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Interior/Exterior Noise Levels of Over-the-Road Trucks: Report of Tests

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Each vehicle was tested utilizing five different operation procedures and each test was number coded as follows: test 1-low idle; test 2-stationary acceleration and high idle; test 3-simulated city start-up; test 4-acceleration test according to SAE Standard J366; test 5-deceleration test according to SAE Standard J366.

Truck 1

Truck 2

Truck 3

Truck 4

Truck 5

Truck 6

Truck 7

Truck 10

Truck 11

Truck 12

Truck 13

Truck 14

Truck 15

Truck 16

Truck 17

Abstract

This report presents the results of interior and exterior noise measurements which were made on a representative sample of fifteen over-the-road trucks under various operational modes. In-cab measurements were made six inches from the right and left ears of the driver with windows open and closed. Simultaneous exterior measurements were made utilizing a six-microphone array. Graphic histories of A-weighted sound level versus time are presented for all test conditions and microphone locations. The National Bureau of Standards made the field measurements and tabulated the data; however, interpretation of the results is the responsibility of the Department of Transportation and the American Trucking Associations -- the joint sponsors of the study. These data supplement the limited in-cab data available in the public domain and will form part of public Docket No. MC-22 Advanced Notice of Proposed Rule Making concerning vehicle interior noise levels which was issued by the Bureau of Motor Carrier Safety, Department of Transportation, in response to Federal Regulations concerning occupational noise exposure.

Key Words: Acoustics; noise measurement; noise (sound); trucks; truck noise (exterior); truck noise (interior).

INTERIOR/EXTERIOR NOISE LEVELS OF OVER-THE-ROAD TRUCKS: REPORT OF TESTS

by

William A. Leasure, Jr., Thomas L. Quindry, Denzil E. Mathews, and James M. Heine

1. Introduction

On November 7, 1970, the Bureau of Motor Carrier Safety (BMCS), Department of Transportation issued an Advanced Notice of Proposed Rulemaking Concerning Vehicle Interior Noise Levels. The Notice was issued ".... for the purpose of reducing the risk that drivers of commercial motor vehicles will incur damage to their hearing or undue fatigue because of the level of vehicle-generated noise to which they are subjected when they operate those vehicles."

The Director of the Bureau of Motor Carrier Safety invited interested persons to submit data on sound levels in present-production, over-the-road vehicles and on sound levels in models of those vehicles projected for future production. In addition, he invited submission of information about hearing loss and driver fatigue as a function of exposure to noise at various levels.

A total of forty responses was received and, according to the Deputy Chief, Regulations Division (BMCS), although they "did provide valuable information for rulemaking and did reinforce the Bureau's concern that driver hearing loss may be a result of high truck noise levels, they provided little real data on the level and effect of in-cab noise on driver hearing and less yet comparing improvements in interior noise levels to decreases in exterior noise levels." Therefore, in order to develop a factual information base regarding the noise levels of typical over-the-road trucks, the National Bureau of Standards conducted a truck noise measurement program under the joint sponsorship of the Office of Noise Abatement, Department of Transportation and the American Trucking Associations Inc. (DOT/ATA).

In-cab noise measurements were made at locations six inches from the right and left ears of the driver, for fifteen representative trucks under various operational modes with windows open and closed. To provide information on total truck noise which affects the community, simultaneous exterior noise measurements were made.

With the recent emphasis on environmental matters, "noise pollution" has emerged as a major concern of several Federal Agencies with regulatory responsibilities, including the Departments of Transportation and Labor, and the Environmental Protection Agency. New regulations are being proposed at state and municipal levels, with community action groups springing up all over the county. The data presented in this report can serve as a basis for the establishment of new standards for regulatory purposes.

2. Field Test Program

There is a definite lack of published data on the interior and exterior noise levels produced by current trucks. In order to establish a physical data base on the noise generated by a cross section of current trucks, a field study was undertaken at Wallops Station (NASA), Virginia. This also was the test site utilized by the National Bureau of Standards for a recent Department of Transportation sponsored study to investigate the noise generation characteristics of truck tires [1].[1/]

Arrangements were made with member firms of the American Trucking Associations to provide in-service vehicles for test purposes. Every attempt was made to arrive at a broad representation of the population of vehicles on the road today. Each of the fifteen vehicles was tested according to a test procedure which included the following: (1) standard operational procedures as defined in Society of Automotive Engineers Recommended Practices [2,3] for the determination of maximum noise output, (2) simulated city start-up, (3) stationary acceleration in neutral gear, and (4) idle conditions. A discussion of the details associated with the establishment of an appropriate and effective field test program follows.

2.1. Field Test Site

The research runway at the Wallops Station, Virginia facility of the National Aeronautics and Space Administration was utilized as the test site for the data acquisition phase of the program. This location provided a flat terrain and a well-defined reflecting surface without any unusual reflection or attenuation effects.

A 100-foot (30.48 meter) test section was established on the smooth concrete[2/] portion of the research runway. Although no lanes, such as one thinks of as being present on highways, were marked on the runway, the concrete was laid in sections 12 feet wide and 20 feet long. For this test program, the truck ran in one of these 12-foot lanes. Due to the deteriorated condition of the pavement surface near the edge of the runway, the truck ran one lane in from the edge.

[1/] Numbers in brackets indicate the literature references at the end of this report.

[2/] A detailed discussion of the composition of the concrete test lane is contained in [1]. Basically it was a substrate of reinforced, air-entrained Portland Cement concrete with a smooth finish (smoothed with a belt of canvas composition).

2.2. Test Vehicles

Motor carriers were invited by the American Trucking Associations (ATA) to participate in this program by donating the use of their trucks at the Wallops Station site for test purposes.

A representative sample (selected by the ATA) of fifteen trucks was tested. All except one -- a delivery van -- were tractor-trailer vehicles. The sample included 13 diesel powered vehicles and 2 vehicles with gasoline engines. Nine different makes were represented in the sample. All vehicles tested were manufactured between 1967 and 1971 with total miles of operation ranging from under 2,000 to over 360,000 miles (3,218-579,540 kilometers).

Section 3 of this report presents a photograph of the exterior of each test truck along with detailed specifications.[3/]

2.3. Vehicle Operation Procedure

For each of the following test conditions simultaneous interior (right and left ear positions) and exterior (array of six microphones) measurements were made. Following SAE recommended practice, repetitive runs were made for each test condition until the two maximum A-weighted sound level readings, as monitored on the real time analyzer for microphone location number 3 (see figure 1) were within 2 dB of each other. Unlike the SAE recommended practice that requires that the average of the two highest readings be reported, the data for all test runs made are presented in this report. For example, if three runs were made at a given test condition, data for all three runs are presented. Measurements were made on both sides of the test vehicle with windows open and with windows closed. Both stationary (idle and acceleration in neutral gear) and moving (simulated city startup and SAE procedures) conditions were specified and are outlined later in this section. The operational procedures for tests 4 and 5 were identical to those specified by SAE Recommended Practice [3]. Prior to the tests, the highest rear axle and/or transmission gear ("highest gear" is used in the visual sense; it is synonymous with the lowest numerical ratio) and an initial vehicle speed must be selected so that at wide open throttle the already-moving vehicle will accelerate from the acceleration point with the following constraints: (1) the test section must be entered at no more than two-thirds of maximum rated or governed engine speed, and (2) maximum rated or governed engine speed must be reached within the end zone without exceeding 35 mph (56.33 kilometers/hour) before reaching the end point.

[3/] The Department of Transportation/American Trucking Associations agreement stipulated that the final test report would embody the results of the program by brand name and model number, specifying the test procedure and the noise characteristics of the individual vehicles. Although it is not the normal policy of the National Bureau of Standards to identify test specimens by brand names, in this case it is imperative since these data will be submitted by DOT to the Bureau of Motor Carrier Safety as part of public Docket No. MC-22 in support of the Proposed Rulemaking on Vehicle Interior Noise Levels which is being written to protect drivers by reducing the risk of hearing damage or undue fatigue which is attributable to high truck noise levels.

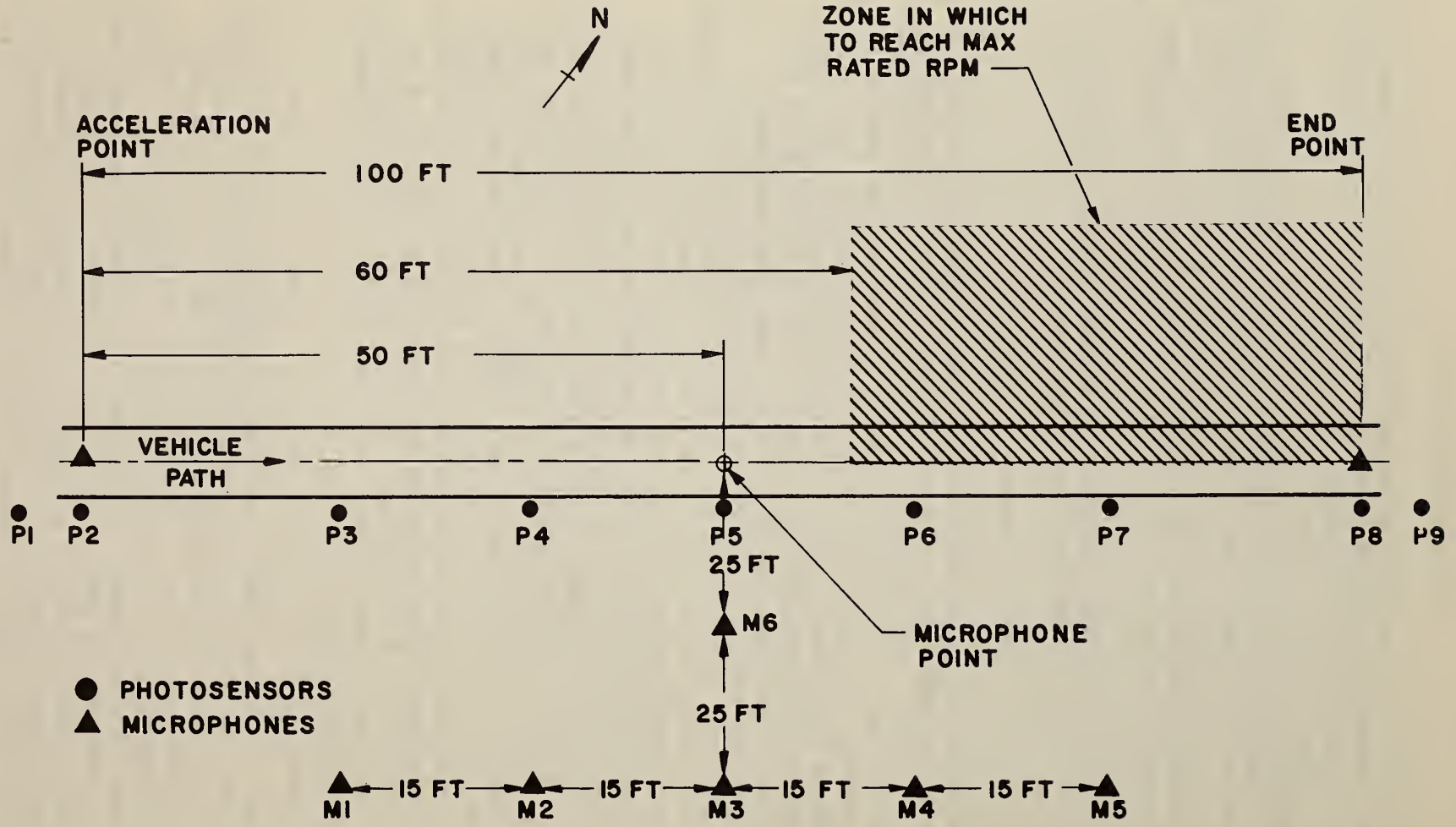

Figure 1. View of test section showing placement of microphones (M1-M6), photosensors (P1-P9), acceleration point, end point, microphone point, and the zone in which the maximum rpm is to be reached.

When maximum rated or governed rpm was attained before reaching the end zone, the approach rpm was decreased in 100 rpm increments until maximum rated or governed rpm was attained within the end zone.

When maximum rated or governed rpm was not attained until beyond the end zone, the next lower gear was selected until maximum rated or governed rpm was attained within the end zone.

When the lowest gear still resulted in reaching maximum rated or governed rpm beyond the permissible end zone, the vehicle was unloaded and/or the approach rpm was increased in 100 rpm increments until the maximum rated or governed rpm was reached within the end zone.

The test conditions were as follows:

a. Stationary Tests

For all stationary tests the truck was parked in the center of the test lane with its exhaust outlet on a line drawn through microphones number 3 and 6 (see figure 1).

Test 1. Idling noise was measured (low idle).

Test 2. (a) Noise was measured as the engine was accelerated from low idle speed with wide open throttle in neutral gear.

(b) Noise was measured with the engine running steadily at maximum governed rpm ("high idle").

b. Moving Tests

Test 3. To simulate a truck starting up in city traffic, the driver located the front bumper of the truck on a line even with microphone number 1 (or microphone number 5 if the truck was headed in the opposite direction) and then proceeded in a typical manner into the initial gears at wide open throttle after each clutch engagement until traversing the entire 100 foot test section.

Test 4. Acceleration Test. The acceleration point was approached using the engine speed and gear ratio selected according to the above procedure and at the acceleration point wide open throttle was rapidly established. Acceleration continued until maximum rated or governed engine speed was reached. Wheel slip, which affects maximum sound level, was to be avoided.

Test 5. Deceleration test. The microphone point was approached at maximum rated or governed engine speed in the gear selected for the acceleration test. At the microphone point, the throttle was closed and the vehicle was allowed to decelerate to one-half of maximum rated or governed rpm.

2.4. Noise Measurement Systems

a. Exterior Measurements

An array of six microphones was utilized to measure exterior truck noise. SAE Recommended Practice J366 requires a single microphone located midway in the 100 foot length of the test section and 50 feet from the centerline of the vehicle path. This corresponds to microphone location number 3 (figure 1). For these tests, four additional microphones were located along a line parallel to the vehicle path and 15 feet and 30 feet on either side of microphone number 3. These were numbered 1, 2, 4, and 5, as shown in figure 1. A sixth microphone was located 25 feet from the centerline of the path of the vehicle directly in line with microphone number 3.

Photosensors, activated by a light beam produced by a spotlight mounted on the front bumper of the truck, were located along the test lane parallel to the path of the vehicle. The signals produced by the photosensors provided information on truck position versus time.

Coaxial cables connected the microphones and photosensors with the tape recording and monitoring equipment housed in the mobile instrumentation van which was located 500 feet back from the edge of the runway in order to comply with an airfield ruling and also to avoid unwanted acoustical reflection effects.

For measurements of the noise produced by moving vehicles, the driver approached the test section in the specified operational mode for the given test. The initial photosensor, which turned on the seven-channel tape recorder, was located so that when the vehicle passed photosensor number 2 the tape recorder was up to speed (servo-control system in phase lock) and data could be recorded. Data from each microphone were recorded on one of six channels of an FM tape recorder. The truck noise (exterior) was recorded during the entire passby. The light beam striking the photosensors caused voltage spikes which were recorded on the seventh channel (direct record) of the tape recorder. The photosensors (photosensors number 2, 3, 4, 5, 6, 7, and 8) were located at the acceleration point, end point and in line with each of the microphone locations. As the truck left the test section, a final photosensor was triggered which stopped the tape recorder. Although the configuration shown in figure 1 corresponds to runs with the test vehicle heading northeast (right side of the truck nearest the microphone array), test runs were also made in a southwesterly direction. (left side of the truck nearest the microphone array). In the latter case the test layout was the mirror image of that shown in figure 1.

Figure 2 identifies the components that constituted the data acquisition system for exterior measurements of total truck noise. To describe the workings of the system, the following example is cited with the contribution of each component discussed.

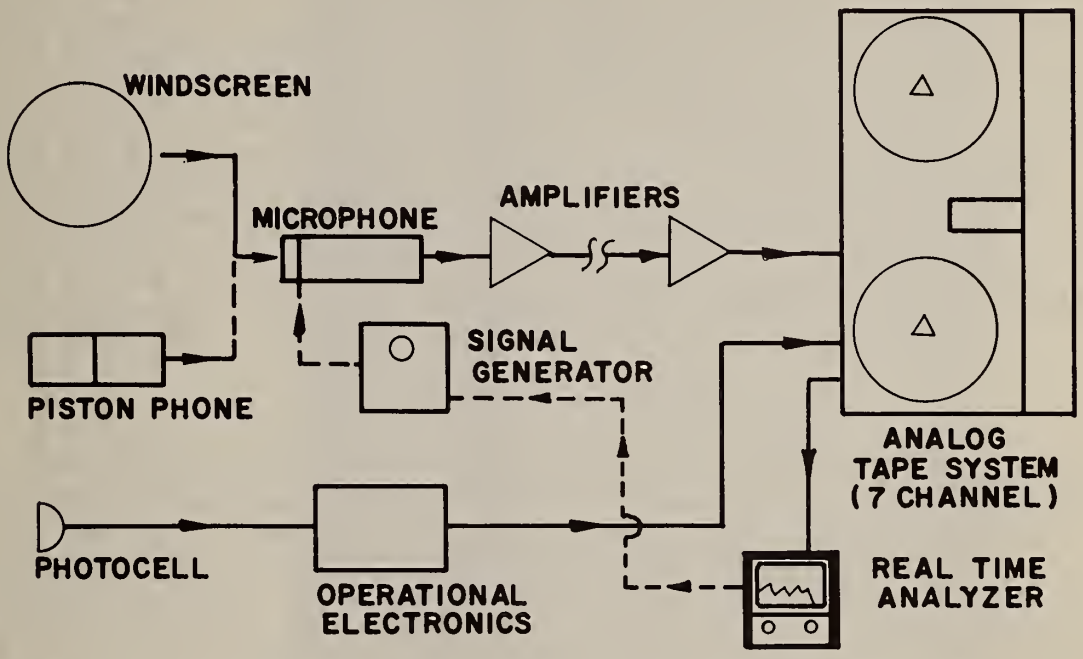

Figure 2. Data acquisition system for the measurement and recording of exterior truck noise.

Consider a truck passing an array of microphones (figure 3). As the truck moved forward, it caused pressure fluctuations which travelled as waves and activated the microphone's diaphragm into vibration. These variations were transduced into an AC voltage which were recorded for analysis at a later time. The microphone itself was a three-part subsystem comprised of a microphone cartridge, protecting grid, and a microphone preamplifier. To maintain the voltage level of the signal at the end of the long cables carrying the signal from the microphone to the recording facility, some line amplification was necessary. The initial amplifier/energizer, in addition to supplying line amplification, supplied the polarization voltage to the microphones. Once the signal reached the tape recorder, a second amplifier (electronic voltmeter) provided signal conditioning -- amplification or attenuation -- prior to actual recording. The meter scale provided an indication of whether or not a tape channel had become saturated (i.e., the signal had exceeded the dynamic range of the recorder) and thus the data were not acceptable. The signal was then recorded on one track of the FM tape recorder. The measurements were performed out-of-doors; therefore, windscreens were placed over the microphones to minimize the noise produced by wind passing over the microphone.

Figure 3. View of a test vehicle passing the microphone array. External noise was measured by an array of six microphones, two of which can be seen at the right. Photosensors mounted on tripods along the vehicle path were activated by a light source mounted on the truck's bumper. Signals from the photosensors provided truck position versus time data. At the same time, two additional microphones inside the cab measured interior noise levels which were recorded on a separate tape recorder.

Calibration and system checkout were performed in two steps. A single point calibration utilizing a pistonphone which produced a 124 dB sound pressure level (re 20 $\mu N/m^2$) at a frequency of 250 Hz was used for system calibration in the field. The system checkout also involved running a frequency response on the system. To perform this checkout, the microphone cartridge was removed and replaced with an adapter which allowed a signal generator to be coupled into the system. The sine-random generator (signal source) was capable of producing wide band "pink noise" (white noise passed through a network which weights at -3 dB per octave). When a display unit, such as a real-time analyzer, was coupled to the output terminals of the tape recorder, a flat frequency response (constant energy per octave of bandwidth) could be observed. In general, a lack of low frequency response would be indicative of overloading of an amplifier and a lack of high frequency response would be indicative of an amplifier failure. This operation also established the integrity of all connecting cables. During actual testing, the real-time analyzer was used to monitor microphone position number 3 (figure 1) which corresponded to the location specified in SAE J366.

b. Interior Measurements

Interior measurements were made six inches from the right and left ears of the driver as shown in figure 4. The data from each microphone were recorded on a two-channel, direct-record tape recorder (figure 5). This tape recorder was not synchronized with the tape recorder in the instrumentation van. For interior measurements a 2 kHz tone was placed manually on the tape as the vehicle neared the acceleration point and when it had passed the end point. Thus the exterior and interior measurements do not have a common time base. It is felt that the instrumentation accuracy is better than the repeatability of the experiment.

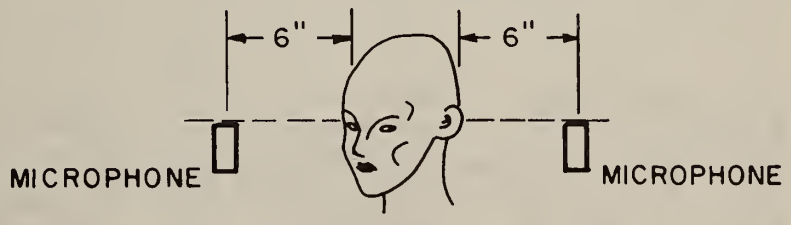

Figure 4. The microphone locations for interior cab noise level measurements six inches from each ear in the same horizontal plane as the driver's ear.

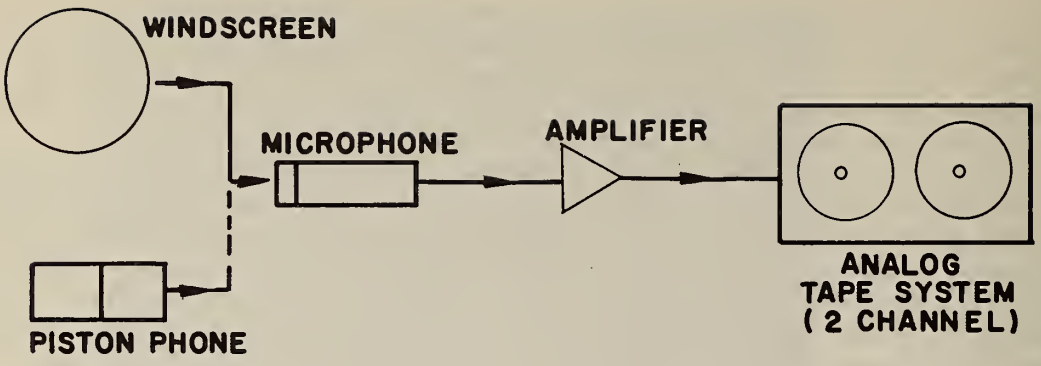

Figure 5. Data acquisition system for the measurement and recording of interior cab noise.

2.5 Data Analysis

Once the data had been recorded, the analog tapes were returned to the National Bureau of Standards for reduction and analysis. Figure 6 identifies the instrumentation which was utilized for analysis purposes. Each tape was played back a channel at a time through the A-weighting network of a measuring amplifier. A graphic level recorder was utilized as the readout device to produce a graphic history of A-weighted sound level versus time, corresponding to runs at each test condition. The writing speed of the graphic level recorder was set at 100 mm/sec and the lower limiting frequency was kept at 20 Hz which ensured stable functioning of the writing system. According to the instrument manufacturer, the averaging time resulting from these settings was equivalent to the standardized meter characteristic "FAST" for sound level meters. The paper speed, and thus the time base, was 10 mm/sec.

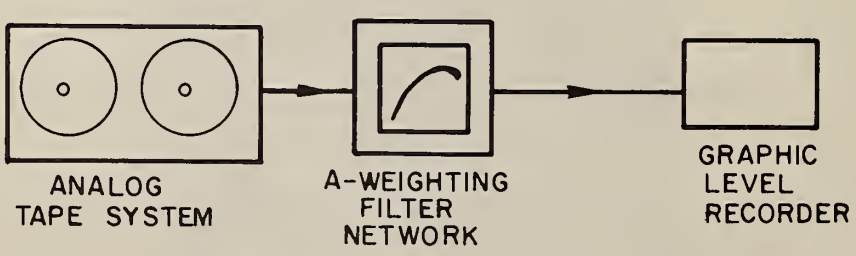

Figure 6. Data reduction and analysis system.

Photosensor signals which were recorded on one channel of the seven channel tape recorder (utilized for exterior measurements) were used to trigger the event marker on the graphic level recorder thus providing truck position versus time information for all moving test conditions.

3. Test Results

The data base on the noise generated by the fifteen over-the-road trucks tested -- both interior noise levels which affect the driver and exterior noise levels which affect the community -- is presented in both graphical and tabular form. Graphic level recordings of A-weighted sound level versus time for all test runs are presented and the maximum A-weighted sound levels for each run are tabulated.

For each truck tested there is the following information:

1. An exterior photograph of the test vehicle.

2. A data sheet providing the detailed specifications of the vehicle including carrier, make, model, year, engine governor setting, total miles of operation, miles since last engine overhaul and/or exhaust work and engine make and model. These data were provided by the carrier who loaned his truck to the project.

Exterior Data

3. A table presenting the maximum A-weighted sound level for all test runs.

4. The graphic level recording of A-weighted sound level versus time for all test runs. Each page presents data for the six microphones for two repeat runs at a given test condition. Data for microphones 1-6 are read from top to bottom on the page. The photosensor signals which were recorded on the seventh channel of the FM tape recorder were used to trigger the event marker on the graphic level recorder. For all moving tests, above the data for microphone number 1 there appears the seven "blips" which provided the information on truck position versus time (see figure 1 for location of photosensors).

Interior Data

5. A table presenting the maximum A-weighted sound level for all test runs.

6. The graphic level recordings of A-weighted sound level versus time for all test runs. Each page presents data resulting from measurements made six inches from the right and left ears of the driver of the vehicle.

It should be noted that although the side of the truck passing the microphone array does not affect the interior noise levels, and exterior noise levels are not affected by the truck windows being open or closed, this information appears in all of the tables for completeness. One can match interior and exterior data which were recorded during the same test run by noting the test and run numbers. Complete correspondence is not possible since the recorder utilized for interior measurements was not synchronized with the recorder used by exterior measurements.

Rather than continue with sequential numbering of figures and tables, it was felt that for the purpose of clarity, the figures and tables in this section should be keyed to the particular test vehicle through the use of a double numerical designation, e.g., figure 1-1. The initial number corresponds to the vehicle number and the second to the sequential presentation of results for tests run on that particular vehicle.

A total of seventeen vehicles were originally scheduled for testing. Each vehicle was assigned a number and photographed. Due to weather conditions and scheduling problems only fifteen vehicles were actually tested. Trucks number 8 and 9 were not tested and therefore no data appears for these vehicles.

Test Vehicle Number 1

Figure 1-1. Test Vehicle Number 1.

Truck Number: 1
Carrier (owner): United Parcel Service
Company Fleet Number: 21205
Make: Mack
Model: F-785T
Serial Number: 5495
Year: 1970
Engine Governor Setting: 2250 rpm (no load)
2100 rpm (full load)
Total Miles of Operation: 177,401
Miles Since Last Engine Overhaul: Original engine
Miles Since Any Exhaust Work: Original exhaust system
Engine: Make - Maxidyne
Model - 675-422084

Exterior

Truck 01

TEST	RUN	SIDE	(WINDOWS)	SOUND LEVEL, dB(A) MICROPHONES					
				1	2	3	4	5	6
1. Low Idle	1	Right	Closed	63	65	64	64	62	70
(Stationary)	2	Left	Open	62	64	64	64	62	70
2. Acceleration	3	Right	Closed	--	--	--	--	--	--
(Stationary)	4	Right	Closed	87	87	86	86	86	92
	5	Left	Open	86	88	87	88	84	91
	6	Left	Open	85	87	86	86	83	90
2. High Idle	3	Right	Closed	--	--	--	--	--	--
(Stationary)	4	Right	Closed	83	84	83	84	82	88
	5	Left	Open	83	83	84	84	82	89
	6	Left	Open	82	84	83	84	83	89
3. City Start Up	7	Right	Closed	83	84	84	84	84	90
	8	Right	Closed	84	84	84	84	83	89
	9	Left	Open	86	86	84	84	83	88
	10	Left	Open	84	84	83	82	82	88
4. J366	11	Right	Closed	86	85	84	84	83	89
(Acceleration)	12	Right	Closed	83	84	83	84	83	88
	13	Left	Open	86	86	85	84	86	90
	14	Left	Open	86	85	83	84	81	89
5. J366	15	Right	Closed	84	83	82	82	80	87
(Deceleration)	16	Right	Closed	84	84	83	82	80	87
Without exhaust	17	Left	Open	81	82	82	85	84	88
brake	18	Left	Open	80	82	82	84	83	87
5. J366	19	Right	Closed	84	84	83	82	81	88
(Deceleration)	20	Right	Closed	84	85	84	83	82	88
With exhaust	21	Left	Open	82	83	83	85	84	89
brake	22	Left	Open	82	84	83	85	84	89

Table 1-1. Maximum A-weighted sound levels as measured at the six exterior microphone locations for all test runs for vehicle number 1.

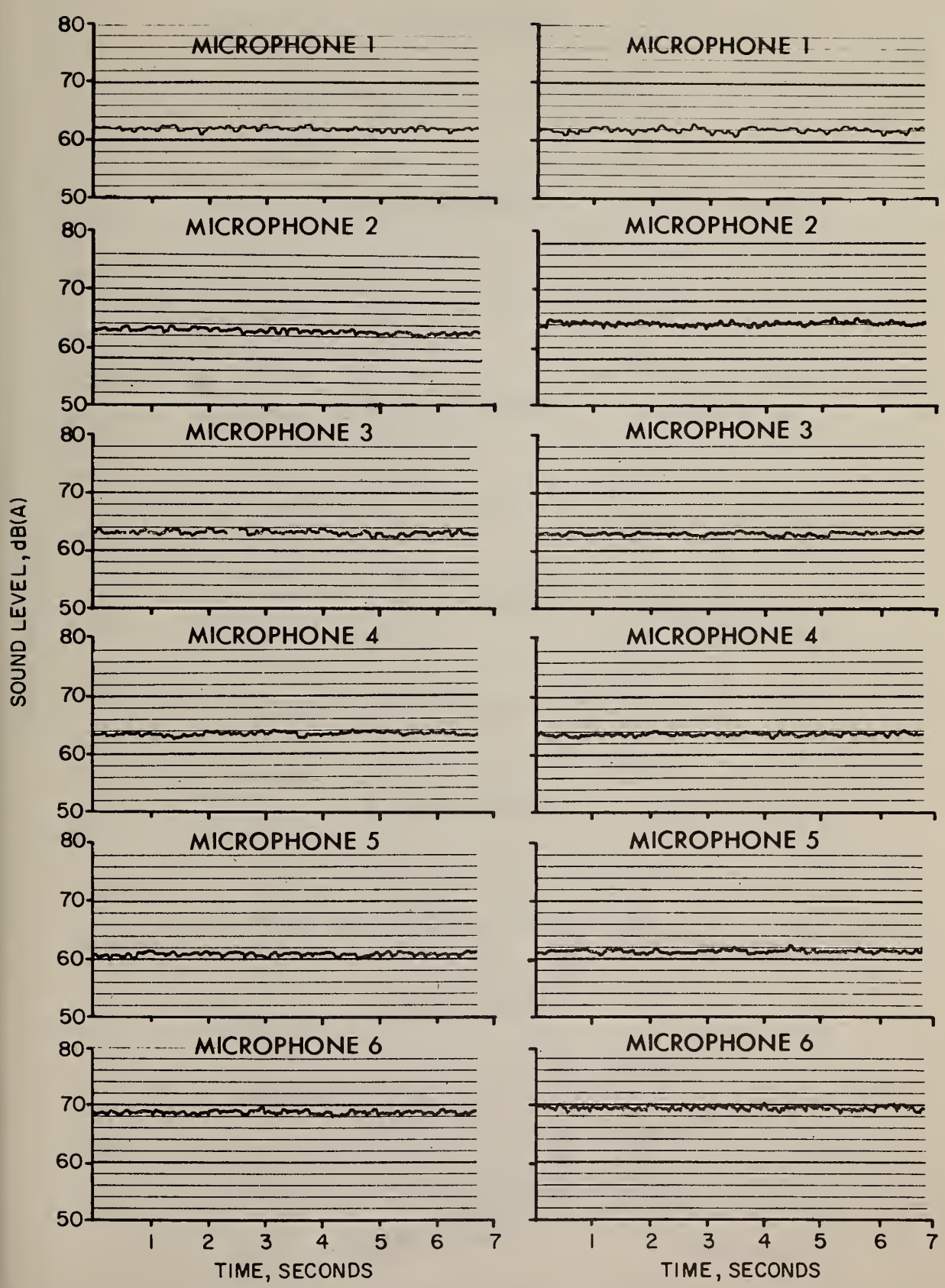

Figure 1-2. Truck 1, Test 1, Runs 1,2. (Exterior)

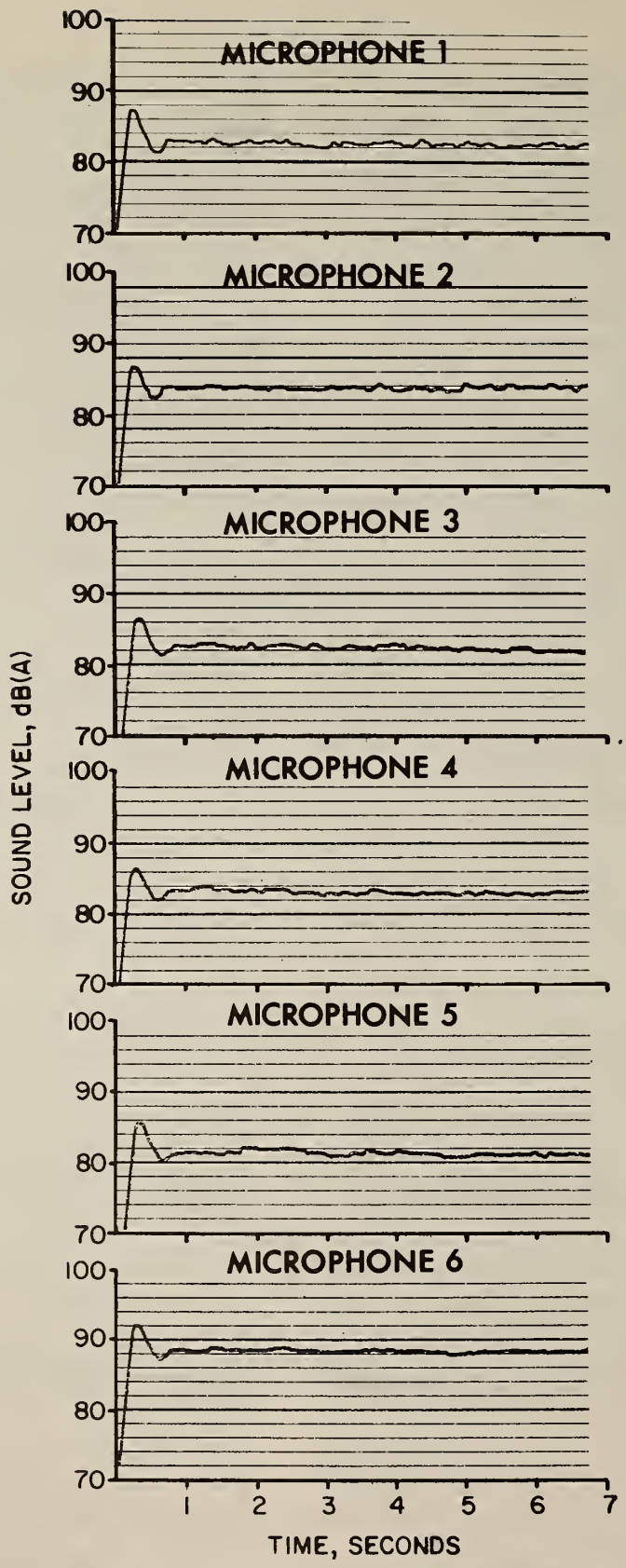

Figure 1-3. Truck 1, Test 2, Run 4. (Exterior)

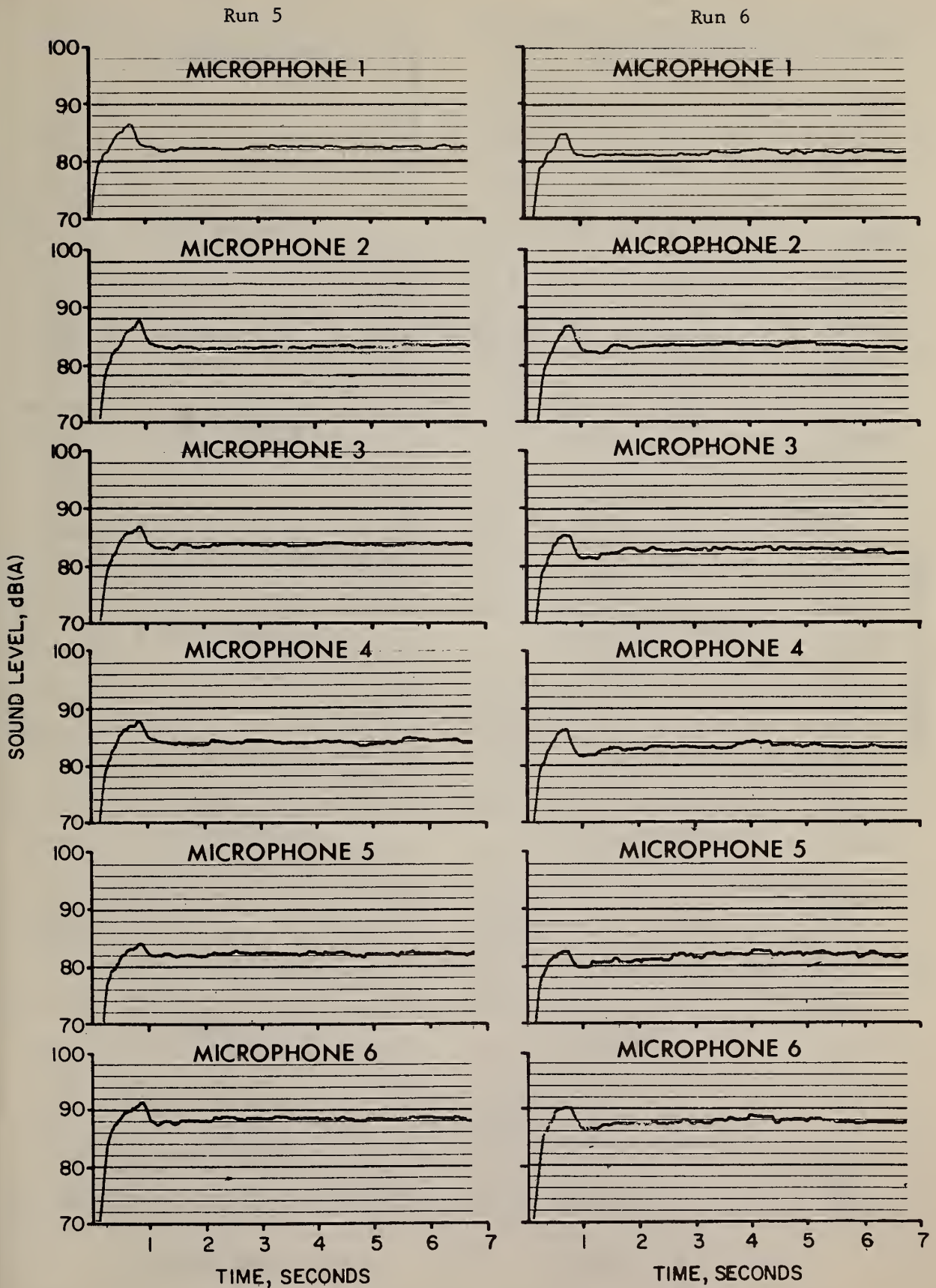

Figure 1-4. Truck 1, Test 2, Runs 5,6. (Exterior)

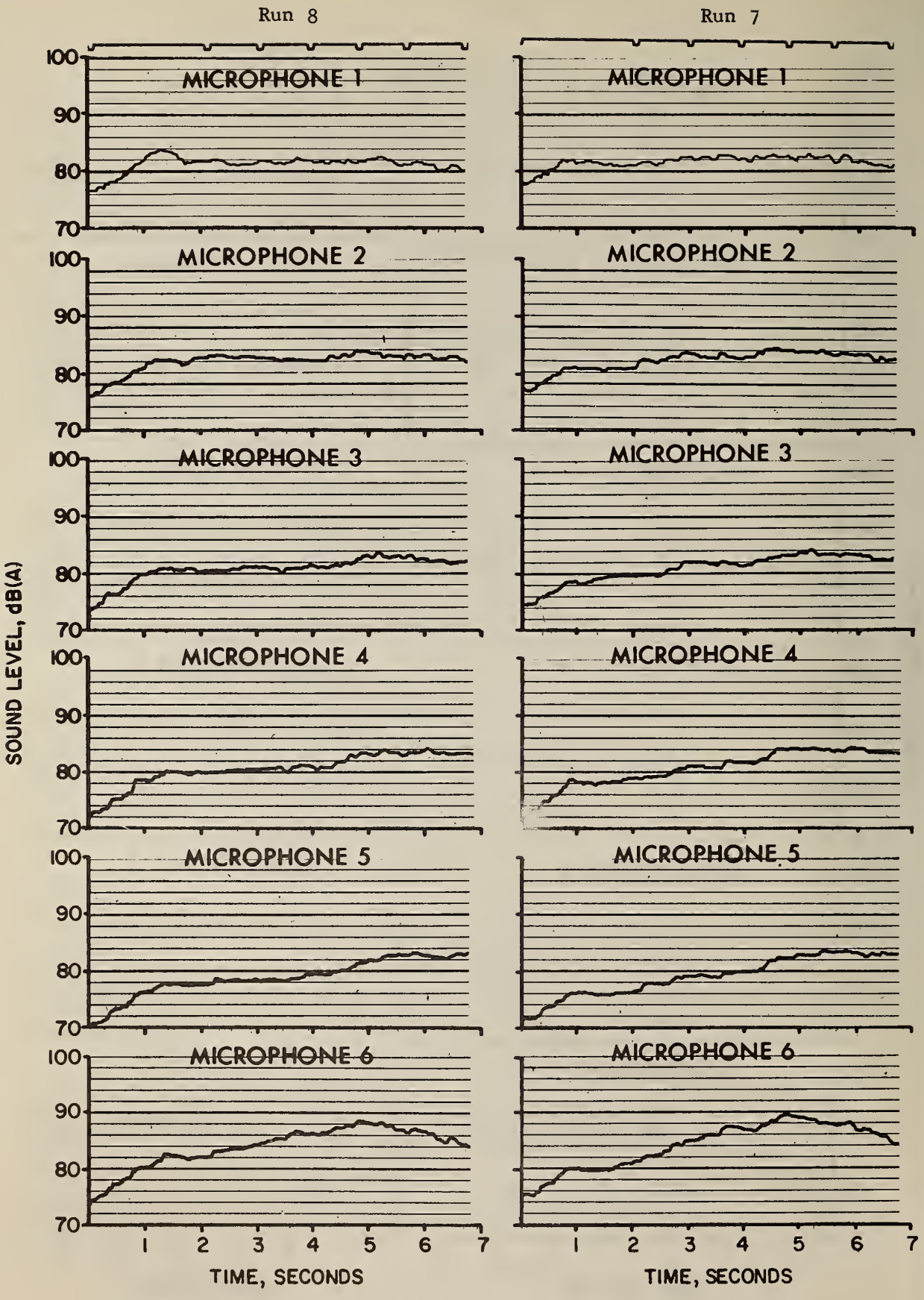

Figure 1-5. Truck 1, Test 3, Runs 7,8. (Exterior)

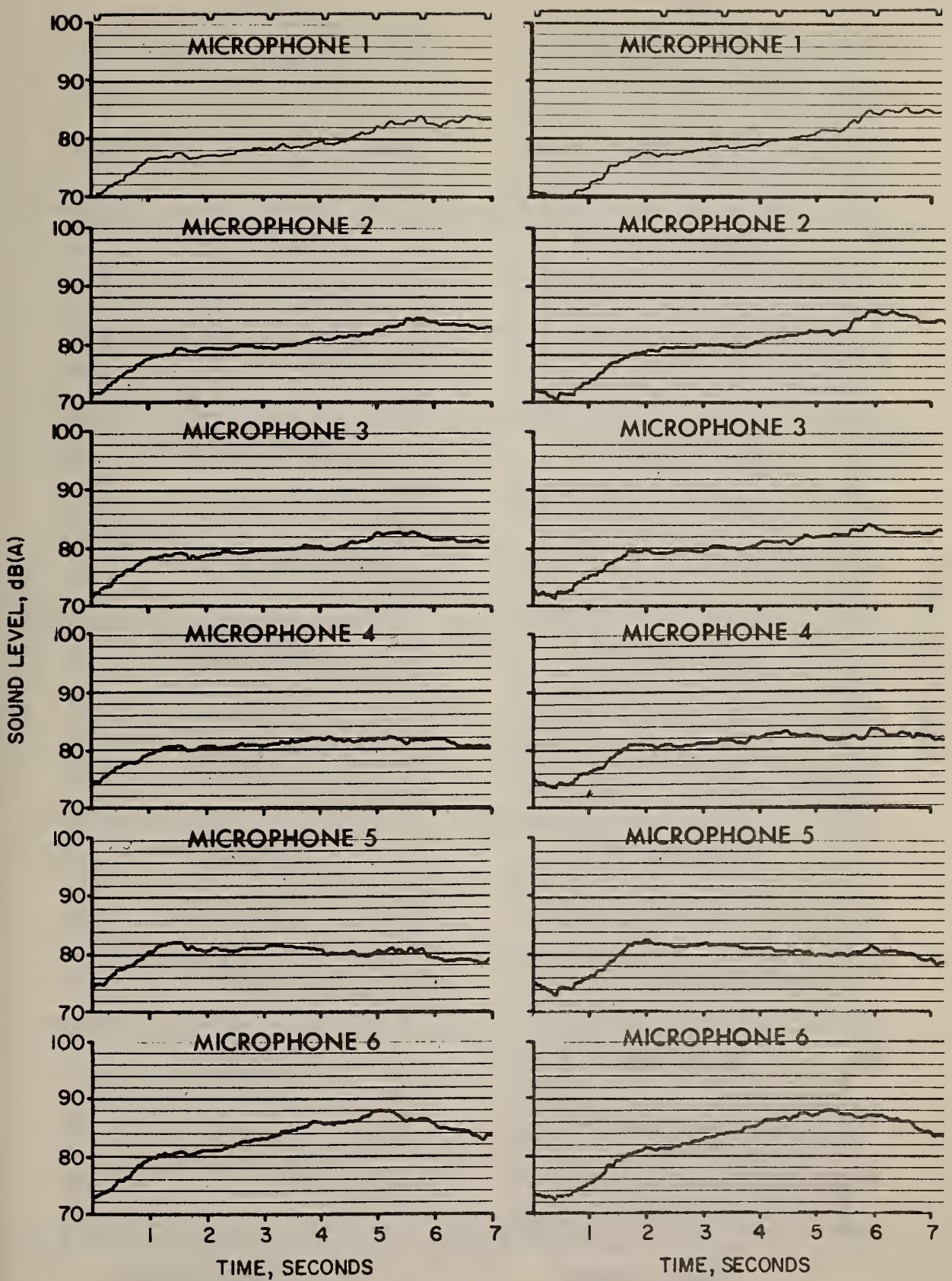

Figure 1-6. Truck 1, Test 3, Runs 9,10. (Exterior)

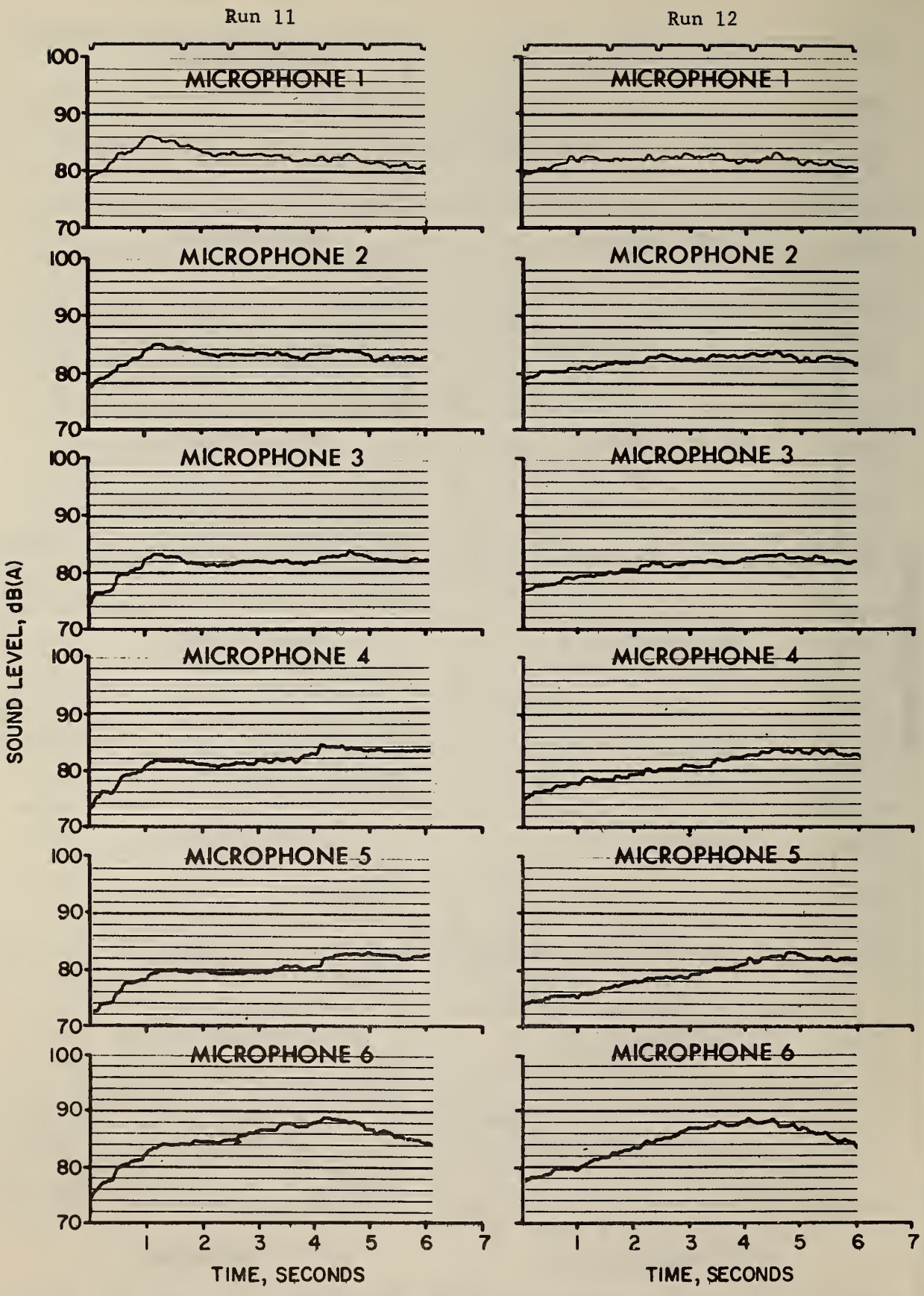

Figure 1-7. Truck 1, Test 4, Runs 11,12. (Exterior)

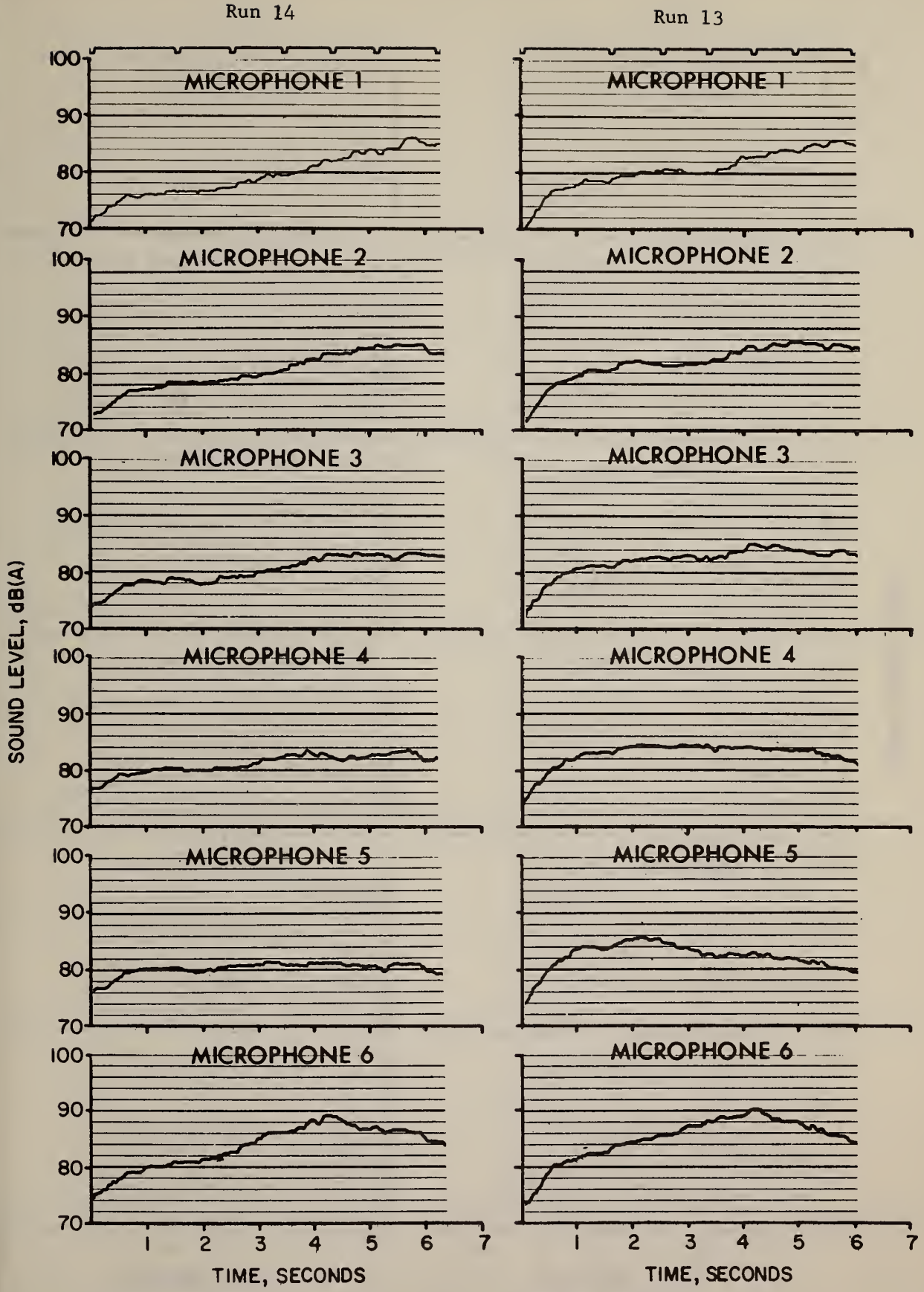

Figure 1-8. Truck 1, Test 4, Runs 13,14. (Exterior)

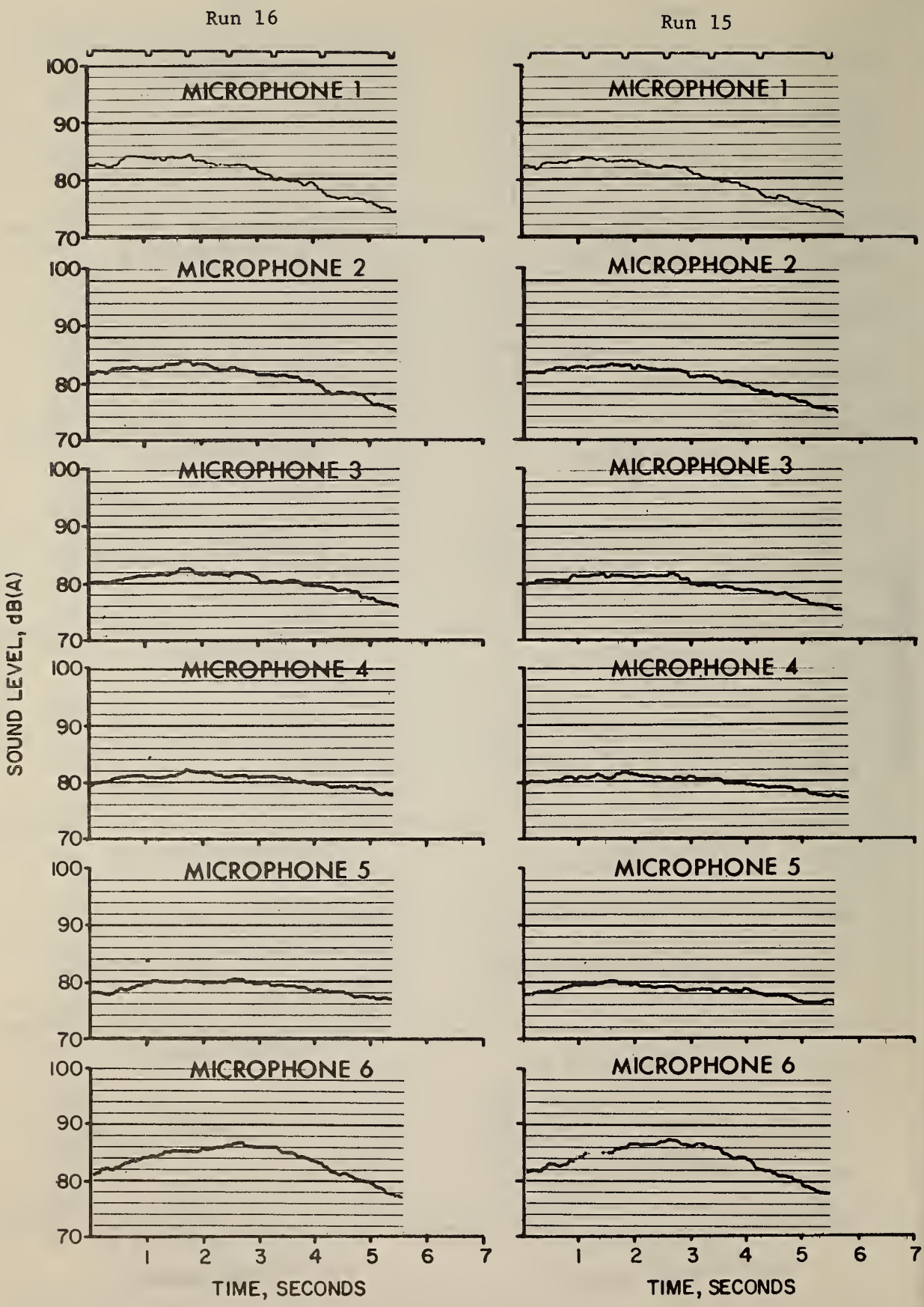

Figure 1-9. Truck 1, Test 5 (without exhaust brake), Runs 15,16. (Exterior)

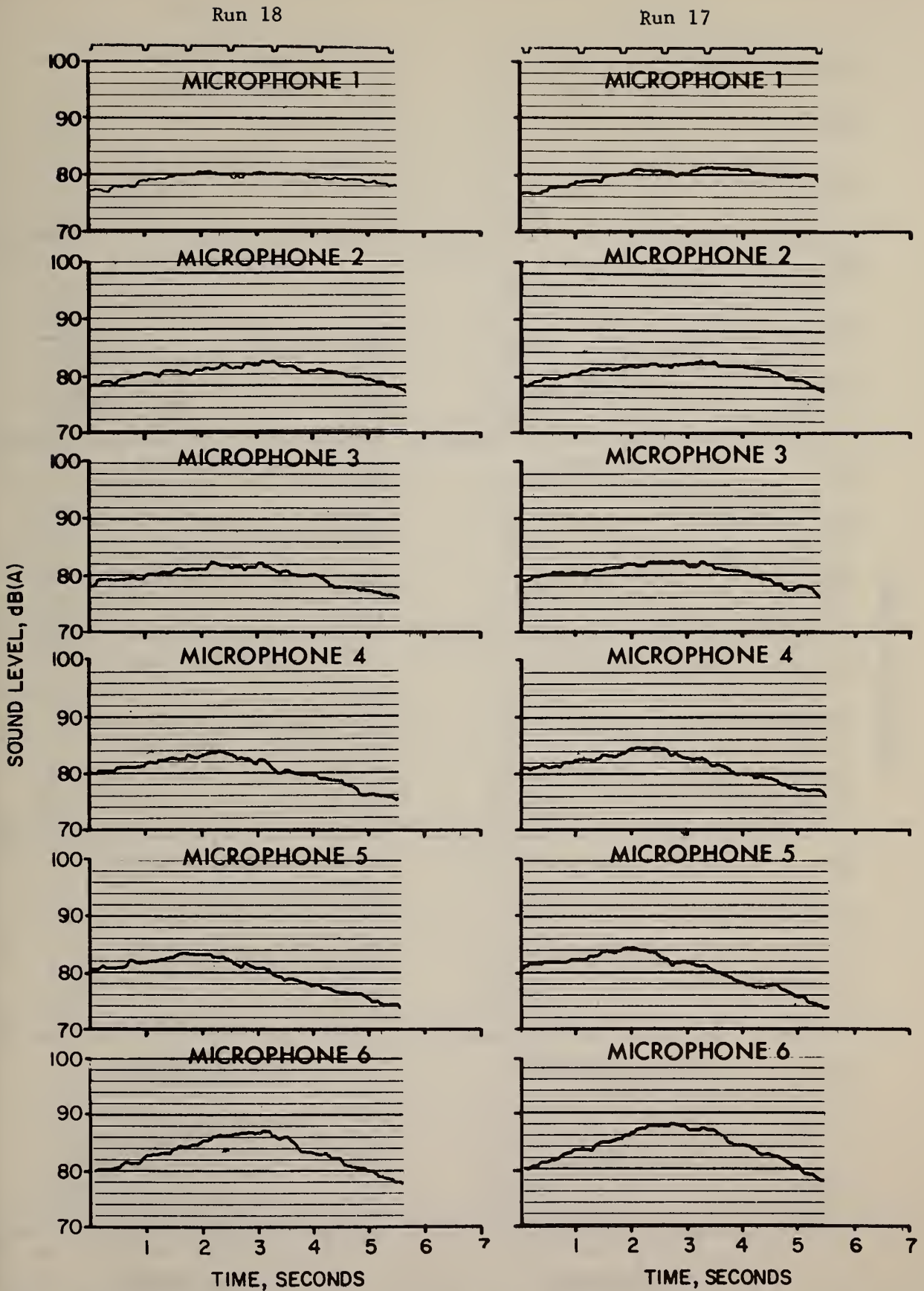

Figure 1-10. Truck 1, Test 5 (without exhaust brake), Runs 17,18. (Exterior)

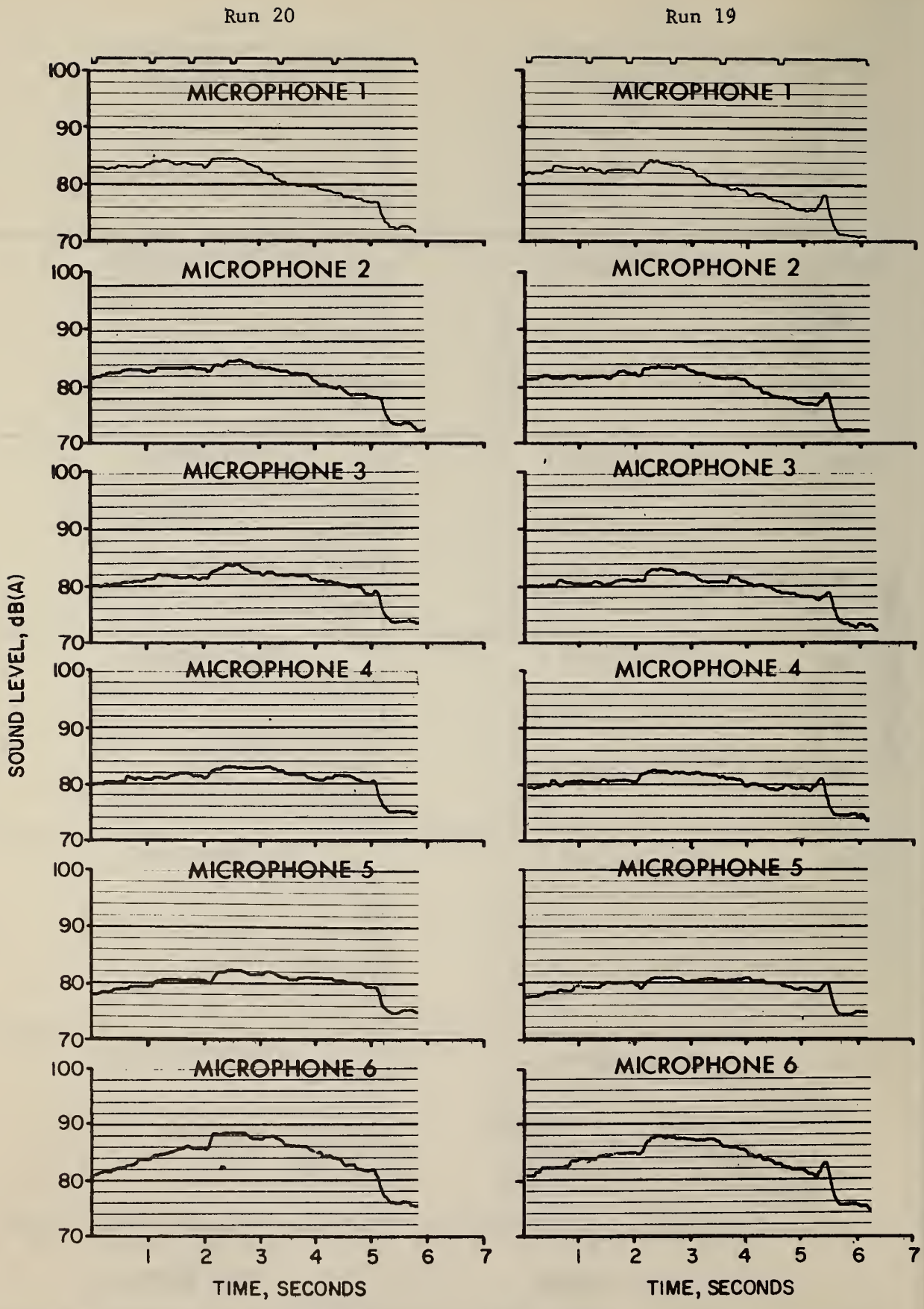

Figure 1-11. Truck 1, Test 5 (with exhaust brake), Runs 19,20. (Exterior)

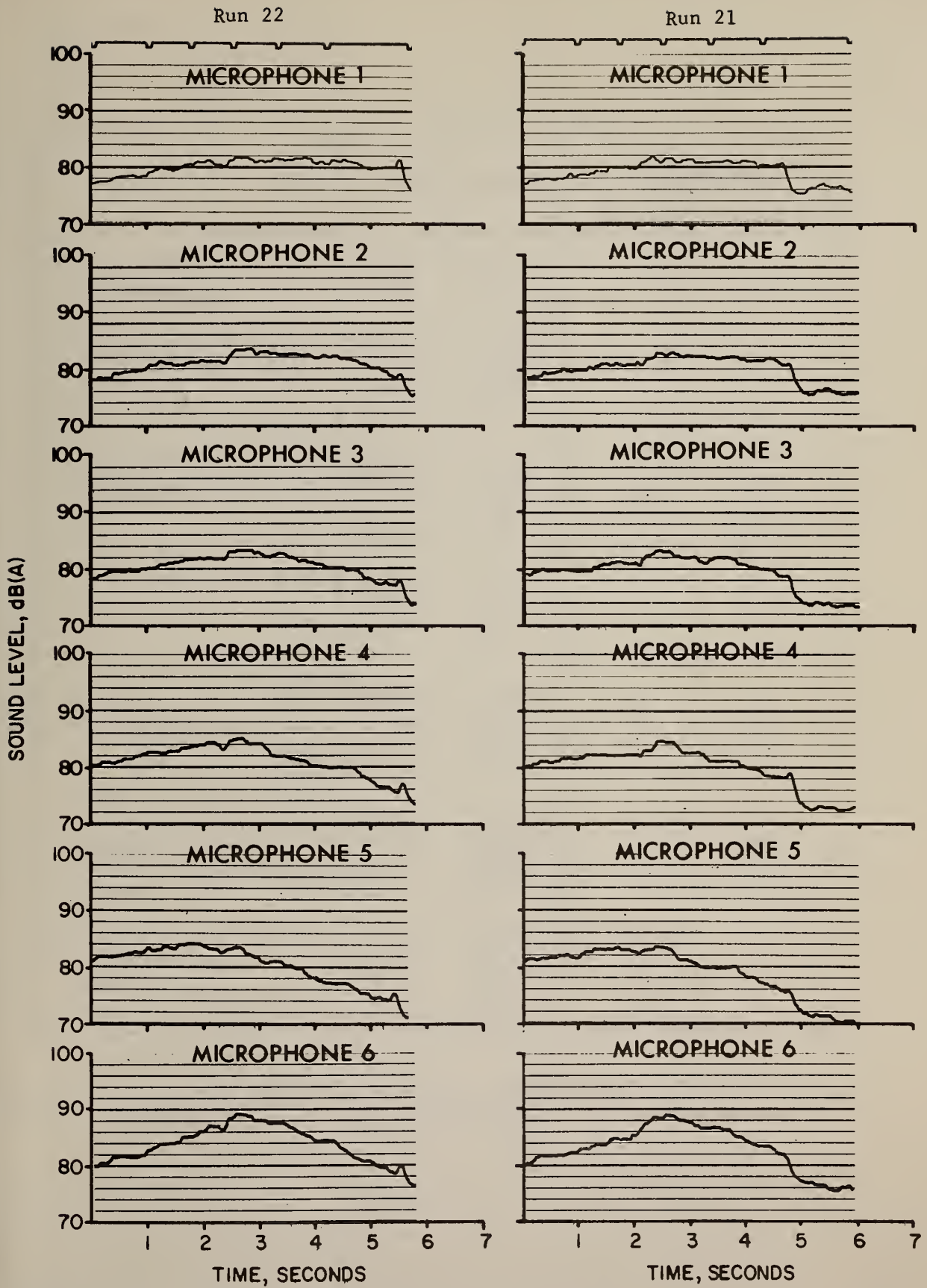

Figure 1-12. Truck 1, Test 5 (with exhaust brake), Runs 21,22. (Exterior)

Interior

Truck 01

TEST	RUN	(SIDE)	WINDOWS	SOUND LEVEL, dB(A) MICROPHONES	
				LEFT EAR	RIGHT EAR
1. Low Idle (Stationary)	1	Right	Closed	--	--
	2	Left	Open	78	77
2. Acceleration (Stationary)	3	Right	Closed	--	--
	4	Right	Closed	--	--
	5	Left	Open	92	89
	6	Left	Open	92	88
2. High Idle (Stationary)	3	Right	Closed	95	92
	4	Right	Closed	96	93
	5	Left	Open	94	93
	6	Left	Open	96	93
3. City Start Up	7	Right	Closed	96	92
	8	Right	Closed	95	92
	9	Left	Open	96	94
	10	Left	Open	95	92
4. J366 (Acceleration)	11	Right	Closed	95	92
	12	Right	Closed	95	92
	13	Left	Open	95	94
	14	Left	Open	95	93
5. J366 (Deceleration) Without exhaust brake	15	Right	Closed	94	94
	16	Right	Closed	94	92
	17	Left	Open	94	94
	18	Left	Open	94	94
5. J366 (Deceleration) With exhaust brake	19	Right	Closed	94	92
	20	Right	Closed	95	92
	21	Left	Open	95	94
	22	Left	Open	94	94

Table 1-2. Maximum A-weighted sound levels as measured at the two interior microphone locations for all test runs for vehicle number 1.

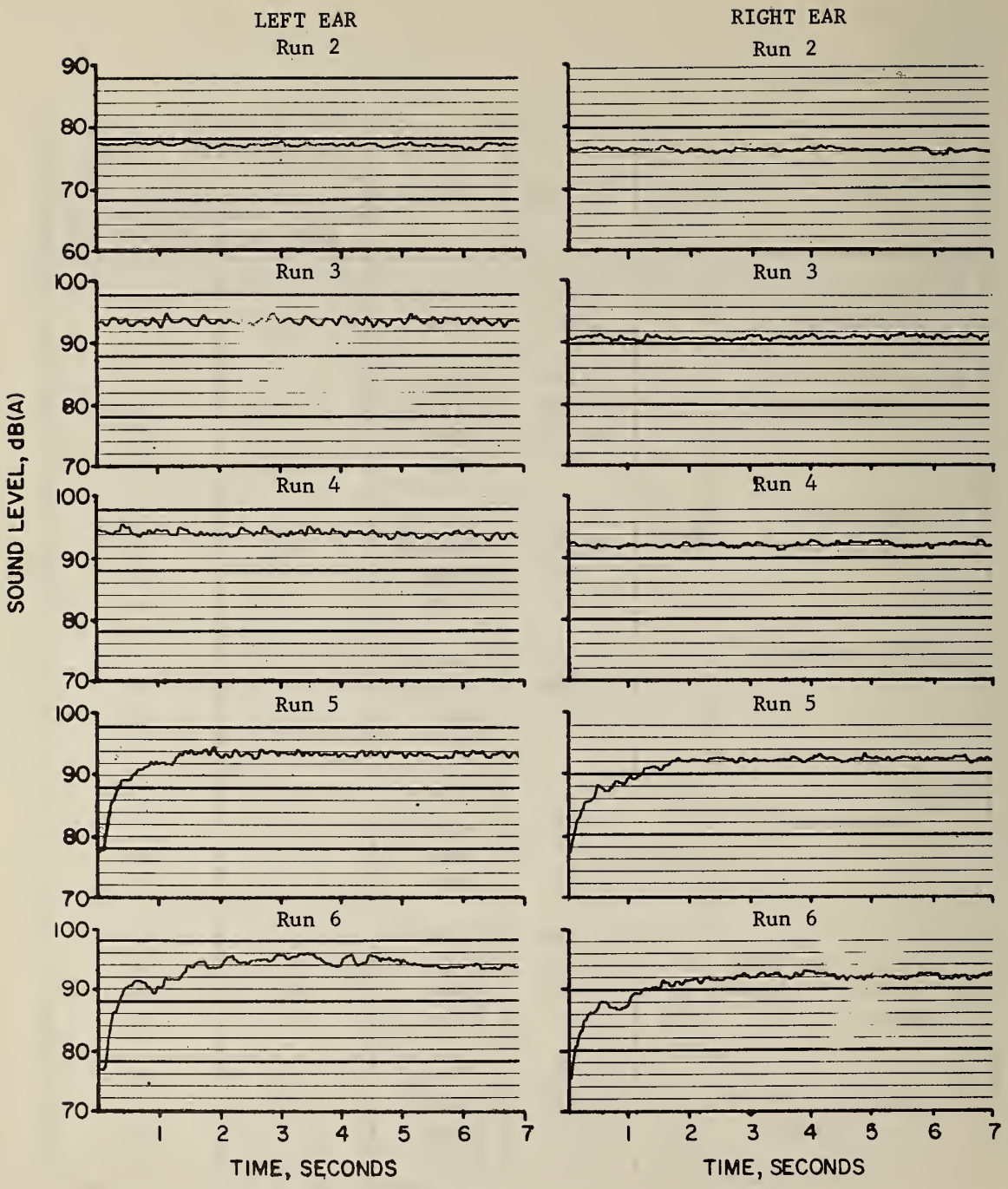

Figure 1-13. Truck 1, Tests 1,2, Runs 2-6. (Interior)

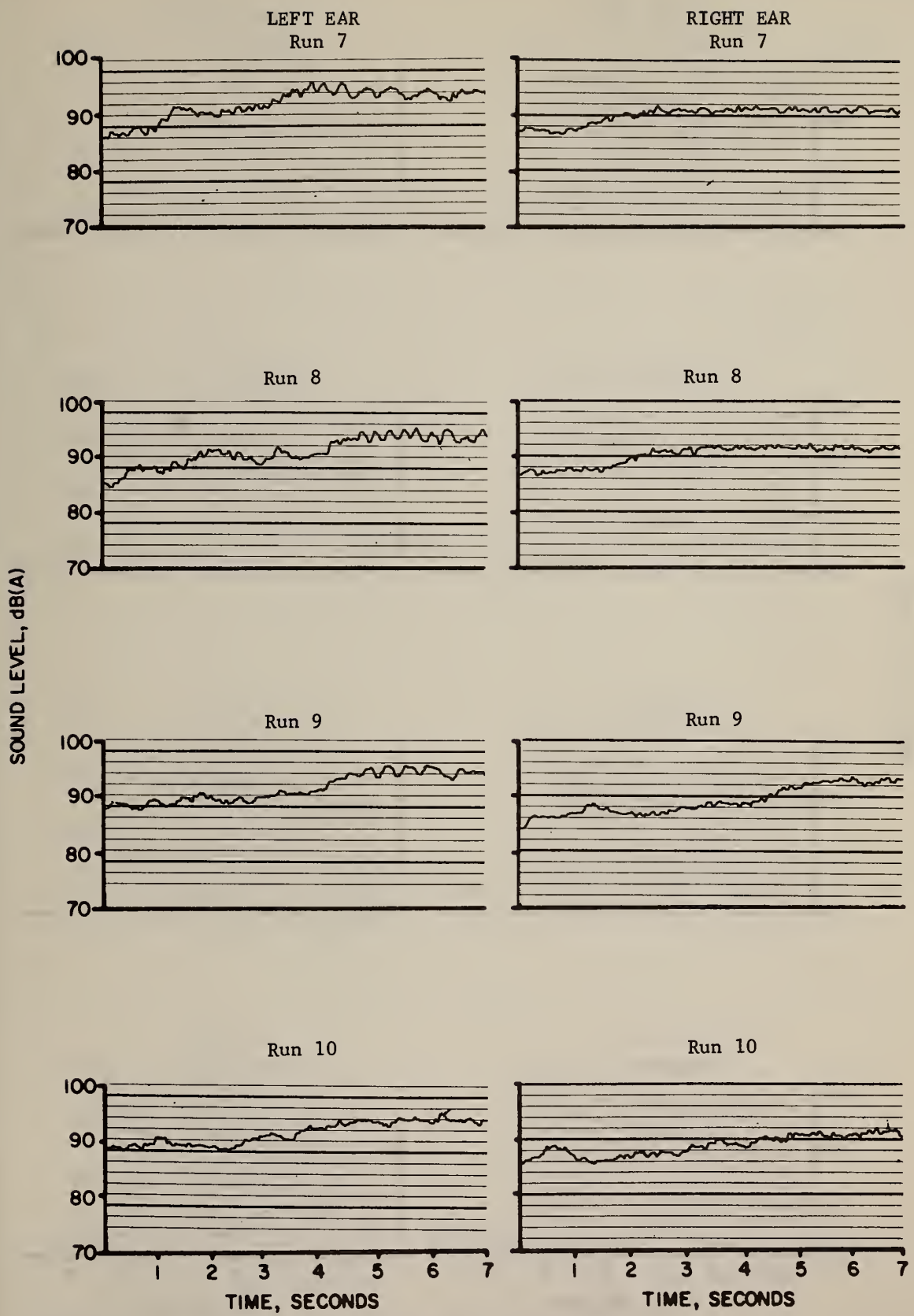

Figure 1-14. Truck 1, Test 3, Runs 7-10. (Interior)

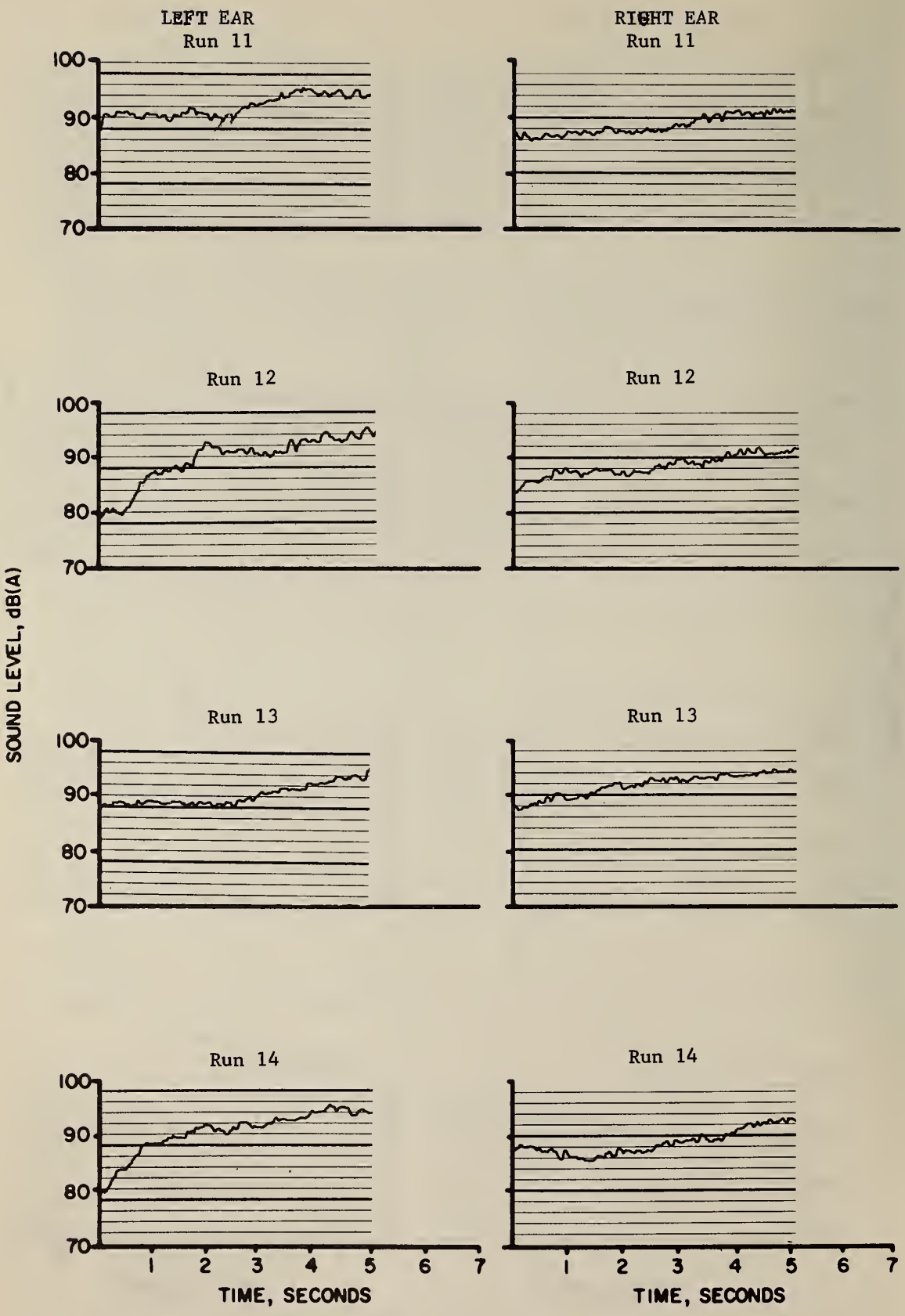

Figure 1-15. Truck 1, Test 4, Runs 11-14. (Interior)

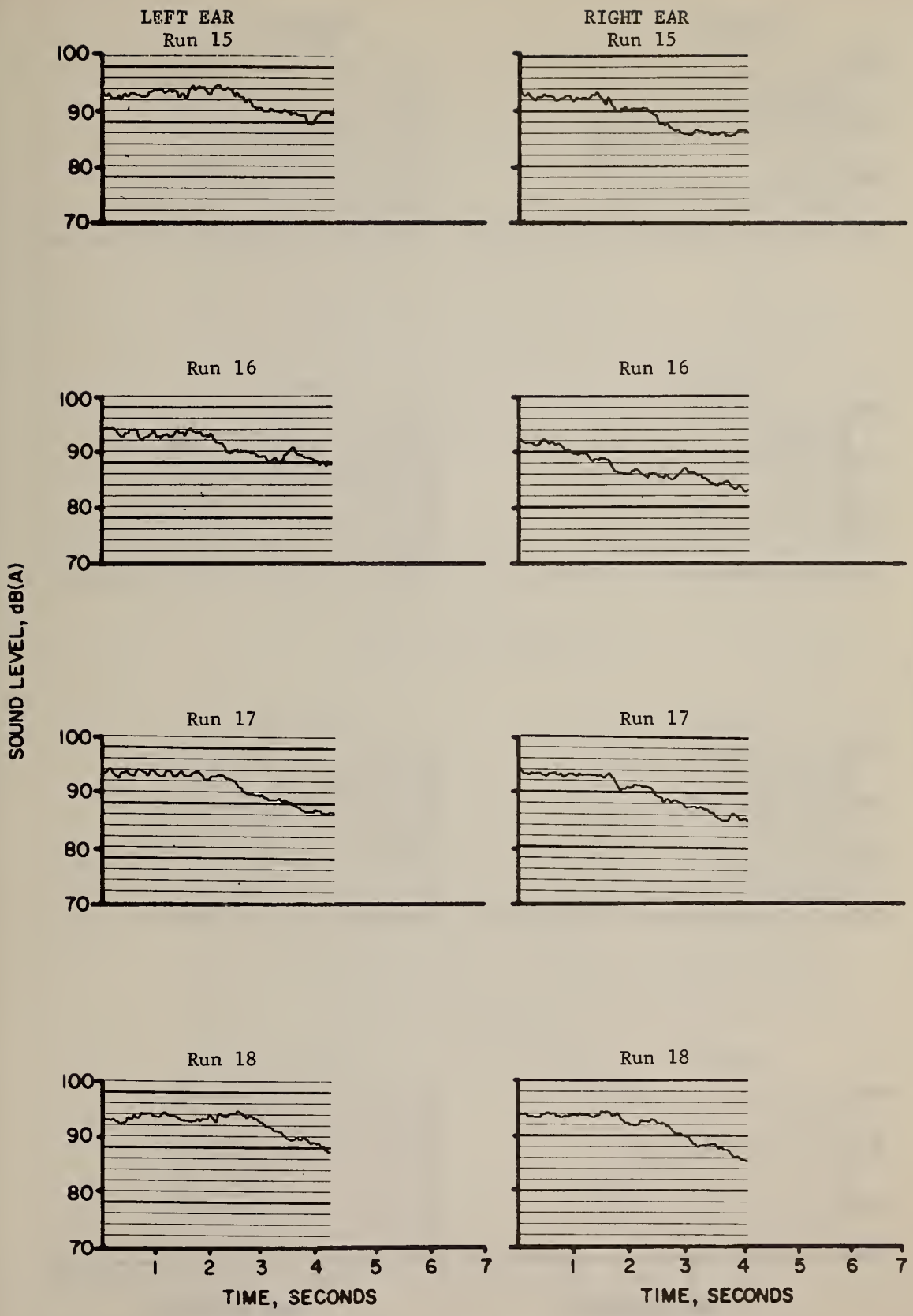

Figure 1-16. Truck 1, Test 5 (without exhaust brake), Runs 15-18. (Interior)

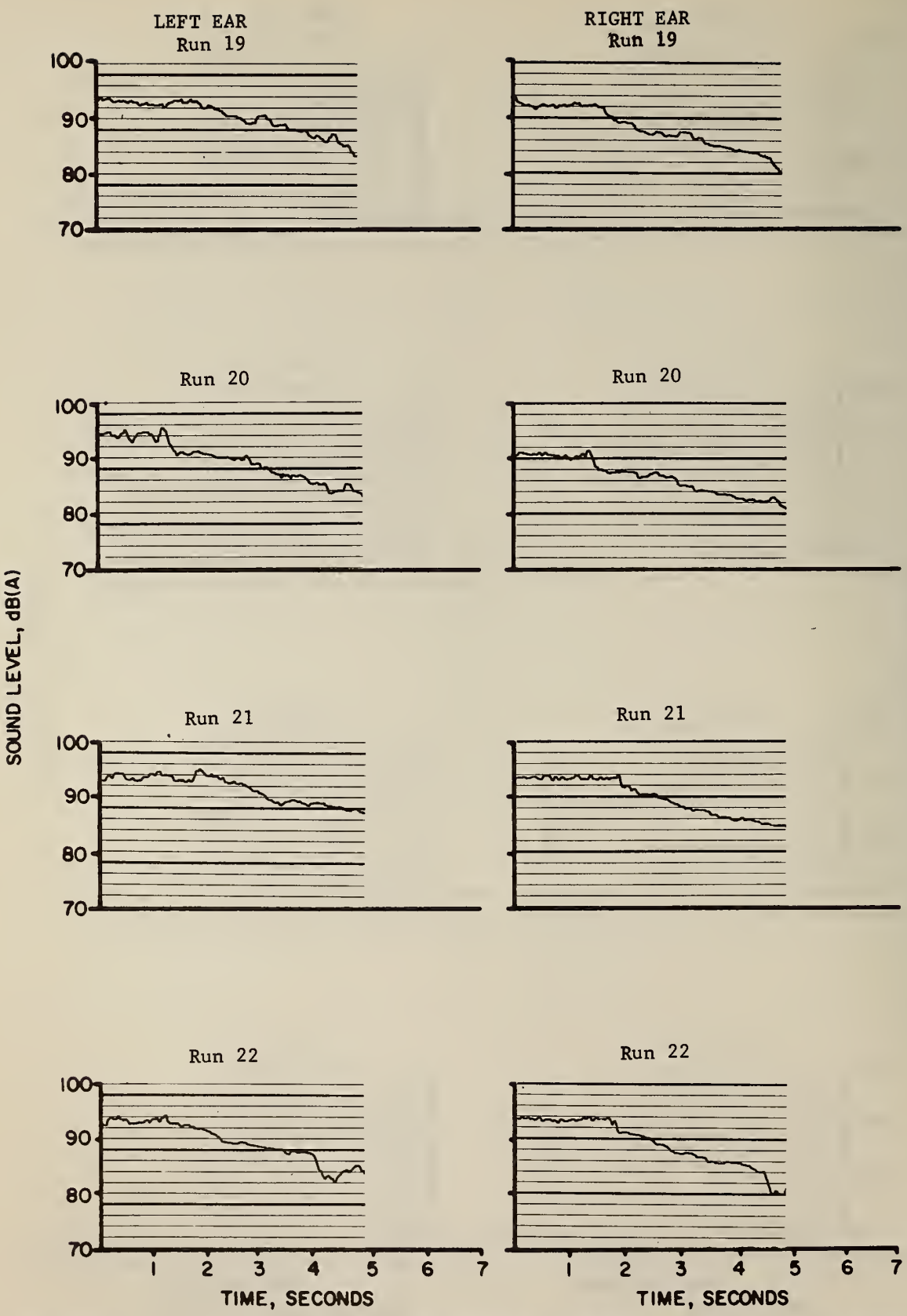

Figure 1-17. Truck 1, Test 5 (with exhaust brake), Runs 19-22. (Interior)

Test Vehicle Number 2

Figure 2-1. Test Vehicle Number 2

Truck Number: 2
Carrier (owner): United Parcel Service
Company Fleet Number: 19960
Make: Ford
Model: P-500
Serial Number: FY 11794
Year: 1970
Engine Governor Setting: 4000 rpm (no load)
3650 rpm (full load)
Total Miles of Operation: 8,426
Miles Since Last Engine Overhaul: Original engine
Miles Since Any Exhaust Work: Original exhaust system
Engine: Make - Ford Truck
Model - P50BVH80161

Exterior

Truck 02

TEST	RUN	SIDE	(WINDOWS)	SOUND LEVEL, dB(A) MICROPHONES					
				1	2	3	4	5	6
1. Low Idle (Stationary)	1	Right	Open						
	2	Left	Closed						
2. Acceleration (Stationary)	3	Right	Open						
	4	Right	Open						
	5	Left	Closed						
	6	Left	Closed						
2. High Idle (Stationary)	3	Right	Open						
	4	Right	Open						
	5	Left	Closed						
	6	Left	Closed						
3. City Start Up	7	Right	Open						
	8	Right	Open						
	9	Left	Closed						
	10	Left	Closed						
4. J366 (Acceleration)	11	Right	Open	80	79	80	80	79	84
	12	Right	Open	80	79	80	79	79	84
	13	Left	Closed	78	76	77	76	76	81
	14	Left	Closed	77	76	76	76	76	81
5. J366 (Deceleration)	15	Right	Open	78	78	78	79	78	83
	16	Right	Open	80	79	80	80	79	84
	17	Left	Closed	76	76	76	76	77	80
	18	Left	Closed	80	79	80	81	81	86

Table 2-1. Maximum A-weighted sound levels as measured at the six exterior microphone locations for all test runs for vehicle number 2.

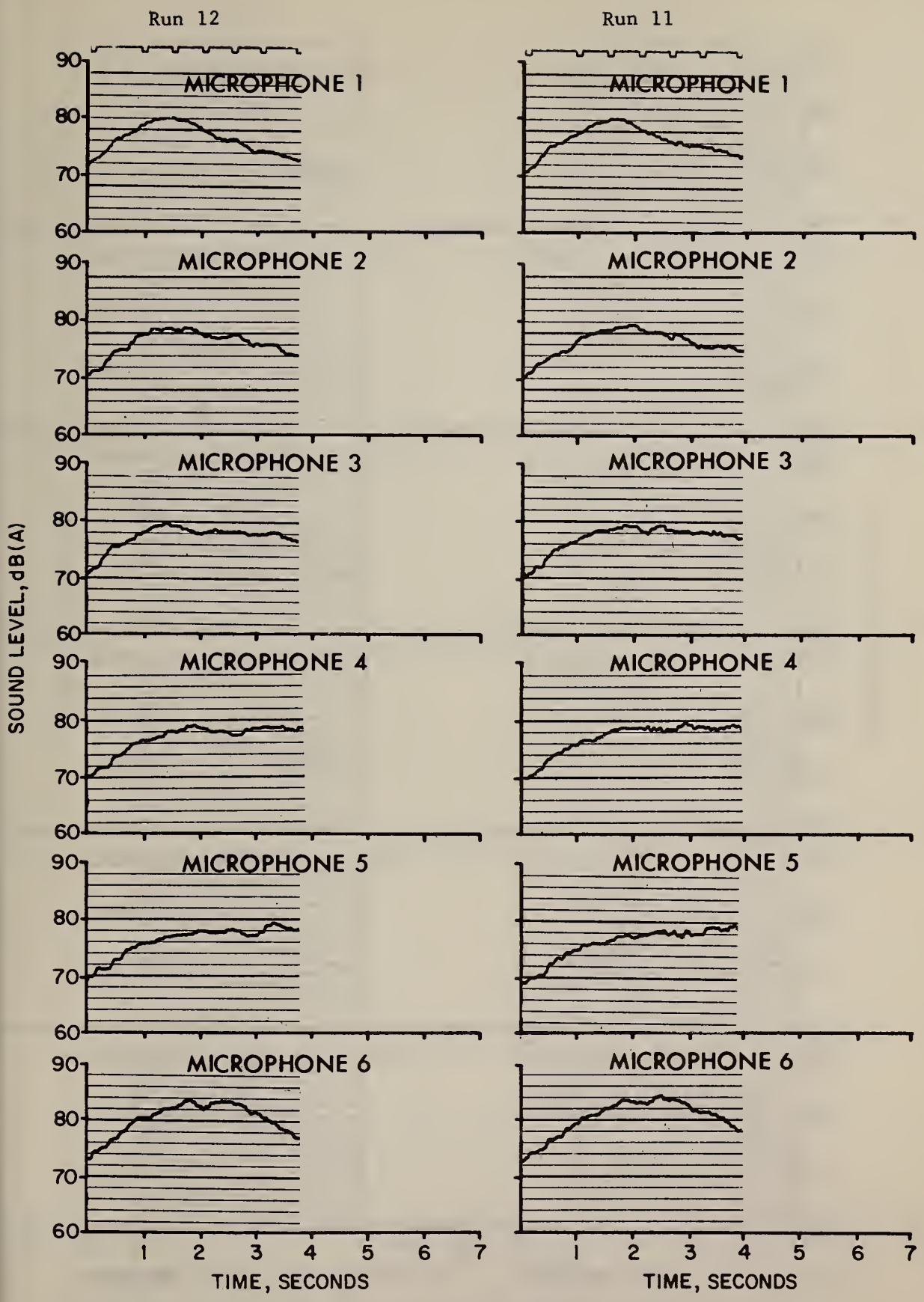

Figure 2-2. Truck 2, Test 4, Runs 11,12. (Exterior)

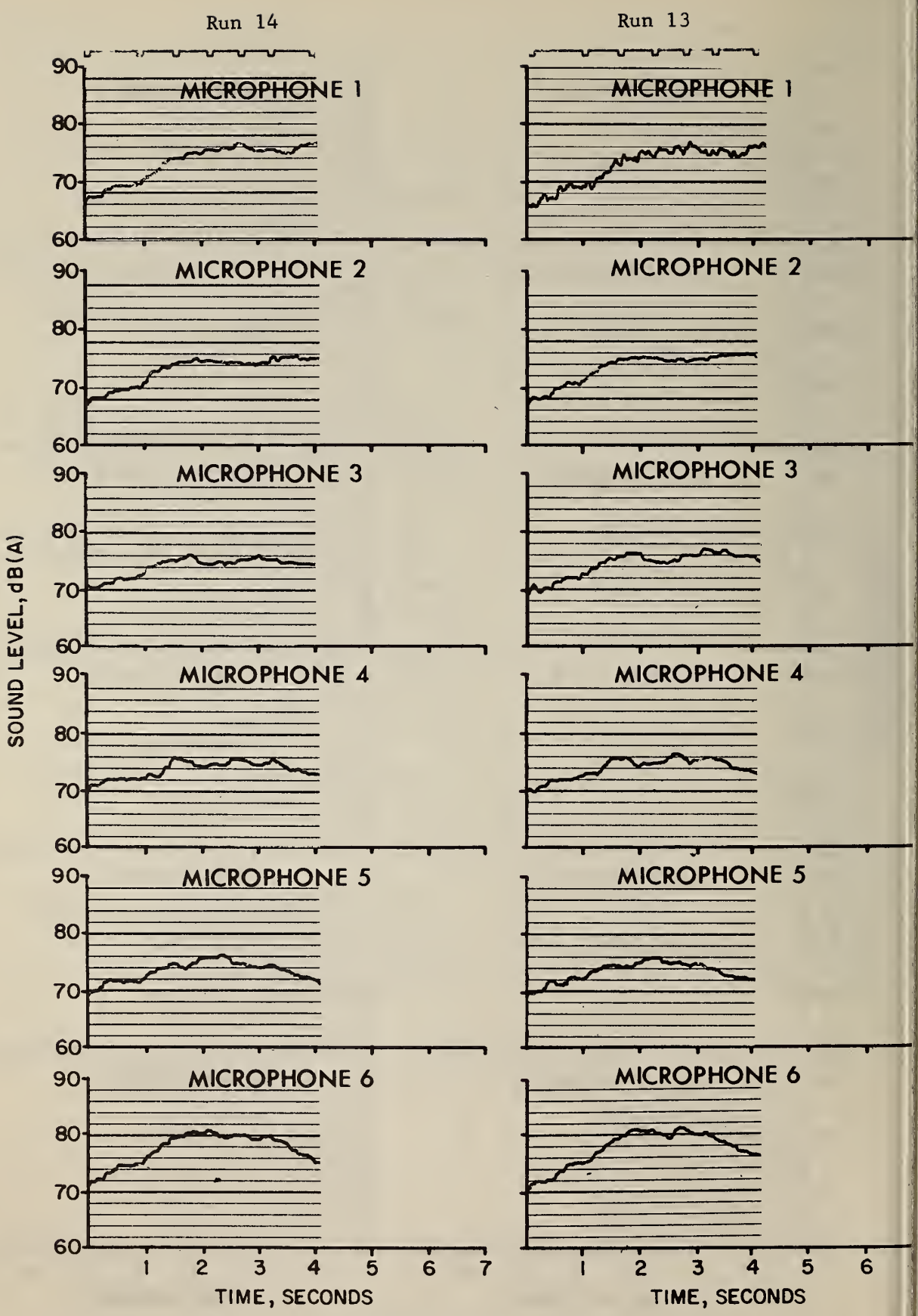

Figure 2-3. Truck 2, Test 4, Runs 13,14. (Exterior)

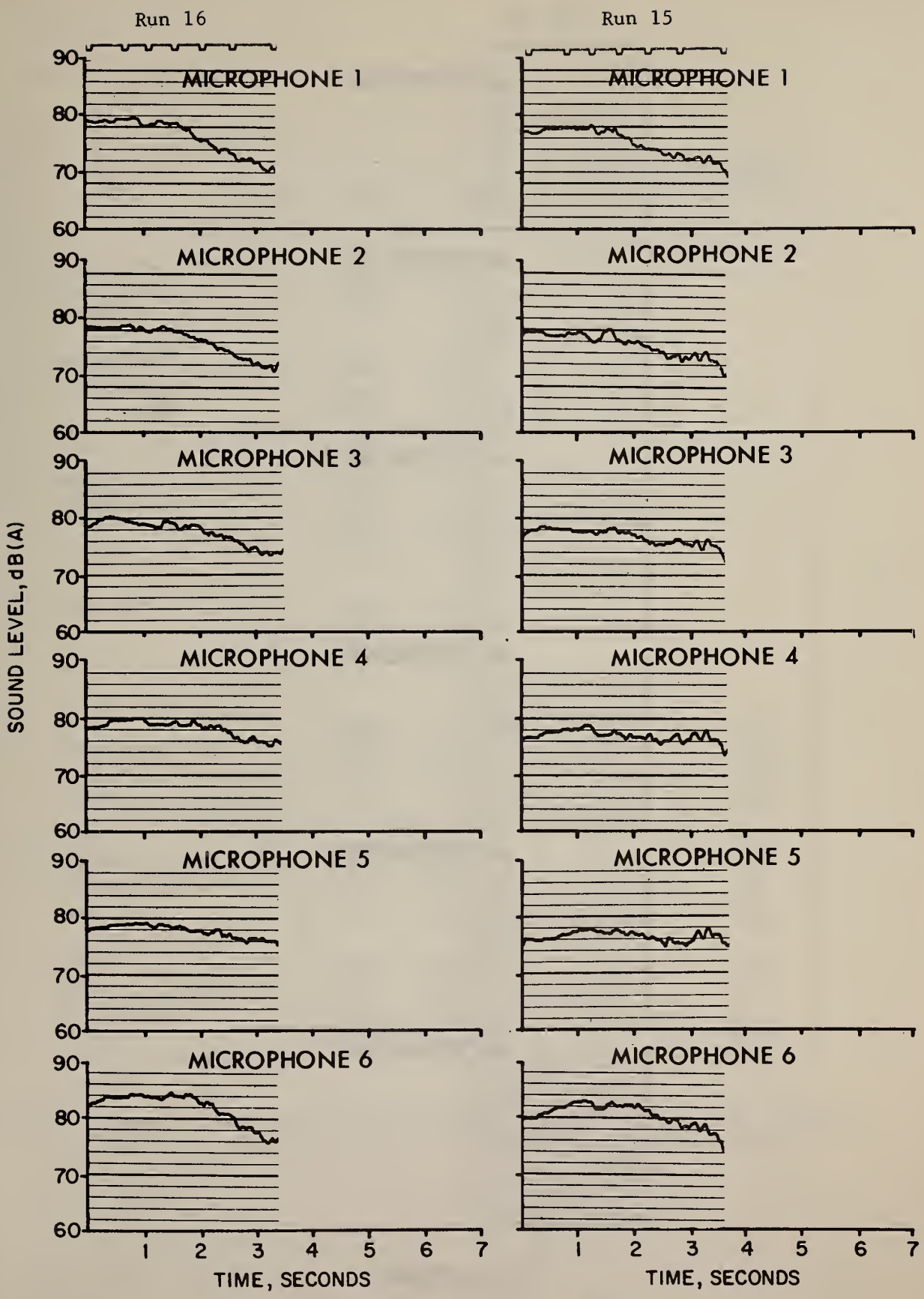

Figure 2-4. Truck 2, Test 5, Runs 15,16. (Exterior)

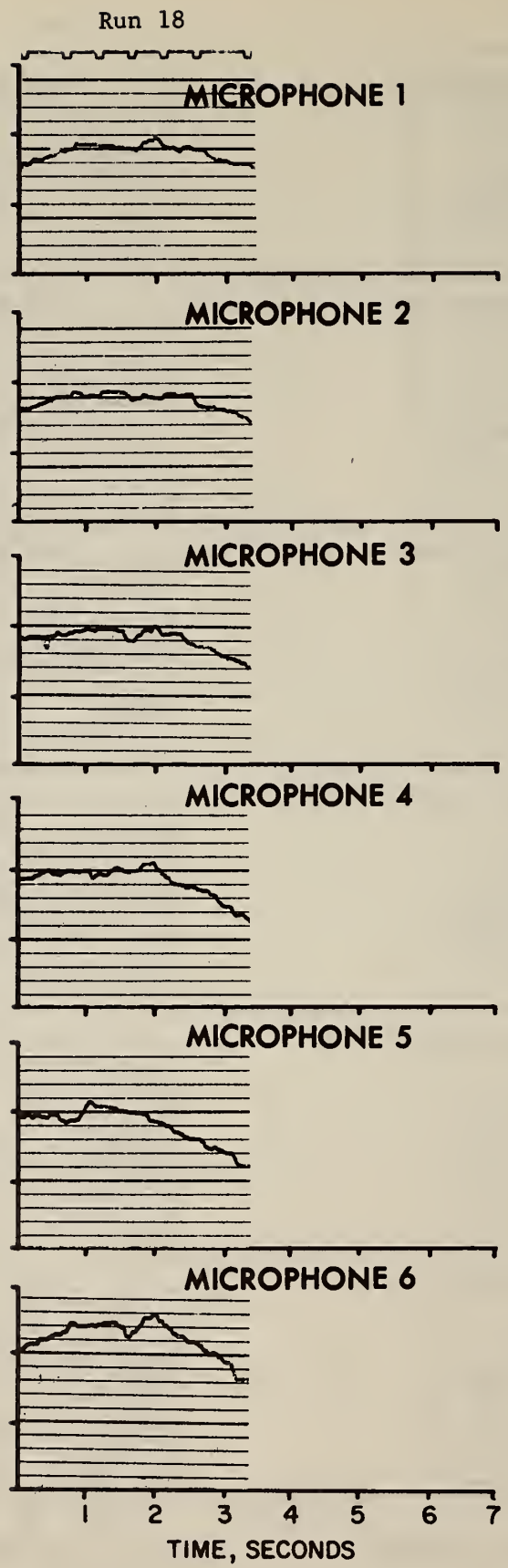

Figure 2-5. Truck 2, Test 5, Run 18. (Exterior)

Interior

Truck 02

TEST	RUN	(SIDE)	WINDOWS	SOUND LEVEL, dB(A) MICROPHONES	
				LEFT EAR	RIGHT EAR
1. Low Idle (Stationary)	1	Right	Open		
	2	Left	Closed		
2. Acceleration (Stationary)	3	Right	Open		
	4	Right	Open		
	5	Left	Closed		
	6	Left	Closed		
2. High Idle (Stationary)	3	Right	Open		
	4	Right	Open		
	5	Left	Closed		
	6	Left	Closed		
3. City Start Up	7	Right	Open		
	8	Right	Open		
	9	Left	Closed		
	10	Left	Closed		
4. J366 (Acceleration) Internal door closed	11	Right	Open	84	85
	12	Right	Open	82	83
	13	Left	Closed	82	84
	14	Left	Closed	84	82
4. J366 (Acceleration) Internal door open	15	Right	Open	82	84
	16	Right	Open	82	83
	17	Left	Closed	84	84
	18	Left	Closed	83	83
5. J366 (Deceleration) Internal door closed	19	Right	Open	85	85
	20	Right	Open	82	84
	21	Left	Closed	87	87
	22	Left	Closed	88	89

Table 2-2. Maximum A-weighted sound levels as measured at the two interior microphone locations for all test runs for vehicle number 2.

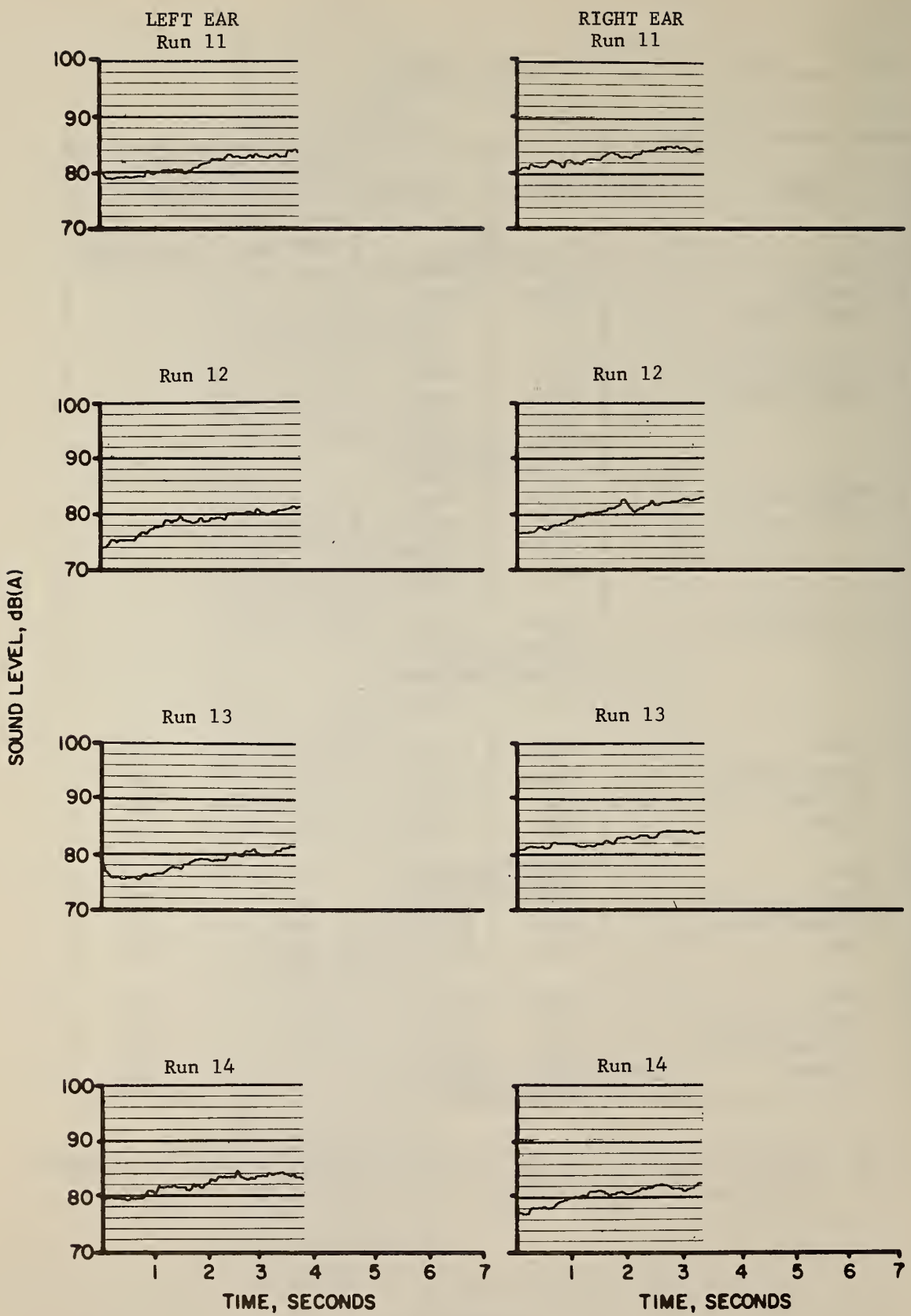

Figure 2-6. Truck 2, Test 4 (internal door closed), Runs 11-14. (Interior)

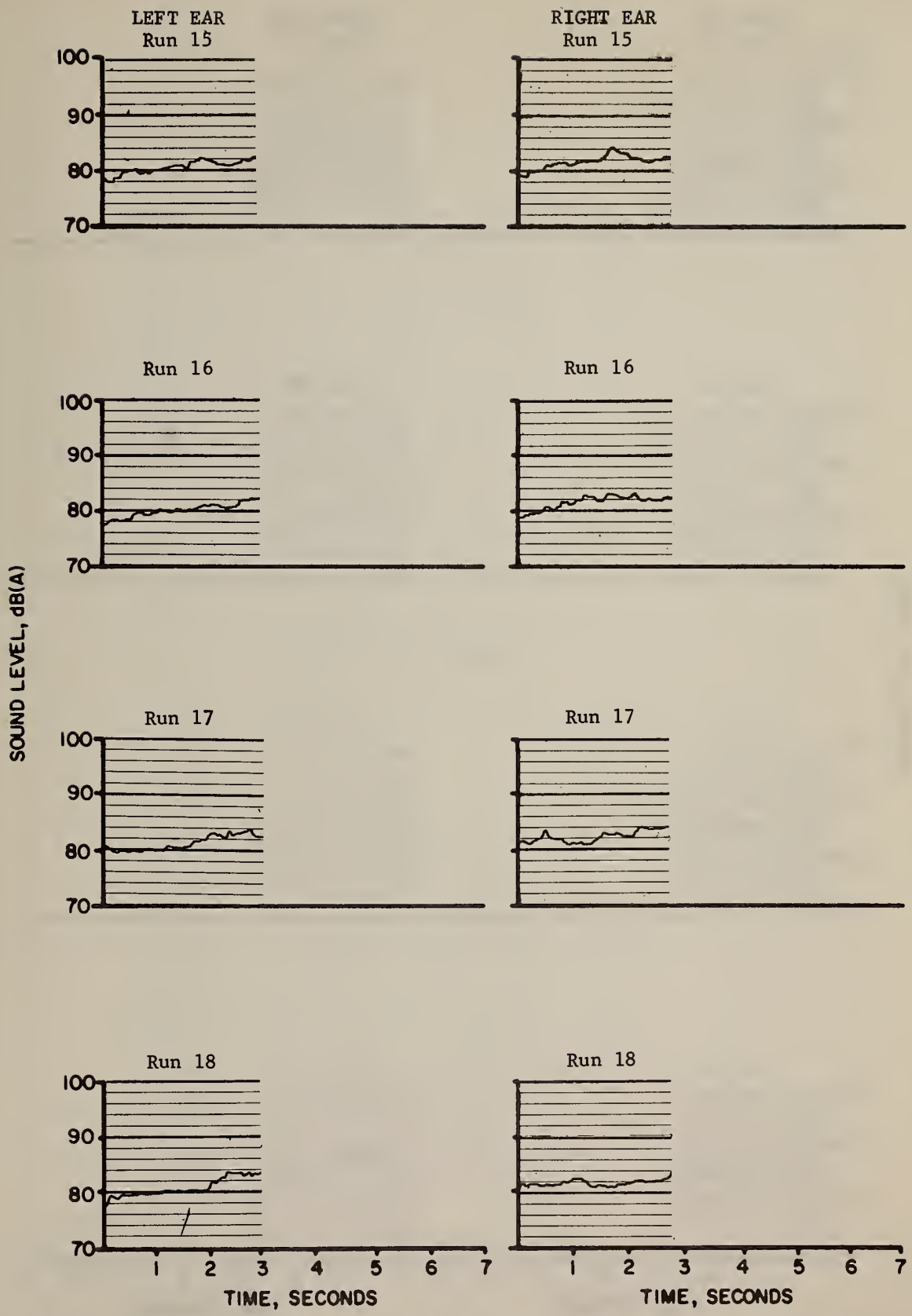

Figure 2-7. Truck 2, Test 4 (internal door open), Runs 15-18. (Interior)

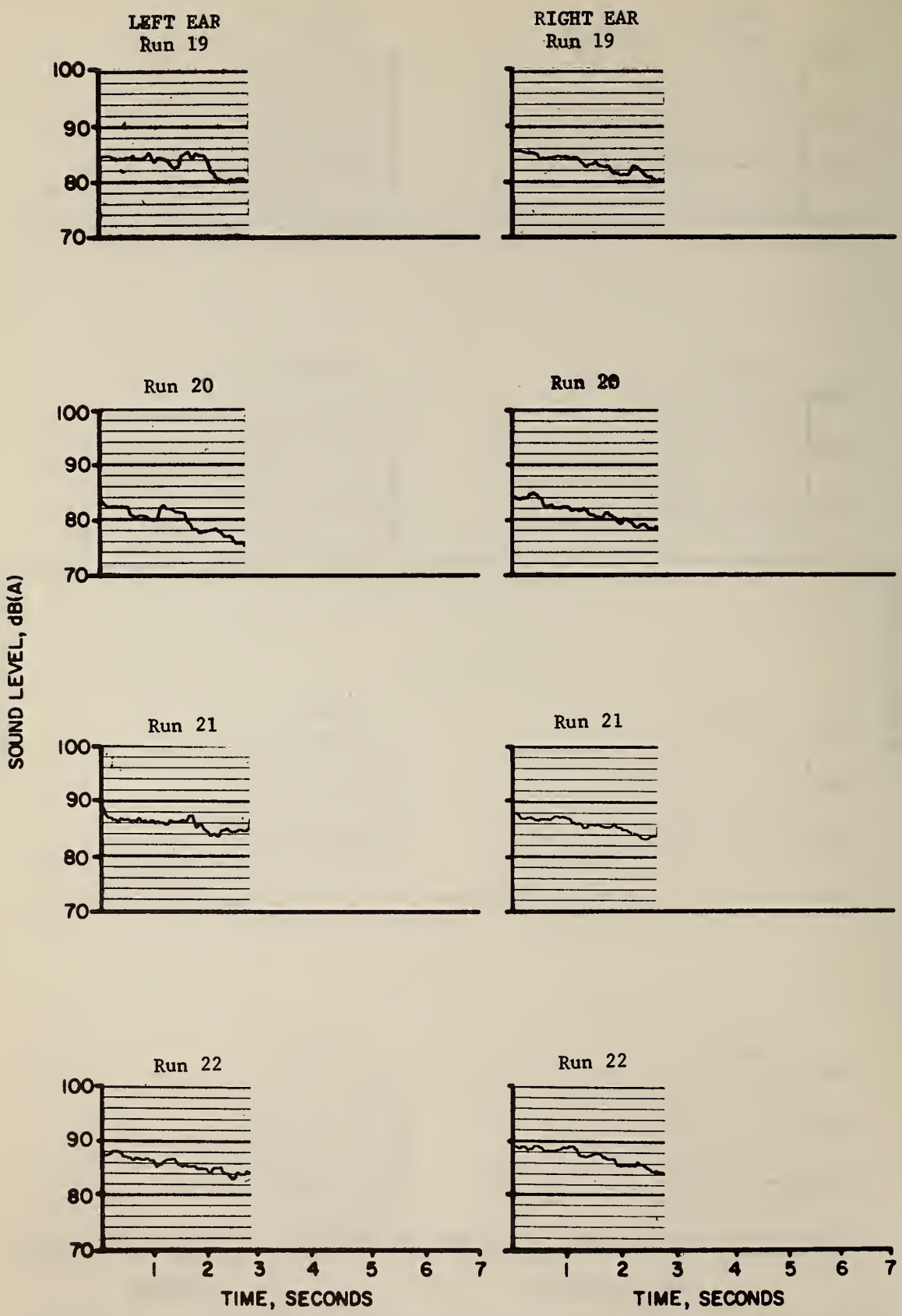

Figure 2-8. Truck 2, Test 5 (internal door closed), Runs 19-22 (Interior).

Test Vehicle Number 3

Figure 3-1. Test Vehicle Number 3.

Truck Number: 3
Carrier (owner): Yellow Freight System, Inc.
Company Fleet Number: 2929
Make: Kenworth
Model: W923
Serial Number: 114213
Year: 1968
Engine Governor Setting: 2300 rpm
Total Miles of Operation: 366,493
Miles Since Last Engine Overhaul: 89,287
Miles Since Any Exhaust Work: Original exhaust system
Engine: Make - Cummins
Model - 250

Exterior

Truck 03

TEST	RUN	SIDE	(WINDOWS)	SOUND LEVEL, dB(A) MICROPHONES					
				1	2	3	4	5	6
1. Low Idle (Stationary)	1	Right	Closed	70	70	69	70	71	76
	2	Left	Open	69	70	70	69	68	75
2. Acceleration (Stationary)	3	Right	Closed	85	86	85	83	84	90
	4	Right	Closed	85	86	86	84	84	91
	5	Left	Open	86	86	86	84	84	92
	6	Left	Open	86	86	86	85	85	92
2. High Idle (Stationary)	3	Right	Closed	85	86	84	83	83	89
	4	Right	Closed	85	86	84	83	83	89
	5	Left	Open	85	85	84	83	84	89
	6	Left	Open	85	85	84	84	84	90
3. City Start Up	7	Right	Closed	86	87	86	84	84	91
	8	Right	Closed	87	87	85	85	84	90
	9	Left	Open	86	86	86	84	85	91
	10	Left	Open	86	86	86	84	84	90
4. J366 (Acceleration)	11	Right	Closed	87	87	87	86	86	92
	12	Right	Closed	86	86	86	86	86	92
	13	Left	Open	86	87	86	85	85	91
	14	Left	Open	86	86	86	86	85	92
5. J366 (Deceleration)	15	Right	Closed	85	85	84	82	82	90
	16	Right	Closed	85	85	84	83	82	89
	17	Left	Open	84	85	84	84	84	90
	18	Left	Open	84	84	85	84	83	90

Table 3-1. Maximum A-weighted sound levels as measured at the six exterior microphone locations for all test runs for vehicle number 3.

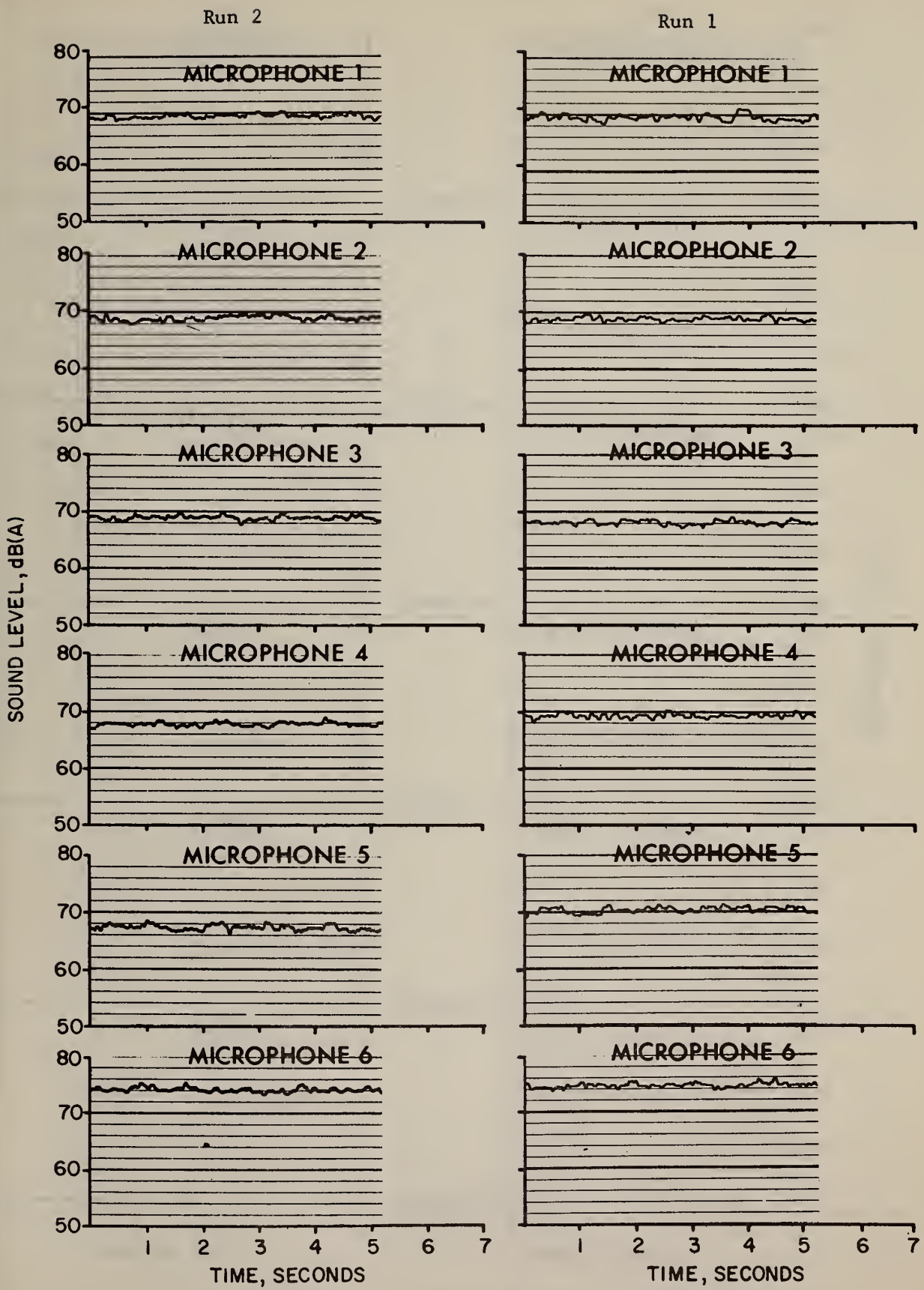

Figure 3-2. Truck 3, Test 1, Runs 1,2. (Exterior)

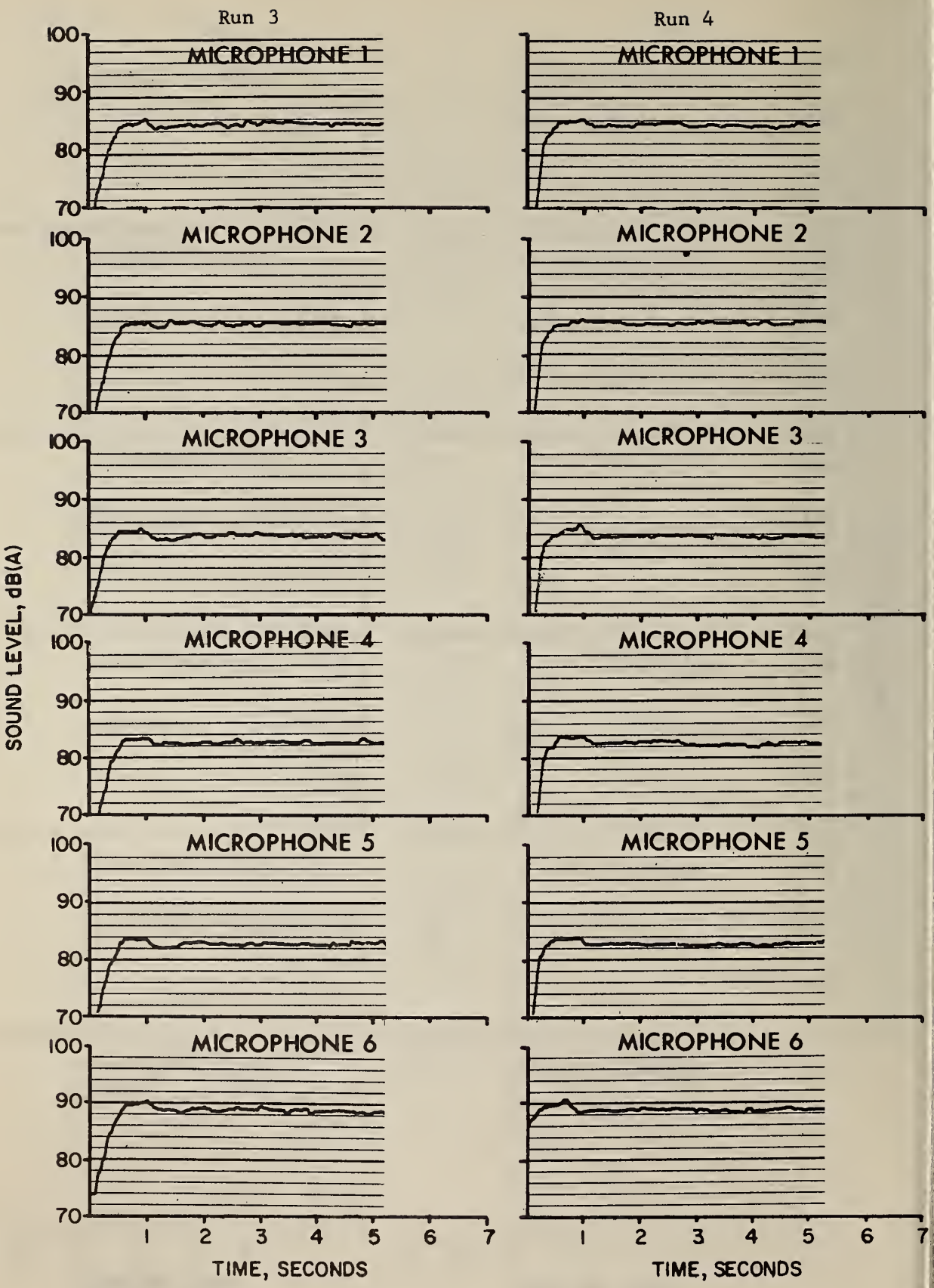

Figure 3-3. Truck 3, Test 2, Runs 3,4. (Exterior)

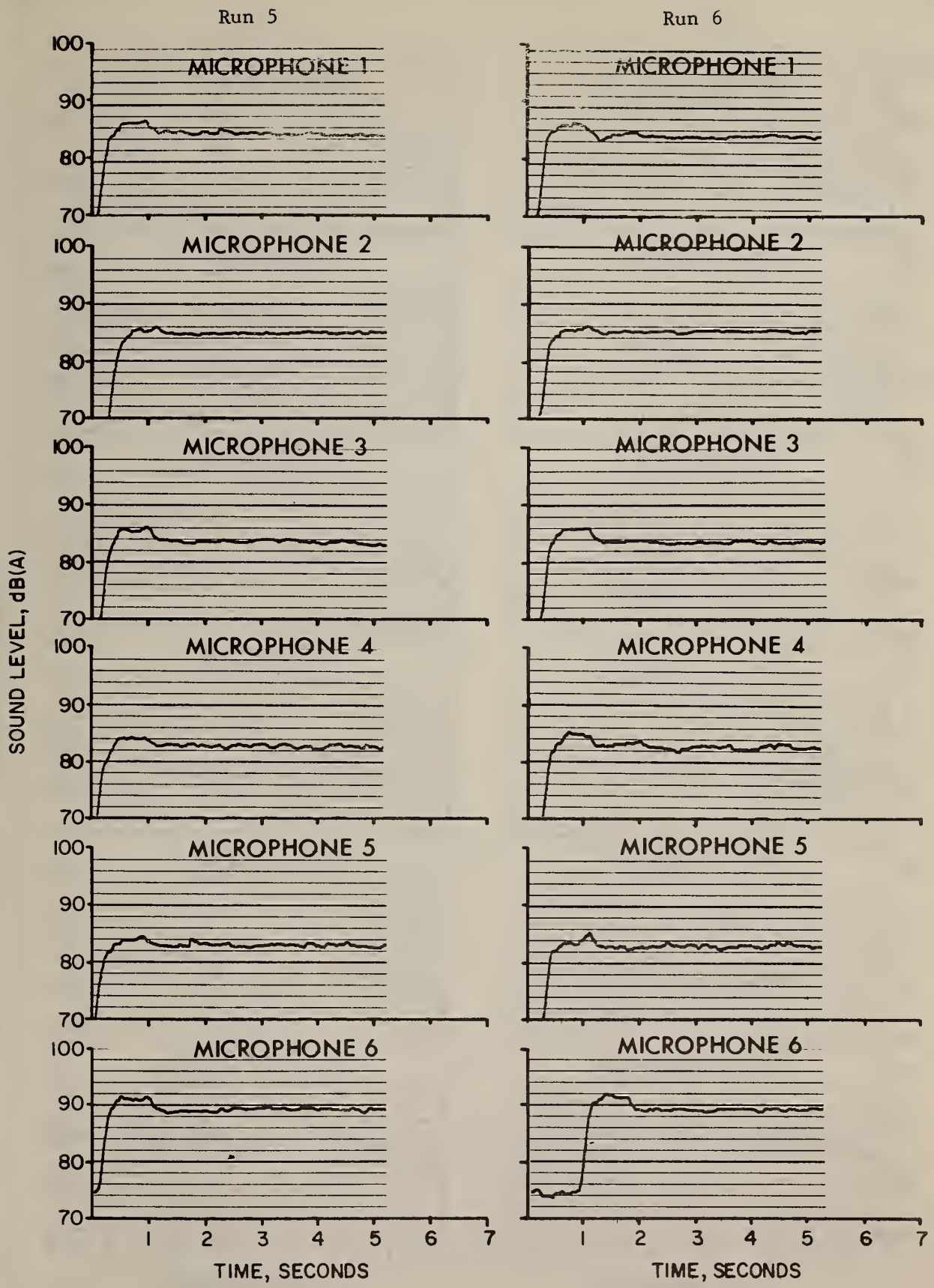

Figure 3-4. Truck 3, Test 2, Runs 5,6. (Exterior)

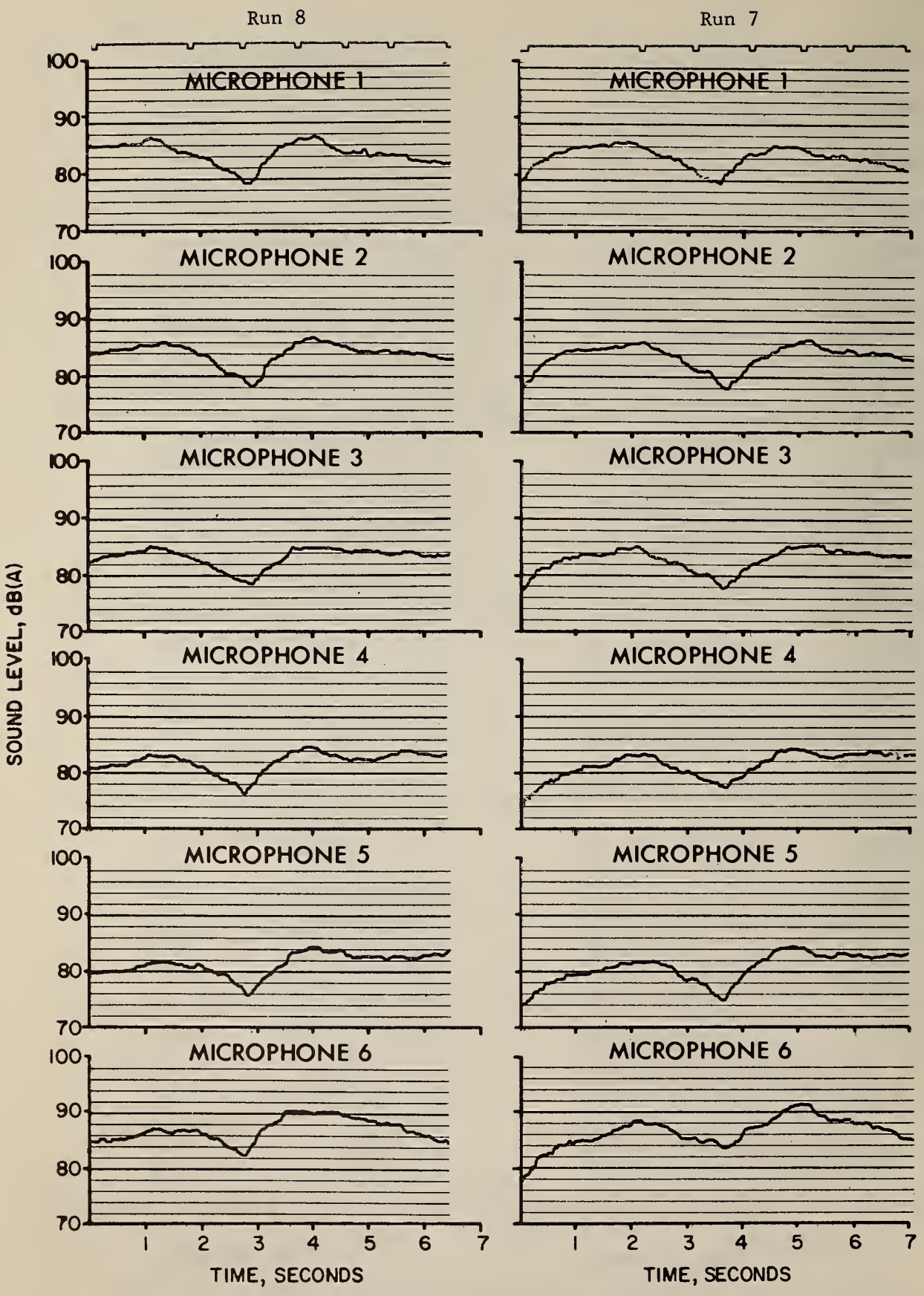

Figure 3-5. Truck 3, Test 3, Runs 7,8. (Exterior)

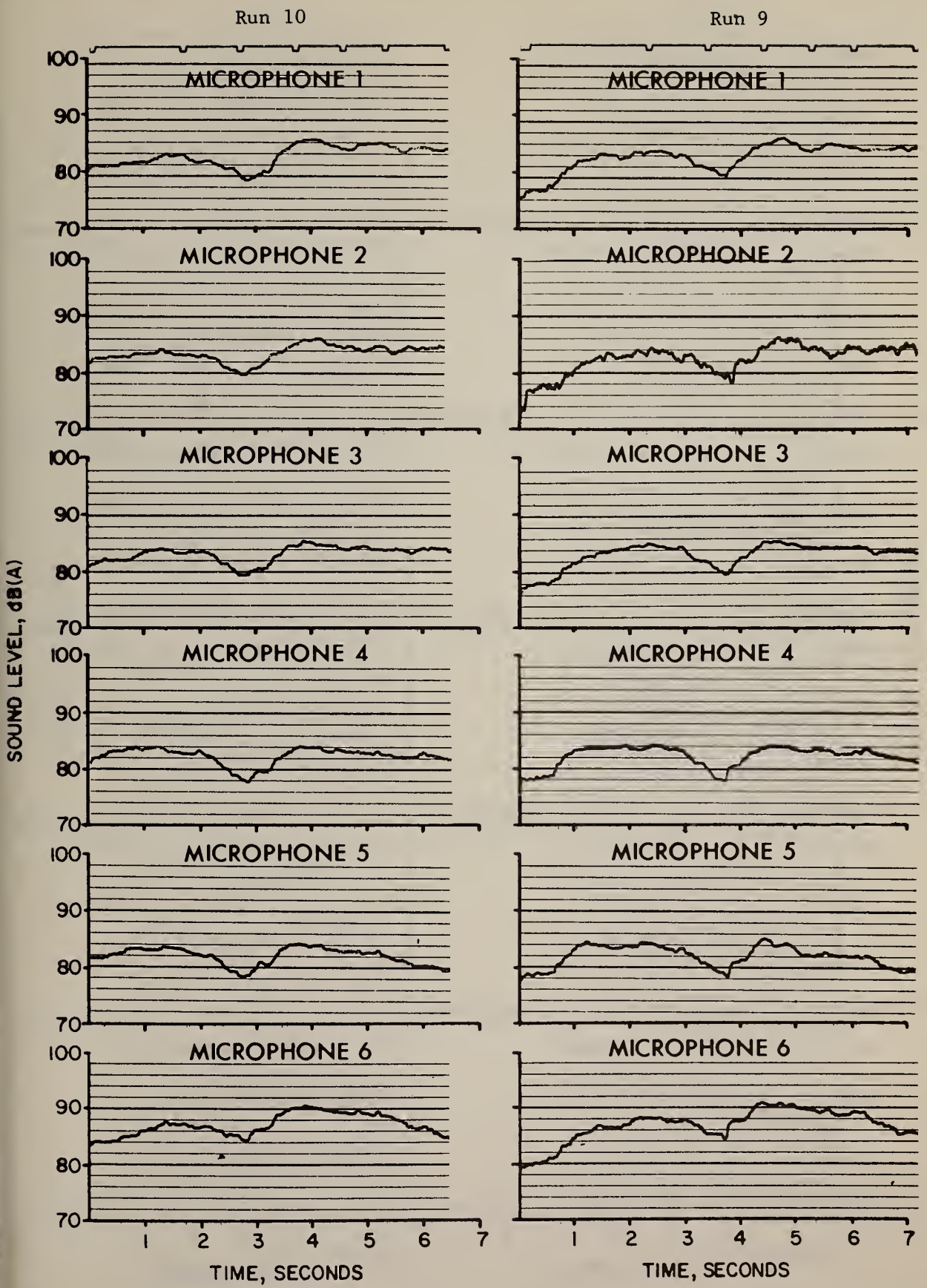

Figure 3-6. Truck 3, Test 3, Runs 9,10. (Exterior)

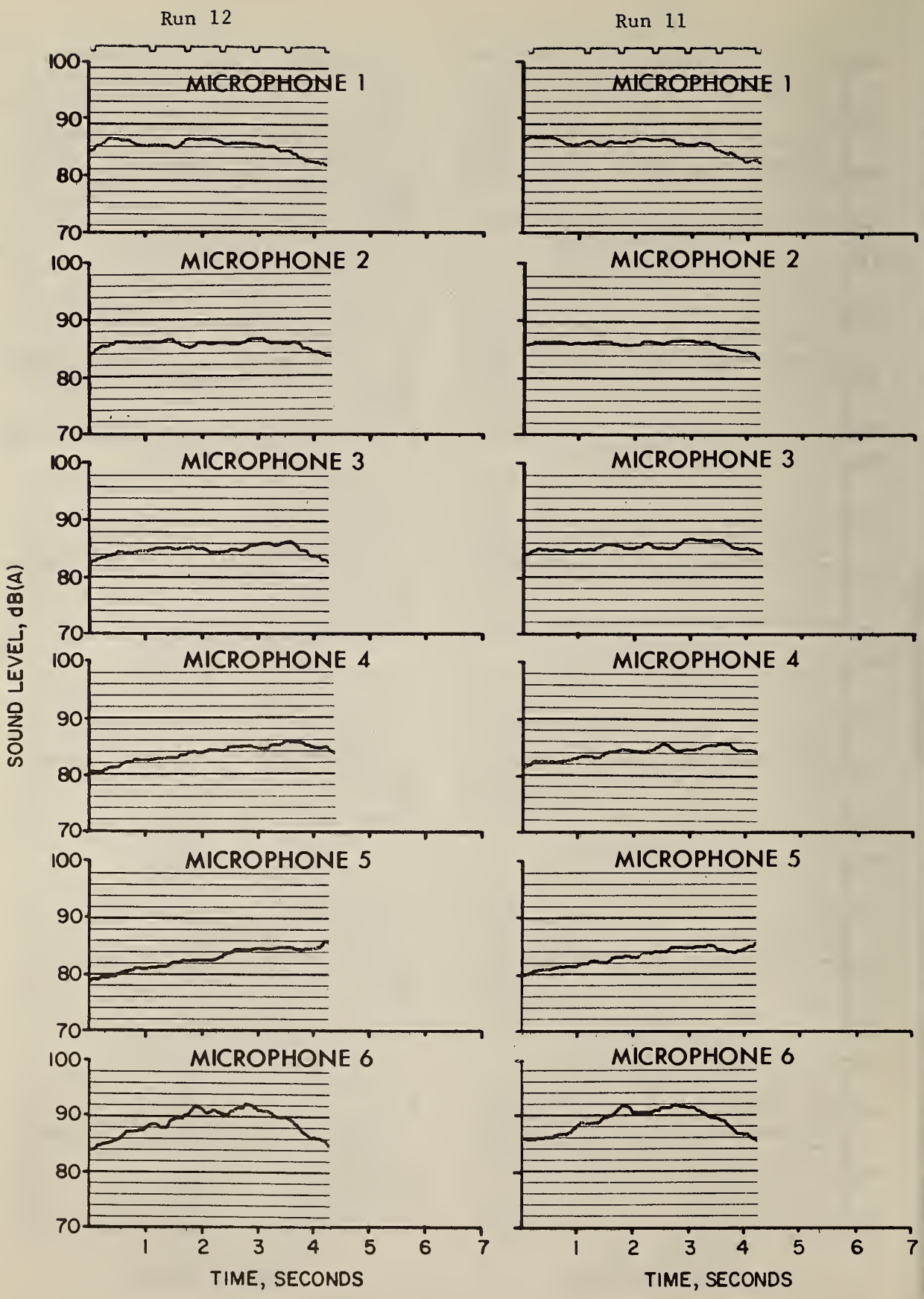

Figure 3-7. Truck 3, Test 4, Runs 11,12. (Exterior)

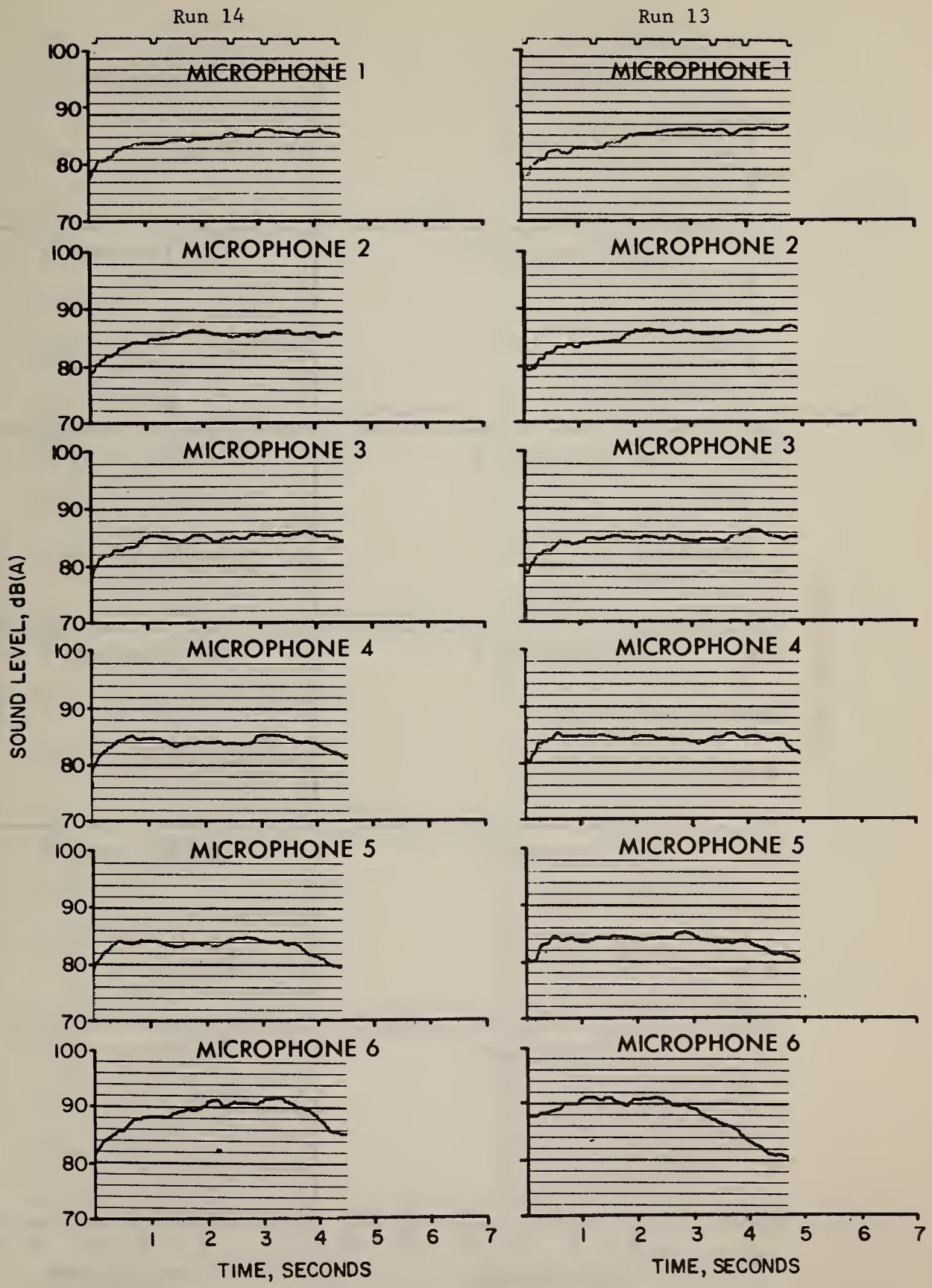

Figure 3-8. Truck 3, Test 4, Runs 13,14. (Exterior)

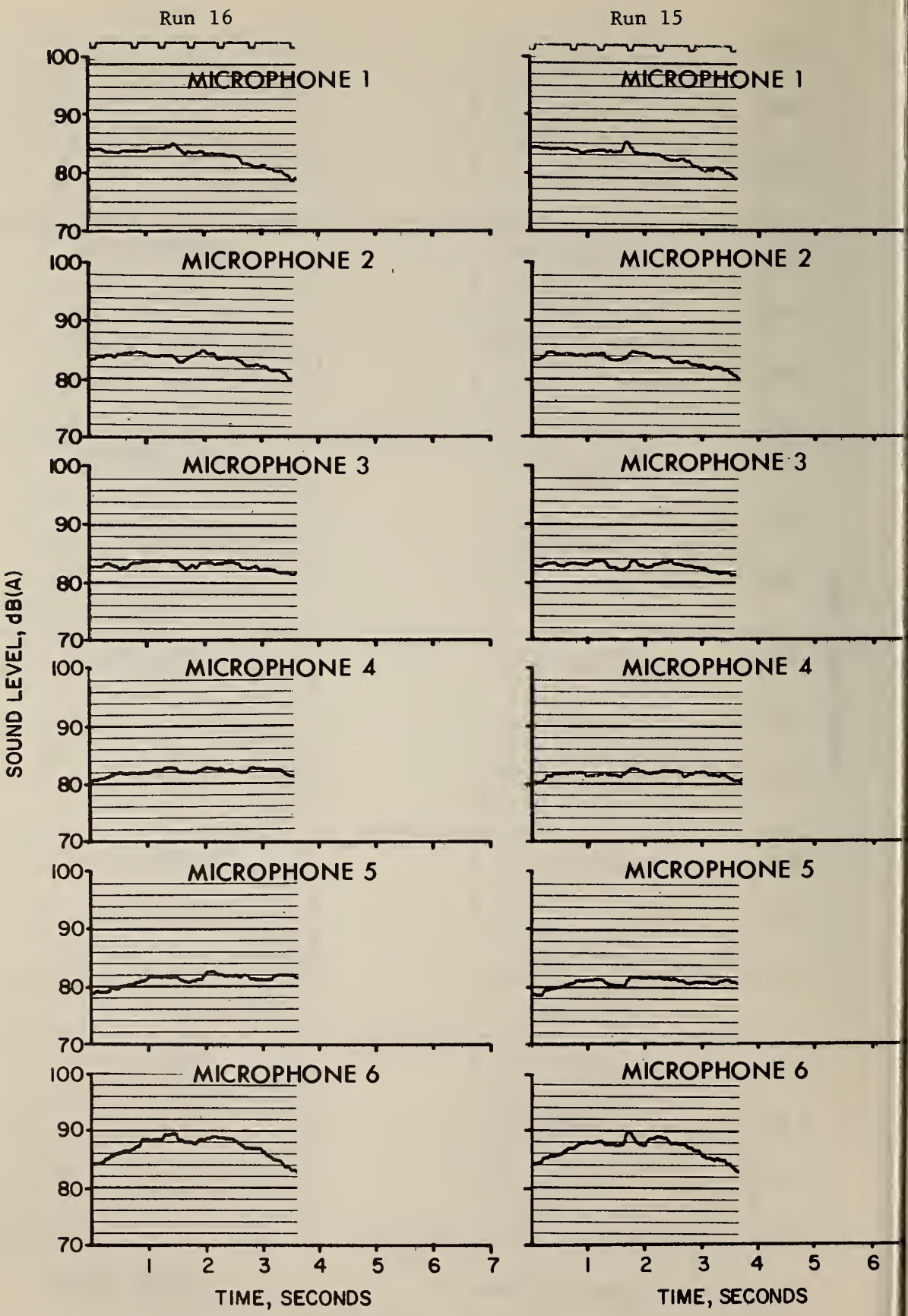

Figure 3-9. Truck 3, Test 5, Runs 15,16. (Exterior)

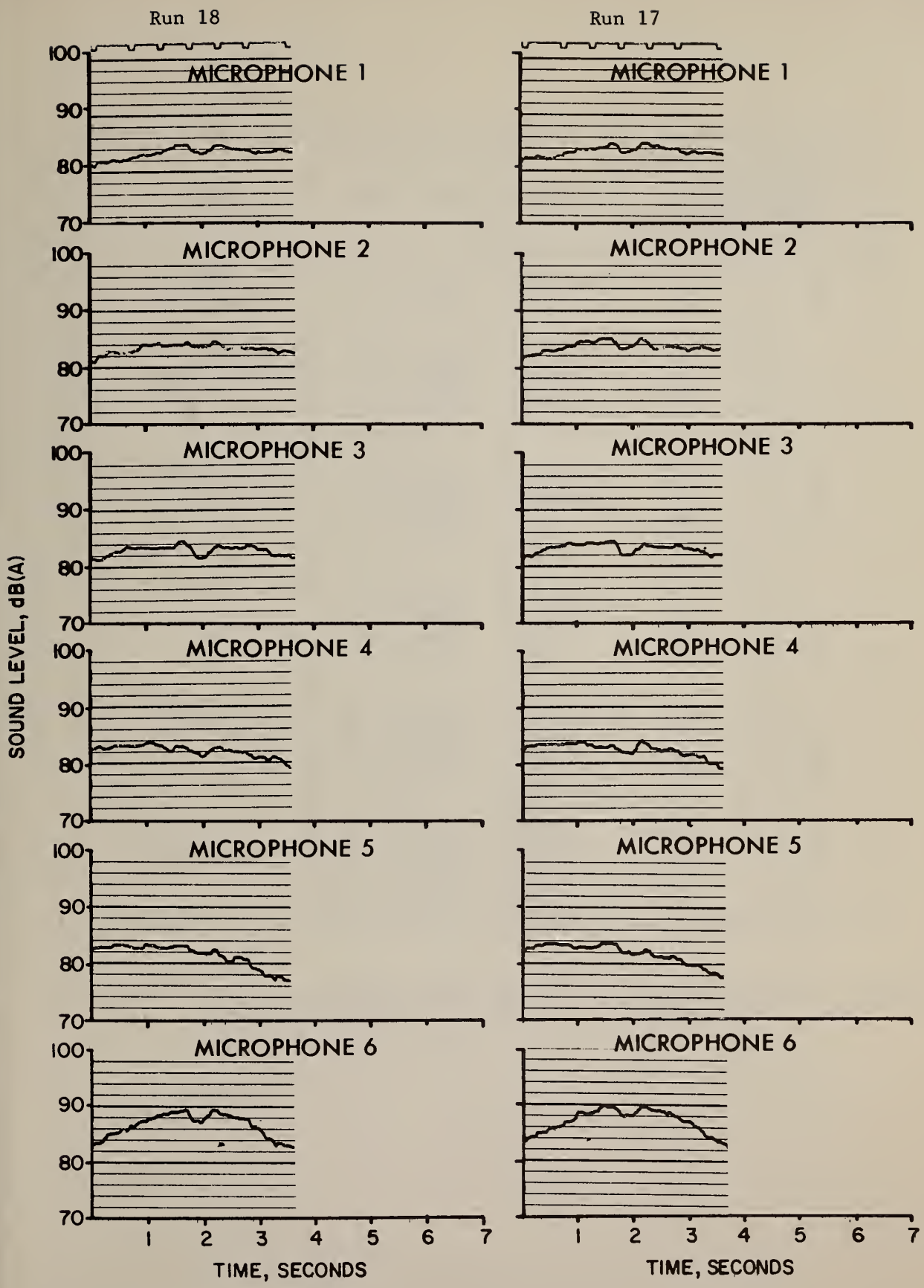

Figure 3-10. Truck 3, Test 5, Runs 17,18. (Exterior)

Interior

Truck 03

TEST	RUN	(SIDE)	WINDOWS	SOUND LEVEL, dB(A) MICROPHONES	
				LEFT EAR	RIGHT EAR
1. Low Idle (Stationary)	1	Right	Closed	79	80
	2	Left	Open	79	79
2. Acceleration (Stationary)	3	Right	Closed	94	--
	4	Right	Closed	91	90
	5	Left	Open	--	--
	6	Left	Open	--	--
2. High Idle (Stationary)	3	Right	Closed	94	90
	4	Right	Closed	94	90
	5	Left	Open	92	92
	6	Left	Open	92	92
3. City Start Up	7	Right	Closed	92	90
	8	Right	Closed	92	90
	9	Left	Open	93	92
	10	Left	Open	94	92
4. J366 (Acceleration)	11	Right	Closed	90	91
	12	Right	Closed	91	91
	13	Left	Open	94	92
	14	Left	Open	96	93
5. J366 (Deceleration)	15	Right	Closed	93	90
	16	Right	Closed	92	90
	17	Left	Open	92	91
	18	Left	Open	91	91

Table 3-2. Maximum A-weighted sound levels as measured at the two interior microphone locations for all test runs for vehicle number 3.

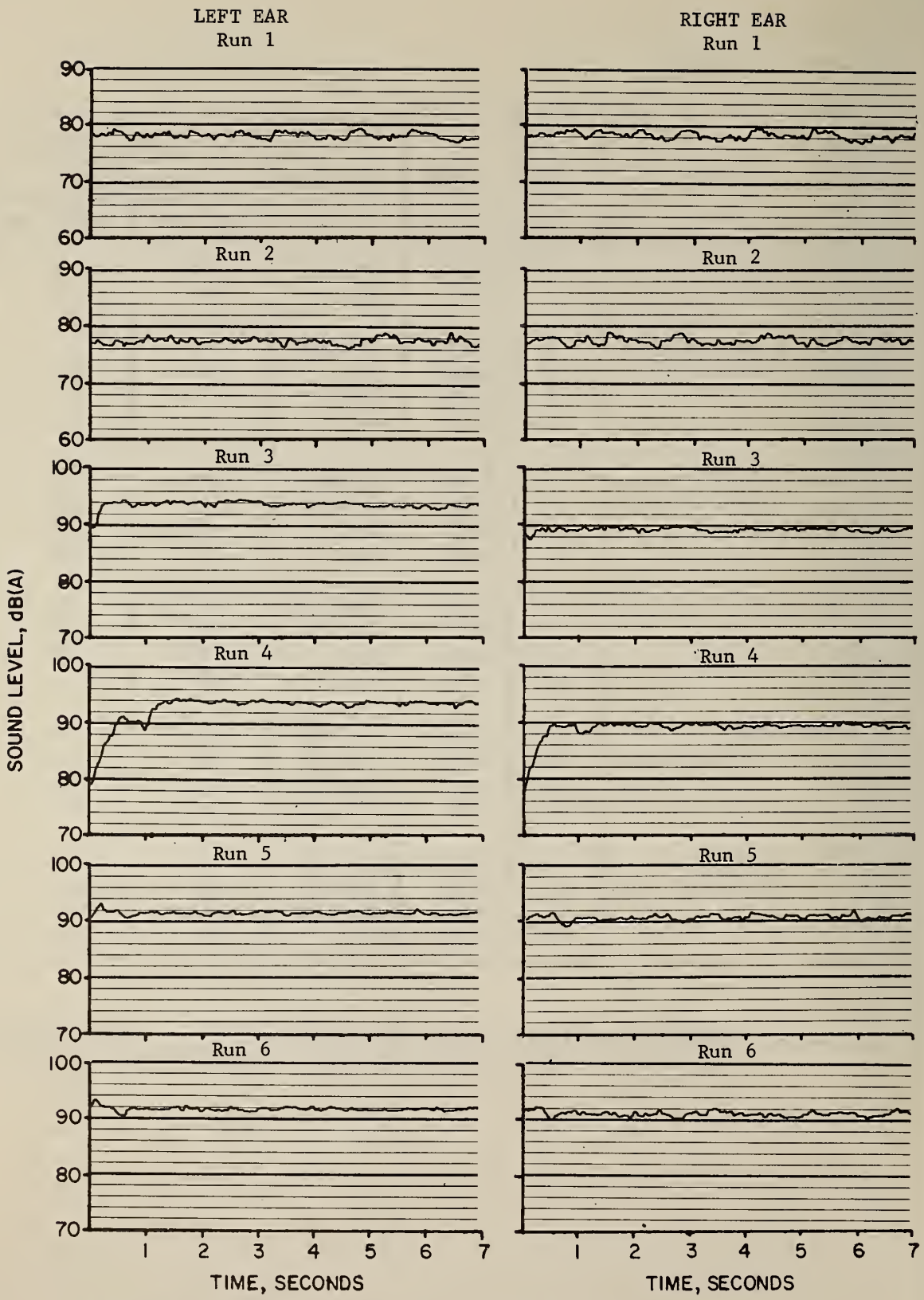

Figure 3-11. Truck 3, Tests 1,2, Runs 1-6. (Interior)

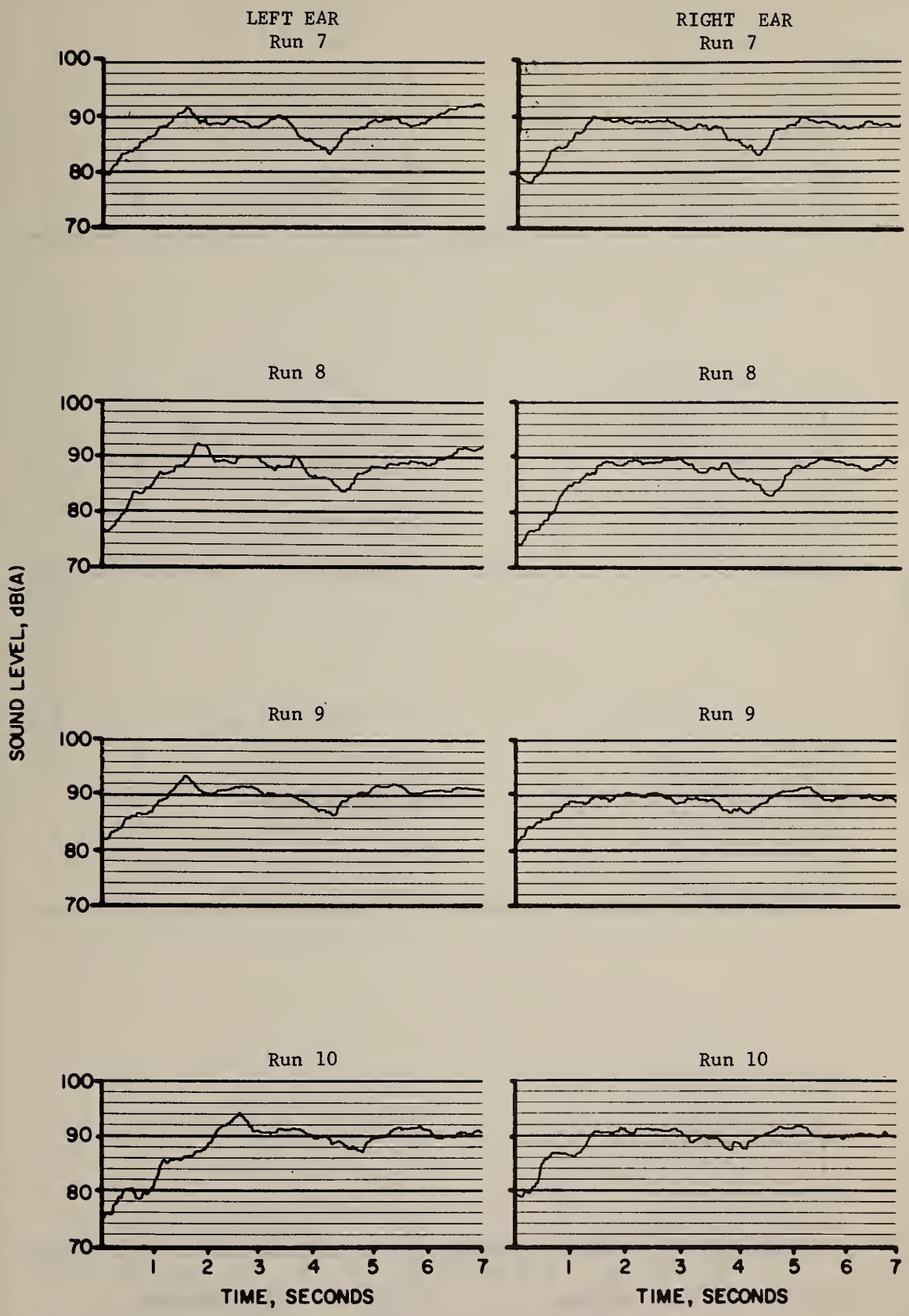

Figure 3-12. Truck 3, Test 3, Runs 7-10. (Interior)

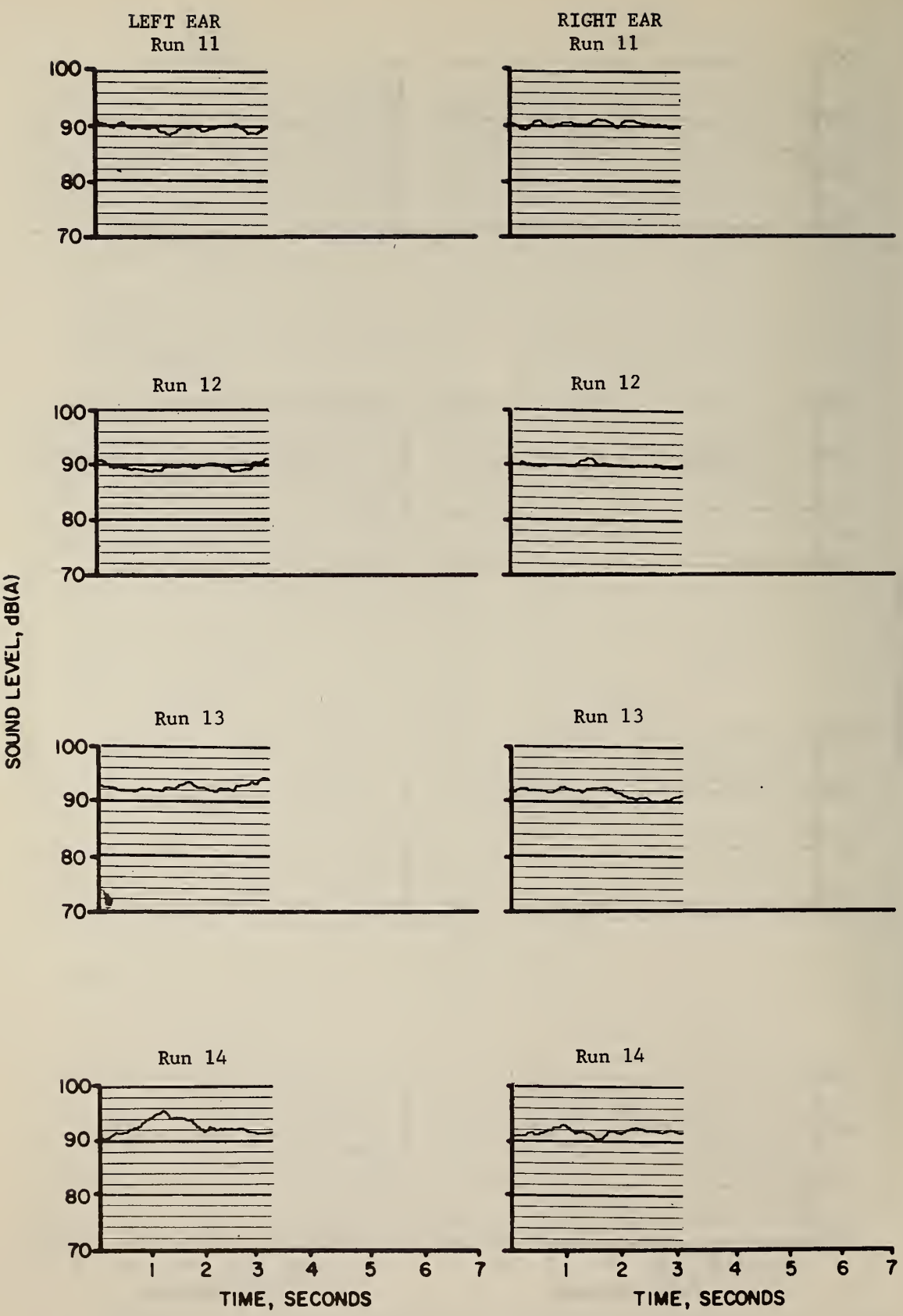

Figure 3-13. Truck 3, Test 4, Runs 11-14. (Interior)

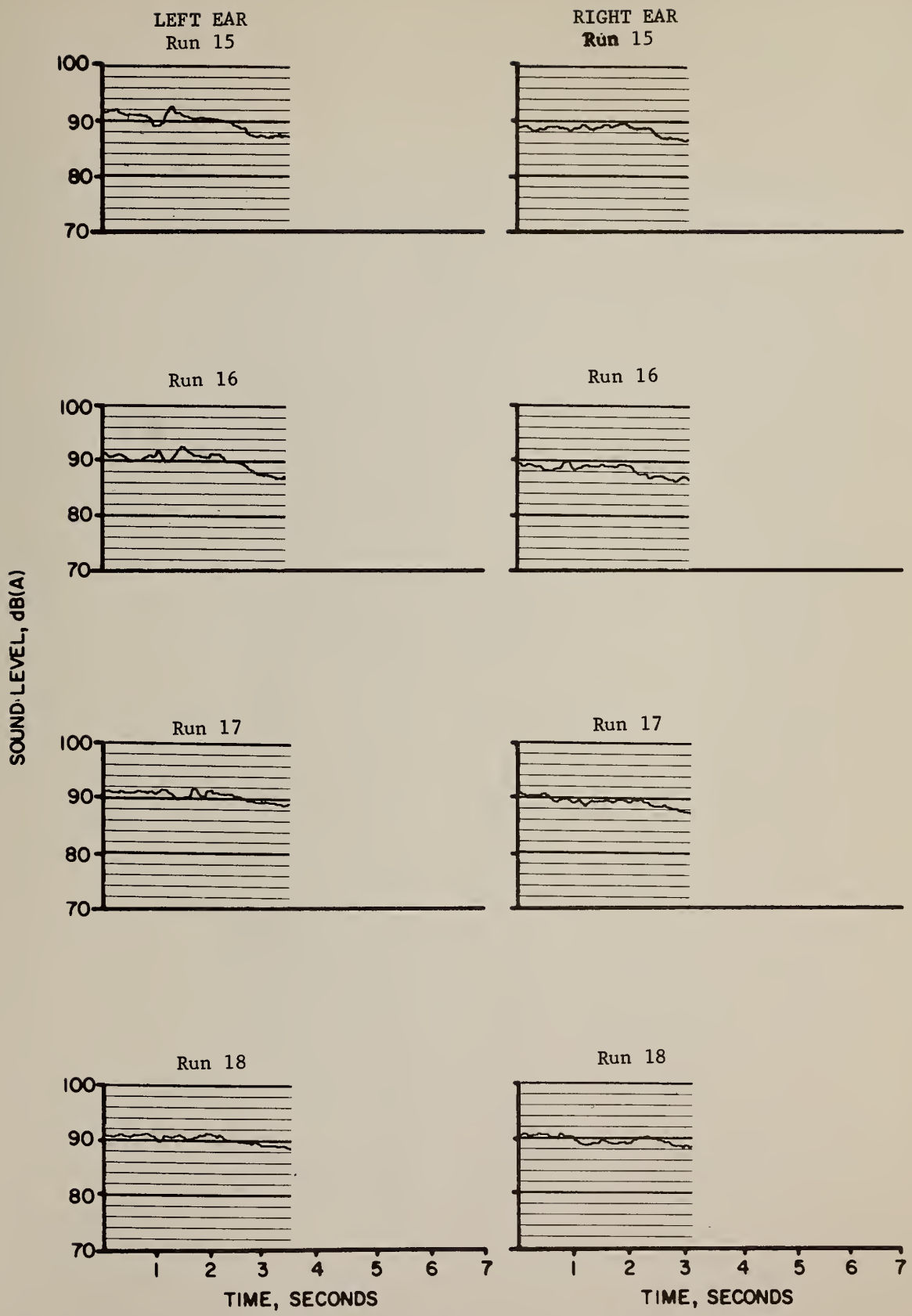

Figure 3-14. Truck 3, Test 5, Runs 15-18. (Interior)

Test Vehicle Number 4

Figure 4-1. Test Vehicle Number 4.

Truck Number: 4
Carrier (owner): Hall's Motor Transit
Company Fleet Number: 1667
Make: International
Model: F2000DYT
Serial Number: 256961
Year: 1967
Engine Governor Setting: 2100 rpm
Total Miles of Operation: 340,023
Miles Since Last Engine Overhaul: 65,156
Miles Since Any Exhaust Work: 19,094
Engine: Make - Cummins
Model - NH250

Exterior

Truck 04

TEST	RUN	SIDE	(WINDOWS)	SOUND LEVEL, dB(A) MICROPHONES					
				1	2	3	4	5	6
1. Low Idle (Stationary)	1	Right	Open	64	64	64	65	64	70
	2	Left	Closed	68	68	67	68	66	74
2. Acceleration (Stationary)	3	Right	Open	85	84	84	84	84	90
	4	Right	Open	84	84	84	84	83	90
	5	Left	Closed	84	83	82	83	82	88
	6	Left	Closed	85	84	84	84	83	90
2. High Idle (Stationary)	3	Right	Open	85	86	84	84	84	90
	4	Right	Open	85	86	85	84	84	90
	5	Left	Closed	83	82	81	82	82	88
	6	Left	Closed	83	82	82	83	82	88
3. City Start Up	7	Right	Open	90	89	88	88	86	95
	8	Right	Open	90	89	87	88	86	94
	9	Left	Closed	87	86	85	86	86	91
	10	Left	Closed	87	86	85	86	86	91
4. J366 (Acceleration)	11	Right	Open	90	89	88	89	86	94
	12	Right	Open	90	89	88	88	86	94
	13	Left	Closed	87	86	85	86	86	90
	14	Left	Closed	87	86	85	86	86	90
5. J366 (Deceleration)	15	Right	Open	89	86	86	86	85	92
	16	Right	Open	89	86	85	85	86	92
	17	Left	Closed	84	84	85	86	86	89
	18	Left	Closed	85	85	85	86	86	90

Table 4-1. Maximum A-weighted sound levels as measured at the six exterior microphone locations for all test runs for vehicle number 4.

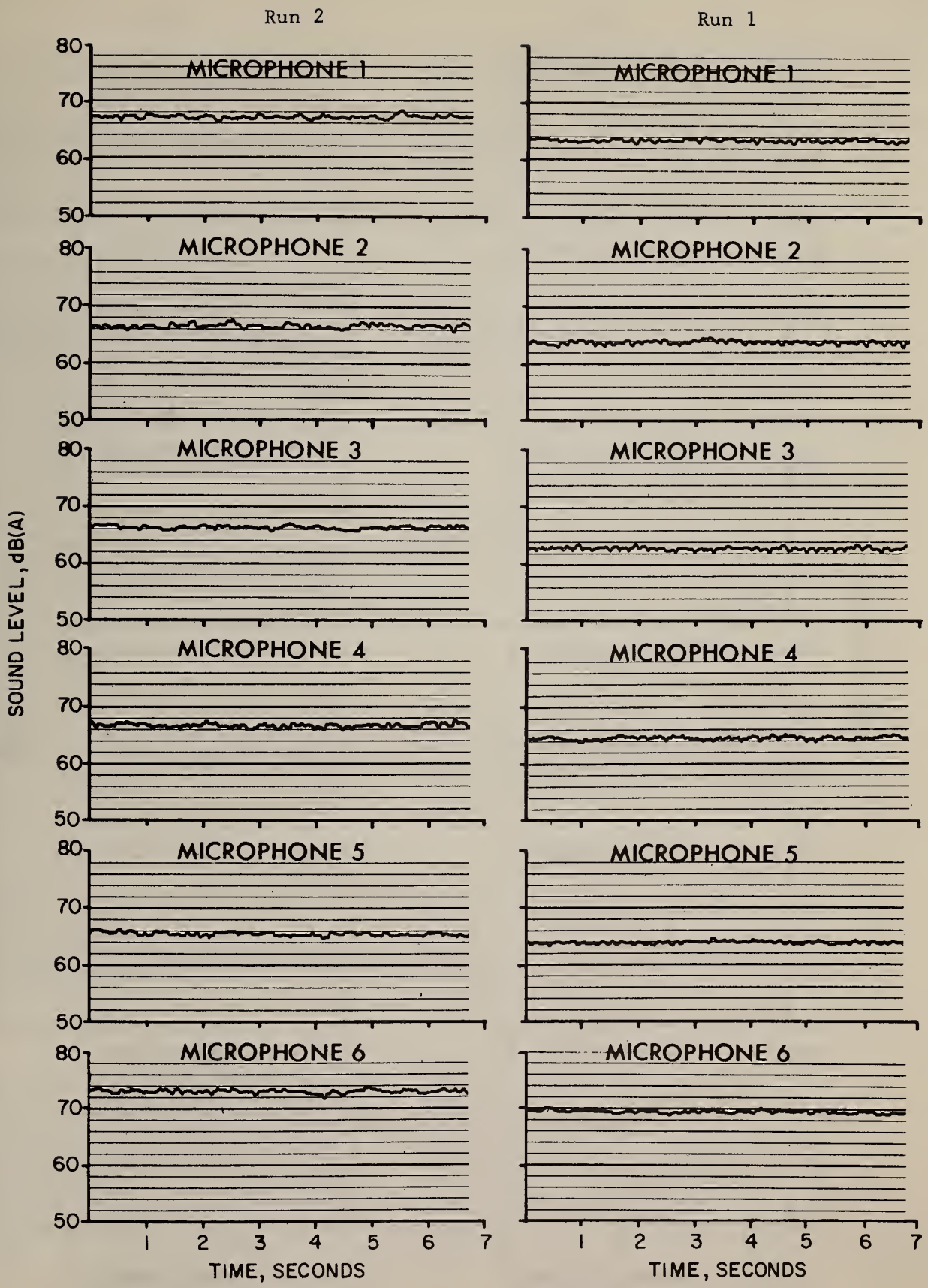

Figure 4-2. Truck 4, Test 1, Runs 1,2. (Exterior)

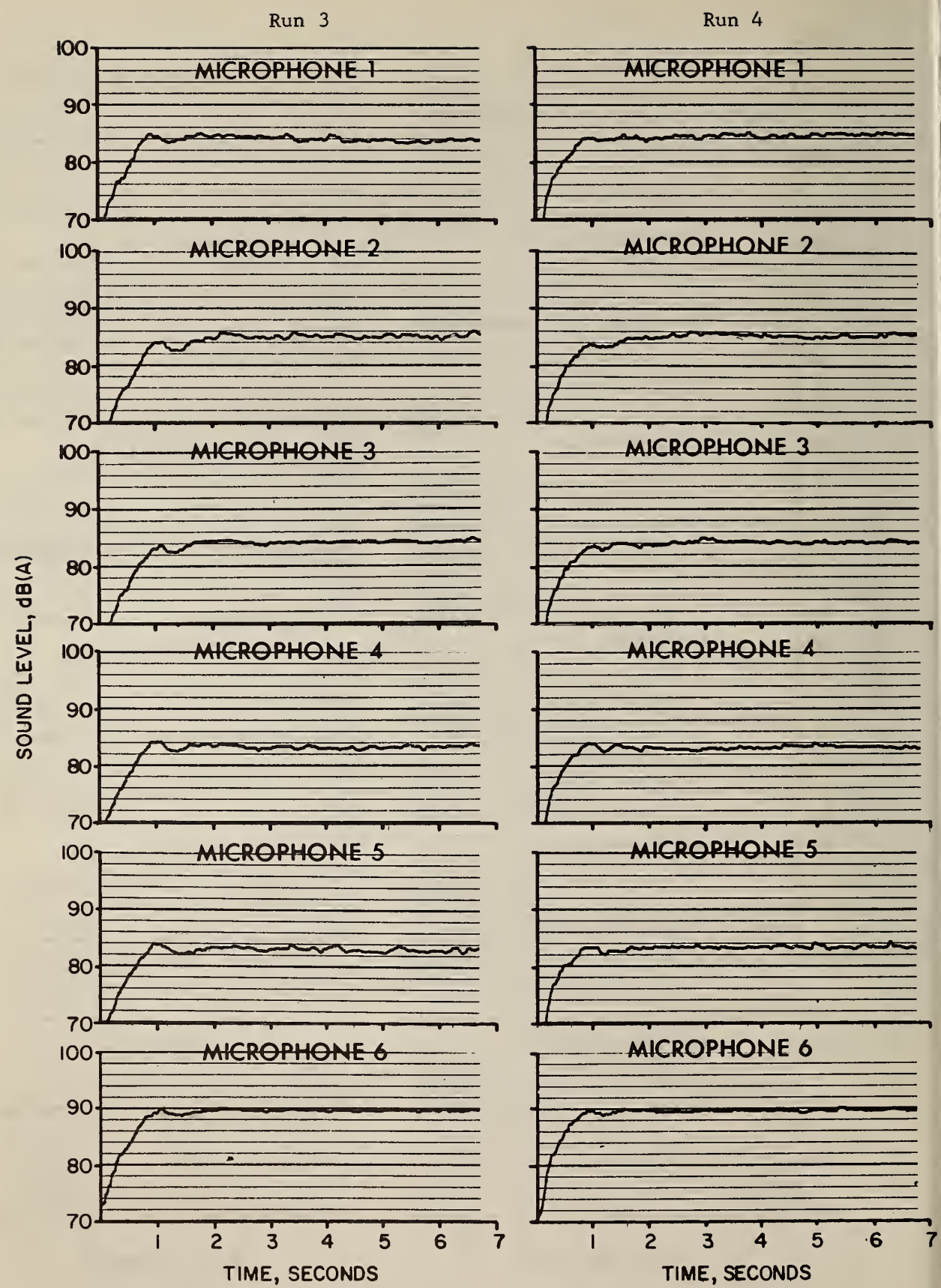

Figure 4-3. Truck 4, Test 2, Runs 3,4. (Exterior)

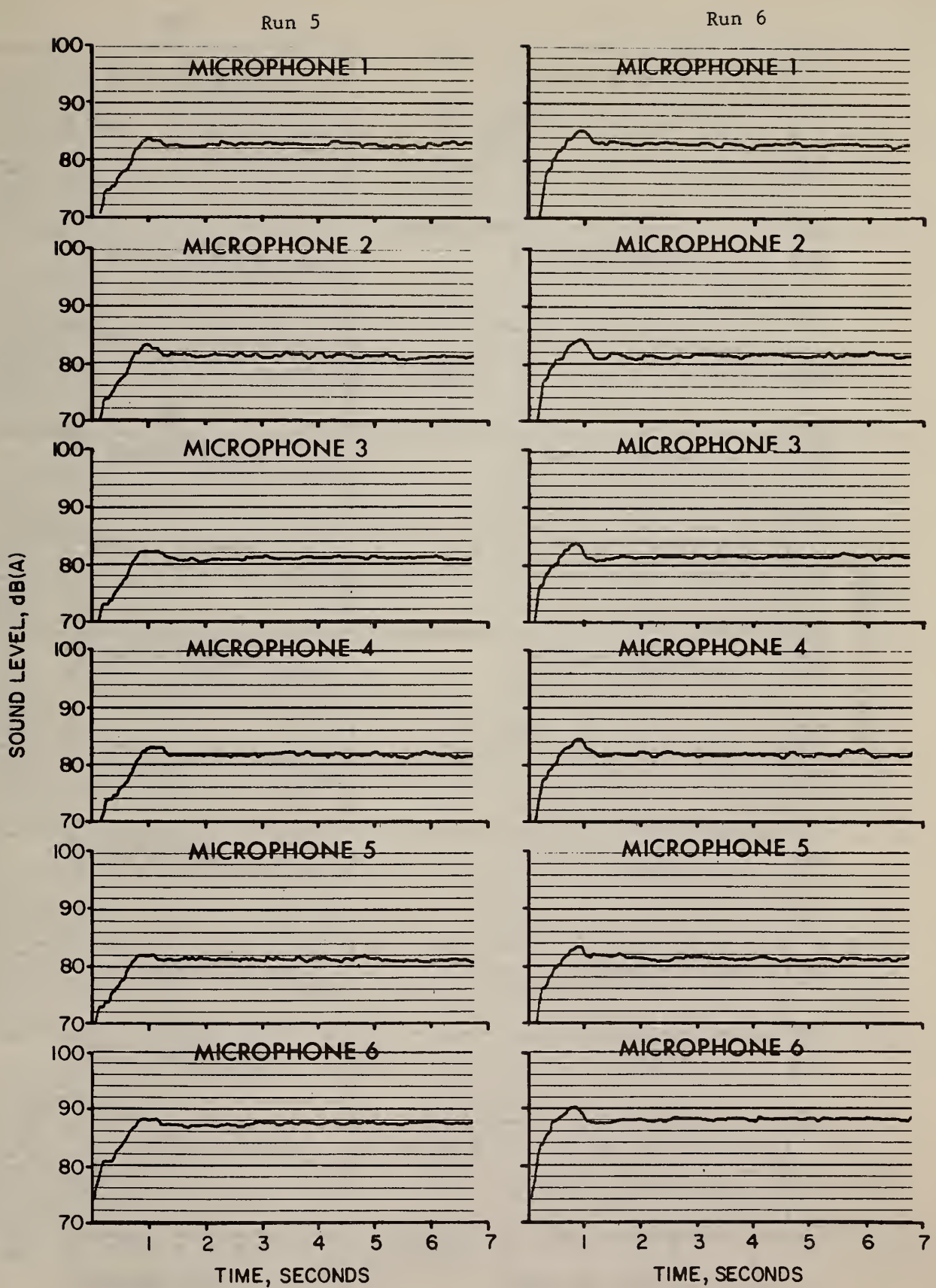

Figure 4-4. Truck 4, Test 2, Runs 5,6. (Exterior)

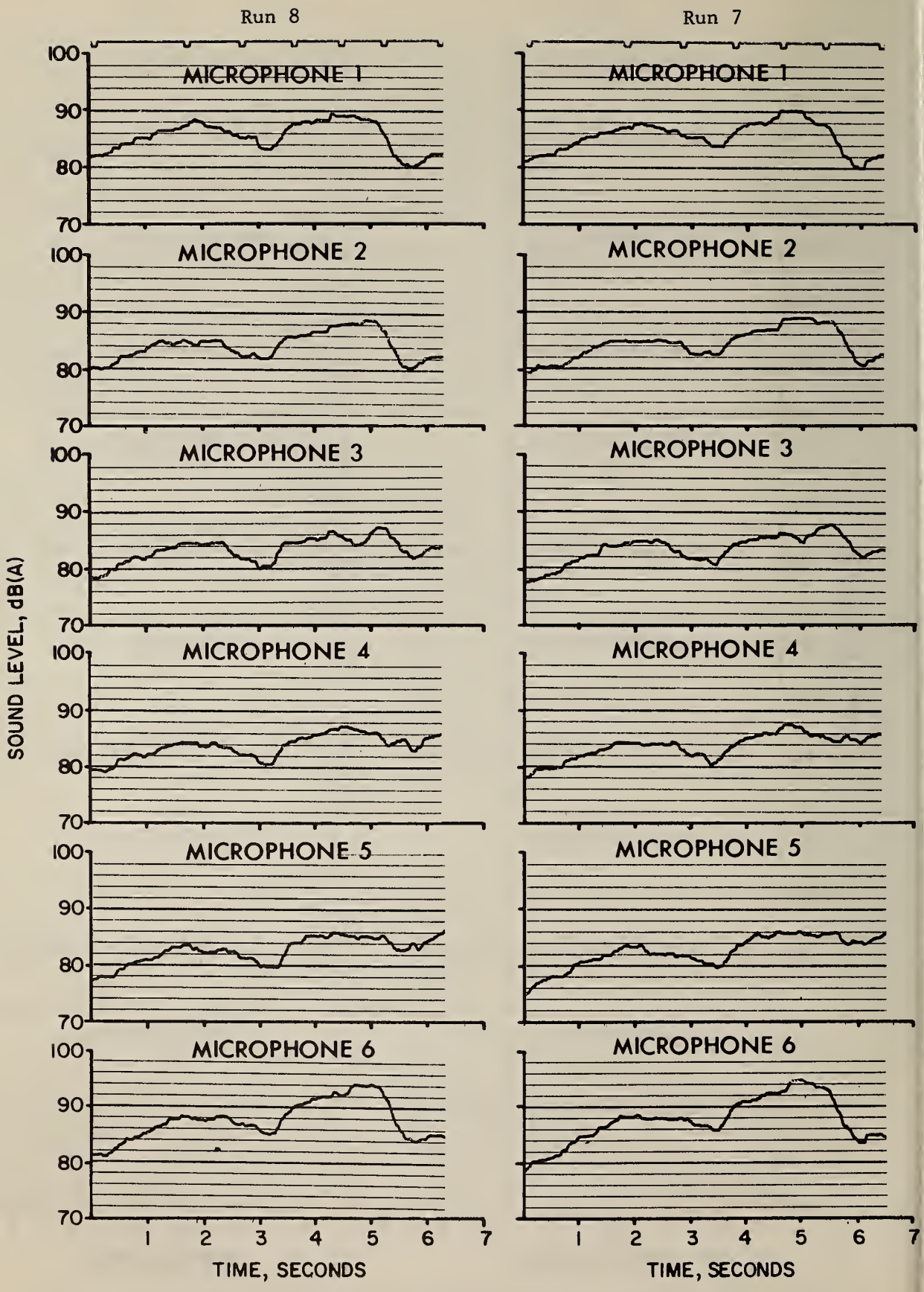

Figure 4-5. Truck 4, Test 3, Runs 7,8. (Exterior)

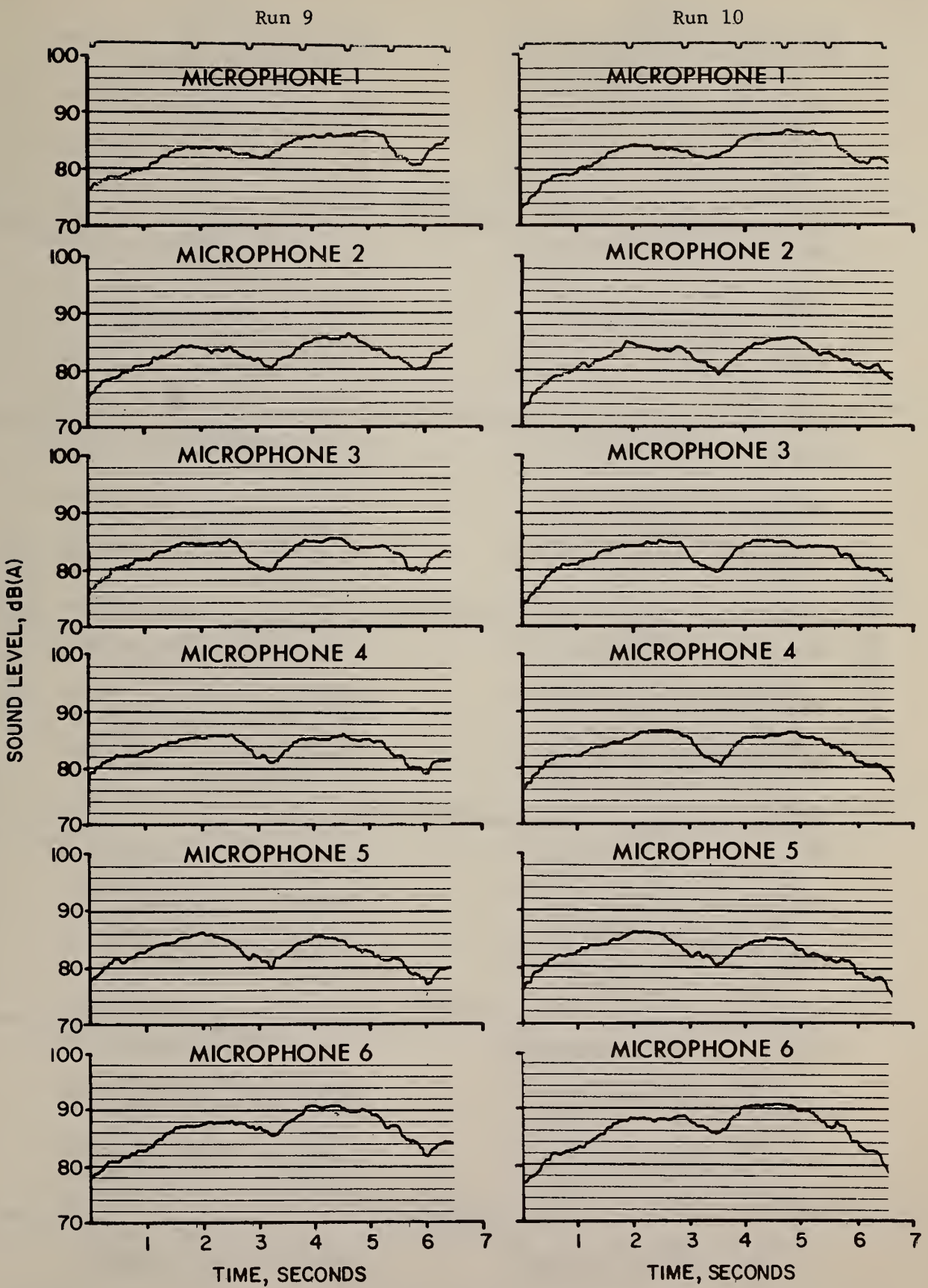

Figure 4-6. Truck 4, Test 3, Runs 9,10. (Exterior)

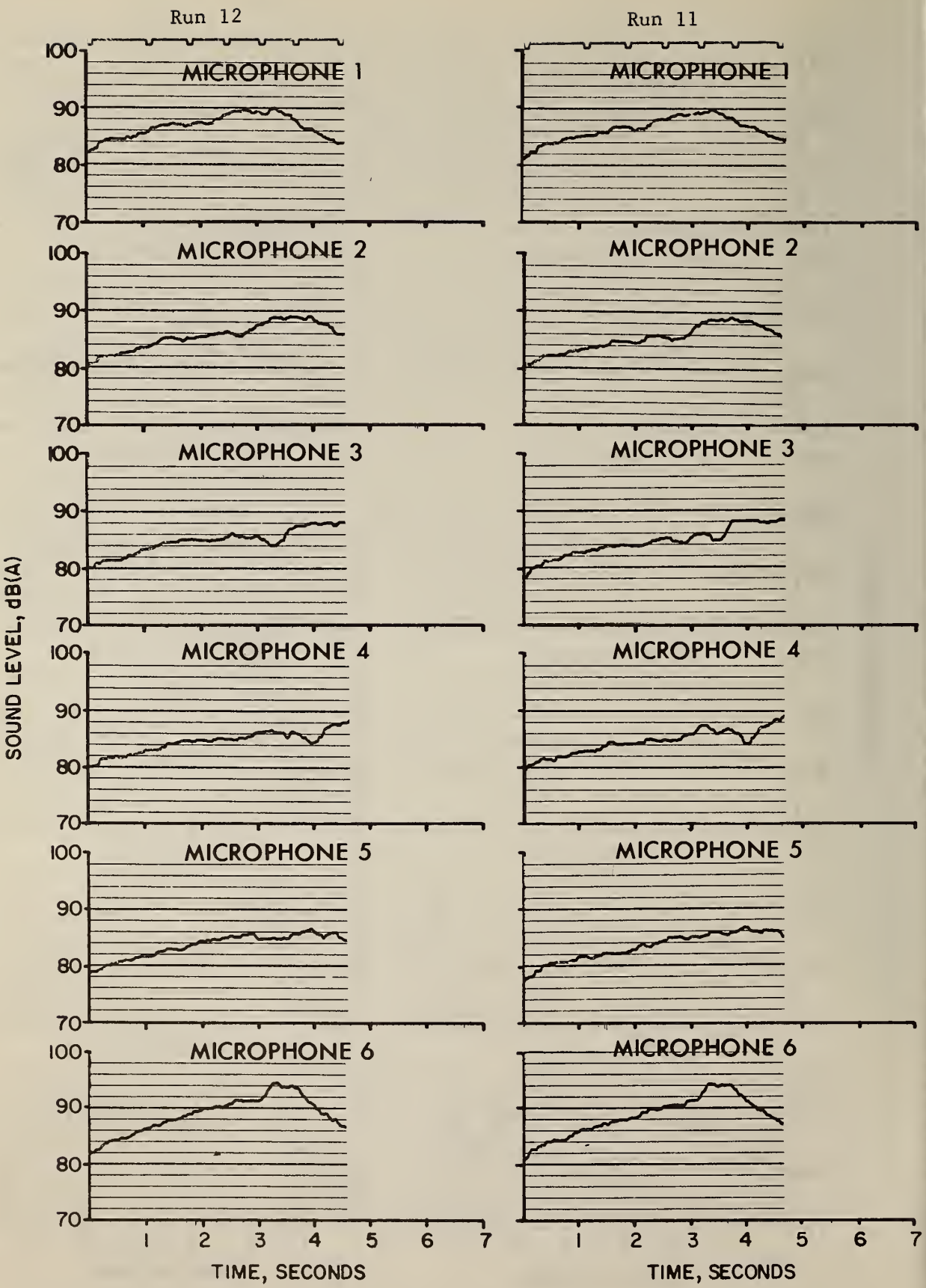

Figure 4-7. Truck 4, Test 4, Runs 11,12. (Exterior)

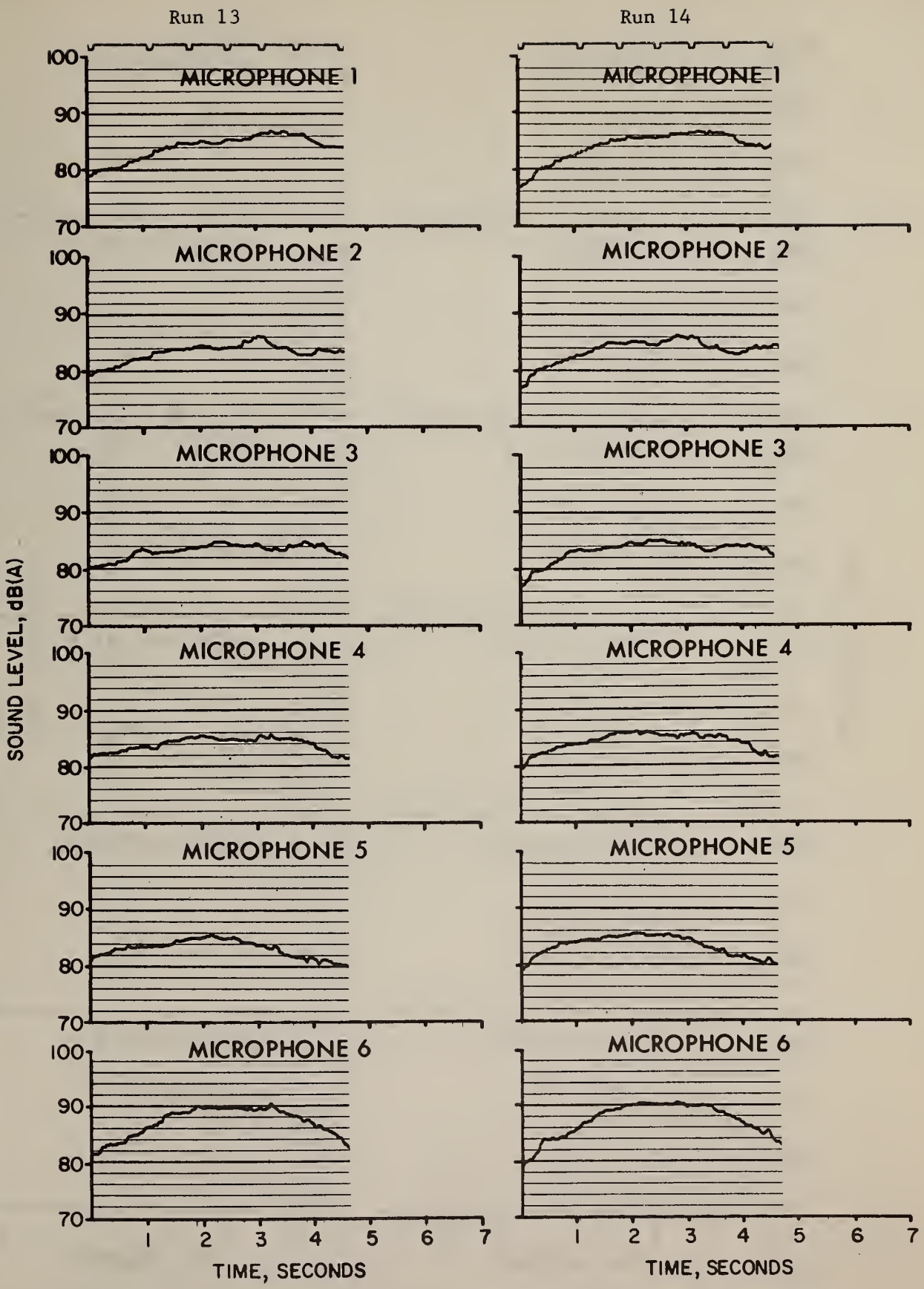

Figure 4-8. Truck 4, Test 4, Runs 13,14. (Exterior)

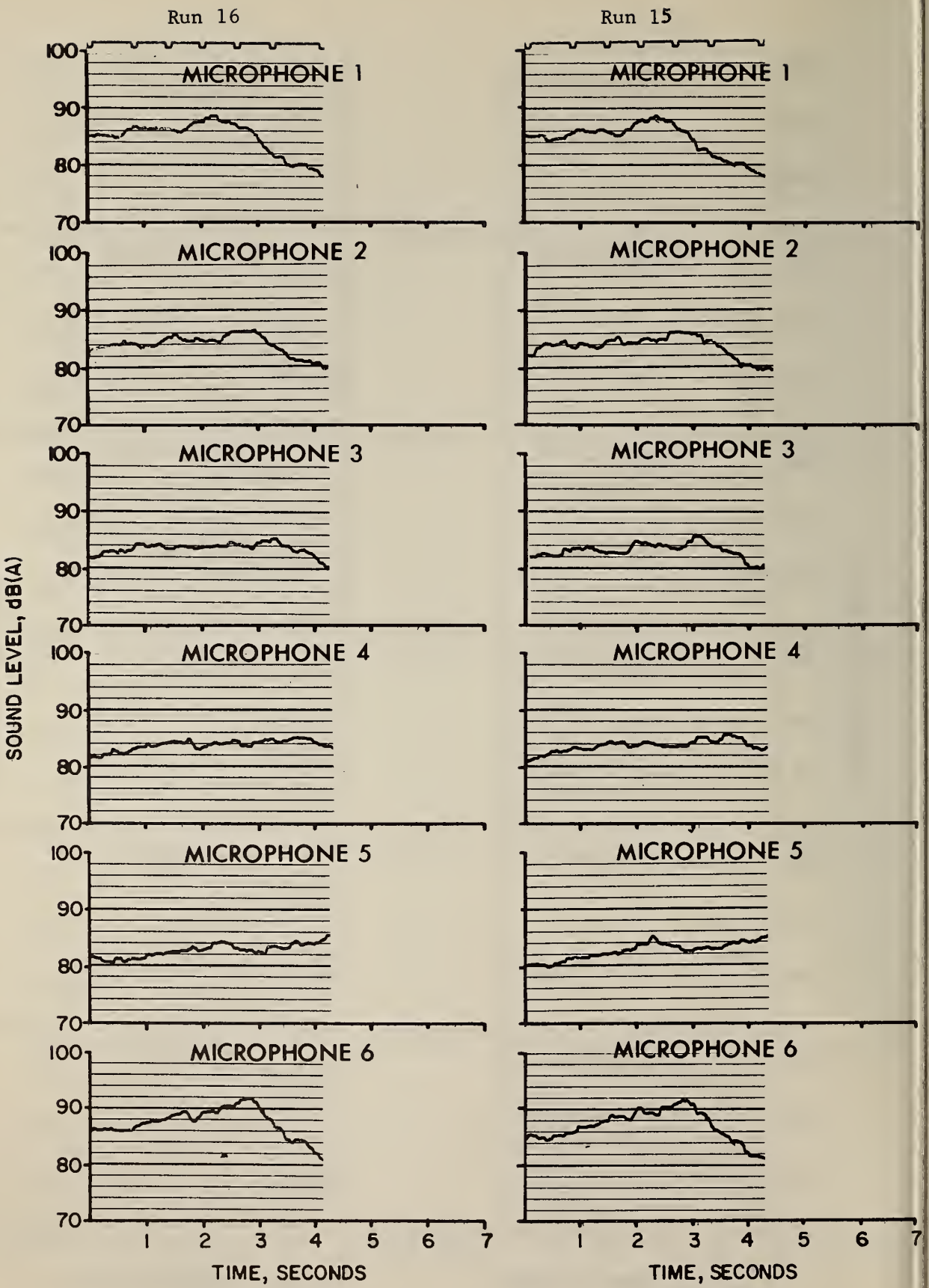

Figure 4-9. Truck 4, Test 5, Runs 15,16. (Exterior)

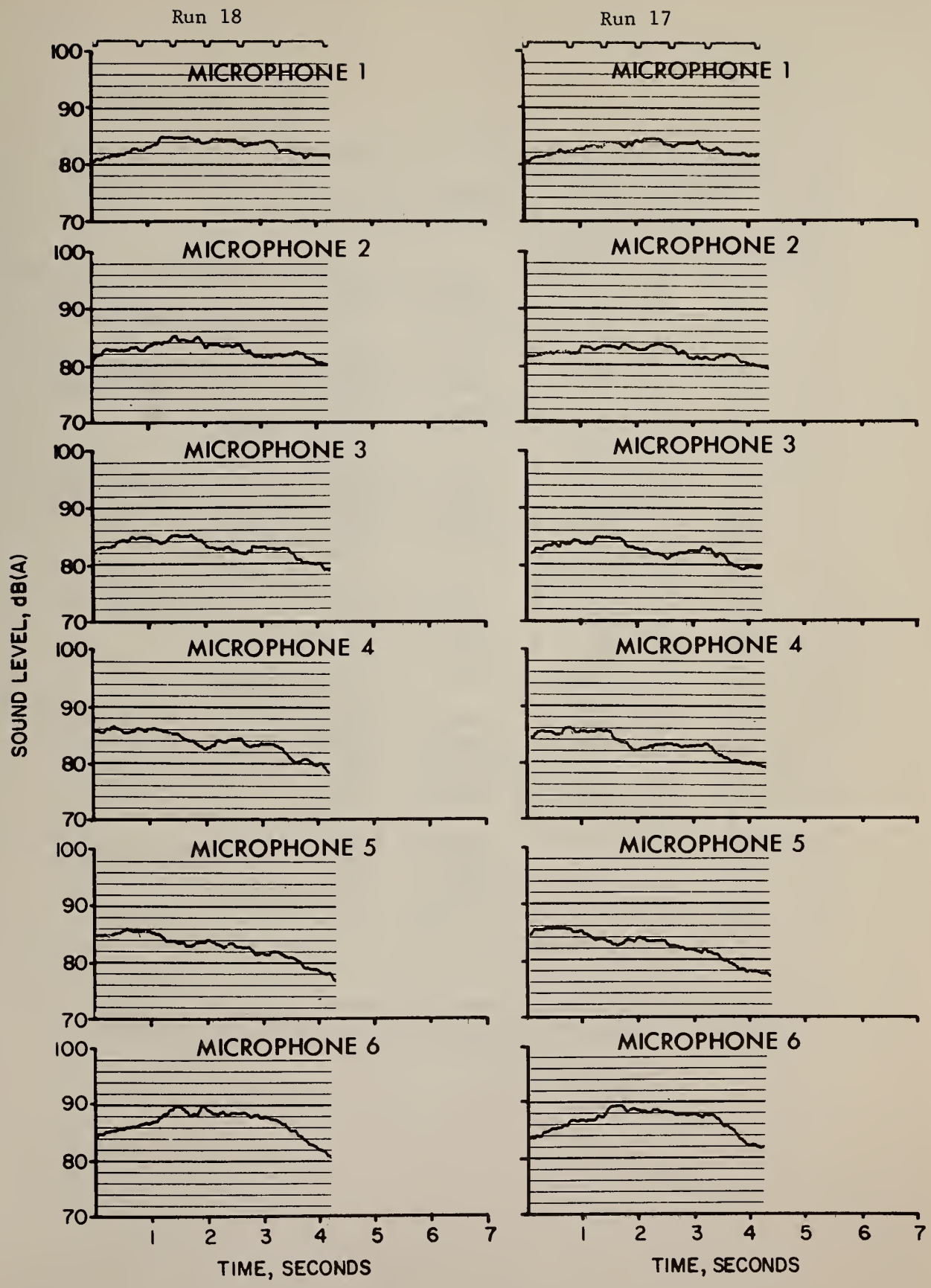

Figure 4-10. Truck 4, Test 5, Runs 17,18. (Exterior)

Interior

Truck 04

TEST	RUN	(SIDE)	WINDOWS	SOUND LEVEL, dB(A) MICROPHONES	
				LEFT EAR	RIGHT EAR
1. Low Idle (Stationary)	1	Right	Open	75	77
	2	Left	Closed	78	77
2. Acceleration (Stationary)	3	Right	Open	--	--
	4	Right	Open	93	94
	5	Left	Closed	--	--
	6	Left	Closed	93	91
2. High Idle (Stationary)	3	Right	Open	93	92
	4	Right	Open	93	94
	5	Left	Closed	92	90
	6	Left	Closed	92	92
3. City Start Up	7	Right	Open	95	95
	8	Right	Open	95	95
	9	Left	Closed	95	95
	10	Left	Closed	95	95
4. J366 (Acceleration)	11	Right	Open	96	95
	12	Right	Open	96	94
	13	Left	Closed	96	94
	14	Left	Closed	96	94
5. J366 (Deceleration)	15	Right	Open	94	94
	16	Right	Open	93	94
	17	Left	Closed	96	94
	18	Left	Closed	95	93

Table 4-2. Maximum A-weighted sound levels as measured at the two interior microphone locations for all test runs for vehicle number 4.

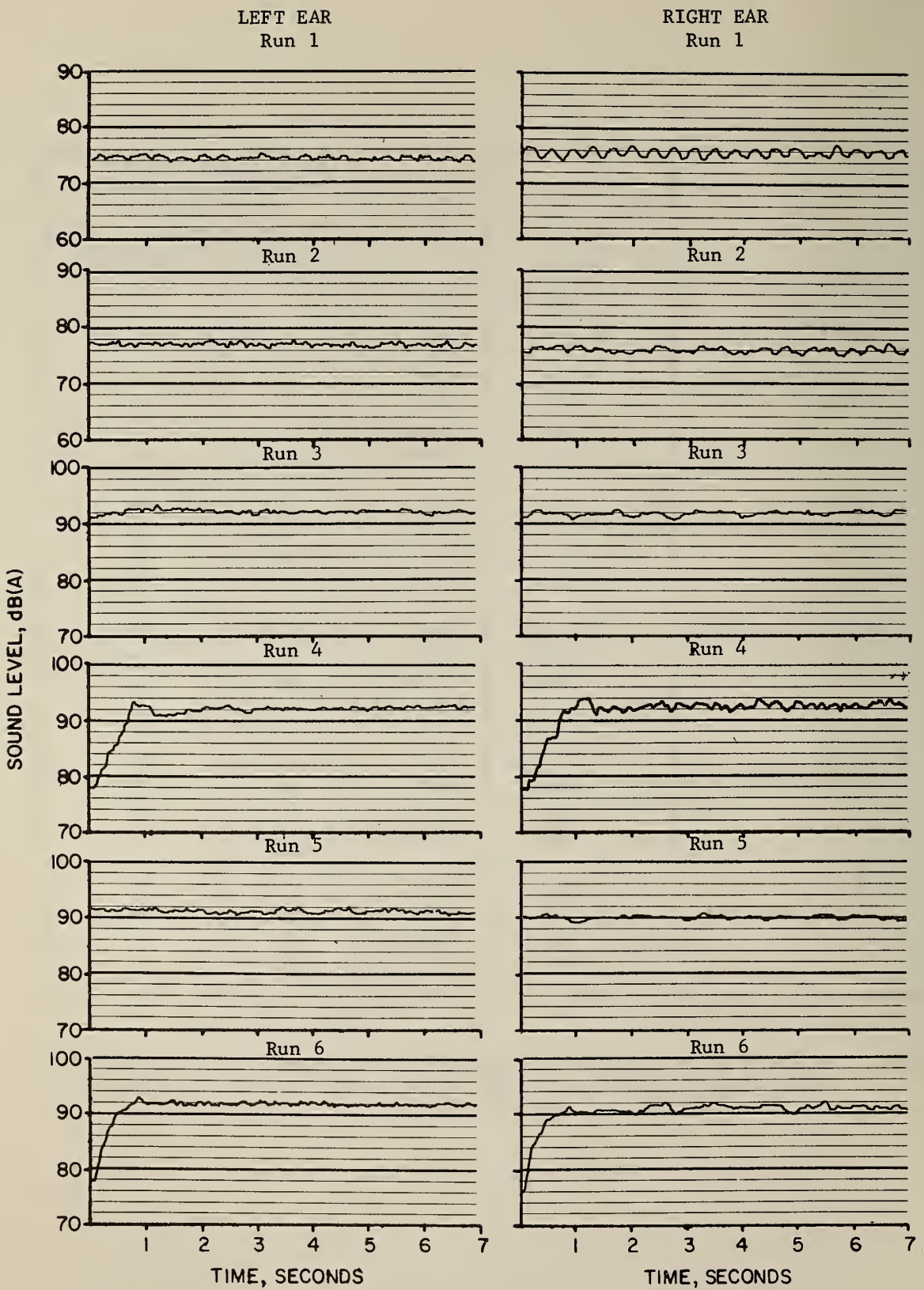

Figure 4-11. Truck 4, Tests 1,2, Runs 1-6. (Interior)

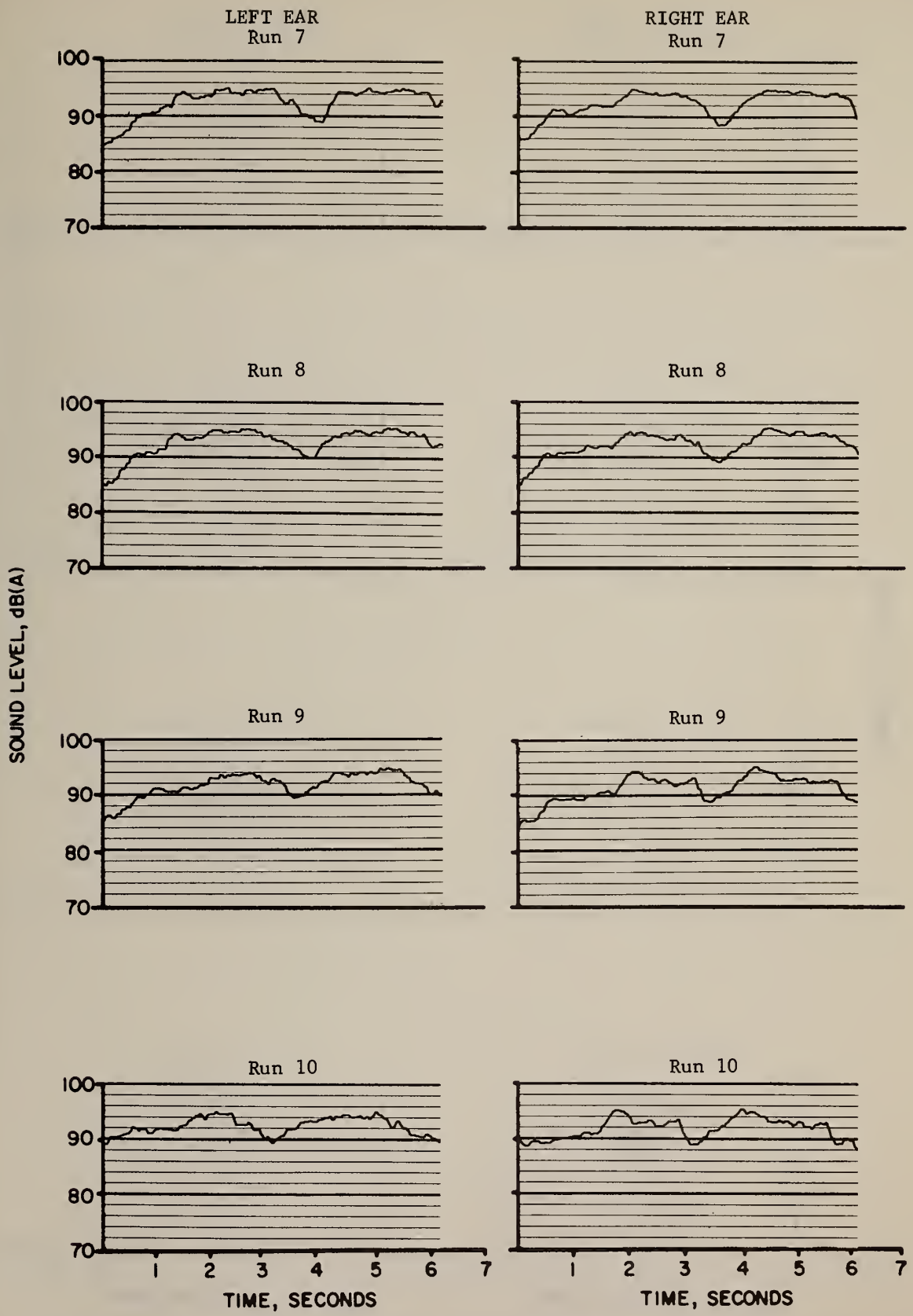

Figure 4-12. Truck 4, Test 3, Runs 7-10. (Interior)

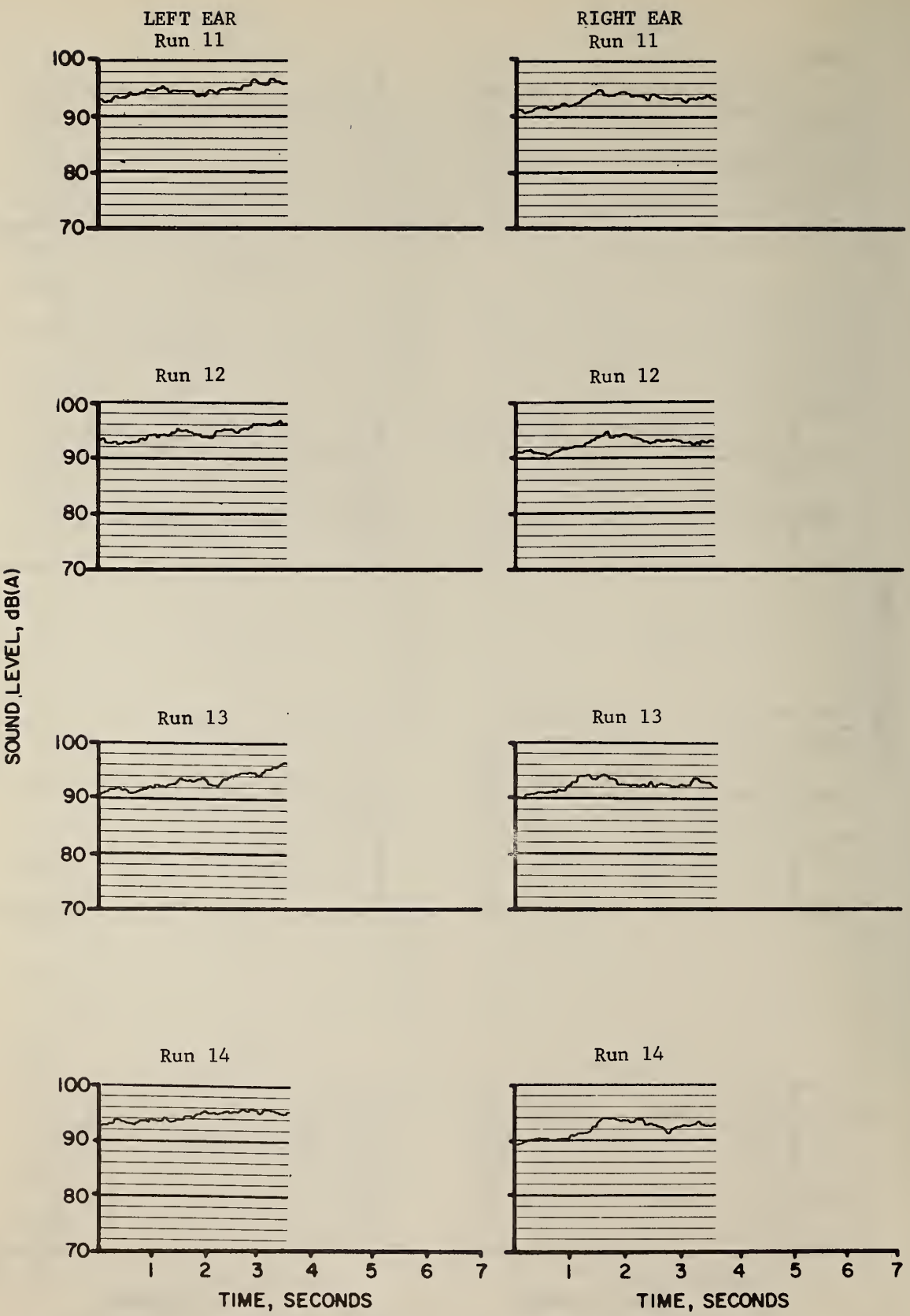

Figure 4-13. Truck 4, Test 4, Runs 11-14. (Interior)

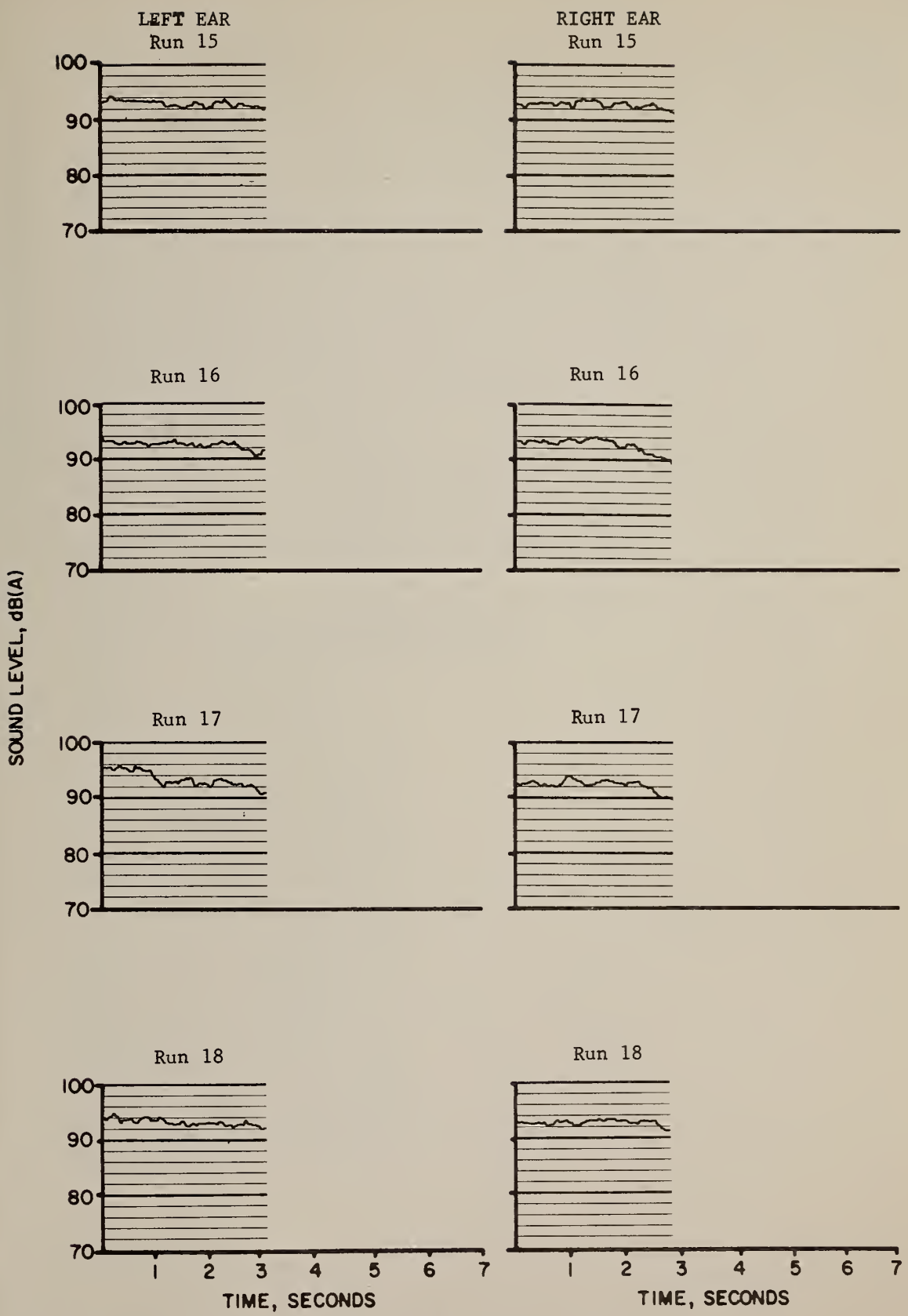

Figure 4-14. Truck 4, Test 5, Runs 15-18. (Interior)

Test Vehicle Number 5

Figure 5-1. Test Vehicle Number 5.

Truck Number: 5
Carrier (owner): Burlington Industries, Inc.
Company Fleet Number: 2401
Make: Mack
Model: FS761LT
Serial Number: --
Year: 1971
Engine Governor Setting: 2600 rpm
Total Miles of Operation: 121,300
Miles Since Last Engine Overhaul: Original engine
Miles Since Any Exhaust Work: 29,850
Engine: Make - Cummins
Model - V903

Exterior

Truck 05

TEST	RUN	SIDE	(WINDOWS)	SOUND LEVEL, dB(A) MICROPHONES 1	2	3	4	5	6
1. Low Idle (Stationary)	1	Right	Open	64	63	61	63	62	68
	2	Left	Closed	63	62	62	62	64	69
2. Acceleration (Stationary)	3	Right	Open	92	89	88	87	86	94
	4	Right	Open	92	90	88	86	86	93
	5	Left	Closed	86	88	86	87	88	92
	6	Left	Closed	85	87	85	86	89	90
2. High Idle (Stationary)	3	Right	Open	92	90	87	83	86	93
	4	Right	Open	92	90	87	83	86	92
	5	Left	Closed	86	88	85	86	89	90
	6	Left	Closed	85	87	85	86	89	90
3. City Start Up	7	Right	Open	89	89	90	89	87	94
	8	Right	Open	90	88	89	89	88	94
	9	Left	Closed	88	86	88	89	88	94
	10	Left	Closed	88	88	88	87	88	93
4. J366 (Acceleration)	11	Right	Open	90	89	90	90	91	95
	12	Right	Open	89	88	88	90	88	94
	13	Left	Closed	88	88	88	89	89	93
	14	Left	Closed	88	88	88	89	89	93
5. J366 (Deceleration)	15	Right	Open	90	88	87	87	85	92
	16	Right	Open	90	88	88	87	86	93
	17	Left	Closed	84	85	86	88	88	91
	18	Left	Closed	84	84	87	88	88	91

Table 5-1. Maximum A-weighted sound levels as measured at the six exterior microphone locations for all test runs for vehicle number 5.

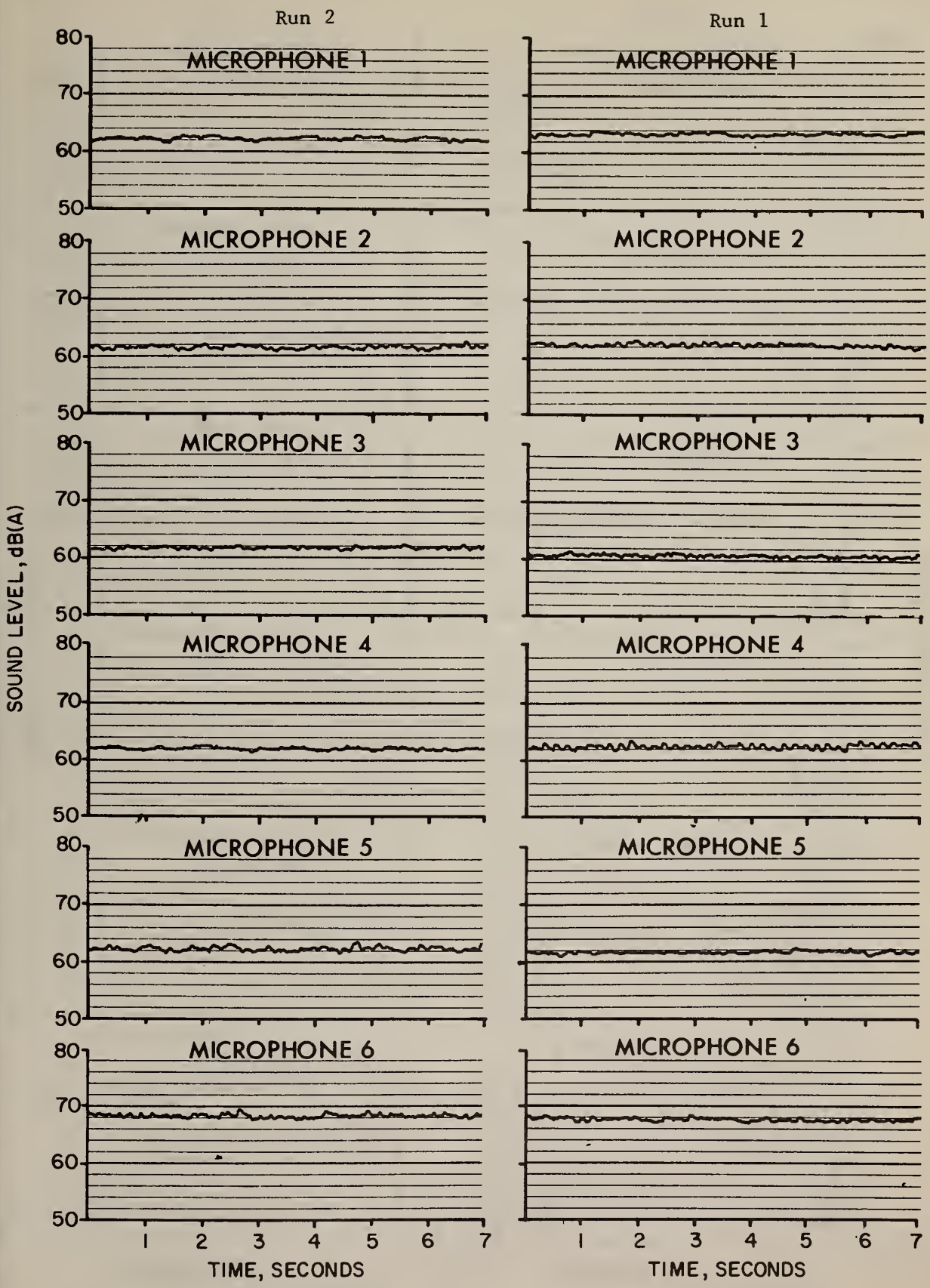

Figure 5-2. Truck 5, Test 1, Runs 1,2. (Exterior)

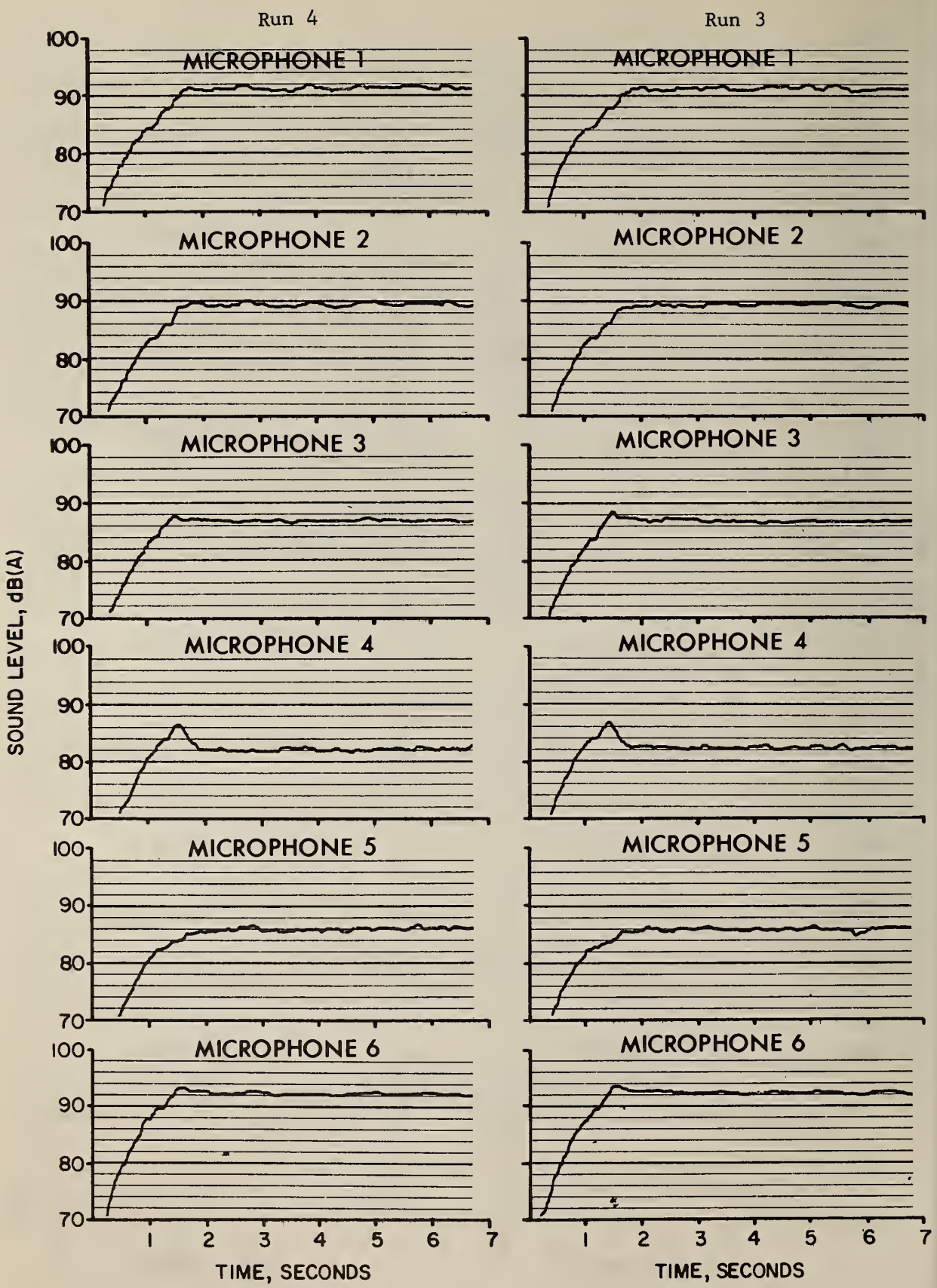

Figure 5-3. Truck 5, Test 2, Runs 3,4. (Exterior)

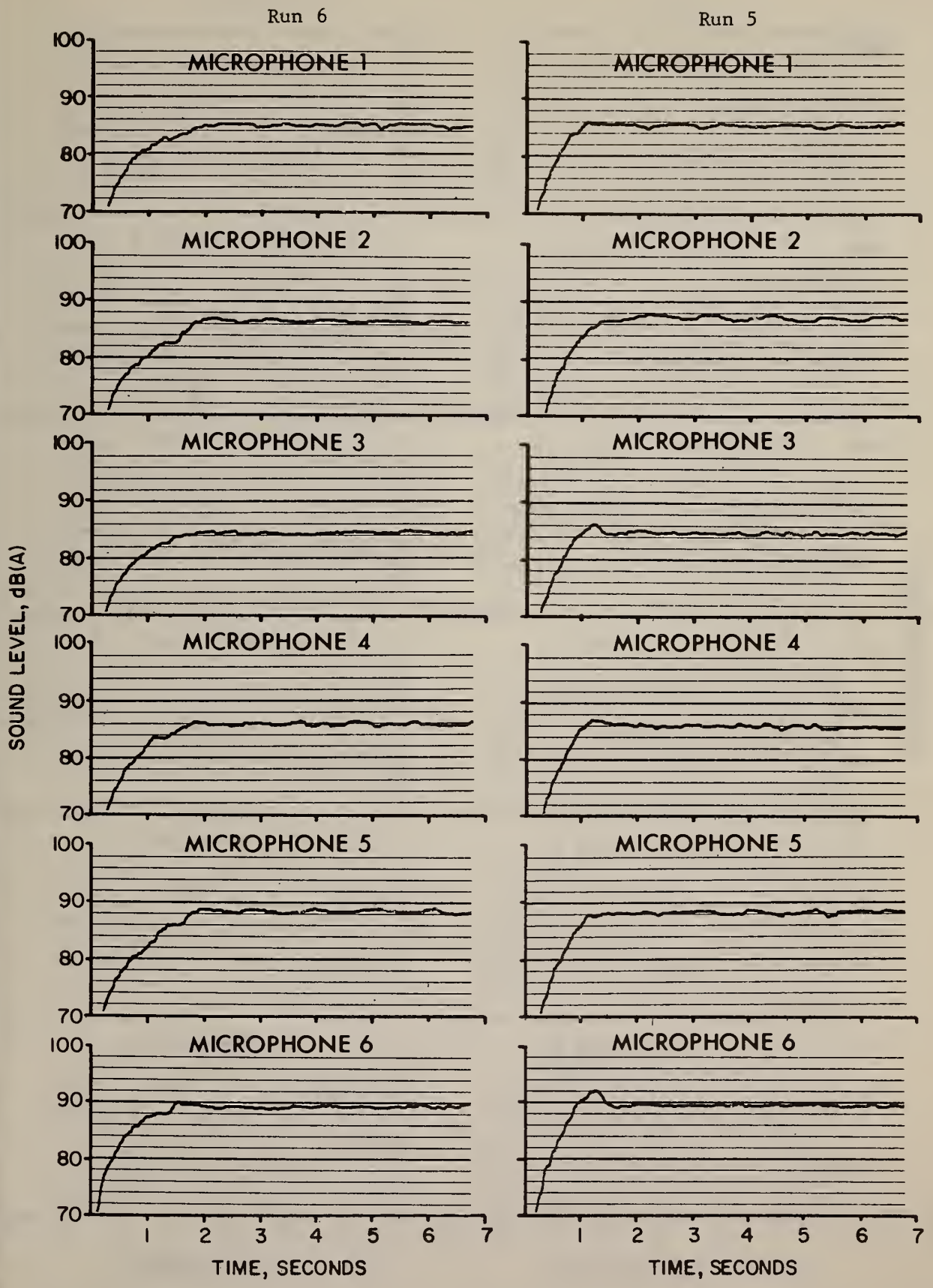

Figure 5-4. Truck 5, Test 2, Runs 5,6. (Exterior)

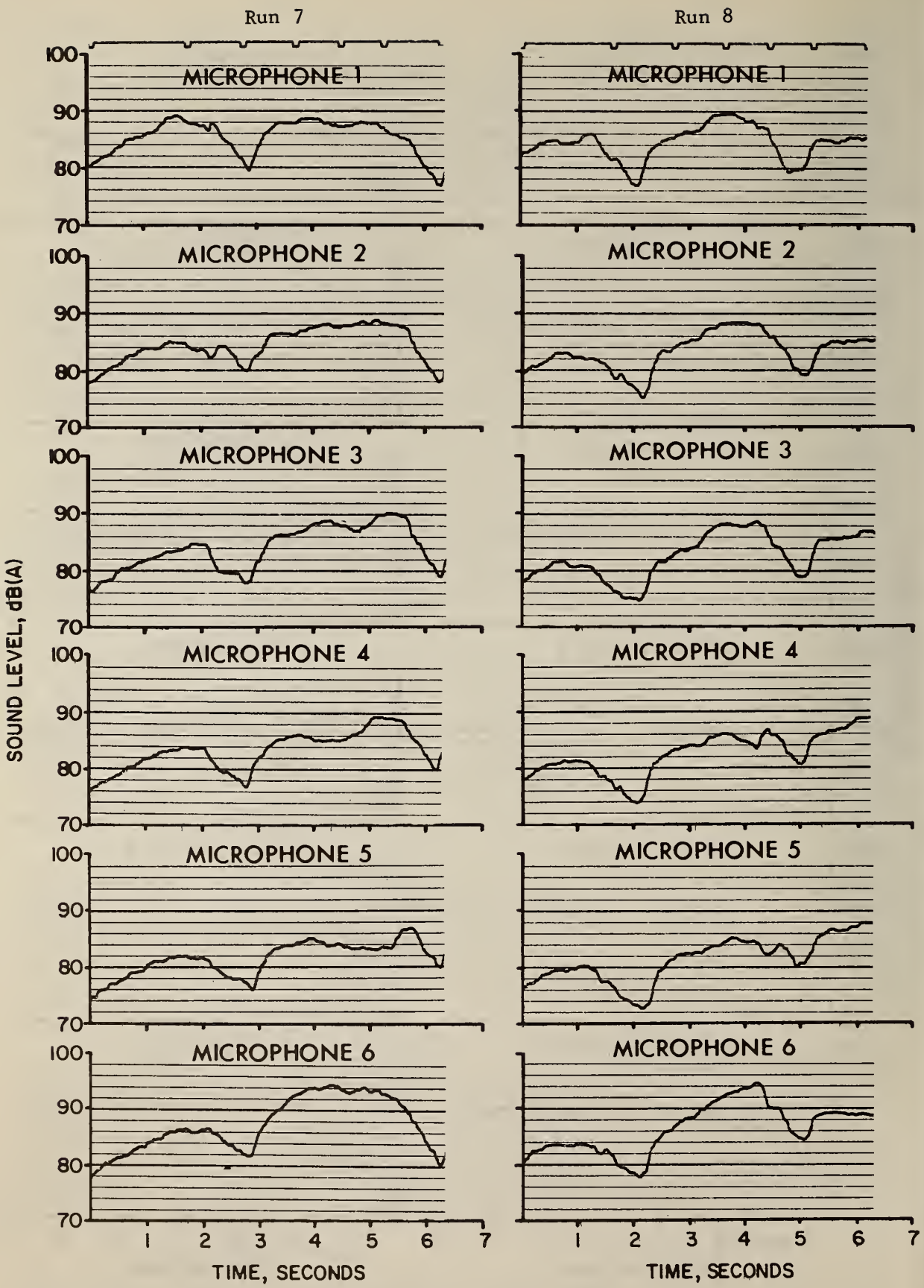

Figure 5-5. Truck 5, Test 3, Runs 7,8. (Exterior)

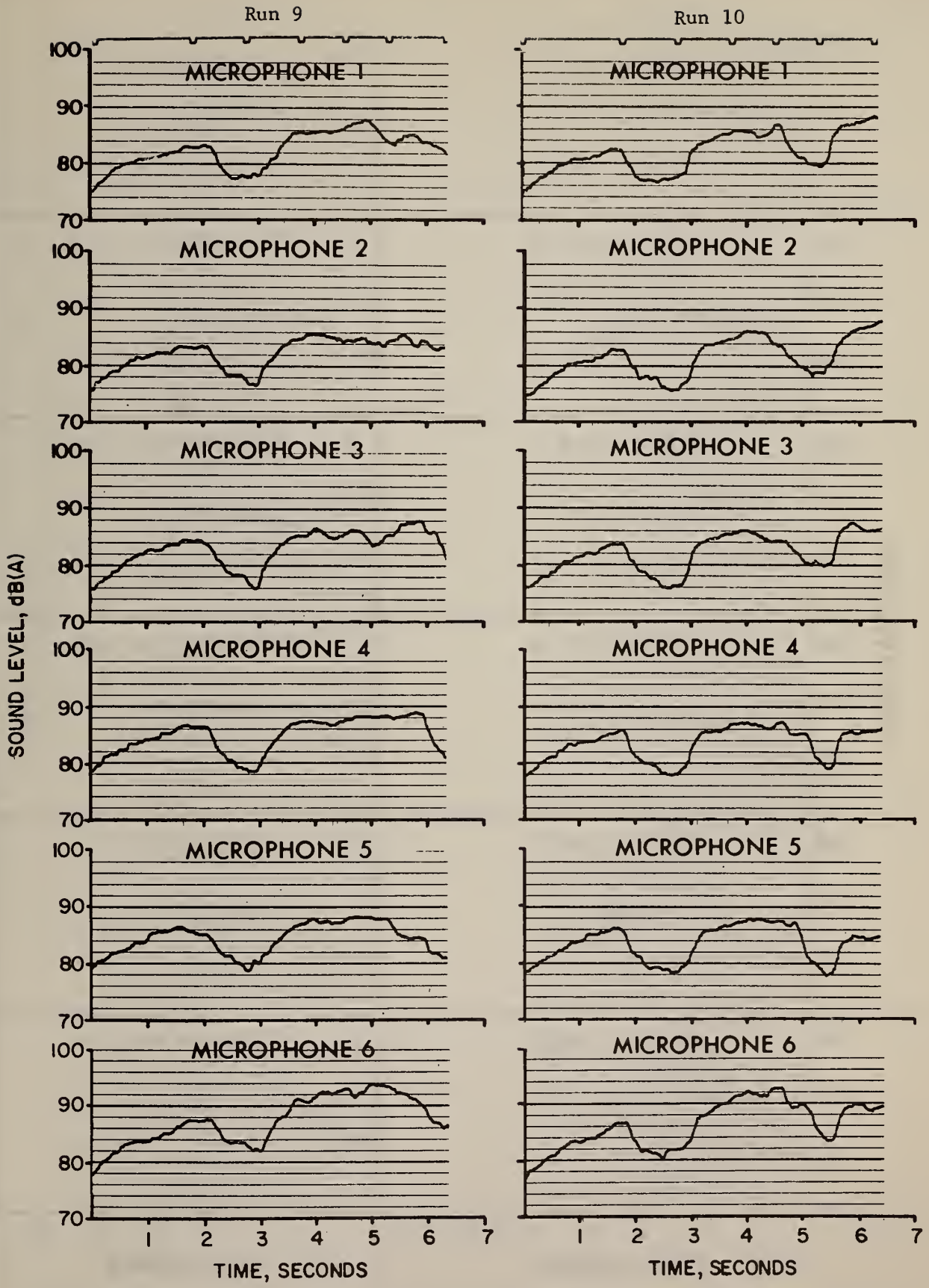

Figure 5-6. Truck 5, Test 3, Runs 9,10. (Exterior)

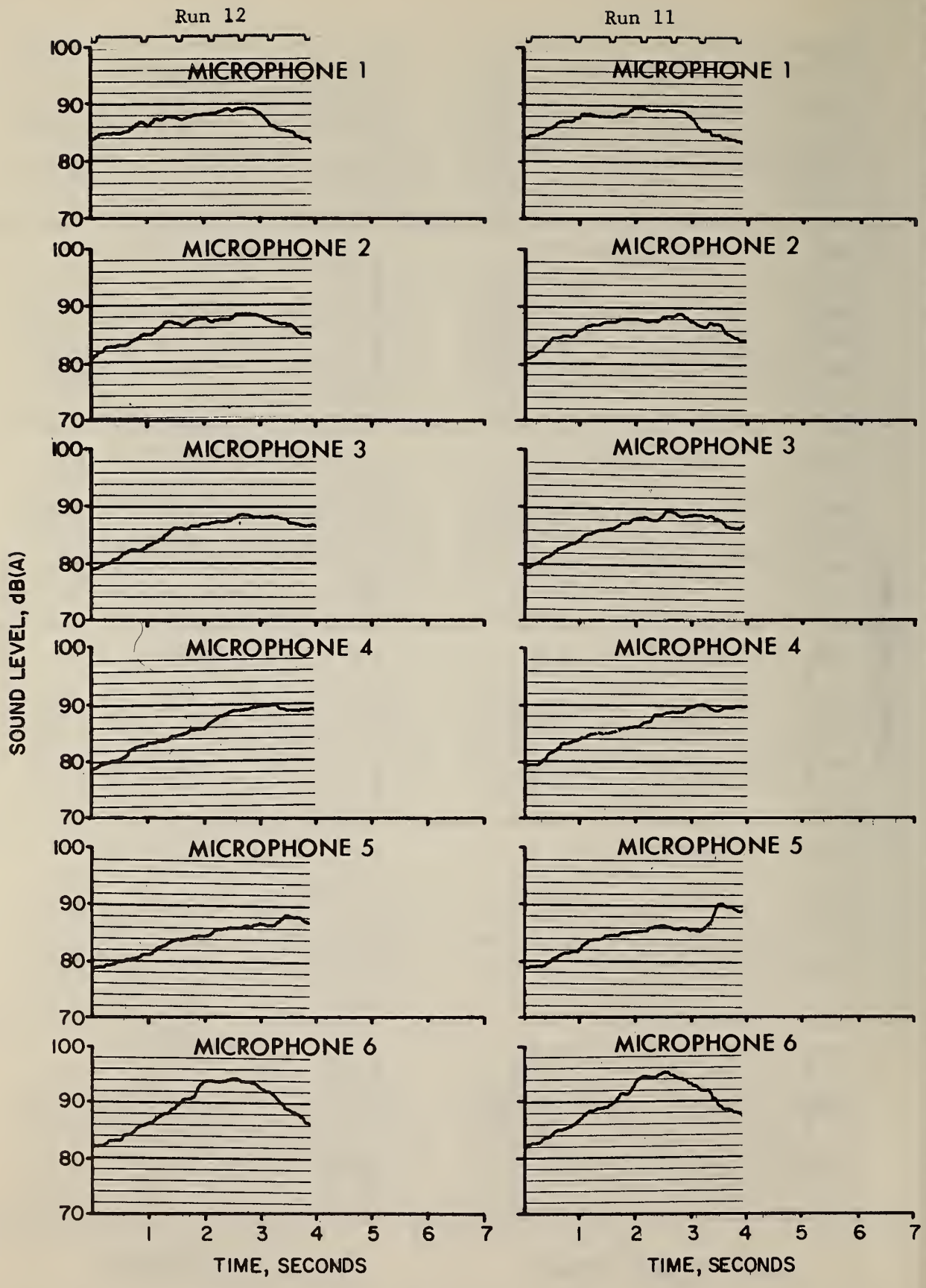

Figure 5-7. Truck 5, Test 4, Runs 11,12. (Exterior)

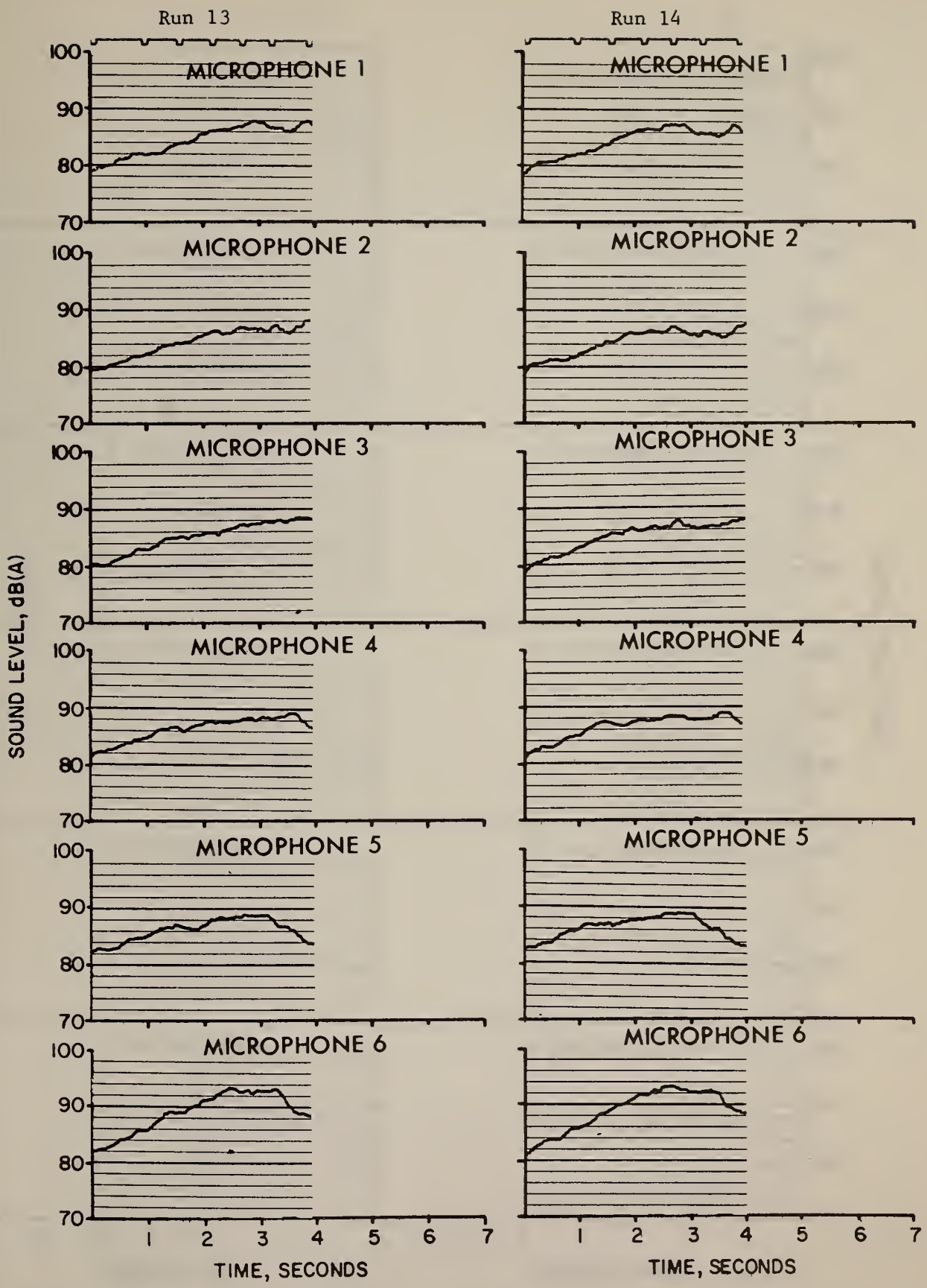

Figure 5-8. Truck 5, Test 4, Runs 13,14. (Exterior)

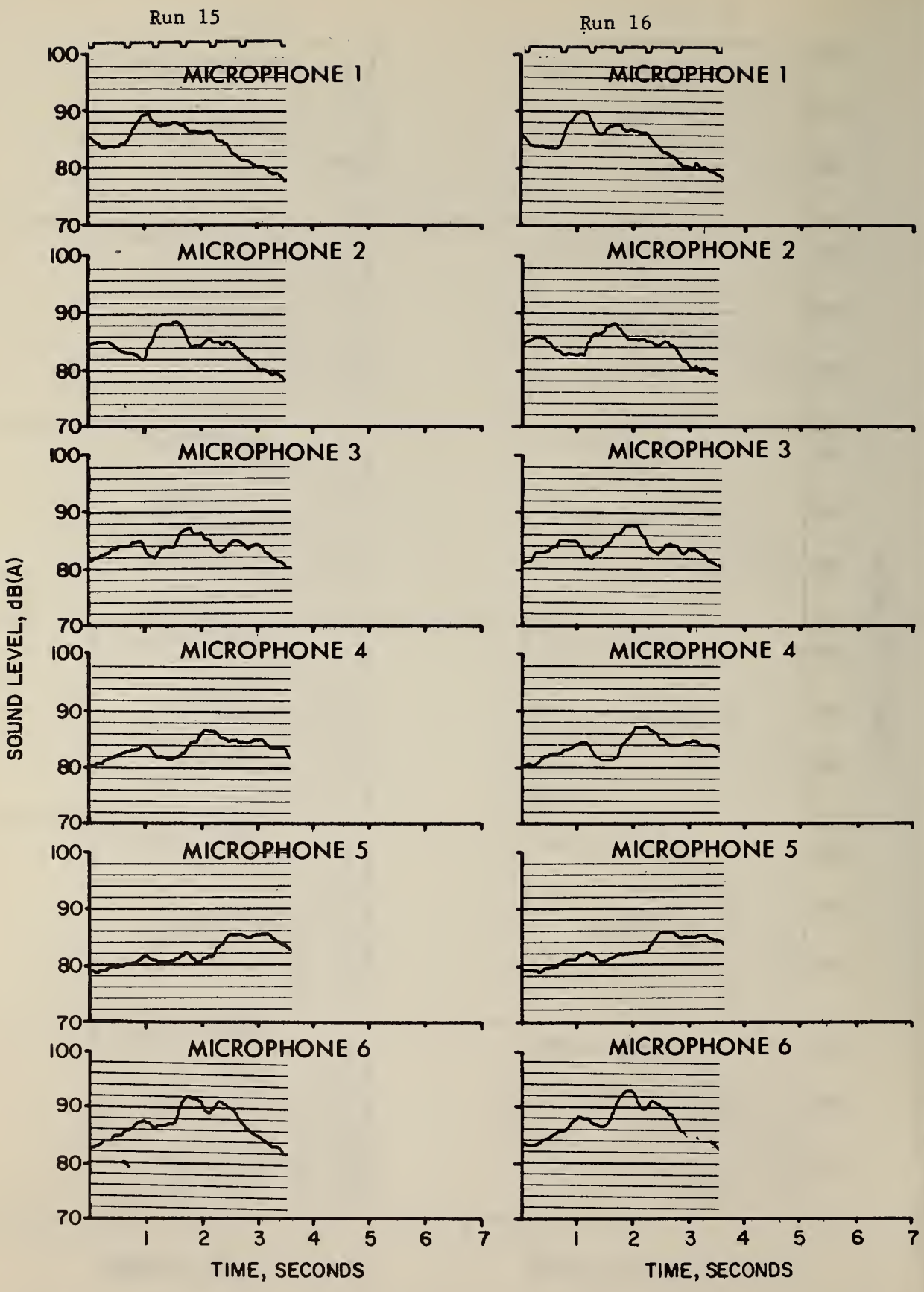

Figure 5-9. Truck 5, Test 5, Runs 15,16. (Exterior)

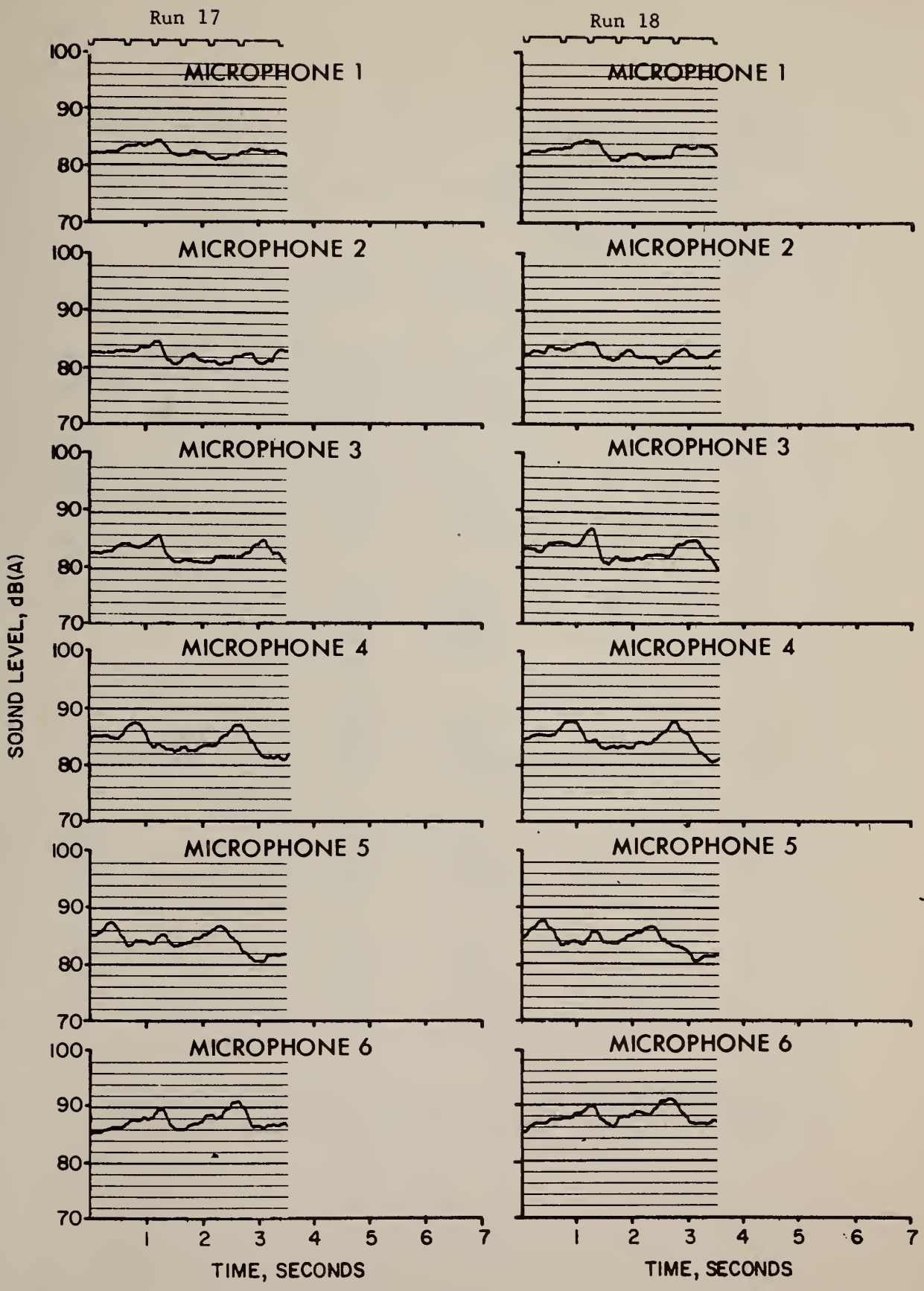

Figure 5-10. Truck 5, Test 5, Runs 17,18. (Exterior)

Interior

Truck 05

TEST	RUN	(SIDE)	WINDOWS	SOUND LEVEL, dB(A)	
				MICROPHONES	
				LEFT EAR	RIGHT EAR
1. Low Idle	1	Right	Open	67	67
(Stationary)	2	Left	Closed	70	69
2. Acceleration	3	Right	Open	96	90
(Stationary)	4	Right	Open	--	--
	5	Left	Closed	96	88
	6	Left	Closed	96	89
2. High Idle	3	Right	Open	96	90
(Stationary)	4	Right	Open	97	90
	5	Left	Closed	96	90
	6	Left	Closed	97	90
3. City Start Up	7	Right	Open	96	92
	8	Right	Open	95	91
	9	Left	Closed	96	91
	10	Left	Closed	96	90
4. J366	11	Right	Open	96	91
(Acceleration)	12	Right	Open	96	91
With bedding	13	Left	Closed	95	90
	14	Left	Closed	96	90
4. J366	15	Right	Open	99	93
(Acceleration)	16	Right	Open	98	92
Without bedding	17	Left	Closed	98	93
	18	Left	Closed	98	93
5. J366	19	Right	Open	97	90
(Deceleration)	20	Right	Open	97	90
With bedding	21	Left	Closed	95	89
	22	Left	Closed	95	90

Table 5-2. Maximum A-weighted sound levels as measured at the two interior microphone locations for all test runs for vehicle number 5.

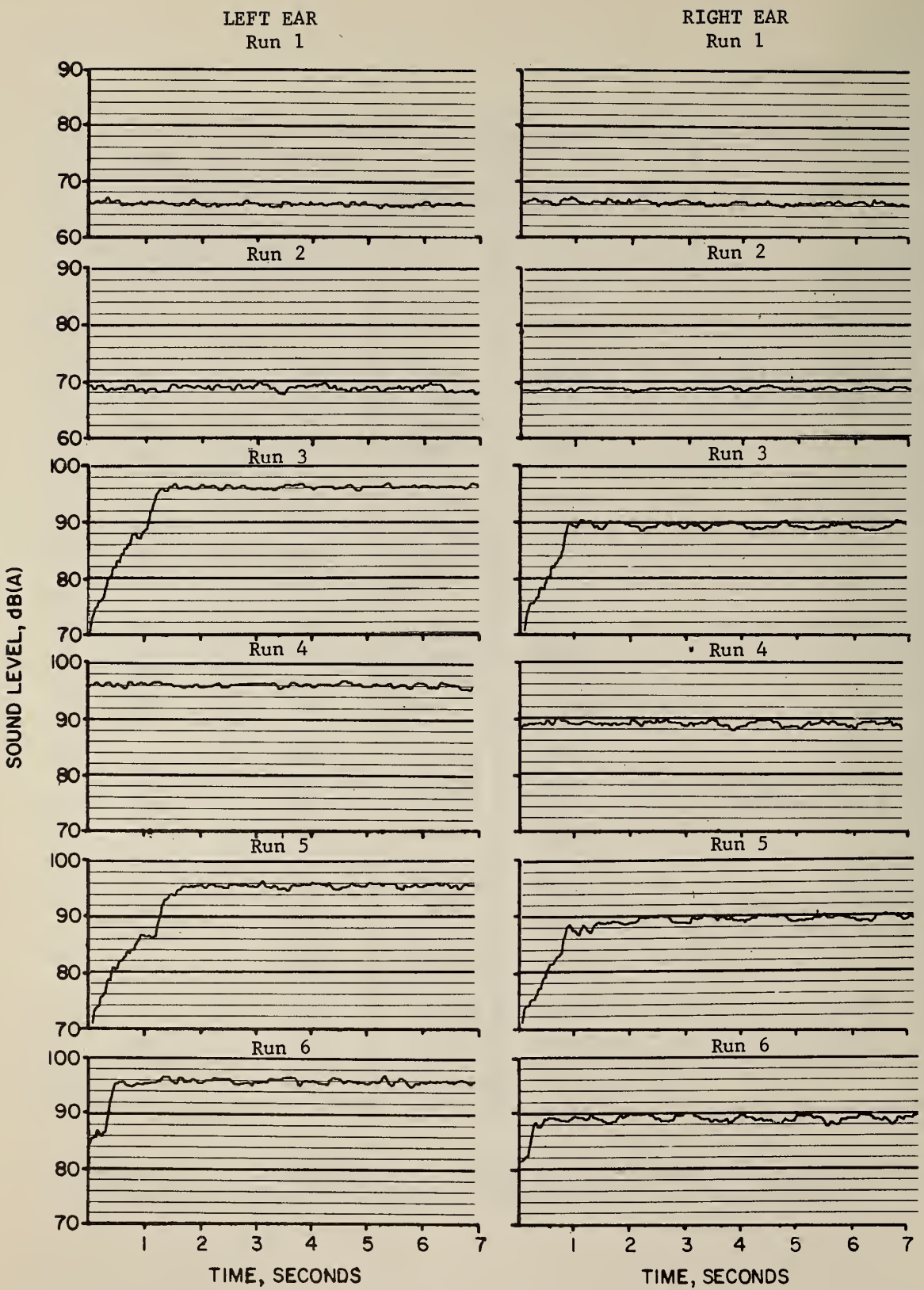

Figure 5-11. Truck 5, Tests 1,2, Runs 1-6. (Interior)

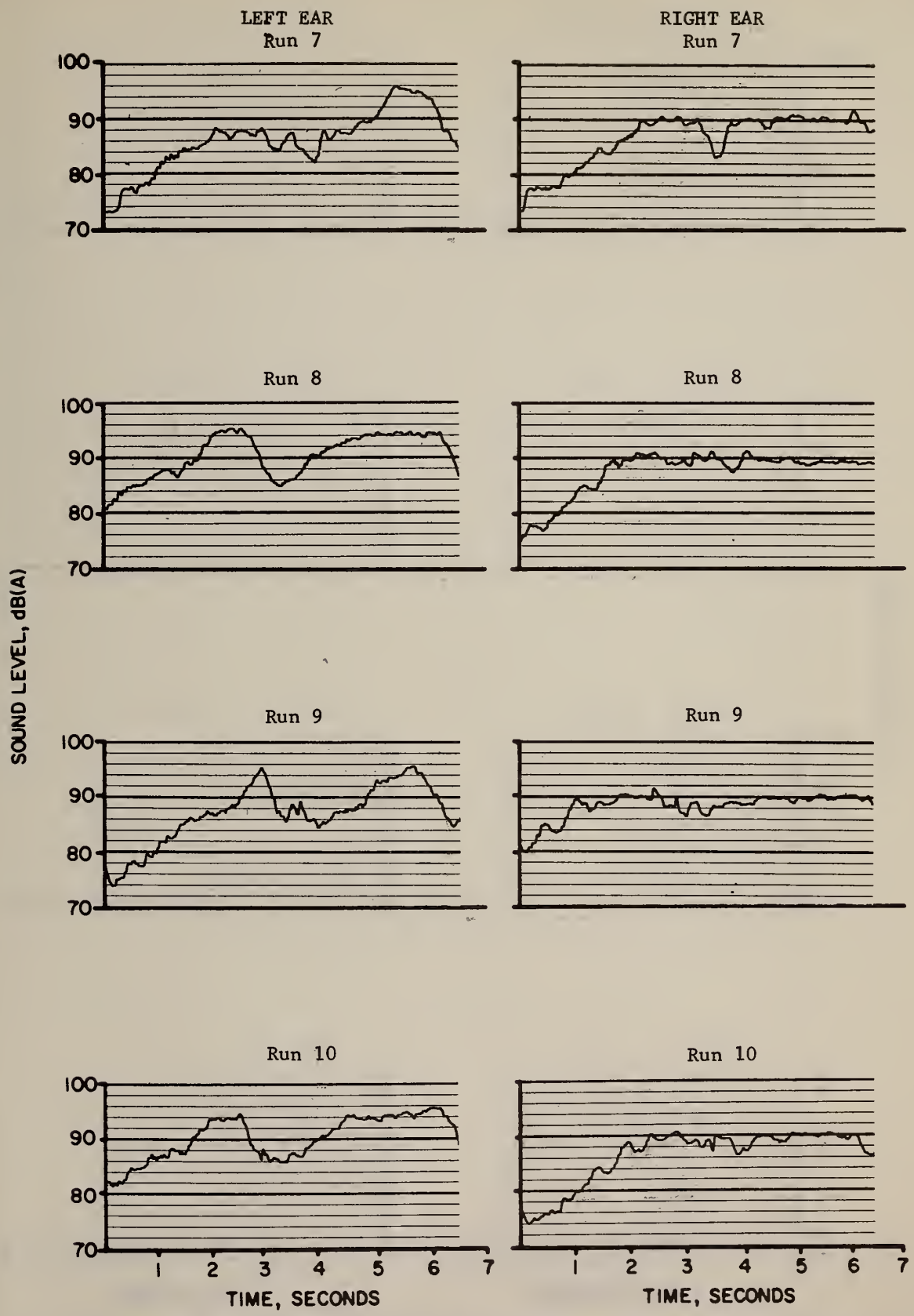

Figure 5-12. Truck 5, Test 3, Runs 7-10. (Interior)

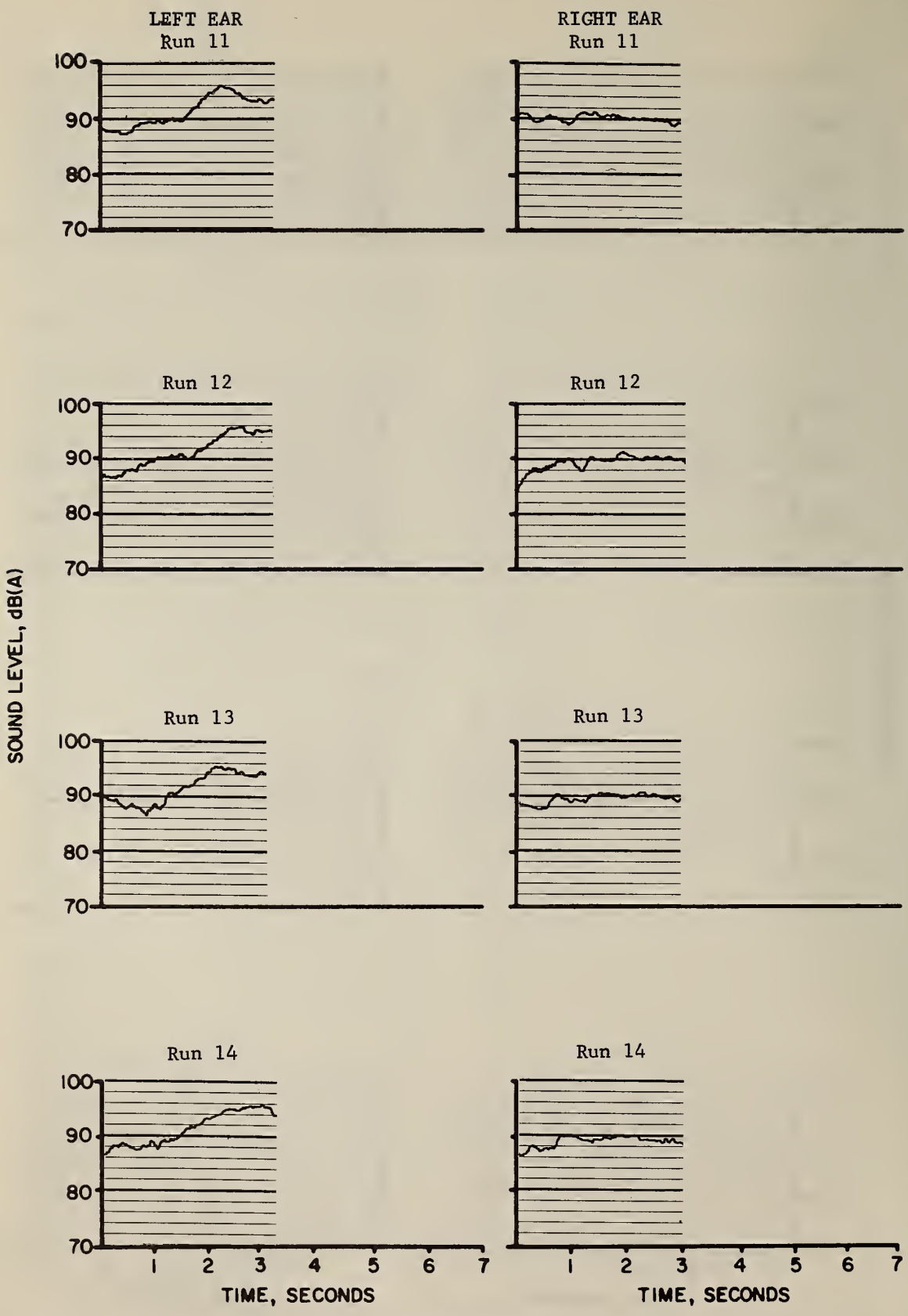

Figure 5-13. Truck 5, Test 4 (with bedding), Runs 11-14. (Interior)

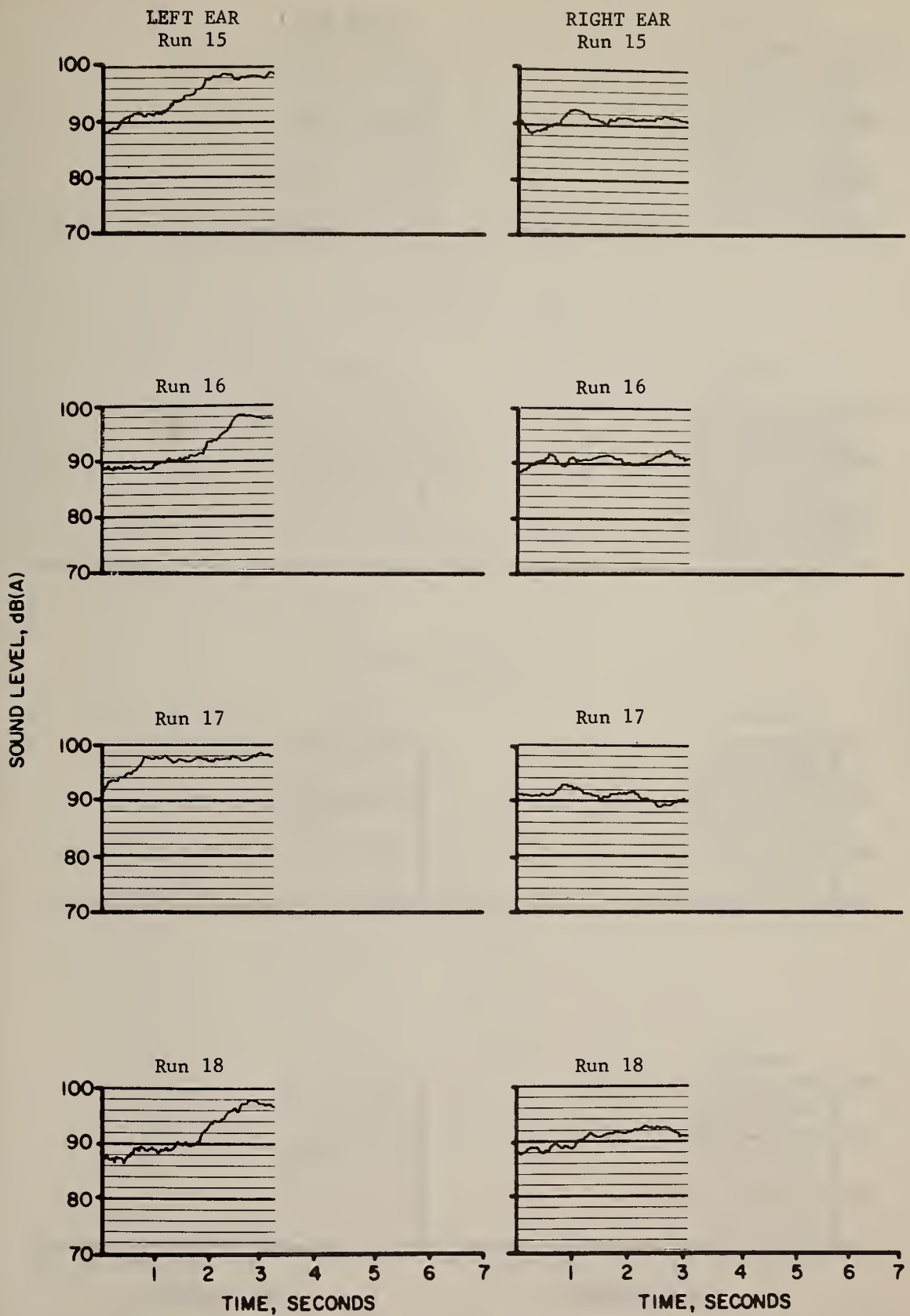

Figure 5-14. Truck 5, Test 4 (without bedding), Runs 15-18. (Interior)

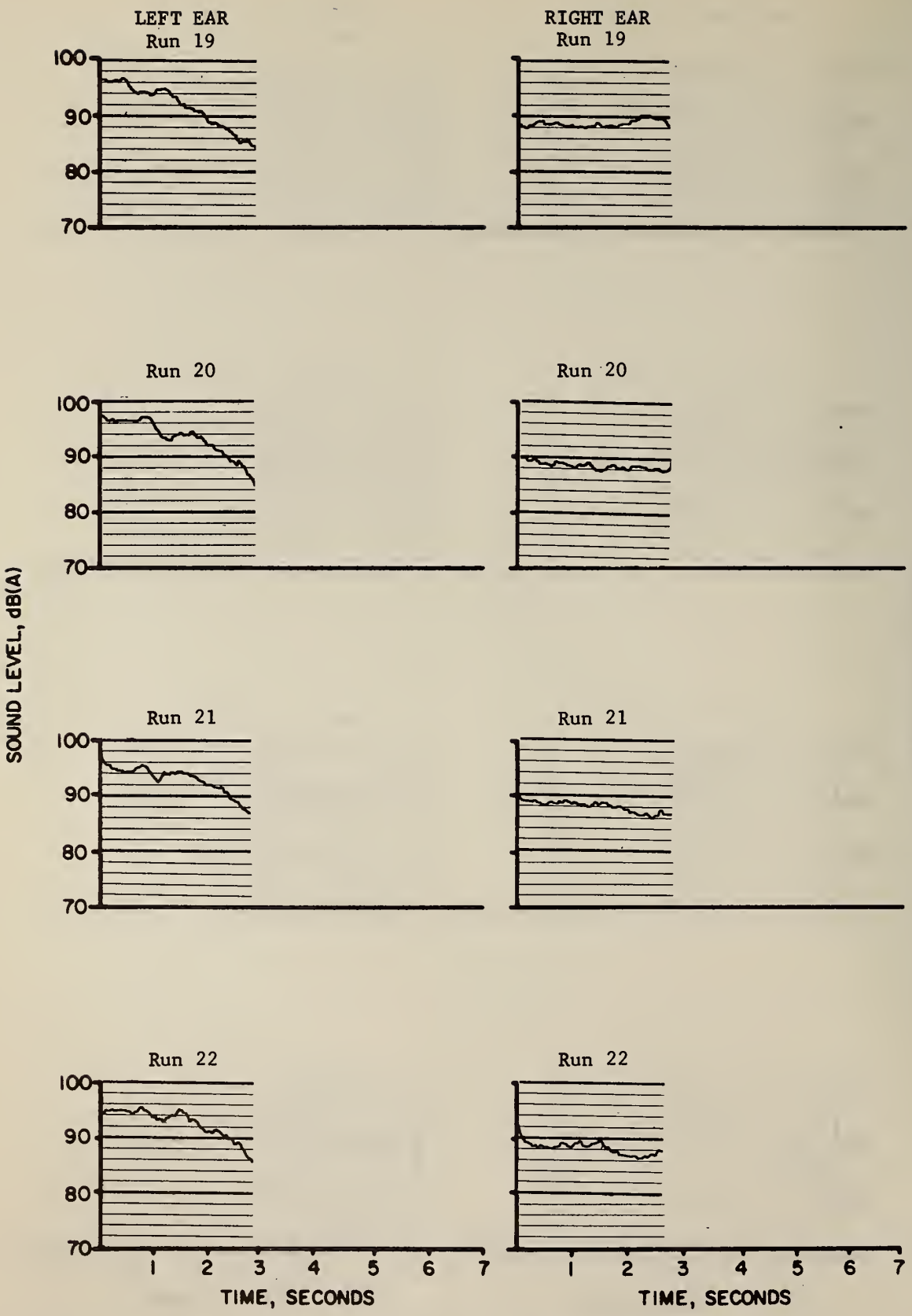

Figure 5-15. Truck 5, Test 5 (with bedding), Runs 19-22 (Interior).

Test Vehicle Number 6

Figure 6-1. Test Vehicle Number 6.

Truck Number: 6
Carrier (owner): Associated Transport, Inc.
Company Fleet Number: 7785
Make: Ford
Model: LN9000
Serial Number: R90JVL10339
Year: 1971
Engine Governor Setting: 2200 rpm
Total Miles of Operation: 54,600
Miles Since Last Engine Overhaul: Original engine
Miles Since Any Exhaust Work: Original exhaust system
Engine: Make - Cummins
Model - NHC 250

Exterior

Truck 06

TEST	RUN	SIDE	(WINDOWS)	SOUND LEVEL, dB(A) MICROPHONES					
				1	2	3	4	5	6
1. Low Idle (Stationary)	1	Right	Open	65	65	66	66	64	72
	2	Left	Closed	66	66	66	66	65	72
2. Acceleration (Stationary)	3	Right	Open	86	86	86	86	84	92
	4	Right	Open	86	86	86	86	84	92
	5	Left	Closed	85	86	86	86	85	91
	6	Left	Closed	84	85	85	86	85	91
2. High Idle (Stationary)	3	Right	Open	85	86	86	86	85	91
	4	Right	Open	85	86	86	86	85	91
	5	Left	Closed	84	84	84	85	84	90
	6	Left	Closed	84	84	84	85	84	90
3. City Start Up	7	Right	Open	86	87	86	87	86	92
	8	Right	Open	86	87	86	87	86	92
	9	Left	Closed	86	86	85	87	86	92
	10	Left	Closed	86	86	85	86	85	91
4. J366 (Acceleration)	11	Right	Open	87	86	86	86	84	91
	12	Right	Open	86	87	85	86	86	91
	13	Left	Closed	85	86	85	86	86	91
	14	Left	Closed	85	86	86	86	85	91
5. J366 (Deceleration)	15	Right	Open	85	85	86	85	84	90
	16	Right	Open	85	85	84	84	83	90
	17	Left	Closed	82	84	84	85	84	89
	18	Left	Closed	83	84	84	85	84	89

Table 6-1. Maximum A-weighted sound levels as measured at the six exterior microphone locations for all test runs for vehicle number 6.

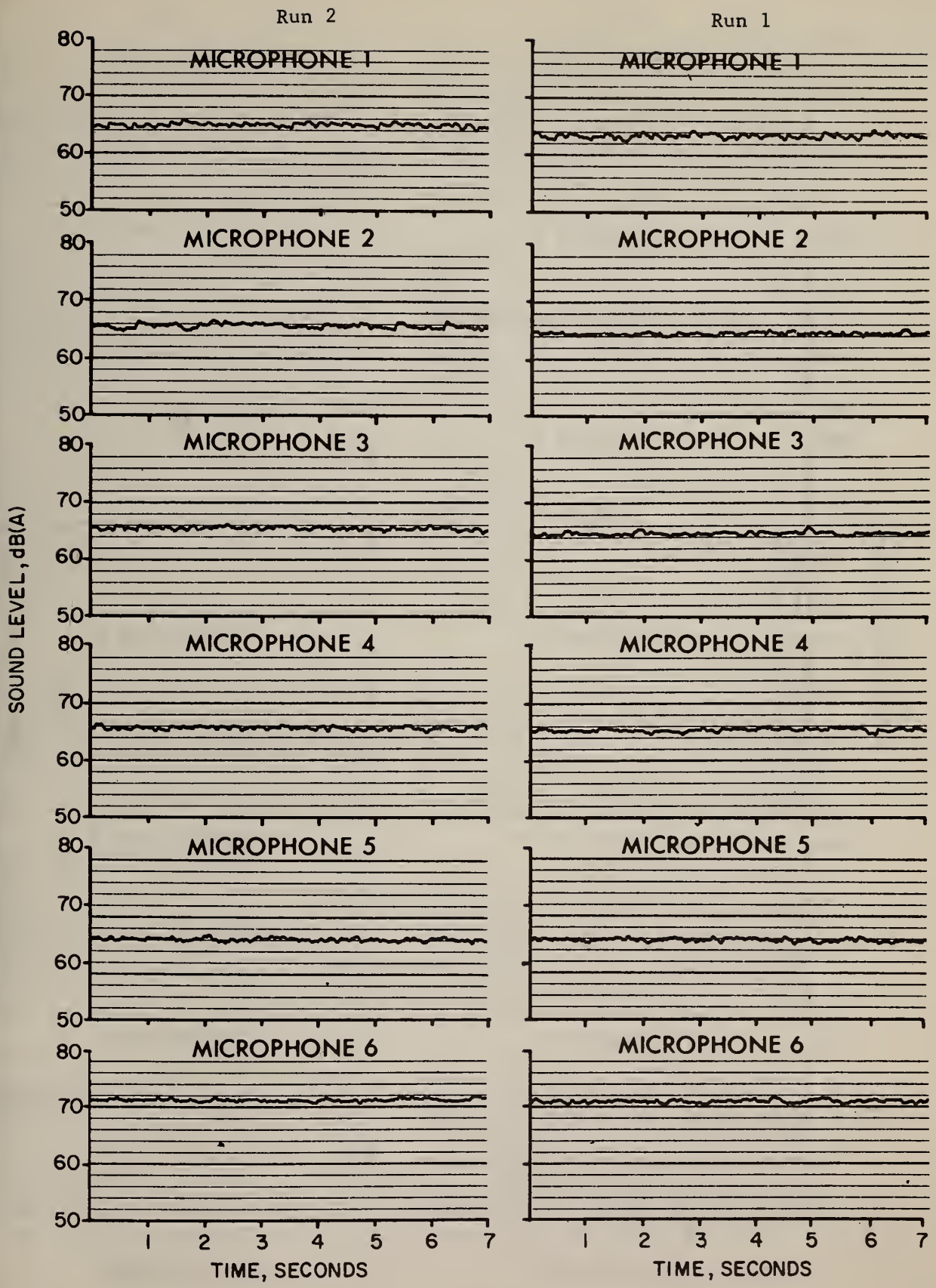

Figure 6-2. Truck 6, Test 1, Runs 1,2. (Exterior)

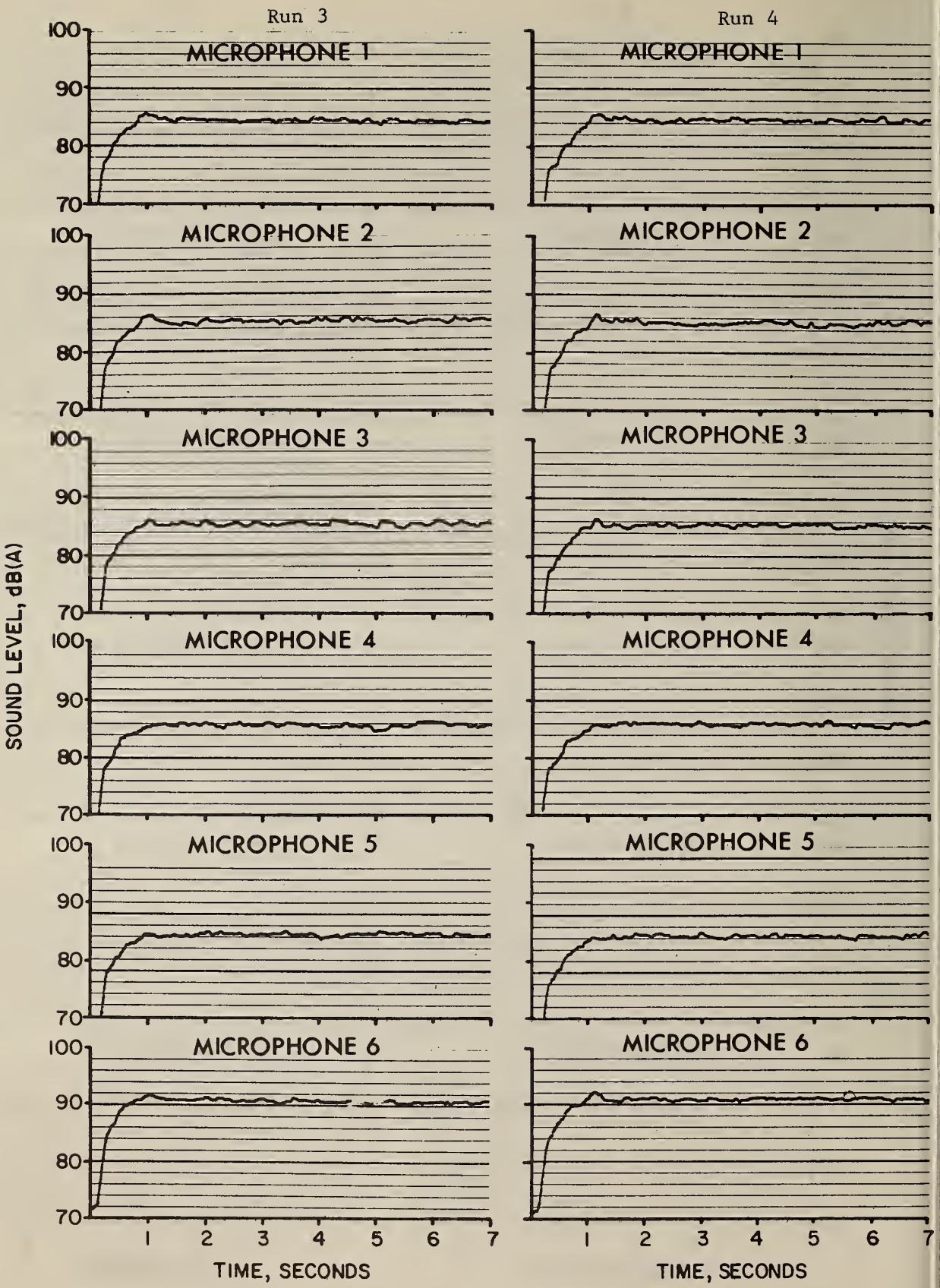

Figure 6-3. Truck 6, Test 2, Runs 3,4. (Exterior)

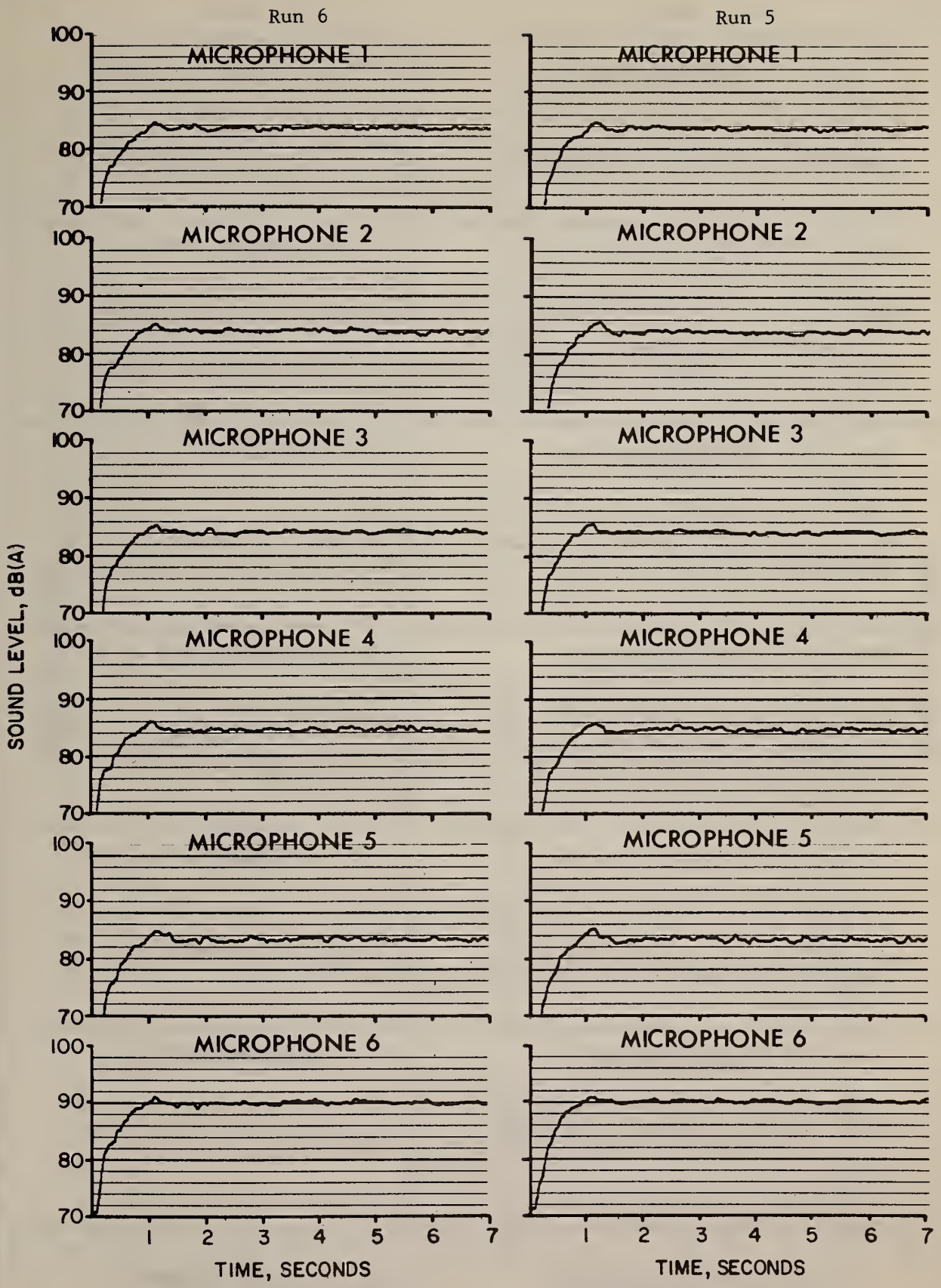

Figure 6-4. Truck 6, Test 2, Runs 5,6. (Exterior)

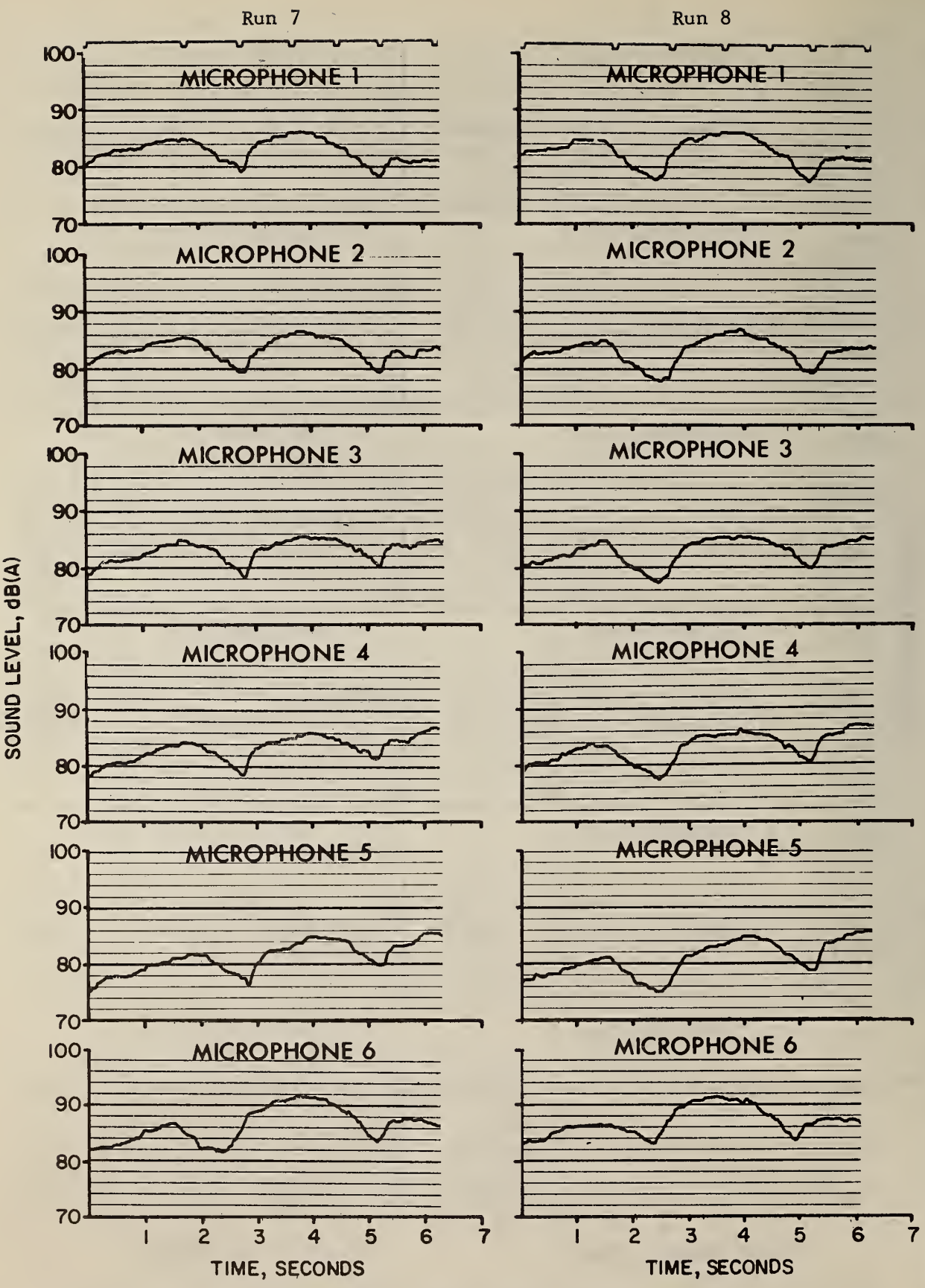

Figure 6-5. Truck 6, Test 3, Runs 7,8. (Exterior)

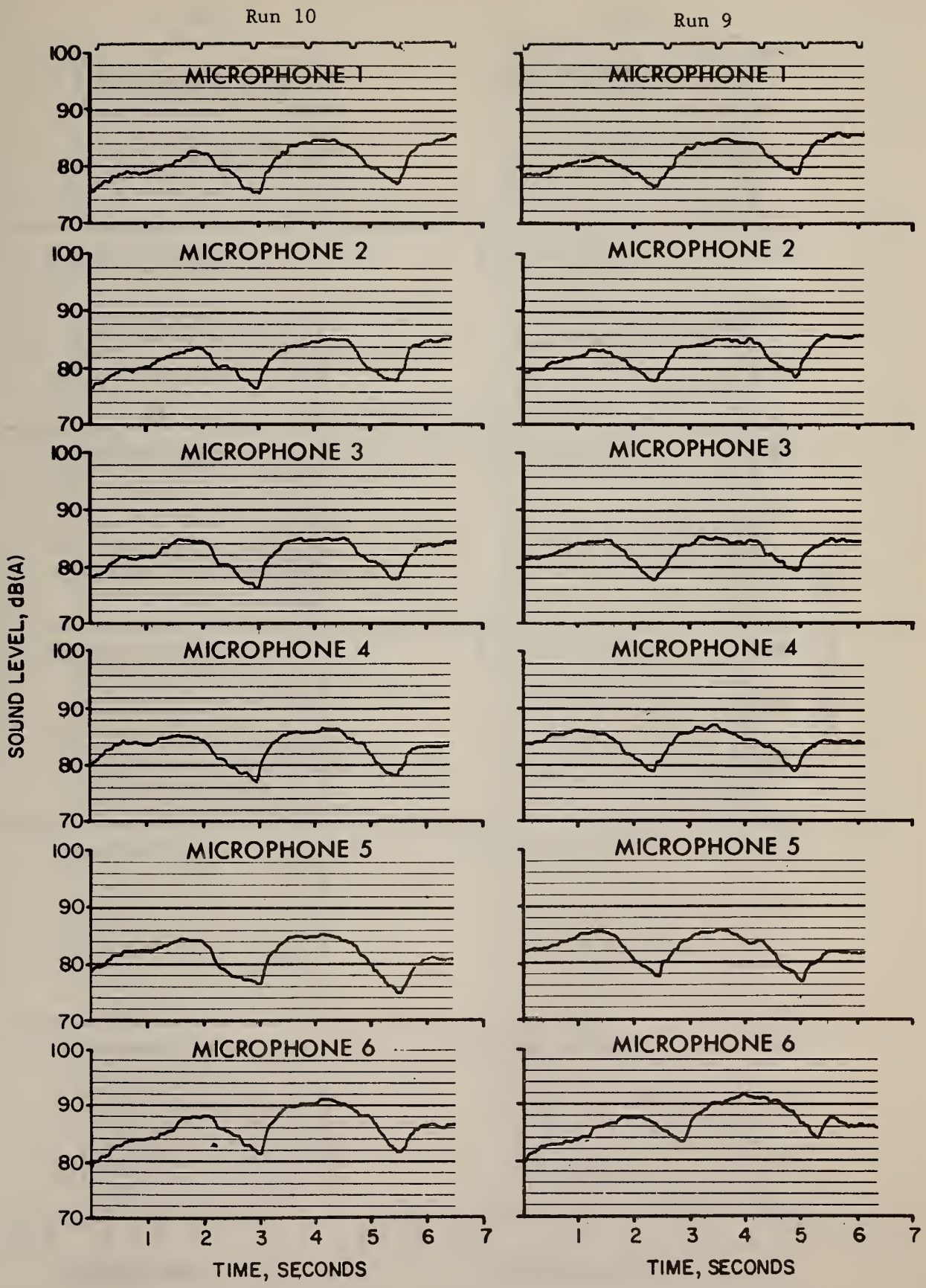

Figure 6-6. Truck 6, Test 3, Runs 9,10. (Exterior)

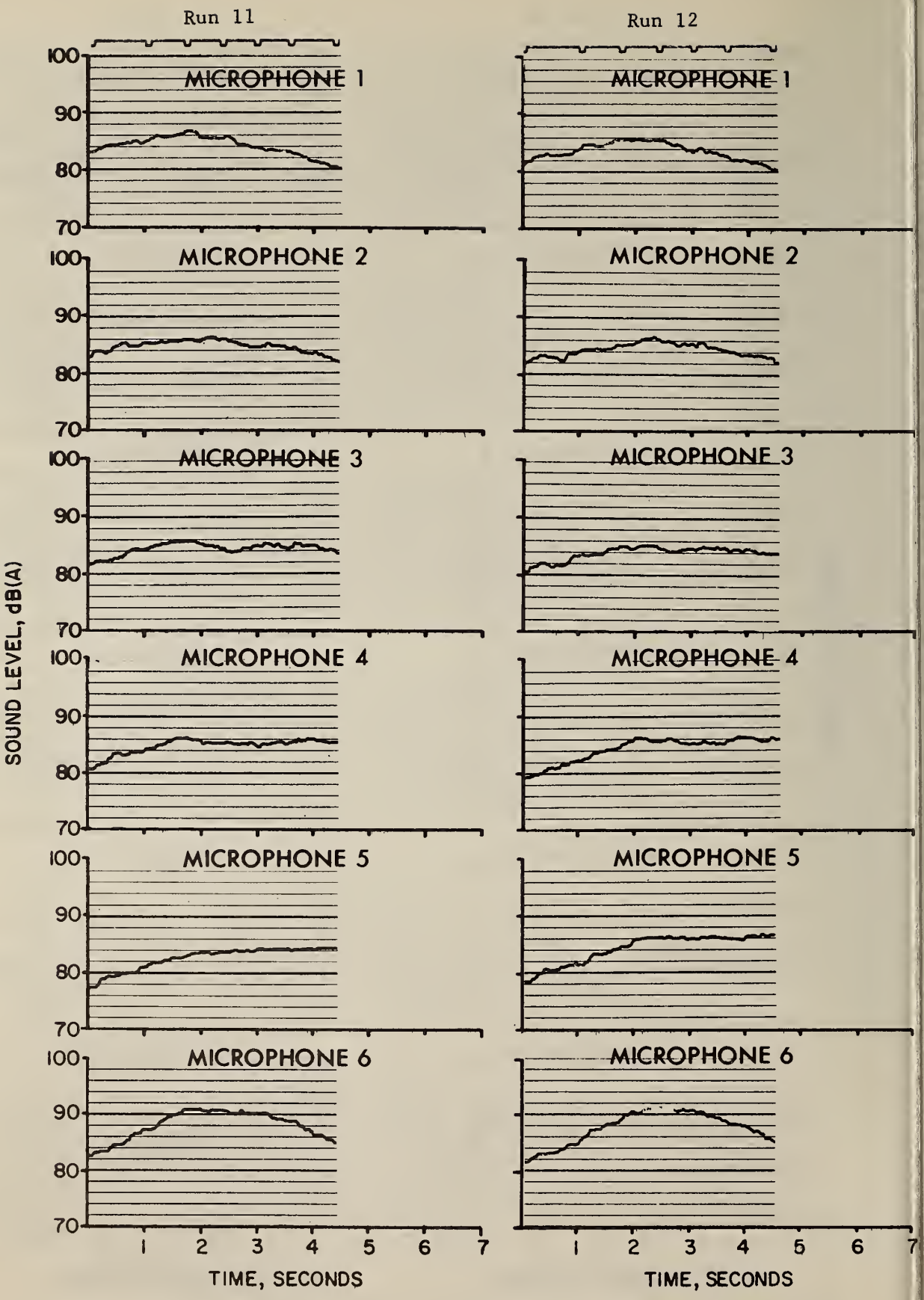

Figure 6-7. Truck 6, Test 4, Runs 11,12. (Exterior)

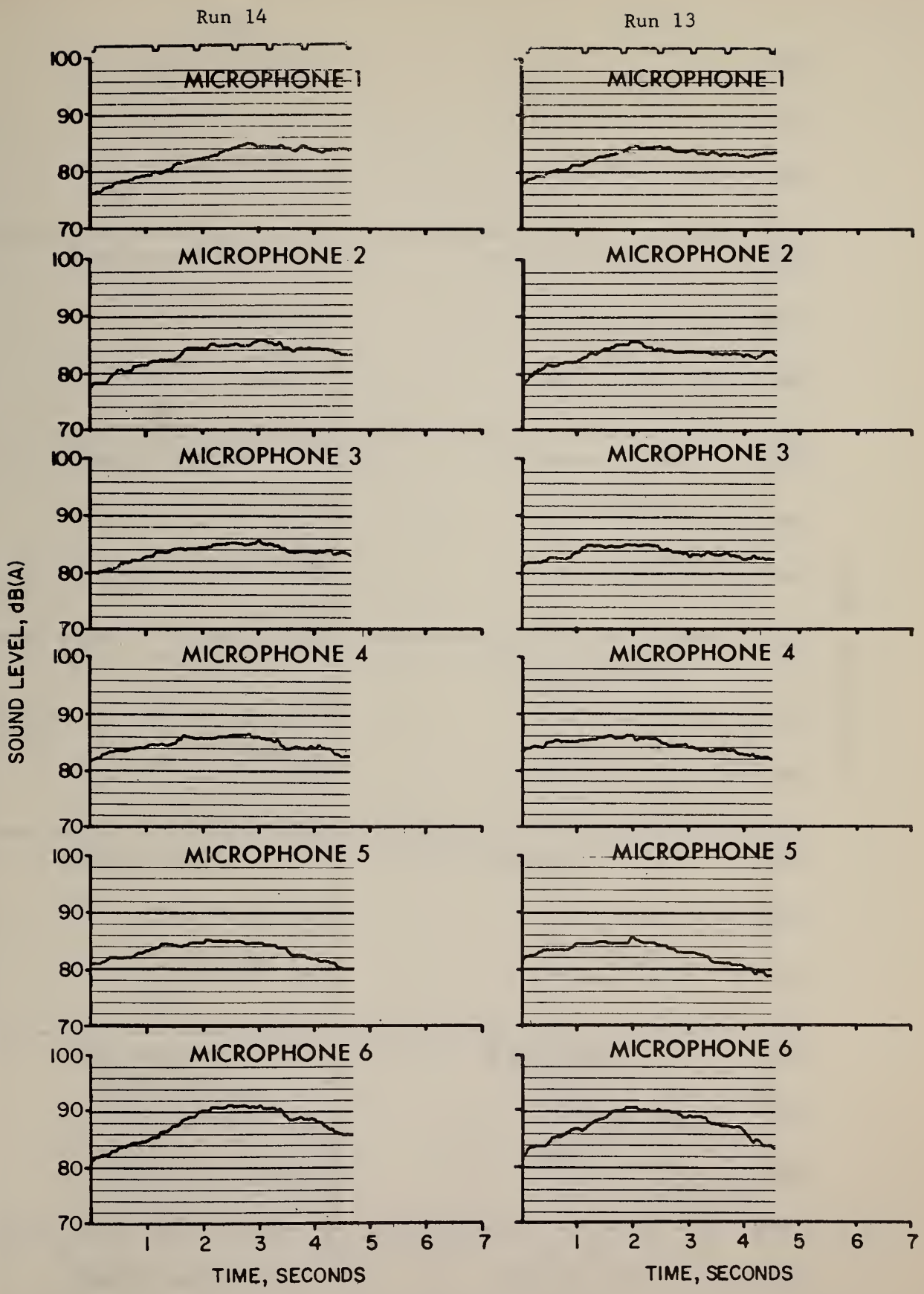

Figure 6-8. Truck 6, Test 4, Runs 13,14. (Exterior)

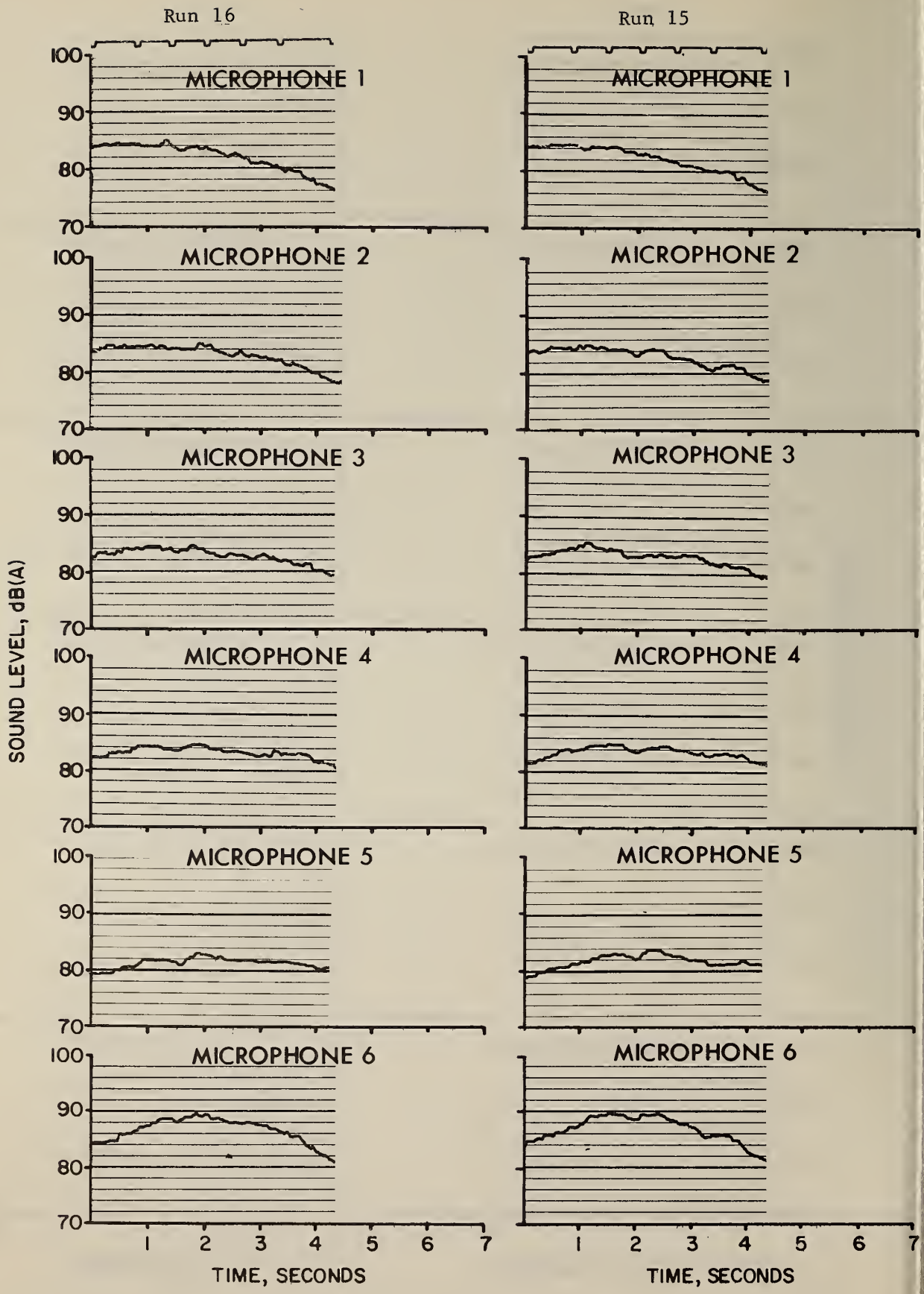

Figure 6-9. Truck 6, Test 5, Runs 15,16. (Exterior)

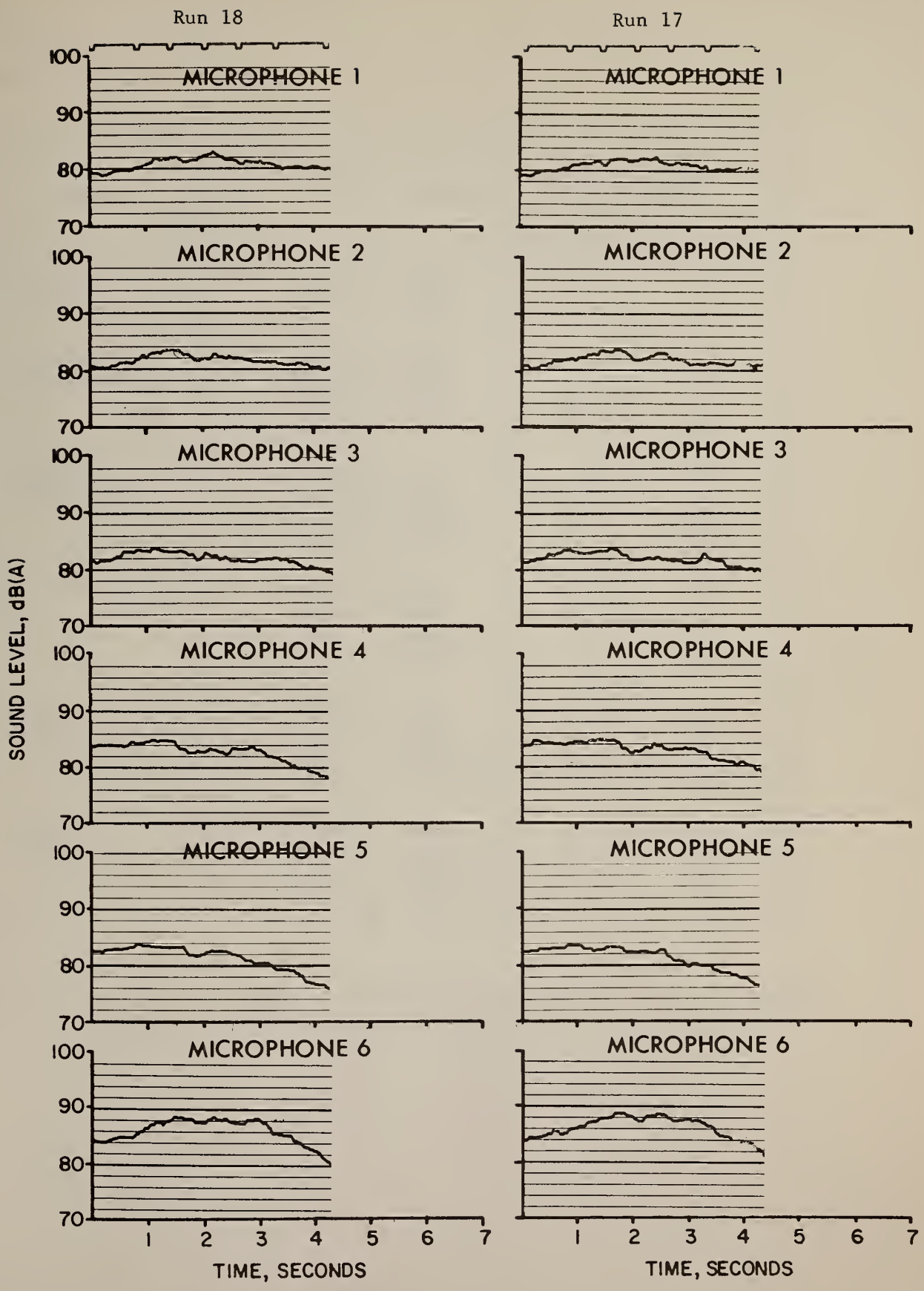

Figure 6-10. Truck 6, Test 5, Runs 17,18. (Exterior)

Interior

Truck 06

TEST	RUN	(SIDE)	WINDOWS	SOUND LEVEL, dB(A) MICROPHONES	
				LEFT EAR	RIGHT EAR
1. Low Idle (Stationary)	1	Right	Open	74	72
	2	Left	Closed	74	74
2. Acceleration (Stationary)	3	Right	Open	93	93
	4	Right	Open	--	--
	5	Left	Closed	92	91
	6	Left	Closed	92	92
2. High Idle (Stationary)	3	Right	Open	93	93
	4	Right	Open	94	93
	5	Left	Closed	93	92
	6	Left	Closed	93	92
3. City Start Up	7	Right	Open	94	94
	8	Right	Open	94	94
	9	Left	Closed	92	92
	10	Left	Closed	93	93
4. J366 (Acceleration)	11	Right	Open	94	93
	12	Right	Open	94	94
	13	Left	Closed	94	94
	14	Left	Closed	94	94
5. J366 (Deceleration)	15	Right	Open	93	92
	16	Right	Open	94	93
	17	Left	Closed	92	92
	18	Left	Closed	92	91

Table 6-2. Maximum A-weighted sound levels as measured at the two interior microphone locations for all test runs for vehicle number 6.

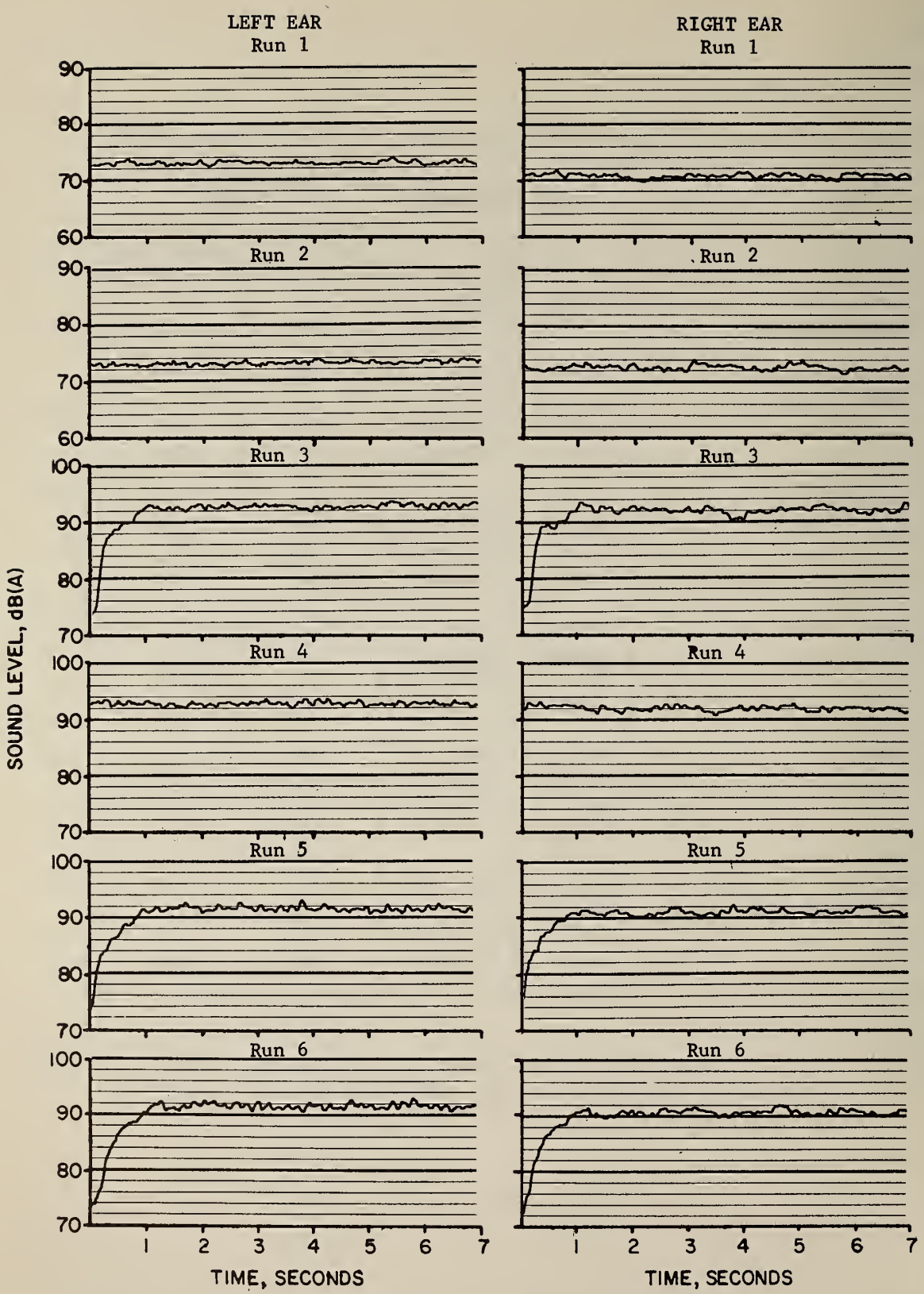

Figure 6-11. Truck 6, Tests 1,2, Runs 1-6. (Interior)

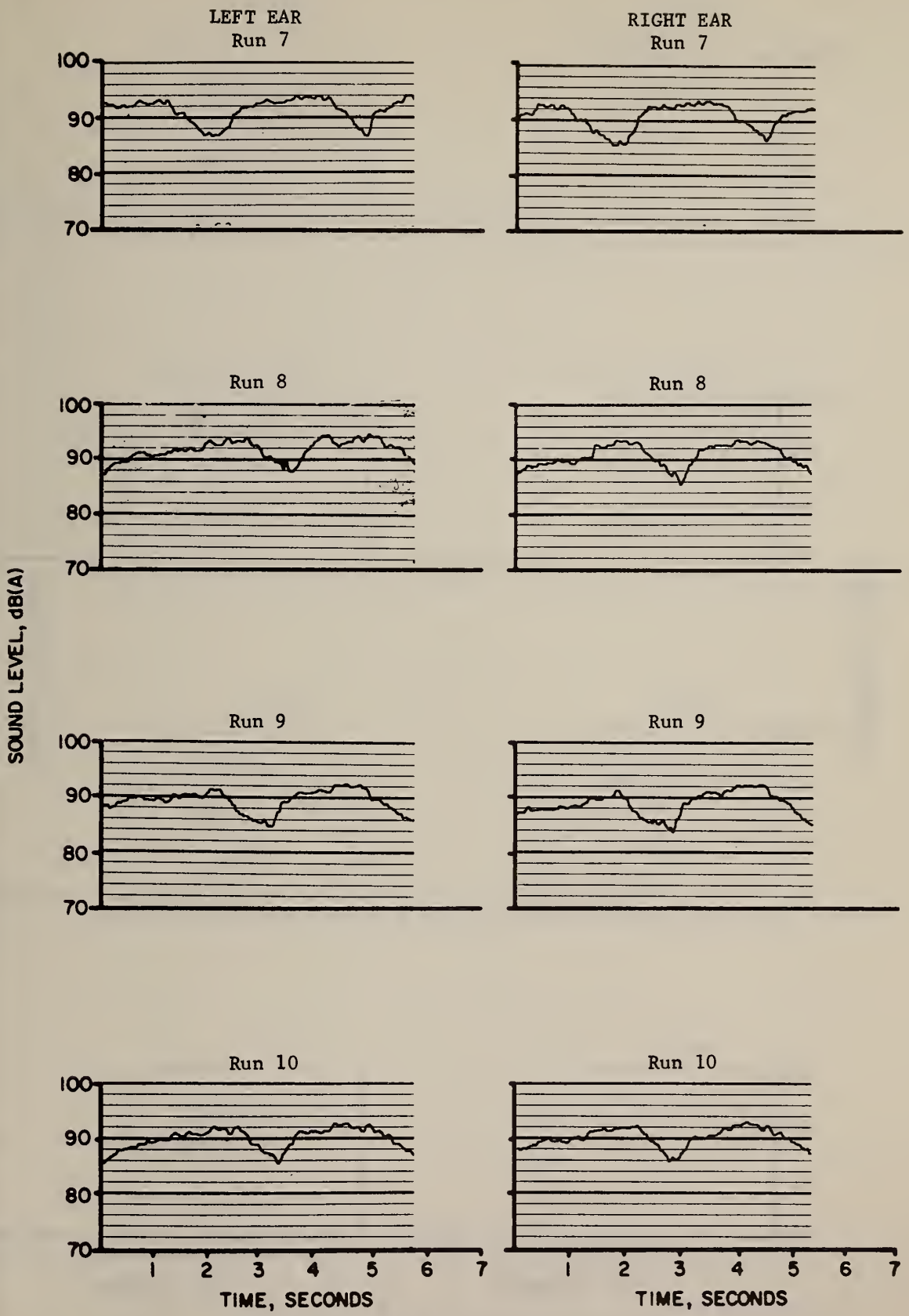

Figure 6-12. Truck 6, Test 3, Runs 7-10. (Interior)

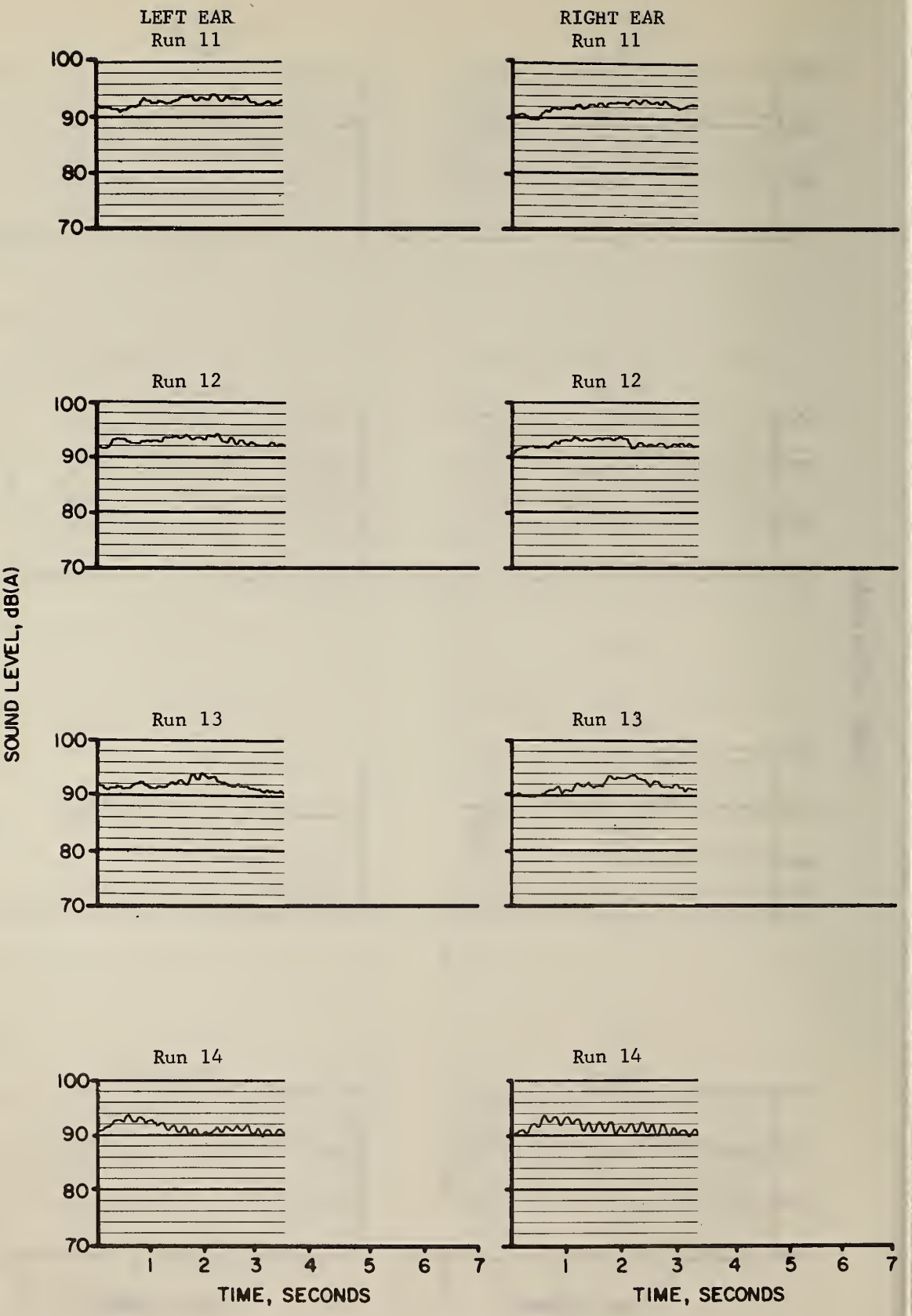

Figure 6-13. Truck 6, Test 4, Runs 11-14. (Interior)

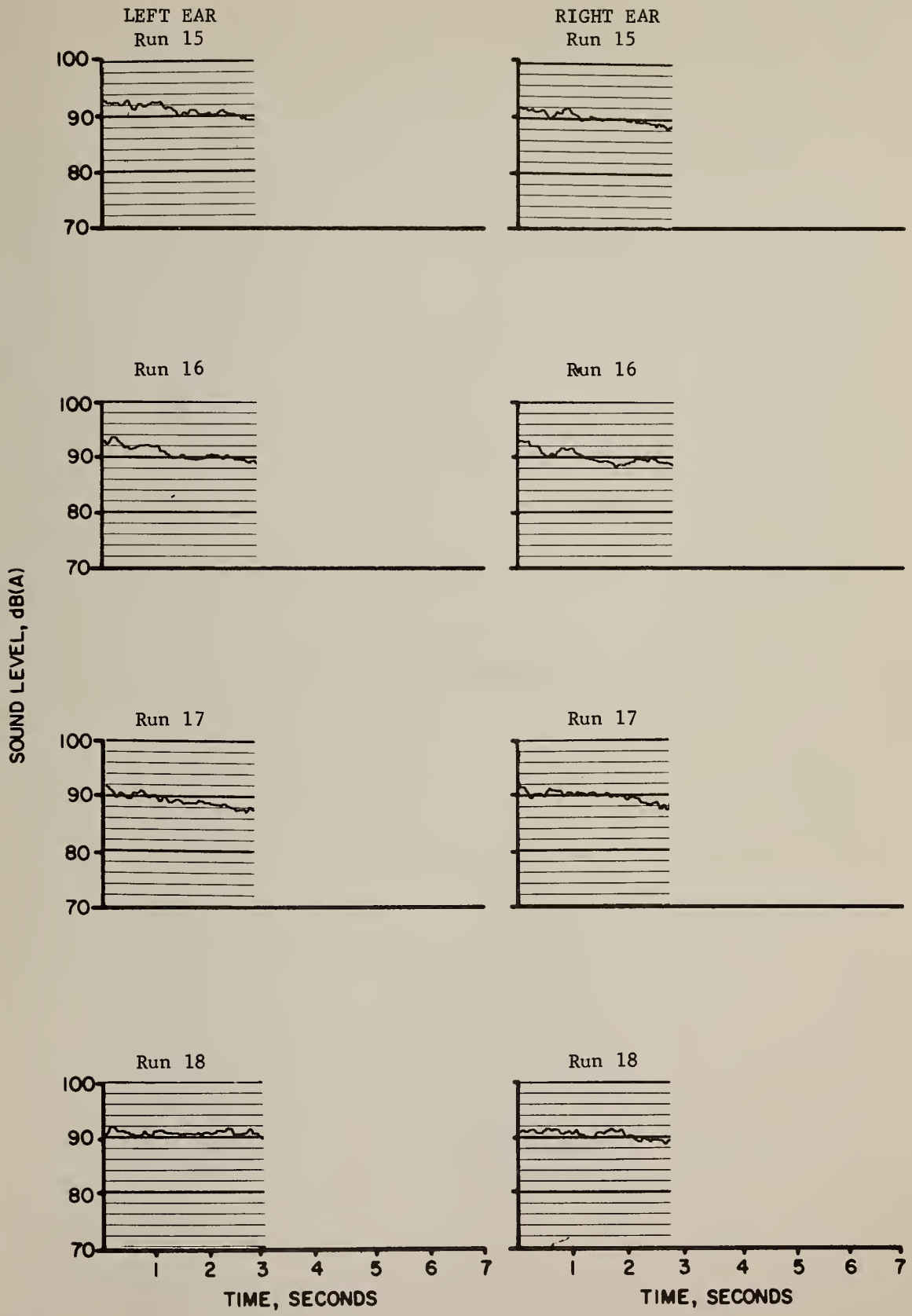

Figure 6-14. Truck 6, Test 5, Runs 15-18. (Interior)

Test Vehicle Number 7

Figure 7-1. Test Vehicle Number 7.

Truck Number: 7
Carrier (owner): Chemical Leaman Tank Lines, Inc.
Company Fleet Number: 1-416
Make: Mack
Model: F685ST
Serial Number: 2944
Year: 1968
Engine Governor Setting: 2000 rpm
Total Miles of Operation: 205,305
Miles Since Last Engine Overhaul: 26,684
Miles Since Any Exhaust Work: 28,354
Engine: Make - Mack
Model - Maxidyne

Exterior

Truck 07

TEST	RUN	SIDE	(WINDOWS)	SOUND LEVEL, dB(A) MICROPHONES					
				1	2	3	4	5	6
1. Low Idle (Stationary)	1	Right	Open	63	63	63	63	62	69
	2	Left	Closed	62	63	63	63	63	69
2. Acceleration (Stationary)	3	Right	Open	--	--	--	--	--	--
	4	Right	Open	85	85	86	86	85	92
	5	Left	Closed	83	85	85	85	85	91
	6	Left	Closed	--	--	--	--	--	--
2. High Idle (Stationary)	3	Right	Open	--	--	--	--	--	--
	4	Right	Open	82	84	84	83	83	89
	5	Left	Closed	80	82	83	83	84	88
	6	Left	Closed	--	--	--	--	--	--
3. City Start Up	7	Right	Open	84	84	83	83	83	87
	8	Right	Open	83	83	83	83	83	86
	9	Left	Closed	82	83	82	82	83	84
	10	Left	Closed	82	83	82	82	83	85
4. J366 (Acceleration)	11	Right	Open	82	83	83	83	83	89
	12	Right	Open	81	82	83	82	83	88
	13	Left	Closed	83	84	83	84	83	90
	14	Left	Closed	83	84	83	83	84	89
5. J366 (Deceleration)	15	Right	Open	83	84	83	82	82	88
	16	Right	Open	83	83	82	81	81	87
	17	Left	Closed	81	82	83	83	84	88
	18	Left	Closed	80	82	82	83	84	88

Table 7-1. Maximum A-weighted sound levels as measured at the six exterior microphone locations for all test runs for vehicle number 7.

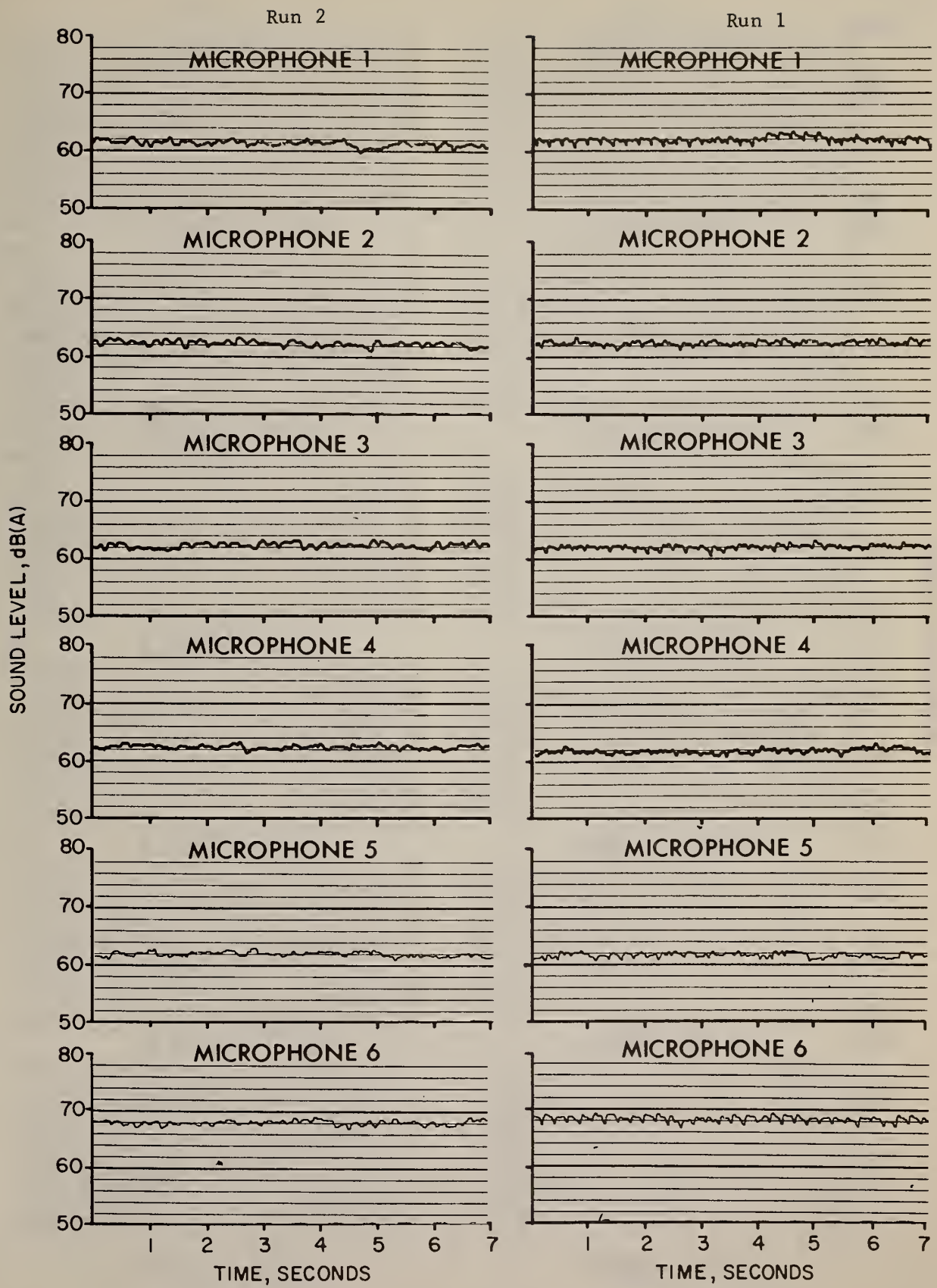

Figure 7-2. Truck 7, Test 1, Runs 1,2. (Exterior)

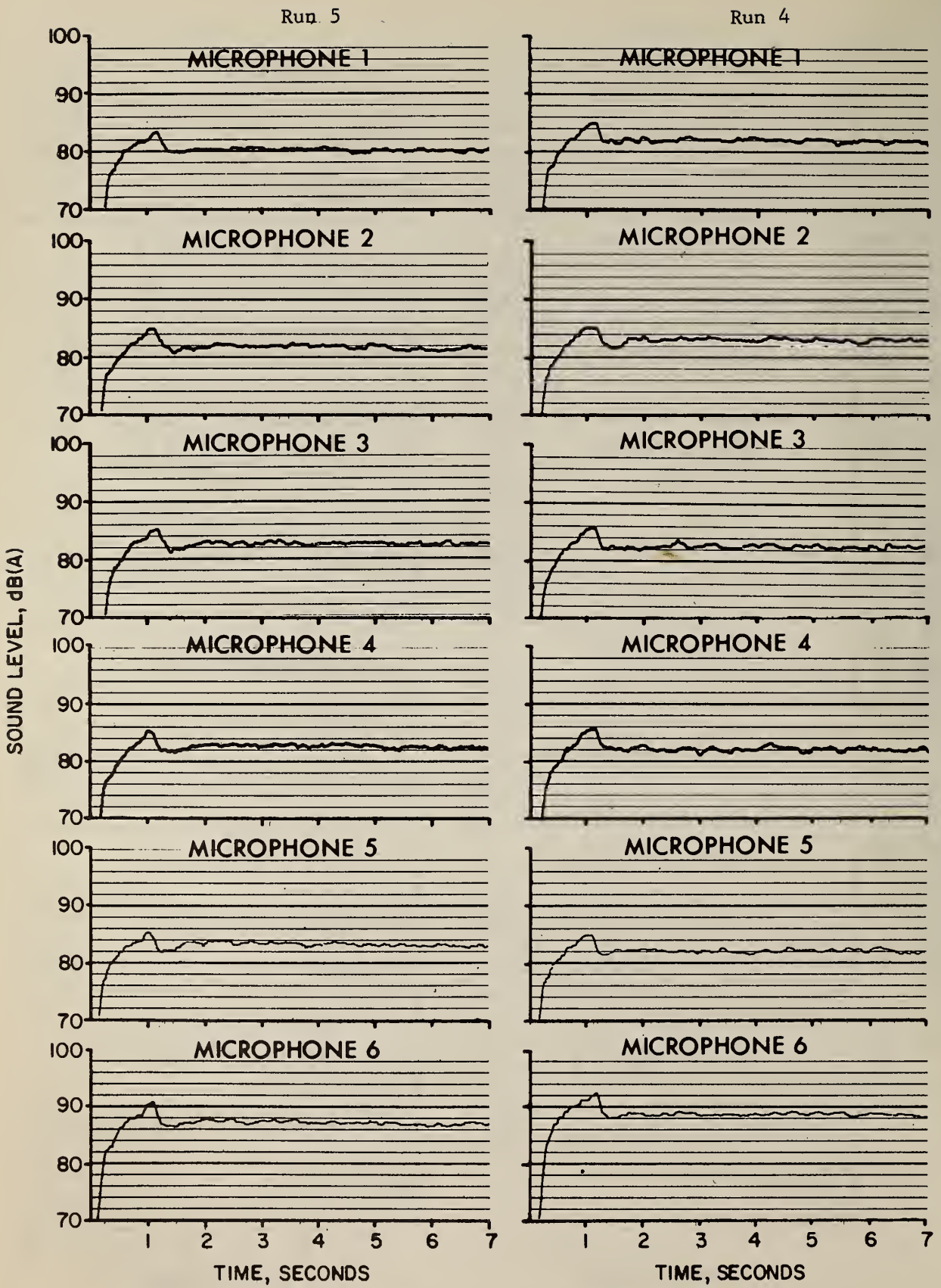

Figure 7-3. Truck 7, Test 2, Runs 4,5. (Exterior)

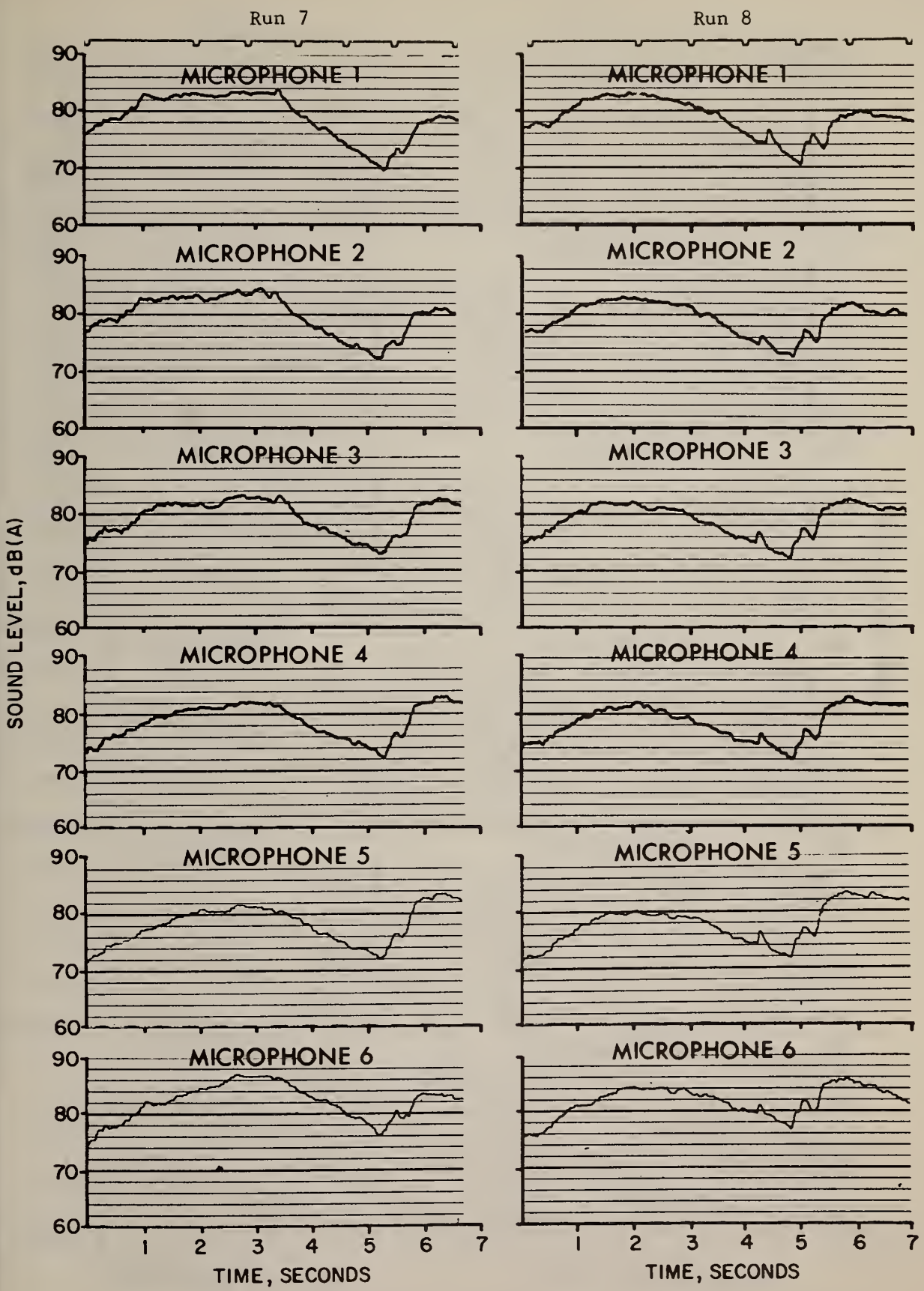

Figure 7-4. Truck 7, Test 3, Runs 7,8. (Exterior)

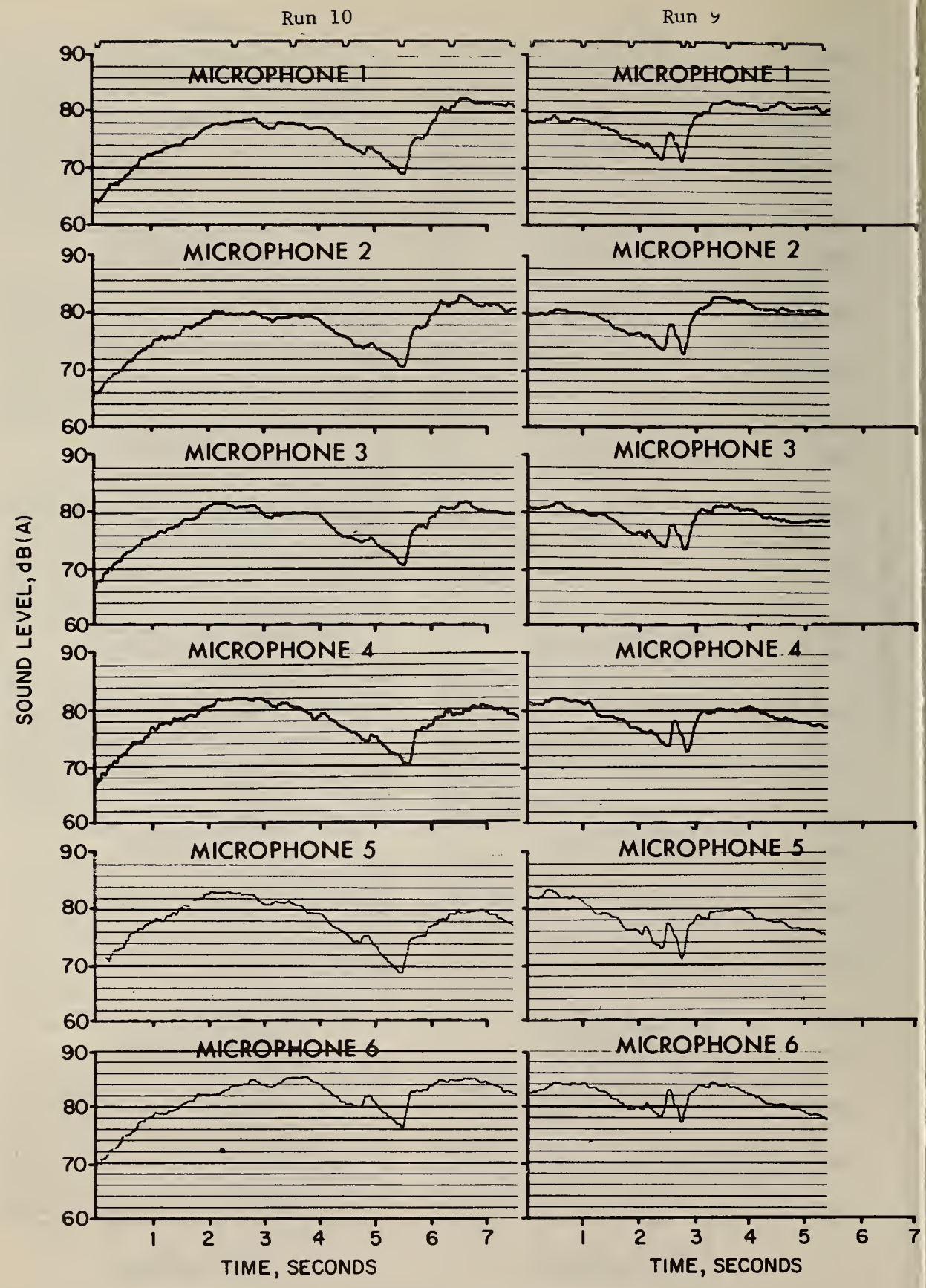

Figure 7-5. Truck 7, Test 3, Runs 9,10. (Exterior)

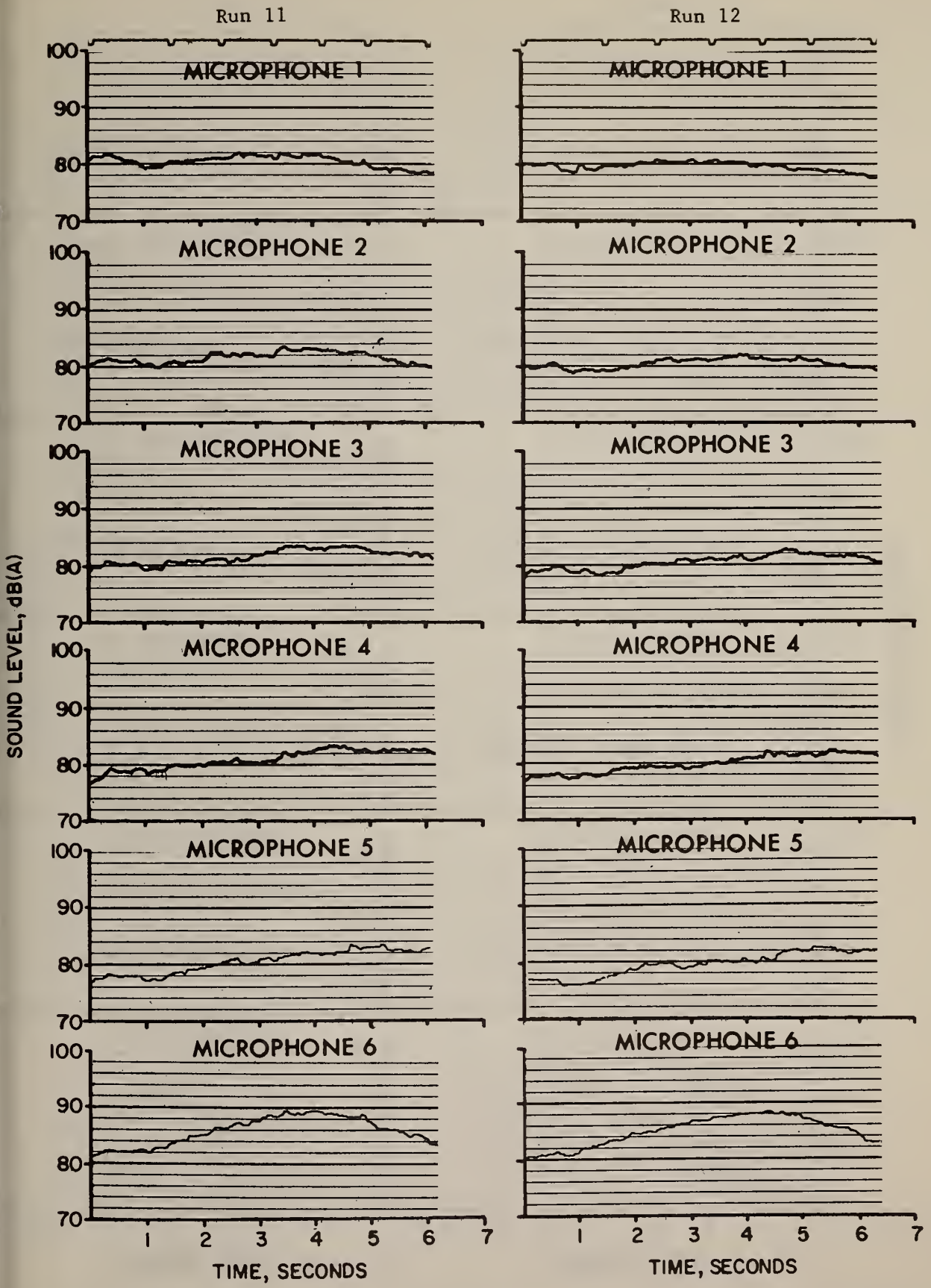

Figure 7-6. Truck 7, Test 4, Runs 11,12. (Exterior)

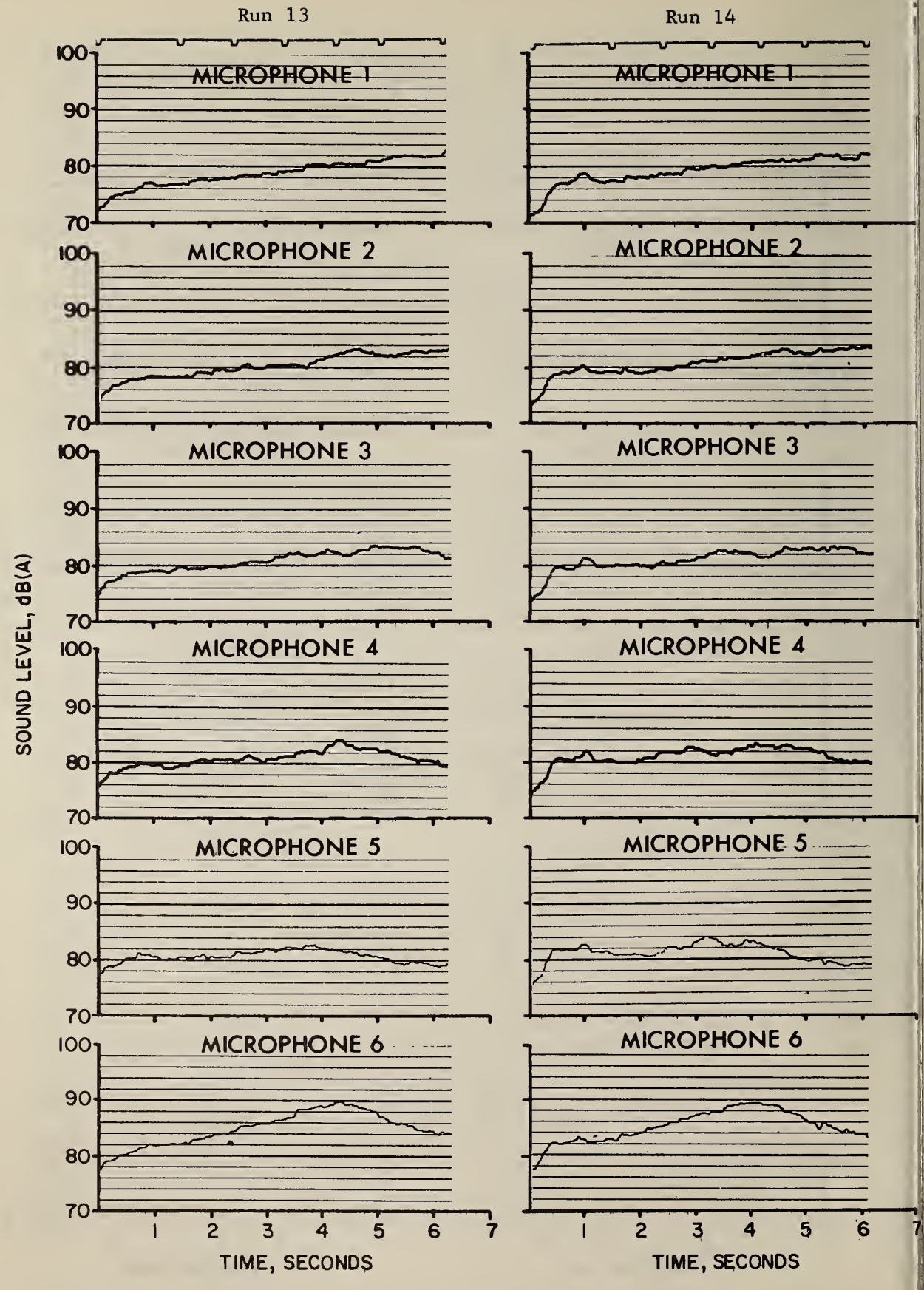

Figure 7-7. Truck 7, Test 4, Runs 13,14. (Exterior)

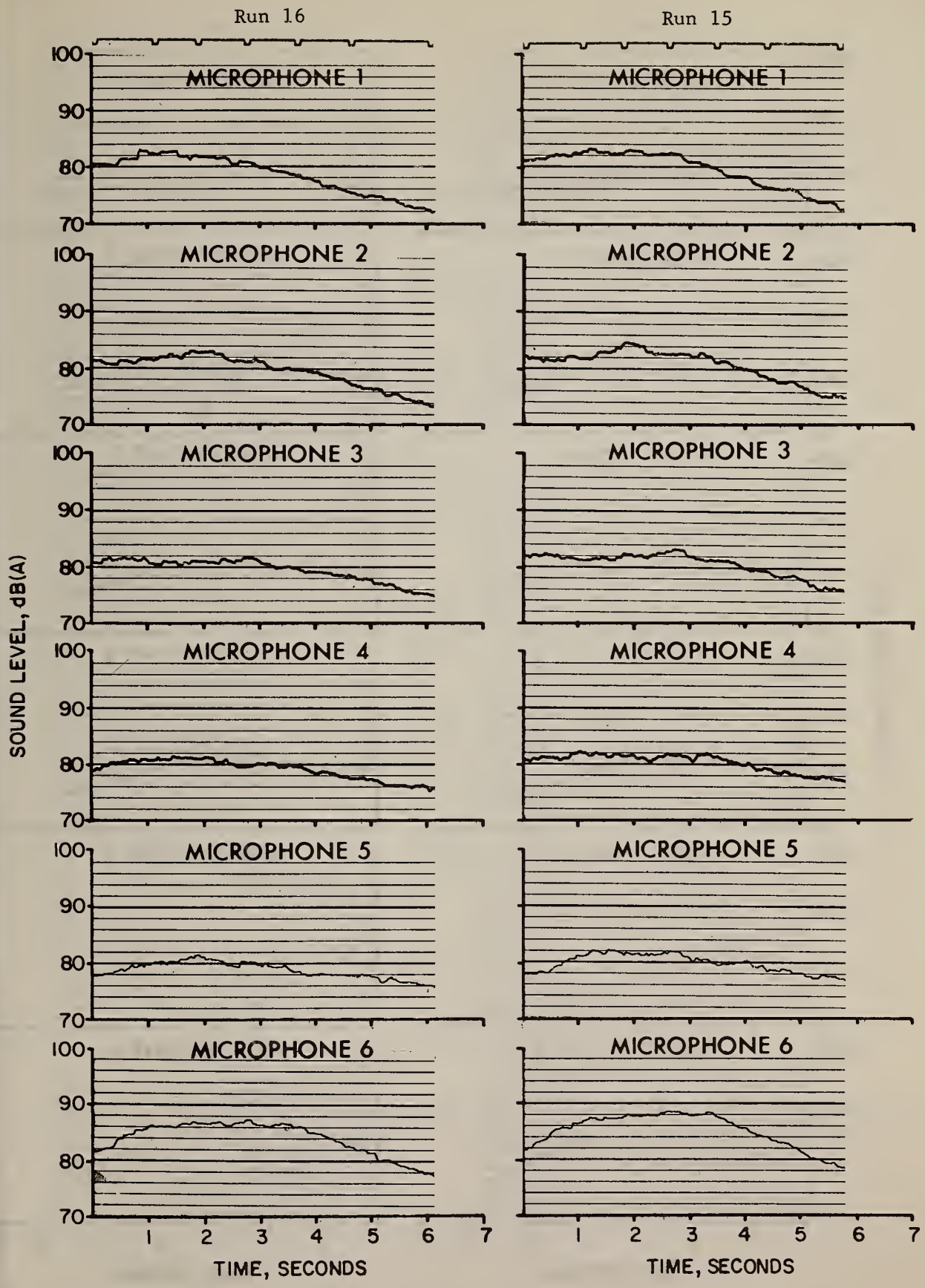

Figure 7-8. Truck 7, Test 5, Runs 15,16. (Exterior)

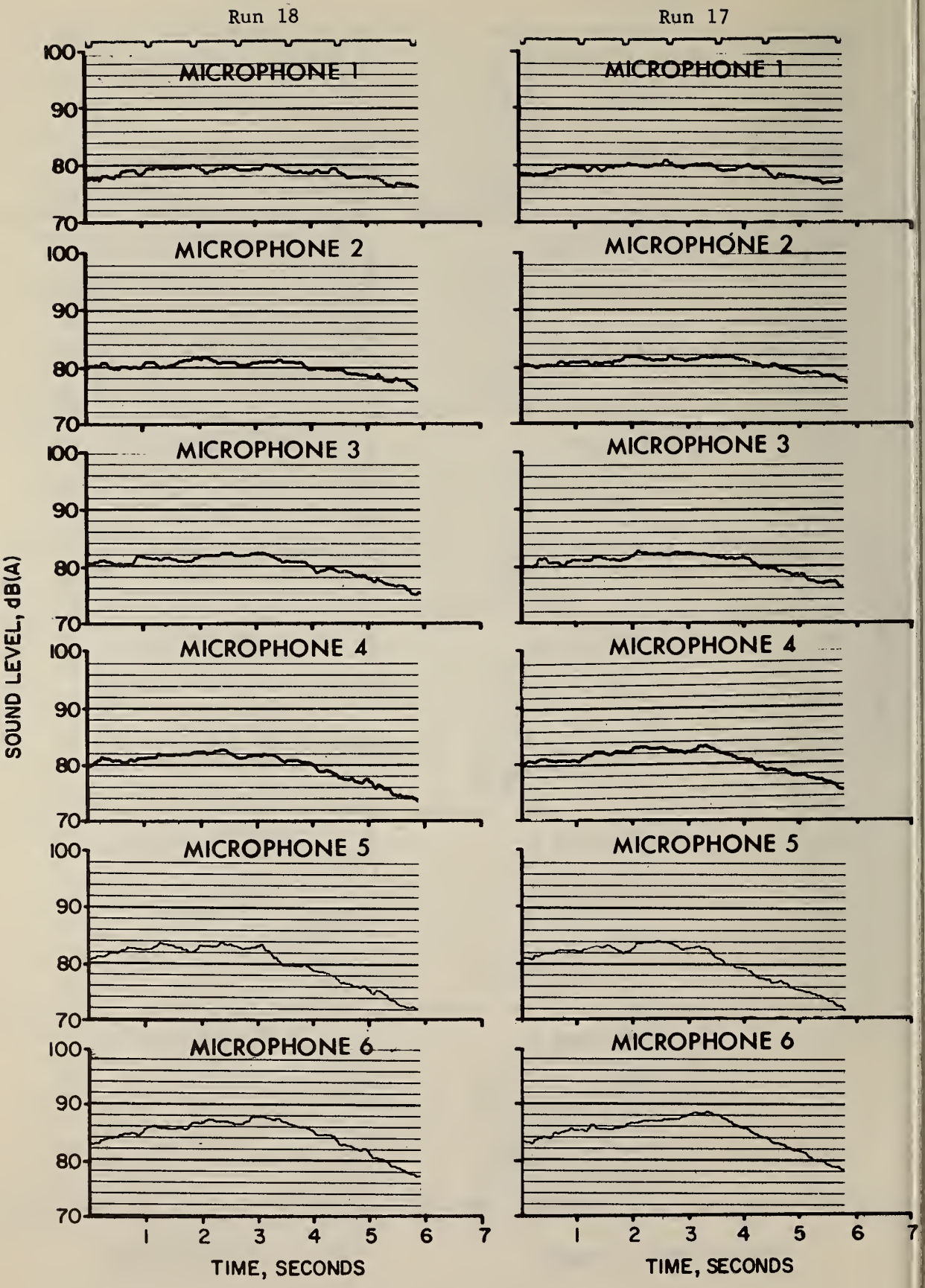

Figure 7-9. Truck 7, Test 5, Runs 17,18. (Exterior)

Interior

Truck 07

TEST	RUN	(SIDE)	WINDOWS	SOUND LEVEL, dB(A) MICROPHONES	
				LEFT EAR	RIGHT EAR
1. Low Idle (Stationary)	1	Right	Open	72	71
	2	Left	Closed	72	70
2. Acceleration (Stationary)	3	Right	Open	90	89
	4	Right	Open	90	88
	5	Left	Closed	89	88
	6	Left	Closed	87	86
2. High Idle (Stationary)	3	Right	Open	91	90
	4	Right	Open	90	90
	5	Left	Closed	92	92
	6	Left	Closed	89	89
3. City Start Up	7	Right	Open	92*/88	88
	8	Right	Open	95*/90	91
	9	Left	Closed	89	89
	10	Left	Closed	95*/88	90*/88
4. J366 (Acceleration) With bedding	11	Right	Open	92	90
	12	Right	Open	90	89
	13	Left	Closed	90	90
	14	Left	Closed	90	90
4. J366 (Acceleration) Without bedding	15	Right	Open	92	92
	16	Right	Open	89	90
	17	Left	Closed	92	90
	18	Left	Closed	91	90
5. J366 (Deceleration) With bedding	19	Right	Open	91	91
	20	Right	Open	91	90
	21	Left	Closed	91	90
	22	Left	Closed	91	90

Table 7-2. Maximum A-weighted sound levels as measured at the two interior microphone locations for all test runs for vehicle number 7.

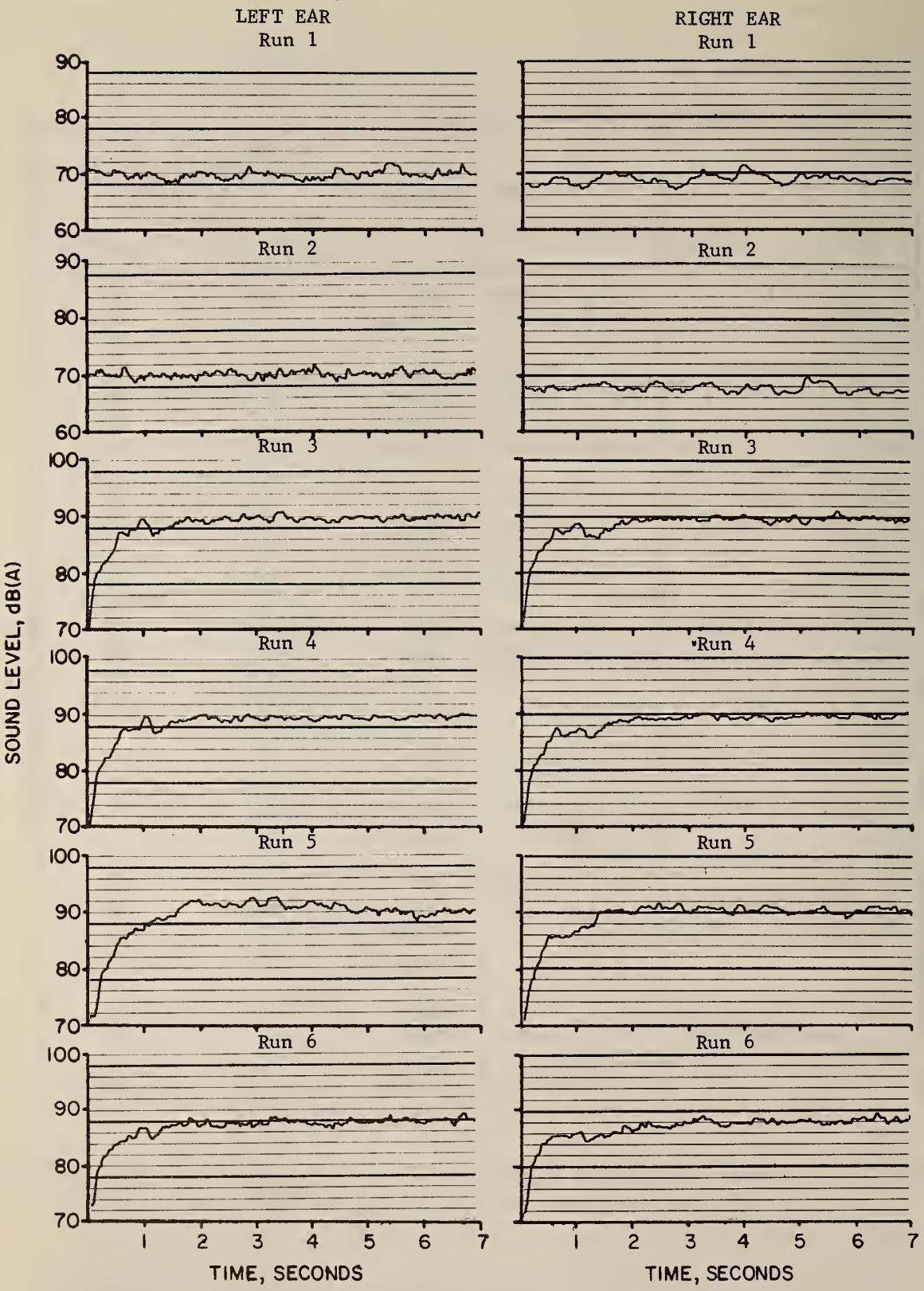

Figure 7-10. Truck 7, Tests 1,2, Runs 1-6. (Interior)

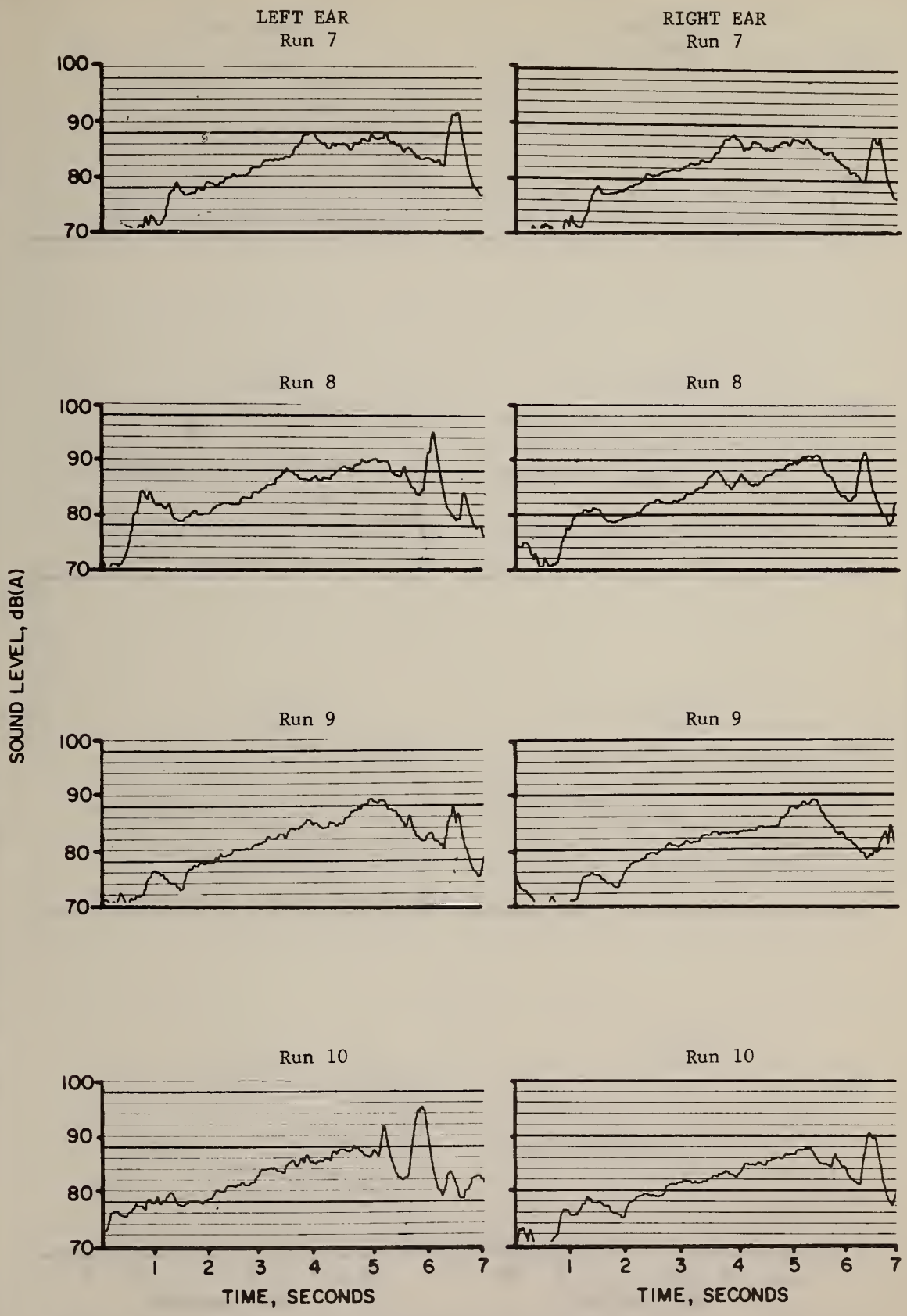

Figure 7-11. Truck 7, Test 3, Runs 7-10. (Interior)

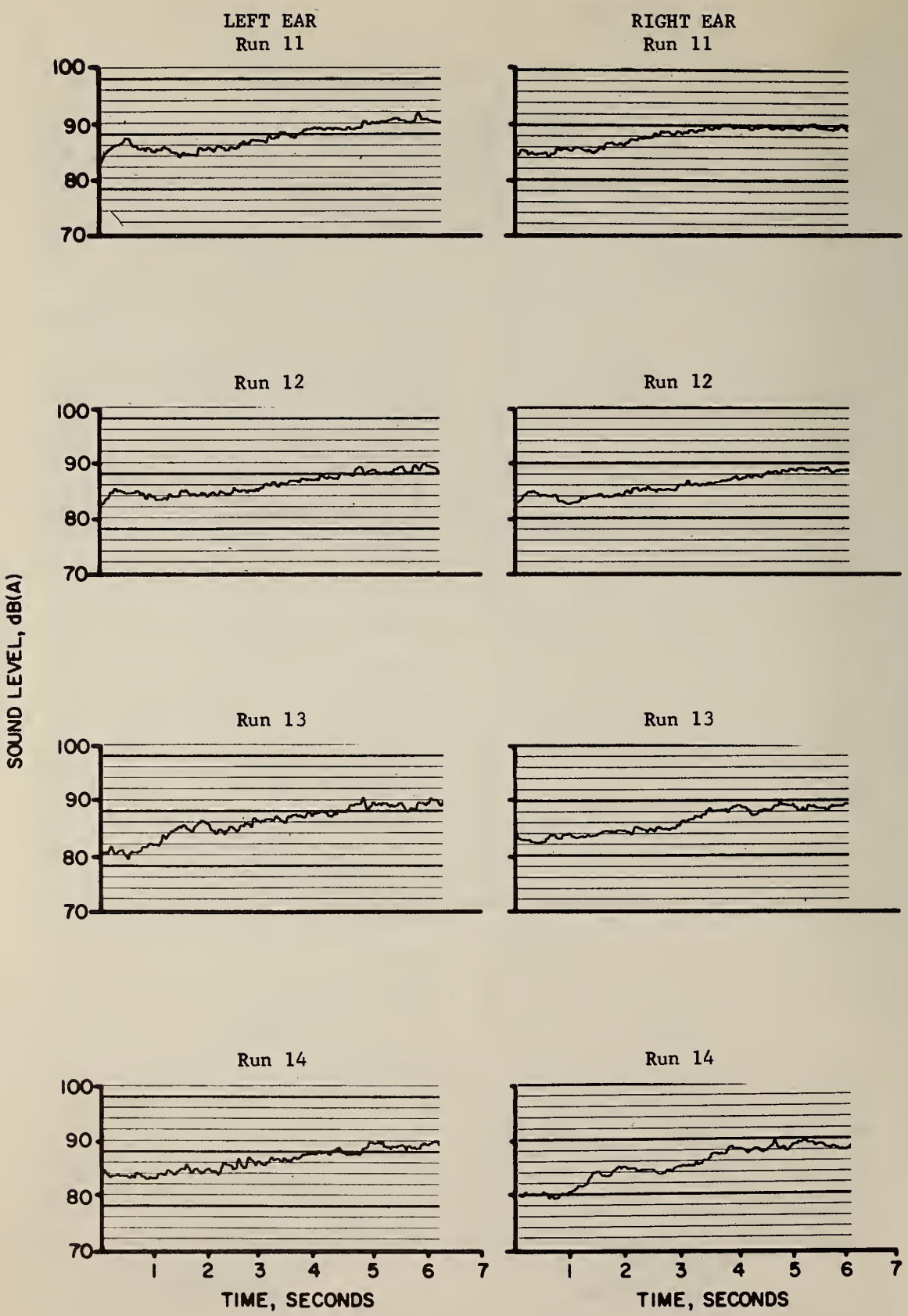

Figure 7-12. Truck 7, Test 4 (with bedding), Runs 11-14. (Interior)

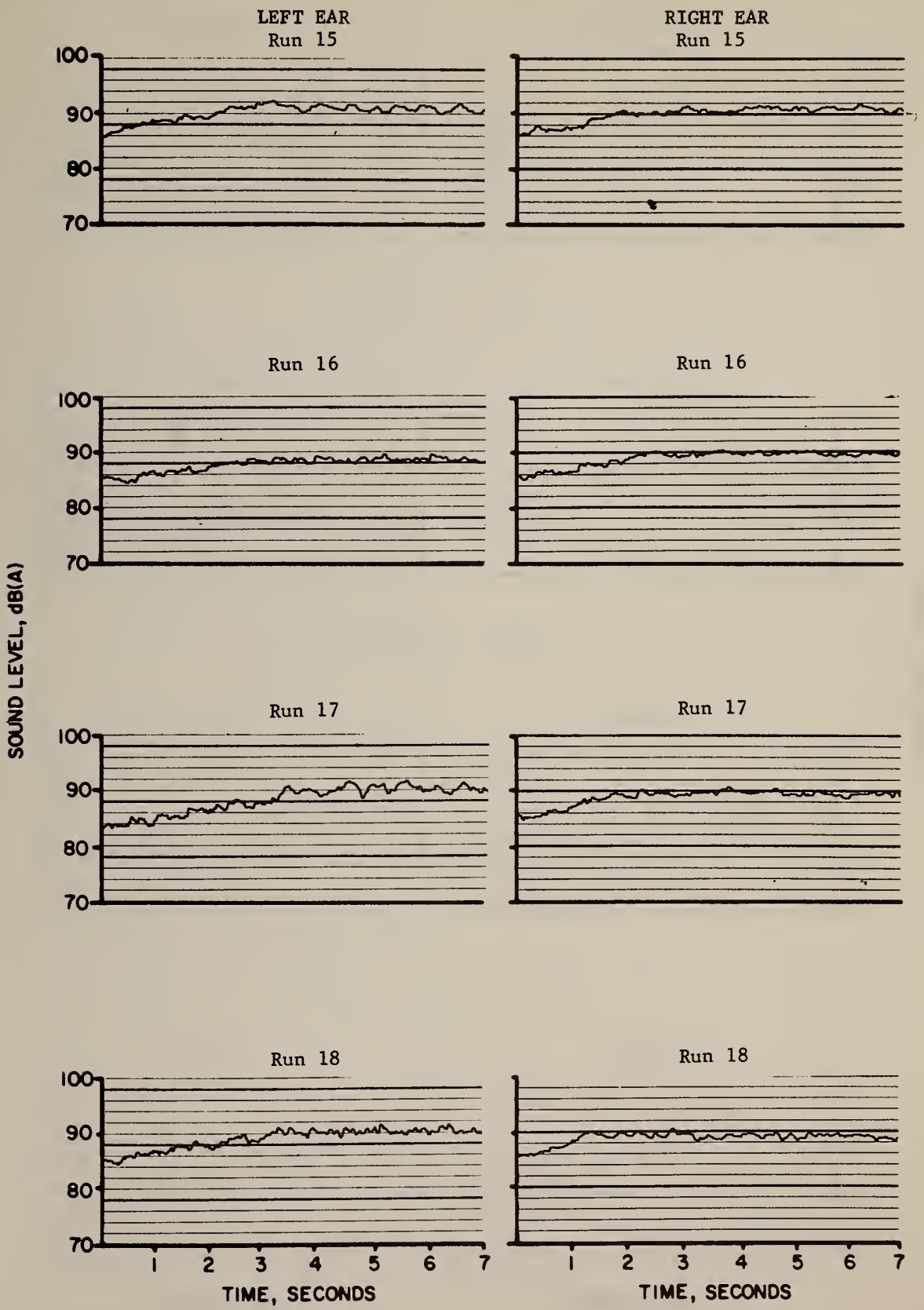

Figure 7-13. Truck 7, Test 4 (without bedding), Runs 15-18. (Interior)

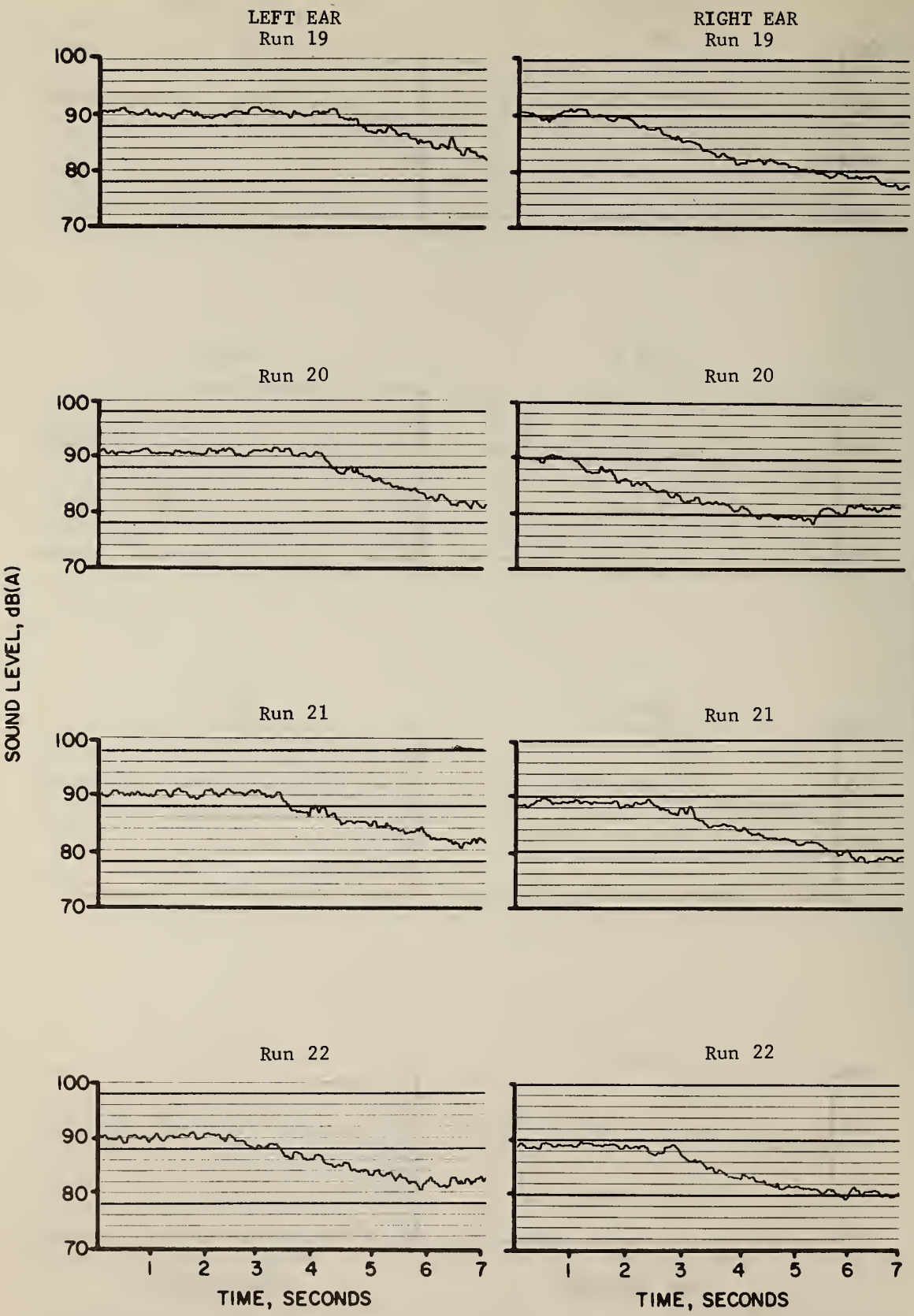

Figure 7-14. Truck 7, Test 5 (with bedding), Runs 19-22 (Interior).

Test Vehicle Number 10

Figure 10-1. Test Vehicle Number 10.

Truck Number: 10
Carrier (owner): Safeway Stores, Inc.
Company Fleet Number: 283B
Make: Freightliner
Model: WFT6364T
Serial Number: CA113HP057327
Year: 1971
Engine Governor Setting: 2600 rpm
Total Miles of Operation: 1,976
Miles Since Last Engine Overhaul: Original engine
Miles Since Any Exhaust Work: Original exhaust system
Engine: Make - Cummins
Model - 903

Exterior

Truck 10

TEST	RUN	SIDE	(WINDOWS)	SOUND LEVEL, dB(A) MICROPHONES					
				1	2	3	4	5	6
1. Low Idle (Stationary)	1	Right	Open	66	66	66	65	65	73
	2	Left	Closed	64	65	66	65	66	73
2. Acceleration (Stationary)	3	Right	Open	88	90	90	88	86	95
	4	Right	Open	88	89	90	88	86	95
	5	Left	Closed	85	86	88	88	89	94
	6	Left	Closed	85	86	88	88	89	94
2. High Idle (Stationary)	3	Right	Open	88	89	90	88	86	94
	4	Right	Open	88	90	90	88	86	94
	5	Left	Closed	84	86	88	90	89	94
	6	Left	Closed	84	86	88	89	89	94
3. City Start Up	7	Right	Open	88	89	87	87	88	93
	8	Right	Open	87	87	87	87	88	93
	9	Left	Closed	88	88	88	87	89	93
	10	Left	Closed	88	89	87	88	89	92
4. J366 (Acceleration)	11	Right	Open	87	88	88	88	89	94
	12	Right	Open	87	88	88	88	89	95
	13	Left	Closed	89	89	89	88	86	94
	14	Left	Closed	88	89	89	88	87	94
5. J366 (Deceleration)	15	Right	Open	88	88	87	86	86	92
	16	Right	Open	88	88	89	88	86	94
	17	Left	Closed	86	88	88	88	89	93
	18	Left	Closed	86	87	88	89	89	93

Table 10-1. Maximum A-weighted sound levels as measured at the six exterior microphone locations for all test runs for vehicle number 10.

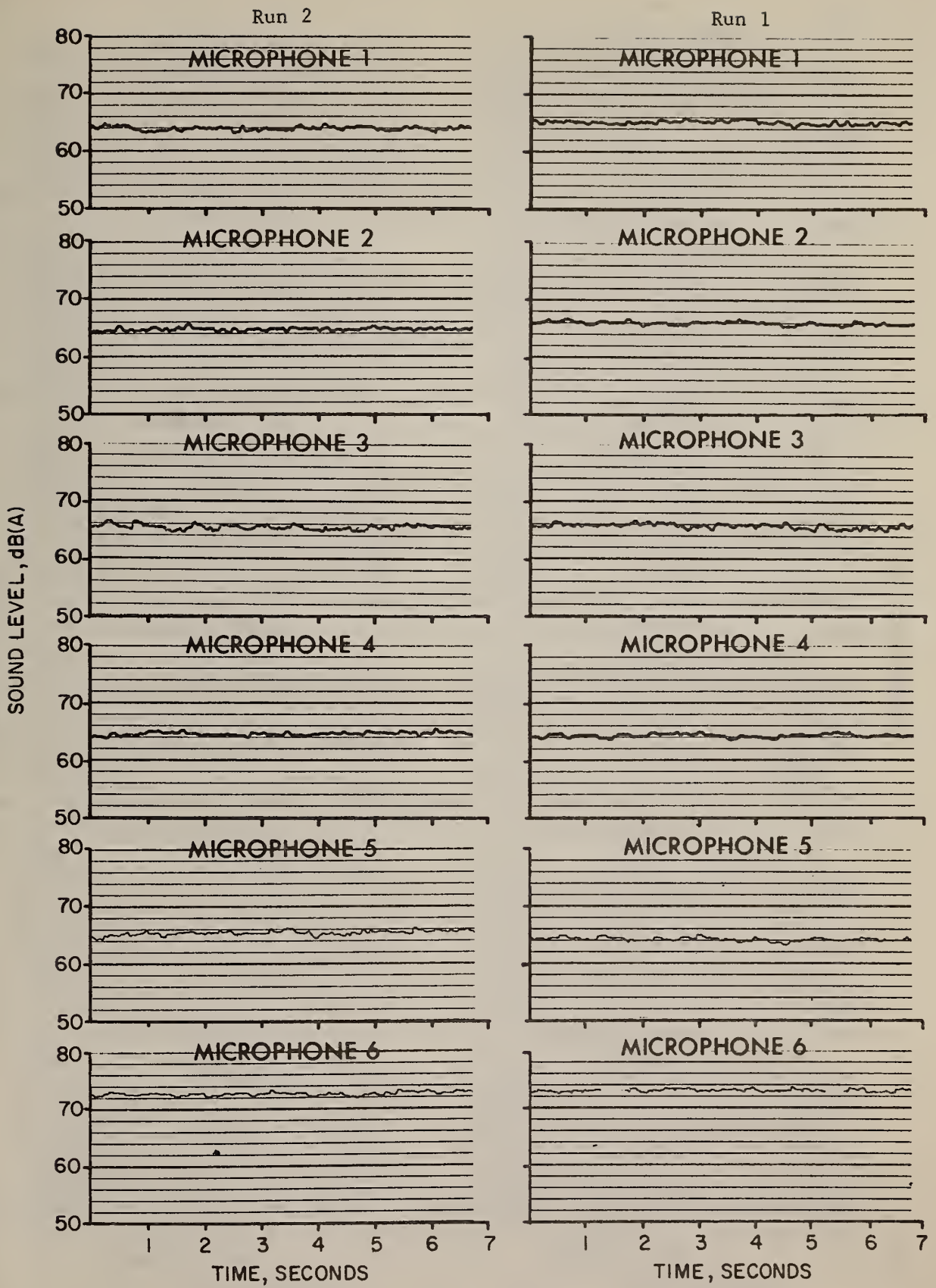

Figure 10-2. Truck 10, Test 1, Runs 1,2. (Exterior)

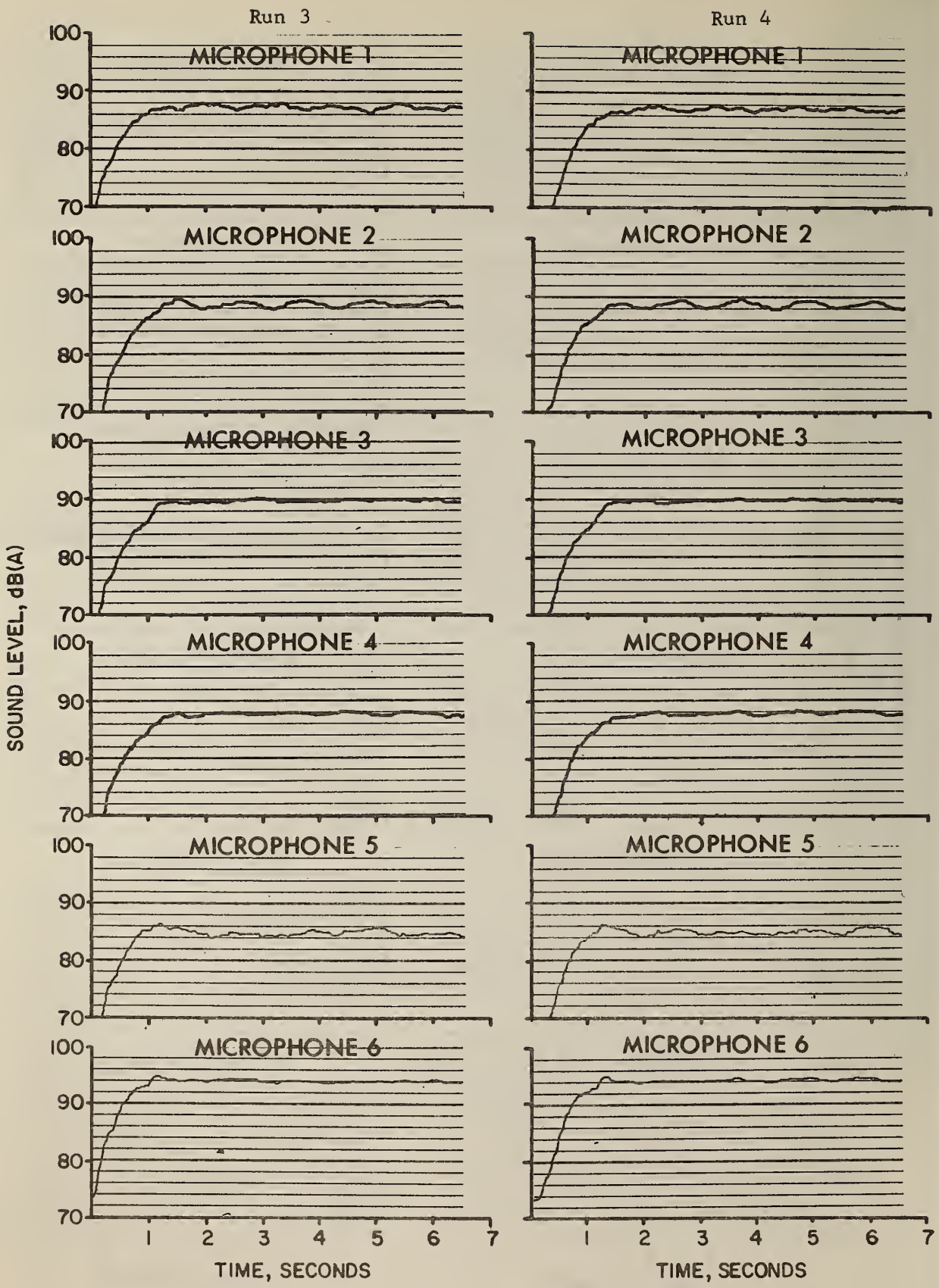

Figure 10-3. Truck 10, Test 2, Runs 3,4. (Exterior)

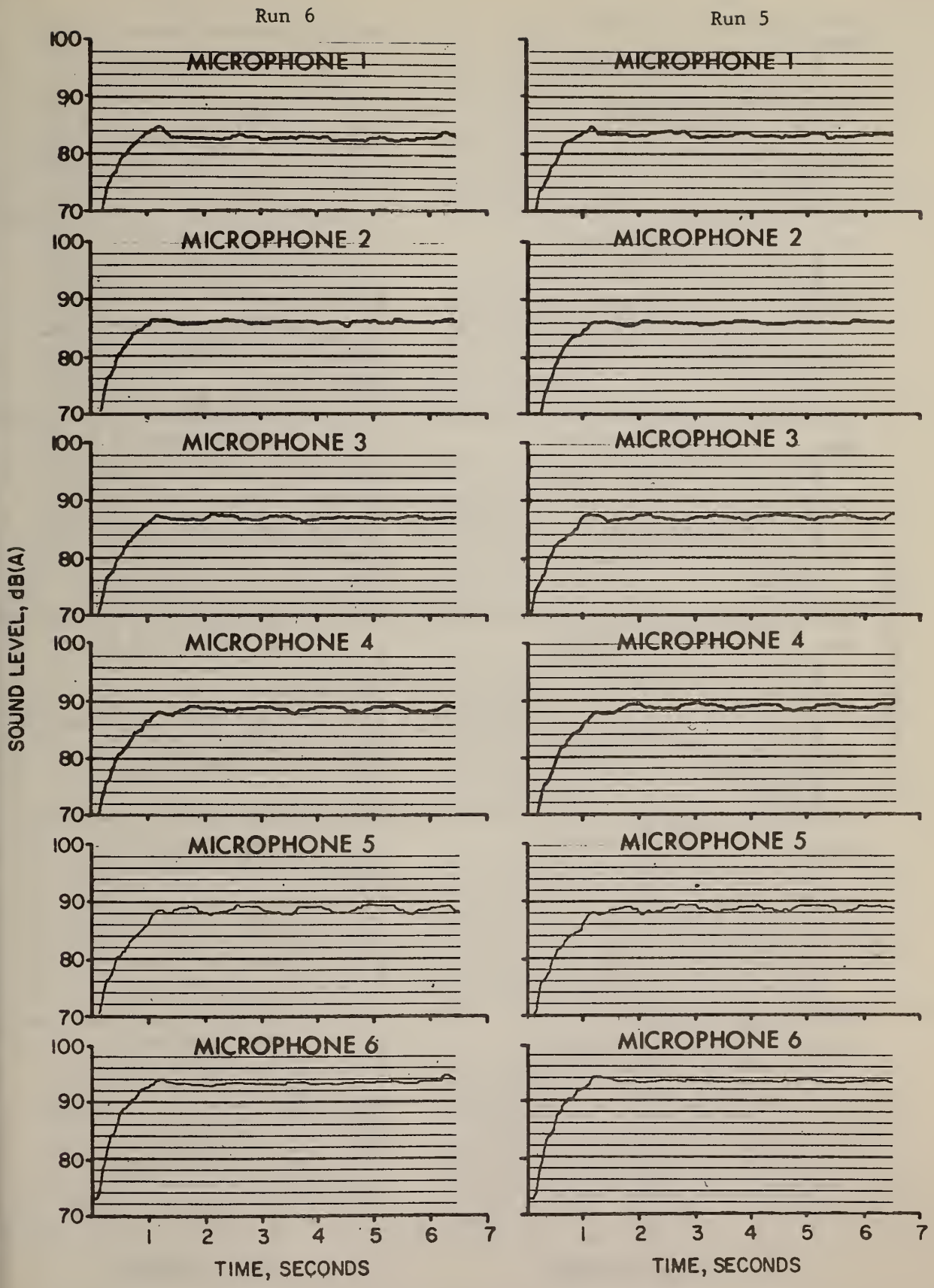

Figure 10-4. Truck 10, Test 2, Runs 5,6. (Exterior)

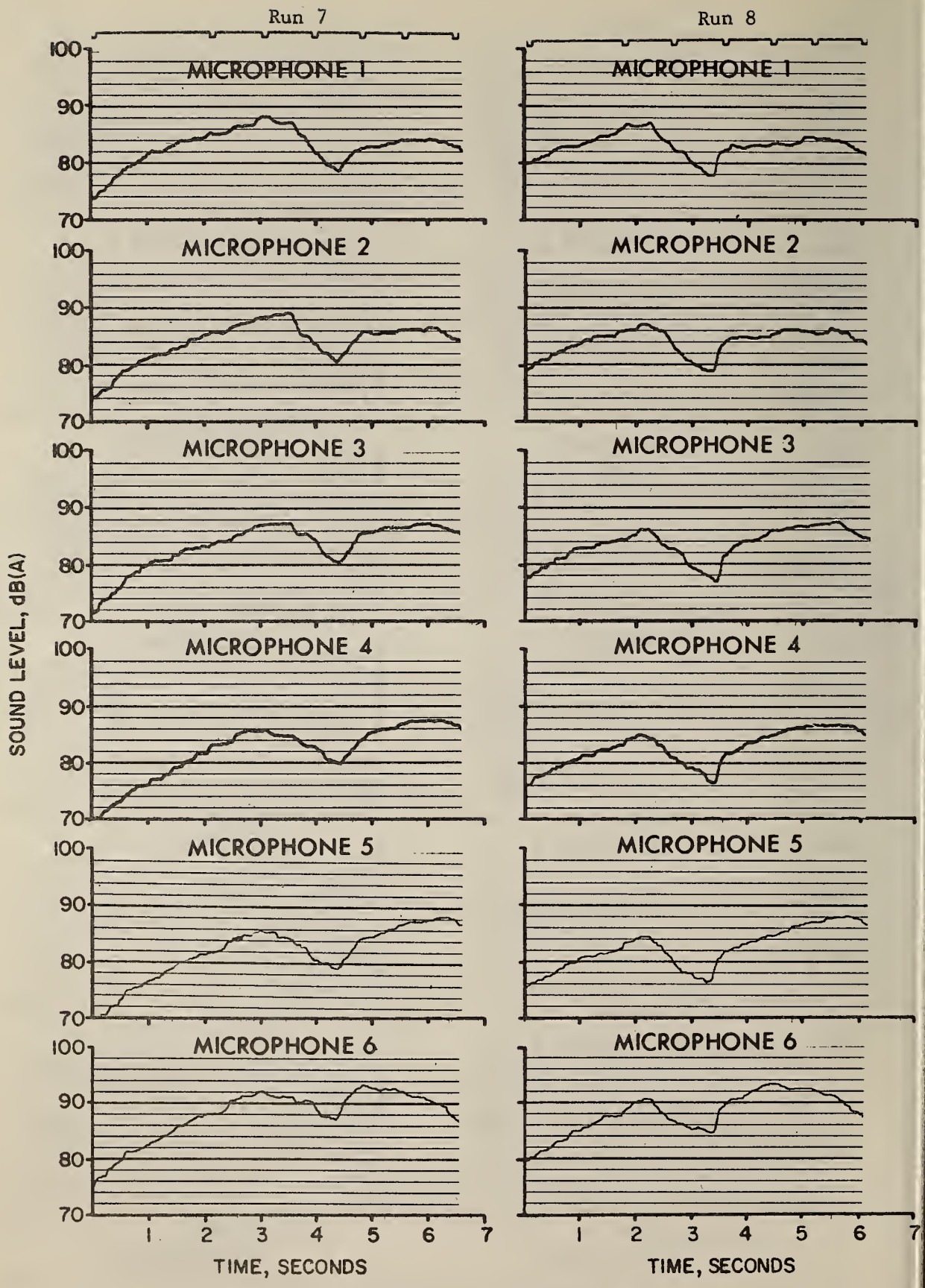

Figure 10-5. Truck 10, Test 3, Runs 7,8. (Exterior)

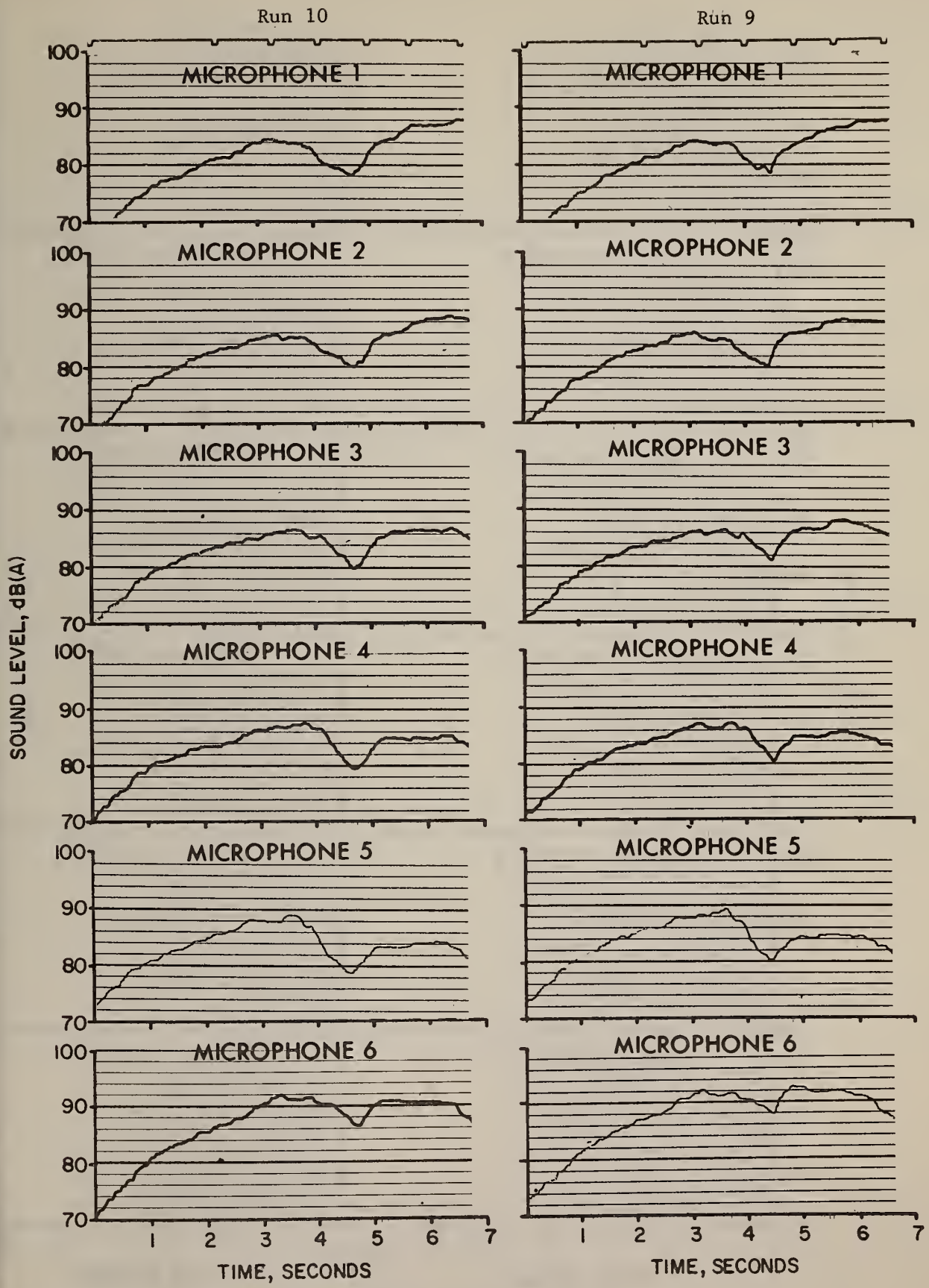

Figure 10-6. Truck 10, Test 3, Runs 9,10. (Exterior)

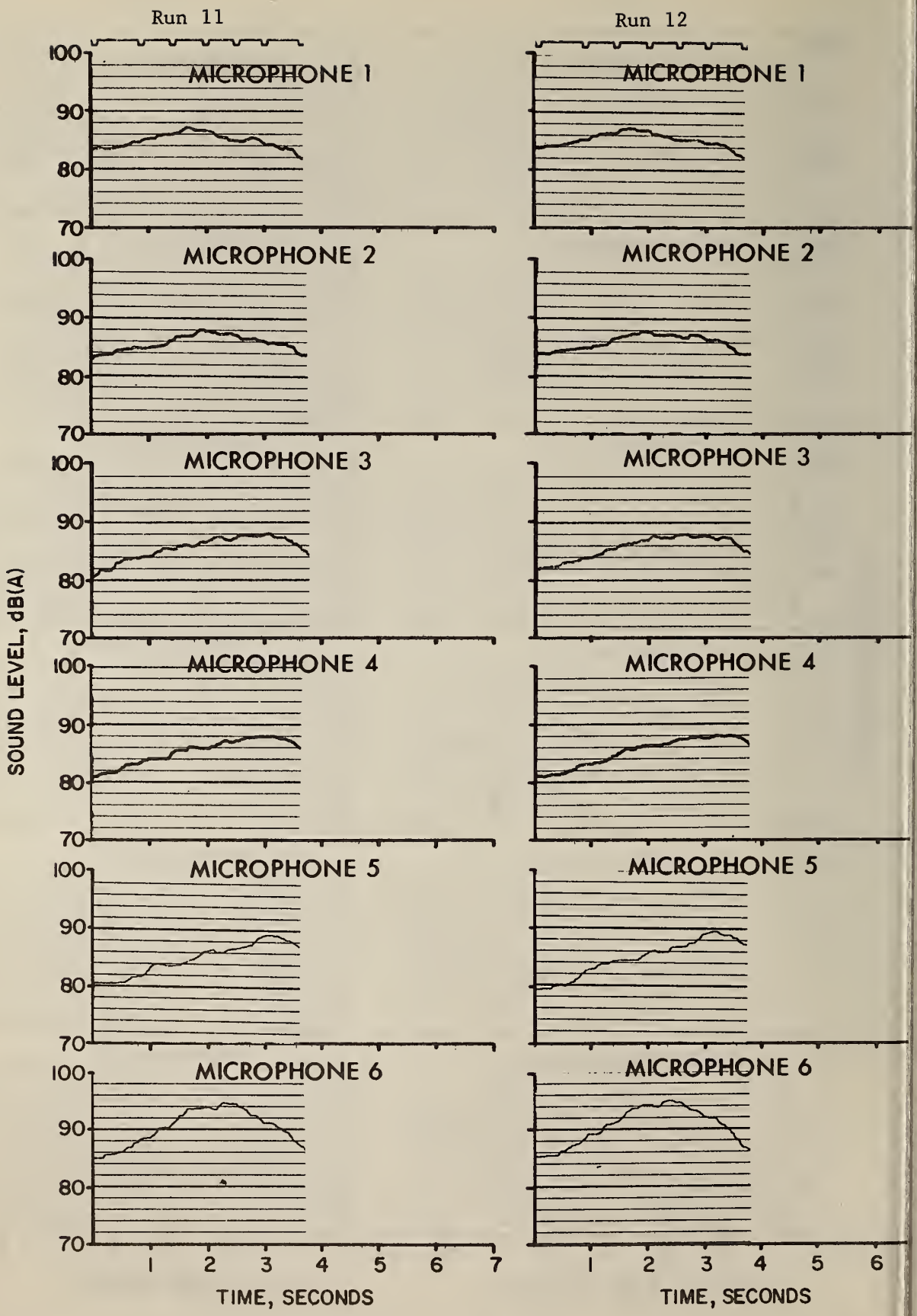

Figure 10-7. Truck 10, Test 4, Runs 11,12. (Exterior)

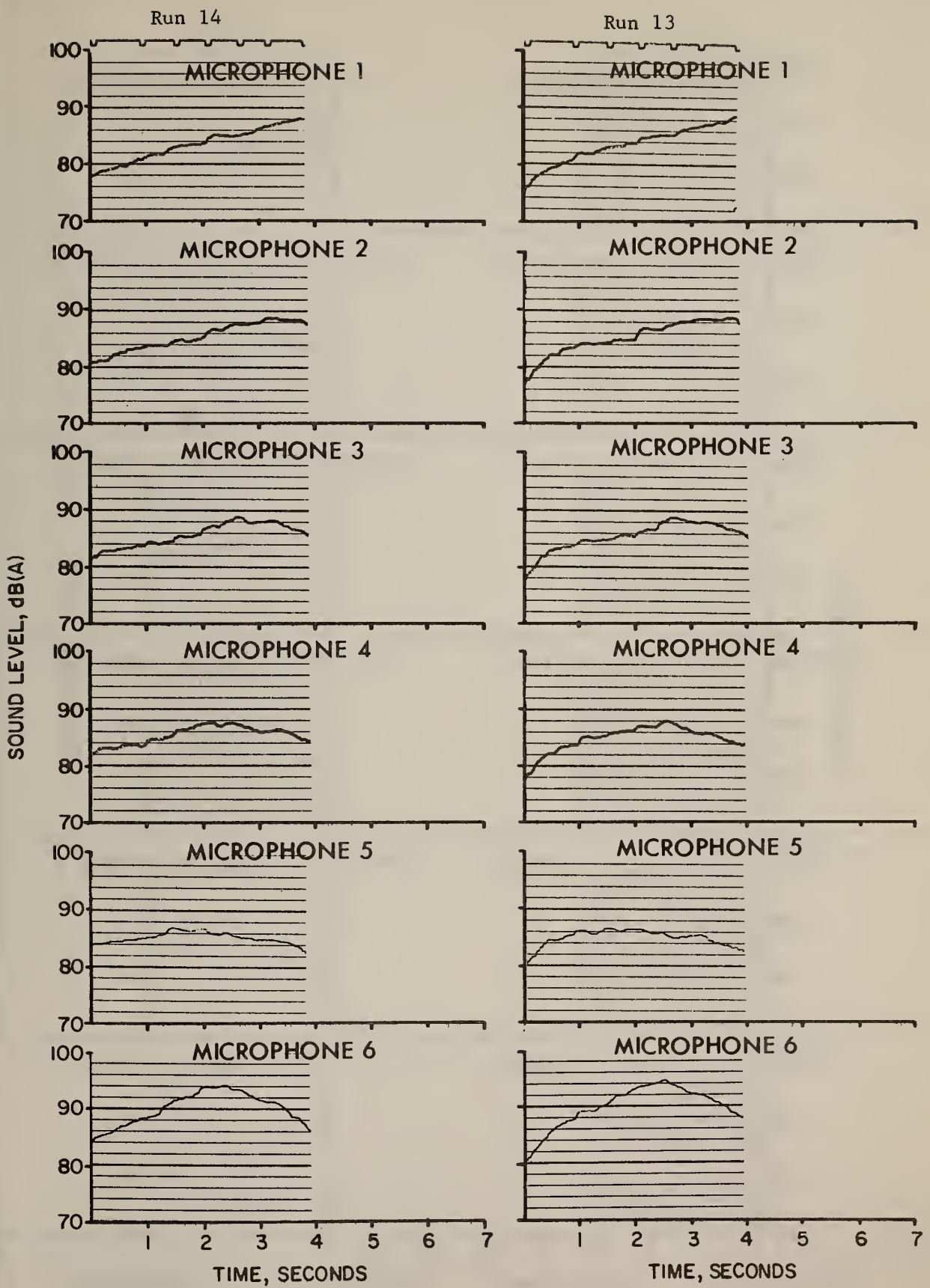

Figure 10-8. Truck 10, Test 4, Runs 13,14. (Exterior)

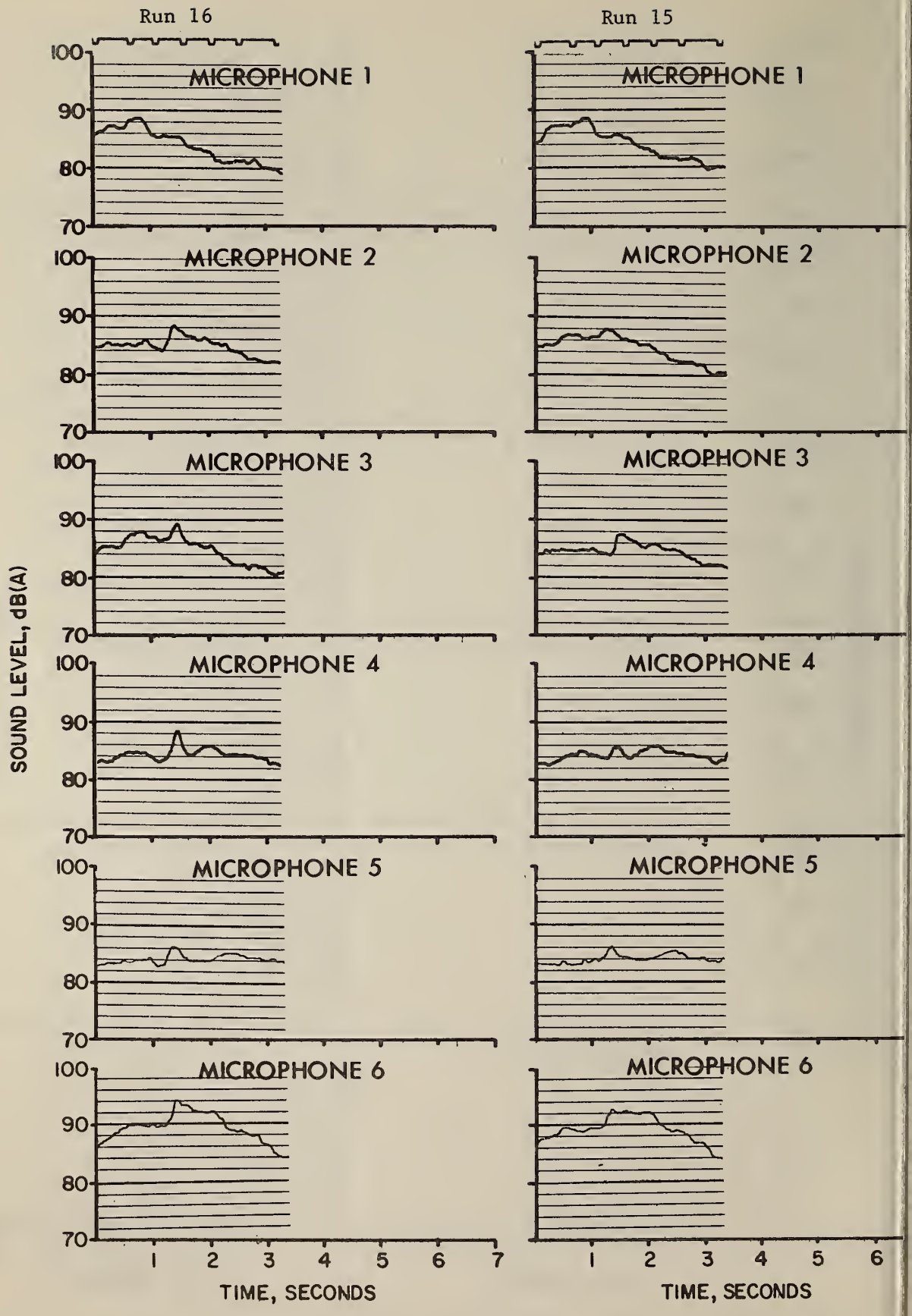

Figure 10-9. Truck 10, Test 5, Runs 15,16. (Exterior)

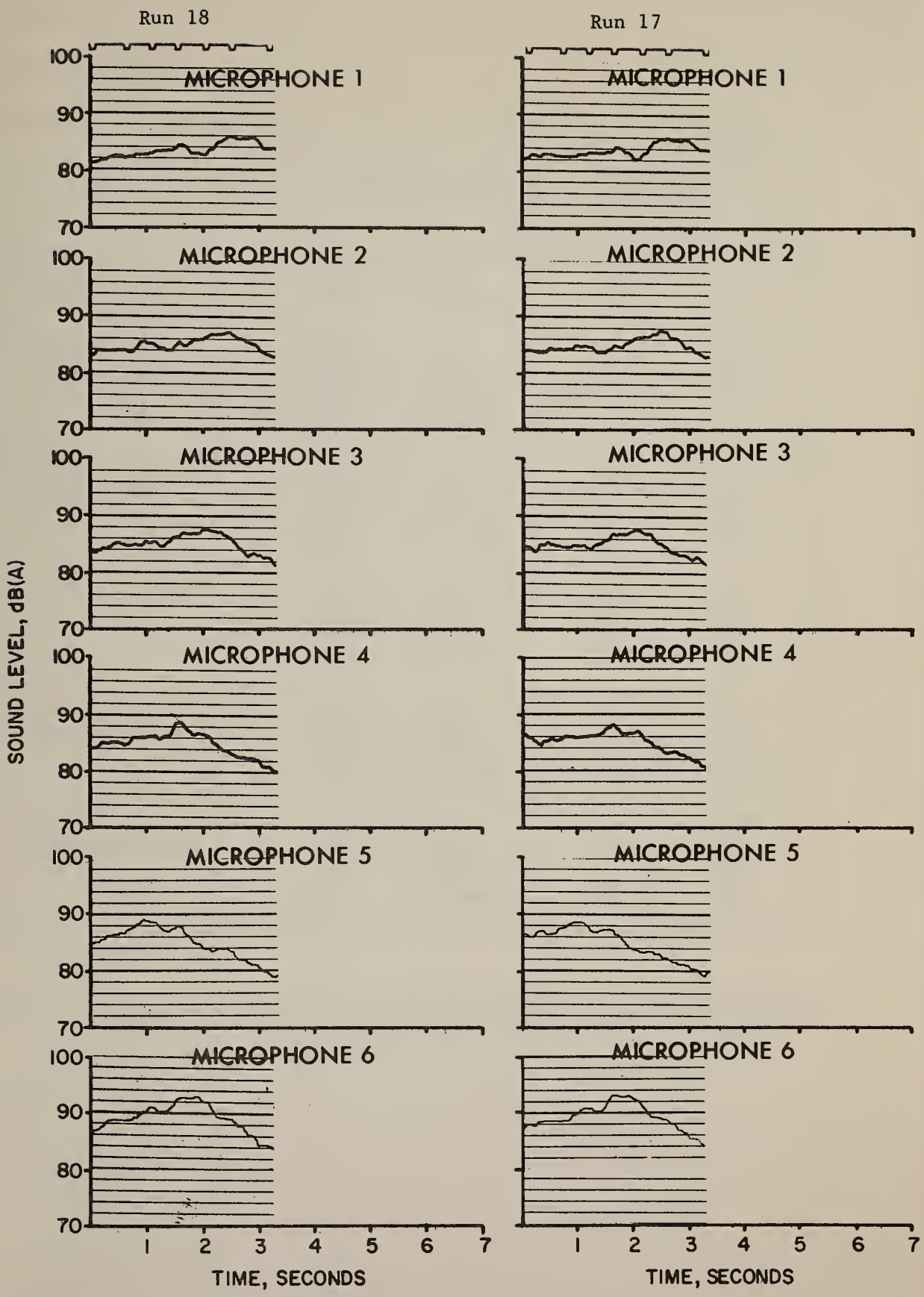

Figure 10-10. Truck 10, Test 5, Runs 17,18. (Exterior)

Interior

Truck 10

TEST	RUN	(SIDE)	WINDOWS	SOUND LEVEL, dB(A) MICROPHONES	
				LEFT EAR	RIGHT EAR
1. Low Idle (Stationary)	1	Right	Open	72	71
	2	Left	Closed	70	69
2. Acceleration (Stationary)	3	Right	Open	95	89
	4	Right	Open	95	90
	5	Left	Closed	91	87
	6	Left	Closed	90	87
2. High Idle (Stationary)	3	Right	Open	91	89
	4	Right	Open	91	90
	5	Left	Closed	91	88
	6	Left	Closed	91	88
3. City Start Up	7	Right	Open	94	89
	8	Right	Open	95	89
	9	Left	Closed	90	87
	10	Left	Closed	90	87
4. J366 (Acceleration)	11	Right	Open	94	90
	12	Right	Open	94	90
	13	Left	Closed	90	87
	14	Left	Closed	90	87
5. J366 (Deceleration)	15	Right	Open	95	88
	16	Right	Open	94	88
	17	Left	Closed	90	88
	18	Left	Closed	90	88

Table 10-2. Maximum A-weighted sound levels as measured at the two interior microphone locations for all test runs for vehicle number 10.

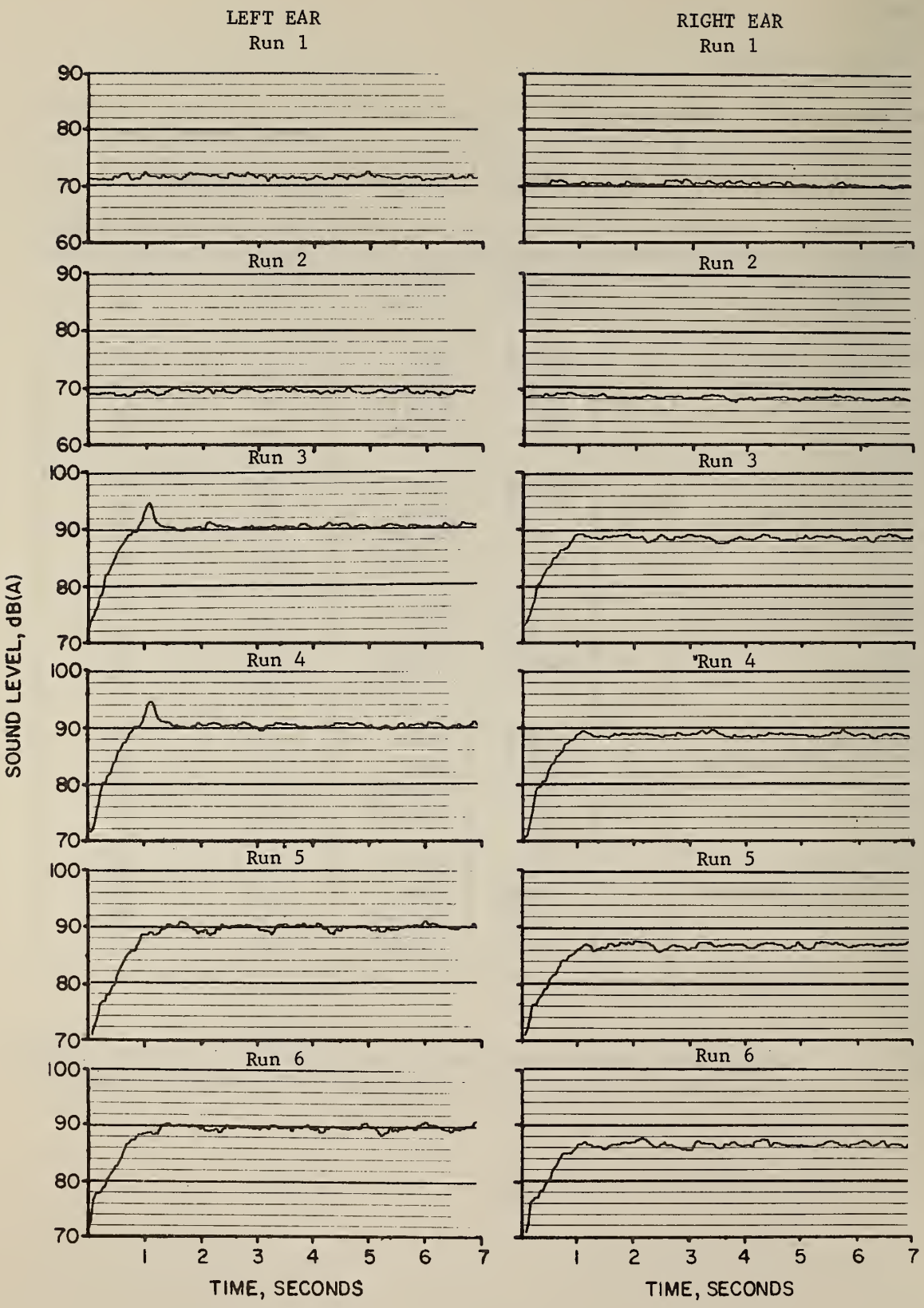

Figure 10-11. Truck 10, Tests 1,2, Runs 1-6. (Interior)

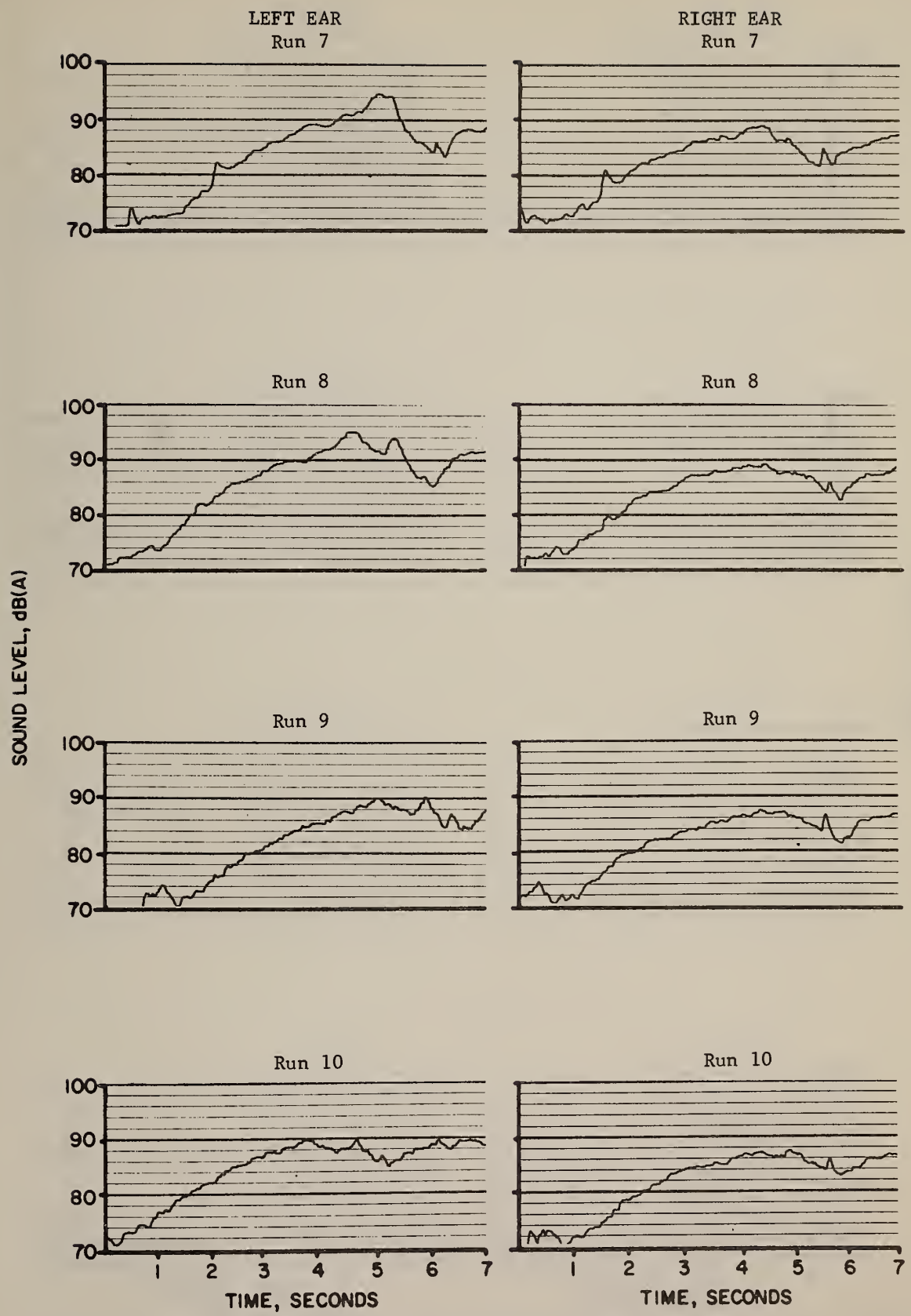

Figure 10-12. Truck 10, Test 3, Runs 7-10. (Interior)

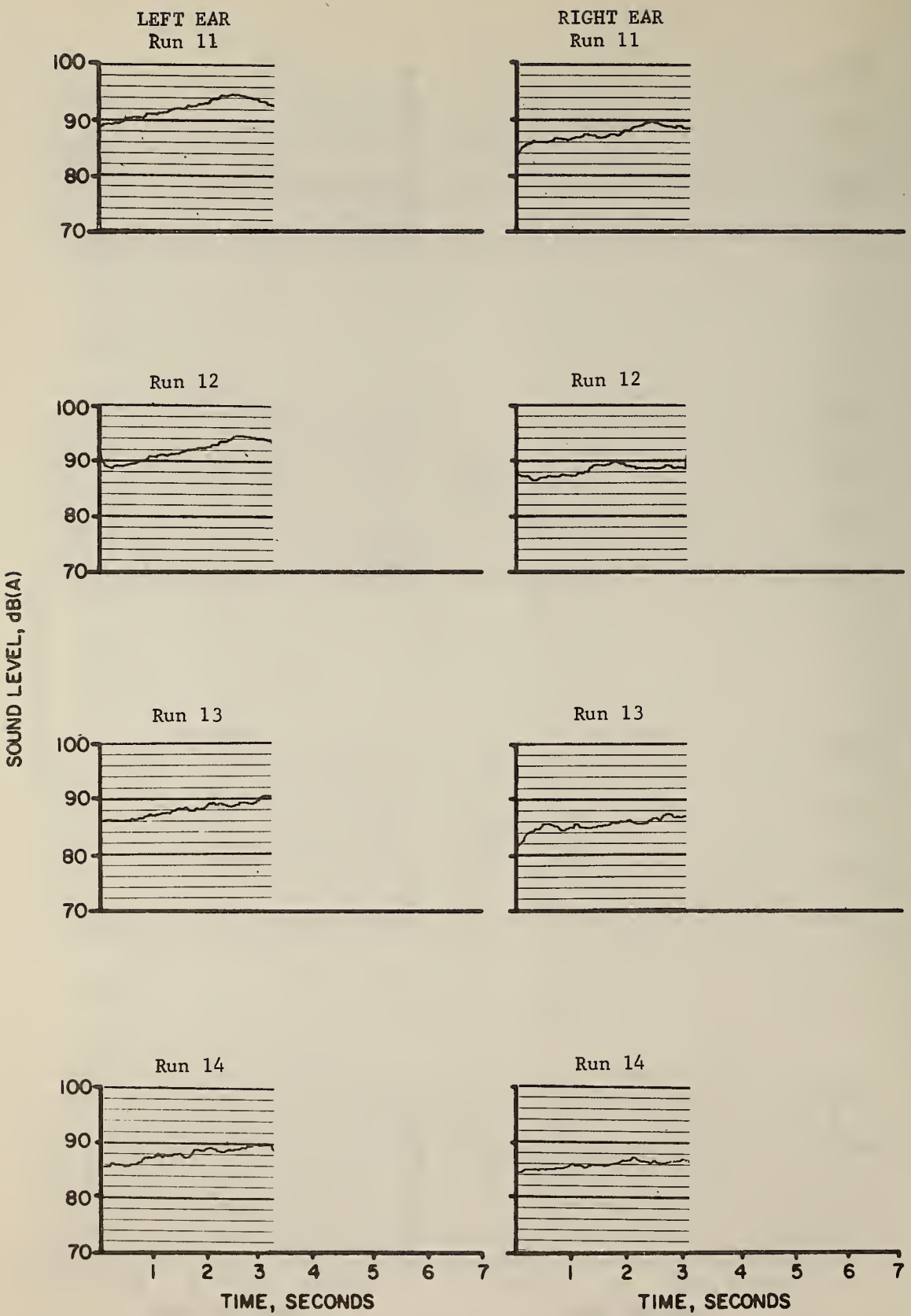

Figure 10-13. Truck 10, Test 4, Runs 11-14. (Interior)

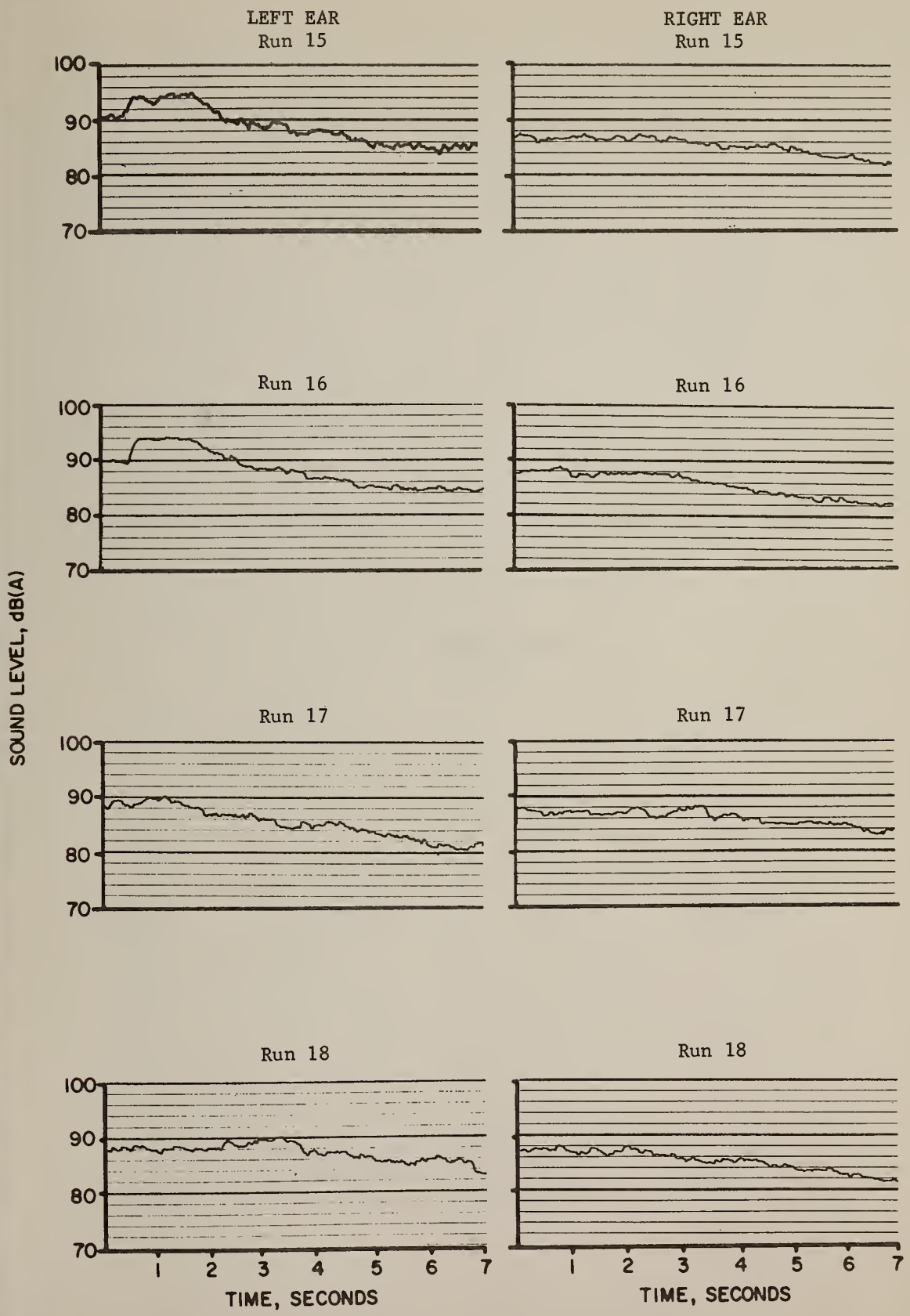

Figure 10-14. Truck 10, Test 5, Runs 15-18. (Interior)

Test Vehicle Number 11

Figure 11-1. Test Vehicle Number 11.

Truck Number: 11
Carrier (owner): Safeway Stores, Inc.
Company Fleet Number: 133B
Make: Peterbilt
Model: 352ST
Serial Number: 24818
Year: 1967
Engine Governor Setting: 2100 rpm
Total Miles of Operation: 205,727
Miles Since Last Engine Overhaul: 4,063
Miles Since Any Exhaust Work: Original exhaust system
Engine: Make - Cummins
Model - NHC 250

Exterior

Truck 11

TEST	RUN	SIDE	(WINDOWS)	SOUND LEVEL, dB(A) MICROPHONES					
				1	2	3	4	5	6
1. Low Idle (Stationary)	1	Right	Open	65	66	65	65	65	71
	2	Left	Closed	64	64	65	65	65	71
2. Acceleration (Stationary)	3	Right	Open	86	86	87	86	85	93
	4	Right	Open	86	86	86	86	86	93
	5	Left	Closed	85	85	86	86	86	92
	6	Left	Closed	85	85	85	86	86	92
2. High Idle (Stationary)	3	Right	Open	84	85	85	84	83	91
	4	Right	Open	84	85	85	84	84	91
	5	Left	Closed	84	83	84	85	85	89
	6	Left	Closed	84	83	83	85	85	89
3. City Start Up	7	Right	Open	85	85	85	85	86	91
	8	Right	Open	86	86	85	85	85	89
	9	Left	Closed	85	85	85	86	86	90
	10	Left	Closed	85	85	85	86	86	90
4. J366 (Acceleration)	11	Right	Open	86	86	86	87	86	92
	12	Right	Open	87	86	87	86	85	93
	13	Left	Closed	86	86	86	86	86	92
	14	Left	Closed	85	86	86	86	87	92
5. J366 (Deceleration)	15	Right	Open	85	83	83	83	83	89
	16	Right	Open	85	83	83	83	83	89
	17	Left	Closed	82	83	84	83	84	88
	18	Left	Closed	83	82	84	84	84	88

Table 11-1. Maximum A-weighted sound levels as measured at the six exterior microphone locations for all test runs for vehicle number 11.

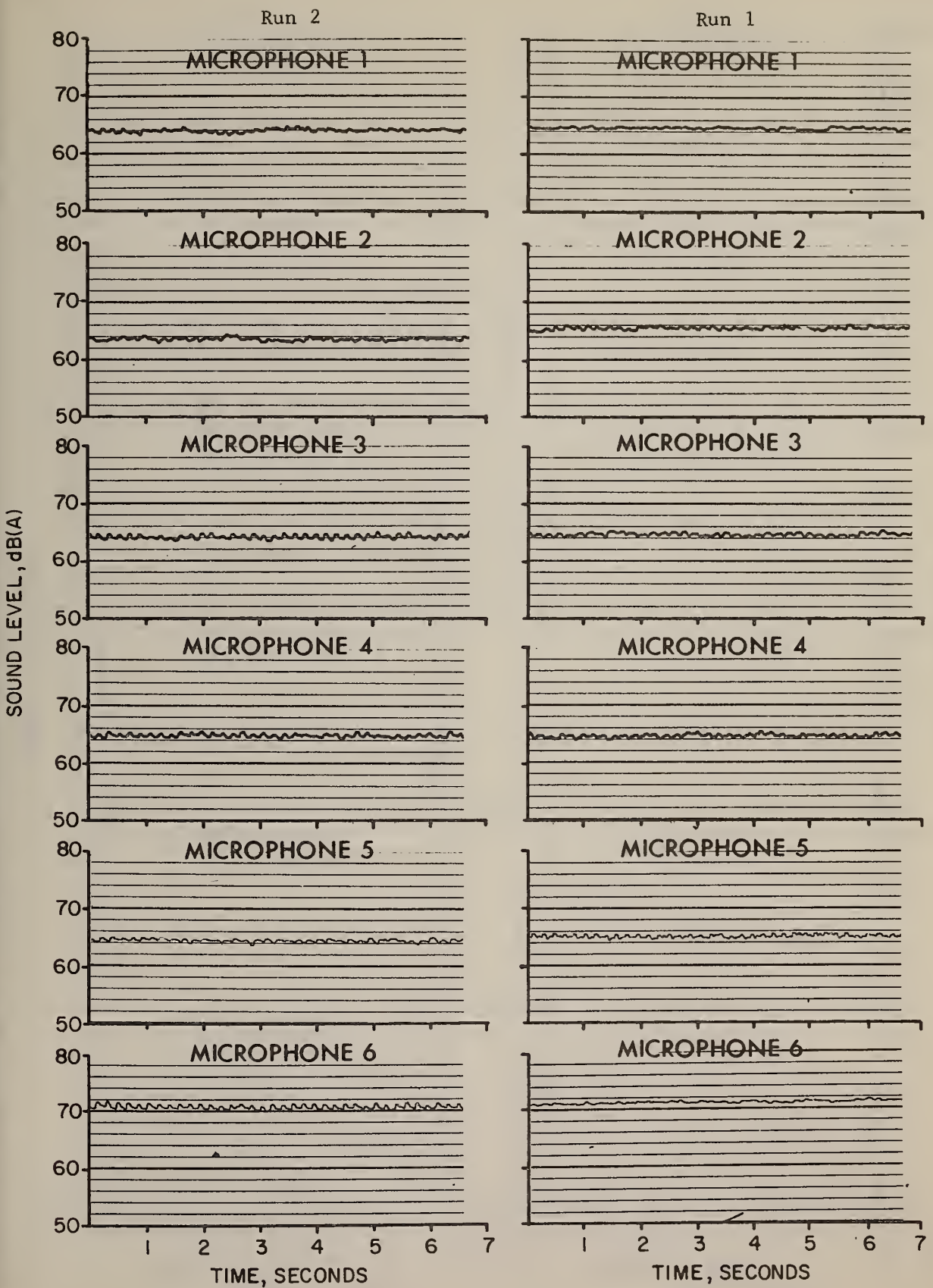

Figure 11-2. Truck 11, Test 1, Runs 1,2. (Exterior)

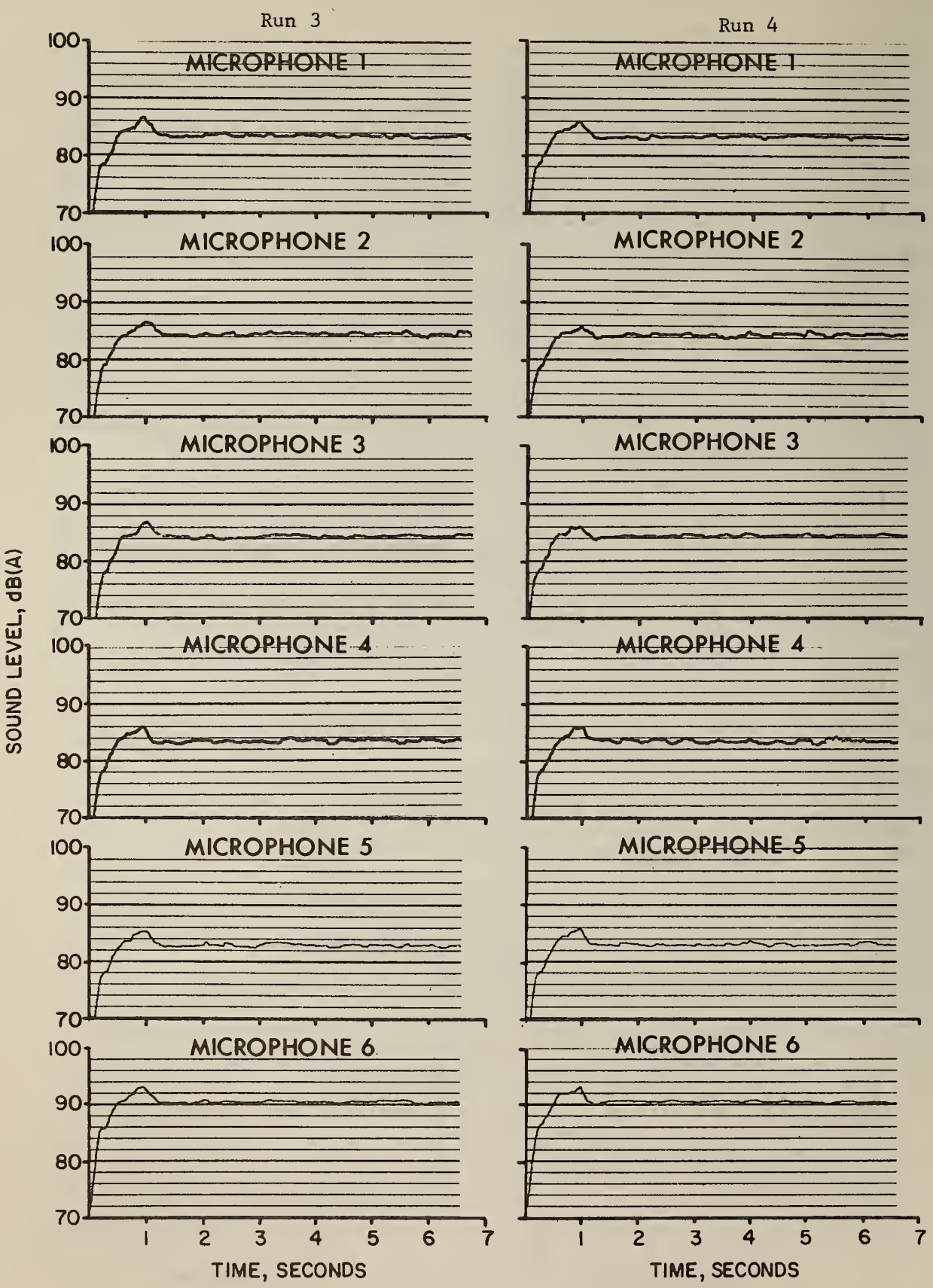

Figure 11-3. Truck 11, Test 2, Runs 3,4. (Exterior)

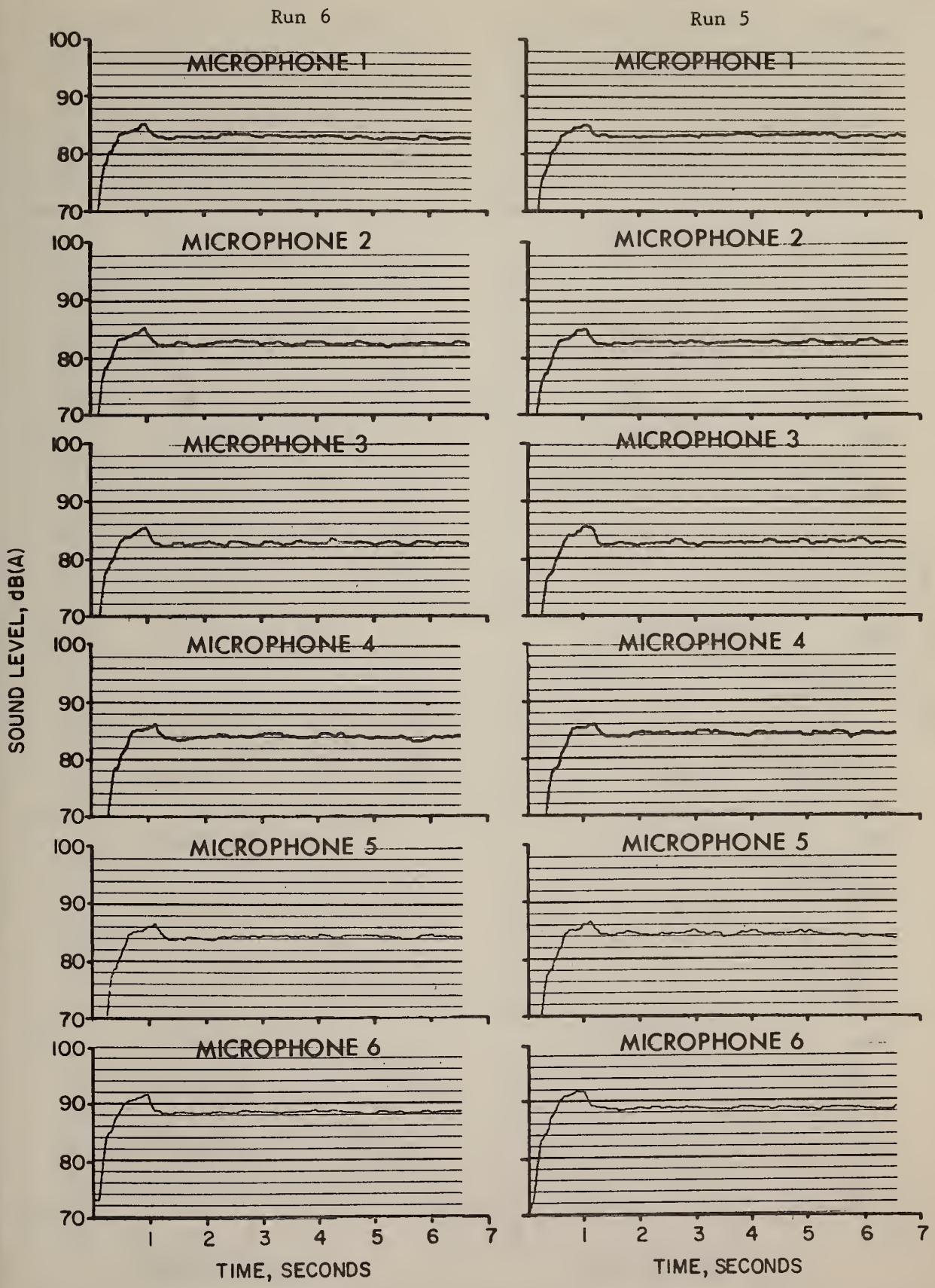

Figure 11-4. Truck 11, Test 2, Runs 5,6. (Exterior)

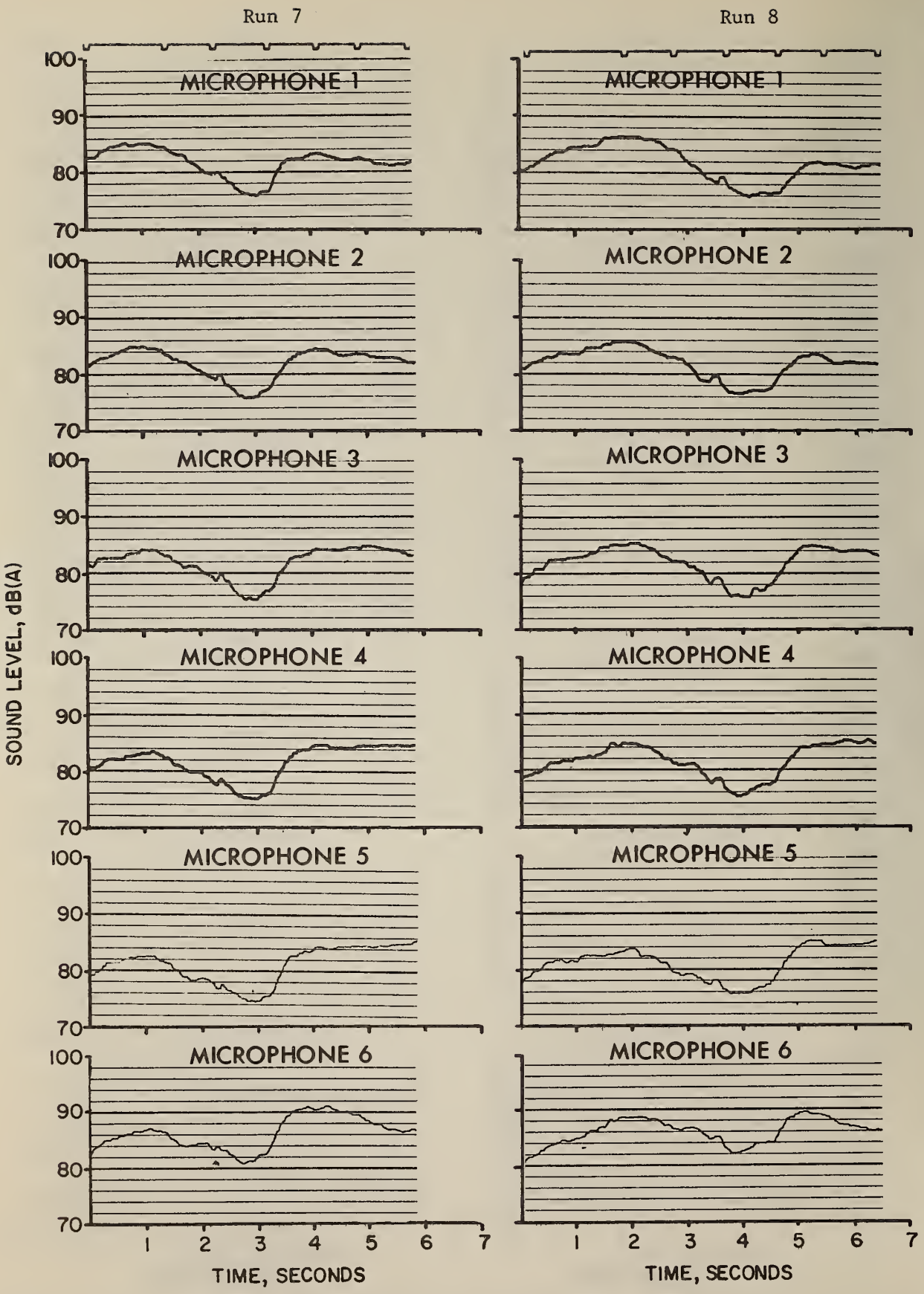

Figure 11-5. Truck 11, Test 3, Runs 7,8. (Exterior)

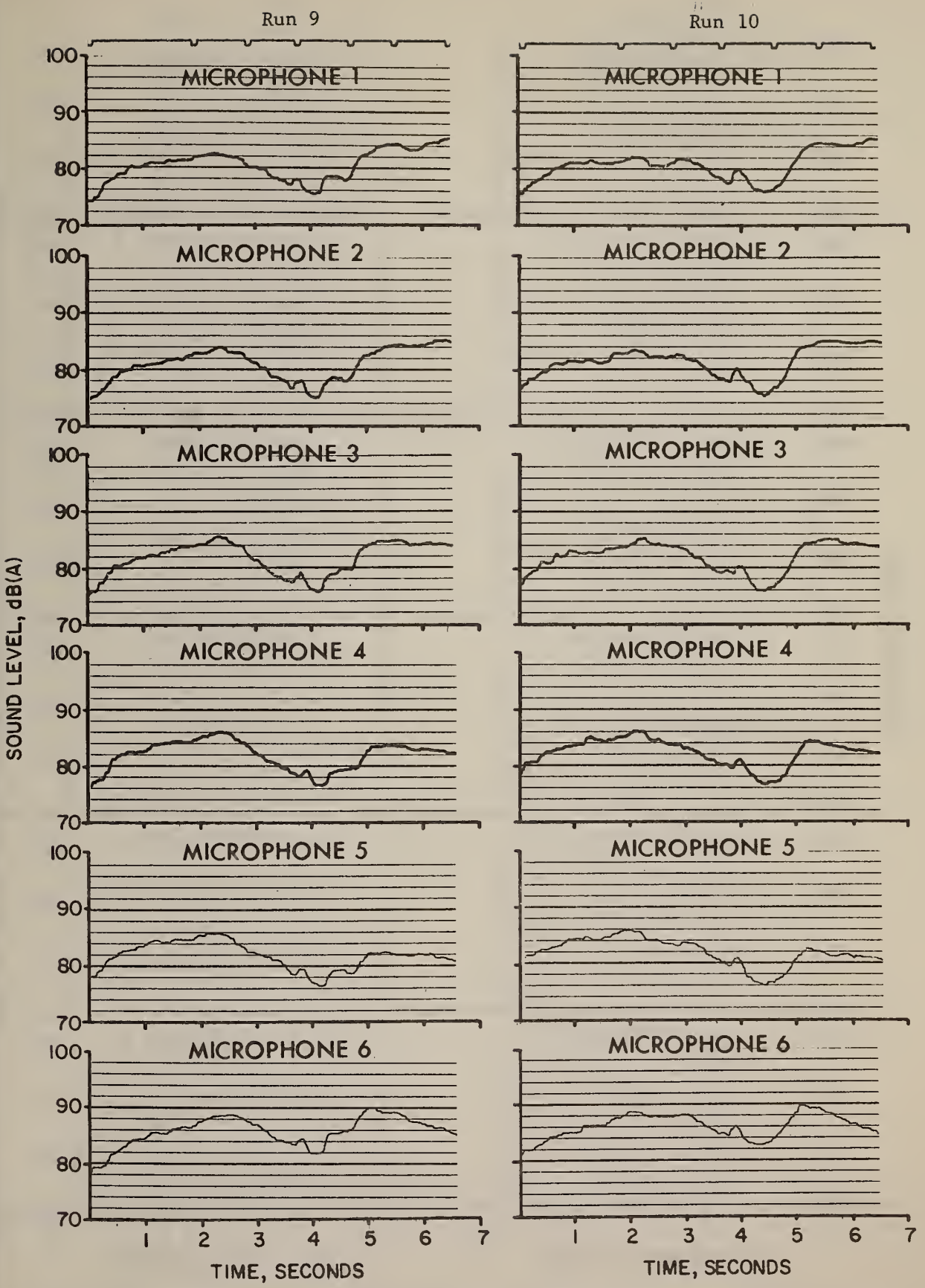

Figure 11-6. Truck 11, Test 3, Runs 9,10. (Exterior)

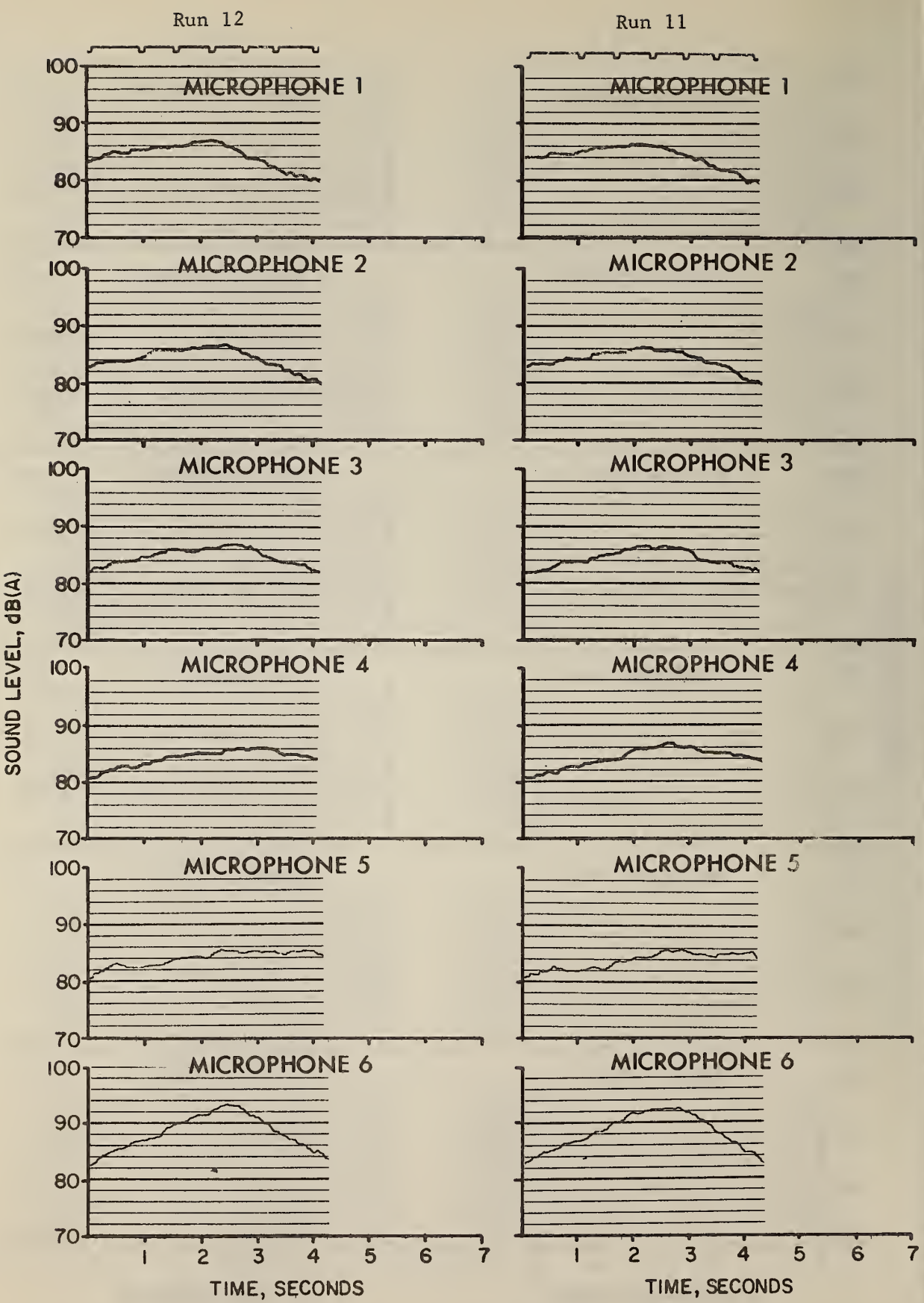

Figure 11-7. Truck 11, Test 4, Runs 11,12. (Exterior)

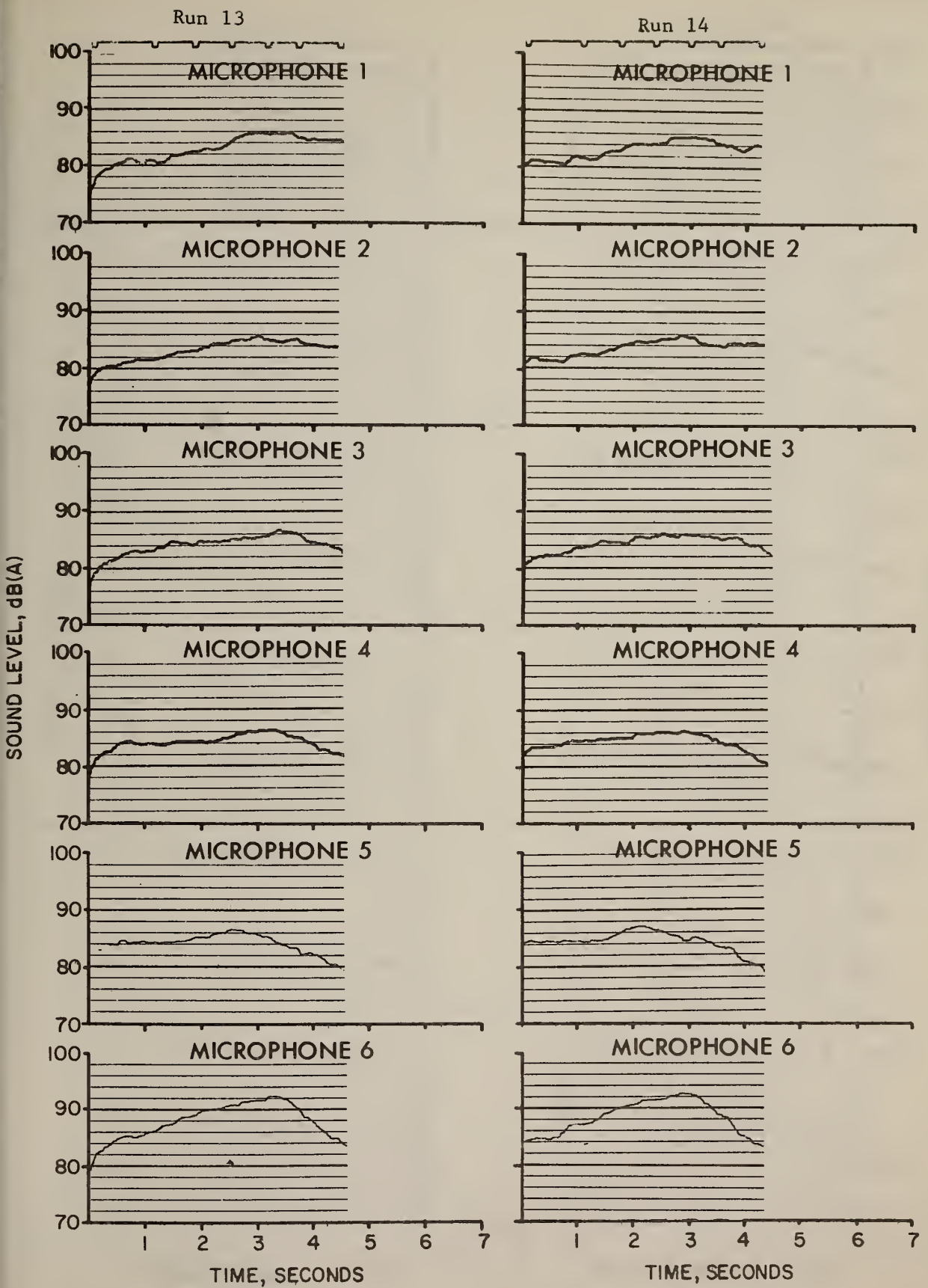

Figure 11-8. Truck 11, Test 4, Runs 13,14. (Exterior)

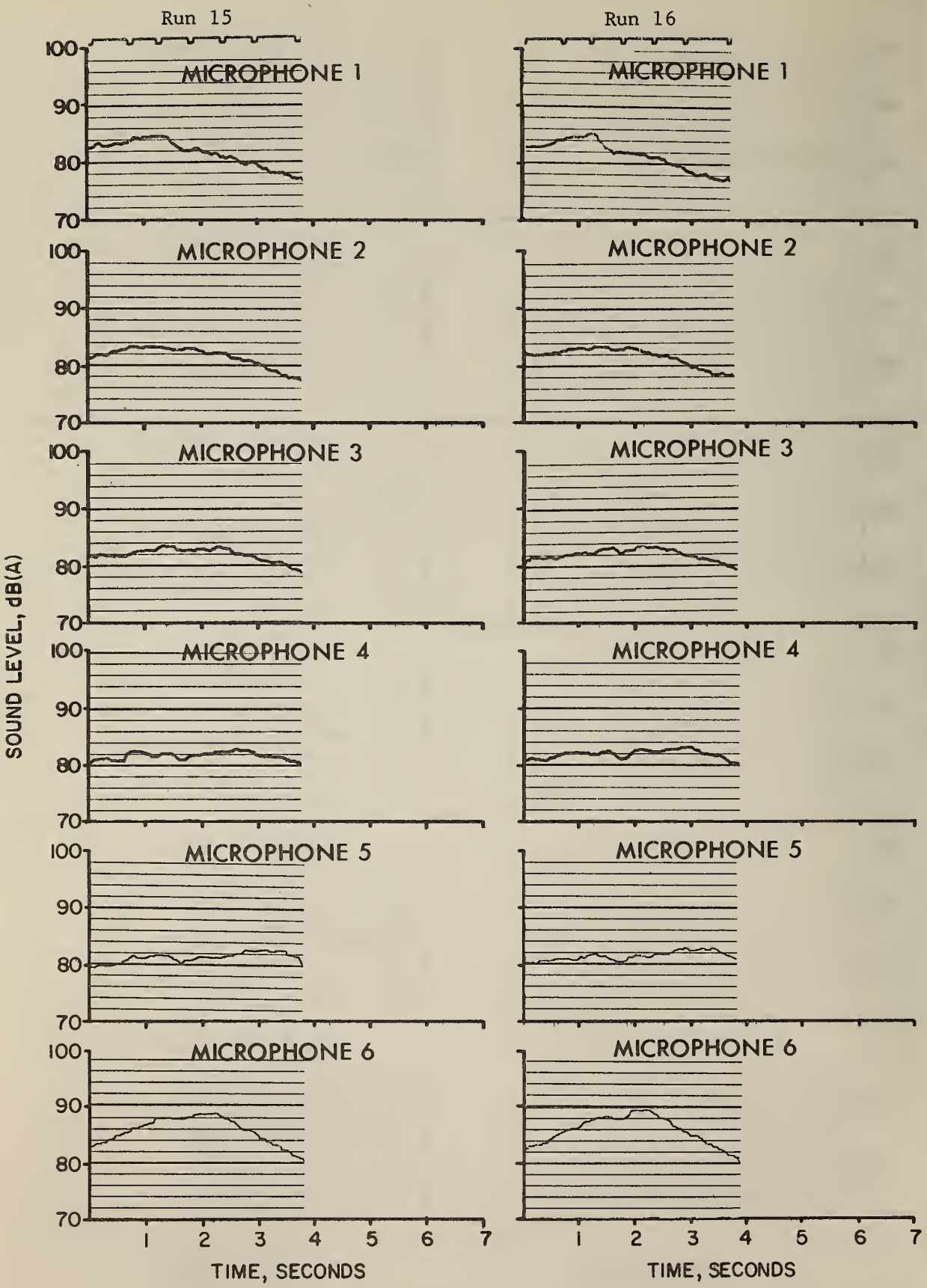

Figure 11-9. Truck 11, Test 5, Runs 15,16. (Exterior)

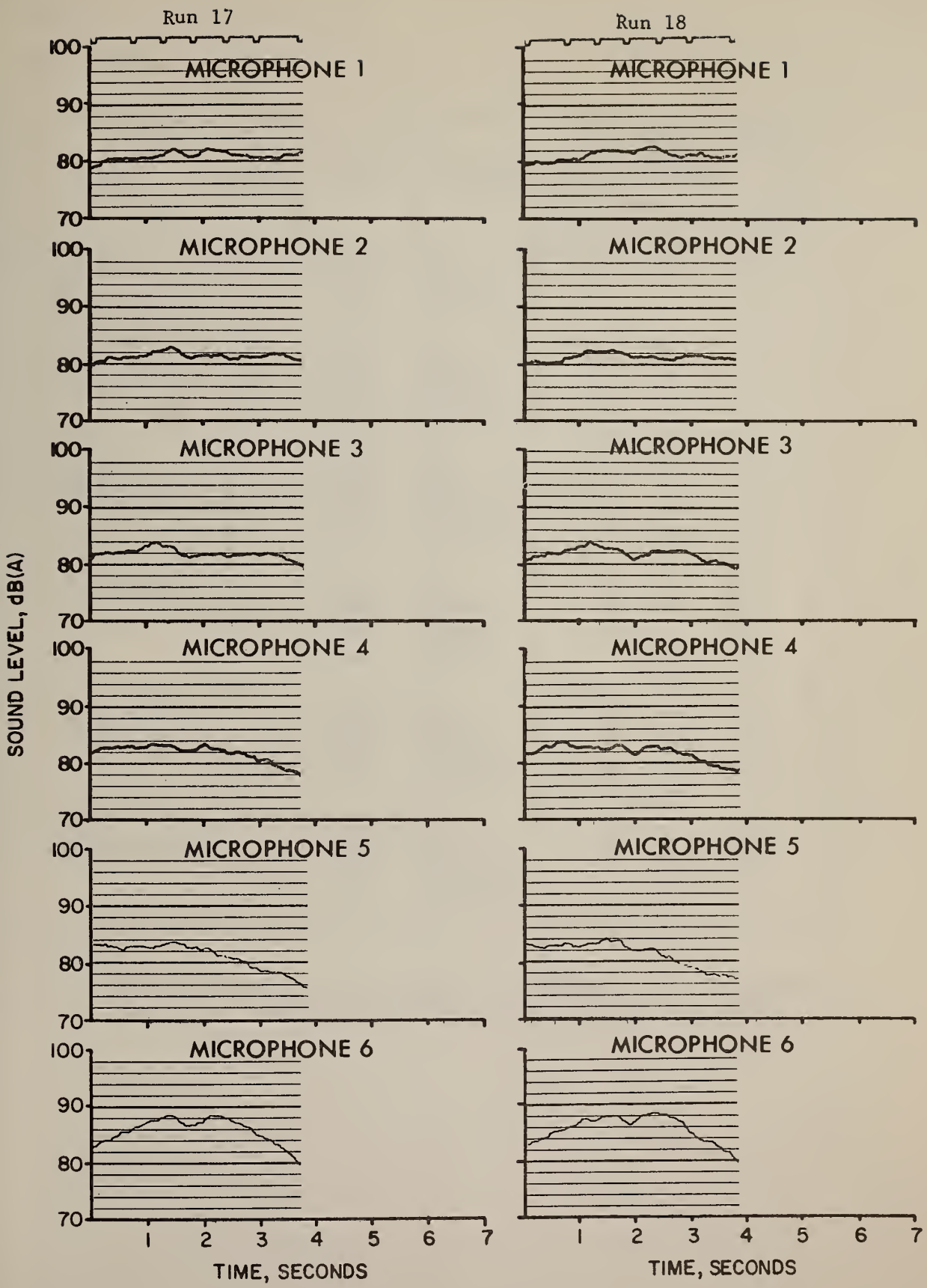

Figure 11-10. Truck 11, Test 5, Runs 17,18. (Exterior)

Interior

Truck 11

TEST	RUN	(SIDE)	WINDOWS	SOUND LEVEL, dB(A) MICROPHONES	
				LEFT EAR	RIGHT EAR
1. Low Idle (Stationary)	1	Right	Open	75	77
	2	Left	Closed	74	75
2. Acceleration (Stationary)	3	Right	Open	92	91
	4	Right	Open	93	91
	5	Left	Closed	92	91
	6	Left	Closed	92	91
2. High Idle (Stationary)	3	Right	Open	92	91
	4	Right	Open	92	92
	5	Left	Closed	93	92
	6	Left	Closed	92	91
3. City Start Up	7	Right	Open	92	89
	8	Right	Open	92	90
	9	Left	Closed	93	89
	10	Left	Closed	92	91
4. J366 (Acceleration)	11	Right	Open	92	92
	12	Right	Open	92	92
	13	Left	Closed	92	92
	14	Left	Closed	93	92
5. J366 (Deceleration)	15	Right	Open	92	92
	16	Right	Open	92	92
	17	Left	Closed	93	92
	18	Left	Closed	93	92

Table 11-2. Maximum A-weighted sound levels as measured at the two interior microphone locations for all test runs for vehicle number 11.

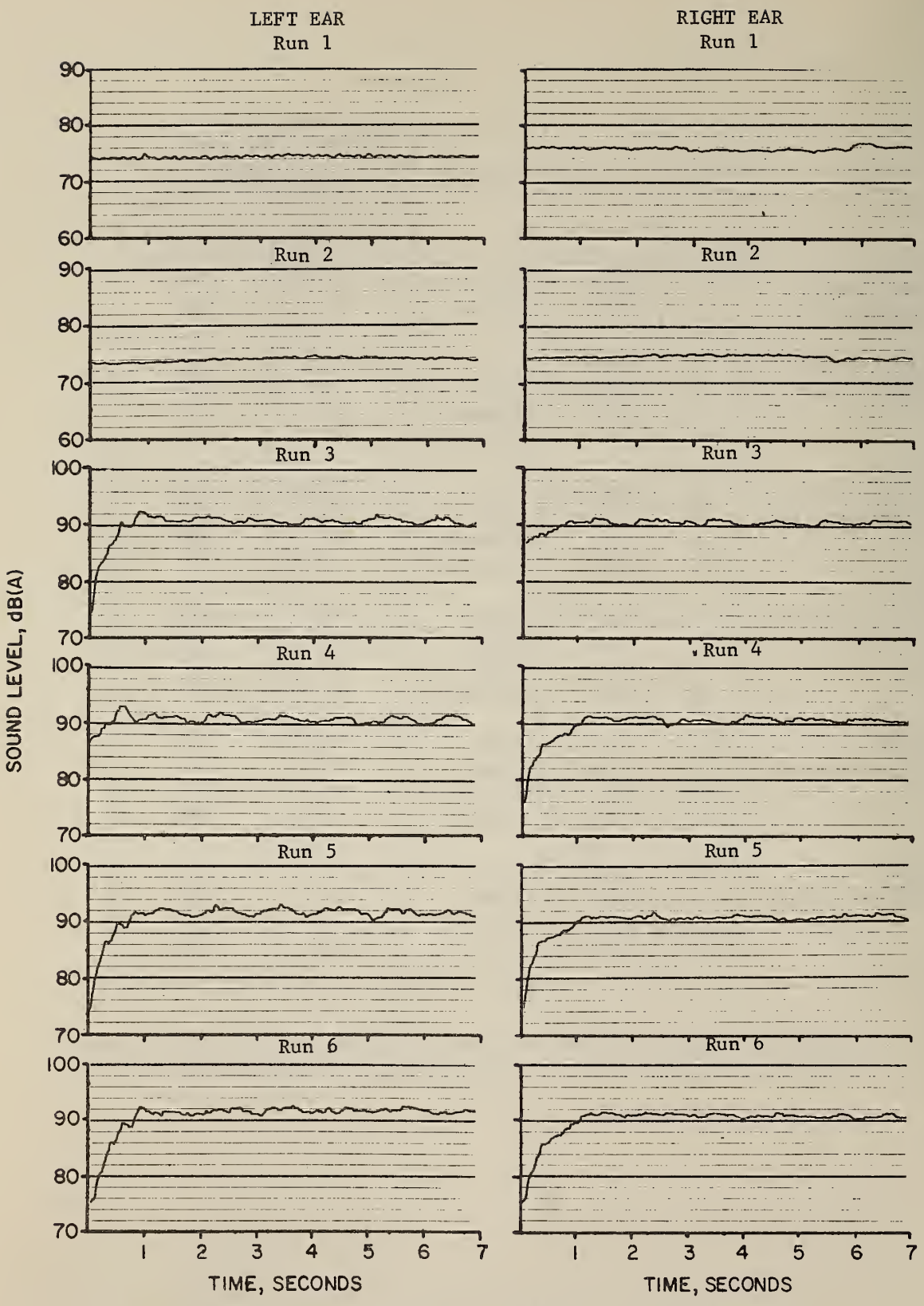

Figure 11-11. Truck 11, Tests 1,2, Runs 1-6. (Interior)

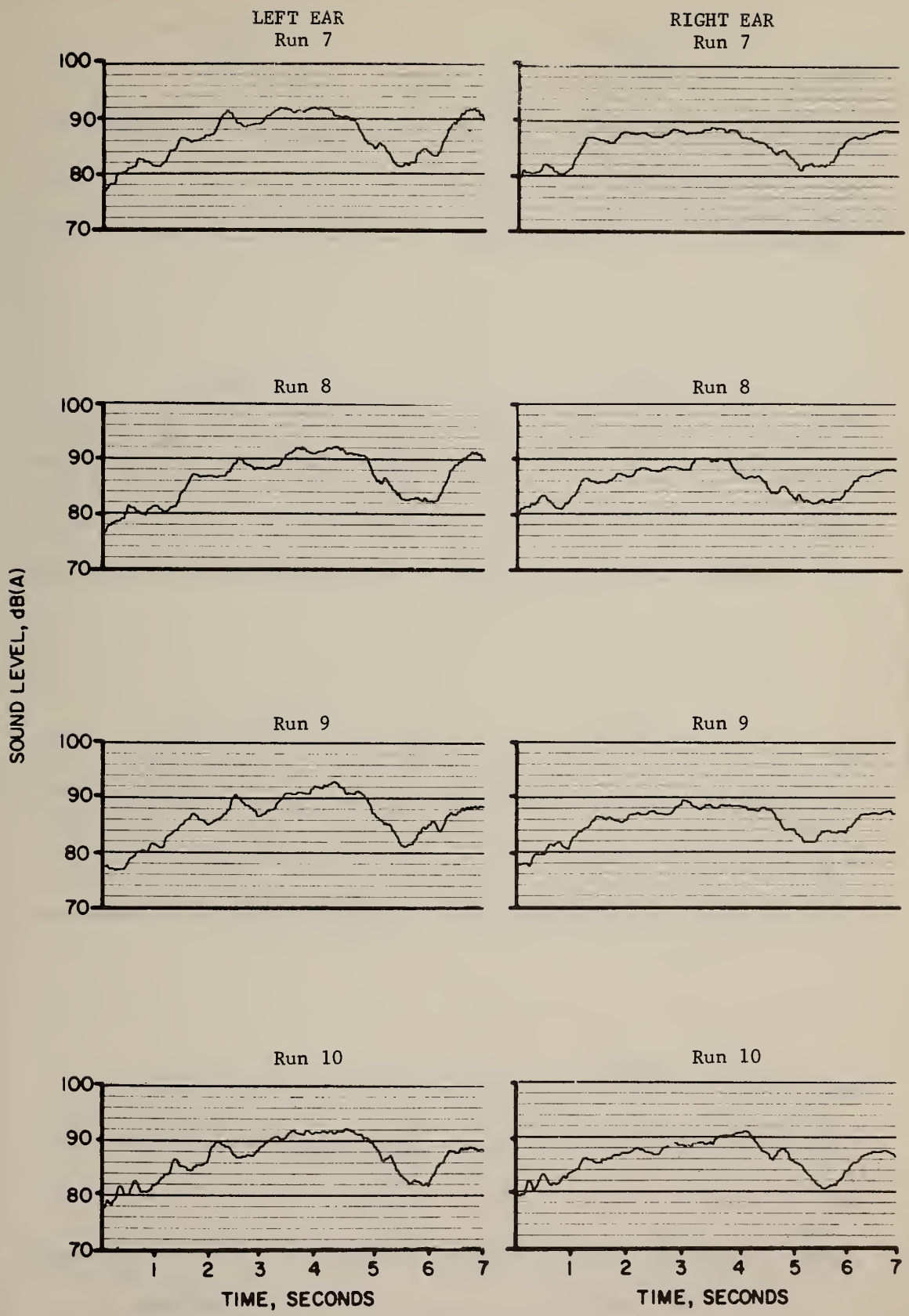

Figure 11-12. Truck 11, Test 3, Runs 7-10. (Interior)

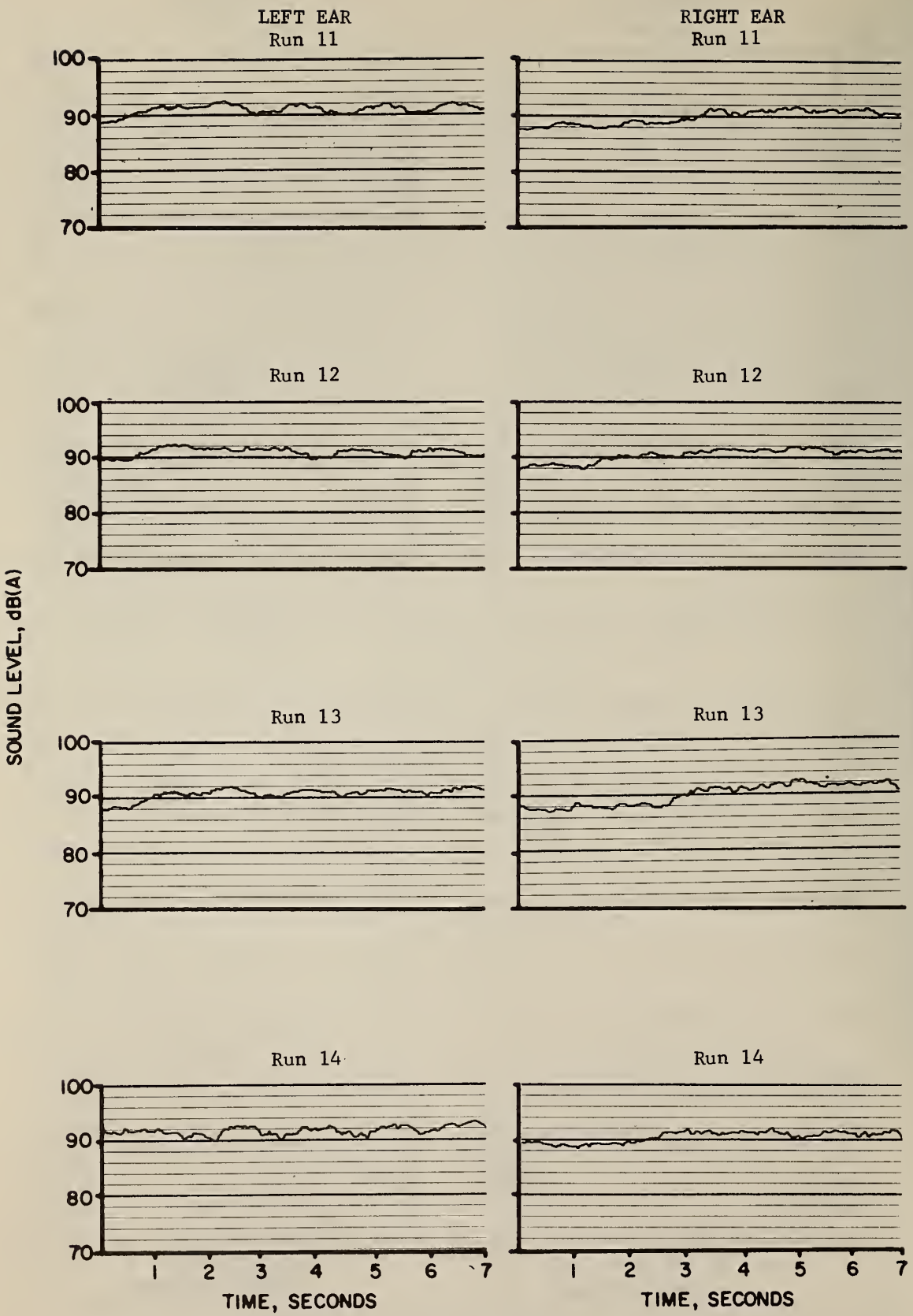

Figure 11-13. Truck 11, Test 4, Runs 11-14. (Interior)

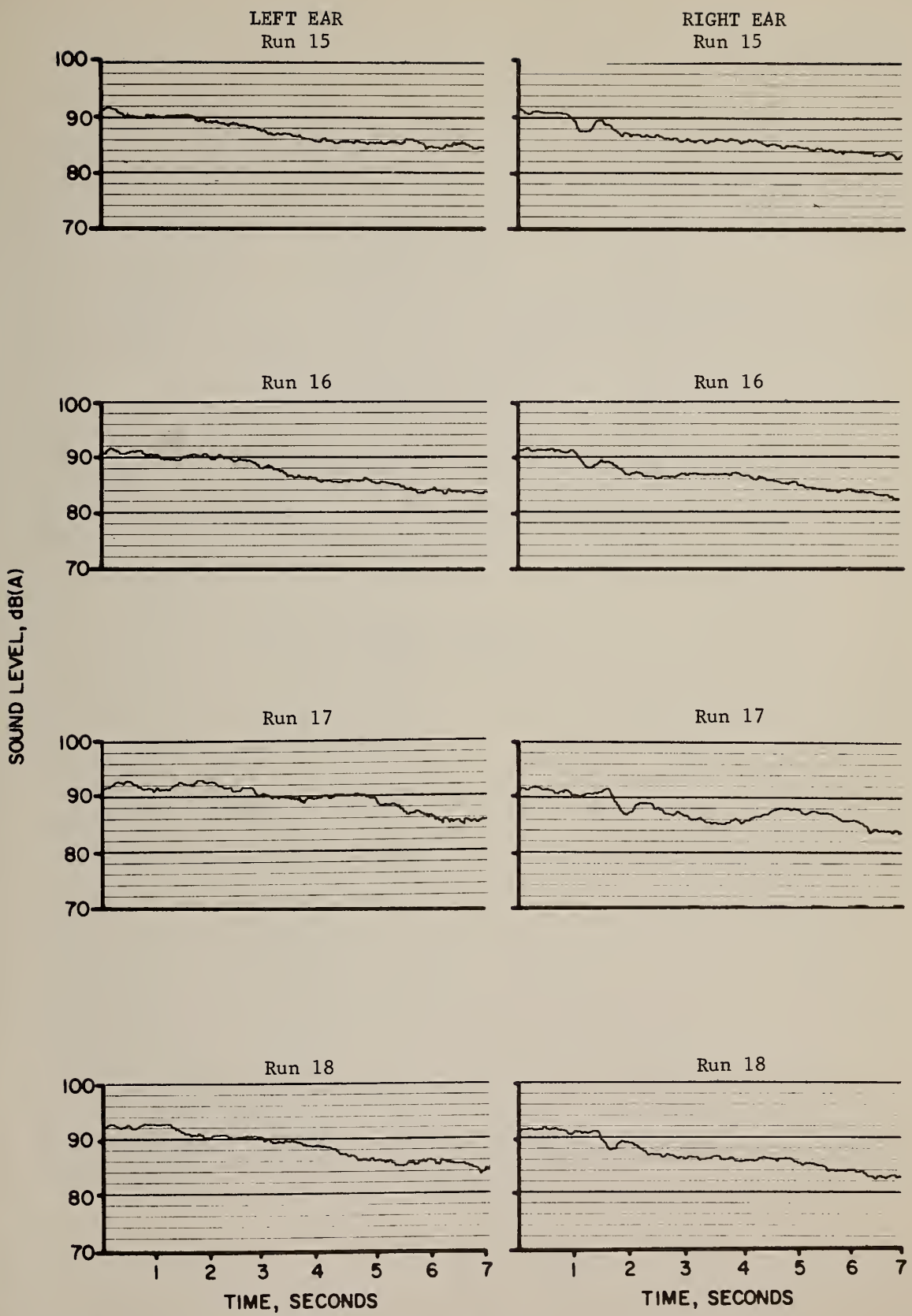

Figure 11-14. Truck 11, Test 5, Runs 15-18. (Interior)

Test Vehicle Number 12

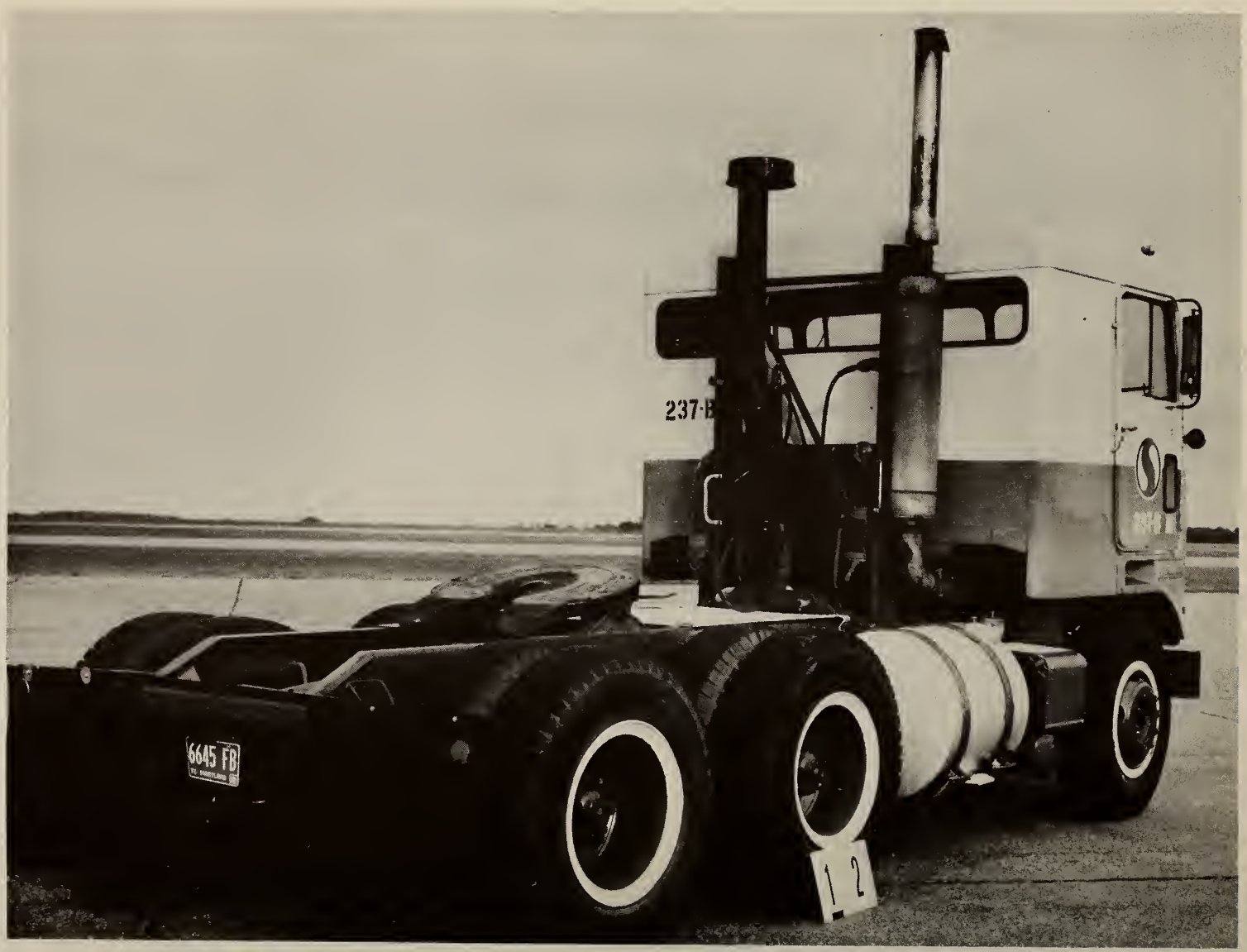

Figure 12-1. Test Vehicle Number 12.

Truck Number: 12
Carrier (owner): Safeway Stores, Inc.
Company Fleet Number: 237B
Make: Kenworth
Model: K123
Serial Number: 208486
Year: 1969
Engine Governor Setting: 2100 rpm
Total Miles of Operation: 139,357
Miles Since Last Engine Overhaul: Original engine
Miles Since Any Exhaust Work: Original exhaust system
Engine: Make - Cummins
Model - NHC 250

Exterior

Truck 12

TEST	RUN	SIDE	(WINDOWS)	SOUND LEVEL, dB(A) MICROPHONES					
				1	2	3	4	5	6
1. Low Idle (Stationary)	1	Right	Open	65	65	68	66	65	72
	2	Left	Closed	66	65	68	66	66	71
	1a	Right	Open-Air*	66-78	66-78	66-83	67-78	66-78	71-87
2. Acceleration (Stationary)	3	Right	Open	86	86	86	85	84	89
	4	Right	Open	86	86	87	85	85	89
	5	Left	Closed	85	84	86	87	86	89
	6	Left	Closed	85	84	86	87	86	89
2. High Idle (Stationary)	3	Right	Open	86	87	85	84	84	88
	4	Right	Open	86	86	85	84	84	88
	5	Left	Closed	84	84	87	87	86	91
	6	Left	Closed	84	83	85	87	86	89
3. City Start Up	7	Right	Open	87	85	87	87	87	88
	8	Right	Open	87	85	86	86	87	87
	9	Left	Closed	86	87	87	85	86	88
	10	Left	Closed	87	86	86	85	86	86
4. J366 (Acceleration)	11	Right	Open	87	87	88	87	86	90
	12	Right	Open	87	86	88	87	86	91
	13	Left	Closed	86	85	86	86	86	89
	14	Left	Closed	86	86	87	86	86	89
5. J366 (Deceleration)	15	Right	Open	87	85	85	84	82	88
	16	Right	Open	86	85	85	84	83	87
	17	Left	Closed	83	83	84	85	85	87
	18	Left	Closed	83	83	84	85	85	87

*Air from blowoff valve.

Table 12-1. Maximum A-weighted sound levels as measured at the six exterior microphone locations for all test runs for vehicle number 12.

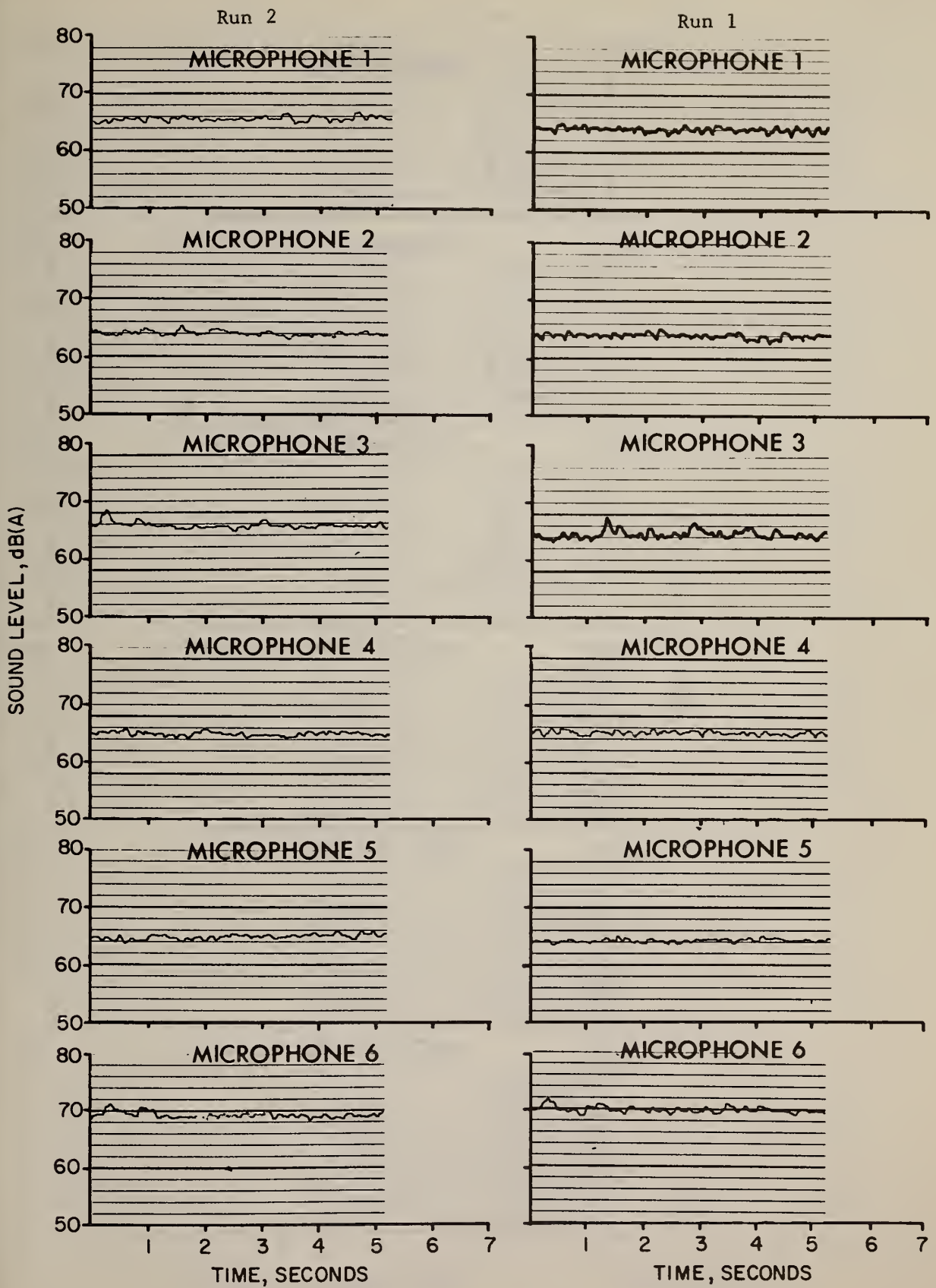

Figure 12-2. Truck 12, Test 1, Runs 1,2. (Exterior)

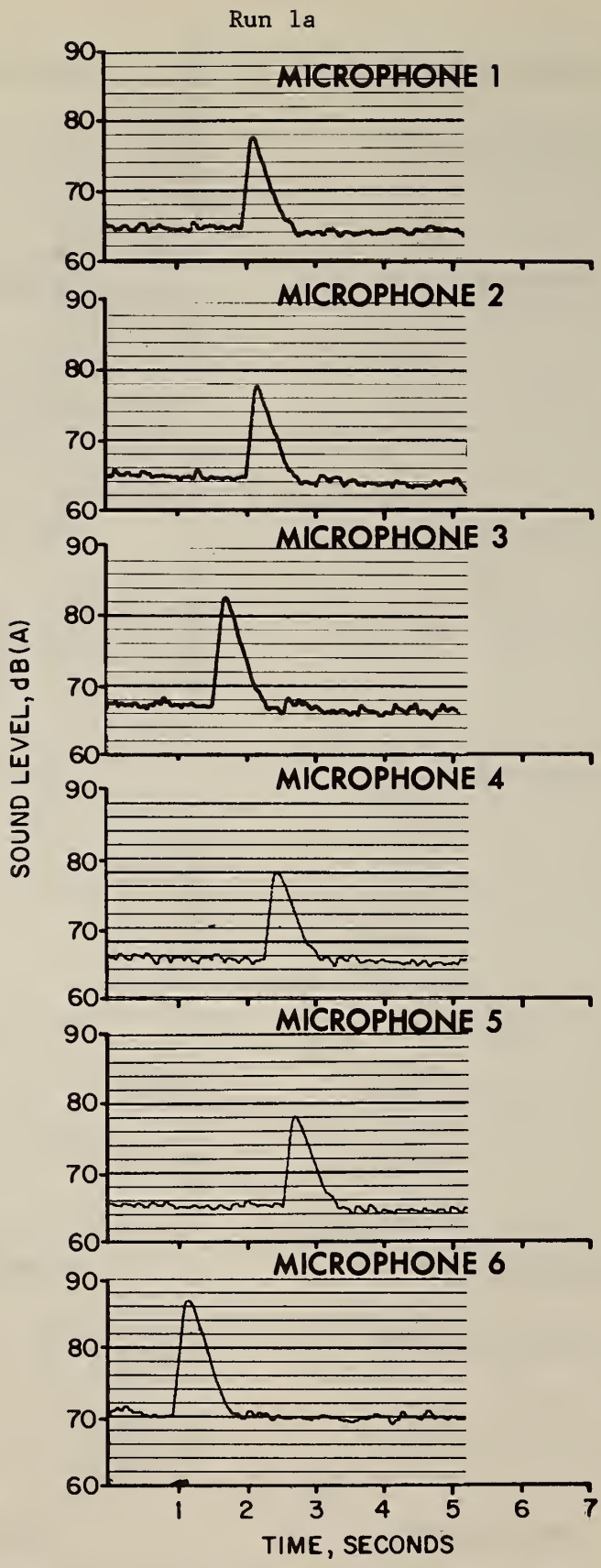

Figure 12-3. Truck 12, Test 1 (air), Run 1a. (Exterior)

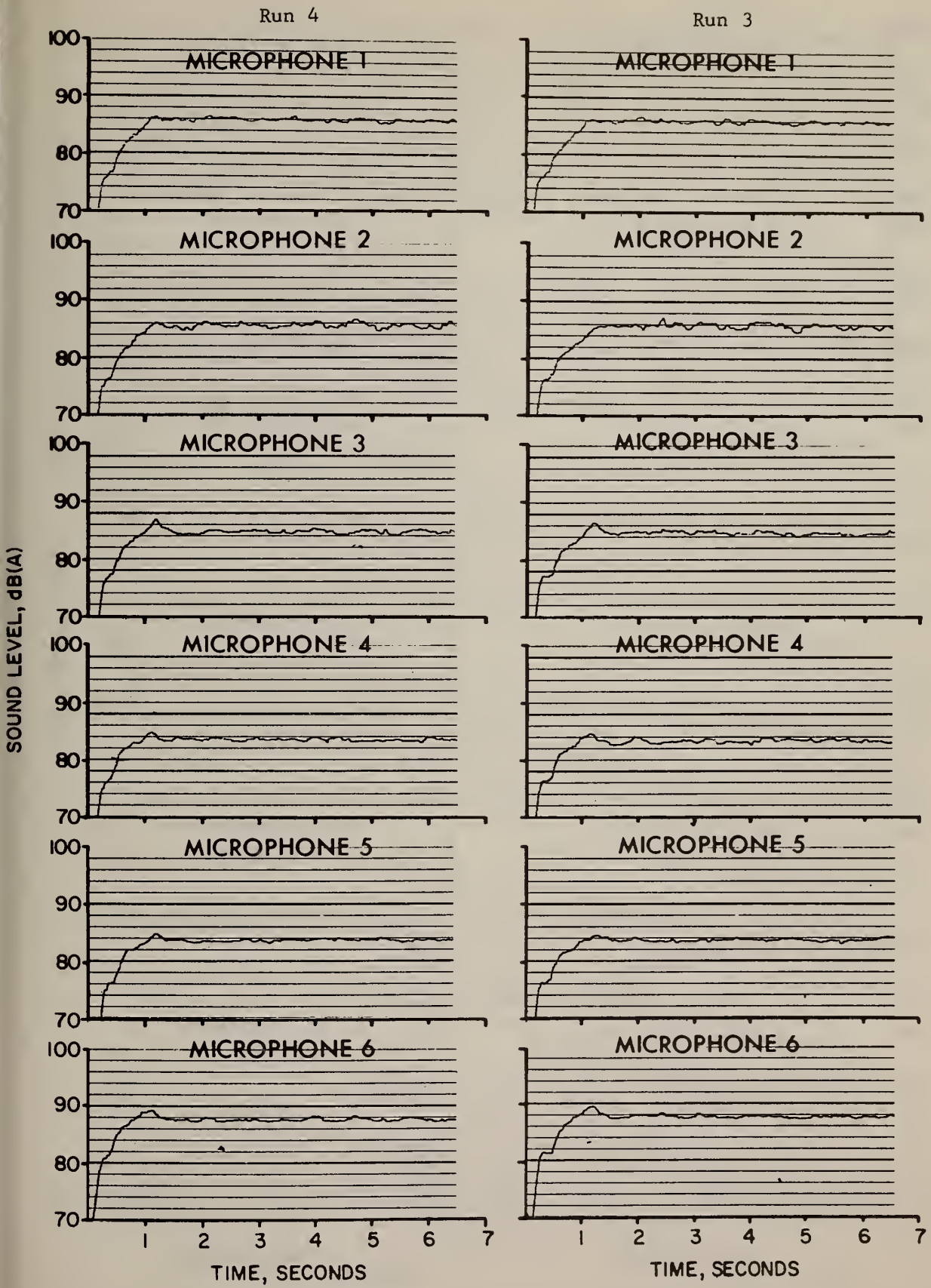

Figure 12-4. Truck 12, Test 2, Runs 3,4. (Exterior)

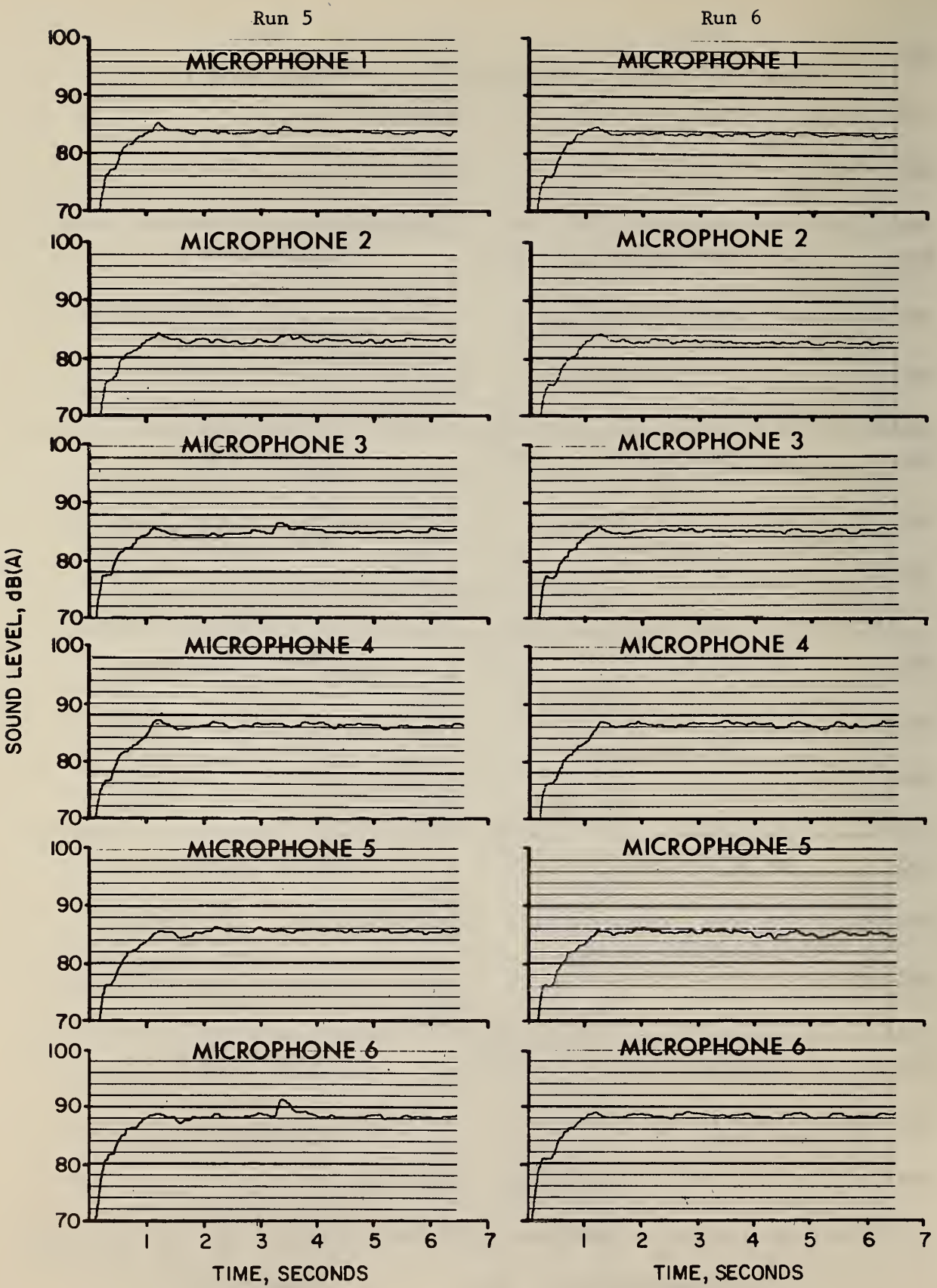

Figure 12-5. Truck 12, Test 2, Runs 5,6. (Exterior)

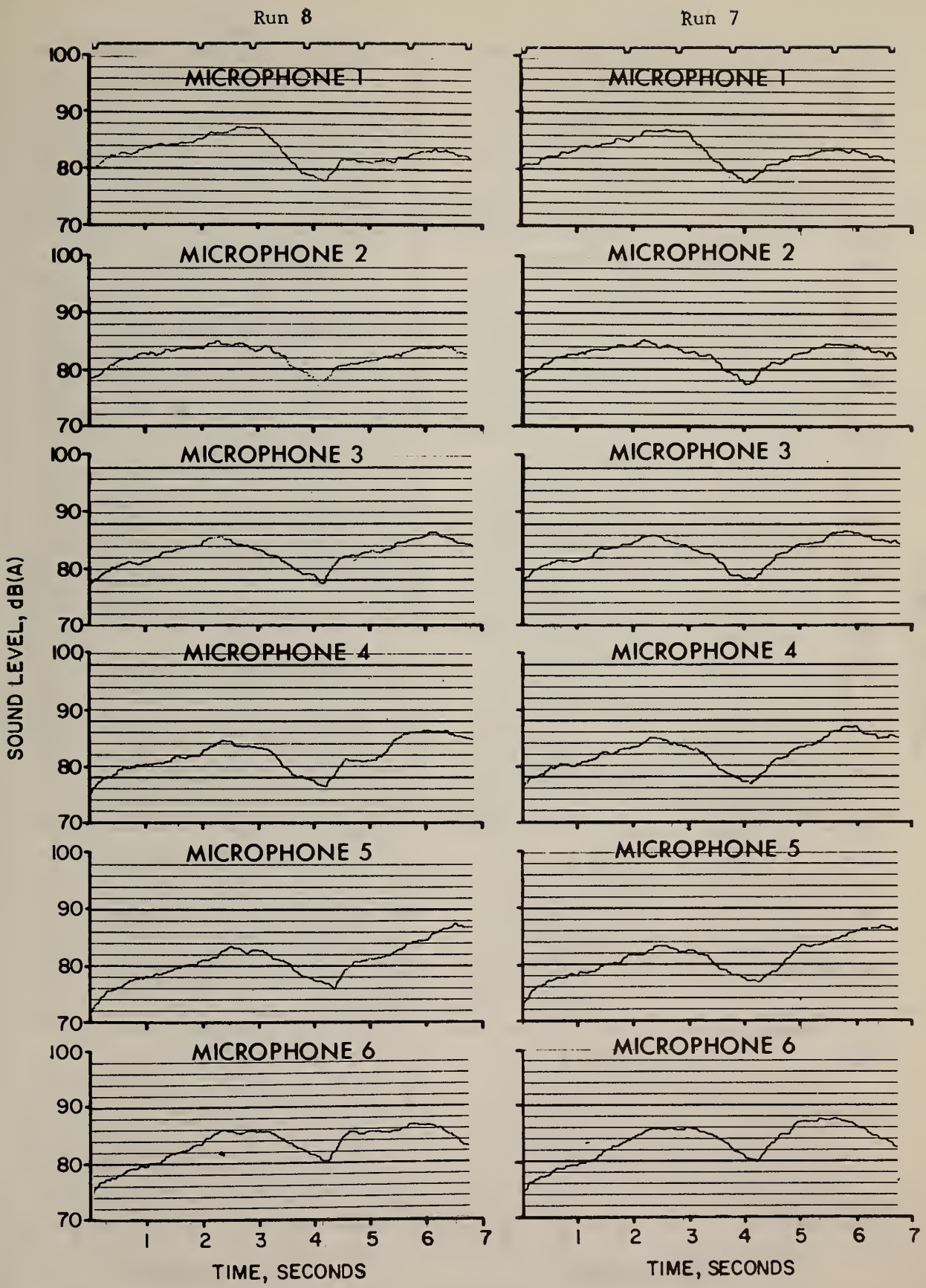

Figure 12-6. Truck 12, Test 3, Runs 7,8. (Exterior)

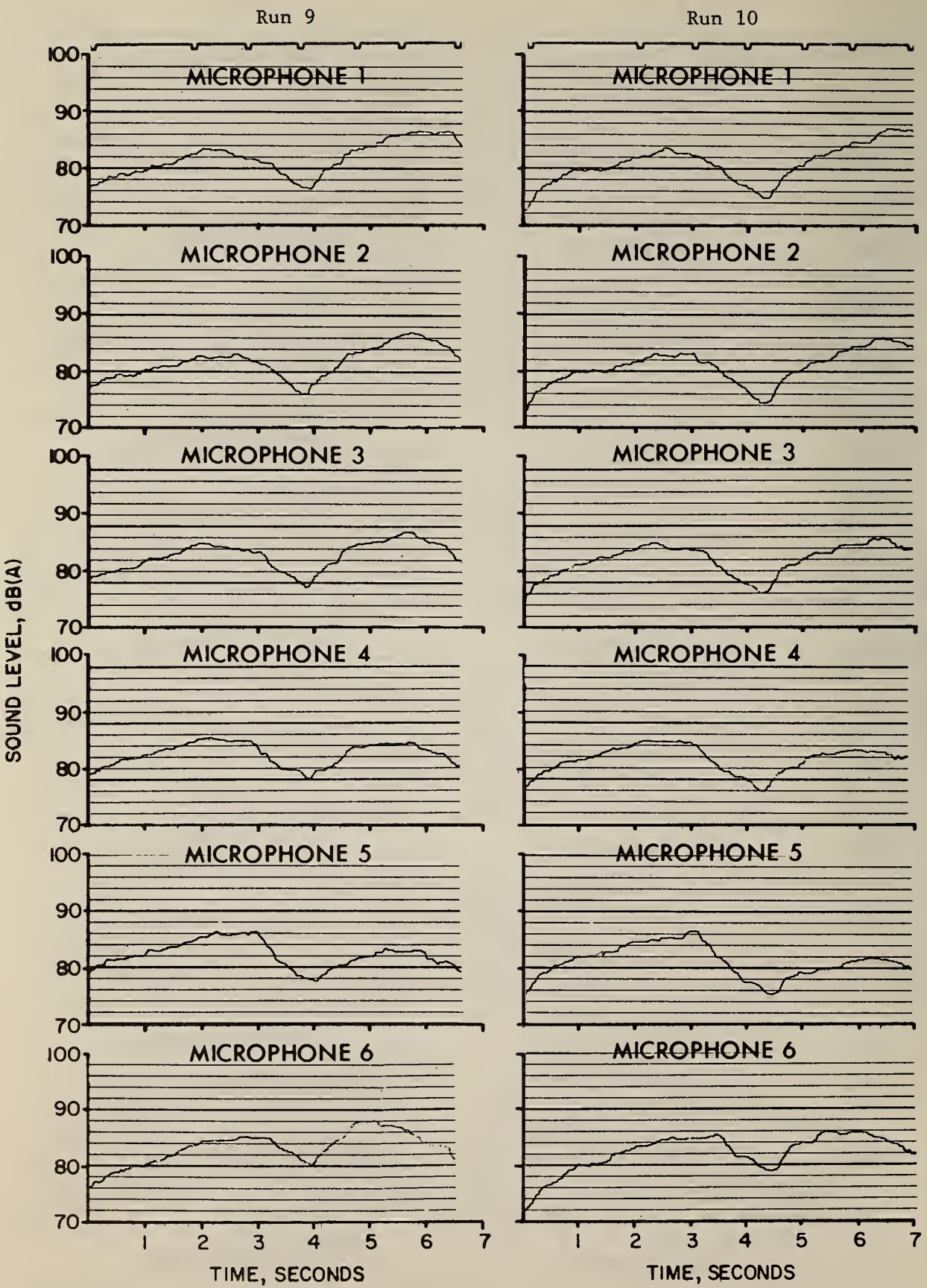

Figure 12-7. Truck 12, Test 3, Runs 9,10. (Exterior)

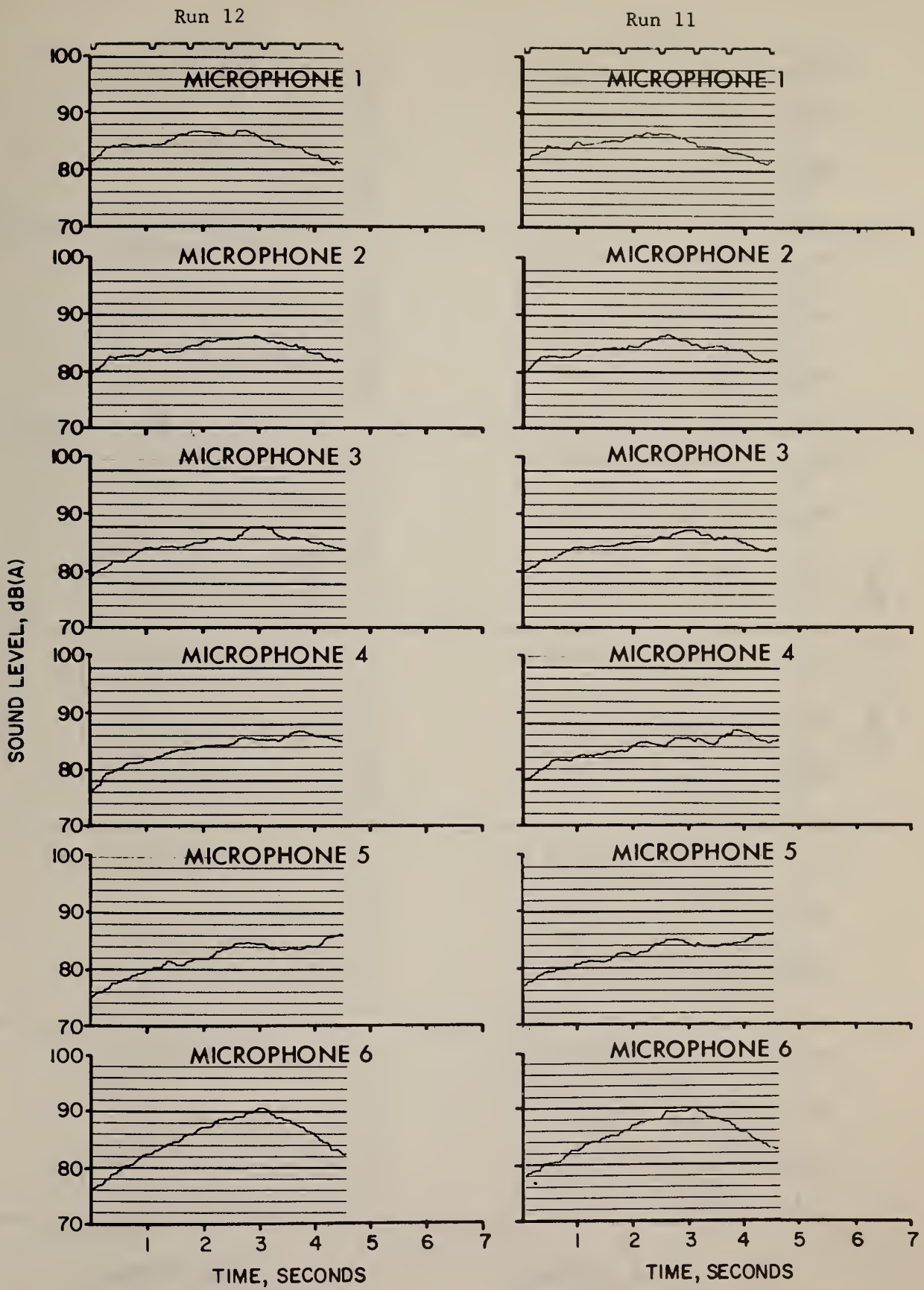

Figure 12-8. Truck 12, Test 4, Runs 11,12. (Exterior)

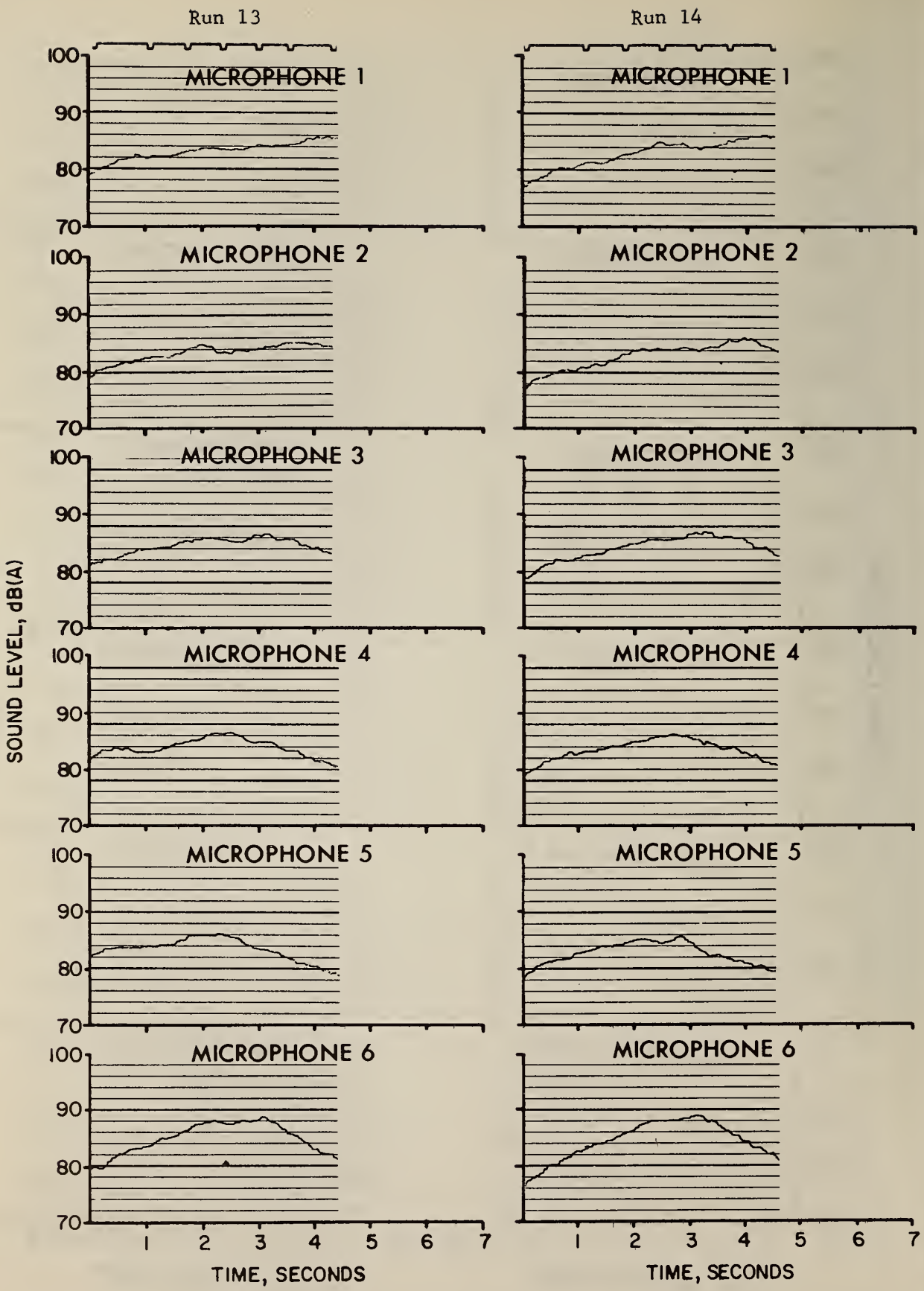

Figure 12-9. Truck 12, Test 4, Runs 13,14. (Exterior)

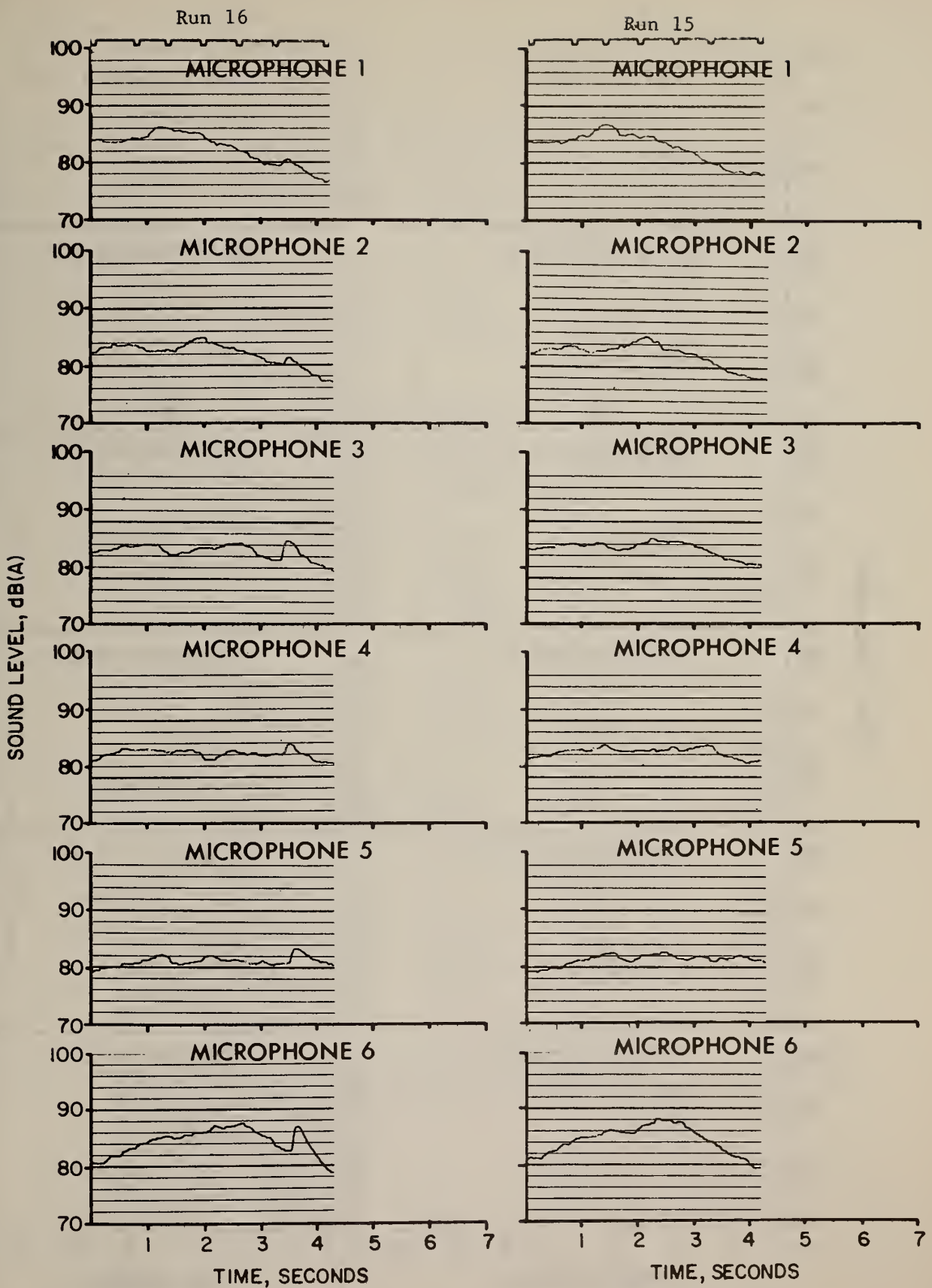

Figure 12-10. Truck 12, Test 5, Runs 15,16. (Exterior)

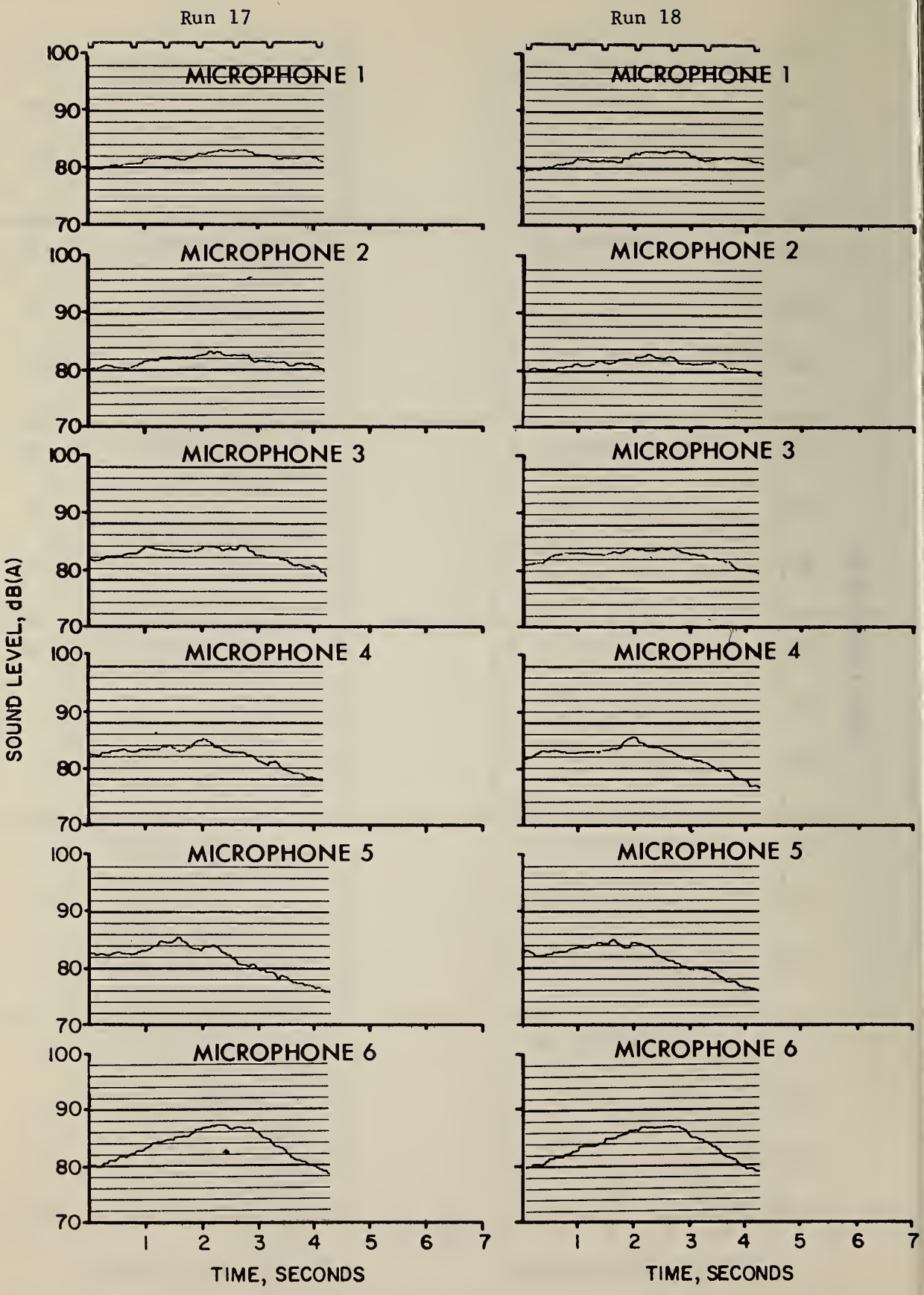

Figure 12-11. Truck 12, Test 5, Runs 17,18. (Exterior)

Interior

Truck 12

TEST	RUN	(SIDE)	WINDOWS	SOUND LEVEL, dB(A) MICROPHONES	
				LEFT EAR	RIGHT EAR
1. Low Idle (Stationary)	1	Right	Open	72	72
	2	Left	Closed	74	73
2. Acceleration (Stationary)	3	Right	Open	92	91
	4	Right	Open	92	90
	5	Left	Closed	90	91
	6	Left	Closed	90	89
2. High Idle (Stationary)	3	Right	Open	90	89
	4	Right	Open	91	89
	5	Left	Closed	90	88
	6	Left	Closed	90	88
3. City Start Up	7	Right	Open	91	91
	8	Right	Open	91	91
	9	Left	Closed	91	91
	10	Left	Closed	91	91
4. J366 (Acceleration)	11	Right	Open	91	91
	12	Right	Open	91	90
	13	Left	Closed	91	91
	14	Left	Closed	90	90
5. J366 (Deceleration)	15	Right	Open	91	88
	16	Right	Open	90	88
	17	Left	Closed	90	90
	18	Left	Closed	90	90

Table 12-2. Maximum A-weighted sound levels as measured at the two interior microphone locations for all test runs for vehicle number 12.

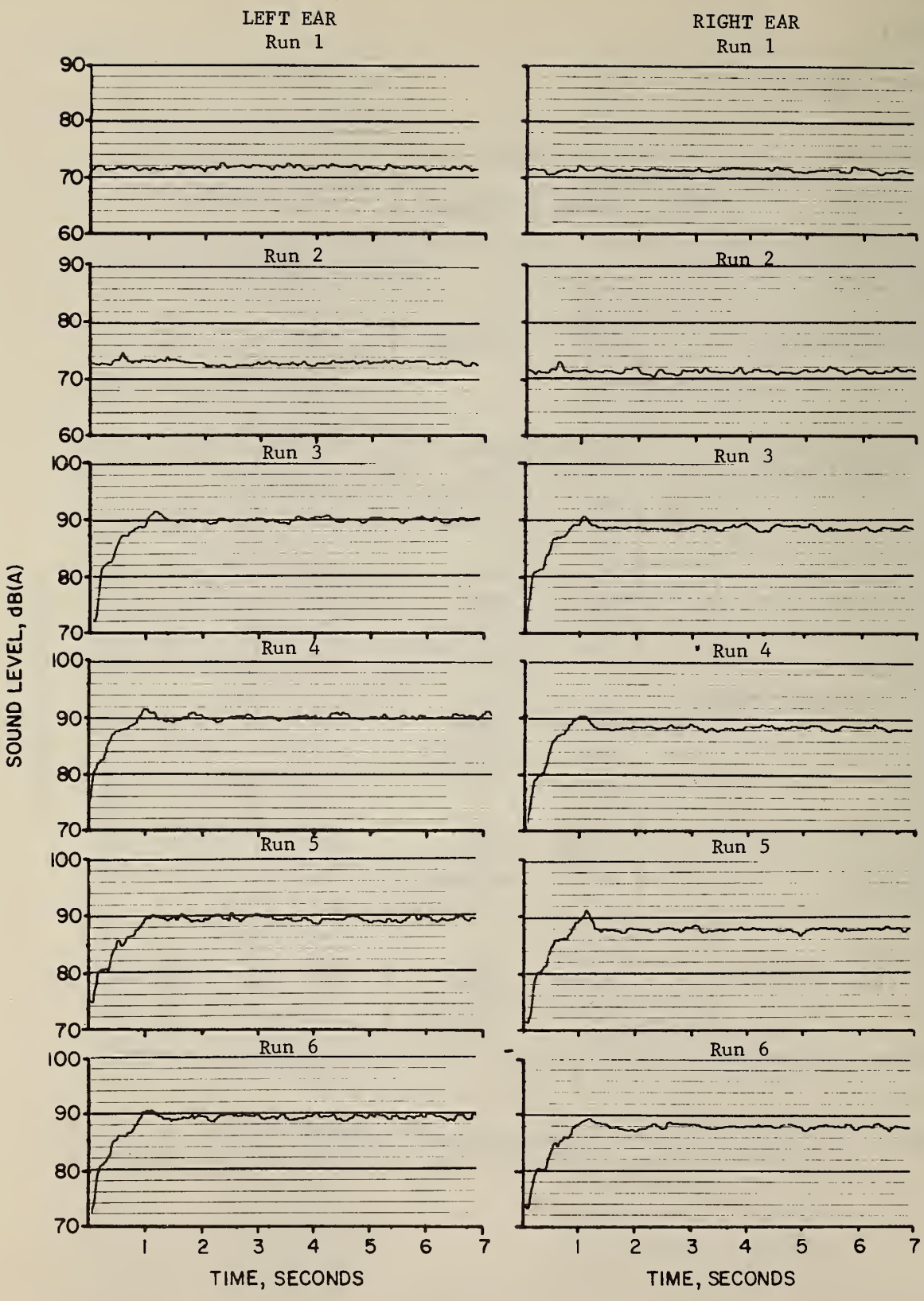

Figure 12-12. Truck 12, Tests 1,2, Runs 1-6. (Interior)

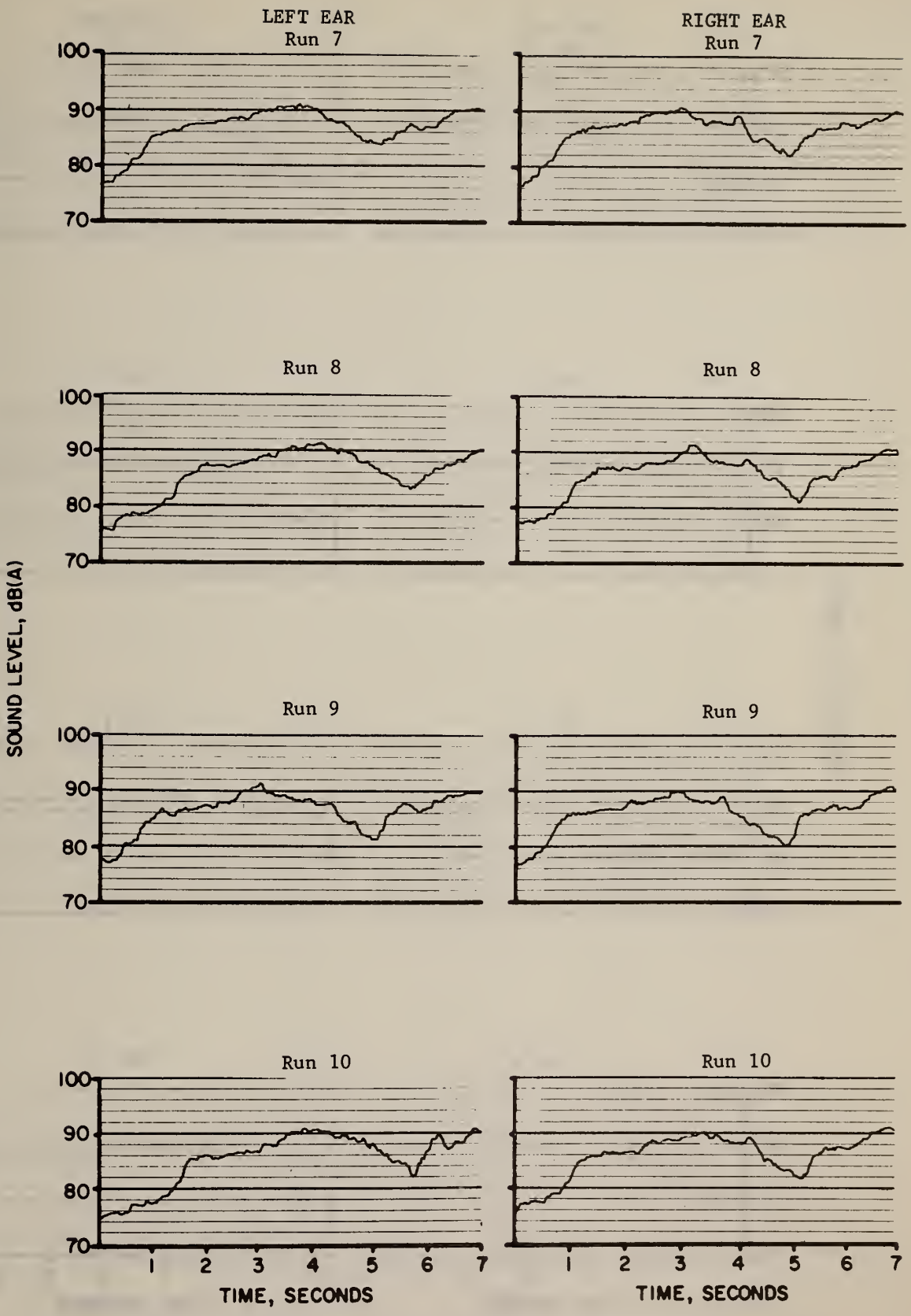

Figure 12-13. Truck 12, Test 3, Runs 7-10. (Interior)

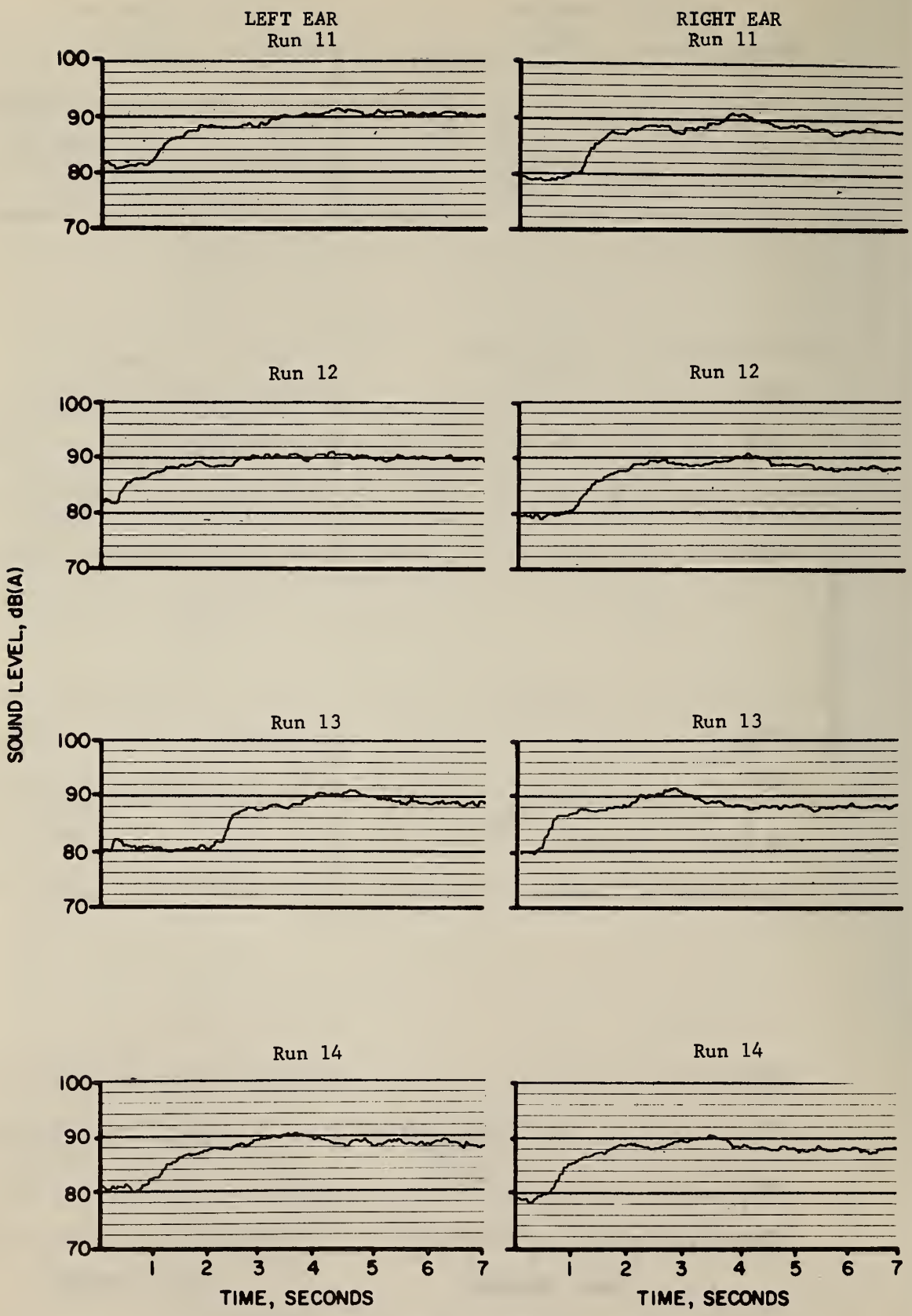

Figure 12-14. Truck 12, Test 4, Runs 11-14. (Interior)

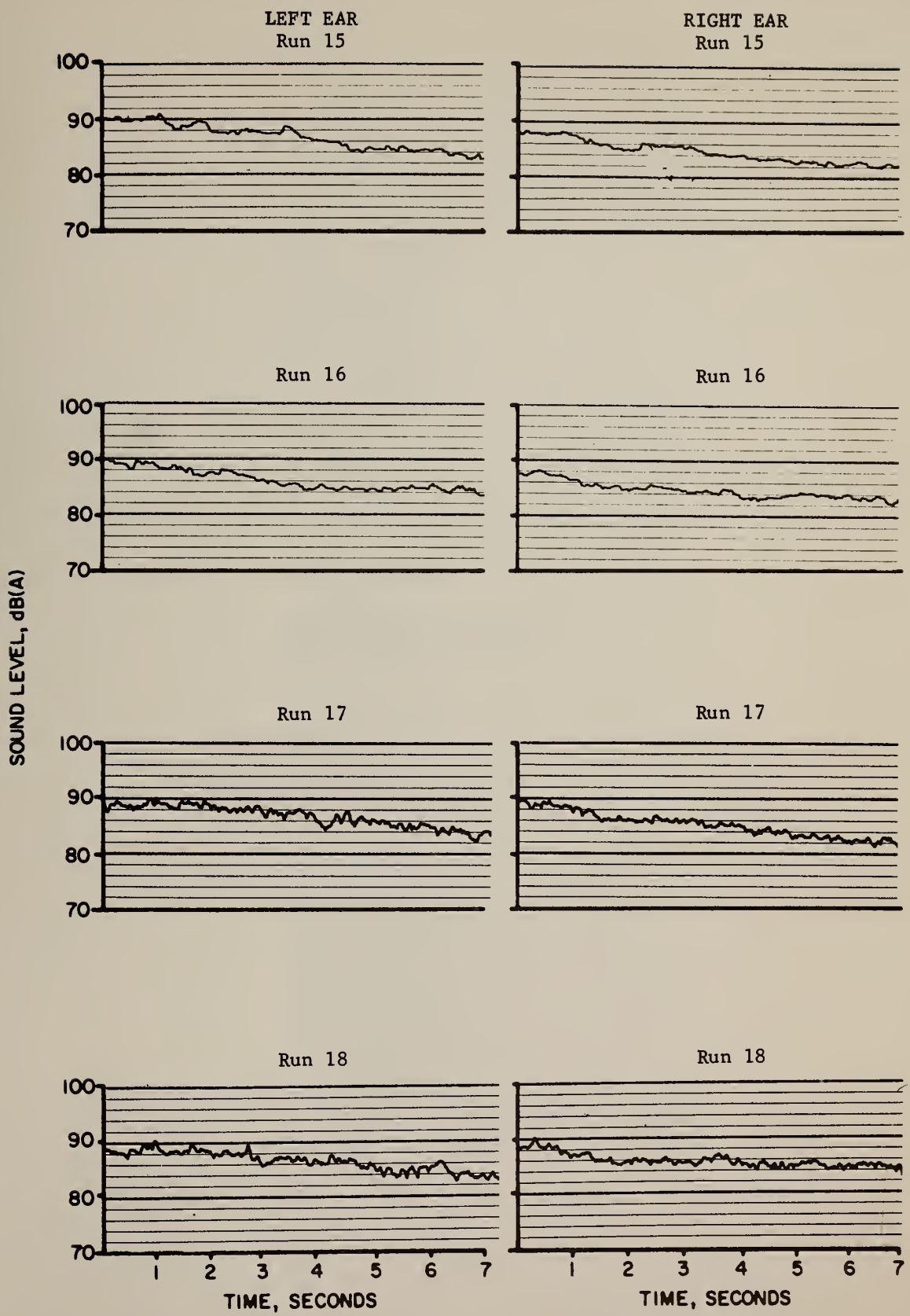

Figure 12-15. Truck 12, Test 5, Runs 15-18. (Interior)

Test Vehicle Number 13

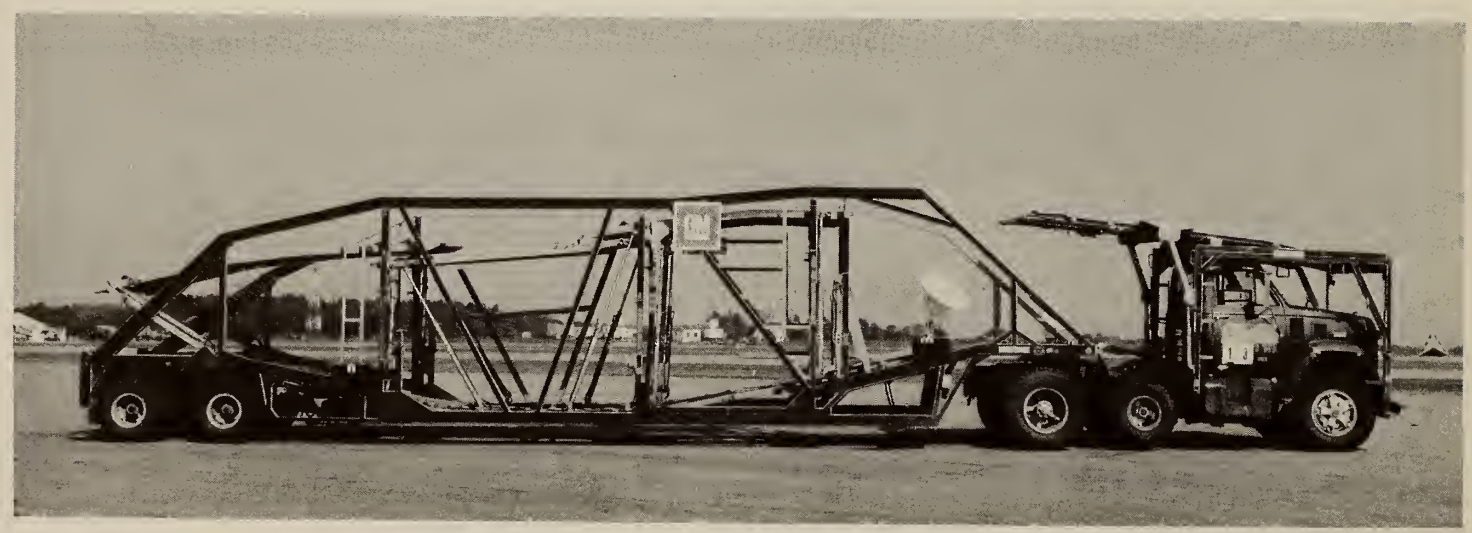

Figure 13-1. Test Vehicle Number 13.

Truck Number: 13
Carrier (owner): Anchor Motor Freight, Inc.
Company Fleet Number: 3244 W1
Make: GMC
Model: HI 9630
Serial Number: D 201474
Year: 1971
Engine Governor Setting: 2250 rpm (no load)
Total Miles of Operation: 4,500
Miles Since Last Engine Overhaul: Original engine
Miles Since Any Exhaust Work: Original exhaust system
Engine: Make - Detroit Diesel
Model - 6-71

Exterior

Truck 13

TEST	RUN	SIDE	(WINDOWS)	SOUND LEVEL, dB(A) MICROPHONES					
				1	2	3	4	5	6
1. Low Idle (Stationary)	1	Right	Open	63	64	64	64	62	70
	2	Left	Closed	63	64	65	64	63	70
2. Acceleration (Stationary)	3	Right	Open	84	87	88	86	86	93
	4	Right	Open	84	87	88	86	86	92
	5	Left	Closed	86	88	88	86	84	94
	6	Left	Closed	86	88	88	85	84	94
2. High Idle (Stationary)	3	Right	Open	79	80	80	80	80	87
	4	Right	Open	79	80	80	80	80	87
	5	Left	Closed	80	81	79	79	78	86
	6	Left	Closed	80	81	80	78	78	86
3. City Start Up	7	Right	Open	85	85	85	85	84	92
	8	Right	Open	85	84	86	85	84	92
	9	Left	Closed	84	85	85	84	82	91
	10	Left	Closed	84	84	84	85	83	91
4. J366 (Acceleration)	11	Right	Open	86	87	88	86	86	93
	12	Right	Open	87	87	87	86	86	93
	13	Left	Closed	86	88	88	87	87	93
	14	Left	Closed	86	86	86	87	86	92
5. J366 (Deceleration)	15	Right	Open	82	82	83	81	80	85
	16	Right	Open	82	82	82	80	78	84
	17	Left	Closed	78	80	80	81	81	85
	18	Left	Closed	78	79	80	80	81	84

Table 13-1. Maximum A-weighted sound levels as measured at the six exterior microphone locations for all test runs for vehicle number 13.

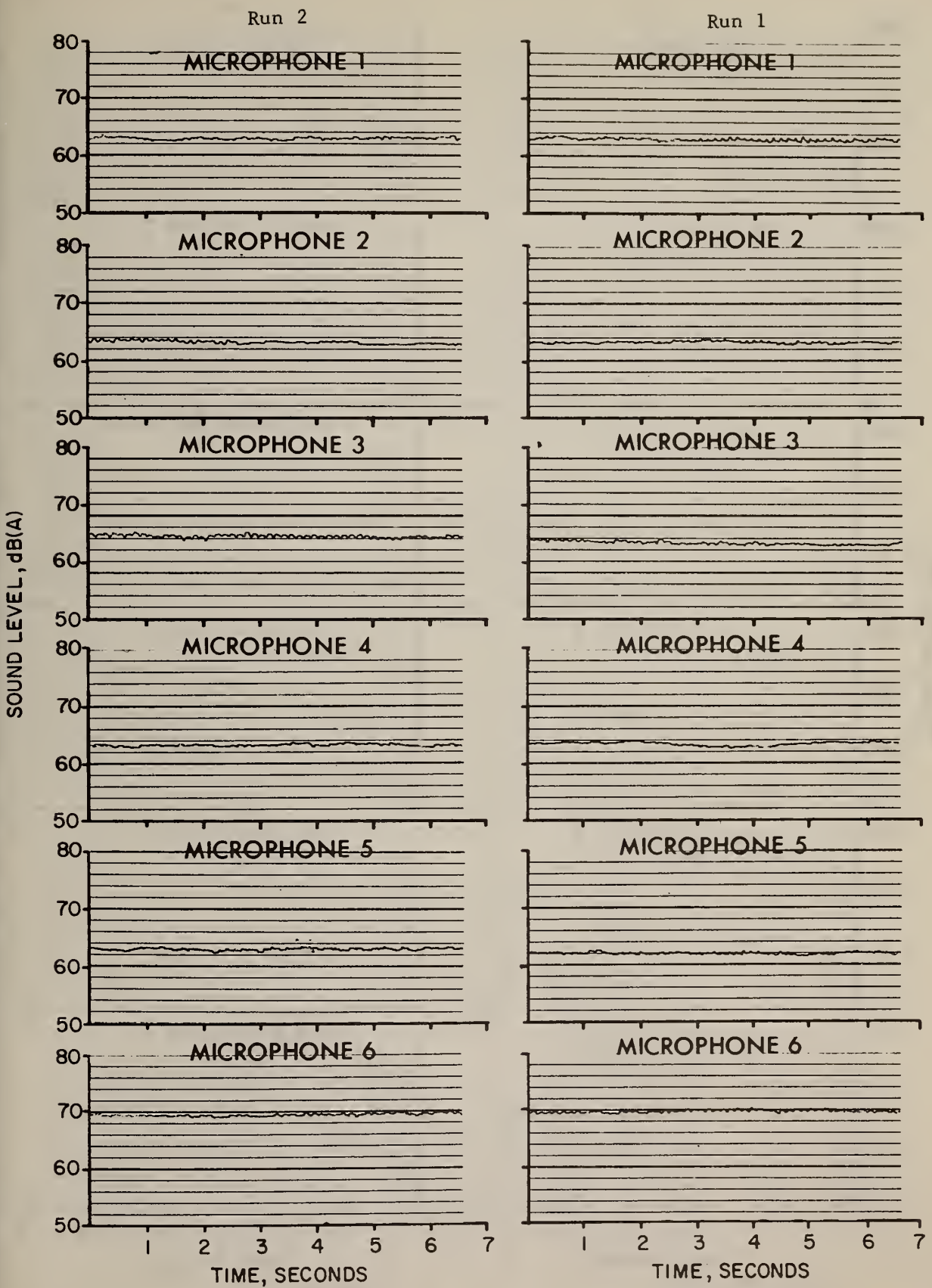

Figure 13-2. Truck 13, Test 1, Runs 1,2. (Exterior)

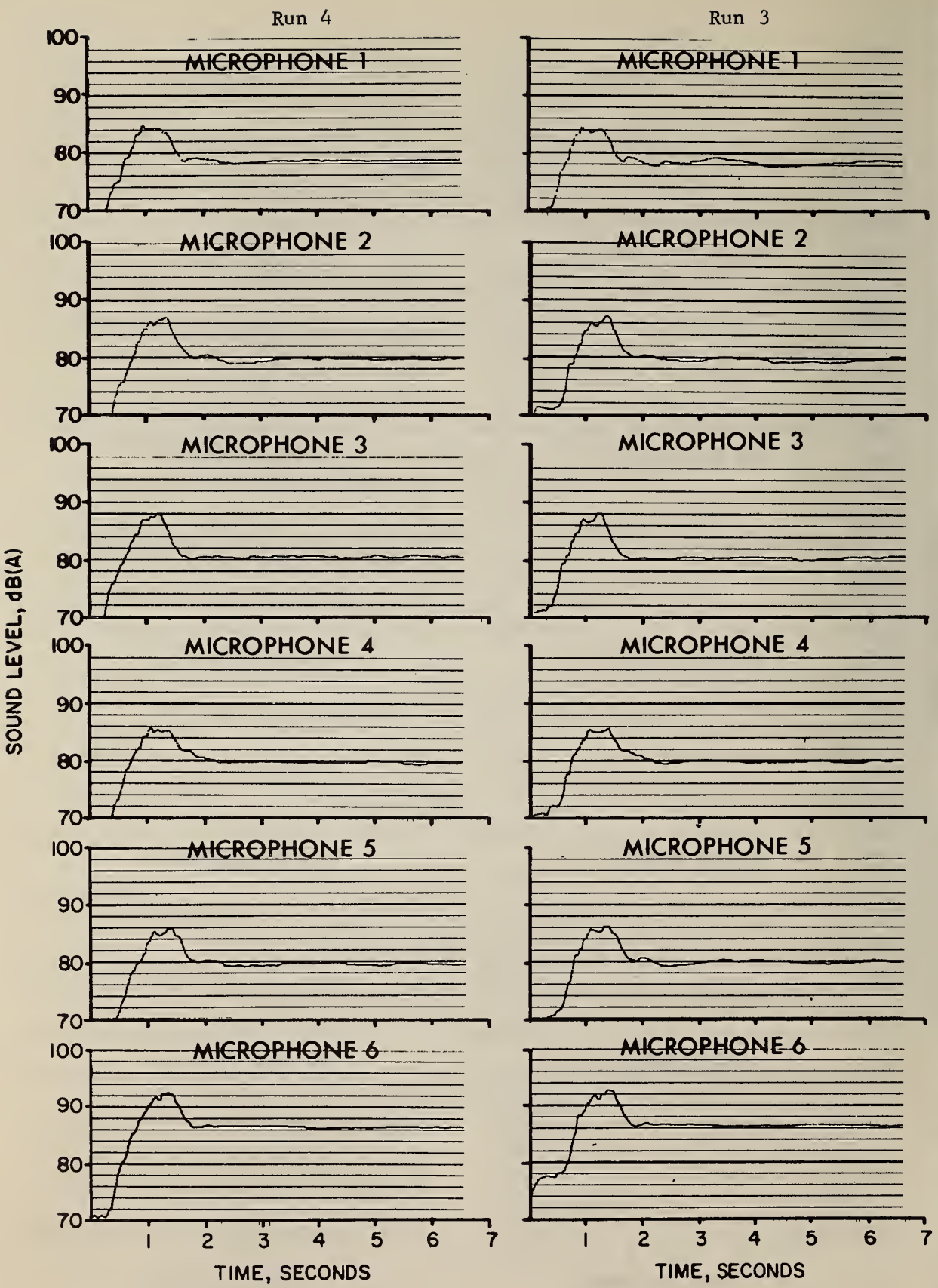

Figure 13-3. Truck 13, Test 2, Runs 3,4. (Exterior)

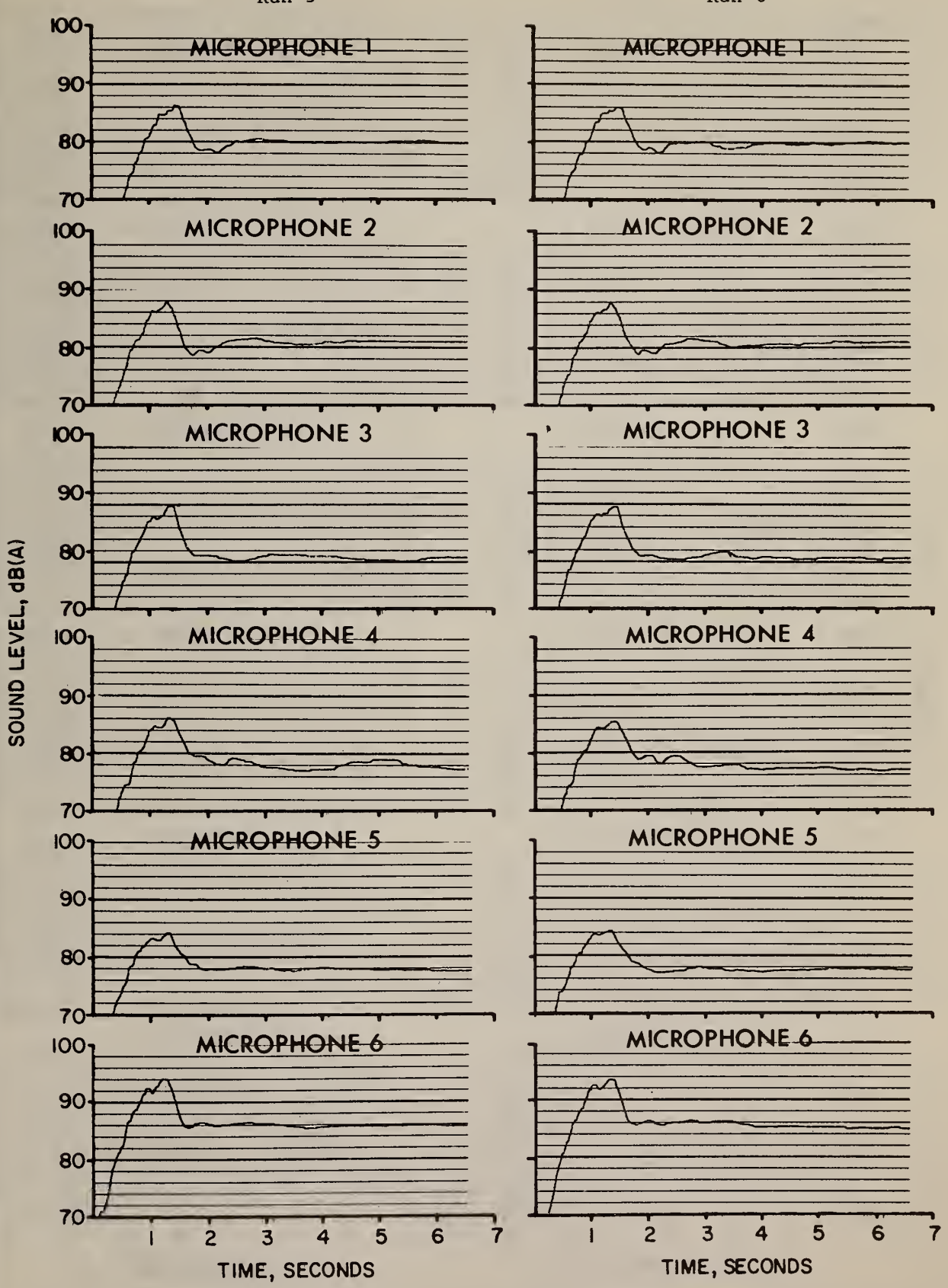

Figure 13-4. Truck 13, Test 2, Runs 5,6. (Exterior)

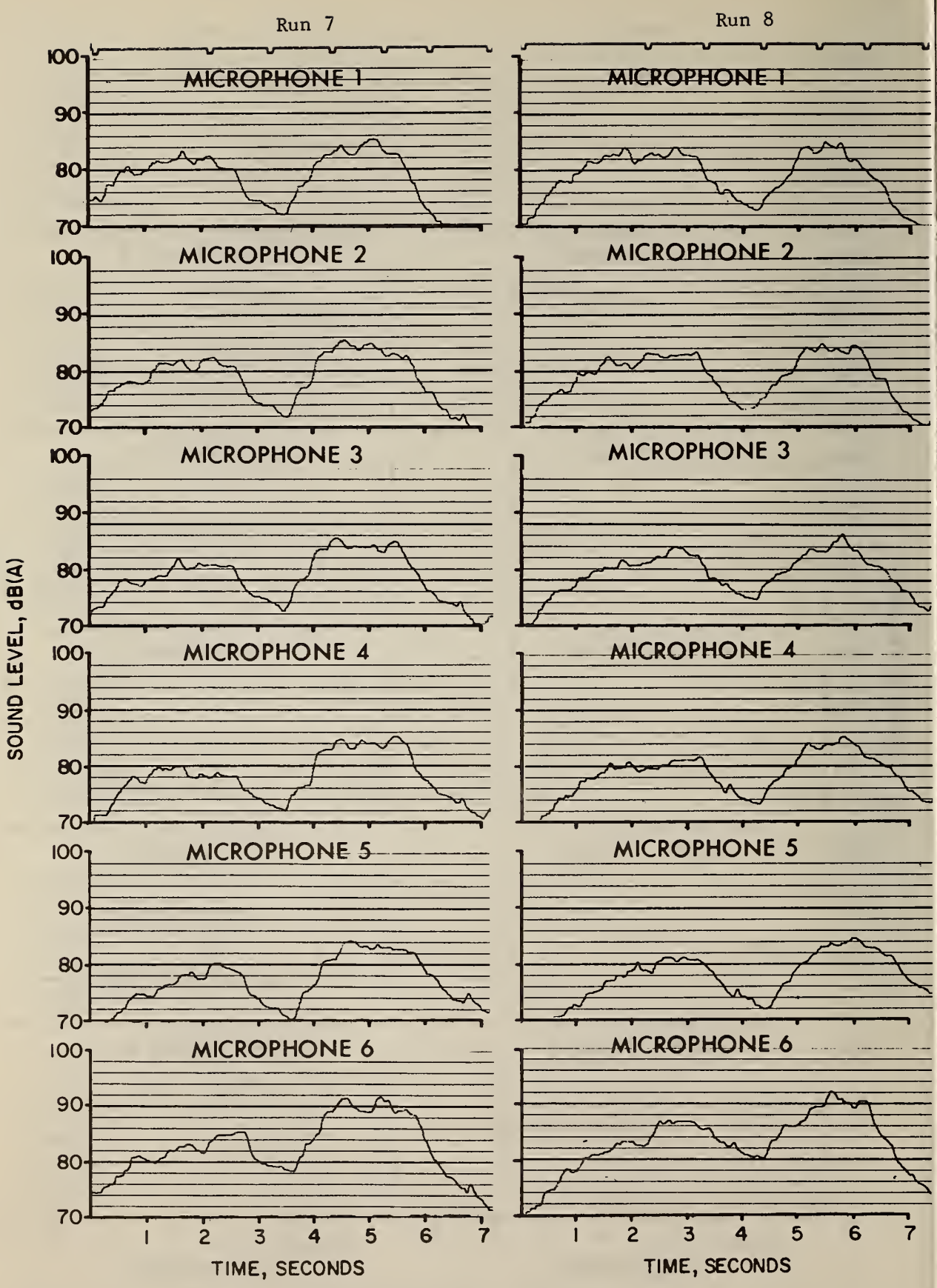

Figure 13-5. Truck 13, Test 3, Runs 7,8. (Exterior)

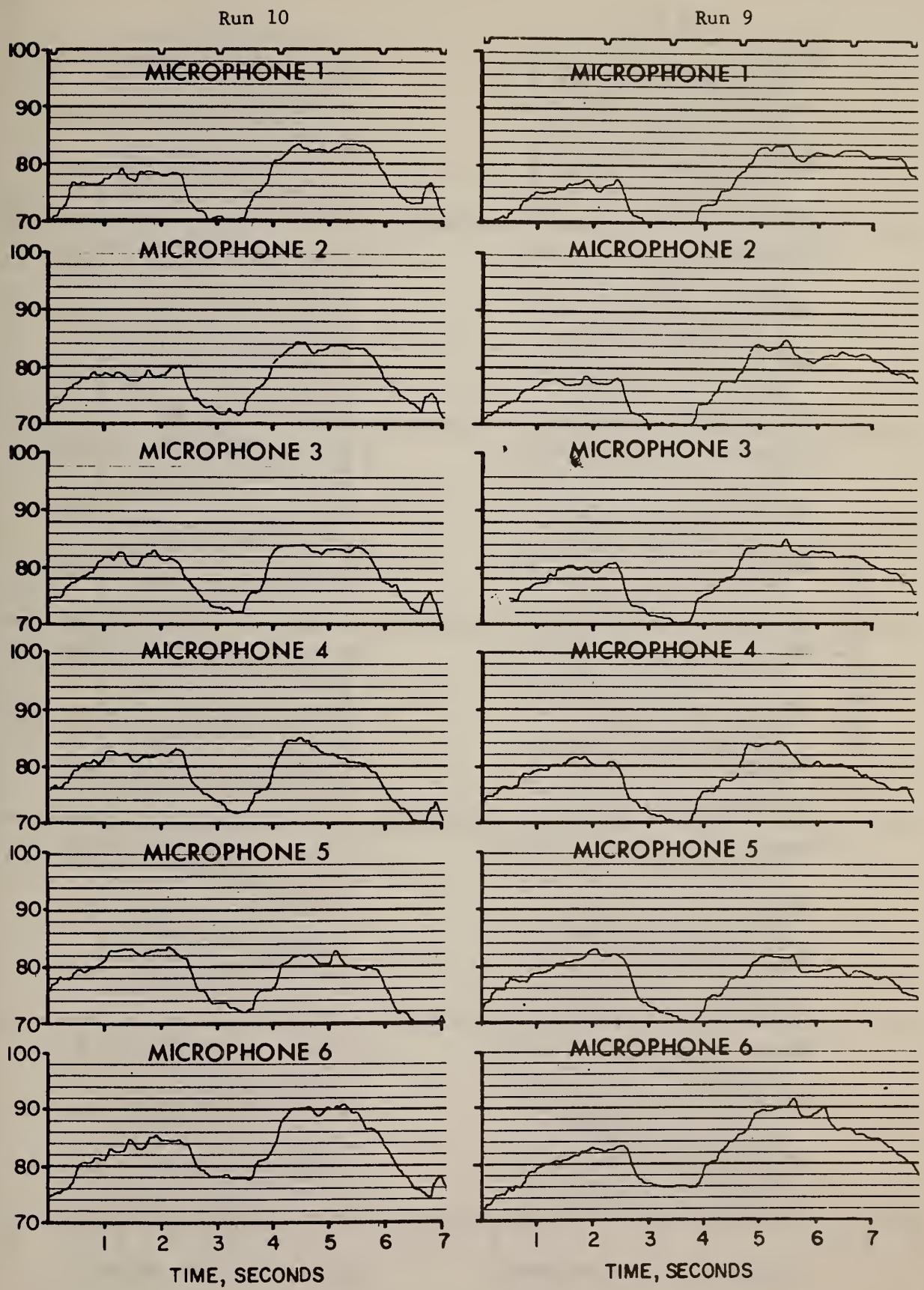

Figure 13-6. Truck 13, Test 3, Runs 9,10. (Exterior)

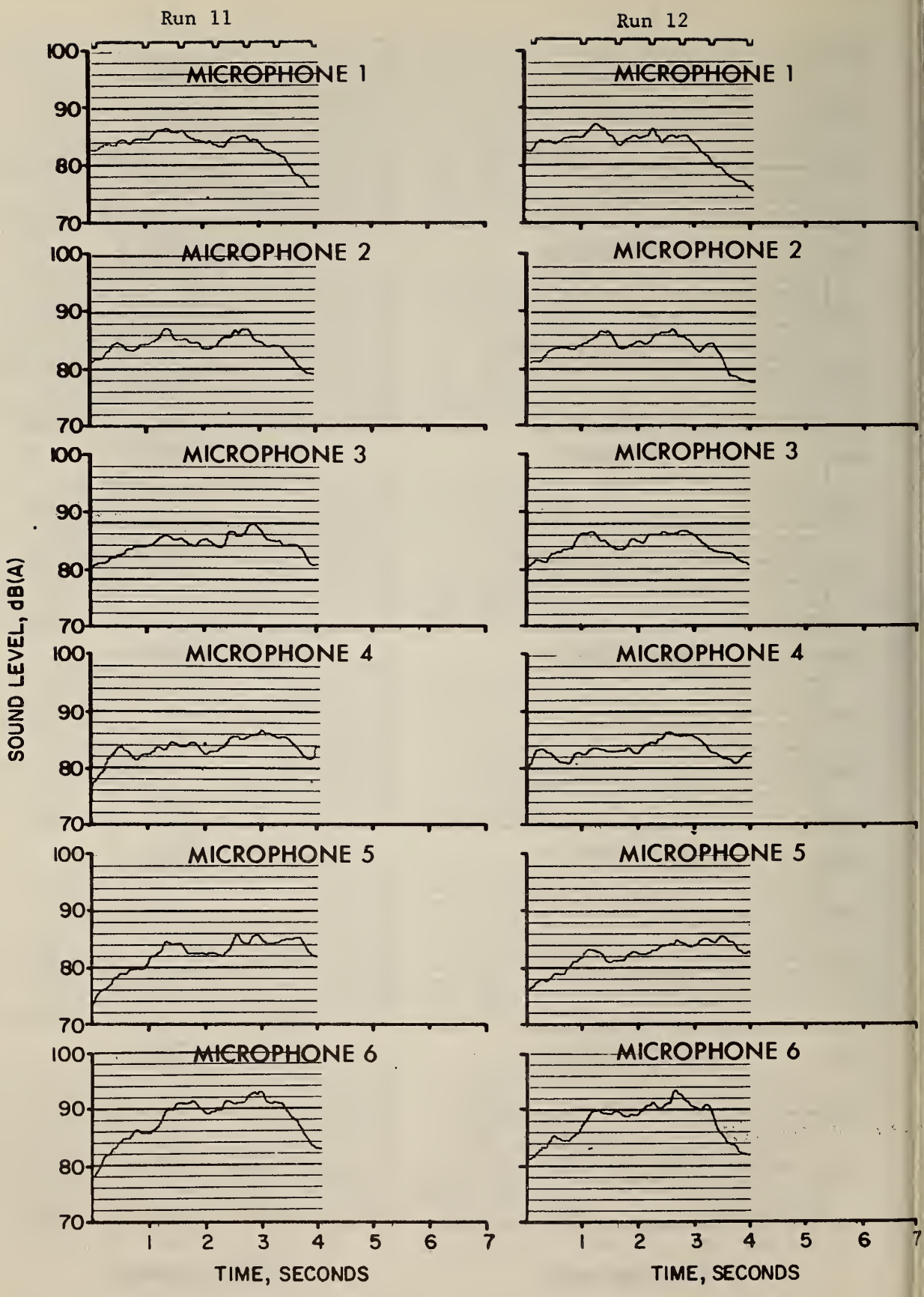

Figure 13-7. Truck 13, Test 4, Runs 11,12. (Exterior)

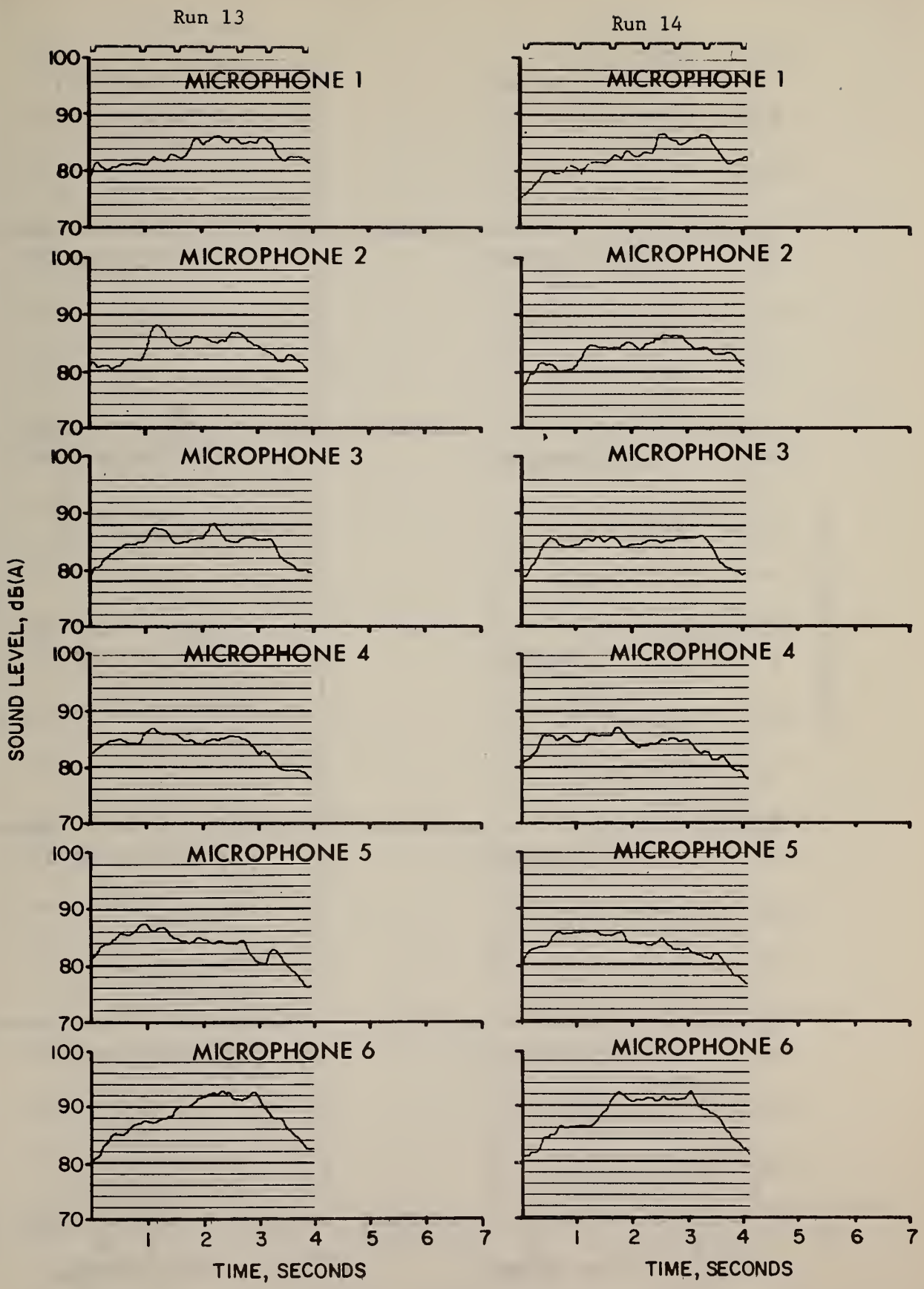

Figure 13-8. Truck 13, Test 4, Runs 13,14. (Exterior)

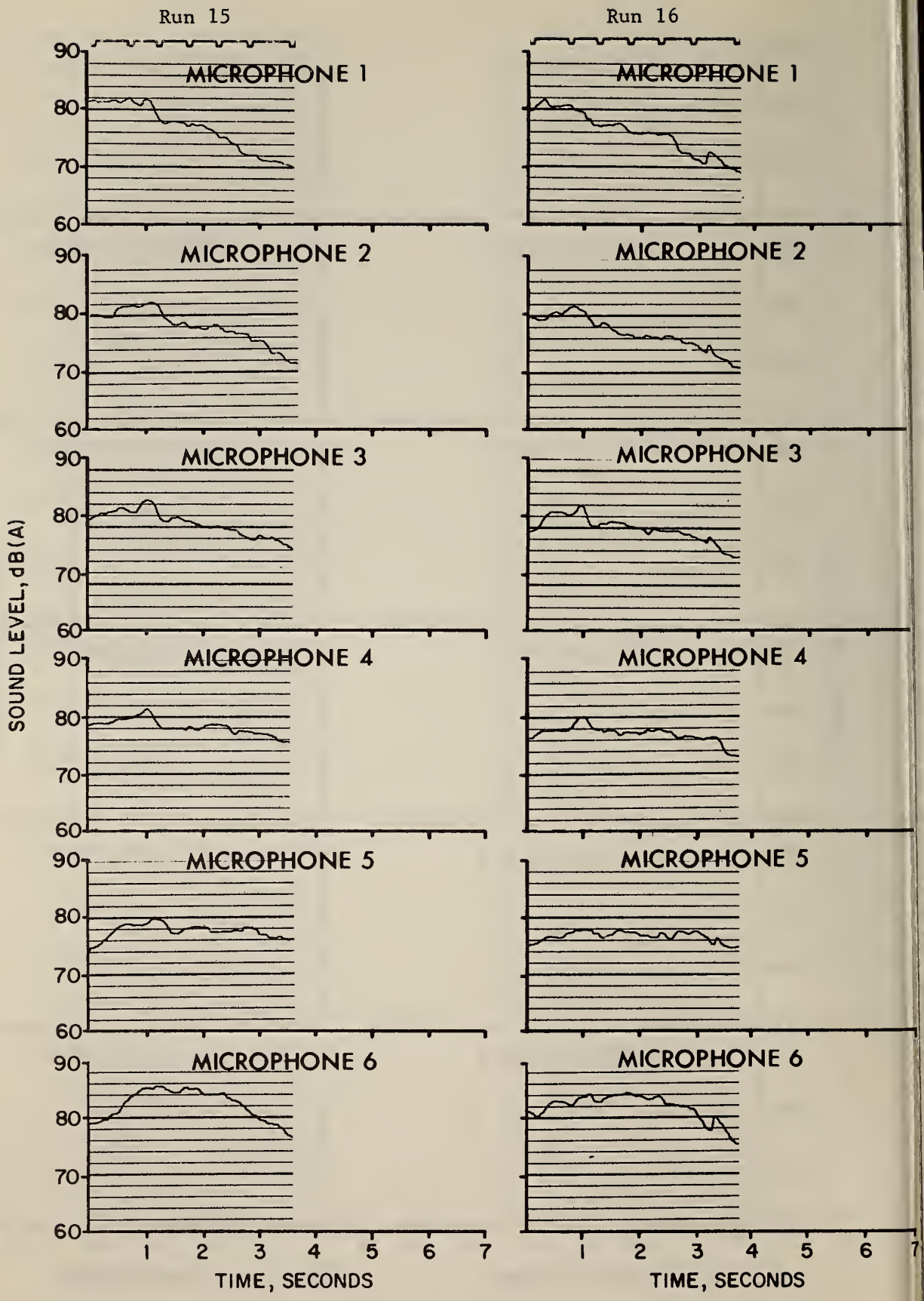

Figure 13-9. Truck 13, Test 5, Runs 15,16. (Exterior)

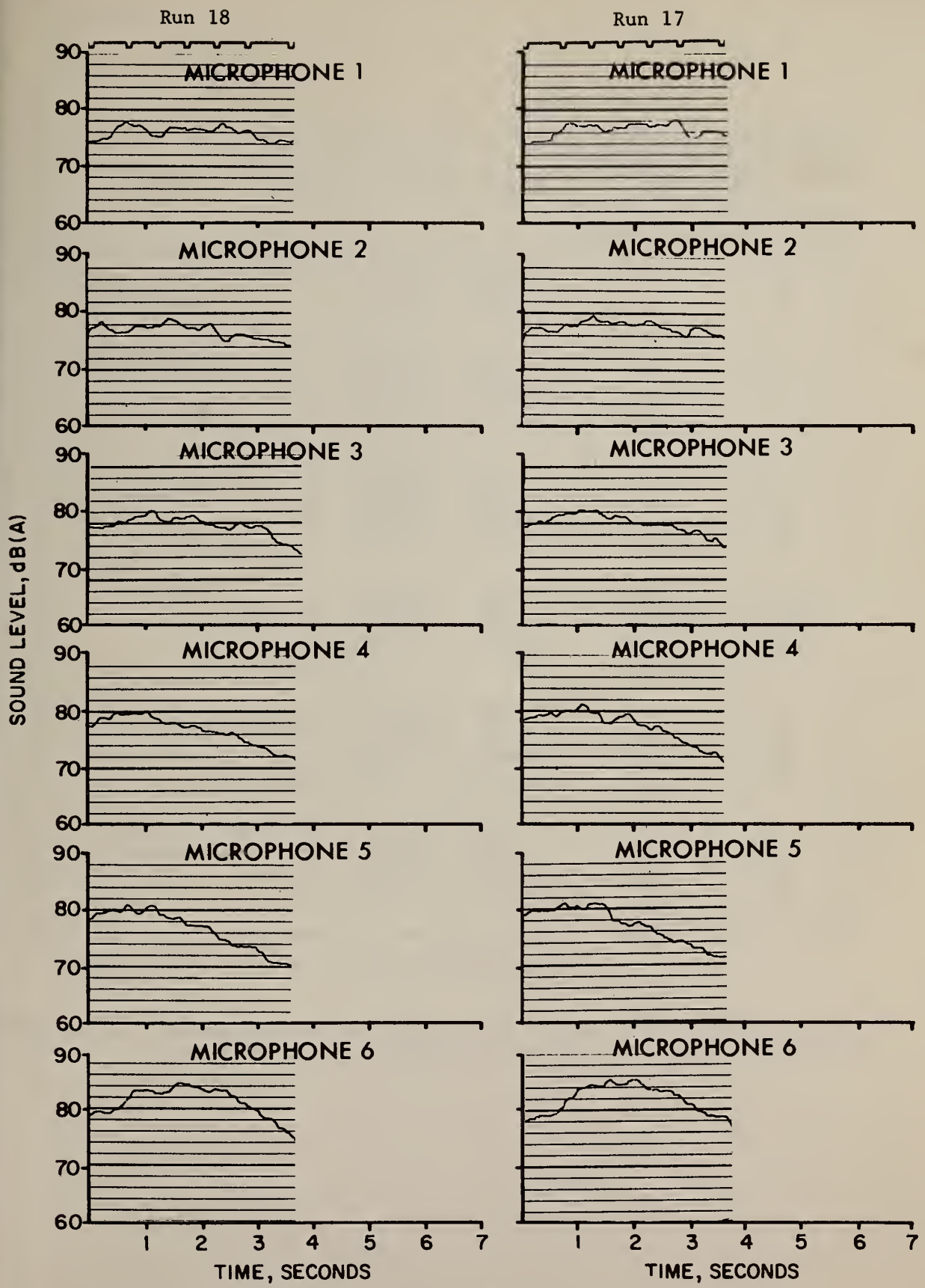

Figure 13-10. Truck 13, Test 5, Runs 17,18. (Exterior)

Interior

Truck 13

TEST	RUN	(SIDE)	WINDOWS	SOUND LEVEL, dB(A) MICROPHONES	
				LEFT EAR	RIGHT EAR
1. Low Idle (Stationary)	1	Right	Open	72	74
	2	Left	Closed	72	72
2. Acceleration (Stationary)	3	Right	Open	91	93
	4	Right	Open	91	94
	5	Left	Closed	92	91
	6	Left	Closed	92	91
2. High Idle (Stationary)	3	Right	Open	88	87
	4	Right	Open	88	86
	5	Left	Closed	88	86
	6	Left	Closed	88	87
3. City Start Up*	7	Right	Open	91*/89	96*/90
	8	Right	Open	91*/89	96*/89
	9	Left	Closed	93*/89	92*/86
	10	Left	Closed	92*/90	92*/87
4. J366 (Acceleration)	11	Right	Open	91	90
	12	Right	Open	91	91
	13	Left	Closed	90	88
	14	Left	Closed	90	88
5. J366 (Deceleration)	15	Right	Open	89	88
	16	Right	Open	88	87
	17	Left	Closed	88	86
	18	Left	Closed	90	89

*First number in pair indicates shift noise.

Table 13-2. Maximum A-weighted sound levels as measured at the two interior microphone locations for all test runs for vehicle number 13.

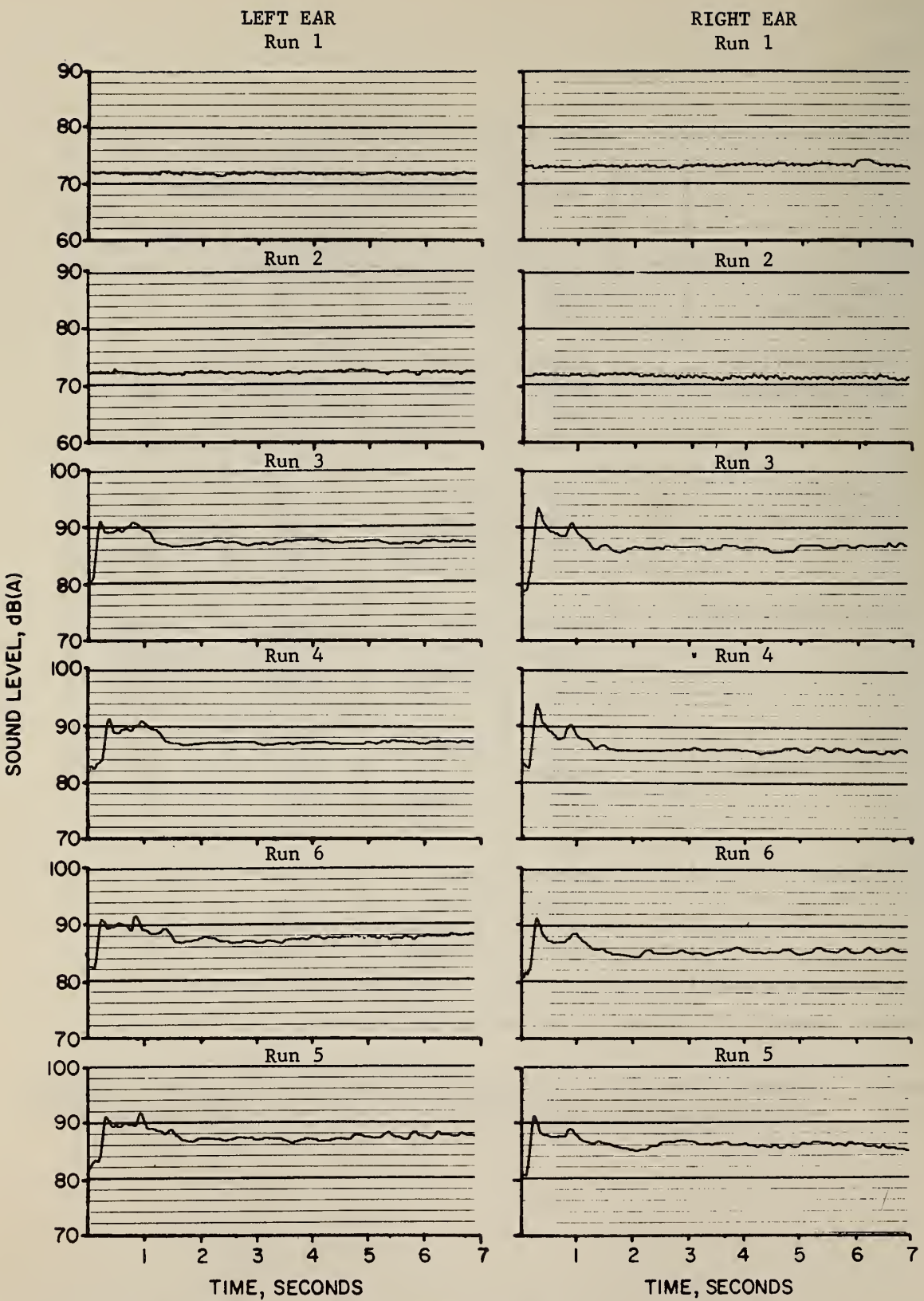

Figure 13-11. Truck 13, Tests 1,2, Runs 1-6. (Interior)

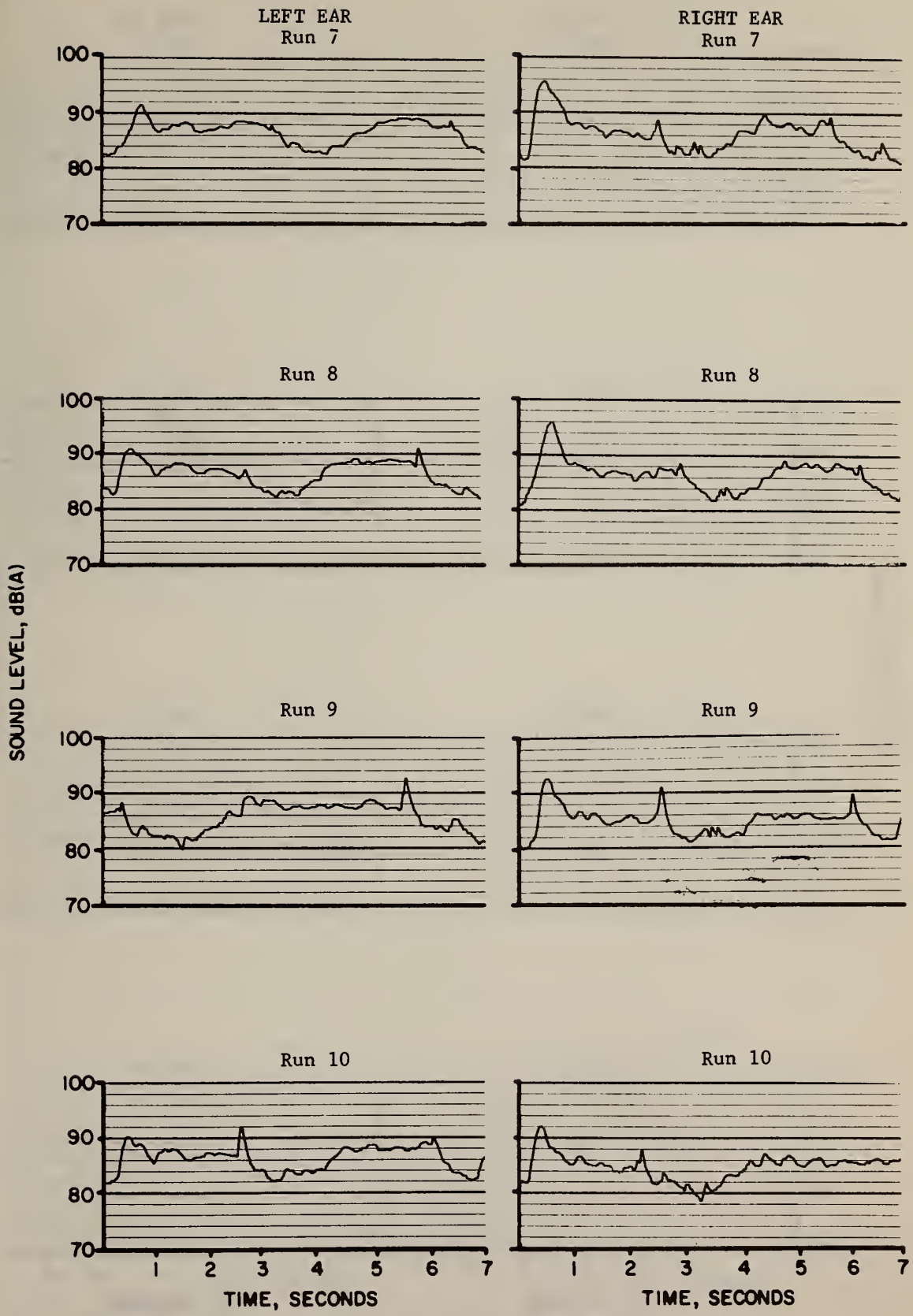

Figure 13-12. Truck 13, Test 3, Runs 7-10. (Interior)

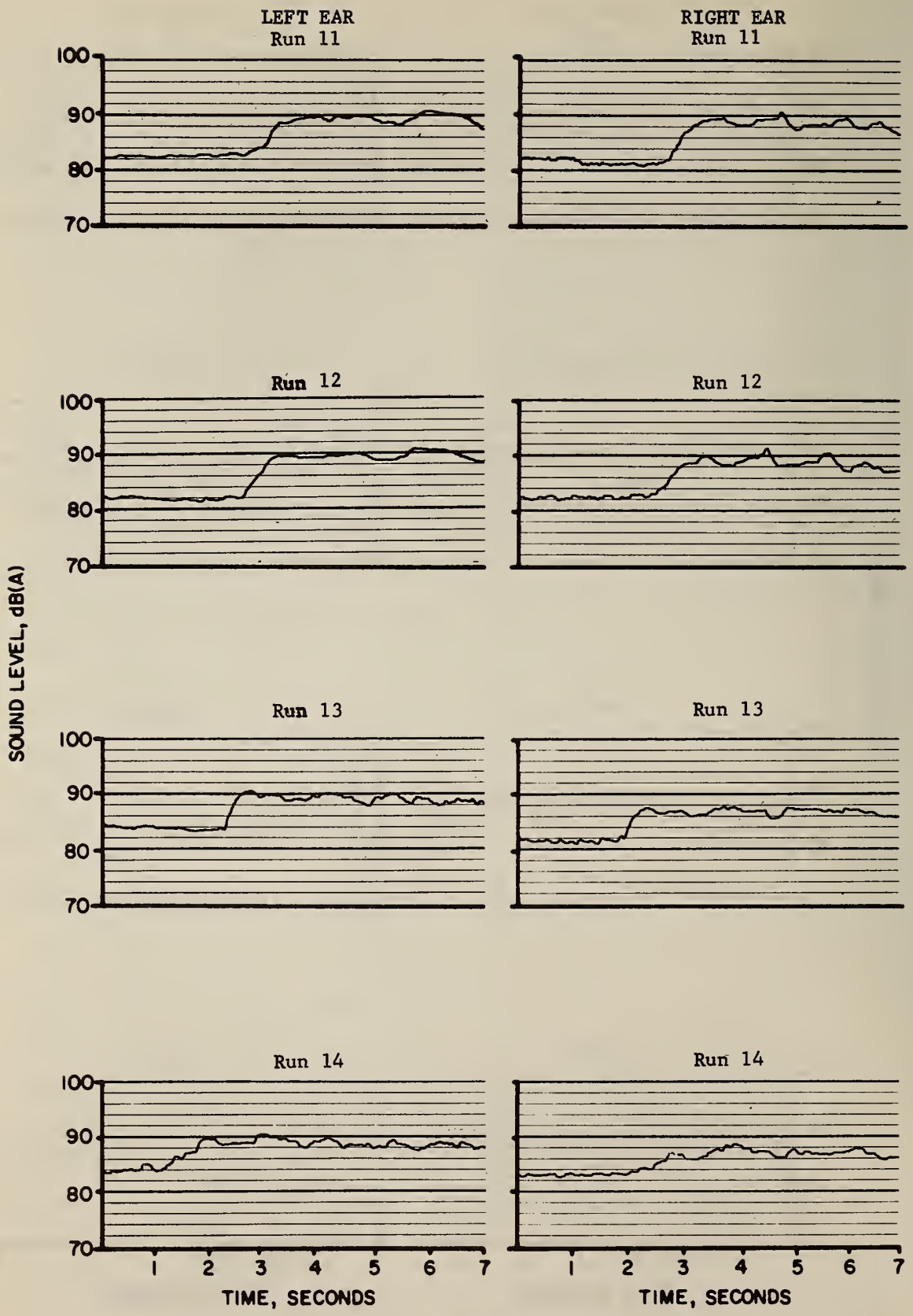

Figure 13-13. Truck 13, Test 4, Runs 11-14. (Interior)

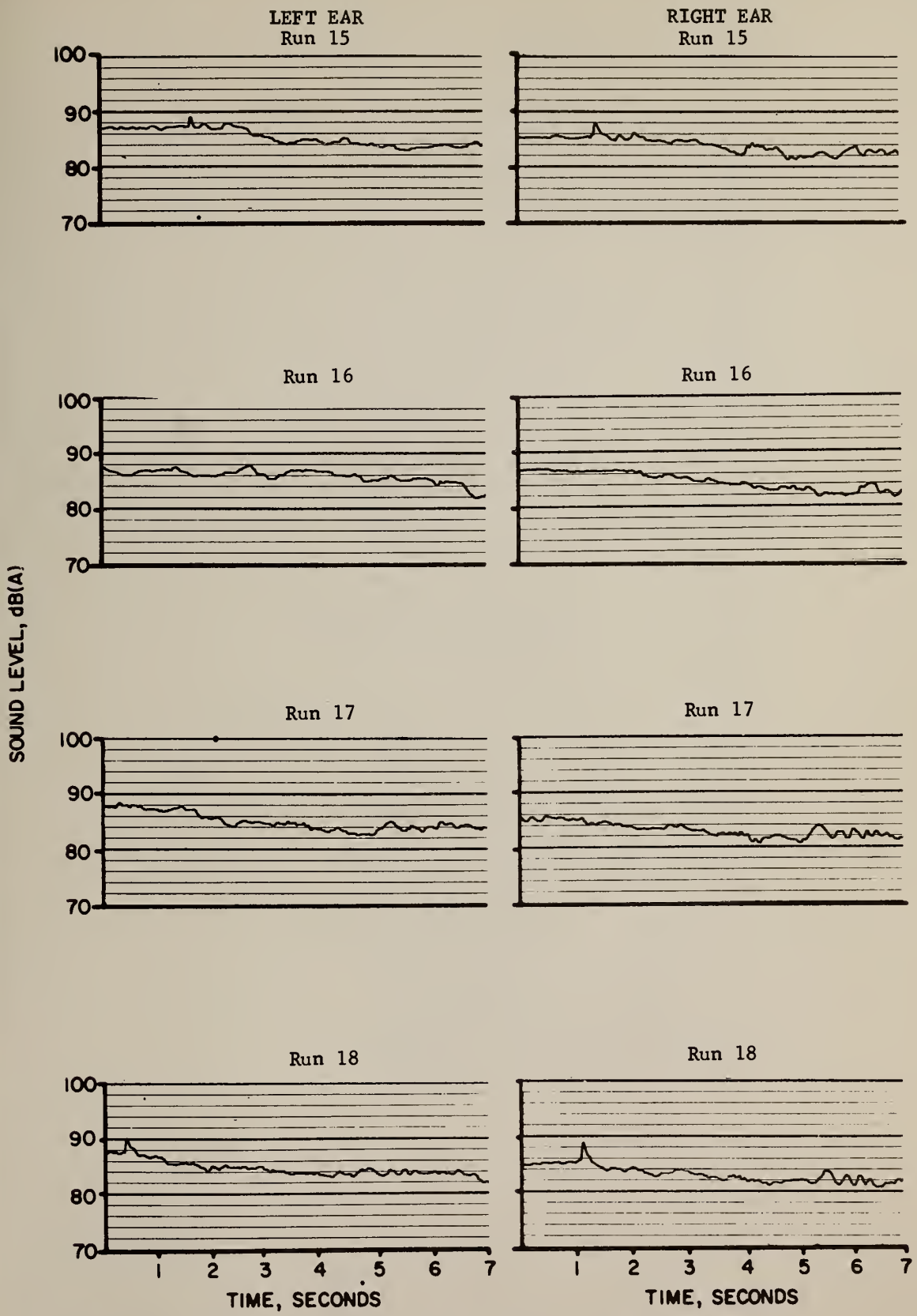

Figure 13-14. Truck 13, Test 5, Runs 15-18. (Interior)

Test Vehicle Number 14

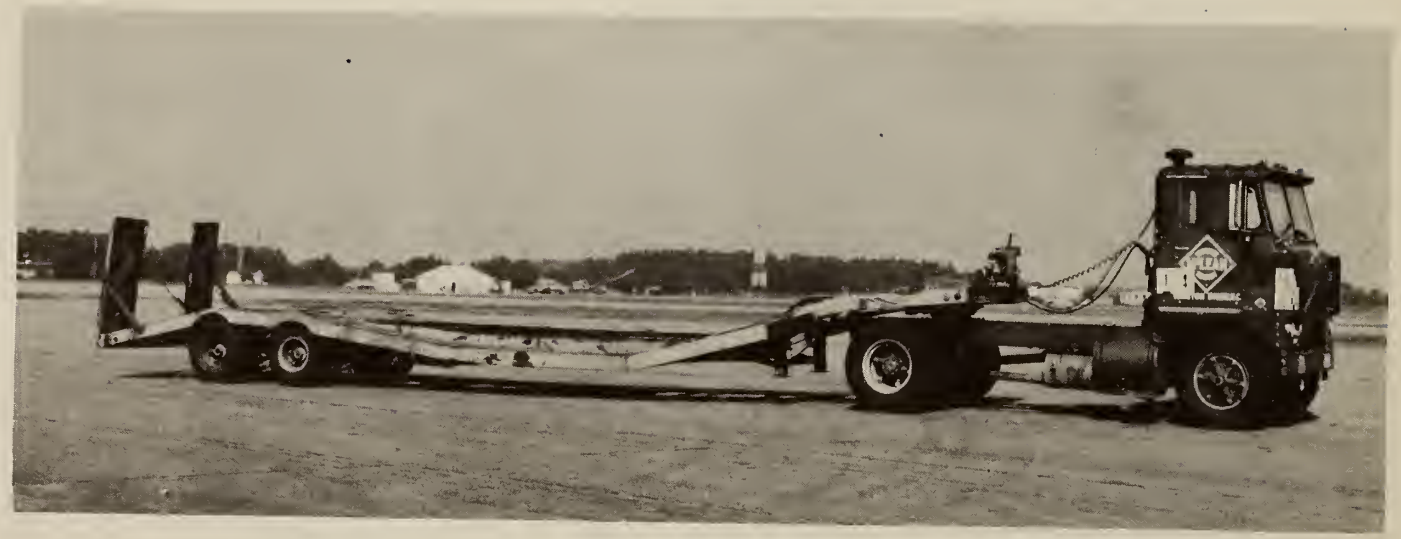

Figure 14-1. Test Vehicle Number 14.

Truck Number: 14
Carrier (owner): McLean Trucking Company
Company Fleet Number: 1561
Make: White
Model: 7464 TDD
Serial Number: 738769
Year: 1970
Engine Governor Setting: 2225 rpm (no load)
1950 rpm (full load)
Total Miles of Operation: 90,590
Miles Since Last Engine Overhaul: Original engine
Miles Since Any Exhaust Work: Original exhaust system
Engine: Make - Detroit Diesel
Model - 6-71N

Exterior

Truck 14

TEST	RUN	SIDE	(WINDOWS)	SOUND LEVEL, dB(A) MICROPHONES					
				1	2	3	4	5	6
1. Low Idle (Stationary)	1	Right	Open -500 rpm	59-69	60-71	60-70	58-68	58-70	67-77
	1a	Right	Open -600 rpm	62-64	64-67	63-66	62-64	62-65	69-72
	2	Left	Closed-500 rpm	60-70	60-70	61-73	60-70	60-70	66-76
	2a	Left	Closed-600 rpm	64	63	66	65	64	70
2. Acceleration (Stationary)	3	Right	Open	83	85	84	82	83	90
	4	Right	Open	83	86	86	82	84	90
	5	Left	Closed	82	85	85	84	85	90
	6	Left	Closed	83	85	86	86	87	91
2. High Idle (Stationary)	3	Right	Open	81	82	83	80	80	87
	4	Right	Open	80	83	82	79	81	88
	5	Left	Closed	82	81	82	82	82	88
	6	Left	Closed	83	81	82	82	82	88
3. City Start Up	7	Right	Open	84	83	82	81	82	88
	8	Right	Open	82	83	84	83	84	89
	9	Left	Closed	83	83	84	81	82	88
	10	Left	Closed	83	84	84	83	82	88
4. J366 (Acceleration)	11	Right	Open	85	85	86	86	85	91
	12	Right	Open	85	86	86	87	85	92
	13	Left	Closed	85	86	87	88	86	92
	14	Left	Closed	86	86	88	89	85	92
5. J366 (Deceleration)	15	Right	Open	83	82	82	81	80	87
	16	Right	Open	82	81	81	80	80	86
	17	Left	Closed	80	81	82	82	82	87
	18	Left	Closed	79	81	81	81	82	87

Table 14-1. Maximum A-weighted sound levels as measured at the six exterior microphone locations for all test runs for vehicle number 14.

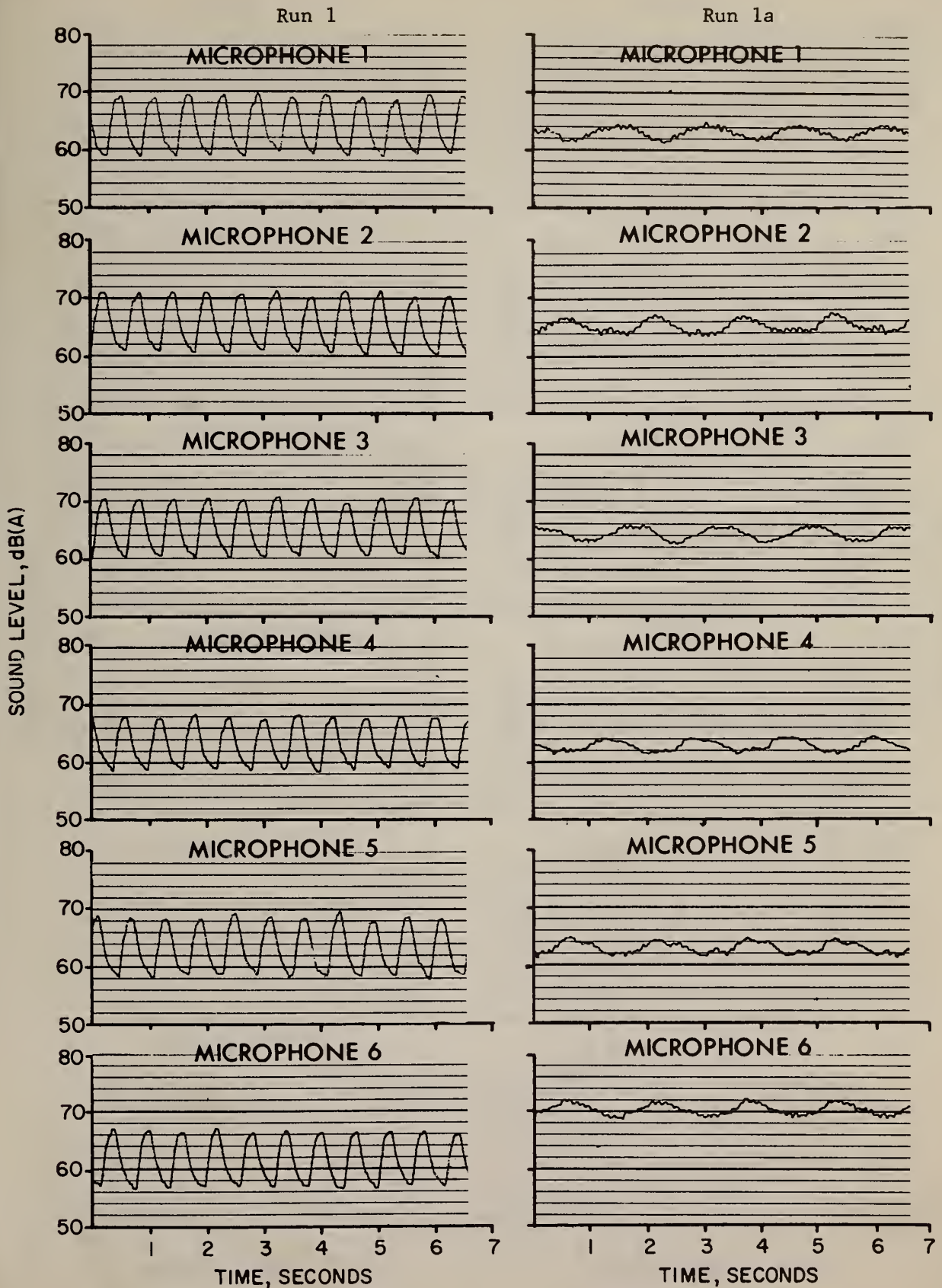

Figure 14-2. Truck 14, Test 1, Runs 1,1a. (Exterior)

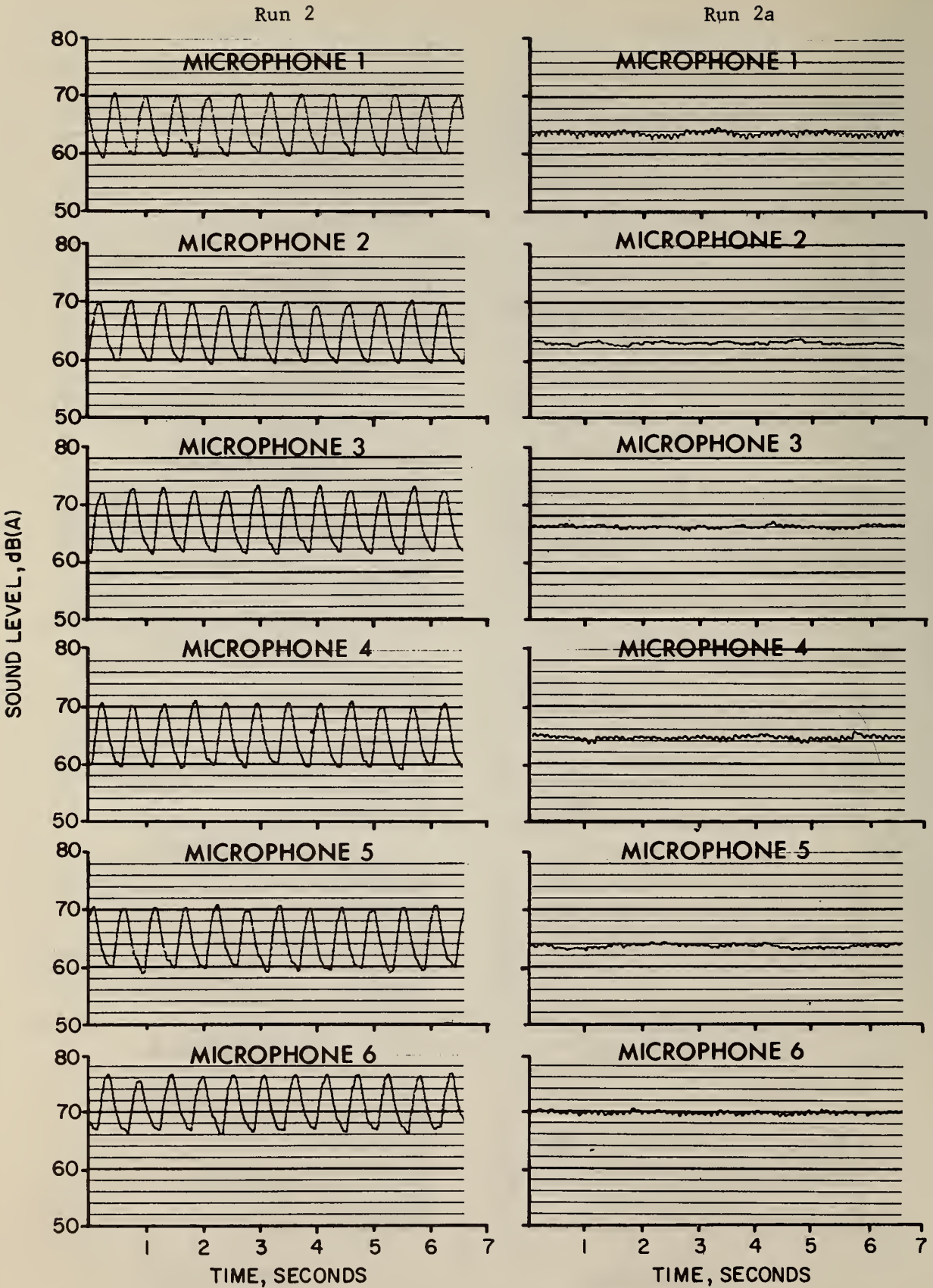

Figure 14-3. Truck 14, Test 1, Runs 2,2a. (Exterior)

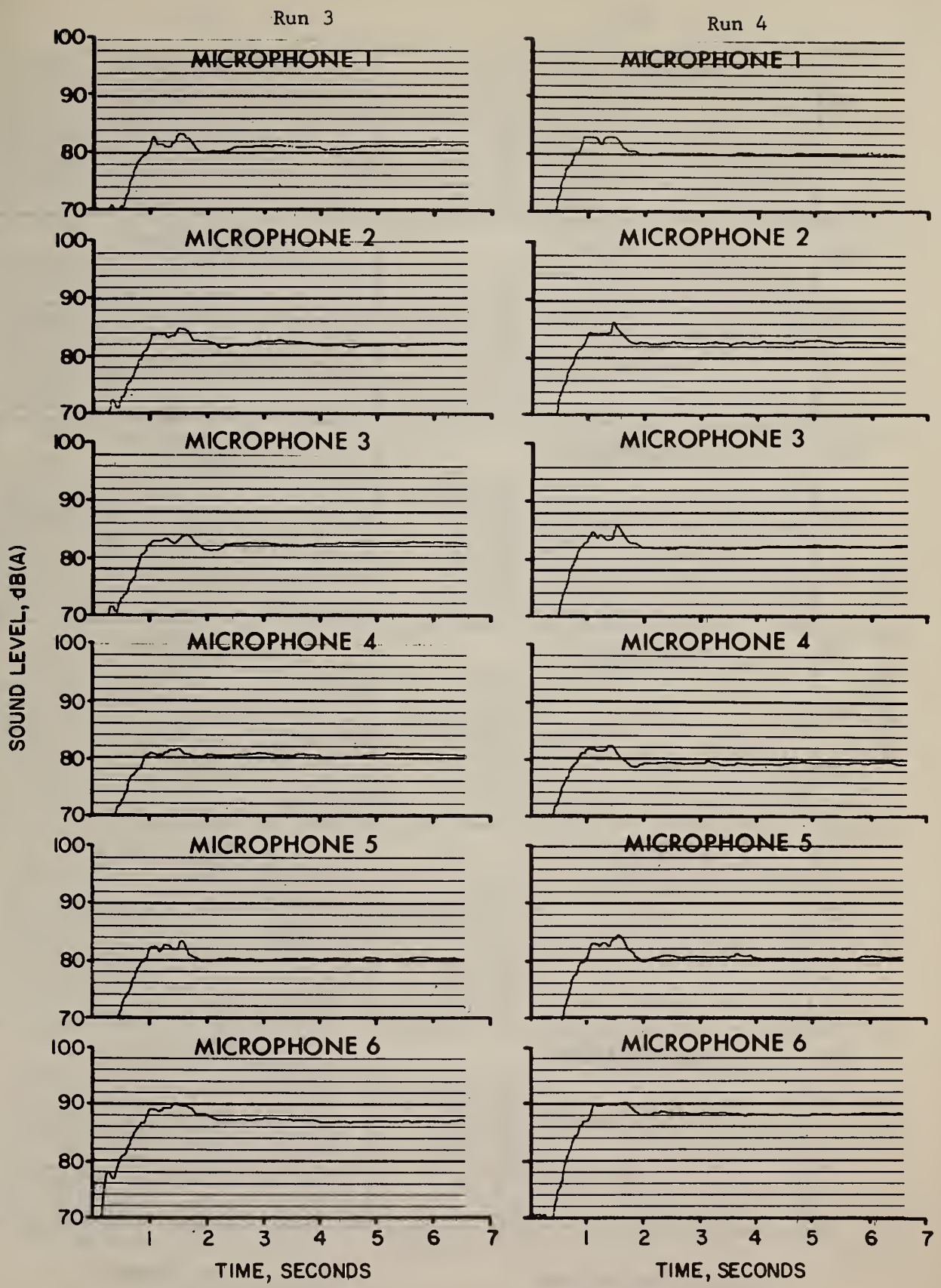

Figure 14-4. Truck 14, Test 2, Runs 3,4. (Exterior)

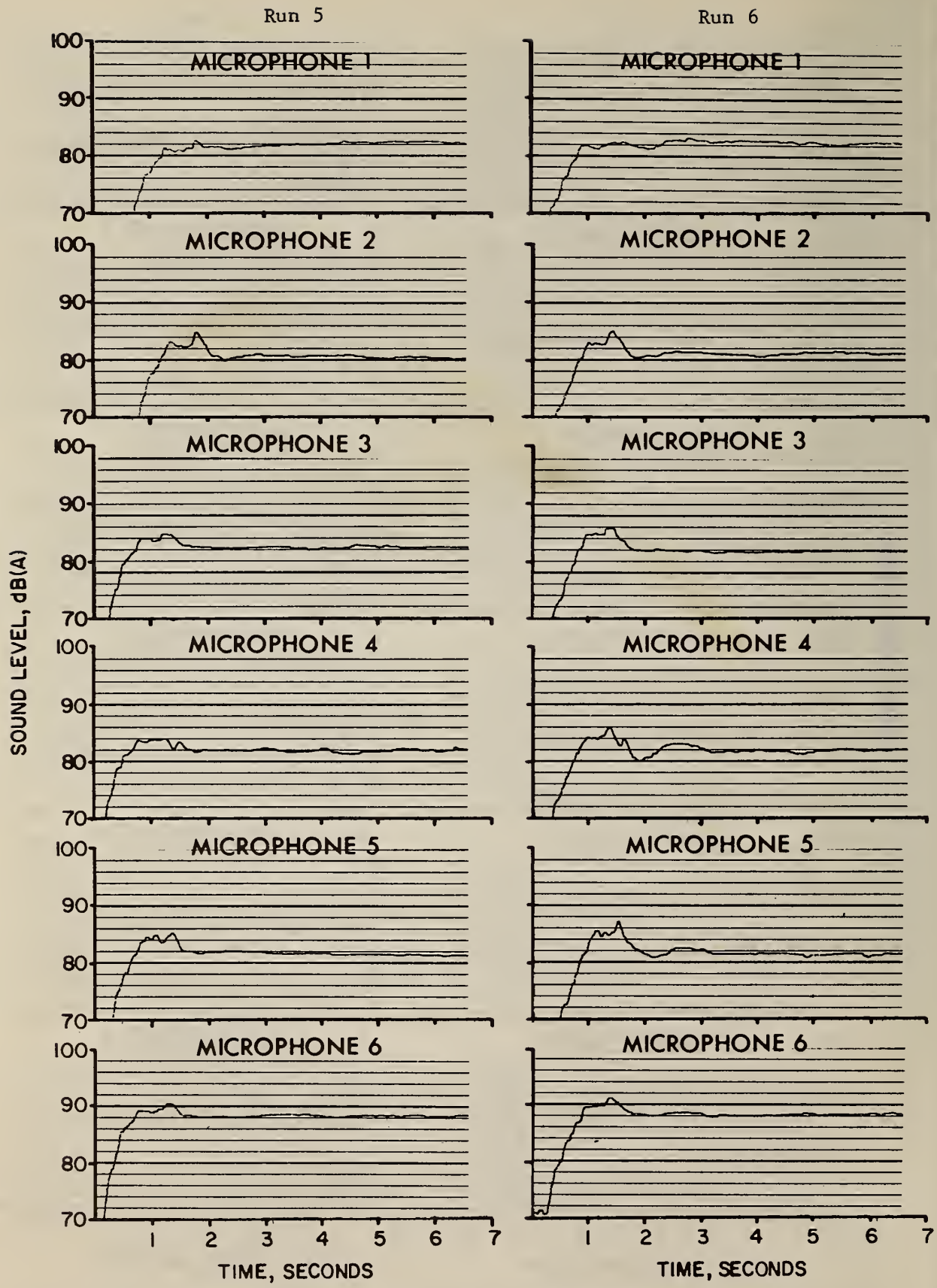

Figure 14-5. Truck 14, Test 2, Runs 5,6. (Exterior)

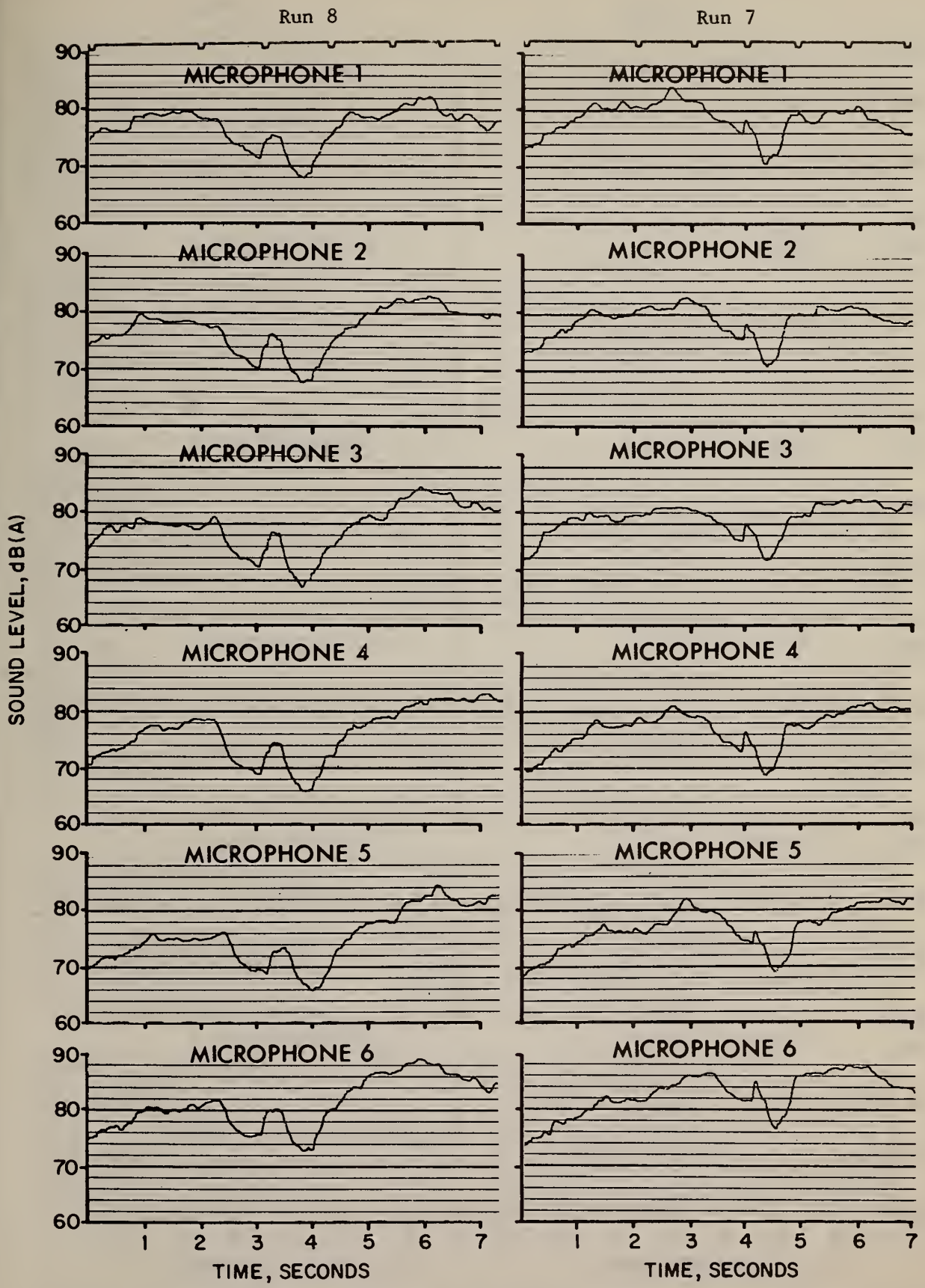

Figure 14-6. Truck 14, Test 3, Runs 7,8. (Exterior)

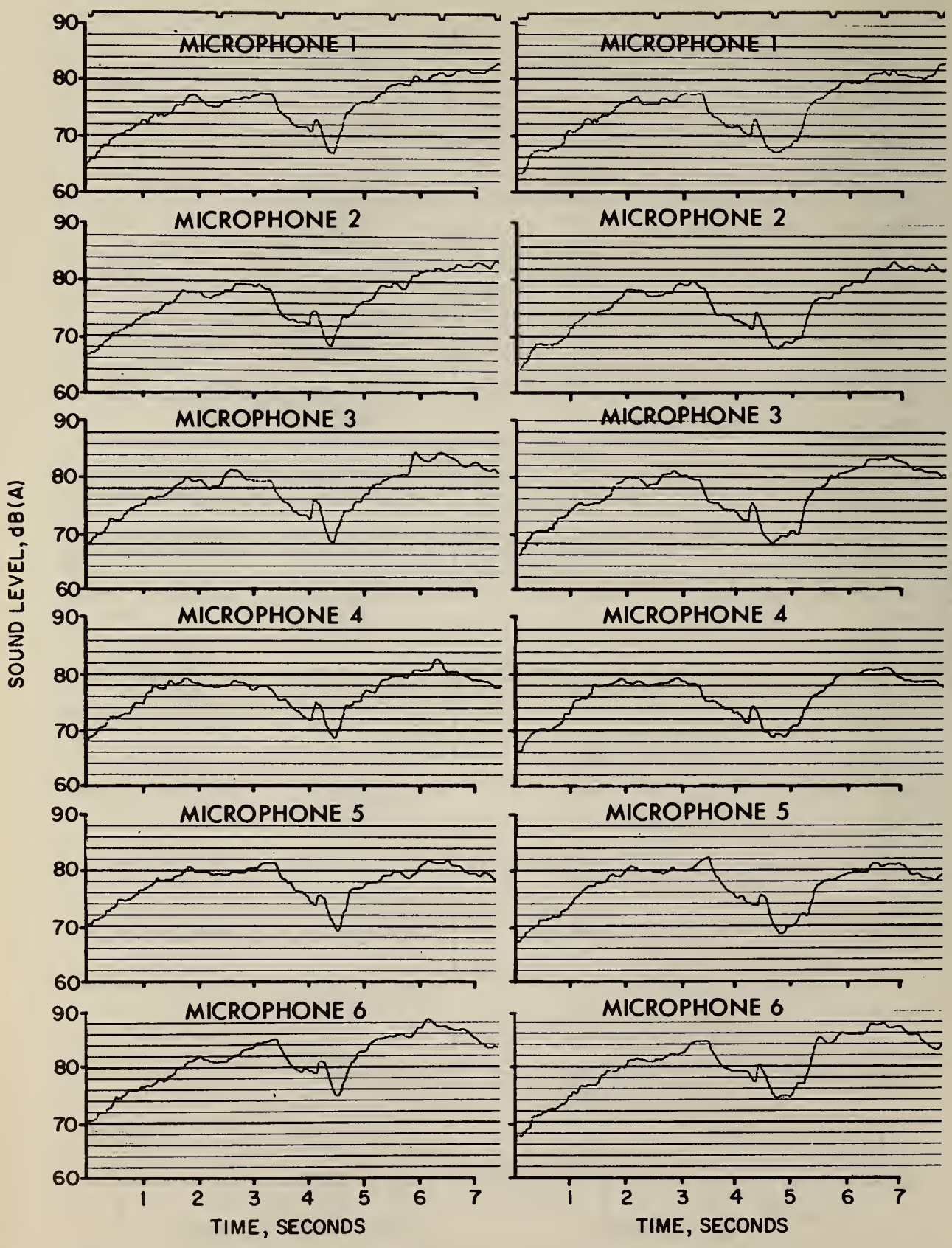

Figure 14-7. Truck 14. Test 3, Runs 9,10. (Exterior)

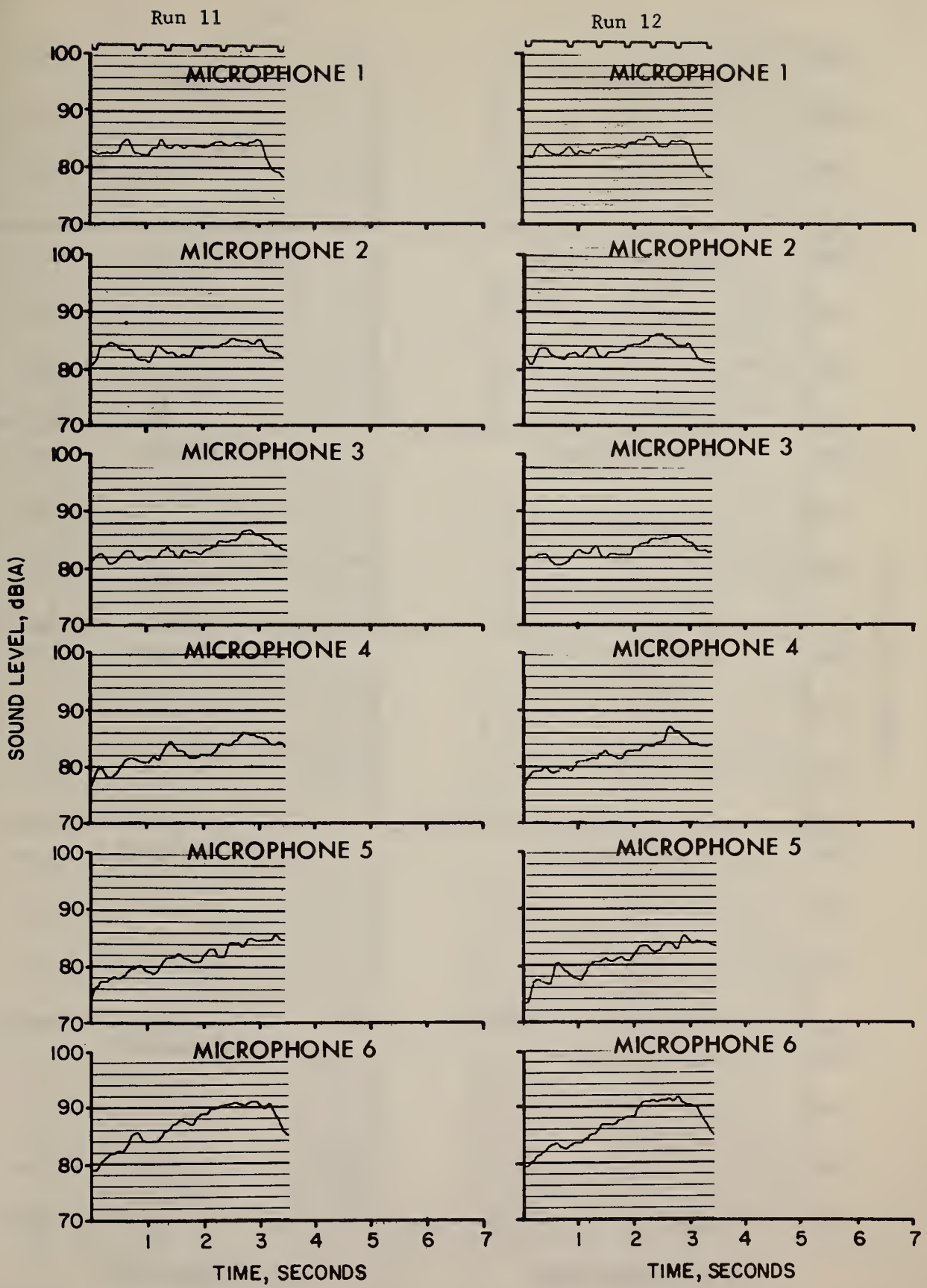

Figure 14-8. Truck 14, Test 4, Runs 11,12. (Exterior)

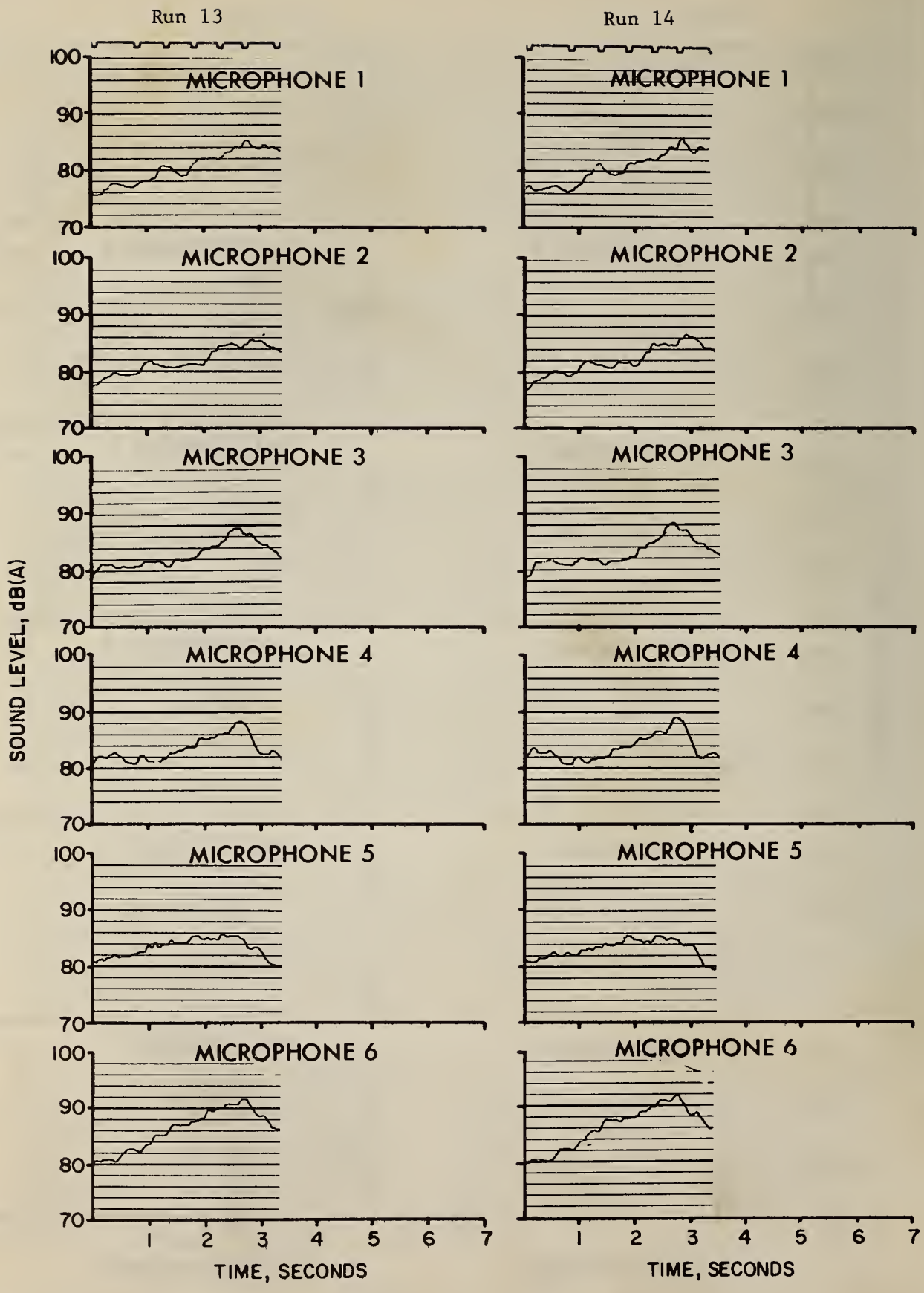

Figure 14-9. Truck 14, Test 4, Runs 13,14. (Exterior)

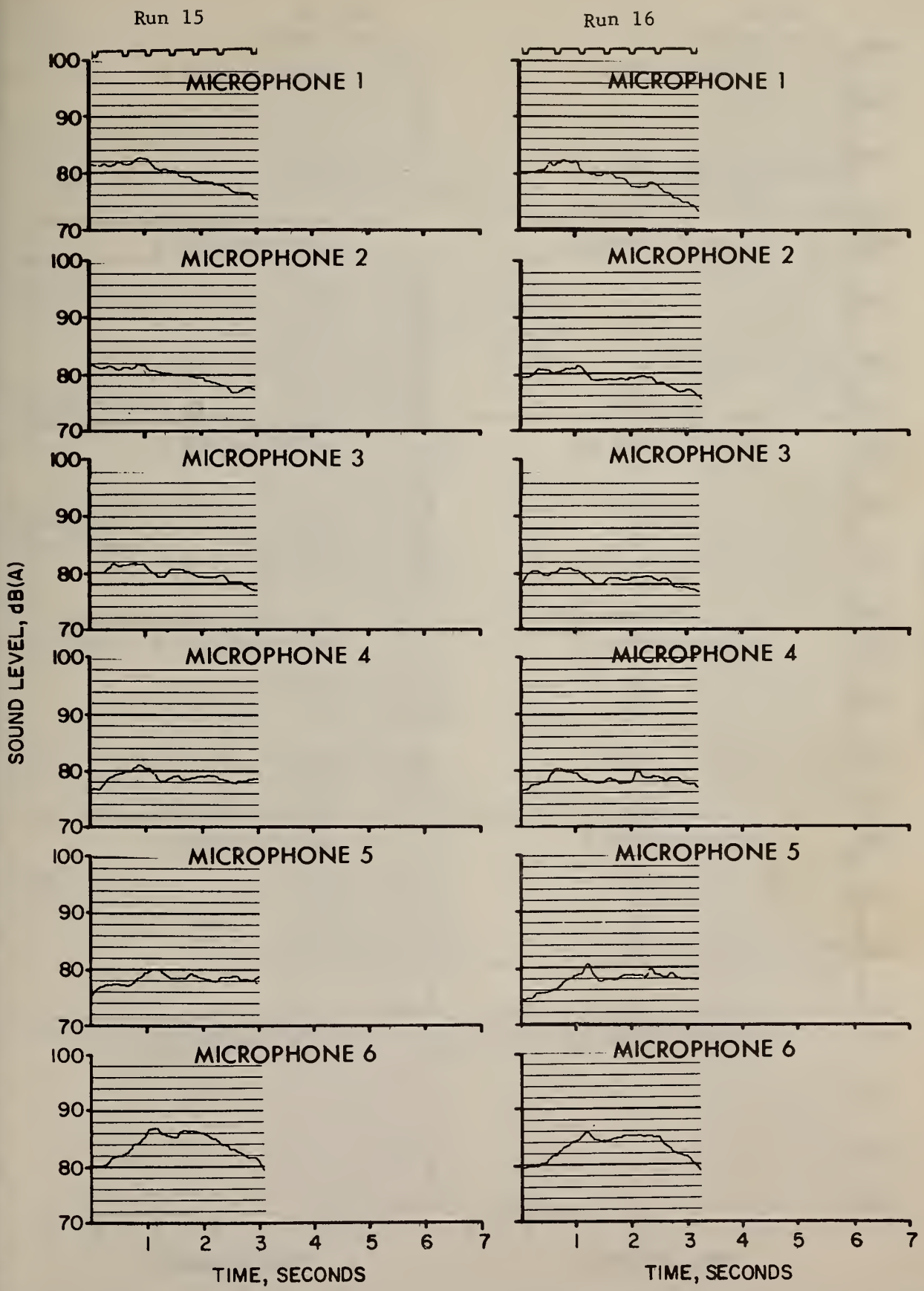

Figure 14-10. Truck 14, Test 5, Runs 15,16. (Exterior)

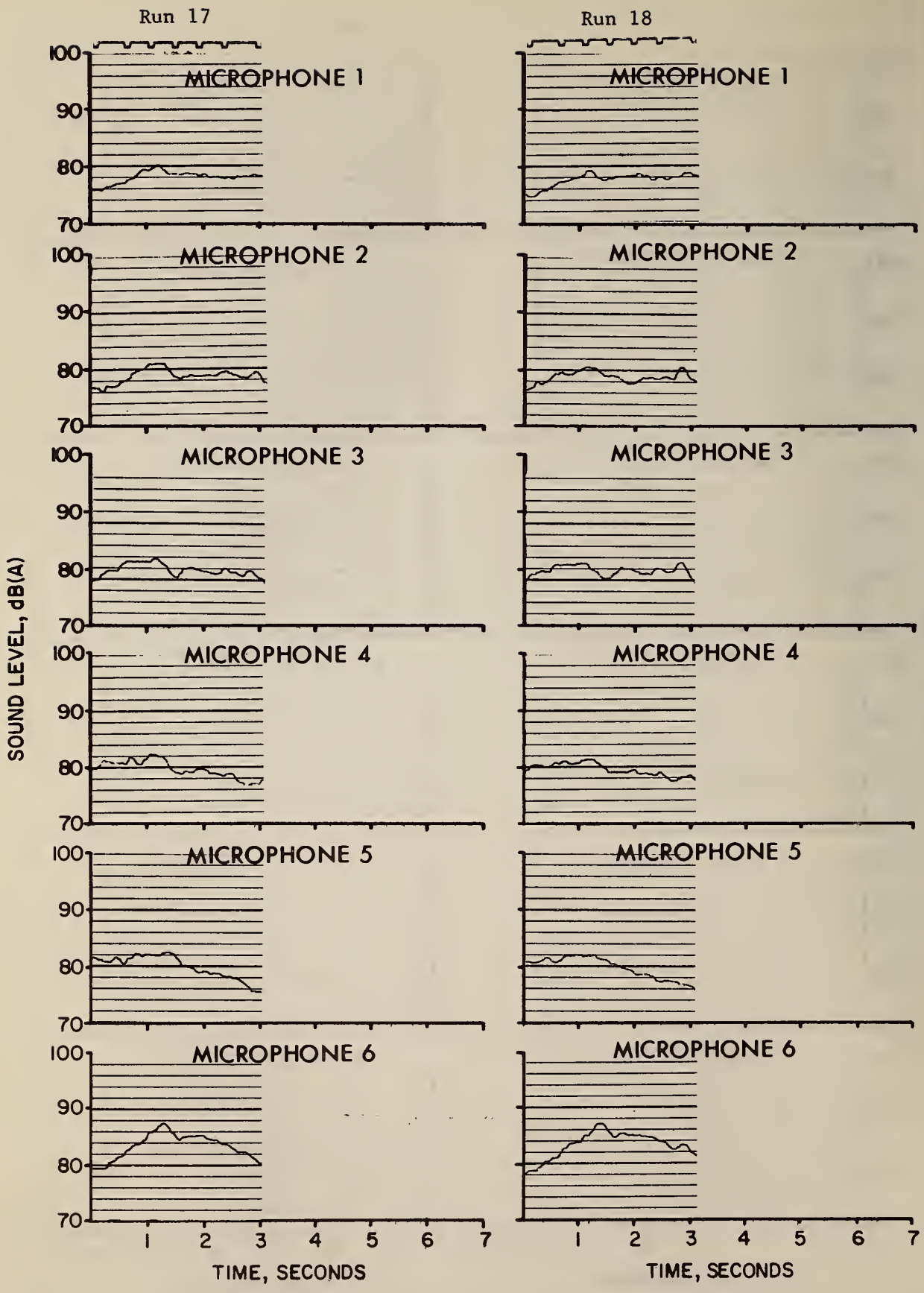

Figure 14-11. Truck 14, Test 5, Runs 17,18. (Exterior)

Interior

Truck 14

TEST	RUN	(SIDE)	WINDOWS	SOUND LEVEL, dB(A) MICROPHONES	
				LEFT EAR	RIGHT EAR
1. Low Idle (Stationary)	1	Right	Open-500 rpm	74-65	72-65
	1a	Right	Open-600 rpm	70-67	70-66
	2	Left	Closed-500 rpm	73-65	73-65
	2a	Left	Closed-600 rpm	68	69
2. Acceleration (Stationary)	3	Right	Open	88	88
	4	Right	Open	88	87
	5	Left	Closed	88	89
	6	Left	Closed	87	88
2. High Idle (Stationary)	3	Right	Open	88	87
	4	Right	Open	87	87
	5	Left	Closed	87	87
	6	Left	Closed	88	87
3. City Start Up	7	Right	Open	87	88
	8	Right	Open	86	86
	9	Left	Closed	86	86
	10	Left	Closed	85	86
4. J366 (Acceleration)	11	Right	Open	88	87
	12	Right	Open	88	88
	13	Left	Closed	88	87
	14	Left	Closed	88	87
5. J366 (Deceleration)	15	Right	Open	87	88
	16	Right	Open	87	86
	17	Left	Closed	87	86
	18	Left	Closed	86	86

Table 14-2. Maximum A-weighted sound levels as measured at the two interior microphone locations for all test runs for vehicle number 14.

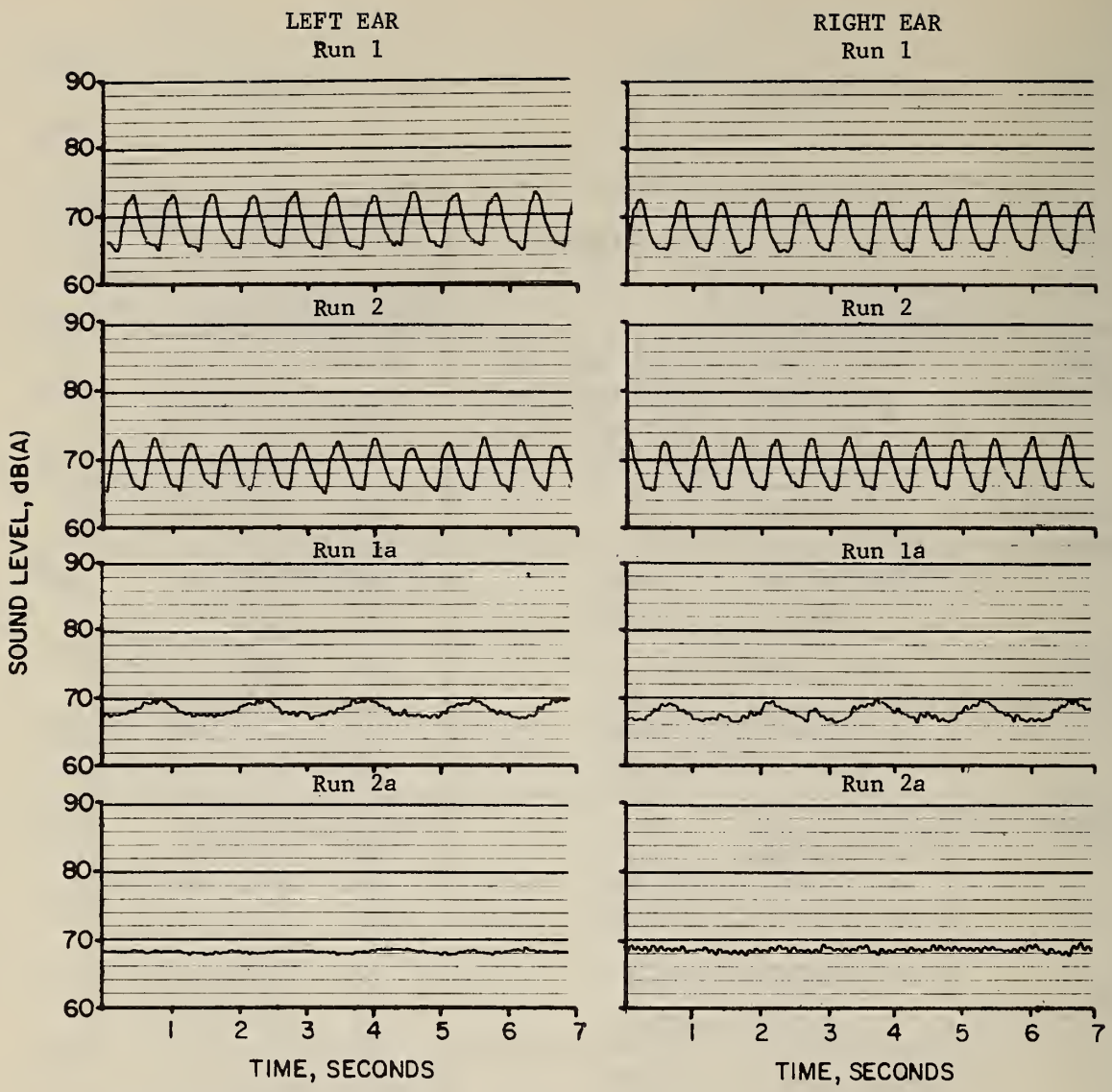

Figure 14-12. Truck 14, Test 1, Runs 1-2a. (Interior)

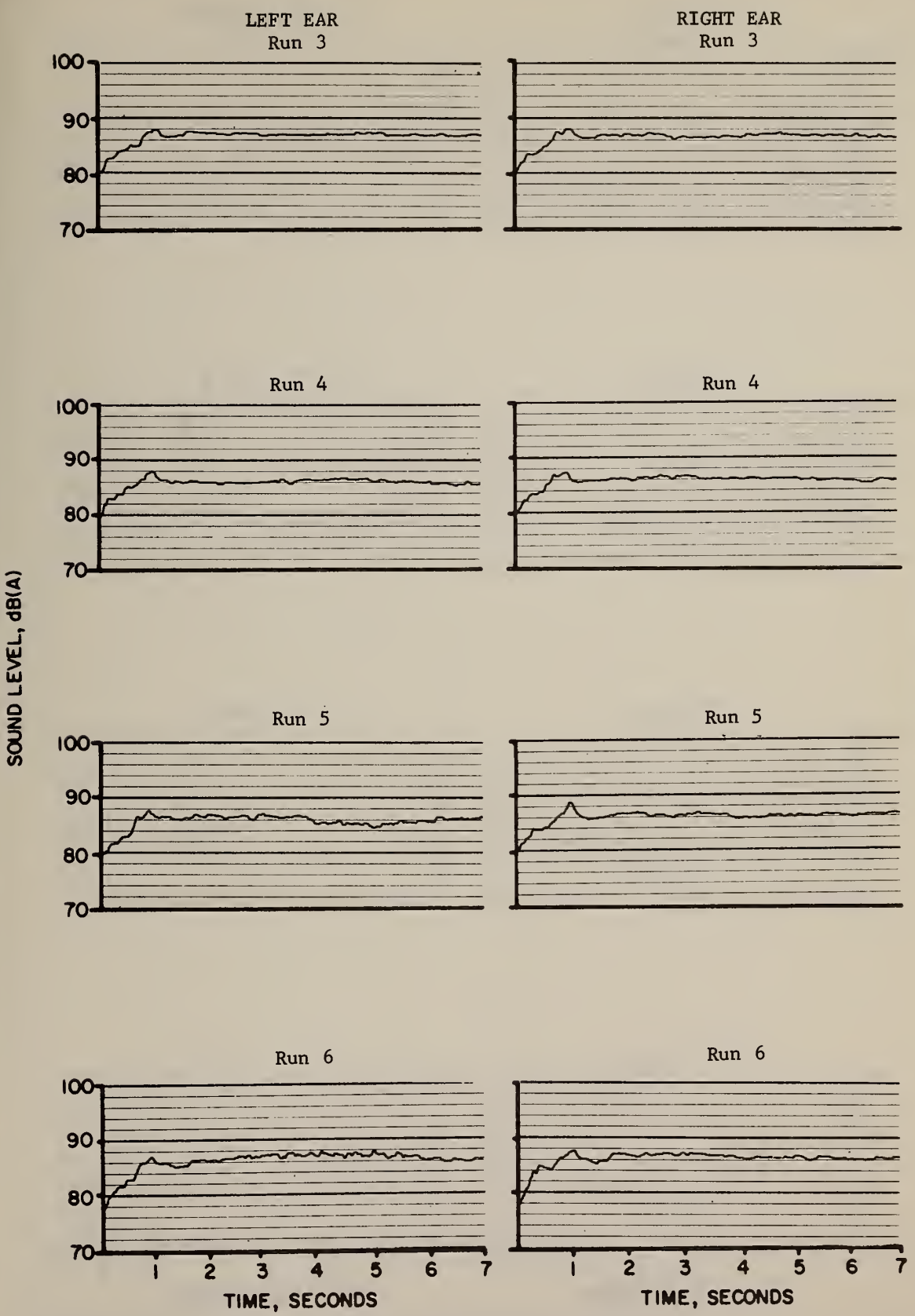

Figure 14-13. Truck 14, Test 2, Runs 3-6. (Interior)

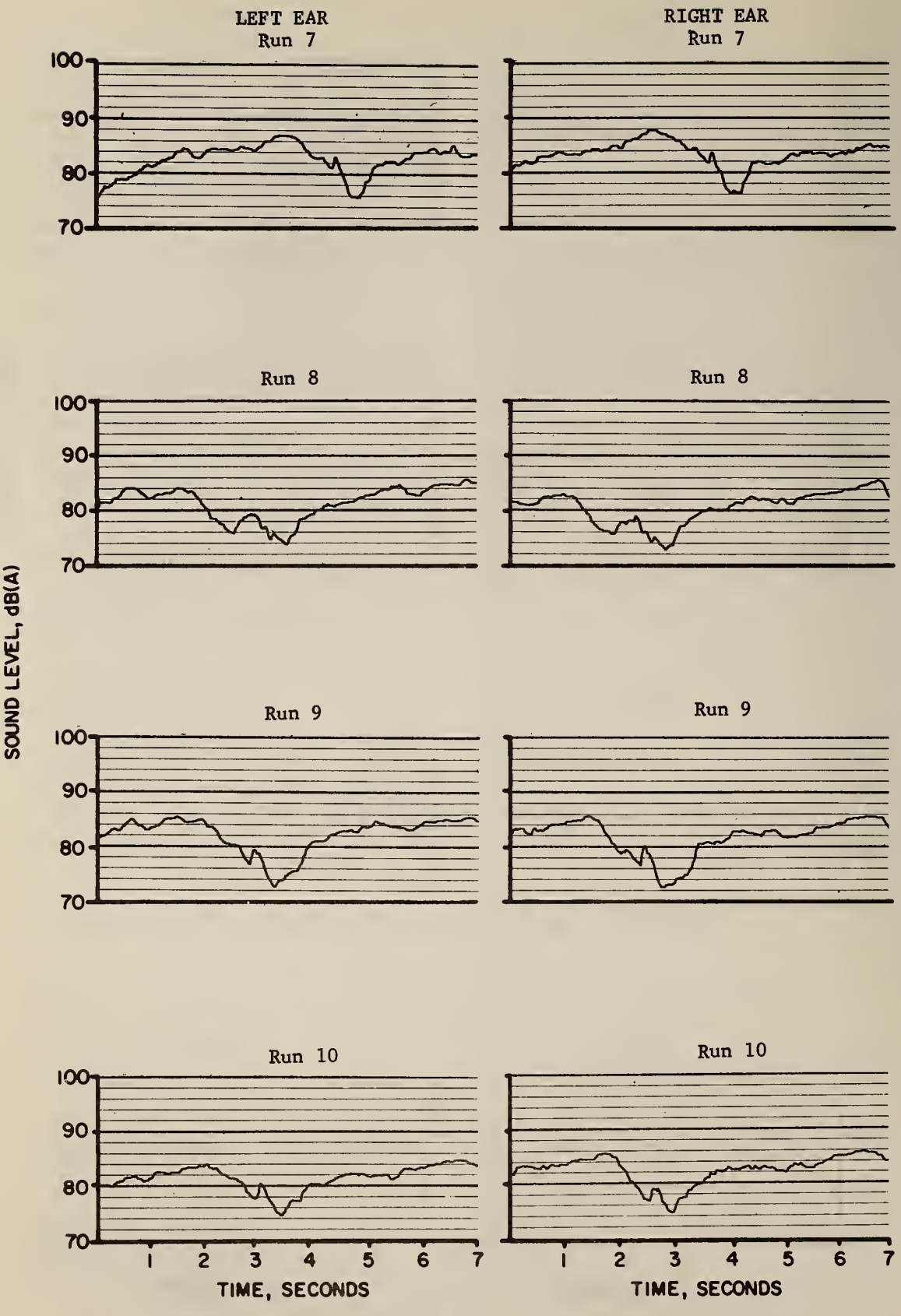

Figure 14-14. Truck 14, Test 3, Runs 7-10. (Interior)

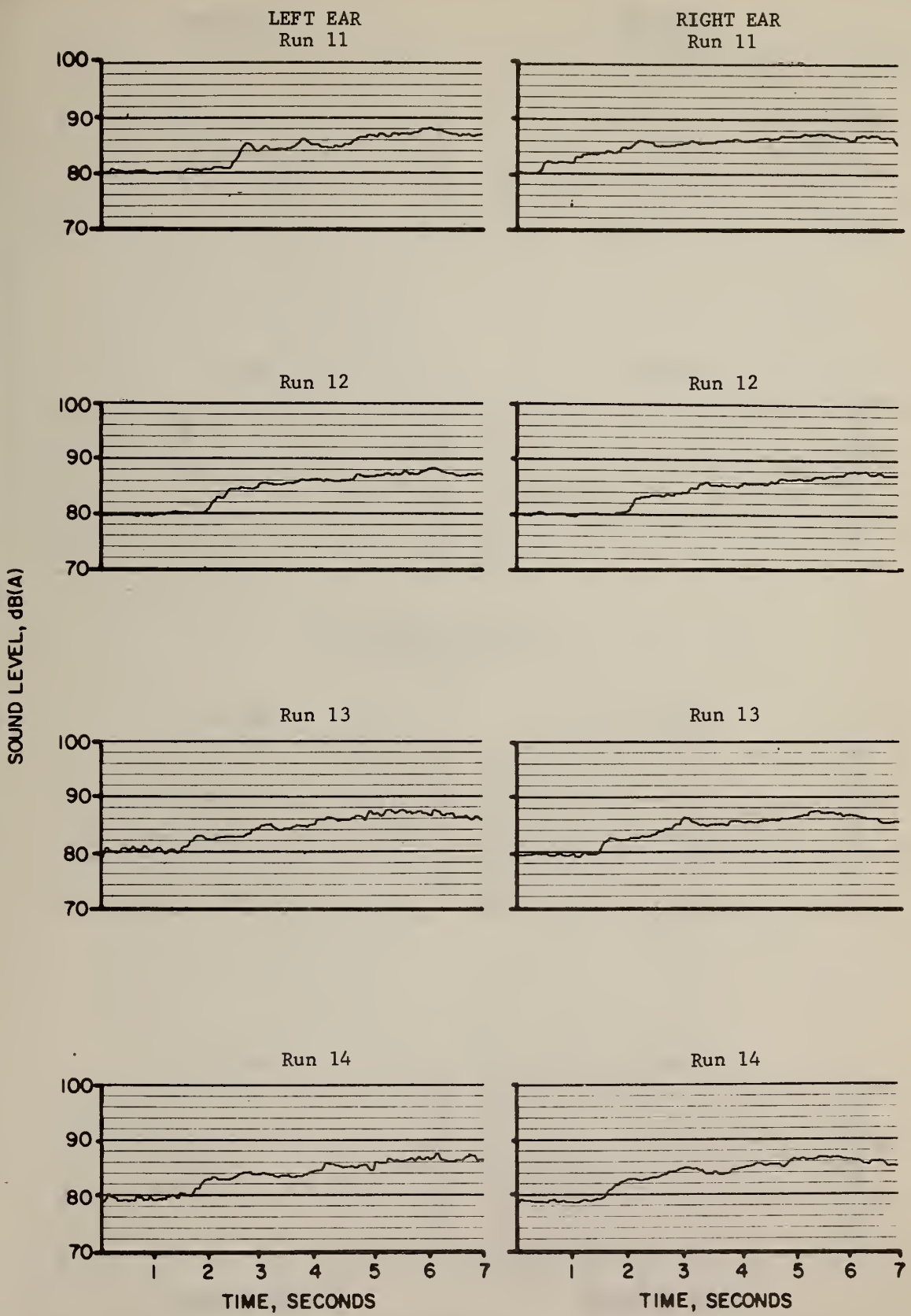

Figure 14-15. Truck 14, Test 4, Runs 11-14. (Interior)

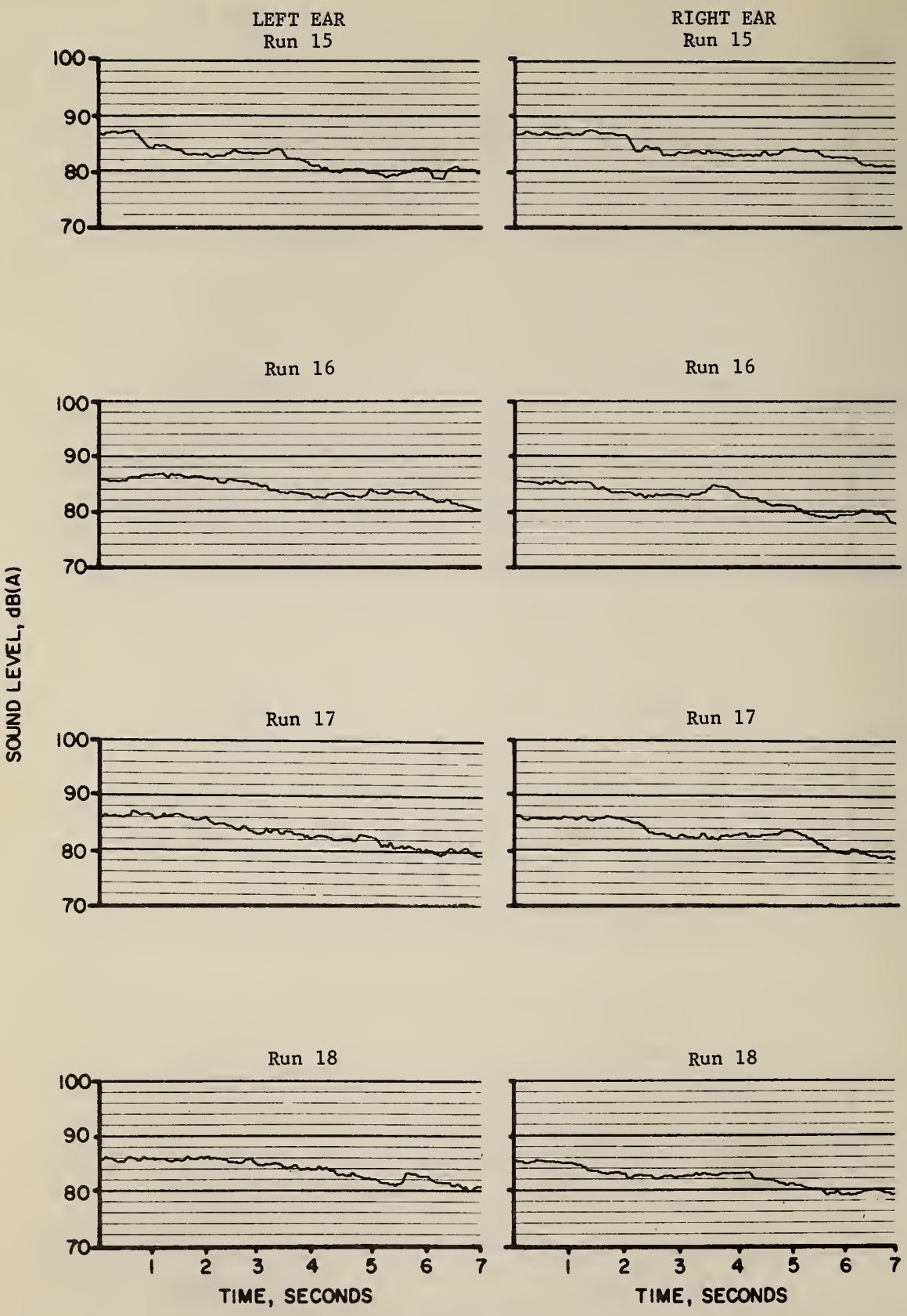

Figure 14-16. Truck 14, Test 5, Runs 15-18. (Interior)

Test Vehicle Number 15

Figure 15-1. Test Vehicle Number 15.

Truck Number: 15
Carrier (owner): McLean Trucking Company
Company Fleet Number: 512
Make: White
Model: 7464 TDB
Serial Number: 730469
Year: 1970
Engine Governor Setting: 2250 rpm (no load)
2100 rpm (full load)
Total Miles of Operation: 222,217
Miles Since Last Engine Overhaul: Original engine
Miles Since Any Exhaust Work: Original exhaust system
Engine: Make - Cummins
Model - NH230-A

Exterior

Truck 15

TEST	RUN	SIDE	(WINDOWS)	SOUND LEVEL, dB(A) MICROPHONES 1	2	3	4	5	6
1. Low Idle (Stationary)	1	Right	Open	66	67	68	68	66	74
	2	Left	Closed	66	67	68	67	66	74
2. Acceleration (Stationary)	3	Right	Open	84	85	86	84	84	92
	4	Right	Open	84	85	86	85	83	92
	5	Left	Closed	83	84	85	85	84	91
	6	Left	Closed	84	84	85	86	85	91
2. High Idle (Stationary)	3	Right	Open	83	85	86	84	84	91
	4	Right	Open	83	84	86	84	83	91
	5	Left	Closed	83	84	85	84	84	91
	6	Left	Closed	83	84	85	84	84	91
3. City Start Up*	7	Right	Open	85	86	85	85	85	92
	8	Right	Open	~~85~~ 84	84	85	85	85	~~91~~ 90
	9	Left	Closed	~~85~~ 84	86	89	87	~~87~~ 84	~~95~~ 90
	10	Left	Closed	86	86	86	86	85	90
4. J366 (Acceleration)	11	Right	Open	86	87	87	86	87	93
	12	Right	Open	86	86	87	86	88	92
	13	Left	Closed	88	86	87	86	86	92
	14	Left	Closed	88	86	87	86	86	92
5. J366 (Deceleration)	15	Right	Open	82	84	86	85	83	89
	16	Right	Open	82	83	85	84	83	89
	17	Left	Closed	83	84	85	84	85	90
	18	Left	Closed	83	85	86	85	85	91

*First number in pair indicates shift noise.

Table 15-1. Maximum A-weighted sound levels as measured at the six exterior microphone locations for all test runs for vehicle number 15.

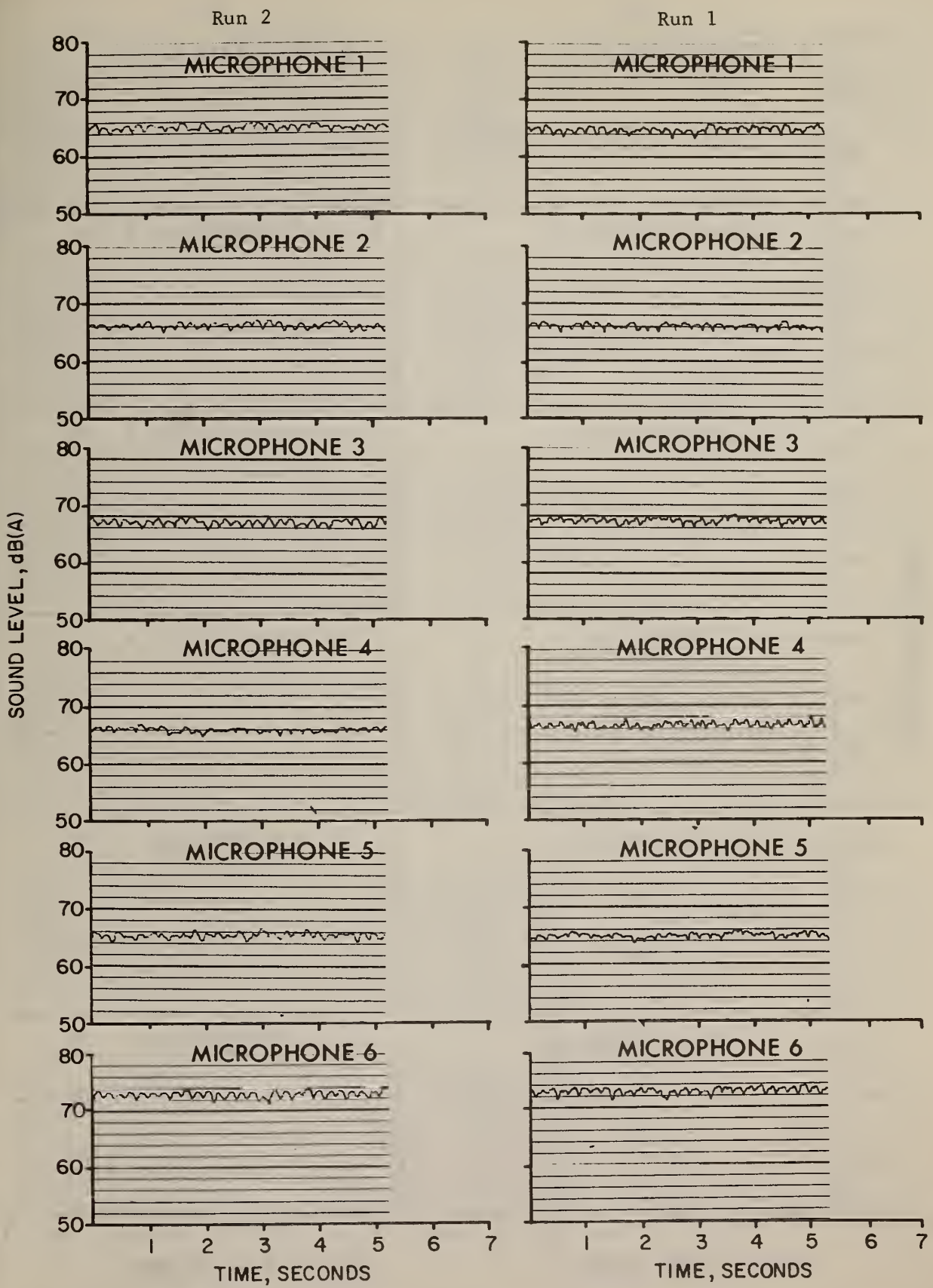

Figure 15-2. Truck 15, Test 1, Runs 1,2. (Exterior)

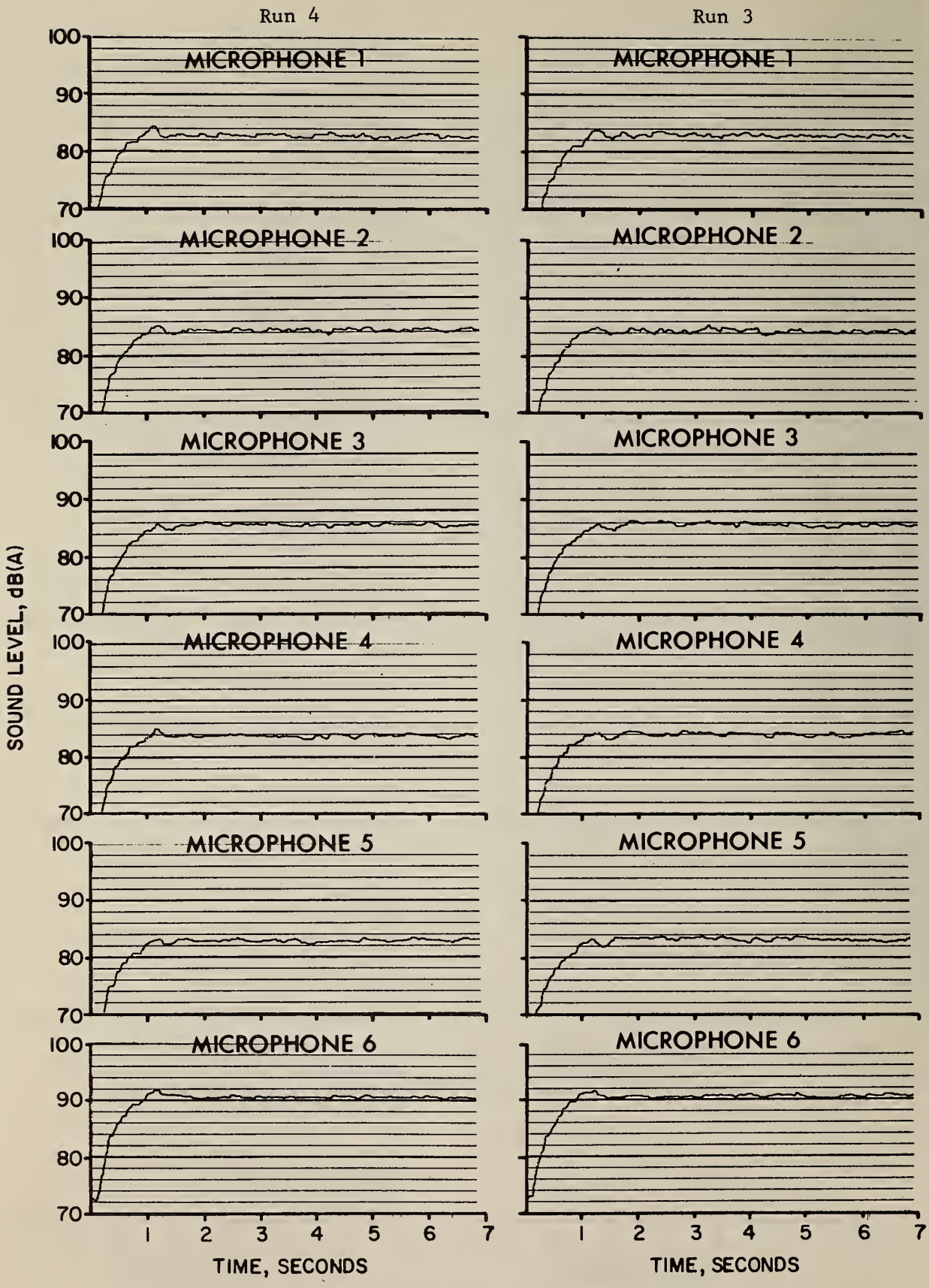

Figure 15-3. Truck 15, Test 2, Runs 3,4. (Exterior)

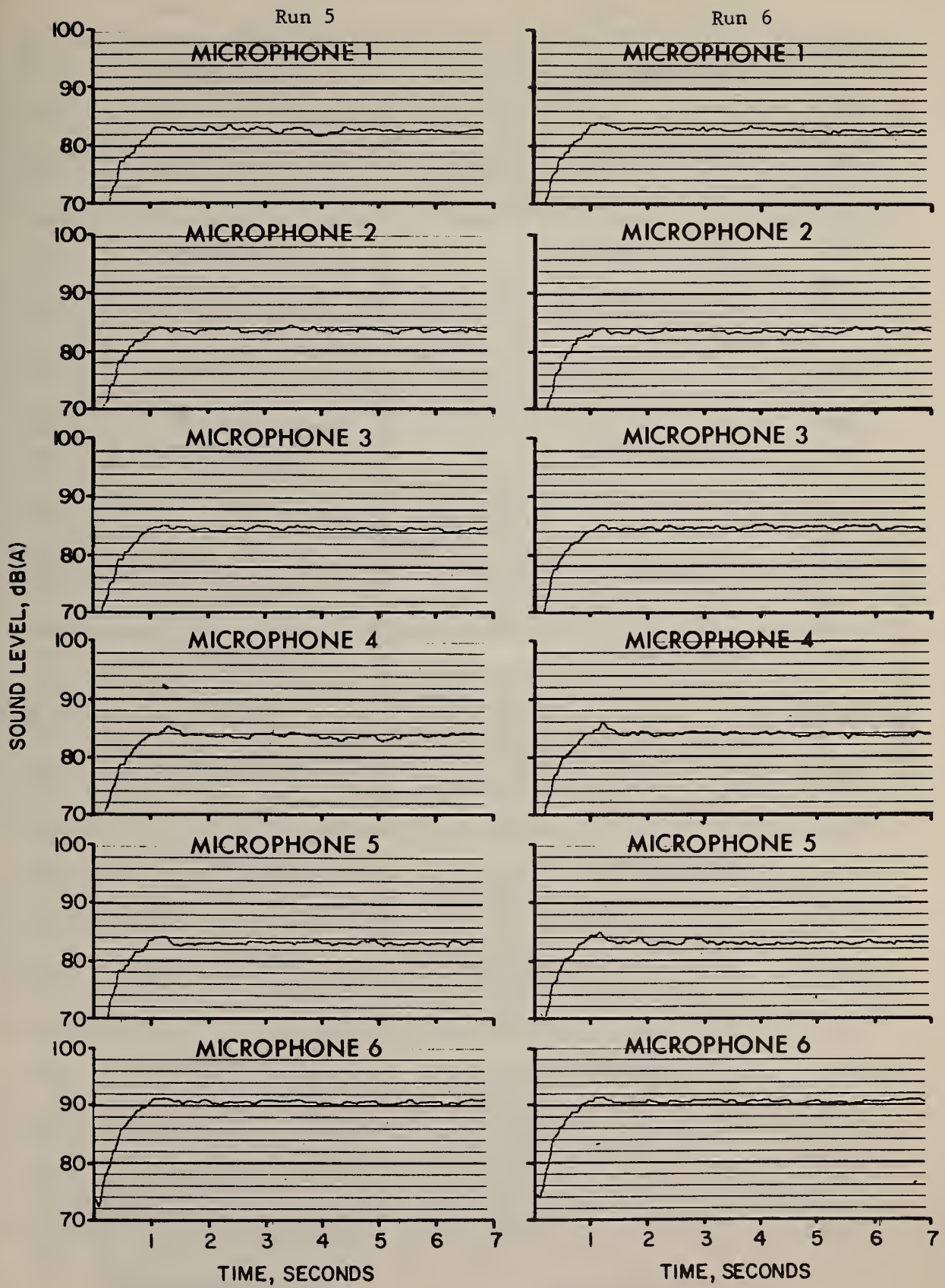

Figure 15-4. Truck 15, Test 2, Runs 5,6. (Exterior)

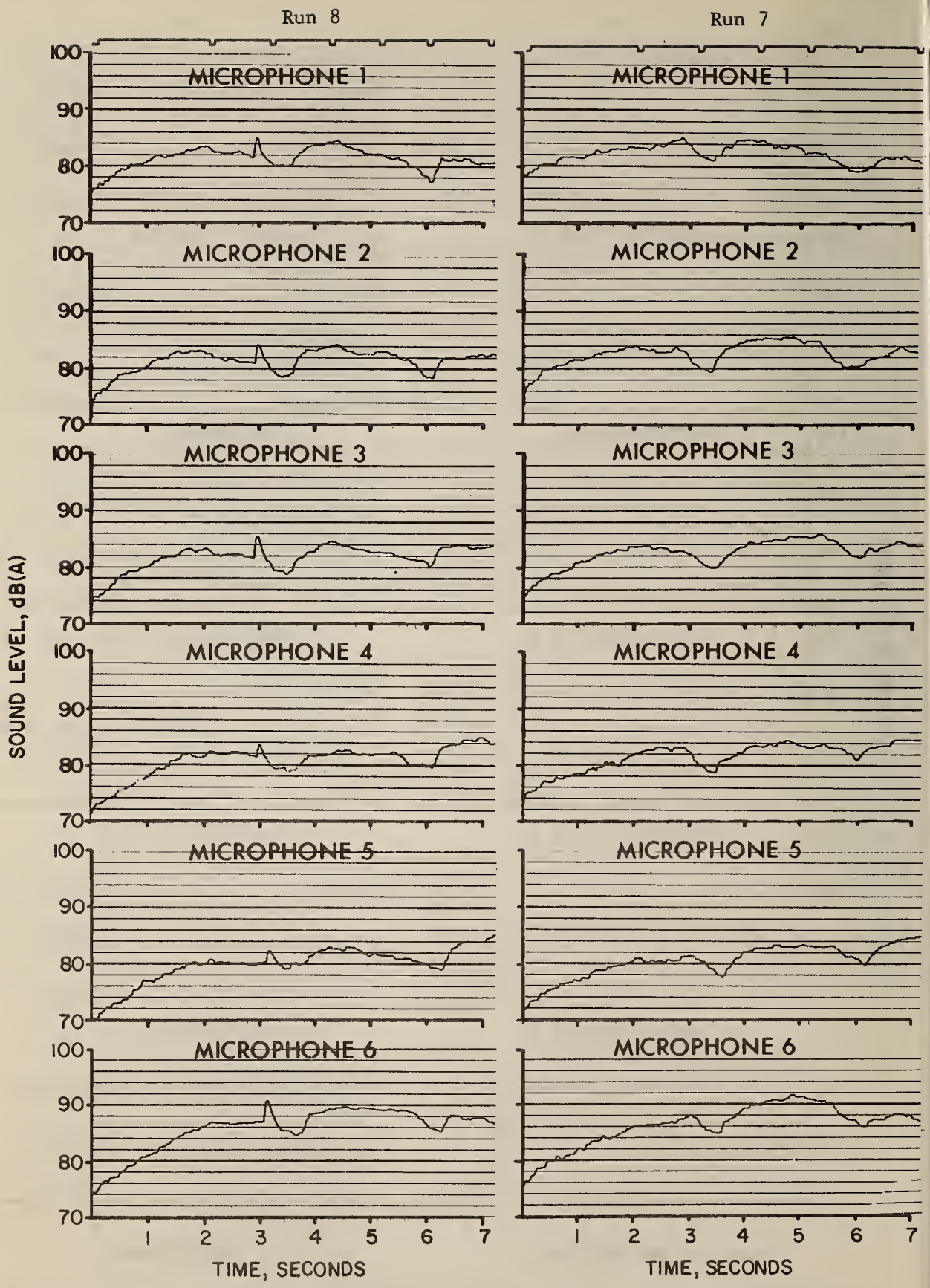

Figure 15-5. Truck 15, Test 3, Runs 7,8. (Exterior)

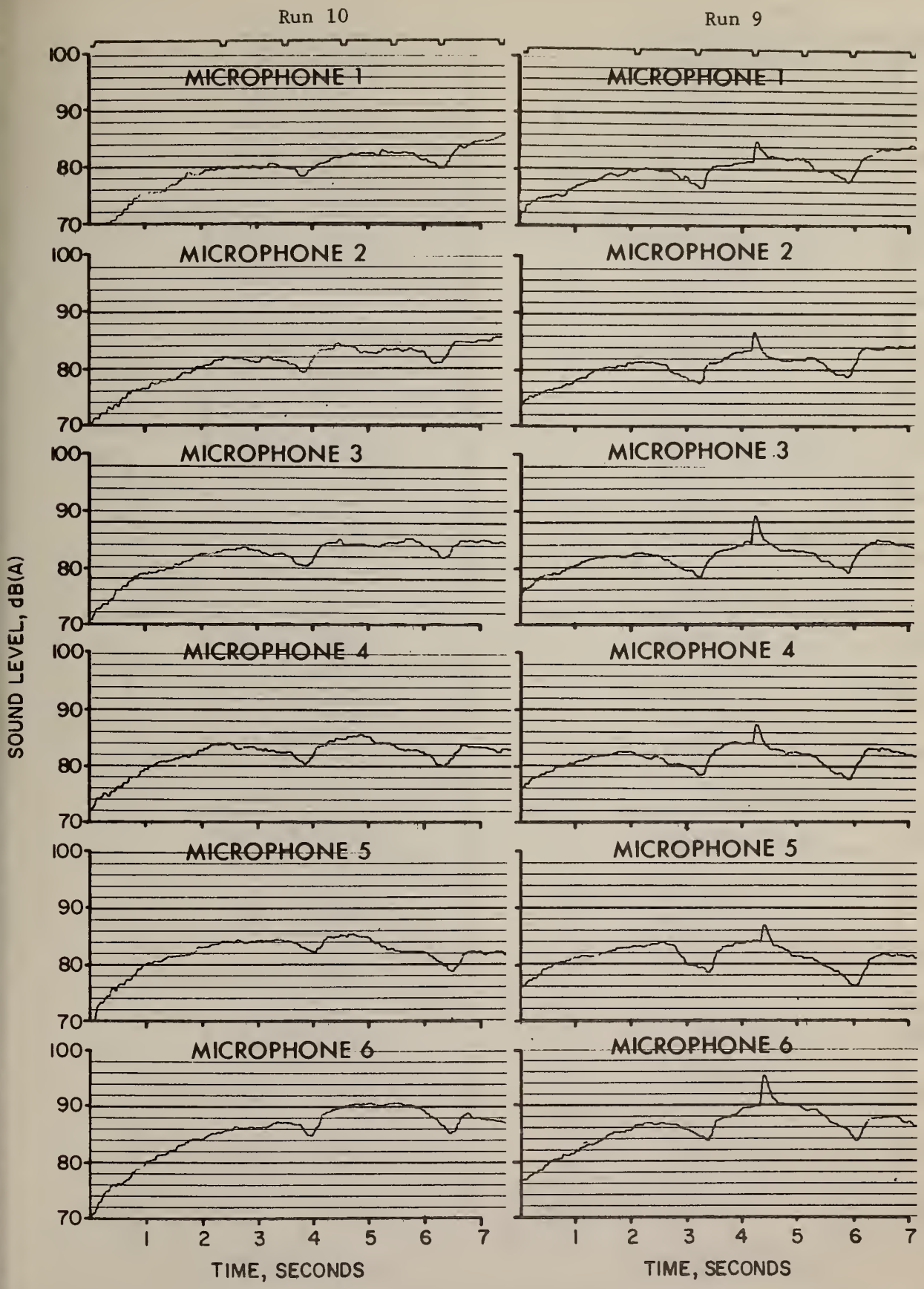

Figure 15-6. Truck 15, Test 3, Runs 9,10. (Exterior)

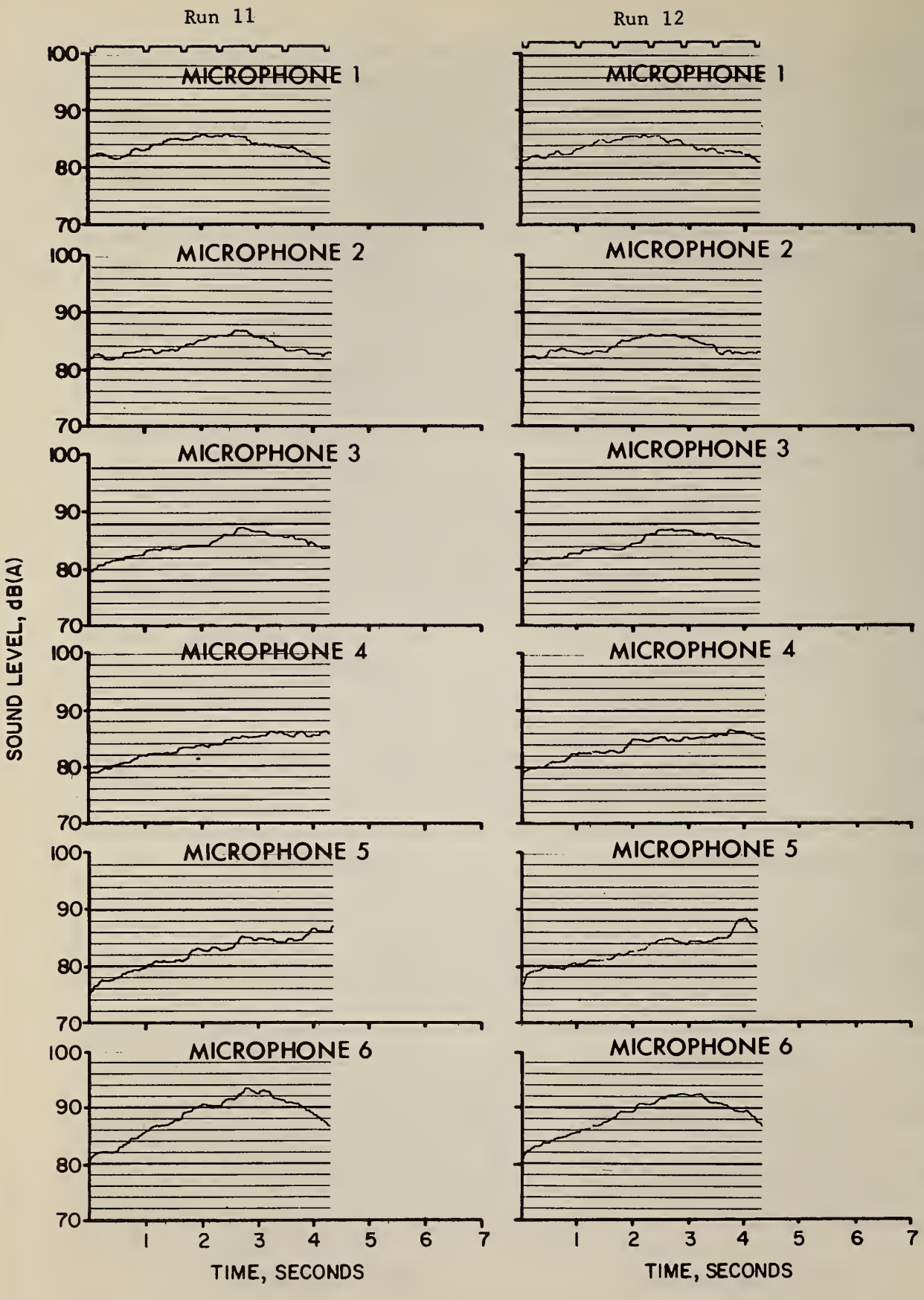

Figure 15-7. Truck 15, Test 4, Runs 11,12. (Exterior)

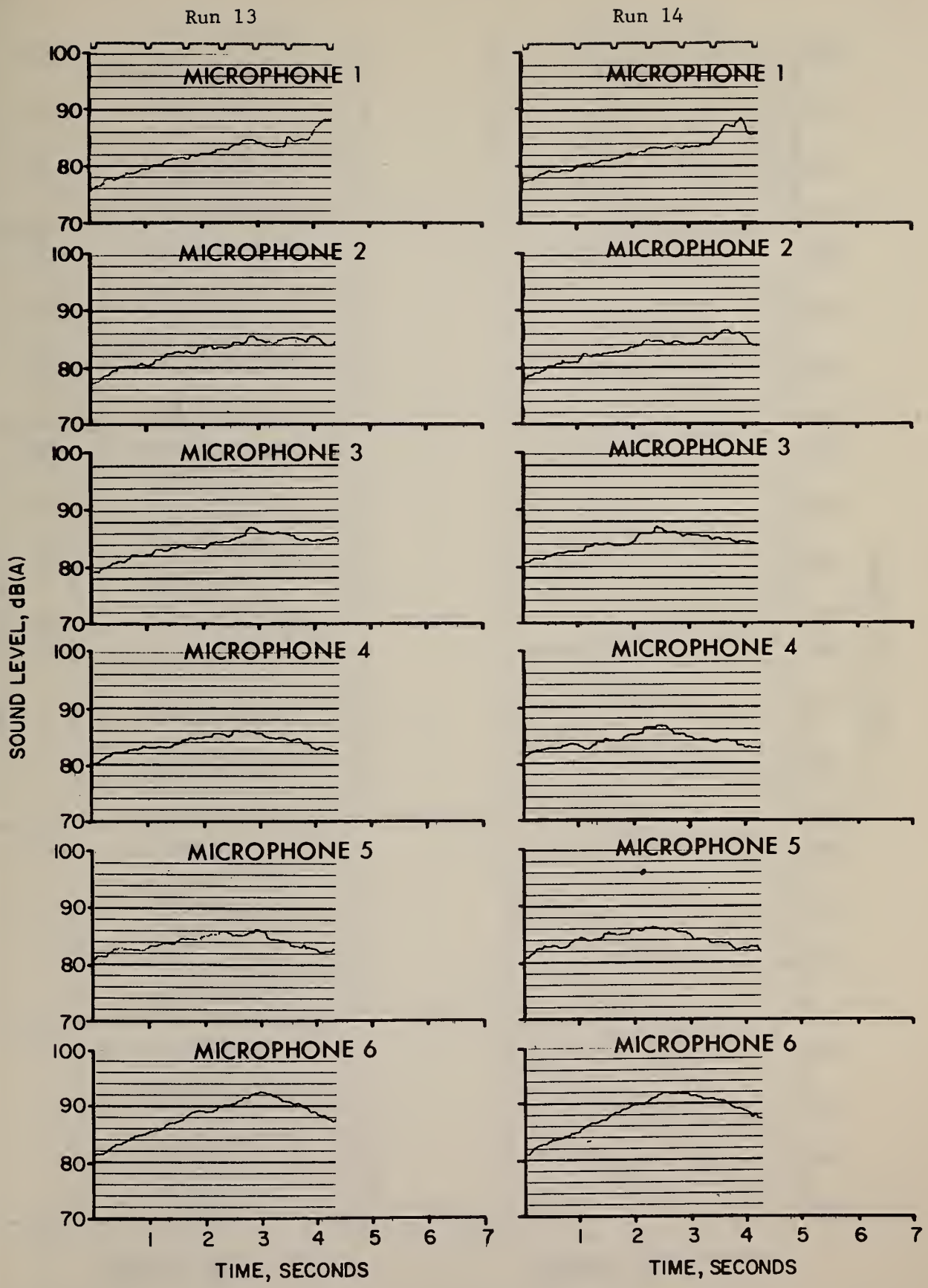

Figure 15-8. Truck 15, Test 4, Runs 13,14. (Exterior)

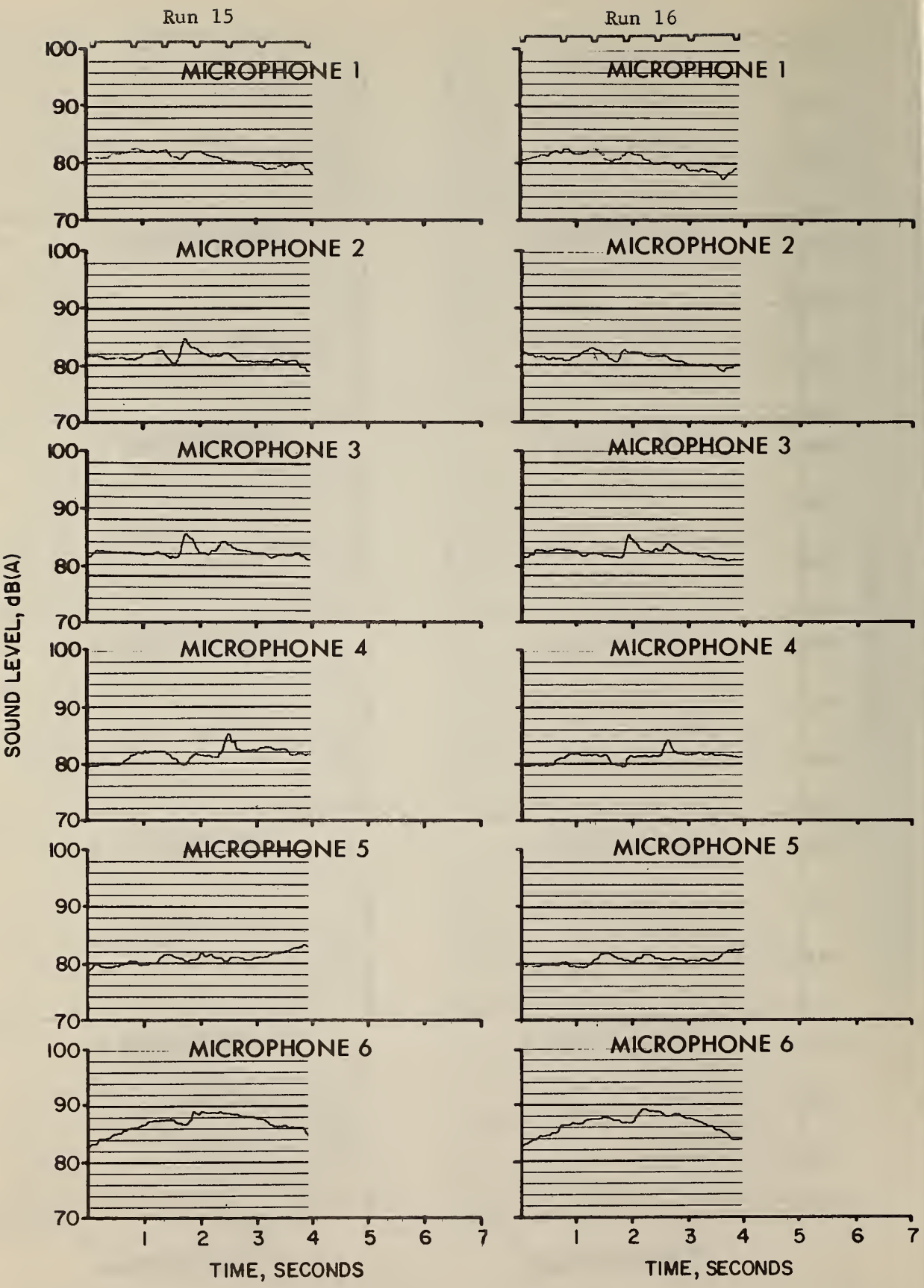

Figure 15-9. Truck 15, Test 5, Runs 15,16. (Exterior)

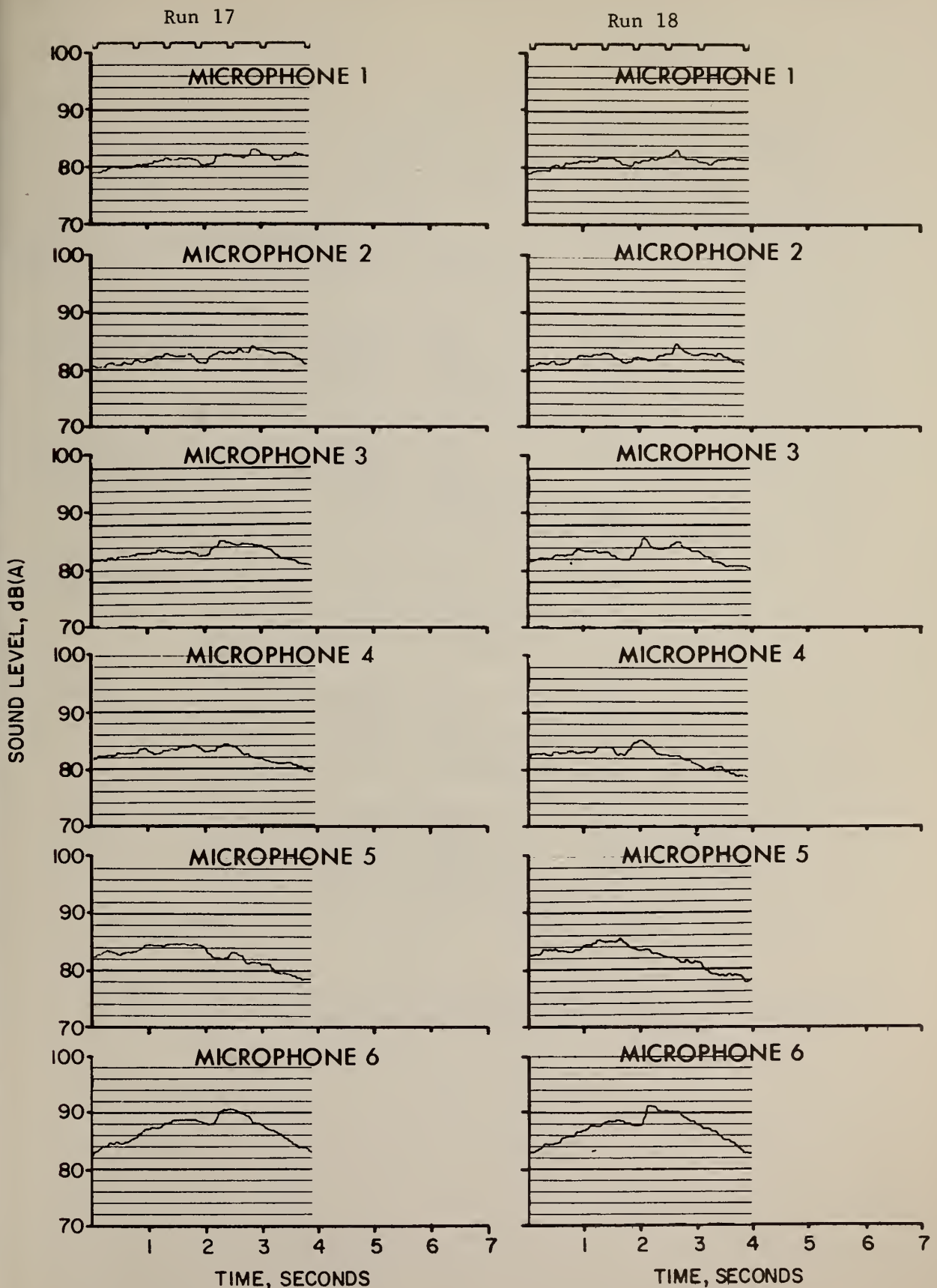

Figure 15-10. Truck 15, Test 5, Runs 17,18. (Exterior)

Interior

Truck 15

TEST	RUN	(SIDE)	WINDOWS	SOUND LEVEL, dB(A) MICROPHONES	
				LEFT EAR	RIGHT EAR
1. Low Idle (Stationary)	1	Right	Open	71	75
	2	Left	Closed	71	75
2. Acceleration (Stationary)	3	Right	Open	90	90
	4	Right	Open	90	90
	5	Left	Closed	90	91
	6	Left	Closed	91	91
2. High Idle (Stationary)	3	Right	Open	89	90
	4	Right	Open	88	90
	5	Left	Closed	89	90
	6	Left	Closed	89	90
3. City Start Up	7	Right	Open	90	91
	8	Right	Open	88	92
	9	Left	Closed	88	92
	10	Left	Closed	90	92
4. J366 (Acceleration)	11	Right	Open	90	91
	12	Right	Open	91	92
	13	Left	Closed	90	92
	14	Left	Closed	92	92
5. J366 (Deceleration)	15	Right	Open	90	89
	16	Right	Open	90	88
	17	Left	Closed	91	90
	18	Left	Closed	91	90

Table 15-2. Maximum A-weighted sound levels as measured at the two interior microphone locations for all test runs for vehicle number 15.

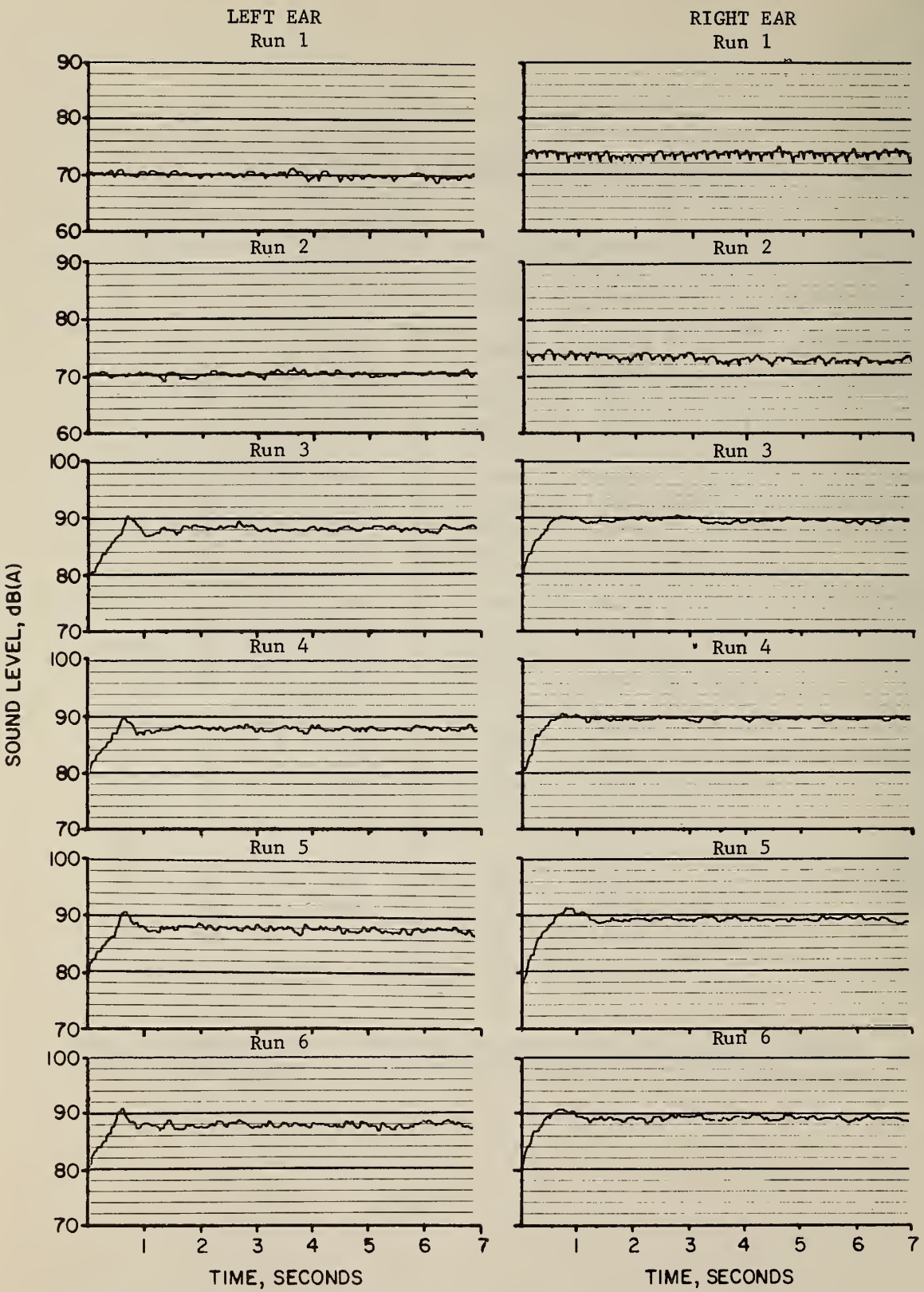

Figure 15-11. Truck 15, Tests 1,2, Runs 1-6. (Interior)

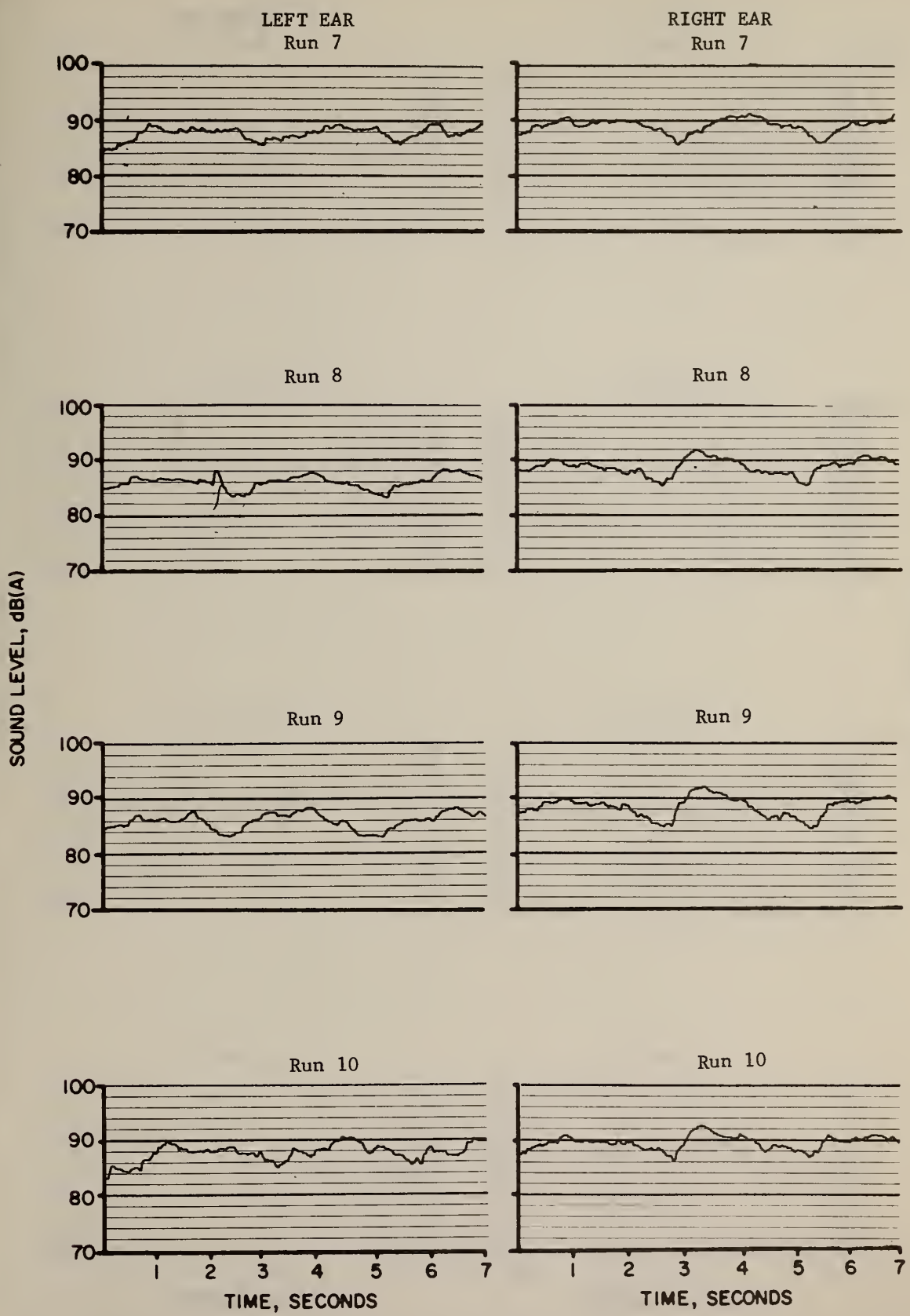

Figure 15-12. Truck 15, Test 3, Runs 7-10. (Interior)

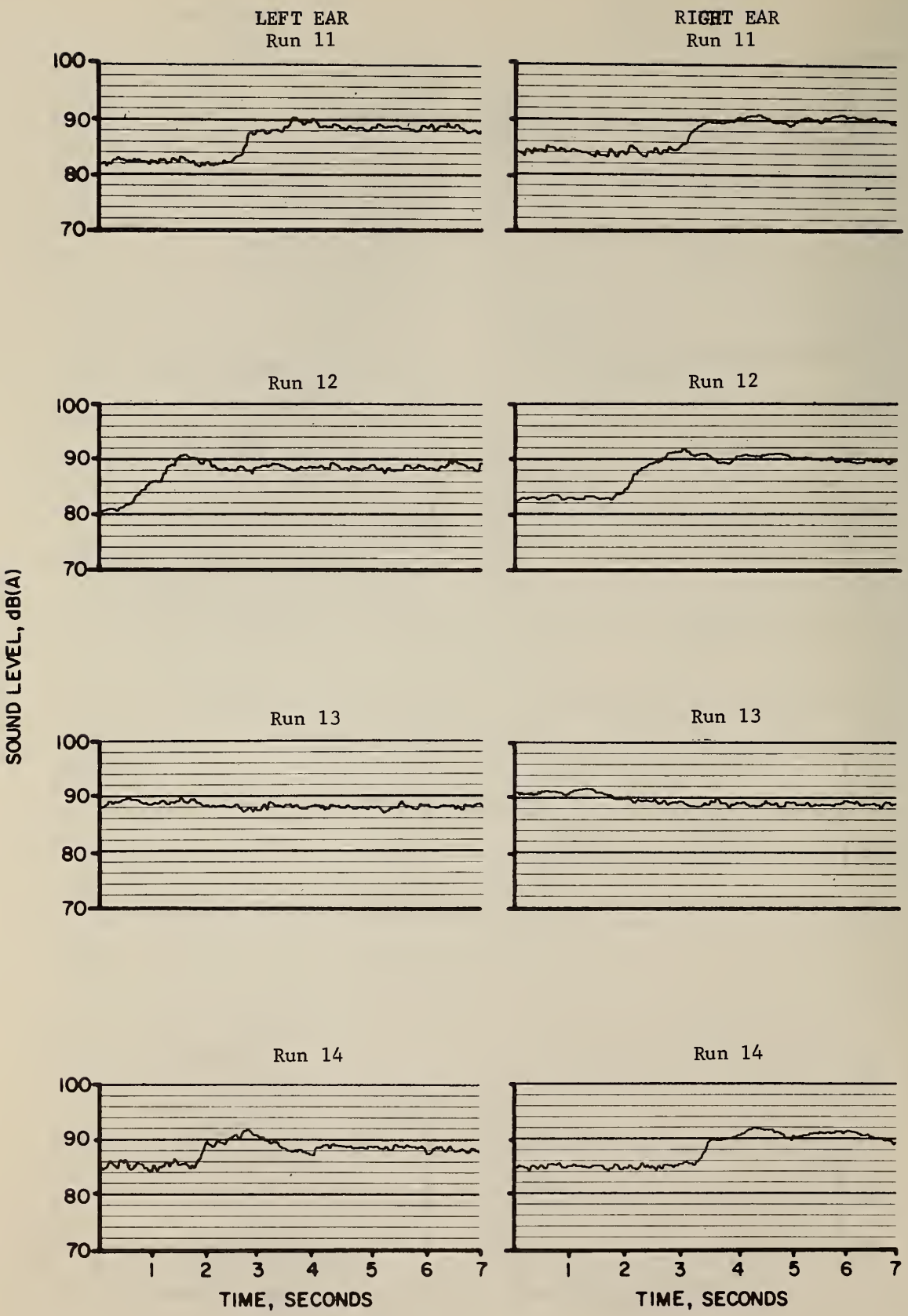

Figure 15-13. Truck 15, Test 4, Runs 11-14. (Interior)

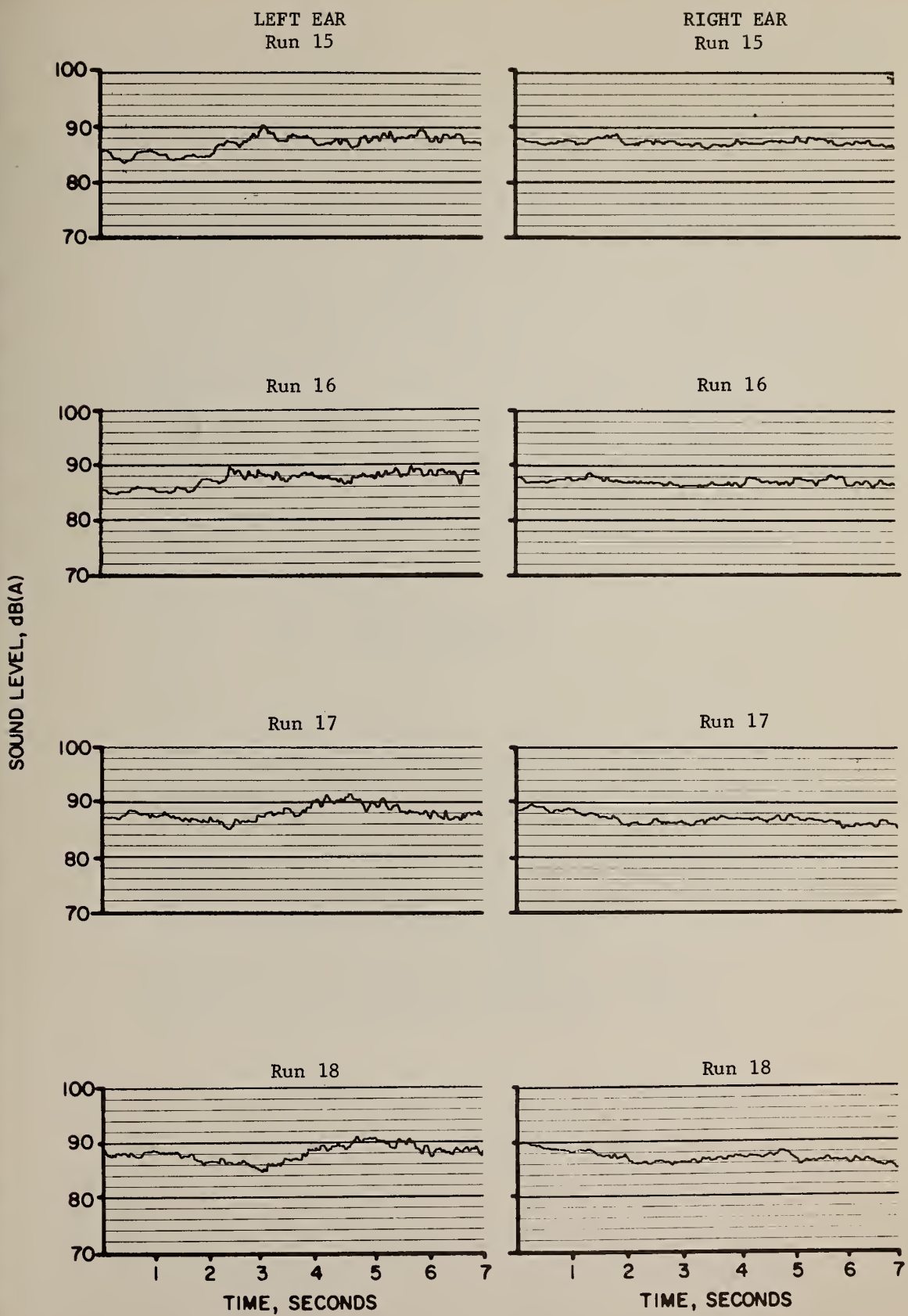

Figure 15-14. Truck 15, Test 5, Runs 15-18. (Interior)

Test Vehicle Number 16

Figure 16-1. Test Vehicle Number 16

Truck Number: 16
Carrier (owner): McLean Trucking Company
Company Fleet Number: 10434
Make: Dodge
Model: C-700
Serial Number: M71FYIT-301559
Year: 1971
Engine Governor Setting: 3600 rpm (no load)
3200 rpm (full load)
Total Miles of Operation: 28,256
Miles Since Last Engine Overhaul: Original engine
Miles Since Any Exhaust Work: Original exhaust system
Engine: Make - Crysler Corp.-Truck premium
Model - 361-3 CID

Exterior

Truck 16

TEST	RUN	SIDE	(WINDOWS)	SOUND LEVEL, dB(A) MICROPHONES					
				1	2	3	4	5	6
1. Low Idle (Stationary)	1	Right	Open	48	49	49	50	49	55
	2	Left	Closed	48	49	50	50	50	56
2. Acceleration (Stationary)	3	Right	Open	77	78	78	79	77	85
	4	Right	Open	77	78	78	79	77	84
	5	Left	Closed	76	76	76	78	76	83
	6	Left	Closed	76	76	76	78	75	83
2. High Idle (Stationary)	3	Right	Open	75	74	75	76	75	82
	4	Right	Open	74	74	75	76	75	82
	5	Left	Closed	75	74	74	76	74	81
	6	Left	Closed	74	74	74	75	74	80
3. City Start Up	7	Right	Open	78	79	78	78	76	83
	8	Right	Open	79	80	78	79	77	83
	9	Left	Closed	75	76	76	78	77	82
	10	Left	Closed	76	77	76	78	78	83
4. J366 (Acceleration)	11	Right	Open	81	81	80	82	81	86
	12	Right	Open	80	81	81	82	81	86
	13	Left	Closed	78	79	79	80	79	85
	14	Left	Closed	78	79	79	82	81	85
5. J366 (Deceleration)	15	Right	Open	78	78	77	78	77	82
	16	Right	Open	77	78	76	78	76	82
	17	Left	Closed	76	76	77	78	77	82
	18	Left	Closed	75	76	76	78	77	82

Table 16-1. Maximum A-weighted sound levels as measured at the six exterior microphone locations for all test runs for vehicle number 16.

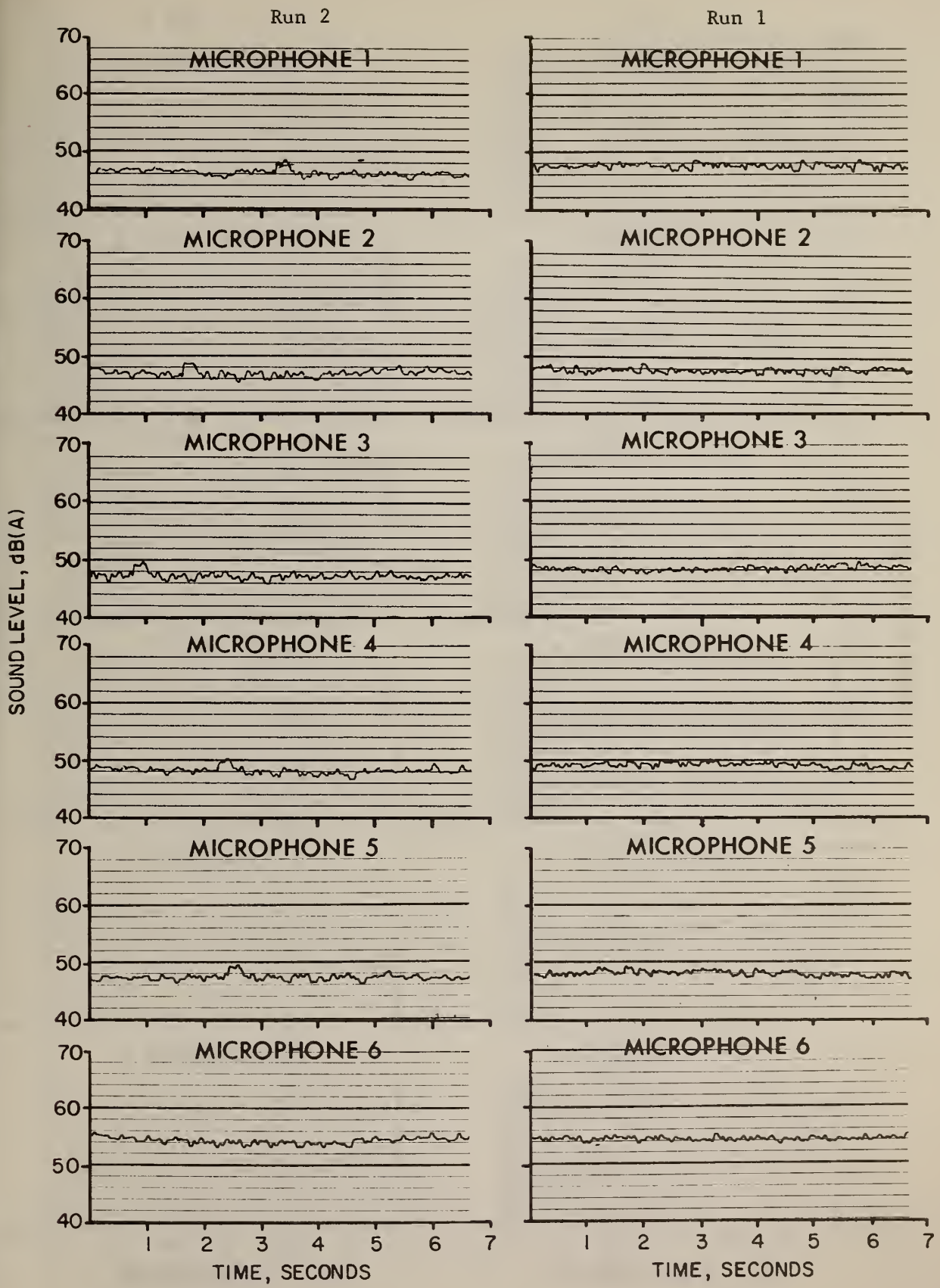

Figure 16-2. Truck 16, Test 1, Runs 1,2. (Exterior)

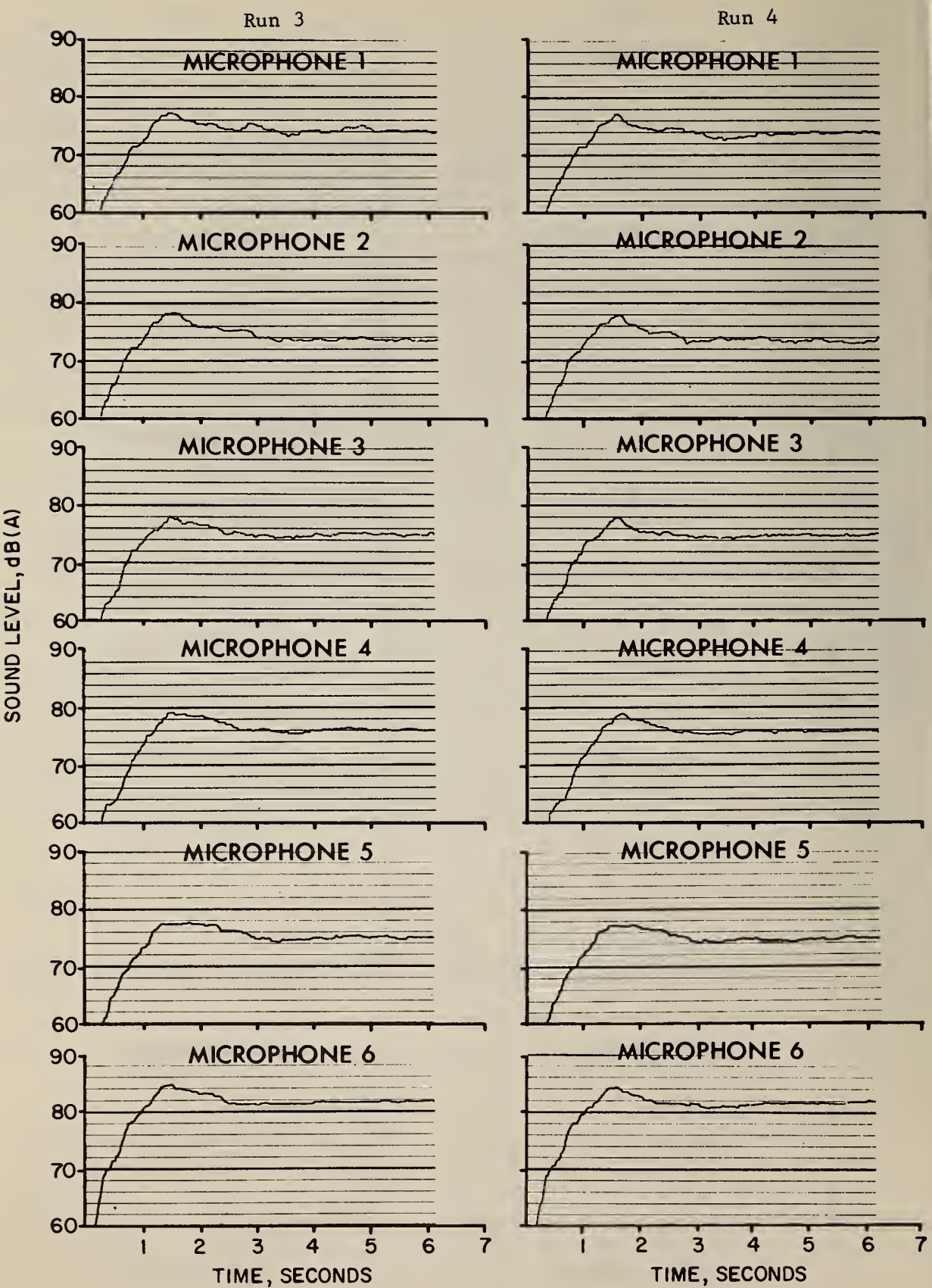

Figure 16-3. Truck 16, Test 2, Runs 3,4. (Exterior)

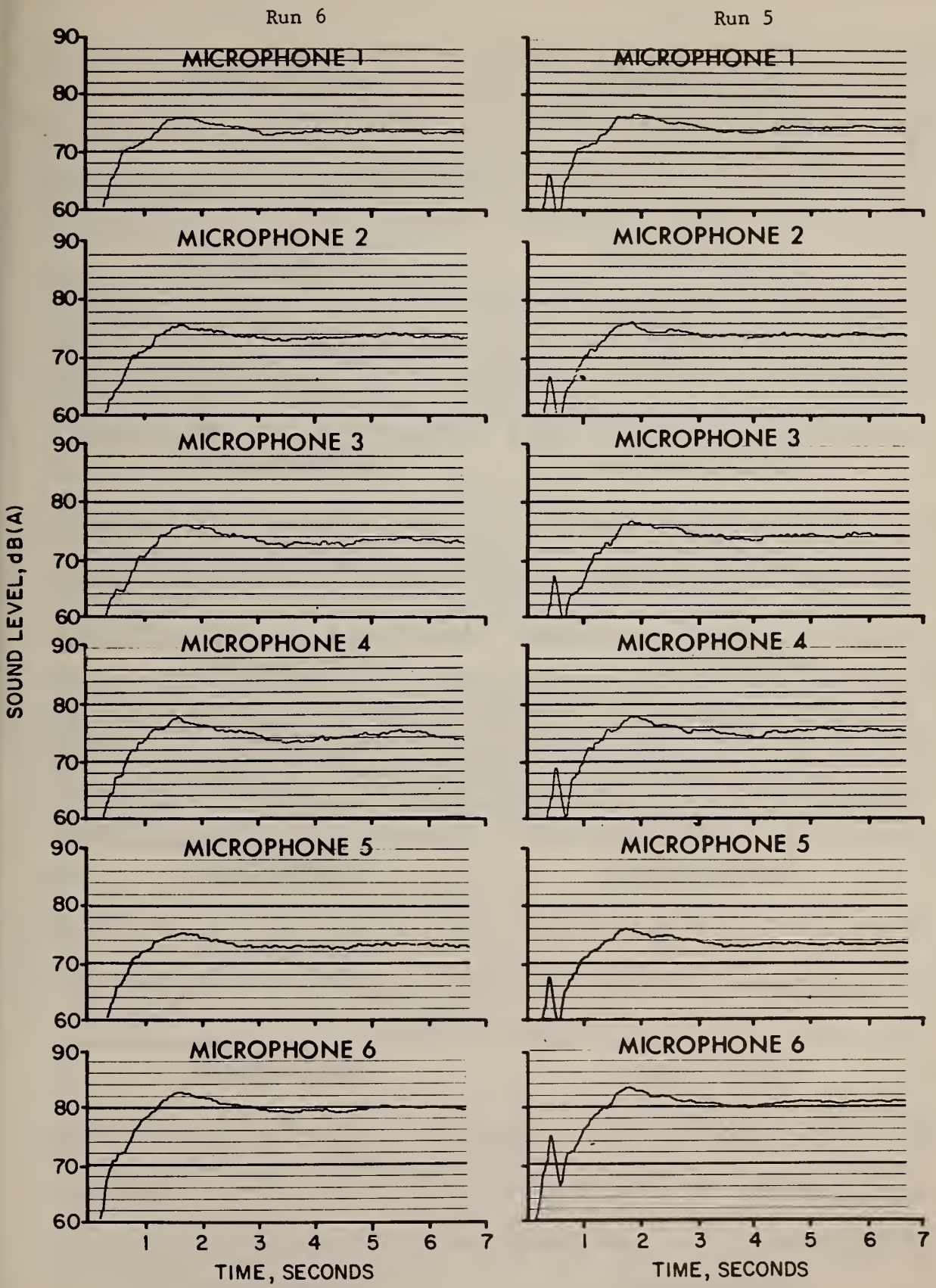

Figure 16-4. Truck 16, Test 2, Runs 5,6. (Exterior)

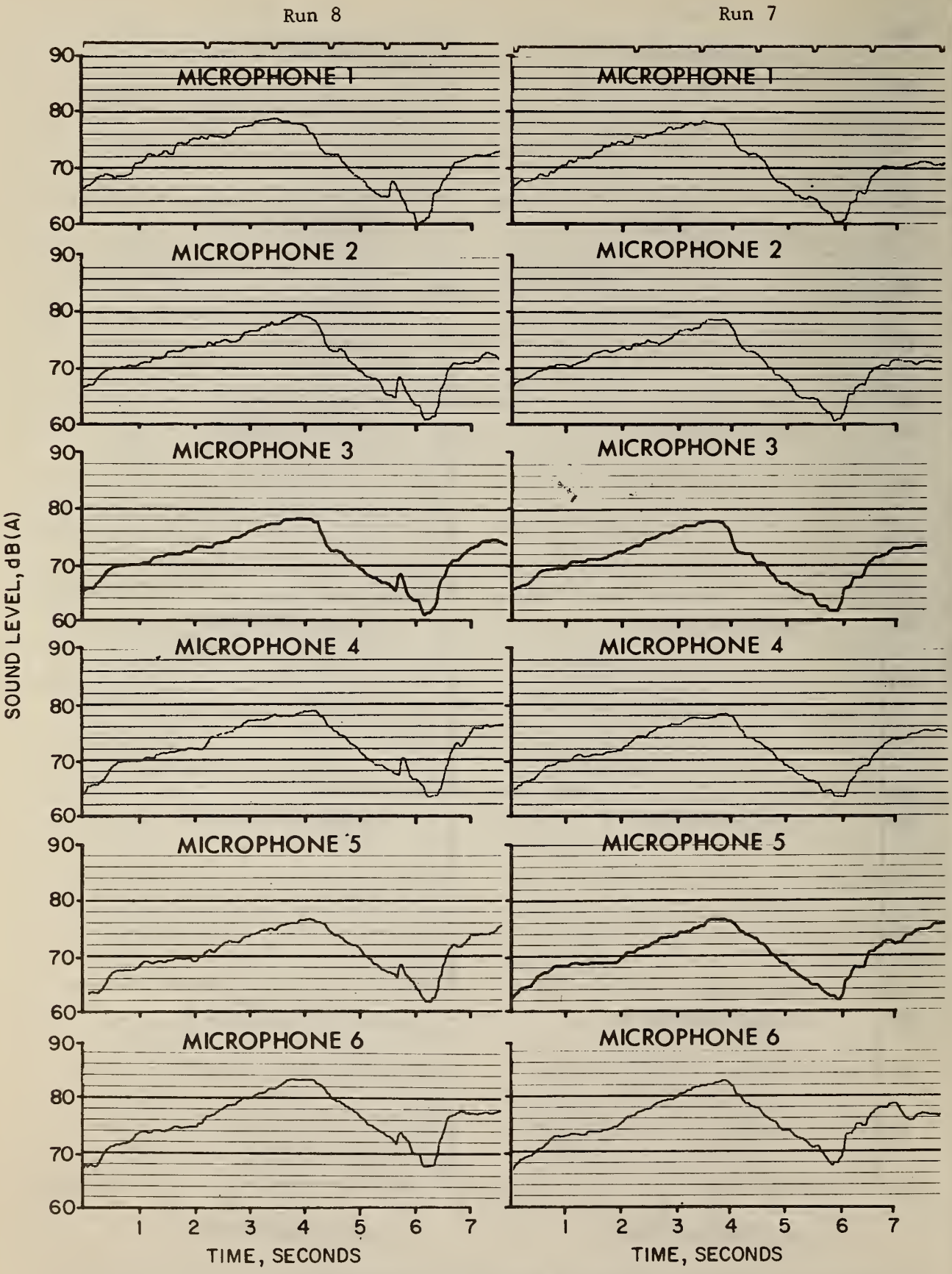

Figure 16-5. Truck 16, Test 3, Runs 7,8. (Exterior)

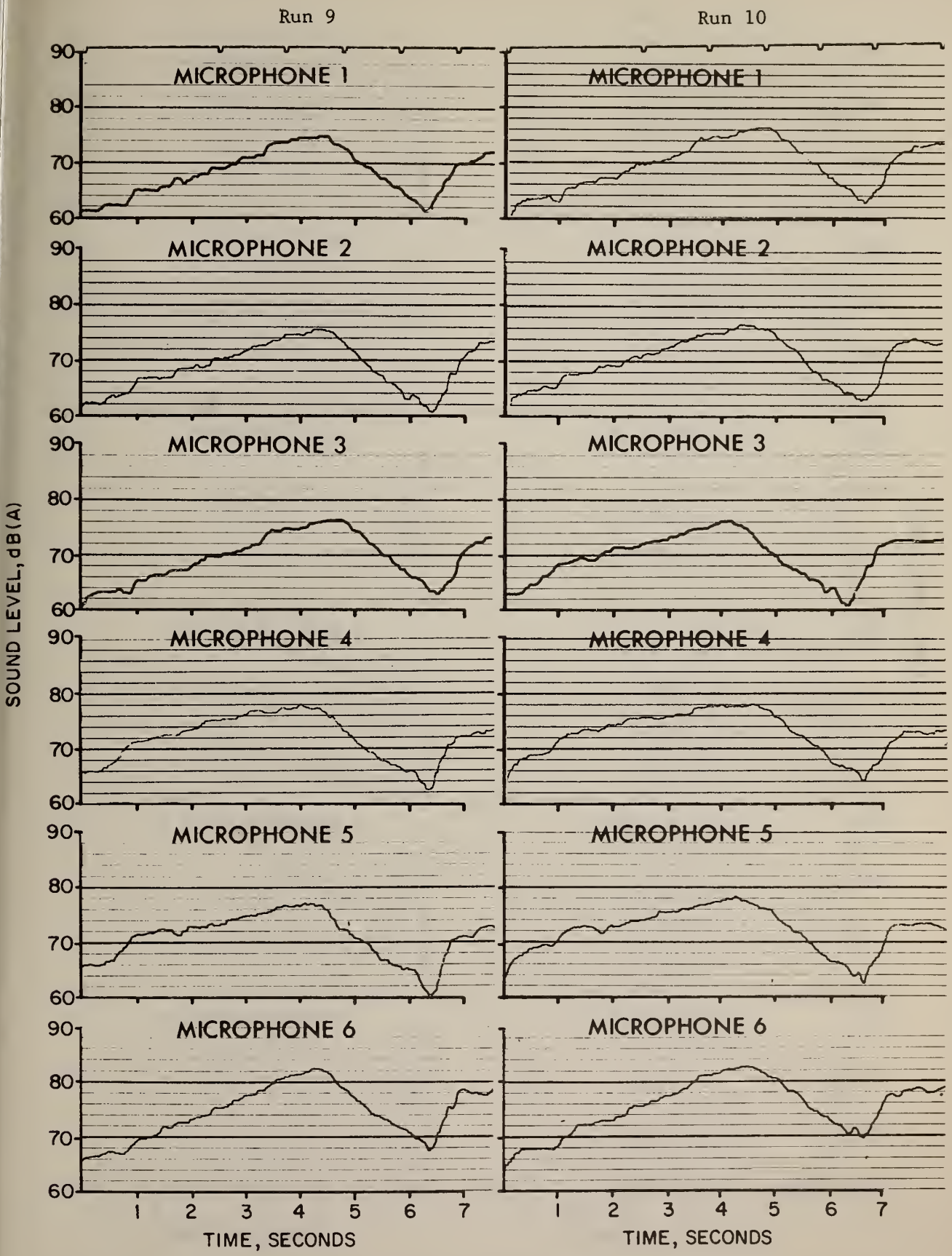

Figure 16-6. Truck 16, Test 3, Runs 9,10. (Exterior)

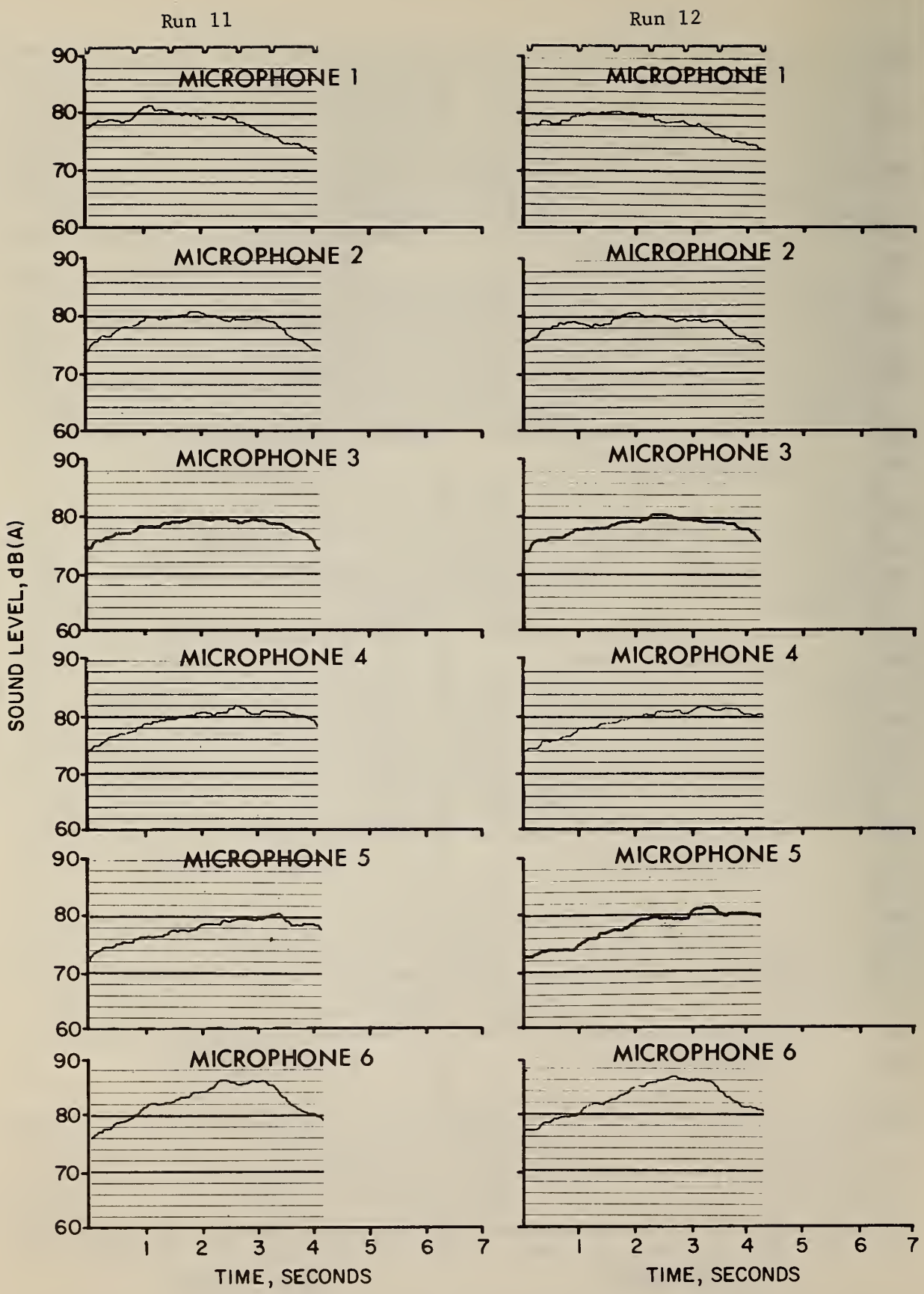

Figure 16-7. Truck 16, Test 4, Runs 11,12. (Exterior)

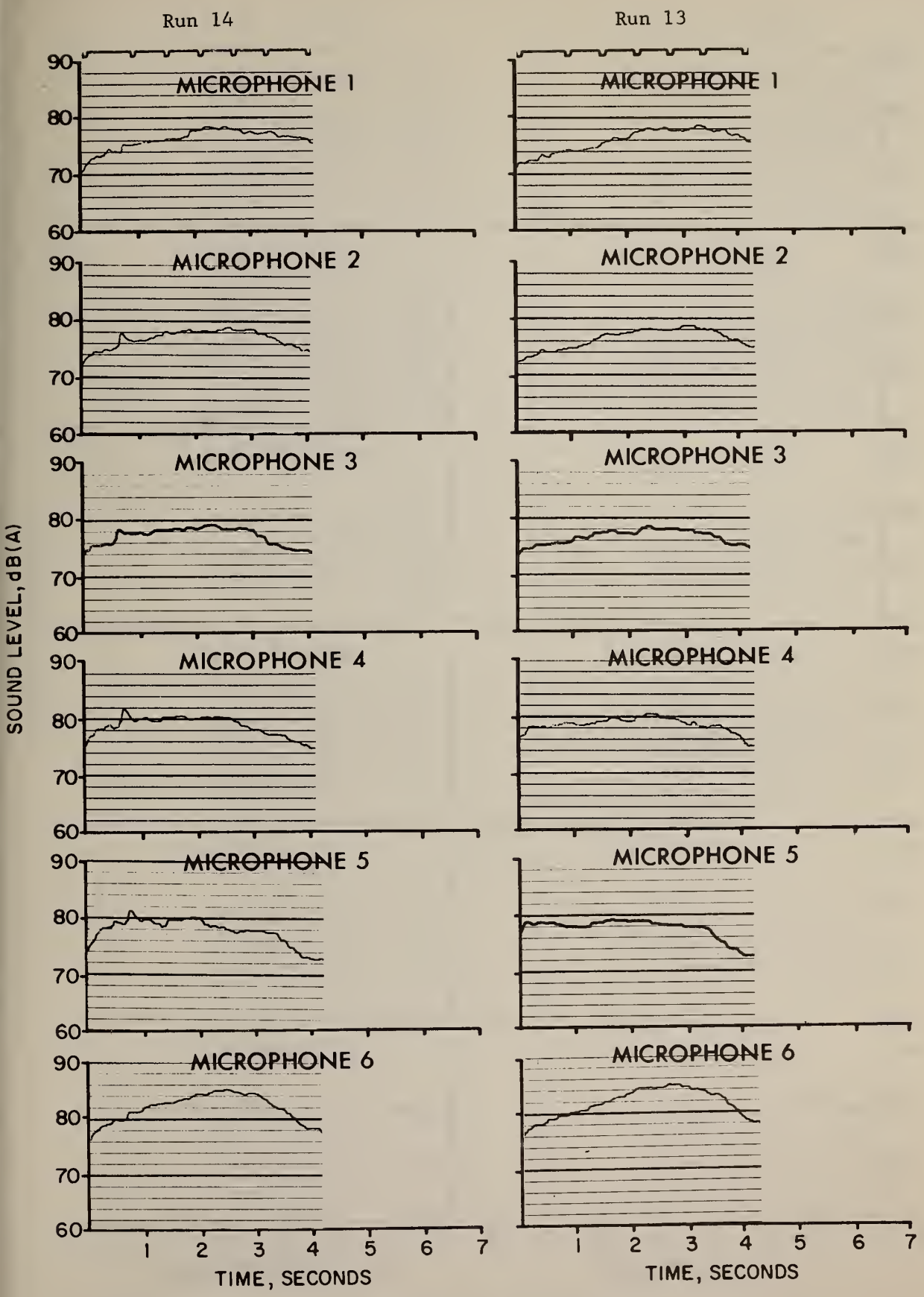

Figure 16-8. Truck 16, Test 4, Runs 13,14. (Exterior)

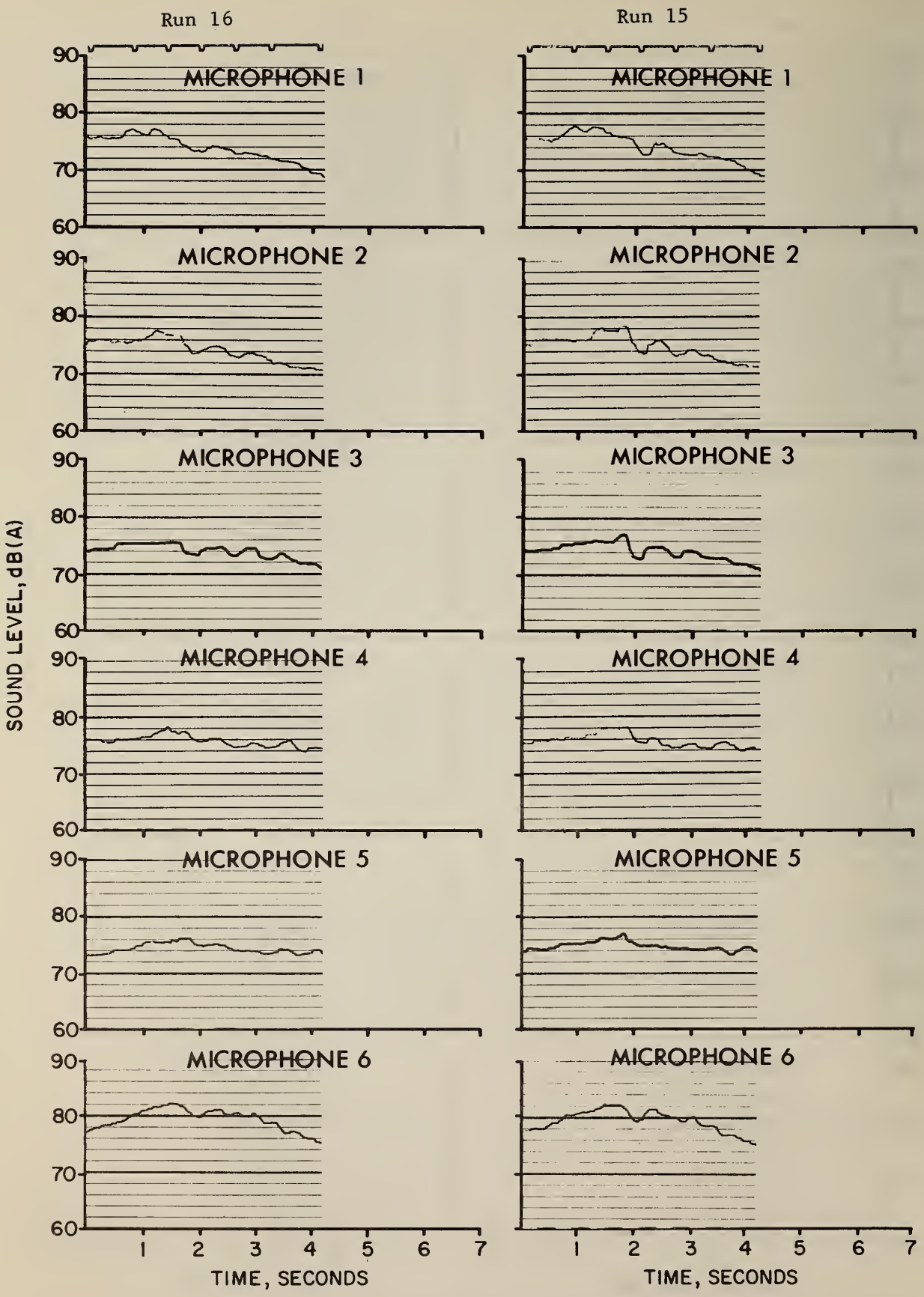

Figure 16-9. Truck 16, Test 5, Runs 15,16. (Exterior)

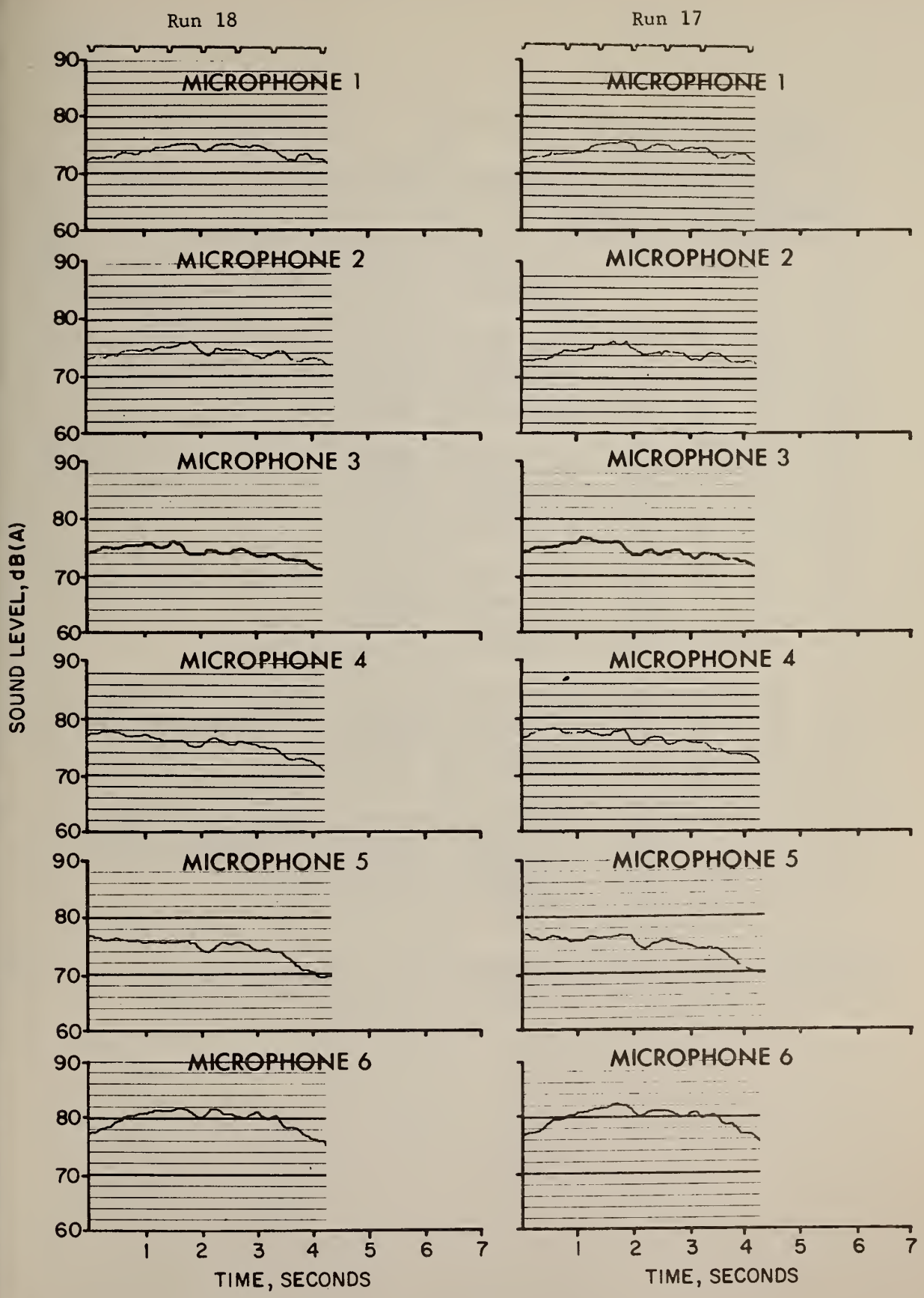

Figure 16-10. Truck 16, Test 5, Runs 17,18. (Exterior)

Interior

Truck 16

TEST	RUN	(SIDE)	WINDOWS	SOUND LEVEL, dB(A) MICROPHONES	
				LEFT EAR	RIGHT EAR
1. Low Idle (Stationary)	1	Right	Open	61	62
	2	Left	Closed	61	61
2. Acceleration (Stationary)	3	Right	Open	87	87
	4	Right	Open	84	86
	5	Left	Closed	82	83
	6	Left	Closed	82	87
2. High Idle (Stationary)	3	Right	Open	82	82
	4	Right	Open	82	82
	5	Left	Closed	81	81
	6	Left	Closed	81	81
3. City Start Up	7	Right	Open	86	89
	8	Right	Open	86	90
	9	Left	Closed	83	85
	10	Left	Closed	83	85
4. J366 (Acceleration)	11	Right	Open	84	85
	12	Right	Open	84	86
	13	Left	Closed	84	87
	14	Left	Closed	84	88
5. J366 (Deceleration)	15	Right	Open	84	83
	16	Right	Open	83	83
	17	Left	Closed	82	83
	18	Left	Closed	82	82

Table 16-2. Maximum A-weighted sound levels as measured at the two interior microphone locations for all test runs for vehicle number 16.

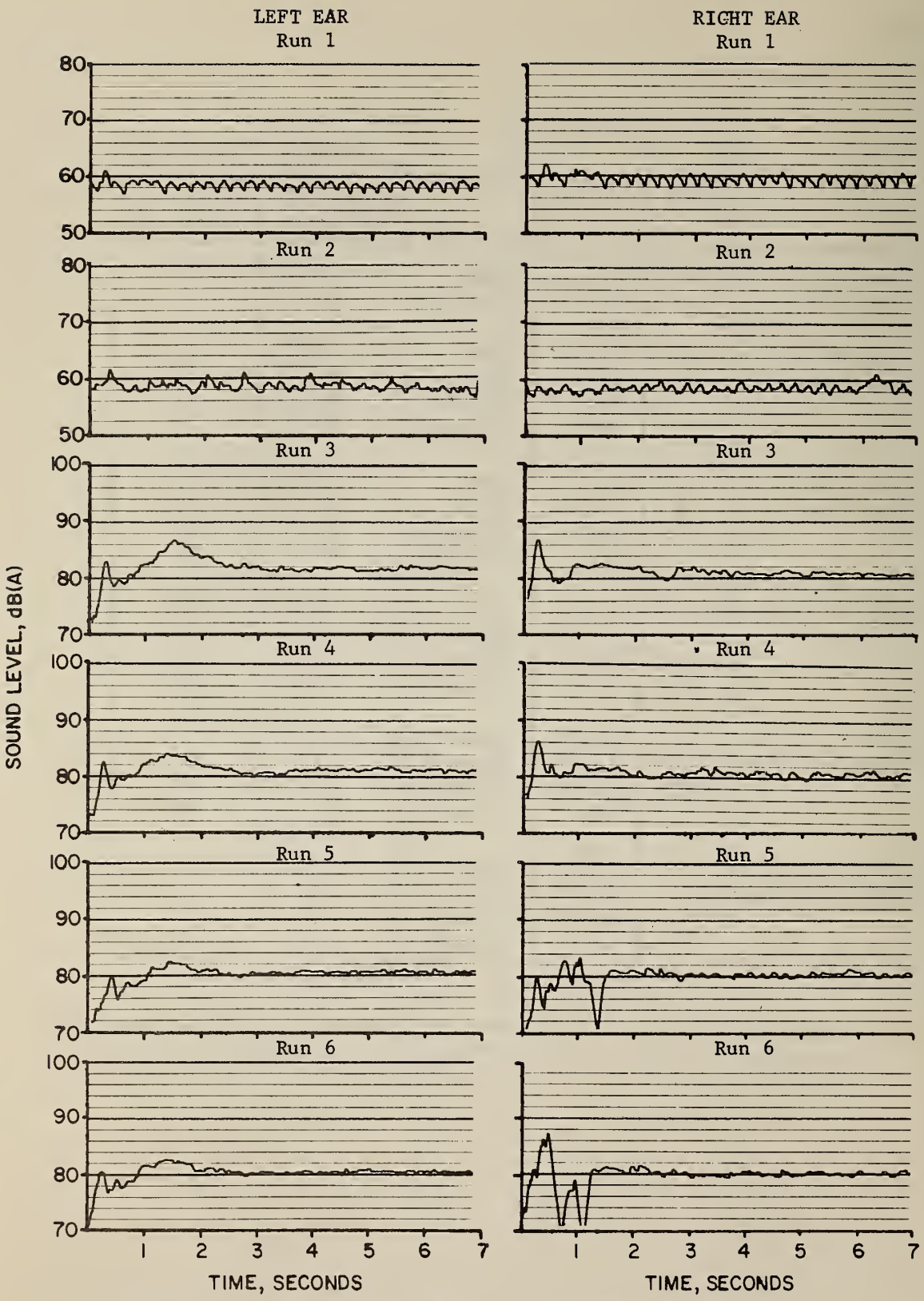

Figure 16-11. Truck 16, Tests 1,2, Runs 1-6. (Interior)

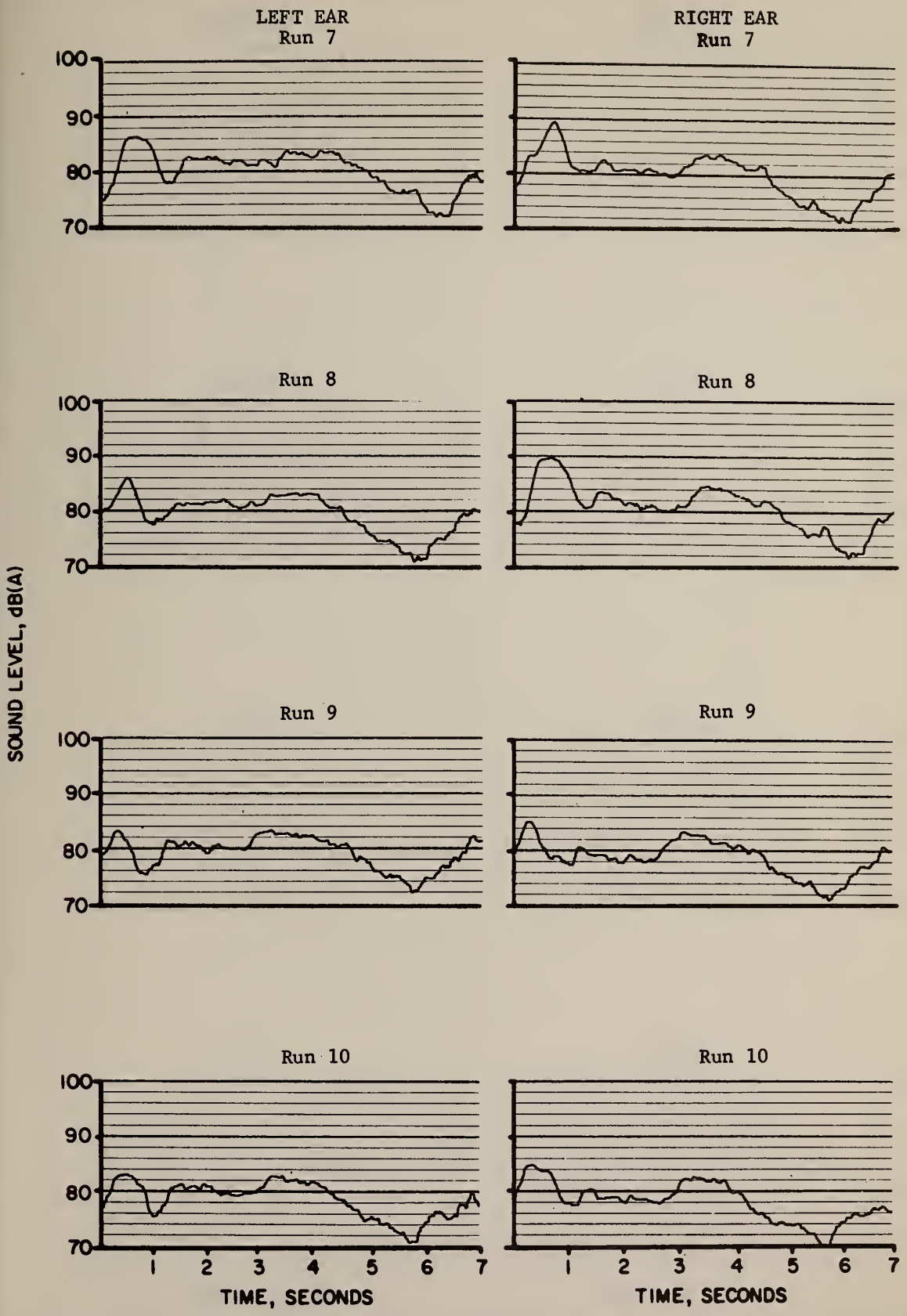

Figure 16-12. Truck 16, Test 3, Runs 7-10. (Interior)

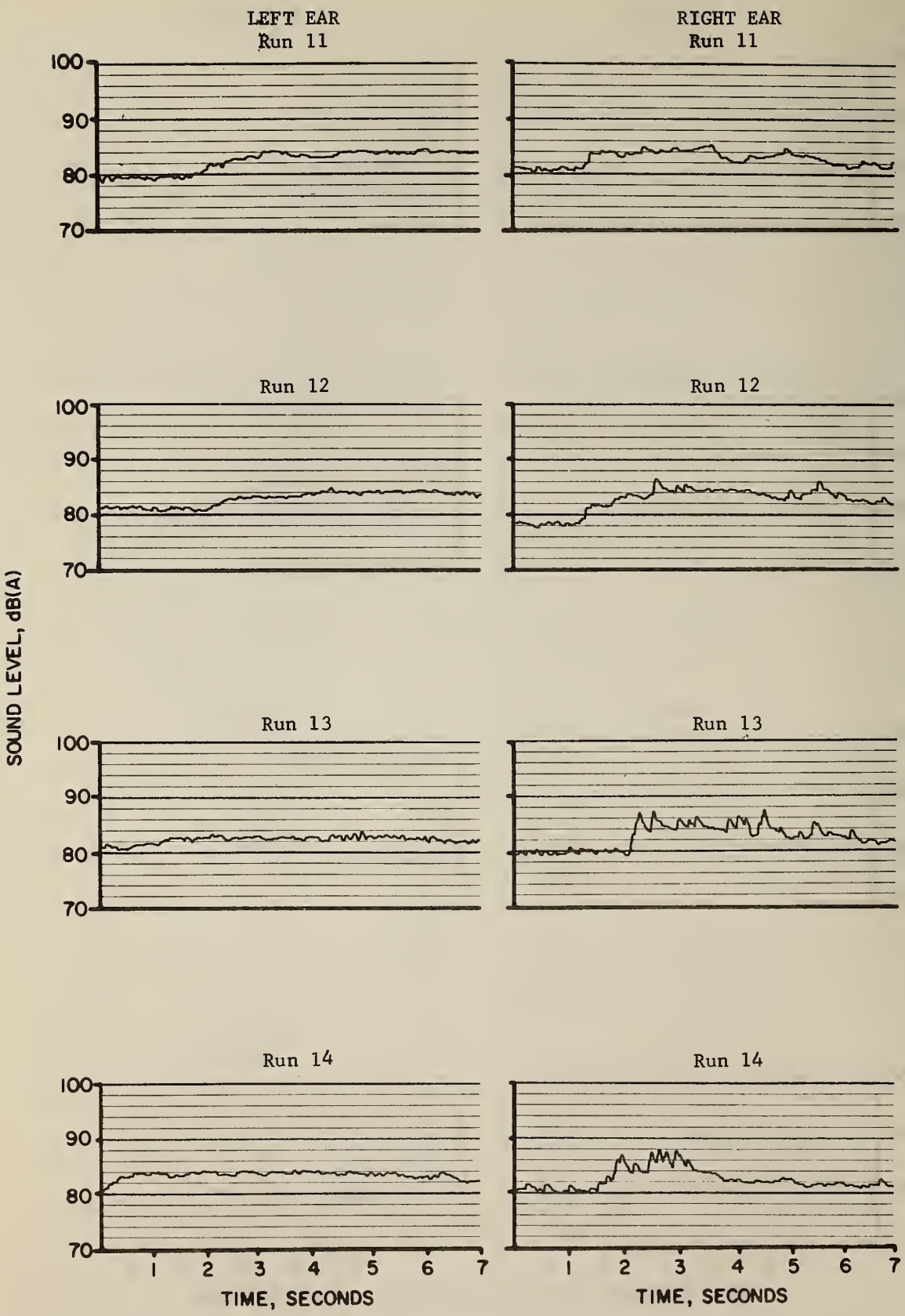

Figure 16-13. Truck 16, Test 4, Runs 11-14. (Interior)

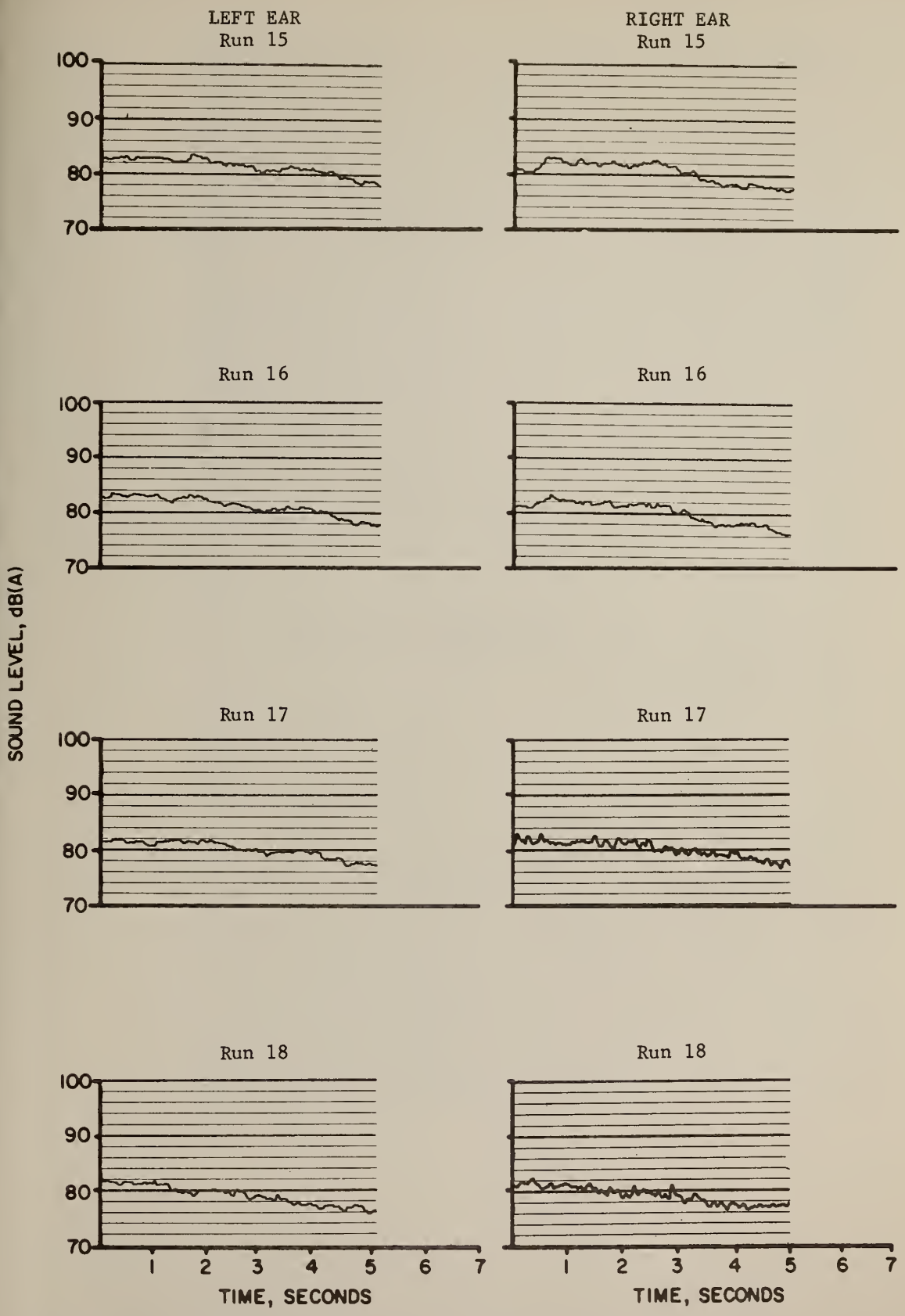

Figure 16-14. Truck 16, Test 5, Runs 15-18. (Interior)

Test Vehicle Number 17

Figure 17-1. Test Vehicle Number 17.

Truck Number: 17
Carrier (owner): Signal Delivery Service, Inc.
Company Fleet Number: 56-070D
Make: Ford
Model: LN9000
Serial Number: R90SVL91650
Year: 1971
Engine Governor Setting: 2250 rpm
Total Miles of Operation: 11,907
Miles Since Last Engine Overhaul: Original engine
Miles Since Any Exhaust Work: Original exhaust system
Engine: Make - Detroit Diesel
Model - 6-71N

Exterior

Truck 17

TEST	RUN	SIDE	(WINDOWS)	SOUND LEVEL, dB(A) MICROPHONES					
				1	2	3	4	5	6
1. Low Idle (Stationary)	1	Right	Open	63	62	62	63	62	70
	2	Left	Closed	62	61	62	63	62	69
2. Acceleration (Stationary)	3	Right	Open	87	89	88	87	86	94
	4	Right	Open	87	88	88	87	86	94
	5	Left	Closed	86	88	88	88	87	94
	6	Left	Closed	86	87	88	88	87	93
2. High Idle (Stationary)	3	Right	Open	84	84	84	83	83	91
	4	Right	Open	84	84	84	84	83	91
	5	Left	Closed	81	81	82	82	81	87
	6	Left	Closed	81	81	81	82	81	87
3. City Start Up	7	Right	Open	87	88	87	86	86	92
	8	Right	Open	86	88	87	87	86	91
	9	Left	Closed	84	84	86	88	87	90
	10	Left	Closed	82	83	85	88	86	89
4. J366 (Acceleration)	11	Right	Open	86	88	89	90	89	93
	12	Right	Open	87	89	88	88	88	93
	13	Left	Closed	87	88	90	90	89	94
	14	Left	Closed	85	88	88	89	90	92
5. J366 (Deceleration)	15	Right	Open	84	84	83	84	82	89
	16	Right	Open	84	84	83	84	82	89
	17	Left	Closed	80	82	82	83	82	87
	18	Left	Closed	80	82	82	83	82	87

Table 17-1. Maximum A-weighted sound levels as measured at the six exterior microphone locations for all test runs for vehicle number 17.

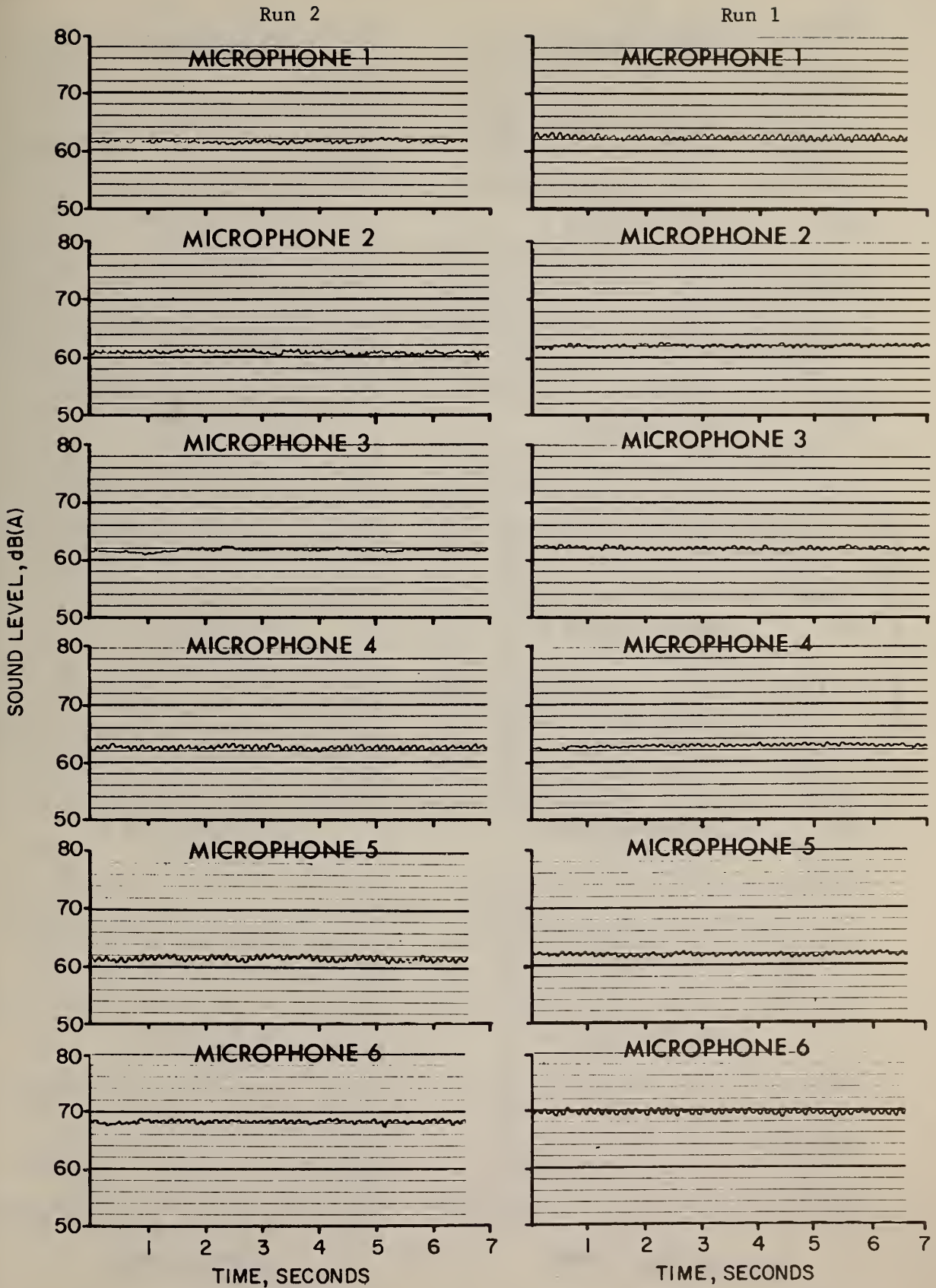

Figure 17-2. Truck 17, Test 1, Runs 1,2. (Exterior)

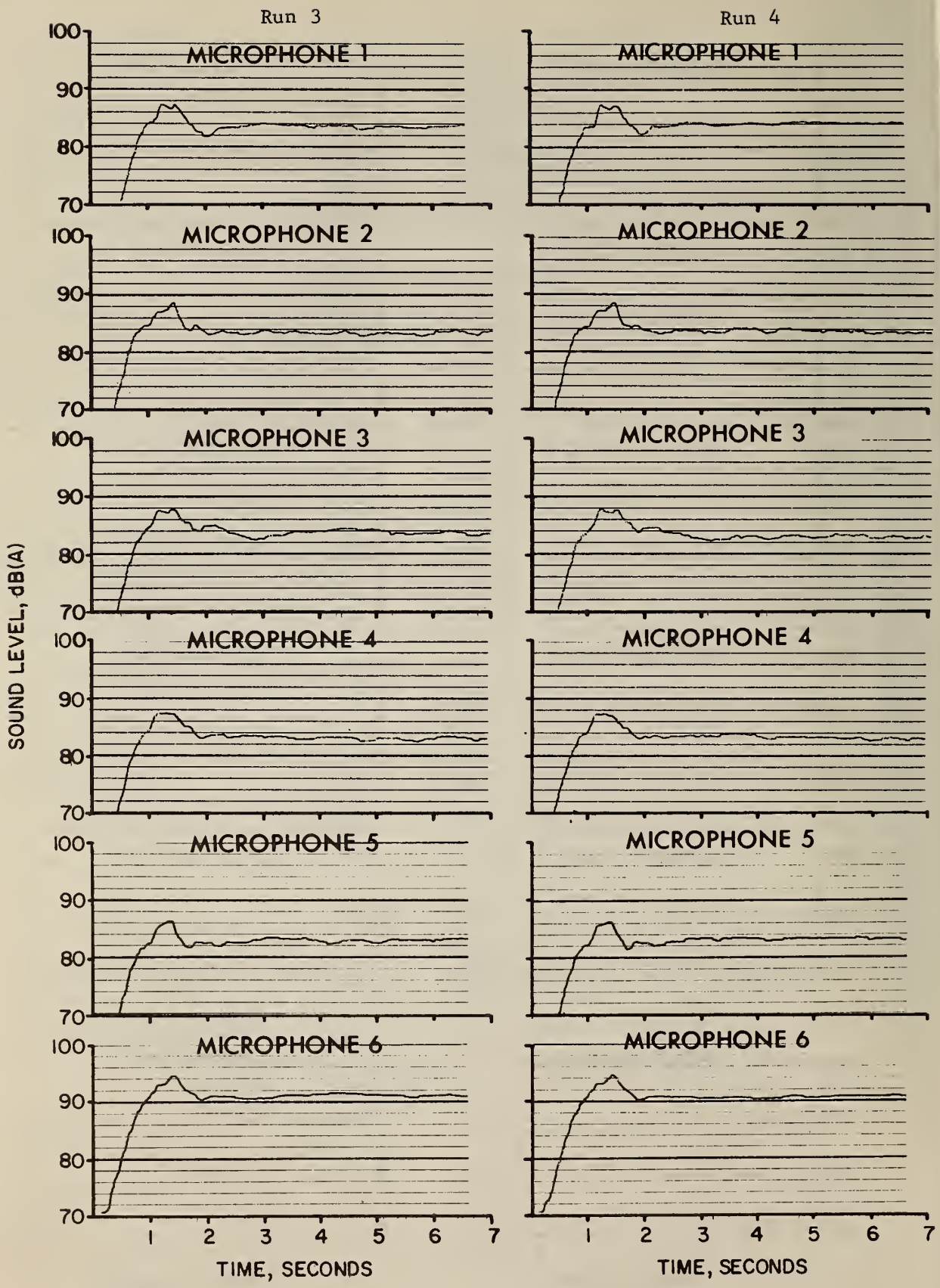

Figure 17-3. Truck 17, Test 2, Runs 3,4. (Exterior)

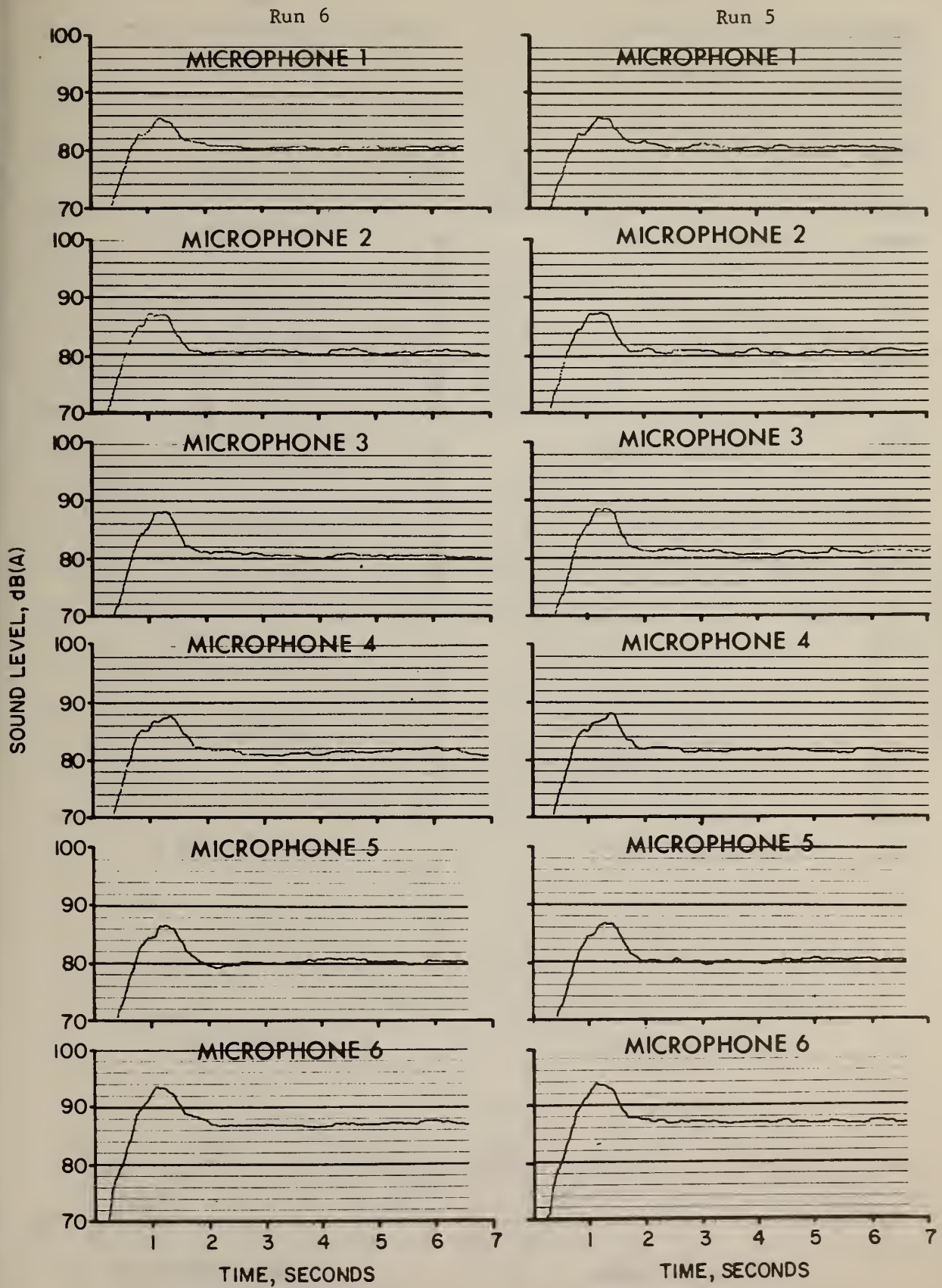

Figure 17-4. Truck 17, Test 2, Runs 5,6. (Exterior)

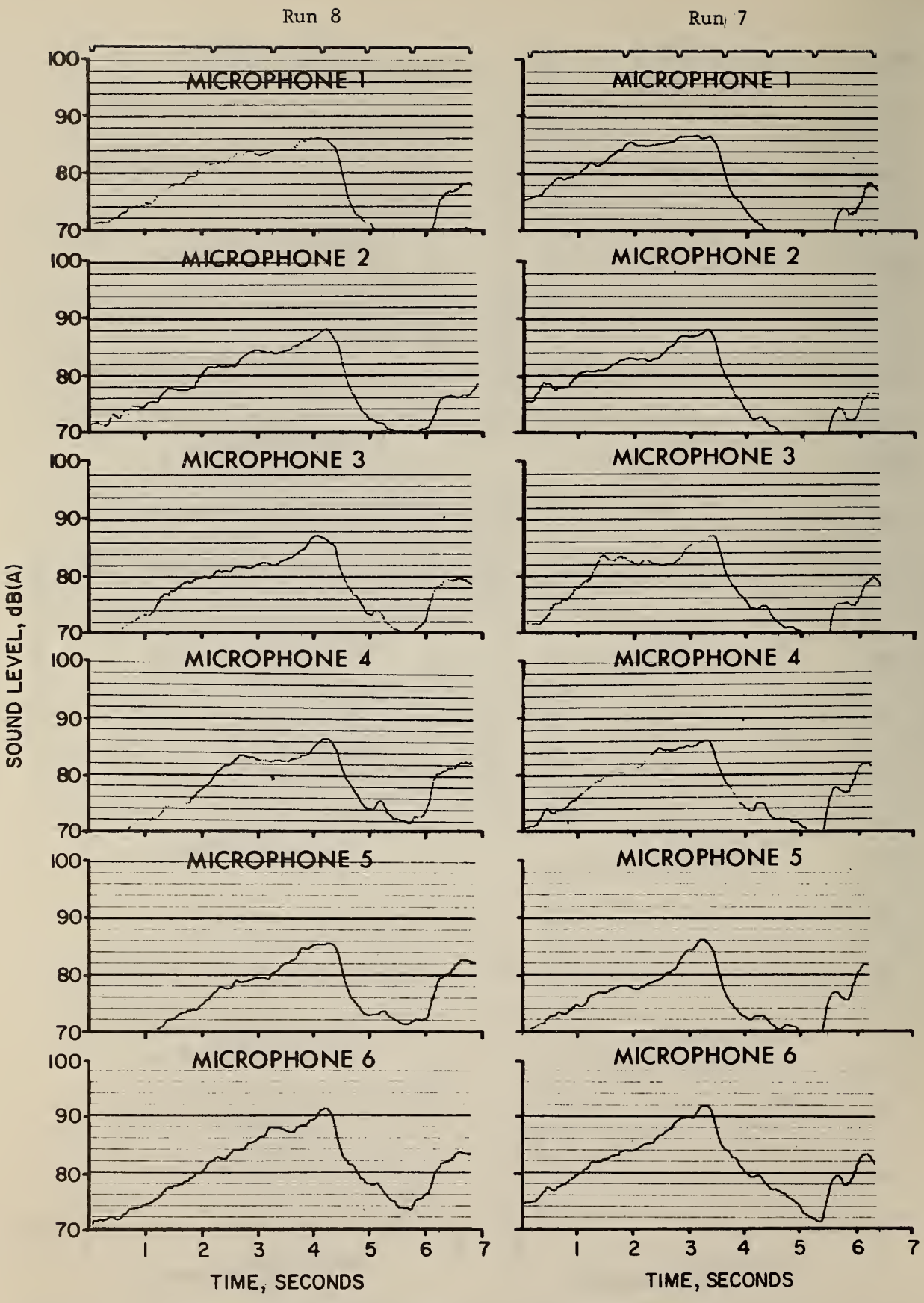

Figure 17-5. Truck 17, Test 3, Runs 7,8. (Exterior)

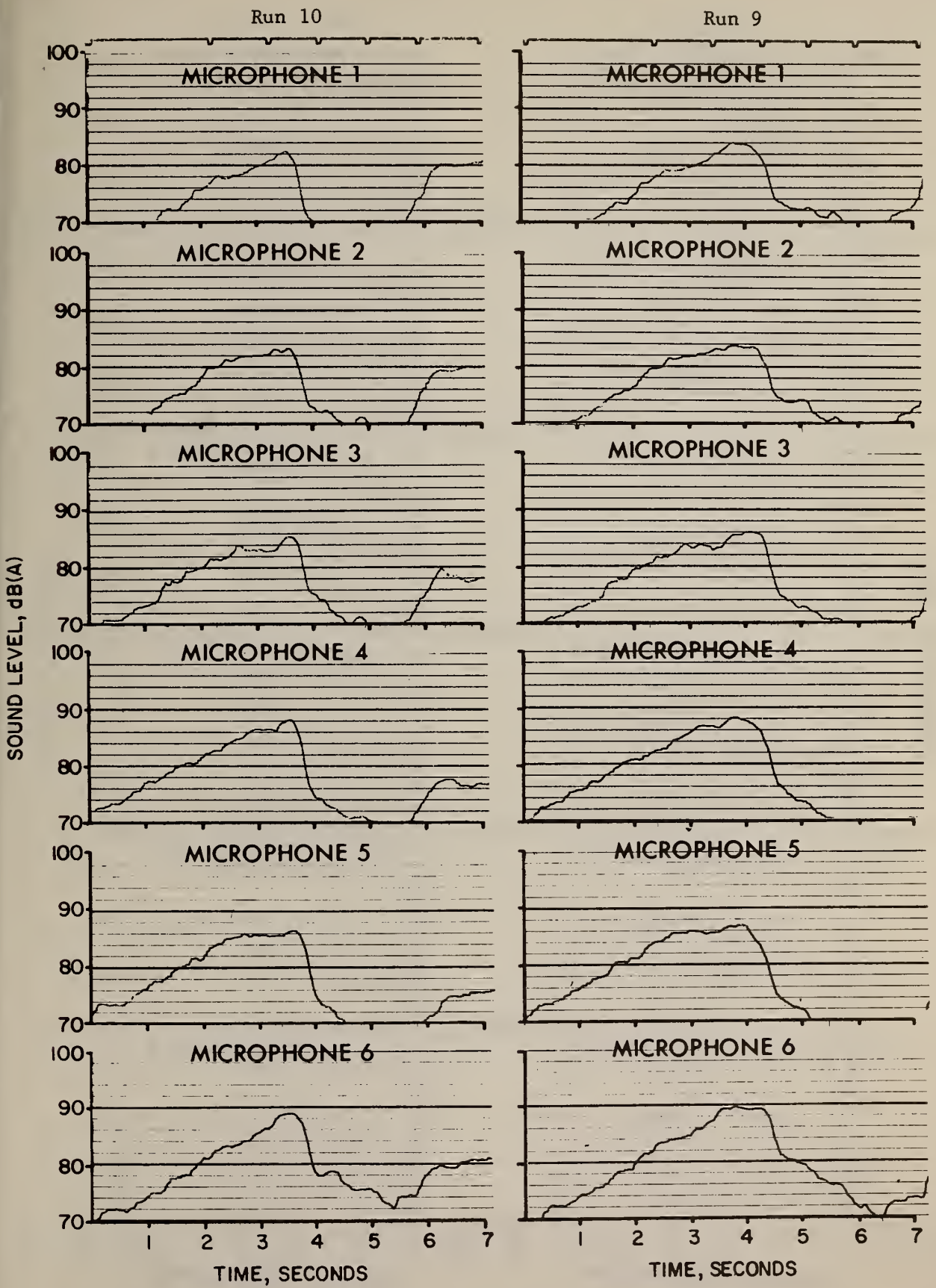

Figure 17-6. Truck 17, Test 3, Runs 9,10. (Exterior)

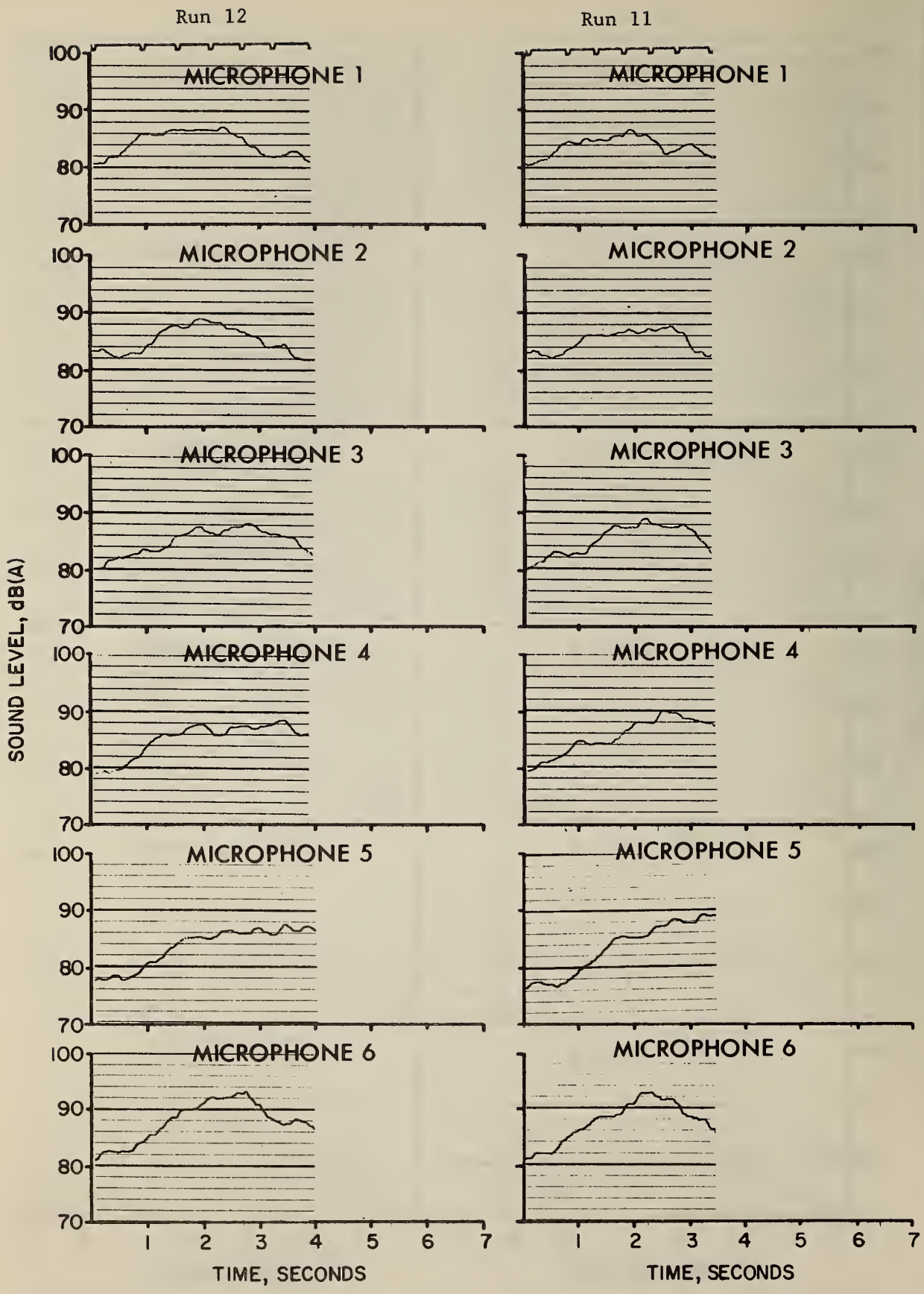

Figure 17-7. Truck 17, Test 4, Runs 11,12. (Exterior)

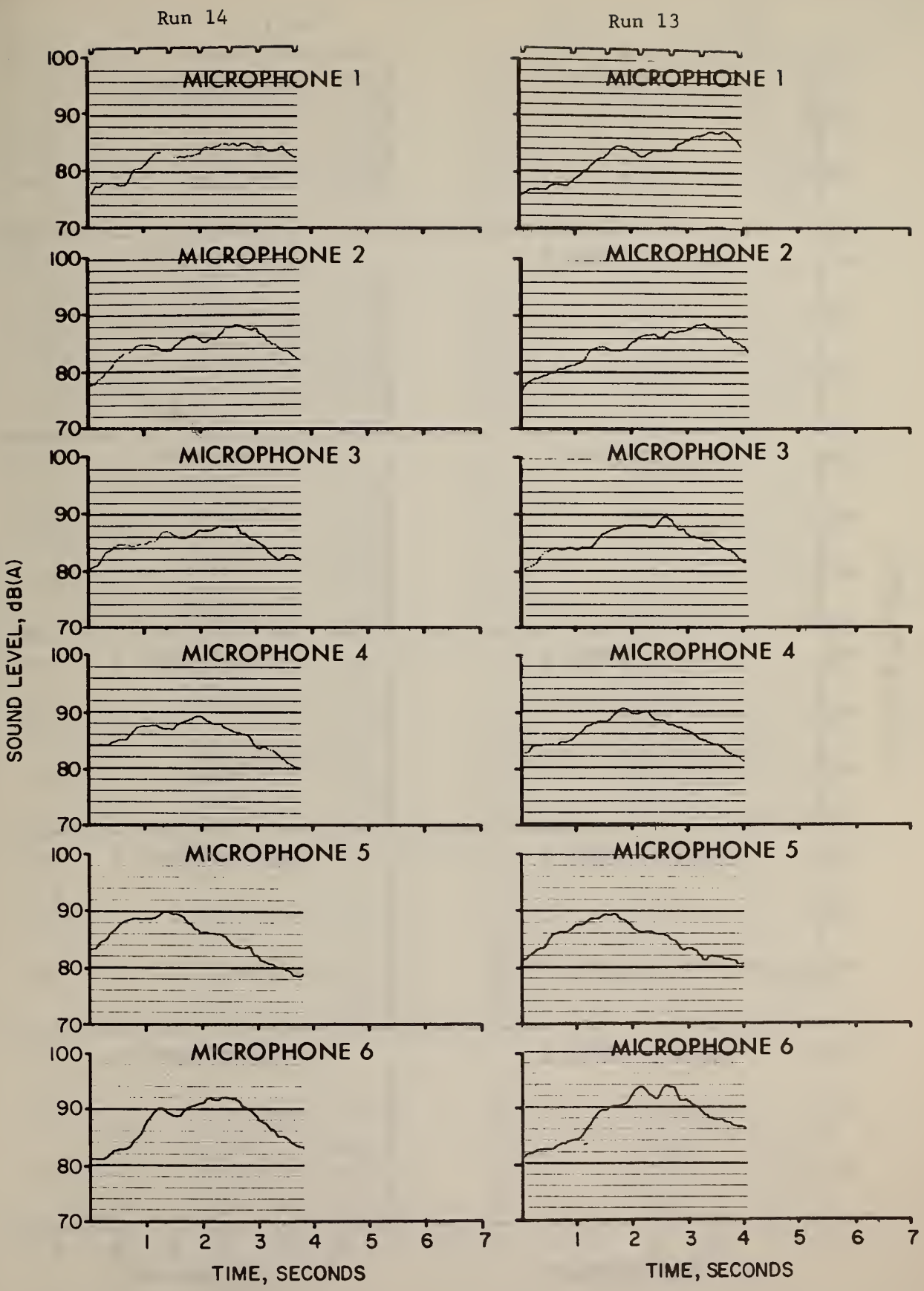

Figure 17-8. Truck 17, Test 4, Runs 13,14. (Exterior)

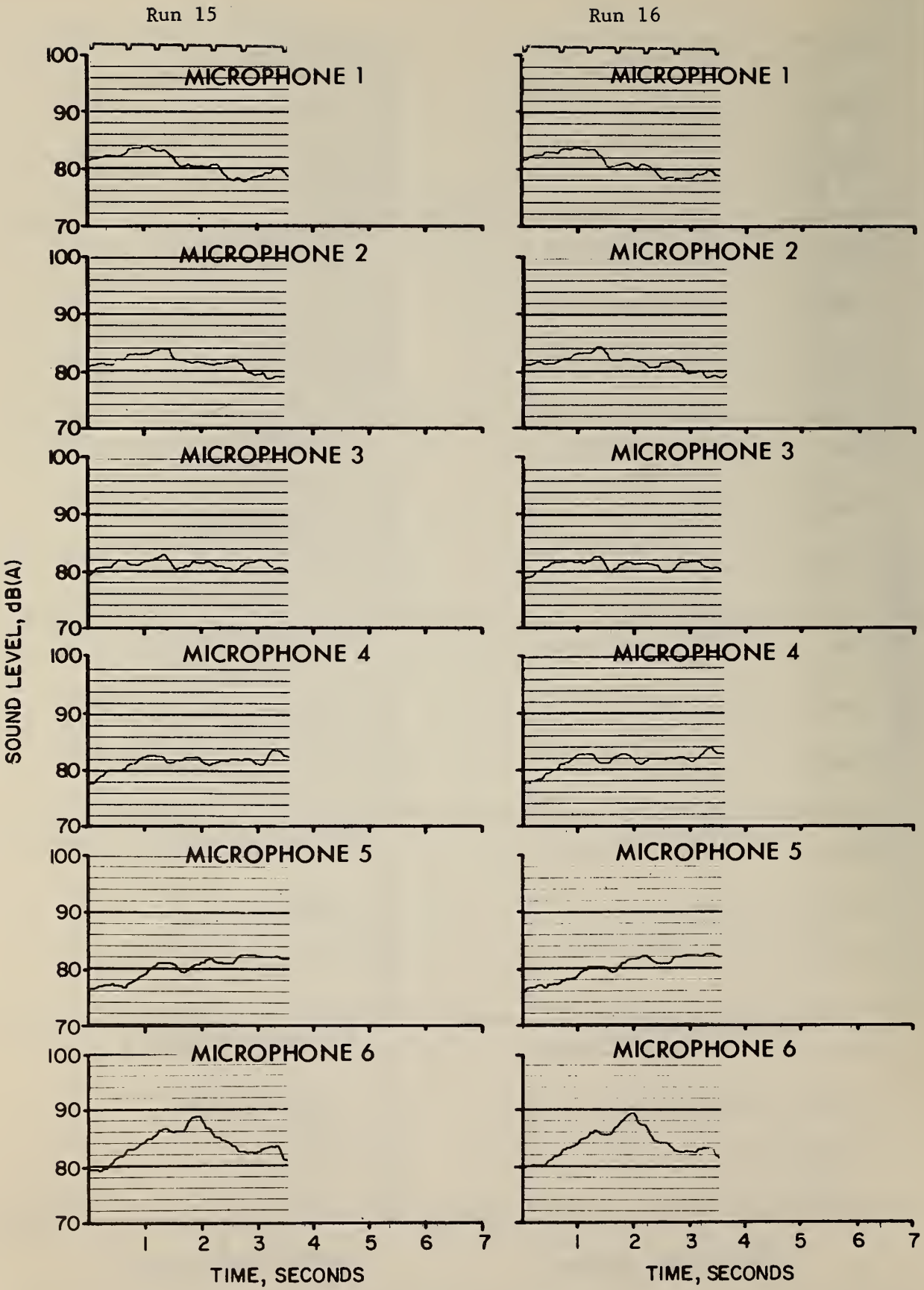

Figure 17-9. Truck 17, Test 5, Runs 15,16. (Exterior)

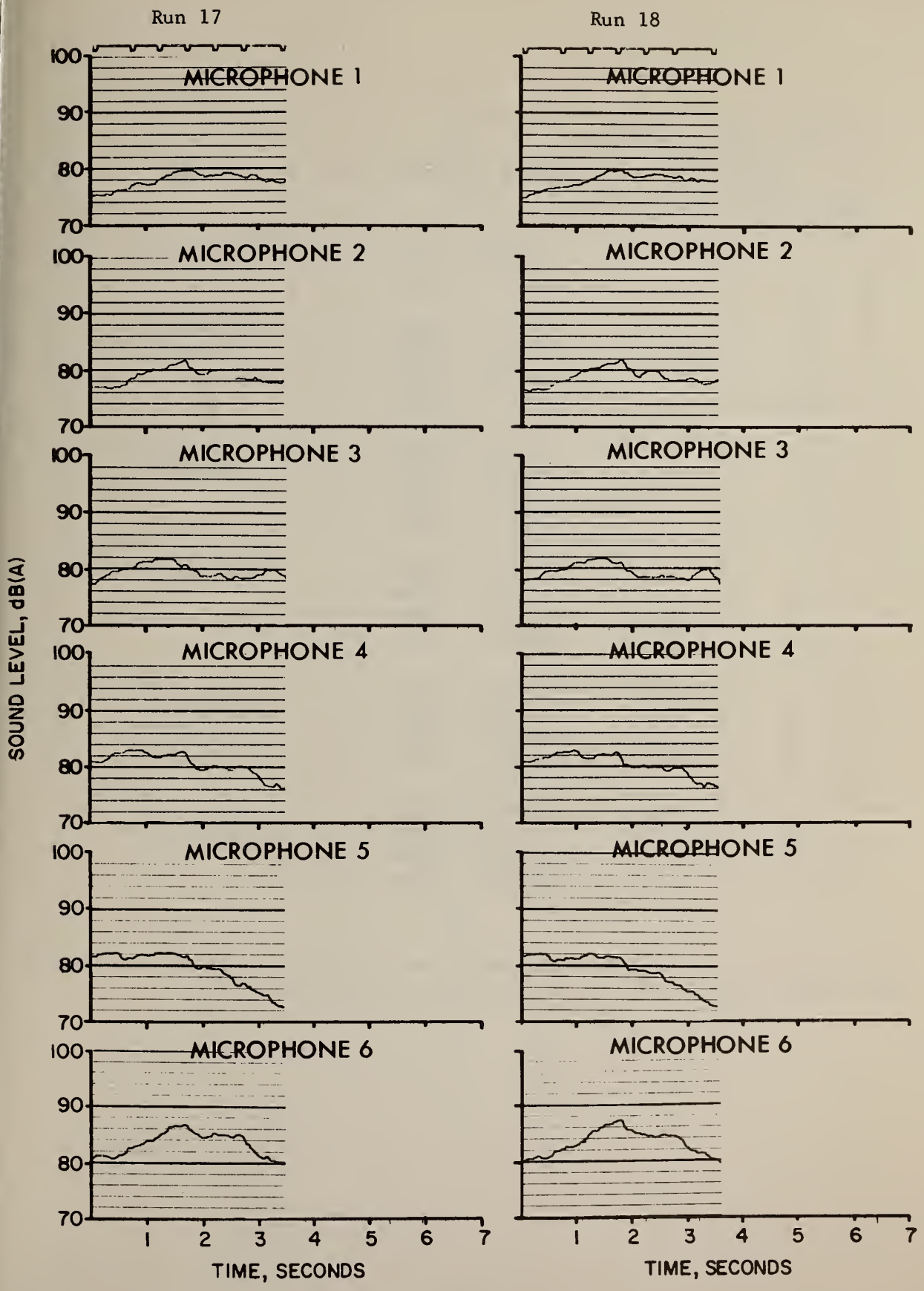

Figure 17-10. Truck 17, Test 5, Runs 17,18. (Exterior)

Interior

Truck 17

TEST	RUN	(SIDE)	WINDOWS	SOUND LEVEL, dB(A) MICROPHONES	
				LEFT EAR	RIGHT EAR
1. Low Idle (Stationary)	1	Right	Open	68	69
	2	Left	Closed	67	67
2. Acceleration (Stationary)	3	Right	Open	92	92
	4	Right	Open	91	92
	5	Left	Closed	87	87
	6	Left	Closed	88	88-85
2. High Idle (Stationary)	3	Right	Open	89	89
	4	Right	Open	88	89
	5	Left	Closed	86	88
	6	Left	Closed	86	88
3. City Start Up	7	Right	Open	93	92
	8	Right	Open	93	92
	9	Left	Closed	89	87
	10	Left	Closed	90	88
4. J366 (Acceleration)	11	Right	Open	92	92
	12	Right	Open	93	93
	13	Left	Closed	88	89
	14	Left	Closed	88	89
5. J366 (Deceleration)	15	Right	Open	91	90
	16	Right	Open	91	90
	17	Left	Closed	86	88
	18	Left	Closed	86	88

Table 17-2. Maximum A-weighted sound levels as measured at the two interior microphone locations for all test runs for vehicle number 17.

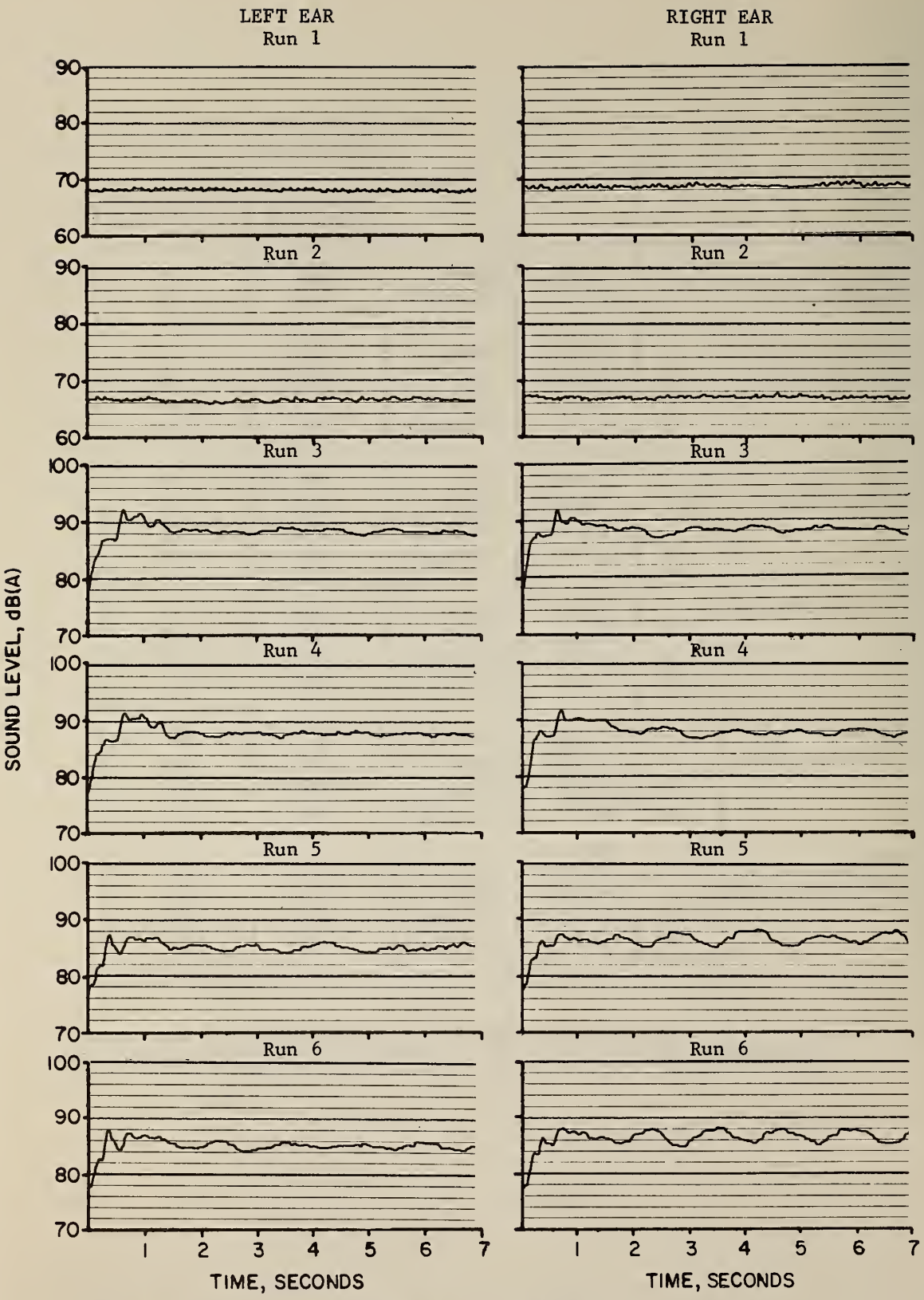

Figure 17-11. Truck 17, Tests 1,2, Runs 1-6. (Interior)

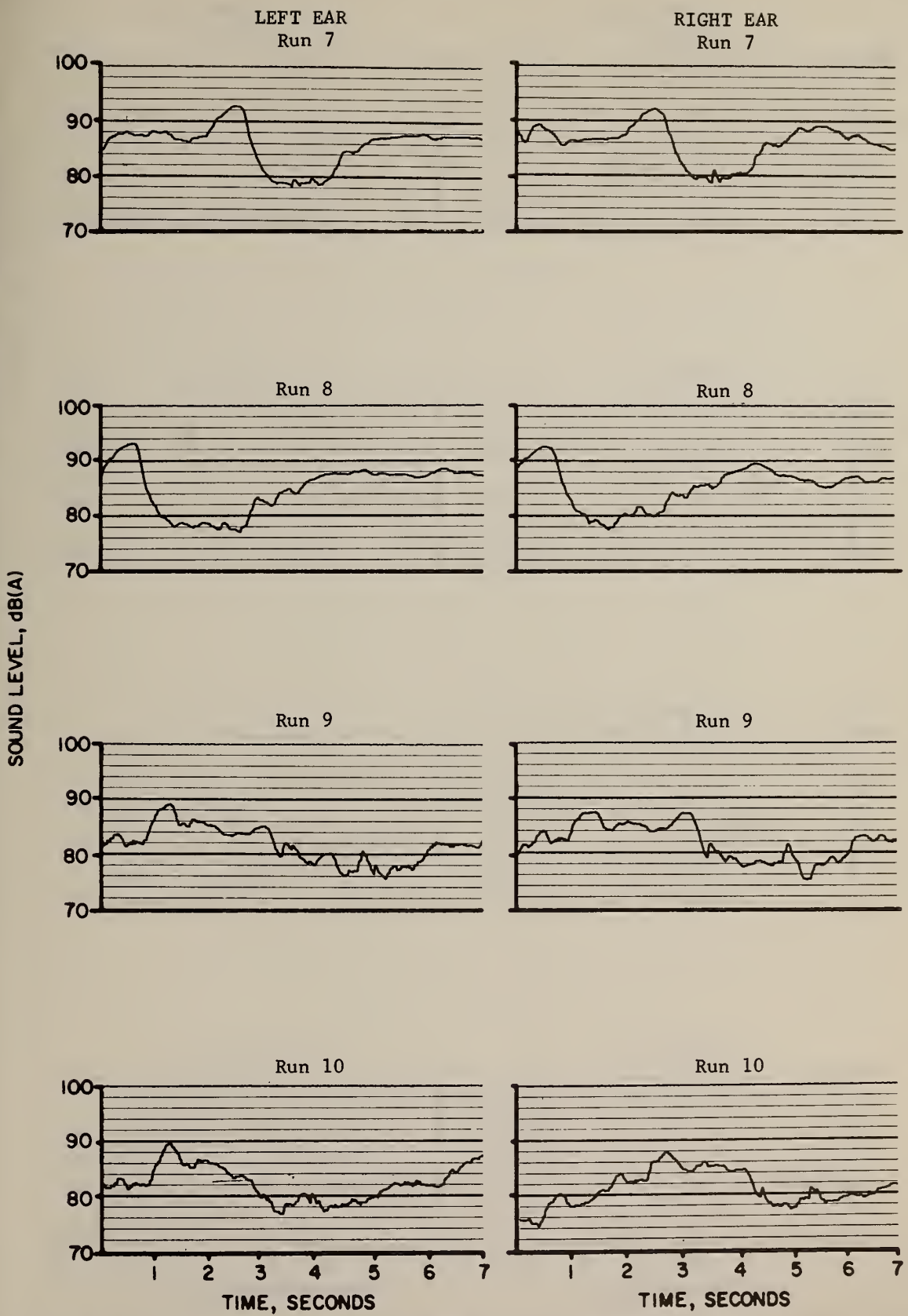

Figure 17-12. Truck 17, Test 3, Runs 7-10. (Interior)

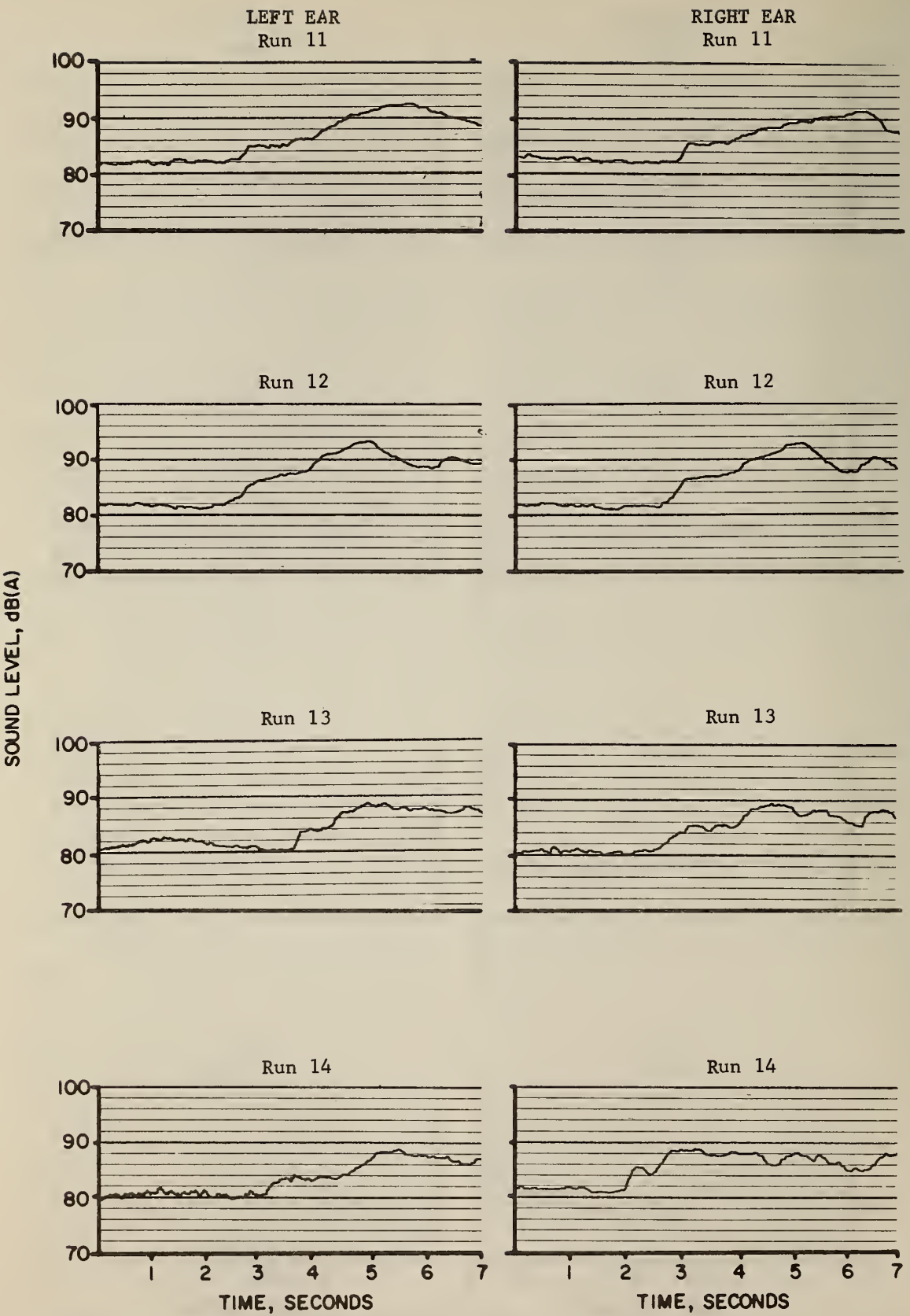

Figure 17-13. Truck 17, Test 4, Runs 11-14. (Interior)

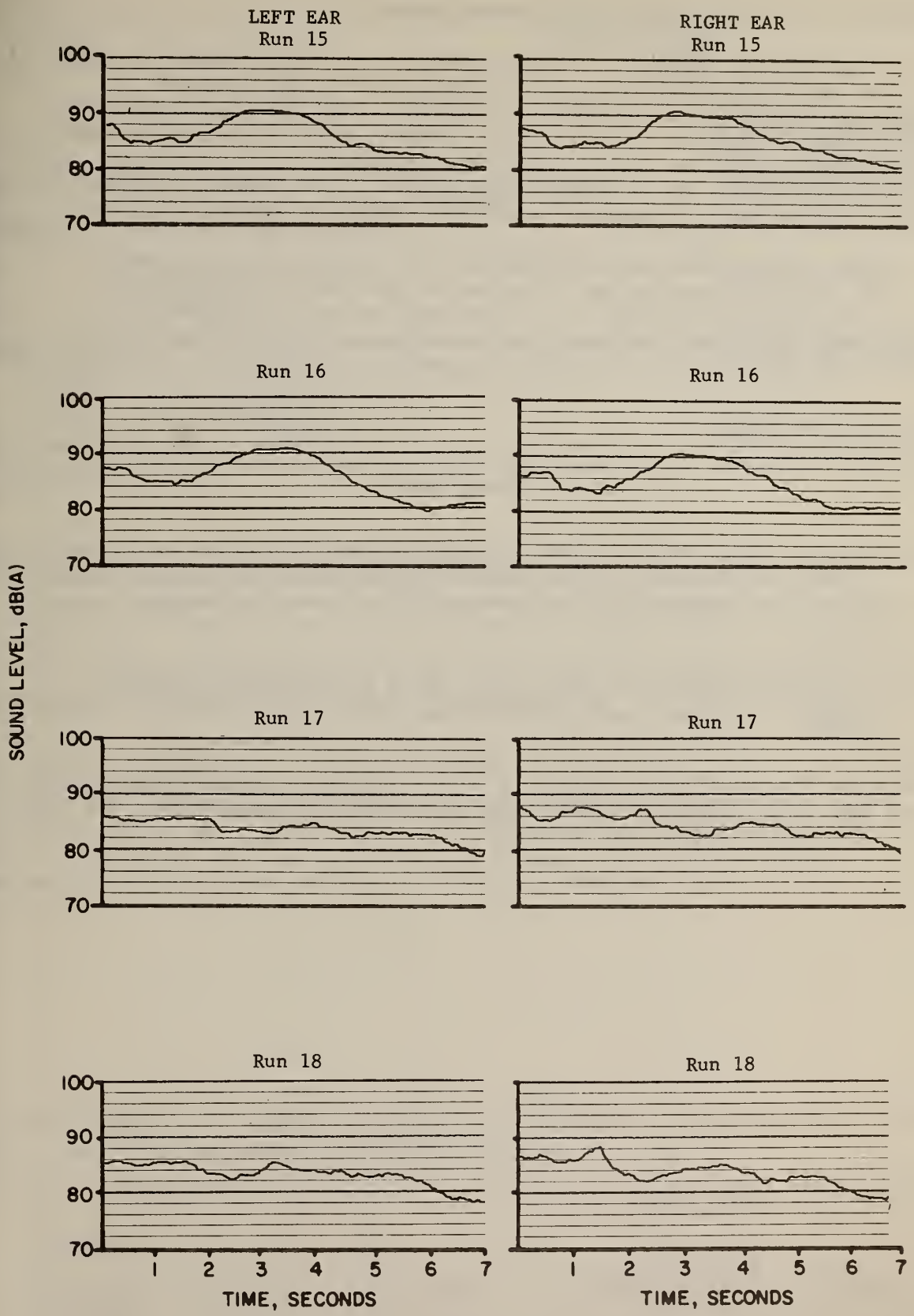

Figure 17-14. Truck 17, Test 5, Runs 15-18. (Interior)

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4. References

[1] Anon., Truck noise-1, peak A-weighted sound levels due to truck tires, Department of Transportation Report OST-ONA-71-9 (National Bureau of Standards Building Research Division, Washington, D.C., 1971).

[2] Society of Automotive Engineers, Inc., J336 - Sound Level for Truck Cab Interior, SAE Recommended Practice (SAE, New York, New York, 1968).

[3] Society of Automotive Engineers, Inc., J366 - Exterior Sound Level for Heavy Trucks and Buses, SAE Recommended Practice (SAE, New York, New York, 1969).

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16. ABSTRACT (A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here.)

This report presents the results of interior and exterior noise measurements which were made on a representative sample of fifteen over-the-road trucks under various operational modes. In-cab measurements were made six inches from the right and left ears of the driver with windows open and closed. Simultaneous exterior measurements were made utilizing a six-microphone array. Graphic histories of A-weighted sound level versus time are presented for all test conditions and microphone locations. The National Bureau of Standards made the field measurements and tabulated the data; however, interpretation of the results is the responsibility of the Department of Transportation and the American Trucking Associations -- the joint sponsors of the study. These data supplement the limited in-cab data available in the public domain and will form part of public Docket No. MC-22 Advanced Notice of Proposed Rule Making concerning vehicle interior noise levels which was issued by the Bureau of Motor Carrier Safety, Department of Transportation, in response to Federal Regulations concerning occupational noise exposure.

17. KEY WORDS (Alphabetical order, separated by semicolons) Acoustics; noise measurement; noise (sound); trucks; truck noise (exterior); truck noise (interior).

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