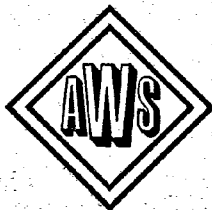
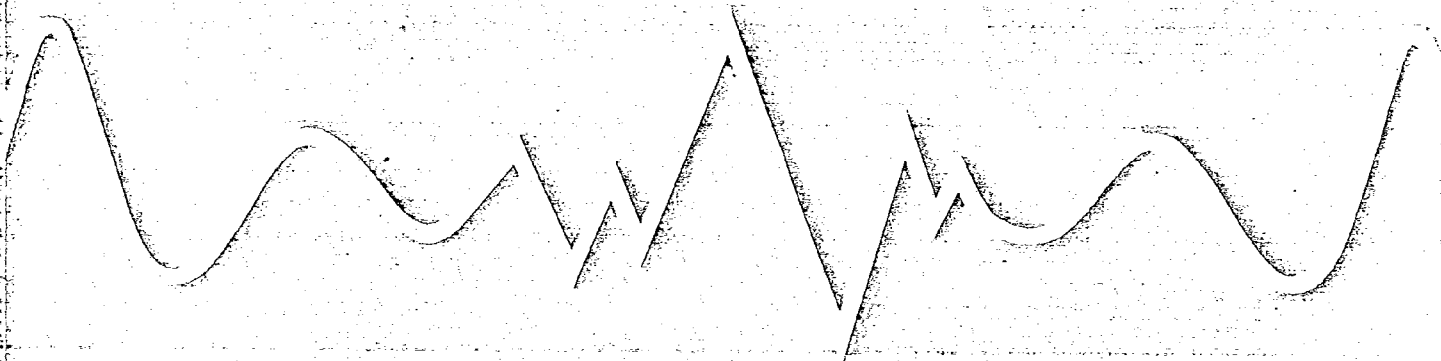


# ARC WELDING AND CUTTING

# NOISE



AMERICAN WELDING SOCIETY

# **Arc Welding and Cutting Noise**

**A research report on one aspect  
of the welding environment**

Based on research performed at Battelle-  
Columbus Laboratories under contract  
with The American Welding Society and  
supported by industry contributions

Under the direction of the AWS Committee  
on Safety and Health, Project Committee  
VI on Noise

Edited by Frank Y. Speight, Secretary,  
and Hallock C. Campbell, Consultant

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## Contents

|                                                                                                              |    |
|--------------------------------------------------------------------------------------------------------------|----|
| <i>Personnel</i> .....                                                                                       | v  |
| <i>Acknowledgement</i> .....                                                                                 | vi |
| <i>Summary</i> .....                                                                                         | 1  |
| <i>Introduction</i> .....                                                                                    | 2  |
| <i>Technical Discussion</i> .....                                                                            | 2  |
| AWS Method for Sound Level Measurement of Manual Arc Welding and Cutting Processes .....                     | 2  |
| 6. Equipment .....                                                                                           | 2  |
| Comments on Section 6 .....                                                                                  | 2  |
| 7. Precautions .....                                                                                         | 4  |
| Comments on Section 7 .....                                                                                  | 6  |
| 8. Sampling .....                                                                                            | 7  |
| Comments on Section 8 .....                                                                                  | 7  |
| 9. Preparation of Equipment .....                                                                            | 7  |
| Comments on Section 9 .....                                                                                  | 8  |
| 10. Calibration .....                                                                                        | 8  |
| Comments on Section 10 .....                                                                                 | 8  |
| 11. Procedure .....                                                                                          | 8  |
| Comments on Section 11 .....                                                                                 | 8  |
| 12. Report .....                                                                                             | 9  |
| Comments on Section 12 .....                                                                                 | 9  |
| <i>Results and Conclusions</i> .....                                                                         | 9  |
| <i>Recommendations for Future Work</i> .....                                                                 | 10 |
| <i>Appendix A: Method for Sound Level Measurement of Manual Arc Welding and Cutting Processes</i> .....      | 11 |
| <i>Appendix B: Table B1 and Data Sheets for Noise Measurement of Arc Welding and Cutting Processes</i> ..... | 19 |

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## Acknowledgement

This report was prepared by Charles W. Rodman, Lynn Faulkner, and Donald Skaggs of Battelle-Columbus Laboratories, dated November 4, 1977. For publication it was edited by Frank Y. Speight and Hallock C. Campbell to AWS style, and the final version of AWS F6.1-78, Method for Sound Level Measurement of Manual Arc Welding and Cutting Processes, has been substituted for the draft version supplied to Battelle.

## Arc Welding and Cutting Noise

### SUMMARY

Measurements of the noise produced by four arc welding processes and one arc cutting process were evaluated under standardized measurement conditions now incorporated in AWS F6.1-78, Method for Sound Level Measurement of Manual Arc Welding and Cutting Processes. Several important areas were surveyed or reviewed:

- (1) Measurement equipment and calibration procedures
- (2) Qualification of the measurement space acoustically
- (3) Evaluation of the sound measurement procedures in the qualified space

The conclusions regarding these items are as follows:

(1) **Equipment.** Manufacturer's procedures and recommendations must be followed with regard to calibration of sound measuring instruments, microphone placement (relative to observer and reflecting surfaces), microphone orientation (angular orientation of microphone axis in relation to sound source), and wind screen corrections. Using the recommended procedures, repeatable measurements within stated limits can be obtained.

(2) **Measurement space.** Qualification of the measurement space was found to be less difficult than anticipated. The major criteria are background sound levels due to other sources in the space, reflection of sound

from room surfaces, and physical size of the space. The background sound levels should be a minimum of 10 dB below the levels to be measured from the welding process. Acoustically reflecting surfaces, particularly walls, must be covered temporarily during measurements. This can be easily achieved by using 4 ft x 8 ft x 2 in. (1.22 x 2.44 x 0.05 m) high-density glass fiber panels to completely surround the measurement location. These panels need not be permanently attached to walls. The room within which the acoustic measurements are to be taken must be large enough to allow microphone positioning at specified locations that will not be close to room surfaces; that is, walls or ceiling. It is recommended that at least 8 ft (2.44 m) of clear space be available on all sides and above the welding table.

(3) **Measurement procedure.** The measurement procedure described in the proposed standard was found to be acceptable for determination of noise levels from welding processes. It is important to maintain the welding process as nearly as possible in a stationary location while making noise measurements. A stationary source and a moving workpiece are recommended.

Recommendations are made for future investigation of the procedure sensitivity to small variations in location of microphones, and to variations in spectra of the process noise and the ambient sound. Conducting a round robin test of this method is also recommended.

## INTRODUCTION

As part of an overall program to investigate the influence of welding operations on the environment of the workplace, Battelle-Columbus Laboratories carried out a series of noise measurements designed to quantify the noise generated by arc welding and cutting processes. The measurement procedure was selected by the American Welding Society's Safety and Health Project Committee VI on Noise. The processes to be measured were selected by Project Committee VIII on Research.

In addition to obtaining data on process noise, one of Battelle's objectives, as specified by AWS, was to evaluate the effectiveness of the proposed AWS F6.1-78, Method for Sound Level Measurement of Manual Arc Welding and Cutting Processes, at that time not yet approved for publication.

Over half of the Battelle effort consisted of participation in the deliberations of the Committee on the draft procedure and in preliminary evaluation of the room qualification requirements of the procedure. The ad hoc task group charged with drafting the procedure released the procedure to Battelle on July 19, 1977, and the list of processes to be measured was received from the Research Committee approximately one week later. Measurements were started on August 9, 1977, and completed August 16, 1977.

## TECHNICAL DISCUSSION

The proposed Method for Sound Level Measurement of Manual Arc Welding and Cutting Processes was followed as closely as possible in order to evaluate the effectiveness of the document. In some cases additional measurement locations and process settings were used to provide insight into the sensitivity of the results to these variables. No attempt was made to analyze the results obtained since this was not included in the scope of the research program. However, comments on the results are included, where appropriate.

The format for the following discussion of the standard and its application consists of statements of each section, alternating with descriptions of the manner in which Battelle used each section in carrying out the measurements.

### AWS Method for Sound Level Measurement of Manual Arc Welding and Cutting Processes

The draft standard, as finally presented to Battelle, was essentially the same as the standard now published. The experimental conditions to be tested were chosen by the AWS Committee on Noise and were those listed in the standard, plus readings with the microphone at the position occupied by the welder or welding operator.

Following are sections of the draft procedure used by Battelle in performing the noise measurements. The approved standard procedure appears as Appendix A.

## 6. Equipment

**6.1** Sound level measurements shall be made using a sound level meter configuration conforming with the requirements of ANSI S1.4 (paragraph 2.1) for type 1 meters.

**6.2** Equipment shall be located in accordance with Fig. A1 in Appendix A, p. 18.

**6.3** The equipment shall be used in a test site that meets the requirements of 9.1 (for outdoor locations), or 9.2 (for semianechoic test rooms), or 9.3 (for in-plant locations).

**6.4** Octave band filter sets, if used, shall meet the requirements of ANSI S1.11-1966 for Class II filters. The octave band frequencies shall be those tabulated in ANSI S1.4-1971.

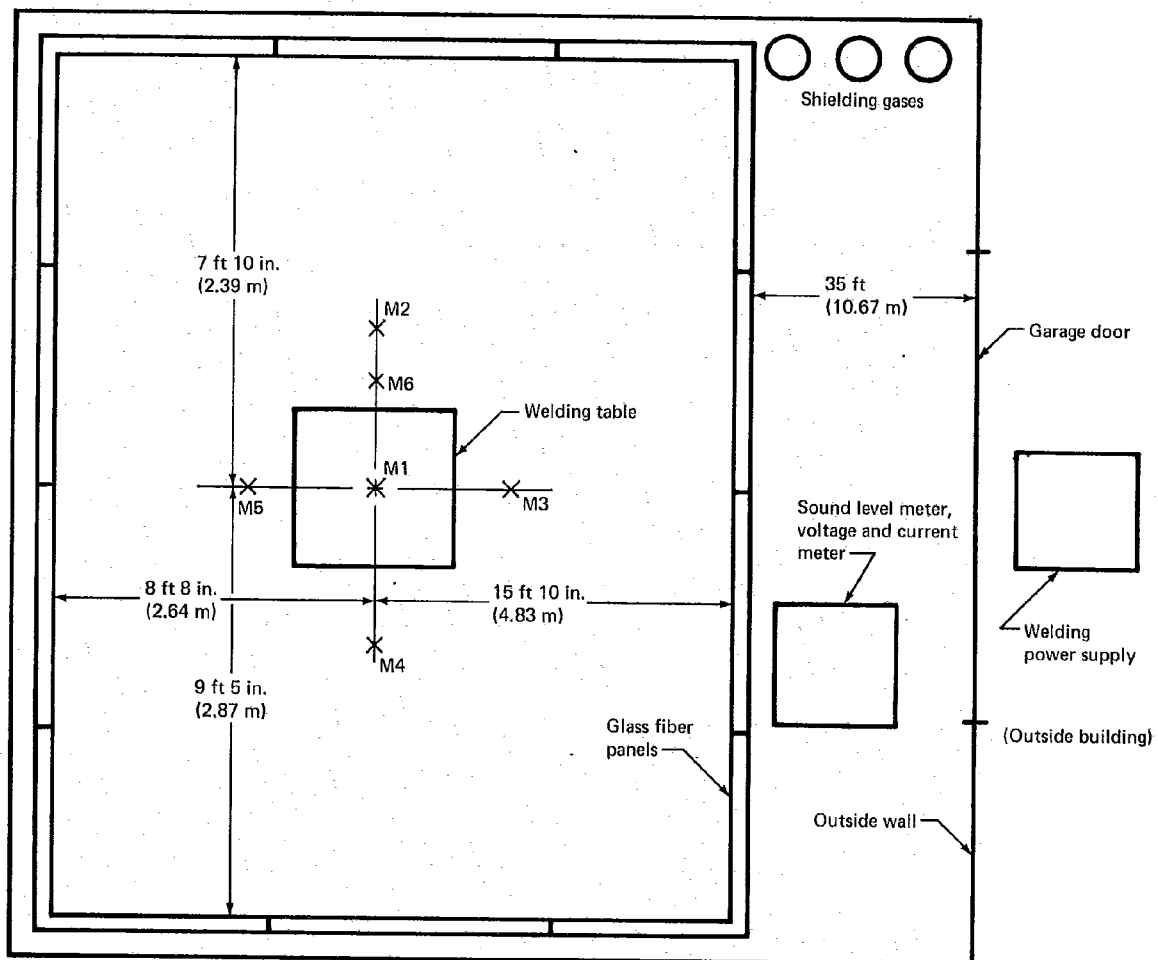
*Note: The octave band filter set is required only for the evaluation of the acoustic environment occurring at the test site.*

## Comments on Section 6

**6.1** The sound level meter used by Battelle was the GenRad Model 1933 Precision Sound Level Meter with Octave Band Analyzer. A one inch (25.4 mm) electret microphone with a foam wind screen recommended by GenRad was used for the measurements. The wind screen introduces less than -0.5 dB error at frequencies up to 5 kHz, and approximately 2 dB in the range 5 kHz to 12 kHz. The effect of the wind screen on A-weighted broad band sound cannot be predicted unless the spectral content of the sound is known; however, the error should not exceed 2 dB.

**6.2** Figure 1, p. 3, shows the layout of the measurement area used. The sound level measurements of manual arc welding and cutting processes were conducted in a simulated in-plant location. The test site was a laboratory space in a steel frame building with corrugated steel panel walls. The acoustical absorption of the thermal insulation on the inside of the walls was augmented by placing 4 ft by 8 ft by 2 in. (1.22 x 2.44 x 0.05 m) high-density<sup>1</sup> acoustical glass fiber panels around the perimeter of the measurement space. The dimensions of the building, consisting of a single open area, are 18 ft by 60 ft (5.49 by 18.29 m) long, by 14 ft (4.27 m) high. The measurement space, as defined by the acoustically absorbent panels, was 24-1/2 ft by 17-1/4 ft (7.47 x 5.26 m). The test site had a concrete floor extending the width of the room. The glass fiber panels were at a distance of no less than 5 ft (1.52 m) from any measurement point.

<sup>1</sup> The panels used have a density of 0.375 lb/ft (1.83 kg/m).

**Fig. 1—Layout of test site**

Note: Not to scale

## 4/ARC WELDING AND CUTTING NOISE

**6.3** The acoustic environment at the measurement points was determined to be free field by measuring the rate of decrease of the sound level along imaginary lines passing through the measurement points. A calibrated ILG fan, used as the sound source, was placed on the floor at the nominal location of the arc. No welding table was present. Octave band sound level measurements were made along four radial lines (through points M2, M3, M4, and M5 of Fig. 1, p. 3) at distances of 39 in. (1 m) and 79 in. (2 m) from the arc. Measurements were made at octave bands having center frequencies at 125 Hz through 8000 Hz. The results of the sound level measurements at points on each of the four radial lines are shown on pp. 4 to 6, Fig. 2 through Fig. 5.<sup>2</sup> Except for one direction, the decrease in octave band sound level with doubling of distance from the fan to the microphone was at least 5 dB. A difference of this magnitude is indicative of a suf-

ficiently free field acoustic condition. One direction, M4, was deficient at 8 kHz with a decrease of only 3 dB. The data are summarized in the Appendix, Table B1.

## 7. Precautions

### 7.1 Technical Precautions

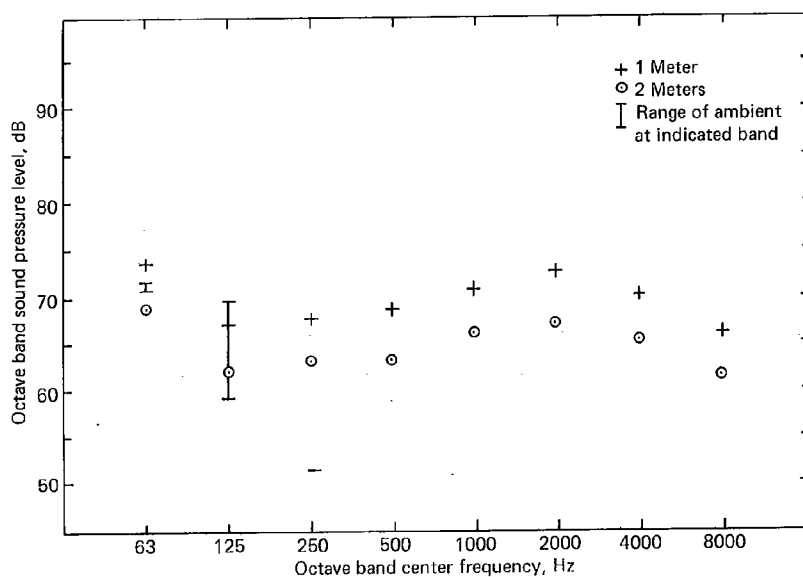
**7.1.1** The sound level meter and the meter calibrator shall be stabilized at the ambient test site conditions before calibration and use.

**7.1.2** The ambient sound level (including wind effects) shall be at least 10 dB lower than the level produced by the arc processes under test. A calibrated windscreen is recommended for outdoor measurements.

**7.1.3** Outdoor measurements are not recommended when the wind velocity exceeds 12 mph (5.4 m/sec.)

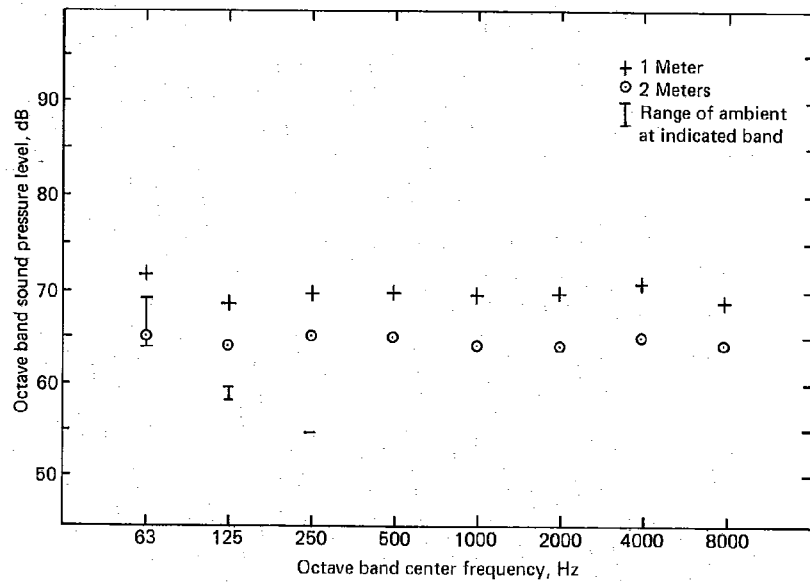
**7.1.4 CAUTION:** Heat and spatter associated with the arc process may damage the measurement equipment. It is recommended that the microphone be protected by a calibrated windscreen. It should be recognized that damage may be sustained by the windscreen.

<sup>2</sup> Optional readings at 63 Hz have been plotted in the figures but not included in Table B1.



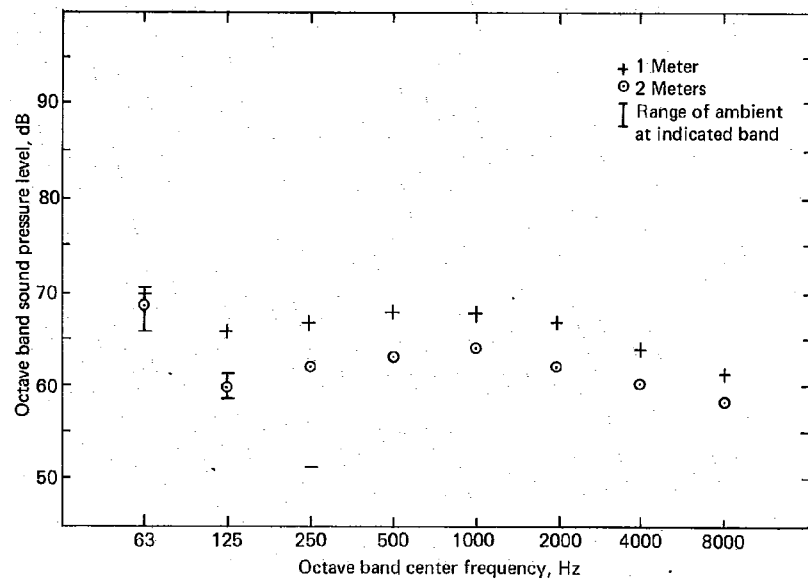
(Data shown in Figs. 2-5 are presented in tabular form in Table B1.)

**Fig. 2—Acoustic environment along measurement direction 2**



(Data shown in Figs. 2-5 are presented in tabular form in Table B1.)

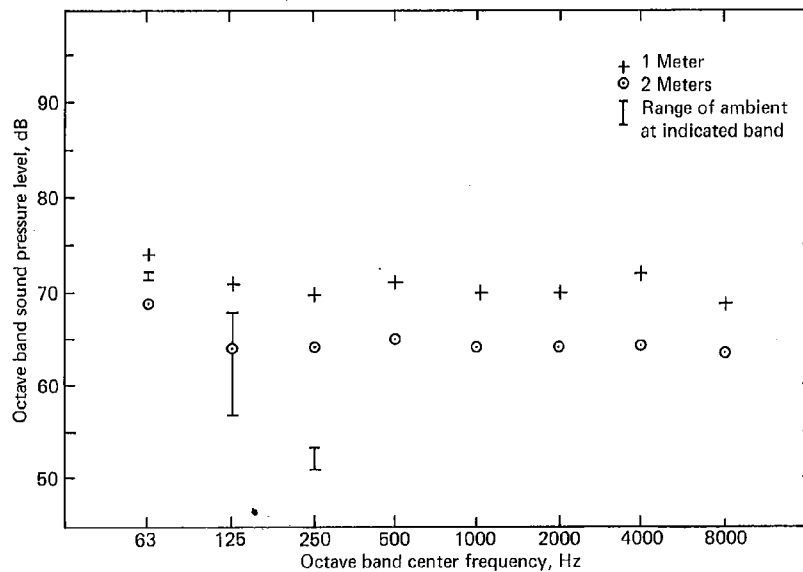
**Fig. 3—Acoustic environment along measurement direction 3**



(Data shown in Figs. 2-5 are presented in tabular form in Table B1.)

**Fig. 4—Acoustic environment along measurement direction 4**

## 6/ARC WELDING AND CUTTING NOISE



(Data shown in Figs. 2-5 are presented in tabular form in Table B1.)

**Fig. 5—Acoustic environment along measurement direction 5**

**7.1.5** The test site (paragraph 6.3) shall be free from all equipment, personnel, or other objects not directly involved with the test. It is recommended that, if available, a microphone extension cable be used and the body of the sound level meter be located remote from the measurement point.\*

**7.1.6** Orient the microphone in accordance with the manufacturer's instructions in order to yield the best possible frequency response at free field conditions.

**7.1.7** Follow the meter manufacturer's recommendations for avoiding errors due to stray electromagnetic radiation or humidity and temperature.

## 7.2 Safety Precautions

**CAUTION:** Certain arc processes generate high sound levels which may be hazardous to the hearing of personnel in the test site. Hearing protection, such as earplugs or muffs, should be worn unless it has been determined that the arc process under test is not hazardous to hearing. All other work practices shall be in accordance with ANSI Z49.1 (paragraph 2.8).

\*If a microphone extension cable is used, it shall conform to the recommendations of the meter manufacturer for maintaining the integrity of a Type 1 measurement.

## Comments on Section 7

**7.1.1** The sound level meter and calibrator were left in the test area at all times during the measurement program to assure that they were stabilized to room temperature.

**7.1.2** For the majority of the measurements, it was possible to comply with the requirement to have the ambient sound level at least 10 dB lower than the process noise; however, for one set of measurements (GTAW), the process noise level was so low it was not feasible to do so.

**7.1.4** The wind screen was inspected frequently for damage by weld splatter. No damage was incurred during the measurement program.

**7.1.5** All sound level measurements were made with the welding power supply placed outside the building in which the test room was located. The sound level meter (except for the microphone) and the voltage and current meters were placed outside the boundaries of the test area, beyond the absorbant panels. A microphone extension cable conforming to the recommendations of the meter manufacturer was used. The only person inside the test area at the time of the measurements was the welder. When GMA and FCA welding were performed,

a wire feeder was located in the test area. The wire feeder gun was rigidly supported above the table at the correct distance for the test being conducted. (It should be noted that the wire feeder was in the test area only when GMA and FCA welding were performed.)

**7.1.6** The microphone, with an approved windscreen, was oriented in accordance with the manufacturer's instructions in order to yield the flattest possible frequency response at free field conditions.

**7.1.7** A series of measurements was made with a dummy microphone installed on the microphone pre-amplifier. The meter indication remained at 22 dBA when the arc was operating, indicating no influence by the arc or cable fields on the preamp or the line leading to the remote sound level meter.

**7.2** The welding operator was an experienced welder on the Battelle technical staff. He is familiar with the requirements of ANSI Z49.1 and the need to comply with the special requirements of the draft procedure. He is the same operator who assisted with the ventilation tests and the fume tests conducted as part of the overall AWS/Battelle program. Other personnel remained outside the test area, behind the acoustic panels.

## 8. Sampling

**8.1** Measurements shall be made at locations specified in Fig. 1,<sup>3</sup> p. 15.

**8.2** Measurements shall be recorded on a form essentially similar to that shown in Fig. 2,<sup>3</sup> p. 16.

**8.3** Case conditions shown on Fig. 2,<sup>3</sup> p. 16.

**8.3.1** Case A.—All equipment operating but without arc initiation. This may require relocation of some equipment outside of the test site, in order to meet the requirements of paragraph 7.1.

**8.3.2** Case B—Maximum recommended operating parameters for the process being measured when the equipment range is adequate to supply process power. Otherwise maximum recommended equipment setting is used to establish the process operating parameters. Refer to paragraphs 2.6 and 2.7.

**8.3.3** Case C—Minimum recommended operating parameters for process being measured when the equipment range is adequate to supply the process power. Otherwise minimum recommended equipment setting is used to establish the process operating parameters. Refer to paragraphs 2.6 and 2.7.

## Comments on Section 8

**8.1** The sound level measurements were made at the five locations shown in Fig. 1 of AWS F6.1-78, see p. 15, and at the level of the welder's ear (M6), see Fig. A1, p. 18.

3. See complete standard in Appendix A.

**8.3** Three case conditions were investigated for each type of welding. Case A measurements were ambient readings with the equipment operating but with no arc. Case B measurements were made with maximum recommended operating conditions for the process being measured. When the equipment range was not adequate to supply process power, maximum recommended equipment settings were used to establish the process operating conditions. Case C measurements were made within minimum recommended operating conditions for the process being measured. When the equipment range was not adequate to supply the specified process power, the minimum recommended equipment setting was used to establish the process operating conditions. On some occasions, a Case D measurement was taken. Case D measurements were made with average or normal operating conditions for the process being measured, as defined by the operator.

## 9. Preparation of Equipment

**9.1** An outdoor location may be used as the test site if it is a flat area free of any large reflecting surfaces, such as buildings, signboards, or hillsides, within 50 ft (15 m) of the arc. The surface of the ground must be free from snow, long grass, loose rock, ashes, or other absorptive material within 4.4 ft (1.4 m) of any measurement point.

**9.2** A semianechoic test room may be used as the test site if it meets the following requirements:

**9.2.1** The floor shall be hard and shall extend the width of the test room. The average sound absorption coefficient of the hard floor shall not exceed 0.1 (a concrete floor is suitable). The sound absorptive treatment of the other surfaces shall be uniformly distributed and their average sound absorption coefficient shall be equal to or greater than 0.99 over the frequency range of 125 to 8000 Hz.

**9.2.2** The room dimensions shall be sufficient so that no measurement point is closer than 26 in. (670 mm) to an absorptive surface or wall.

**9.2.3** There shall be no acoustically reflecting surfaces other than the floor and obstacles associated with the test.

**9.3** An in-plant location may be used as the test site if it meets the following requirements:

**9.3.1** The floor shall be acoustically reflective. A concrete, sealed asphalt, or similar hard floor material is suitable.

**9.3.2** There shall be no hard reflective surface other than the floor within 4.4 ft. (1.4 m) of any measurement point.

**9.3.3** The acoustic environment at the measurement points shall be approximately free field. The existence of a free field condition shall be determined by measur-

## 8/ARC WELDING AND CUTTING NOISE

ing the rate of decay of the sound level at the measurement points. A sound source<sup>4</sup> shall be placed at the location of the arc. Octave band sound level measurements shall be made along four radial lines at distances of 39 in. (1 m) and 79 in. (2 m) from the arc. Measurements shall be made at octave bands having center frequencies at 125 Hz through 8000 Hz. To be classified as approximately free field, the difference in sound pressure level measured at the two distances should be 4 dB or greater.<sup>5</sup>

## Comments on Section 9

The test location used is typical of an in-plant location, with overhead duct work and a high ceiling. The concrete floor had a shallow pit directly under the work table. The pit was partially covered with plywood and two adjacent sides were lined with glass fiber acoustical material to suppress the formation of acoustic standing waves in the cavity. As mentioned earlier, the metal walls of the building were lined with thermal insulation batting and additional acoustic panels were installed temporarily. The minimum distance from any measurement point to absorbent panel was 94 inches. The minimum overhead distance was 99 inches.

**9.3** As described in the comment for section 6.3, the measurement space was satisfactory from the standpoint of free field performance.

## 10. Calibration

**10.1** All sound measurement equipment shall have been calibrated as specified by the manufacturer, but in no case shall the period between calibrations be longer than one year. Calibration shall be performed by the manufacturer, his designated representative, or a calibration laboratory.

**10.2** The sound level meter calibration shall be field checked according to the manufacturer's recommendations.

4. Suitable sound sources are the calibrated ILG fan available from ILG Industries, Chicago, Illinois, or the type 4204 Reference Sound Source available from B&K, Cleveland, Ohio.

5. Free-field conditions occur when the difference in the sound level at 39 in. (1 m) vis-a-vis that at 79 in. (2 m) is 6 dB. A difference of less than 6 dB is an indication that some reverberation is occurring. It is recommended that in-plant locations having a difference of less than 4 dB not be used as measurement sites because the measured values would be higher than would be produced by the same arc under purely free field conditions such as would occur in outdoor locations.

## Comments on Section 10

The sound level meter and acoustic calibrator used for the measurements were calibrated by the manufacturer, GenRad, in September, 1976. The sound level meter was calibrated, using the GenRad Model 1562-A 5-frequency calibrator, at the beginning and end of each measurement series. (A series consists of all the measurements required for a specific process.)

## 11. Procedure

**11.1** Set up the arc welding or arc cutting process as illustrated in Fig. 1, p. 15.

**11.2** Field check the sound level meter (refer to 10.2) calibration.

**11.3** Set the sound level meter to A-weighting, slow response.

**11.4** Measure the ambient sound level at each of the measurement points shown in Fig. 1 (omit point M6).

**11.5** For each of the arc operating conditions of 8.3, measure the sound level at measurement points shown on Fig. 1, p. 15. The measured sound level shall be the value of central tendency during a five (5) second time period, rounded off to the nearest even integer, when the meter fluctuation is 3 dB or less. When the fluctuation is greater than 3 dB, the recorded value shall be 3 dB less than the maximum value observed.

**11.6** Repeat 11.5 two times for a total of three runs.

**11.7** Repeat the ambient sound measurements and field check of the sound level meter calibration.

**Note:** Field check of the sound level meter calibration and measurement of ambient sound level shall be performed immediately before and after each period of testing. If the above testing is interrupted, then additional field checks and ambient sound measurements shall be performed if required.

## Comments on Section 11

At the beginning of each test period, the sound level meter was checked for calibration, using the 5-frequency acoustic calibrator. The sound level meter was then set to A-weighting, slow response. The ambient sound level was taken at each of the six measurement points. Then, for each arc process, the sound level was measured over a five (5) second time period with the actual reading being the central tendency during that time rounded off to the nearest even integer. If the meter fluctuation happened to be greater than 3 dB, then the recorded value was 3 dB less than the measured value observed. The measurement at each location was repeated two additional times for a total of three runs. The calibration was then re-checked.

## 12. Report

**12.1** Record all measured values on test data sheets such as the example shown in Fig. 2, p. 16.

**12.2** Calculate the arithmetic average of the three sound level values for each location and each arc operating condition. Round off the average to the nearest integer. In case of 0.5, round off to the nearest even integer. Enter the average values on the data sheet.

**12.3** Sketch a layout of the test site showing the locations of the measurement points, configuration of the arc set-up, and the location of any other objects or personnel in the test site on a form such as shown on Fig. 3, p. 17. Include descriptions of the acoustical measurement instrumentation and the arc process workpiece. Operating conditions in 8.3.2 and 8.3.3 are to be described on a form essentially similar to that shown in Fig. 3. This will include arc voltage and current, as well as other information described as "essential variables" in the reference of paragraph 2.4.

**12.4** Conformance with this standard method, to the extent true, shall be stated in the test report. Any deviation from recommended procedures or practice shall be noted, together with the reason for doing so, and an estimate of the change in accuracy resulting from the deviation.

## Comments on Section 12

The completed data sheets for the measurements performed are presented in Appendix B. The data sheets are essentially the same as those suggested by the draft procedure.

"Special" conditions are shown on individual data sheets as appropriate. Some of these conditions are described in the following paragraph.

Each of the welding processes tested had its own special conditions. For example, in SMA welding, which was the first type tested, it was found that the position of the welder had an effect on the sound level measurements. At position M4, readings were first taken with the welder standing between the arc and the microphone. These readings were between 5 and 6 dB less than if he were standing off to one side. After this observation, all subsequent readings were taken with the welder standing so as to not be between the arc and the microphone.<sup>6</sup> The air carbon arc process produced a difficulty in which a constant current level could not be obtained. Therefore, it was decided to change the air pressure used to clear away the molten metal. The maximum pressure used was

that available in the test room and the minimum pressure used was that pressure needed to barely carry the molten metal out of the cut and off the welding table. GTA welding produced the problem of having too little difference between the ambient sound levels and those produced by the welding process. In order to alleviate this problem, the power supply, which was outdoors, was oriented in such a way that the blower outlet was directed away from the test area. Also, glass fiber panels were put around the power supply. GMA welding had an interesting feature in that the sound levels recorded overhead were somewhat lower than the other locations. It was thought that the welder's arm might have been causing this reduction, since it was necessary to reach over the table to start the wire feeder and the welding process.

## RESULTS AND CONCLUSIONS

The data sheets completed during the measurement program are reproduced as Appendix B. In practically all cases, the results of three different measurements of a specific process at a specific location were within  $\pm 2$  dB.

Relative noise levels of various arc welding processes can be seen in Fig. 6, p. 10, which summarizes the processes investigated and their range of noise levels. The figure shows the range from minimum to maximum A-weighted sound level measured at the five primary measurement locations, over the range of welding current, for each process and condition.

From the information shown in the figure, the processes can be rank ordered with respect to noise as follows: GTAW is quietest, with SMAW, GMAW, and FCAW following in order of increasing loudness, except for the special case when FCAW is used with stainless base and wire materials, and the resulting sound level is more nearly like that of GTAW. There is also some indication of an increase in noise with a decrease in current down to the point of arc instability. Air carbon arc cutting has a characteristically high noise level.

In general, the conclusion is that the techniques spelled out in the proposed Method for Sound Level Measurement of Manual Arc Welding and Cutting Processes are adequate for setting up and qualifying a measurement space and performing the noise measurements required.

Precision and accuracy should be considered from two different points of view. The first consideration is for precision and accuracy of the sound measurements. This is primarily a function of the condition and calibration of the noise measuring equipment used. The second is the precision and accuracy of the method. Determination of values for precision and accuracy of the method cannot be done with a single set of measurements. Rather, the same process must be measured by several investigators, and some standard value must be agreed upon, before the precision and accuracy are known.

6. Figure 1, p. 15, shows the ear of the welder or operator at the side of the table in front of microphone location M2, which, accordingly, was a suitable position for readings at M3, M4, and M5. For reading M2, the welder or operator worked from one of the other sides of the table.

## 10/ARC WELDING AND CUTTING NOISE

| Process | Rod <sup>1</sup> |          | Base <sup>1</sup> |            | A-weighted sound pressure level, dB <sup>2</sup> |         |    |    |     |     |
|---------|------------------|----------|-------------------|------------|--------------------------------------------------|---------|----|----|-----|-----|
|         | Diam.            | Material | Thickness         | Material   | Amperes                                          | 40      | 60 | 80 | 100 | 120 |
|         | in.              | (mm)     | in.               | (mm)       |                                                  |         |    |    |     |     |
| GTAW    | 3/32             | (2.4)    | ER308-L           | 1/2 (12.7) | SS                                               | 130-190 | ■  |    |     |     |
| GMAW    | .045             | (1.1)    | E70S-3            | 3/4 (19.2) | MS                                               | 210-275 |    | ■  |     |     |
| FCAW    | 3/32             | (2.4)    | E308-L            | 1/2 (12.7) | SS                                               | 130-190 | ■  |    |     |     |
| FCAW    | 3/32             | (2.4)    | E70T-1            | 3/4 (19.1) | MS                                               | 290-540 |    | ■  |     |     |
| FCAW    | 3/32             | (2.4)    | E70T-4            | 3/4 (19.1) | MS                                               | 260-515 |    | ■  |     |     |
| SMAW    | 5/32             | (4.0)    | E6010 IP          | 3/4 (19.1) | MS                                               | 130-190 | ■  |    |     |     |
| SMAW    | 5/32             | (4.0)    | E6010 IP          | 3/4 (19.1) | MS                                               | 115-180 |    | ■  |     |     |
| SMAW    | 5/32             | (4.0)    | E7018             | 3/8 (9.5)  | MS                                               | 130-190 |    | ■  |     |     |
| AAC     | 3/16             | (4.8)    | CC                | 3/4 (19.1) | MS                                               | NA      |    |    | ■   |     |
| AAC     | 3/16             | (4.8)    | CC                | 3/4 (19.1) | MS                                               | NA      |    |    | ■   |     |

1. See Data Sheets for detailed information

2. The dotted bars following each process description represent the range of sound pressure levels measured at the five primary locations over the range of current values used (eliminating measurement M6 at the level of the welder's or operator's ear).

**Fig. 6—Relative A-weighted sound pressure levels of arc welding processes**

## RECOMMENDATIONS FOR FUTURE WORK

The development of a draft recommended method for measuring noise from arc welding processes and the subsequent program conducted by Battelle represent a major advance in the state of documented knowledge relative to the noise characteristics of welding processes. In order that the knowledge gained be put to the most effective use and the draft standard method fully qualified for acceptance as a consensus standard by an organization such as ASTM, ANSI, or SAE, a follow-up program is recommended in which the sensitivity of the procedure to

user interpretation and to the spectra of the process noise would be determined. The first program would consist of planning and supervising a round robin evaluation of the draft procedure. The results of the round robin would provide the data needed to develop a statement about precision and accuracy. The second program, which should be planned by the Project Committee on Noise, would investigate in depth the effects of such things as ambient spectra, process spectra, and the sensitivity of the method to small deviations from the microphone locations called for by the draft procedure. (For example, the importance of maintaining a specific height for the microphone above the work piece would be determined.)

## Appendix A: F6.1-78 Method For Sound Level Measurement of Manual Arc Welding and Cutting Processes

by  
American Welding Society  
Project Committee on Noise,  
under the direction of the  
Committee on Safety and Health

### 1. Introduction and Scope

This standard method describes the equipment and procedure to be used in measuring sound levels of manual arc welding and cutting processes. The procedure described allows the user to measure the sound level associated with specific processes in a reproducible manner that permits comparison with other selected processes. This method is not applicable to the determination of operator exposure to process sound. The standard method assures that manual arc process sound level data obtained by different individuals in different locations are comparable. Sound levels can be identified as being measured in accordance with this AWS standard only if obtained under strict adherence to this method. Data obtained using any nonadherent methods cannot be identified as being obtained in accordance with this AWS standard.

The sound level meter and associated equipment used in the measurement procedure shall be an ANSI S1.4 Type 1 (also known as S1A).<sup>1</sup>

### 2. Applicable Documents

**2.1** ANSI S1.4 (1971 R1976), Specification for Sound Level Meters, American National Standards Institute, Inc., N.Y., N.Y.

<sup>1</sup>An ANSI S1.4 Type 2 sound level meter may be used for information gathering or survey purposes if less accuracy is acceptable to the user. However, such measurements cannot be identified as being in accordance with this AWS standard (2.1).

**2.2** ANSI S1.11 (1966 R1976), Octave, Half-Octave, and Third-Octave Band Filter Sets, American National Standards Institute, Inc., N.Y., N.Y.

**2.3** ACGIH 1977 TLVs®, Threshold Limit Values for Physical Agents, American Conference of Governmental Industrial Hygienists

**2.4** AWS D1.1-REV-1-1976, Structural Welding Code

**2.5** AWS A3.0-1976, Welding Terms and Definitions

**2.6** NEMA EW3-1976, Semiautomatic Wire Feed Systems for Arc Welding, National Electrical Manufacturers Association

**2.7** NEMA EW1-1971, REV 3 (ANSI C87.1-1976), Electric Arc Welding Apparatus

**2.8** ANSI Z49.1-1973, Safety in Welding and Cutting, available from American Welding Society

### 3. Summary of Method

The sound level generated by manual arc welding or arc cutting processes is measured with the A-weighted, slow response meter setting. Measurements are made at radial locations one meter from the arc center. The preferred acoustic environment is free field over a reflecting plane, such as occurs in semianechoic test rooms or outdoors. Measurements are also permitted in approximately free field conditions such as would occur in in-plant locations. Users of this method should be aware that measurements made in in-plant locations may be higher than those made in semianechoic test rooms or outdoors.

## 4. Significance and Use

The purpose of this standard method is the establishment of the conditions under which reproducible sound level measurement data shall be taken for the various manual arc welding and cutting processes. This method is not applicable to the determination of operator exposure to process sound.

## 5. Terminology

**A-weighted.** The specific prescribed frequency response of the sound level meter. ANSI S1.4 requires A, B, and C response characteristics for general use instruments. A-weighting is assumed unless otherwise specified.

**free field.** In practice, an area of measurement in which the effects of the boundaries are negligible for the region of interest.

**meter calibration.** The procedure by which the important changes in performance of an instrument are discovered and corrected. Normally the procedure is provided by the instrument manufacturer.

**octave band.** A frequency band whose upper frequency is twice its lower frequency.

**process power.** A general descriptive term referring to the source of electrical energy which is required for arc operation.

**reflecting plane.** The ground or surface over which the measurements are made. Sound will be reflected from the plane unless the reflections are reduced by acoustic absorbing materials.

**semianechoic test room.** A laboratory test room that produces an acoustic environment that is free field over a reflecting plane. It is essentially an anechoic room with one of the surfaces, usually the floor, acoustically reflective.

**slow response.** The speed of response, designated as slow by ANSI S1.4, when making measurements with a sound level meter conforming to the standard.

**sound absorption coefficient.** Typically, a number between zero and one which describes the sound absorption qualities of a material. Total absorption is given as one.

**sound level meter.** A meter constructed according to ANSI S1.4 standards for the measurement of sound level. It consists of a microphone, amplifier, indicating meter, and weighting filters.

**windscreen.** A screen used to protect the microphone of a sound level meter from the noise effects of wind. It is designed to reduce the wind noise significantly without a serious effect on the system's frequency response.

## 6. Equipment

**6.1** Sound level measurements shall be made using a sound level meter configuration conforming to the requirements of ANSI S1.4 for Type 1 meters.

**6.2** Equipment shall be located in accordance with Fig. 1, p. 15.

**6.3** The equipment shall be used in a test site that meets the requirements of 9.1 (for outdoor locations), 9.2 (for semianechoic test rooms), or 9.3 (for inplant locations).

**6.4** Octave band filter sets, if used, shall meet the requirements of ANSI S1.11 - 1971. The octave band frequencies shall be those tabulated in ANSI S1.4-1971 (2.2).

*Note:* The octave band filter set is required only for the evaluation of the acoustic environment occurring at the test site.

## 7. Precautions

### 7.1 Technical Precautions

**7.1.1** The sound level meter and the meter calibrator shall be temperature stabilized at the ambient test site conditions before calibration and use.

**7.1.2** The ambient sound level (including wind effects) shall be at least 10 dB (on the A scale) lower than the level produced by the arc process under test (Cases B and C of 8.3). A calibrated windscreen is recommended for outdoor measurements.

**7.1.3** Outdoor measurements are not recommended when the wind velocity exceeds 5 m/s (approximately 12 mph).

**7.1.4 CAUTION:** Heat and spatter associated with the arc process may damage the measuring equipment. It is recommended that the microphone be protected by a calibrated windscreen. It should be recognized that damage may be sustained by the windscreen.

**7.1.5** The test site (6.3) shall be free from all equipment, personnel, or objects not directly involved with the test.

When a microphone extension cable is used it shall conform to the recommendations of the meter manufacturer for maintaining the integrity of an ANSI S1.4 Type 1 measurement system.

**7.1.6** The microphone shall be oriented in accordance with the manufacturer's instructions in order to yield the flattest possible frequency response at free field conditions.

**7.1.7** The meter manufacturer's recommendations for avoiding errors due to stray electromagnetic radiation, humidity, or temperature shall be followed.

## 7.2 Safety Precautions

**CAUTION:** Certain arc processes generate high sound levels. Hearing protection, such as earplugs or muffs, shall be worn unless it has been determined that the arc process under test is not hazardous to hearing. All other work practices shall be in accordance with ANSI Z49.1 (2.8).

## 8. Sampling

**8.1** Measurements shall be made at the locations specified in Fig. 1, p. 15.

**8.2** Measurements shall be recorded on a form essentially similar to that shown in Fig. 2, p. 16.

**8.3** Case conditions shown on Fig. 2, p. 16.

**8.3.1 Case A**—All equipment operating, but without arc initiation. This may require relocation of some equipment outside the test site, in order to meet the requirements of 7.1. This case allows measurement of the sound generated by that equipment which is essential to the arc process and which cannot be readily placed in a position remote to the test site.

**8.3.2 Case B**—Maximum recommended operating conditions for the process, measured when the equipment range is adequate to supply process power. Otherwise, maximum recommended equipment setting is used to establish the process operating conditions. Refer to 2.6 and 2.7.

**8.3.3 Case C**—Minimum recommended operating conditions for the process, measured when the equipment range is adequate to supply process power. Otherwise, minimum recommended equipment setting is used to establish the process operating conditions. Refer to 2.6 and 2.7.

## 9. Preparation of Equipment

**9.1** An outdoor location may be used as the test site if it is a flat area free of any large reflecting surfaces such as buildings, signboards, or hillsides within 15 m (50 ft) of the arc. The surface of the ground must be free from snow, long grass, loose rock, ashes, or other absorptive material within 1.4 m (4.6 ft) of any measurement point.

**9.2** A semianechoic test room may be used as the test site if it meets the following requirements:

**9.2.1** The floor shall be hard and shall extend the width of test room. The average sound absorption coefficient of the hard floor shall not exceed 0.1 (a concrete floor is suitable). The sound absorptive treatment of the other surfaces shall be uniformly distributed and their average sound absorption coefficient shall be equal to or greater than 0.99 over the (frequency range of) 125 to 8000 Hz octave bands.

**9.2.2** The room dimensions shall be sufficient so that no measurement point is closer than 660 mm (26 in.) to an absorptive surface or wall.

**9.2.3** There shall be no acoustically reflecting surfaces other than the floor and the equipment associated with the test.

**9.3** An in-plant location may be used as the test site if it meets the following requirements:

**9.3.1** The floor shall be acoustically reflective. Concrete, sealed asphalt, or a similar hard floor material is suitable.

**9.3.2** There shall be no acoustically reflective surface other than the floor and equipment associated with the test within 1.4 m (4.6 ft) of any measurement point.

**9.3.3** The acoustic environment at the measurement points shall be approximately free field. The existence of a free field condition shall be determined by measuring, at the specified measurement points, the reduction of the sound level with distance from the source. A sound source<sup>2</sup> shall be placed at the location of the arc. Octave band sound level measurements shall be made along four radial lines at distances of 1 and 2 m (39 and 79 in.) from the arc position. Measurements shall be made at octave bands having center frequencies at 125 Hz through 8000 Hz. To be classified as approximately free field, the difference in sound pressure level measured at the two distances should be 4 dB or greater.<sup>3</sup>

## 10. Calibration

**10.1** All sound measurement equipment shall have been calibrated as specified by the manufacturer, but in no case shall the period between calibrations be longer than one year. Calibration shall be performed by the manufacturer, his designated representative, or a calibration laboratory.

**10.2** The sound level meter shall be field calibrated according to the manufacturer's recommendation.

<sup>2</sup>Suitable sound sources are the calibrated ILG Fan available from ILG Industries, Div. of Carrier Corp., 2850 North Pulaski Rd., Chicago, IL 60641, or the Type 4204 Reference Sound Source available from B&K Instruments, Inc., 5111 W. 164 St., Cleveland, OH 44142.

<sup>3</sup>Free field conditions occur when the difference in the sound level at 1 m (39 in.) vis-a-vis that at 2 m (79 in.) is 6 dB. A difference of less than 6 dB is an indication that some reverberation is occurring. It is recommended that in-plant locations having a difference of less than 4 dB not be used as measurement sites because the measured values would be higher than would be produced by the same arc under purely free field conditions, such as would occur in outdoor locations. The welding table may be removed during the measurements.

## 14/ARC WELDING AND CUTTING NOISE

**11. Procedure**

**11.1** Set up the arc welding or arc cutting process as illustrated in Fig. 1, p. 15.

**11.2** Field calibrate the sound level meter (10.2).

**11.3** Set the sound level meter to A-weighting, slow response.

**11.4** Measure the ambient sound level at any one of the measurement points shown in Fig. 1, p. 15.

**11.5** For each of the arc operating conditions of 8.3, measure the sound level at measurement points shown in Fig. 1, p. 15. The measured sound level shall be the value of central tendency during a five (5) second time period, rounded off to the nearest whole integer, when the meter fluctuation is 3 dB or less. When the meter fluctuation is greater than 3 dB, the recorded value shall be 3 dB less than the maximum observed value.

**11.6** Repeat 11.5 two times for a total of three runs.

**11.7** Repeat the ambient sound measurements and the field check of the sound level meter calibration. Repeat the entire *Procedure* when more than a 1 dB drift is determined to have occurred in the sound level meter calibration or the requirements of 7.1.2 are no longer met.

*Note:* A field check of the sound level meter calibration and measurement of ambient sound level shall be performed immediately before and after each period of testing. If the above testing is interrupted, then additional field checks and sound measurements shall be performed as required.

**12. Report**

**12.1** Record all measured values on test data sheets such as the example shown in Fig. 2, p. 16.

**12.2** Calculate the arithmetic average of the three sound level values for each location and each arc operating condition. Round off this average to the nearest integer; round off values ending in .5 to the nearest even integer. Enter the average values on the data sheet. If successive measurements vary by more than 5 dB, the data shall not be averaged arithmetically and the test shall be considered not sufficiently reproducible.

**12.3** Sketch a layout of the test site on a form as shown in Fig. 3, p. 17, showing the locations of the measurement points, configuration of the arc set-up, and the location of any objects or personnel in the area. Include descriptions of the acoustical measurement instrumentation including calibration and the arc process workpiece. The operator's position shall be shown and the distance, D, from the arc to the filter plate in the operator's helmet shall be recorded in Fig. 3. Operating conditions in 8.3.2 and 8.3.3 are to be described on a form similar to that shown in Fig. 3. This description will include arc voltage and current, as well as other information, such as "essential variables" in AWS D1.1, Section 5.5.2 (reference in 2.4).

**12.4** The extent of conformance with this standard method shall be stated in the test report. Any deviation from recommended procedures or practice shall be noted, together with the reason for so deviating, and an estimate of the change in accuracy resulting from the deviation.

**13. Precision and Accuracy**

**13.1** There is no experience, at present, with the use of this method. The sources of variation of results can be grouped into three classes: meter accuracy, arc variations, and acoustic environment.

**13.2** The ANSI S1.4 Type 1 sound level meter should yield a precision of better than 1 dB.

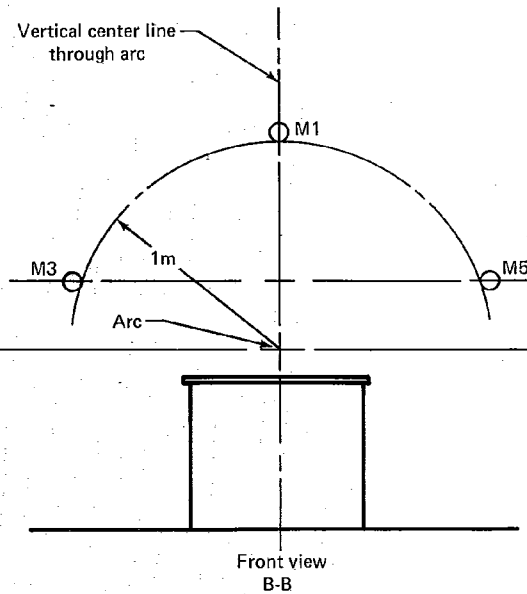
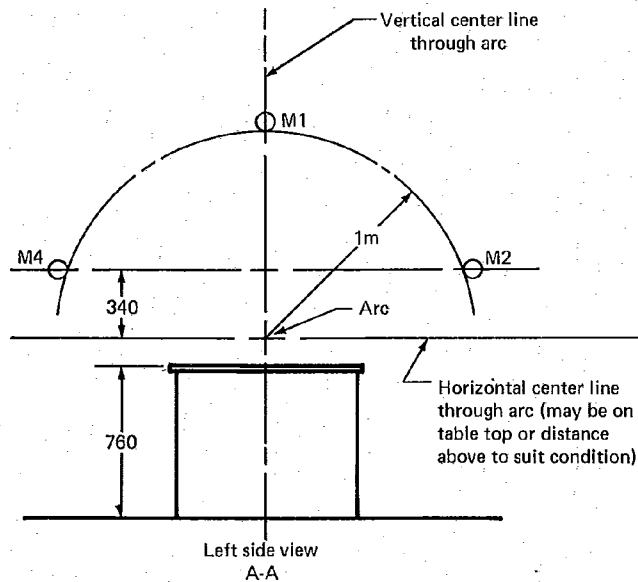
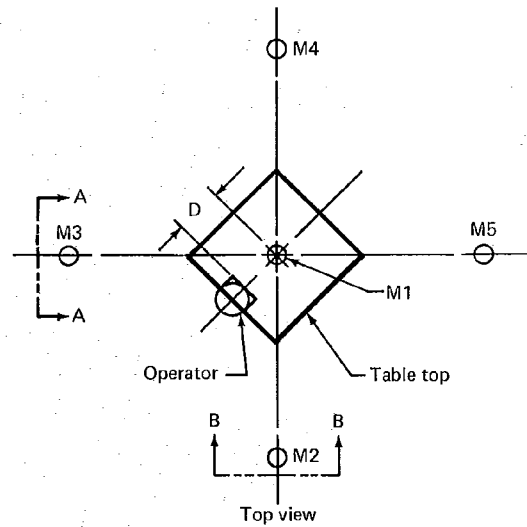
**13.3** The magnitude of scatter in the sound level due to variations in the arc cannot be estimated at this time. The very fact that the arc is manually controlled would lead one to anticipate variations in sound level.

**13.4** Sound level differences will result when test sites having different acoustic environments are used. An in-plant test site could produce results that are 2 dBA higher than would be obtained from any identical arc process tested in a semianechoic test room or outdoors and still meet the criteria for test sites.

**13.5** The accuracy of this test method is estimated to be the same as the sound level meter accuracy. That is, the agreement between the measured values and the true values of sound level generated by any arc process at any location and under any given operating condition is within 1 dBA.

**Notes:**

1. The recommended table top is approximately 610 x 610 mm (24 x 24 in.).
2. All distances will be referenced to the approximate midpoint of the arc.
3. Microphone position M1 is 1 m (39 in.) directly above the arc center.
4. Orthogonal microphone positions M2, M3, M4, and M5 are all in a horizontal plane 340 mm (13-1/4 in.) above the arc center.
5. Microphone positions M2, M3, M4, and M5 are 1 m (39 in.) in the radial direction from the arc center.
6. Microphone locations may be offset from the established pattern due to inaccessibility of desired location.
7. There shall be no obstruction between the arc and the microphones.
8. The operator shall be located between positions M2 and M3.



Scale: 1 mm = 30 mm

**Fig. 1—Measurement point locations**

## 16/ARC WELDING AND CUTTING NOISE

AMERICAN WELDING SOCIETY METHOD  
FOR SOUND LEVEL MEASUREMENT OF MANUAL ARC WELDING AND CUTTING PROCESSES

Power source \_\_\_\_\_ Manufacturer \_\_\_\_\_ Serial Number \_\_\_\_\_  
 Type of process \_\_\_\_\_ Filler Material \_\_\_\_\_  
 Base material \_\_\_\_\_ Shielding material \_\_\_\_\_

Important note: Completion of Fig. 3 form is required also.

| Measured A-weighted slow response<br>sound levels |       |         |      |    |    |    |    |    |      |
|---------------------------------------------------|-------|---------|------|----|----|----|----|----|------|
| Microphone location                               |       |         | Amb. | M1 | M2 | M3 | M4 | M5 | M6** |
| Run                                               | Case* | Remarks |      |    |    |    |    |    |      |
| 1                                                 | A     |         |      |    |    |    |    |    |      |
|                                                   | B     |         |      |    |    |    |    |    |      |
|                                                   | C     |         |      |    |    |    |    |    |      |
| 2                                                 | A     |         |      |    |    |    |    |    |      |
|                                                   | B     |         |      |    |    |    |    |    |      |
|                                                   | C     |         |      |    |    |    |    |    |      |
| 3                                                 | A     |         |      |    |    |    |    |    |      |
|                                                   | B     |         |      |    |    |    |    |    |      |
|                                                   | C     |         |      |    |    |    |    |    |      |

| Calculated average A-weighted slow response sound levels |         |      |    |    |    |    |    |    |
|----------------------------------------------------------|---------|------|----|----|----|----|----|----|
| Microphone location                                      |         | Amb. | M1 | M2 | M3 | M4 | M5 | M6 |
| Case*                                                    | Remarks |      |    |    |    |    |    |    |
| A                                                        |         |      |    |    |    |    |    |    |
| B                                                        |         |      |    |    |    |    |    |    |
| C                                                        |         |      |    |    |    |    |    |    |

\*Case

|   |                                                           |
|---|-----------------------------------------------------------|
| A | Equipment ON — arc not initiated (see 8.3.1)              |
| B | Maximum recommended equipment/process setting (see 8.3.2) |
| C | Minimum recommended equipment/process setting (see 8.3.3) |

\*\*Data column for additional measurement at arbitrary location. *For informational purposes only.* If used, enter description of microphone location and other data on Figs. 1 and 3.

Tested by: \_\_\_\_\_ Test date: \_\_\_\_\_

**Fig. 2—Test data sheet**

AMERICAN WELDING SOCIETY METHOD  
FOR SOUND LEVEL MEASUREMENT OF MANUAL ARC WELDING AND CUTTING PROCESSES

|                       |                          |                     |
|-----------------------|--------------------------|---------------------|
| Power source _____    | Manufacturer _____       | Serial Number _____ |
| Type of process _____ | Filler material _____    |                     |
| Base material _____   | Shielding material _____ |                     |

Sound level test instrumentation identification (manufacturer, model, etc.)

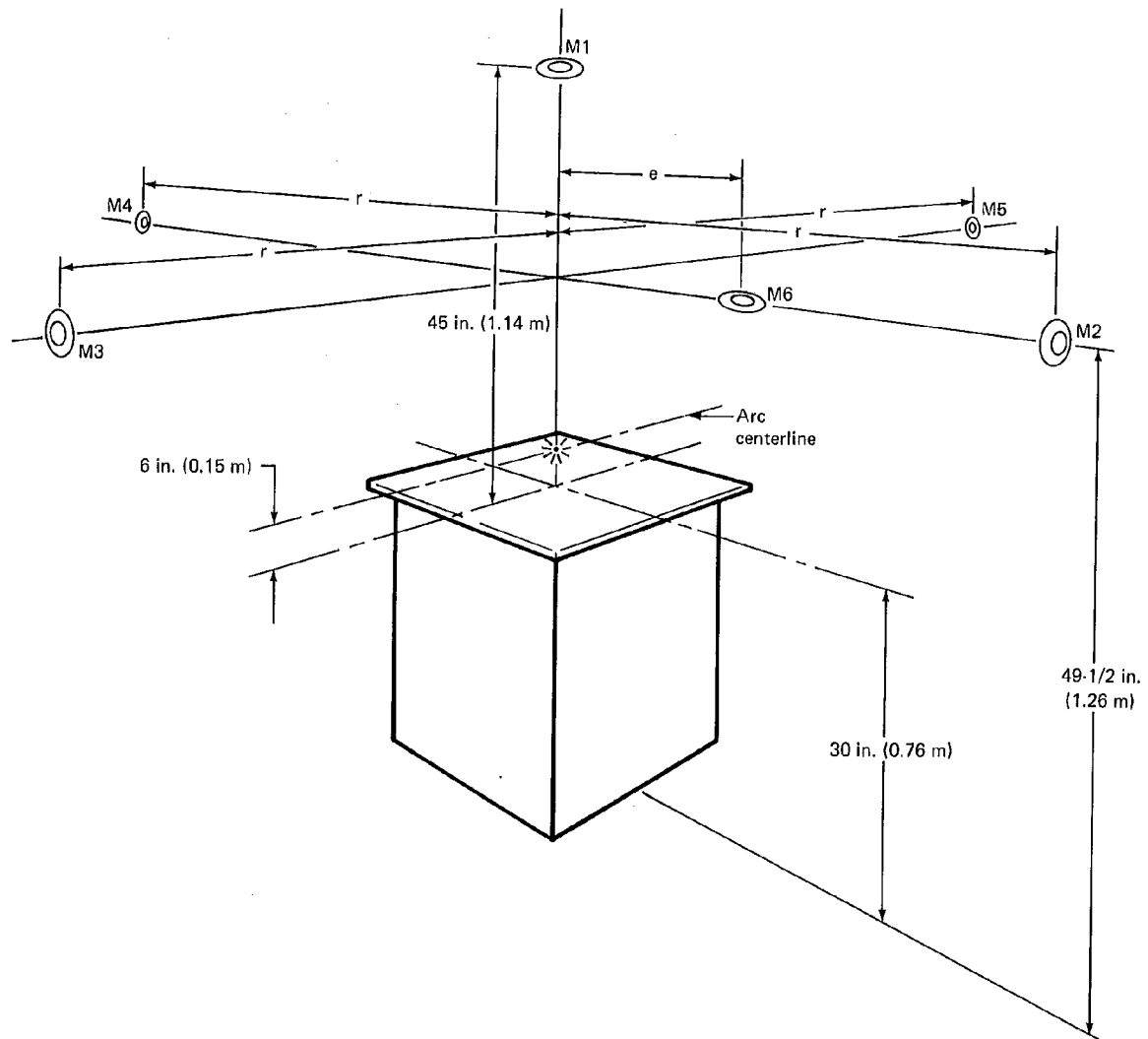
|                         |          |                        |
|-------------------------|----------|------------------------|
| Sound level meter _____ | SN _____ | Calibration date _____ |
| Microphone _____        | SN _____ | Calibration date _____ |
| Field calibrator _____  | SN _____ | Calibration date _____ |

Sketch: Identify the arc process location, including distance from arc to table top,  
and the location of and dimensions to the microphone.

Description of welding conditions ("essential variables" [2.4])

**Fig. 3—Test site and measurement details**

## 18/ARC WELDING AND CUTTING NOISE



## Notes:

1. Surface of table is 30 in. (.76 m) above floor.
2. Table top measures 24 in. x 24 in. (.61 m x .61 m).
3. Position M1 is 45 in. (1.14 m) above the table center.
4. Microphone positions M2 - M5 and e are in a plane 49-1/2 in. (1.26 m) above and parallel to the floor.
5. Arc is 6 in. (0.15 m) above the center of the table surface.
6.  $r = 37$  in. (.94 m),  $e = 12$  in. (.30 m).
7. Microphone locations labeled M1 through M5 are the minimum number of positions desired. The distance from arc to microphone is 39 in. (approximately 1.0 m). (See note below.)
8. Points may be offset from the established pattern due to inaccessibility of desired location.
9. There shall be no obstruction or blockage between the noise source and the microphone.  
Note: Locations M1, M5, and M6 have been renumbered here, and in the data sheets that follow, to correspond to the numbering system now spelled out in the Standard Method, F6.1-78.

**Fig. A1—Noise measurement locations used in the noise measurement program**

## Appendix B: Table B1 and Data Sheets for Noise Measurement of Arc Welding and Cutting Processes

**Table B1**  
**Summary of site qualification measurements**

| Octave band center, Hz | Octave band sound pressure level,* dB |    |           |    | Level difference |
|------------------------|---------------------------------------|----|-----------|----|------------------|
|                        | Source off ambient                    |    | Source on |    |                  |
|                        | 1m                                    | 2m | 1m        | 2m |                  |
| Direction M2           |                                       |    |           |    |                  |
| 125                    | 52                                    | 52 | 69        | 62 | 7                |
| 250                    | 44                                    | 43 | 68        | 63 | 5                |
| 500                    | 31                                    | 31 | 69        | 63 | 6                |
| 1000                   | 25                                    | 24 | 71        | 66 | 5                |
| 2000                   | 20                                    | 19 | 73        | 67 | 6                |
| 4000                   | 20                                    | 20 | 70        | 65 | 5                |
| 8000                   | 20                                    | 20 | 66        | 51 | 5                |
| Direction M3           |                                       |    |           |    |                  |
| 125                    | 53                                    | 53 | 69        | 64 | 5                |
| 250                    | 45                                    | 45 | 70        | 65 | 5                |
| 500                    | 32                                    | 32 | 70        | 65 | 5                |
| 1000                   | 25                                    | 23 | 70        | 64 | 6                |
| 2000                   | 22                                    | 22 | 70        | 64 | 6                |
| 4000                   | 20                                    | 19 | 71        | 65 | 6                |
| 8000                   | 21                                    | 20 | 69        | 64 | 5                |
| Direction M4           |                                       |    |           |    |                  |
| 125                    | 51                                    | 51 | 66        | 60 | 6                |
| 250                    | 43                                    | 44 | 67        | 62 | 5                |
| 500                    | 31                                    | 32 | 68        | 63 | 5                |
| 1000                   | 24                                    | 25 | 68        | 64 | 4                |
| 2000                   | 21                                    | 20 | 67        | 62 | 5                |
| 4000                   | 18                                    | 18 | 64        | 60 | 4                |
| 8000                   | 19                                    | 20 | 61        | 58 | 3                |
| Direction M5           |                                       |    |           |    |                  |
| 125                    | 53                                    | 51 | 71        | 64 | 7                |
| 250                    | 46                                    | 44 | 70        | 64 | 6                |
| 500                    | 31                                    | 32 | 71        | 65 | 6                |
| 1000                   | 25                                    | 24 | 70        | 64 | 6                |
| 2000                   | 24                                    | 20 | 70        | 64 | 6                |
| 4000                   | 21                                    | 21 | 72        | 64 | 8                |
| 8000                   | 21                                    | 21 | 69        | 63 | 6                |

\*Reference level 20  $\mu$ Pa

## 20/ARC WELDING AND CUTTING NOISE

AMERICAN WELDING SOCIETY METHOD  
FOR SOUND LEVEL MEASUREMENT OF MANUAL ARC WELDING AND CUTTING PROCESSES

Model tested 250 amp Motor Generator Manufacturer Hobart SN AAW-21330  
 Type of process SMAW Filler material E7018 electrode, 5/32 in.  
 Base material 3/8 in. mild steel Shielding material None

Important note: Completion of second part of form is required also.

|     |      | Measured A-weighted slow response sound levels |    |    |    |    |    |    |
|-----|------|------------------------------------------------|----|----|----|----|----|----|
|     |      | Microphone location                            | M1 | M2 | M3 | M4 | M5 | M6 |
| Run | Case | Condition*                                     |    |    |    |    |    |    |
| 1   | A    |                                                | 45 | 45 | 45 | 46 | 45 | 46 |
|     | B    |                                                | 70 | 74 | 74 | 74 | 74 | 76 |
|     | C    |                                                | 66 | 70 | 72 | 72 | 72 | 78 |
|     | D    |                                                | 68 | 72 | 72 | 72 | 72 | 76 |
| 2   | A    |                                                | 45 | 46 | 45 | 44 | 46 | 44 |
|     | B    |                                                | 70 | 74 | 74 | 74 | 72 | 76 |
|     | C    |                                                | 68 | 72 | 72 | 72 | 72 | 76 |
|     | D    |                                                | 70 | 72 | 72 | 72 | 72 | 78 |
| 3   | A    |                                                | 46 | 46 | 46 | 46 | 46 | 46 |
|     | B    |                                                | 68 | 74 | 74 | 74 | 72 | 76 |
|     | C    |                                                | 68 | 72 | 70 | 72 | 72 | 78 |
|     | D    |                                                | 68 | 72 | 74 | 72 | 70 | 76 |

## Calculated average A-weighted slow response sound levels

|      |            | Microphone location | M1 | M2 | M3 | M4 | M5 | M6 |
|------|------------|---------------------|----|----|----|----|----|----|
| Case | Condition* |                     |    |    |    |    |    |    |
| A    |            |                     | 45 | 46 | 45 | 45 | 46 | 45 |
| B    |            |                     | 69 | 74 | 74 | 74 | 73 | 76 |
| C    |            |                     | 67 | 71 | 71 | 72 | 72 | 77 |
| D    |            |                     | 69 | 72 | 73 | 72 | 71 | 77 |

\*Case conditions

Remarks

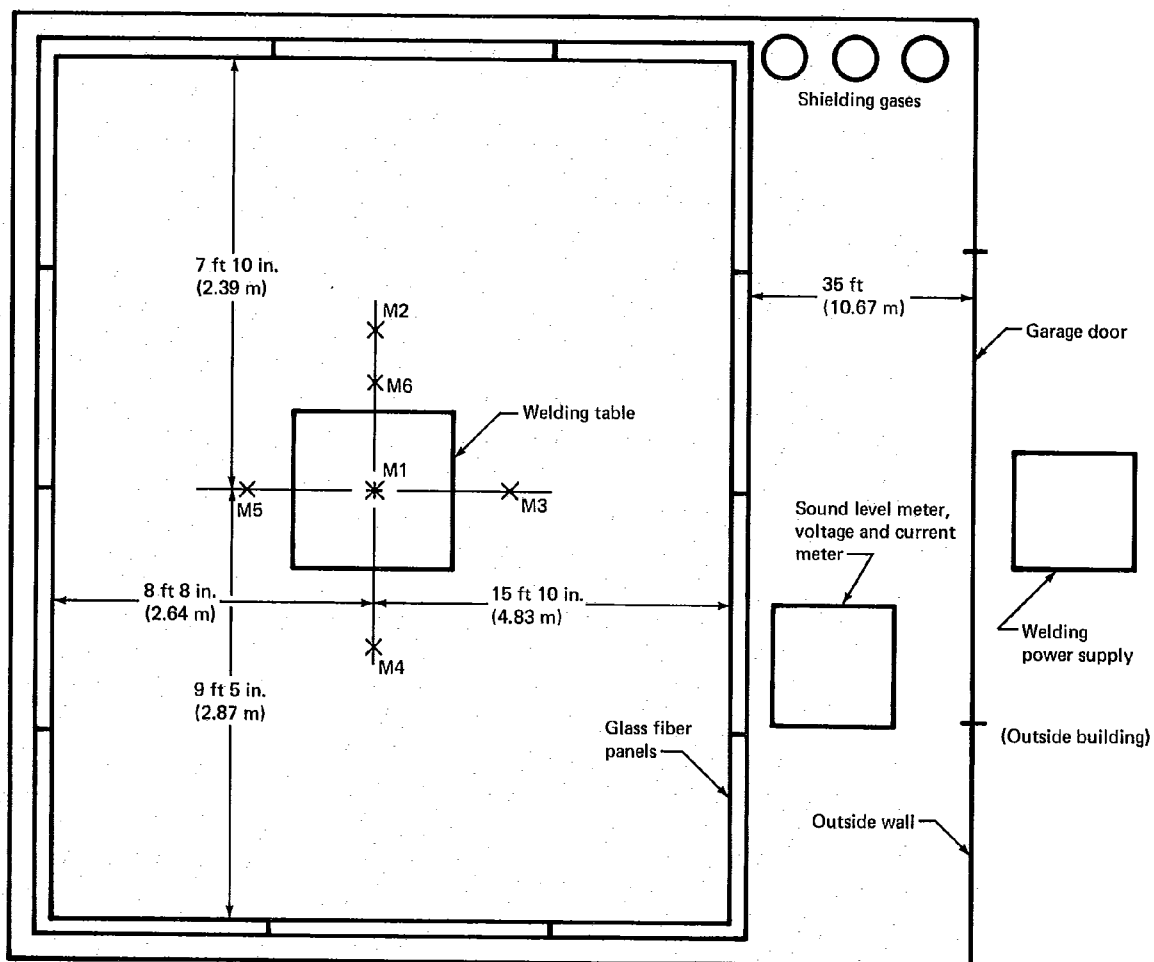
|   |                                               |       |
|---|-----------------------------------------------|-------|
| A | Ambient condition—No arc—Equipment "ON"       |       |
| B | Maximum recommended equipment/process setting | 190 A |
| C | Minimum recommended equipment/process setting | 130 A |
| D | Average recommended equipment/process setting | 160 A |

Tested by: D. Skaggs Test date: August 10, 1977

## Run 1. Sound Level Measurements

**AMERICAN WELDING SOCIETY METHOD  
FOR SOUND LEVEL MEASUREMENT OF MANUAL ARC WELDING AND CUTTING PROCESSES**

Model tested 250 amp Motor Generator Manufacturer Hobart SN AAW-21330  
 Essential variables  
 Type of process SMAW Filler material E7018 electrode, 5/32 in.  
 Base material 3/8 in. mild steel Shielding material None  
 Power supply: Type ac ☒ dc Polarity: straight ☒ reversed  
 Joint detail bead on plate  
 Traverse speed 12 in./min Length 2-3 in. Dwell time 0  
 Sound level test instrumentation identification (manufacturer, model, etc.)  
 Sound level meter GenRad 1933 SN 850 Calibration date Sept. 1976  
 Microphone GenRad 1961-9601 SN 1110 Calibration date Sept. 1976  
 Field calibrator GenRad 1562A SN 997 Calibration date Sept. 1976



**Run 1. Layout of Test Site**

Note: Not to scale

## 22/ARC WELDING AND CUTTING NOISE

AMERICAN WELDING SOCIETY METHOD  
FOR SOUND LEVEL MEASUREMENT OF MANUAL ARC WELDING AND CUTTING PROCESSES

Model tested 250 amp Motor Generator Manufacturer Hobart SN AAW-21330  
 Type of process Air Carbon Arc Cutting Filler material None; 3/16 in. copper clad carbon elec-  
 Base material 3/4 in. mild steel Shielding material None trodes used  
 Important note: Completion of second part of form is required also.

|     |      | Measured A-weighted slow response sound levels |     |     |     |     |     |     |
|-----|------|------------------------------------------------|-----|-----|-----|-----|-----|-----|
|     |      | Microphone location                            | M1  | M2  | M3  | M4  | M5  | M6  |
| Run | Case | Condition*                                     |     |     |     |     |     |     |
| 1   | A    |                                                | 50  | 50  | 49  | 49  | 49  | 49  |
|     | B    |                                                | 108 | 110 | 108 | 106 | 106 | 114 |
|     | C    |                                                | 98  | 98  | 102 | 100 | 100 | 106 |
|     | D    |                                                | 102 | 104 | 104 | 102 | 104 | 108 |
| 2   | A    |                                                | 49  | 49  | 50  | 49  | 49  | 49  |
|     | B    |                                                | 106 | 112 | 110 | 104 | 106 | 112 |
|     | C    |                                                | 100 | 100 | 100 | 100 | 104 | 104 |
|     | D    |                                                | 100 | 102 | 104 | 102 | 102 | 108 |
| 3   | A    |                                                | 49  | 50  | 48  | 49  | 49  | 49  |
|     | B    |                                                | 108 | 110 | 108 | 106 | 104 | 116 |
|     | C    |                                                | 98  | 100 | 100 | 98  | 100 | 106 |
|     | D    |                                                | 100 | 104 | 104 | 104 | 106 | 108 |

## Calculated average A-weighted slow response sound levels

|      |            | Microphone location | M1  | M2  | M3  | M4  | M5  | M6  |
|------|------------|---------------------|-----|-----|-----|-----|-----|-----|
| Case | Condition* |                     |     |     |     |     |     |     |
| A    |            |                     | 49  | 50  | 49  | 49  | 49  | 49  |
| B    |            |                     | 107 | 111 | 109 | 105 | 105 | 114 |
| C    |            |                     | 99  | 99  | 101 | 99  | 101 | 105 |
| D    |            |                     | 101 | 103 | 104 | 103 | 104 | 108 |

## \*Case conditions

## Remarks

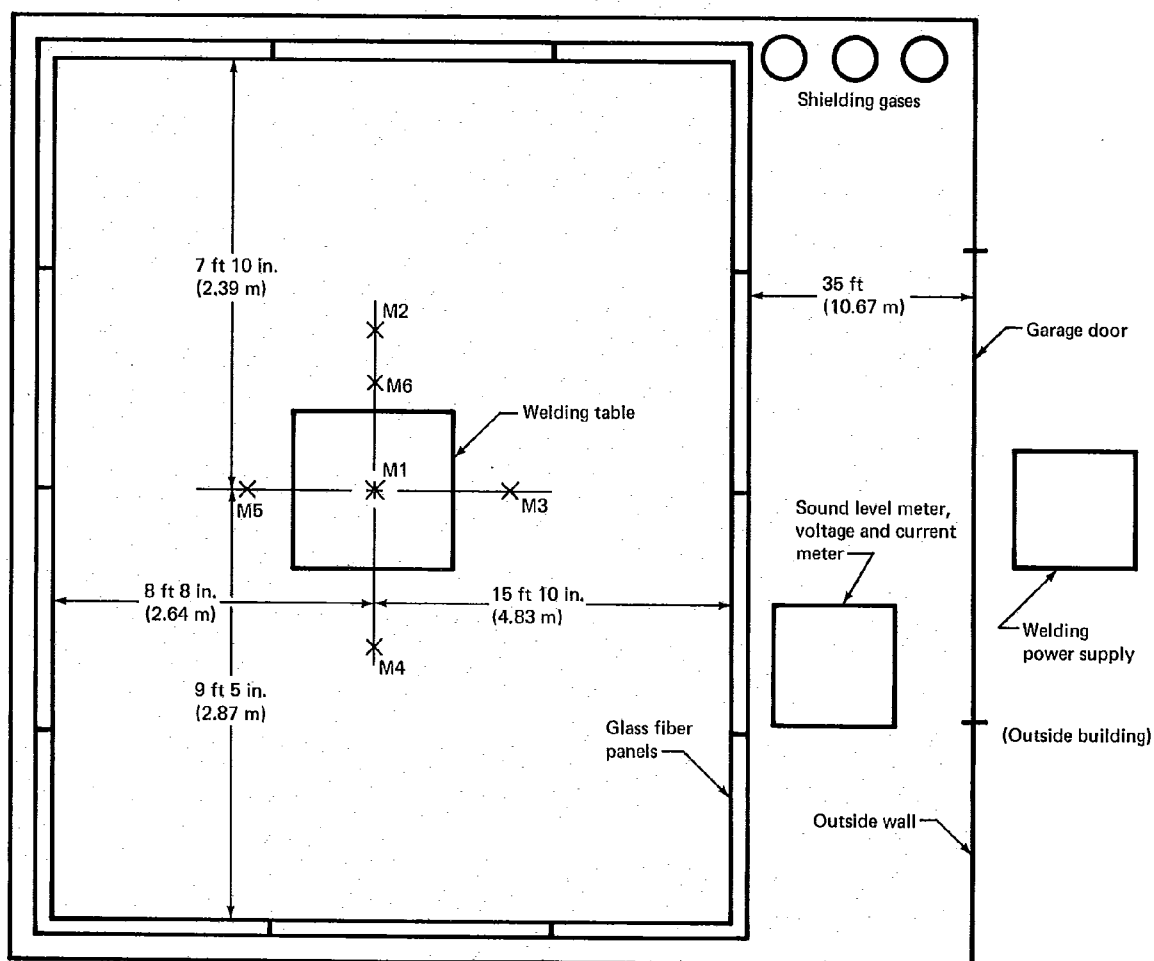
|   |                                               |                     |
|---|-----------------------------------------------|---------------------|
| A | Ambient condition—No arc—Equipment "ON"       |                     |
| B | Maximum recommended equipment/process setting | 32 psi air pressure |
| C | Minimum recommended equipment/process setting | 16 psi air pressure |
| D | Average recommended equipment/process setting | 24 psi air pressure |

Tested by: D. Skaggs Test date: August 11, 1977

## Run 2. Sound Level Measurements

**AMERICAN WELDING SOCIETY METHOD  
FOR SOUND LEVEL MEASUREMENT OF MANUAL ARC WELDING AND CUTTING PROCESSES**

Model tested 250 amp Motor Generator Manufacturer Hobart SN AAW-21330  
 Essential variables  
 Type of process Air carbon arc cutting Filler material None; 3/16 in. copper clad carbon  
 Base material 3/4 in. mild steel Shielding material None electrodes used  
 Power supply: Type ac ☒ dc Polarity: straight ☒ reversed  
 Joint detail \_\_\_\_\_  
 Traverse speed 12 in./min Length 2-3 in. Dwell time 0 \_\_\_\_\_  
 Sound level test instrumentation identification (manufacturer, model, etc.)  
 Sound level meter GenRad 1933 SN 850 Calibration date Sept. 1976  
 Microphone GenRad 1961-9601 SN 1110 Calibration date Sept. 1976  
 Field calibrator GenRad 1562A SN 997 Calibration date Sept. 1976



Run 2. Layout of Test Site

Note: Not to scale

## 24/ARC WELDING AND CUTTING NOISE

AMERICAN WELDING SOCIETY METHOD  
FOR SOUND LEVEL MEASUREMENT OF MANUAL ARC WELDING AND CUTTING PROCESSES

Model tested 250 amp Motor Generator Manufacturer Hobart SN AAW-21330  
 Type of process GTAW Filler material ER308L low carbon 3/32 in.  
 Base material Stainless steel 1/2 in. Shielding material Argon 30 CFH 55 rod

Important note: Completion of second part of form is required also.

## Measured A-weighted slow response sound levels

| Microphone location |      |            | M1 | M2 | M3 | M4 | M5 | M6 |
|---------------------|------|------------|----|----|----|----|----|----|
| Run                 | Case | Condition* |    |    |    |    |    |    |
| 1                   | A    |            | 49 | 49 | 48 | 49 | 49 | 48 |
|                     | B    |            | 54 | 54 | 52 | 54 | 54 | 58 |
|                     | C    |            | 54 | 54 | 52 | 50 | 52 | 58 |
|                     | D    |            | 54 | 54 | 52 | 52 | 52 | 58 |
| 2                   | A    |            | 49 | 49 | 49 | 49 | 49 | 50 |
|                     | B    |            | 54 | 54 | 54 | 54 | 54 | 58 |
|                     | C    |            | 54 | 52 | 52 | 50 | 52 | 56 |
|                     | D    |            | 54 | 52 | 52 | 50 | 52 | 58 |
| 3                   | A    |            | 49 | 49 | 48 | 50 | 49 | 49 |
|                     | B    |            | 54 | 54 | 54 | 54 | 54 | 60 |
|                     | C    |            | 54 | 52 | 52 | 50 | 52 | 58 |
|                     | D    |            | 54 | 52 | 52 | 50 | 52 | 58 |

## Calculated average A-weighted slow response sound levels

| Microphone location |            | M1 | M2 | M3 | M4 | M5 | M6 |
|---------------------|------------|----|----|----|----|----|----|
| Case                | Condition* |    |    |    |    |    |    |
| A                   |            | 49 | 49 | 48 | 49 | 49 | 49 |
| B                   |            | 54 | 54 | 53 | 54 | 54 | 59 |
| C                   |            | 54 | 53 | 52 | 50 | 52 | 57 |
| D                   |            | 54 | 53 | 52 | 51 | 52 | 58 |

\*Case conditions

Remarks

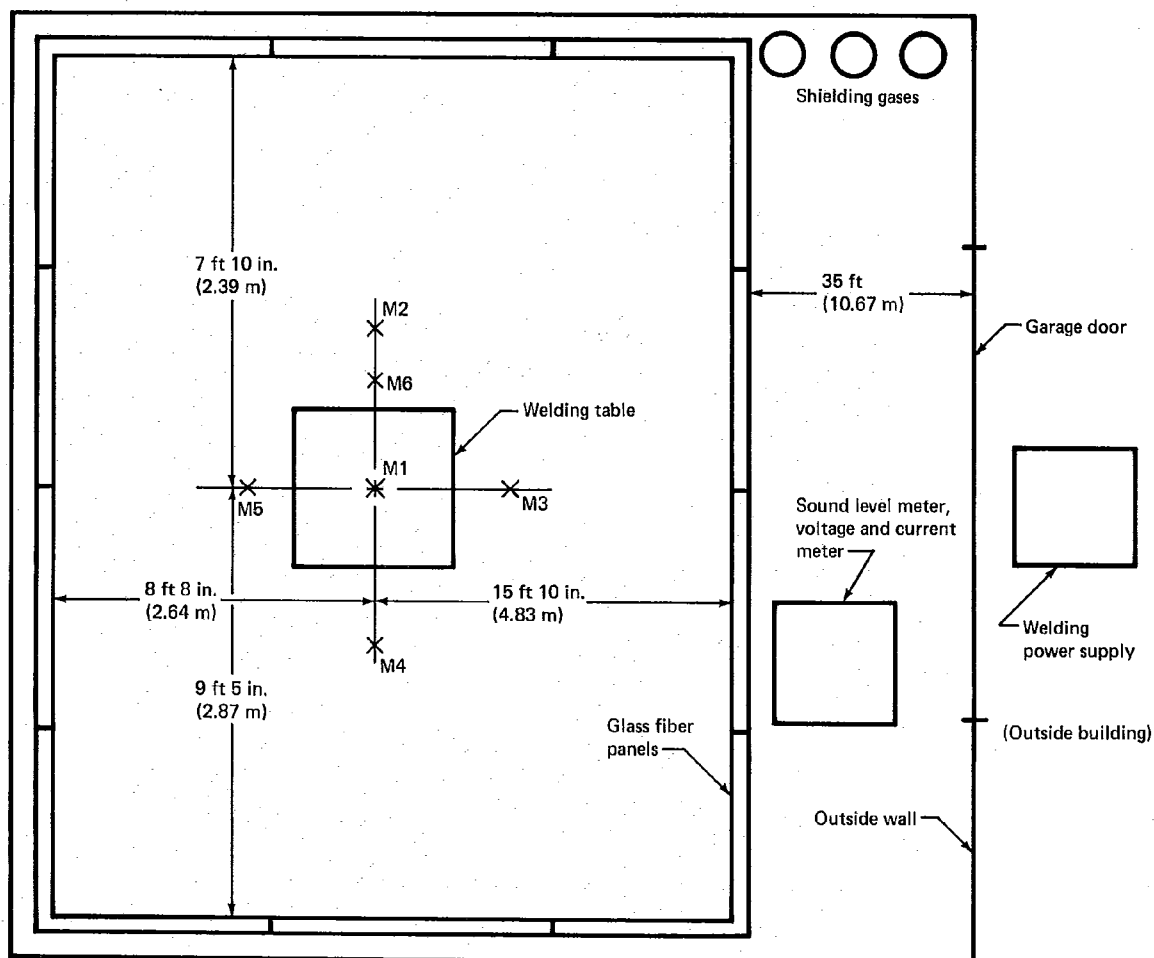
|   |                                               |       |
|---|-----------------------------------------------|-------|
| A | Ambient condition—No arc—Equipment "ON"       |       |
| B | Maximum recommended equipment/process setting | 190 A |
| C | Minimum recommended equipment/process setting | 130 A |
| D | Average recommended equipment/process setting | 160 A |

Tested by: A. SkaggsTest date: August 11, 1977

## Run 3. Sound Level Measurements

**AMERICAN WELDING SOCIETY METHOD  
FOR SOUND LEVEL MEASUREMENT OF MANUAL ARC WELDING AND CUTTING PROCESSES**

Model tested 250 amp Motor-Generator Manufacturer Hobart SN AAW-21330  
 Essential variables  
 Type of process GTAW Filler material ER308L low carbon, 3/32 in.  
 Base material Stainless steel 1/2 in. Shielding material Argon 30 CFH 55 rod  
 Power supply: Type ac ☒ dc Polarity: ☒ straight ☐ reversed  
 Joint detail \_\_\_\_\_  
 Traverse speed 12 in./min Length 2-3 in. Dwell time 0  
 Sound level test instrumentation identification (manufacturer, model, etc.)  
 Sound level meter GenRad 1933 SN 850 Calibration date Sept. 1976  
 Microphone GenRad 1961-9601 SN 1110 Calibration date Sept. 1976  
 Field calibrator GenRad 1562A SN 997 Calibration date Sept. 1976



Run 3. Layout of Test Site

Note: Not to scale

## 26/ARC WELDING AND CUTTING NOISE

AMERICAN WELDING SOCIETY METHOD  
FOR SOUND LEVEL MEASUREMENT OF MANUAL ARC WELDING AND CUTTING PROCESSES

Model tested 750 amp Rectifier Manufacturer Linde SN E-1661993  
 Type of process GMAW Filler material Bare steel wire, E70S-3, .045 in.  
 Base material 3/4 in. mild steel Shielding material Cond. B 98% Argon, 2% Oxygen;  
Cond. C 91% Argon, 9% CO<sub>2</sub>; both 50 CFH  
 Important note: Completion of second part of form is required also. Wire Feed 318 in./min (ca. 13 m/sec)

## Measured A-weighted slow response sound levels

|     |      | Microphone location | M1 | M2 | M3 | M4 | M5 | M6 |
|-----|------|---------------------|----|----|----|----|----|----|
| Run | Case | Condition*          |    |    |    |    |    |    |
| 1   | A    |                     | 46 | 46 | 46 | 46 | 46 | 46 |
|     | B    |                     | 72 | 74 | 74 | 74 | 74 | 82 |
|     | C    |                     | 72 | 76 | 74 | 72 | 78 | 80 |
|     | D    |                     |    |    |    |    |    |    |
| 2   | A    |                     | 46 | 46 | 46 | 46 | 46 | 46 |
|     | B    |                     | 72 | 76 | 74 | 74 | 74 | 82 |
|     | C    |                     | 72 | 74 | 74 | 74 | 76 | 80 |
|     | D    |                     |    |    |    |    |    |    |
| 3   | A    |                     | 46 | 46 | 46 | 46 | 46 | 46 |
|     | B    |                     | 70 | 74 | 72 | 72 | 72 | 82 |
|     | C    |                     | 72 | 76 | 74 | 74 | 74 | 82 |
|     | D    |                     |    |    |    |    |    |    |

## Calculated average A-weighted slow response sound levels

|      |            | Microphone location | M1 | M2 | M3 | M4 | M5 | M6 |
|------|------------|---------------------|----|----|----|----|----|----|
| Case | Condition* |                     |    |    |    |    |    |    |
| A    |            |                     | 46 | 46 | 46 | 46 | 46 | 46 |
| B    |            |                     | 71 | 75 | 73 | 73 | 73 | 82 |
| C    |            |                     | 72 | 75 | 74 | 73 | 76 | 81 |
| D    |            |                     |    |    |    |    |    |    |

## \*Case conditions

## Remarks

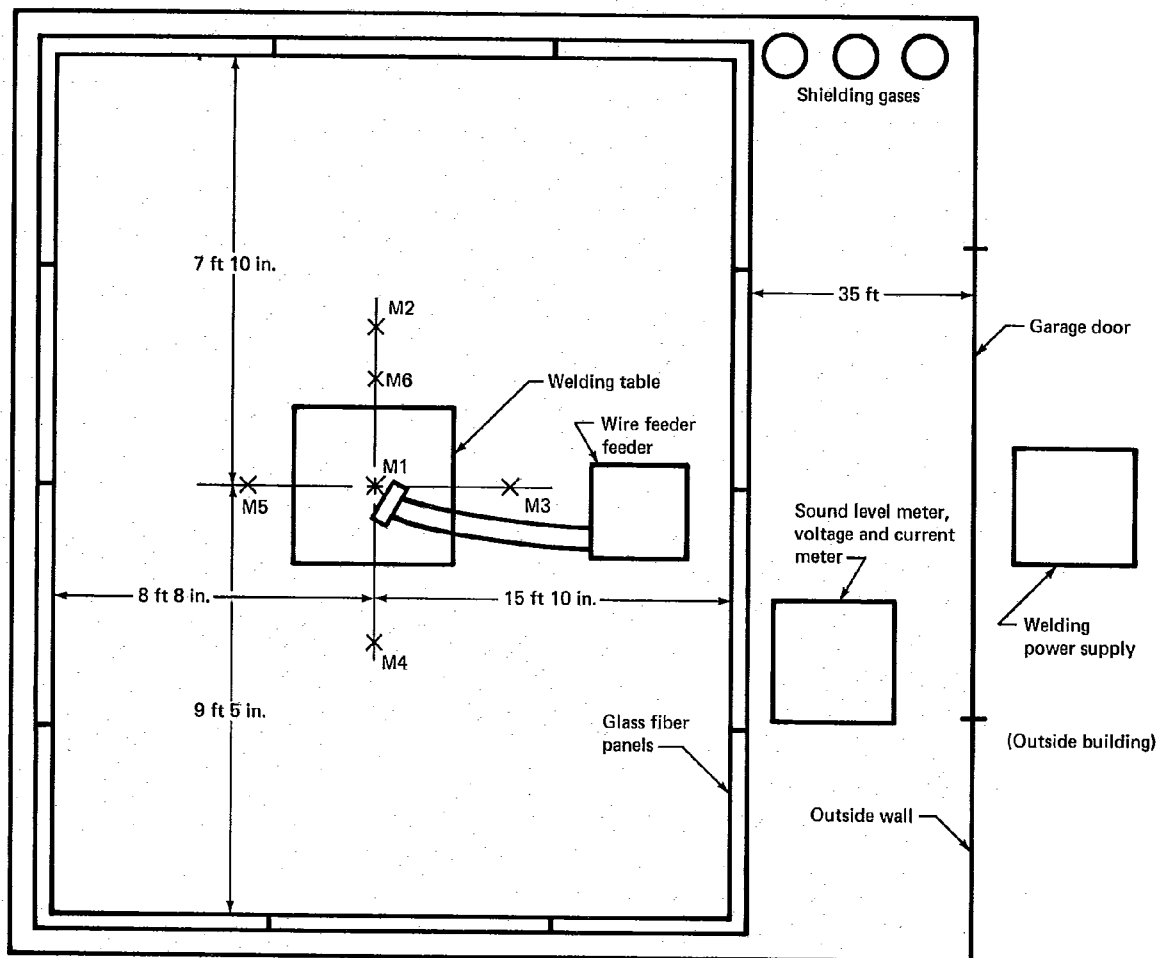
|   |                                               |                          |
|---|-----------------------------------------------|--------------------------|
| A | Ambient condition—No arc—Equipment "ON"       |                          |
| B | Maximum recommended equipment/process setting | 275 A } 1 in. electrical |
| C | Minimum recommended equipment/process setting | 210 A } stickout         |
| D | Average recommended equipment/process setting |                          |

Tested by: D. SkaggsTest date August 12, 1977

## Run 4. Sound Level Measurements

**AMERICAN WELDING SOCIETY METHOD  
FOR SOUND LEVEL MEASUREMENT OF MANUAL ARC WELDING AND CUTTING PROCESSES**

|                                                                             |                                                                               |                                                               |
|-----------------------------------------------------------------------------|-------------------------------------------------------------------------------|---------------------------------------------------------------|
| Model tested <u>750 amp Rectifier</u>                                       | Manufacturer <u>Linde</u>                                                     | SNE-1661993                                                   |
| Essential variables                                                         | <u>Wire Feed 313 in./min (0.13 m/sec)</u>                                     |                                                               |
| Type of process <u>GMAW</u>                                                 | Filler material <u>Bare wire (steel), E70S-3, .045</u>                        |                                                               |
| Base material <u>3/4 in. mild steel</u>                                     | Shielding material <u>Cond. B 98% Argon, 2% Oxy-</u>                          |                                                               |
| Power supply: Type <u>ac</u> <input checked="" type="checkbox"/> <u>dc</u>  | Polarity: <u>straight</u> <input checked="" type="checkbox"/> <u>reversed</u> | <u>gen; Cond. C 91% Argon, 9% CO<sub>2</sub>; both 50 CFH</u> |
| Joint detail _____                                                          |                                                                               |                                                               |
| Traverse speed <u>12</u> in./min                                            | Length <u>2-3</u> in.                                                         | Dwell time <u>0</u>                                           |
| Sound level test instrumentation identification (manufacturer, model, etc.) |                                                                               |                                                               |
| Sound level meter <u>Gen Rad 1933</u>                                       | SN <u>850</u>                                                                 | Calibration date <u>Sept. 1976</u>                            |
| Microphone <u>GenRad 1961-9601</u>                                          | SN <u>1110</u>                                                                | Calibration date <u>Sept. 1976</u>                            |
| Field calibrator <u>GenRad 1562A</u>                                        | SN <u>997</u>                                                                 | Calibration date <u>Sept. 1976</u>                            |



**Run 4. Layout of Test Site**

Note: Not to scale

## 28/ARC WELDING AND CUTTING NOISE

AMERICAN WELDING SOCIETY METHOD  
FOR SOUND LEVEL MEASUREMENT OF MANUAL ARC WELDING AND CUTTING PROCESSES

Model tested 250 amp Motor Generator Manufacturer Hobart SN AAW-21330  
 Type of process SMAW Filler material E6010-1P electrode, 5/32 in.  
 Base material 3/4 in. mild steel Shielding material None

Important note: Completion of second part of form is required also.

|                     |      |            | Measured A-weighted slow response sound levels |    |    |    |    |    |
|---------------------|------|------------|------------------------------------------------|----|----|----|----|----|
| Microphone location |      |            | M1                                             | M2 | M3 | M4 | M5 | M6 |
| Run                 | Case | Condition* |                                                |    |    |    |    |    |
| 1                   | A    |            | 42                                             | 43 | 43 | 42 | 43 | 43 |
|                     | B    |            | 74                                             | 76 | 78 | 80 | 78 | 82 |
|                     | C    |            | 70                                             | 76 | 78 | 78 | 78 | 80 |
|                     | D    |            | 72                                             | 76 | 78 | 78 | 78 | 82 |
| 2                   | A    |            | 43                                             | 42 | 43 | 44 | 43 | 43 |
|                     | B    |            | 72                                             | 76 | 78 | 80 | 76 | 82 |
|                     | C    |            | 68                                             | 74 | 78 | 78 | 78 | 80 |
|                     | D    |            | 68                                             | 76 | 76 | 78 | 76 | 82 |
| 3                   | A    |            | 44                                             | 43 | 43 | 43 | 43 | 43 |
|                     | B    |            | 72                                             | 76 | 78 | 80 | 78 | 82 |
|                     | C    |            | 68                                             | 76 | 78 | 78 | 76 | 80 |
|                     | D    |            | 72                                             | 76 | 78 | 80 | 76 | 82 |

## Calculated average A-weighted slow response sound levels

|      |            | Microphone location | M1 | M2 | M3 | M4 | M5 | M6 |
|------|------------|---------------------|----|----|----|----|----|----|
| Case | Condition* |                     |    |    |    |    |    |    |
| A    |            |                     | 43 | 43 | 43 | 43 | 43 | 43 |
| B    |            |                     | 73 | 76 | 78 | 80 | 77 | 82 |
| C    |            |                     | 69 | 75 | 78 | 78 | 77 | 80 |
| D    |            |                     | 71 | 76 | 77 | 79 | 77 | 82 |

\*Case conditions

Remarks

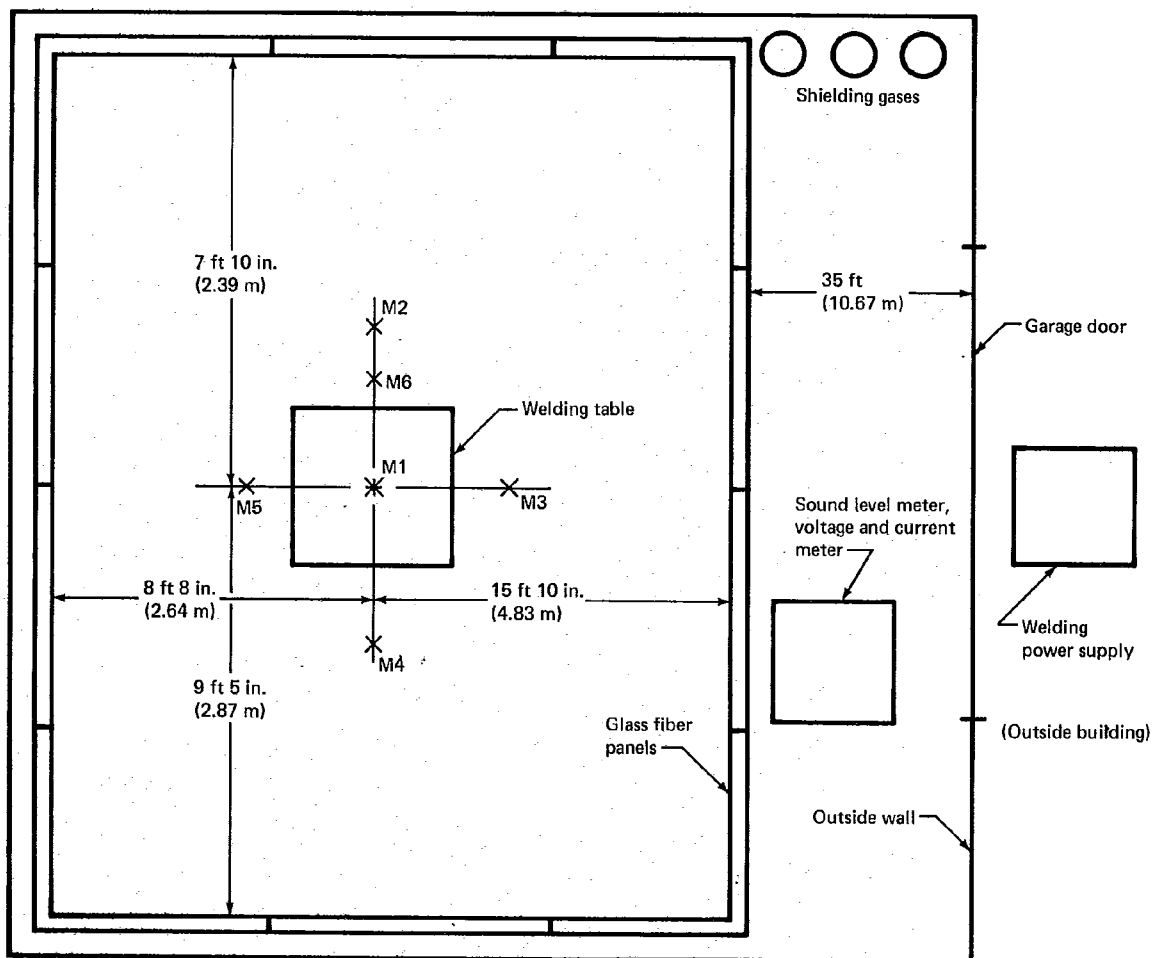
|   |                                               |       |
|---|-----------------------------------------------|-------|
| A | Ambient condition—No arc—Equipment "ON"       |       |
| B | Maximum recommended equipment/process setting | 180 A |
| C | Minimum recommended equipment/process setting | 115 A |
| D | Average recommended equipment/process setting | 150 A |

Tested by: D. Skaggs Test date August 15, 1977

## Run 5. Sound Level Measurements

**AMERICAN WELDING SOCIETY METHOD  
FOR SOUND LEVEL MEASUREMENT OF MANUAL ARC WELDING AND CUTTING PROCESSES**

Model tested 250 amp Motor Generator Manufacturer Hobart SN AAW-21330  
 Essential variables  
 Type of process SMAW Filler material E6010-IP electrode, 5/32 in.  
 Base material 3/4 in. mild steel Shielding material None  
 Power supply: Type ac ☒ dc Polarity: straight ☒ reversed  
 Joint detail \_\_\_\_\_  
 Traverse speed 12 in./min Length 2-3 in. Dwell time 0  
 Sound level test instrumentation identification (manufacturer, model, etc.)  
 Sound level meter Gen Rad 1933 SN 850 Calibration date Sept. 1976  
 Microphone Gen Rad 1961-9601 SN 1110 Calibration date Sept. 1976  
 Field calibrator Gen Rad 1562 A SN 997 Calibration date Sept. 1976



**Run 5. Layout of Test Site**

Note: Not to scale

## 30/ARC WELDING AND CUTTING NOISE

AMERICAN WELDING SOCIETY METHOD  
FOR SOUND LEVEL MEASUREMENT OF MANUAL ARC WELDING AND CUTTING PROCESSESModel tested 250 amp Motor-GeneratorManufacturer Hobart SN AAW-21330Type of process FCAWFiller material E308L 3/32 in. low carbon ssBase material 1/2 in. stainless steelShielding material Argon 30 CFH electrodeImportant note: Completion of second part  
of form is required also.Wire Feed Rate - 124 in./min (52.5 mm/sec)

## Measured A-weighted slow response sound levels

|     |      | Microphone location | M1 | M2 | M3 | M4 | M5 | M6 |
|-----|------|---------------------|----|----|----|----|----|----|
| Run | Case | Condition*          |    |    |    |    |    |    |
| 1   | A    |                     | 43 | 42 | 44 | 43 | 43 | 43 |
|     | B    |                     | 54 | 54 | 54 | 54 | 54 | 60 |
|     | C    |                     | 52 | 52 | 52 | 52 | 52 | 56 |
|     | D    |                     | 56 | 52 | 54 | 56 | 54 | 60 |
| 2   | A    |                     | 42 | 43 | 43 | 44 | 43 | 43 |
|     | B    |                     | 56 | 52 | 54 | 56 | 56 | 60 |
|     | C    |                     | 52 | 50 | 52 | 52 | 52 | 56 |
|     | D    |                     | 56 | 52 | 54 | 56 | 54 | 62 |
| 3   | A    |                     | 43 | 43 | 43 | 43 | 43 | 42 |
|     | B    |                     | 56 | 52 | 54 | 54 | 54 | 60 |
|     | C    |                     | 54 | 50 | 52 | 54 | 52 | 56 |
|     | D    |                     | 56 | 54 | 54 | 56 | 54 | 62 |

## Calculated average A-weighted slow response sound levels

|      |            | Microphone location | M1 | M2 | M3 | M4 | M5 | M6 |
|------|------------|---------------------|----|----|----|----|----|----|
| Case | Condition* |                     |    |    |    |    |    |    |
| A    |            |                     | 43 | 43 | 43 | 43 | 43 | 43 |
| B    |            |                     | 55 | 53 | 54 | 55 | 55 | 60 |
| C    |            |                     | 53 | 51 | 52 | 53 | 52 | 56 |
| D    |            |                     | 56 | 53 | 54 | 56 | 54 | 61 |

\*Case conditions

Remarks

A Ambient condition—No arc—Equipment "ON"

B Maximum recommended equipment/process setting

190 A

C Minimum recommended equipment/process setting

130 A

D Average recommended equipment/process setting

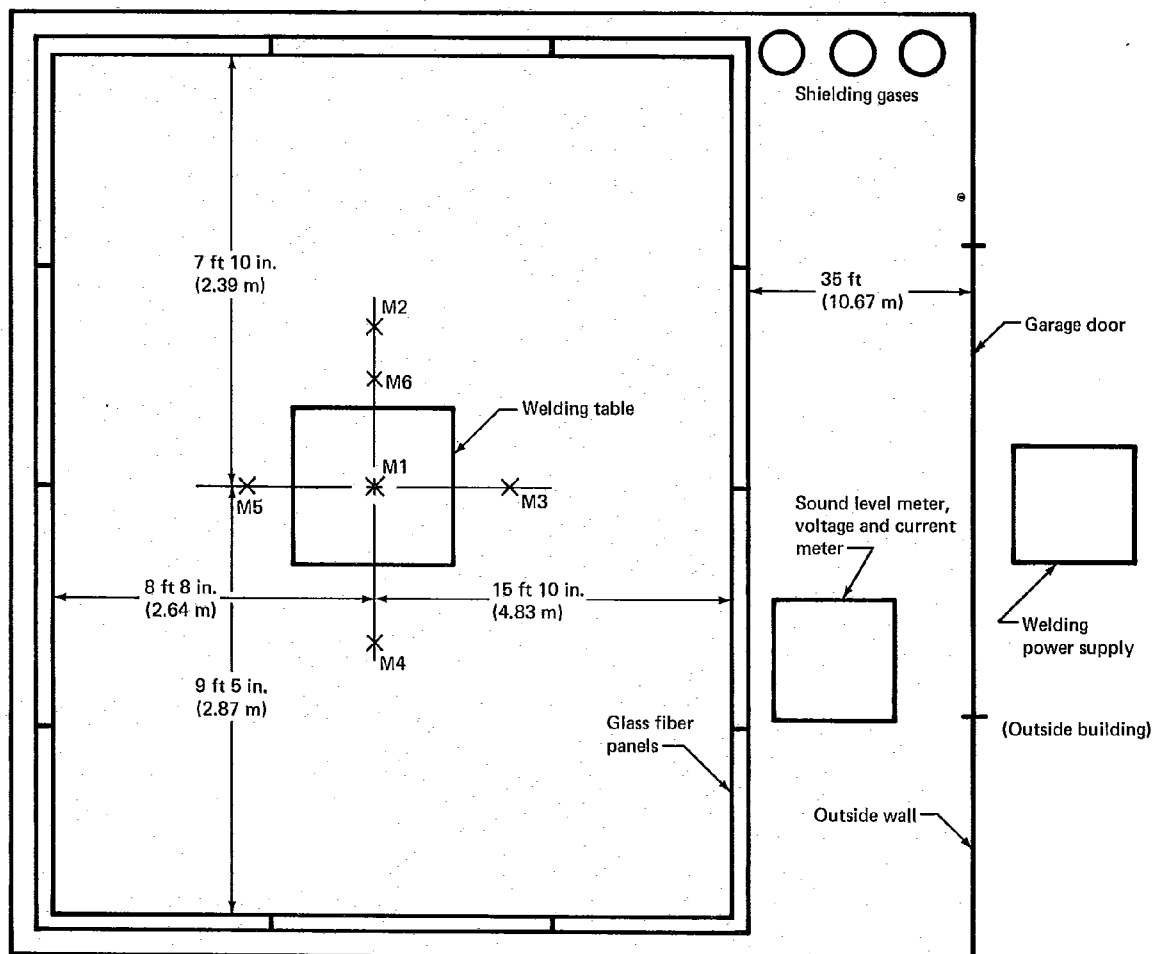
160 A

Tested by: D. SkaggsTest date August 15, 1977

## Run 6. Sound Level Measurements

**AMERICAN WELDING SOCIETY METHOD  
FOR SOUND LEVEL MEASUREMENT OF MANUAL ARC WELDING AND CUTTING PROCESSES**

|                                                                             |                                                 |                                    |
|-----------------------------------------------------------------------------|-------------------------------------------------|------------------------------------|
| Model tested <u>250 amp Motor Generator</u>                                 | Manufacturer <u>Hobart</u>                      | SN <u>AAW-2/330</u>                |
| Essential variables                                                         | <u>Wire Feed 12.4 in./min (52.5 mm/sec)</u>     |                                    |
| Type of process <u>FCAW</u>                                                 | Filler material <u>E308L 3/32 low carbon ss</u> |                                    |
| Base material <u>1/2 in. stainless steel</u>                                | Shielding material <u>Argon 30 CFH</u>          | <u>electrode</u>                   |
| Power supply: Type <u>ac</u> <u>X</u> dc                                    | Polarity: <u>X</u> straight <u>reversed</u>     |                                    |
| Joint detail                                                                |                                                 |                                    |
| Traverse speed <u>12</u> in./min                                            | Length <u>2-3</u> in.                           | Dwell time <u>0</u>                |
| Sound level test instrumentation identification (manufacturer, model, etc.) |                                                 |                                    |
| Sound level meter <u>GenRad 1933</u>                                        | SN <u>850</u>                                   | Calibration date <u>Sept. 1976</u> |
| Microphone <u>GenRad 1961-9601</u>                                          | SN <u>1110</u>                                  | Calibration date <u>Sept. 1976</u> |
| Field calibrator <u>GenRad 1562 A</u>                                       | SN <u>997</u>                                   | Calibration date <u>Sept. 1976</u> |



**Run 6. Layout of Test Site**

Note: Not to scale

## 32/ARC WELDING AND CUTTING NOISE

AMERICAN WELDING SOCIETY METHOD  
FOR SOUND LEVEL MEASUREMENT OF MANUAL ARC WELDING AND CUTTING PROCESSESModel tested 250 amp Motor GeneratorManufacturer HobartSN AAW-21330Type of process Air carbon arc cuttingFiller material None; 3/16 in. copper clad carbonBase material 3/4 in. mild steelShielding material None electrode used

Important note: Completion of second part of form is required also.

## Measured A-weighted slow response sound levels

| Run | Case | Microphone location<br>Condition* | M1  | M2  | M3  | M4  | M5  | M6  |
|-----|------|-----------------------------------|-----|-----|-----|-----|-----|-----|
| 1   | A    |                                   | 46  | 46  | 46  | 46  | 46  | 46  |
|     | B    |                                   | 96  | 96  | 96  | 100 | 96  | 108 |
|     | C    |                                   | 102 | 100 | 100 | 106 | 100 | 108 |
|     | D    |                                   | 90  | 92  | 90  | 94  | 90  | 102 |
| 2   | A    |                                   | 46  | 46  | 46  | 46  | 46  | 46  |
|     | B    |                                   | 96  | 96  | 98  | 100 | 96  | 104 |
|     | C    |                                   | 104 | 100 | 100 | 104 | 100 | 108 |
|     | D    |                                   | 90  | 90  | 90  | 94  | 92  | 102 |
| 3   | A    |                                   | 46  | 46  | 46  | 46  | 46  | 46  |
|     | B    |                                   | 98  | 98  | 98  | 100 | 96  | 104 |
|     | C    |                                   | 102 | 98  | 102 | 106 | 98  | 106 |
|     | D    |                                   | 92  | 90  | 92  | 94  | 92  | 102 |

## Calculated average A-weighted slow response sound levels

| Case | Microphone location<br>Condition* | M1  | M2 | M3  | M4  | M5 | M6  |
|------|-----------------------------------|-----|----|-----|-----|----|-----|
| A    |                                   | 46  | 46 | 46  | 46  | 46 | 46  |
| B    |                                   | 97  | 97 | 97  | 100 | 96 | 105 |
| C    |                                   | 103 | 99 | 101 | 105 | 99 | 107 |
| D    |                                   | 91  | 91 | 91  | 94  | 91 | 102 |

\*Case conditions

Remarks

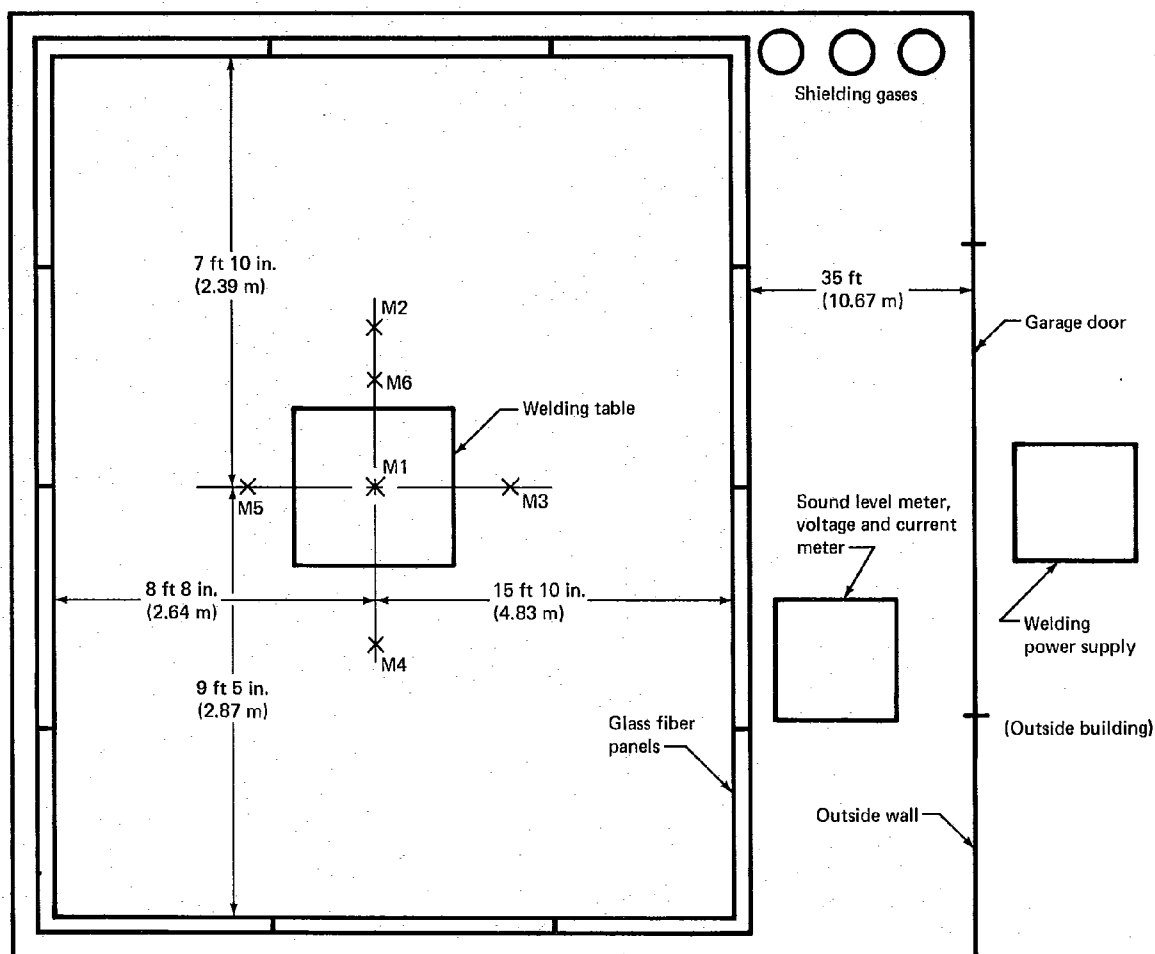
A Ambient condition—No arc—Equipment "ON"

B Maximum recommended equipment/process setting 16 psi air pressureC Minimum recommended equipment/process setting 24 psi air pressureD Average recommended equipment/process setting 16 psi air pressure, mic dist: 2 mTested by: D. SkaggsTest date: August 15, 1977

## Run 7. Sound Level Measurements

AMERICAN WELDING SOCIETY METHOD  
FOR SOUND LEVEL MEASUREMENT OF MANUAL ARC WELDING AND CUTTING PROCESSES

Model tested 250 amp Motor-Generator Manufacturer Hobart SN AAW-21330  
 Essential variables  
 Type of process Air carbon arc cutting Filler material None; 3/16 in. copper clad carbon  
 Base material 3/4 in. mild steel Shielding material None electrode used  
 Power supply: Type ac ☒ dc Polarity: straight ☒ reversed  
 Joint detail \_\_\_\_\_  
 Traverse speed 12 in./min Length 2-3 in. Dwell time 0  
 Sound level test instrumentation identification (manufacturer, model, etc.)  
 Sound level meter GenRad 1933 SN 850 Calibration date Sept. 1976  
 Microphone GenRad 1961-9601 SN 1110 Calibration date Sept. 1976  
 Field calibrator GenRad 1562A SN 997 Calibration date Sept. 1976



**Run 7. Layout of Test Site**

Note: Not to scale

## 34/ARC WELDING AND CUTTING NOISE

AMERICAN WELDING SOCIETY METHOD  
FOR SOUND LEVEL MEASUREMENT OF MANUAL ARC WELDING AND CUTTING PROCESSES

Model tested 250 amp Motor-Generator Manufacturer Hobart SN AAW-21330  
 Type of process SMAW Filler material E 6010-IP electrode, 5/32 in.  
 Base material 3/4 in. mild steel Shielding material None

Important note: Completion of second part of form is required also.

## Measured A-weighted slow response sound levels

| Microphone location |      |            | M1 | M2 | M3 | M4 | M5 | M6 |
|---------------------|------|------------|----|----|----|----|----|----|
| Run                 | Case | Condition* |    |    |    |    |    |    |
| 1                   | A    |            | 46 | 46 | 46 | 46 | 46 | 46 |
|                     | B    |            |    | 64 | 66 | 66 | 66 |    |
|                     | C    |            |    | 62 | 64 | 62 | 64 |    |
|                     | D    |            |    | 64 | 66 | 64 | 66 |    |
| 2                   | A    |            | 46 | 46 | 46 | 46 | 46 | 46 |
|                     | B    |            |    | 66 | 66 | 66 | 66 |    |
|                     | C    |            |    | 62 | 64 | 64 | 64 |    |
|                     | D    |            |    | 64 | 66 | 66 | 66 |    |
| 3                   | A    |            | 46 | 46 | 46 | 46 | 46 | 46 |
|                     | B    |            |    | 66 | 68 | 66 | 66 |    |
|                     | C    |            |    | 64 | 64 | 64 | 64 |    |
|                     | D    |            | *  | 66 | 66 | 66 | 64 |    |

## Calculated average A-weighted slow response sound levels

| Microphone location |            | M1 | M2 | M3 | M4 | M5 | M6 |
|---------------------|------------|----|----|----|----|----|----|
| Case                | Condition* |    |    |    |    |    |    |
| A                   |            | 46 | 46 | 46 | 46 | 46 | 46 |
| B                   |            |    | 65 | 67 | 66 | 66 |    |
| C                   |            |    | 63 | 64 | 63 | 64 |    |
| D                   |            |    | 65 | 66 | 65 | 65 |    |

## \*Case conditions

## Remarks

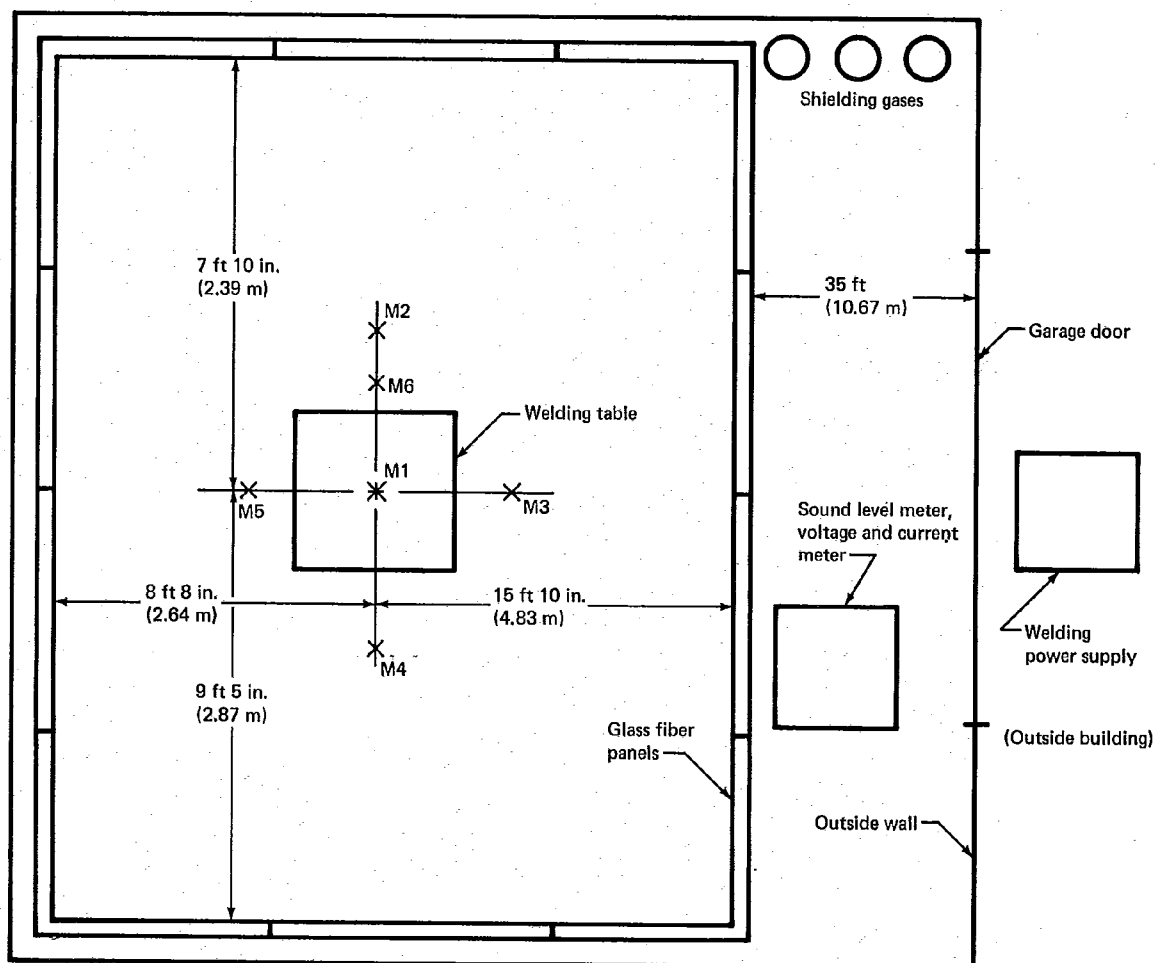
|   |                                               |       |
|---|-----------------------------------------------|-------|
| A | Ambient condition—No arc—Equipment "ON"       |       |
| B | Maximum recommended equipment/process setting | 190 A |
| C | Minimum recommended equipment/process setting | 130 A |
| D | Average recommended equipment/process setting | 160 A |

Tested by: D. SkaggsTest date August 15, 1977

## Run 8. Sound Level Measurements

AMERICAN WELDING SOCIETY METHOD  
FOR SOUND LEVEL MEASUREMENT OF MANUAL ARC WELDING AND CUTTING PROCESSES

Model tested 250 amp Motor-Generator Manufacturer Hobart SN AAW-21330  
 Essential variables  
 Type of process SMAW Filler material E6010-IP electrode, 5/32 in.  
 Base material 3/4 in. mild steel Shielding material None  
 Power supply: Type ac ☒ dc Polarity: straight ☒ reversed  
 Joint detail \_\_\_\_\_  
 Traverse speed 12 in./min Length 2-3 in. Dwell time 0  
 Sound level test instrumentation identification (manufacturer, model, etc.)  
 Sound level meter GenRad 1933 SN 850 Calibration date Sept. 1976  
 Microphone GenRad 1961-9601 SN 1110 Calibration date Sept. 1976  
 Field calibrator GenRad 1562A SN 997 Calibration date Sept. 1976



Run 8. Layout of Test Site

Note: Not to scale

## 36/ARC WELDING AND CUTTING NOISE

AMERICAN WELDING SOCIETY METHOD  
FOR SOUND LEVEL MEASUREMENT OF MANUAL ARC WELDING AND CUTTING PROCESSESModel tested 750 amp RectifierManufacturer LindeSN E-1661993Type of process FCAWFiller material E70T-1, 3/32 in.Base material 3/4 in. mild steelShielding material CO<sub>2</sub> 50 cFHImportant note: Completion of second part  
of form is required also.Wire Feed Rate - 124 in./min (52.5 mm/sec)

## Measured A-weighted slow response sound levels

| Microphone location |      |            | M1 | M2 | M3 | M4 | M5 | M6 |
|---------------------|------|------------|----|----|----|----|----|----|
| Run                 | Case | Condition* |    |    |    |    |    |    |
| 1                   | A    |            | 45 | 44 | 44 | 45 | 45 | 45 |
|                     | B    |            | 74 | 80 | 80 | 82 | 80 | 84 |
|                     | C    |            | 70 | 78 | 76 | 76 | 76 | 82 |
|                     | D    |            | 74 | 80 | 82 | 82 | 80 | 84 |
| 2                   | A    |            | 43 | 44 | 44 | 44 | 44 | 44 |
|                     | B    |            | 74 | 82 | 80 | 78 | 80 | 86 |
|                     | C    |            | 70 | 80 | 76 | 74 | 76 | 82 |
|                     | D    |            | 74 | 80 | 80 | 78 | 78 | 84 |
| 3                   | A    |            | 44 | 44 | 44 | 44 | 44 | 44 |
|                     | B    |            | 72 | 82 | 82 | 80 | 80 | 82 |
|                     | C    |            | 70 | 80 | 76 | 74 | 78 | 82 |
|                     | D    |            | 72 | 82 | 80 | 80 | 82 | 86 |

## Calculated average A-weighted slow response sound levels

| Microphone location |            | M1 | M2 | M3 | M4 | M5 | M6 |
|---------------------|------------|----|----|----|----|----|----|
| Case                | Condition* |    |    |    |    |    |    |
| A                   |            | 44 | 44 | 44 | 44 | 44 | 44 |
| B                   |            | 73 | 81 | 81 | 80 | 80 | 84 |
| C                   |            | 70 | 79 | 76 | 75 | 77 | 82 |
| D                   |            | 73 | 81 | 81 | 80 | 80 | 85 |

## \*Case conditions

## Remarks

|   |                                               |       |
|---|-----------------------------------------------|-------|
| A | Ambient condition—No arc—Equipment "ON"       |       |
| B | Maximum recommended equipment/process setting | 540 A |
| C | Minimum recommended equipment/process setting | 290 A |
| D | Average recommended equipment/process setting | 460 A |

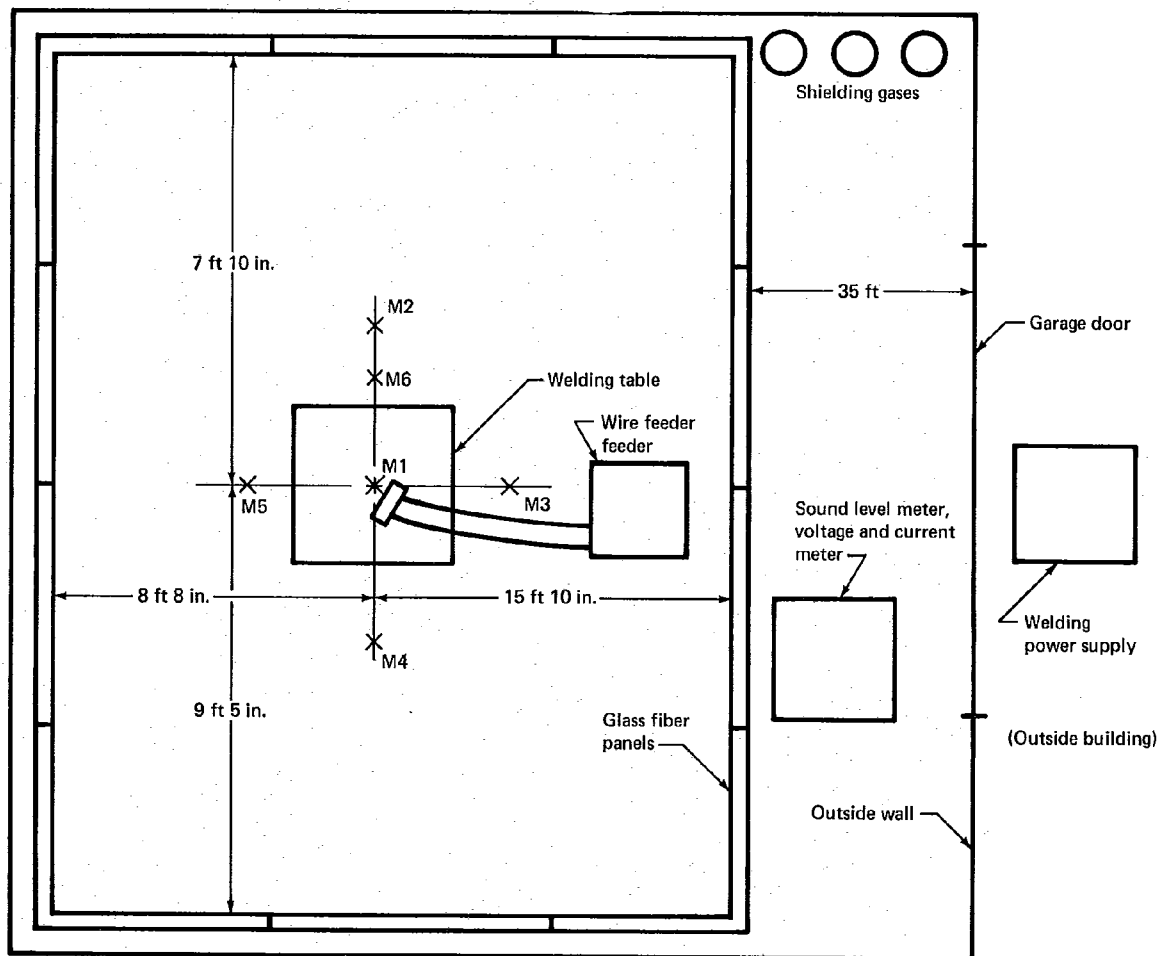
1-1/2 in.  
electrical  
stickout

Tested by: D. SkaggsTest date: August 16, 1977

## Run 9. Sound Level Measurements

**AMERICAN WELDING SOCIETY METHOD  
FOR SOUND LEVEL MEASUREMENT OF MANUAL ARC WELDING AND CUTTING PROCESSES**

|                                                                             |                                                                               |                                    |
|-----------------------------------------------------------------------------|-------------------------------------------------------------------------------|------------------------------------|
| Model tested <u>750 amp Rectifier</u>                                       | Manufacturer <u>Linde</u>                                                     | SN <u>E-1661993</u>                |
| Essential variables                                                         | <u>Wire Feed</u>                                                              | <u>12.4 in./min (52.5 mm/sec)</u>  |
| Type of process <u>FCAW</u>                                                 | Filler material <u>E70T-1, 3/32 in.</u>                                       |                                    |
| Base material <u>3/4 in. mild steel</u>                                     | Shielding material <u>CO<sub>2</sub></u>                                      | <u>50 CFH</u>                      |
| Power supply: Type <u>ac</u> <input checked="" type="checkbox"/> <u>dc</u>  | Polarity: <u>straight</u> <input checked="" type="checkbox"/> <u>reversed</u> |                                    |
| Joint detail _____                                                          |                                                                               |                                    |
| Traverse speed <u>12</u> in./min                                            | Length <u>2-3</u> in.                                                         | Dwell time <u>0</u>                |
| Sound level test instrumentation identification (manufacturer, model, etc.) |                                                                               |                                    |
| Sound level meter <u>GenRad 1933</u>                                        | SN <u>850</u>                                                                 | Calibration date <u>Sept. 1976</u> |
| Microphone <u>GenRad 1961-9601</u>                                          | SN <u>1110</u>                                                                | Calibration date <u>Sept. 1976</u> |
| Field calibrator <u>GenRad 1562A</u>                                        | SN <u>997</u>                                                                 | Calibration date <u>Sept. 1976</u> |



**Run 9. Layout of Test Site**

Note: Not to scale

## 38/ARC WELDING AND CUTTING NOISE

AMERICAN WELDING SOCIETY METHOD  
FOR SOUND LEVEL MEASUREMENT OF MANUAL ARC WELDING AND CUTTING PROCESSESModel tested 750 amp RectifierManufacturer Linde SN E-1661993Type of process FCAWFiller material E70T-4, 3/32 in.Base material 3/4 in. mild steelShielding material NoneImportant note: Completion of second part  
of form is required also.Wire Feed Rate 124 in./min (52.5 mm/sec)

## Measured A-weighted slow response sound levels

| Microphone location |      |            | M1 | M2 | M3 | M4 | M5 | M6 |
|---------------------|------|------------|----|----|----|----|----|----|
| Run                 | Case | Condition* |    |    |    |    |    |    |
| 1                   | A    |            | 45 | 45 | 46 | 46 | 45 | 45 |
|                     | B    |            | 76 | 84 | 84 | 82 | 82 | 88 |
|                     | C    |            | 70 | 78 | 76 | 74 | 78 | 80 |
|                     | D    |            | 72 | 80 | 78 | 82 | 78 | 84 |
| 2                   | A    |            | 44 | 44 | 44 | 44 | 44 | 44 |
|                     | B    |            | 76 | 84 | 86 | 82 | 82 | 86 |
|                     | C    |            | 70 | 76 | 74 | 74 | 76 | 80 |
|                     | D    |            | 72 | 80 | 78 | 82 | 78 | 82 |
| 3                   | A    |            | 44 | 44 | 43 | 43 | 44 | 44 |
|                     | B    |            | 76 | 84 | 86 | 82 | 82 | 86 |
|                     | C    |            | 70 | 76 | 76 | 74 | 76 | 82 |
|                     | D    |            | 72 | 82 | 78 | 80 | 78 | 86 |

## Calculated average A-weighted slow response sound levels

| Microphone location |            | M1 | M2 | M3 | M4 | M5 | M6 |
|---------------------|------------|----|----|----|----|----|----|
| Case                | Condition* |    |    |    |    |    |    |
| A                   |            | 44 | 44 | 44 | 44 | 44 | 44 |
| B                   |            | 76 | 84 | 85 | 82 | 82 | 87 |
| C                   |            | 70 | 77 | 75 | 74 | 77 | 81 |
| D                   |            | 72 | 81 | 78 | 81 | 78 | 84 |

## \*Case conditions

## Remarks

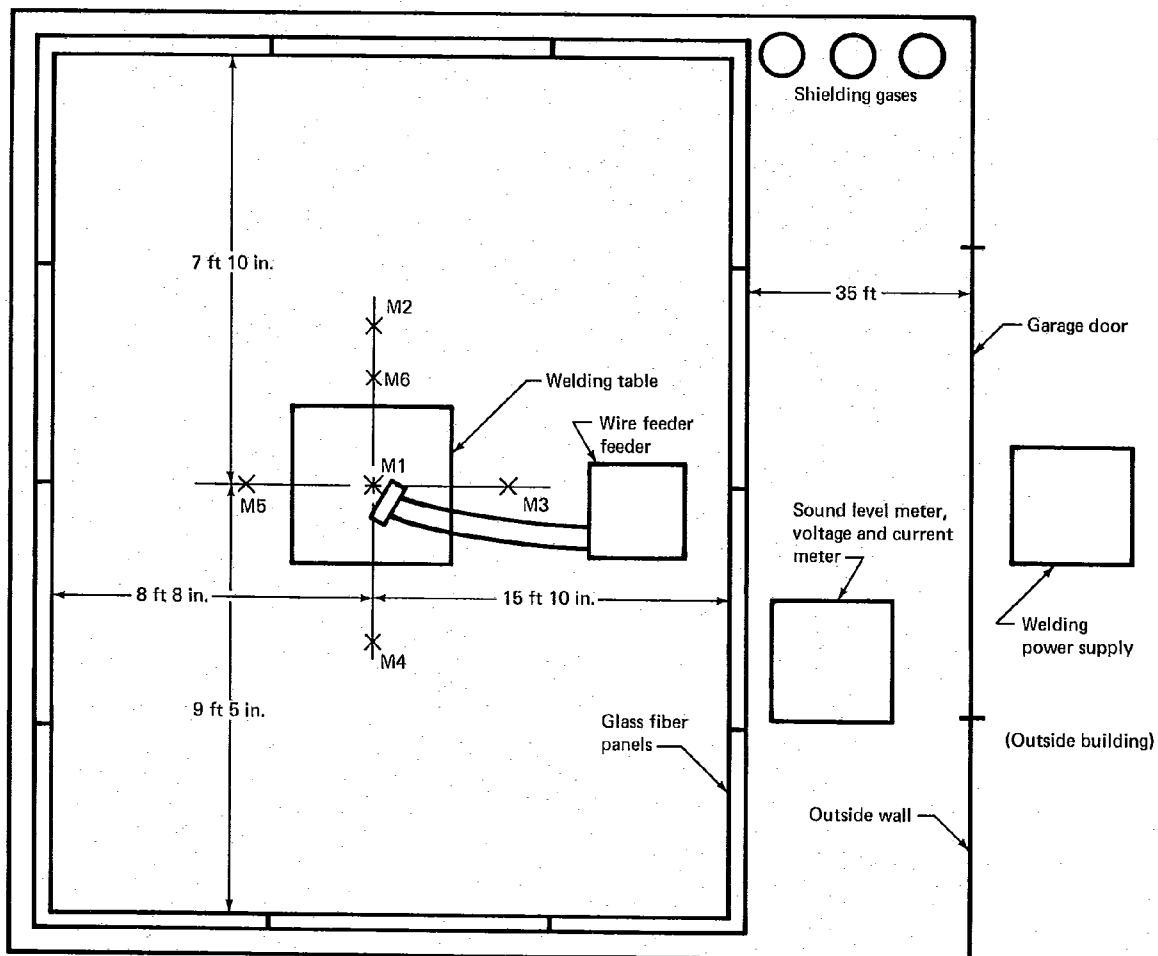
|   |                                               |       |
|---|-----------------------------------------------|-------|
| A | Ambient condition—No arc—Equipment "ON"       |       |
| B | Maximum recommended equipment/process setting | 515 A |
| C | Minimum recommended equipment/process setting | 260 A |
| D | Average recommended equipment/process setting | 390 A |

2-3/4 in.  
electrical  
stickoutTested by: D. S. LagoTest date August 16, 1977

## Run 10. Sound Level Measurements

**AMERICAN WELDING SOCIETY METHOD  
FOR SOUND LEVEL MEASUREMENT OF MANUAL ARC WELDING AND CUTTING PROCESSES**

Model tested 750 amp Rectifier Manufacturer Linde SN E-1661993  
 Essential variables Wire feed 124 in./min (52.5 mm/sec)  
 Type of process FCAW Filler material E70T-4, 3/32 in.  
 Base material 3/4 in. mild steel Shielding material None  
 Power supply: Type ac ☒ dc Polarity: straight ☒ reversed  
 Joint detail \_\_\_\_\_  
 Traverse speed 12 in./min Length 2-3 in. Dwell time 0  
 Sound level test instrumentation identification (manufacturer, model, etc.)  
 Sound level meter GenRad 1933 SN 850 Calibration date Sept. 1976  
 Microphone GenRad 1961-9601 SN 1110 Calibration date Sept. 1976  
 Field calibrator GenRad 1562A SN 997 Calibration date Sept. 1976



Run 10. Layout of Test Site

Note: Not to scale