trailer (full, semi-, centre-axle) with air brake system acc. to UN/ECE-R.13.11

distribution: OP8020

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 (V6.19.11.07).
-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 V6.19.11.07 db 15.09.2022

vehicle manufacturer: OP8020
trailer model : GPNED2
trailer type : 4-axle-semi-trailer
remarks : air / hydraulic / VA suspension
WABCO TRAILER - EBS E
TRISTOP 1+2+3+4: 30/30
245/70 R 17,5

axle 1 + 2 + 3 + 4 : SAF, SNK 300x200S, TDB 0882 ECE,

		unladen	laden
total mass	P in kg	16300 - 16300	69000 - 69000
king-pin	PS kg	5540 - 5540	25000 - 25000
axle 1	P1 in kg	2690	11000
axle 2	P2 in kg	2690	11000
axle 3	P3 in kg	2690	11000
axle 4	P4 in kg	2690	11000
total axle mass	PR in kg	10760	44000
wheel base	E in mm	11670 - 20670	
centre of gravity height	h in mm	800	1800
K-factor		Kv min 2,0748	Kc min 1,1903
K-factor		Kv max 2,0964	Kc max 1,2599

		axle 1	axle 2	axle 3	axle 4
no. of combined axles		1	1	1	1
no. of brake chambers per axle line	KDZ	2	2	2	2
The power output corresponds to		BC 0024.1	BC 0024.1	BC 0024.1	BC 0024.1
brake chamber manufacturer		WABCO	WABCO	WABCO	WABCO
chamber size		30/30	30/30	30/30	30/30
lever length	lBh in mm	152	152	152	152
brake factor	[-]	7,50	7,50	7,50	7,50
dyn. rolling radius	rdyn min in mm	383	383	383	383
dyn. rolling radius	rdyn max in mm	383	383	383	383
threshold torque	Co Nm	30,0	30,0	30,0	30,0
calculation:					
chamber pressure(rdyn min)	pH at z=22,5% bar	2,4	2,4	2,4	2,4
chamber pressure(rdyn max)	pH at z=22,5% bar	2,4	2,4	2,4	2,4
chamber press.(servo)	pcha at pm6,5bar bar	5,7	5,7	5,7	5,7
piston force	ThA at pm6,5bar N	10329	10329	10329	10329
brake force(rdyn min)	T lad. at pm6,5bar N	61393	61393	61393	61393
brake force(rdyn max)	T lad. at pm6,5bar N	61393	61393	61393	61393
Brake force incl. 1 % rolling resistance					
proportion	%	25,0	25,0	25,0	25,0

braking rate z laden	0,569	for rdyn min
z = sum (TR)/PRmax	0,569	for rdyn max

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

brake diagram : 841 701 050 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 925 377 1.. 0 / 925 377 000/001 0

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

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

  brake cylinder: WABCO 925 377 1.. 0 / 925 377 000/001 0

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

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

  brake cylinder: WABCO 925 377 1.. 0 / 925 377 000/001 0

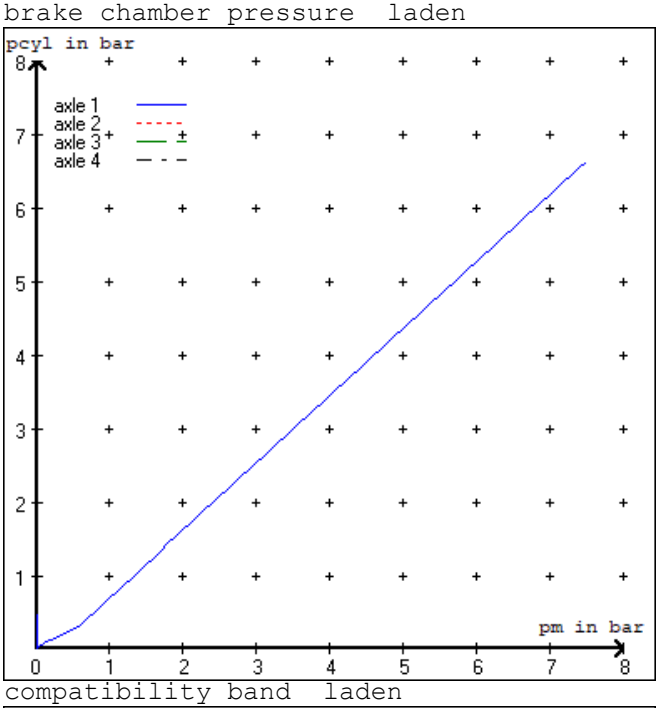
axle 4:
  valve 1: 971 002 ... 0 WABCO
           EBS emergency valve

  valve 2: 480 207 0.. 0 WABCO or 480 207 2.. 0
           EBS relay valve

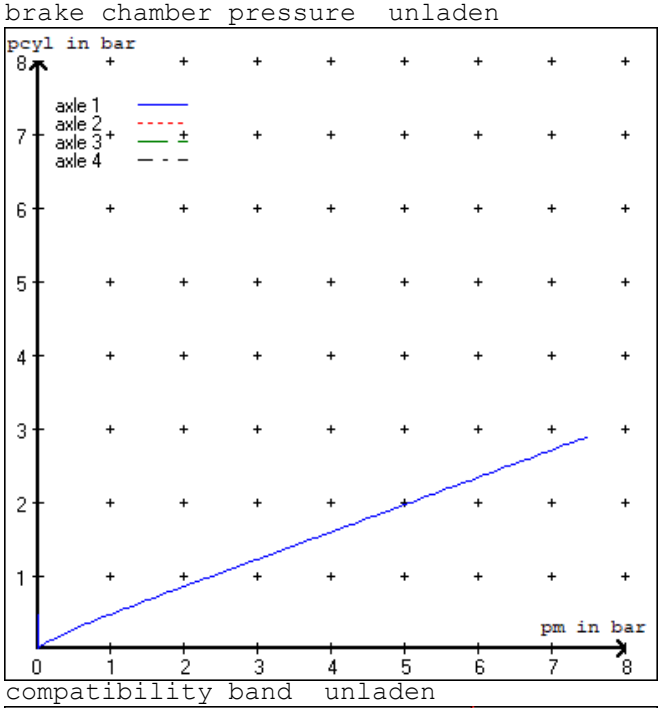
  brake cylinder: WABCO 925 377 1.. 0 / 925 377 000/001 0

test type III (zIII = 0,30)	for rdyn min :	axle1	axle2	axle3	axle4
at pm 3,6 bar =>	pcha in bar :	3,1	3,1	3,1	3,1
test type III (zIII = 0,06)	for rdyn min :	axle1	axle2	axle3	axle4
at pm 1,1 bar =>	pcha in bar :	0,8	0,8	0,8	0,8

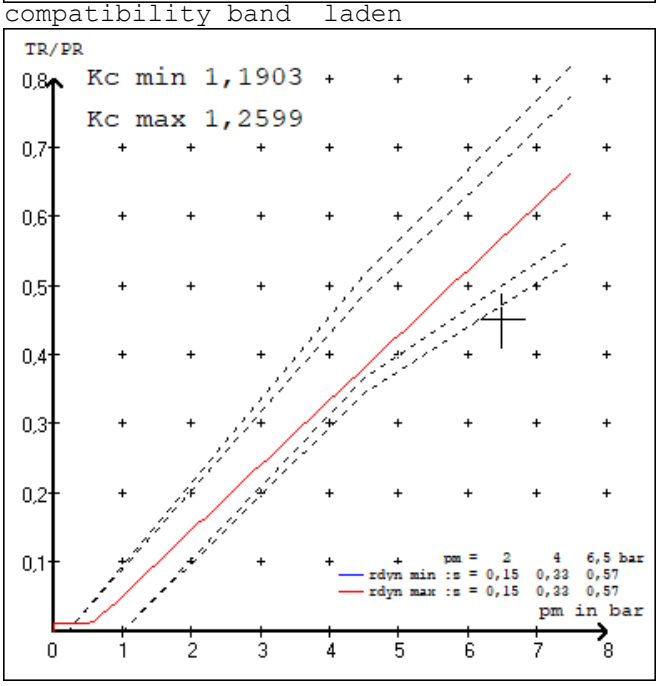
brake chamber pressure laden



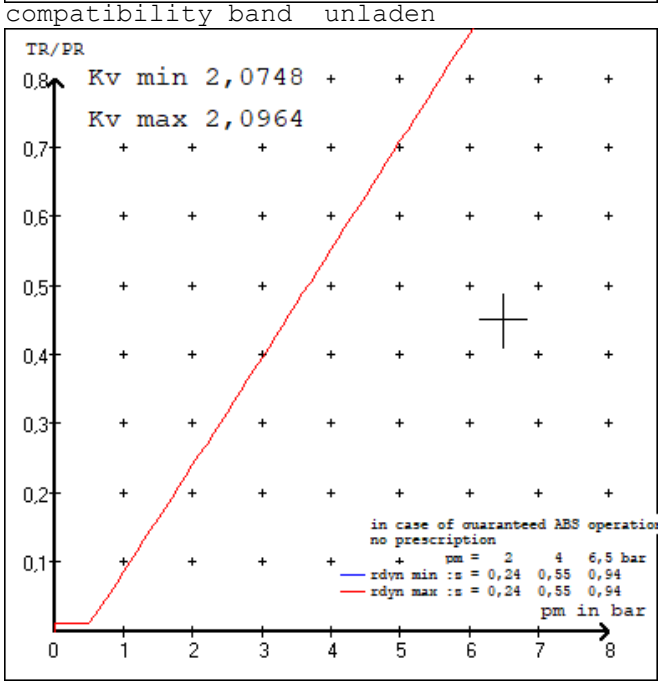
brake chamber pressure unladen



compatibility band laden



compatibility band unladen



vehicle manufacturer: OP8020
trailer model : GPNED2
trailer type : 4-axle-semi-trailer

brake chamber and lever length :
axle 1 : 2 x type/diameter 30/30 (WABCO) lever length 152 mm
axle 2 : 2 x type/diameter 30/30 (WABCO) lever length 152 mm
axle 3 : 2 x type/diameter 30/30 (WABCO) lever length 152 mm
axle 4 : 2 x type/diameter 30/30 (WABCO) lever length 152 mm

brake diagram : 841 701 050 0

valve :
971 002 ... 0 WABCO EBS emergency valve
480 102 ... 0 WABCO EBS trailer modulator
480 207 0.. 0 WABCO EBS relay valve or 480 207 2.. 0

EBS input data
==========
vehicle manufacturer: OP8020
trailer model : GPNED2
trailer type : 4-axle-semi-trailer
brake calculation no. : ROJ 10000S

tire circumference main axle : 2400 for rdyn max
tire circumference auxiliary axle : 2400 for rdyn max

assignment pm / deceleration z: pm 0,6 bar z = 0,010
(laden condition) 2,0 bar z = 0,142
6,5 bar z = 0,565

control pressure pm			6,5	control pressure pm		0,6	2,0	6,5
axle	axle load unladen	bellow pr. unladen	brake pr. unladen	axle load laden	bellow pr. laden	brake pr. laden		
1	2690	to be entered by the vehicle manufact.	2,5	11000	to be entered by the vehicle manufact.	0,3	1,6	5,7
2	2690		2,5	11000		0,3	1,6	5,7
3	2690		2,5	11000		0,3	1,6	5,7
4	2690		2,5	11000		0,3	1,6	5,7
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 4	
axle load	pcyl	axle load	pcyl	axle load	pcyl	axle load	pcyl
2690	2,5	2690	2,5	2690	2,5	2690	2,5
3190	2,7	3190	2,7	3190	2,7	3190	2,7
3690	2,9	3690	2,9	3690	2,9	3690	2,9
4190	3,1	4190	3,1	4190	3,1	4190	3,1
4690	3,3	4690	3,3	4690	3,3	4690	3,3
5190	3,5	5190	3,5	5190	3,5	5190	3,5
5690	3,7	5690	3,7	5690	3,7	5690	3,7
6190	3,8	6190	3,8	6190	3,8	6190	3,8
11000	5,7	11000	5,7	11000	5,7	11000	5,7

data sheet to ECE vehicle type-approval certificate concerning braking equipment: according to ECE R13 annex 11

axle 1 :	reference axle: SAF	SNK 3020	brake lining: SAF 636	
	test report :	TDB 0882 ECE	date	: 20160303
axle 2 :	reference axle: SAF	SNK 3020	brake lining: SAF 636	
	test report :	TDB 0882 ECE	date	: 20160303
axle 3 :	reference axle: SAF	SNK 3020	brake lining: SAF 636	
	test report :	TDB 0882 ECE	date	: 20160303
axle 4 :	reference axle: SAF	SNK 3020	brake lining: SAF 636	
	test report :	TDB 0882 ECE	date	: 20160303

calc. verif. of residual (hot) braking force type III
(item 4.2.1 of appendix 2 to annex 11)

axle 1	(rdyn 383 mm)	T = 27,5 % Fe
axle 2	(rdyn 383 mm)	T = 27,5 % Fe
axle 3	(rdyn 383 mm)	T = 27,5 % Fe
axle 4	(rdyn 383 mm)	T = 27,5 % Fe

calculated actuator stroke in mm
(item 4.3.1.1 of appendix 2 to annex 11)

axle 1	(sp = 73 mm)	s = 67 mm
axle 2	(sp = 73 mm)	s = 67 mm
axle 3	(sp = 73 mm)	s = 67 mm
axle 4	(sp = 73 mm)	s = 67 mm

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

axle1	ThA = 10329 N
axle2	ThA = 10329 N
axle3	ThA = 10329 N
axle4	ThA = 10329 N

calc. residual (hot) braking force in N
(item 4.3.1.4 of appendix 2 to annex 11)

axle 1	(rdyn 383 mm)	T = 52326 N
axle 2	(rdyn 383 mm)	T = 52326 N
axle 3	(rdyn 383 mm)	T = 52326 N
axle 4	(rdyn 383 mm)	T = 52326 N

	basic test of subject trailer (E)	type III (calculated) residual (hot)braking
braking rate of the vehicle (item 4.3.2 to appendix 2 to annex 11)	0,57	0,48
required braking rate (items 1.5.3 and 1.7.2 to annex 11)		>= 0,4 and >= 0,6*E (0,34)

axle 1	(rdyn 383 mm)	T = 52326 N
axle 2	(rdyn 383 mm)	T = 52326 N
axle 3	(rdyn 383 mm)	T = 52326 N
axle 4	(rdyn 383 mm)	T = 52326 N

	basic test of subject trailer (E)	type III (calculated) residual (hot)braking
braking rate of the vehicle (item 4.3.2 to appendix 2 to annex 11)	0,57	0,48
required braking rate (items 1.5.3 and 1.7.2 to annex 11)		>= 0,4 and >= 0,6*E (0,34)

spring parking brake

	axle 1	axle 2	axle 3	axle 4
no of TRISTOP-actuators per axle line KDZ	2	2	2	2
TRISTOP-actuator type	30/30	30/30	30/30	30/30
lever length lBh in mm	152	152	152	152
stat. tyre radius rstat max in mm	367	367	367	367
at a stroke of s in mm	30	30	30	30
min. force of spring brake TFZ in N	6520	6520	6520	6520
sp.brake chamber no 925	377 1.. 0377	1.. 0377	1.. 0377	1.. 0
sp.brake chamber no 925	377 000/0377	000/0377	000/0377	000/0
release pressure pLs in bar	4,8	4,8	4,8	4,8

calculation:

ratio until road	3,1063	3,1063	3,1063	3,1063
iFb = lBh*Eta*C*rBt/(2*rBn*rstat) for rstat in mm	367	367	367	367
brake force of spring br. Tf in N	39280	39280	39280	39280
Tf = (TFZ*KDZ-2*Co/lBh)*iFb				

braking rate zf laden 0,242
zf = sum (Tf)/P + 0,01

Test of the frictional connection required by the parking brake

Min. wheelbase/min. supporting width (theoretical proof / no ECE regulation!):
In the event of non-compliance, carry out a practical test or use the procedure described in ECE / Appendix 20.

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

min Ef = 5874 mm for E = 11670 mm
==========
min Ef = 10081 mm for E = 20670 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	=	1800 mm	height of center of gravity - laden
PR	=	44000 kg	maximum bogie mass - laden
P	=	69000 kg	maximum total mass - laden
nf	=	4	no. of axle(s) with TRISTOP spring brake actuators
ng	=	4	no. of bogie axle(s)

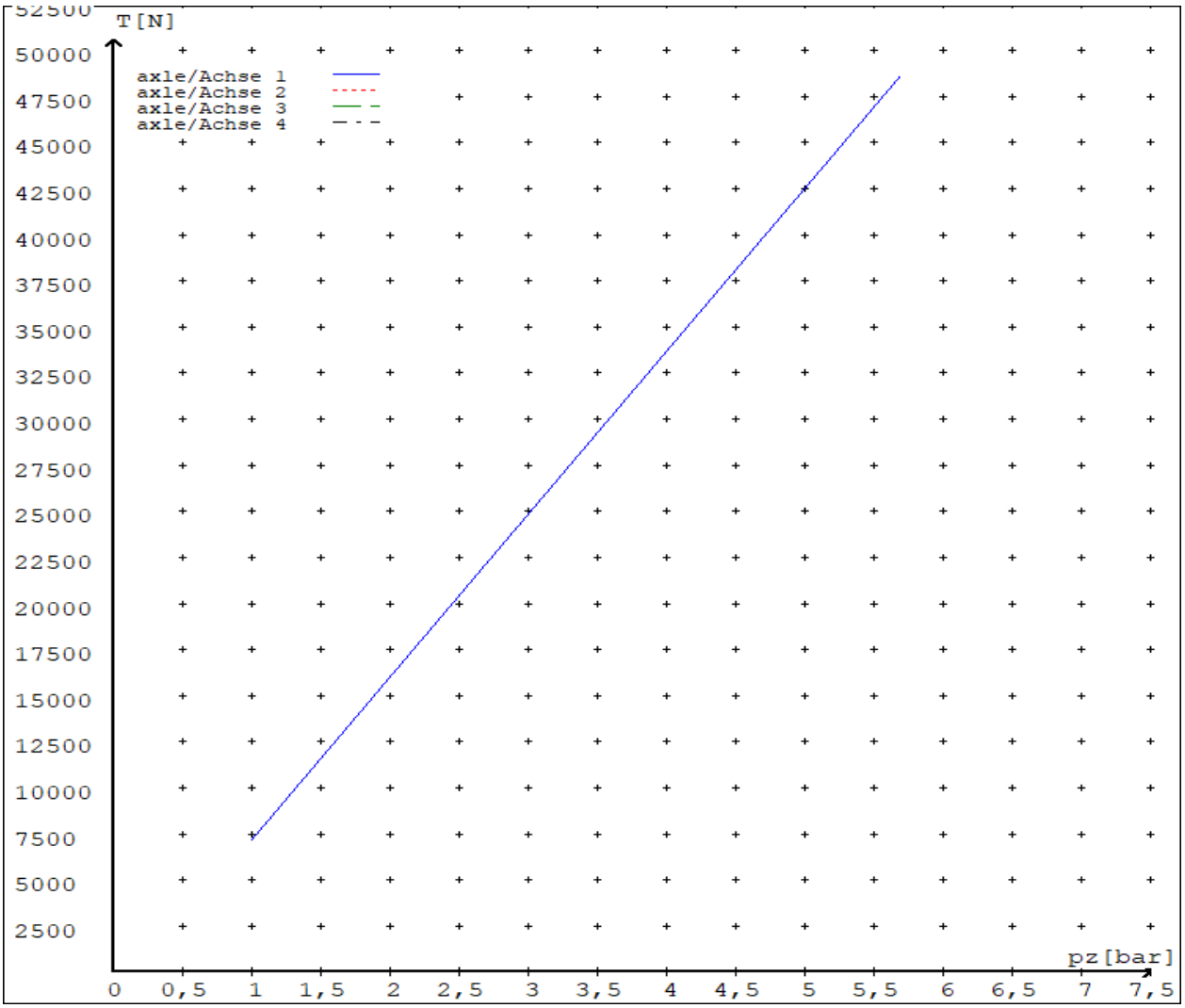
reference values

reference values for z = 45% for max rdyn: 383 mm

	pz [bar]	T [N]	T [N]
axle 1	1,0 5,7	7109 48554	
axle 2	1,0 5,7	7109 48554	
axle 3	1,0 5,7	7109 48554	
axle 4	1,0 5,7		7109 48554

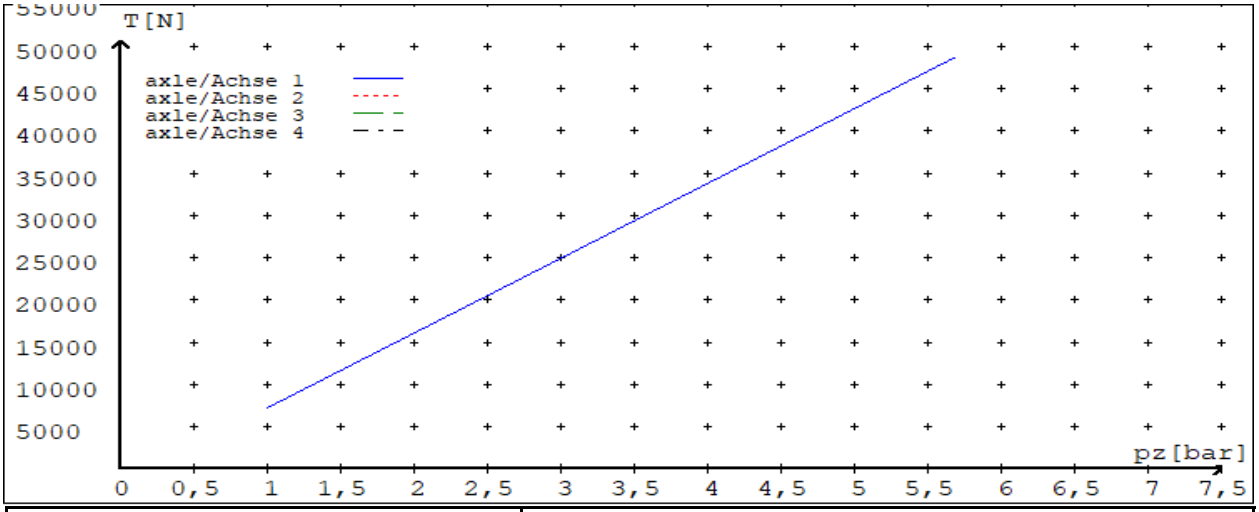
VIN - no.:

	Axle(s) / Achse(n)				
brake cylinder type (service / parking) Bremszylinder Typ (Betrieb / Fest)	30/30	30/30	30/30	30/30	/
Maximum stroke smax = ...mm maximaler Hub smax = ...mm	75	75	75	75	
Lever length = ...mm Hebellänge = ...mm	152	152	152	152	



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

reference values for z = 0,45 **for max rdyn: 383 mm**
Angabe der Referenzwerte für z = 0,45 für max rdyn: 383 mm
brake calculation no: ROJ 10000S date 15.11.2022
Bremsberechnung Nr: ROJ 10000S vom 15.11.2022



	Axle(s) / Achse(n)				
brake cylinder type (service / parking) Bremszylinder Typ (Betrieb / Fest)	30/30	30/30	30/30	30/30	/
Maximum stroke smax = ...mm maximaler Hub smax = ...mm	75	75	75	75	
Lever length = ...mm Hebellänge = ...mm	152	152	152	152	