WABCO -brake calculation no: WPL 74117S date 20.05.2011

trailer (full, semi-, centre-axle) with air brake system acc. to 71/320/EEC, last amended by 98/12/EC and 2006/96/EC or UN/ECE-R.13.11

distribution: BODEX
WAU-PL

please note

This brake calculation is made under consideration of
-the legal precriptions mentioned above in the version valid at the time of making the program (V6.11.04.19),
-the functional characteristics of our products as well as the data of the brake out of the test approvals of the axle manufacturers, and
-the other vehicle data included in the brake calculation.
Please check whether these data correspond to the actual vehicle data.
Our conditions of delivery apply (particularly section 9.0).
In any case we commend to do a braking harmonisation!
WABCOBrake V6.11.04.19 db 19.04.2011

vehicle manufacturer: BODEX
trailer model :
trailer type : 3-axle-semi-trailer
remarks : air / hydraulic / VA suspension
WABCO TRAILER - EBS
TRISTOP 2+3: 16/24
385/65 R 22,5

axle 1 + 2 + 3 : SAF, SB 7... / SK 7..., 36110303,

		unladen	laden
total mass	P in kg	7000 - 7000	39000 - 39000
king-pin	PS kg	1900 - 1900	12000 - 12000
axle 1	P1 in kg	1700	9000
axle 2	P2 in kg	1700	9000
axle 3	P3 in kg	1700	9000
total axle mass	PR in kg	5100	27000
wheel base	E in mm	5500 - 5500	
centre of gravity height	h in mm	1600	2400
K-factor		Kv min 1,4979	Kc min 0,8729
K-factor		Kv max 1,4979	Kc max 0,8729

		axle 1	axle 2	axle 3
no. of combined axles		1	1	1
no. of brake chambers per axle line	KDZ	2	2	2
The power output corresponds to		KO 195.0	KO 196.3	KO 196.3
brake chamber manufacturer		WABCO	WABCO	WABCO
chamber size		16	16/24	16/24
lever length	lBh in mm	76	76	76
brake factor	[-]	26,13	26,13	26,13
dyn. rolling radius	rdyn min in mm	517	517	517
dyn. rolling radius	rdyn max in mm	517	517	517
threshold torque	Co Nm	10,0	10,0	10,0

calculation:				
chamber pressure (rdyn min)	pH at z=22,5% bar	2,7	2,7	2,7
chamber pressure (rdyn max)	pH at z=22,5% bar	2,7	2,7	2,7
chamber press. (servo)	pcha at pm6,5bar bar	6,3	6,3	6,3
piston force	ThA at pm6,5bar N	6383	6383	6383
brake force (rdyn min)	T lad. at pm6,5bar N	48905	48905	48905
brake force (rdyn max)	T lad. at pm6,5bar N	48905	48905	48905
brake force within 1 % rolling friction proportion	%	33,3	33,3	33,3

braking rate z laden
z = sum (TR)/PRmax

0,554 for rdyn min
0,554 for rdyn max

Trailer may only be operated in combination with trucks/tractors with ISO 7638 supply (5 or 7 polar).

brake diagram : 841 701 101 0

maximum pressure: 8,5 bar

axle 1:
valve 1: 971 002 ... 0 WABCO
EBS emergency valve

valve 2: 480 102 ... 0 WABCO
EBS trailer modulator

brake cylinder: WABCO 423 104 710 0

axle 2:
valve 1: 971 002 ... 0 WABCO
EBS emergency valve

valve 2: 480 102 ... 0 WABCO
EBS trailer modulator

brake cylinder: WABCO 925 464 50. 0

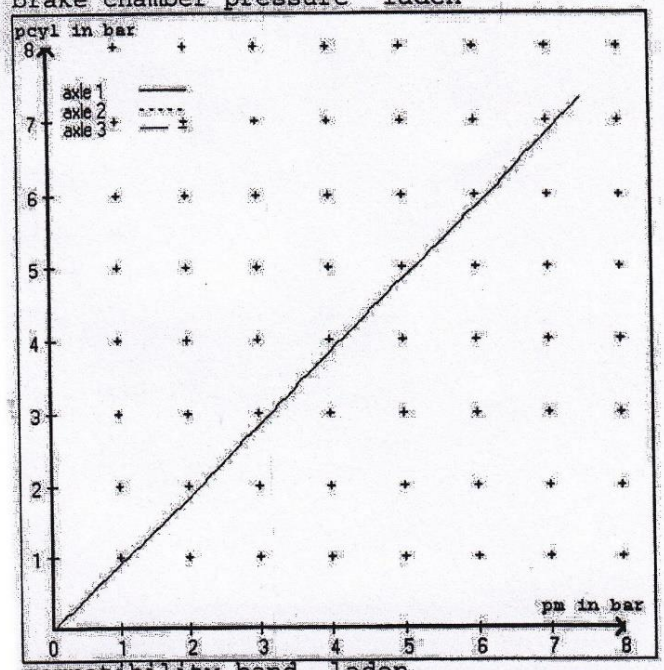
axle 3:
valve 1: 971 002 ... 0 WABCO
EBS emergency valve

valve 2: 480 102 ... 0 () WABCO or 480 207 0.. 0
EBS trailer modulator

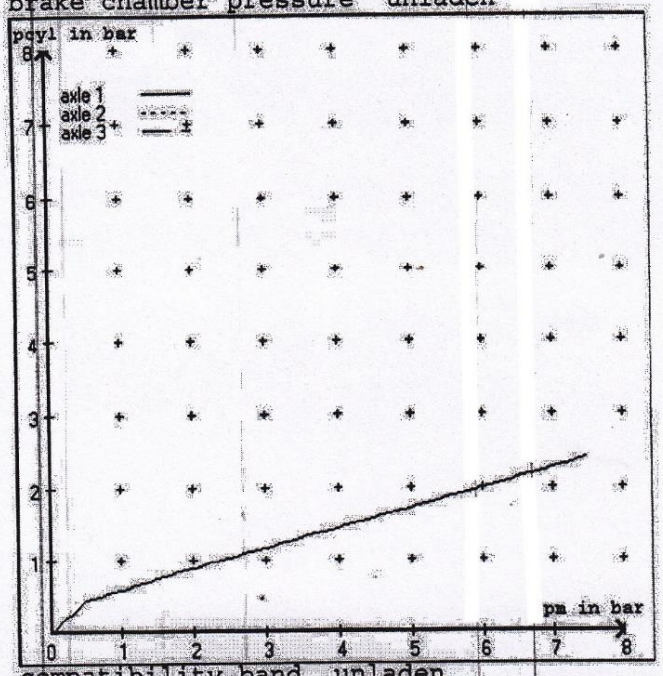
brake cylinder: WABCO 925 464 50. 0

test type III (zIII = 0,30)	for rdyn min :	axle1	axle2	axle3
at pm 3,8 bar =>	pcha in bar :	3,6	3,6	3,6
test type III (zIII = 0,06)	for rdyn min :	axle1	axle2	axle3
at pm 1,0 bar =>	pcha in bar :	1,0	1,0	1,0

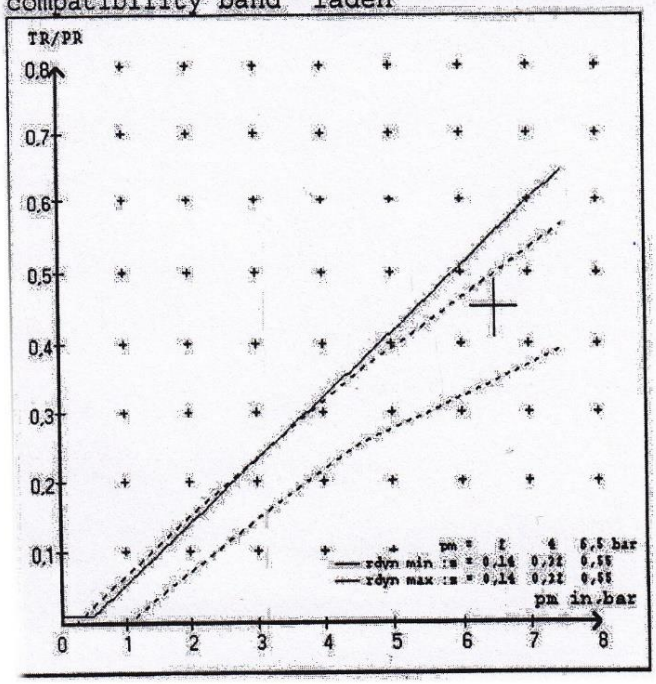
brake chamber pressure laden



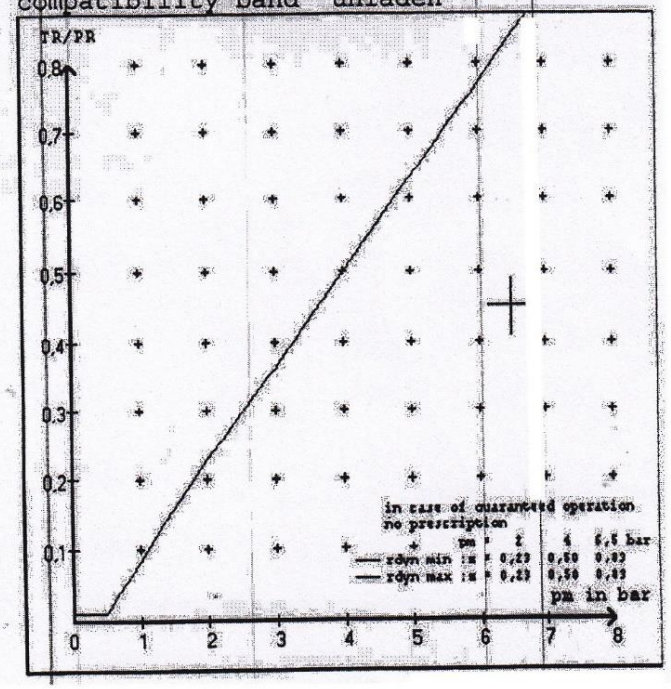
brake chamber pressure unladen



compatibility band laden



compatibility band unladen



vehicle manufacturer: BODEX
trailer model : SU90333GHBSBU1288
trailer type : 3-axle-semi-trailer

brake chamber and lever length :

axle 1 :	2 x type/diameter	16	(WABCO)	lever length 76 mm
axle 2 :	2 x type/diameter	16/24	(WABCO)	lever length 76 mm
axle 3 :	2 x type/diameter	16/24	(WABCO)	lever length 76 mm

brake diagram : 841 701 101 0

valve :

971 002 ... 0	WABCO EBS emergency valve
480 102 ... 0	WABCO EBS trailer modulator
480 102 ... 0	WABCO EBS trailer modulator or 480 207 0.. 0

EBS input data
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vehicle manufacturer: BODEX
trailer model : SU90333GHBSBU1288
trailer type : 3-axle-semi-trailer
brake calculation no. : WPL 74117S

tire circumference main axle : 3250 for rdyn max
tire circumference auxiliary axle : 3250 for rdyn max

assignment pm / deceleration z: pm 0,5 bar z = 0,000
(laden condition) 2,0 bar z = 0,140
6,5 bar z = 0,550

control pressure pm			6,5	control pressure pm		0,5	2,0	6,5
axle	axle load unladen	bellow pr. unladen	brake pr. unladen	axle load laden	bellow pr. laden	brake pr. laden		
1	1700	to be entered by the vehicle manufact.	2,1	9000	to be entered by the vehicle manufact.	0,5	1,8	6,3
2	1700		2,1	9000		0,5	1,8	6,3
3	1700		2,1	9000		0,5	1,8	6,3
4	0		0,0	0		0,0	0,0	0,0
5	0		0,0	0		0,0	0,0	0,0

The unladen values indicated in the above table are values for the basic parameter set. Higher unladen axle loads and liftaxles are automatically recognized and do not require separate adjustment.
The above unladen axle loads must not be fallen below.
==========

axle 1		axle 2		axle 3	
axle load	pcyl	axle load	pcyl	axle load	pcyl
1700	2,1	1700	2,1	1700	2,1
2200	2,4	2200	2,4	2200	2,4
2700	2,7	2700	2,7	2700	2,7
3200	3,0	3200	3,0	3200	3,0
3700	3,3	3700	3,3	3700	3,3
4200	3,5	4200	3,5	4200	3,5
4700	3,8	4700	3,8	4700	3,8
5200	4,1	5200	4,1	5200	4,1
8000	5,7	8000	5,7	8000	5,7
9000	6,3	9000	6,3	9000	6,3

data sheet to EC/ECE vehicle type-approval certificate concerning braking equipment: according to 98/12/EC annex IX 2.7.4 / ECE R13 annex 11

axle 1 :	reference axle: SAF	SBK 2243-..	brake lining: Jurid 539	
	test report :	36110303	date	: 25.03.2009
axle 2 :	reference axle: SAF	SBK 2243-..	brake lining: Jurid 539	
	test report :	36110303	date	: 25.03.2009
axle 3 :	reference axle: SAF	SBK 2243-..	brake lining: Jurid 539	
	test report :	36110303	date	: 25.03.2009

calc. verif. of residual (hot) braking force type III
(item 4.2 of appendix I to annex VII)

axle 1	(rdyn 517 mm)	T = 24,5 % Fe
axle 2	(rdyn 517 mm)	T = 24,5 % Fe
axle 3	(rdyn 517 mm)	T = 24,5 % Fe

calculated actuator stroke in mm
(item 4.3.1.1 of appendix I to annex VII)

axle 1	(sp = 49 mm)	s = 46 mm
axle 2	(sp = 49 mm)	s = 46 mm
axle 3	(sp = 49 mm)	s = 46 mm

average thrust output in N at pm = 6,5 bar (however max. pcha = 7,0 bar

axle1	ThA = 6383 N
axle2	ThA = 6383 N
axle3	ThA = 6383 N

calc. residual (hot) braking force in N
(item 4.3.1.4 of appendix I to annex VII)

axle 1	(rdyn 517 mm)	T = 42101 N
axle 2	(rdyn 517 mm)	T = 42101 N
axle 3	(rdyn 517 mm)	T = 42101 N

	basic test of subject trailer (z)	type III (calculated) residual (hot) braking
braking rate of the vehicle (item 4.3.2 to appendix I to annex VII)	0,55	0,48
required braking rate (items 1.3.3 and 1.6.2 to annex II)		>= 0,4 and >= 0,6*z (0,33)

calc. residual (hot) braking force in N
(item 4.3.1.4 of appendix I to annex VII)

axle 1	(rdyn 517 mm)	T = 42101 N
axle 2	(rdyn 517 mm)	T = 42101 N
axle 3	(rdyn 517 mm)	T = 42101 N

	basic test of subject trailer (z)	type III (calculated) residual (hot) braking
braking rate of the vehicle (item 4.3.2 to appendix I to annex VII)	0,55	0,48
required braking rate (items 1.3.3 and 1.6.2 to annex II)		>= 0,4 and >= 0,6*z (0,33)

spring parking brake

		axle 2	axle 3
no of TRISTOP-actuators per axle line	KDZ	2	2
TRISTOP-actuator type		16/24	16/24
lever length	lBh in mm	76	76
stat. tyre radius	rstat max in mm	494	494
at a stroke of	s in mm	30	30
min. force of spring brake	TFZ in N	7602	7602
sp.brake chamber no 925		464 50. 0464	50. 0
release pressure	pLs in bar	5,0	5,0

calculation:

ratio until road		4,0200	4,0200
iFb = lBh*Eta*C*rBt/(rBn*rstat)			
	for rstat in mm	494	494
brake force of spring br. Tf	in N	60062	60062
Tf = (TFZ*KDZ-2*Co/lBh)*iFb			

braking rate zf laden 0,324
zf = sum (Tf)/P + 0,01

Test of the frictional connection required by the parking brake

minimum wheelbase/minimum supporting width min Ef necessary to fulfil the regulations

min Ef = E * (1 - PR/P + zferf * h/E) / (1 - zferf / (fzul * nf/ng))

min Ef = 3207 mm for E = 5500 mm
==========
min Ef = 3207 mm for E = 5500 mm
==========

min Ef	=		minimum distance between front axle(s) (trailer) or support (semitrailer) and the rear axle(s) (resultant of the bogie)
E	=		wheel base
fzul	=	0,80	maximum permissible frictional connection required
zferf	=	0,18	maximum required braking ratio of the parking brake
h	=	2400 mm	height of center of gravity - laden
PR	=	27000 kg	maximum bogie mass - laden
P	=	39000 kg	maximum total mass - laden
nf	=	2	no. of axle(s) with TRISTOP spring brake actuators
ng	=	3	no. of bogie axle(s)

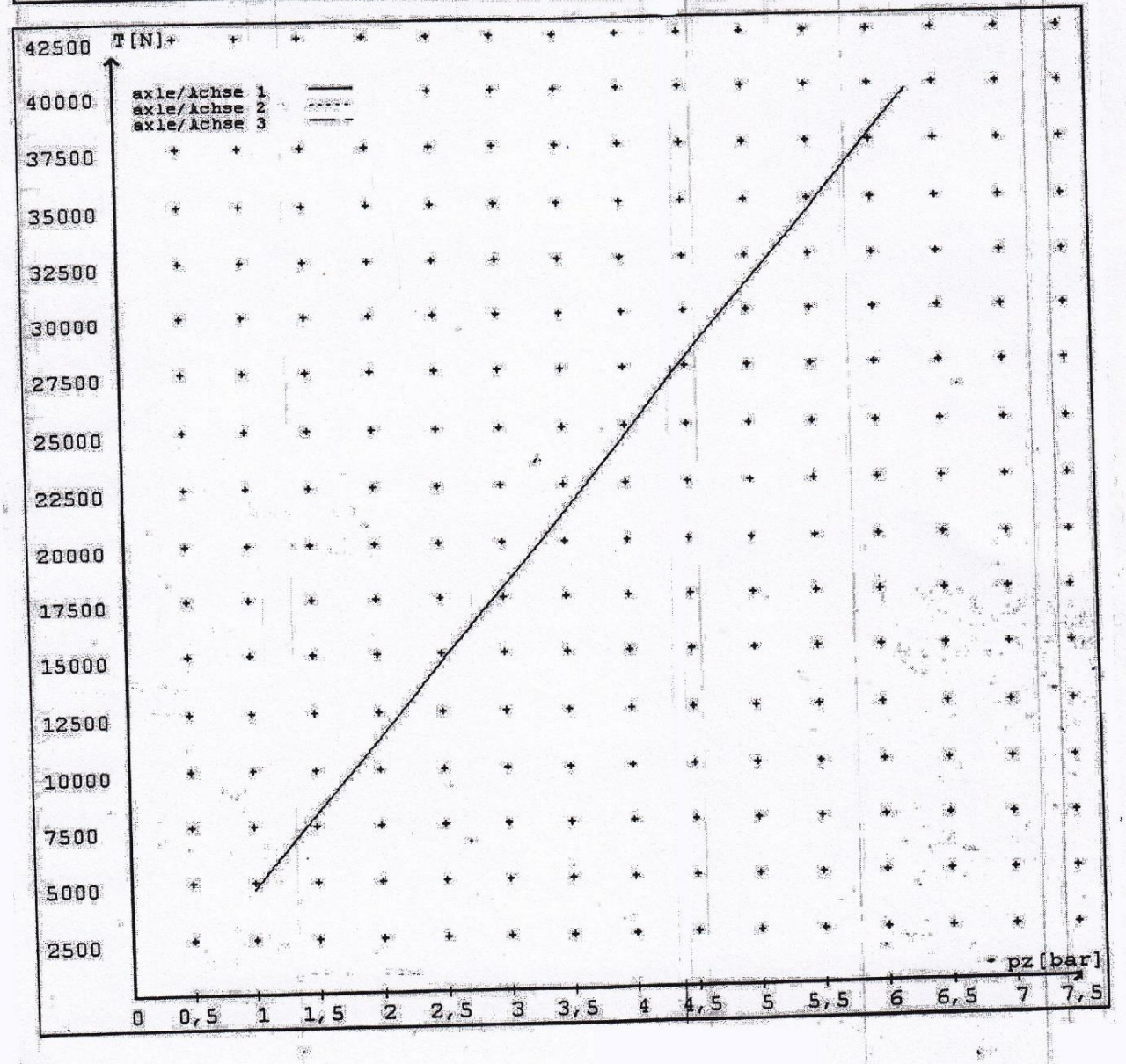
reference values

reference values for z = 45% for max rdyn: 517 mm

	pz [bar]	T [N]	T [N]
axle 1	1,0 6,3		4601 39724
axle 2	1,0 6,3		4601 39724
axle 3	1,0 6,3		4601 39724

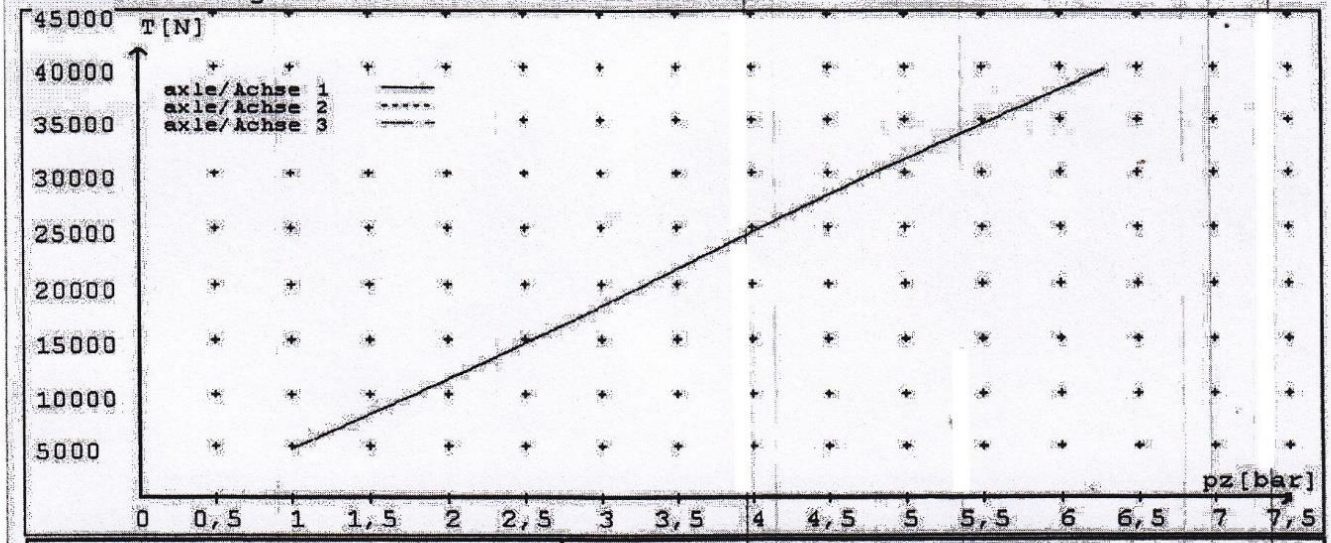
VIN - no.:

	Axle(s) / Achse(n)					
brake cylinder type (service / parking) Bremszylinder Typ (Betrieb / Fest)	16/	16/24	16/24	/	/	
Maximum stroke smax = ...mm maximaler Hub smax = ...mm	57	57	57			
Lever length = ...mm Hebellänge = ...mm	76	76	76			



Print on WABCO no. 899 200 922 4 (only possible with laser printers!)

reference values for z = 0,45 — **for max rdyn: 517 mm**
Angabe der Referenzwerte für z = 0,45 — für max rdyn: 517 mm
brake calculation no: WPL 74117S date 20.05.2011
Bremsberechnung Nr: WPL 74117S vom 20.05.2011



		Axle(s) / Achse(n)				
brake cylinder type (service / parking) Bremszylinder Typ (Betrieb / Fest)	16/	16/24	16/24	/	/	
Maximum stroke smax = ...mm maximaler Hub smax = ...mm	57	57	57			
Lever length = ...mm Hebellänge = ...mm	76	76	76			