RESEARCH PROJECT ON HOUSEHOLD APPLIANCE NOISE REDUCTION THROUGH A HAMBRO CONCRETE FLOOR

CMHC File: 6791-19-1

DCI Project: P-92-116

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NOTE: **DISPONIBLE AUSSI EN FRANÇAIS SOUS LE TITRE:**

PROJET DE RECHERCHE SUR LA RÉDUCTION DU BRUIT D'APPAREILS MÉNAGERS AU TRAVERS D'UN PLANCHER DE BÉTON HAMBRO

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DISCLAIMER

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EXECUTIVE SUMMARY

CMHC commissioned a second part to the "Research Project on Household Appliance Noise in Multi-Unit Buildings" (1), the main difference this time being the use of a Hambro concrete floor instead of the wood floor used in the initial research project.

This second part essentially aims at quantifying, on a comparative basis, the degree of soundproofing obtained using various resilient materials installed under certain household and sanitary appliances, with respect to the transmission of noise to a unit directly below and to an adjacent unit.

The tests were performed in newly-built condominiums with several vacant units. The following household and sanitary appliances were installed in the laundry room of one of the second-floor units, and submitted to the following conditions:

- washing machine : normal cycle
- dryer : normal cycle
- dishwasher : normal cycle
- toilet : water flowing from a height of 80 cm from the floor

The resilient materials that were tested are listed below; they were selected based on their availability, cost, and current use on the market.

- Neoprene waffle pads, DURO 30, 14 mm thick
- Cork flooring, Dodge Cork, 5 mm thick
- Recycled rubber flooring, Everlast, 10 mm thick
- Ribbed neoprene pads, DURO 60, 6 mm thick
- Toilet joint, GLH
- Floating floor, plywood on Acousti-mat
- Floating floor, plywood on Enkasonic
- Floating floor, plywood on Sonopan
- Floating floor, GLH

The main conclusions that were drawn from the tests are summarized below:

- In spite of the fact that the walls and ceilings had a sound transmission class rating of at least 55, the household and sanitary appliances tested were all audible in the units that were adjacent and directly below. The noise levels were as follows:

Unit directly below:

Washing machine	: 29 dBA
Dryer	: 22 dBA
Dishwasher	: 29 dBA
Toilet	: 38 dBA

Adjacent unit:

Washing machine	: 25 dBA
Dryer	: 19 dBA
Dishwasher	: 24 dBA
Toilet	: 37 dBA

It should be mentioned, however, that the condominium units where the measurements were taken were located in a particularly quiet environment and that several units were vacant, indicating that the background noise was very low and, consequently, that any disturbing noise could easily be heard.

- In typical conditions, based on a National Research Council of Canada study (2), the background noise (i.e. the noise with no human activities going on) in a unit should be sufficiently loud to cover the noise produced by an household appliance operating in an adjacent unit. Furthermore, in normal living conditions, this type of noise could be equivalent to that of the refrigerator in an occupied unit.

- During the tests, the toilet was the appliance that generated the highest noise level, louder than the typical background noise mentioned above. Moreover, of all sources of noise, this is probably the one that most people would find disturbing.

- There was as much structural noise transmitted to the unit directly below than to the adjacent unit, as demonstrated by the noise levels measured during the test with the toilet.

- The 14 mm thick, DURO 30 neoprene pads generally worked best to reduce the transmission of vibrations to the floor, and also to eliminate low-frequency noise, such as that generated by the household appliances.

The floating floors that were tested all had about the same performance.

As for the toilet, the noise transmitted to adjacent units was inaudible during tests of both the GLH joint and the floating floors.

The following figure indicates the noise levels measured in the unit directly below, for each of the four appliances tested.

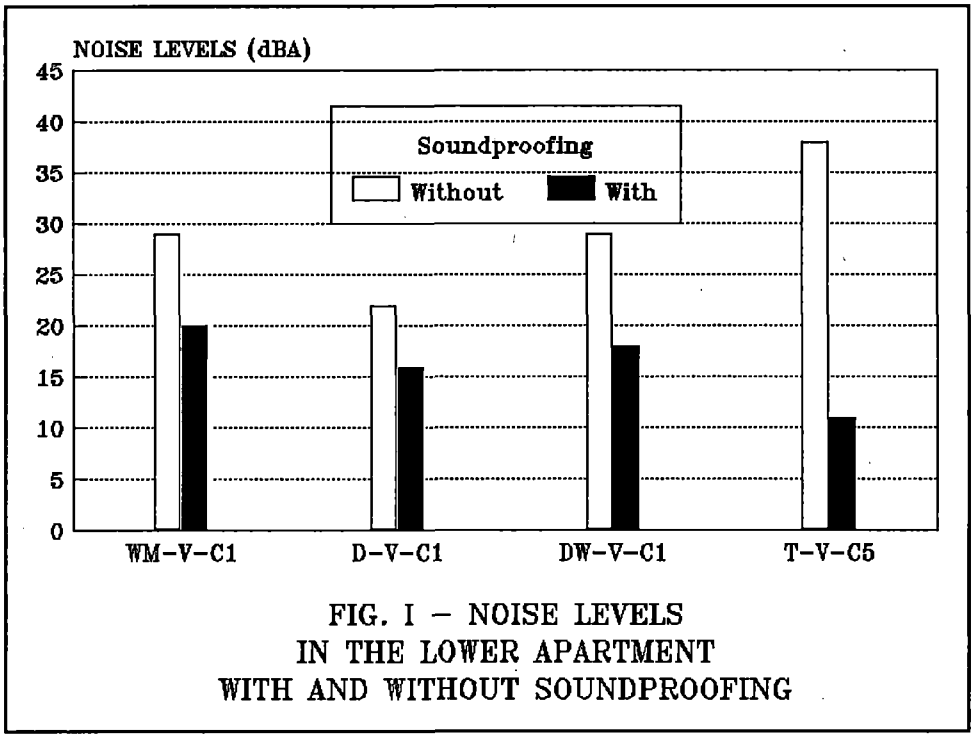

FIG. I – NOISE LEVELS
IN THE LOWER APARTMENT
WITH AND WITHOUT SOUNDPROOFING

Key:
- WM : Washing machine
- D : Dryer
- DW : Dishwasher
- T : Toilet
- V : Vertical noise transmission
- C_1 : 14 mm thick, DURO 30 neoprene waffle pads
- C_5 : GLH toilet joint

Based on these conclusions, the following recommendations can be made:

Short-Term:

- During construction or renovation of housing units where the concrete is one of the floor elements, toilets should be installed on GLH joints or on floating floors like the ones tested in this study.

- Where a high degree of soundproofing is sought, it is recommended that the contractor place neoprene strips where household appliances are to be installed.

  However, it should be noted that the plumbing noise at the beginning of the wash cycle of the washing machine (and the dishwasher) was around 38 dBA in the unit directly below, even though noise absorption was present in the wall cavity containing pipes. This noise is therefore louder than that generated by the appliances that were tested and, consequently, the pipes should be better insulated in such a situation.

Long-Term:

- Manufacturers of household and sanitary appliances should provide for the installation of pads on the appliance ground supports (or the counter in the case of the dishwasher); such pads would allow to sufficiently reduce vibrations to virtually eliminate structure-borne noise transmission.

Finally, it was demonstrated that floating floors were most effective when used with toilets, and moderately effective when used with household appliances, mainly because they produced lower-frequency noise. It is likely that floating floors tested would have a similar effect on impact noises, i.e., they would be better at reducing high-frequency than low-frequency noise. In general, this would be deemed unacceptable since footsteps, for example, would still be audible.

Therefore, new studies should be initiated to determine the composition of a floating floor that would meet residential construction imperatives (lowest possible cost, reduced height, availability of materials, ease of installation, etc.) and reduce the transmission of impact noises and, consequently, household and sanitary appliance noise.

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LIST OF ABBREVIATIONS

CMHC: Canada Mortgage and Housing Corporation

SOUNDPROOFING:

0 : Test without any soundproofing system

B : Test without any appliance in operation

C_1 : 50 mm X 50 mm neoprene waffle pads, DURO 30, 14 mm thick, installed under the appliance support points

C_2 : 1000 mm X 1000 mm cork flooring, Dodge Cork, 5 mm thick

C_3 : 1000 mm X 1000 mm recycled rubber flooring, Everlast, 10 mm thick

C_4 : Ribbed neoprene pads, DURO 60, 6 mm thick

C_5 : Toilet joint, GLH

FF_1 : Floating floor, plywood on Acousti-mat

FF_2 : Floating floor, plywood on Enkasonic

FF_3 : Floating floor, plywood on Sonopan

FF_4 : Floating floor, GLH

/J : Test on the dryer containing a jacket with several metallic buttons

/0 : Without jacket

Fl. fl. : Floating floor

APPLIANCES: WM: Washing Machine
D : Dryer
DW : Dishwasher
T : Toilet

INTRODUCTION

A research project carried out for CMHC (1) had demonstrated the extent to which structures transmit noise generated by household and sanitary appliances.

It had been recommended that the same tests be performed using another floor type than the wood floor used previously.

CMHC has therefore commissioned a second part to the initial research project, using a Hambro concrete floor this time.

CHAPTER 1
DESCRIPTION OF THE STUDY

1.1 OBJECTIVE

This study essentially aims at quantifying, on a comparative basis, the degree of soundproofing obtained using various resilient materials, in the form of pads or floating floors, installed under certain household and sanitary appliances on a Hambro floor.

1.2 METHODOLOGY

The general methodology developed to assess the efficiency of the selected anti-vibration materials is as follows. First, the noise generated by an appliance in one unit was measured from the lower and adjacent units. Then, the interface between the appliance and the base floor was modified; the transmitted noise was measured again and compared to the first measurements. (See Figure 1 for the location of the measurement points.)

This study assessed the noise emitted by the appliances listed in Table 1, installed on the anti-vibration materials indicated in Table 2. It should be noted that the abbreviations given on page xi were used to identify these materials on the figures in this report.

TABLE 1
LIST OF APPLIANCES

washing machine
dryer
dishwasher
toilet*

* fixed to the floor with a standard flange, with no connections to conducting lines

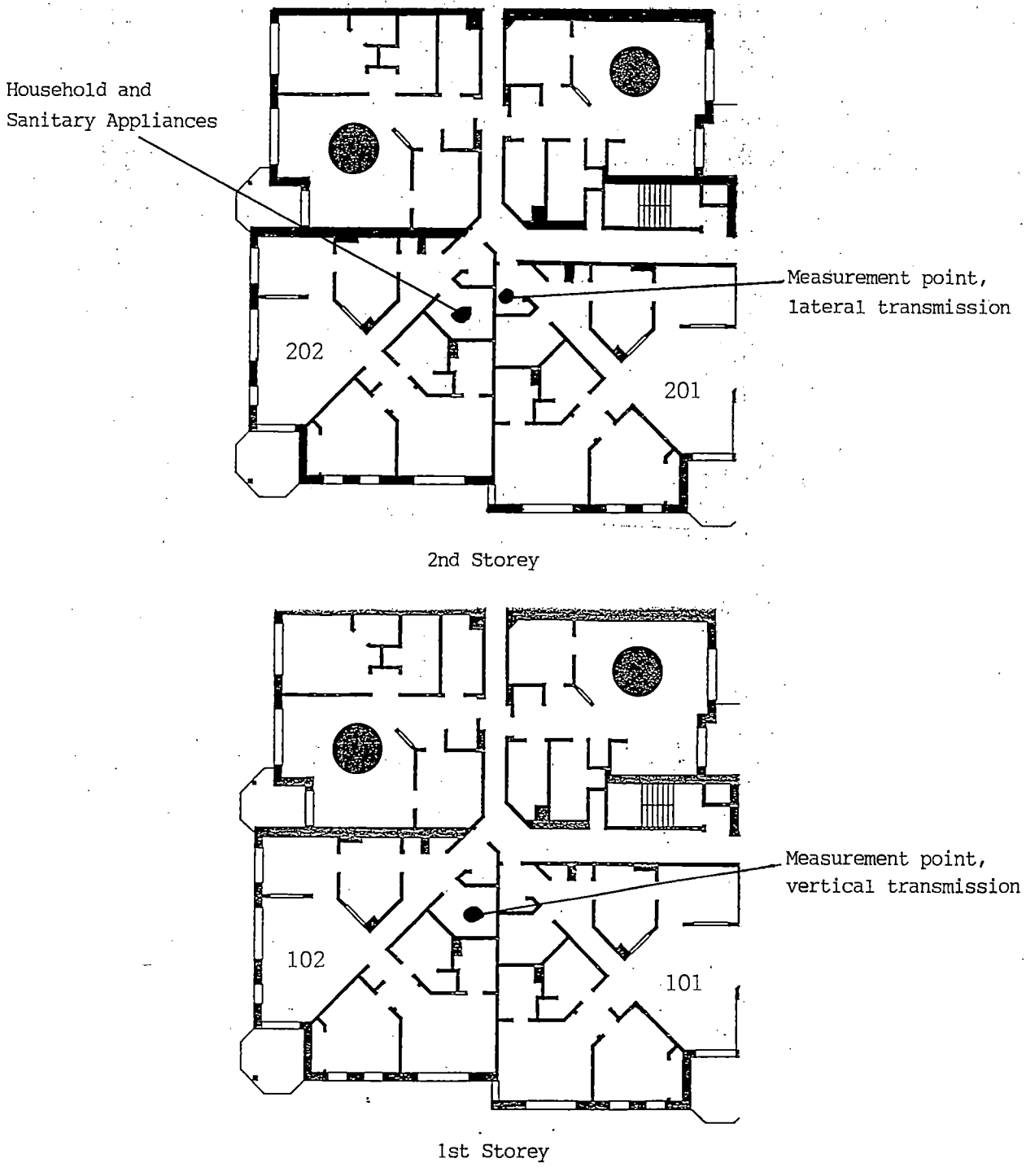

FIGURE 1 - LOCATION OF MEASUREMENT POINTS

TABLE 2
LIST OF ANTI-VIBRATION MATERIALS

50 mm X 50 mm neoprene waffle pads, DURO 30, 14 mm thick
1000 mm X 1000 mm cork flooring, Dodge Cork, 5 mm thick
1000 mm X 1000 mm recycled rubber flooring, Everlast, 10 mm thick
Ribbed neoprene pads, DURO 60, 6 mm thick
Floating floor, plywood on Acousti-mat
Floating floor, plywood on Enkasonic
Floating floor, plywood on Sonopan
Floating floor, GLH

The floating floors had a surface of 1000 mm by 1000 mm and were made up of two superimposed 19 mm sheets of plywood (except the GLH floor, with an area of approximately 1000 mm by 2000 mm) mounted on the product specified in Table 2 installed on the floor. Technical brochures for some of the products listed in Table 2 are supplied in Appendix II.

The different tests were carried out mainly during the night in order to minimize the impact of external noise. The background noise was measured at regular intervals and subtracted from the noise measured when the appliances were operating. In addition, another test was performed to check the minimum threshold of the measuring instrumentation that were used. This threshold turned out to be 0 dBA for the most of the 1/3 octave bands that were considered.

The tests were performed in real units (newly-built condominiums with several vacant units). A quick check made it possible to determine that the noise was transmitted mainly through the floor. However, this noise transmission could be either structure-borne (i.e. appliance vibrations transmitted directly to the floor) or airborne (i.e. airborne appliance noise that causes the floor to vibrate).

Consequently, a particular resilient product cannot be deemed ineffective, even if the noise is only slightly reduced. This is because, if the transmission is airborne, the reduced vibrations would have only a negligible impact on the amount of noise transmitted to the adjacent unit.

The floor/ceiling assembly and wall compositions are given in Tables 3 and 4, respectively.

TABLE 3
FLOOR/CEILING ASSEMBLY COMPOSITION

Concrete, 95 mm
Hambro Metallic Structure, 355 mm
Acoustic Wool, 65 mm
Masonite, 12.7 mm
Metallic Furrings, 25.4 mm
Gypsum Board, 15.9 mm

TABLE 4
WALL COMPOSITION

Gypsum Board, 15.9 mm, FC
Acoustic Wool, 90 mm
Metallic Studs, 90 mm
Gypsum Board, 15.9 mm, FC
Metallic Studs, 90 mm
Acoustic Wool, 90 mm
Gypsum Board, 12.7 mm, FC

Table 5 presents the list of tests that were carried out:

TABLE 5
LIST OF TESTS

Appliance	Materials to Test									
	B	0	C_1	C_2	C_3	C_4	PF_1	PF_2	PF_3	PF_4
Washing Machine	X	X	X	X	X		X	X	X	X
Dryer	X	X	X	X	X		X	X	X	X
Dishwasher	X	X	X	X	X		X	X	X	X
Toilet	X	X		X	X	X	X	X	X	X*

1.3 INSTRUMENTATION

The following instruments used during the tests:

- Sound Level Meters, Bruël & Kjaer, 2230 and 2231
- Calibrator, B & K, 4230
- Tape recorder, B & K, 7006
- Analyzer, Nicolet Scientific Corporation, 446B

Each instrument was calibrated on a regular basis during the measurement sessions, and corrections were made as required.

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* *This test was carried out for lateral transmission only, since the signal was very weak.*

CHAPTER 2
RESULTS AND MEASUREMENT ANALYSIS

The complete results of the noise measurements are presented in Appendix I.

The noise measured with no soundproofing was compared to the background noise measured in 602 housing units in Canada by the National Research Council of Canada (2). If the level of noise generated by an appliance is lower than the background noise, it would not be audible in most cases. The appliances would only be heard in housing units located in particularly quiet environments with a very low level of background noise, as was the case with the condominiums where the tests were performed.

2.1 NOISE GENERATED WITH NO SOUNDPROOFING

2.1.1 Washing Machine

The washing machine generated mainly low-frequency noise, as shown in Figure 2. The noise was louder than the background noise within certain 1/3 octave bands suggesting that it would be audible in most units. However, this noise could be mistaken for the noise generated by the refrigerator in the occupied unit and, consequently, should not be very disturbing. This noise would still be audible in very quiet places and the occupants would benefit from noise reduction in these locations.

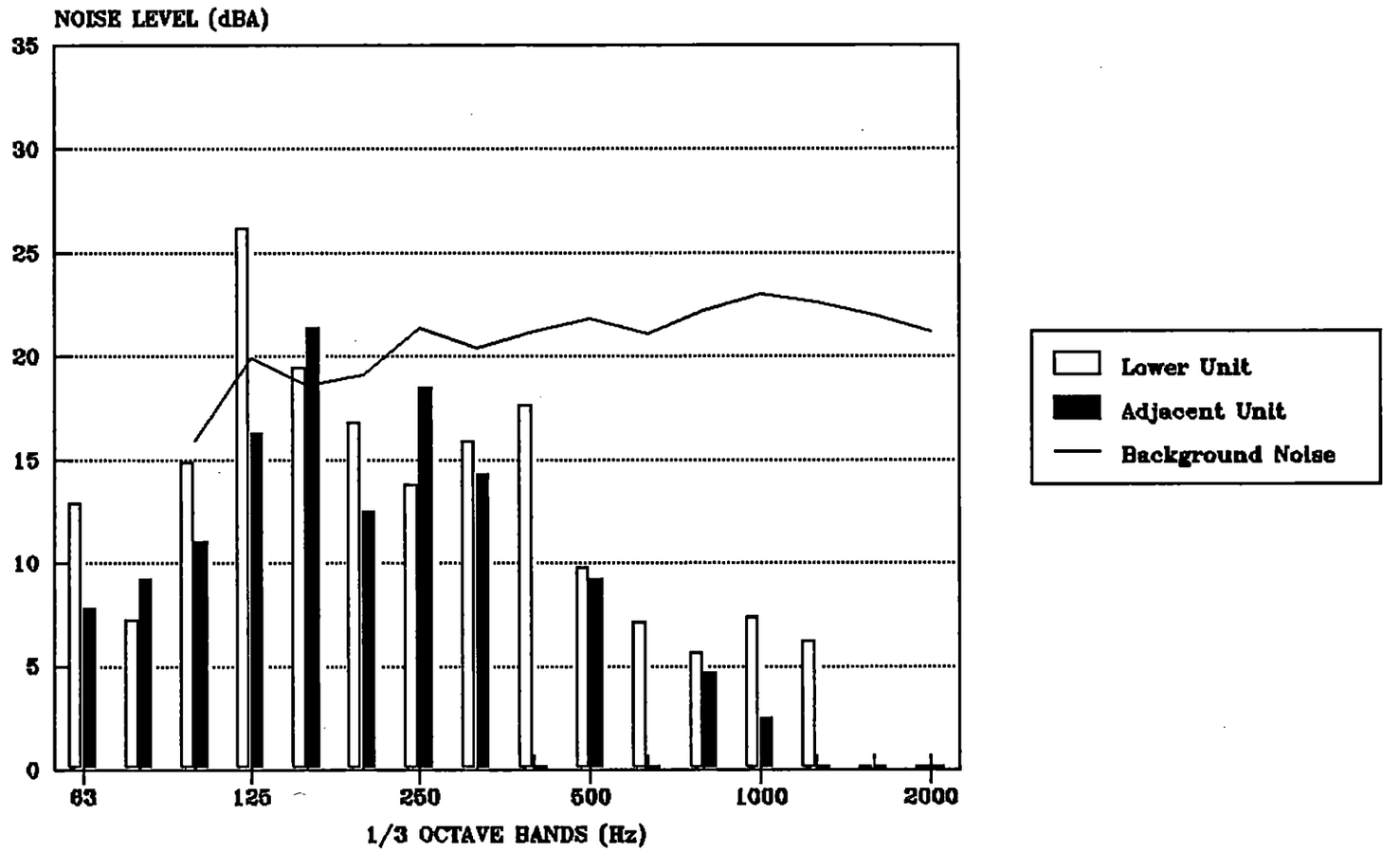


FIG. 2 – SPECTRUM OF NOISE MEASURED WITH THE WASHING MACHINE

2.1.2 Dryer

As indicated in Figure 3, the dryer produced noise around the frequencies of 125 Hz and 500 Hz, the motor being responsible for the first peak, and the ventilator, for the second. The noise levels at frequencies around 500 Hz were not significantly reduced in any of the tests using the various materials (see Figure I-2), suggesting that the transmission was mainly airborne.

In addition, one test was carried out while the dryer contained a jacket with several metallic buttons (see Figure I-3). The noise of the buttons on the dryer drum transmitted to adjacent units was mostly in the middle frequencies (500 Hz and 1000 Hz) and was also airborne.

Finally, it should be noted that the noise produced was lower than the typical background noise, suggesting that it would not be disturbing.

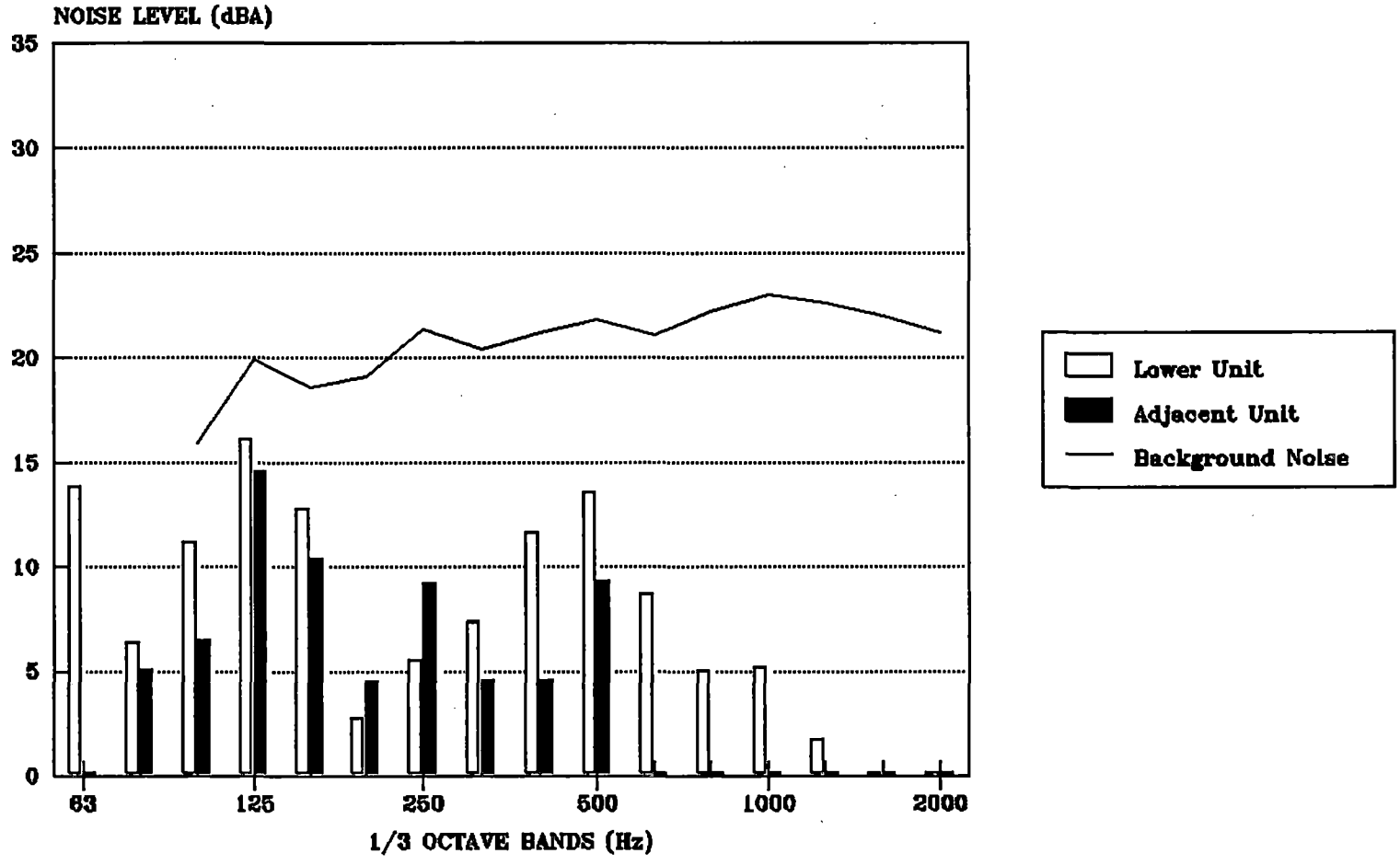


FIG. 3 – SPECTRUM OF NOISE MEASURED WITH THE DRYER

2.1.3 Dishwasher

The overall noise level generated by the dishwasher was about the same as the washing machine, but the spectrum of noise was better balanced because the water hitting the inner surfaces of the machine produced noise in the middle frequencies.

As indicated in Figure 4, the noise transmitted to the lower unit was louder than the typical background noise for two different 1/3 octave bands, whereas the noise transmitted to the adjacent unit was lower.

As mentioned above, since the noise produced by the dishwasher presents a balanced spectrum, which generally makes it more difficult to discern from other noises in a unit, it would not be disturbing either.

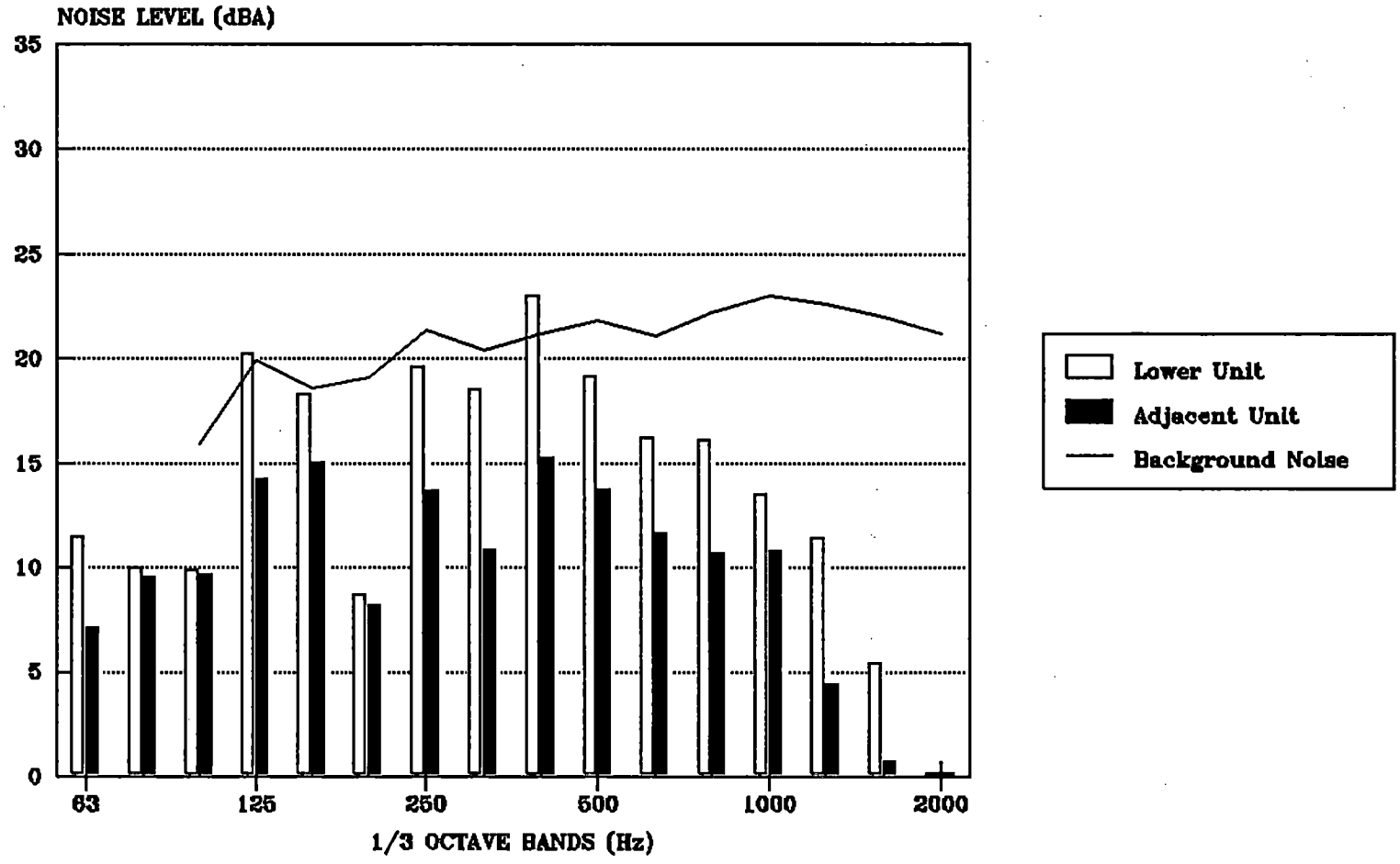


FIG. 4 – SPECTRUM OF NOISE MEASURED WITH THE DISHWASHER

2.1.4 Toilet

Water running in the toilet produced a significantly higher noise level than the other appliances tested, and was also 10 dBA higher than the typical background noise. Subjectively, this type of noise is likely to be deemed the most disturbing of all the appliances tested. In addition, people often consider this noise as a flagrant lack of soundproofing.

As discussed in Section 2.2, this noise is only structure-borne.

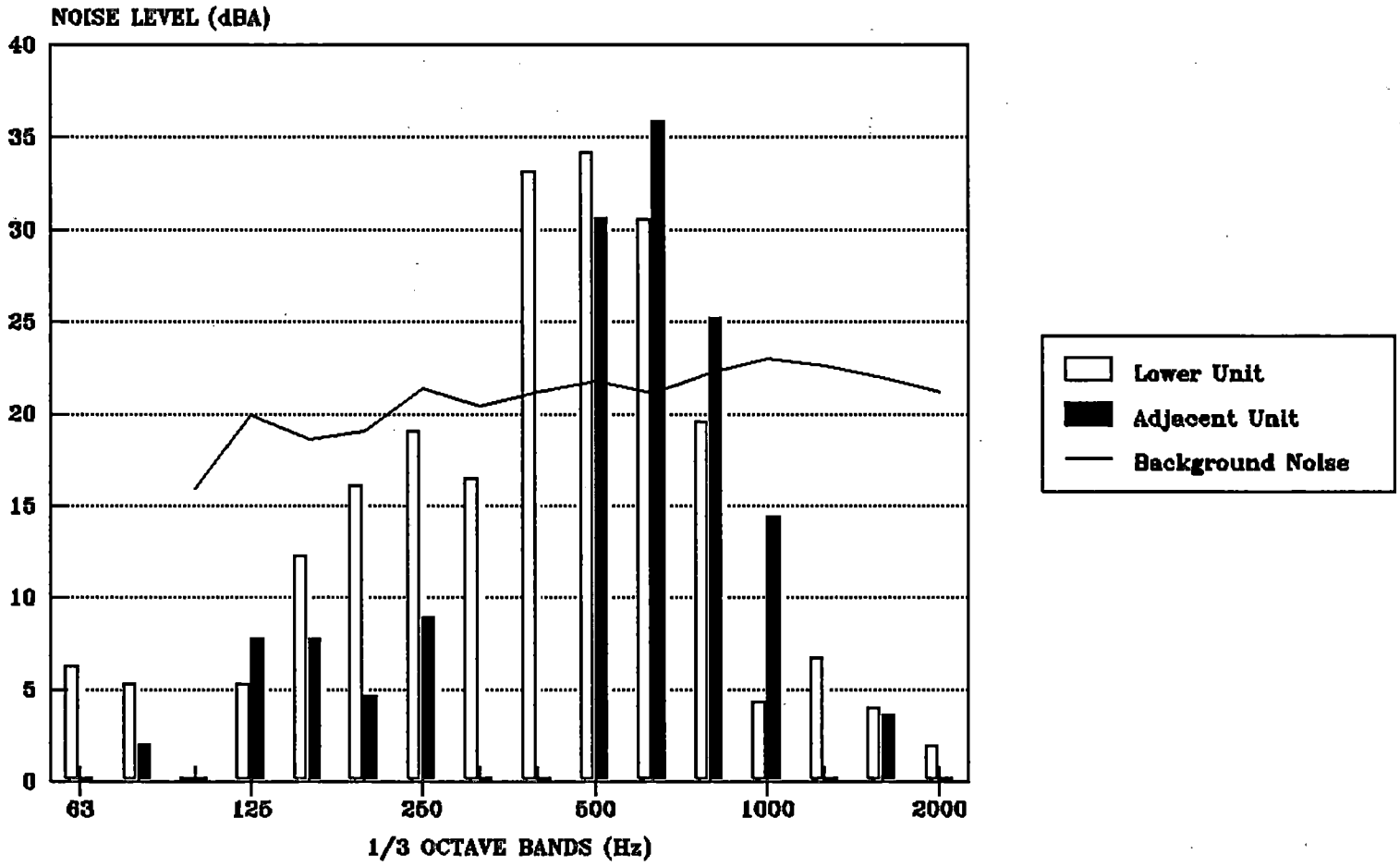


FIG. 5 – SPECTRUM OF NOISE MEASURED WITH THE TOILET

2.2 CLASSIFICATION OF RESILIENT PRODUCTS

In this section, the products tested were classified according to the extent to which they reduced the overall level of noise, compared to a situation where no resilient products were used. When various products gave similar noise reductions, the standard deviation between the noise levels measured in dBA for the different 1/3 octave bands from 63 Hz to 2000 Hz was used to differentiate the products. A small standard deviation indicates that the spectrum is well balanced and that the noise is therefore less likely to be disturbing.

In the case of the dryer, it should be noted that the products were classified based on measured noise levels between 63 Hz and 250 Hz, since the transmission of higher frequency noise was airborne and, therefore, did not change from one resilient product to another.

In addition, an overall classification of the products was obtained by adding the noise reduction levels of each product used with all the different appliances.

2.2.1 Household Appliances

Figures 6 to 11 present the various resilient products classified according to their use with each appliance type, starting with the best products, i.e., those with the lowest noise level measurements. The overall classification is shown in Table 6.

TABLE 6
Overall Classification of the Products Tested
with the Different Household Appliances

Products	Total Noise Reduction
C_1 : neoprene, 14 mm	57
FF_1 : floating floor; Acousti-mat	47
FF_2 : floating floor; Enkasonic	46
C_3 : rubber; Everlast; 10 mm	45
FF_4 : floating floor; GLH	40
FF_3 : floating floor; Sonopan	32
C_2 : cork; Dodge Cork; 5 mm	17

The following guidelines are suggested by this overall classification:

- Of all the products tested, the 14 mm thick neoprene (treatment C_1) stands out as it gave the greatest noise reduction in most situations;

2.2.1 Household Appliances (cont'd)

- A group of products (the Acousti-mat, Enkasonic, and GLH floating floors, and the recycled rubber flooring) all accounted for about the same, significant noise reduction.

- The floating floor with Sonopan gave the lowest noise reduction, while the cork flooring barely reduced the noise during all the tests.

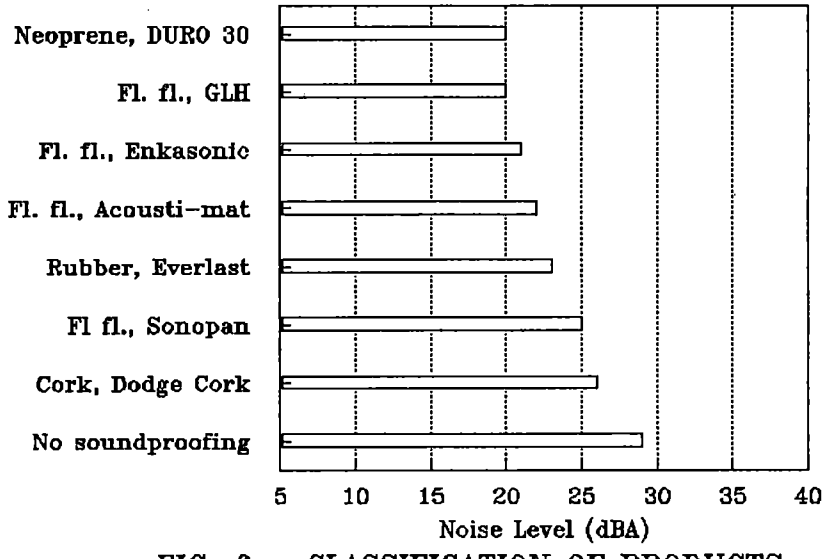


FIG. 6 – CLASSIFICATION OF PRODUCTS TESTED WITH THE WASHING MACHINE (VERTICAL TRANSMISSION)

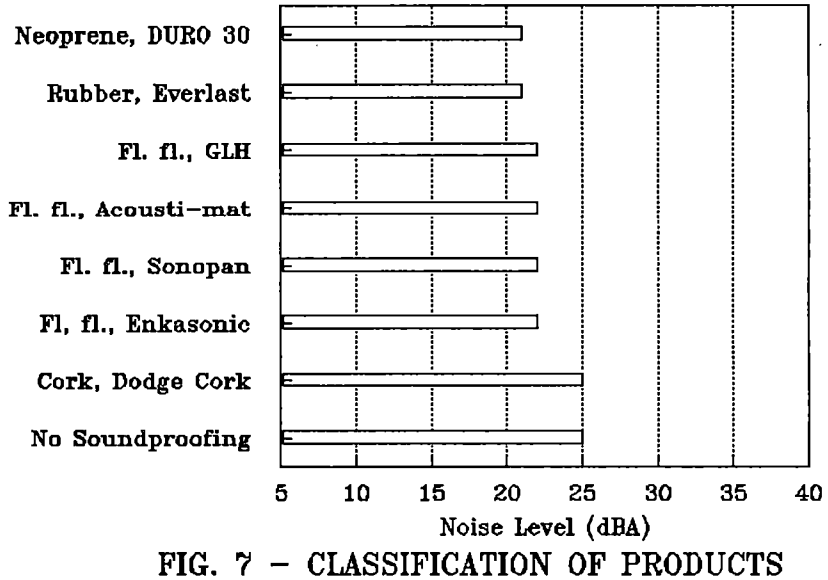


FIG. 7 – CLASSIFICATION OF PRODUCTS TESTED WITH THE WASHING MACHINE (LATERAL TRANSMISSION)

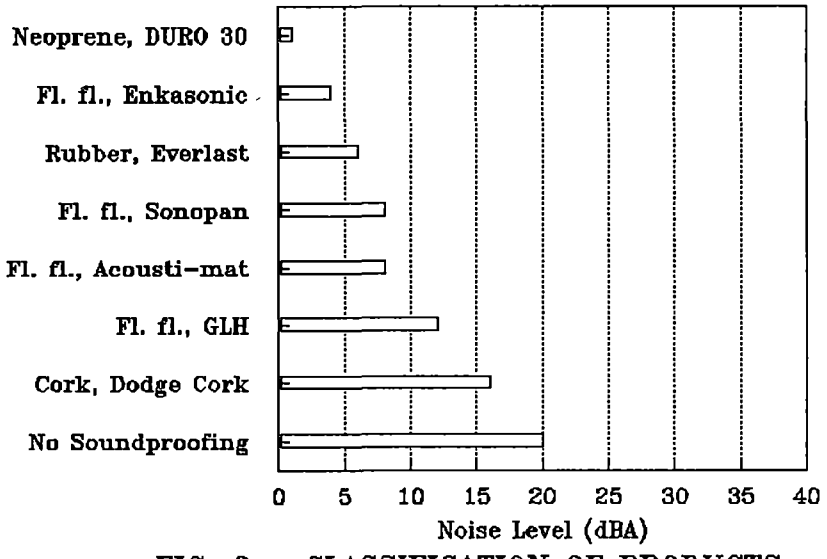


FIG. 8 – CLASSIFICATION OF PRODUCTS TESTED WITH THE DRYER (VERTICAL TRANSMISSION)

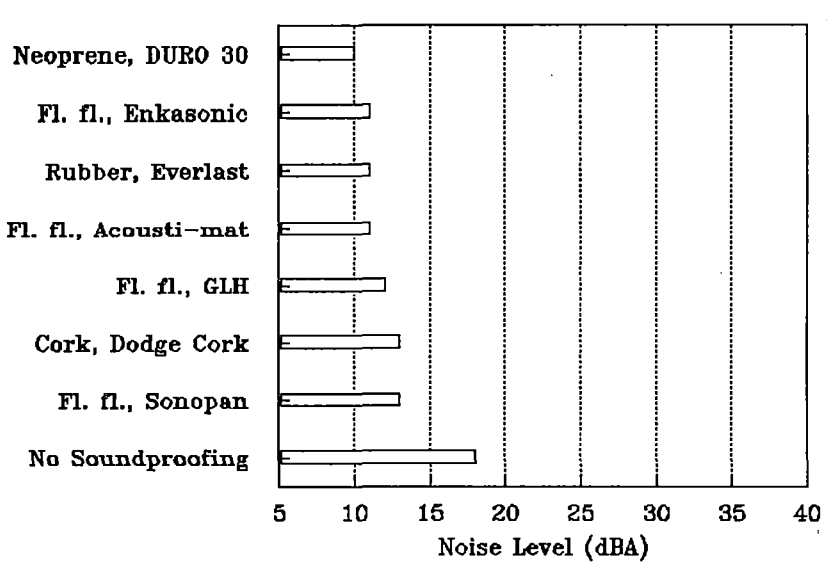


FIG. 9 – CLASSIFICATION OF PRODUCTS TESTED WITH THE DRYER (LATERAL TRANSMISSION)

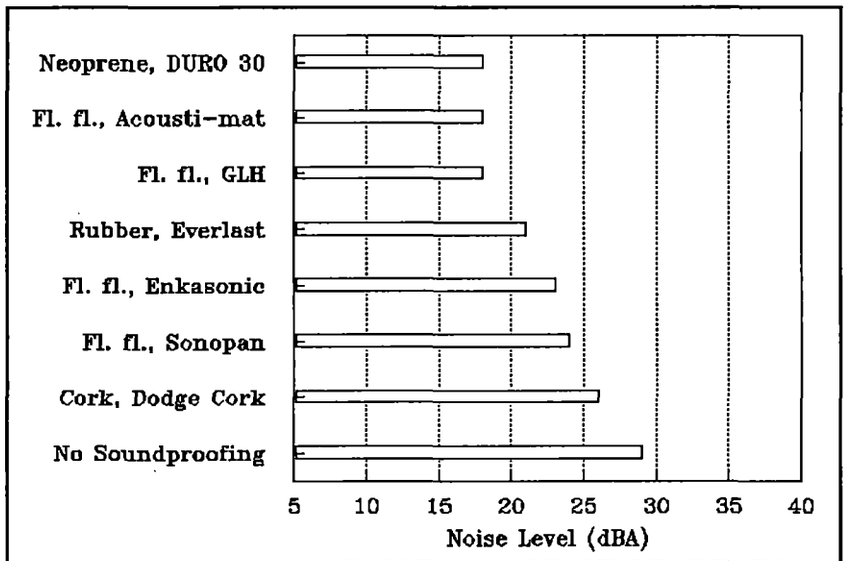


FIG. 10 – CLASSIFICATION OF PRODUCTS TESTED WITH THE DISHWASHER (VERTICAL TRANSMISSION)

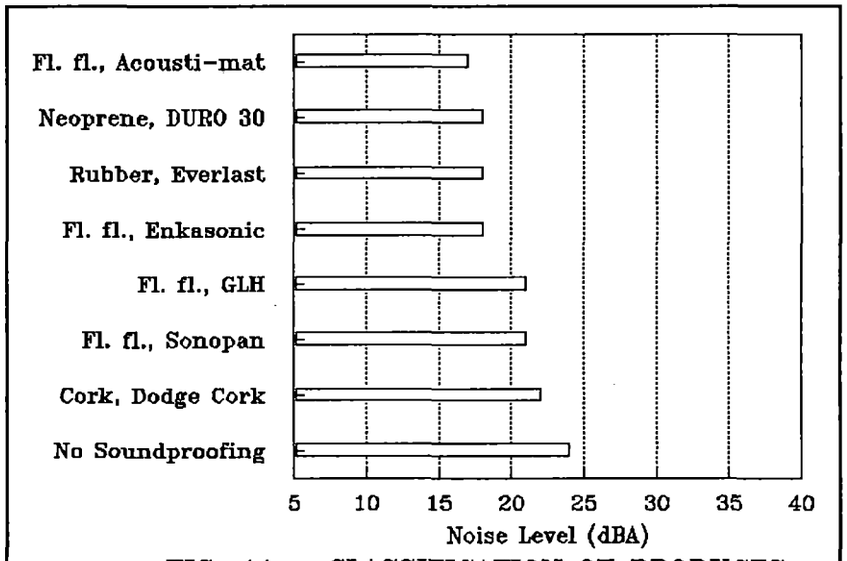


FIG. 11 – CLASSIFICATION OF PRODUCTS TESTED WITH THE DISHWASHER (LATERAL TRANSMISSION)

2.2.2 Sanitary Appliance (Toilet)

The classification of products tested for vertical and lateral noise transmission is shown in Figures 12 and 13.

These results are only significant for the products that gave the lowest noise reductions. In fact, for both the GLH toilet joint and all the floating floors, the noise of water running in the toilet was inaudible at the measurement points and, consequently, all these products must be considered equally effective.

The test with the toilet best illustrated the extent to which resilient products can reduce structure-borne noise transmission (noise was reduced by over 30 dBA).

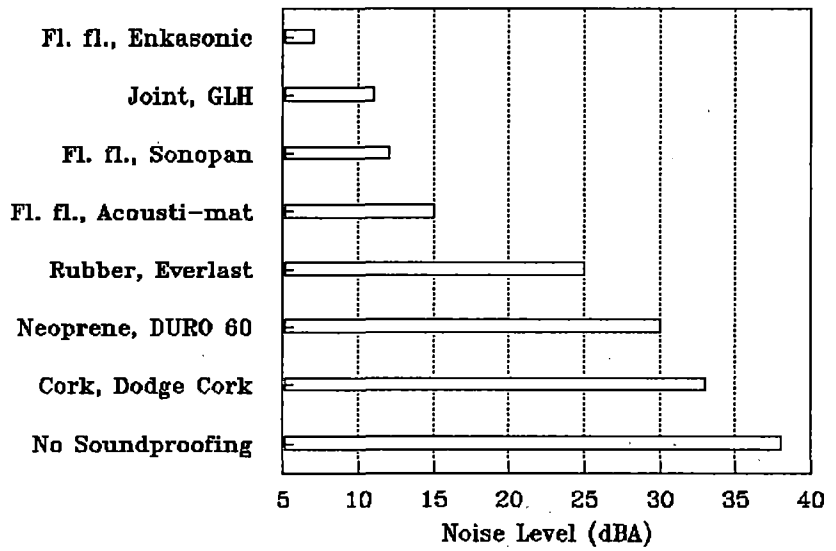


FIG. 12 – CLASSIFICATION OF PRODUCTS TESTED WITH THE TOILET (VERTICAL TRANSMISSION)

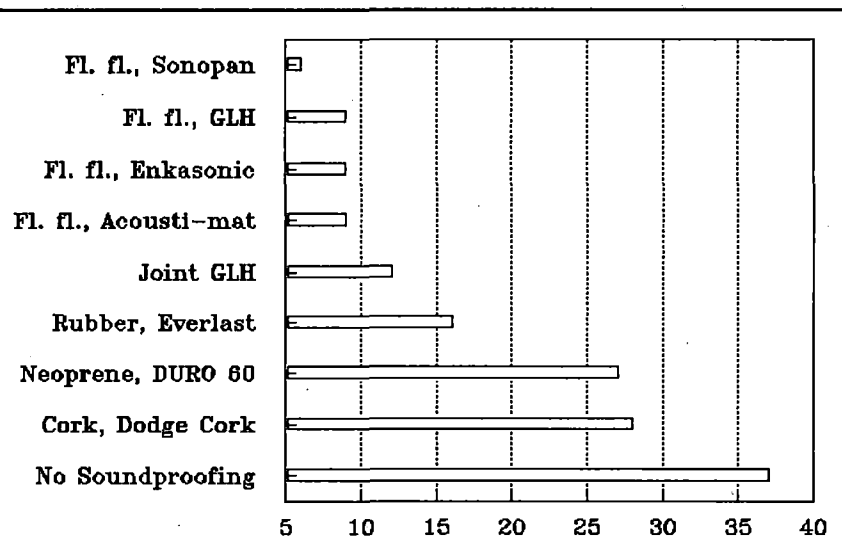


FIG. 13 – CLASSIFICATION OF PRODUCTS TESTED WITH THE TOILET (LATERAL TRANSMISSION)

CONCLUSIONS

(1) In spite of the fact that the walls and ceiling had a sound transmission class rating at least 55, the household and sanitary appliances tested were all audible in the units that were adjacent and directly below.

(2) In typical conditions, based on a National Research Council of Canada study [2], the background noise (i.e. the noise with no human activities going on) in a unit should be sufficiently loud to cover the noise produced by an household appliance operating in an adjacent unit. Moreover, this type of noise could be equivalent to that of the refrigerator in an occupied unit in normal living conditions.

(3) During the tests, the toilet was the appliance that generated the highest noise level, louder than the typical background noise. Moreover, of all sources of noise, this is probably the one that most people would find disturbing.

(4) The DURO 30, 14 mm thick neoprene pads generally worked best to reduce the transmission of vibrations to the floor and to eliminate low frequency noise. As for the toilet, the noise transmitted to adjacent units was inaudible during tests of both the GLH joint and all the floating floors.

(5) With a floor like the one used in this study, as much structural noise was transmitted to the unit directly below than to the adjacent unit.

RECOMMENDATIONS

Short-Term:

- During construction or renovation of housing units where the concrete is one of the floor elements, toilets should be installed on GLH joints or on floating floors like the ones tested in this study.

- Where a high degree of soundproofing is sought, it is recommended that the contractor place neoprene strips where household appliances are be installed.

  However, it should be noted that the plumbing noise at the beginning of the wash cycle of the washing machine (and the dishwasher) was around 38 dBA in the unit directly below, even though noise absorption was present in the wall cavity containing pipes. This noise is therefore louder than that generated by the appliances that were tested and, consequently, the pipes should be better insulated in such a situation.

Long-Term:

- Manufacturers of household and sanitary appliances should provide for the installation of pads on the appliance ground supports (or the counter in the case of the dishwasher); such pads would allow to sufficiently reduce vibrations to virtually eliminate structure-borne noise transmission.

Finally, it was demonstrated that floating floors were most effective when used with toilets, and moderately effective when used with household appliances, mainly because they produced lower-frequency noise. It is likely that floating floors tested would have a similar effect on impact noises, i.e., they would be better at reducing high-frequency than low-frequency noise. In general, this would be deemed unacceptable since footsteps, for example, would still be audible.

Therefore, new studies should be initiated to determine the composition of a floating floor that would meet residential construction imperatives (lowest possible cost, reduced height, availability of materials, ease of installation, etc.) and reduce the transmission of impact noises and, consequently, household and sanitary appliance noise.

It is recommended that the system using neoprene pads (C_1) be tested in various housing units with several types of floor/ceiling assemblies having structure-borne noise reduction capacities lower than that of the floor used in this study, including a concrete floor. The effectiveness of this system could then be measured in different real conditions and the recommendation of its general use could then be confirmed.

Martin Meunier, Engineer
Pointe-Claire

REFERENCES

1. Decibel Consultants Inc., "Research Project on Household Appliance Noise in Multi-Unit Buildings", CMHC project 6792-12, March 1992.

2. Bradley, J.S., "Acoustical Measurements in Some Canadian Homes", National Research Council of Canada, IRC Paper No. 1423.

APPENDIX I

Test Results

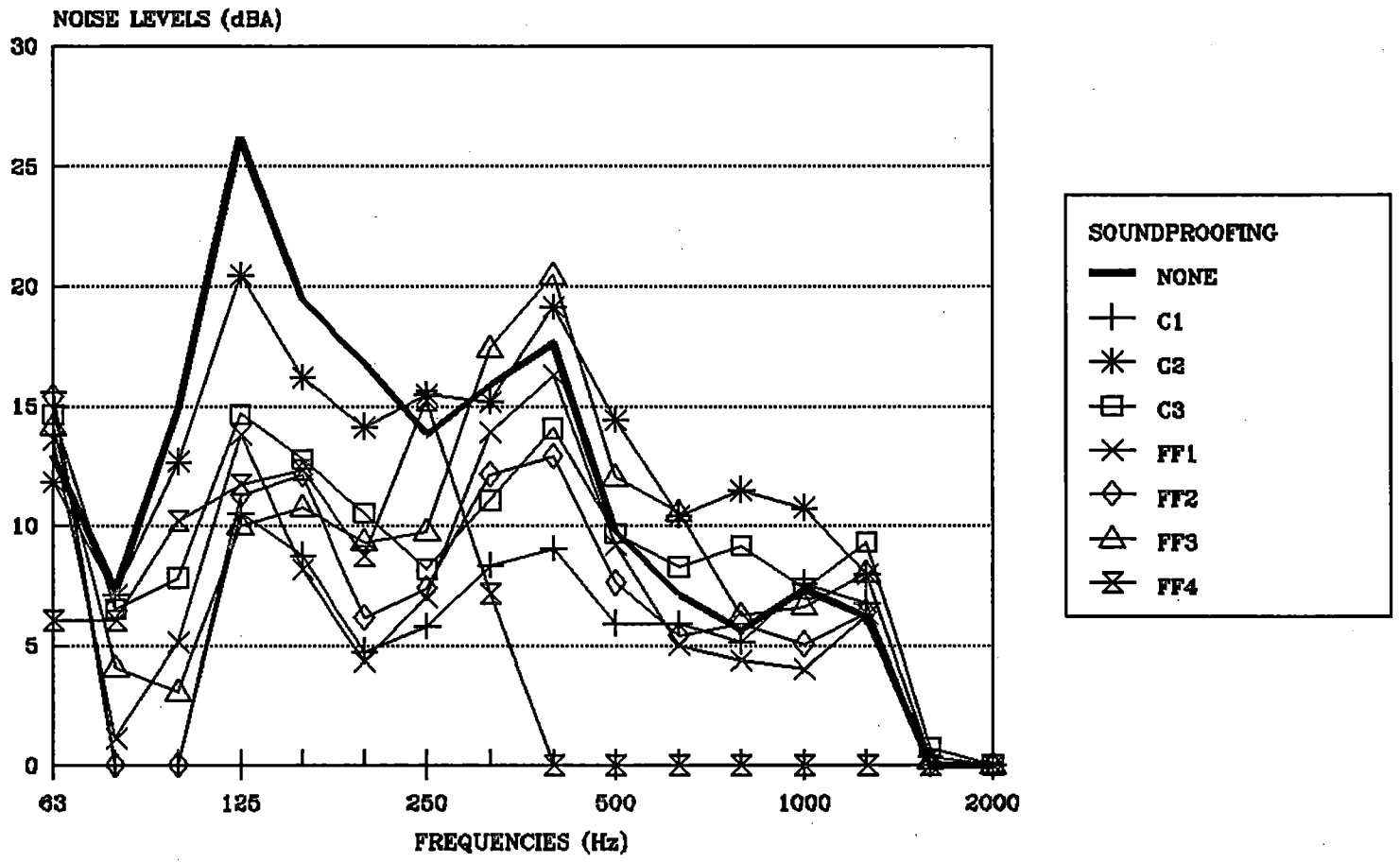


FIG. I–1 – VERTICAL TRANSMISSION
OF NOISE GENERATED BY A WASHING MACHINE

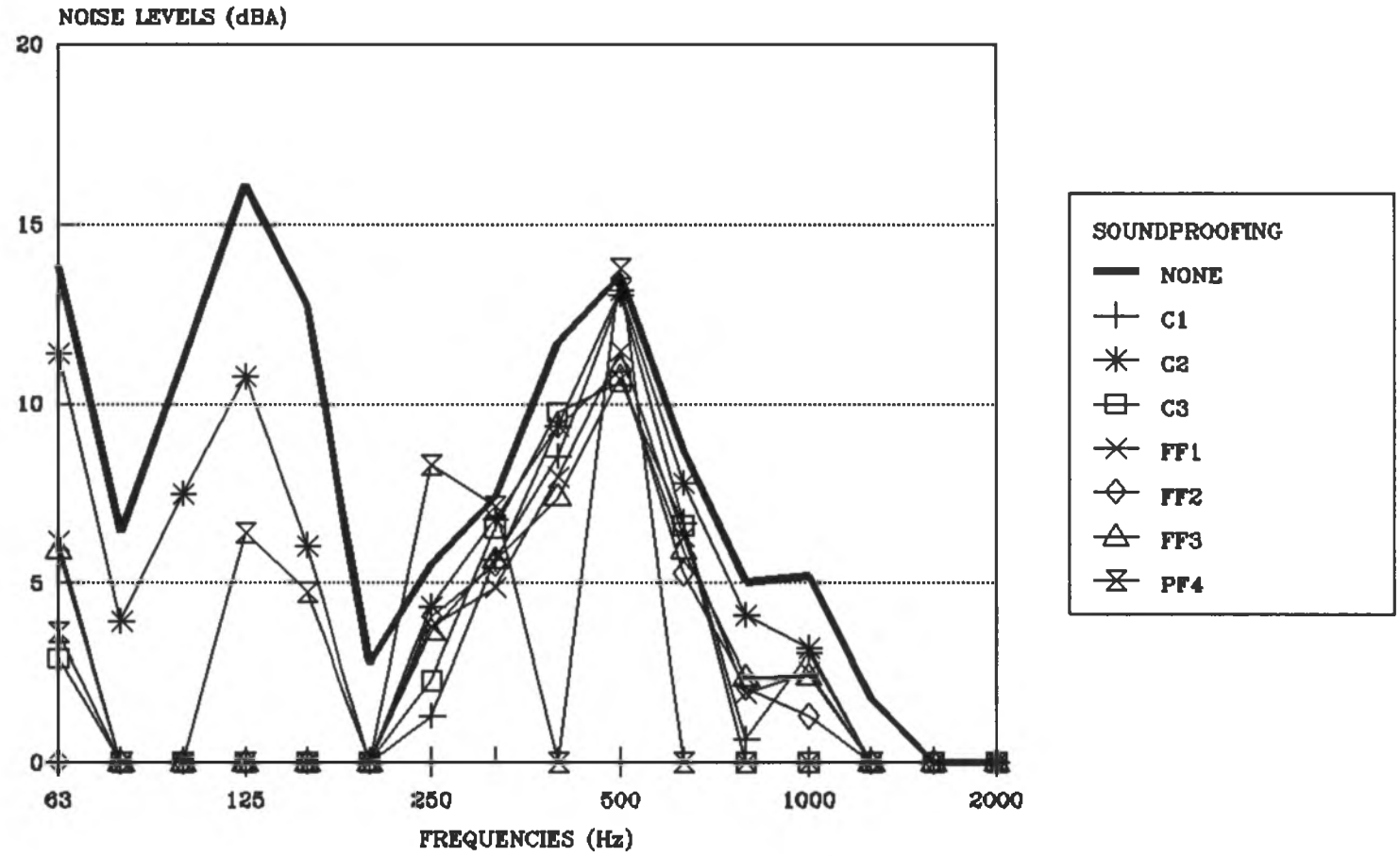


FIG. I–2 – VERTICAL TRANSMISSION OF NOISE GENERATED BY A DRYER

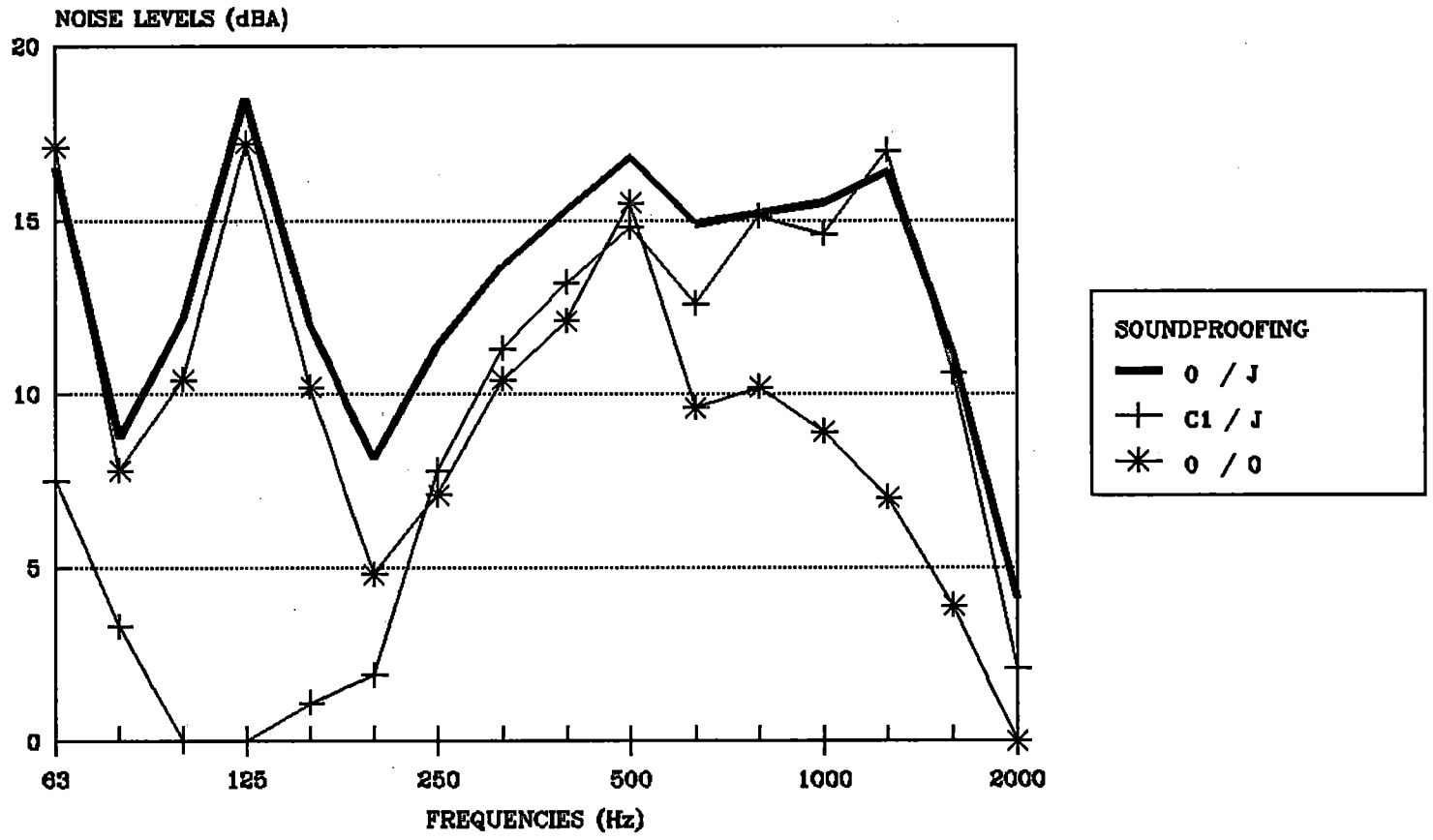


FIG. I–3 – VERTICAL TRANSMISSION OF NOISE GENERATED BY A DRYER WITH AND WITHOUT A JACKET

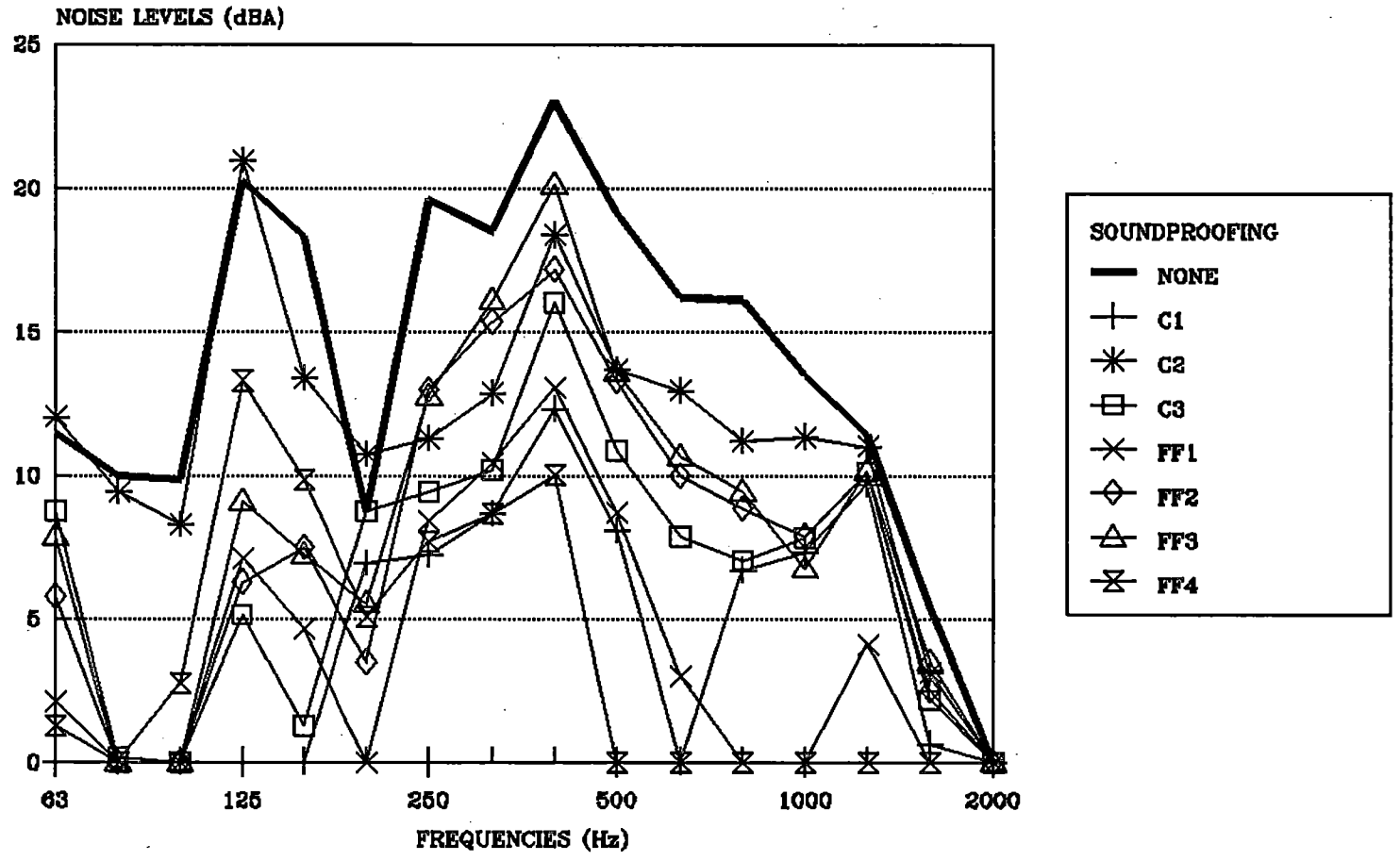


FIG. I–4 – VERTICAL TRANSMISSION
OF NOISE GENERATED BY A DISHWASHER

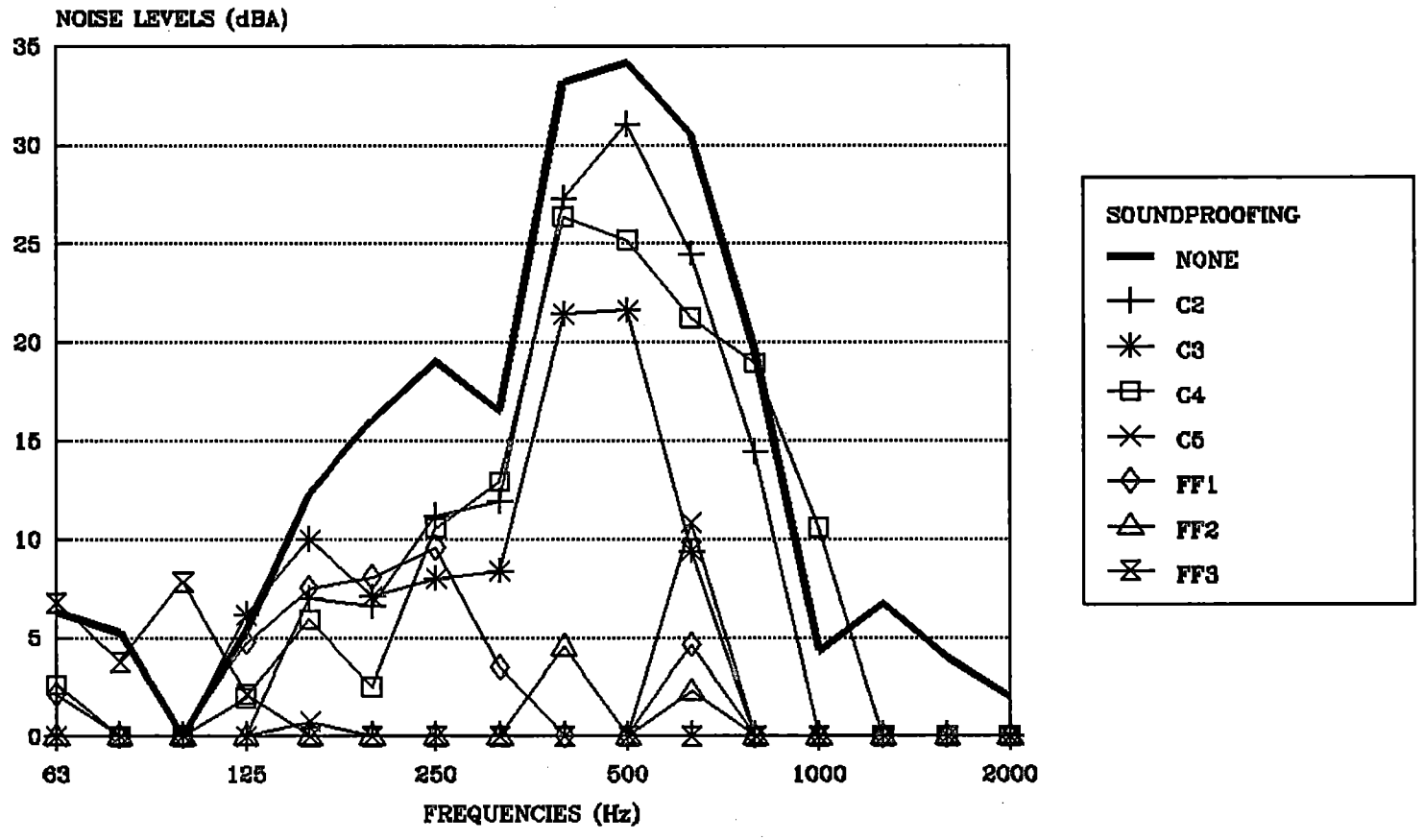


FIG. I–5 – VERTICAL TRANSMISSION OF NOISE GENERATED BY RUNNING WATER IN A TOILET

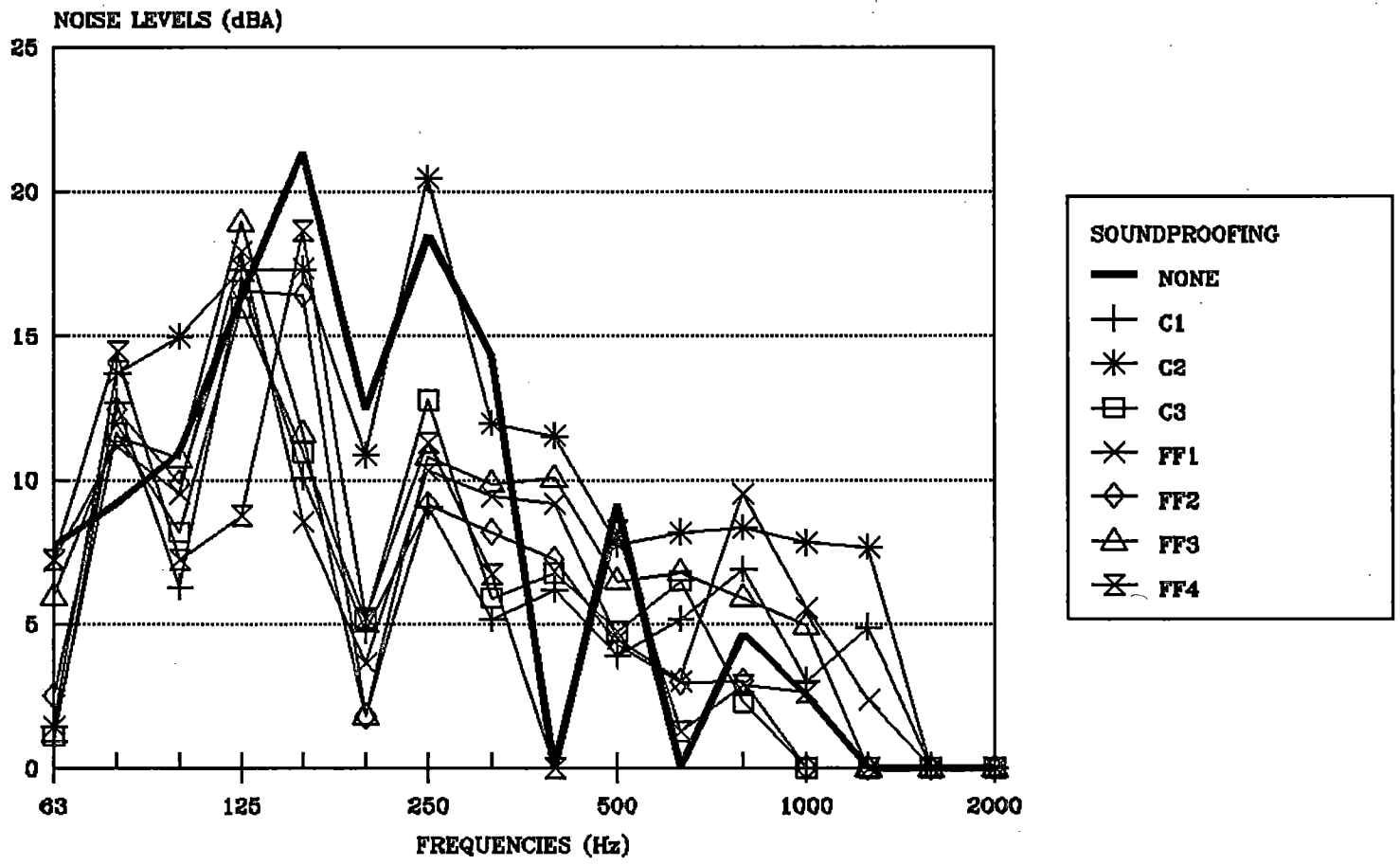


FIG. I–6 – LATERAL TRANSMISSION OF NOISE GENERATED BY A WASHING MACHINE

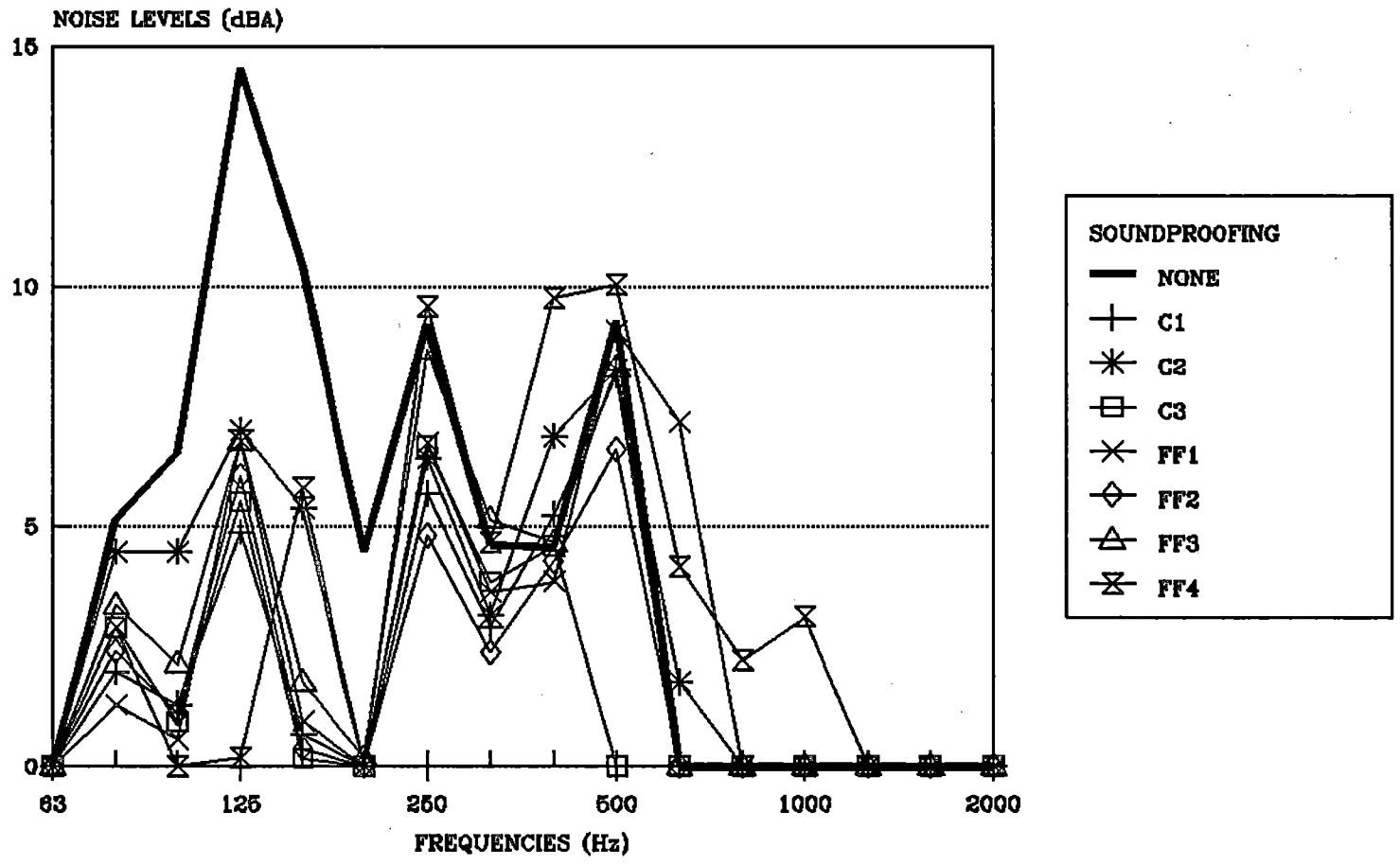


FIG. I–7 – LATERAL TRANSMISSION OF NOISE GENERATED BY A DRYER

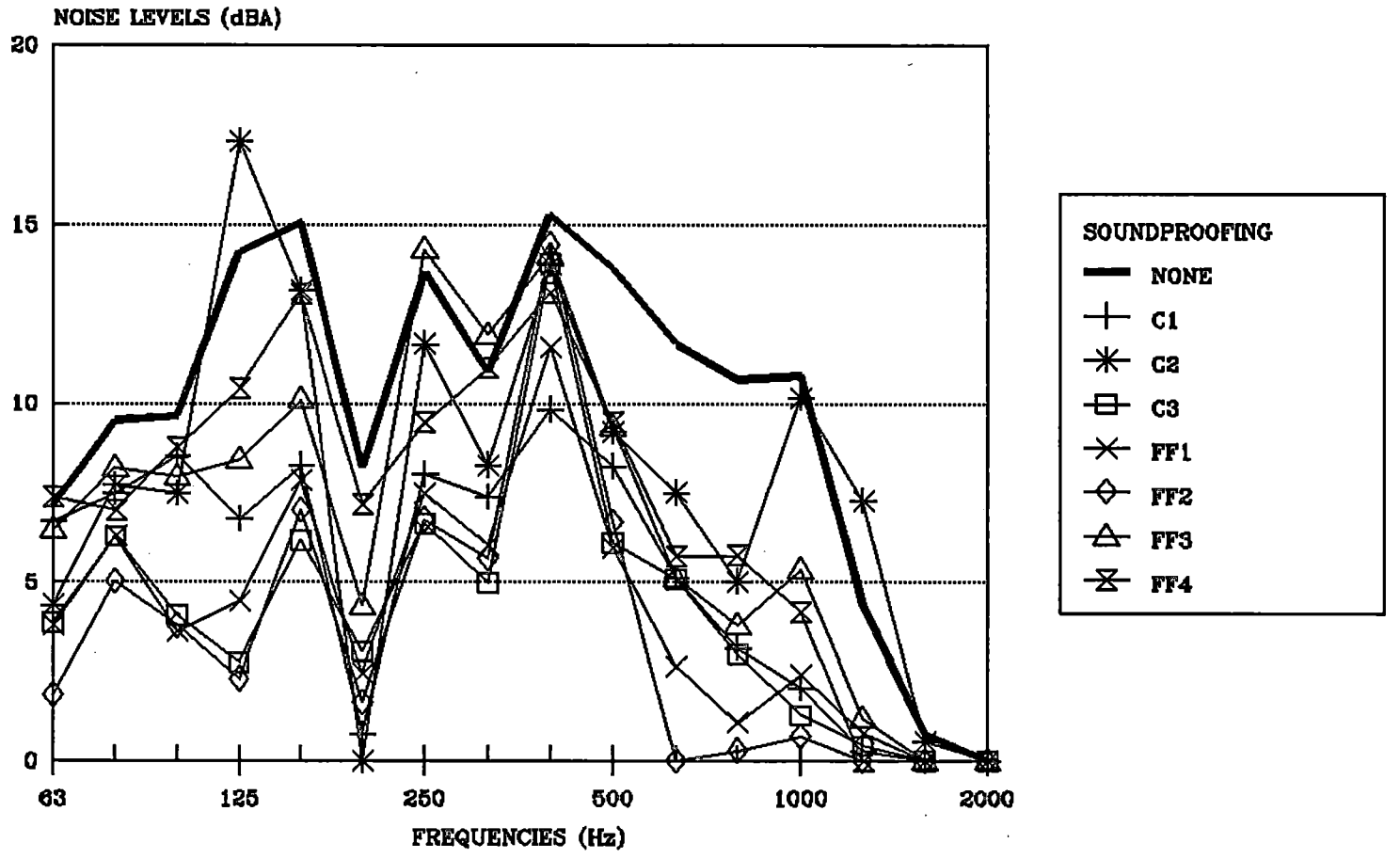


FIG. I–8 – LATERAL TRANSMISSION OF NOISE GENERATED BY A DISHWASHER

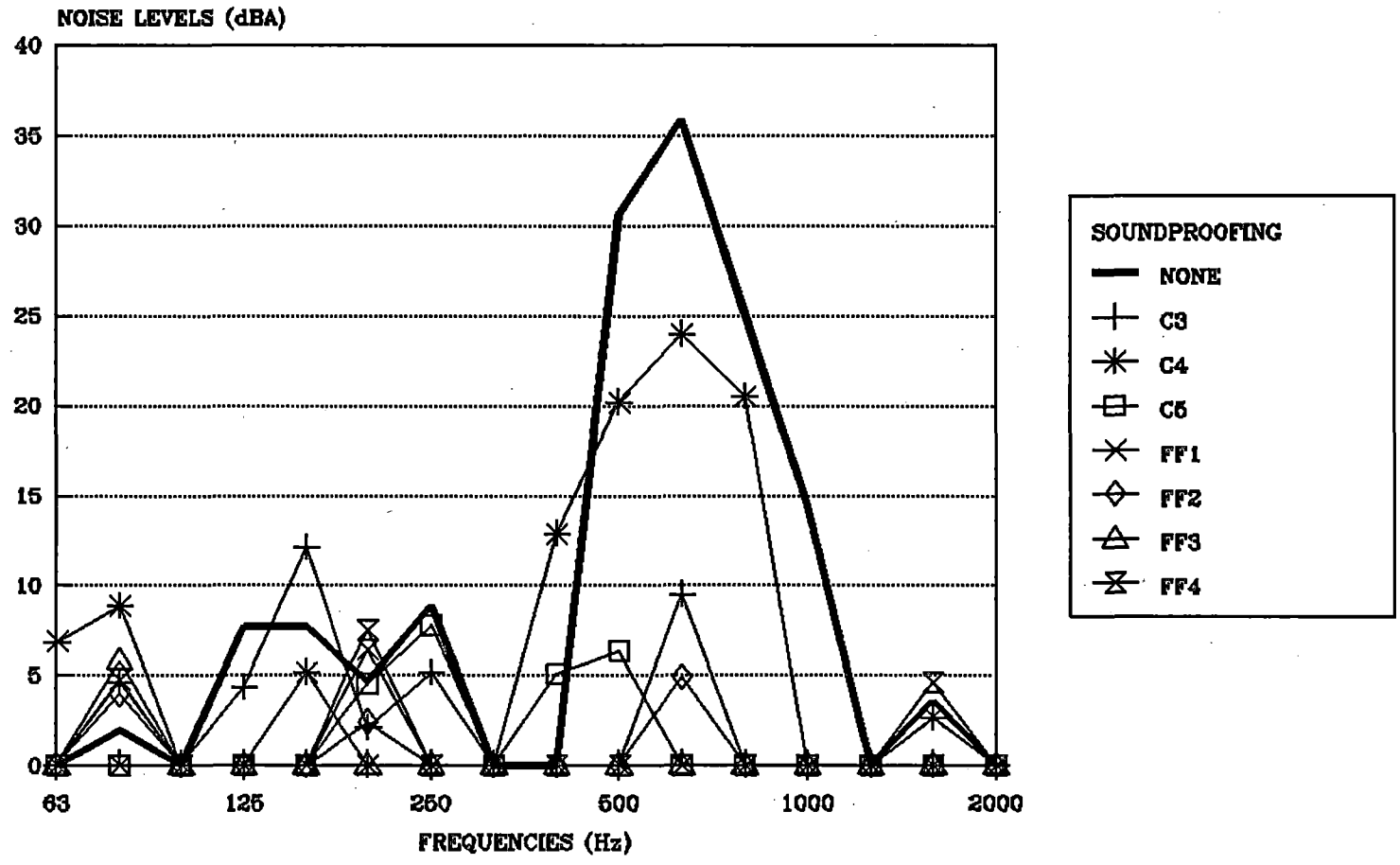


FIG. I–9 – LATERAL TRANSMISSION
GENERATED BY RUNNING WATER IN A TOILET

APPENDIX II

BROCHURES ON SOME OF THE RESILIENT PRODUCTS

LIST OF SUPPLIERS OF RESILIENT MATERIALS

C_1 : 50 mm X 50 mm neoprene waffle pads, DURO 30, 14 mm thick, installed under the appliance support points

C_4 : Ribbed neoprene pads, DURO 60, 6mm thick

RACAN INDUSTRIES Inc.
3737 Lite Blvd.
Laval, Quebec
H7E 4X8 Telephone: (514) 324-5050

C_2 : 1000 mm X 1000 mm cork flooring, Dodge Cork, 5 mm thick

C_3 : 1000 mm X 1000 mm recycled rubber flooring, Everlast, 10 mm thick

PHOENIX, Produits pour plancher et mur
(Floor and Wall Products)
6660 Côte-de-Liesse
St-Laurent, Quebec
H4T 1E3 Telephone: (514) 942-3000

FF_1 : 1000 mm X 1000 mm floating floor, Acousti-mat

FF_2 : 1000 mm X 1000 mm floating floor, Enkasonic

NOMAT
3175 Industrial Blvd.
Laval, Quebec Telephone: (514) 662-2604

FF_3 : 1000 mm X 1000 mm floating floor, Sonopan

Quincaillerie Val-Royal (Val-Royal Hardware)

FF_4 : GLH floating floor

C_5 : GLH toilet joint

INSONORISATION GLH INC.
911 Saint-Antoine
Saint-Ferréol-les-Neiges, Quebec
GOA 3R0 Telephone: (418) 826-2589

DODGE-REGUPOL
INCORPORATED

SPECIFICATION SHEET

1. PRODUCT NAME

Everlast Tile

2. MANUFACTURER

Dodge-Regupol, Inc.
P.O. Box 989
Laurel & Manor Streets
Lancaster, Pa. 17603
Tel.: (717) 295-3400
Fax: (717) 295-3414

3. PRODUCT DESCRIPTION

Basic Use: The all rubber Everlast Tile, available in a wide range of colors, is specially designed and manufactured for weight rooms, aerobic areas, health clubs/fitness centers, ice rink walkways, locker rooms and pro shop areas. Everlast is the ideal tile floor covering for areas which require resilient shock absorbing, spike resistant and anti-skid surfacing. Everlast Tile also acts as an effective buffer against acoustic vibration.

Composition of Materials: Everlast is a non-laminated, one piece floor tile consisting of polymerically bound recycled rubber mixed with colored EPDM granules or pigmented SBR rubber. The colored rubber particles are homogeneously mixed throughout the entire tile and have no chance of wearing away.

Standard Sizes: Everlast Tile is offered in 18" x 18" (2.25 sq ft.) x 1/4" or 36" x 36" (3 sq ft.) x 3/8" thickness.

Life Expectancy: Everlast Tile, if properly installed and maintained, should endure for at least 10 years.

4. TECHNICAL DATA

Weight: Approx. 1.8 lbs/sq ft. at 1/4" thickness
Approx. 2.5 lbs/sq ft. at 3/8" thickness
Density: 67 lbs/cu ft.
Shore A Hardness ASTM Test: 60 +/-5
Compression at 100 psi: 5 to 15
Recovery: 85 min.
Electric Conductivity: 1.1 x 10.2
Chemical Resistance: Unaffected by most acids and chlorine.
Abrasion Resistance: (2100 cycl.): .5150
Coefficient of Friction: .057 dry; .072 wet
Compression Endurance: 10,000 cycles with 4-9 ton load.
Acoustic Rating: Superior
Colors: Gray, Green, Red, Brown, White, Blue and Custom Blended
New York State Fire Gas Toxicity Test:
09300-900216-4006

5. PREPARATION OF SUBFLOORS

All subfloors should be thoroughly cleaned, filled, and primed. Remove paint, varnish, oil, grease, and wax. On wood floors, use a chemical paint or varnish remover. On concrete, use solution of trisodium phosphate (or xylol for rubber based paint). For oil, grease, or wax, scrub with trisodium phosphate or machine sand. In all cases, complete with thorough washing and rinsing.

Concrete floors must be made even with latex floor fill. Fill cracks with latex crack filler. If floor is new, be sure it is completely dry (several months curing is preferred). Sweep clean.

In wood floors, fill cracks with plastic wood, sand uneven boards, renail loose boards, or replace where necessary, and prime with floor size. If needed, floor may be covered with 5-ply 5/8" plywood or hardboard, or covered with latex floor fill. Single wood floors of tongue and groove construction should be completely covered with latex floor fill or hardboard or plywood, and primed with floor size.

6. INSTALLATION

After the subfloor has been properly prepared, laying the tile floor may begin.

Mark the floor into quarters with chalk and lay tile a quarter at a time. Start from center and work to borders. Follow lines of permanent fixtures. For protective edges use bevelled edging.

Spread adhesive, being Synthetic Surfaces #78H Epoxy or equal in accordance with the instructions provided with the adhesive. Please note, Synthetic Surfaces #78H Epoxy is a non-solvent adhesive and a material safety data sheet is available from the manufacturer upon request. Press the tile firmly to adhesive and butt to adjacent tile. Roll with 100 lb. roller. Remove excess adhesive. When floor is completed, roll again.

7. MAINTENANCE

Do not wash the floor for at least 5 days after installation. Otherwise, we recommend general cleaning with a damp mop and mild detergent (with or without a germicide) on a regular basis. You may choose to apply a liquid acrylic wax but test to make sure no fading or dulling of colors occurs.

Ideally we recommend Taski Sutter's program for sealing, protecting, cleaning and resurfacing of Everlast. Their range of products includes: Taski Undercover, Brilliant and Ombra as acrylic sealers, if desired, Taski Solsan, R50 or Profi for regular cleaning, and finally Taski Wiwax for alternate cleaning days. For additional information regarding this program please call: Taski, (803) 767-0540.

CAUTION

1. Avoid abrasive alkaline or cheap cleaners.
2. Keep surface free of grit, sand and cinders.
3. Protect against indentation from furniture, by using furniture rests.
4. Finished floors should not be exposed to direct sunlight or high intensity lamps as fading may occur.

ACOUSTI-MAT™
Product Specification Sheet

1 Product

Acousti-Mat™

2 Manufacturer

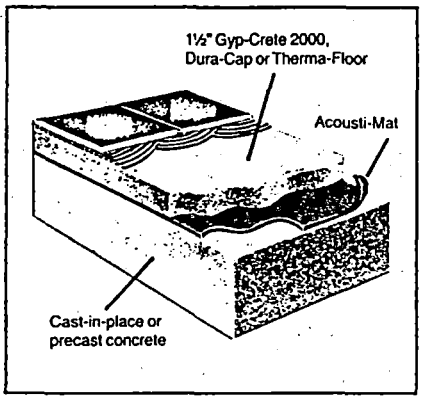
Gyp-Crete Corporation
920 Hamel Road
P.O. Box 253
Hamel, Minnesota 55340
Phone: (612) 478-6072
FAX: (612) 478-2431

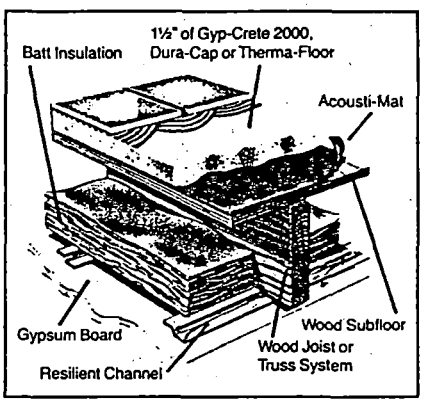
3 Description

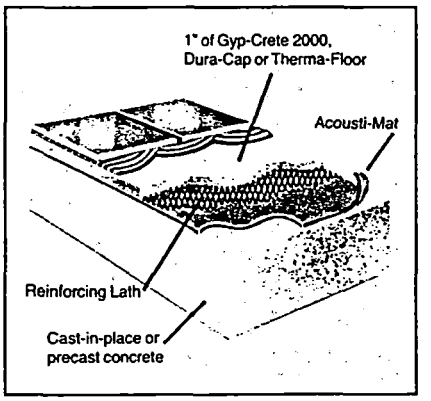
Basic Use: Acousti-Mat is a dense rubber pad that inhibits the transfer of impact noise through floor/ceiling assemblies. Acousti-Mat is installed over wood or concrete subfloors in structures that require an Impact Insulation Class (IIC) rating of not less than 50 and a Sound Transmission Class (STC) rating of not less than 50. The Acousti-Mat is covered with a high-strength Gyp-Crete Floor Underlayment which serves as the base for new floor coverings. Acousti-Mat can be used in conjunction with radiant floor heat.
Color: Blue
Packaging: 120-lb. rolls
Composition: Acousti-Mat is a complex blend of Styrene Butadiene rubber that resists deterioration and crumbling.
Limitations: (1) The structural floor should be adequate to withstand design loads with a deflection limitation of L-360. (2) Acousti-Mat should be installed after the drywall. (3) Acousti-Mat should not be installed over delaminated wood subfloors.

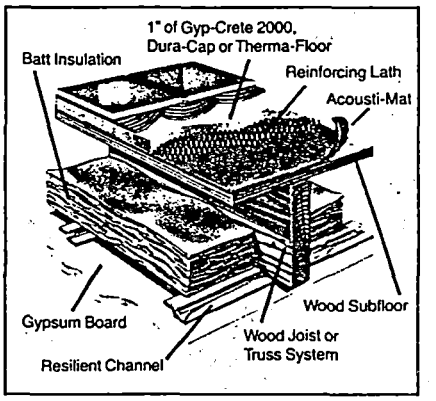
4 Physical Properties

Thickness: ¼"
Width: 54"
Length: 60'
Density: 20 lbs.per cubic foot (min.)
R-Value: 0.31









Flammability Tests: ASTM E-662 Pass (smoke chamber) ASTM E-84 Class B
Acoustical Performance: See Table 1. The sound tests F-STC (Field Sound Transmission Class) were performed in accordance with ASTM E 336 and E 413. The F-IIC (Field Impact Insulation Class) were performed in accordance with ASTM E 1007, E 989, and C 423.

5 Installation

Building interior should be enclosed and maintained at a temperature above 50°F until structure and subfloor temperatures are stabilized. Preferred wood frame construction is agency approved, ¾ inch tongue and groove veneer or nonveneer subfloors. The subfloor must be broom clean and contaminant free.

Before rolling out Acousti-Mat, the subfloor is coated with a company-approved primer.

Acousti-Mat is rolled up the walls approximately 2" to isolate sound transfer. The Acousti-Mat is taped at butt joints.

The Acousti-Mat surface is coated with a company-approved primer before the underlayment is poured.

Continuous ventilation and adequate heat should be provided to rapidly remove moisture from the area until the underlayment is dry. The general contractor must supply mechanical ventilation and heat, if necessary. Under the above conditions, 10 to 14 days are usually adequate drying time.
Testing: Compressive strength testing must be performed in accordance with modified ASTM C 472. Before independent sampling, contact the Gyp-Crete Corporation quality control department to ensure that proper procedures are followed.

ACOUSTI-MAT™
Product Specification Sheet

6 Product Support

Additional product literature and information are available upon request. Material and installation costs can be obtained from the nearest Gyp-Crete dealer. Acousti-Mat is available throughout the United States, Canada, Scandinavia, New Zealand and Australia.

7 Warranty

The Gyp-Crete Corporation guarantees that Acousti-Mat will not crumble as a result of oxidation or aging under a Gyp-Crete gypsum floor underlayment. This warranty applies only to the original installation, and only when properly installed over smooth, flat, structurally sound subfloors.

This warranty does not include any cost or expense for removal or installation of Acousti-Mat or the Gyp-Crete underlayment. Gyp-Crete Corporation assumes no liability for any incidental or consequential loss, damage or expense.

Gyp-Crete underlayments are warranted to be free from manufacturing defects. Manufacturing defects are considered to be those defects that occur due to the quality of the ingredients or from the manufacturing process itself. For complete warranty information, see your Gyp-Crete products dealer.

8 Technical Services

Technical performance verification and acoustical consulting services are available through official testing laboratories. Write for further information.

Underlayment Compressive Strengths

Gyp-Crete 2000	Dura-Cap	Therma-Floor
Typical range of 1,600 to 2,000 psi for the 1.8 mix design.	Typical range of 1,900 to 2,500 psi for the 1.8 mix design.	Typical range of 1,600 to 2,000 psi for the 1.8 mix design.
Typical range of 2,000 to 2,500 psi for the 1.4 mix design.	Typical range of 2,500 to 3,000 psi for the 1.4 mix design.	Typical range of 2,000 to 2,500 psi for the 1.4 mix design.

Sound Tests. (Table 1)

Type of Subfloor	¼" Acousti-Mat	Under-layment	Batt Insula-tion	Ceiling Suspended on Channel	Floor Covering	Ceiling Drywall	Rating	Test Number
Wood Joist with ¾" OSB Subfloor, 2" x 10" Joists	Yes	1½" Gyp-Crete 2000®	3½"	Yes	Vinyl	⅝"	56-FIIC	4143-90-0156.6
Wood Joist with ¾" OSB Subfloor, 2" x 10" Joists	Yes	1½" Gyp-Crete 2000	3½"	Yes	None	⅝"	56-FSTC	4143-90-0156.8
6" Cast-in-Place Concrete	No	None	None	None	None	None	36 F-IIC	4143-90-0420.4
6" Cast-in-Place Concrete	Yes	1½" Gyp-Crete 2000	None	None	Ceramic Tile	None	54 F-IIC	4143-90-0420.1
6" Cast-in-Place Concrete	Yes	1" Gyp-Crete 2000 rein-forced with metal lath	None	None	Ceramic Tile	None	55 F-IIC	4143-90-0420.3
6" Cast-in-Place Concrete	Yes	1½" Gyp-Crete 2000	None	None	Vinyl	None	59 F-IIC	4143-90-0420.2

F-IIC (Field Impact Insulation Class) sound tests were performed in accordance with ASTM E-1007 and E-989. F-STC (Field Sound Transmission Class) sound tests were performed in accordance with ASTM E-336 and E-413. Actual tests are available upon request. Gyp-Crete Underlayments and Acousti-Mat are but two components of an effective sound control system. No sound control system is better than its weakest component. Care must be taken in the installation of components of construction to assure the ultimate designed acoustical performance.

ACOUSTI-MAT™

Gyp-Crete Corporation
920 Hamel Road
P.O. Box 253
Hamel, Minnesota 55340
Phone: (612) 478-6072
Fax: (612) 478-2431

For more information contact:

9/90 2211

ENKASONIC®
Sound Control Matting

SPECIFICATIONS

Description

ENKASONIC sound control matting is a composite of extruded nylon filaments forming a three-dimensional geomatrix that has a nonwoven fabric heat bonded to its upper surface. The durable yet pliable construction of ENKASONIC obstructs sound transmission by its ability to convert and store vibrational energy.

Recommended Use

For sound-rated floors requiring an Impact Insulation Class (IIC) rating of not less than 50 and a Sound Transmission Class (STC) rating of not less than 50 when used with recommended floor systems. The STC ratings are determined by ASTM Standards E90 or E336 and E413. The IIC ratings are determined by ASTM Standard E492.

Nominal Dimensions and Weights

	Type 9110
Material	Nylon 6
Width	39 (plus 3 in. overlap)
Length	111 ft.
Area	360 ft²
Thickness	0.4 in.
Roll Diameter	27 in.
Gross Roll Weight	58 lbs.
Total Weight	22.9 oz/yd²
Matrix Weight	19.4 oz/yd²
Fabric Weight	3.5 oz/yd²

Deflection

Deflection characteristics of the most pliable of the CTI approved ENKASONIC Sound-Rated Floor Systems; Case #5—ENKASONIC overlain by Wonder-Board®.

Pressure (psf)	Deflection (In.)
100	0.028
200	0.046
300	0.061
400	0.075
500	0.087
1000	0.131
2000	0.189
4000	0.256

Flammability

Fuel Contribution	0	ASTM E-84
Smoke Density	NFPA Class A	ASTM E-84
Flame Spread	NFPA Class A	ASTM E-84

Standards

Tile Council of America Inc. RF900-89
New York City Dept. of Buildings MEA 144-89-M
Ceramic Tile Institute CTI-R 4-113-79
ICBO Report 4778

AKZO

Akzo Industrial
Systems Company
P.O. Box 7249
Asheville, NC 28802
Telephone (704) 665-5050
Telefax (704) 665-5009

FICHE 1

PLANCHER ACOUSTIQUE
(brevet en instance)

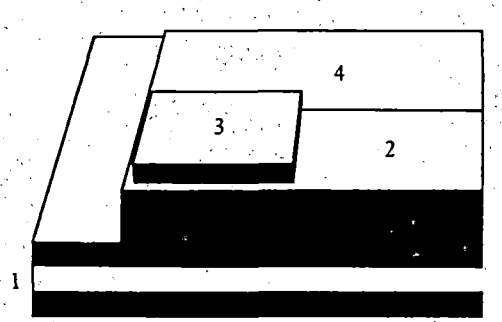
Un des problèmes majeurs dans l'insonorisation du bâtiment est, sans doute, l'isolation sonore des bruits de chocs : bruits de pas, de chaises, chocs de panneaux d'armoire, claquement des portes, etc. Aussi, est-il difficile de respecter la norme FIIC 65 en utilisant des matériaux de finition de plancher comme le bois dur, la marqueterie, le marbre, la céramique, le linoléum.

Insonorisation GLH inc. a développé, après plusieurs années de recherches en laboratoire et d'essais sur le chantier, un nouveau plancher acoustique qui permet de dépasser cette norme FIIC 65. Composé et assemblé en usine, ce nouveau plancher acoustique comprend :

- un panneau composite bois-gypse;
- des lattes de bois;
- des pastilles résilientes spéciales qui assurent l'isolation vibratoire;
- un matelas absorbant.

Plusieurs principes d'isolation sonore sont en action dans cette composition originale. Le dépassement de la norme FIIC 65 est garanti lorsque le montage est conforme aux instructions. **Insonorisation GLH inc.** peut s'occuper de son installation ou former votre équipe d'installateurs.

Ce nouveau plancher acoustique a été choisi et installé par les promoteurs des copropriétés de la Cité Bellevue (Québec), lauréats du prix Nobilis 1989, notamment pour la meilleure insonorisation (cuisine et salle d'eau surélevées sur plancher acoustique).

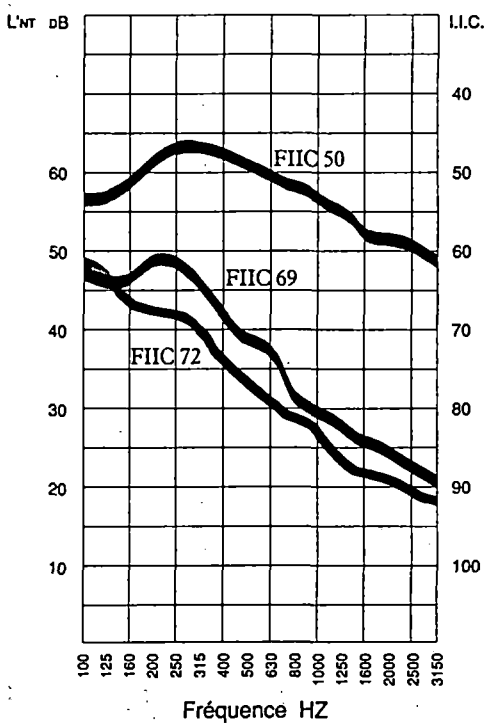


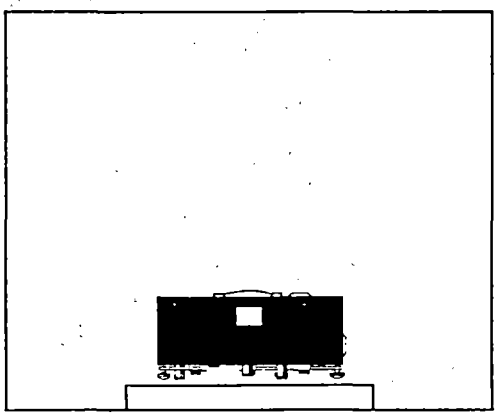
1 un panneau composite bois-gypse
2 lattes de bois
3 pastilles résilientes spéciales qui assurent l'isolation vibratoire
4 un matelas absorbant

Insonorisation GLH inc.
911, Saint-Antoine
Saint-Ferréol-les-Neiges
Québec
G0A 3R0
(418) 826-2589

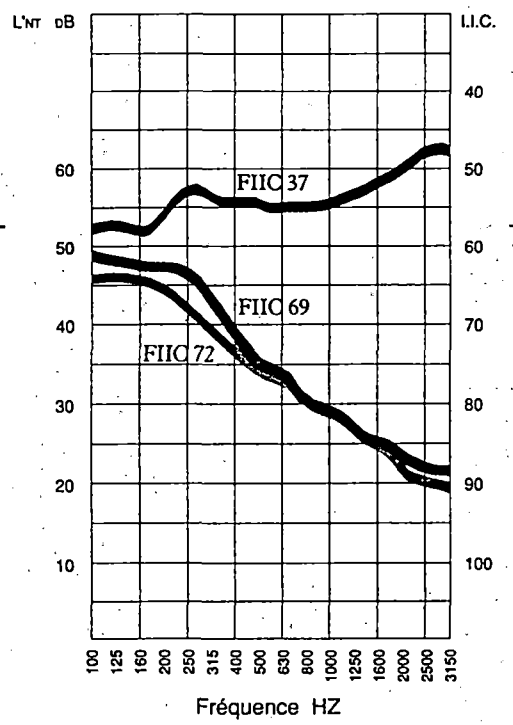
ISOLATION ACOUSTIQUE STANDARDISÉE AUX BRUITS DE CHOCS

↔	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	HZ
FIIC 50	56	56	58	61	63	63	62	61	59	58	56	55	52	52	51	49	dB
FIIC 69	48	47	47	50	50	47	43	40	39	33	31	29	27	26	24	22	dB
FIIC 72	48	48	44	43	43	42	37	35	33	30	29	26	23	23	21	20	dB





dalle de béton



↕	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	HZ
FIIC 37	54	54	53	56	59	57	57	56	56	56	57	58	59	61	64	63	dB
FIIC 69	50	49	48	48	47	43	39	36	35	31	30	27	26	24	23	22	dB
FIIC 72	47	47	46	45	43	41	38	36	34	31	30	27	26	23	22	21	dB

FIIC 37
FIIC 50 : dalle de béton (seule)
FIIC 69 : marqueterie
FIIC 72 : céramique

FICHE 4

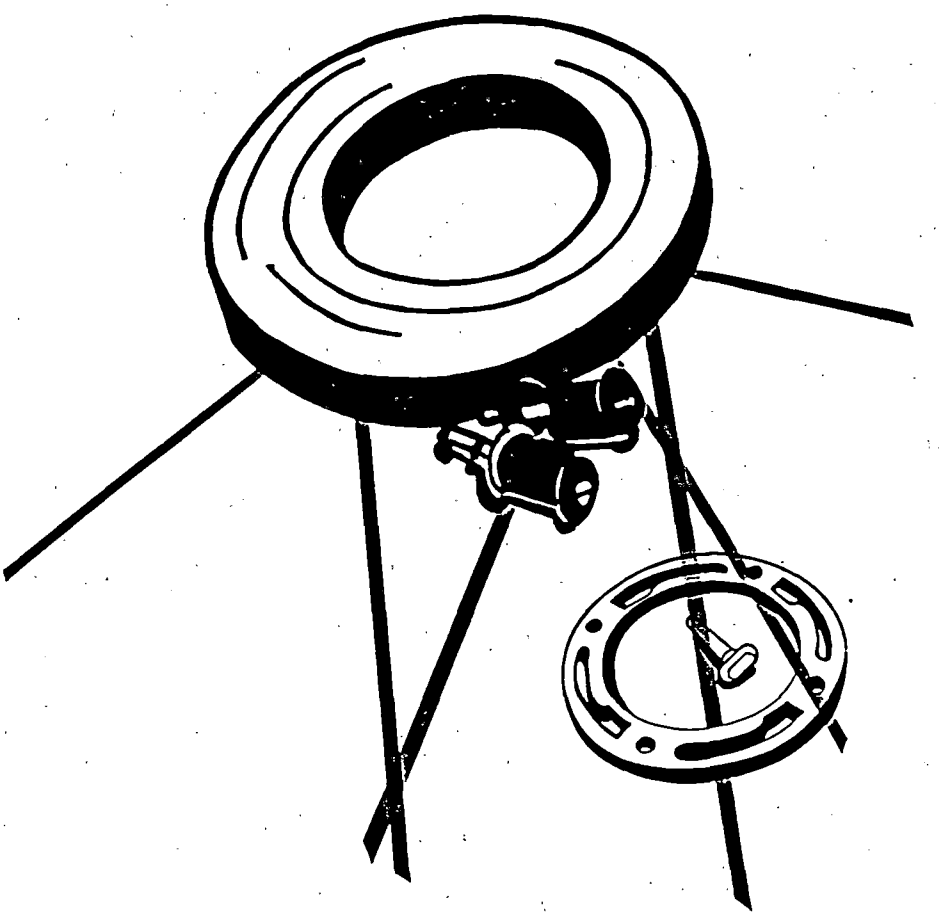
PRÊT-À-MONTER POUR L'INSONORISATION DE LA CUVETTE DES CABINETS

(brevet en instance)

Un des problèmes acoustiques les plus fréquents dans l'habitation est, sans contredit, le bruit transmis lors de l'utilisation des cabinets ou toilettes, plus particulièrement celui émanant de la cuvette. Le bruit est transmis par la dalle de béton aux surfaces voisines qui, en vibrant, regénèrent et amplifient ce bruit quelque peu ennuyeux, sinon agaçant.

Après plusieurs recherches et essais en laboratoire, **Insonorisation GLH inc.** a trouvé une solution pour isoler ce bruit. Offert sous forme de prêt-à-monter, l'ensemble comprend une bande résiliente autocollante et deux attaches flexibles s'adaptant à la forme et aux caractéristiques de la cuvette.

D'installation facile, l'ensemble assure la discrétion souhaitée en éliminant le bruit à la source...



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