

JIS

JAPANESE INDUSTRIAL STANDARD

**Fans, blowers and
compressors — Determination of
A-weighted sound pressure level**

JIS B 8346—1991

Translated and Published

by

Japanese Standards Association

In the event of any doubt arising,
the original Standard in Japanese is to be final authority.

JAPANESE INDUSTRIAL STANDARD

J I S

Fans, blowers and compressors — Determination of
A-weighted sound pressure level

B 8346-1991

1. Scope

This Japanese Industrial Standard specifies determination of A-weighted sound pressure level of stationary noise⁽¹⁾ radiated from fans, blowers, and compressors of all types.

Note ⁽¹⁾ The sound continuing approximately stationarily for over at least 30 s or more.

Remarks 1. The determination of band sound pressure level in decibels and the determination of sound power level in decibels are respectively indicated in Informative References 1, 2 and 4.

2. Applicable Standards to this Standard are shown in Attached Table 3.

3. Corresponding International Standards to this Standard are shown in Attached Table 4.

2. Definitions

For the purposes of this Standard main definitions are in accordance with JIS Z 8106, and to others the following apply.

(1) sound pressure level Ten times the common logarithm of ratio of square of real effective value of sound pressure to square of reference sound pressure. The reference sound pressure is 20 μ Pa. Unit is decibel, unit symbol is dB and quantity symbol is L_p .

(2) A-weighted sound pressure level Ten times the common logarithm of ratio of square of real effective value of sound pressure weighted with A characteristics specified in JIS C 1502 or JIS C 1505 to square of reference sound pressure (20 μ Pa). The Unit is decibel, unit symbol is dB⁽²⁾, and the quantity symbol is L_{PA} .

Note ⁽²⁾ It is expressed also by dB (A) in some cases.

(3) band sound pressure level The sound pressure level of sound included in a certain frequency zone. In the case where the width of the frequency zone is 1 or $\frac{1}{3}$ octave, it is called respectively octave band sound pressure level or $\frac{1}{3}$ octave band sound pressure level. The unit is decibel and the unit symbol is dB.

(4) sound power level⁽³⁾ Ten times the common logarithm of ratio of total sound power⁽⁴⁾ radiated from sound source to reference sound power. The reference sound power is 1 pW. Unit is decibel, unit symbol is dB.

Notes ⁽³⁾ It is called also sound power level in decibels. Particularly in the case of no fear for confusion, it may be called simply the power level.

⁽⁴⁾ It is called also sound power of a source.

(5) background noise A-weighted sound pressure level, sound pressure level or band sound pressure level at measuring point of the sound radiated from those other than measuring objects (fans, blowers and compressors) during measuring noise.

- (6) reference sound source The small type broad zone noise sound source having sufficient, stable output, flat frequency characteristics and good whole directivity in the measuring frequency range, of which sound power level when set on the reflection surface according to JIS Z 8732 is calibrated⁽⁵⁾. The sound power level of this sound source is called the calibrated sound power level of reference sound source.

Note ⁽⁵⁾ In the case of being used only for measuring of double distance attenuation characteristics of sound field, the sound power level may not be calibrated.

- (7) representative length The quantity relating to distance up to the measuring point of A-weighted sound pressure level and in the case where the radiation sound from the suction opening and discharge opening is made the object, its impeller diameter or 1 m whichever is larger is taken. In the case where the radiation sound from casing is made the object, 1 m is taken.

- (8) measured value The value of read-out value corrected relative to the influence of background noise.

3. Measuring item

A-weighted sound pressure level at the specific point at the periphery of fan, blower and compressor shall be measured under the operating conditions of 4.2.

- Remarks 1. In the case where the band sound pressure level is required, measure it with taking reference to the method indicated in Informative Reference 1.
2. In the case where the sound power level radiated from fan, blower and compressor body is required, measure it with taking reference to the method indicated in Informative Reference 2.
3. In the case where the sound power level radiated to duct from blower, measure it with taking reference to the method indicated in Informative Reference 4.

4. Measuring conditions

4.1 Measuring environment

4.1.1 Measuring place The measuring place shall be little in reflection of sound from the places other than the floor surface and, satisfy either of the following conditions.

- (1) Under the operating conditions of specimen fan, blower or compressor, the difference of A-weighted sound pressure level at the point apart by the representative length from the following point and that at the point apart by twice the representative length is not less than 5 dB.
- (a) On the suction opening central axis, suction-opening the middle (in the case of measuring the radiation sound from the suction opening)
- (b) Discharge-opening the middle in the direction of 45° to the discharge-opening middle axis (in the case of measuring the radiation sound from the discharge opening)
- (c) In one direction of the reverse side to motor at the casing surface (in the case of measuring the radiation sound from the casing)

- (2) With placing the reference sound source at specimen blower or installing place of specimen compressor or its neighborhood, the difference of A-weighted sound pressure levels at points apart by once and twice the distance to the measuring point indicated in 6.2 or that at the points apart by $\frac{1}{2}$ time and once is to be not less than 5 dB.

In case where these conditions are not satisfied, the condition of measuring place (indoor dimensions, dimensions of apparatus, arrangement, sound field measuring results, etc.) is to be described specially.

4.1.2 Background noise The background noise level at measuring point should preferably be smaller by 10 dB or more from the reading-out value of objective sound source. However, in case where this condition can not be obtained, as far as the difference of reading-out values is in the range of 4 to 9 dB, the reading-out value of A-weighted sound pressure level of objective sound source with correcting may be used. The corrected value shall be as given in Table 1.

Table 1. Corrected value to influence of background noise

Unit: dB						
Difference of A-weighted sound pressure levels when the fan, blower and compressor are working and stopping	4	5	6	7	8	9
Correcting value	- 2		- 1			

4.2 Operating conditions The measurement of noise shall be carried out on the specified rotary speed⁽⁶⁾ and specified air quantity. In case of measuring unavoidably under other condition than the specified conditions, the agreement between the parties concerned with delivery shall be carried out and the operating conditions, described clearly.

Note ⁽⁶⁾ The setting permissible value of specified rotary speed is to be within 5 %.

5. Measuring device and tester

5.1 Measuring device The measuring device shall be the sound level meter specified in JIS C 1502 or precision sound level meter specified in JIS C 1505 or the measuring device having performance equivalent or superior thereto (hereinafter referred to as the "sound level meter").

5.2 Tester The tester for fans, blowers and compressors shall be in accordance with the Japanese Industrial Standard⁽⁷⁾ relating to the corresponding test method.

Further, the tester shall be set with taking into consideration the following each point.

Note ⁽⁷⁾ JIS B 8330, JIS B 8340, JIS B 8341 and JIS B 8345

- (1) Take cares so as the radiated sound from floor surface and others due to vibrations of specimen fan, blower and compressor to be as small as possible. When required, carry out the vibration preventive support, sound insulation and other countermeasures.

- (2) In the case where the generating noise of motor is large, execute the sound preventive treatment. However, except where in a small apparatus the motor can be considered a part of the apparatus.

Further, in case where the motor is large and the sound preventive treatment is not easy, it is to be in accordance with agreement between the parties concerned with delivery.

- (3) In the case where the radiated sound from the suction and discharge piping of specimen compressor is remarkable, execute the sound-preventive treatment or the like to make the sound from the piping not to give influence to the measured value. However, in case where such conditions can not be satisfied, it is to be in accordance with agreement between the parties concerned with delivery.

Further, relating to the compressor to be used in opening of ordinary suction opening near the body, this item does not apply and including the noise radiated from the suction opening it is taken as the noise of the compressor.

- (4) Attaching of accessory devices such as pressure regulation valve, flowmeter, etc. are to be in accordance with JIS⁽⁷⁾, but relating to the generating noise, remove the influence as far as possible.
- (5) Indicate the condition of tester in a figure, describe the existence of noise counter-measures against the periphery device together with the condition, and relating to the noise source considered to give specially the influence to measured results, it should be preferable to append the A-weighted sound pressure level near it.

6. Measurement of A-weighted sound pressure level

6.1 Measuring point

6.1.1 Blower The measuring point of blower shall be as follows.

- (1) In the case where the suction opening is opened to atmosphere, measure the noise radiated from the suction opening at the point apart by representative length from the middle of suction opening on the suction-opening central axis (Fig. 1-1 measuring point S).
- (2) In the case where the discharge opening is opened to atmosphere, measure the noise radiated from the discharge opening at the point apart by representative length from the middle of discharge opening in the direction of 45° to the central axis of discharge opening (Fig. 1-2 measuring point D). However, in the case of receiving the influence of discharge air flow, apart up to the place where the influence extinguishes in the direction and describe the point clearly.
- (3) In the case where both the suction opening and the discharge opening are connected to duct, measure the radiated sound from body casing at the point apart by 1 m from the surface of casing on the straight line toward the geometrical center of the impeller in the axial horizontal plane (Fig. 1-3 measuring points C-1, C-2, ..., M-1, M-2...).

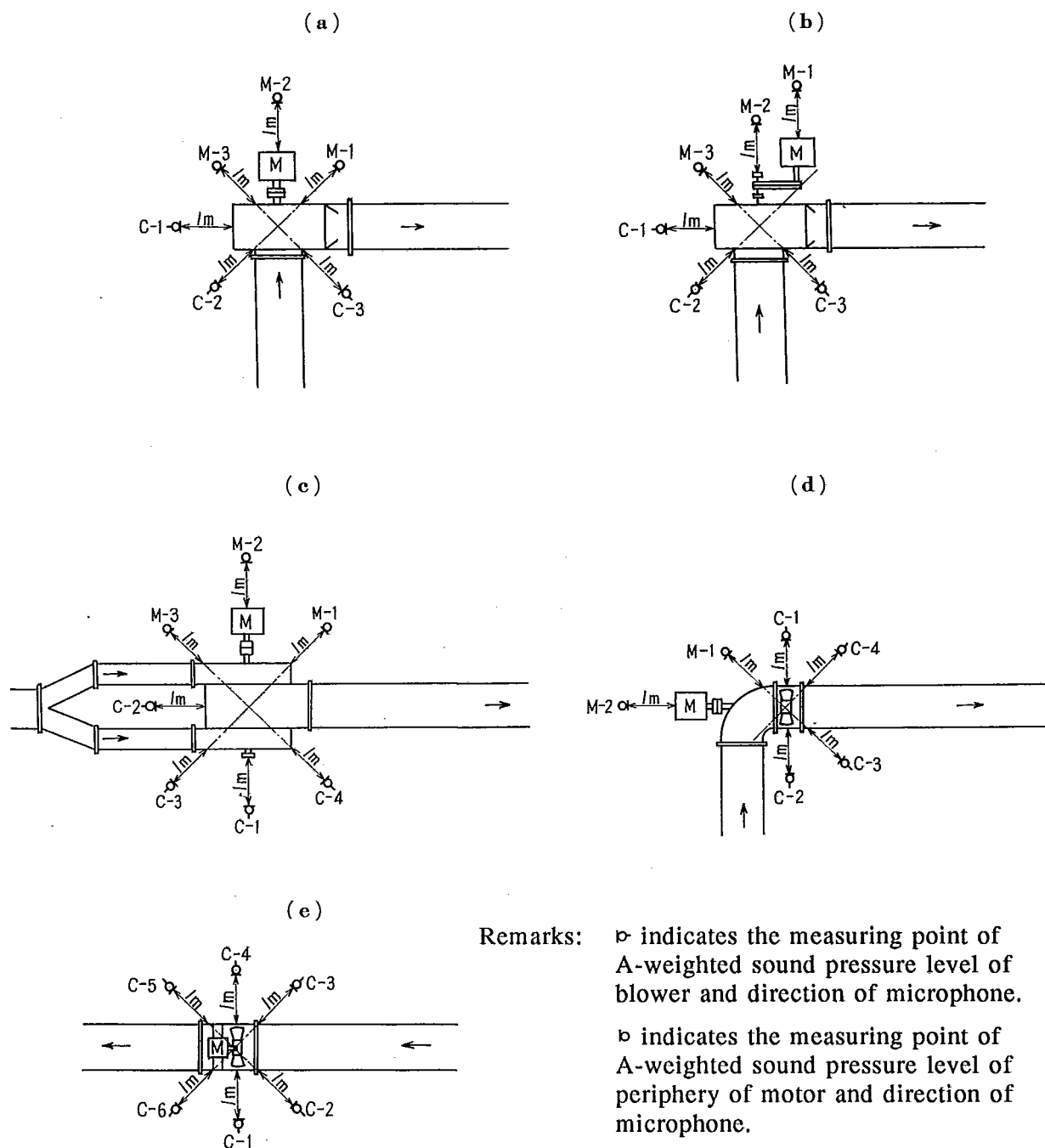
Further, take the measured value at measuring points M-1, M-2 at the motor side in Fig. 1-3 as the informative reference value.

Further, in the case where the noise radiated from the opening part can not be negligible such as the case where the duct opening part is in the neighborhood, add the measuring of noise radiated from opening part at the points equivalent to (1) and (2). In that case, describe clearly the dimensions of the opening part, positional relation to impeller, and measuring points.

- (4) In the case where both the suction opening and discharge opening are opened to atmosphere, measure any of noise radiated from suction opening or discharge opening. The measuring points are equivalent to (1) and (2).

Further, in all the above-mentioned, the height of suction opening, discharge opening centers or the center of casing surface should preferably be 1 m or more. In case where this is difficult, make the height of measuring point 1 m, and the distance up to the suction opening, discharge opening centers or the casing surface to be the representative length.

Fig. 1-3. Measuring point of A-weighted sound pressure level of blower
(In the case where both suction opening and discharge opening
are connected to duct)



6.1.2 Compressor The measuring point of compressor shall be as follows.

- (1) In the case where the motor and compressor body are integrated such as package type, measure at points apart by 1 m from the apparatus surface⁽⁸⁾ in four peripheral directions. Make the height of measuring point approximately $\frac{1}{2}$ of compressor body. However, in the case where the height is less than 1 m from the floor surface, measure at the height of 1 m (Fig. 2-1, measuring points C-1, C-2, ...).

Note ⁽⁸⁾ Neglect the individual protrusions on the surface considered not to give such influence to noise of apparatus, and consider the shape of surface of apparatus with simplifying.

- (2) In the case where the motor and compressor are integrated such as tank mount type or the like, measure at points apart by 1 m from the apparatus surface in four peripheral directions. Make the height of measuring point the height of rotary shaft center of the apparatus. However, the height is less than 1 m from the floor surface, measure at the height of 1 m (Fig. 2-2, measuring points C-1, C-2, ...).
- (3) In the case where the motor and compressor body are not integrated, measure at points apart by 1 m from the body surface in four directions of periphery of compressor body.

Further, in the case where the length and width of body exceeds 2 m and not more than 4 m, make two places in the directions, and in the case where exceeds 4 m and not more than 6 m, make three places (hereinafter to be in accordance with this, as appropriate), in the case of horizontal type, make on the horizontal surface including the rotary axis center or including the stroke axis center, and in the case of vertical type, make approximately $\frac{1}{2}$ of height on the vertical surface including the rotary axis center or stroke axis center. However, in the case where the height is less than 2 m from the floor surface, measure at the height of 1 m (Fig. 2-3, Fig. 2-4 measuring points C-1, C-2, ..., M-1, M-2...).

Further, take the measured values at measuring points M-1, M-2 of motor side as the informative reference value.

6.2 Measuring methods The measuring methods of noise shall be as follows.

- (1) Frequency corrected circuit of sound level meter For the frequency corrected circuit of sound level meter, use A characteristics.
- (2) Direction of sound level meter Direct the microphone of sound level meter in the direction of sound source.
- (3) Dynamic characteristics of sound level meter For the dynamic characteristics of sound level meter, use the slow dynamic characteristics (SLOW).
- (4) Reading-out of background noise Prior to measurement of A-weighted sound pressure level, measure the background noise level. Take the value as the integer value nearest the indicated value.
- (5) Reading out of A-weighted sound pressure level Take the reading out value of A-weighted sound pressure level as the integer value nearest the indicated value.

Further, in the case where the indicated value fluctuates, take the integer value nearest the mean value.

- (6) Correction of background noise Relating to reading out value of A-weighted sound pressure level, carry out the correction to the influence of background noise of 4.1.2 and obtain the measured value.

Remarks 1. For the sound level meter, carry out the calibration before and after measuring.

2. At the time of measuring, take care so as to make as small as possible the influence of reflection from all surfaces other than the floor surface including the measuring person himself.

7. Calculation method of representative A-weighted sound pressure level

Make the representative A-weighted sound pressure level $\overline{L_{pA}}$ (dB) as the energy mean of measured values⁽⁹⁾ at each measuring point, obtain according to the following formula, and take it as the integer value nearest this.

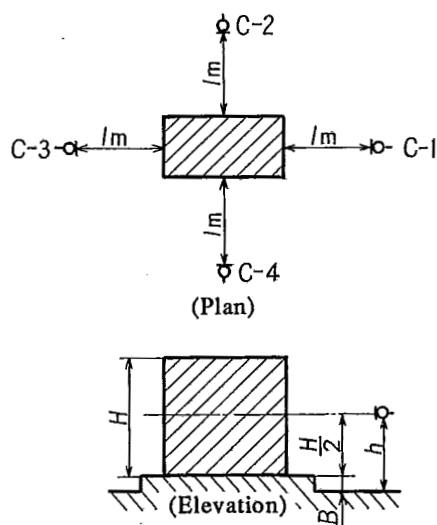
$$\overline{L_{pA}} = 10 \log_{10} \left[\frac{1}{N} \sum_{i=1}^N 10^{L_{pAi}/10} \right] \dots\dots\dots (1)$$

where, L_{pAi} : measured value of A-weighted sound pressure level at i -th measuring point (dB)

N : number of measured values

Note ⁽⁹⁾ Relating to read-out value at each measuring point, carry out the correction to the influence to background noise of 4.1.2.

Fig. 2-1. Measuring point of A-weighted sound pressure level of compressor
(In the case of package type or the like)



H : height of apparatus

B : height of foundation stand

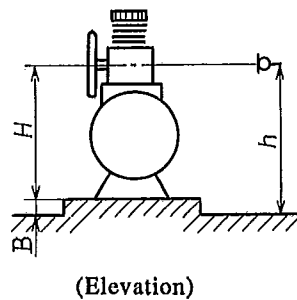
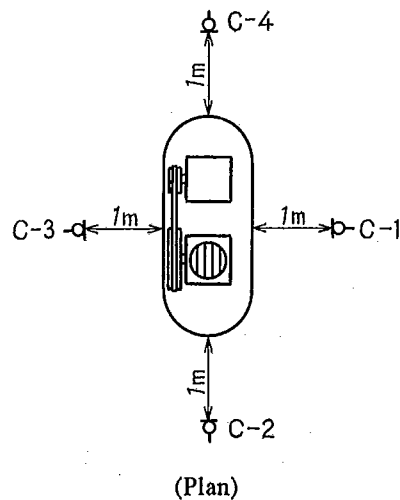
h : height of measuring point

When $\frac{H}{2} + B < 1 \text{ m}$, $h = 1 \text{ m}$

When $1 \text{ m} \leq \frac{H}{2} + B$, $h = \frac{H}{2} + B$

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Fig. 2-2. Measuring point of A-weighted sound pressure level of compressor
(In the case of tank mount type or the like)



H : height of axial centre of apparatus

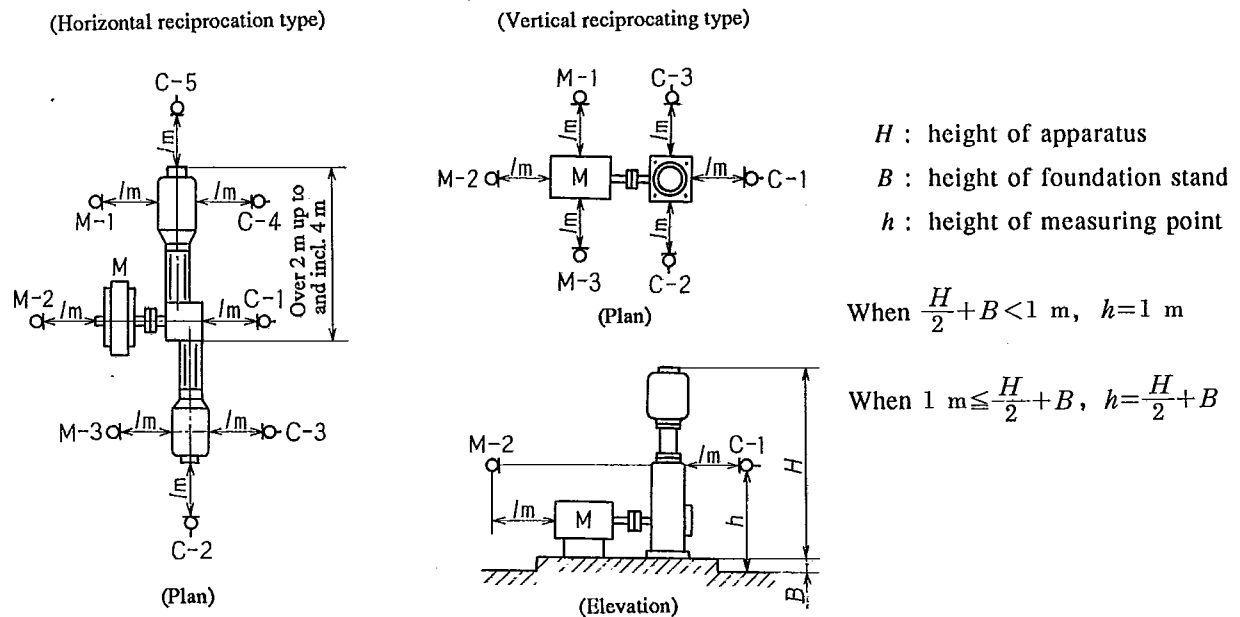
B : height of foundation stand

h : height of measuring point

When $H + B < 1 \text{ m}$, $h = 1 \text{ m}$

When $1 \text{ m} \leq H + B$, $h = H + B$

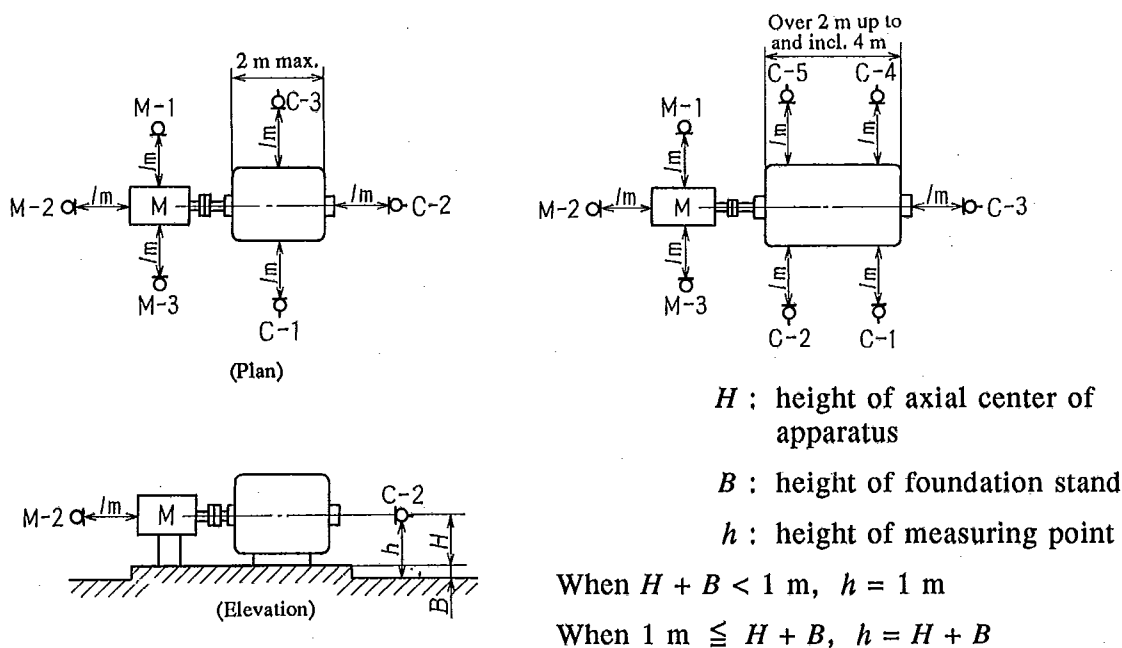
Fig. 2-3. Measuring point of A-weighted sound pressure level of compressor



Remarks: $\odot$ indicates the measuring point of A-weighted sound pressure level and direction of microphone.

$\bullet$ indicates the measuring point of A-weighted sound pressure level of periphery of motor and direction of microphone.

Fig. 2-4. Measuring point of A-weighted sound pressure level of compressor
(Rotary, centrifugal or axial flow type)



Remarks: $\circ$ indicates the measuring point of A-weighted sound pressure level and direction of microphone.

$\bullet$ indicates the measuring point of A-weighted sound pressure level of periphery of motor and direction of microphone.

8. Recording data and recording specifications

8.1 Recording data On the test report, record and mark the measured value of A-weighted sound pressure level at each measuring point, and the representative A-weighted sound pressure level of measuring objective sound source calculated from this, and for others the main elements such as measuring apparatus figure and measuring points, names of blower and compressor, type, opening diameter, manufacturer's name, etc., test conditions and using measuring device, test sound field also. If required, record and mark the performance test results before and after test of blower and compressor also.

8.2 Recording specifications Record the measured results together with the test conditions according to Attached Table 1 or Attached Table 2, as appropriate.

Remarks: In case where the test conditions do not satisfy the conditions to the sound field conditions and background noise, or in case where the operation conditions do not satisfy the permissible fluctuation value, describe clearly that the measured results of A-weighted sound pressure level are the informative reference values on the Remark column or the like.

Attached Table 1. Blower noise measurement record

Name of orderer _____		Manufacturer's name _____																																			
Manufacturing number _____		Measuring date _____																																			
Specified conditions	Size and type _____	Measuring place _____																																			
		Measuring person _____																																			
Operating conditions	Air quantity m^3/min	Blower total (static) pressure Pa	Total (static) pressure efficiency rate %																																		
	Rotary speed r/min	Motor output kW																																			
	Air temperature $^{\circ}\text{C}$	Treating gas _____	Humidity %																																		
	Air quantity m^3/min	Blower total (static) pressure Pa	Total (static) pressure efficiency rate %																																		
	Rotary speed r/min	Motor output kW																																			
	Air temperature $^{\circ}\text{C}$	Treating gas _____	Humidity %																																		
Measuring device	Type and name of sound level meter _____	(Type and name of frequency analyzer _____)																																			
Tester	Outline figure and measuring point (Dimension entering) • Noise from suction opening, noise from discharge opening, and radiation sound from casing		(Remarks) : • Enclose any one by ○																																		
Measuring results	<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th colspan="2">Measuring point</th> <th colspan="3">A-weighted sound pressure level dB</th> <th rowspan="2">Representative A-weighted sound pressure level dB</th> </tr> <tr> <th>No.</th> <th>Measuring distance</th> <th>Background noise</th> <th>Read-out value</th> <th>Measured value ※</th> </tr> </thead> <tbody> <tr> <td>S</td> <td></td> <td rowspan="4"></td> <td></td> <td></td> <td>(Suction opening)</td> </tr> <tr> <td>D</td> <td></td> <td></td> <td></td> <td>(Discharge opening)</td> </tr> <tr> <td>C-1 to C-6</td> <td></td> <td></td> <td></td> <td>(Casing)</td> </tr> <tr> <td>(Reference) M-1 to M-3</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>					Measuring point		A-weighted sound pressure level dB			Representative A-weighted sound pressure level dB	No.	Measuring distance	Background noise	Read-out value	Measured value ※	S					(Suction opening)	D				(Discharge opening)	C-1 to C-6				(Casing)	(Reference) M-1 to M-3				
Measuring point		A-weighted sound pressure level dB			Representative A-weighted sound pressure level dB																																
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D					(Discharge opening)																																
C-1 to C-6					(Casing)																																
(Reference) M-1 to M-3																																					
Meteorological environment	Air temperature $^{\circ}\text{C}$	Atmospheric pressure kPa	Relative humidity %																																		
Measuring place and sound field measured results (Drawing indication)																																					

Item of () is to be described when required.

※ measured value is to be the value of read-out value corrected to background noise.

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Attached Table 2. Compressor noise measurement record

Name of orderer _____		Manufacturer's name _____																										
Manufacturing number _____		Measuring date _____																										
Specified conditions	Size and type _____	Measuring place _____																										
		Measuring person _____																										
Operating conditions	Air quantity m³/min	Suction pressure kPa	Discharge pressure kPa																									
	Rotary speed r/min	Motor output kW	Treating gas _____																									
	Air quantity m³/min	Suction pressure kPa	Discharge pressure kPa																									
	Rotary speed r/min	Motor output kW	Efficiency (Total heat insulation, equal temperature) %																									
	Suction temperature °C	Discharge temperature °C	Treating gas _____																									
Measuring device	Type and name of sound level meter _____	(Type and name of frequency analyzer _____)																										
Tester	Outline figure and measuring point (Dimension entering)		(Remarks):																									
Measuring results	<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <th colspan="2">Measuring point</th> <th colspan="3">A-weighted sound pressure level dB</th> <th rowspan="2">Representative A-weighted sound pressure level dB</th> </tr> <tr> <th>No.</th> <th>Measuring distance</th> <th>Background noise</th> <th>Read-out value</th> <th>Measured value ※</th> </tr> <tr> <td>C-1 to C-5</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>(Reference) M-1 to M-3</td> <td></td> <td></td> <td></td> <td></td> <td style="text-align: right;">/</td> </tr> </table>					Measuring point		A-weighted sound pressure level dB			Representative A-weighted sound pressure level dB	No.	Measuring distance	Background noise	Read-out value	Measured value ※	C-1 to C-5						(Reference) M-1 to M-3					/
Measuring point		A-weighted sound pressure level dB			Representative A-weighted sound pressure level dB																							
No.	Measuring distance	Background noise	Read-out value	Measured value ※																								
C-1 to C-5																												
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Meteorological environment	Air temperature °C	Atmospheric pressure kPa	Relative humidity %																									
Measuring place and sound field measured results (Drawing indication)																												

Item of () is to be described when required.

※ measured value is to be the value of read-out value corrected to background noise.

Attached Table 3. Applicable Standards

- JIS B 8330-Testing Methods for Turbo-Fans and Blowers
JIS B 8340-Testing Methods for Turbo-Blowers and Compressors
JIS B 8341-Testing Methods for Displacement Compressors
JIS B 8345-Testing Methods of Turbo Blowers and Compressors for Gases by Loop Arrangement
JIS C 1502-Sound Level Meters
JIS C 1505-Precision Sound Level Meters
JIS Z 8106-Glossary of Acoustical Terms (General)
JIS Z 8732-Precision Methods for the Measurement of Sound Power Level in Anechoic and Hemi-Anechoic Rooms
JIS Z 8733-Engineering and Survey Methods for the Determination of Sound Power Level in General Sound Fields

Attached Table 4. Corresponding International Standards

- ISO 3744-1981 Acoustics—Determination of sound power levels of noise sources—Engineering methods for free-field conditions over a reflecting plane
ISO 3746-1979 Acoustics—Determination of sound power levels of noise sources—Survey method

Reference Standards:

- JIS A 1409-Method for Measurement of Sound Absorption Coefficients in a Reverberation Room
JIS C 1513-Octave and Third-Octave Band Analyzers for Sounds and Vibrations
JIS Z 8731-Methods of Measurement and Description of A-Weighted Sound Pressure Level
JIS Z 8734-Precision Methods for the Determination of Sound Power Level in Reverberation Rooms
ISO 3740-1980 Acoustics—Determination of sound power levels of noise sources—Guidelines for the use of basic standards and for the preparation of noise test codes

Informative Reference 1. Determination of band sound pressure level of fans, blowers and compressors

This Informative Reference 1 describes the determination of band sound pressure level of noise radiated from fans, blowers and compressors and is not a part of the specification.

Remarks: In the case of measuring the octave band sound pressure level, the central frequency is to be 63 to 8000 Hz, in the case of measuring $\frac{1}{3}$ octave band sound pressure level, the central frequency is to be 50 to 10000 Hz.

1. Operating conditions and tester

The operating conditions and tester are in accordance with 4.2 and 5.2 of Body.

2. Measuring device

The measuring device is to be the sound level meter specified in 5.1 of Body and frequency analyzer specified in JIS C 1513.

3. Measuring point

The measuring point is to be in accordance with 6.1 of Body. It may be a representative point.

4. Measuring method

- (1) Frequency correction circuit of sound level meter Flat characteristics or C characteristics are to be used.
- (2) Dynamic characteristics of sound level meters As a rule, slow dynamic characteristics (SLOW) are to be used. The observing time of band sound pressure level, relating to the band of not more than 160 Hz in central frequency is to be not less than 30 s, relating to band of not less than 200 Hz is to be not less than 10 s, and take the integer value nearest the mean value of run-out of pointer as the read-out value.
- (3) Background noise The sound pressure level of background noise should preferably be less by not less than 10 dB than the read-out value of objective sound source. However, in case where the conditions can not be obtained, limited to the case where the difference of read-out values is in the range of 4 to 9 dB, the read-out value of sound pressure level of objective sound source may be used with correcting. The correction value is to be in accordance with Informative Reference 1 Table 1.

Informative Reference 1 Table 1. Correction values to influence of background noise

Unit: dB						
Difference of band sound levels when the fan, blower and compressor are working and when stopping	4	5	6	7	8	9
Correction value	- 2		- 1			