REPORT NUMBER 124-GTL-07-002

SAFETY COMPLIANCE TESTING FOR FMVSS 124 ACCELERATOR CONTROL SYSTEMS

VOLKSWAGEN AG GERMANY
2007 VOLKSWAGEN RABBIT,
4-DOOR PASSENGER CAR
NHTSA NO. C75800

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

NOVEMBER 27, 2007

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
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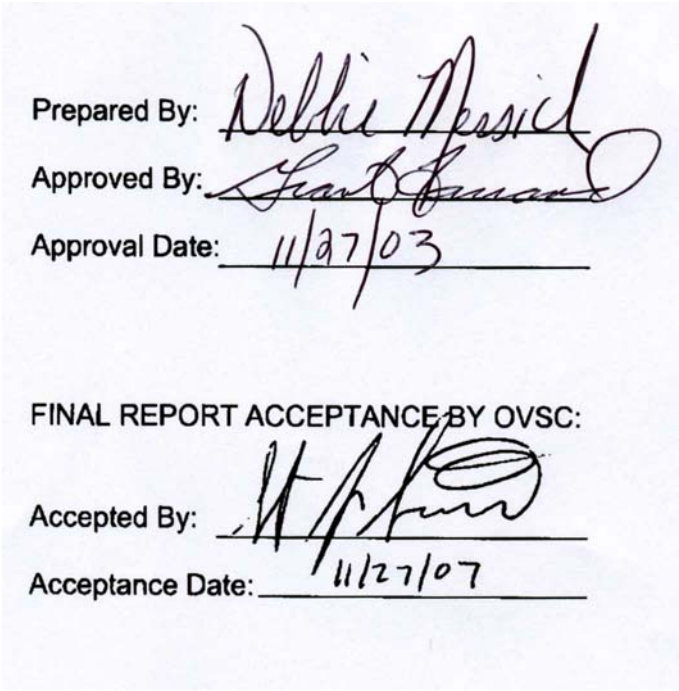

Technical Report Documentation Page

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15. Supplementary Notes

16. Abstract

Compliance tests were conducted on the subject 2007 Volkswagen Rabbit 4-door Passenger Car in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-124-06 for the determination of FMVSS 124 compliance.

Test failures identified were as follows: None

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SECTION 1
PURPOSE OF COMPLIANCE TEST

FMVSS 124 specifies requirements for the return of a vehicle's throttle to the idle position when the driver removes the actuating force from the accelerator control, or in the event of a severance or disconnection in the accelerator control system. The purpose of FMVSS 124 is to reduce the number of deaths and injuries resulting from engine overspeed caused by malfunctions in the accelerator control system. This standard applies to passenger cars, multipurpose passenger vehicles (MPV's), trucks and buses.

SECTION 2
TEST PROCEDURES AND DISCUSSION OF RESULTS

Compliance testing was conducted on a 2007 Volkswagen Rabbit 4-door Pssenger Car, NHTSA No. C75201 in accordance with the National Highway Traffic Safety Administration (NHTSA) Laboratory Procedure TP-124-06.

The vehicle is equipped with an electronic throttle control system with an Accelerator Pedal Position Senson (APS), a Throttle Plate Position Sensor (TPS), an Electronic control Module (ECM) and an Air Throttle Plate Actuator Motor.

Output from the vehicle throttle position sensor on the air throttle plate shaft was used to measure throttle position and data was recorded at 100 HZ with GTL' s data acquisition system. Testing was conducted to simulate the normal removal of the driver's foot from the accelerator pedal. This was performed by depressing the accelerator with a gloved hand which incorporated an electrical contact strip in the depressing forefinger. The accelerator was depressed to the required amount and then the forefinger was quickly removed from the pedal, releasing the accelerator and activating the contact strip for time zero. Failures (excluding spring disconnect) were induced simultaneously with release of the accelerator pedal. Testing was performed with the vehicle in park and the engine running. Return to idle times were determined for four throttle plate positions (25%, 50%, 75% and 100%) with the accelerator control system complete and with each of the two APS return springs in the accelerator pedal assembly independently disconnected. Disconnection of the TPS spring would not allow any engine control by the accelerator pedal. With each of the wires to the APS and throttle plate position sensor disconnected and shorted to ground, return to idle times were determined at the worst case condition – wide open throttle (100%). In addition, tests

SECTION 2 (Continued)

were conducted with the APS and TPS connectors disconnected.

Some system faults resulted in no data output as the TPS used for throttle position data was itself disconnected for that part of the test. For these cases, return to idle state or limp-home mode was determined by laboratory personnel observation. A number of induced failures resulted in the throttle plate return to or below the idle state then shifting to a Limp-Home mode position which allows the vehicle to be removed from the roadway.

The return times for some normal operation and fault conditions resulted in return time greater than 1 second. In these cases, throttle angle position decreased rapidly followed by a controlled ramp down to the original idle position. Manufacturers sometimes use this ramp-down strategy for improved emission control which may be the case here. No engine “racing” was observed at any point in the testing.

This testing was performed at mid ambient temperature of 10º C to 46º C, in accordance with the NHTSA Test Procedure TP-124-06.

SECTION 3
COMPLIANCE TEST DATA

Test data for this test can be found on the following pages. Photographs are found in Section 5 and Test Plots are found in Section 6.

DATA SHEET 1
VEHICLE DESCRIPTION

VEHICLE MY/MAKE/MODEL/BODY STYLE: 2007 VOLKSWAGEN RABBIT PSGR. CAR
VEHICLE NHTSA NO.: C75800
VEHICLE VIN: WVWCR71K67W131176
DATE OF TEST: AUGUST 20-22, 2007
TEST LAB: GENERAL TESTING LABORATORIES
VEHICLE ENGINE TYPE: GAS GVWR: 1880 KG
VEHICLE ENGINE SIZE: 2.5 L 5 CYL.
VEHICLE ACCEL. CONTROL SYSTEM (ACS) (Air or Fuel Throttled): AIR
MAX. BHP ENGINE SPEED: 150 HP
MFR. IDLE RPM: 675 RPM
FUEL METERING DEVICE (Carburetor, fuel injection, etc): FUEL INJECTION

REMARKS: None

RECORDED BY: G. FARRAND DATE: 08/20/07

APPROVED BY: D. MESSICK

DATA SHEET 2
NORMAL OPERATION TEST
(fully operational system)

VEHICLE MY/MAKE/MODEL/BODY STYLE: 2007 VOLKSWAGEN RABBIT PSGR. CAR
VEHICLE NHTSA NO.: C75800
DATE OF TEST: AUGUST 22, 2007

Check one:

Mid Temp. Test: X Low Temp. Test: High Temp. Test:

SYSTEM CONDITION: COMPLETE (no modifications) Normal Operation

GTL #	ACCELERATOR POSITION % WIDE OPEN THROTTLE (WOT)	THROTTLE POSITION SENSOR READING	RPM	TEMPERATURE (ºC)		THROTTLE POSITION SENSOR READING @ IDLE (BASELINE)	RETURN TIME TO IDLE (Msec)	PASS/ FAIL
				ENGINE COOLANT	AMBIENT			
5761	25%	15%	675	86	23	2%	2810	*
5762	50%	28%	675	86	23	2%	3000	*
5763	75%	39%	675	86	23	2%	3380	*
5764	100%	81%	675	86	23	2%	3240	*

RETURN TIME REQUIREMENTS:

1 second (1000 ms) for vehicles less than 4536 kg.
2 seconds (2000 ms) for vehicles more than 4536 kg.
3 seconds (3000 ms) for vehicles exposed to -18º C or less

PASS * FAIL

REMARKS: When driver accelerator control is moved to 25, 50, 75 and 100% throttle positions, the throttle body butterfly only opens to a position as controlled by the engine control computer and oscillates open/close even though accelerator is held at a steady state.

* See Section 2 – Discussion of Results

RECORDED BY: G. FARRAND DATE: 08/22/07

APPROVED BY: D. MESSICK

DATA SHEET 3 (1 of 2)
FAIL-SAFE OPERATION DISCONNECTION

VEHICLE MY/MAKE/MODEL/BODY STYLE: 2007 VOLKSWAGEN RABBIT PSGR. CAR
VEHICLE NHTSA NO.: C75800
DATE OF TEST: AUGUST 23, 2007

Check one:

Mid Temp. Test: X Low Temp. Test: High Temp. Test:

	SYSTEM CONDITION: #1 SPRING DISCONNECTED IN APS (INNER SPRING)							
GTL #	ACCELERATOR POSITION % WIDE OPEN THROTTLE (WOT)	THROTTLE POSITION SENSOR READING	RPM	TEMPERATURE (ºC)		THROTTLE POSITION SENSOR READING @ IDLE (BASELINE)	RETURN TIME TO IDLE (Msec)	PASS/ FAIL
				ENGINE COOLANT	AMBIENT			
5791	25%	12%	675	86	28	2%	2190	*
5792	50%	37%	675	86	28	2%	3570	*
5793	75%	38%	675	86	28	2%	3560	*
5794	100%	82%	675	86	28	2%	3450	*

RETURN TIME REQUIREMENTS:

1 second (1000 ms) for vehicles less than 4536 kg.
2 seconds (2000 ms) for vehicles more than 4536 kg.
3 seconds (3000 ms) for vehicles exposed to -18º C or less

PASS * FAIL

REMARKS:

* See Section 2 – Discussion of Results

RECORDED BY: G. FARRAND DATE: 08/23/07

APPROVED BY: D. MESSICK

DATA SHEET 3 (2 of 2)
FAIL-SAFE OPERATION DISCONNECTION

VEHICLE MY/MAKE/MODEL/BODY STYLE: 2007 VOLKSWAGEN RABBIT PSGR. CAR
VEHICLE NHTSA NO.: C75800
DATE OF TEST: AUGUST 23, 2007

Check one:

Mid Temp. Test: X Low Temp. Test: High Temp. Test:

	SYSTEM CONDITION: #2 SPRING DISCONNECTED IN APS (OUTER SPRING)							
GTL #	ACCELERATOR POSITION % WIDE OPEN THROTTLE (WOT)	THROTTLE POSITION SENSOR READING	RPM	TEMPERATURE (ºC)		THROTTLE POSITION SENSOR READING @ IDLE (BASELINE)	RETURN TIME TO IDLE (Msec)	PASS/ FAIL
				ENGINE COOLANT	AMBIENT			
5795	25%	16%	675	86	28	2%	1710	*
5796	50%	31%	675	86	28	2%	3630	*
5797	75%	47%	675	86	28	2%	3610	*
5798	100%	83%	675	86	28	2%	3530	*

RETURN TIME REQUIREMENTS:

1 second (1000 ms) for vehicles less than 4536 kg.
2 seconds (2000 ms) for vehicles more than 4536 kg.
3 seconds (3000 ms) for vehicles exposed to -18º C or less

PASS * FAIL

REMARKS:

* See Section 2 – Discussion of Results

RECORDED BY: G. FARRAND DATE: 08/23/07

APPROVED BY: D. MESSICK

DATA SHEET 4
FAIL-SAFE OPERATION

VEHICLE MY/MAKE/MODEL/BODY STYLE: 2007 VOLKSWAGEN RABBIT PSGR. CAR
VEHICLE NHTSA NO.: C75800
DATE OF TEST: AUGUST 24, 2007

Check one:

Mid Temp. Test: X Low Temp. Test: High Temp. Test:

	SYSTEM CONDITION: SPRING REMOVED IN TPS							
GTL #	ACCELERATOR POSITION % WIDE OPEN THROTTLE (WOT)	THROTTLE POSITION SENSOR READING	RPM	TEMPERATURE (ºC)		THROTTLE POSITION SENSOR READING @ IDLE (BASELINE)	RETURN TIME TO IDLE (Msec)	PASS/ FAIL
				ENGINE COOLANT	AMBIENT			
	25%	*						
	50%	*						
	75%	*						
	100%	*						

RETURN TIME REQUIREMENTS:

1 second (1000 ms) for vehicles less than 4536 kg.
2 seconds (2000 ms) for vehicles more than 4536 kg.
3 seconds (3000 ms) for vehicles exposed to -18º C or less

PASS _____ FAIL _____

REMARKS: *Engine would not rev above limp home mode with spring #3 removed. Engine control computer would not let throttle butterfly open when accelerator was depressed.

RECORDED BY: G. FARRAND DATE: 08/24/07

APPROVED BY: D. MESSICK

DATA SHEET 5
FMVSS 124

VEHICLE MY/MAKE/MODEL/BODY STYLE: 2007 VOLKSWAGEN RABBIT PSGR. CAR
VEHICLE NHTSA NO.: C75800
DATE OF TEST: AUGUST 22, 2007

GTL #	CONNECTOR	WIRE/PIN DESCRIPTION	FAULT CONDITION	ENGINE TEMP. ºC	% THROTTLE/ RETURN TIME (MS)	PASS/FAIL/NOTES
5765	TPS	#1/PURPLE	OPEN	86	100/30	Limp Home @7%
5766	TPS	#1/PURPLE	SHORT	86	100/40	Limp Home @7%
5767	TPS	#2/TAN	OPEN	86	100/80	Limp Home @7%
5768	TPS	#2/TAN	SHORT	86	100/150	Limp Home @7% to 20%
5769	TPS	#3/YELLOW	OPEN	86	100/1660	*Limp Home @7%
5770	TPS	#3/YELLOW	SHORT	86	100/1630	*Limp Home @7%
5771	TPS	#4/GREEN	OPEN	86	100/0**	Limp Home
5772	TPS	#4/GREEN	SHORT	86	100/0**	Limp Home
5773	TPS	#5/BLACK	OPEN	86	100/1470	*Limp Home @7% 3540 ms to 2%
5774	TPS	#5/BLACK	SHORT	86	100/0**	Limp Home
5775	TPS	#6/BLACK#2	OPEN	86	100/0**	Limp Home
5776	TPS	#6/BLACK#2	SHORT	86	100/0**	Limp Home
5777	TPS	CONNECTOR	DISCONNECT	86	100/0**	Limp Home
5778	APS	#7/WHT/BLACK	OPEN	86	100/3500	*
5779	APS	#7/WHT/BLACK	SHORT	86	100/30	Engine Started
5780	APS	#8/WHT/BLUE	OPEN	86	100/3580	*
5781	APS	#8/WHT/BLUE	SHORT	86	100/3500	*
5782	APS	#9/YEL/GREEN	OPEN	86	100/3520	*
5783	APS	#9/YEL/GREEN	SHORT	86	100/0**	Limp Home
5784	APS	#10/BLU/RED	OPEN	86	100/3570	*
5785	APS	#10/BLU/RED	SHORT	86	100/3450	*
5786	APS	#11/BLU/BRWN	OPEN	86	100/1680	*Limp Home @7%
5787	APS	#11/BLU/BRWN	SHORT	86	100/3810	*
5788	APS	#12/WHT/BLU	OPEN	86	100/3450	*
5789	APS	#12/WHT/BLU	SHORT	86	100/3380	*
5790	APS	CONNECTOR	DISCONNECT	86	100/0**	Engine Started

REMARKS:

* See Section 2 – Discussion of Results

** Induced wire fault causes loss or throttle position sensor reading. Limp Home condition based on laboratory observation.

RECORDED BY: G. FARRAND DATE: 08/22/07

APPROVED BY: D. MESSICK

SECTION 4
TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

EQUIPMENT	DESCRIPTION	MODEL/ SERIAL NO.	CAL. DATE	NEXT CAL. DATE
CONTINUOUS RECORDER	OMEGA	CT485	06/07	06/08
ENGINE RECORDING	GTL COMPUTER	CPU1	BEFORE USE	BEFORE USE
ENGINE RECORDING	MONARCH	1444664	08/07	08/08
SOFTWARE	GTL	N/A	BEFORE USE	BEFORE USE
CHAMBER	GTL	N/A	N/A	N/A
EXHAUST DUCT	GTL	N/A	N/A	N/A

SECTION 5
PHOTOGRAPHS

2007 VOLKSWAGEN RABBIT
NHTSA NO. C75800
FMVSS NO. 124

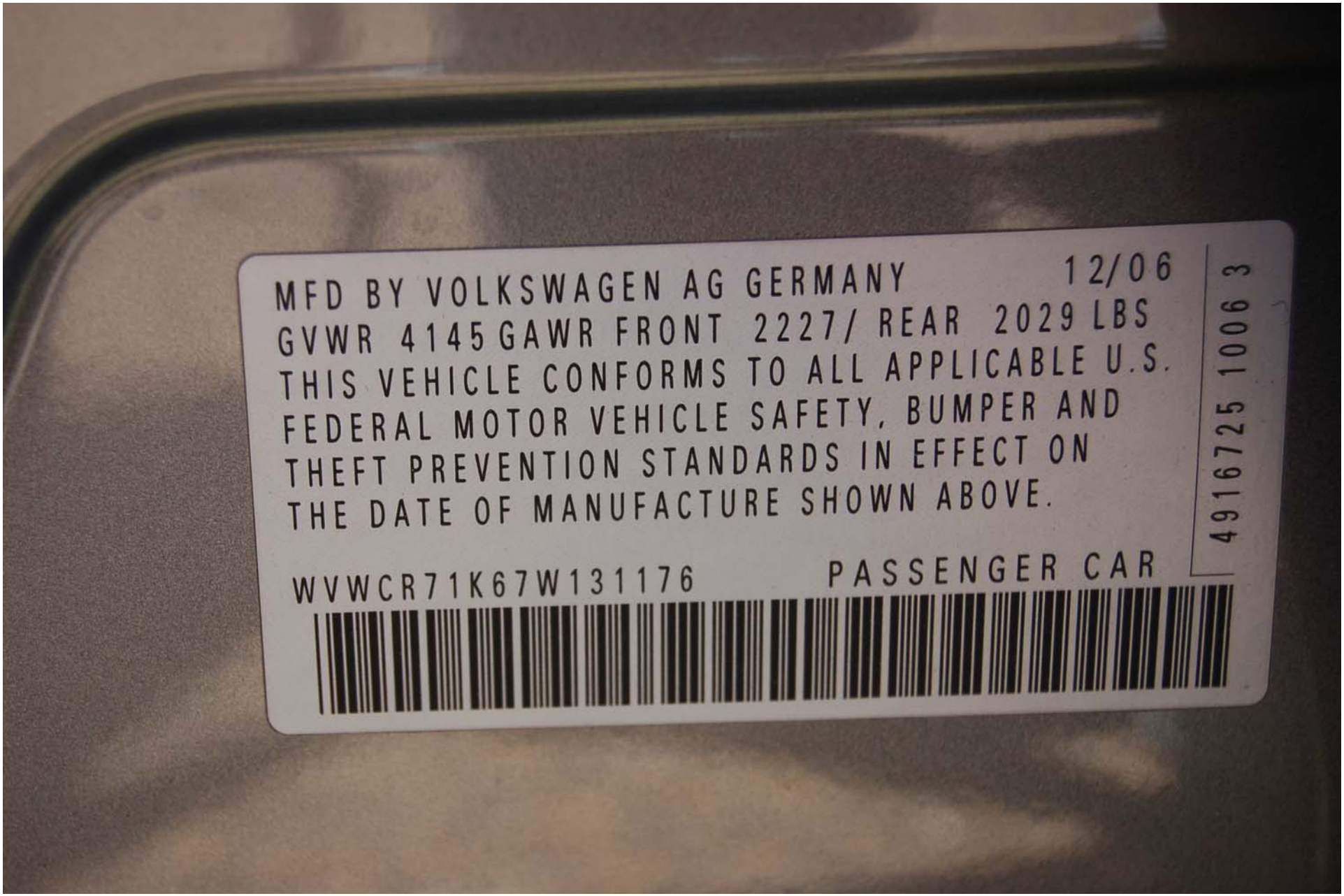
FIGURE 5.1
FRONT VIEW OF VEHICLE

2007 VOLKSWAGEN RABBIT
NHTSA NO. C75800
FMVSS NO. 124

FIGURE 5.2
LEFT SIDE VIEW OF VEHICLE

2007 VOLKSWAGEN RABBIT
NHTSA NO. C75800
FMVSS NO. 124

FIGURE 5.3
RIGHT SIDE VIEW OF VEHICLE



2007 VOLKSWAGEN RABBIT
NHTSA NO. C75800
FMVSS NO. 124

FIGURE 5.4
CLOSE-UP VIEW OF VEHICLE CERTIFICATION LABEL

2007 VOLKSWAGEN RABBIT
NHTSA NO. C75800
FMVSS NO. 124

FIGURE 5.5
CLOSE-UP VIEW OF VEHICLE PLACARD

2007 VOLKSWAGEN RABBIT
NHTSA NO. C75800
FMVSS NO. 124

FIGURE 5.6
TOP VIEW OF THROTTLE BODY

2007 VOLKSWAGEN RABBIT
NHTSA NO. C75800
FMVSS NO. 124

FIGURE 5.7
SIDE VIEW OF THROTTLE BODY

2007 VOLKSWAGEN RABBIT
NHTSA NO. C75800
FMVSS NO. 124

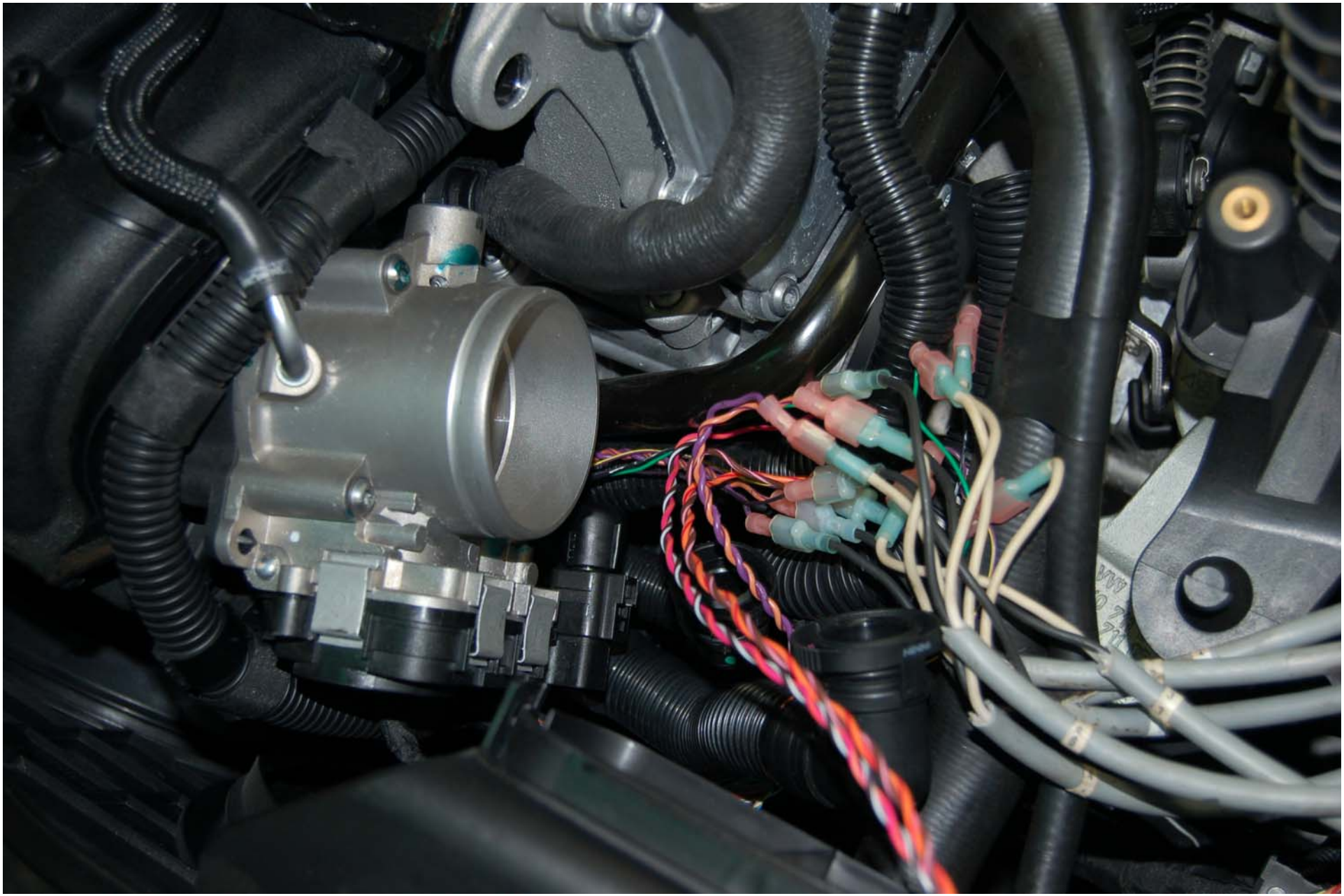
FIGURE 5.8
THROTTLE BODY MOTOR AND POSITION SENSOR

2007 VOLKSWAGEN RABBIT
NHTSA NO. C75800
FMVSS NO. 124

FIGURE 5.9
THROTTLE PLATE RETURN SPRING

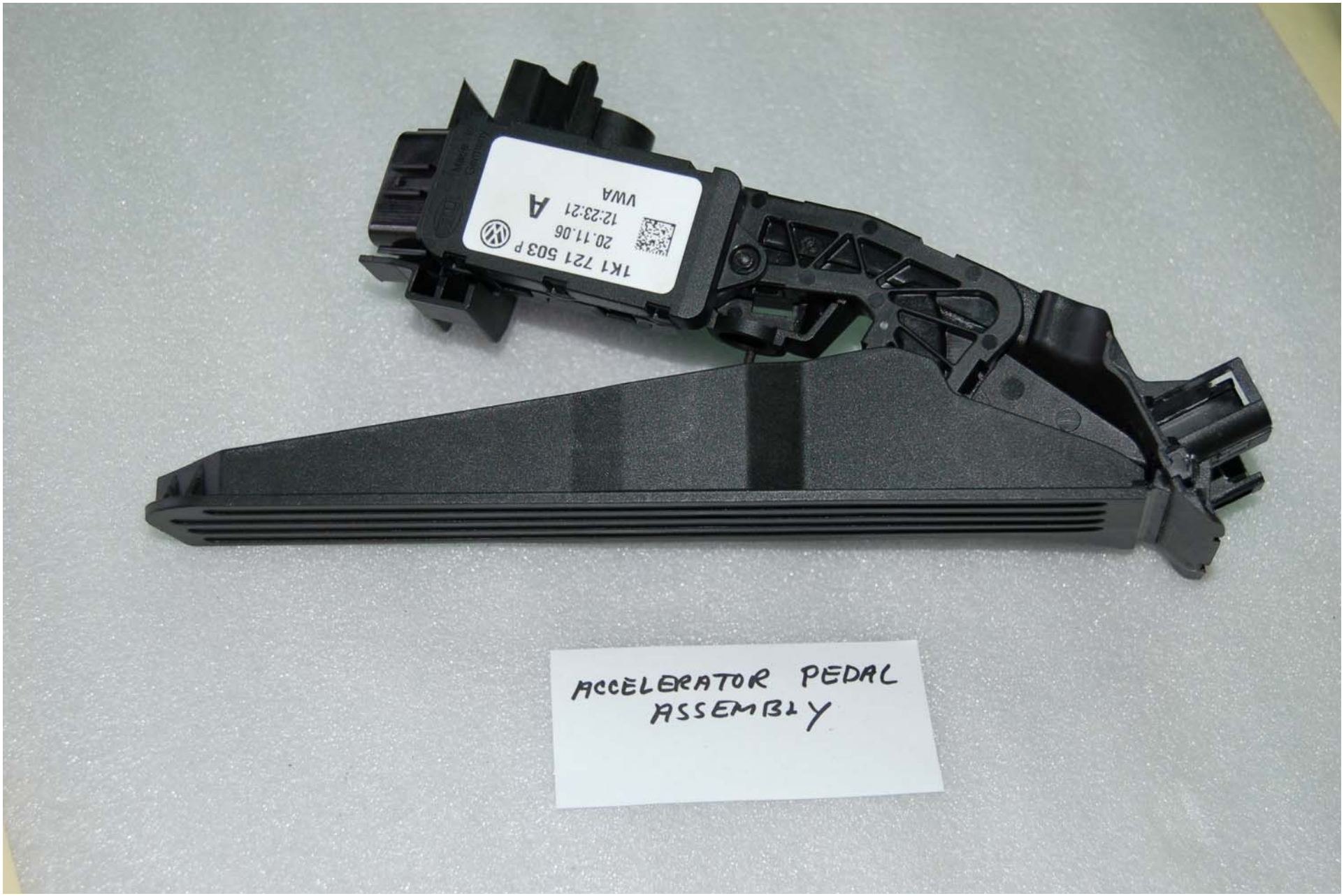
2007 VOLKSWAGEN RABBIT
NHTSA NO. C75800
FMVSS NO. 124

FIGURE 5.10
THROTTLE PLATE RETURN SPRING



2007 VOLKSWAGEN RABBIT
NHTSA NO. C75800
FMVSS NO. 124

FIGURE 5.11
THROTTLE BODY TEST SET-UP



2007 VOLKSWAGEN RABBIT
NHTSA NO. C75800
FMVSS NO. 124

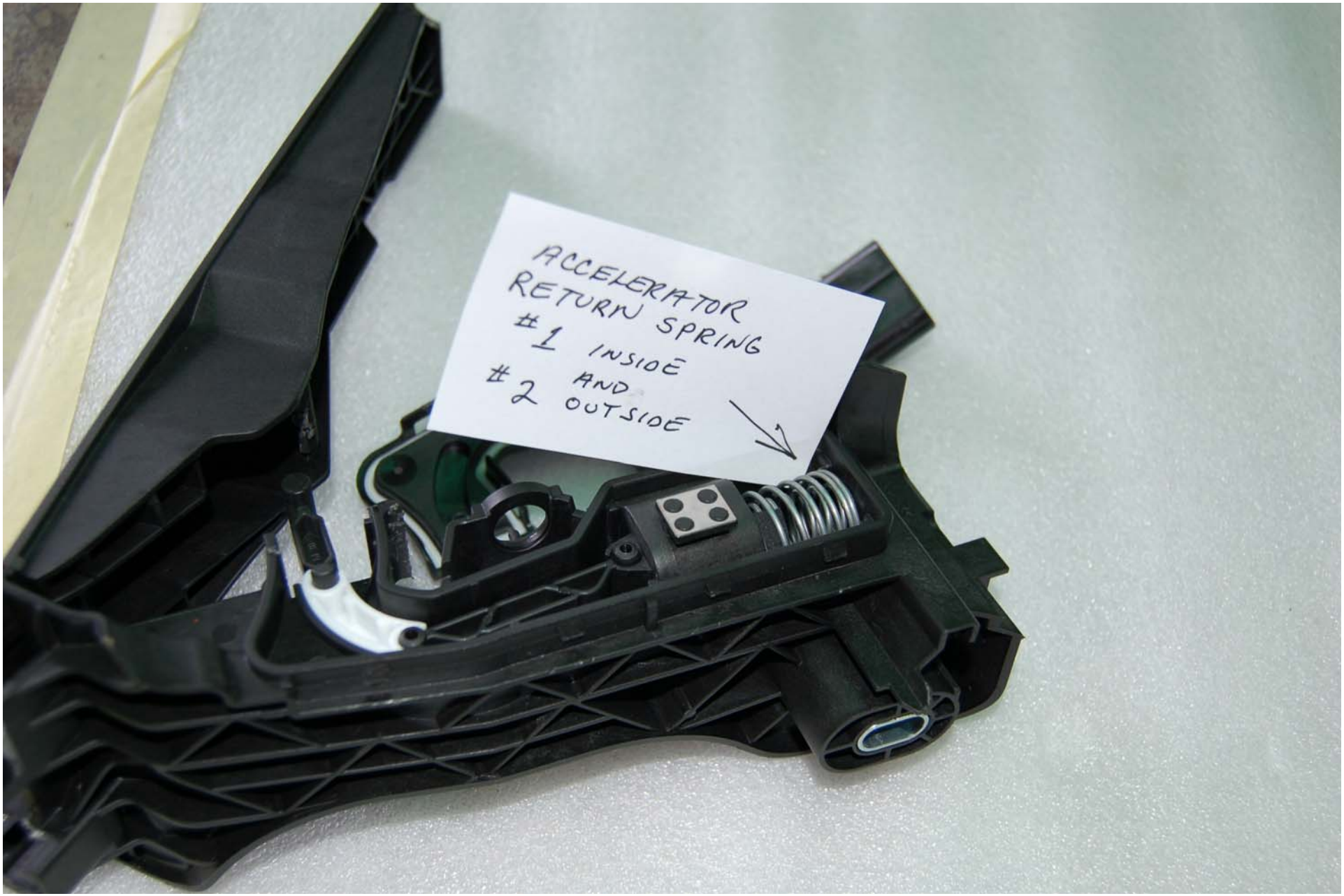
FIGURE 5.12
ACCELERATOR PEDAL ASSEMBLY

2007 VOLKSWAGEN RABBIT
NHTSA NO. C75800
FMVSS NO. 124

FIGURE 5.13
ACCELERATOR PEDAL ASSEMBLY

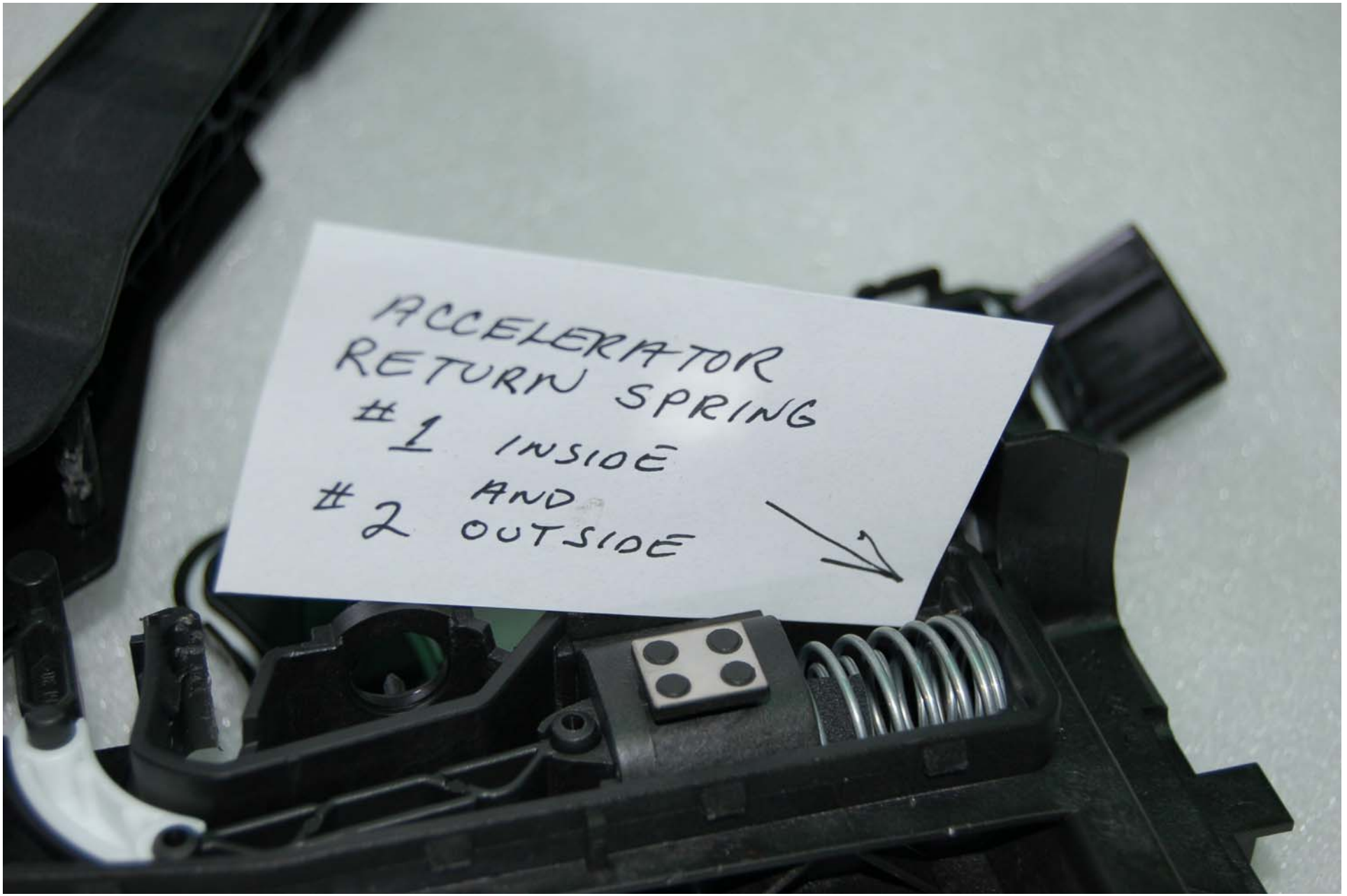
2007 VOLKSWAGEN RABBIT
NHTSA NO. C75800
FMVSS NO. 124

FIGURE 5.14
ACCELERATOR PEDAL ASSEMBLY



2007 VOLKSWAGEN RABBIT
NHTSA NO. C75800
FMVSS NO. 124

FIGURE 5.15
ACCELERATOR RETURN SPRINGS



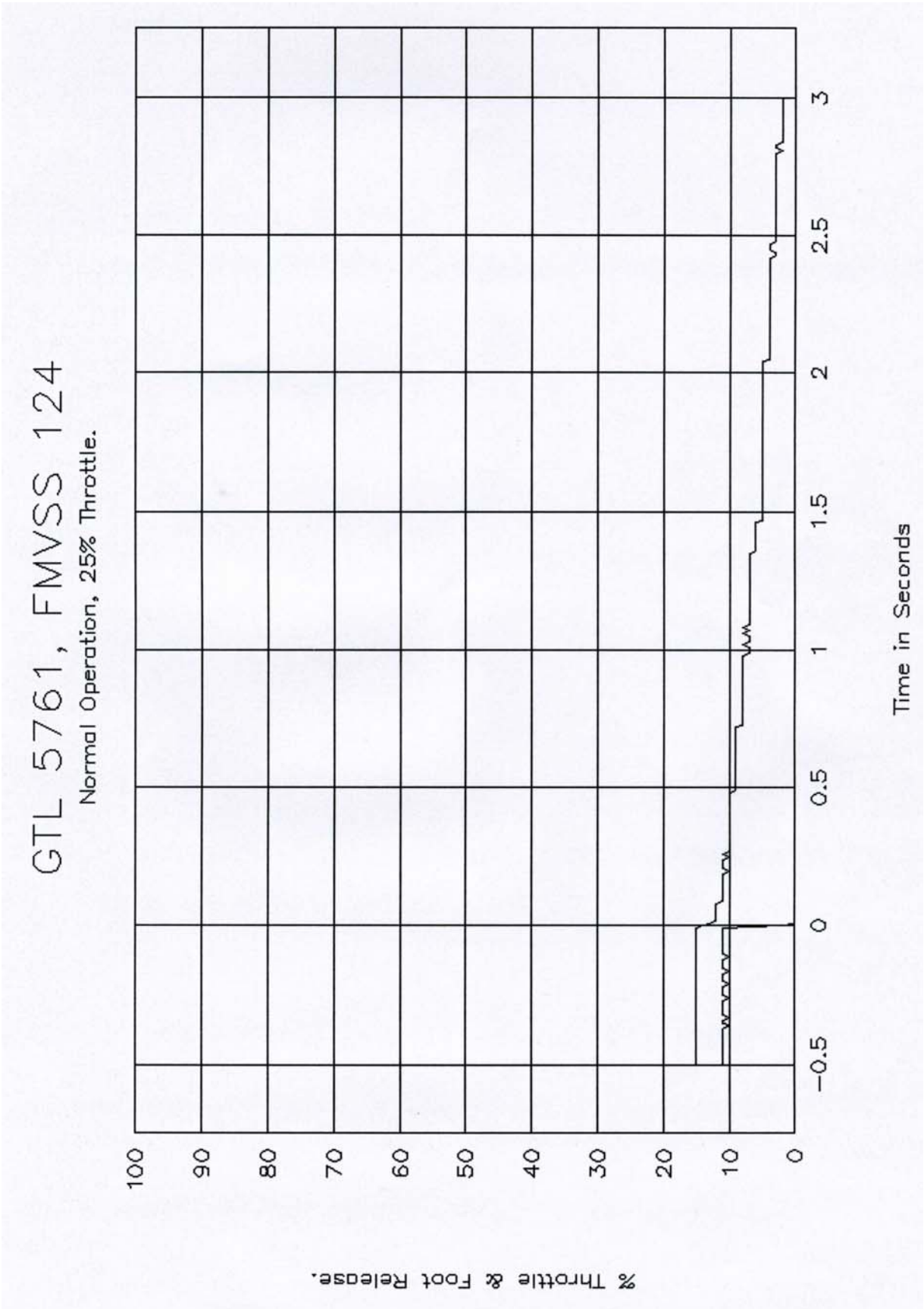
2007 VOLKSWAGEN RABBIT
NHTSA NO. C75800
FMVSS NO. 124

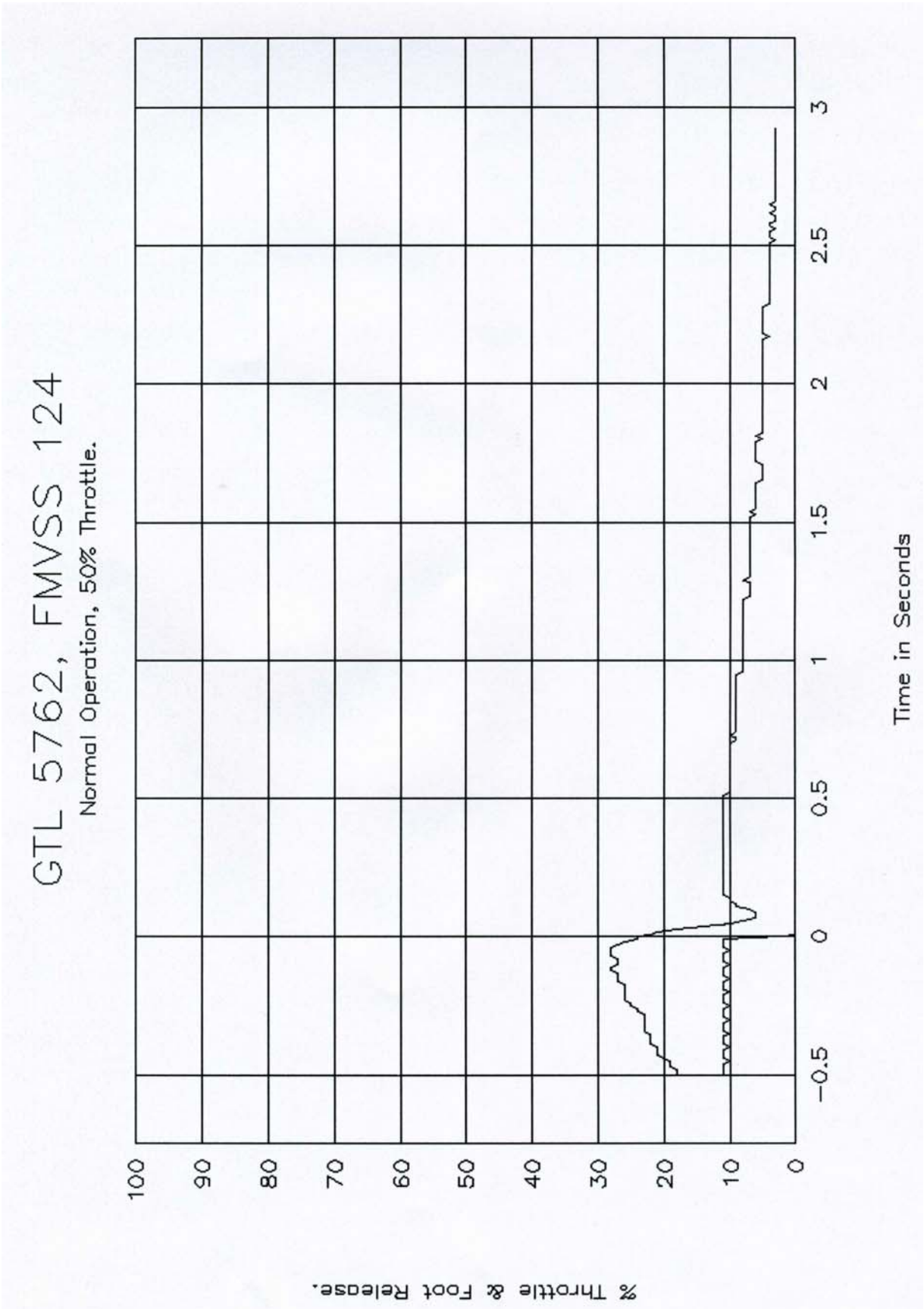
FIGURE 5.16
ACCELERATOR RETURN SPRINGS CLOSE-UP

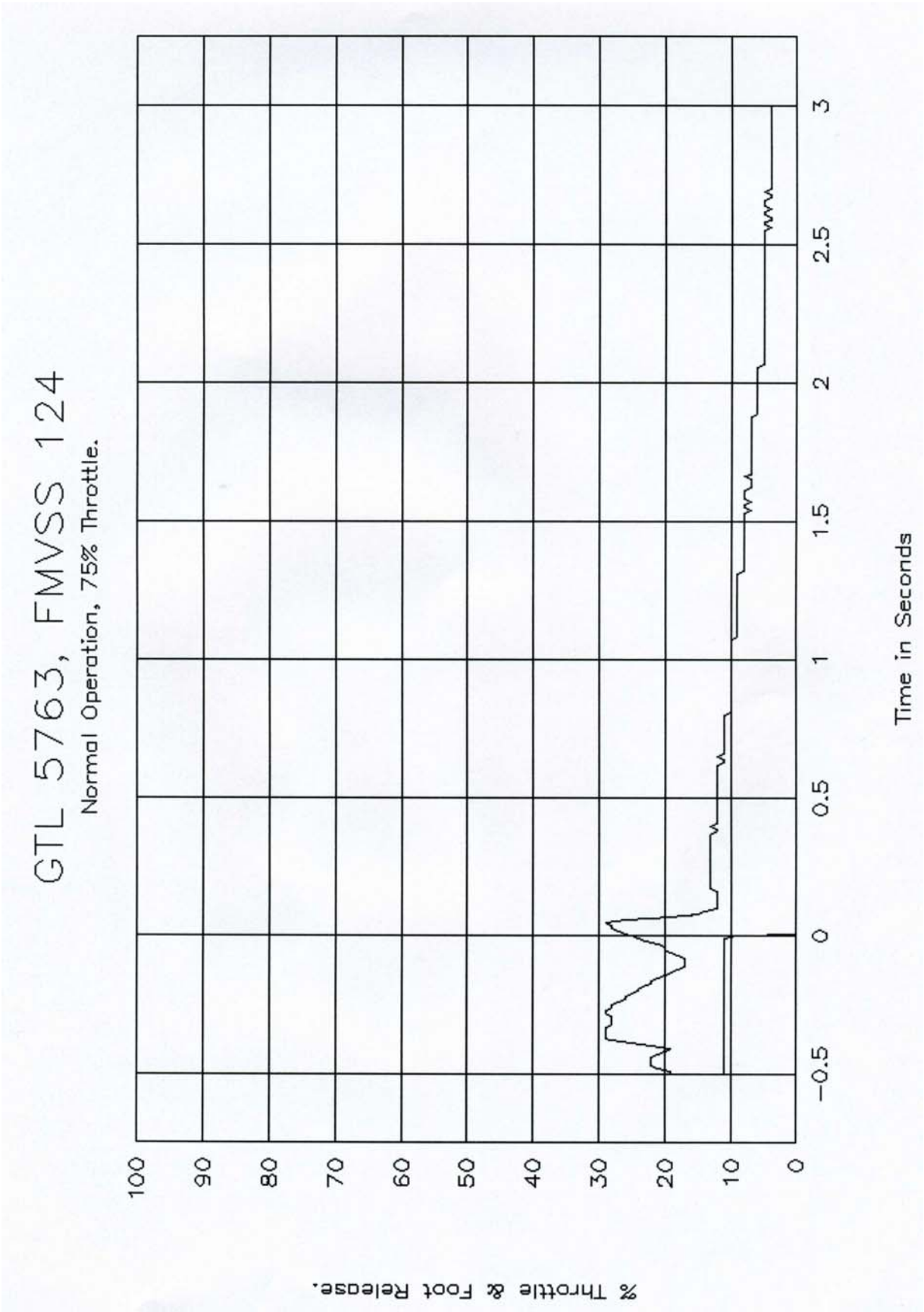
2007 VOLKSWAGEN RABBIT
NHTSA NO. C75800

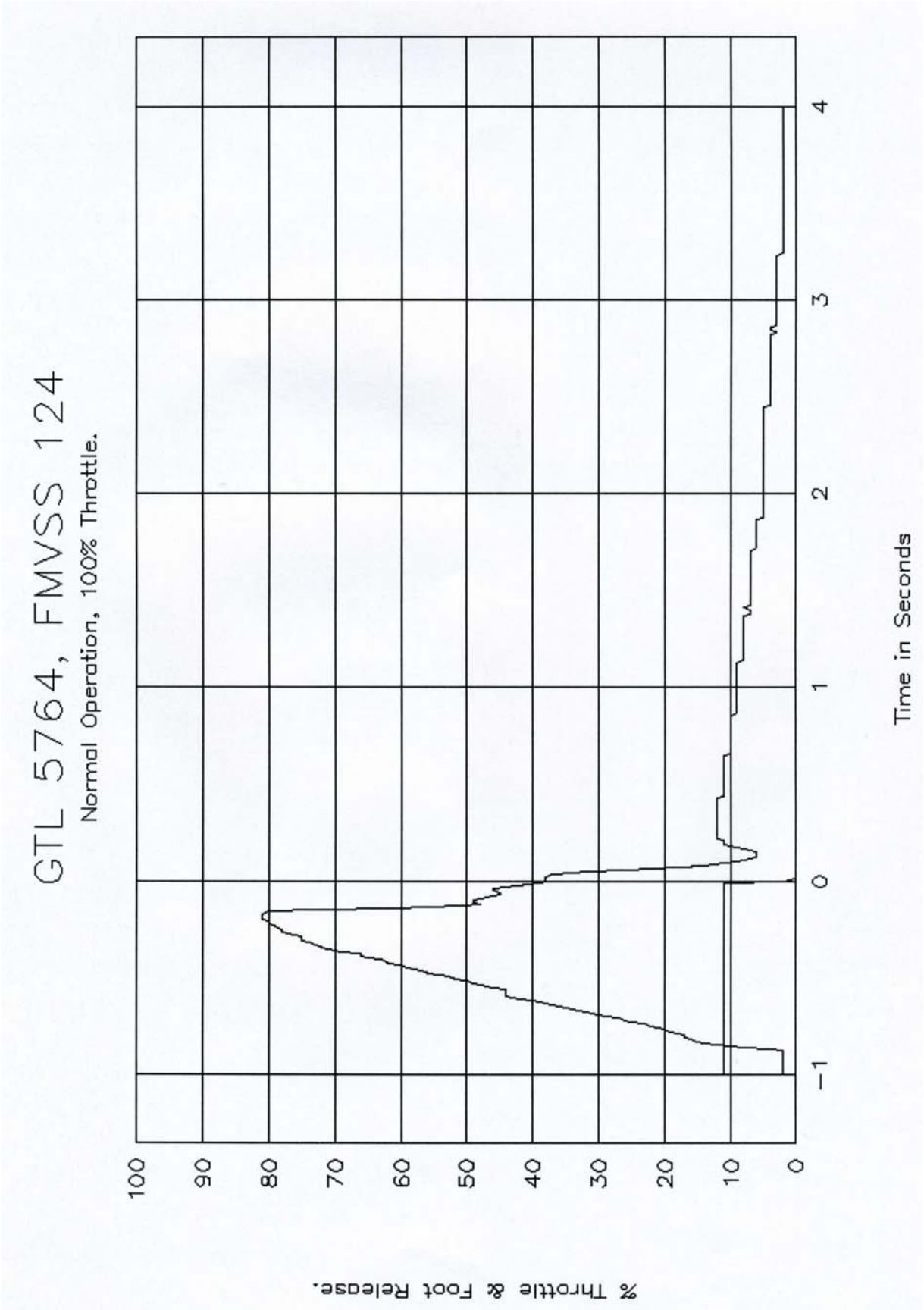
FIGURE 5.17
OVERALL TEST SET-UP

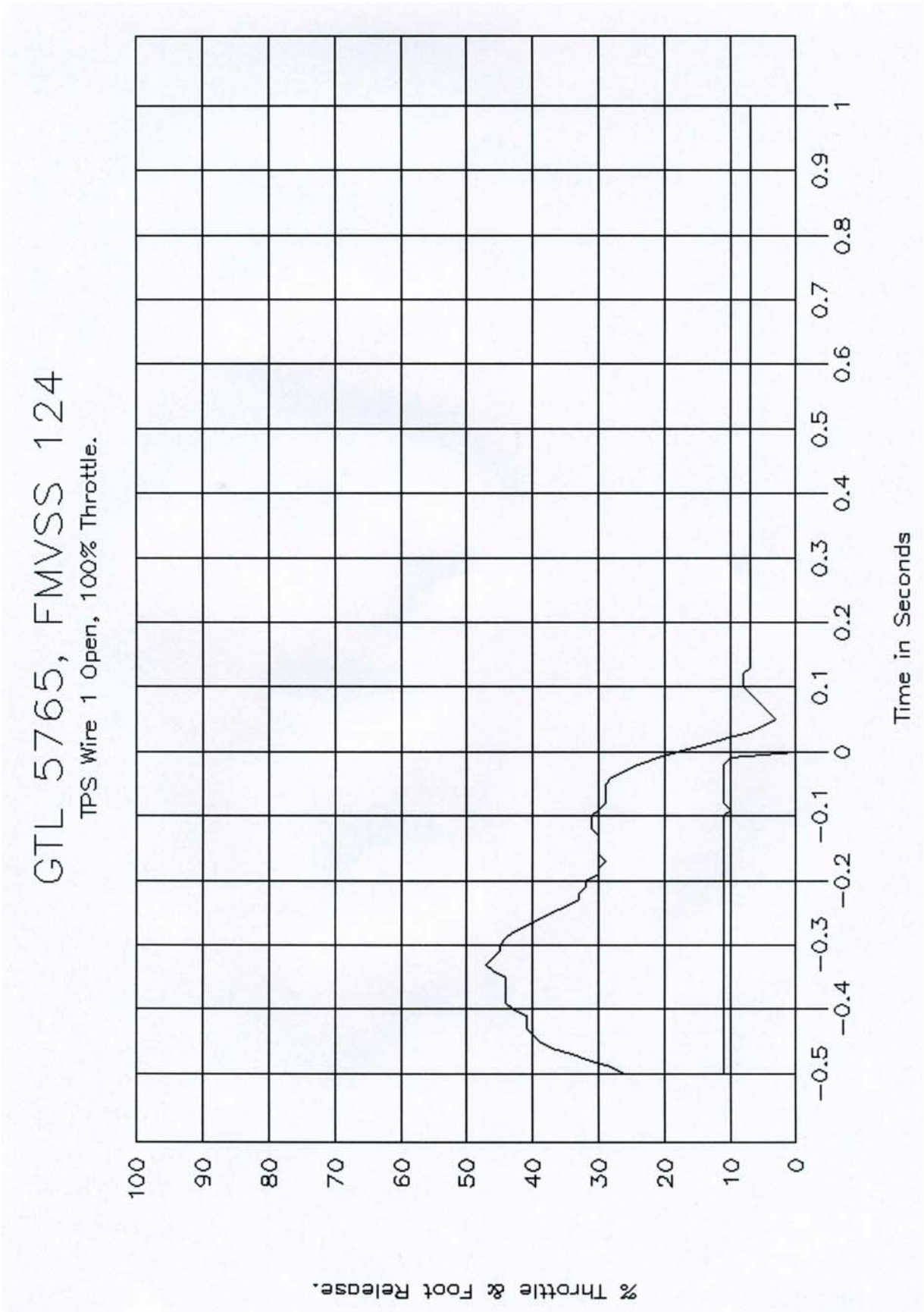
SECTION 6
PLOTS

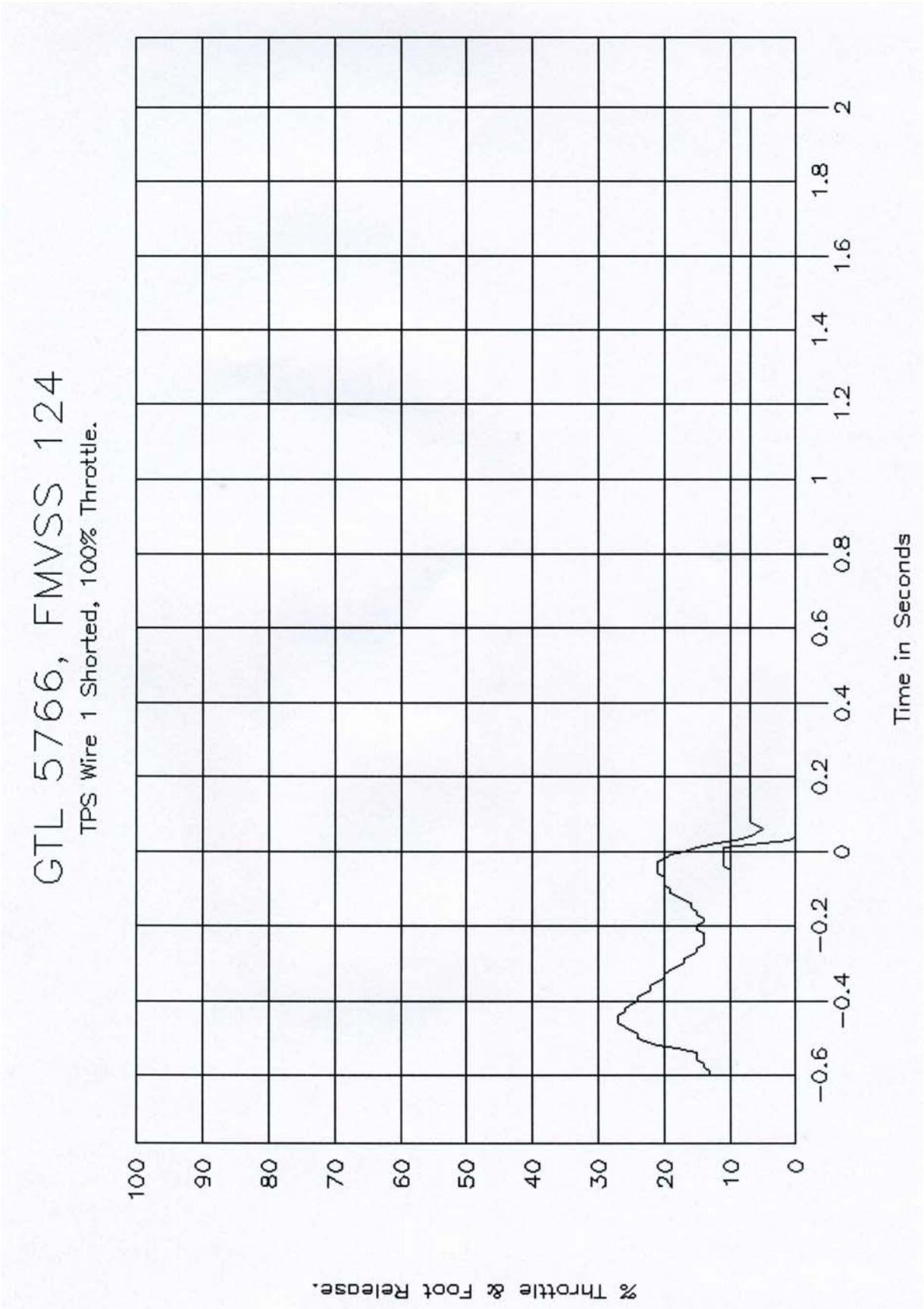

GTL 5761, FMVSS 124
Normal Operation, 25% Throttle.
% Throttle & Foot Release.
100
90
80
70
60
50
40
30
20
10
0
-0.5
0
0.5
1
1.5
2
2.5
3
Time in Seconds

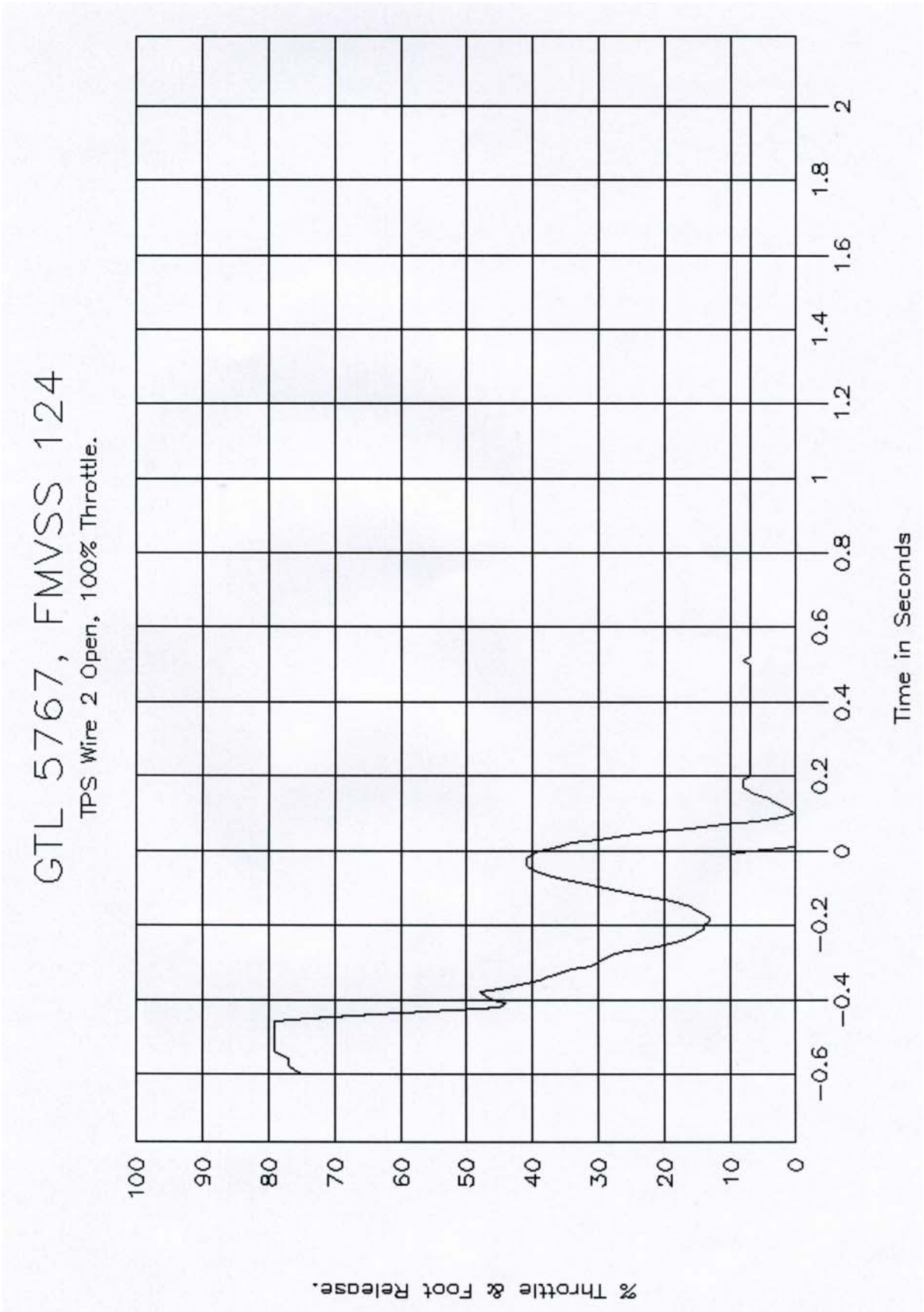

GTL 5762, FMVSS 124
Normal Operation, 50% Throttle.
% Throttle & Foot Release.
100
90
80
70
60
50
40
30
20
10
0
-0.5
0
0.5
1
1.5
2
2.5
3
Time in Seconds

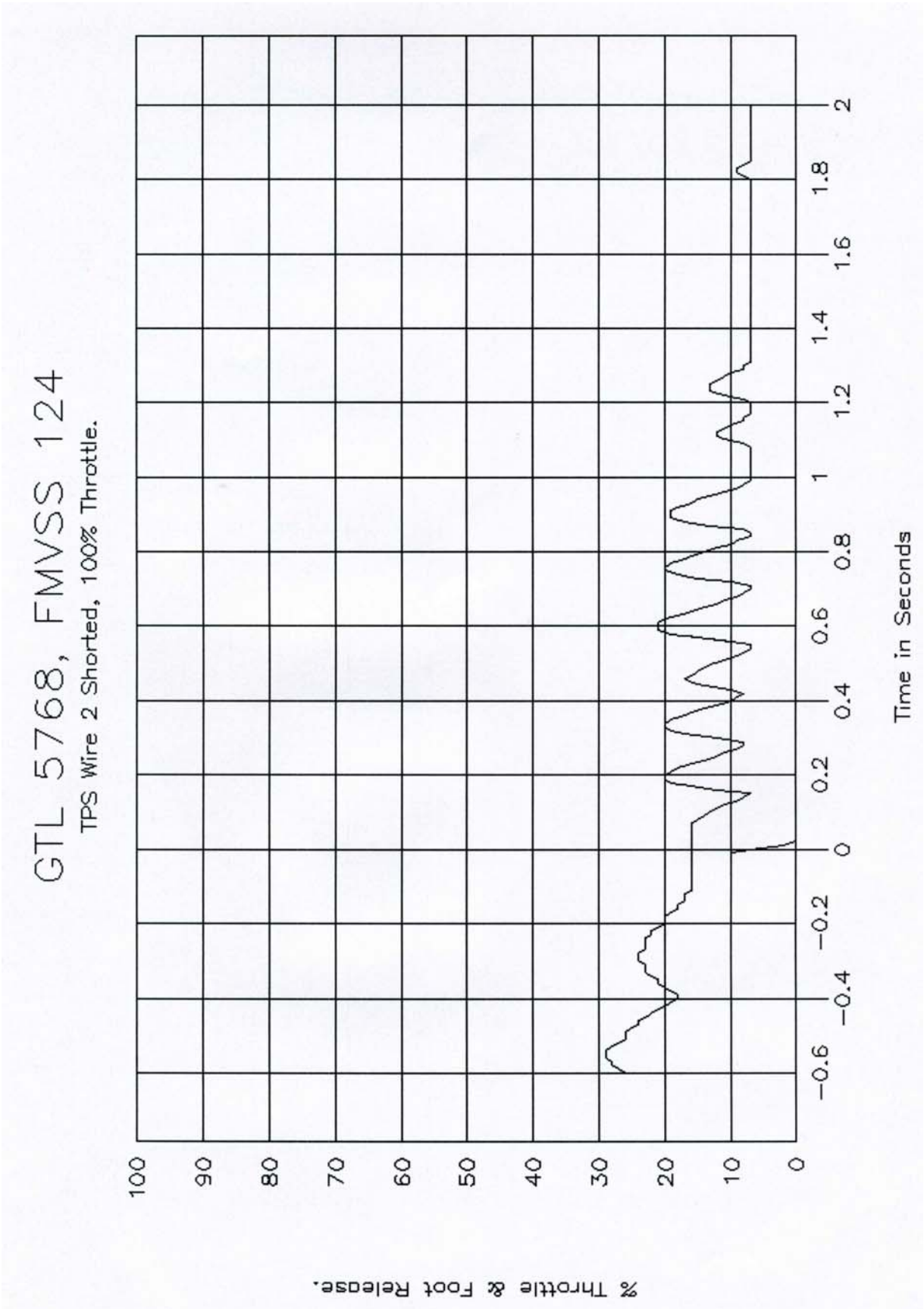

GTL 5763, FMVSS 124
Normal Operation, 75% Throttle.
% Throttle & Foot Release.
100
90
80
70
60
50
40
30
20
10
0
-0.5
0
0.5
1
1.5
2
2.5
3
Time in Seconds

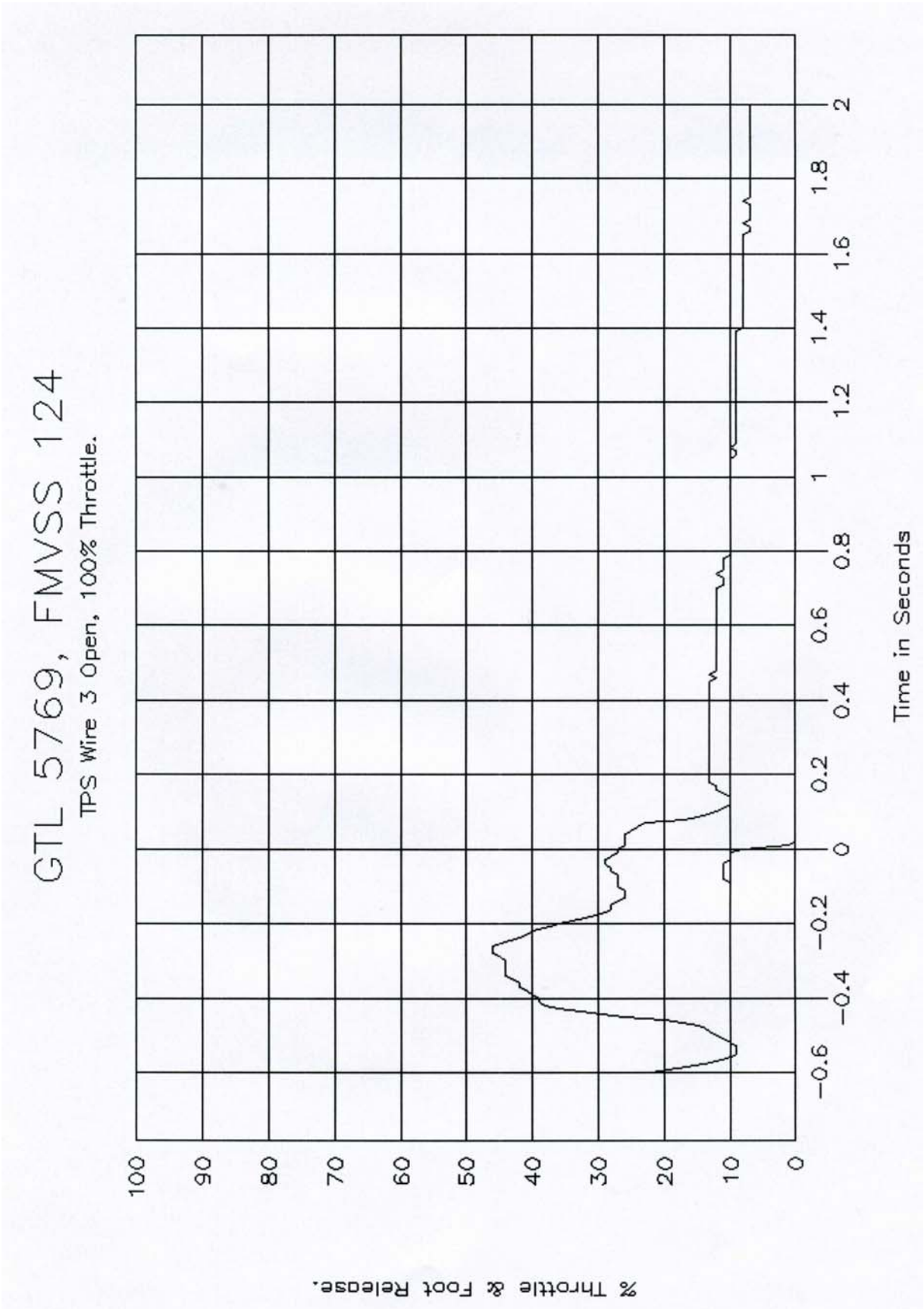

GTL 5764, FMVSS 124
Normal Operation, 100% Throttle.
% Throttle & Foot Release.
100
90
80
70
60
50
40
30
20
10
0
-1
0
1
2
3
4
Time in Seconds


GTL 5765, FMVSS 124
TPS Wire 1 Open, 100% Throttle.
% Throttle & Foot Release.
100
90
80
70
60
50
40
30
20
10
0
-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
Time in Seconds


GTL 5766, FMVSS 124
TPS Wire 1 Shorted, 100% Throttle.
% Throttle & Foot Release.
100
90
80
70
60
50
40
30
20
10
0
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Time in Seconds


GTL 5767, FMVSS 124
TPS Wire 2 Open, 100% Throttle.
% Throttle & Foot Release.
Time in Seconds
100
90
80
70
60
50
40
30
20
10
0
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2


GTL 5768, FMVSS 124
TPS Wire 2 Shorted, 100% Throttle.
% Throttle & Foot Release.
Time in Seconds
100
90
80
70
60
50
40
30
20
10
0
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2


GTL 5769, FMVSS 124
TPS Wire 3 Open, 100% Throttle.
% Throttle & Foot Release.
Time in Seconds
100
90
80
70
60
50
40
30
20
10
0
-0.6
-0.4
-0.2
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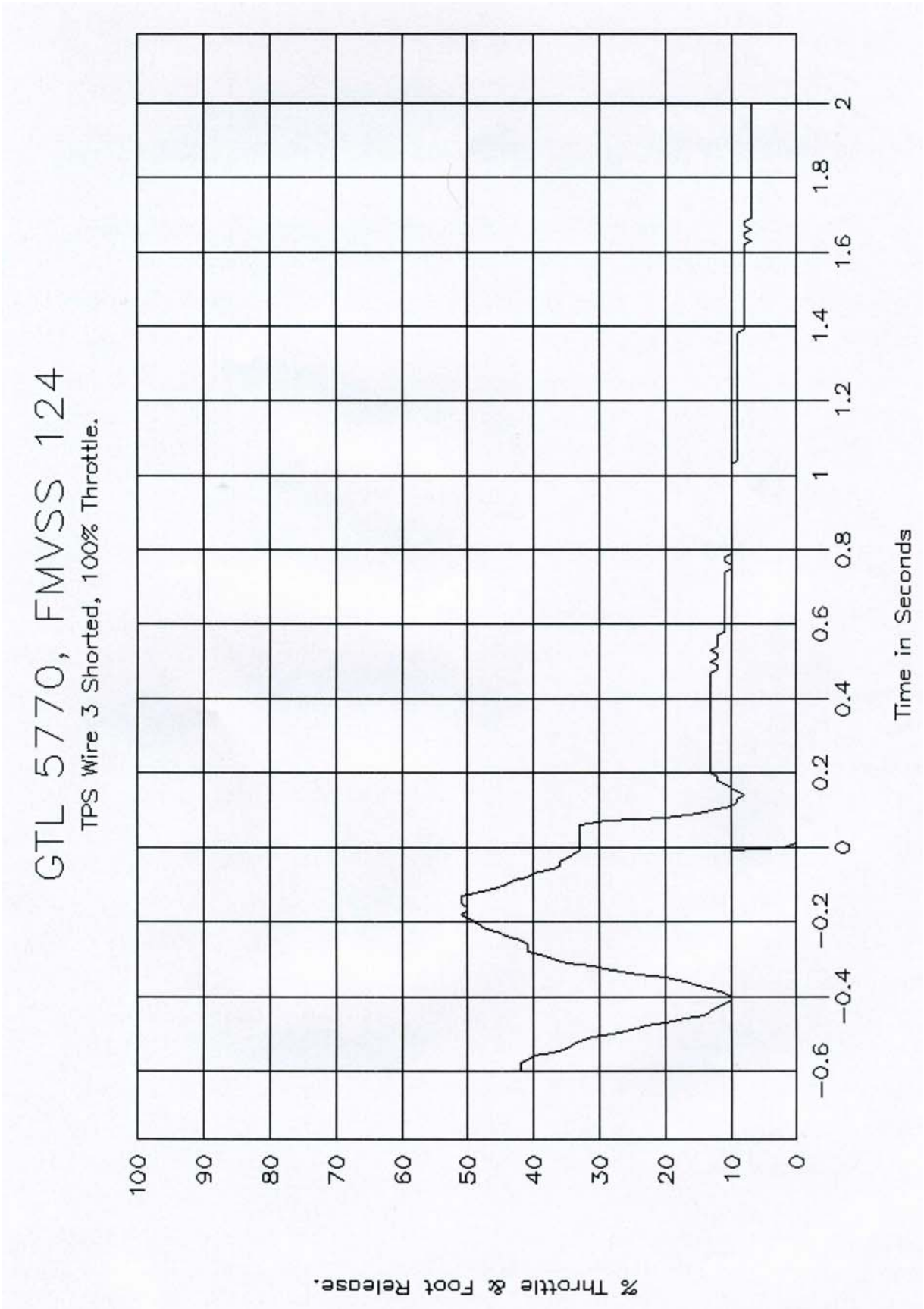
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2


GTL 5770, FMVSS 124
TPS Wire 3 Shorted, 100% Throttle.
% Throttle & Foot Release.
100
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80
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60
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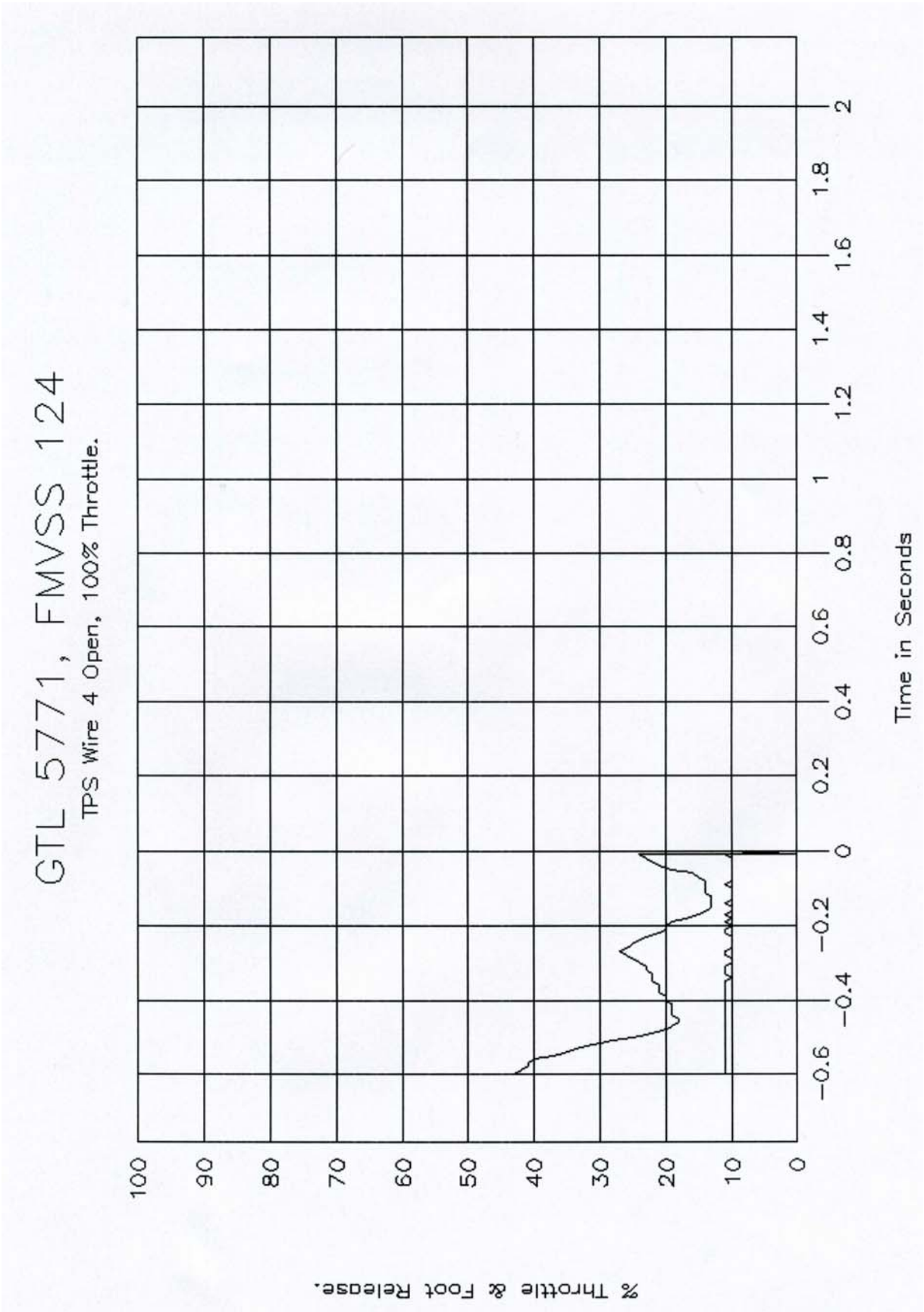
30
20
10
0
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Time in Seconds


GTL 5771, FMVSS 124
TPS Wire 4 Open, 100% Throttle.
% Throttle & Foot Release.
Time in Seconds
100
90
80
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60
50
40
30
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-0.6
-0.4
-0.2
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0.4
0.6
0.8
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1.2
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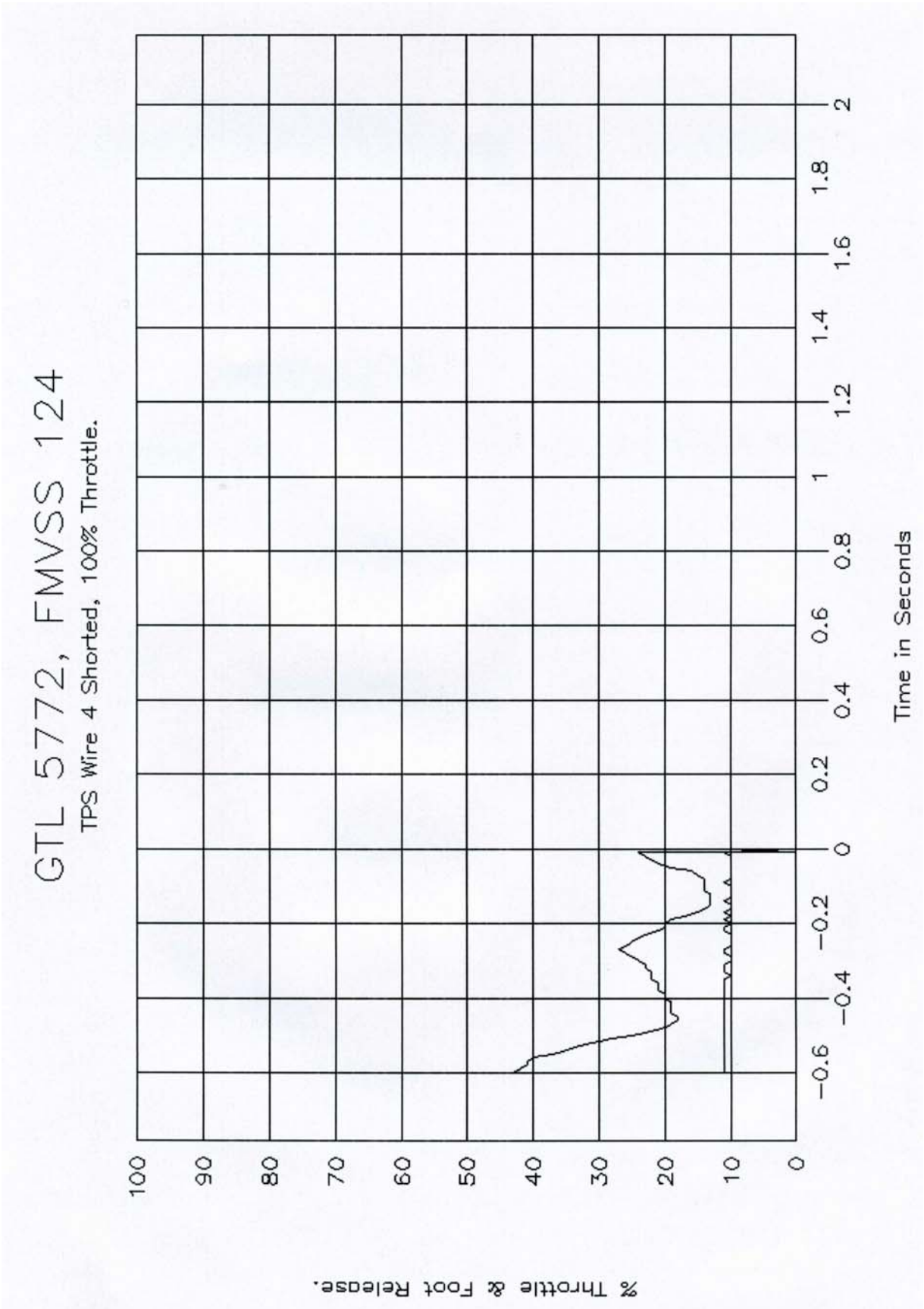
GTL 5772, FMVSS 124
TPS Wire 4 Shorted, 100% Throttle.
% Throttle & Foot Release.
Time in Seconds
100
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10
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-0.6
-0.4
-0.2
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0.6
0.8
1
1.2
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1.8
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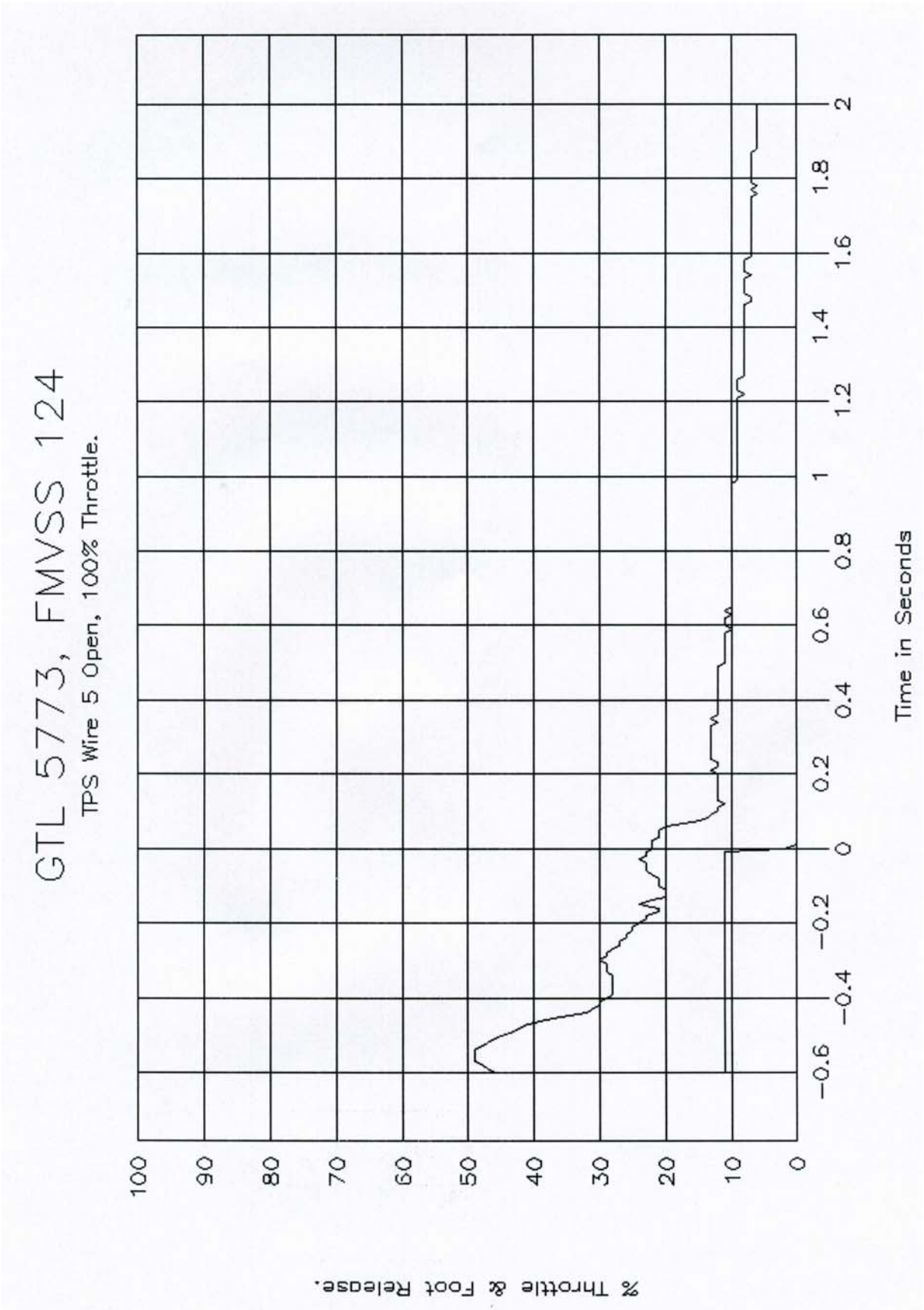
GTL 5773, FMVSS 124
TPS Wire 5 Open, 100% Throttle.
% Throttle & Foot Release.
100
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80
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60
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30
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−0.6
−0.4
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1
1.2
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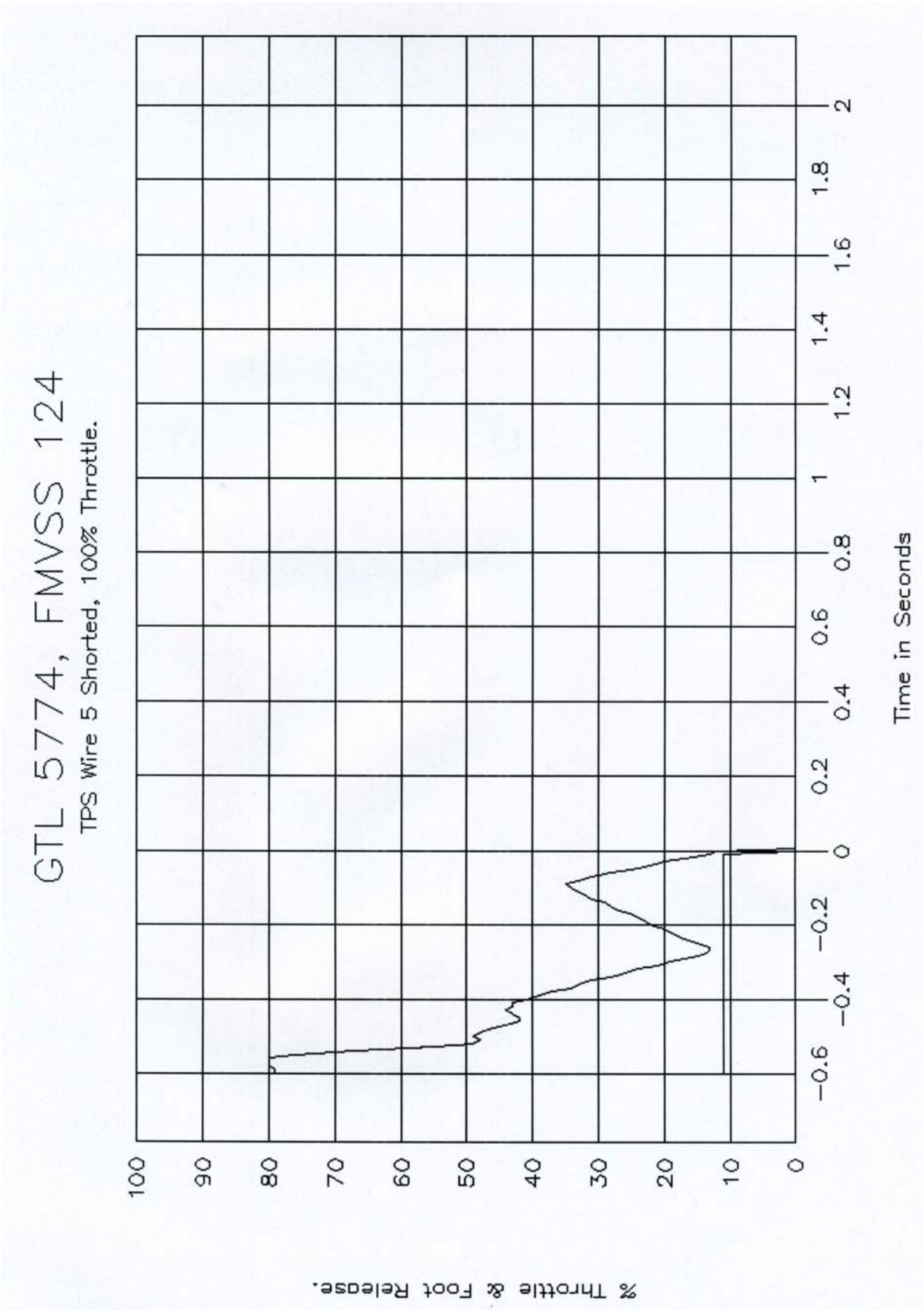
1.8
2
Time in Seconds


GTL 5774, FMVSS 124
TPS Wire 5 Shorted, 100% Throttle.
% Throttle & Foot Release.
100
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30
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-0.6
-0.4
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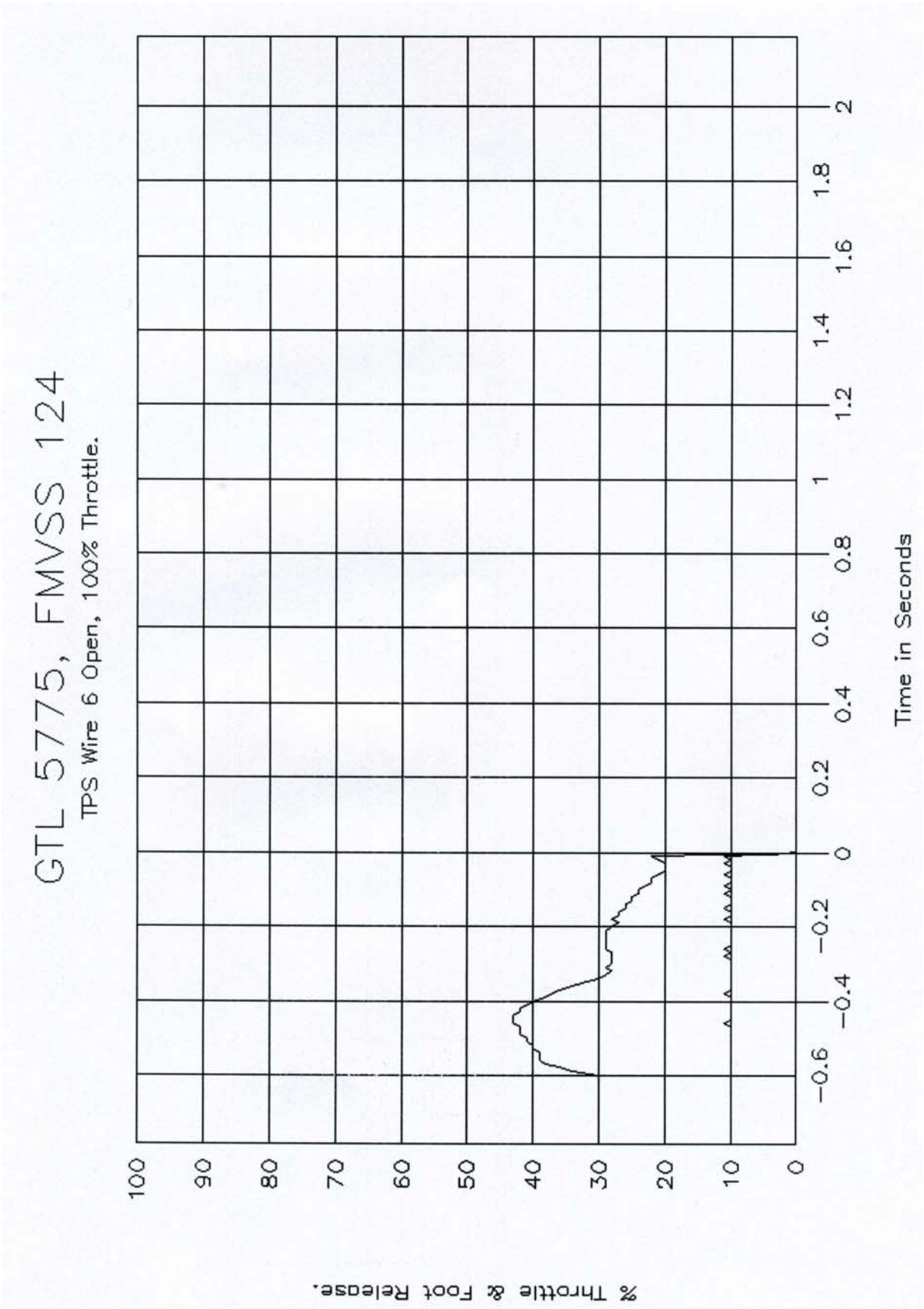
0.8
1
1.2
1.4
1.6
1.8
2
Time in Seconds


GTL 5775, FMVSS 124
TPS Wire 6 Open, 100% Throttle.
% Throttle & Foot Release.
100
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-0.6
-0.4
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1.2
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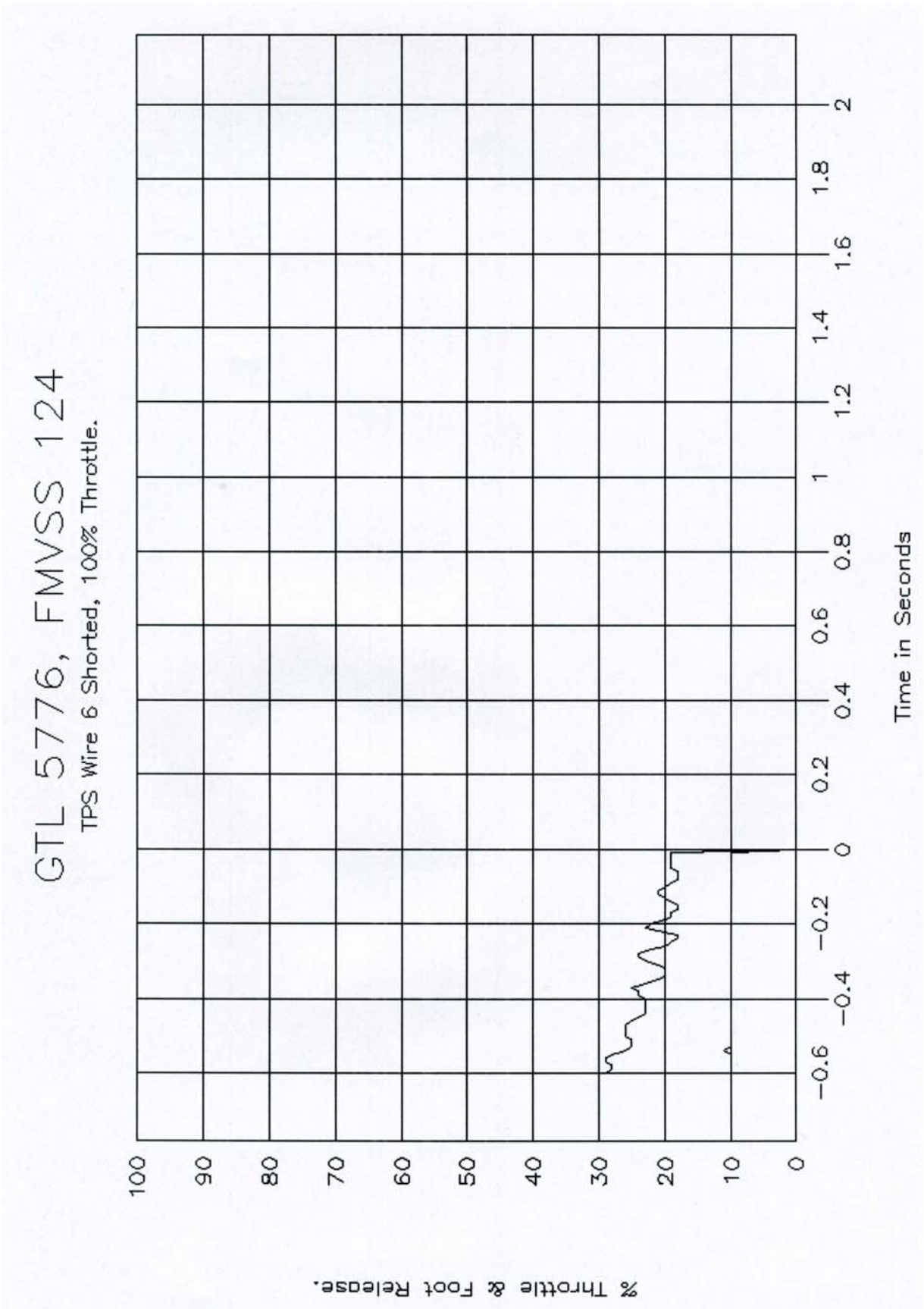
1.6
1.8
2
Time in Seconds


GTL 5776, FMVSS 124
TPS Wire 6 Shorted, 100% Throttle.
% Throttle & Foot Release.
100
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80
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−0.6
−0.4
−0.2
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0.2
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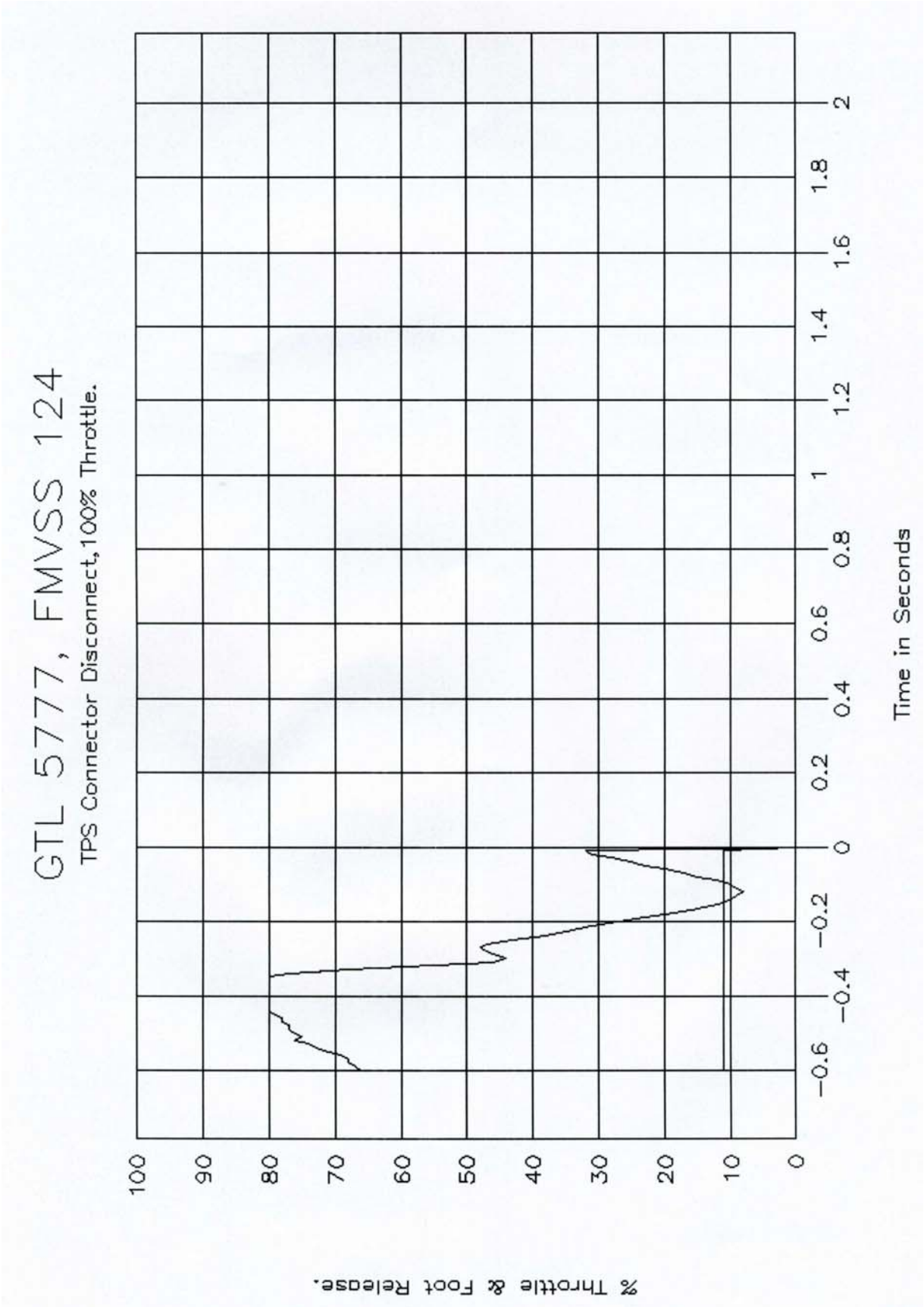
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Time in Seconds


GTL 5777, FMVSS 124
TPS Connector Disconnect, 100% Throttle.
% Throttle & Foot Release.
Time in Seconds
100
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-0.6
-0.4
-0.2
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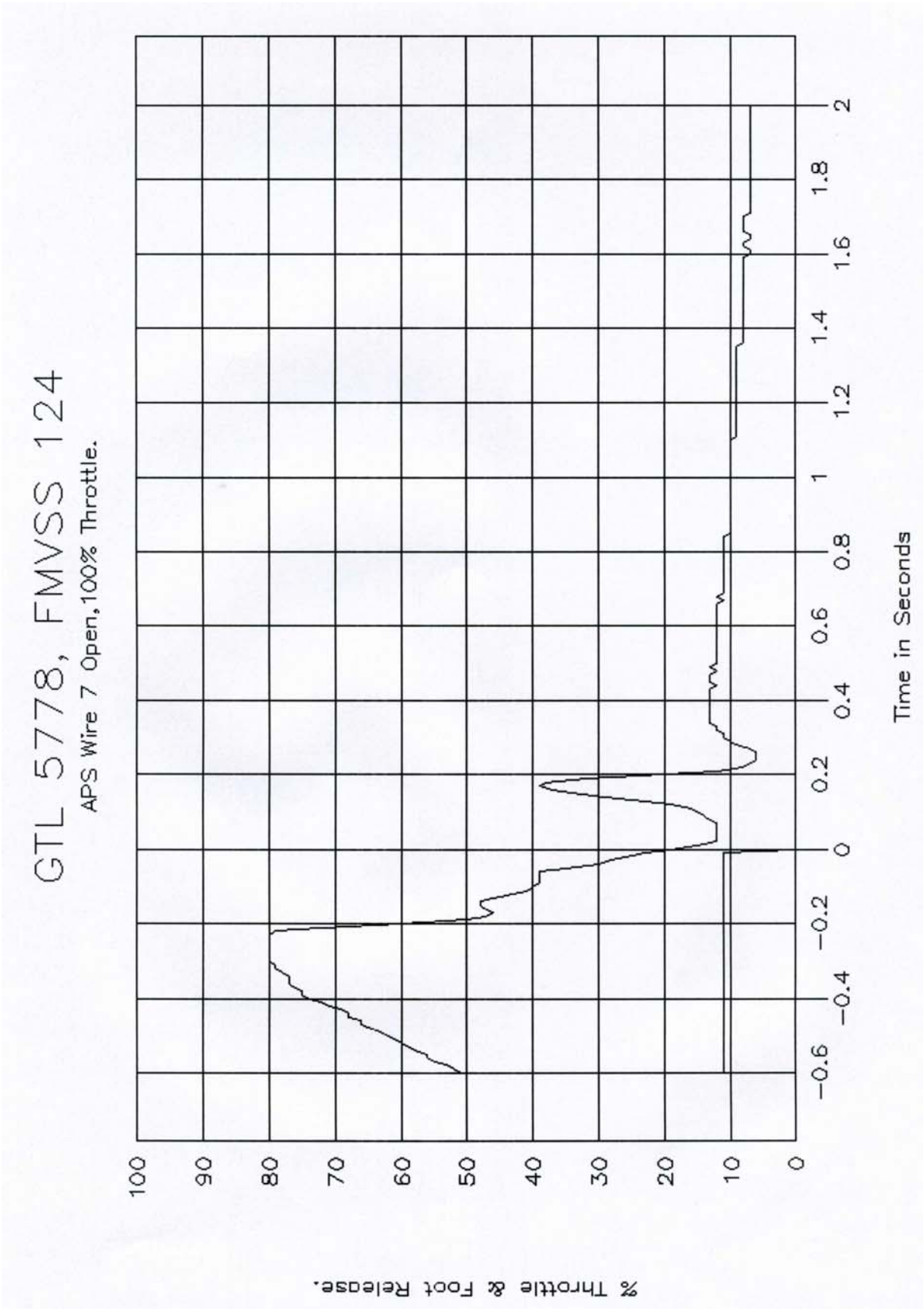
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2


GTL 5778, FMVSS 124
APS Wire 7 Open, 100% Throttle.
% Throttle & Foot Release.
100
90
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70
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30
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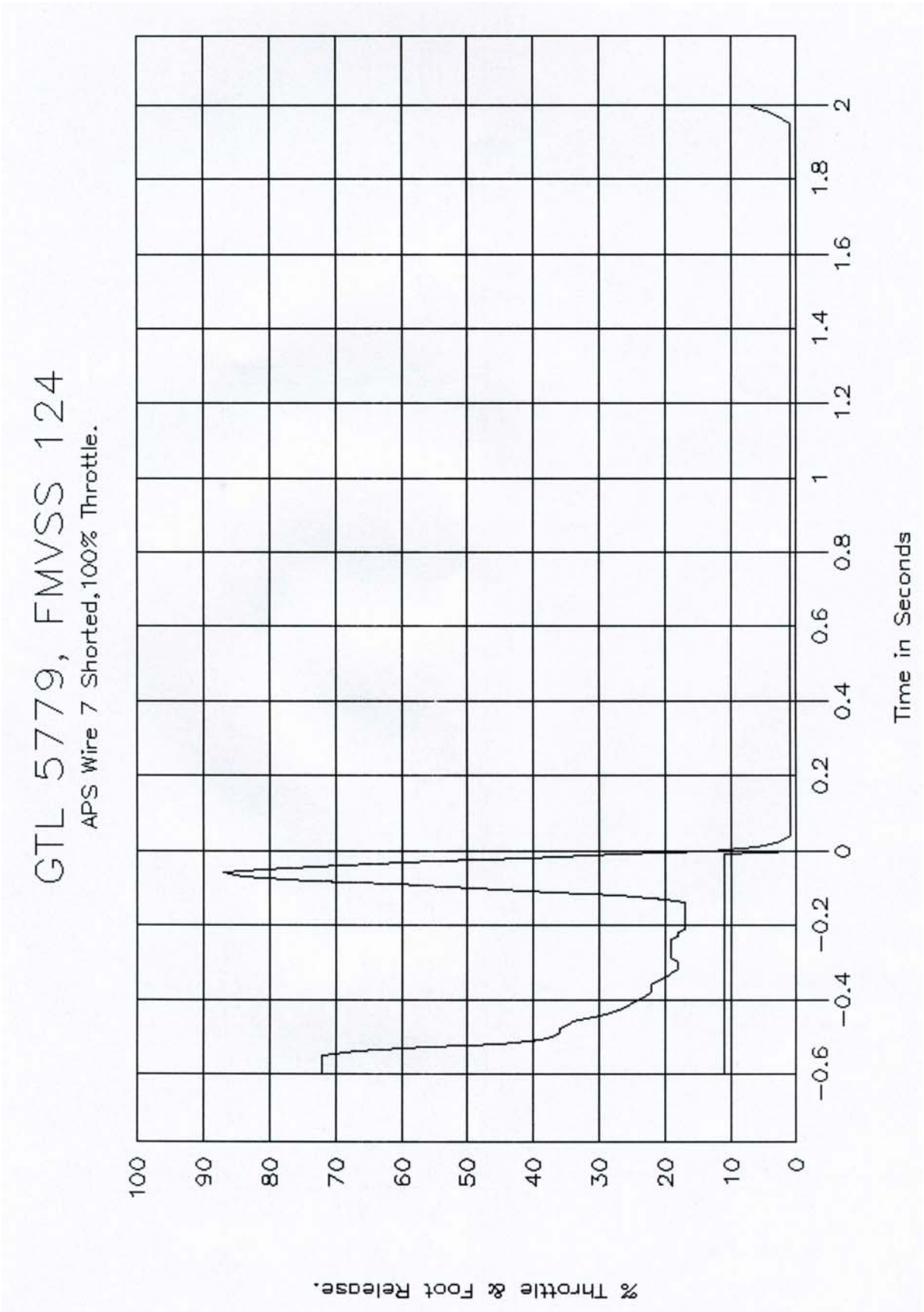
−0.6
−0.4
−0.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Time in Seconds


GTL 5779, FMVSS 124
APS Wire 7 Shorted,100% Throttle.
% Throttle & Foot Release.
100
90
80
70
60
50
40
30
20
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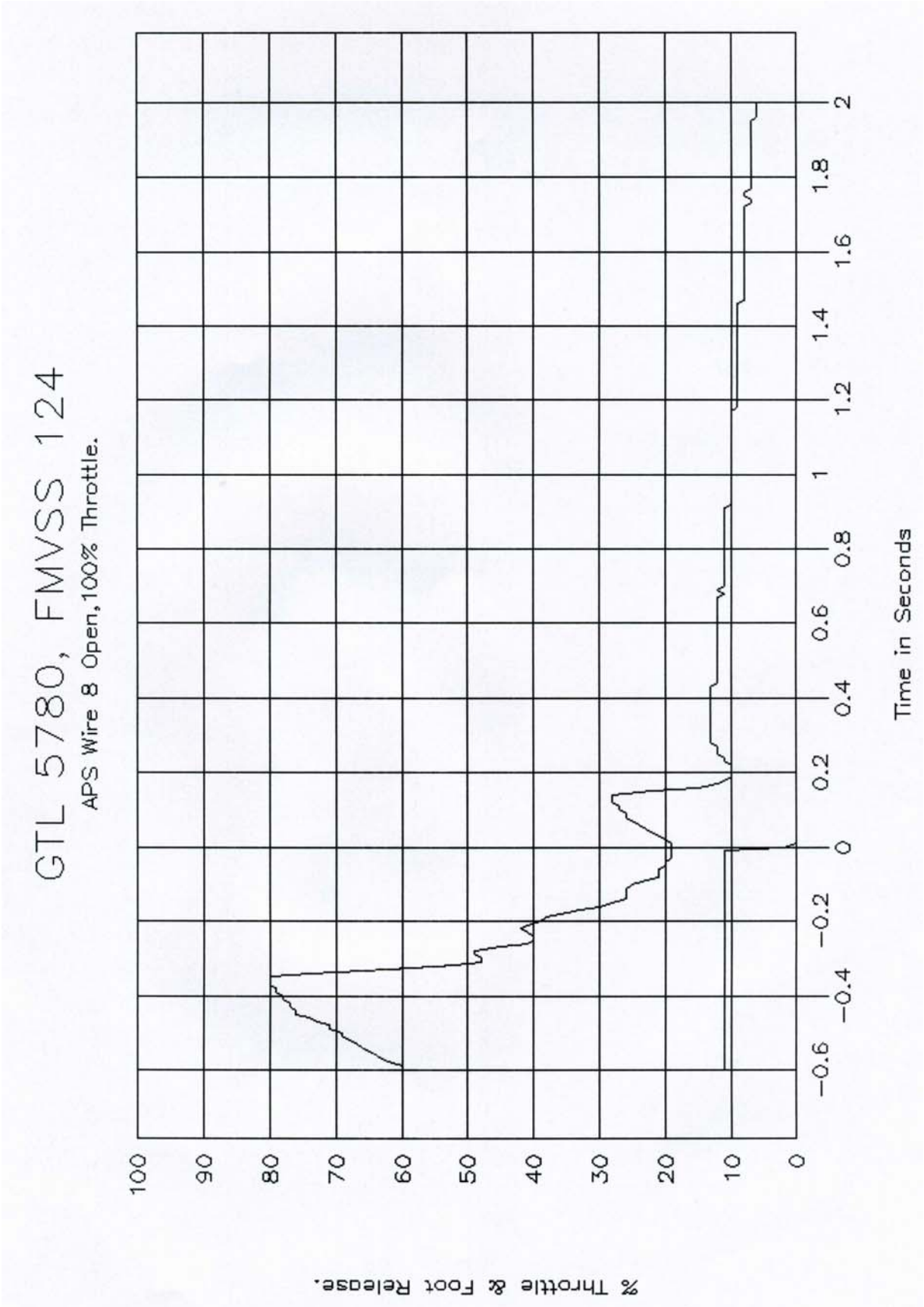
−0.6
−0.4
−0.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Time in Seconds


GTL 5780, FMVSS 124
APS Wire 8 Open, 100% Throttle.
% Throttle & Foot Release.
Time in Seconds
100
90
80
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60
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40
30
20
10
0
-0.6
-0.4
-0.2
0
0.2
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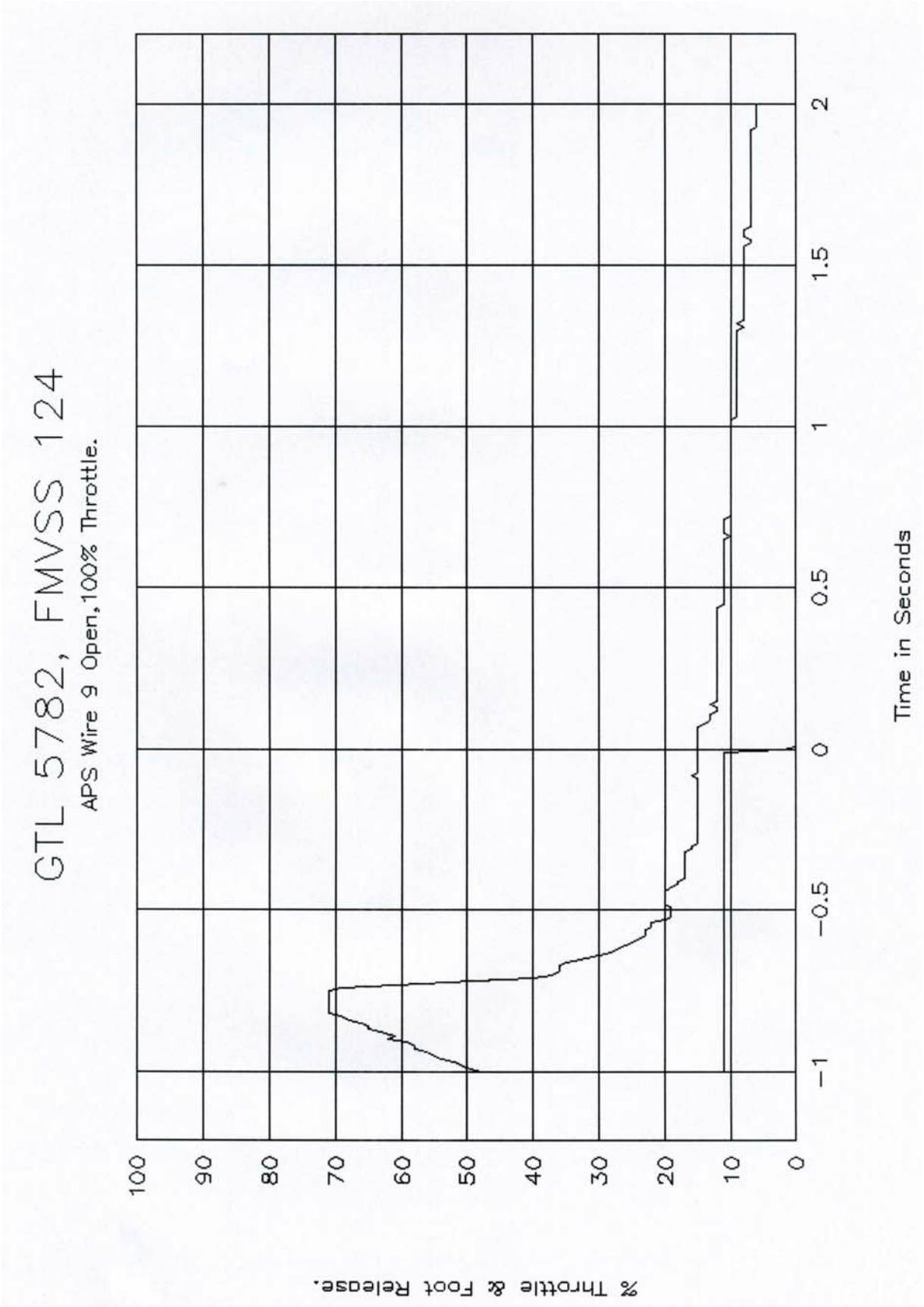
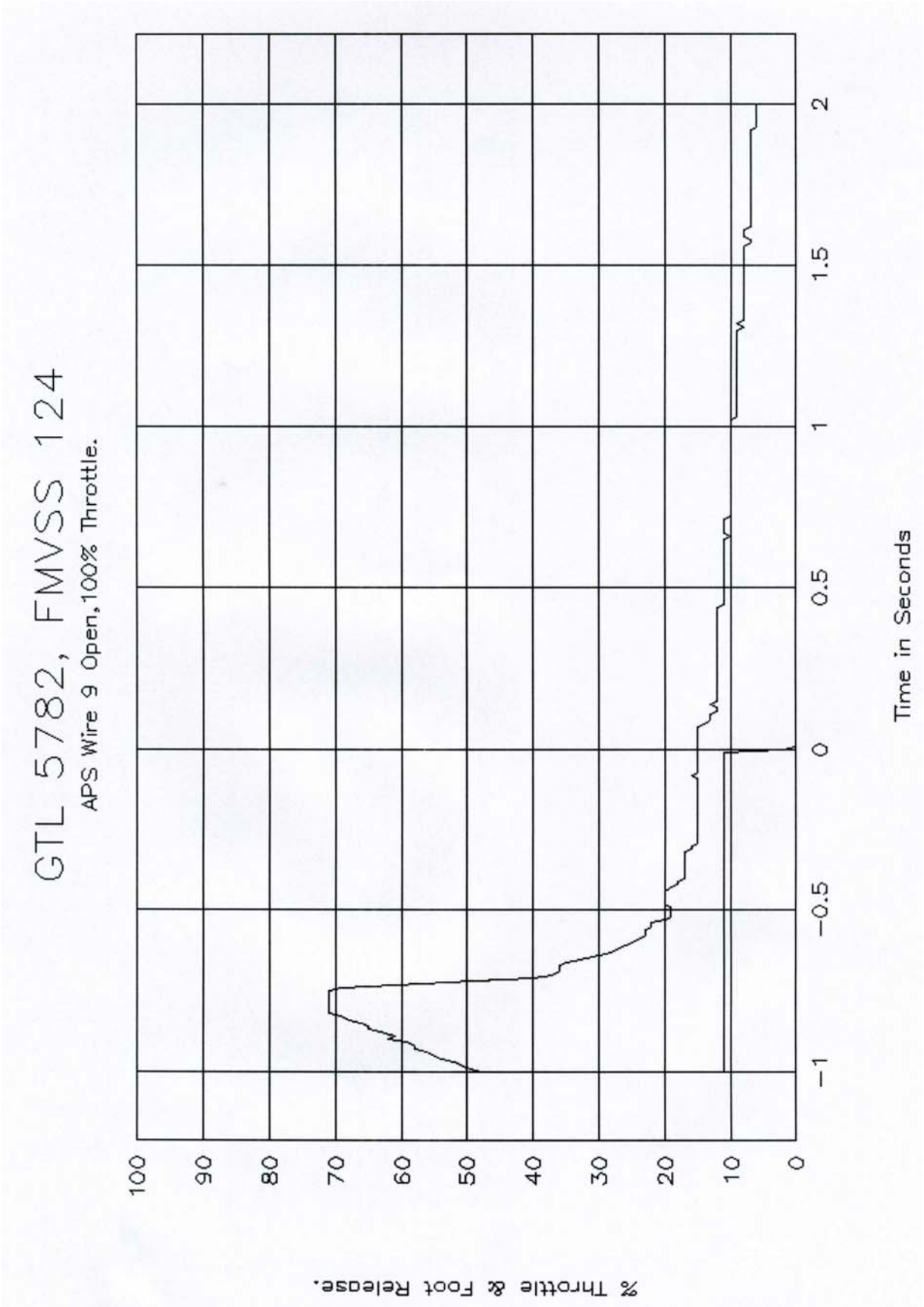
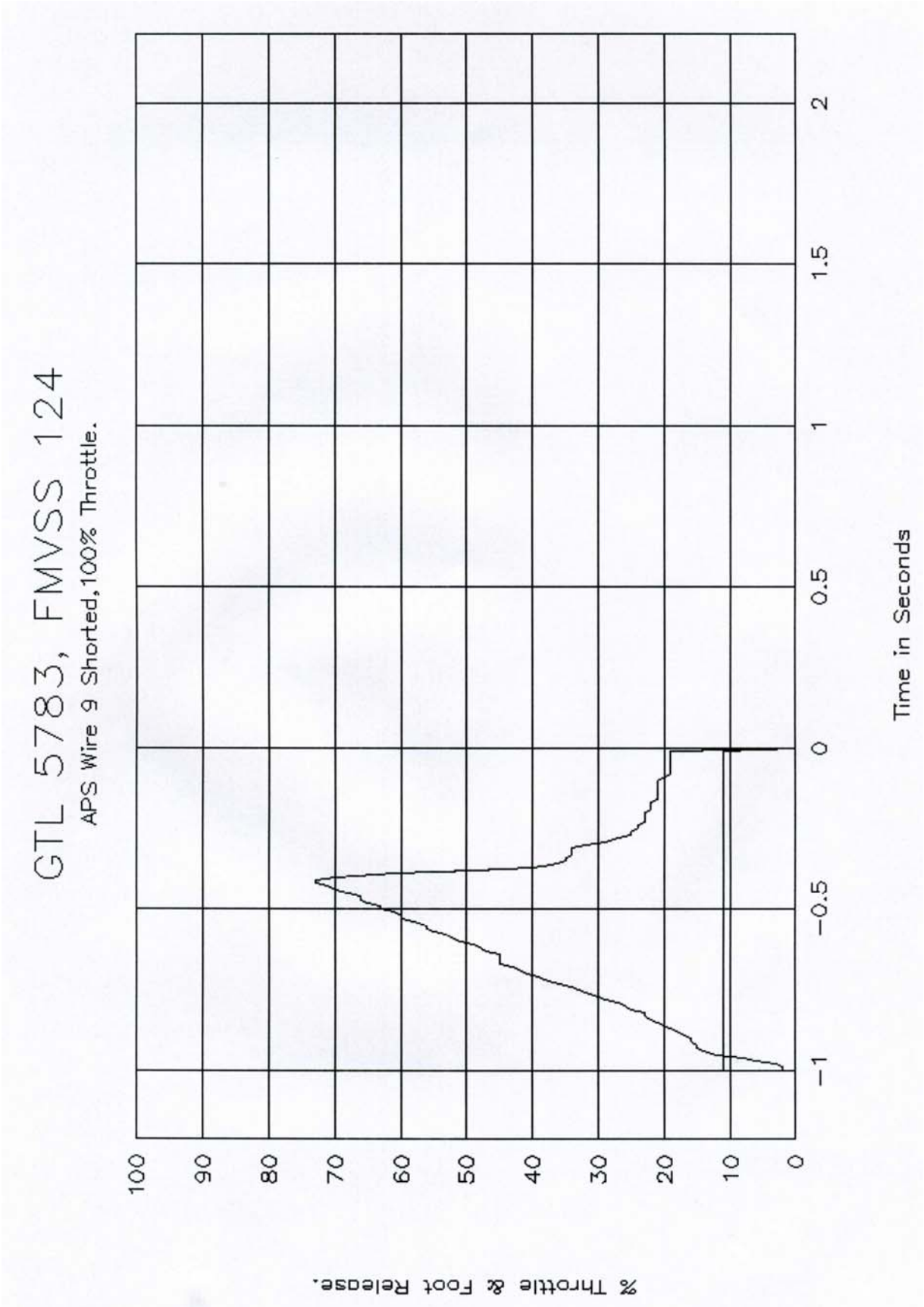
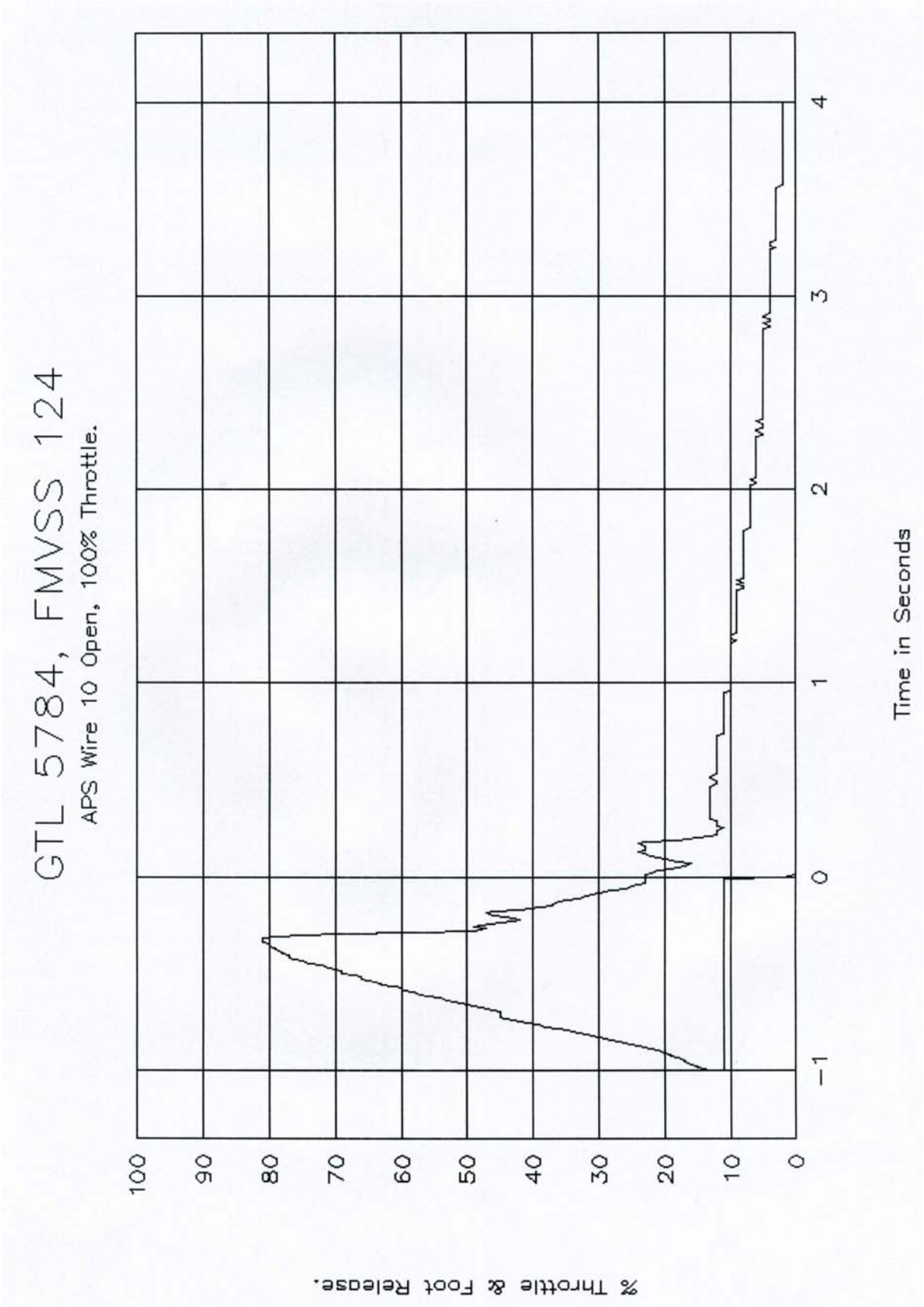
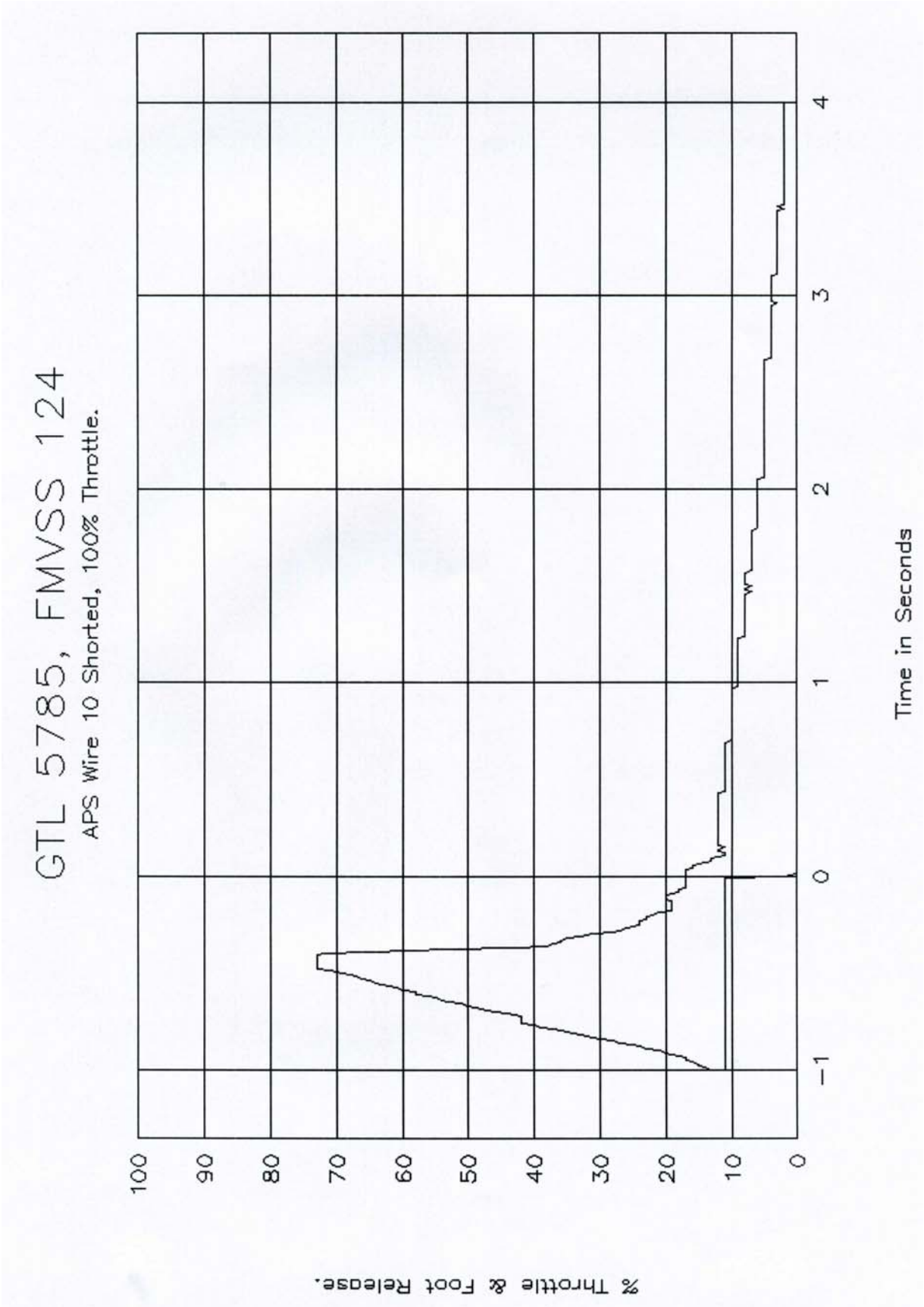
0.6
0.8
1
1.2
1.4
1.6
1.8
2


GTL 5782, FMVSS 124
APS Wire 9 Open, 100% Throttle.
% Throttle & Foot Release.
100
90
80
70
60
50
40
30
20
10
0
−1
−0.5
0
0.5
1
1.5
2
Time in Seconds


GTL 5782, FMVSS 124
APS Wire 9 Open, 100% Throttle.
% Throttle & Foot Release.
100
90
80
70
60
50
40
30
20
10
0
−1
−0.5
0
0.5
1
1.5
2
Time in Seconds


GTL 5783, FMVSS 124
APS Wire 9 Shorted, 100% Throttle.
% Throttle & Foot Release.
100
90
80
70
60
50
40
30
20
10
0
-1
-0.5
0
0.5
1
1.5
2
Time in Seconds


GTL 5784, FMVSS 124
APS Wire 10 Open, 100% Throttle.
% Throttle & Foot Release.
100
90
80
70
60
50
40
30
20
10
0
-1
0
1
2
3
4
Time in Seconds


GTL 5785, FMVSS 124
APS Wire 10 Shorted, 100% Throttle.
% Throttle & Foot Release.
100
90
80
70
60
50
40
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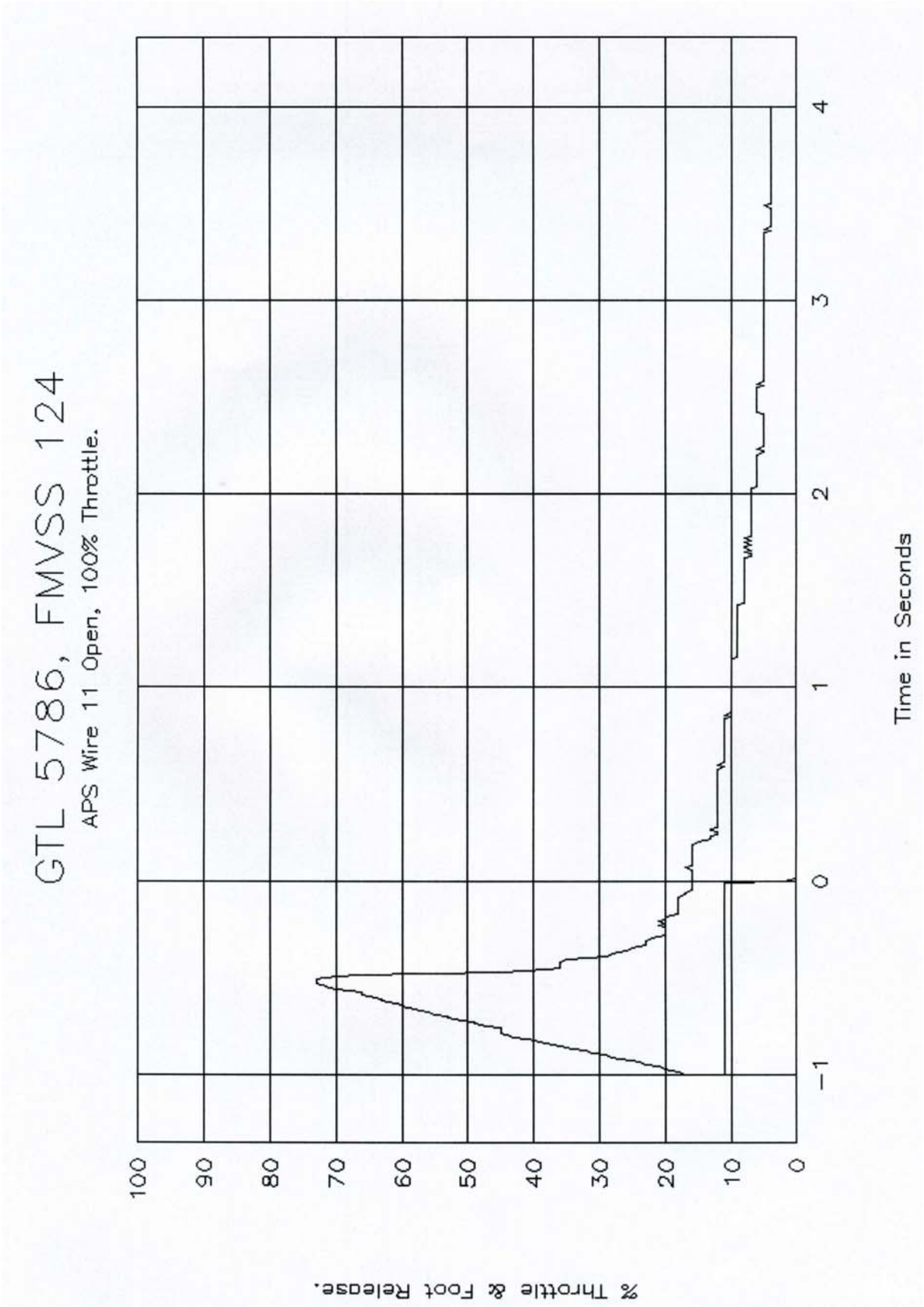
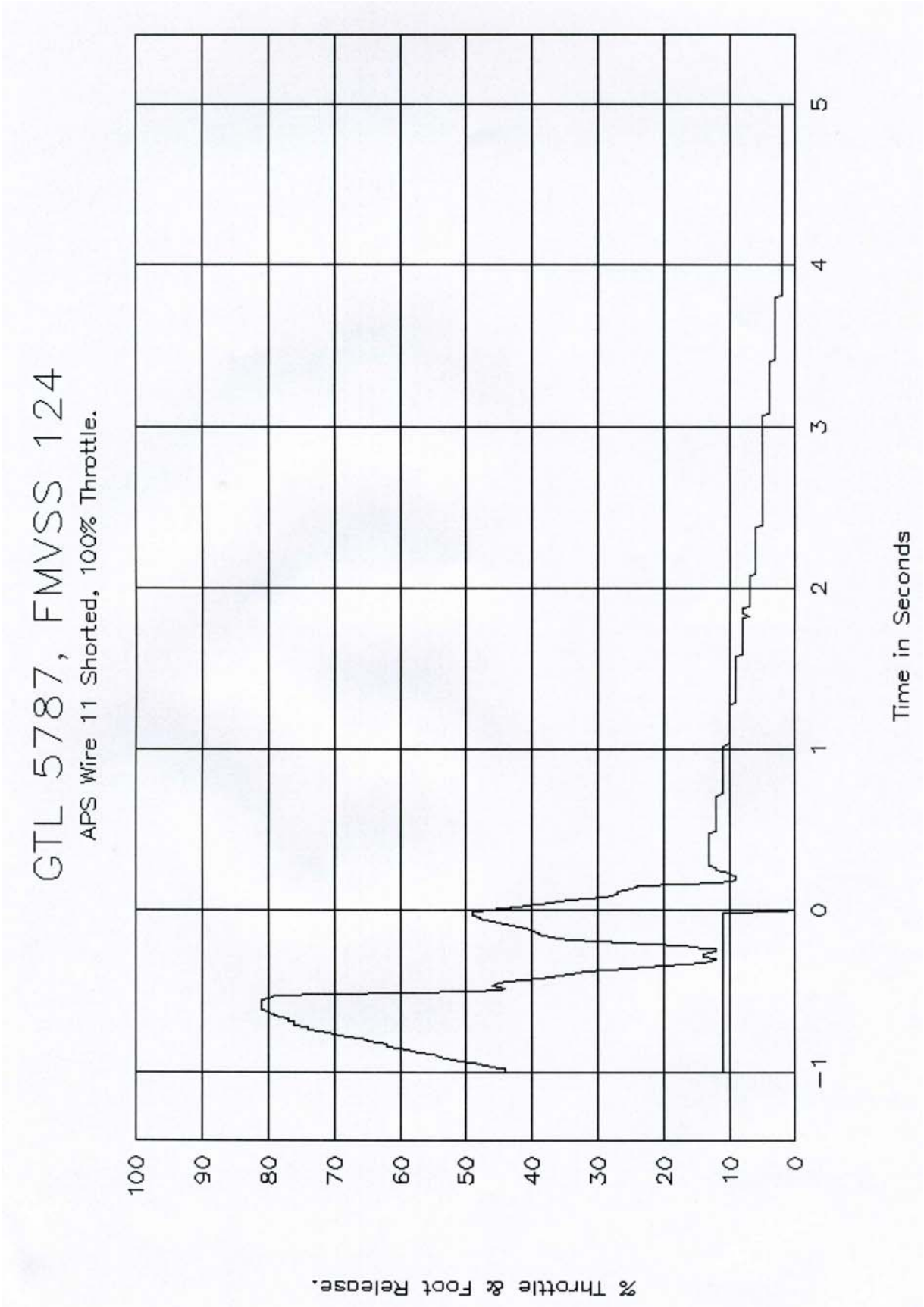
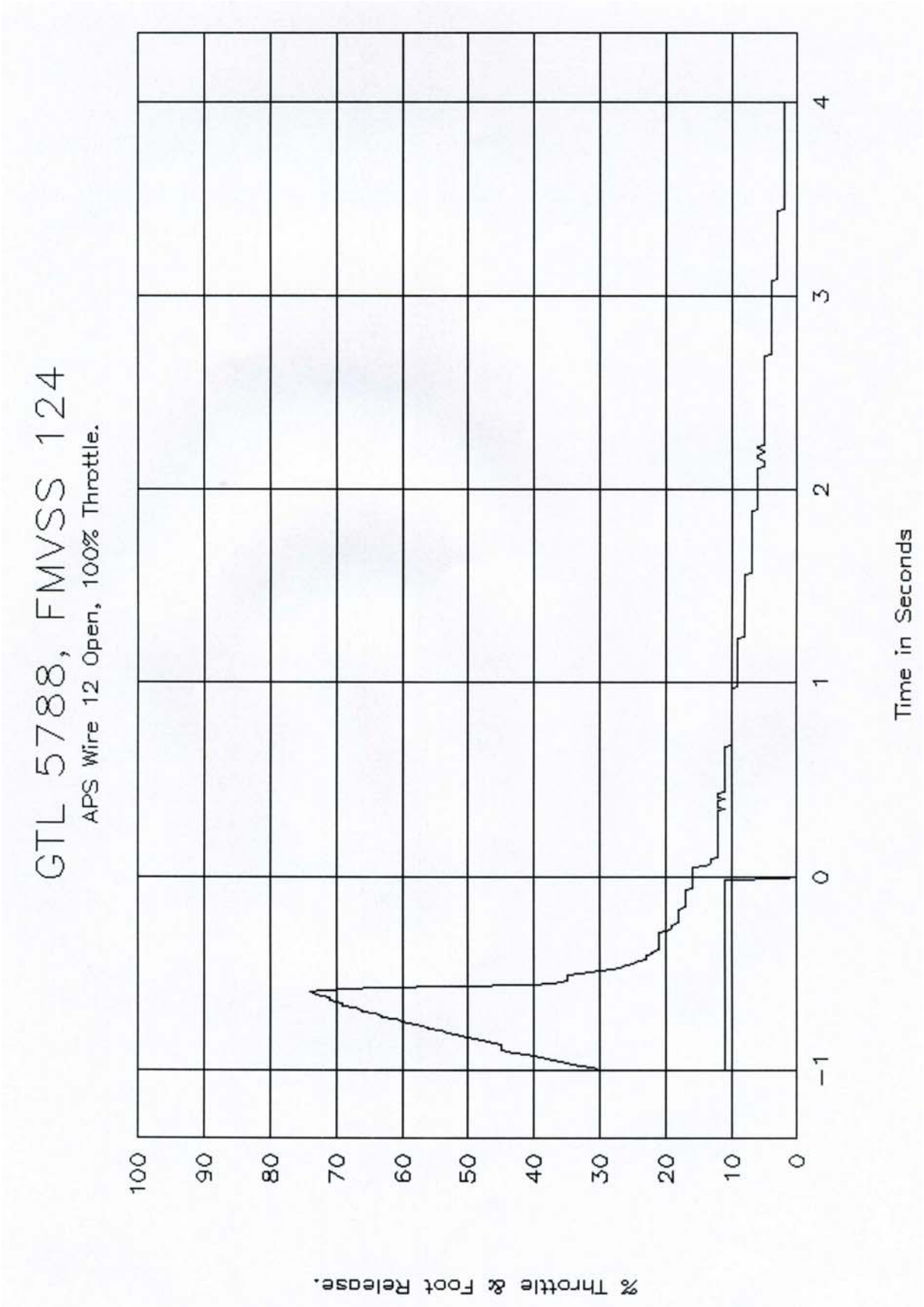
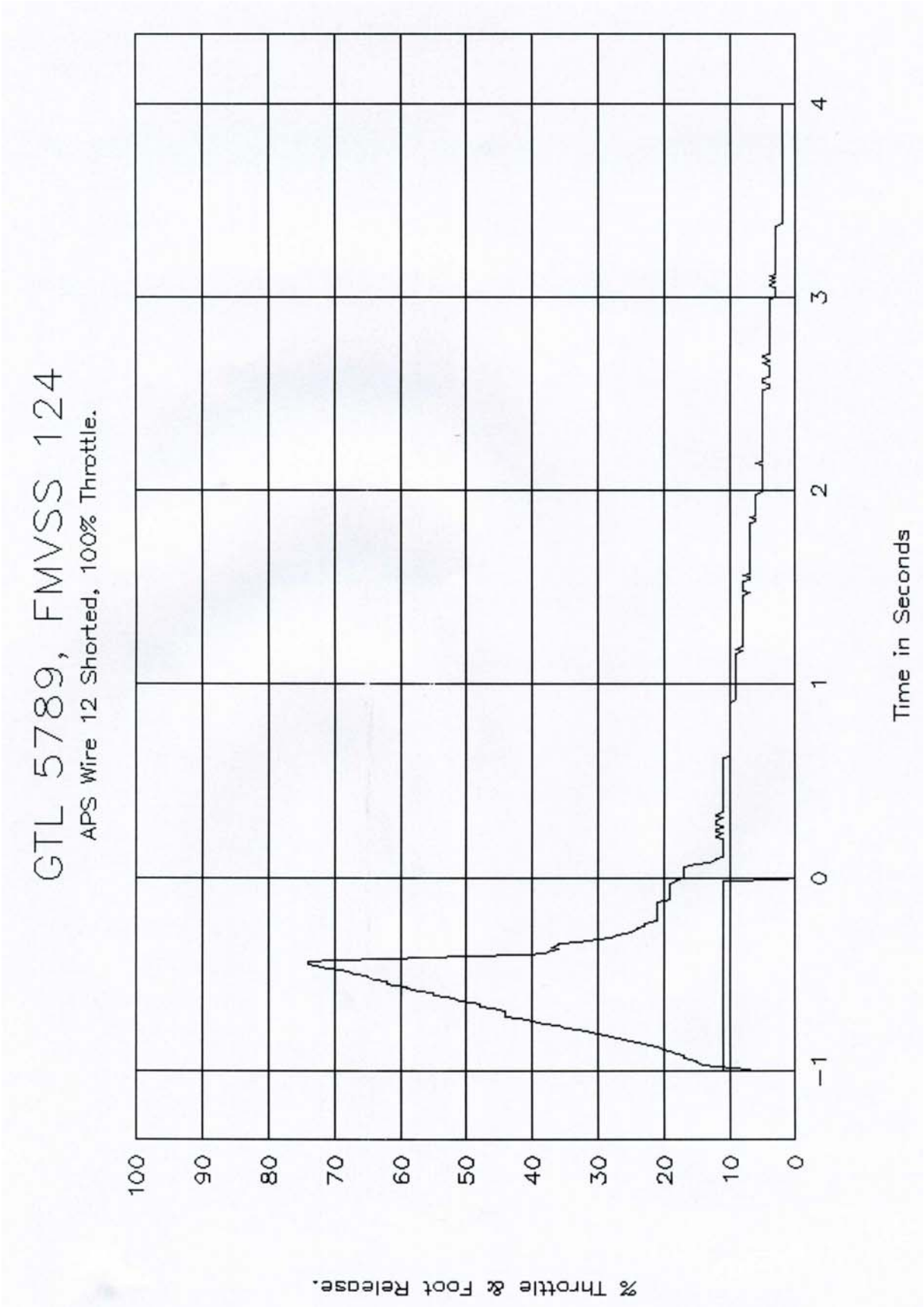
0
-1
0
1
2
3
4
Time in Seconds


GTL 5786, FMVSS 124
APS Wire 11 Open, 100% Throttle.
% Throttle & Foot Release.
100
90
80
70
60
50
40
30
20
10
0
-1
0
1
2
3
4
Time in Seconds


GTL 5787, FMVSS 124
APS Wire 11 Shorted, 100% Throttle.
% Throttle & Foot Release.
100
90
80
70
60
50
40
30
20
10
0
-1
0
1
2
3
4
5
Time in Seconds


GTL 5788, FMVSS 124
APS Wire 12 Open, 100% Throttle.
% Throttle & Foot Release.
100
90
80
70
60
50
40
30
20
10
0
-1
0
1
2
3
4
Time in Seconds


GTL 5789, FMVSS 124
APS Wire 12 Shorted, 100% Throttle.
% Throttle & Foot Release.
100
90
80
70
60
50
40
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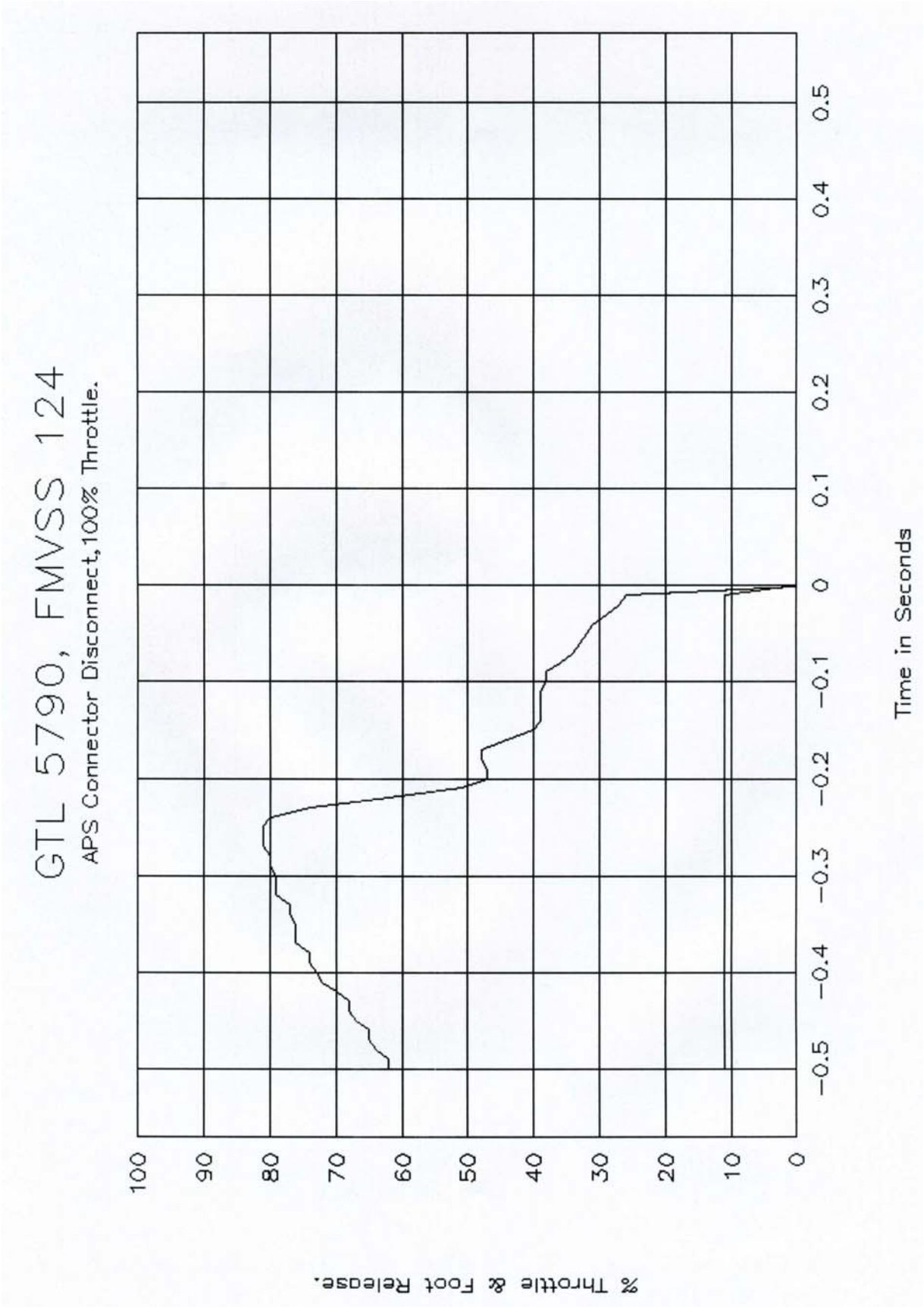
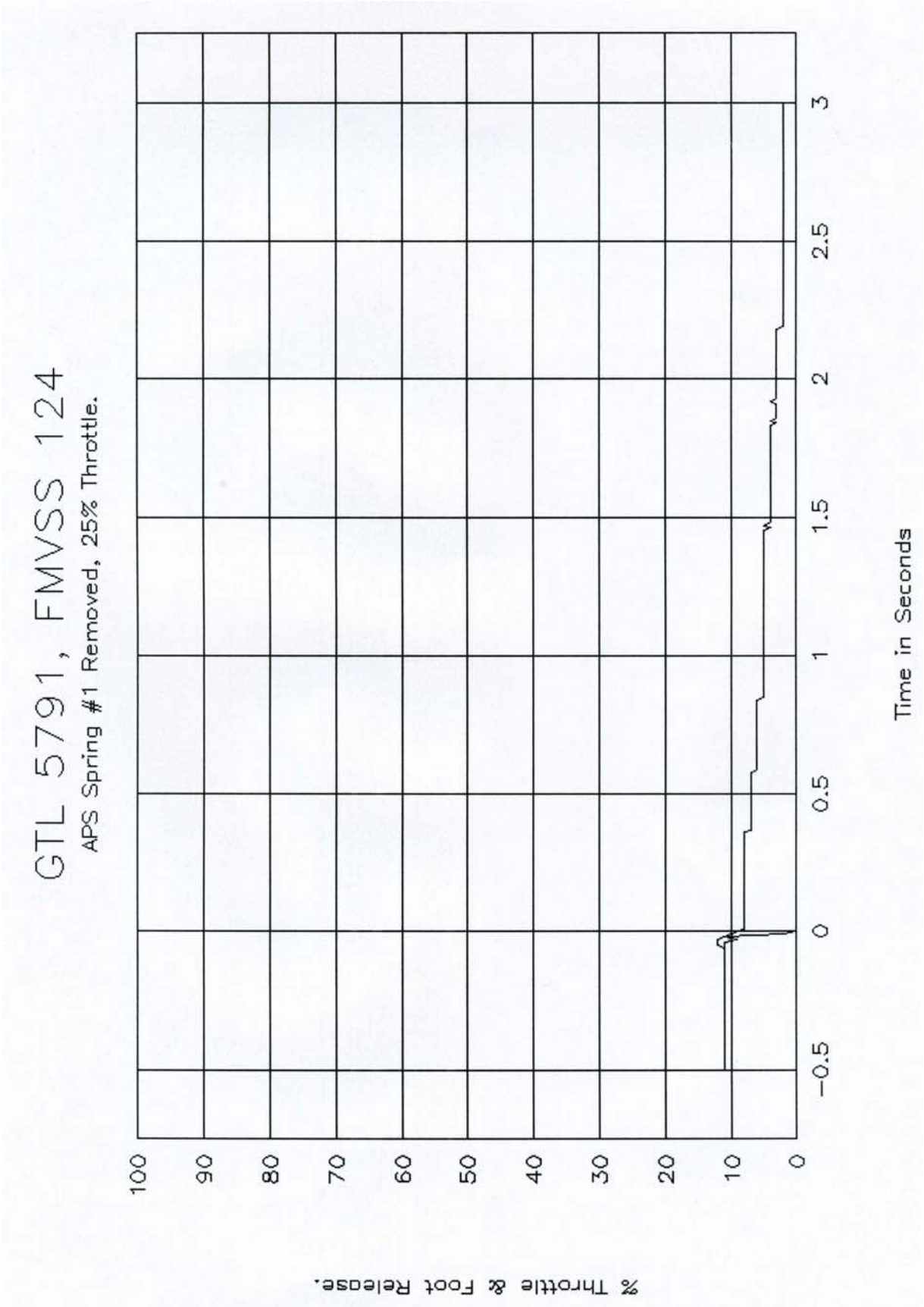
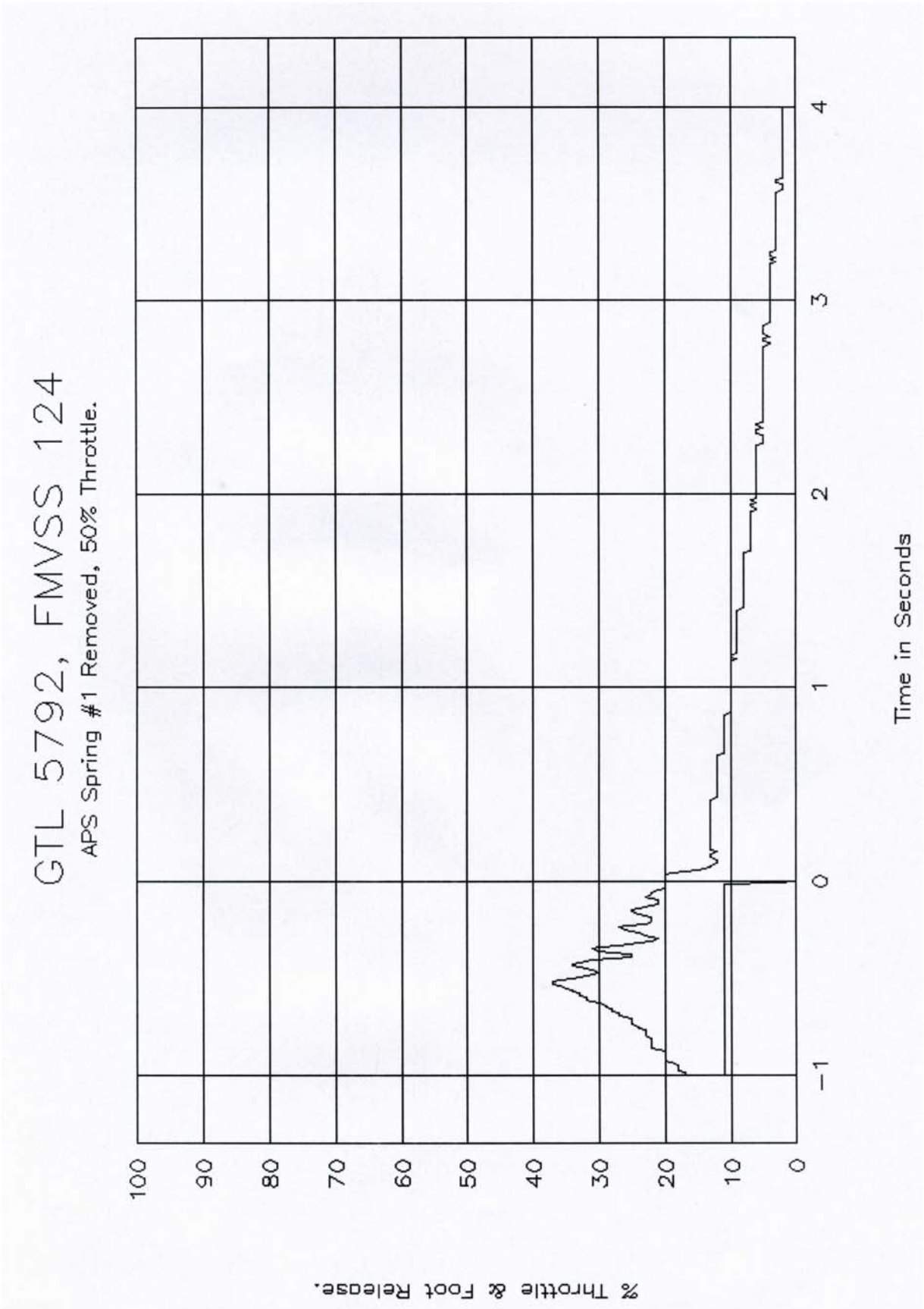
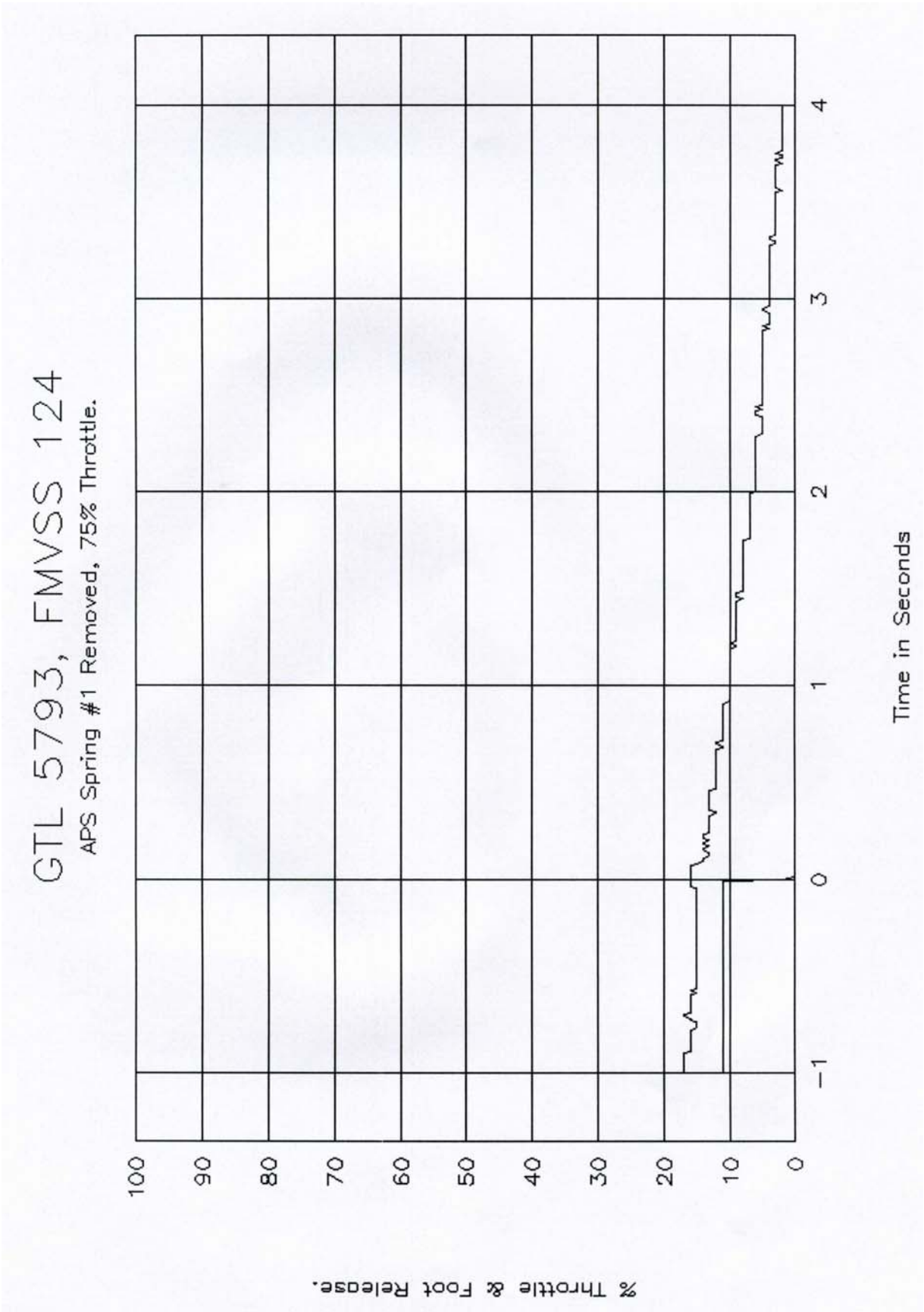
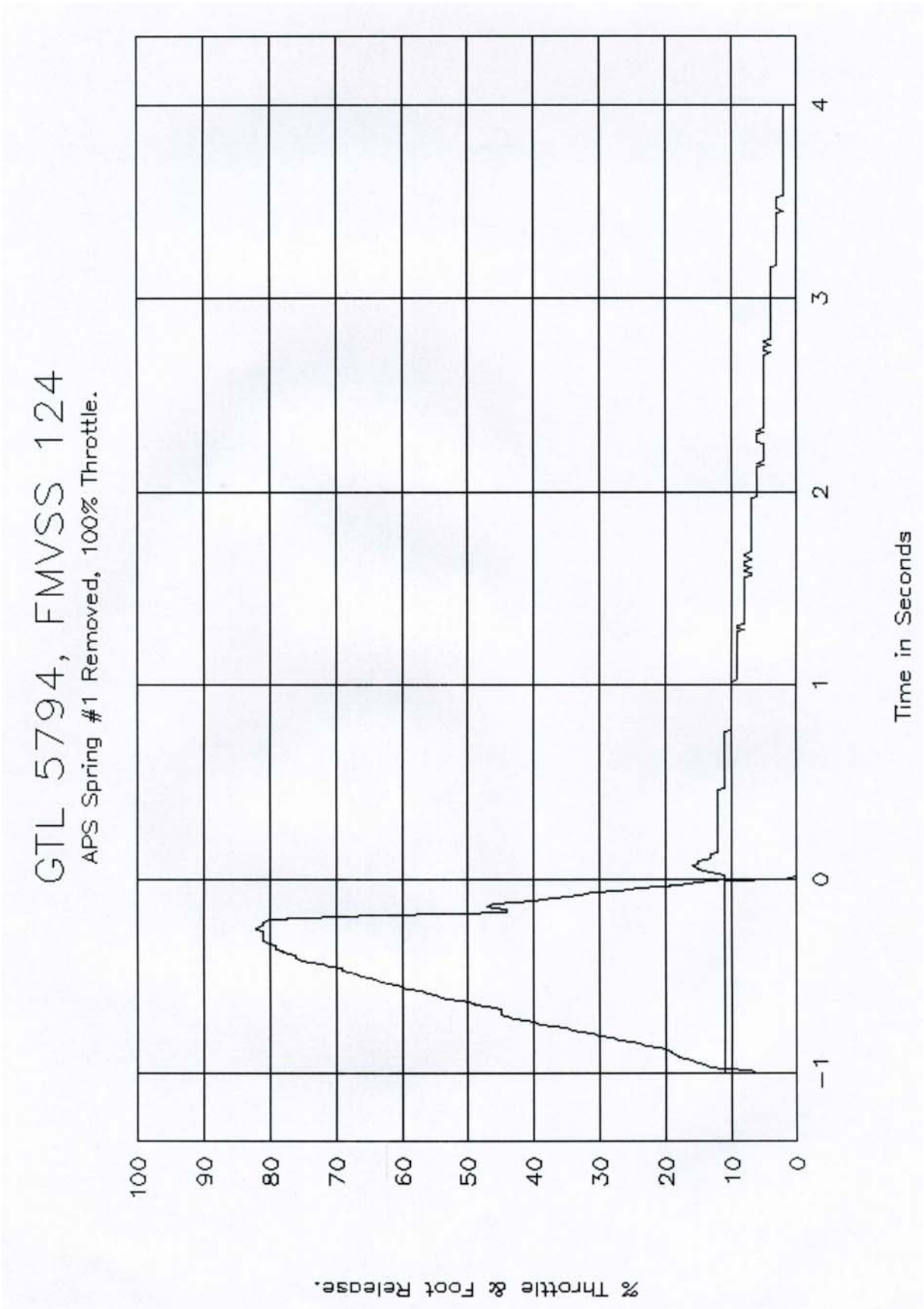
0
−1
0
1
2
3
4
Time in Seconds

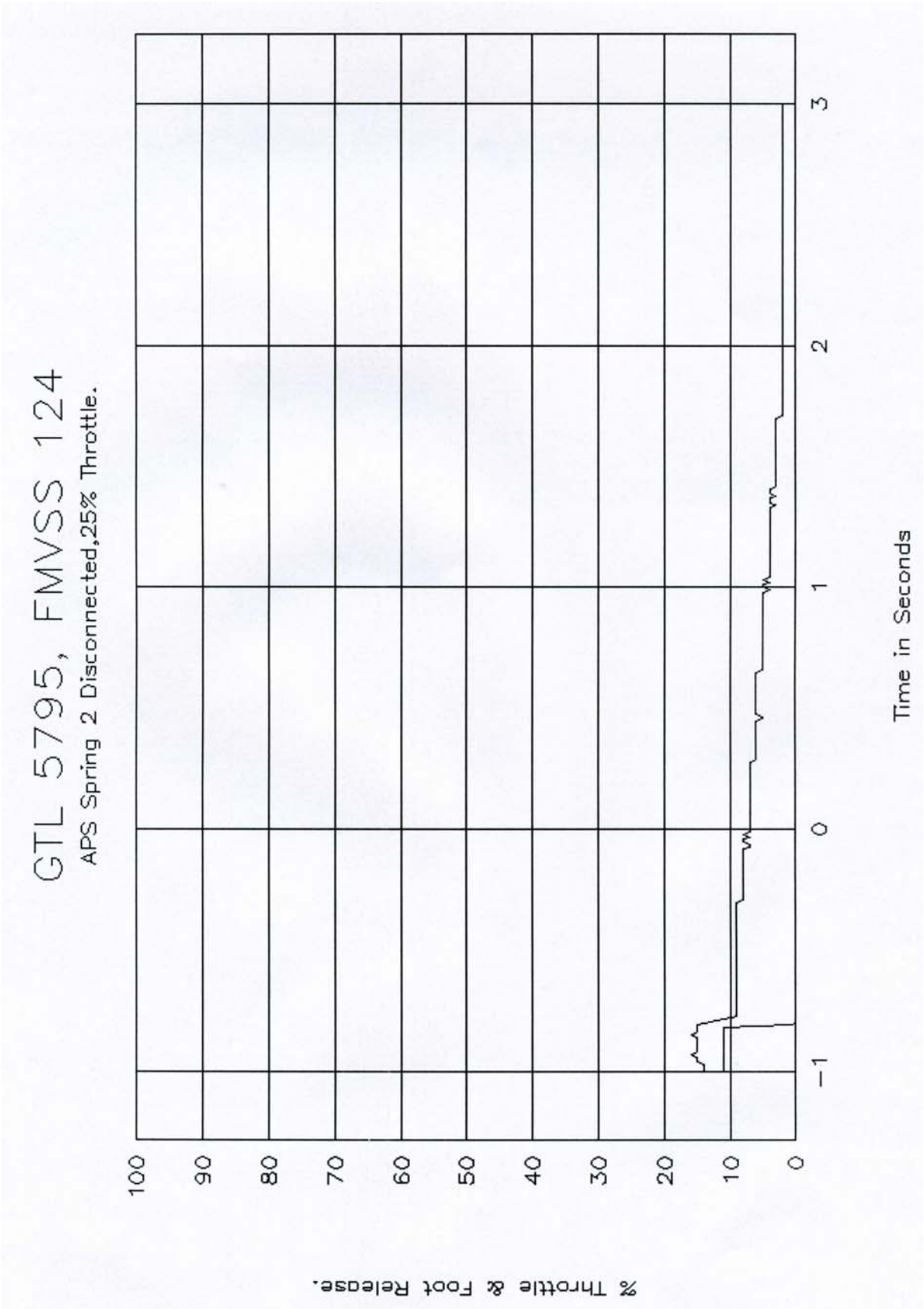

GTL 5790, FMVSS 124
APS Connector Disconnect,100% Throttle.
% Throttle & Foot Release.
100
90
80
70
60
50
40
30
20
10
0
-0.5
-0.4
-0.3
-0.2
-0.1
0
0.1
0.2
0.3
0.4
0.5
Time in Seconds


GTL 5791, FMVSS 124
APS Spring #1 Removed, 25% Throttle.
% Throttle & Foot Release.
100
90
80
70
60
50
40
30
20
10
0
−0.5
0
0.5
1
1.5
2
2.5
3
Time in Seconds

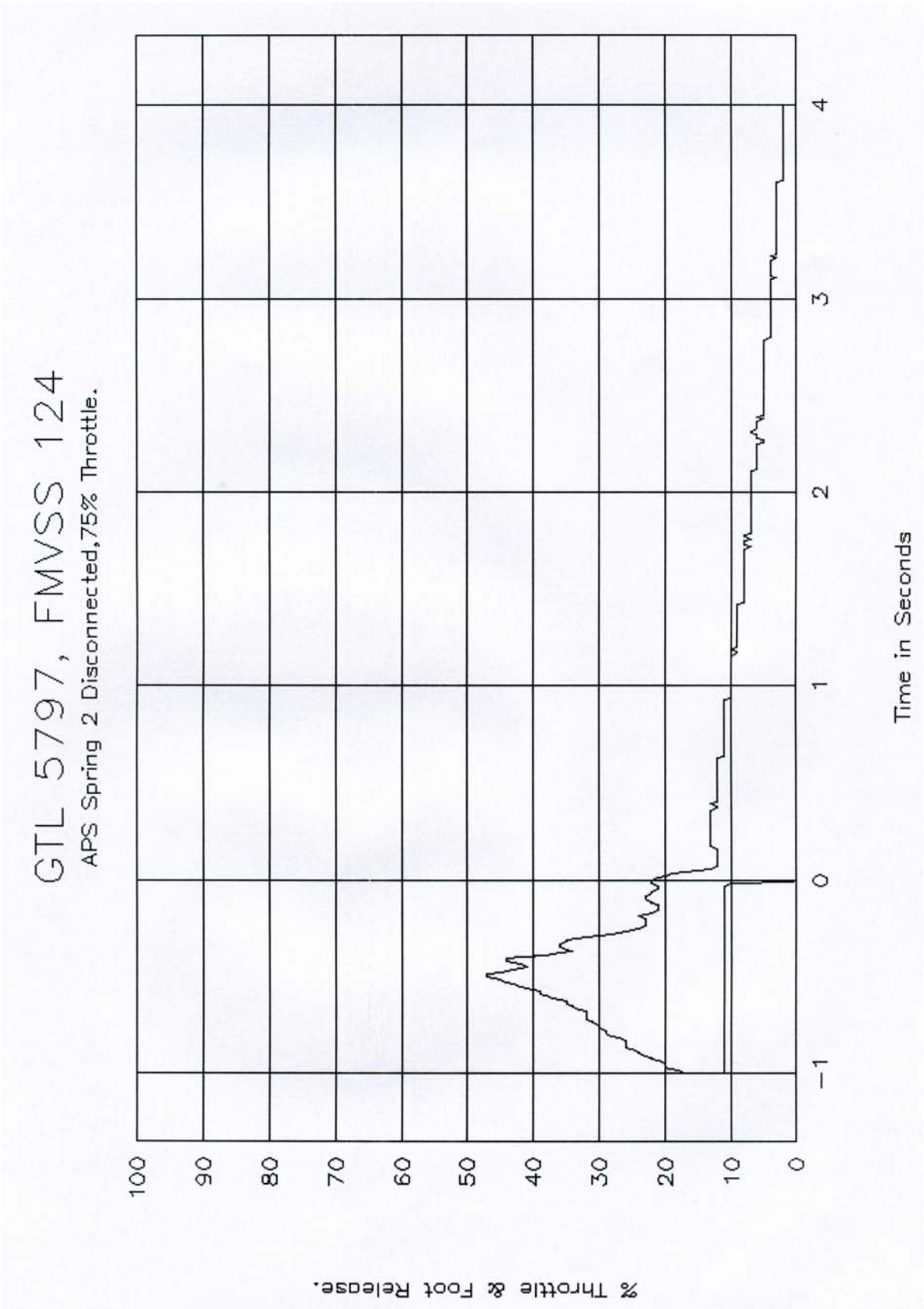

GTL 5792, FMVSS 124
APS Spring #1 Removed, 50% Throttle.
% Throttle & Foot Release.
100
90
80
70
60
50
40
30
20
10
0
-1
0
1
2
3
4
Time in Seconds

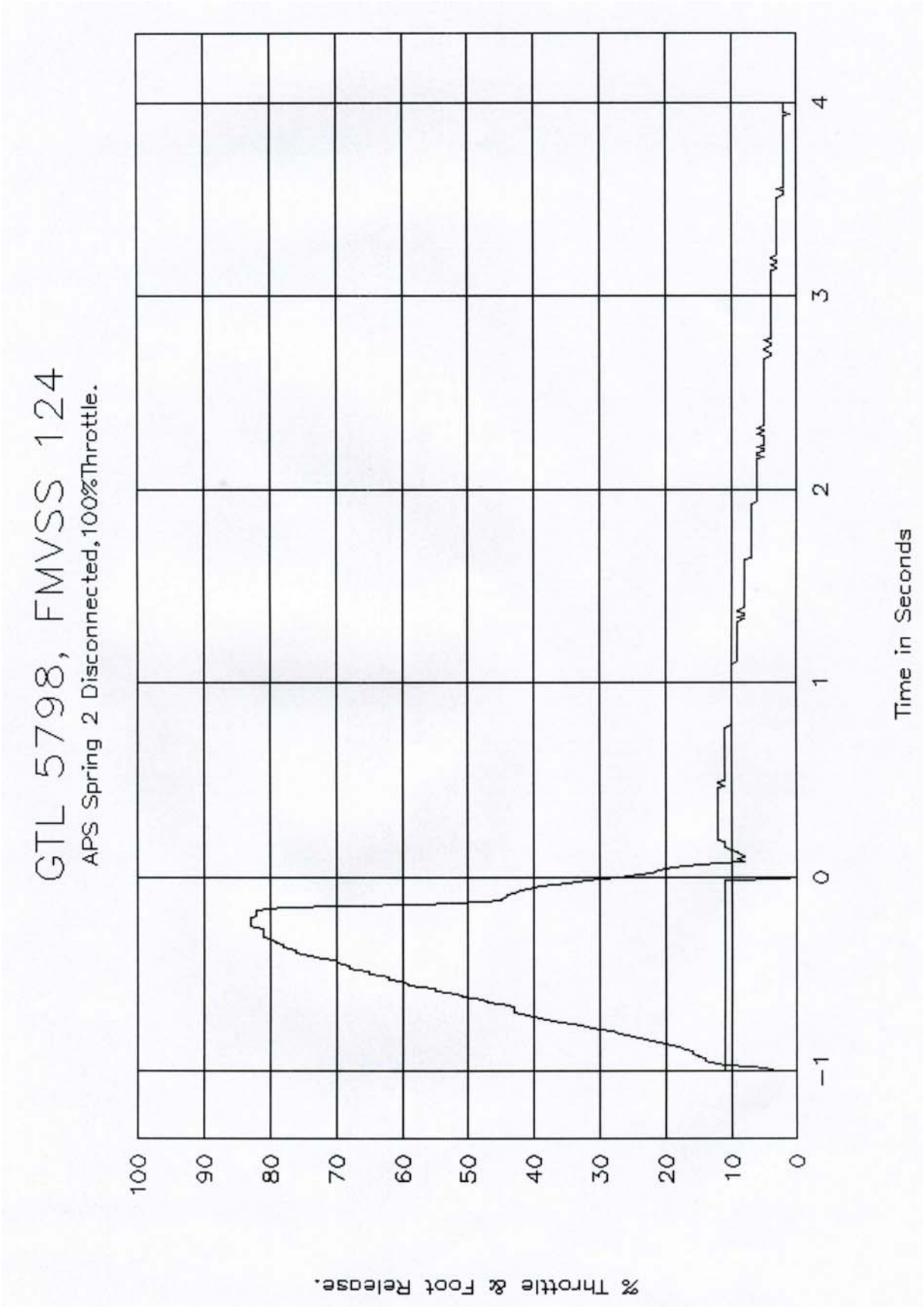

GTL 5793, FMVSS 124
APS Spring #1 Removed, 75% Throttle.
% Throttle & Foot Release.
100
90
80
70
60
50
40
30
20
10
0
-1
0
1
2
3
4
Time in Seconds


GTL 5794, FMVSS 124
APS Spring #1 Removed, 100% Throttle.
% Throttle & Foot Release.
100
90
80
70
60
50
40
30
20
10
0
-1
0
1
2
3
4
Time in Seconds


GTL 5795, FMVSS 124
APS Spring 2 Disconnected,25% Throttle.
% Throttle & Foot Release.
100
90
80
70
60
50
40
30
20
10
0
-1
0
1
2
3
Time in Seconds


GTL 5796, FMVSS 124
APS Spring 2 Disconnected,50% Throttle.
% Throttle & Foot Release.
100
90
80
70
60
50
40
30
20
10
0
-1
0
1
2
3
4
Time in Seconds


GTL 5797, FMVSS 124
APS Spring 2 Disconnected,75% Throttle.
% Throttle & Foot Release.
100
90
80
70
60
50
40
30
20
10
0
-1
0
1
2
3
4
Time in Seconds


GTL 5798, FMVSS 124
APS Spring 2 Disconnected,100%Throttle.
% Throttle & Foot Release.
100
90
80
70
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50
40
30
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10
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-1
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1
2
3
4
Time in Seconds

SECTION 7
MANUFACTURER'S DRAWINGS

FORM – 124
Rev. 10/24/2003

VEHICLE INFORMATION / TEST SPECIFICATIONS

FMVSS No. 124

Gasoline Engines

Requested Information:

1. A sketch of the driver operated accelerator control system (ACS) starting from the accelerator pedal up to and including the fuel metering device (carburetor, fuel injectors, fuel distributor, or fuel injection pump).

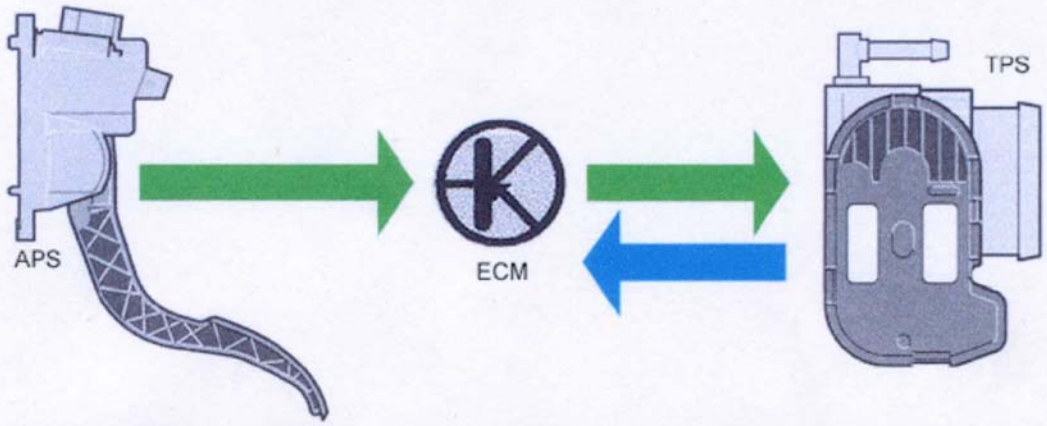

Figure 1: Schematic representation of the ACS of a gasoline passenger car
APS Accelerator Pedal Position Sensor
ECM Electronic Control Module
TPS Throttle Plate Position Sensor

2. For Normal ACS operation, the method utilized to determine the engine idle state (air throttle plate position, fuel delivery rate, other).

The electronic throttle valve is adjusted by an electric motor which moves the throttle valve over the complete range from zero to full open throttle. The driver depresses the accelerator pedal witch corresponds to the driver's requested engine torque. The accelerator pedal position is captured by a signal from the pedal sensor system. This activates the throttle valve adjustment motor and adjusts the throttle valve from a closed to open position in direct response to driver input. With the information from the throttle valve position sensor system the throttle valve position can be determined at any time.

3. For Fail-Safe operation of the ACS (disconnection or severance), the method utilized to determine return of engine power to the idle state (air throttle plate position, fuel delivery rate, air intake, engine rpm, other)

Both energy sources, the throttle valve adjustment motor and the throttle valve return spring work independently from one another and are alone able to return the throttle valve in a idle position over the complete temperature range from +52°C to –40°C.

4. Is the vehicle ACS equipped with any of the following:

A. Accelerator Pedal Position Sensor (APS)
B. Throttle Plate Position Sensor (TPS)
C. Electronic Control Module (ECM)
D. Air throttle plate actuator motor

The vehicle ACS is equipped with all from A to D.

5. If air throttle plate equipped, is there a procedure which can be utilized by the test laboratory to measure the position of the throttle plate by tapping into the TPS or ECM? If so, please describe.

The throttle valve housing includes the throttle valve position sensor system. A wire adapter can be positioned between the throttle valve housing and the wire harness in the engine compartment to measure the voltage. The voltage recorded provides a measure to definitely determine the throttle valve position.

6. Point(s) chosen to demonstrate compliance with FMVSS No. 124 for single point disconnect and severance.

Should the throttle valve adjustment motor loose voltage, the throttle valve returns within the specified time period, by means of the throttle valve return spring in the throttle valve housing, to a predetermined idle position.

If there is a disconnected wire at the accelerator pedal, the throttle valve adjustment motor and the throttle valve return spring together return the throttle valve to the predetermined idle position.

7. Where applicable, were connections in the ACS beyond the ECM such as the fuel injectors tested for disconnection and severance. If yes, provide details.

By air regulated engines (λ=1) the air mass is the controlling quantity and is dependent on the throttle valve so that the throttle valve and not the injectors is the relevant component.

8. Where applicable, were idle return times tested for electrical severance accompanied by shorting to ground? If yes, please provide details.

The redundant and diverse energy sources in the throttle valve are independent. Each of them is able to bring the throttle valve at any time back to the predetermined idle setting. The reset times are determined as follows:

During the depressing of the accelerator pedal with an operating unit and switch will b electrically opened (see Figure 2). Then the accelerator pedal is quickly released, at which time the switch closes, and that signal is the trigger for the timing of the measurement.

Figure 2: Operating means for accelerator pedal movement.

To test the throttle valve adjustment motor and the throttle plate independently from th return spring, the return spring is released. Figure 3 shows such a throttle valve.

Figure 3: Throttle valve with return spring released (not actuated ► fully opened !

Using the measuring technique represented in Figure 4, the timing of the throttle valve movement to the idle operating position can be noted and evaluated.

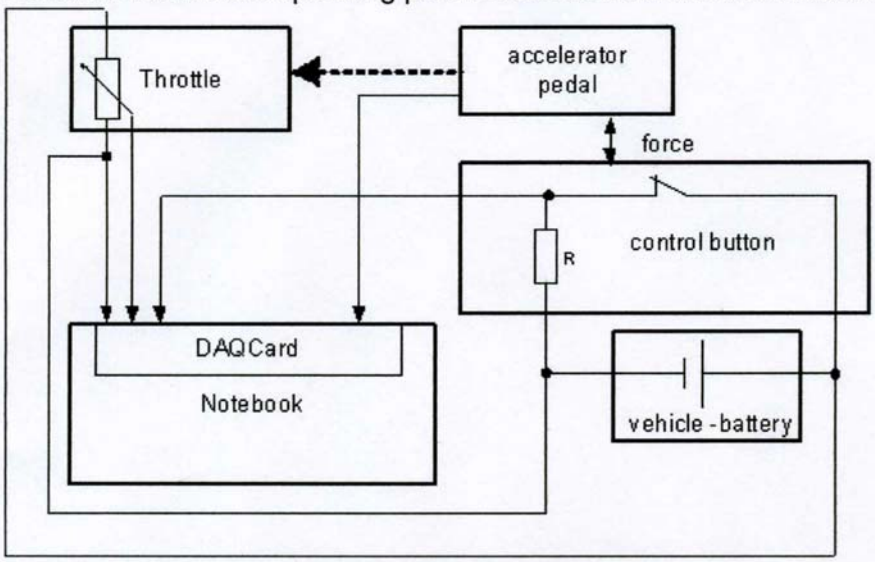

Figure 4: Schematic representation of measuring technique.

To test the function of the return spring in the throttle valve housing a complete throttle valve with return spring is used and the voltage supply to the throttle valve adjustment motor is cut-off. The time required for the throttle valve to return to the idle position is evaluated and analyzed.

9. All sources of return energy (springs) for the accelerator pedal and if applicable, the air throttle plate.

Accelerator Pedal - The accelerator pedal has two redundant working springs that return the pedal to the starting position.

Throttle Valve - The throttle valve adjustment motor is an electric motor that opens or closes the throttle valve in response to driver input and is capable of doing so even in the event that the throttle valve return spring is defective. If the voltage supply is interrupted or if the electric motor is defective, the throttle valve return spring brings the throttle valve back to the predetermined idle position.

10. If fuel delivery rate is used to demonstrate return to idle state, provide:

A. The method used to measure this signal i.e. connection to standard SAE J1587 data bus.
B. Equipment required to measure signal.

In air flow regulated engines the air mass is the power controlling quantity and this is dependent on the throttle valve which is the test relevant part and not the injectors.

A. The fuel supply is not measured on air regulated engines.
B. None

11. Fuel rate signal output range at the idle state.

None. See above.

12. Is the ACS equipped with a limp home mode? If yes, provide operation description.

Yes. A limp mode to permit the vehicle to drive home is included. In case of a failure, the engine speed and the engine torque will be automatically reduced and continued driving at reduced engine output is possible.

13. Method by which the test laboratory can record engine RPM by connection to ECM, OBD connector, etc.

The engine RPM can be recorded with a generic scan tool in address 33 (scan-tool OBD) in mode 1 pid $0c. The scan tool should be connected to the OBD socket.