

# NOISE AND VIBRATION CONTROL

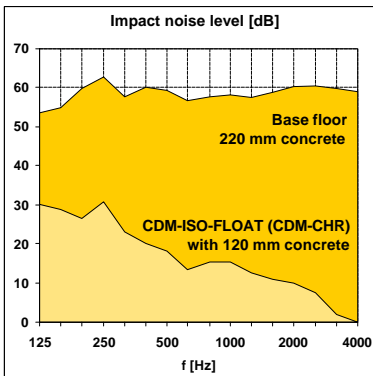
## CDM-ISO-FLOAT



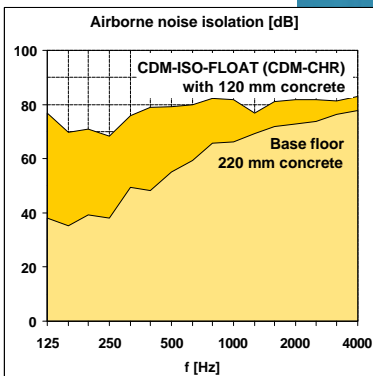
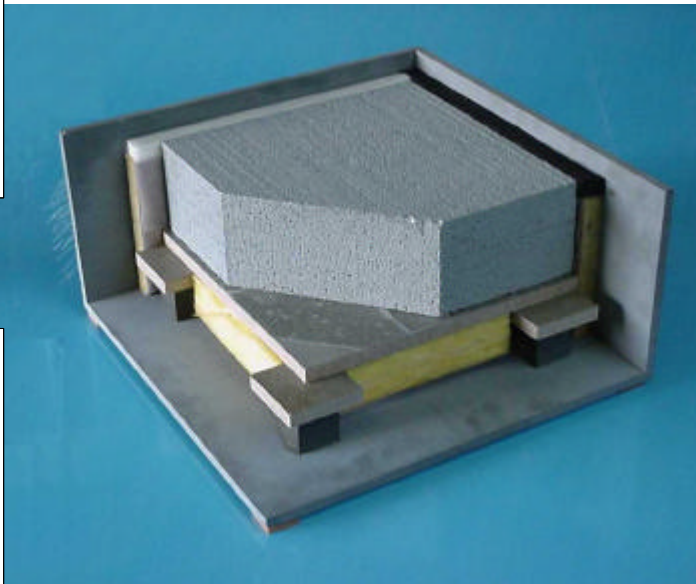
### Floating floor system on discrete bearings

$f_{res} = 4 - 9 \text{ Hz}$

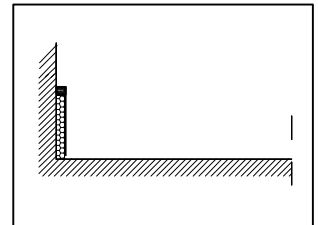
#### Performance



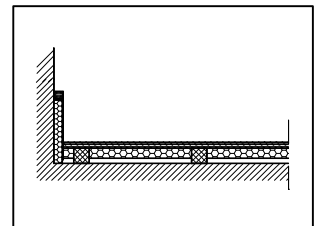
#### Concept



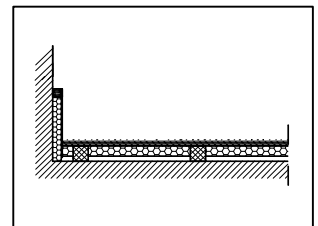
#### Installation



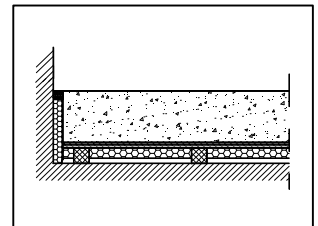
1. Lateral isolation



2. CDM-ISO-FLOAT panels



3. Waterproof membrane



4. Concrete slab + finishing

#### Resilient bearings

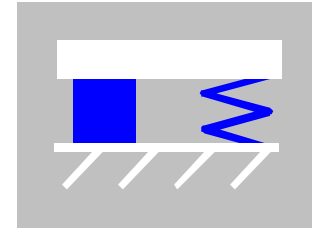


#### CDM-ISO-FLOAT

- ready-to-install floating floor system
- includes resilient bearings, formwork panel, absorption layer of mineral wool, lateral isolation, PVC membrane and installation plan
- available with CDM-CHR springs ( $f_{res} = 4-5 \text{ Hz}$ ) or with CDM-elastomeric bearings ( $f_{res} = 6-9 \text{ Hz}$ )
- for high acoustic performance
- floating floor natural frequency can be tuned to meet specification by changing air void or by altering bearing natural frequency
- more than 150000 m<sup>2</sup> installed

## 2.1 DISCRETE BEARINGS

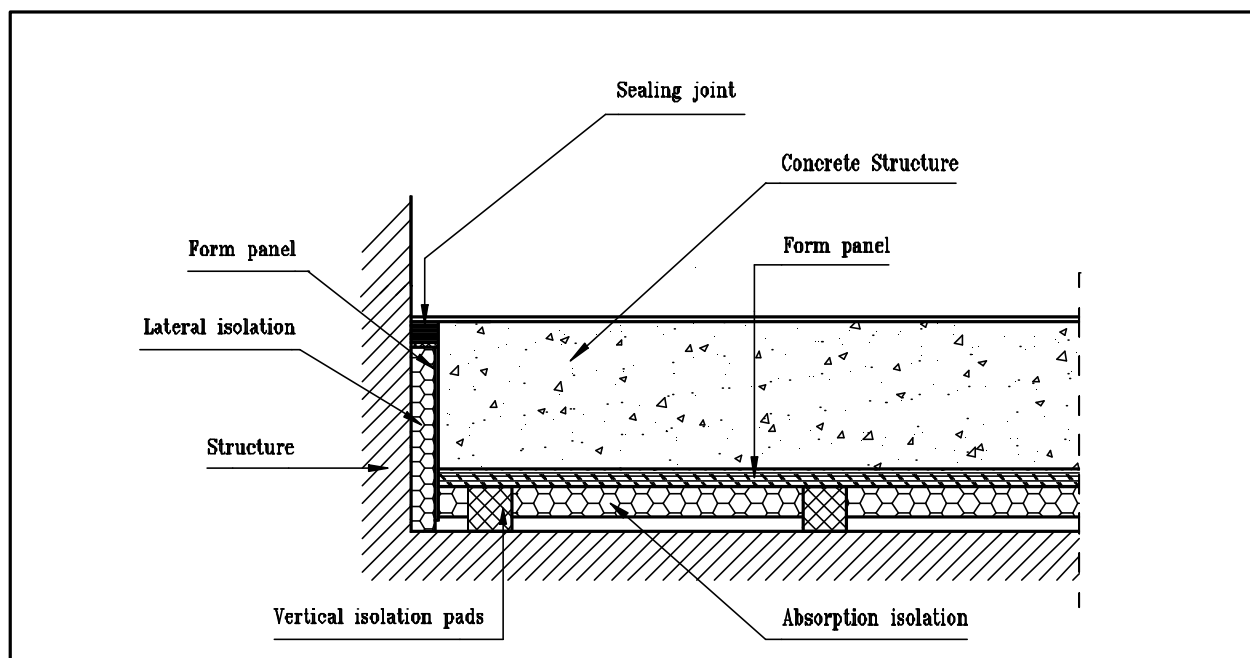
### 2.1.1 CDM-ISO-FLOAT



CDM-ISO-FLOAT/ISO-MONT

## 1. APPLICATIONS

The **CDM-ISO-FLOAT** system is a floating floor system on discrete bearings (elastomer or steel springs) to obtain high performances on the isolation of airborne and structure-borne sound transmission. This system is used in areas where low background noise levels are required (such as recording studios, concert halls, anechoic rooms, auditoria etc).



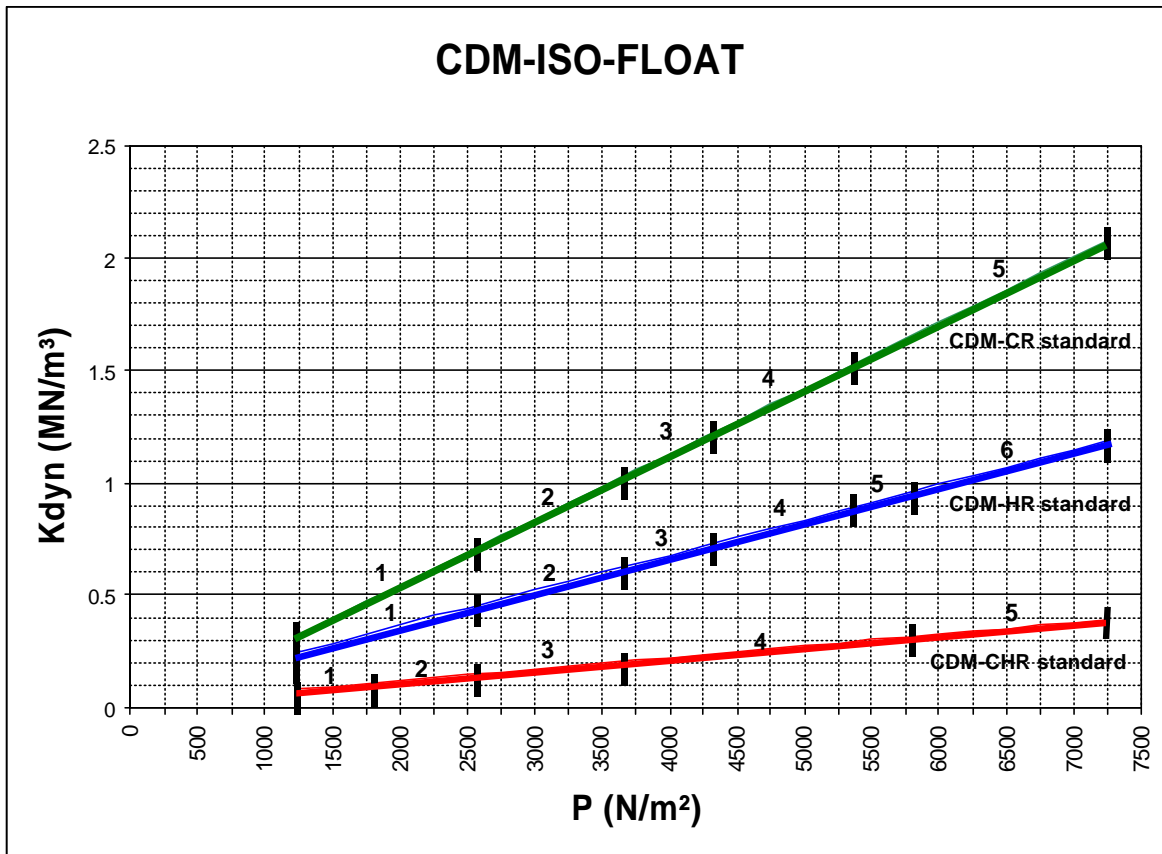
## 2. CDM PRODUCTS AND SYSTEMS

Depending on the loads (static and dynamic) and the required dynamic stiffness, three main types of CDM bearings can be proposed:

1. **CDM-CR** elastomer bearings with an optimal resonance frequency of 9 Hz
2. **CDM-HR** elastomer bearings with an optimal resonance frequency of 6 Hz
3. **CDM-CHR** steel springs with an optimal resonance frequency of 4 Hz

The following graph determines the type of bearing and its distribution per m<sup>2</sup> as a function of the two parameters P (the acoustic load) and  $K_{dyn}$  (the dynamic stiffness of the bearing). More details about the calculation of these parameters can be found in the introduction.





Area in graph	Type of CDM-ISO-FLOAT bearing and number per m <sup>2</sup>					
	CDM-CR (9 Hz) 50*50*50 mm		CDM-HR (6 Hz) 50*50*50 mm		CDM-CHR (4 Hz) 100*100*120 mm	
1	15050	2.8 per m <sup>2</sup>	79050	2.8 per m <sup>2</sup>	500	2.8 per m <sup>2</sup>
2	15050	4.2 per m <sup>2</sup>	80050	2.8 per m <sup>2</sup>	500	4.2 per m <sup>2</sup>
3	17050	2.8 per m <sup>2</sup>	79050	4.2 per m <sup>2</sup>	1000	2.8 per m <sup>2</sup>
4	15050	6.3 per m <sup>2</sup>	80050	4.2 per m <sup>2</sup>	1000	4.2 per m <sup>2</sup>
5	17050	4.2 per m <sup>2</sup>	79050	6.3 per m <sup>2</sup>	1000	6.3 per m <sup>2</sup>
6			80050	6.3 per m <sup>2</sup>		

(2.8 bearings per m<sup>2</sup> = 2x2 per formwork panel; 4.2 per m<sup>2</sup> = 3x2 per panel; 6.3 per m<sup>2</sup> = 3x3 per panel; formwork panel dimensions are around 1.2 x 1.1 m)

In case a point ( $P$ ,  $K_{dyn}$ ) is not situated directly near one of the three curves, three possibilities can be considered:

1. Take  $P$  constant and alter  $K_{dyn}$  until one of the three curves is reached but this alters the performance of the floating floor. Compensation is (partly) possible by altering the height of the air layer, e.g. by introducing overheight blocks - dim. 100x100x18mm), and thus decreasing  $K_{dyn}$  (air).
2. Take  $K_{dyn}$  constant and reduce or increase  $P$  by altering the mass, and consequently the thickness of the floating floor.
3. Use an out-of-standard CDM bearing with reduced or increased thickness (e.g. 20, 30, 40 or 60 mm), possibly combined with overheight blocks to keep  $K_{dyn}$  (air) constant. Use the datasheets of the CDM materials for the calculation of the required thickness. Sometimes it can be useful to use other bearing types, contact our specialists to advise you.



More technical information (e.g. static deflection and resonance frequency) on the CDM standard bearings can be found on the following product sheets.

### 3. PERFORMANCES

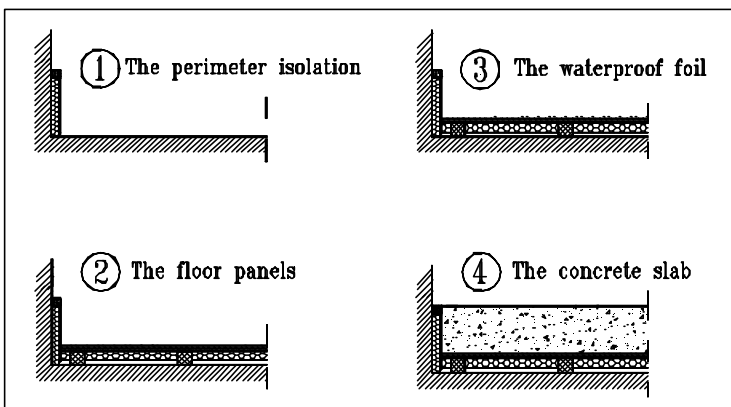
As a rule of thumb, the following isolation improvements can be expected between 100 and 500 Hz, compared to the non-isolated case: (following NBN S01-006 / 8, NBN S01-400, ISO 140/7, ISO 717/1, ISO 717/2)

ISO-FLOAT	Impact noise: $DL_n$	Airborne noise: $DR_w$
CDM-CR	37 – 43 dB	17 – 23 dB
CDM-HR	40 – 46 dB	20 – 26 dB
CDM-CHR	43 – 49 dB	23 – 29 dB

It is important to note that the isolation performances also depend on the impedance of the structural floor. As an example, some test reports are enclosed.

### 4. INSTALLATION

Mounting principles:



1. Installation of lateral isolation
2. Installation of the floor panels
3. Installation of waterproof foil
4. Installation of reinforced concrete
5. Finish with flexible sealing joint

CDM provides the **ISO-FLOAT** system as a complete package consisting of:

- the CDM bearings (with overheight blocks if needed), glued on a formwork panel in fibrocement, OSB-wood or multiplex, together with an absorption layer of mineral wool
- the perimeter isolation in mineral wool + formwork panel
- a covering layer in transparent PVC
- installation drawings and details
- technical assistance at installation

Some recommendations:

- When considering dynamic impacts, it is of most importance that a maximum of (suspended) mass is brought into movement and that both, the supporting floor and the suspended floor, have a higher structural stiffness than if no vibration isolation was installed.
- Avoid all stiff contacts between the floating floor and the structural floor. Special interest should therefore be paid to the perimeter of the floor, structural columns, and ducting facilities.
- Watertight lateral joints can be installed once the floating floor is finished.



- The supporting surface, onto which the bearings are to be installed, needs to be horizontal and clean: a tolerance of 1/1000 is acceptable (e.g. 2 mm on 2 m linear). Exceptional local roughnesses can be accepted as long as they do not create any danger for bridging between the isolated and non-isolated floors.
- To obtain maximum efficiency of the floating floor, we recommend to fill the air void between the bearings with a light density (< 20 kg/m<sup>3</sup>) mineral wool with an open cell structure.
- No maintenance required after installation.

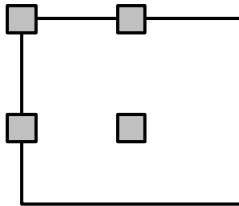
## 5. CALCULATION EXAMPLE

**Given:**

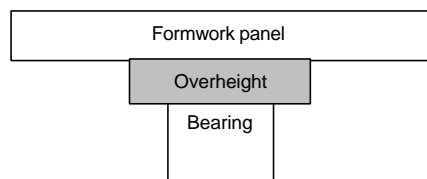
Floating floor thickness	$t = 0.1 \text{ m}$
Live load	$Q = 3000 \text{ N/m}^2$
Air gap	$a = 0.06 \text{ m}$
Dynamic floor stiffness required	$K_{\text{dyn}} (\text{floor}) = 2.5 \text{ MN/m per m}^2$

**Wanted:** Bearing type and distribution

- Solution:**
1. Acoustic load  $P = (t \times 25000 \text{ N/m}^3) + (Q / 3) = 3500 \text{ N/m}^2$
  2. Dynamic stiffness of the bearings:  $K_{\text{dyn}} = K_{\text{dyn}}(\text{floor}) - K_{\text{dyn}}(\text{air}) = 2.5 \cdot 10^6 \text{ N/m}^3 - (110000 / 0.06) = 666666 \text{ N/m}^3 = 0.67 \text{ MN/m}^3$
  3. In the ISO-FLOAT graph the point (3500; 0.67) is nearest to the CDM-HR-2 curve. This means standard CDM-80050 bearings at a distribution of 2.8 per m<sup>2</sup> = 2 x 2 bearings per formwork panel:



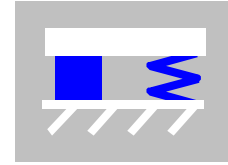
4. ISO-FLOAT data sheet → Static deflection of CDM-80050 bearing at a load of 3500 N / 2.8 = 1250 N is 8 mm. Thus the height of the bearing after deflection = 50 mm – 8 mm = 42 mm. This means 1 overheight block required (18 mm) to obtain an air void of 60 mm = 0.06 m.





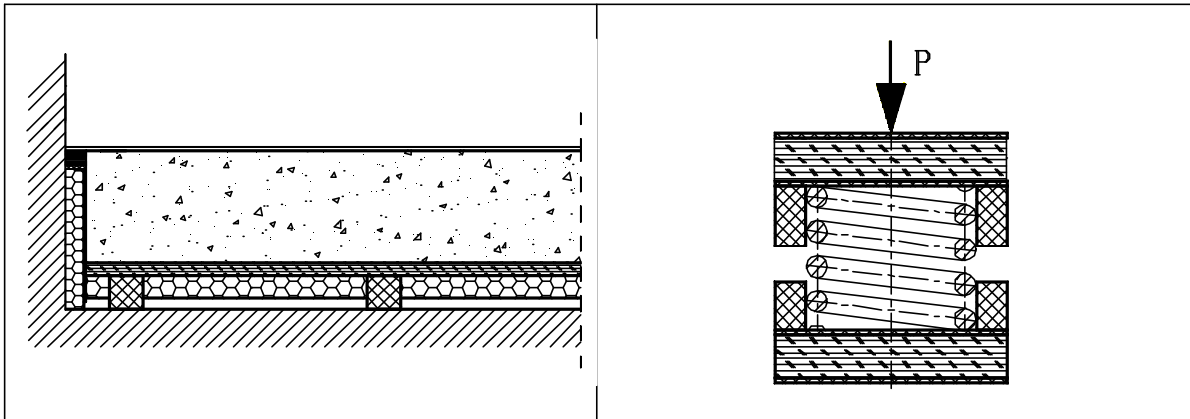
Product sheet

# CDM-CHR

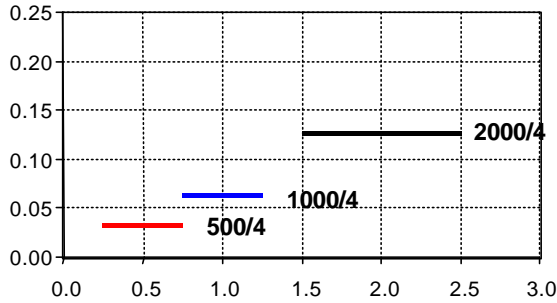


CDM-ISO-FLOAT

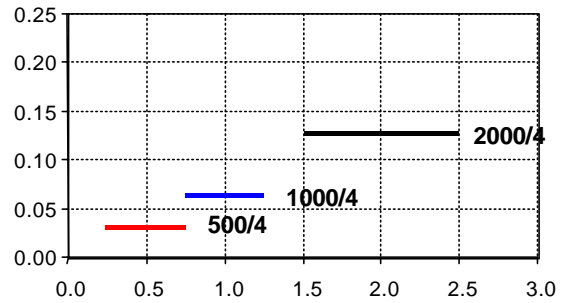
Type		500 / 4	1000 / 4	2000 / 4
Constitution		FD SiCr	FD SiCr	FD SiCr
Static load range	[N]	250 - 500	750 - 1000	1500 - 2000
Maximum total load	[N]	750	1500	2500
Creep rate	[%/Dec.]	-	-	-
Density	[kg/m³]	-	-	-
Colour		Orange	Green	Black
Pad dimensions	[mm]	A=100, B=100, H=120		



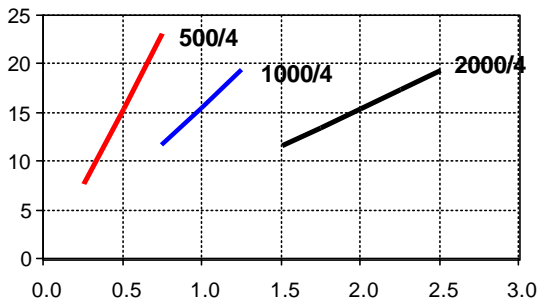
Static stiffness [MN/m]



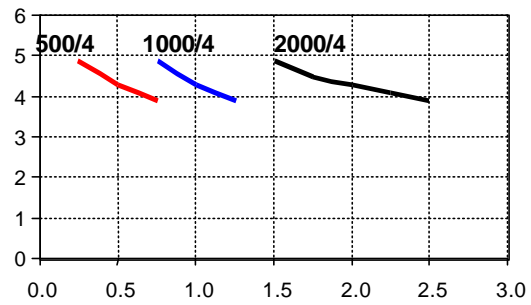
Dynamic stiffness [MN/m]



Deflection [mm]



Resonance frequency [Hz]



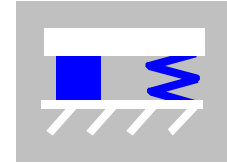
CDM-ISO-FLOAT CDM-CHR 4 Hz





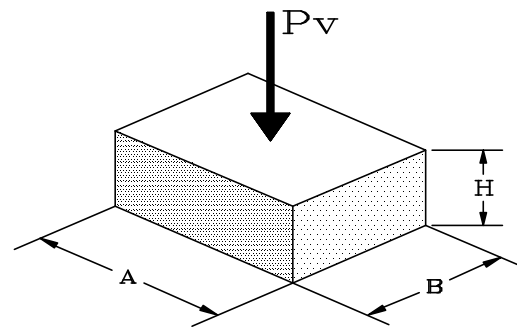
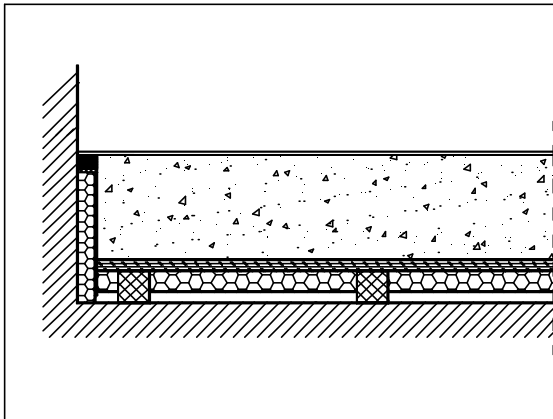
Product sheet

# CDM-HR

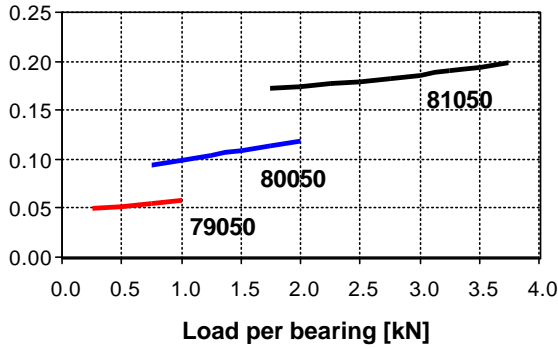


CDM-ISO-FLOAT

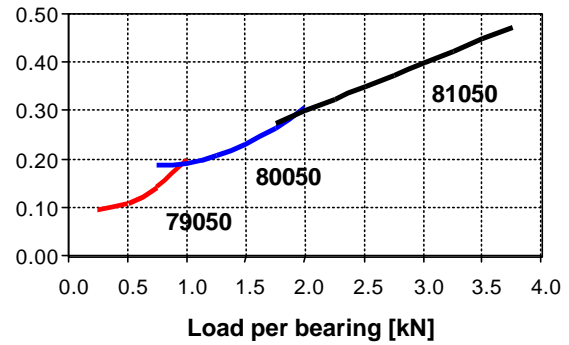
Type		79050	80050	81050
Constitution		NR	NR	NR
Static load range	[N/mm <sup>2</sup> ]	0.10 - 0.25	0.20 - 0.60	0.40 - 1.20
Maximum total load	[N/mm <sup>2</sup> ]	0.36	0.8	1.5
Creep rate	[%/Dec.]	1.5 (0.2 N/mm <sup>2</sup> )	0.8 (0.8 N/mm <sup>2</sup> )	0.5 (1.0 N/mm <sup>2</sup> )
Density	[kg/m <sup>3</sup> ]	600 - 735	940 - 1030	1000 - 1100
Colour		Red	Blue	Brown
Pad dimensions	[mm]	A=50, B=50, H=50		



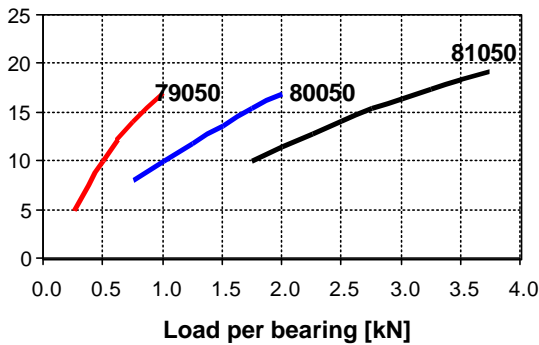
Static stiffness [MN/m]



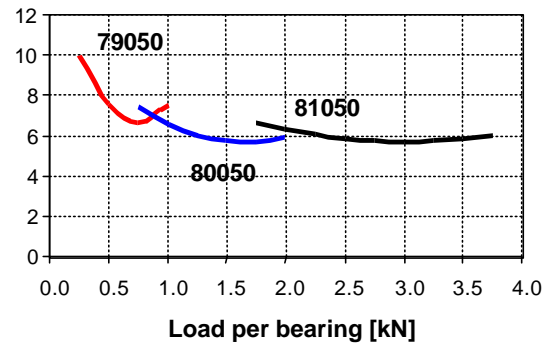
Dynamic stiffness [MN/m]



Deflection [mm]



Resonance frequency [Hz]



CDM-ISO-FLOAT 6 Hz

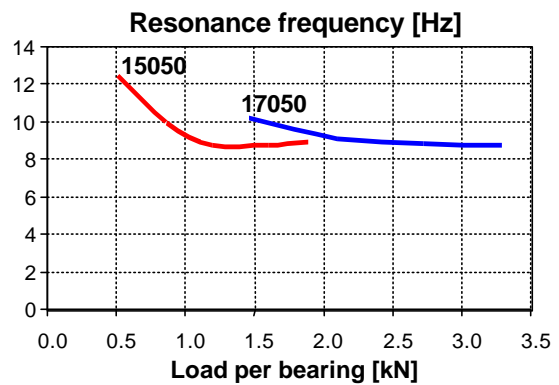
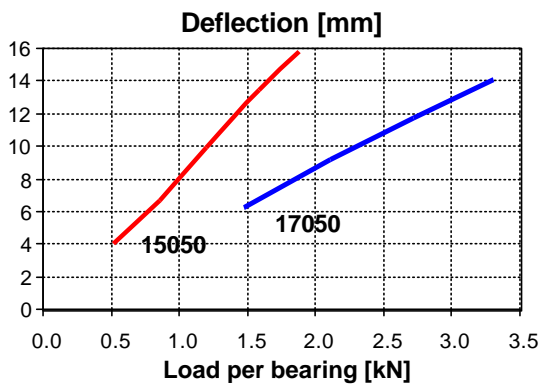
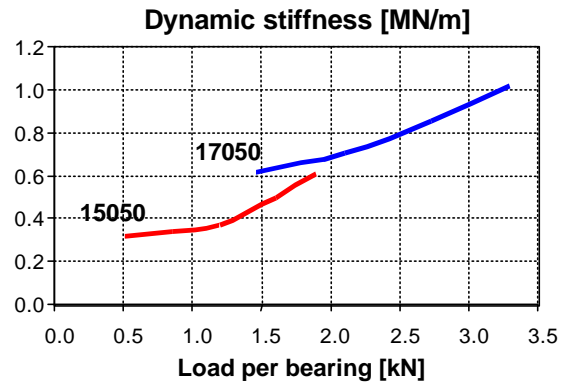
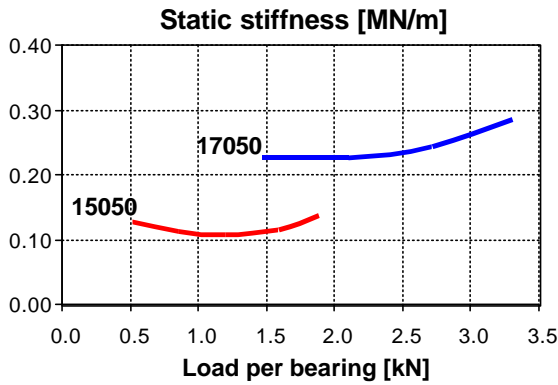
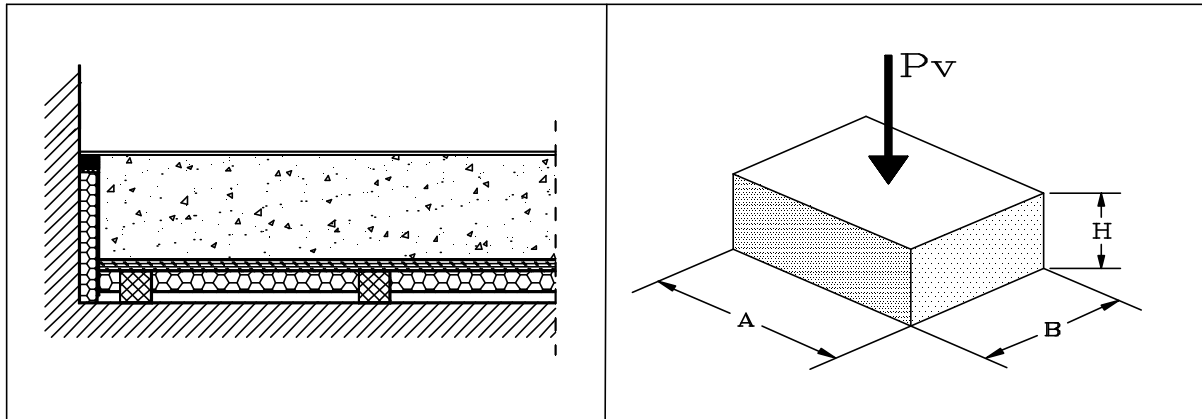


Product sheet

# CDM-CR



Type		15050	17050
Material		RR	RR
Static load range	[N/mm <sup>2</sup> ]	0.3 - 0.6	0.5 - 1.0
Maximum total load	[N/mm <sup>2</sup> ]	1.0	2.0
Creep rate	[%/Dec.]	1.6 (0.5 N/mm <sup>2</sup> )	1.7 (1.7 N/mm <sup>2</sup> )
Density	[kg/m <sup>3</sup> ]	550 - 700	900 - 1020
Colour		Brown	Black
Pad dimensions	[mm]	A=50, B=50, H=50	



CDM-ISO-FLOAT 9 Hz



Test info sheet

# CDM-1000/4

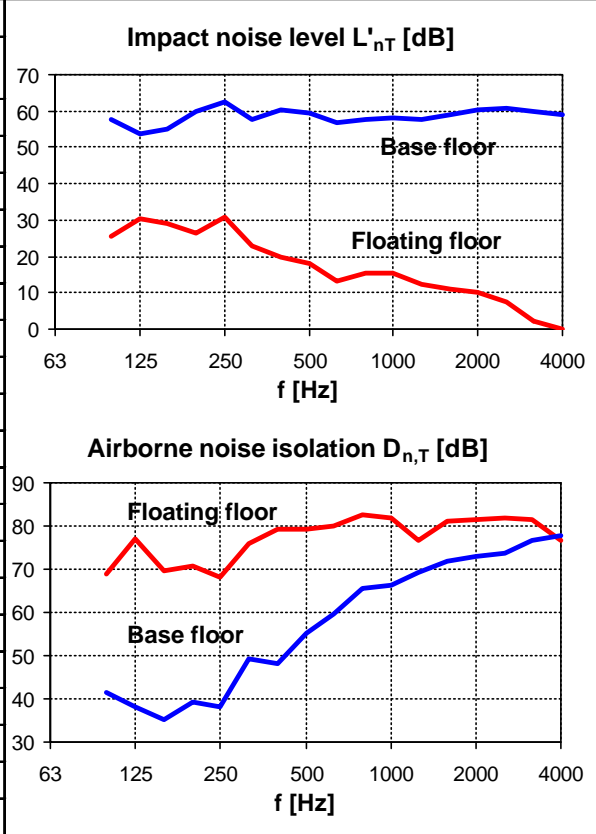


<b>CDM-product tested</b>	CDM-CHR 1000/4 section 100x100x120
<b>Description</b>	CDM-ISO-FLOAT, see drawing and legend
<b>Tested by</b>	Instituut De Nayer Departement Industriële Wetenschappen J. De Nayerlaan 5, Mechelen
<b>Test site</b>	CDM Overijse, floor between test room and office
<b>Test date</b>	1997
<b>Test method</b>	NBN S01-006, NBN S01-008
<b>Measured parameter</b>	Impact noise level $L'_{n,T}$ and airborne noise isolation $D_{n,T}$

**Legend**

- Concrete floor 220 mm
- CDM-CHR 1000/4 bearing
- Air gap
- Form work 18 mm
- Waterproof membrane
- Floating floor 120 mm
- Mineral wool 45 mm
- Lateral isolation
- Lateral form work

Measurements [dB]				
f [Hz]	$L'_{n,T}$	$L'_{n,T}$ base floor	$D_{n,T}$	$D_{n,T}$ base floor
100	26	58	69	42
125	30	54	77	38
160	29	55	70	35
200	27	60	71	39
250	31	63	68	38
315	23	58	76	49
400	20	60	79	48
500	18	59	79	55
630	13	57	80	60
800	15	58	83	66
1000	15	58	82	66
1250	13	58	77	69
1600	11	59	81	72
2000	10	60	82	73
2500	8	61	82	74
3150	2	60	81	77
4000	0	59	77	78
$D_{nT,w}$			<b>80</b>	<b>55</b>
$DL'_{nT,w}$	<b>45</b>			



Test info sheet

# CDM-81060

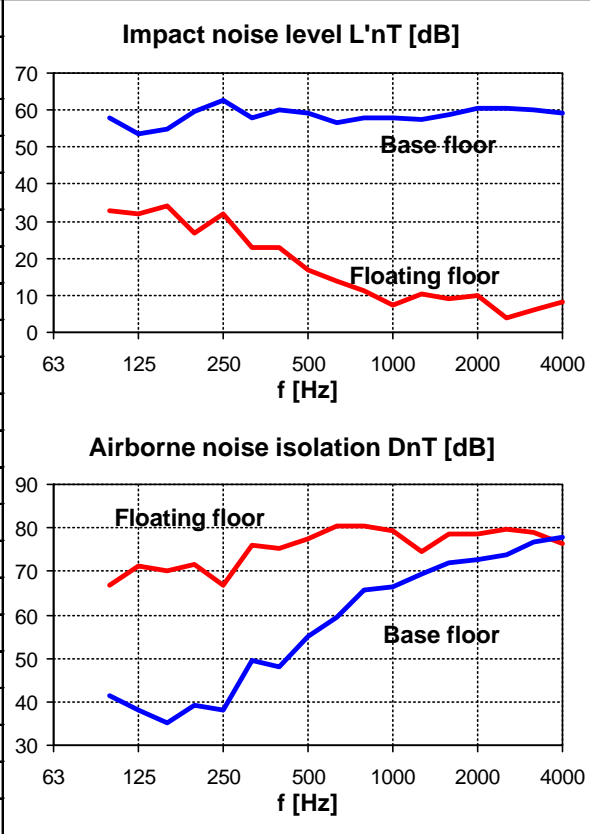


<b>CDM-product tested</b>	CDM-81060 section 50x50x60
<b>Description</b>	CDM-ISO-FLOAT, cfr. drawing and legend
<b>Tested by</b>	Instituut De Nayer Departement Industriële Wetenschappen J. De Nayerlaan 5, Mechelen
<b>Test site</b>	CDM Overijse, floor between test room and office
<b>Test date</b>	1997
<b>Test method</b>	NBN S01-006, NBN S01-008
<b>Measured parameter</b>	Impact noise level $L'_{nT}$ and airborne noise isolation $D_{nT}$

**Legend**

1. Concrete floor 220 mm
2. CDM-81060 bearing
3. Air void
4. Form work 18 mm
5. Waterproof membrane
6. Floating floor 120 mm
7. Mineral wool 45 mm
8. Lateral isolation
9. Lateral form work

Measurements [dB]				
f [Hz]	$L'_{nT}$	$L'_{nT}$ base floor	$D_{n,T}$	$D_{n,T}$ base floor
100	33	58	67	42
125	32	54	71	38
160	34	55	70	35
200	27	60	72	39
250	32	63	67	38
315	23	58	76	49
400	23	60	75	48
500	17	59	78	55
630	14	57	80	60
800	11	58	80	66
1000	8	58	79	66
1250	10	58	75	69
1600	9	59	79	72
2000	10	60	79	73
2500	4	61	80	74
3150	6	60	79	77
4000	8	59	76	78
<b><math>D_{nT,w}</math></b>			<b>78</b>	<b>55</b>
<b><math>DL'_{nT,w}</math></b>	<b>42</b>			



Test info sheet

# CDM-33060



<b>CDM-product tested</b>	CDM-33060 section 50x50x60
<b>Description</b>	CDM-ISO-FLOAT, cfr. drawing and legend
<b>Tested by</b>	Instituut De Nayer Departement Industriële Wetenschappen J. De Nayerlaan 5, Mechelen
<b>Test site</b>	CDM Overijse, floor between test room and office
<b>Test date</b>	1997
<b>Test method</b>	NBN S01-006, NBN S01-008
<b>Measured parameter</b>	Impact noise level $L'_{nT}$ and airborne noise isolation $D_{n,T}$

**Legend**

1. Base floor 220 mm concrete
2. CDM-33060 bearing
3. Air gap
4. Form work 18 mm
5. Waterproof membrane
6. Floating floor 120 mm
7. Mineral wool 45 mm
8. Lateral isolation
9. Lateral form work

Measurements [dB]				
f [Hz]	$L'_{nT}$	$L'_{nT}$ base floor	$D_{n,T}$	$D_{n,T}$ base floor
100	28	58	53	42
125	31	54	57	38
160	36	55	60	35
200	27	60	61	39
250	29	63	57	38
315	21	58	70	49
400	24	60	72	48
500	18	59	76	55
630	15	57	79	60
800	14	58	81	66
1000	14	58	81	66
1250	14	58	84	69
1600	14	59	85	72
2000	11	60	86	73
2500	12	61	83	74
3150	14	60	86	77
4000	15	59	86	78
<b>DnTw</b>			<b>75</b>	<b>55</b>
<b>DL'nT,w</b>	<b>42</b>			

