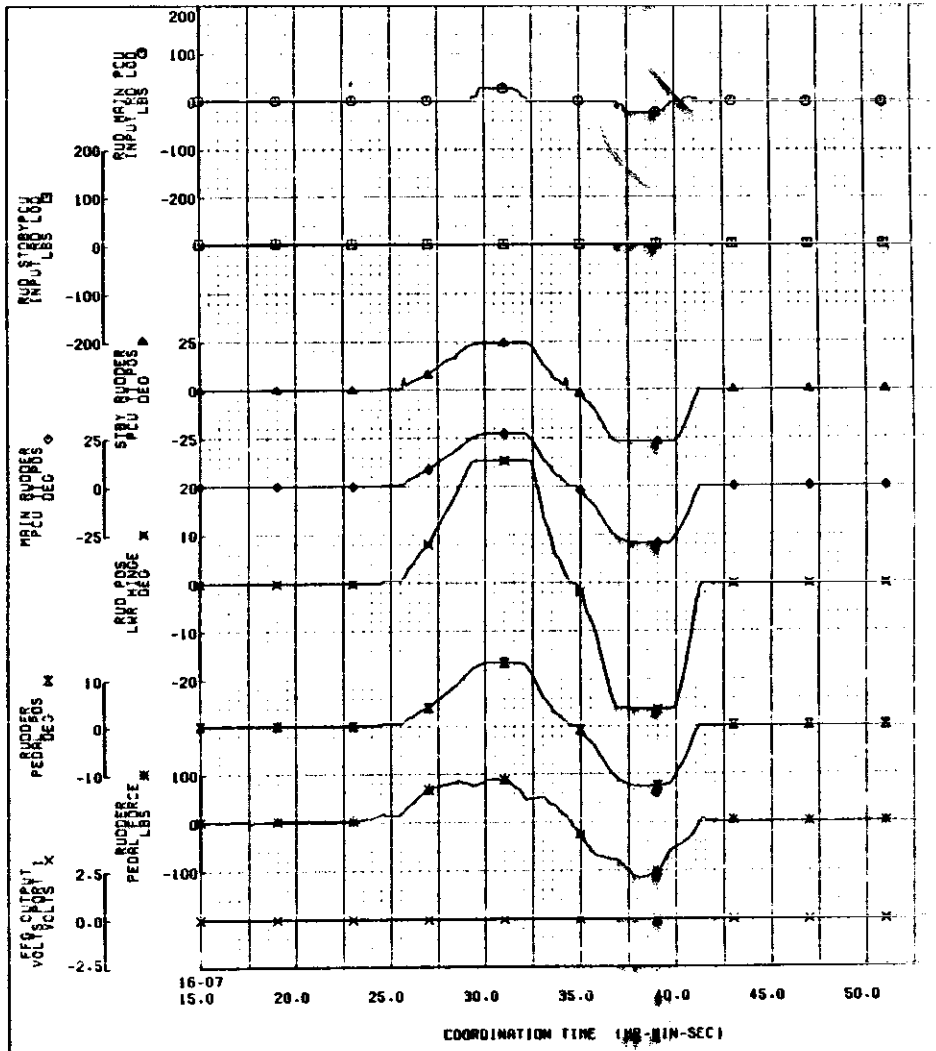

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CALC			REVISED	DATE		
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APR					THE BOEING COMPANY	PAGE
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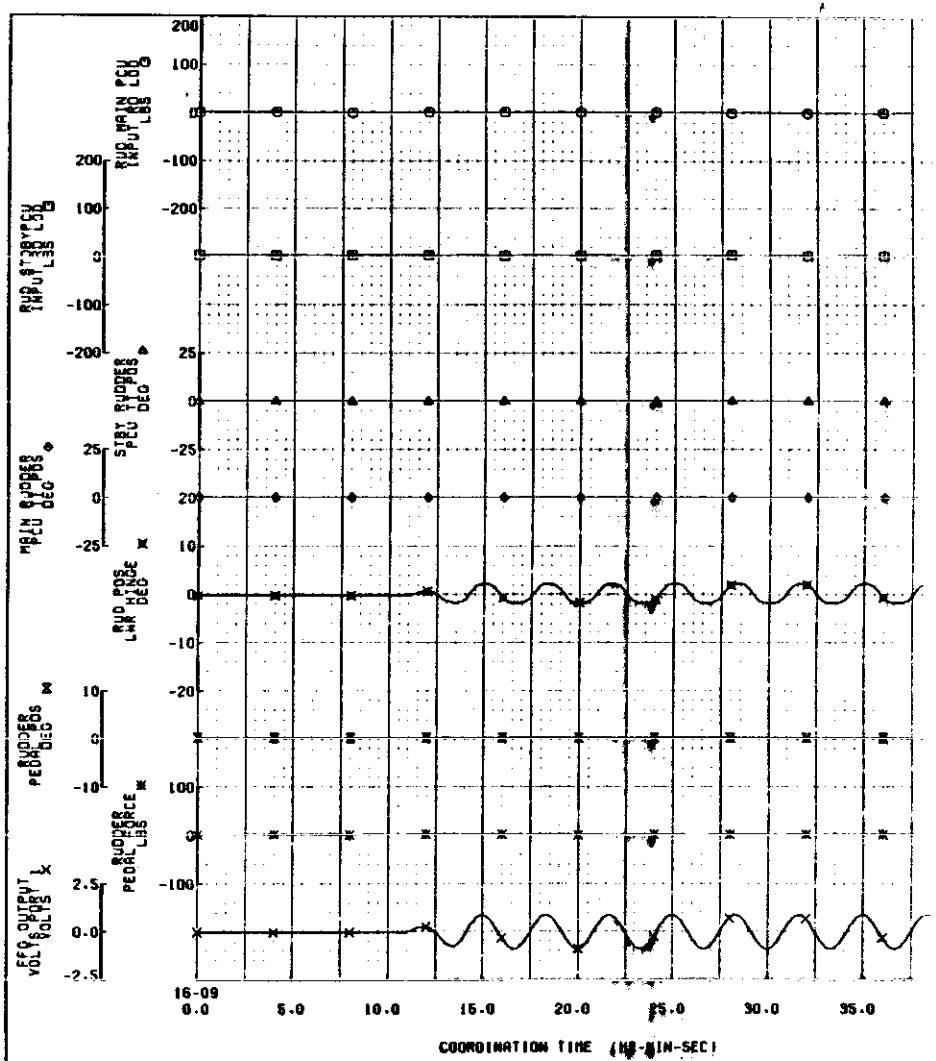

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CHECK					CONDITION NO. B1.39-0928-206	
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APR					THE BOEING COMPANY	PAGE

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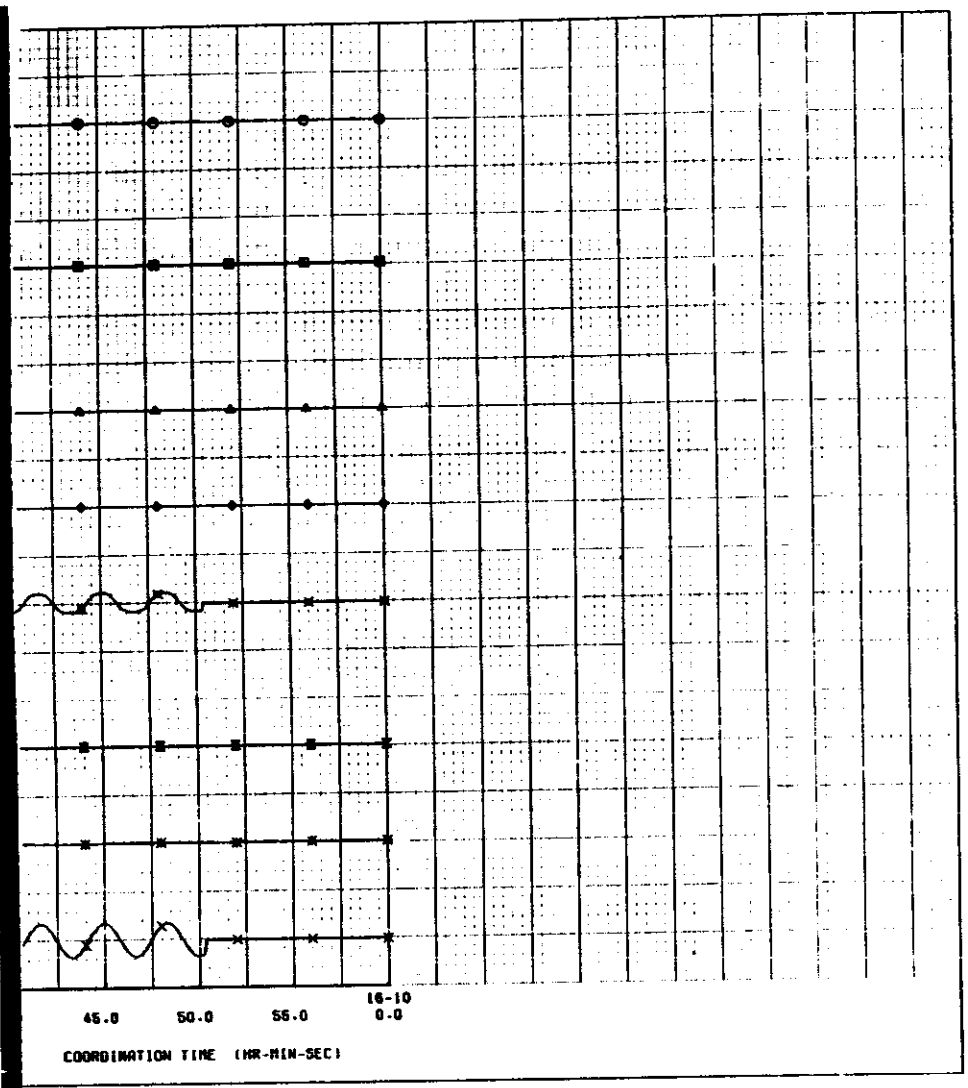

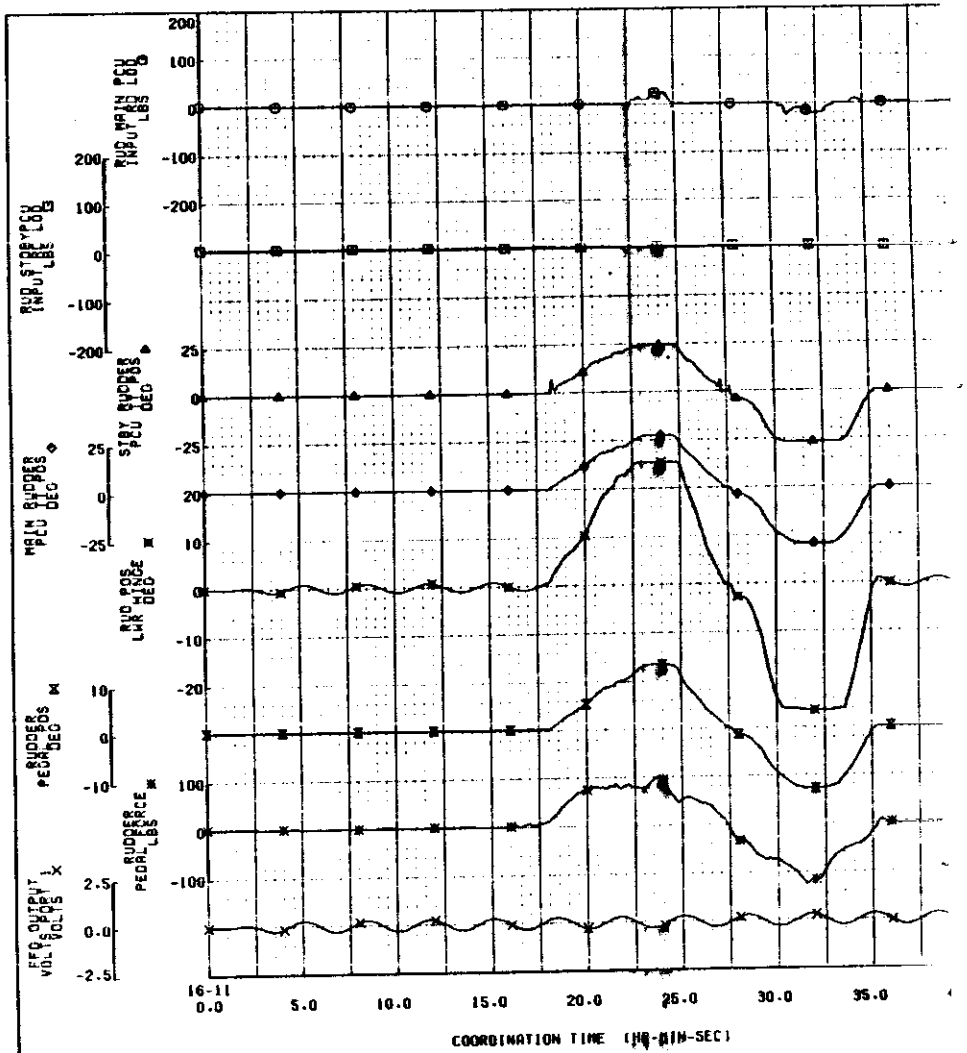

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CALC			REVISED DATE		
CHECK				CONDITION NO. 81.39.0928,207 TEST 001-08 TEST DATE 02/29/96	81.39.0928
APR				THE BOEING COMPANY	PAGE
APR					

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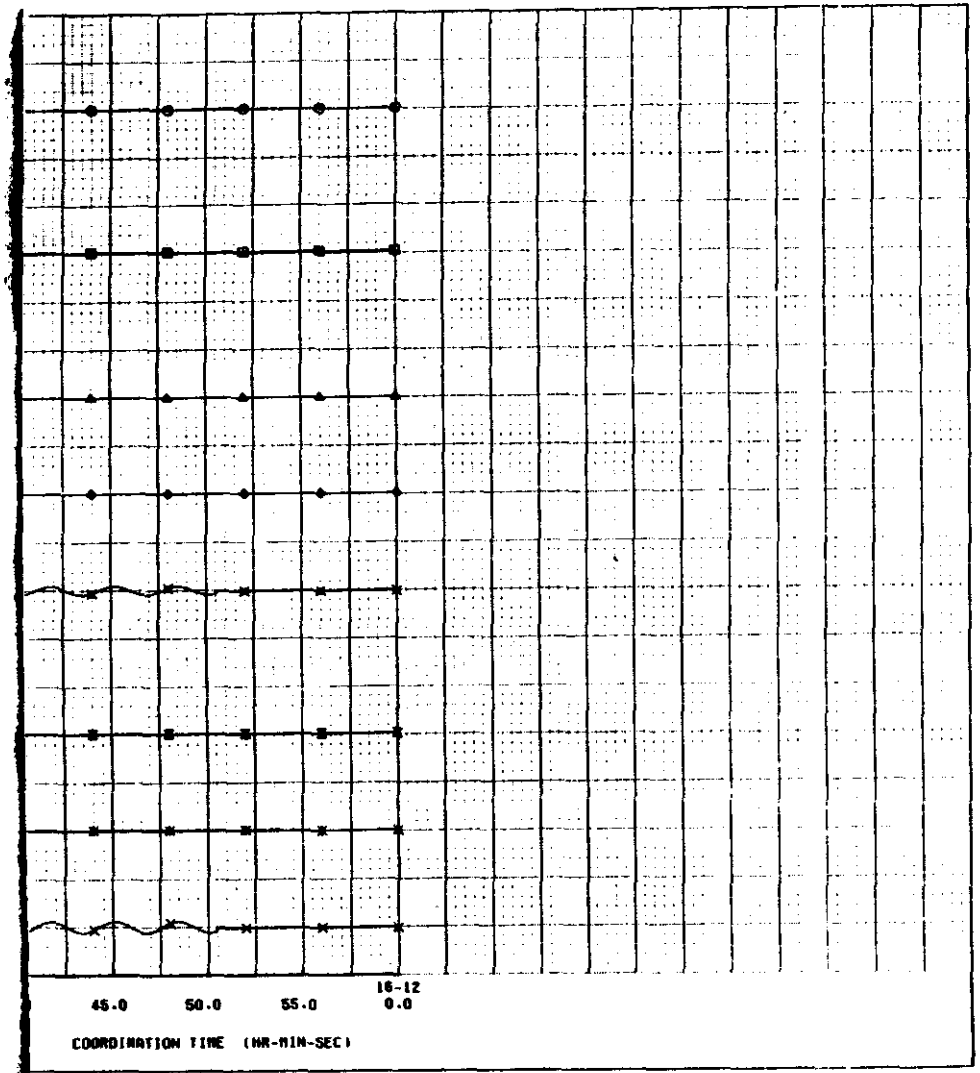

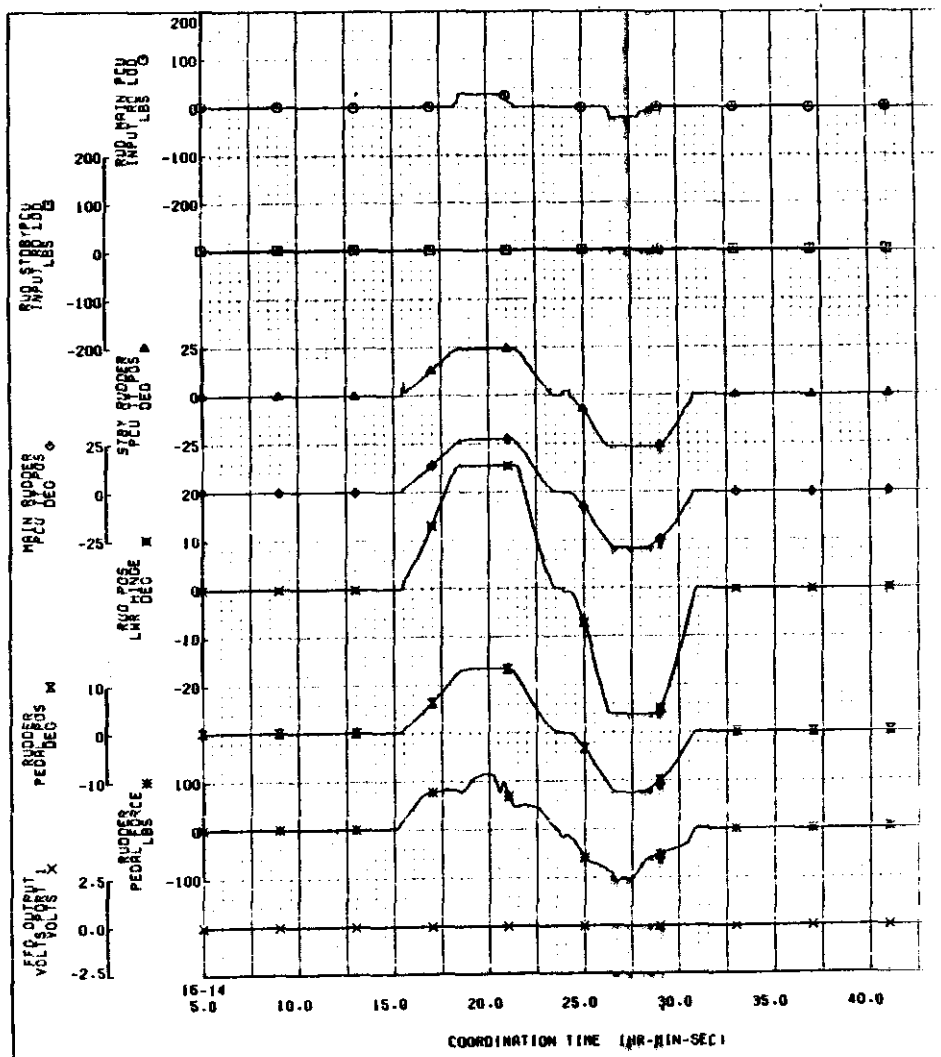

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CALC			REVISED	DATE		
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APR					THE BOEING COMPANY	PAGE

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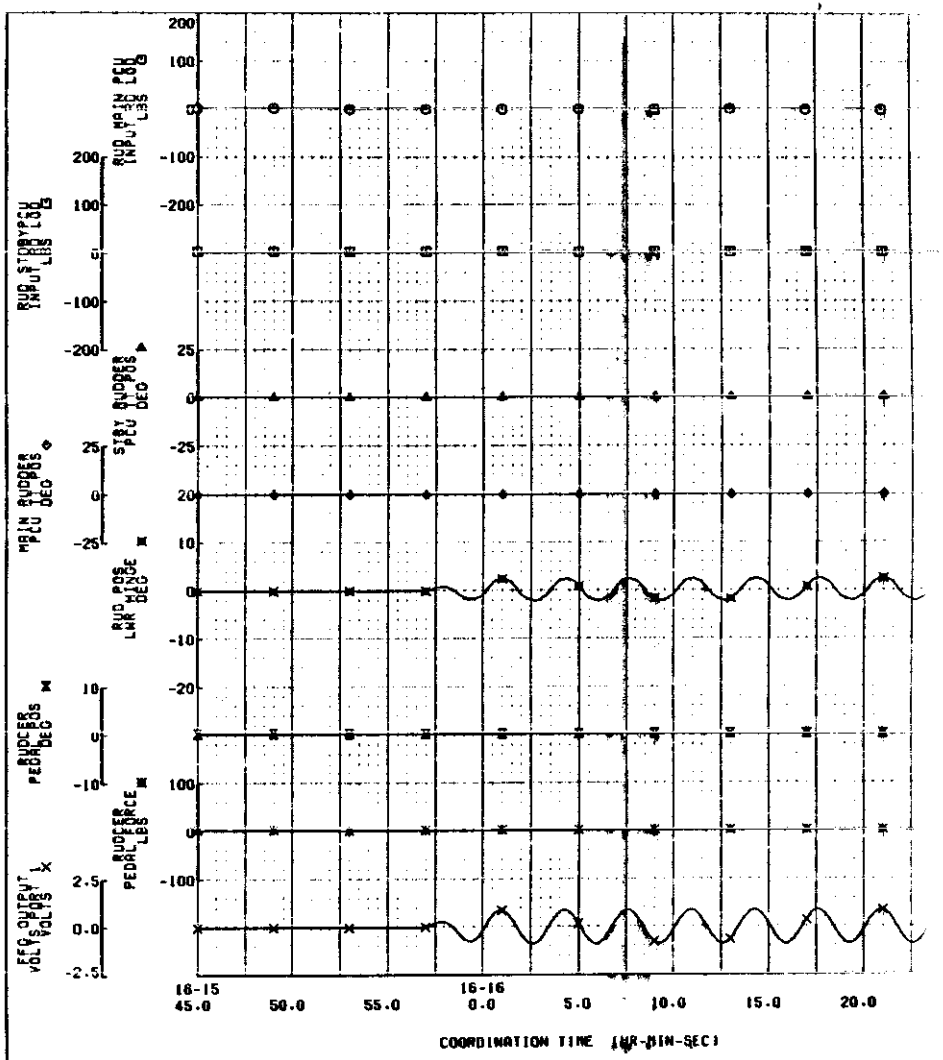

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CALC			REVISED	DATE		
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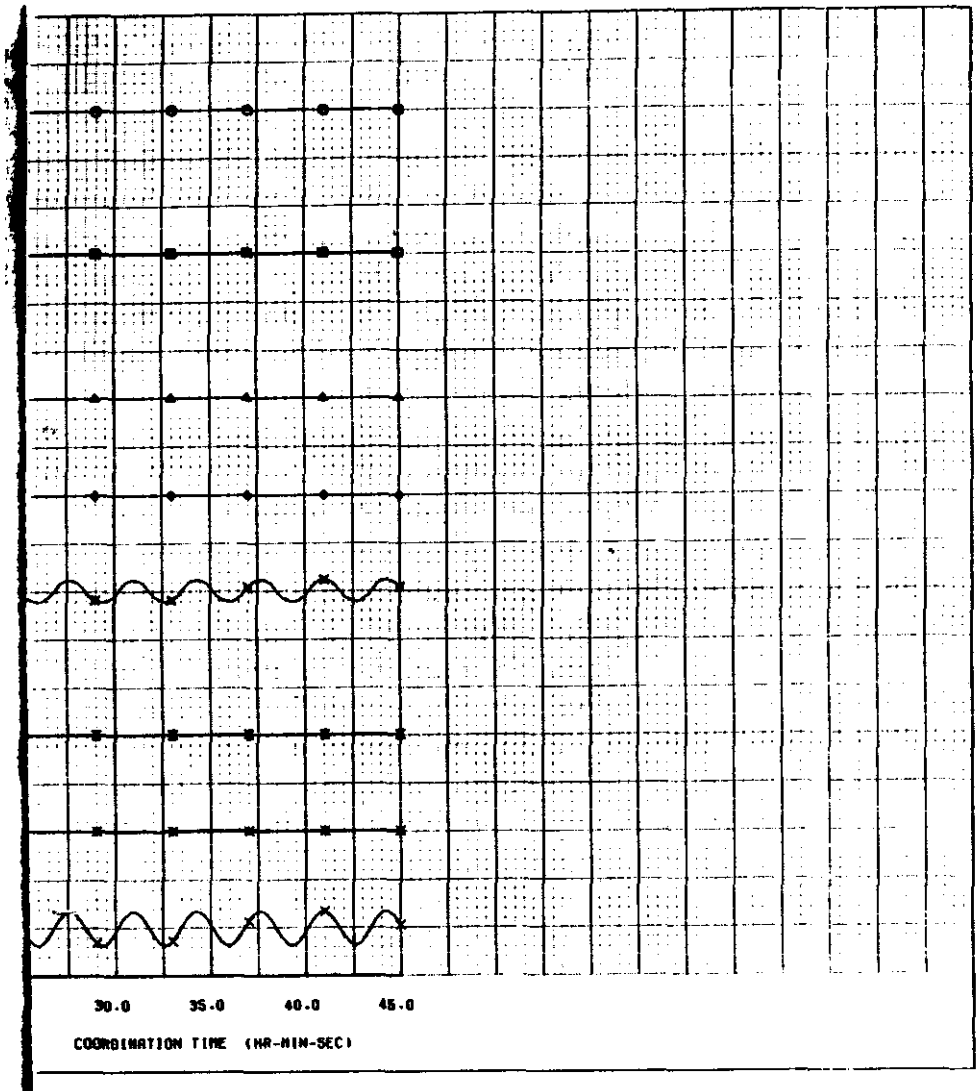

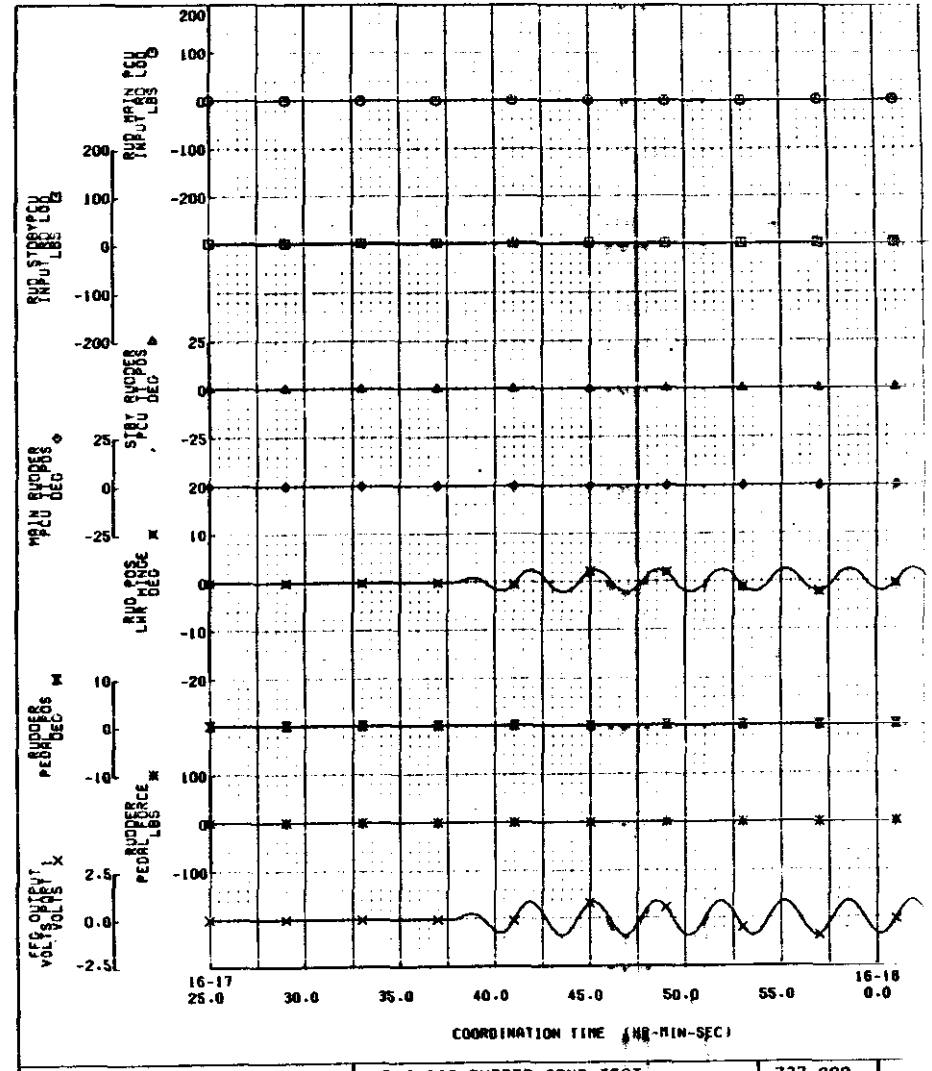

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CALC			REVISED	DATE		
CHECK					CONDITION NO. 81.39.0928.209.1	
APR					TEST 001-08 TEST DATE 02/29/96	81.39.0928
APR					THE BOEING COMPANY	PAGE

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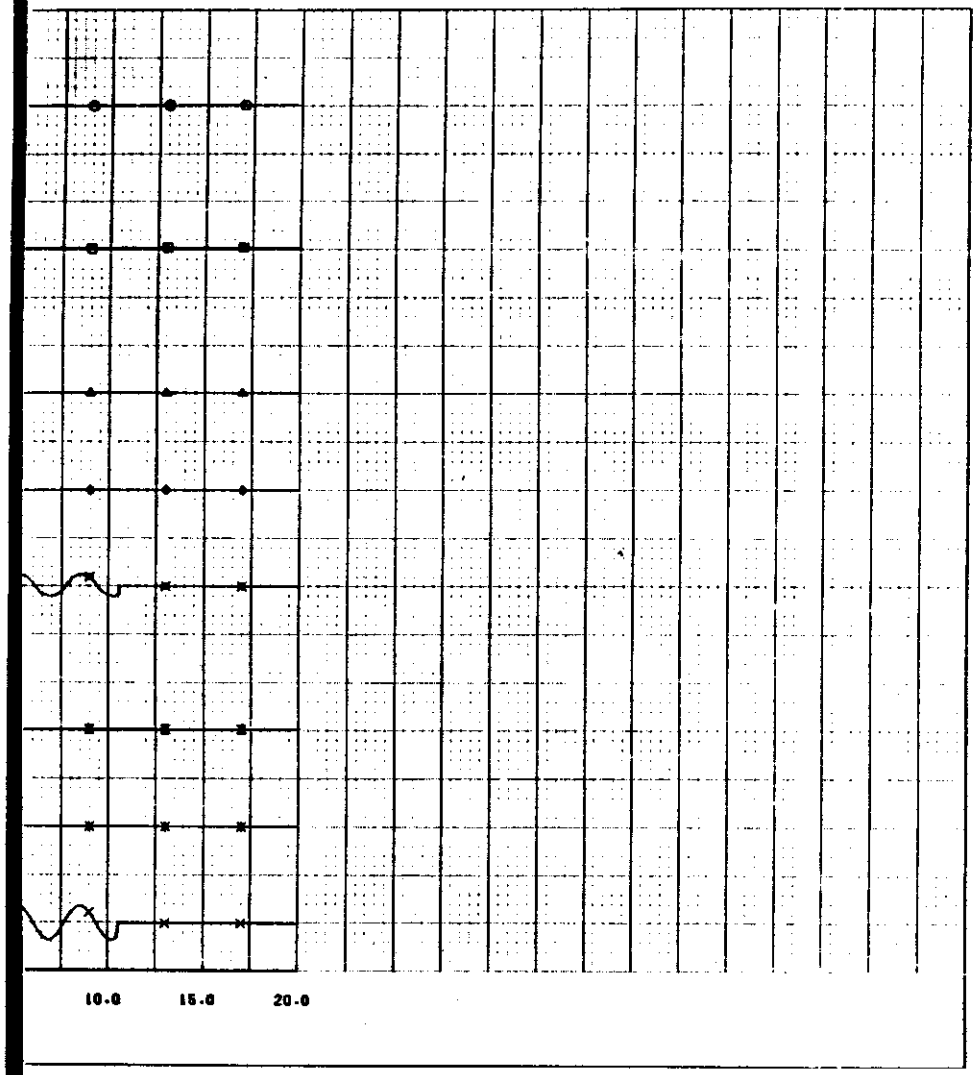
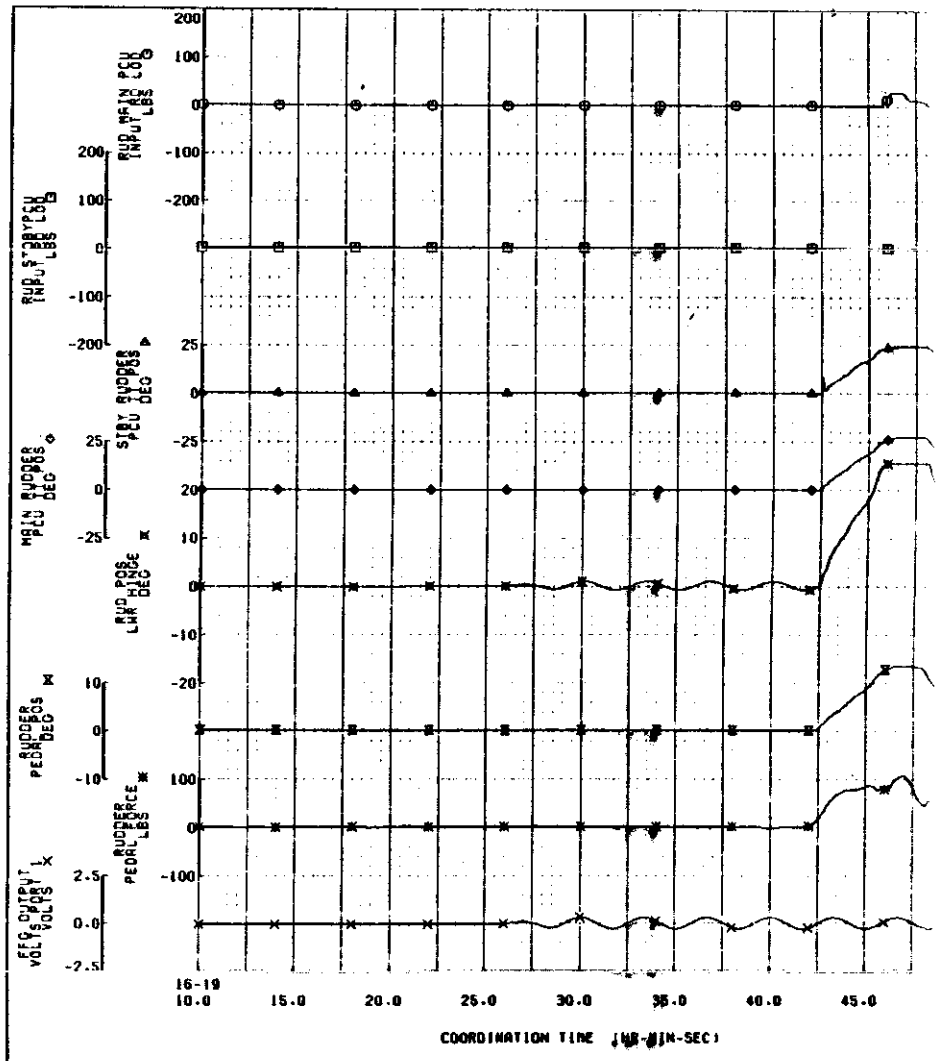
737-200, PG309, RUDDER SYSTEM GROUND TESTING





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CALC			REVISED	DATE		
CHECK					CONDITION NO. 81.39.0928.210	
APR					TEST 001-08 TEST DATE 02/29/96	81.39.0928
APR					THE BOEING COMPANY	PAGE

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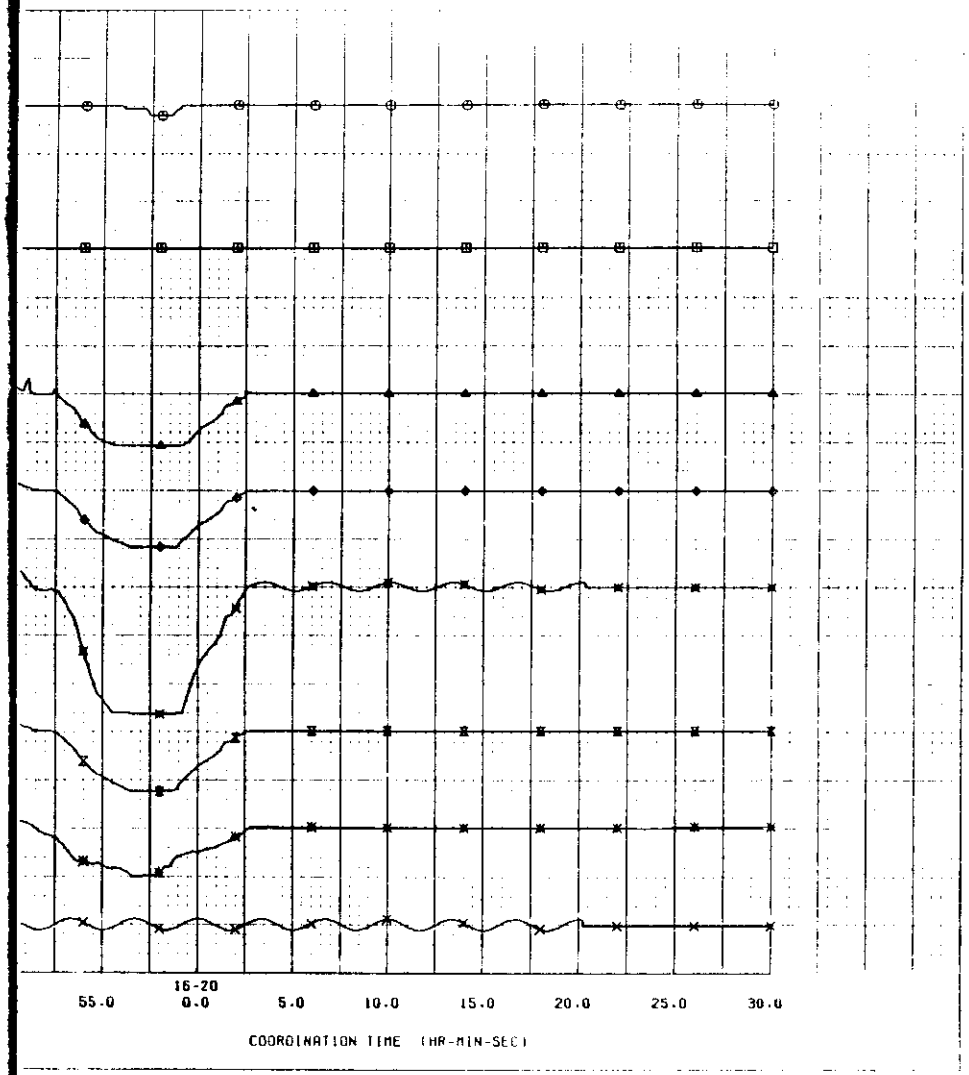
737-200, PG309, RUDDER SYSTEM GROUND TESTING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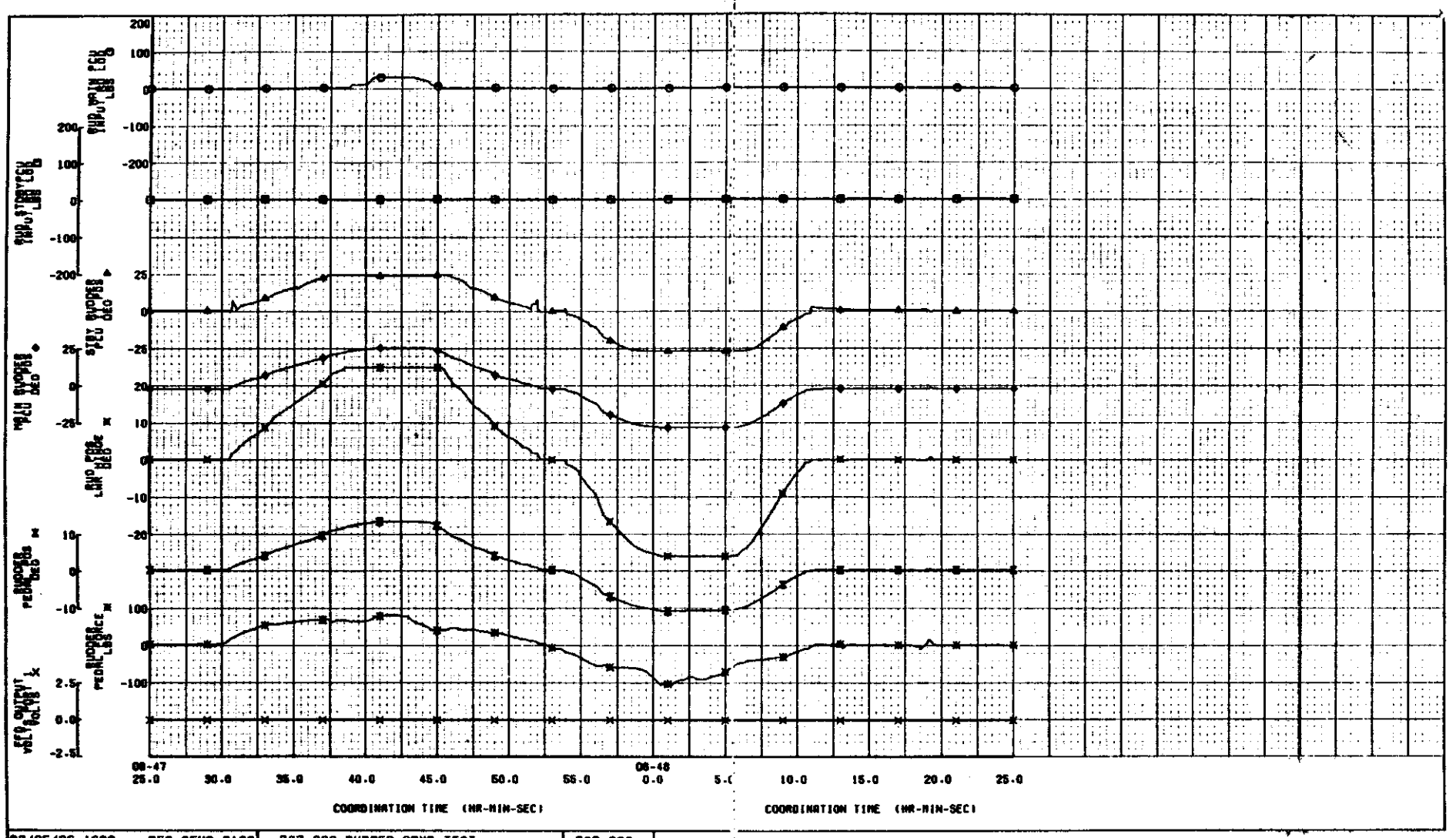

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CALC			REVISED	DATE		
CHECK					CONDITION NO. B1.39.0928.101	
APR					TEST 001-08 TEST DATE 02/29/96	B1.39.0928
APR					THE BOEING COMPANY	PAGE

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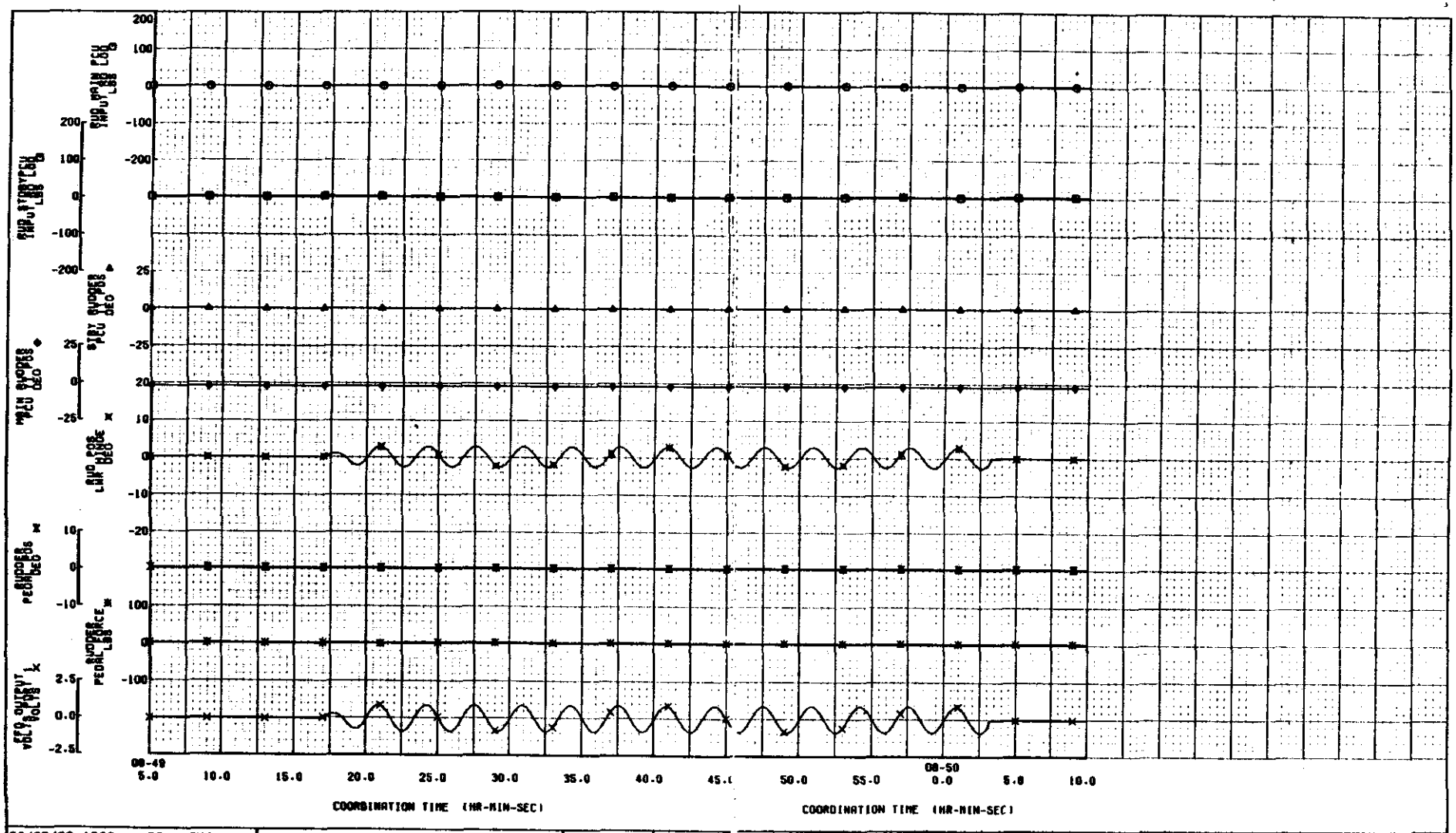
737-200, PG309, RUDDER SYSTEM GROUND TESTING



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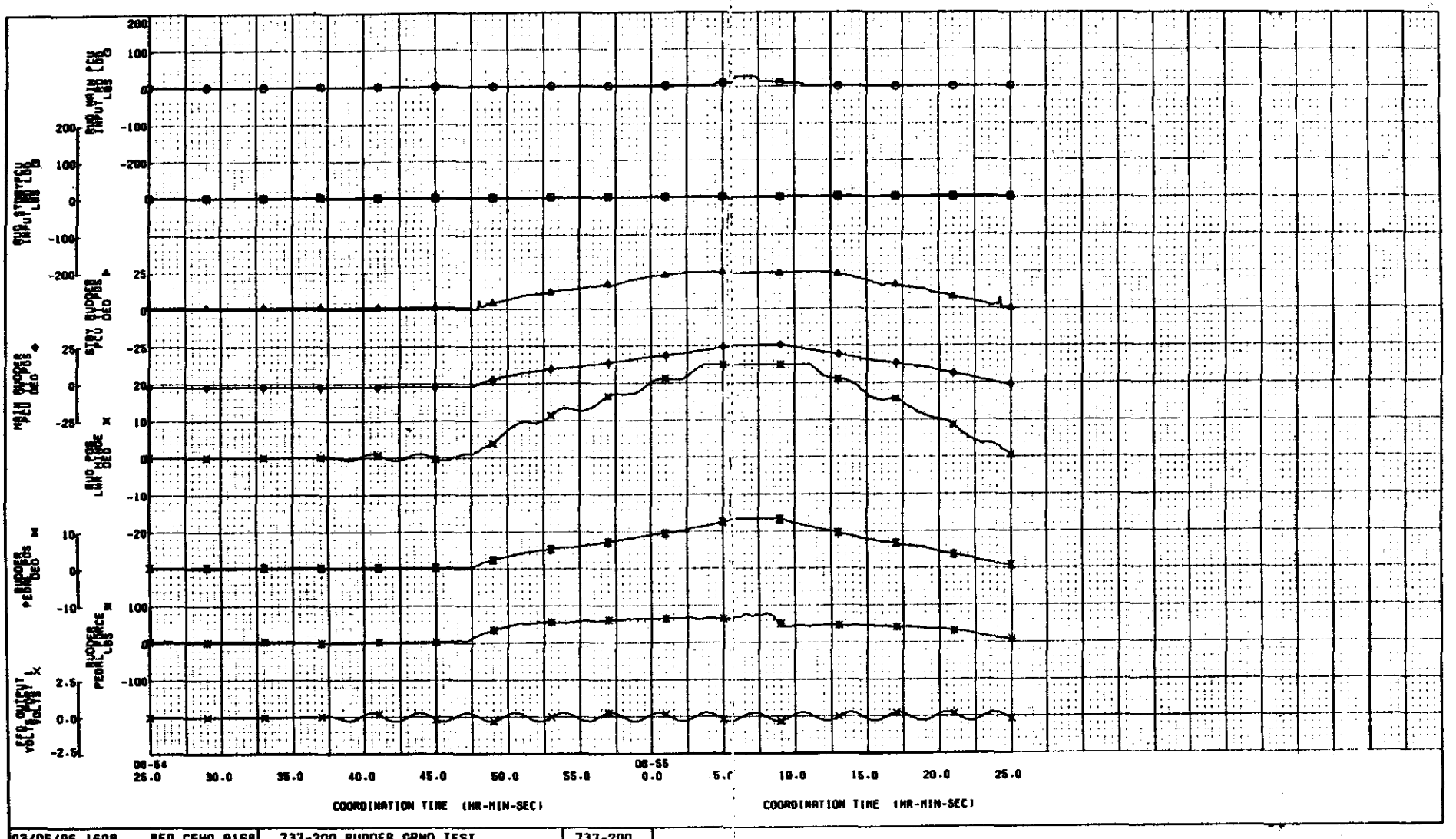

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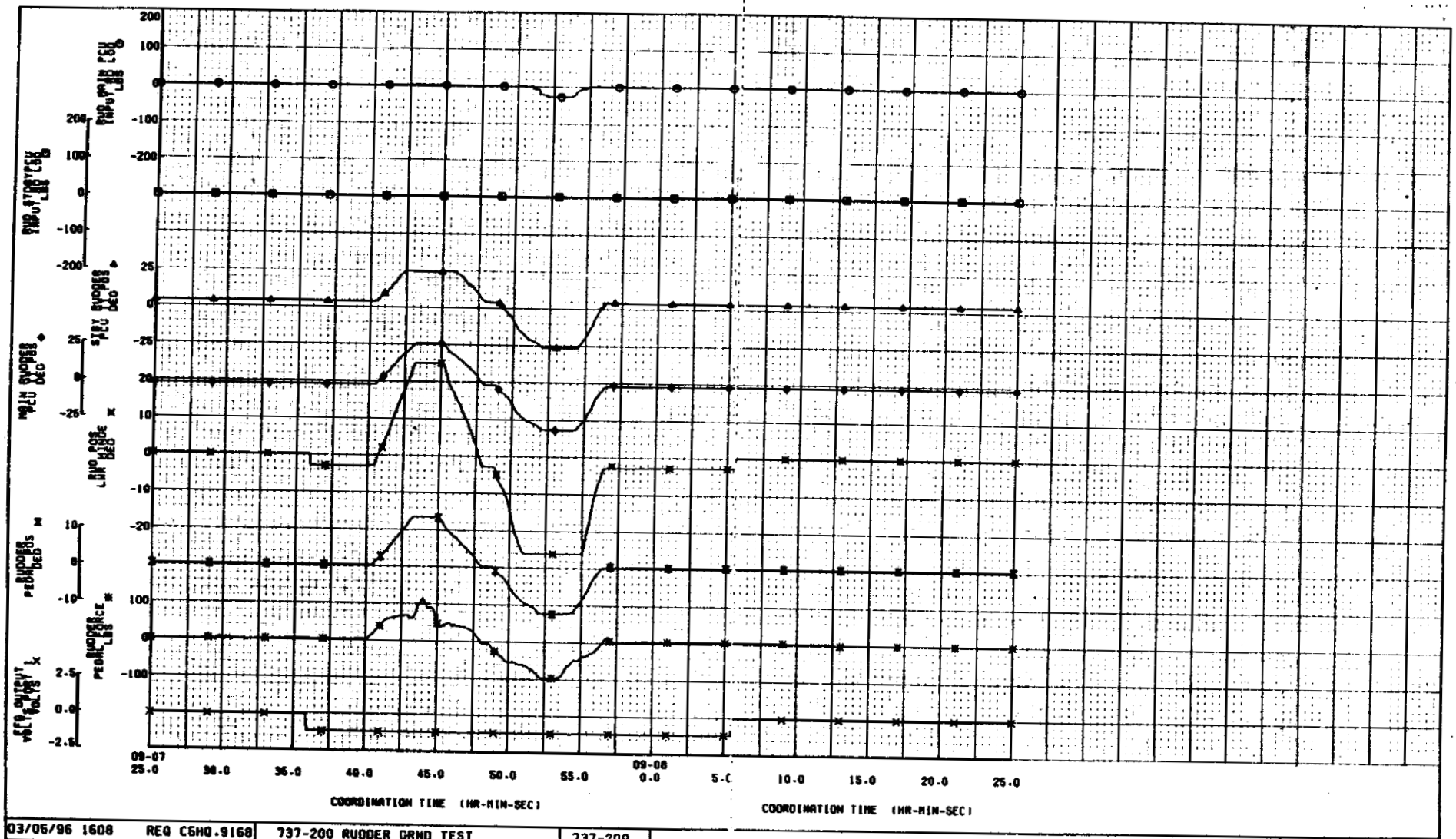

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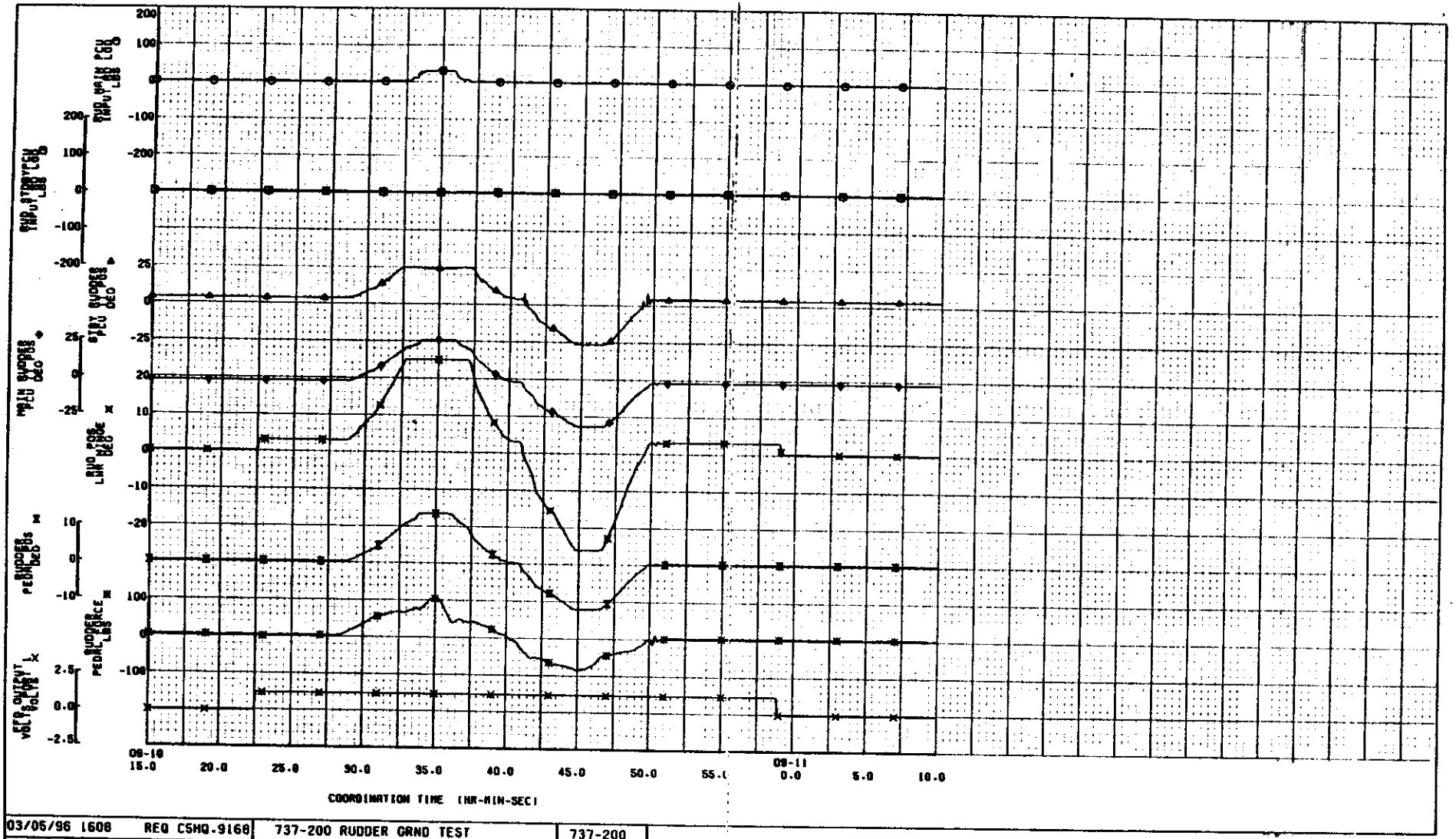

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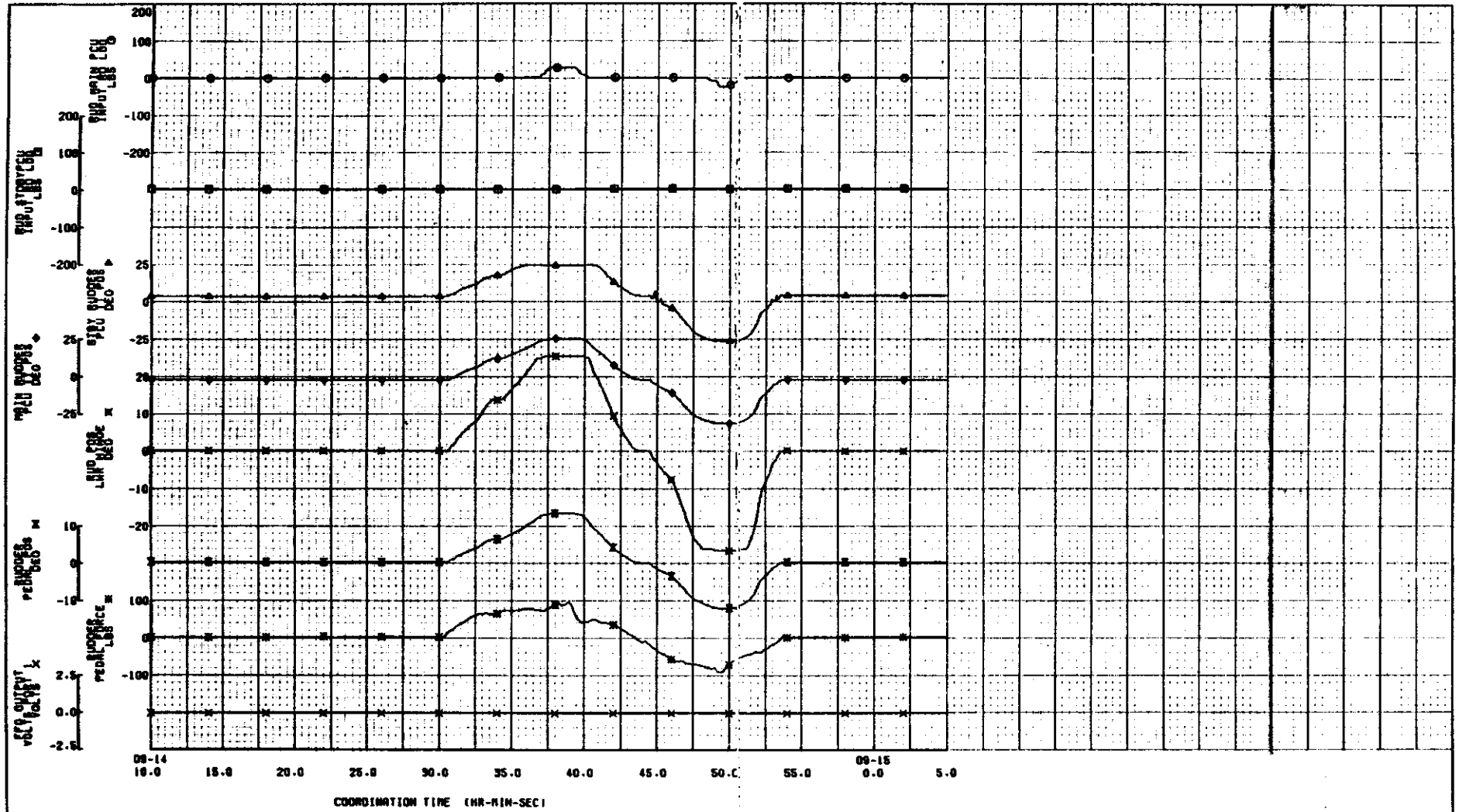

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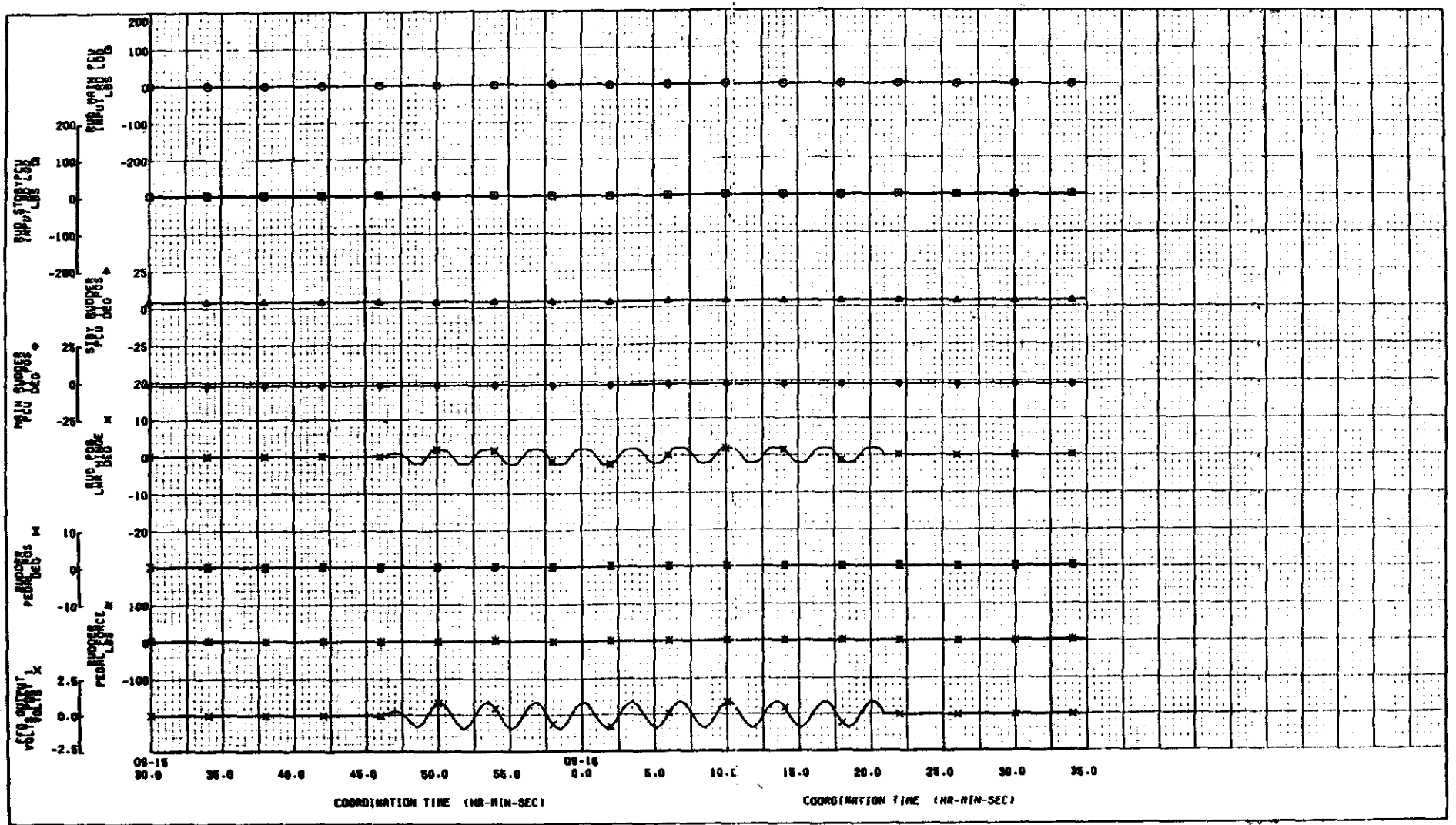

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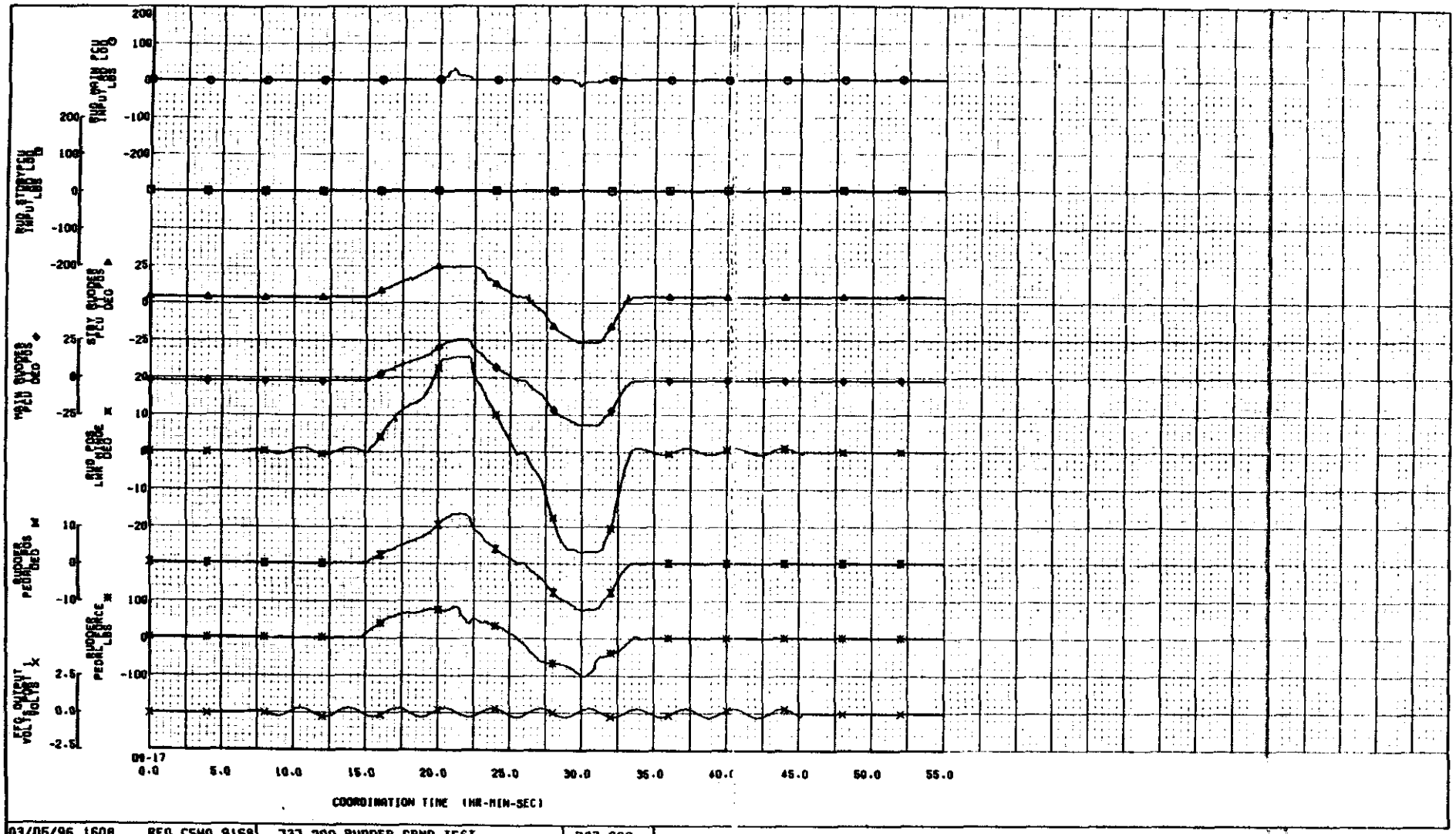

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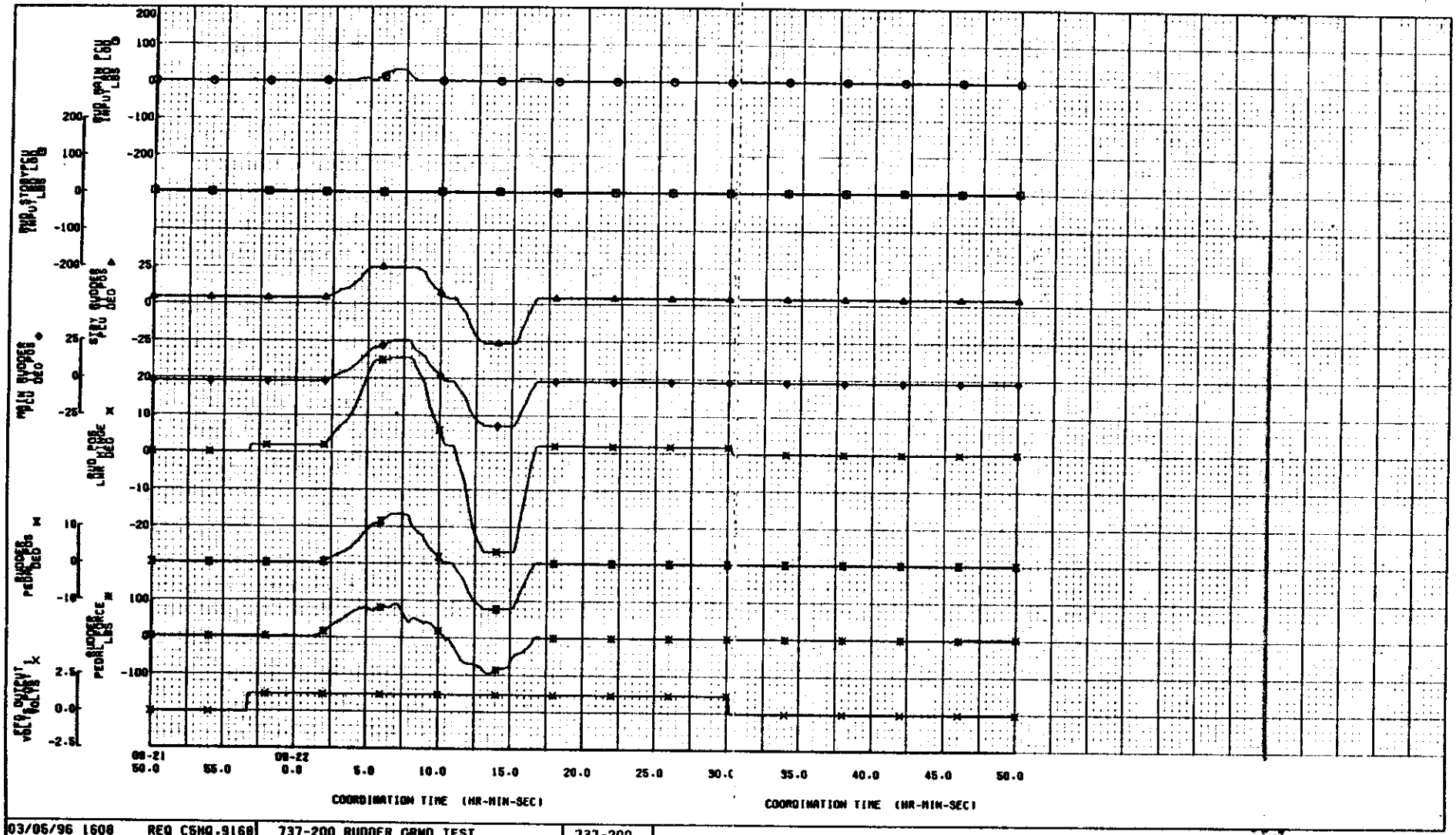

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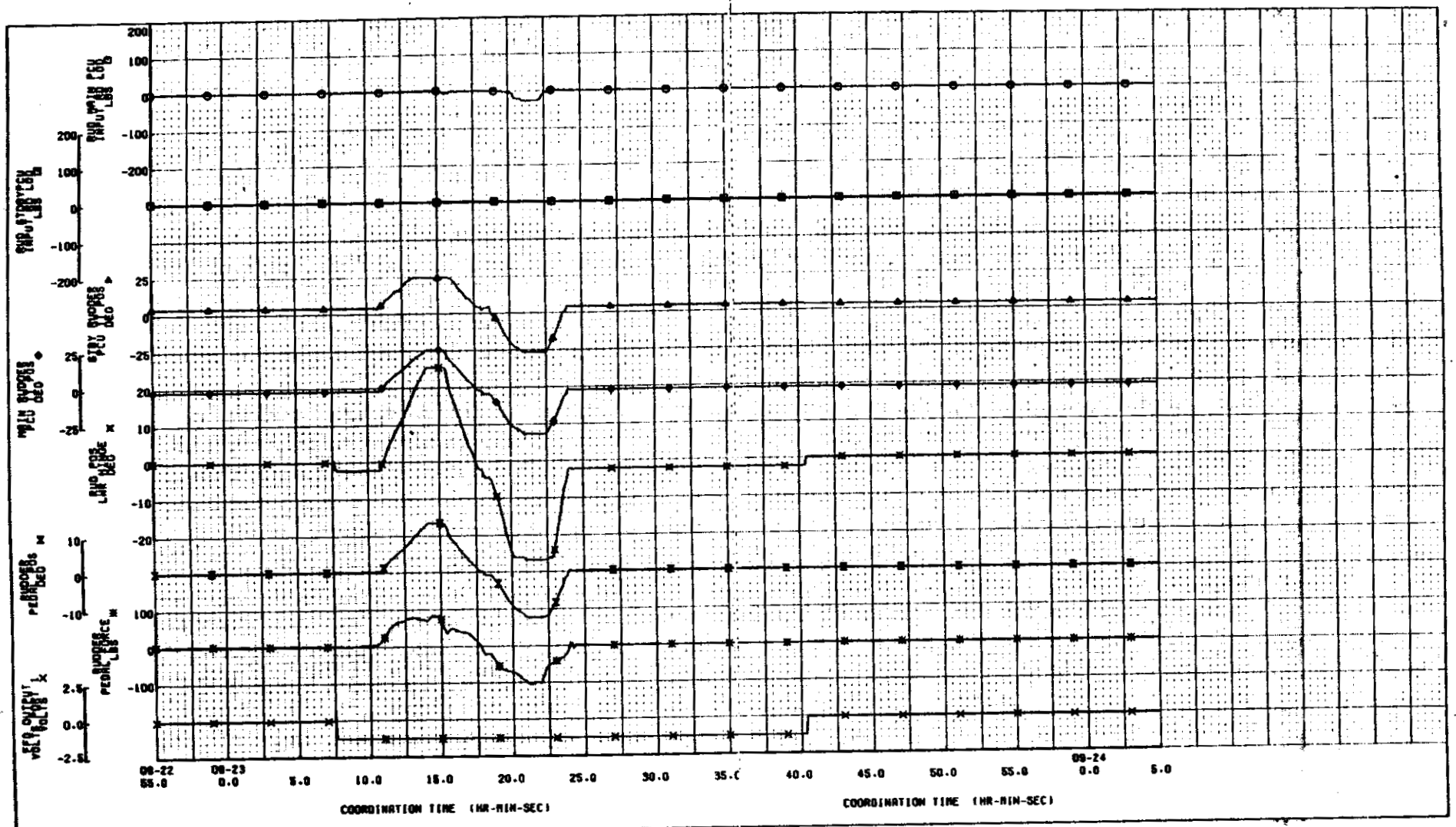

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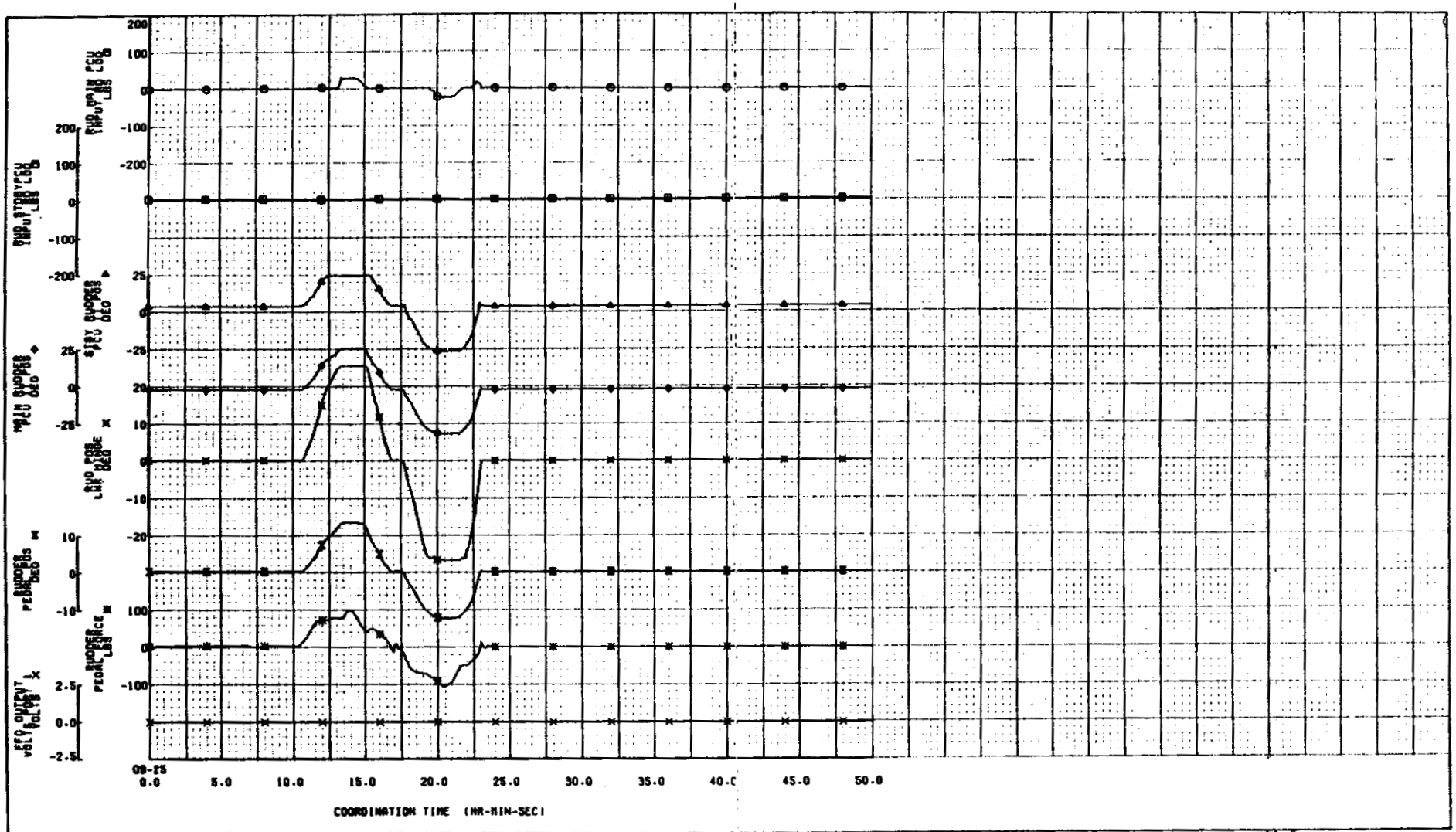

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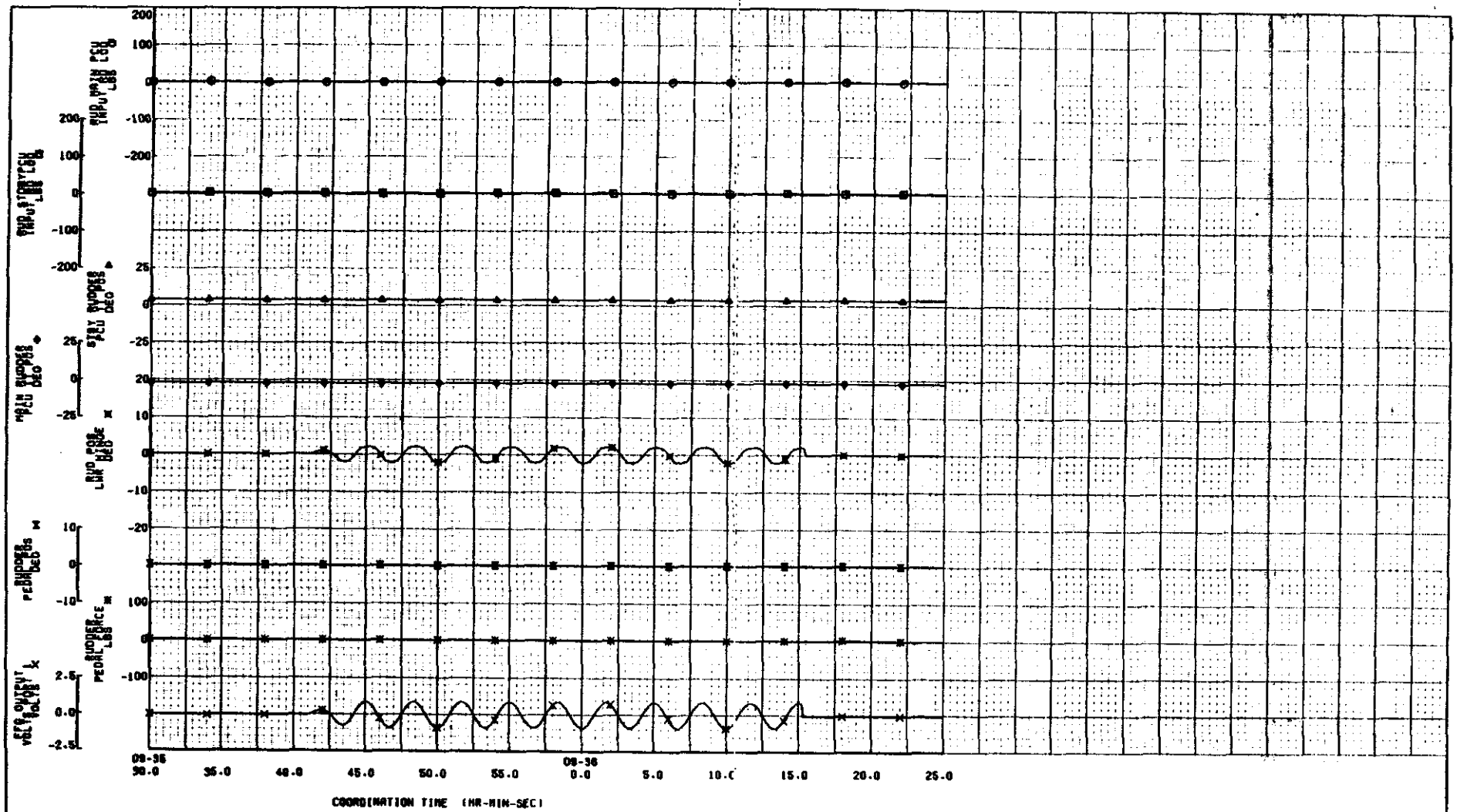

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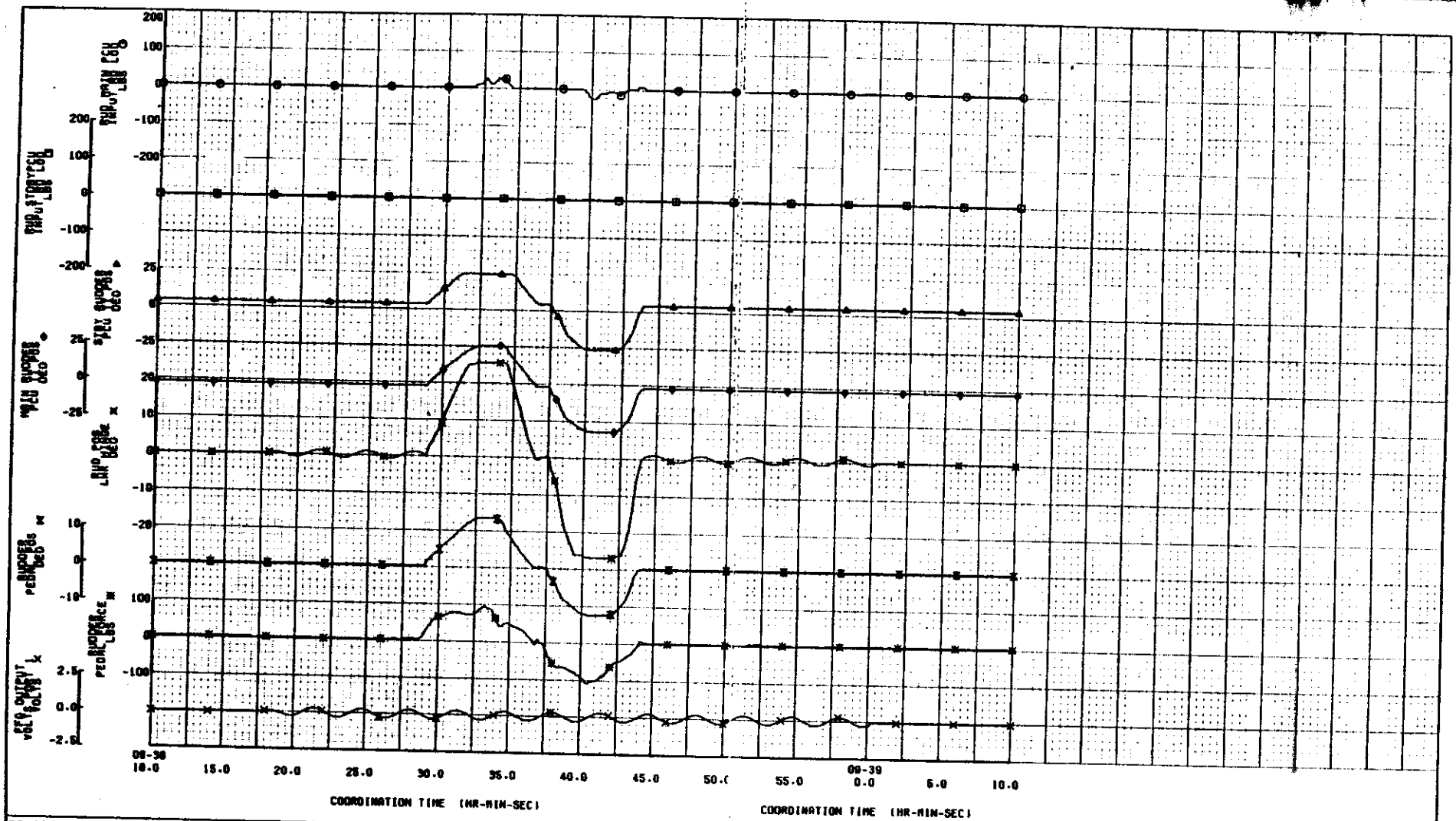

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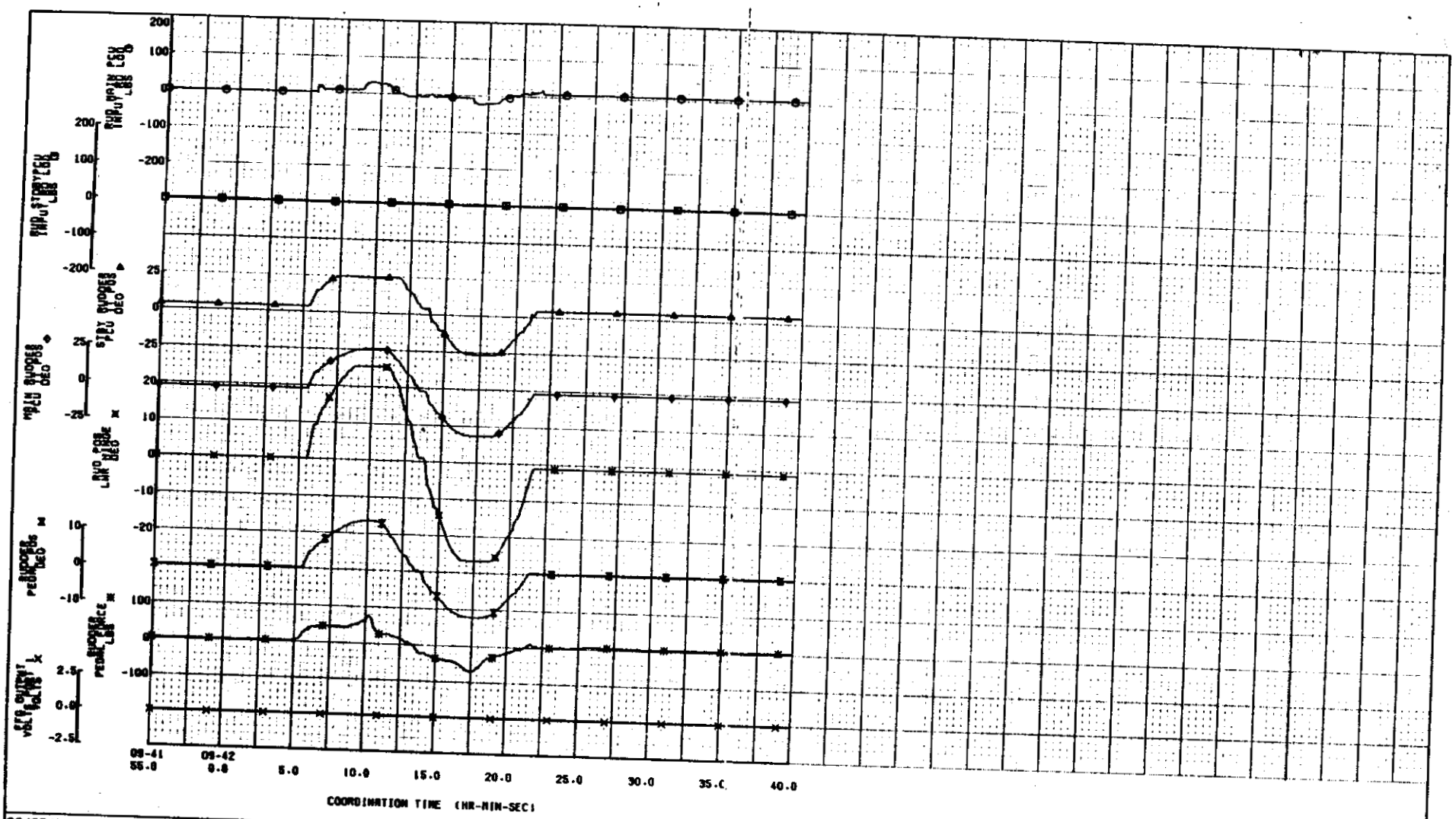

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APR				TEST 001-08 TEST DATE 02/29/96	81.39.0928
APR				THE BOEING COMPANY	PAGE

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SCHEDULED TESTING

T.P. #	Test Item Title
B1.39.0928	737-200 STANDBY RUDDER ACTUATOR FAILURE GROUND TEST - B

PURPOSE OF TEST

Jams of the standby rudder PCU control valve lever will be introduced on the ground. The resulting rudder control system operational characteristics will be investigated with various initial conditions and subsequent yaw damper, rudder pedal, and rudder trim inputs. The intent is to allow evaluation of these characteristics with an actual airplane's flight control system compliance, backlash, control valve flow, and pressure gains.

TEST PARAMETERS

☐Hydraulic Power - Supplied to the A & B systems.

☐Electrical Power - ON

☐Nose wheel Steering - Disabled (either install nose gear steering lockout pin in nose gear steering depressurization valve per maintenance manual 32-00-01, or pull the nose gear air/ground circuit breaker on the P-6 panel).

TEST CONDITIONS

CONDITIONS .001 THRU .021 HAVE BEEN PREVIOUSLY COMPLETED AND ARE OPTIONAL.

Rigging Check and Functional Test

Condition No.	Operation
☐*B1.39.0928.001*	*Perform various rigging checks of the rudder control system. Note rudder control cable rig loads, rig pin fit, PCU force fight, and control surface alignment with the index mark.*
☐*.002*	*Disable the nose wheel steering.*
☐*.003*	*Perform rudder system functional testing, paragraphs 5.0 through 5.11, of document D6-17554:27-21:0003B.*
☐*.004*	*Turn A and B hydraulic systems ON with 3000 psi, pressurize the tail, and set the rudder trim to zero.*
☐*.005*	*Confirm that the yaw damper is OFF.*
☐*.006*	*Note instrumentation data with the rudder pedals centered.*
☐*.007*	*Note instrumentation data with full left pedal.*
☐*.008*	*Note instrumentation data with full right pedal.*

Instrument Verification

Condition No.	Operation
☐1.39.0928.009	*With the rudder pedal in its detent, apply full left rudder trim. Note instrumentation.*
☐.010	*With the rudder pedal in its detent, apply full right rudder trim. Note instrumentation.*
☐.011	*Turn OFF all hydraulic power, cycle the flight controls to bleed pressure, and set all FLT CTRL switches to OFF.*
☐.012	*Remove the Standby Rudder PCU input rod.*
☐.013	*Remove the Rudder Feel unit input rods from the rudder torque tube.*
☐.014	*Perform a slow rudder pedal cycle with no hydraulic power. Note the response of the Main Rudder PCU rod force.*
☐.015	*Connect the Standby Rudder PCU input rod.*
☐.016	*Remove the Main PCU rudder input rod.*
☐.017	*Using the blocking tool, Jam the Standby Rudder PCU Valve lever at a ± 0.0 degree input arm position.*
☐.018	*Slowly apply rudder pedal force. Note the response of the Standby Rudder PCU rod force.*
☐.019	*Connect the Main PCU input rod.*
☐.020	*Connect the Rudder Feel unit input rod.*
☐.021	*Conduct other verification tests as requested by Engineering.*

Baseline Testing - Production Standby PCU Shaft and Bearing

- *A production Rudder Standby PCU with a production PCU input shaft and bearing will be installed.*
- *Set the Hydraulic System as noted.*
- *Perform noted conditions.*

Condition No.	Hyd Pressure	Operation
☐B1.39.0928.101	A & B	Cycle the rudder pedals through full deflection and note the system response.
☐.102	A & B	Input a ±3.0 degree yaw damper command at 0.3 Hz. Record the system response.
☐.103	A & B	Input a ±1.0 degree Yaw Damper Command at 0.3 Hz. Cycle the rudder pedals through full displacement during the frequency input. Record system response.
☐.104	- - - -	Confirm a simulated airload has been applied to the rudder trailing edge.
☐.105	B & Stby	Cycle the rudder pedals through full deflection and note the system response.
☐.106	B & Stby	Input a ±3.0 degree yaw damper command at 0.3 Hz. Record the system response.
☐.107	B & Stby	Input a ±1.0 degree Yaw Damper Command at 0.3 Hz. Cycle the rudder pedals through full displacement during the frequency input. Record system response.
☐.108	A,B & Stby	Cycle the rudder pedals through full deflection and note the system response.
☐.109	A,B & Stby	Input a ±3.0 degree yaw damper command at 0.3 Hz. Record the system response.
☐.110	A,B & Stby	Input a ±1.0 degree yaw damper command at 0.3 Hz. Cycle the rudder pedals through full displacement during the frequency input. Record the system response.

-RECONFIGURE A/P-FOR NTSB BEARING JAMS-

System Effects with a Standby Rudder PCU Input Shaft Provided by the NTSB

- *A Standby Rudder PCU Input Shaft and bearing provided by the NTSB will be installed.*
- *Set the Hydraulic System as noted.*
- *Perform noted conditions.*

Condition No.	Hyd Pressure	Operation
☐B1.39.0928.201	A & B	Cycle the rudder pedals through full deflection and note the system response.
☐.202	A & B	Input a ±3.0 degree yaw damper command at 0.3 Hz. Record the system response.
☐.203	A & B	Input a ±1.0 degree Yaw Damper Command at 0.3 Hz. Cycle the rudder pedals through full displacement during the frequency input. Record system response.
☐.204	- - - -	Confirm a simulated airload has been applied to the rudder trailing edge.
☐.205	B & Stby	Cycle the rudder pedals through full deflection and note the system response.
☐.206	B & Stby	Input a ±3.0 degree yaw damper command at 0.3 Hz. Record the system response.
☐.207	B & Stby	Input a ±1.0 degree Yaw Damper Command at 0.3 Hz. Cycle the rudder pedals through full displacement during the frequency input. Record system response.
☐.208	A,B & Stby	Cycle the rudder pedals through full deflection and note the system response.
☐.209	A,B & Stby	Input a ±3.0 degree yaw damper command at 0.3 Hz. Record the system response.
☐.210	A,B & Stby	Input a ±1.0 degree Yaw Damper Command at 0.3 Hz. Cycle the rudder pedals through full displacement during the frequency input. Record system response.