REPORT NUMBER 202-GTL-08-004

SAFETY COMPLIANCE TESTING FOR FMVSS NO. 202 HEAD RESTRAINTS – STATIC REQUIREMENTS

HYUNDAI MOTOR MANUFACTURING ALABAMA, LLC
2008 HYUNDAI SONATA, PASSENGER CAR
NHTSA NO. C80507

GENERAL TESTING LABORATORIES, INC.
1623 LEEDSTOWN ROAD
COLONIAL BEACH, VIRGINIA 22443

February 25, 2009

FINAL REPORT

PREPARED FOR

U. S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
1200 NEW JERSEY AVE., SE
WASHINGTON, D.C. 20590

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FINAL REPORT ACCEPTANCE BY OVSC:

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Date: 2009.02.25 09:48:49 -05'00'

Acceptance Date: _____

1. Report No. 202-GTL-08-004	2. Government Accession No. N/A	3. Recipient's Catalog No. N/A
4. Title and Subtitle Final Report of FMVSS 202 Compliance Testing of 2008 Hyundai Sonata, Passenger Car NHTSA No. C80507		5. Report Date February 25, 2009 6. Performing Organ. Code GTL
7. Author(s) Grant Farrand, Project Engineer Debbie Messick, Project Manager		8. Performing Organ. Rep# GTL-DOT-08-202-004
9. Performing Organization Name and Address General Testing Laboratories, Inc. 1623 Leedstown Road Colonial Beach, Va 22443		10. Work Unit No. (TRAIS) N/A 11. Contract or Grant No. DTNH22-06-C-00032
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Admin. Enforcement Office of Vehicle Safety Compliance (NVS-220) 1200 New Jersey Ave., S.E., Washington, DC 20590		13. Type of Report and Period Covered Final Test Report November 21, 2008 14. Sponsoring Agency Code NVS-221
15. Supplementary Notes		
16. Abstract Compliance tests were conducted on the subject, 2008 Hyundai Sonata, Passenger Car in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-202-08 for the determination of FMVSS 202 compliance. Test failures identified were as follows: NONE		
17. Key Words Compliance Testing Safety Engineering FMVSS 202	18. Distribution Statement Copies of this report are available from NHTSA Technical Information Services (TIS) Room W45-212 (NPO-411) 1200 New Jersey Ave., S.E. Washington, DC 20590 Telephone No. (202) 366-4947	
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Form DOT F 1700.7 (8-72)

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SECTION 1

PURPOSE OF COMPLIANCE TEST

1.0 PURPOSE OF COMPLIANCE TEST

A 2008 Hyundai Sonata, Passenger Car was subjected to Federal Motor Vehicle Safety Standard (FMVSS) No. 202 testing to determine if the vehicle was in compliance with the requirements of the standard. The purpose of this standard is to establish requirements for head restraints to reduce the frequency and severity of neck injury in rear end and other collisions.

1.1 The test vehicle was a 2008 Hyundai Sonata, Passenger Car. Nomenclature applicable to the test vehicle are:

A. Vehicle Identification Number: 5NPET46C28H355451

B. NHTSA No.: C80507

C. Manufacturer: HYUNDAI MOTOR MANUFACTURING ALABAMA, LLC

D. Manufacture Date: Jul/27/07

1.2 TEST DATE

The test vehicle was subjected to FMVSS No. 202 testing on November 21, 2008.

SECTION 2

COMPLIANCE TEST RESULTS

2.0 TEST RESULTS

All tests were conducted in accordance with NHTSA, Office of Vehicle Safety Compliance (OVSC) Laboratory Procedures, TP-202-08 dated 12 Oct. 1989.

Based on the test performed, the 2008 Hyundai Sonata Passenger Car appeared to meet the requirements of FMVSS 202 testing.

SECTION 3

COMPLIANCE TEST DATA

3.0 TEST DATA

The following data sheets document the results of testing on the 2008 Hyundai Sonata Passenger Car.

DATA SHEET 1
SUMMARY OF RESULTS

VEH. MOD YR/MAKE/MODEL/BODY STYLE: 2008 HYUNDAI SONATA PASSENGER CAR

VEH. NHTSA NO.: C80507 ; VIN: 5NPET46C28H355451

VEH. BUILD DATE: Jul/27/07 ; TEST DATE: November 21, 2008

TEST LABORATORY: GENERAL TESTING LABORATORIES

OBSERVERS: G. FARRAND, J. LATANE

A. VISUAL INSPECTION OF TEST VEHICLE

Upon receipt for completeness, function, and discrepancies or damage which might influence the testing.

RESULTS: OK for testing.

B. DIMENSIONAL REQUIREMENTS	**PASS**	**FAIL**	**N/A**
Driver's Side	X		
Passenger's Side	X		

C. HEAD FORM DISPLACEMENT	**PASS**	**FAIL**
Driver's Side	X	
Passenger's Side	X	

D. HEAD RESTRAINT STRENGTH	**PASS**	**FAIL**	**N/A**
Driver's Side	X		
Passenger's Side	X		

RECORDED BY: G. FARRAND DATE: 11/21/08

APPROVED BY: D. MESSICK

DATA SHEET 2
PRETEST PREPARATION

VEH. MOD YR/MAKE/MODEL/BODY STYLE: 2008 HYUNDAI SONATA PASSENGER CAR

VEH. NHTSA NO.: C80507 ; VIN: 5NPET46C28H355451

VEH. BUILD DATE: Jul/27/07 ; TEST DATE: November 21, 2008

TEST LABORATORY: GENERAL TESTING LABORATORIES

OBSERVERS: G. FARRAND, J. LATANE

MANUFACTURER'S DATA FOR LOCATING SEATING REFERENCE POINT (SRP)

NOTE: Dimensions are obtained from the vehicle manufacturer and provided to the test laboratory by the OVSC COTR.

	DRVR SIDE	PSGR SIDE
Manufacturer's Torso Line Angle (degrees)	25°	25°
SRP Location (inches)		
(Measured from Driver's Front Outboard Seat Track Anchorage Location)		
X (Longitudinal)	345 mm	344 mm
Y (Lateral or Transverse)	240 mm	980 mm
X (Vertical)	215 mm	220 mm

For rearward simulated occupant loading of a front seat head restraint system, seat adjusters(tracks) shall be located in the FULL REARWARD position.

REMARKS:

RECORDED BY: G. FARRAND DATE: 11/21/08

APPROVED BY: D. MESSICK

DATA SHEET 3
DIMENSIONAL REQUIREMENTS

VEH. MOD YR/MAKE/MODEL/BODY STYLE: 2008 HYUNDAI SONATA PASSENGER CAR

VEH. NHTSA NO.: C80507 ; VIN: 5NPET46C28H355451

VEH. BUILD DATE: Jul/27/07 ; TEST DATE: November 21, 2008

TEST LABORATORY: GENERAL TESTING LABORATORIES

OBSERVERS: G. FARRAND, J. LATANE

TEST REQUIREMENT	**DEMONSTRATION REQUIREMENT**	**TEST RESULT**	**Pass**	**Fail**
Provide Head Restraints	Driver's Side	YES	X	
	Passenger's Side	YES	X	
Height Above SRP	≥698 mm	Drvr Side– 833 mm	X	
		Psgr Side- 828 mm	X	
Lateral Width of Head Restraint Measured Either 65 mm below Top OR 635 mm Above SPR (whichever is greater)	Not Less Than--	Driver's Side		
	A. 254 mm(Bench Seat)	A. N/A	N/A	N/A
	B. 158 mm (Bucket Seat)	B. 270 mm	X	
		Passenger's Side		
		A. N/A	N/A	N/A
		B. 270 mm	X	

REMARKS:

RECORDED BY: G. FARRAND DATE: 11/21/08

APPROVED BY: D. MESSICK

DATA SHEET 4 (1 of 2)
HEAD FORM DISPLACEMENT

VEH. MOD YR/MAKE/MODEL/BODY STYLE: 2008 HYUNDAI SONATA PASSENGER CAR

VEH. NHTSA NO.: C80507 ; VIN: 5NPET46C28H355451

VEH. BUILD DATE: Jul/27/07 ; TEST DATE: November 21, 2008

TEST LABORATORY: GENERAL TESTING LABORATORIES

OBSERVERS: G. FARRAND, J. LATANE

TEST REQUIREMENT	DEMONSTRATION REQUIREMENT	TEST DATA	Pass	Fail
Torso Line Angle (Unloaded)	Measure Using Test Device OR Data Provided by COTR	Drvr Side 25°	N/A	N/A
		Psgr Side 25°	N/A	N/A
Displaced Torso Line Angle	S202, 5.2(b)	Drvr Side 39.8°	N/A	N/A
		Psgr Side 40.1°	N/A	N/A
	Force(lbs) req'd to Provide 373Nm Moment to Back Pan	Drvr Side 1286 N	N/A	N/A
		Psgr Side 1286 N	N/A	N/A
	Distance from SRP to Load Application on Back Pan (meters)	Drvr Side .29 M	N/A	N/A
		Psgr Side .29 M	N/A	N/A
Displacement of Head Form Rearward of Displaced Torso Line when loaded to 373Nm Moment 65 mm below Top of Head Restraint	Shall not be displaced more than 102 mm rearward of Displaced Extended Torso Line	Drvr Side -29 mm*	X	
		Psgr Side -14 mm*	X	N/A
	Distance from SRP to Point on Head Form where load is applied (meters)	Drvr Side .83 M	N/A	N/A
		Psgr Side .83 M	N/A	N/A

DATA SHEET 4 (2 of 2)
HEAD FORM DISPLACEMENT

TEST REQUIREMENT	DEMONSTRATION REQUIREMENT	TEST DATA	Pass	Fail
Displacement of Head Form Rearward of Displaced Torso Line when loaded to 373Nm Moment 65 mm below top of head restraint	Force applied to head form to produce 373 Nm moment (lbs)	Drvr Side 449 N Psgr Side 449 N	N/A N/A	N/A N/A

REMARKS: * = Before reaching displaced torso line.

TEST # 6125 – Driver Side Back Pan
6126 – Driver Side Head Form
6127 – Passenger Side Back Pan
6128 – Passenger Side Head Form

RECORDED BY: G. FARRAND DATE: 11/21/08

APPROVED BY: D. MESSICK

DATA SHEET 5
OWNER'S MANUAL

VEH. MOD YR/MAKE/MODEL/BODY STYLE: 2008 HYUNDAI SONATA PASSENGER CAR

VEH. NHTSA NO.: C80507 ; VIN: 5NPET46C28H355451

VEH. BUILD DATE: Jul/27/07 ; TEST DATE: November 21, 2008

TEST LABORATORY: GENERAL TESTING LABORATORIES

OBSERVERS: G. FARRAND, J. LATANE

Results of increased load application to 199.5 lbs. OR until failure occurs:

_____ Head Restraint Failure at _____lbs

_____ Seat or Seat Belt Failure at _____lbs

__X__ Application of 890 N WITHOUT failure

Describe failure, if encountered, below. If permanent head restraint or seat back deformation is observed, describe below.

REMARKS:

RECORDED BY: G. FARRAND DATE: 11/21/08

APPROVED BY: D. MESSICK

SECTION 4
INSTRUMENTATION AND EQUIPMENT LIST

TABLE 1 – INSTRUMENTATION & EQUIPMENT LIST

EQUIPMENT	DESCRIPTION	MODEL/ SERIAL NO.	CAL. DATE	NEXT CAL. DATE
HRMD	RONA KINETICS & ASSOCIATES LTD.	HRMD 0-62	N/A	N/A
J826 MANIKIN	ALDERSON RESEARCH LABS	3 DM/92	N/A	N/A
DIGITAL PROTRACTOR	MITUTOYO	950-315 PRO 360	BEFORE USE	BEFORE USE
RULE/SCALE	STARRET	C331		
TORPEDO LEVEL	SANDS	500	BEFORE USE	BEFORE USE
FORCE GAUGE	CHATILLON	DPPN-50 870	BEFORE USE	BEFORE USE
CALIPER	STARRET	N/A	BEFORE USE	BEFORE USE
LEVEL, LASER	BLACK & DECKER	360	BEFORE USE	BEFORE USE
LEVEL, LASER	SEAN & STEPHEN CORP	90º, 45º	BEFORE USE	BEFORE USE
LEVEL, LASER	GAERTNER	2789-A	BEFORE USE	BEFORE USE
ACCELEROMETER	ENDEVCO	F209	11/08	11/09
LOAD CELL	SENSOTEC	257818	01/08	01/09
LOAD CELL	INTERFACE	27246	05/08	05/09
STRING POT	WALDALE	102	BEFORE USE	BEFORE USE
STRING POT	CELESCO	69	BEFORE USE	BEFORE USE

SECTION 5
PHOTOGRAPHS

2008 HYUNDAI SONATA
NHTSA NO. C80507
FMVSS NO. 202a

FIGURE 5.1
LEFT SIDE VIEW OF VEHICLE

2008 HYUNDAI SONATA
NHTSA NO. C80507
FMVSS NO. 202a

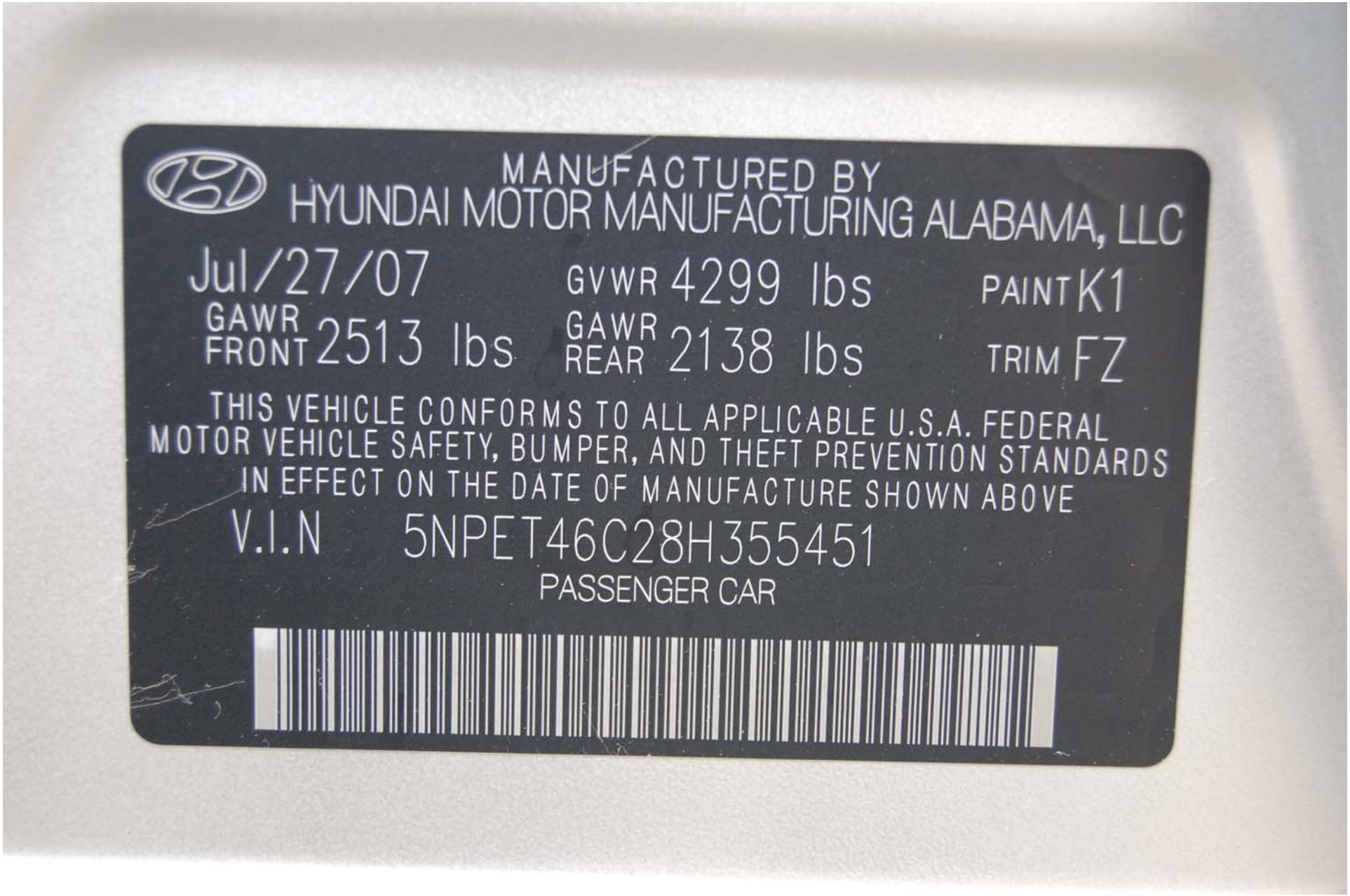
FIGURE 5.2
RIGHT SIDE VIEW OF VEHICLE

2008 HYUNDAI SONATA
NHTSA NO. C80507
FMVSS NO. 202a

FIGURE 5.3
¾ FRONTAL VIEW FROM LEFT SIDE OF VEHICLE

2008 HYUNDAI SONATA
NHTSA NO. C80507
FMVSS NO. 202a

FIGURE 5.4
¾ REAR VIEW FROM RIGHT SIDE OF VEHICLE



2008 HYUNDAI SONATA
NHTSA NO. C80507
FMVSS NO. 202a

FIGURE 5.5
VEHICLE CERTIFICATION LABEL

2008 HYUNDAI SONATA
NHTSA NO. C80507
FMVSS NO. 202a

FIGURE 5.6
VEHICLE TIRE INFORMATION LABEL

2008 HYUNDAI SONATA
NHTSA NO. C80507
FMVSS NO. 202a

FIGURE 5.7
DRIVER SEAT HEAD RESTRAINT

2008 HYUNDAI SONATA
NHTSA NO. C80507
FMVSS NO. 202a

FIGURE 5.8
TYPICAL HEAD RESTRAINT ADJUSTMENT BUTTON

2008 HYUNDAI SONATA
NHTSA NO. C80507
FMVSS NO. 202a

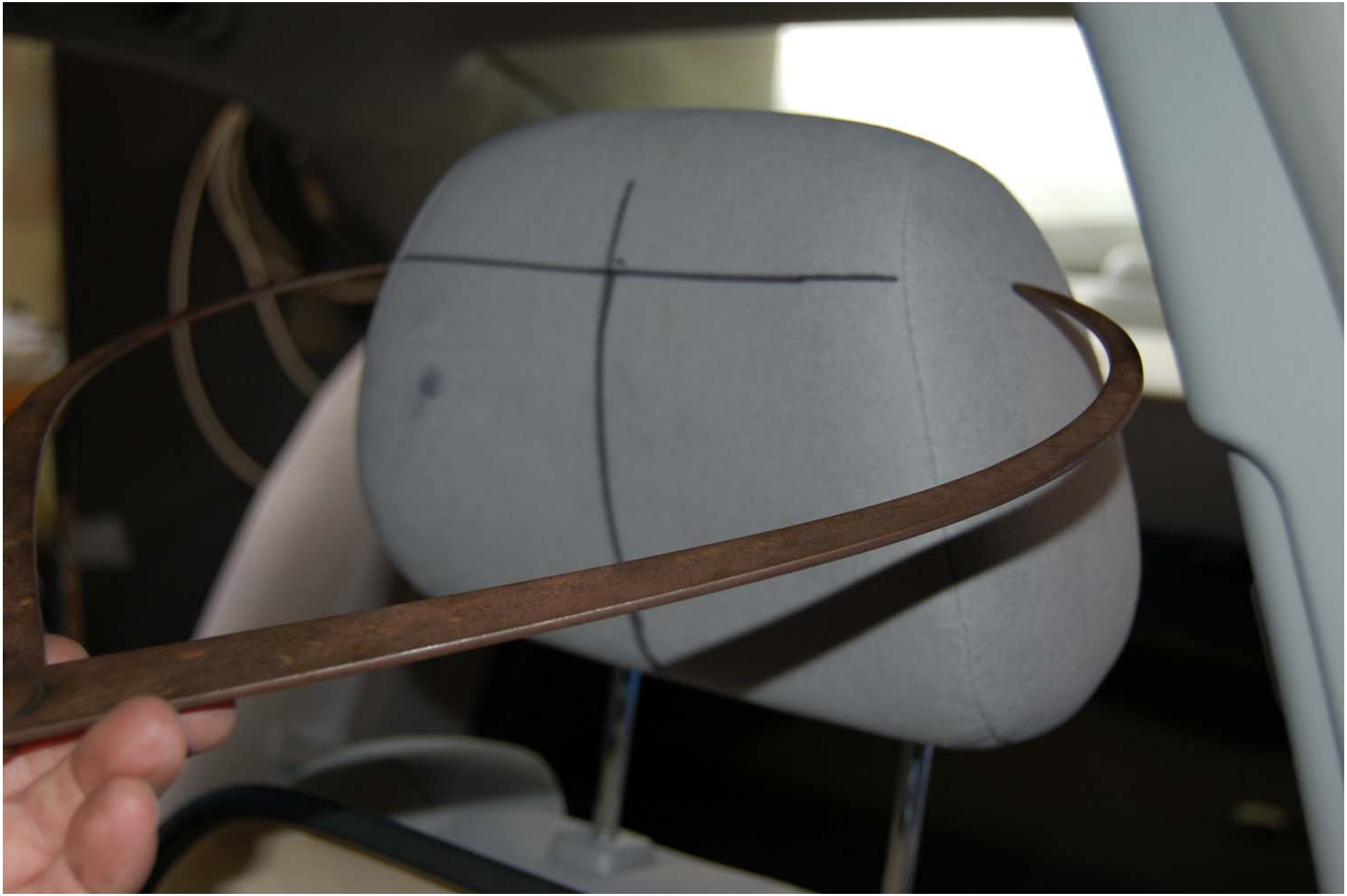
FIGURE 5.9
PASSENGER SEAT HEAD RESTRAINT

2008 HYUNDAI SONATA
NHTSA NO. C80507
FMVSS NO. 202a

FIGURE 5.10
J826 MANIKIN POSITIONED IN DRIVERS SEAT

2008 HYUNDAI SONATA
NHTSA NO. C80507
FMVSS NO. 202a

FIGURE 5.11
DRIVERS HEAD RESTRAINT IN HIGHEST POSITION



2008 HYUNDAI SONATA
NHTSA NO. C80507
FMVSS NO. 202a

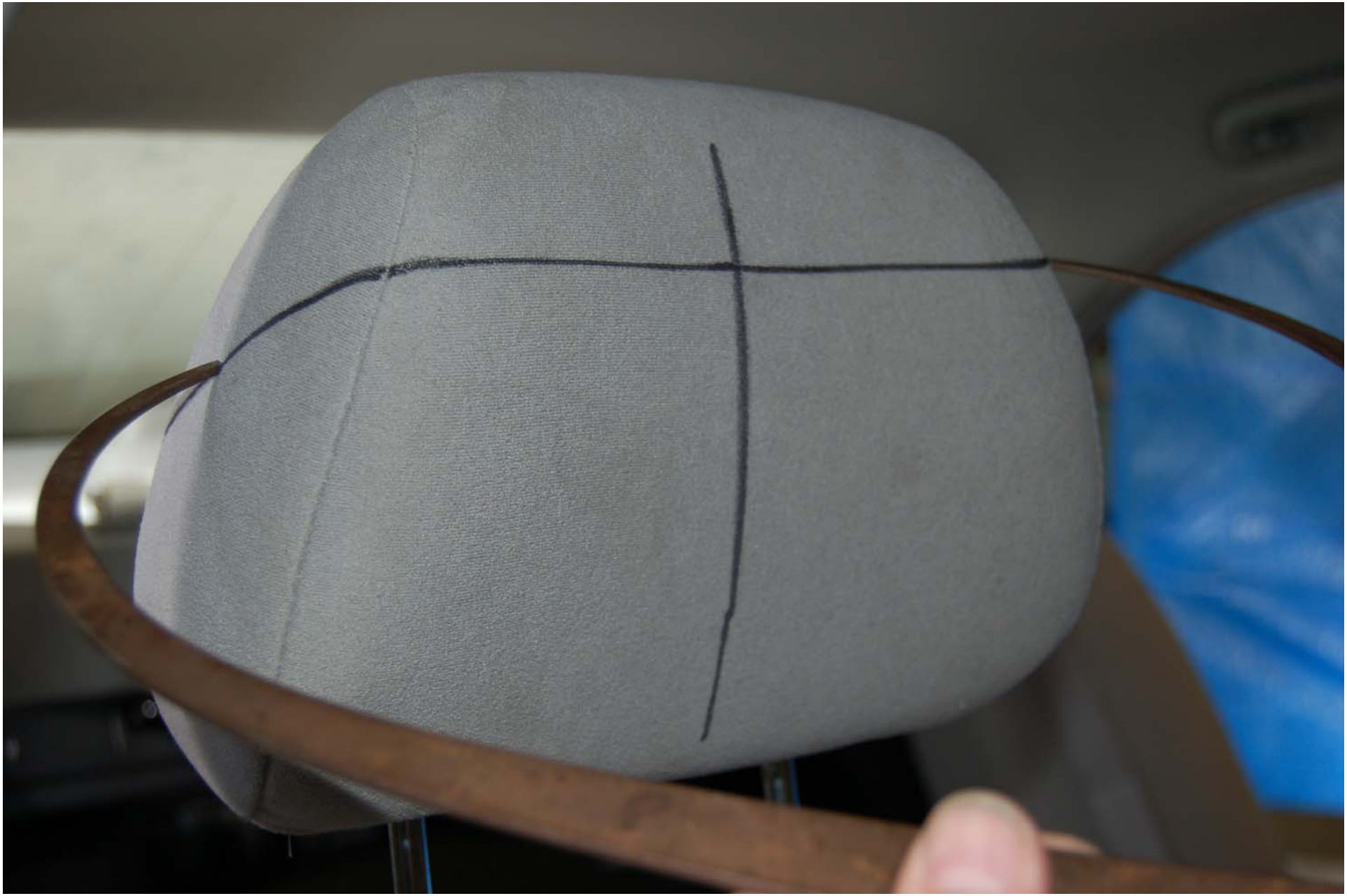
FIGURE 5.12
DRIVERS HEAD RESTRAINT IN HIGHEST POSITION

2008 HYUNDAI SONATA
NHTSA NO. C80507
FMVSS NO. 202a

FIGURE 5.13
J826 MANIKIN POSITIONED IN PASSENGER SEAT

2008 HYUNDAI SONATA
NHTSA NO. C80507
FMVSS NO. 202a

FIGURE 5.14
PASSENGER HEAD RESTRAINT IN HIGHEST POSITION



2008 HYUNDAI SONATA
NHTSA NO. C80507
FMVSS NO. 202a

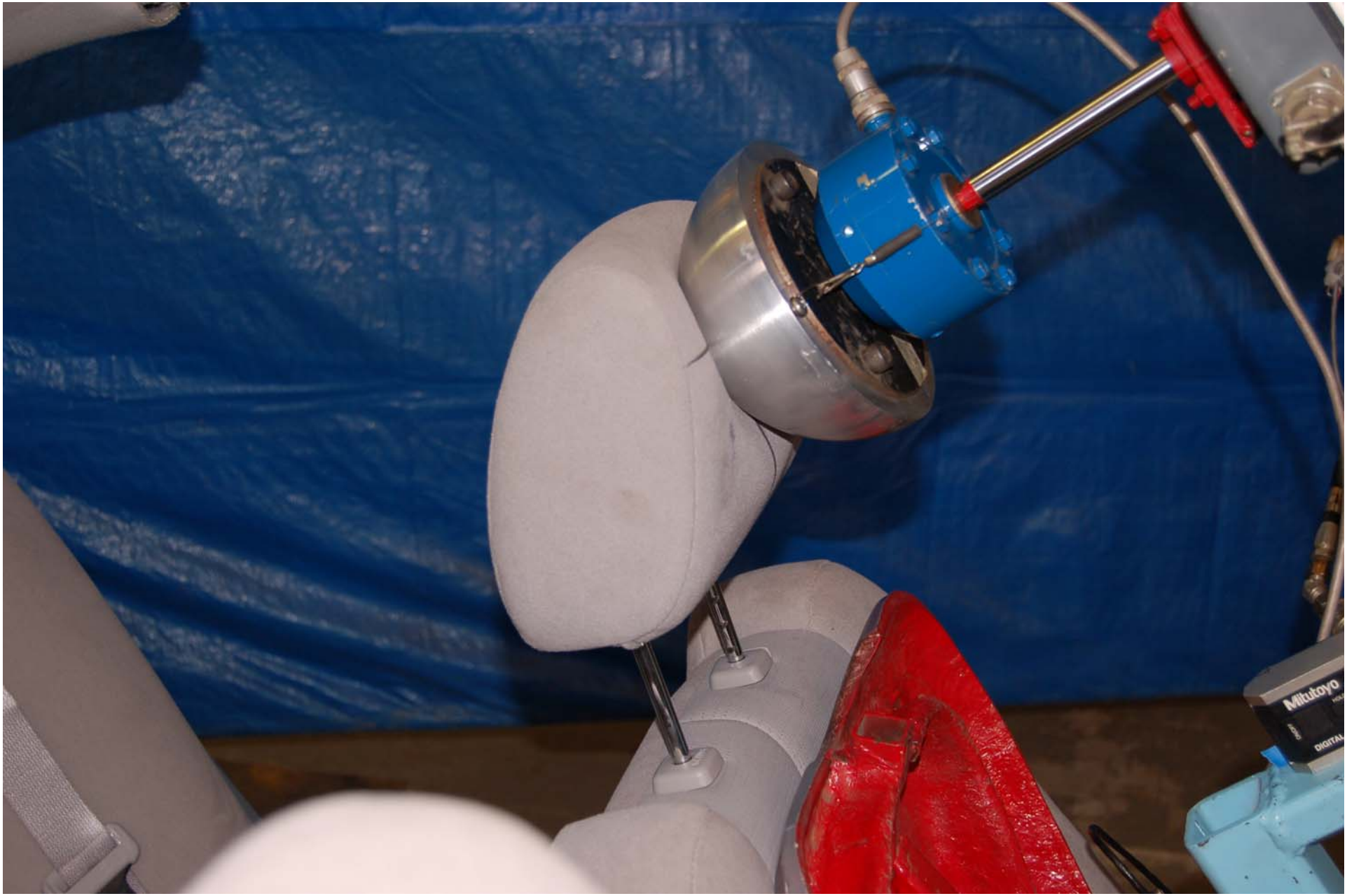
FIGURE 5.15
PASSENGER HEAD RESTRAINT WIDTH MEASUREMENT

2008 HYUNDAI SONATA
NHTSA NO. C80507
FMVSS NO. 202a

FIGURE 5.16
PRE-TEST SET-UP FOR DRIVER SEAT TEST

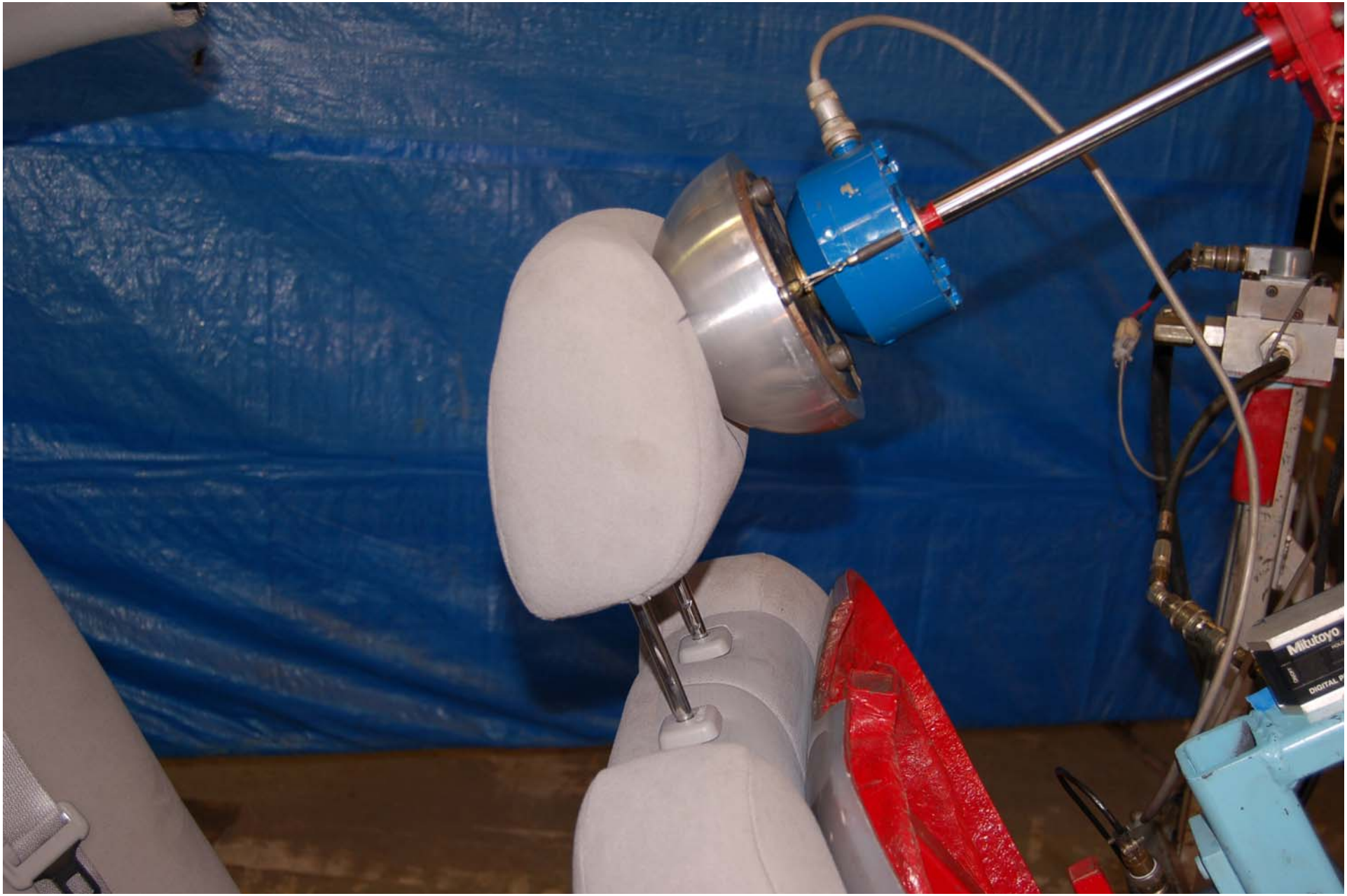
2008 HYUNDAI SONATA
NHTSA NO. C80507
FMVSS NO. 202a

FIGURE 5.17
BACK PAN LOADING FOR DISPLACED TORSO LINE



2008 HYUNDAI SONATA
NHTSA NO. C80507
FMVSS NO. 202a

FIGURE 5.18
HEAD RESTRAINT WITH 373 Nm LOAD

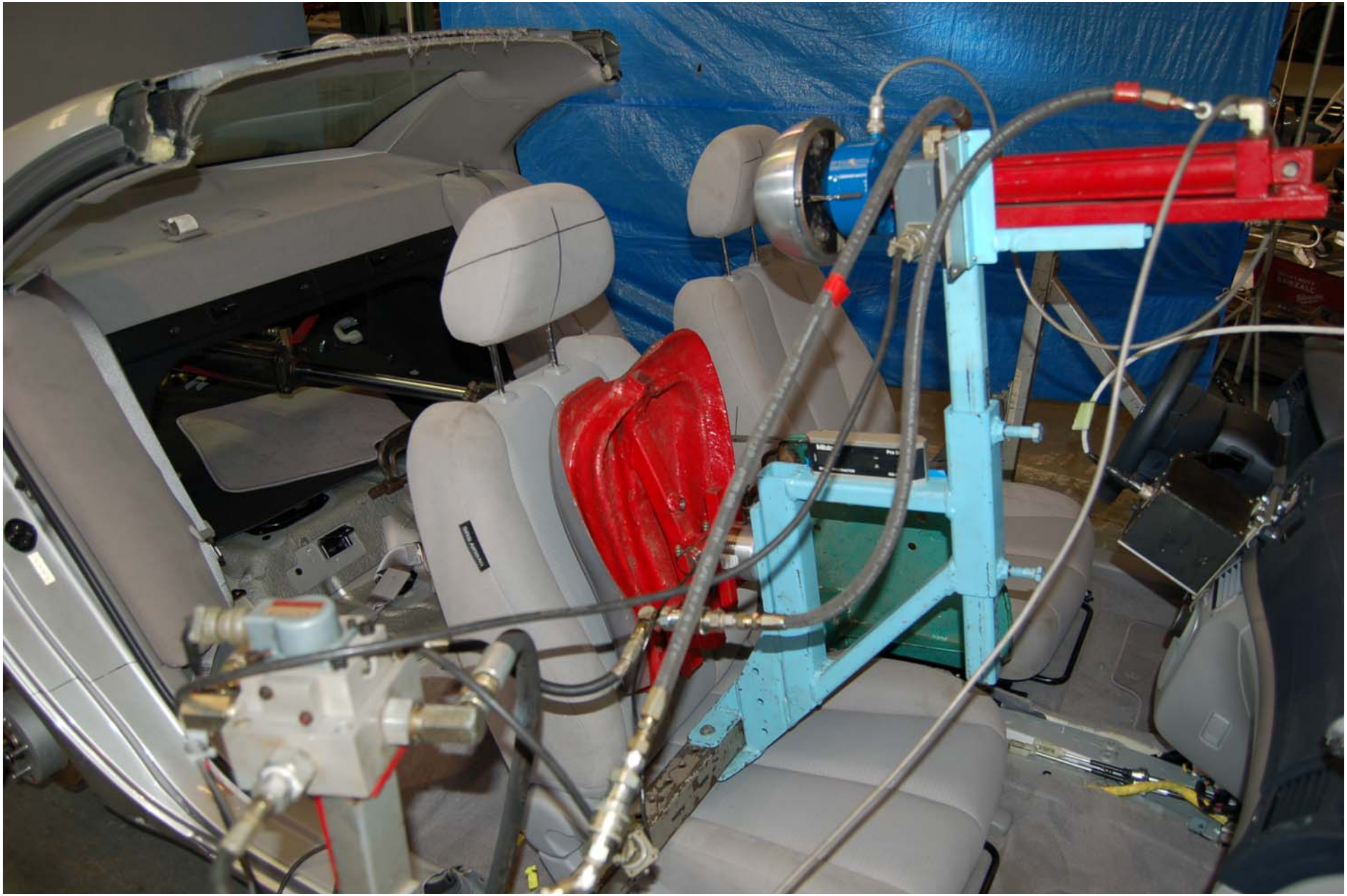


2008 HYUNDAI SONATA
NHTSA NO. C80507
FMVSS NO. 202a

FIGURE 5.19
HEAD RESTRAINT WITH 895 N LOAD

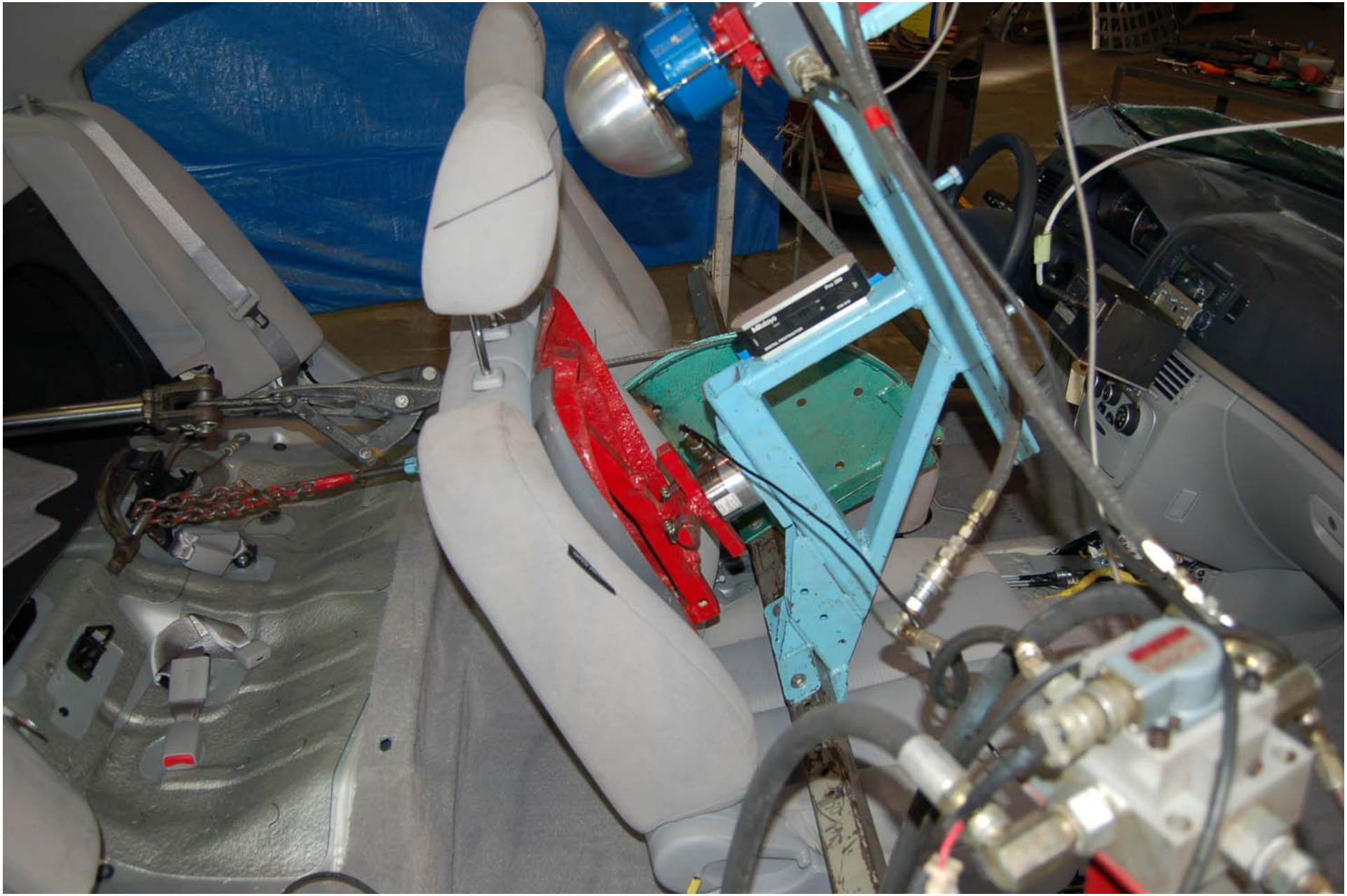
2008 HYUNDAI SONATA
NHTSA NO. C80507
FMVSS NO. 202a

FIGURE 5.20
POST TEST DRIVER SEAT



2008 HYUNDAI SONATA
NHTSA NO. C80507
FMVSS NO. 202a

FIGURE 5.21
PRE-TEST SET-UP FOR PASSENGER SEAT TEST

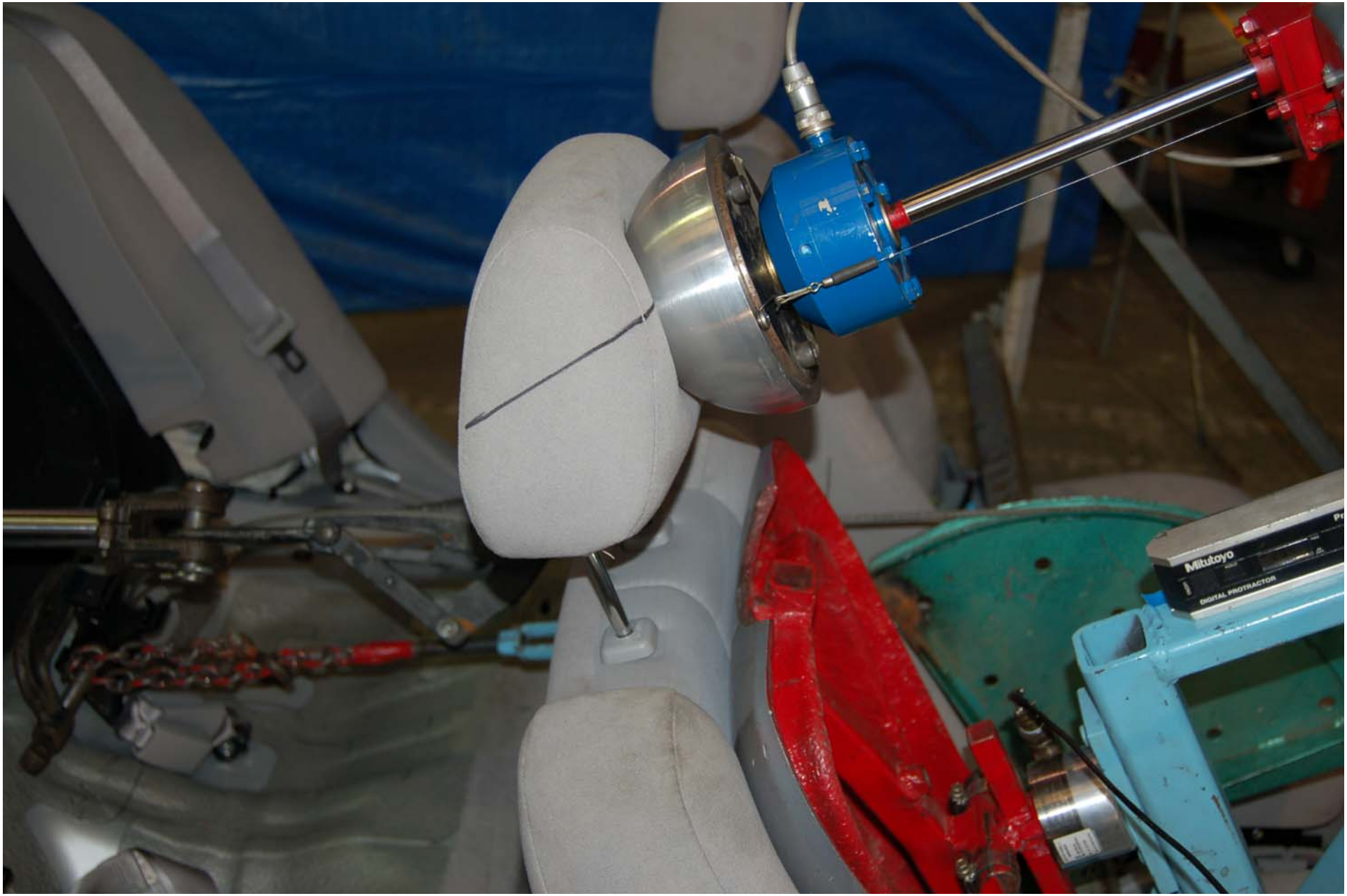


2008 HYUNDAI SONATA
NHTSA NO. C80507
FMVSS NO. 202a

FIGURE 5.22
BACK PAN LOADING FOR DISPLACED TORSO LINE

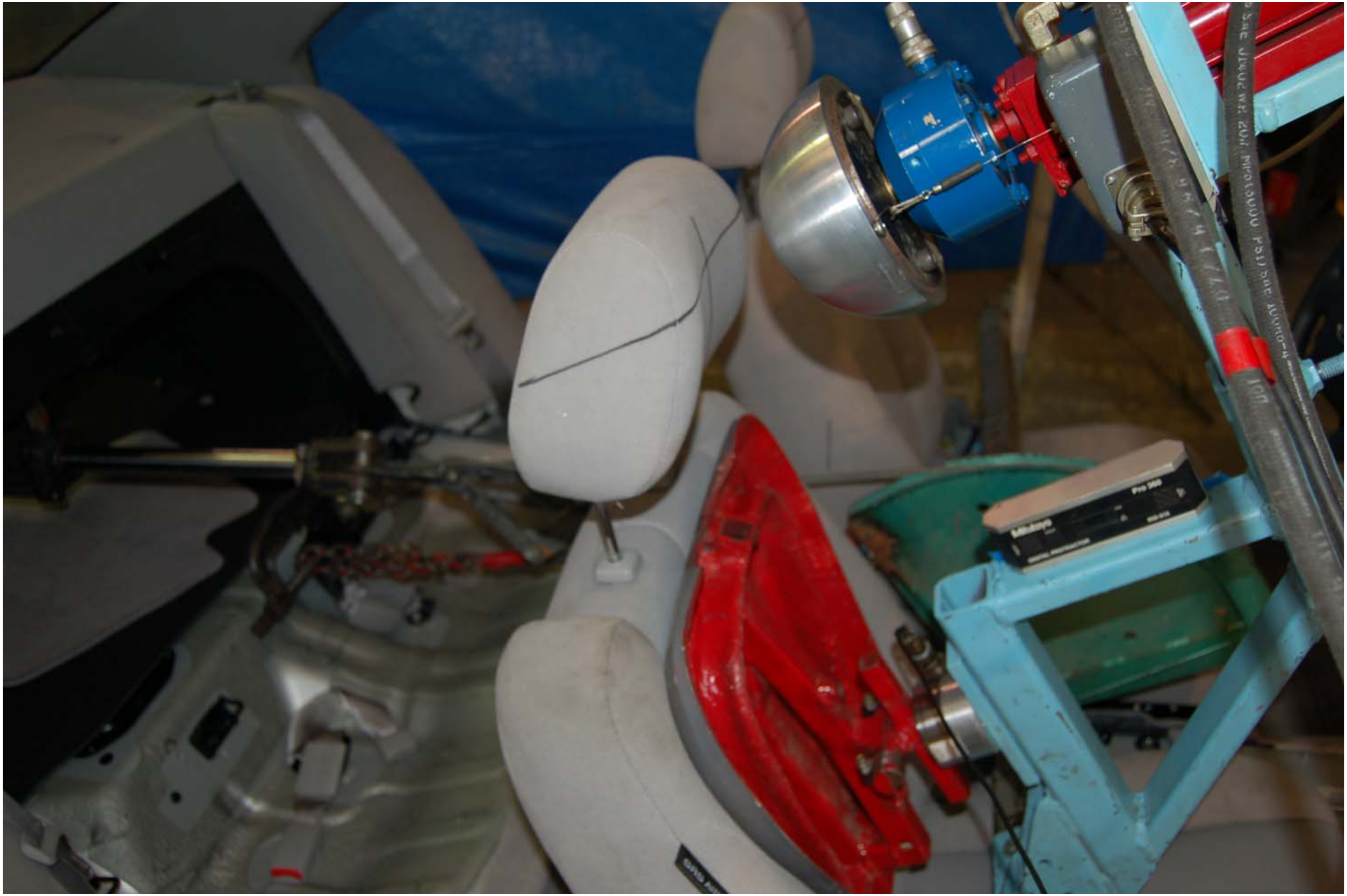
2008 HYUNDAI SONATA
NHTSA NO. C80507
FMVSS NO. 202a

FIGURE 5.23
HEAD RESTRAINT WITH 373 Nm LOAD



2008 HYUNDAI SONATA
NHTSA NO. C80507
FMVSS NO. 202a

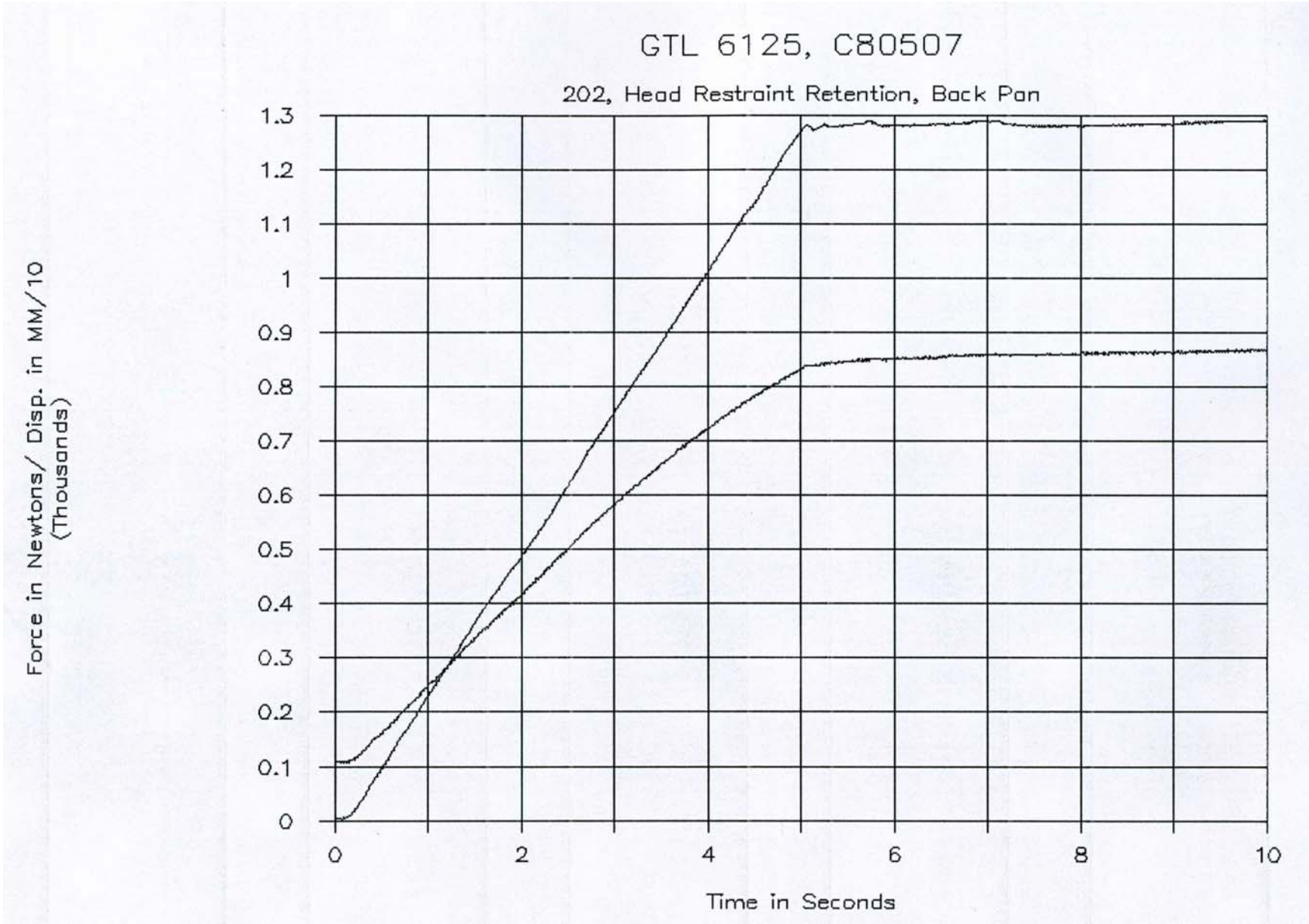
FIGURE 5.24
HEAD RESTRAINT WITH 895 N LOAD

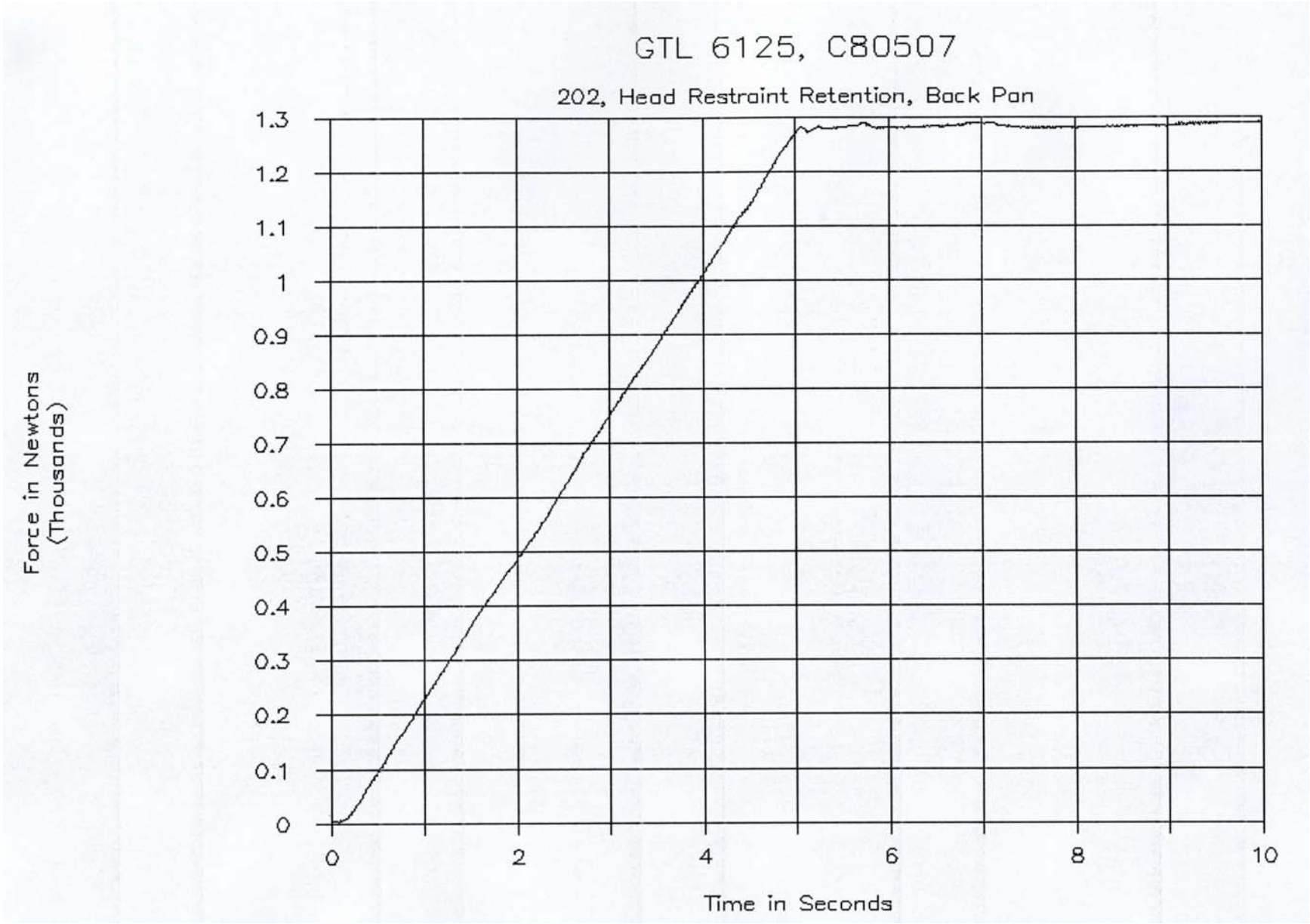


2008 HYUNDAI SONATA
NHTSA NO. C80507
FMVSS NO. 202a

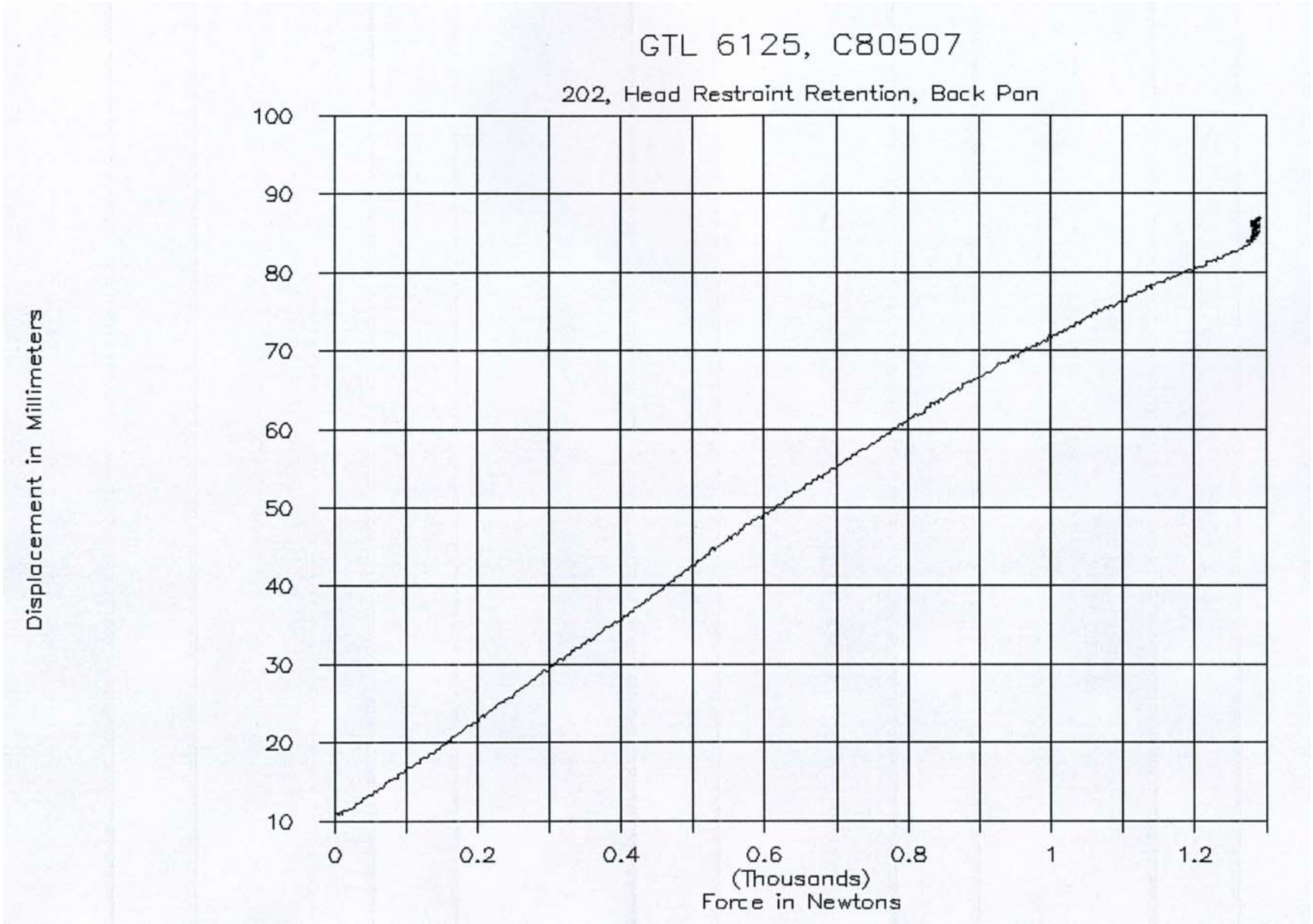
FIGURE 5.25
POST TEST PASSENGER SEAT

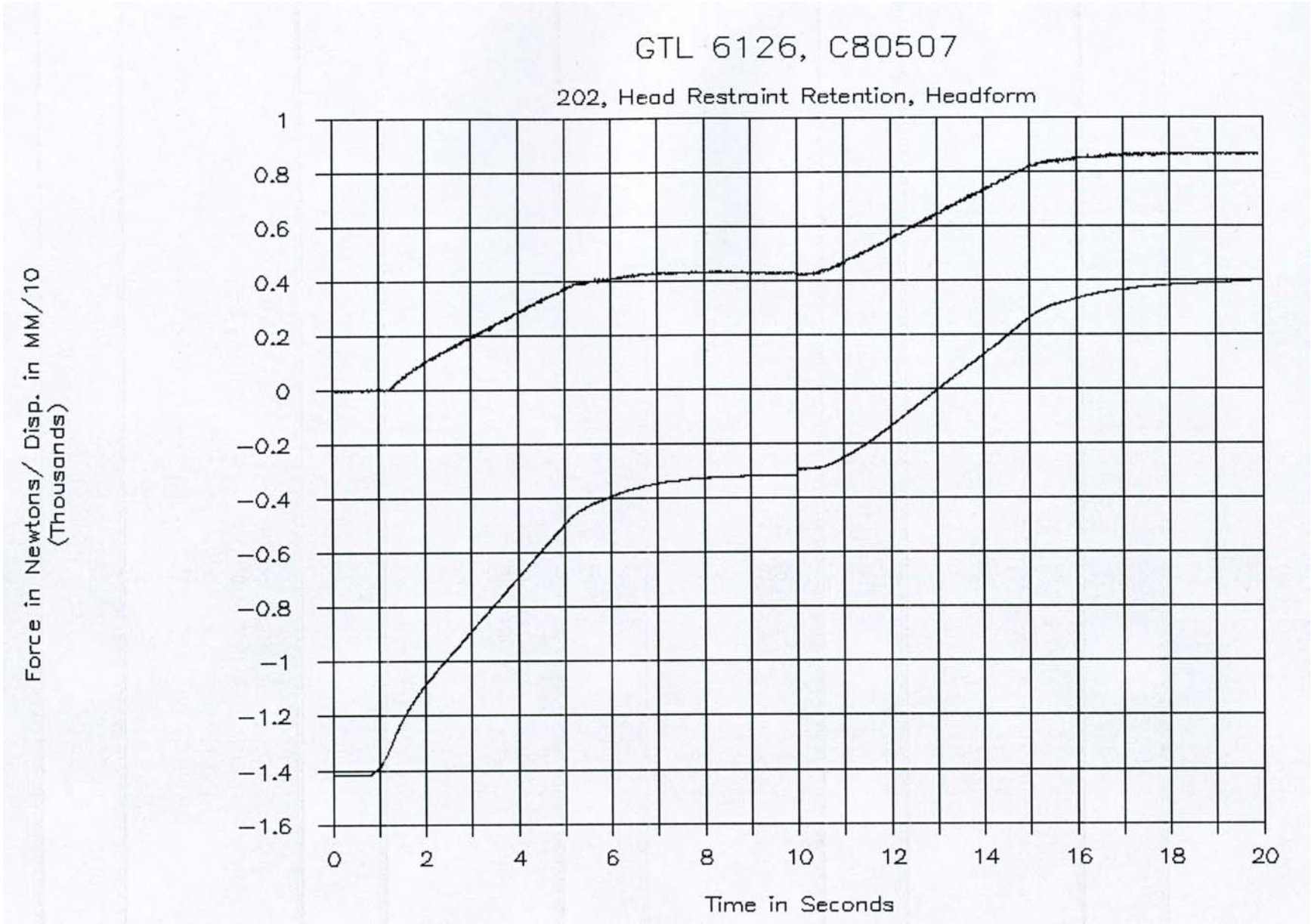
SECTION 6
TEST PLOTS

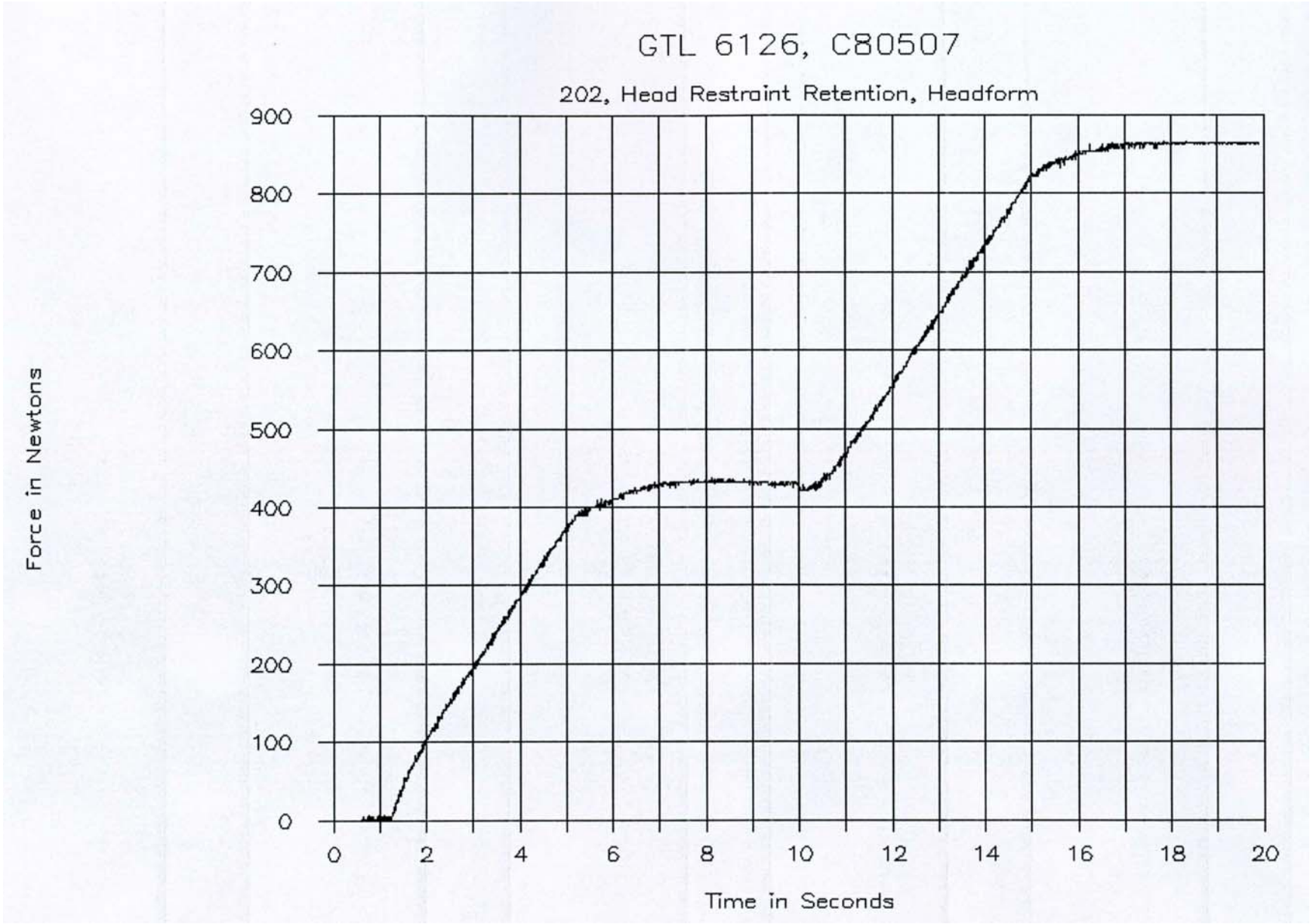

GTL 6125, C80507
202, Head Restraint Retention, Back Pan
Force in Newtons/ Disp. in MM/10
(Thousands)
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
2
4
6
8
10
Time in Seconds

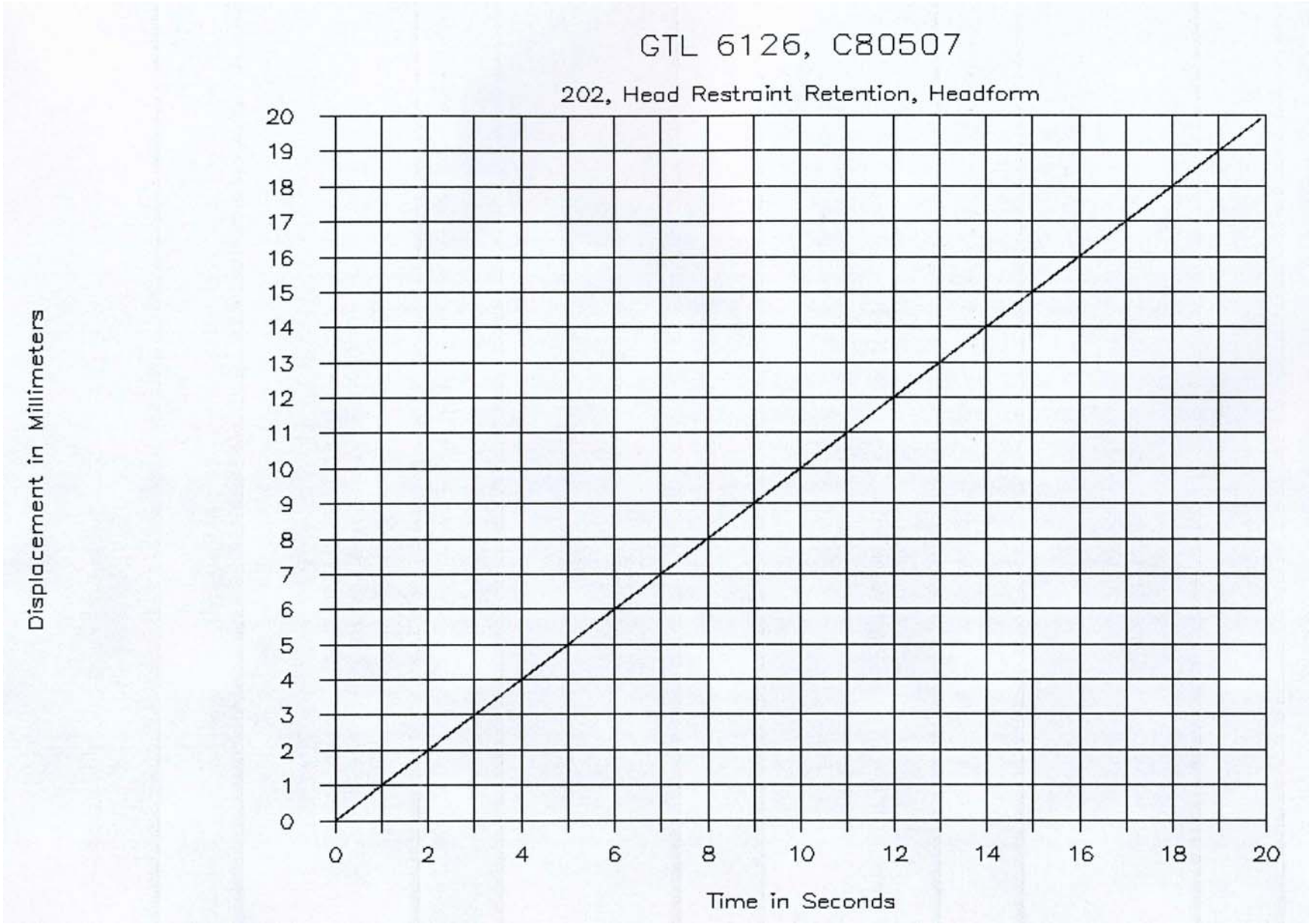

GTL 6125, C80507
202, Head Restraint Retention, Back Pan
Force in Newtons
(Thousands)
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
2
4
6
8
10
Time in Seconds


GTL 6125, C80507
202, Head Restraint Retention, Back Pan
Force in Newtons
90
80
70
60
50
40
30
20
10
0
2
4
6
8
10
Time in Seconds

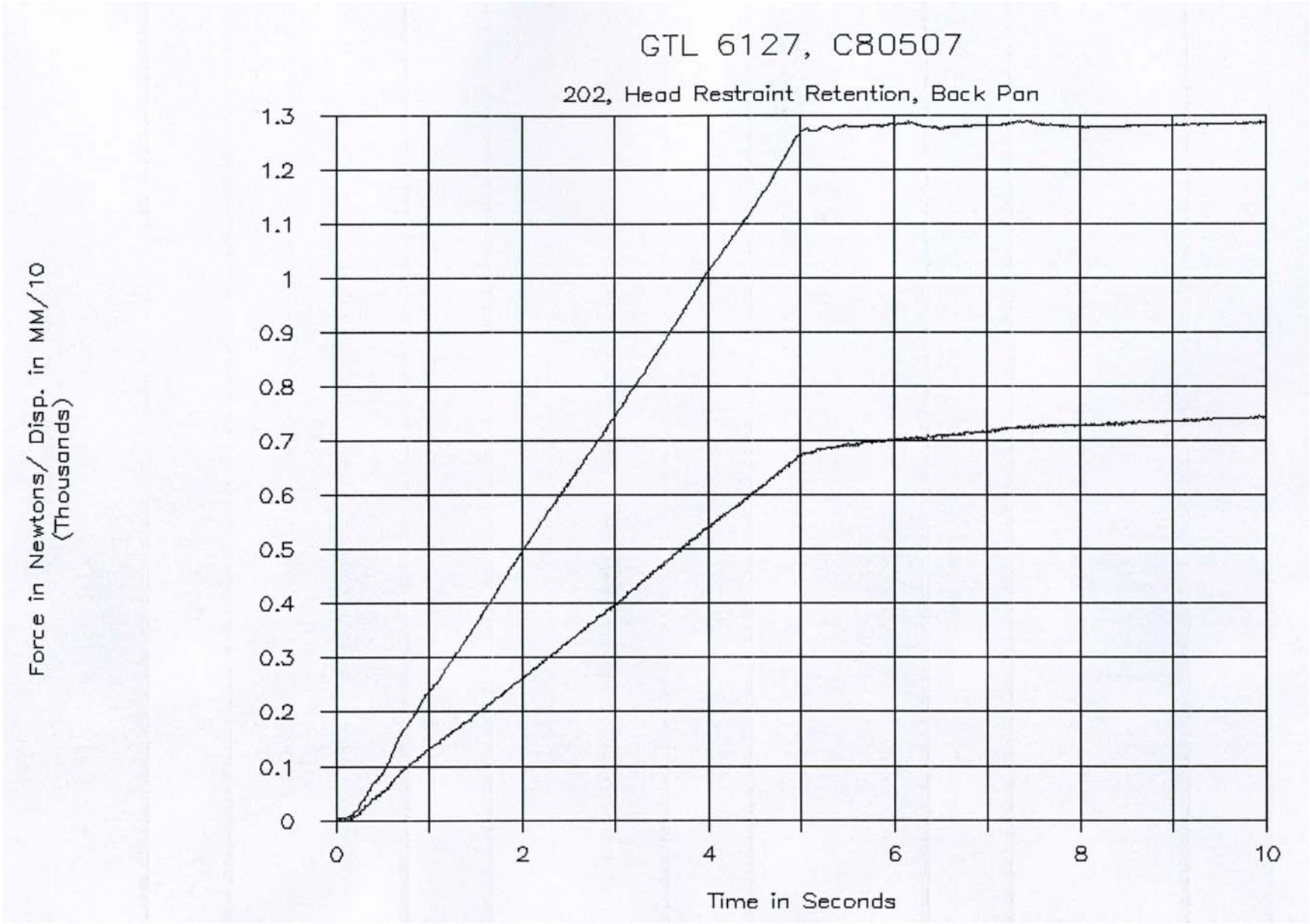

GTL 6125, C80507
202, Head Restraint Retention, Back Pan
Displacement in Millimeters
100
90
80
70
60
50
40
30
20
10
0
0.2
0.4
0.6
0.8
1
1.2
(Thousands)
Force in Newtons

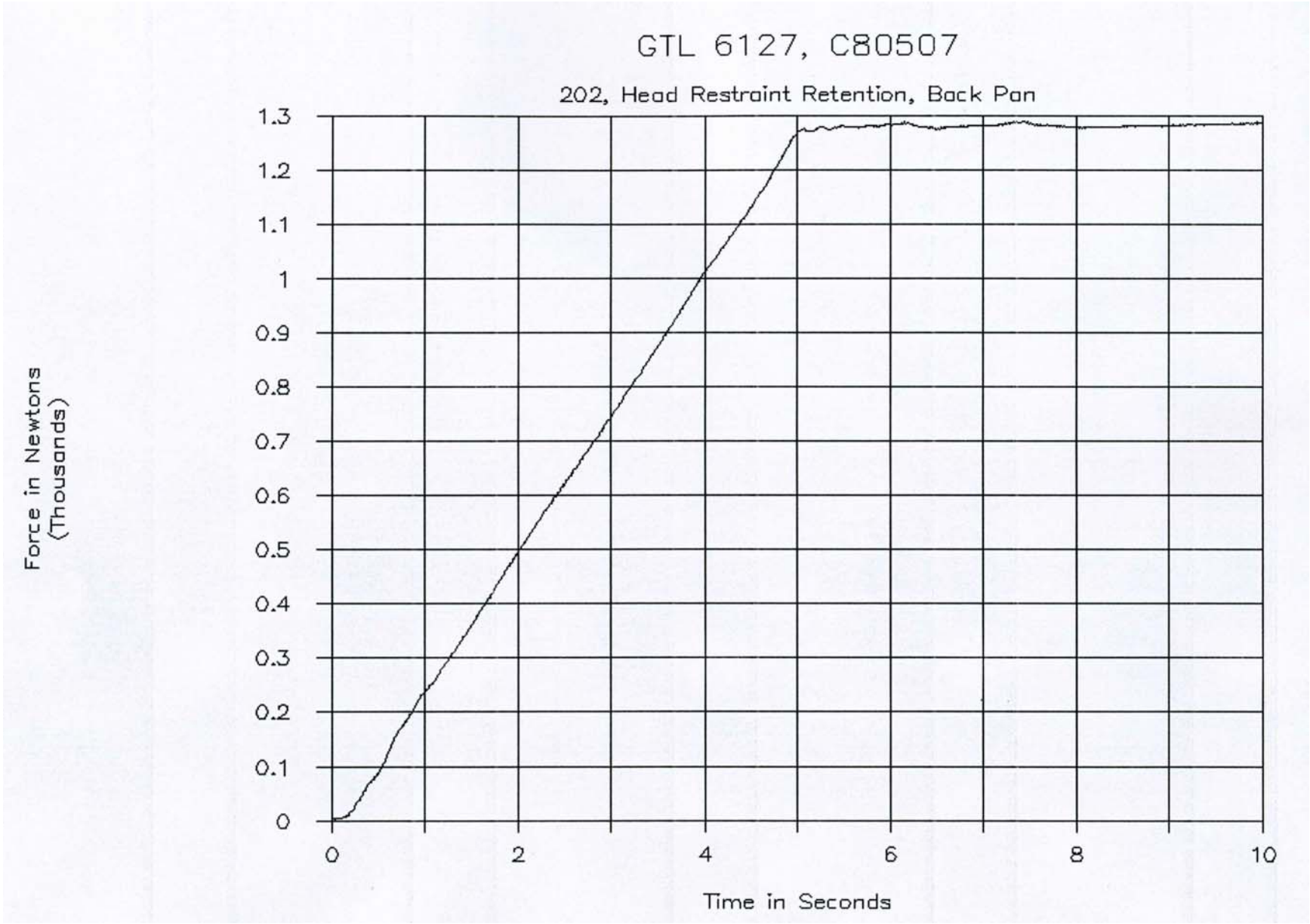

GTL 6126, C80507
202, Head Restraint Retention, Headform
Force in Newtons/ Disp. in MM/10
(Thousands)
1
0.8
0.6
0.4
0.2
0
−0.2
−0.4
−0.6
−0.8
−1
−1.2
−1.4
−1.6
0
2
4
6
8
10
12
14
16
18
20
Time in Seconds


GTL 6126, C80507
202, Head Restraint Retention, Headform
Force in Newtons
900
800
700
600
500
400
300
200
100
0
0
2
4
6
8
10
12
14
16
18
20
Time in Seconds


GTL 6126, C80507
202, Head Restraint Retention, Headform
Displacement in Millimeters
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
0
2
4
6
8
10
12
14
16
18
20
Time in Seconds

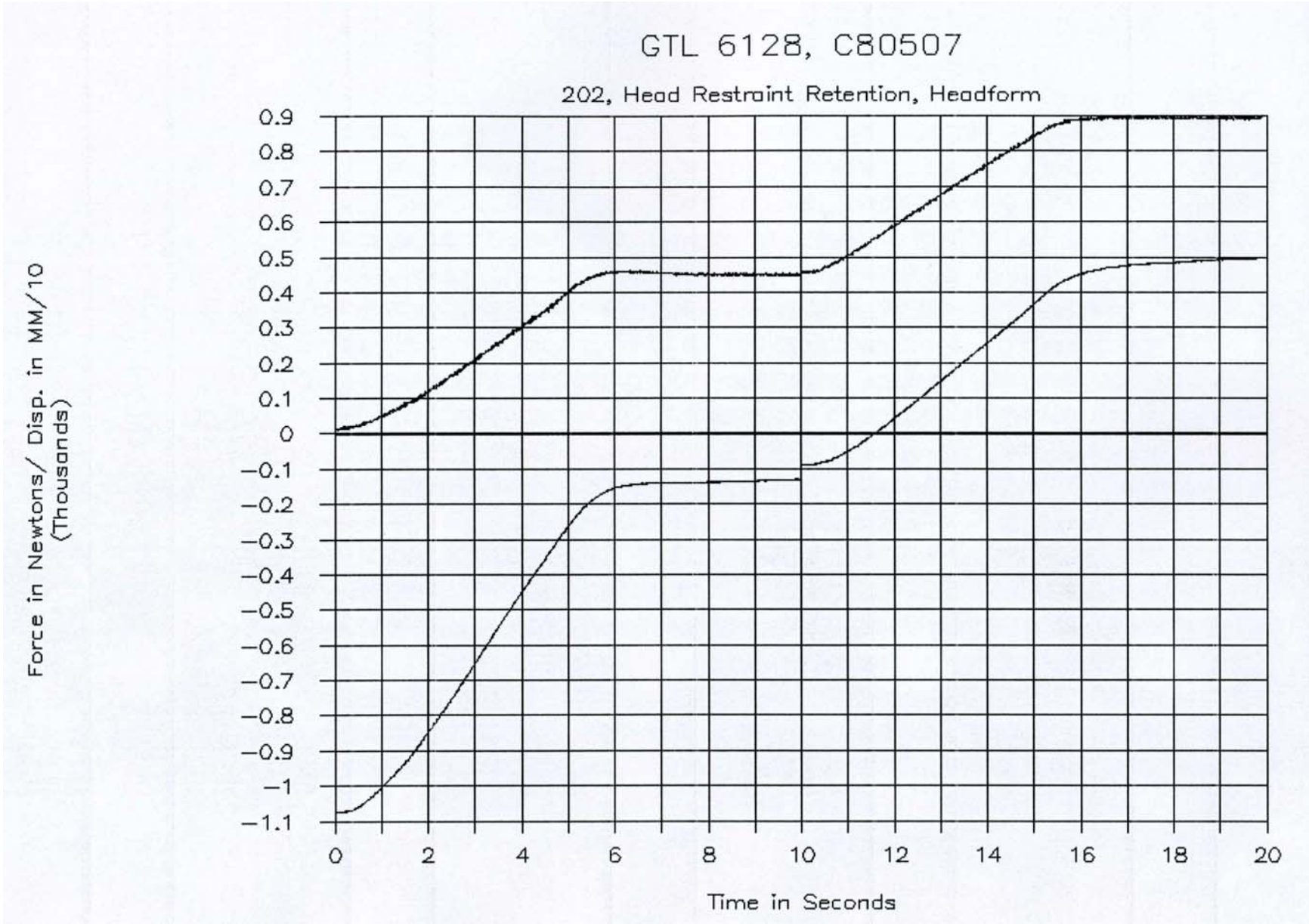

GTL 6126, C80507
202, Head Restraint Retention, Headform
Displacement in Millimeters
40
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
−100
−110
−120
−130
−140
−150
0
200
400
600
800
Force in Newtons


GTL 6127, C80507
202, Head Restraint Retention, Back Pan
Force in Newtons/ Disp. in MM/10
(Thousands)
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
2
4
6
8
10
Time in Seconds

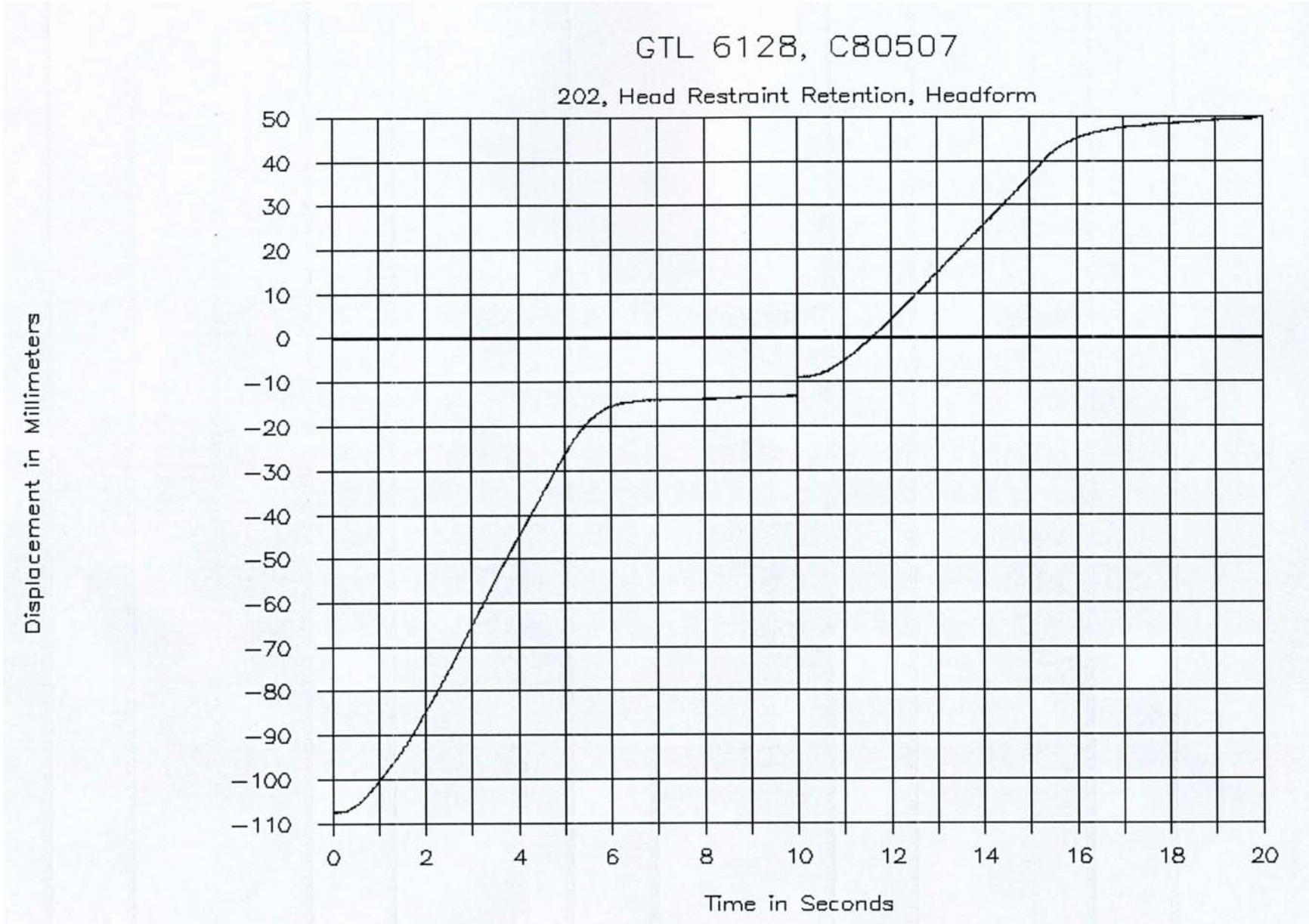

GTL 6127, C80507
202, Head Restraint Retention, Back Pan
Force in Newtons
(Thousands)
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
2
4
6
8
10
Time in Seconds


GTL 6127, C80507
202, Head Restraint Retention, Back Pan
Displacement in Millimeters
80
70
60
50
40
30
20
10
0
0
2
4
6
8
10
Time in Seconds


GTL 6127, C80507
202, Head Restraint Retention, Back Pan
Displacement in Millimeters
80
70
60
50
40
30
20
10
0
0
0.2
0.4
0.6
0.8
1
1.2
(Thousands)
Force in Newtons


GTL 6128, C80507
202, Head Restraint Retention, Headform
Force in Newtons/ Disp. in MM/10
(Thousands)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
−0.1
−0.2
−0.3
−0.4
−0.5
−0.6
−0.7
−0.8
−0.9
−1
−1.1
0
2
4
6
8
10
12
14
16
18
20
Time in Seconds


GTL 6128, C80507
202, Head Restraint Retention, Headform
Force in Newtons
900
800
700
600
500
400
300
200
100
0
0
2
4
6
8
10
12
14
16
18
20
Time in Seconds


GTL 6128, C80507
202, Head Restraint Retention, Headform
Displacement in Millimeters
50
40
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
−100
−110
0
2
4
6
8
10
12
14
16
18
20
Time in Seconds


GTL 6128, C80507
202, Head Restraint Retention, Headform
Displacement in Millimeters
50
40
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
−100
−110
0
200
400
600
800
Force in Newtons

SECTION 7
OWNER'S MANUAL INFORMATION

B080C02A-AAT

Adjusting Seatback Angle

HNF2033

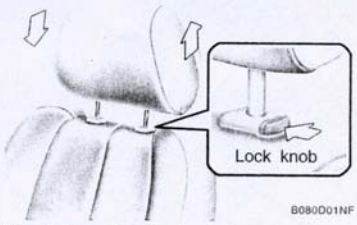
To recline the seatback, lean forward to take your weight off it, then pull up on the recliner control lever at the outside edge of the seat. Now lean back until the desired seatback angle is achieved. To lock the seatback into position, release the recliner control lever.

WARNING:

Riding with a reclined seatback increases your chance of serious or fatal injuries in the event of a collision or sudden stop. The protection of your restraint system (seat belts and airbags) is greatly reduced by reclining your seat. Seat belts must be snug against your hips and chest to work properly. The more the seatback is reclined, the greater the chance that an occupant's hips will slide under the lap belt or the occupant's neck will strike the shoulder belt. Drivers and passengers should always sit well back in their seats, properly belted, and with the seatbacks upright.

B080D02JM-AAT

Adjustable Headrests



B080D01NF

Headrests are designed to help reduce the risk of neck injuries.

To raise the headrest, pull it up. To lower the headrest, push it down while pressing the lock knob. To remove the headrest, raise it as far as it can go then press the lock knob while pulling upward. This should only be done when the seat is not occupied.

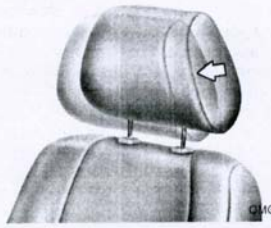
WARNING:

B080D01JM

- **For maximum effectiveness in case of an accident the headrest should be adjusted so the middle of the headrest is at the same height as the top of the occupant's eyes. For this reason, the use of a cushion that holds the body away from the seatback is not recommended.**
- **Do not operate the vehicle with the headrests removed as injury to the occupants may occur in the event of an accident. Headrests may provide protection against neck injuries when properly adjusted.**
- **Do not adjust the headrest height while the vehicle is in motion.**

B081D01NF-AAT

Adjusting Headrest Forward and Rearward



OMG035101

The headrest may be adjusted forward to three different positions by pulling the headrest forward. To adjust the headrest rearward, pull it fully forward to the farthest position and release it. Adjust the headrest so that it properly supports the head and neck.

B083D01NF-AAT

Active Headrests

HNF2041-1

The active headrest is designed to move forward and upward during a rear impact. This helps to prevent the driver's and front passenger's head from moving backward and thus helps prevent neck injuries.