DELTA

TEST REPORT

DANAK

Reg. no. 116

COPY

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DANAK 2073

Laboratory measurement of airborne sound insulation for a pipe penetration with a steel pipe sealed with RISE Pipe Sealing System

Client: CSD International BV - Beele Engineering BV

6 December 2000

DELTA

Title
Laboratory measurement of airborne sound insulation for a pipe penetration with a steel pipe sealed with RISE Pipe Sealing System

Report	*J.no.*	*Our ref.*	*Date of test*
DANAK 2073	K 872089	ECM-DBP/lan	31 October 2000

Client
CSD International BV - Beele Engineering BV
Beunkdijk 11
NL-7122 NZ Aalten
The Netherlands

Client ref.
Hans Beele

Test conditions

Laboratory:	EN ISO 140-1:1997
Measuring method:	EN 20140-10:1992
Evaluation:	EN ISO 717-1:1996

Results
Airborne sound insulation measured in the laboratory, weighted element-normalized level difference according to EN ISO 717-1:1996:

$D_{n,e,w}$ (C; C_{tr}) = 70 (-1; -5) dB

Graph sheet no. 1 shows the element-normalized level difference for every one-third octave band together with the shifted reference curve corresponding to the measured $D_{n,e,w}$-value.

Remarks
The reference area is 10 m^2 for calculation of the element-normalized level difference $D_{n,e}$.
The results are valid for positions away from adjoining walls, floors and ceilings.

Description of the test specimen and mounting in the laboratory: See enclosures 1-4. Measuring conditions and equipment: See enclosures 5-6. The test result applies to the tested specimen only.

Aarhus, 6 December 2000
DELTA

ECM

Erik C. Miranda
M.Sc.
Acoustics & Vibration

DBP

Dan Brøsted Pedersen
M.Sc.
Acoustics & Vibration

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Reg. no. 116

GRAPH SHEET 1
DANAK 2073
K 872089

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Laboratory measurement of element-normalized level difference according to EN 20140-10:1992

Client: CSD International BV - Beele Engineering BV, Beunkdijk 11, NL-7122 NZ Aalten, The Netherlands

Date of test: 31 October 2000

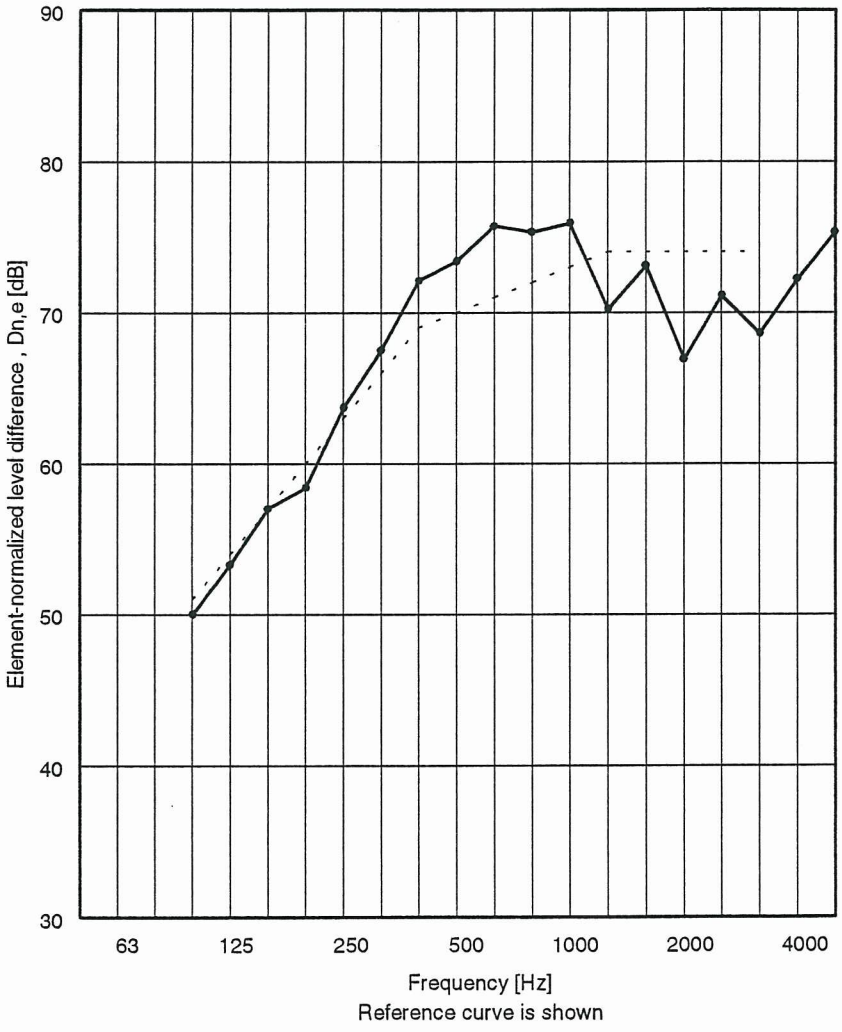
Description of the test specimen: Pipe penetration with a steel pipe sealed with RISE Pipe Sealing System. (The construction of the test object and the mounting in the laboratory are described in enclosures 1-4.)

Test specimen mounted by: The client and DELTA

Air temperature: 21°C
Air humidity: 54% RH
Source room volume: 117.7 m³
Receiving room volume: 64.8 m³

Frequency f [Hz]	$D_{n,e}$ One-third octave [dB]
100	50.0 *)
125	53.3 *)
160	57.0 *)
200	58.4 *)
250	63.7 *)
315	67.5 *)
400	72.1 *)
500	73.4 *)
630	75.7 *)
800	75.3 *)
1000	75.9 *)
1250	70.2
1600	73.1
2000	66.9
2500	71.1
3150	68.6
4000	72.2
5000	75.3

*) See enclosure 5



Reference curve is shown

Weighted element-normalized level difference according to EN ISO 717-1:1996:

$D_{n,e,w}$ (C; C_{tr}) = 70 (-1; -5) dB

Evaluation based on laboratory measurement results obtained by an engineering method: EN 20140-10:1992.

DELTA, 6 December 2000

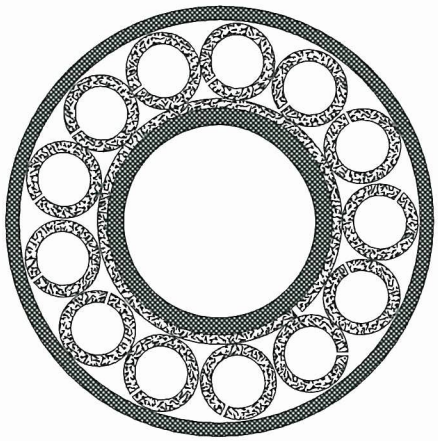
Dan Brøsted Pedersen, Acoustics & Vibration DBP

Description of the test specimen

The test object was a pipe penetration with a steel pipe of approx. 3.2 m sealed with RISE Pipe Sealing System. The length and diameter of the pipe penetration was 160 mm and 107 mm, respectively. The RISE Pipe Sealing System consists of FRR/LEHF vinyl acetate insert sleeves, FRR/LEHF rubber filler sleeves and 1-compound silicone sealant type FIWA.

An insert sleeve (190 mm x 60 mm x 5 mm) was wrapped around the pipe and 13 filler sleeves type 20/14 with a length of 120 mm were placed in the penetration. See section below. The 20 mm free space at each end of the penetration was sealed with FIWA silicone.

The steel pipe was made of three pipe sections (diameter 60.3 mm) which were all provided with flanges at both ends. A pipe section was bent 90 degrees on each side of the measurement opening. The flanges were held together by four studs around a rubber gasket. The ends of the steel pipe were fastened to a flag by means of four screws, and between flange and flag a rubber gasket was mounted for sealing. The flags were placed on a mineral wool plate. The wall thickness of the steel pipe was 3.5 mm.

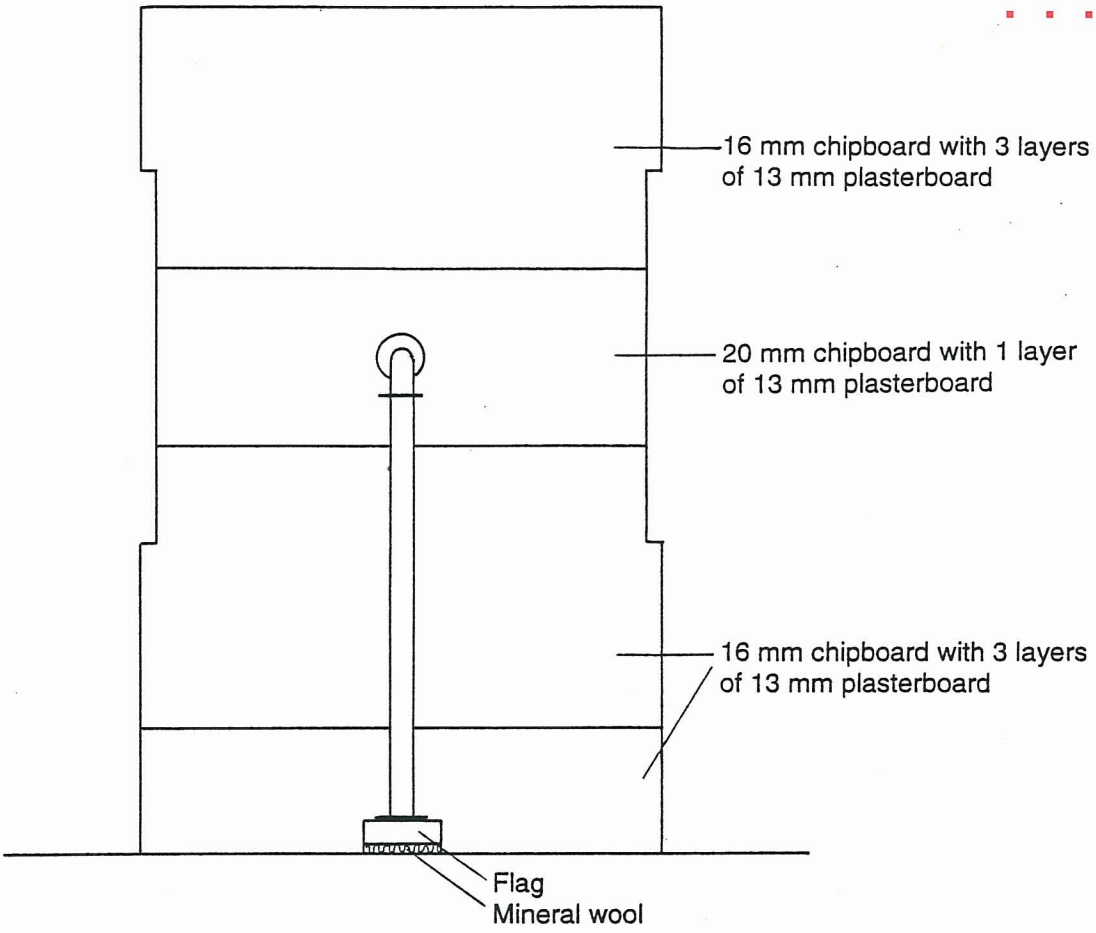


Mounting in the laboratory

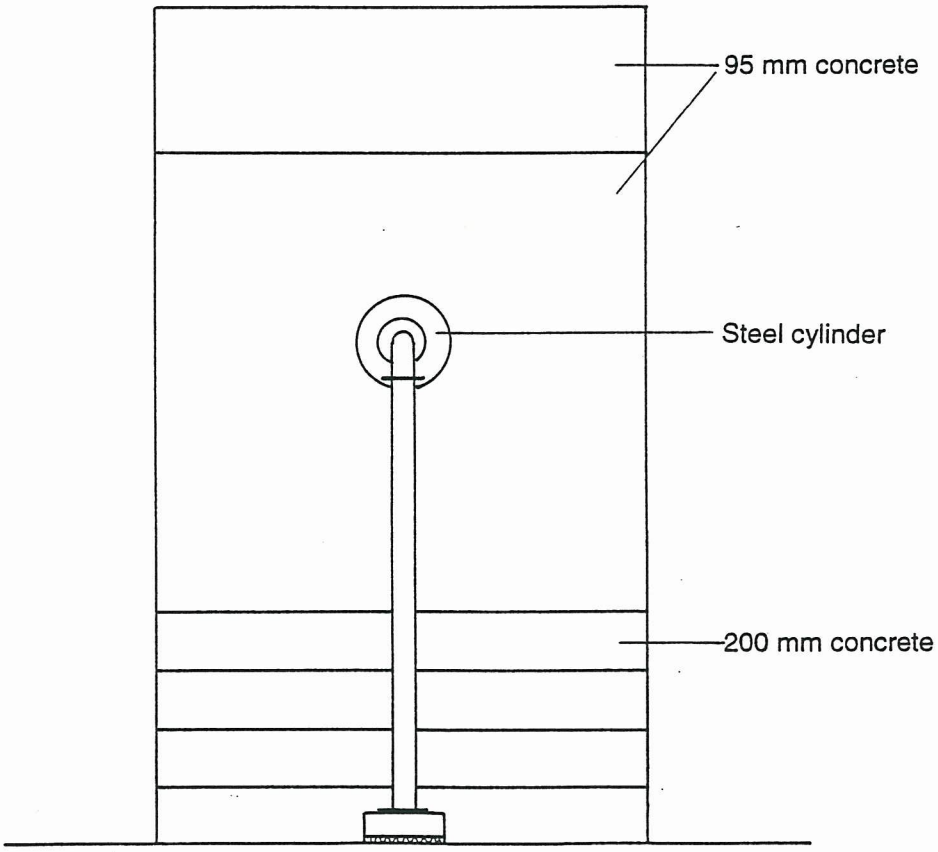
The test opening of the laboratory was adapted with a concrete construction with a steel adapter on the source room side and a plasterboard and chipboard construction on the receiver room side. The joints between the adapters and the test opening were sealed with putty. The cavity between concrete and the lightweight construction was partly filled with mineral wool. In the adaptation construction a steel pipe (length 160 mm and inner diameter of 107 mm) was fastened for pipe penetration, in which the test object was mounted. Putty was used for sealing around the steel pipe from both the source room and receiver room side. Mounting was carried out by DELTA.

Enclosures 2-4 show elevation and sectional drawings of the test object mounted in the laboratory; they have been prepared by DELTA.

Elevation receiving room, 1:20



Elevation source room, 1:20



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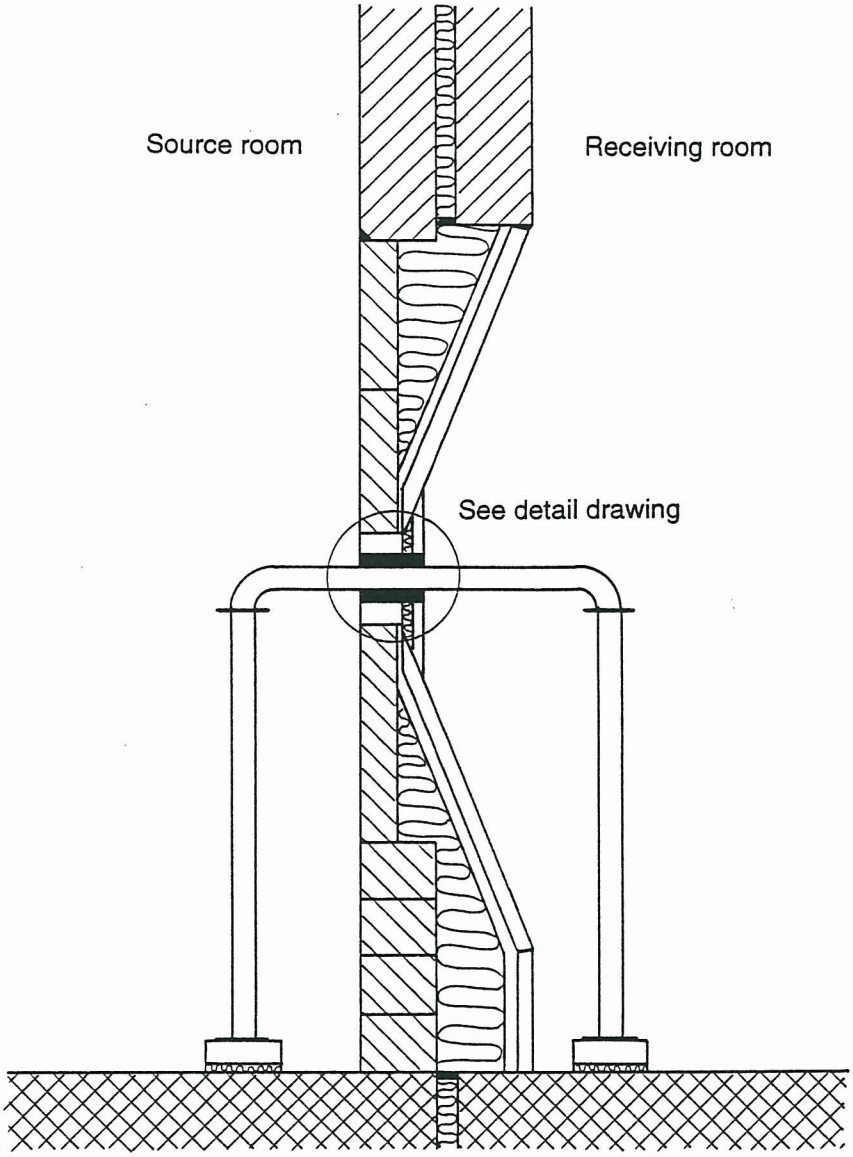
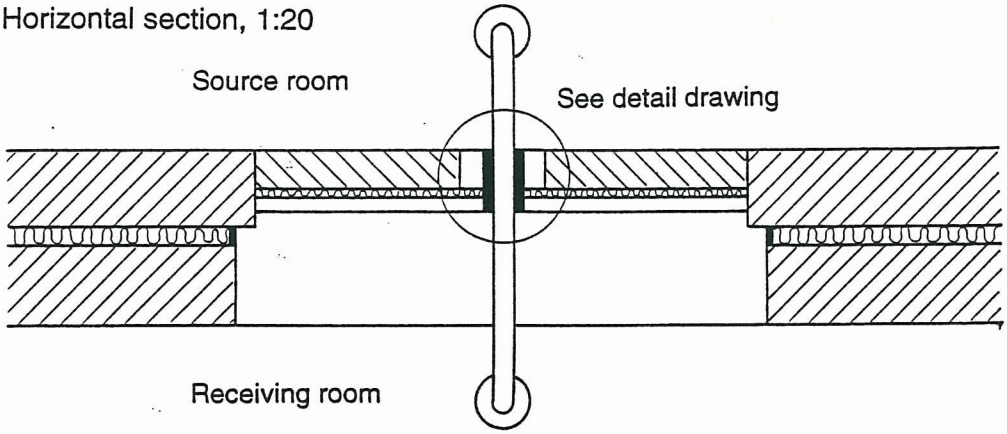
Vertical section, 1:20



Horizontal section, 1:20



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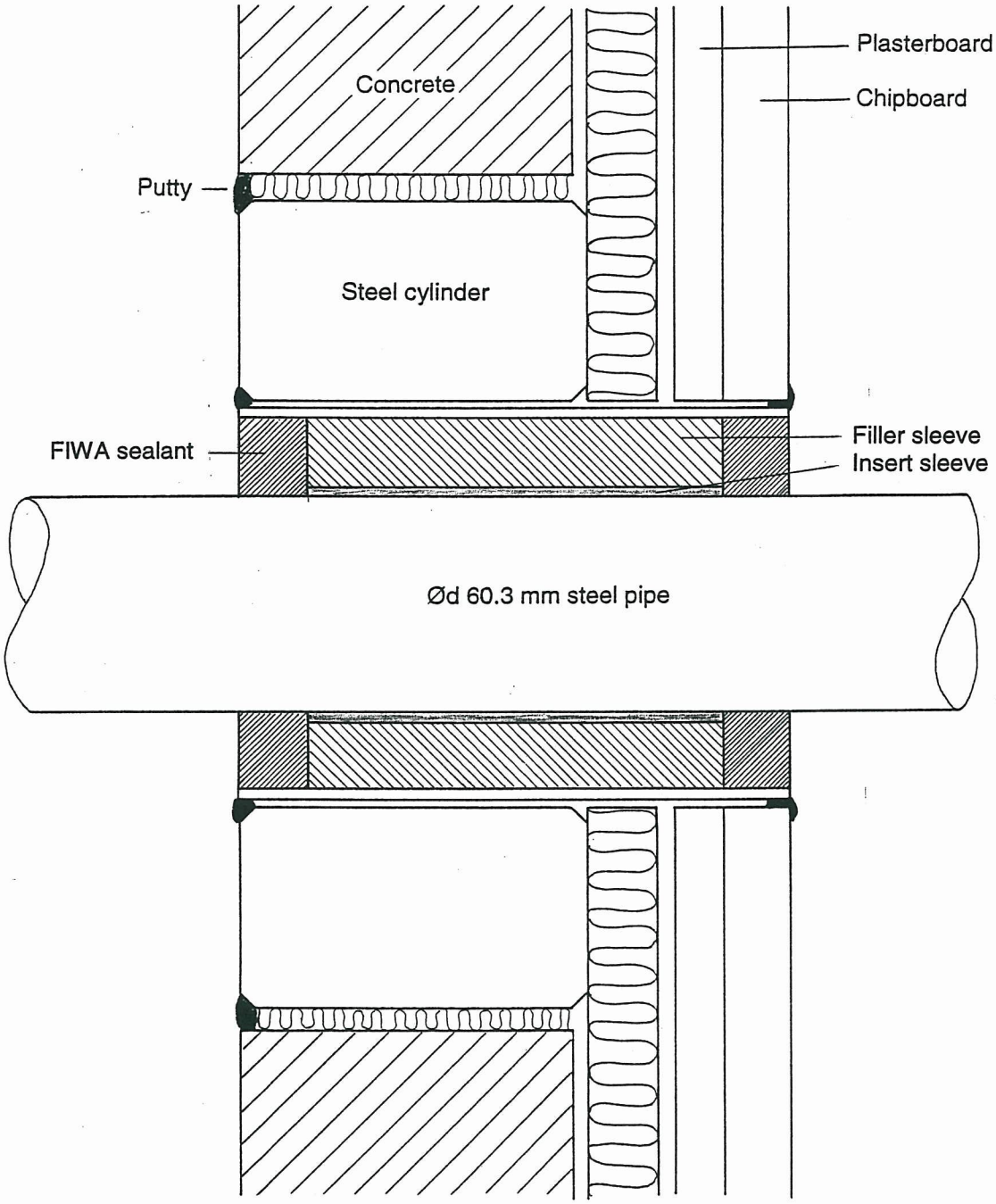
Detail drawing, 1:2



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Measuring conditions and equipment

Source room:	Volume = 117.7 m^3 7 diffusing elements, 1.0 m x 1.2 m Reverberation time ≤ 1.4 s
Receiving room:	Volume = 64.8 m^3 5 diffusing elements, 1.0 m x 1.2 m Reverberation time ≤ 2.0 s
Depth of test opening:	0.16 m
Total partition wall area:	16.2 m^2
Loudspeaker system:	Dodecahedron loudspeaker moving along a traverse for measurements of sound pressure levels. Cycle time approximately 176 s. Open loudspeaker in one position for measurement of reverberation time.
Microphone system:	Rotating (32 s/rotation). Integration time: 352 s for measurements of sound pressure levels. The reverberation time is measured in twenty microphone positions distributed on the microphone path.
Sound signal:	Wideband pink noise
Filters:	One-third octave band filters with centre frequencies within the frequency range 100-5000 Hz

The element-normalized level differences in graph sheet no. 1 are corrected for sound transmission around the test specimen (flanking transmission). The correction value must not exceed 1.3 dB corresponding to a transmission ratio of 1:3. The correction for results marked by *) has been changed to 1,3 dB. Accordingly, these results should be regarded as minimum values. This limitation of the correction means that the weighted value, $D_{n,e,w}$, should likewise be regarded as a minimum value.

In enclosure 6 the maximum obtainable element-normalized level difference, $D_{n,e,F}$, that can be measured in the laboratory is listed together with the corrections which are included in the results in graph sheet no. 1.

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Correction for flanking transmission

Frequency [Hz]	$D_{n,e,F}$ [dB]	Correction [dB]
100	48.1	1.3
125	51.9	1.3
160	54.8	1.3
200	57.3	1.3
250	61.8	1.3
315	66.3	1.3
400	71.0	1.3
500	72.1	1.3
630	75.2	1.3
800	76.9	1.3
1000	78.9	1.3
1250	78.4	0.6
1600	79.3	0.9
2000	81.0	0.2
2500	83.9	0.2
3150	85.5	0.0
4000	85.2	0.2
5000	83.5	0.6

Measuring equipment

Instrument	Manufacturer	Type	Serial no.
Dodecahedron loudspeaker	Norsonic	229	20712
Dual channel frequency analyzer	Norsonic	RTA 840-2	18751
Power amplifier	Master	DL 1800	DLB 69670698
Equalizer	dbx	2031	-
Sound level calibrator	Brüel & Kjær	4231	1800543
Microphone, source room	Brüel & Kjær	4166	1440622
Microphone, receiving room	Brüel & Kjær	4166	1072077
Microphone preamplifier, source room	Brüel & Kjær	2669	2025403
Microphone preamplifier, receiving room	Brüel & Kjær	2619	855256
Rotating microphone boom, source room	Brüel & Kjær	3923	1213938
Rotating microphone boom, receiving room	Brüel & Kjær	3923	983339
Open loudspeaker cabinet	DELTA	-	-
Loudspeaker unit	Celestion	G12H-100	-

The equipment is checked regularly in accordance with the DANAK guidelines.

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DANAK 2071

Laboratory measurement of airborne sound insulation for a pipe penetration with a steel pipe sealed with CSD Sealing Plugs type FRR

Client: CSD International BV - Beele Engineering BV

28 November 2000

DELTA

Title
Laboratory measurement of airborne sound insulation for a pipe penetration with a steel pipe sealed with CSD Sealing Plugs type FRR

Report	*J.no.*	*Our ref.*	*Date of test*
DANAK 2071	K 872089	ECM-DBP/lan	1 November 2000

Client
CSD International BV - Beele Engineering BV
Beunkdijk 11
NL-7122 NZ Aalten
The Netherlands

Client ref.
Hans Beele

Test conditions

Laboratory:	EN ISO 140-1:1997
Measuring method:	EN 20140-10:1992
Evaluation:	EN ISO 717-1:1996

Results
Airborne sound insulation measured in the laboratory, weighted element-normalized level difference according to EN ISO 717-1:1996:

$D_{n,e,w}$ (C; C_{tr}) = 71 (-2; -6) dB

Graph sheet no. 1 shows the element-normalized level difference for every one-third octave band together with the shifted reference curve corresponding to the measured $D_{n,e,w}$-value.

Remarks
The reference area is 10 m^2 for calculation of the element-normalized level difference $D_{n,e}$.
The results are valid for positions away from adjoining walls, floors and ceilings.

Description of the test specimen and mounting in the laboratory: See enclosures 1-4. Measuring conditions and equipment: See enclosures 5-6. The test result applies to the tested specimen only.

Aarhus, 28 November 2000
DELTA

ECM

Erik C. Miranda
M.Sc.
Acoustics & Vibration

DBP

Dan Brøsted Pedersen
M.Sc.
Acoustics & Vibration

DANAK
Reg. no. 116

GRAPH SHEET 1
DANAK 2071
K 872089

DELTA

Laboratory measurement of element-normalized level difference according to EN 20140-10:1992

Client: CSD International BV - Beele Engineering BV, Beunkdijk 11, NL-7122 NZ Aalten, The Netherlands

Date of test: 1 November 2000

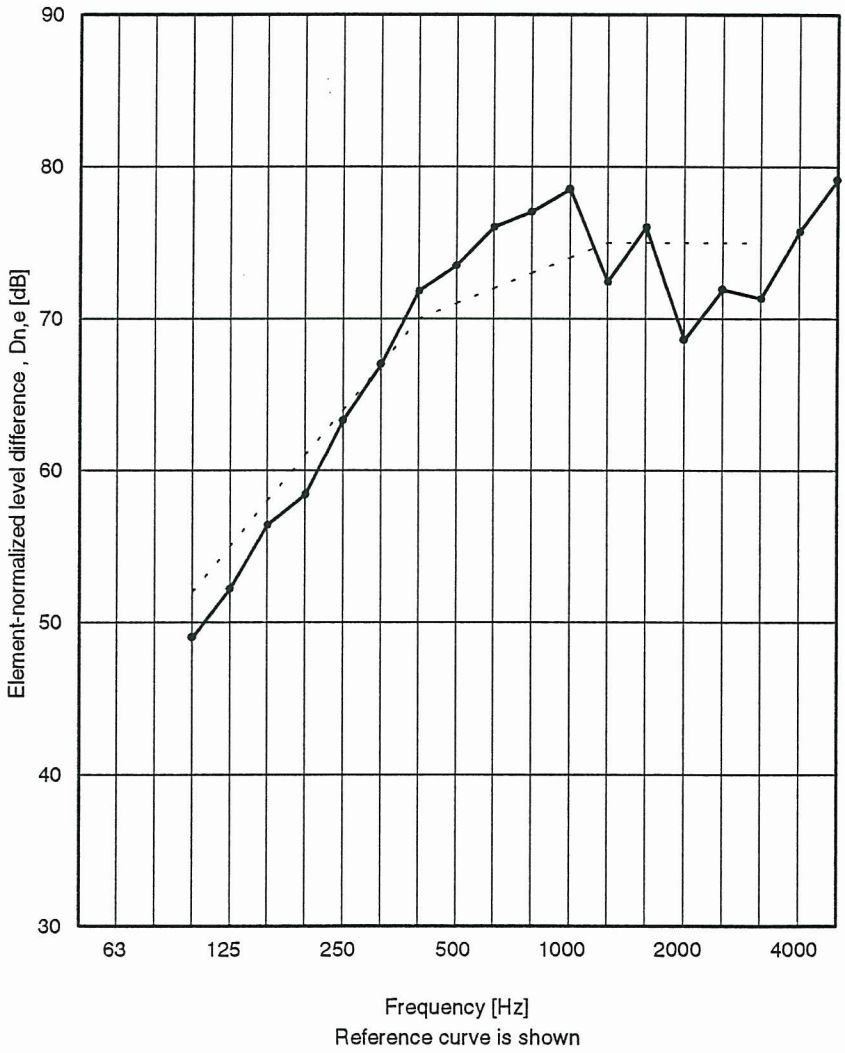
Description of the test specimen: Pipe penetration with a steel pipe sealed with CSD Sealing Plugs type FRR. (The construction of the test object and the mounting in the laboratory are described in enclosures 1-4.)

Test specimen mounted by: The client and DELTA

Air temperature: 20°C
Air humidity: 51% RH
Source room volume: 117.7 m³
Receiving room volume: 64.8 m³

Frequency f [Hz]	$D_{n,e}$ One-third octave [dB]
100	49.0 *)
125	52.2 *)
160	56.4 *)
200	58.4 *)
250	63.3 *)
315	67.0 *)
400	71.8 *)
500	73.5 *)
630	76.0 *)
800	77.0 *)
1000	78.5 *)
1250	72.4
1600	76.0 *)
2000	68.6
2500	71.9
3150	71.3
4000	75.7
5000	79.1 *)

*) See enclosure 5



Reference curve is shown

Weighted element-normalized level difference according to EN ISO 717-1:1996:

$D_{n,e,w}(C; C_{tr})$ = 71 (-2; -6) dB

Evaluation based on laboratory measurement results obtained by an engineering method: EN 20140-10:1992.

DELTA, 28 November 2000

Dan Brøsted Pedersen, Acoustics & Vibration

DBP

Description of the test specimen

The test object was a pipe penetration with a steel pipe of approx. 3.2 m mounted with two CSD Sealing Plugs type FRR. The length and diameter of the pipe penetration was 160 mm and 107, respectively. A CSD Sealing Plug type FRR consists of two neoprene segments squeezed into the pipe penetration in the wall and around the pipe. A CSD Sealing Plug type FRR was mounted in the hole from each side of the wall.

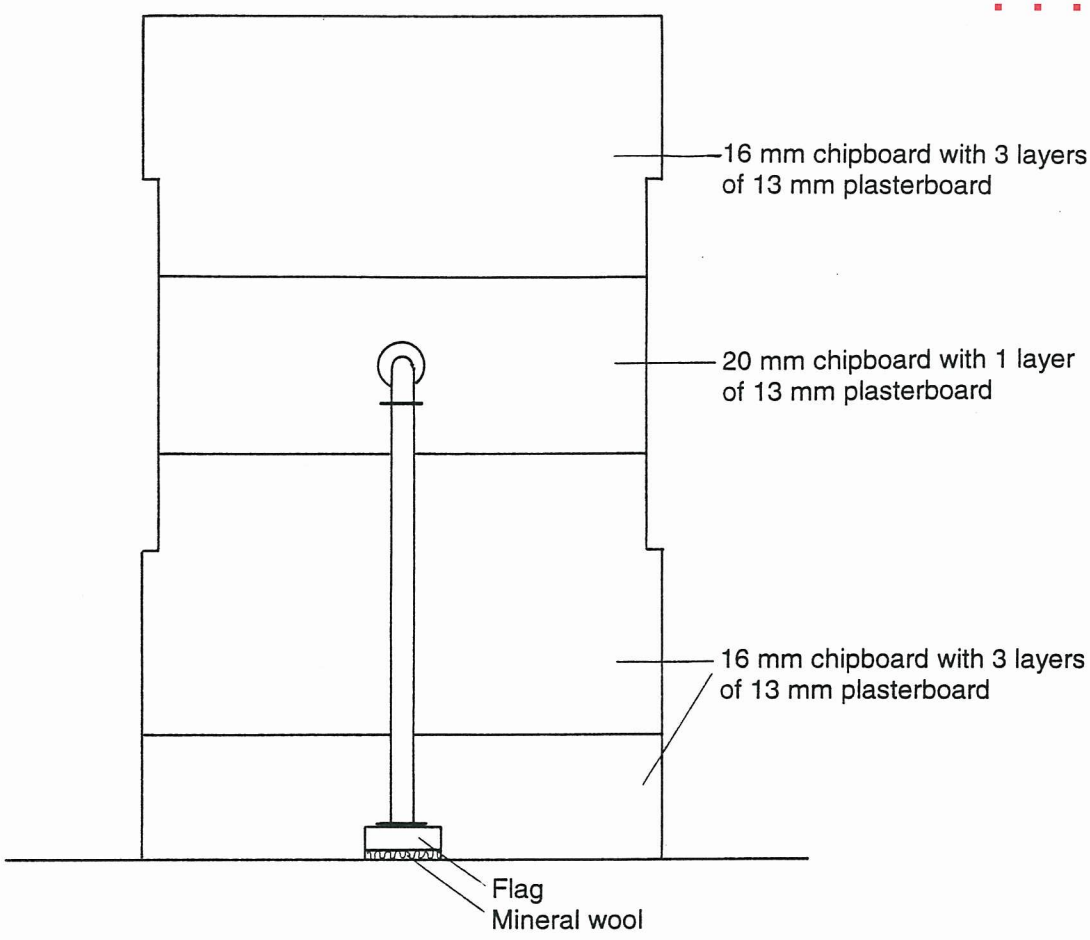
The steel pipe was made of three pipe sections (diameter 60.3 mm) which were all provided with flanges at both ends. A pipe section was bent 90 degrees on each side of the measurement opening. The flanges were held together by four studs around a rubber gasket. The ends of the steel pipe were fastened to a flag by means of four screws, and between flange and flag a rubber gasket was mounted for sealing. The flags were placed on a mineral wool plate. The wall thickness of the steel pipe was 3.5 mm.

Mounting in the laboratory

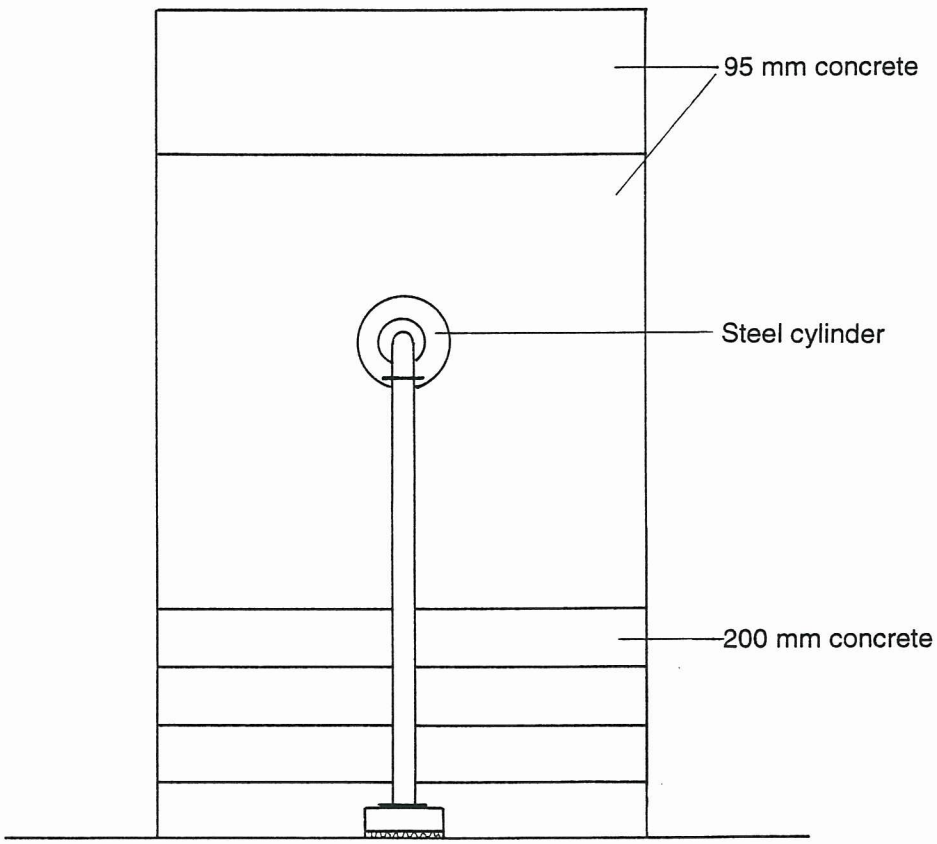
The test opening of the laboratory was adapted with a concrete construction with a steel adapter on the source room side and a plasterboard and chipboard construction on the receiver room side. The joints between the adapters and the test opening were sealed with putty. The cavity between concrete and the lightweight construction was partly filled with mineral wool. In the adaptation construction a steel pipe (length 160 mm and inner diameter of 107 mm) was fastened for pipe penetration, in which the test object was mounted. Putty was used for sealing around the steel pipe from both the source room and receiver room side. Mounting was carried out by the client and DELTA.

Enclosures 2-4 show elevation and sectional drawings of the test object mounted in the labo-rataory; they have been prepared by DELTA.

Elevation receiving room, 1:20



Elevation source room, 1:20



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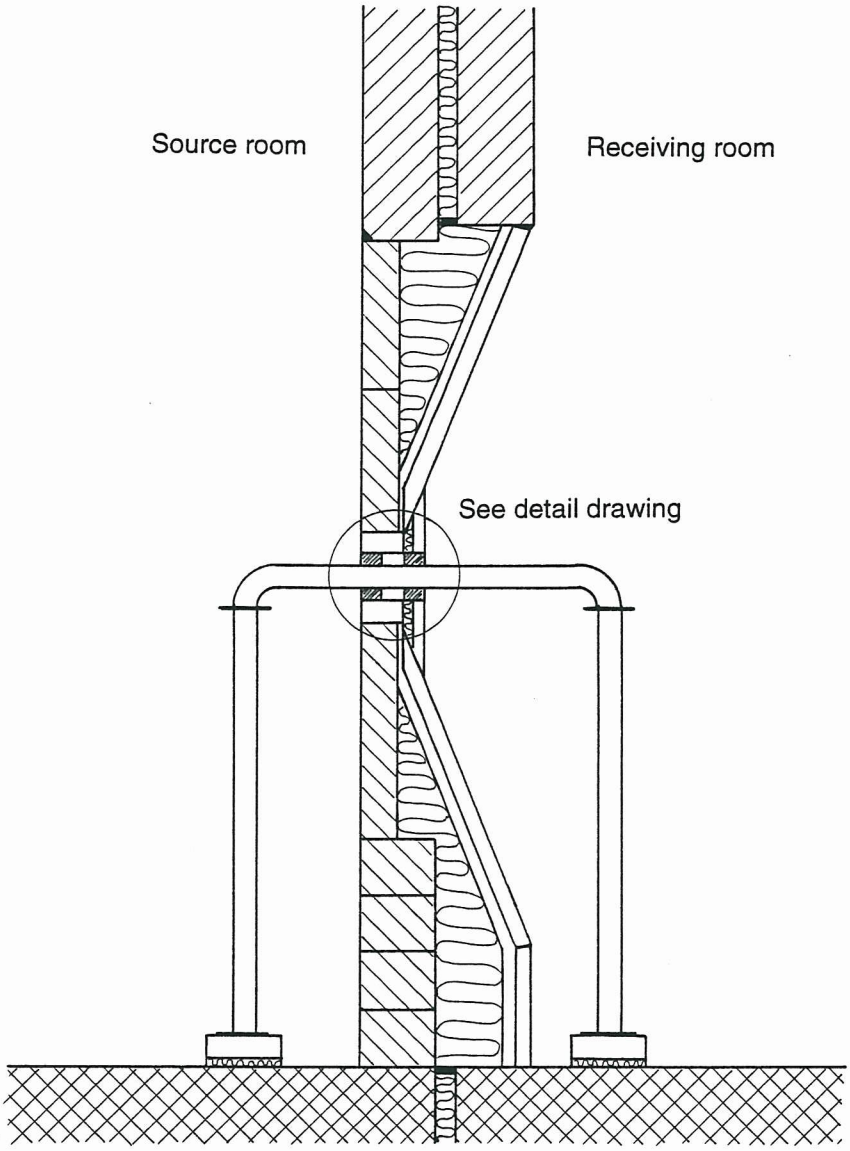
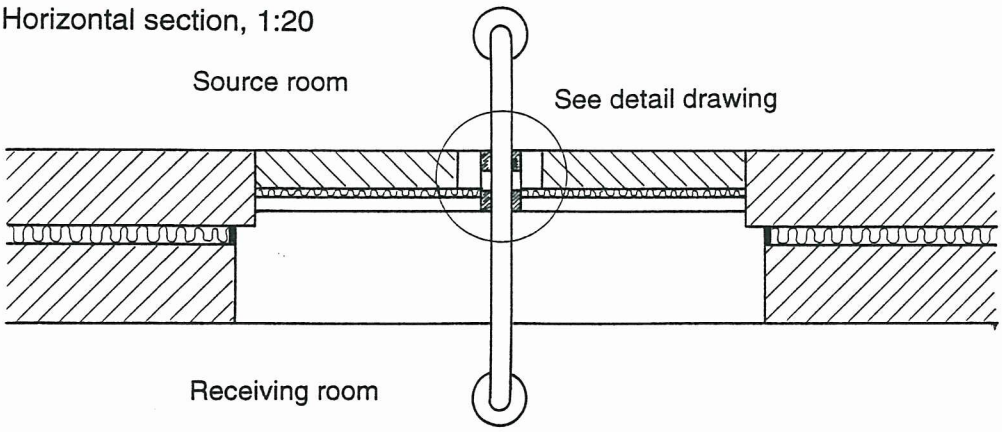
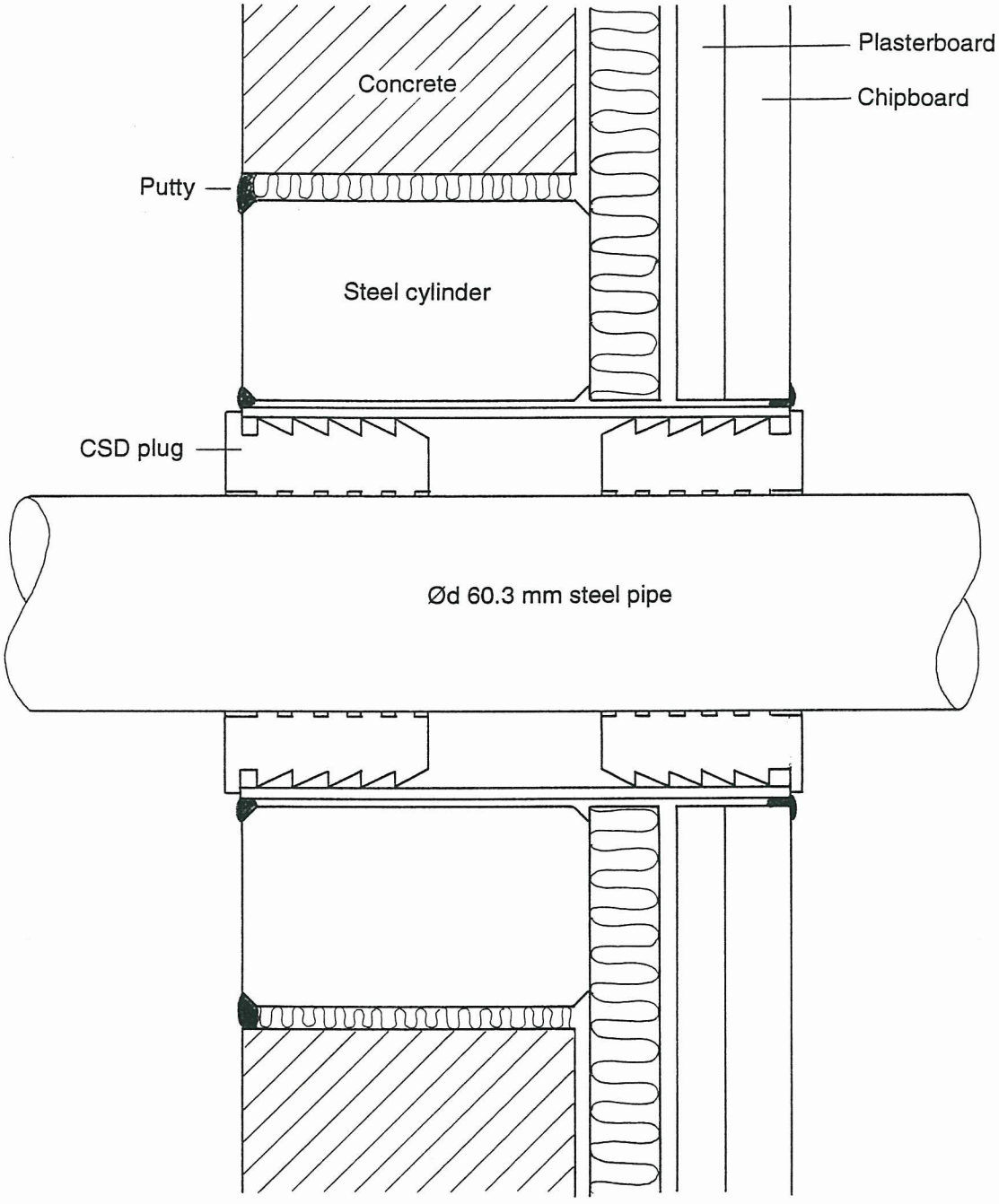
Vertical section, 1:20



Horizontal section, 1:20



Detail drawing, 1:2



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Measuring conditions and equipment

Source room:	Volume = 117.7 m^3 7 diffusing elements, 1.0 m x 1.2 m Reverberation time ≤ 1.4 s
Receiving room:	Volume = 64.8 m^3 5 diffusing elements, 1.0 m x 1.2 m Reverberation time ≤ 2.0 s
Depth of test opening:	0.16 m
Total partition wall area:	16.2 m^2
Loudspeaker system:	Dodecahedron loudspeaker moving along a traverse for measurements of sound pressure levels. Cycle time approximately 176 s. Open loudspeaker in one position for measurement of reverberation time.
Microphone system:	Rotating (32 s/rotation). Integration time: 352 s for measurements of sound pressure levels. The reverberation time is measured in twenty microphone positions distributed on the microphone path.
Sound signal:	Wideband pink noise
Filters:	One-third octave band filters with centre frequencies within the frequency range 100-5000 Hz

The element-normalized level differences in graph sheet no. 1 are corrected for sound transmission around the test specimen (flanking transmission). The correction value must not exceed 1.3 dB corresponding to a transmission ratio of 1:3. The correction for results marked by *) has been changed to 1.3 dB. Accordingly, these results should be regarded as minimum values. This limitation of the correction means that the weighted value, $D_{n,e,w}$, should likewise be regarded as a minimum value.

In enclosure 6 the maximum obtainable element-normalized level difference, $D_{n,e,F}$, that can be measured in the laboratory is listed together with the corrections which are included in the results in graph sheet no. 1.

DELTA

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315	66.3	1.3
400	71.0	1.3
500	72.1	1.3
630	75.2	1.3
800	76.9	1.3
1000	78.9	1.3
1250	78.4	1.0
1600	79.3	1.3
2000	81.0	0.2
2500	83.9	0.3
3150	85.5	0.2
4000	85.2	0.5
5000	83.5	1.3

Measuring equipment

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Power amplifier	Master	DL 1800	DLB 69670698
Equalizer	dbx	2031	-
Sound level calibrator	Brüel & Kjær	4231	1800543
Microphone. source room	Brüel & Kjær	4166	1440622
Microphone. receiving room	Brüel & Kjær	4166	1072077
Microphone preamplifier. source room	Brüel & Kjær	2669	2025403
Microphone preamplifier. receiving room	Brüel & Kjær	2619	855256
Rotating microphone boom. source room	Brüel & Kjær	3923	1213938
Rotating microphone boom. receiving room	Brüel & Kjær	3923	983339
Open loudspeaker cabinet	DELTA	-	-
Loudspeaker unit	Celestion	G12H-100	-

The equipment is checked regularly in accordance with the DANAK guidelines.