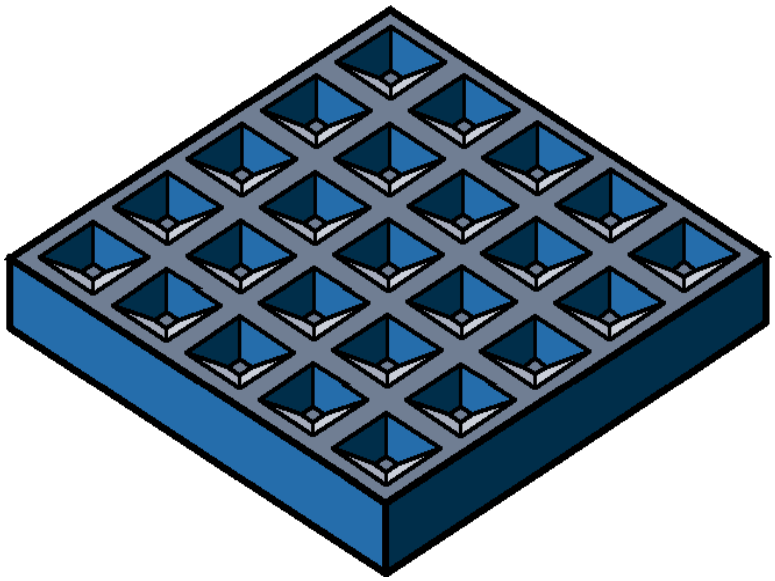
Official Certificate

No. 850.0425

Calenberg
Compact Bearing CR 2000

unreinforced structural bearing
high loadable



MPA HANNOVER

Extension of validity of Official Testing Certificate

Certificate No.	850.0425
Subject:	Unreinforced structural bearing:
	Calenberg Compact Bearing CR 2000
Date of first issue:	10.07.2000
Now valid till:	31.12.2014
Intended Purpose:	Supports according to DIN 4141 part 3, Sept. 1984 Support in civil engineering Support for building construction Support class 2

This extension includes 1 page and is valid only in connection with the actual version of certificate 850.0425.
(1. issue: 10.07.2000, 1. extension: 24.09.2003, English translation: 20.04.2005, 2. extension: 26.03.2008).

Garbsen, 14.01.2010

RD Dr.-Ing. Seidel
Head of Testing Institute

Materialprüfanstalt für Werkstoffe und Produktionstechnik · MPA HANNOVER

Dipl.-Ing. Robert Witte
Deputy

Materialprüfanstalt für Werkstoffe
und Produktionstechnik
An der Universität 2
D-30823 Garbsen

Tel. +49(0)511-762 43 62
Fax +49(0)511-762 30 02
info@mpa-hannover.de
www.mpa-hannover.de

Landesbetrieb gemäß
§ 26 Nds. LHO

Vorstand:
Prof. Dr.-Ing. Bernd-Arno Behrens · Sprecher
Dr.-Ing. Andreas Kinzel · Geschäftsführer
Dr.-Ing. Hans-Joachim Seidel · Geschäftsführer

MPA HANNOVER

Official Certificate

Certificate No.	850.0425
Subject:	Unreinforced structural bearing **Calenberg Compact Bearing CR 2000** Data of manufacturer and of chemical compounds are deposited at the Material Testing Institute
Intended Purpose:	Supports according to DIN 4141 part 3, Sept. 1984 Support in civil engineering Support for building construction Support class 2
Applicant:	Calenberg Ingenieure planmäßig elastisch lagern GmbH Am Knübel 2-4 D-31020 Salzhemmendorf Germany
Date of issue:	first: 10.07.2000 1. prolongation: 24.09.2003 english translation: 20.04.2005 2. prolongation: 26.03.2008
Valid till:	26.03.2010

Due to this certificate the above mentioned subject is applicable to the state's building regulations.

This certificate includes 12 pages and 10 enclosures.

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und Produktionstechnik
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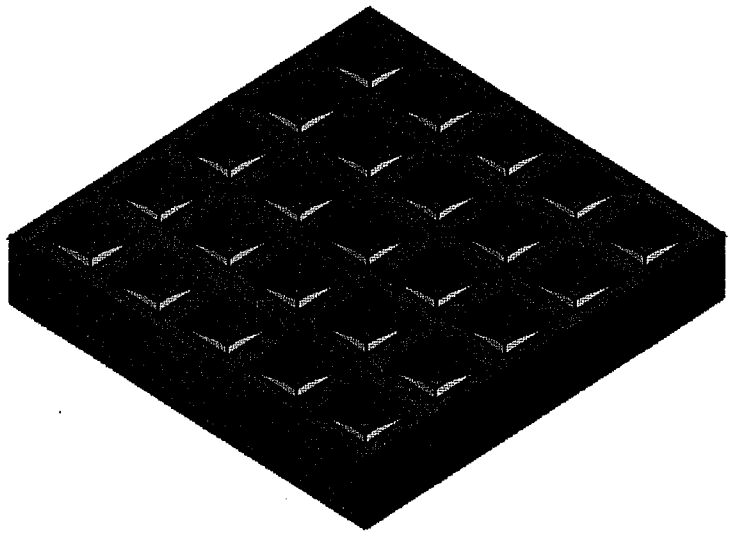
1. Subject and Field of Application:

1.1 Subject:

The Calenberg Compact Bearing CR 2000 is an unreinforced profiled elastomer bearing. The bearing plates have on one side a negative embossed pattern of frustums of pyramid with a quadratic base of approx. 6 x 6 mm², a cross section of approx. 1 x 1 mm² and a depth of approx. 1 mm. The distance between axles is approx. 9 mm.



Picture 1: Calenberg Compact Bearing CR 2000

The Calenberg Compact Bearing CR 2000 is manufactured in thicknesses of 11, 16 and 21 mm. Length and width are variable. They conform to the particular bearing stress for the intended purpose under consideration of the below mentioned bearing reactions.

1.2 Field of Application:

The Calenberg Compact Bearing CR 2000 can be used for supports of components and structures in building construction according to bearing class 2 of DIN 4141 part 3, Sept. 84.
Basic requirement for the application is that the adjacent components are only stressed irrevantly by other bearing reactions. The stability of the structue must not be endangered by excessive stress of the bearing or failure of the bearing function.
This certificate is only valid if demands on sound protection have not to be met.
Due to the declaration of the applicant there was no reason to test the effects of the installed building product regarding to demands on health and environmental protection.

The bearings are shape dependant applicable up to a maximum vertical load according to table 1:

Bearing Thickness in mm	11	16	21
	Maximal permissible compression stress in N/mm²		
Bearing Area Length x Width in mm²			
80 x 80	12,5	7,3	5,4
100 x 50	9,7	6,0	-
190 x 50	12,3	7,3	5,3
120 x 120	20	-	-
100 x 100	20	9,7	6,8
190 x 100	20	14,2	9,5
150 x 150	20	17,4	11,4
250 x 250	20	-	-

Table1: Calenberg Compact Bearing CR 2000 Matrix of the maximum permissible compression stress

Length and width are variable.They conform to the particular bearing stresses of the case of application considering the below mentioned bearing reactions.
The data of the defined bearing areas in the following chapters may be used for the interpolation of bearing reactions of bearing areas differing from these bearing areas.

2. Requirements on the Building Product

2.1 Characteristics, Characteristic Values and Composition of the Calenberg Compact Bearing CR 2000

2.1.1 Characteristics

2.1.1.1 Physical Characteristics

The physical characteristics of the elastomer – tested on test sheets – have to be proved according to chapter 2.1.2.5 and 2.2.1.

2.1.1.2 Bearing Reactions

The essential characteristics restricting the application are the bearing reactions on

- the transmission of vertical loads (compression spring reaction) and thus implied bearing elongation
- shear stress (determination of the shear modulus)
- unplanned bearing load beyond the defined vertical load (compression stress overload)
- creeping of the bearing under long-term load (long-term stability)

The bearing reactions have to be proved on bearing dimensions according to table 2

Bearing Dimensions Length x Width in mm	Thick-ness in mm	Max. Load for the Determination of the Compression Spring Reaction in N/mm²	Load Area for the Determination of the Shear Modulus in N/mm²	Overload in N/mm²	Determination of the Bearing Elongation at max. Load	Long-term Test
80 x 80	11	12,5			X	
100 x 50	11	9,7			X	
120 x 120	11	20			X	
190 x 50	11	12,3			X	
100 x 100	11	20		X, 80	X	X
190 x 100	11	20	X, 2,0 – 12,0		X	
150 x 150	11	20			X	
250 x 250	11	20			X, at 16 N/mm²	
80 x 80	16	7,3			X	
100 x 50	16	6,0			X	
190 x 50	16	7,3			X	
100 x 100	16	9,7	X, 2,0 – 12,0		X	
190 x 100	16	14,2			X	
150 x 150	16	17,4			X	
80 x 80	21	5,4			X	
190 x 50	21	5,3			X	
100 x 100	21	6,8			X	X
190 x 100	21	9,5	2,0 -12,0		X	
150 x 150	21	11,4				

Table 2: Test Scope of Bearing Reactions

2.1.2 Characteristic Values

2.1.2.1 Bearing Reaction at Vertical Load

The compression stress at deflection due to vertical load must correspond to the nominal values of the deflection-dependent stress in the diagrams 1 to 8 – load deflection curves - (enclosures) with a compression stress tolerance of ± 10 % related to the particular deflection.

The nominal values of the permissible concentric bearing elongation at maximum vertical compression stress can be taken from the following table 3. The nominal values of the bearing elongation have to be in a tolerance range of ± 10 %.

	Bearing Thickness in mm					
	11		16		21	
	Maximum Test Load σ in N/mm² and Correspondind Bearing Elongation A in mm²					
Nominal Bearing Area Length x Width without load in mm²	σ	A	σ	A	σ	A
80 x 80	12,5	92 x 92	7,3	96 x 95	5,4	95 x 93
100 x 50	9,7	114 x 69	6,0	116 x 71	-	-
190 x 50	12,3	205 x 61	7,3	208 x 73	5,3	207 x 61
120 x 120	20	145 x 145	-	-	-	-
100 x 100	20	124 x 122	9,7	118 x 121	6,8	116 x 116
190 x 100	20	221 x 121	14,2	222 x 125	9,5	219 x 123
150 x 150	20	171 x 172	17,4	183 x 174	11,4	182 x 174
250 x 250	16	260 x 258	-	-	-	-

Table 3: Calenberg Compact Bearing CR 2000 Bearing Elongation at Load

2.1.2.2 Bearing Reaction at Shear Stress

The shear moduli of the bearing at horizontal shear stress and simultaneous vertical stress must correspond to the nominal values in diagram 9 of the enclosure with a tolerance of the shear modulus at the particular vertilcal load of ± 10 %.

2.1.2.3 Bearing Reaction at Vertical Overload

The vertical load at a value of the vertical deflection higher than the maximum vertical deflection permitted must correspond to the nominal values of the vertical compression stress according to the enclosed diagram 10 with a tolerance of ± 15 %.

After the compression failure test the bearing should neither show visible abrasion nor any beginning cracks or damage.

2.1.2.4 Long-Term Durability

The creep value must be less than 30 %. The obvious damaged bearing surface must be less than 25 % of the total surface.

2.1.2.5 Physical Characteristics

The physical characteristics of the elastomer have to meet the demands of table 4.

Characteristics	Demand
Shore-A-hardness	70 ± 5 Shore-A
Tensile strength (standard specimen S2)	≥ 15 N/mm²
Tensile elongation (standard specimen S2)	≥ 230 %
Compression set DVR 24h/70°C	≤ 20 %
Crack growth resistance	≥ 4,0 N/mm²
Behaviour after heat effect 7d/70°C - reduction of tensile strength - reduction of tensile elongation - change of the Shore-A-hardness	 max. 5 Shore-A max. 15 % max. 25 % (rel.)
Behaviour under ozone influence 23°C/200pphm/96h/20% elongation	crack degree 0
Table 4: Physical Characteristics of the Elastomer	

2.1.2.6 Limit Dimensions of the Bearing

The limit dimensions of the bearing must follow class M4 DIN 7715 part 2.

2.1.3 Compound

The elastomer material consists of a CR based vulcanizate. The data of the chemical compound are deposited at the Material Testing Institute Hannover.

The components according to table 5 have to be proved.

Component
Rubber content and proof
Soot content
Auxiliary material
Table 5: Proof of Chemical Compound

2.2 Applied Test Methods

2.2.1 Physical Characteristics of the Elastomer

Test with Test Sheets

Characteristics	Test according to:
Shore-A-hardness	DIN 4141 part 140/01.91, chapter 4.1.6
Tensile strength (standard specimen S2)	DIN 4141 part 140/01.91, chapter 4.1.7
Tensile elongation (standard specimen S2)	DIN 4141 part 140/01.91, chapter 4.1.7
Compression set DVR 24h/70°C	DIN 4141 part 140/01.91, chapter 4.1.9
Crack growth resistance	DIN 4141 part 140/01.91, chapter 4.1.8
Behaviour under heat effect 7d/70°C - reduction of tensile strength - reduction of tensile elongation - increase of the Shore-A-hardness	DIN 4141 part 140/01.91, chapter 4.1.11 chapter 4.1.7 chapter 4.1.7 chapter 4.1.6
Behaviour under ozone influence 23°C /200pphm/96h/20% elongation	DIN 53509
Table 6: Procedure for the Proof of Physical Characteristics	

2.2.2 Compound

Component	Test Procedure, Test with Bearing
Rubber content and proof	DIN 4141 part 140/01.91 chapter 4.1.2
Auxiliary material	DIN 53553 or alternative procedure
Soot content	Decomposition with tertiary Butylhydroperoxide with Osmiumtetroxide in 1.4-Dichlorbenzene or alternative procedure
Table 7: Procedure for the Proof of Chemical Compound	

2.2.3 Bearing Reactions

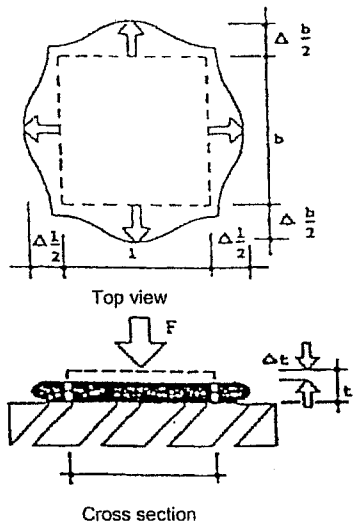
2.2.3.1 Determination of Bearing Reaction due to Vertical Load

The static load deflection curves are determined between formed concrete plates according to DIN 4141, part 150.

Three load and relief graphs a time will be completed. The test velocity is 10 mm/min.
The third compression loading will be registered as graph.

At maximum load during the third loading the bearing elongation will be measured according to picture 2.

The size of the test is according to the specification in table 2, column 3 and 6.
The bearing elongation will be determined as shown in picture 2.



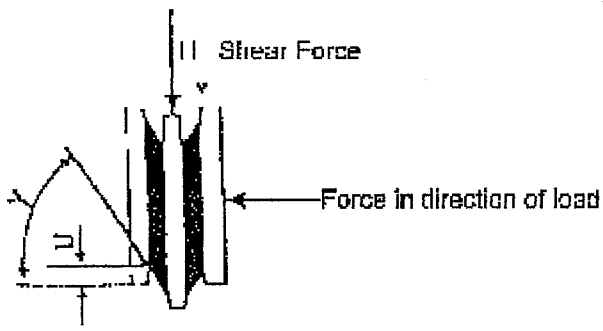
l	=	Length of elastomer sheet
b	=	Width of elastomer sheet
t	=	Thickness of elastomer sheet
T	=	Total thickness of steel reinforced elastomer
Δl	=	Max. crosswise deformation in bearing length
Δb	=	Max. crosswise deformation in bearing width
Δt	=	Vertical deflection of the elastomer sheet
ΔT	=	Vertical deflection of steel reinforced elastomer bearings

Picture 2:
Measurement of the area deformation of a concentric loaded Calenberg Compact Bearing CR 2000 between load transmitting areas of the adjacent components (concrete according to DIN 4141 part 150) with thus partly hindered transverse elongation.

2.2.3.2 Shear Deformation Test

The shear deformation graphs will be determined according to picture 3 following DIN 4141 part 150 between corundum-covered steel plates with a deformation speed of 1.5 mm/s.

On this occasion bearings with four different preloads according to the beginning, the middle and the end of the complete load area of table 2, column 4 will be tested.
The third loading will be registered and analysed regarding the shear deformation modulus according to picture 3.



$$G = \frac{\Delta\tau}{\Delta \tan\gamma} \qquad \tau = \frac{H}{A} \qquad \tan\gamma = \frac{u}{t_0}$$

$$\tan\gamma_1 = 0.2 \quad \rightarrow \quad u_{0,2} = 0.2 \times t_0$$

$$\tan\gamma_2 = 0.2 \quad \rightarrow \quad u_{0,9} = 0.9 \times t_0$$

$$G = \frac{H_2 - H_1}{2A\left(\frac{u_2}{t_0} - \frac{u_1}{t_0}\right)} = \frac{H_2 - H_1}{2A \times 0{,}7}$$

A = Ground area of the bearing
u = Shear deformation
H = Shear force
t_0 = Bearing thickness

Picture 3: Scheme of the Shear Modulus Test

2.2.3.3 Compression Failure Test

The bearings will be loaded up to a top force of 800 kN. The test speed is 10 mm/min.

The bearing will be loaded once.

The compression failure test is done between rough rolled steel plates according to DIN 4141 part 150.

Through evaluation of the force-deflection-diagram as well as a visual examination of the free side areas and the surfaces, the bearing will be examined regarding possibly occurring failure features (cracks, scaling).

2.2.3.4 Durability Test

Two bearings with dimension of 100 mm x 100 mm x 11 mm will be tested according to DIN 4141 part 150, chapter 4.1.10, considering a different raised load of 80 N/mm².

2.3 Design and Calculation

For design and calculation of the Calenberg Compact Bearing CR 2000 DIN 4141 is decisive in its actual valid edition under the extended consideration of the area load according to table 1 of this Official Certificate.

In this connection the above mentioned bearing reactions
- compression spring reaction
- shear reaction
- creep

and the bearing characteristics
- physical properties
- creep tendency
- ageing behaviour

have to be considered specifically in regard to its proof scope, -kind and –magnitude whenever used.
For the execution the following standards, including their hints indicating other rules and documents have to be considered additionally in their respective valid edition regarding this certificate's date of issue.

- DIN 1045 Concrete and Steel reinforced Concrete Construction, Design and Execution
- DIN 1055 Design Loads for Structures

- German Committee for Steel reinforced Concrete, Booklet 339, Column Joints in Precast Steel reinforced Concrete Structures with unreinforced Elastomer Bearings

- DIN 18800 Steel Construction
- DIN 1052 Timber Construction
- DIN 1053 Brick Construction (Masonry)

The Calenberg Compact Bearing CR 2000 is manufactured in thicknesses of 11, 16 and 21 mm. Length and width are variable. They conform to the particular bearing stress due to the intended purpose under consideration of the bearing reactions.
The data about characteristics and nominal values of Calenberg Compact Bearing CR 2000 in the above mentioned chapters for defined bearing areas can be used for the interpolation of bearing reactions of differing bearing areas to those shown above.

2.4 Execution

The above mentioned bearing reactions and bearing characteristics regarding their proof scope have to be considered specifically when using the bearings.
For the application the following standards, including their hints indicating other rules and documents have to be considered additionally in their respective valid edition regarding this certificate's date of issue.

- DIN 4141 Structural Bearings
- DIN 1045 Concrete and Steel reinforced Concrete Construction, Design and Execution
- DIN 1055 Design Loads for Structures

- German Committee for Steel reinforced concrete, Booklet 339, Column Joints in Precast Steel reinforced Concrete Structures with unreinforced Elastomer Bearings

- DIN 18800 Steel Construction
- DIN 1052 Timber Construction
- DIN 1053 Masonry

2.5 Use, Maintenance

For use and maintenance the instructions of the standards listed in chapter 2.4 – so far described as necessary – have to be considered additionally in their respective valid edition regarding this certificate's date of issue.
In this context the above mentioned bearing reactions and bearing characteristics have to be considered regarding their proof scope, -kind and –magnitude.

3. Conformity Procedure

According to the A-list of building rules part 2, edition 99/1 the procedure of the conformity proof follows the "ÜH" regulations – conformity declaration of the manufacturer – based on a "P"-proof of use – Official Certificate P-850.0425, dated 27.03.2002 (first: 10.07.2000) of the Testing Institute for Mechanical Engineering Materials and Plastics.
The manufacturer has to supervise the production as described in table 8.

Kind of Test	Specification	Frequency
Chemical compounds	chapter 2.2.2 table 7	each mixture charge
Physical properties	chapter 2.2.1 table 6	each mixture charge
Load deflection graph	chapter 2.2.3.1 bearing size 100x100xthickness	each thickness once a year
Shear modulus	chapter 2.2.3.2	each thickness once a year

Table 8: Scope of Works Internal Production Control

4. Conformity Brand

The building product "Calenberg Compact Bearing CR 2000" has to be marked by the manufacturer with the conformity brand (Ü-brand) to conformity brand regulation of the countries. The Ü-brand has to be affixed with the prescribed data on the building product "Calenberg Compact Bearing CR 2000" or on its packing (an add packing note is also valid) or if this is not possible on the delivery note.

5. Legal Basis

This Official Certificate is granted on base of §§ 25a of the building code of Niedersachsen in connection to the standard construction list A, part 2.

6. Legal Remedy Instruction

Against this Official Certificate can be contradicted within one month after publication. The contradiction has to be lodged by letter or writing down at the Material Testing Institute of Mechanical Engineering and Plastic.

7. Common Hints

7.1 The Official Certificate does not replace the legally prescribed approvals, agreements and certifications.

7.2 The Official Certificate is granted without prejudice of the rights of thirds, especially private protective rights.

7.3 The contractor has to hold ready the general supervisory certification on the jobsite.

7.4 The Official Certificate is only to be duplicated completely. A publication in extracts needs the agreement of the Material Testing Institute of Mechanical Engineering and Plastics. Sketches of advertising brochures are not allowed to contradict to the Official Certificate. Translations of the Official Certificate must include the hint: "Translation of the original German issue not examined from the Material Testing Institute of Mechanical Engineering and Plastics ".

Garbsen, 26.03.2008

Head of Testing Institute

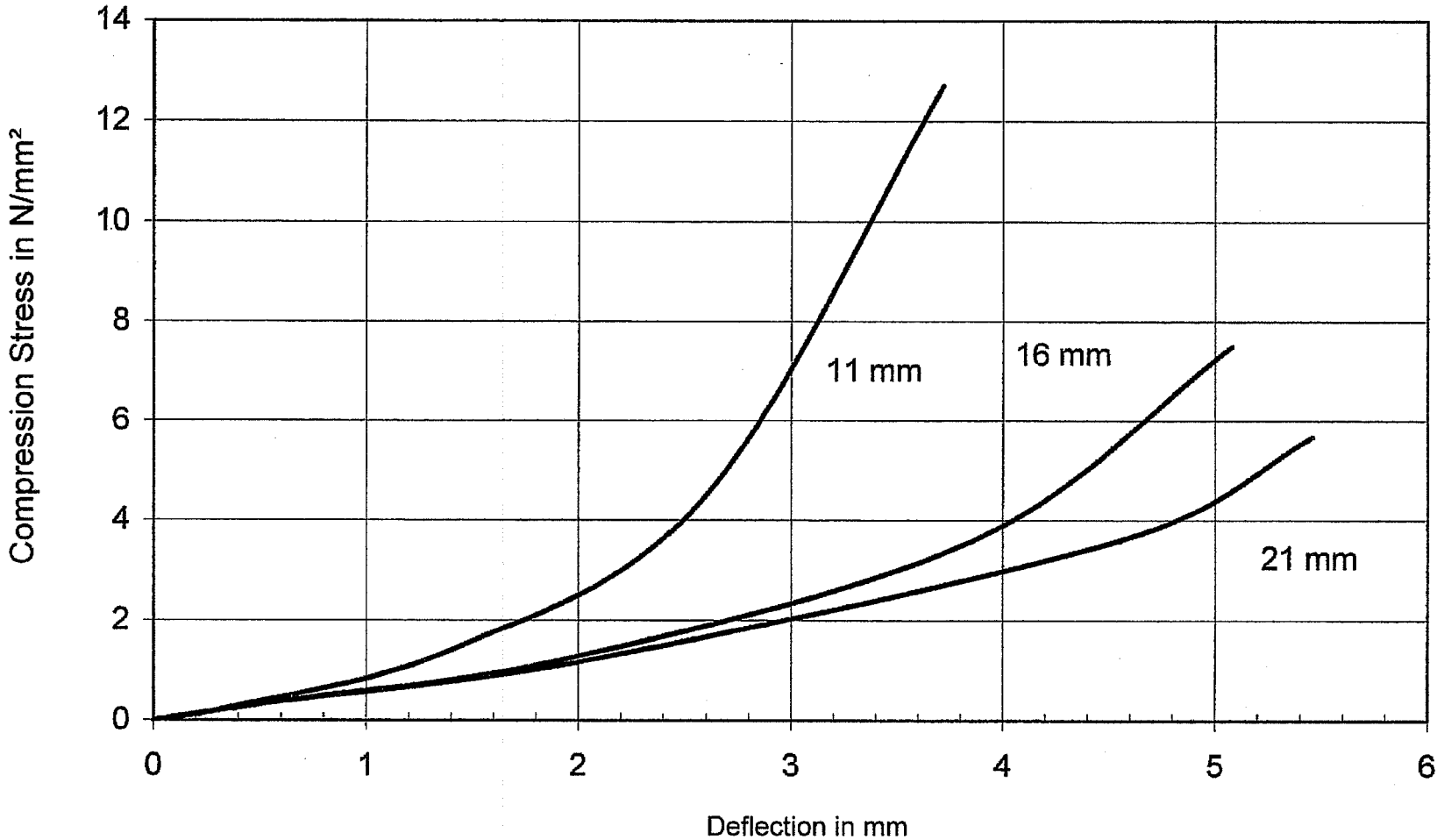
RD Dr.-Ing. Seidel

Deputy

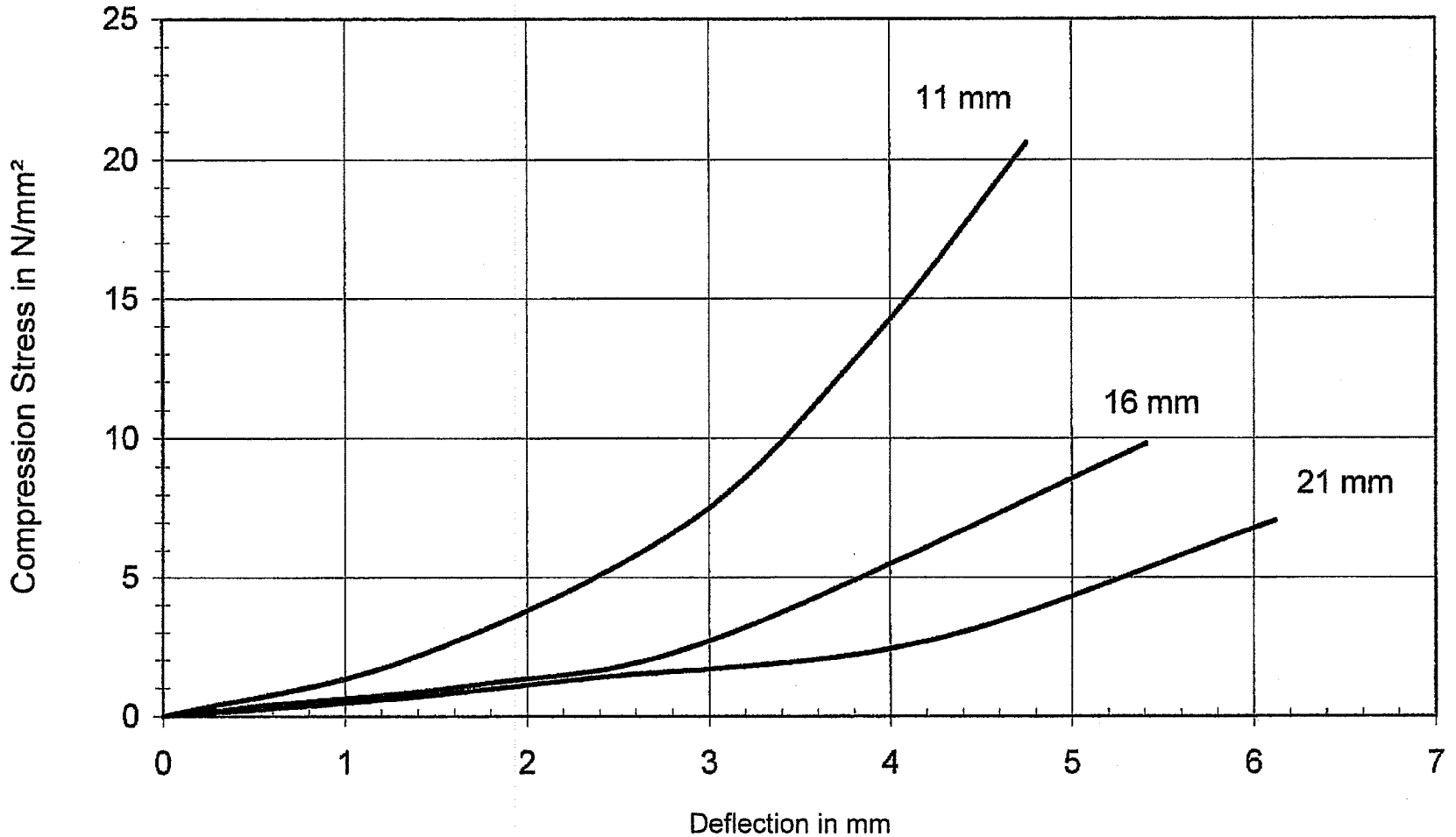
Dipl.-Ing. Witte

10 Enclosures diagrams

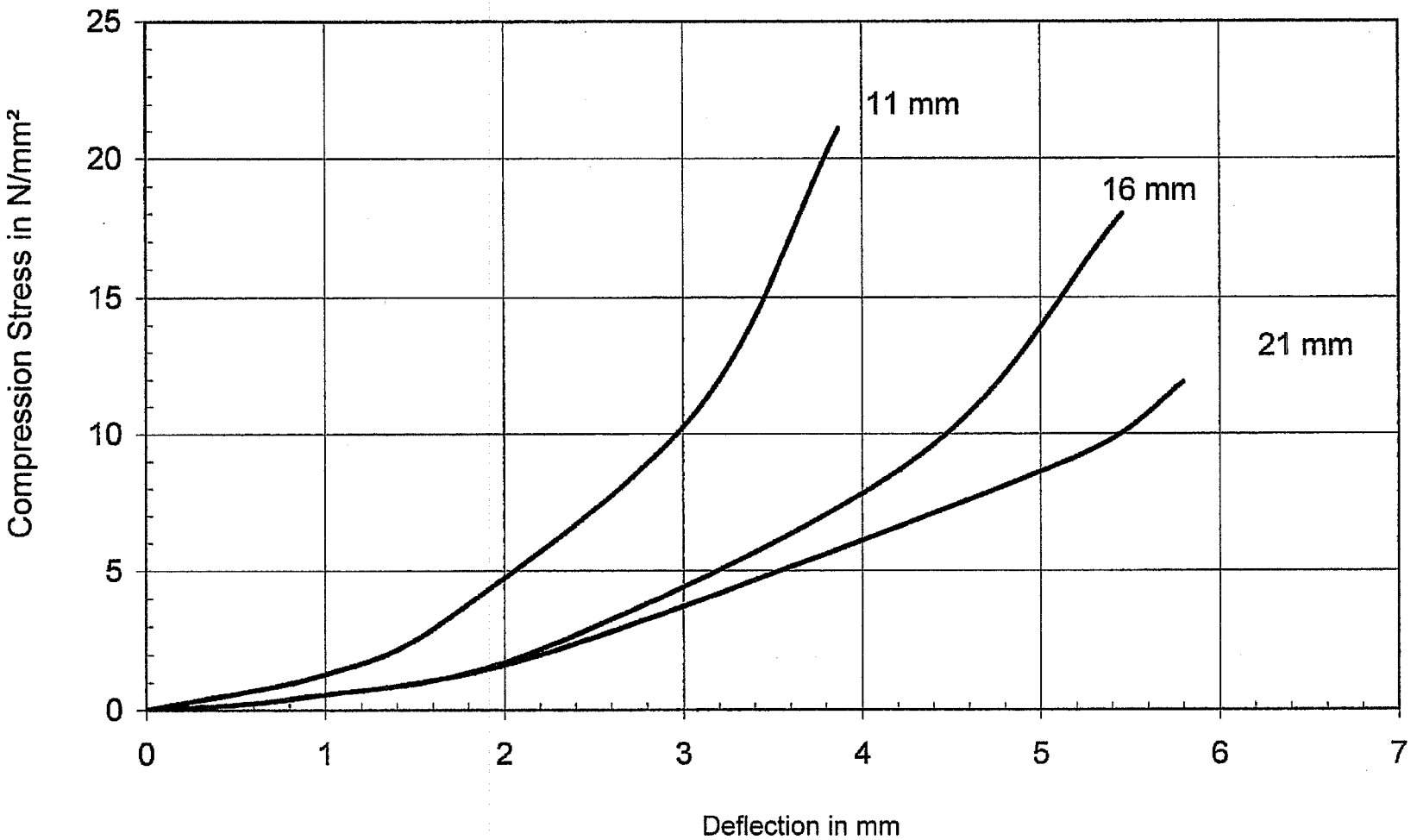
Load Deflection Curve
Calenberg Compact Bearing CR 2000, 80 x 80 mm²
850.0425



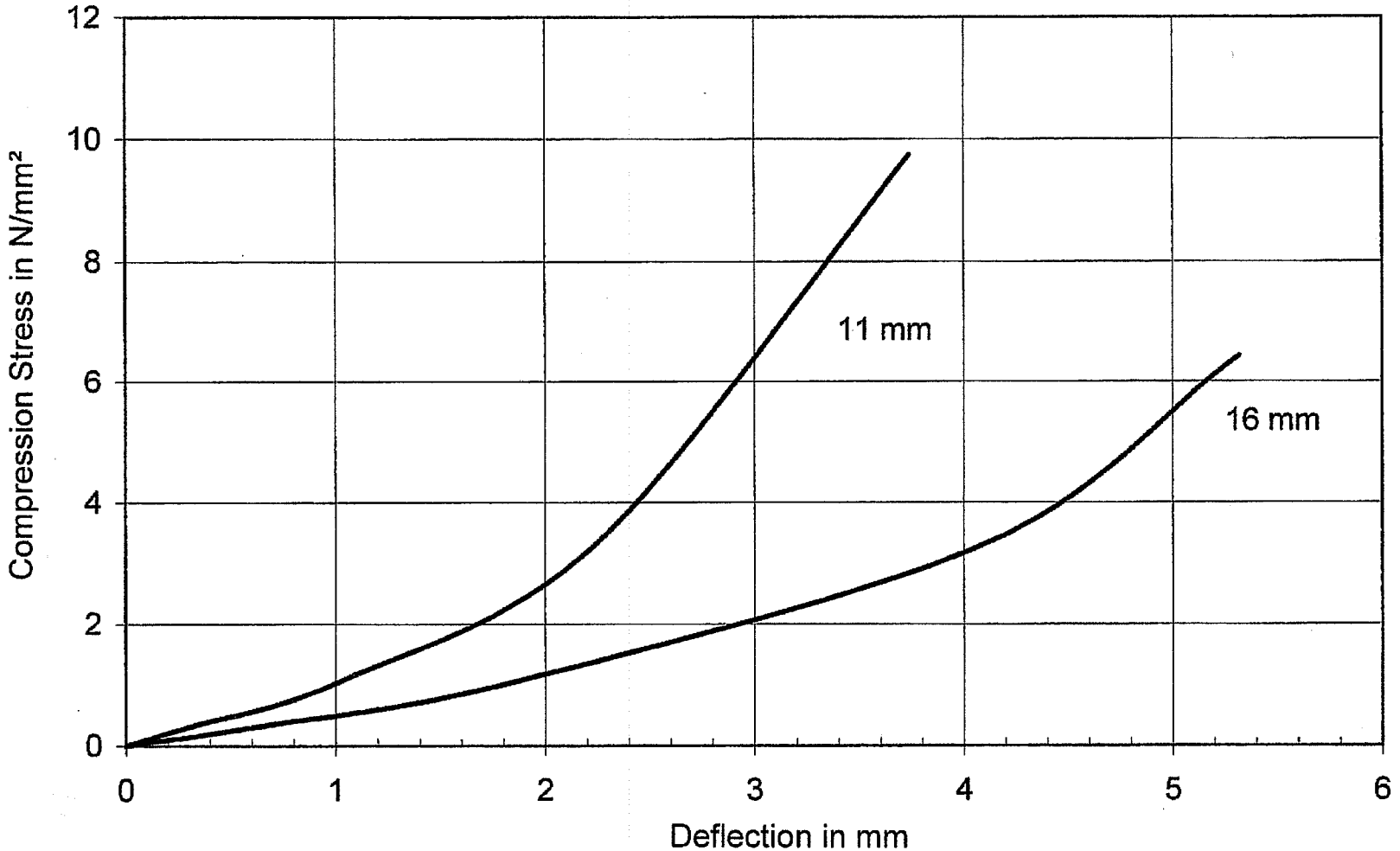
850.0425, Load Deflection Curve
Calenberg Compact Bearing CR 2000, 100 x 100 mm²



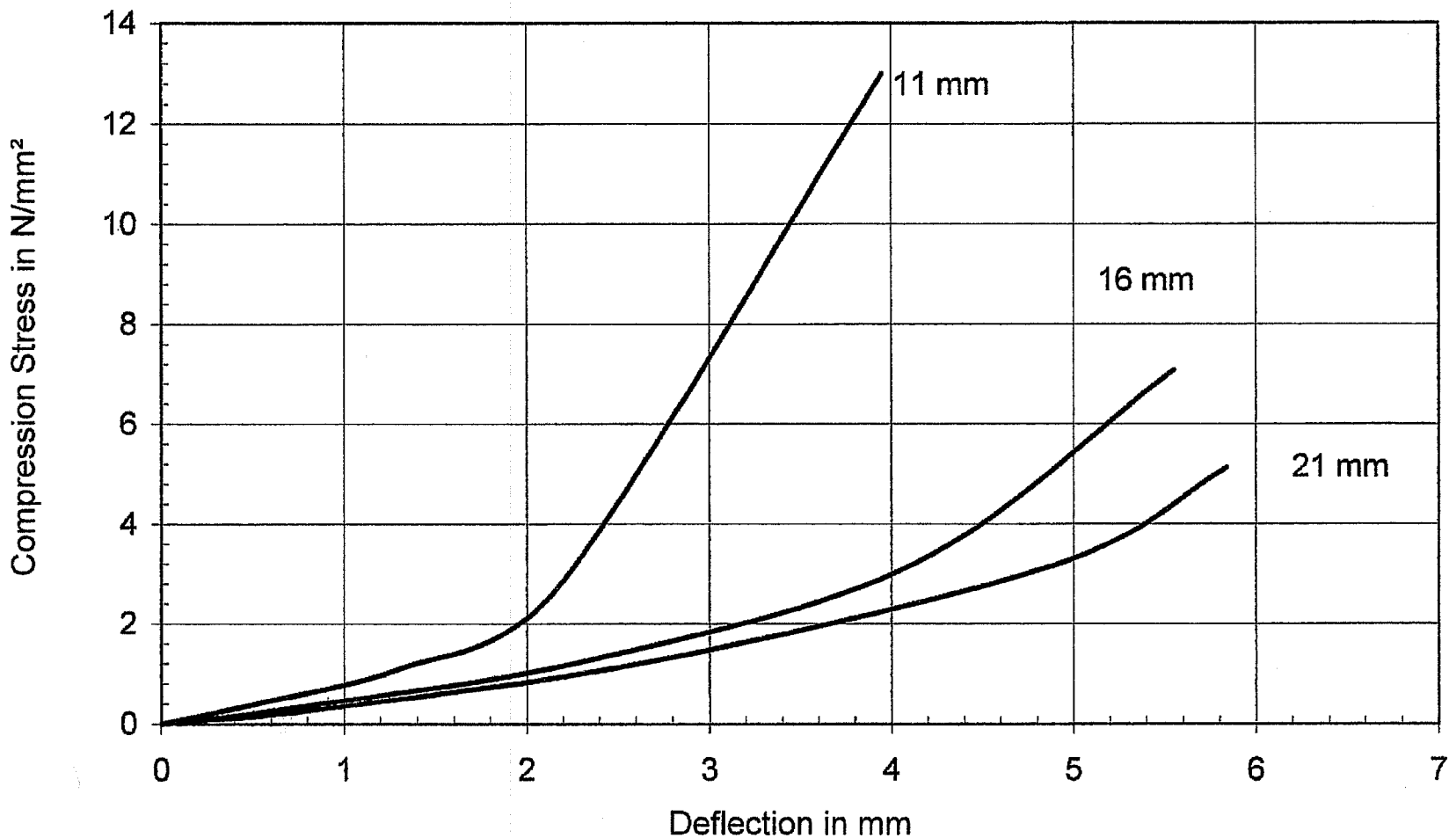
850.0425, Load Deflection Curve
Calenberg Compact Bearing CR 2000, 150 x 150 mm²



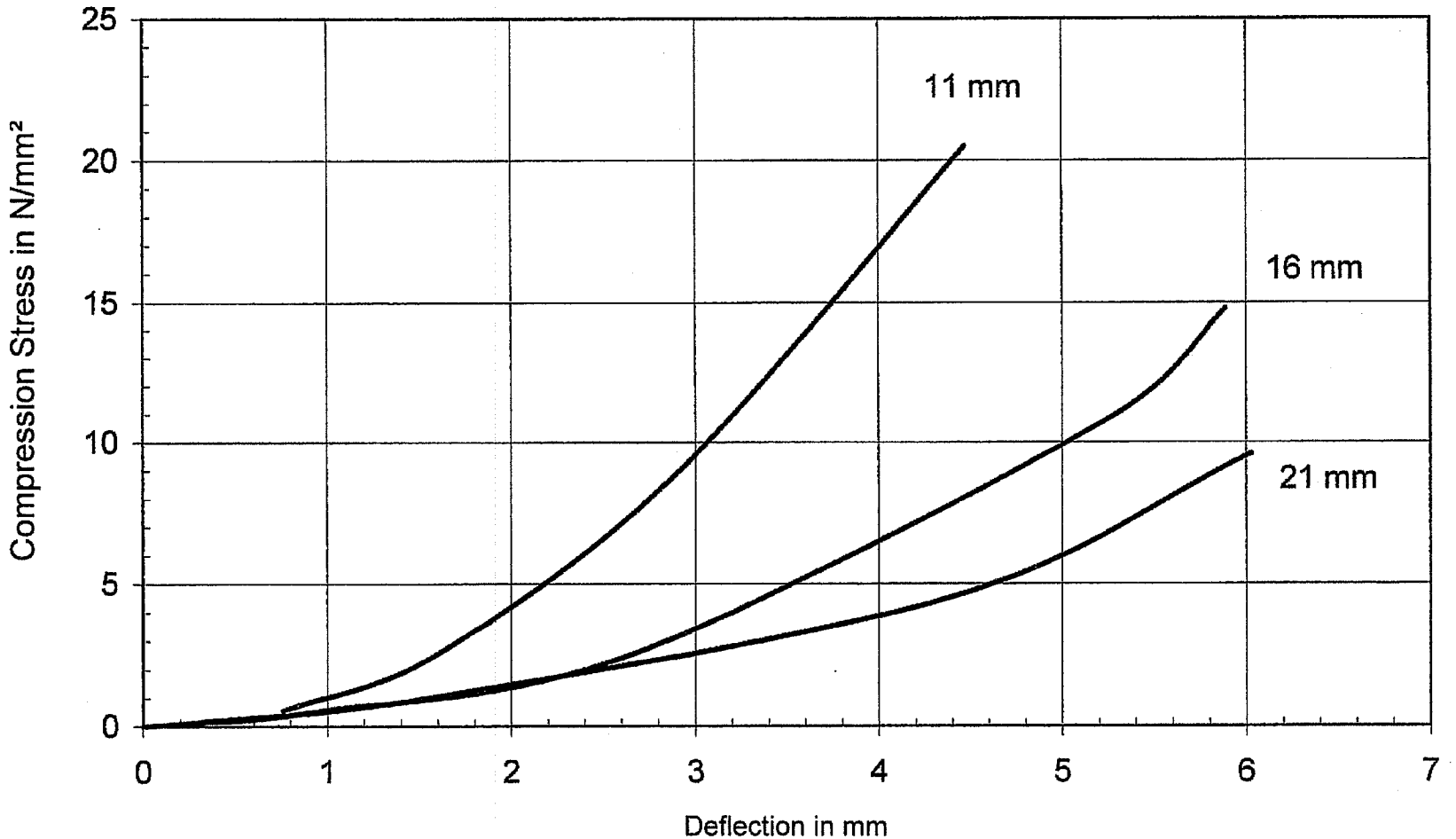
850.0425, Load Deflection Curve
Calenberg Compact Bearing CR 2000, 50 x 100 mm²



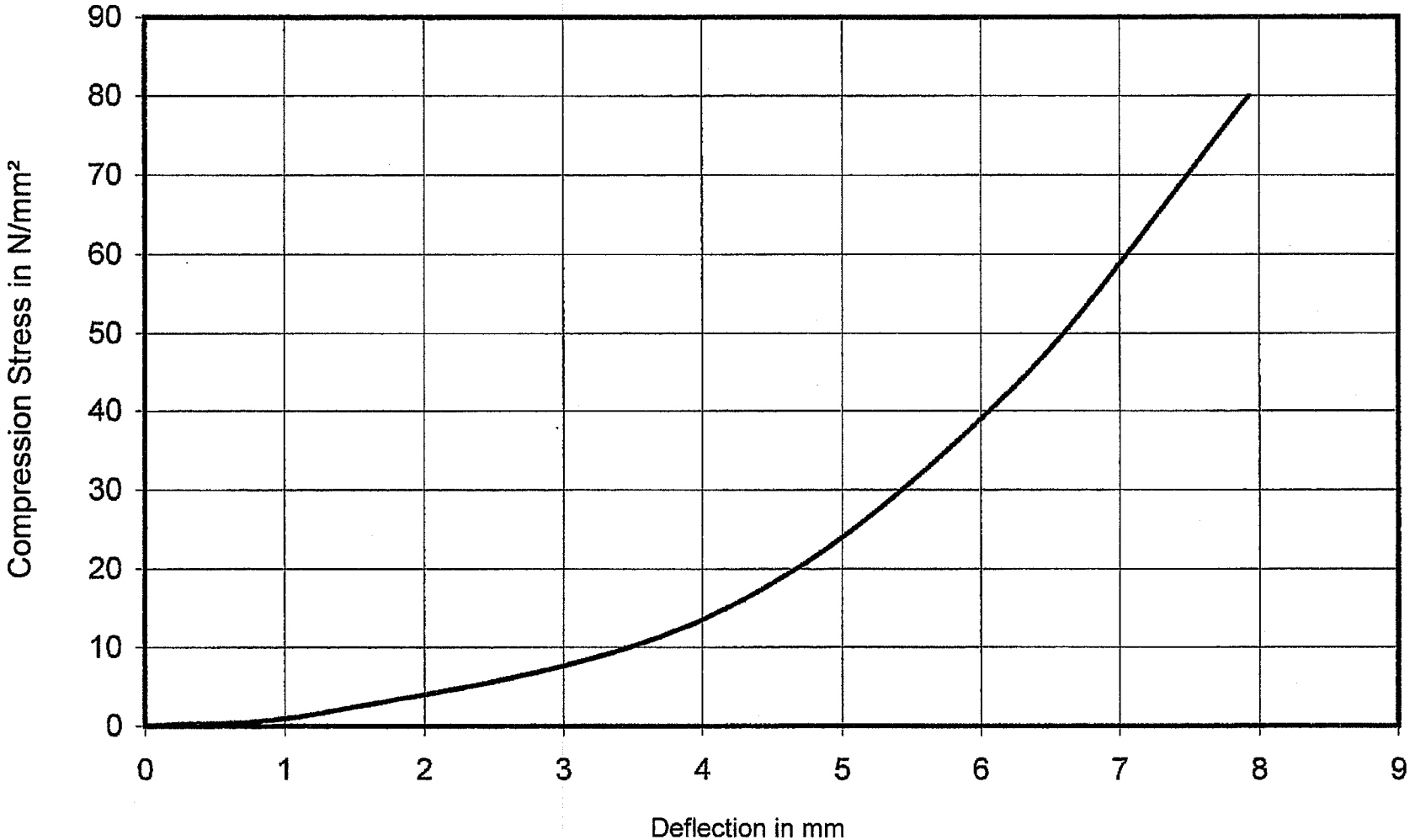
850.0425, Load Deflection Curve
Calenberg Compact Bearing CR 2000, 190 x 50 mm²



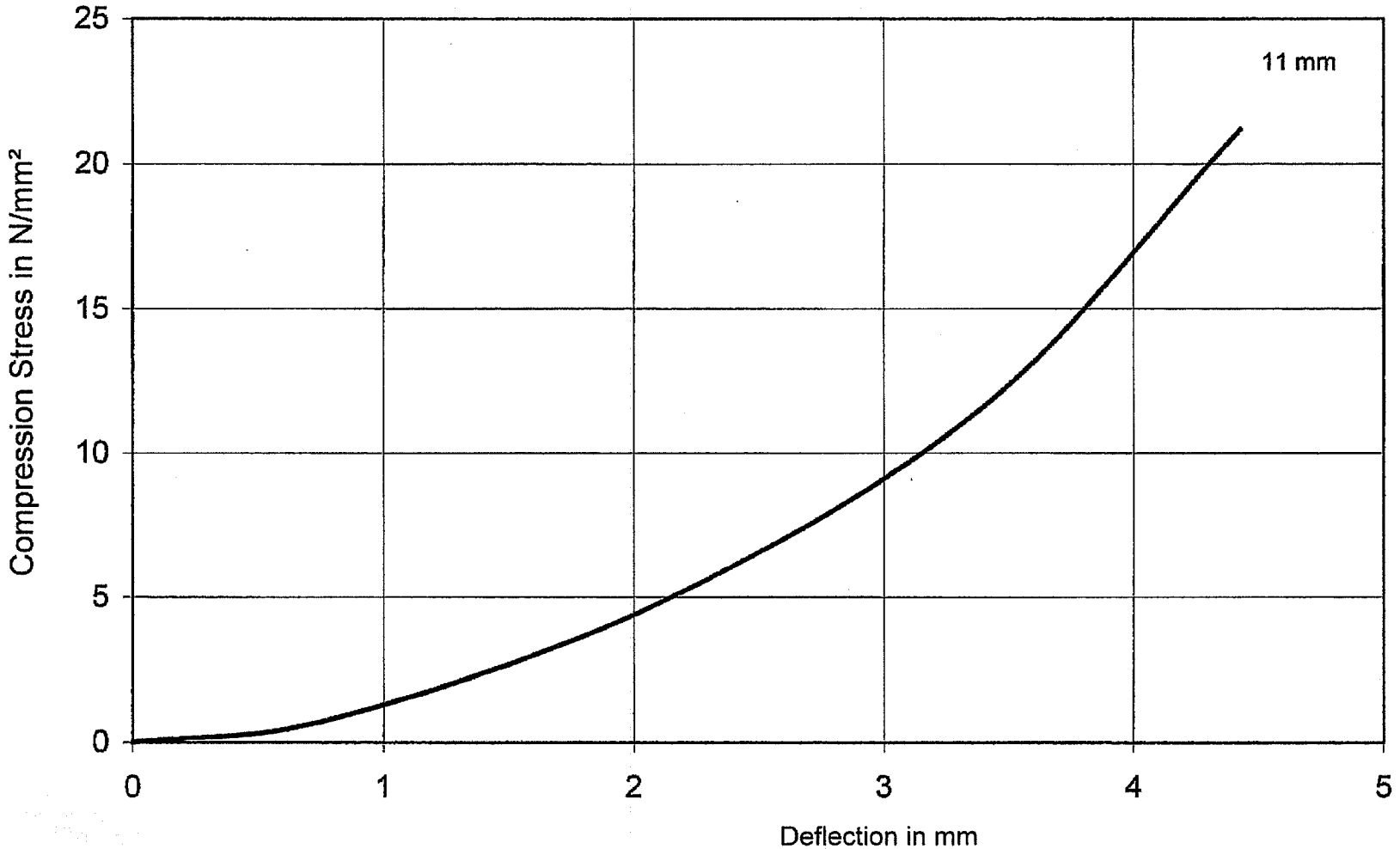
850.0425, Load Deflection Curve
Calenberg Compact Bearing CR 2000, 190 x 100 mm²



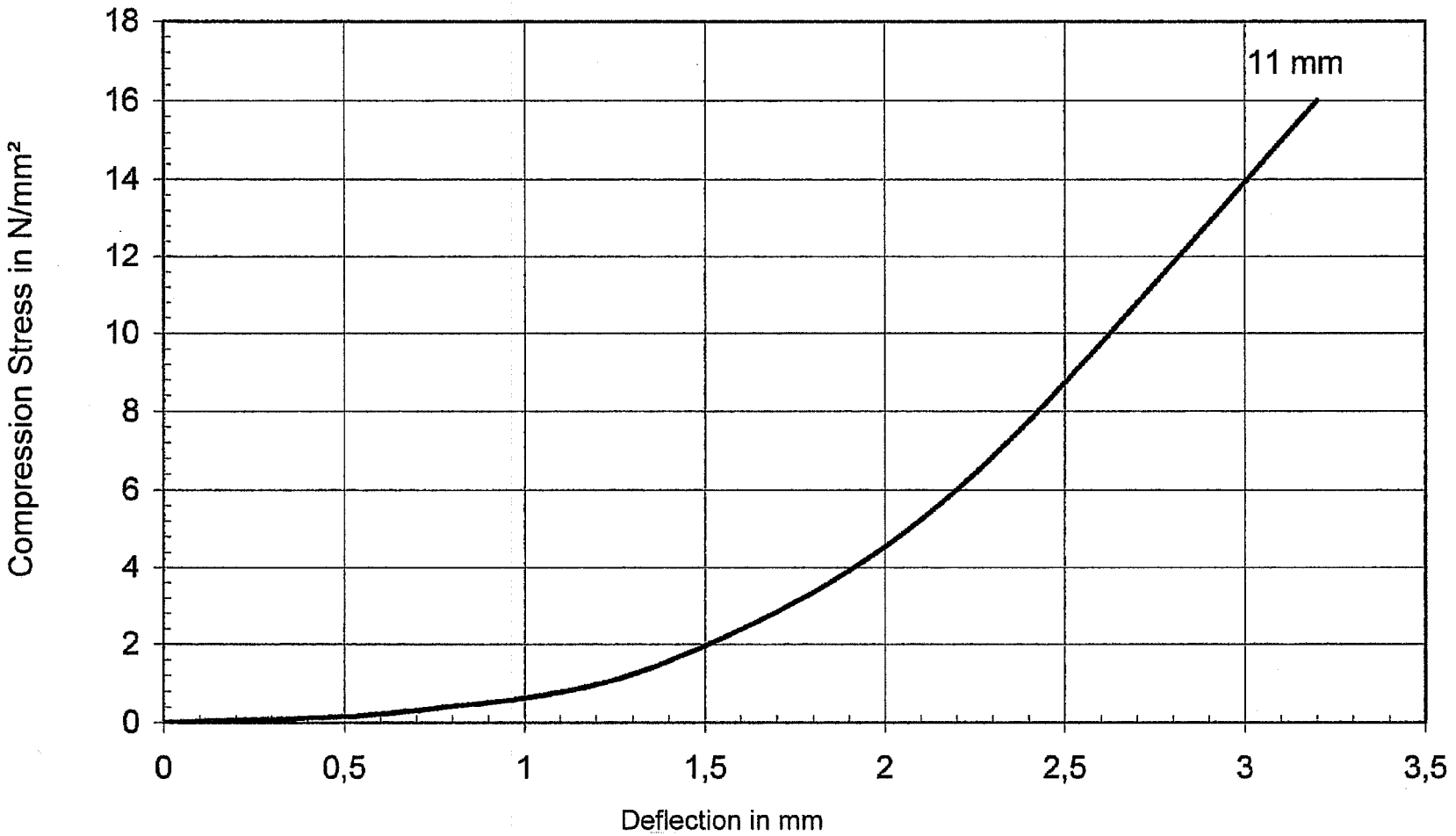
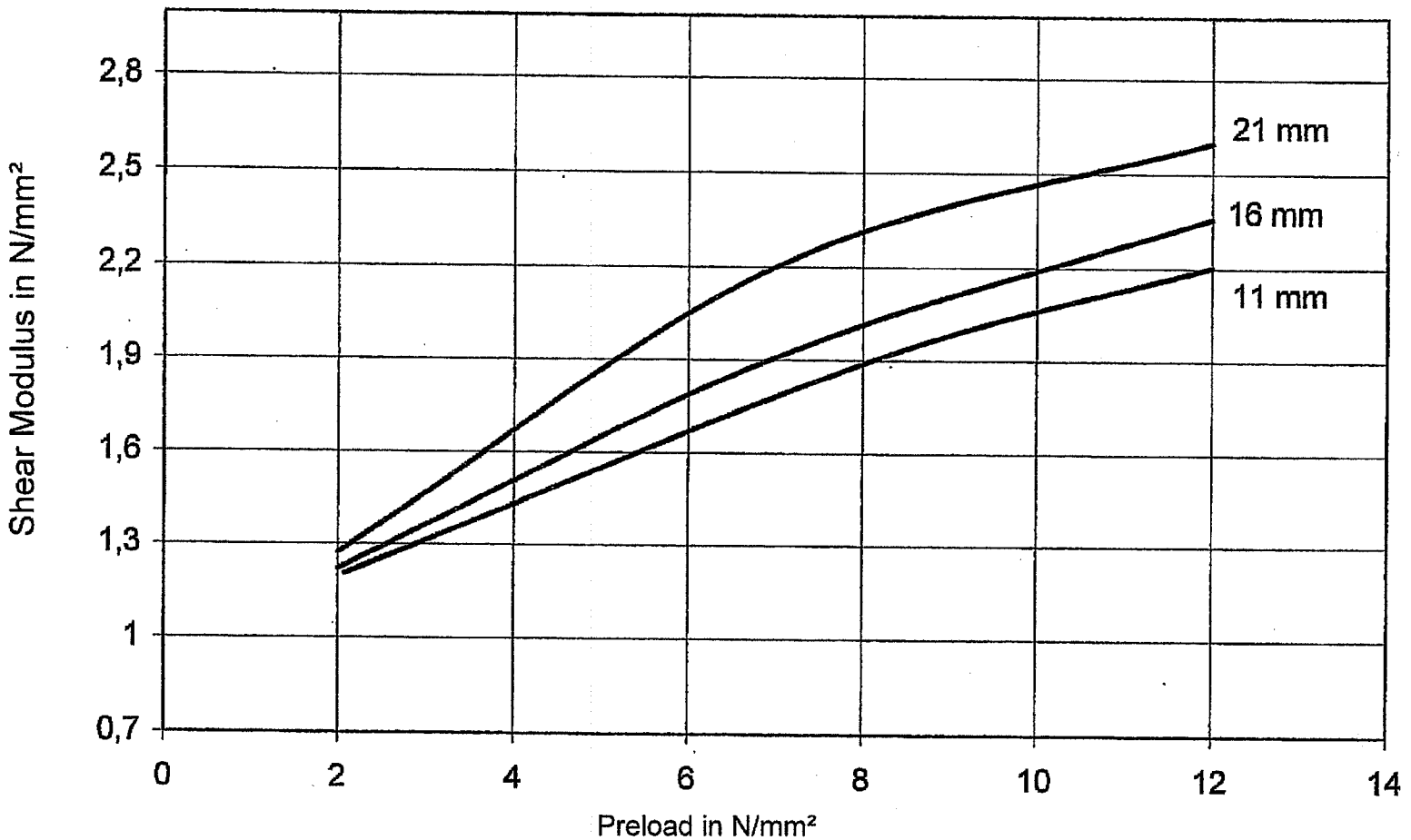
850.0425, Load Deflection Curve
Calenberg Compact Bearing CR 2000, 100 x 100 x 11mm³



850.0425, Load Deflection Curve
Calenberg Compact Bearing CR 2000, 120 x 120 mm²



850.0425, Load Deflection Curve
Calenberg Compact Bearing CR 2000, 250 x 250 mm²



850.0425, Shear Modulus
Calenberg Compact Bearing CR 2000