A.4. INDIVIDUAL PROOF OF WEAPONS

A.4.1. MATERIAL QUALITIY AND WALL THICKNESS OF BARREL AND CHAMBER OF SMALL ARMS - RECOMMENDATION [Minutes XVII, XXIII]

1. Preamble

C.I.P. recognises that the specifications of the materials used and the thickness of the chamber and barrel walls are important factors governing the safety of firearms. Nevertheless, it is recognised that, in principle, this is the manufacturers responsibility.

2. Steel Specifications

2.1. Standards

The specification of steels for heat treatment are contained in Standards ISO 683.
The following references are the most relevant.

ISO 683/XVIII - 1976: Non-alloy steels.
ISO R683/IV - 1970: Alloy steels with 1% chrome and 2% molybdenum.
ISO R683/VI - 1970: Alloy steels with 3% chrome and 0,5 molybdenum.
ISO R683/VIII - 1970: Alloy steels with chrome, nickel and molybdenum.

ISO Standards do not directly refer to steels for firearm barrels. However, there are national standards within member countries of C.I.P. For example: Austrian Standards ÖNORM M.3170 - 1981: Steels for firearm barrels.

Steel standards specify:
- The chemical composition of the steel.
- The heat treatment.
- Mechanical properties.
- Test samples and method of testing.

2.2. Chemical Composition

For firearms, certain of the alloy ingredients call for particular attention:

The maximum content of the elements phosphorus and sulphur must be 0,025 - 0,035%.
A high degree of steel purity sought after from the point of view of elasticity is linked with some loss of machineability. In this connection, ISO Standards provide in each case a maximum and minimum percentage for sulphur content.

Chrome molybdenum vanadium steels are sought after for their resistance to tencity up to 550ºC (They are not however included yet in ISO Standards but are used nevertheless in certain countries within C.I.P.).

2.3. Heat Treatment

For firearm barrels, after tempering the steel is annealed to the desired softness at which it should possess the mechanical properties standard for that particular steel.

An appropriate treatment should be applied equally to other parts. The Standards indicate temperatures for the treatment concerned (for example, normalising) and for forging.

2.4. Mechanical Properties

Steels for use in the manufacture of firearms, after having been heat treated, should possess well defined mechanical properties. Elasticity limit (0,2%), tensile strength, yield point, hardness (which is proportional the tensile strength)..

2.5. Choice of Steel

The Standards mentioned as well as the methods of production of the steels account for much of their quality. The choice of a steel for the manufacture of gun barrels is thus very complex and prescribes directly the thickness of barrel walls. In paragraph 3 in the Appendix some examples of dimensions are given supposing that the metal of the barrel is submitted to artificial static stress. This does not happen in practice of course, because when a shot is fired the stress is applied dynamically in a very short space of time.

Conclusions concerning the behaviour of the barrel over a period of time should be known and Annex 1 has been produced to draw the attention of barrel makers and Proof House personnal to the problems which can eventually result.

In order to facilitate the choice of steel, barrel steels have been divided into 4 categories (Annex 2). Steel will be classed into one of these categories following the steel makers confirmation of order.
Particular attention will be paid to the presence of dangerous inclusions.

The elastic limit of barrel steels should not be less than 450 N/mm^2 for smooth-bore barrels and 550 N/mm^2 for rifled barrels.

3. Thickness of Barrel Walls

3.1. Calculation of Wall Thickness

The wall thickness given to firearm barrels, so as to gurantee that the gun can be used with complete safety is conditional on the steel utilised. This calculation is complex and carries additionally a subjective element in that there is the question of defining the co-efficients of safety (that is to say, the relationship between maximum stress on the barrel section asnd the elastic limit of the steel). There exist several Bibliographical references and the long experience of the Proof Houses concerning this question.

Accordingly, a minimum wall thickness for the barrel and chamber ssuming proper concentricity has been fixed for each steel category.

In this case of sleeved barrels a reduction may perhaps be effected covering the length of the sleeve provided that the 'frettage' is fully effective.

3.2. Minimum Thickness for Smooth-bore Guns

For 12, 16 and 20 bore shotguns, the minimum wall thickness of the chamber and barrel are given at various distances from the breech (Annex 3).

3.3. Minimum Thickness for Rifle Barrel Guns

For rifled barrel guns, the minimum wall thickness of the chamber and barrel, at location of the extractors and soldering distances are given for steel quality categories 2,3 and 4. (Annex 4).
Furthermore, in Annex 5, some examples of combination guns (drilling etc.) are shown indicating the place where minimum thickness are involved.

Annex 1

STRESS ARISING IN RIFLE BARRELS

(see Annex A.4.2.)

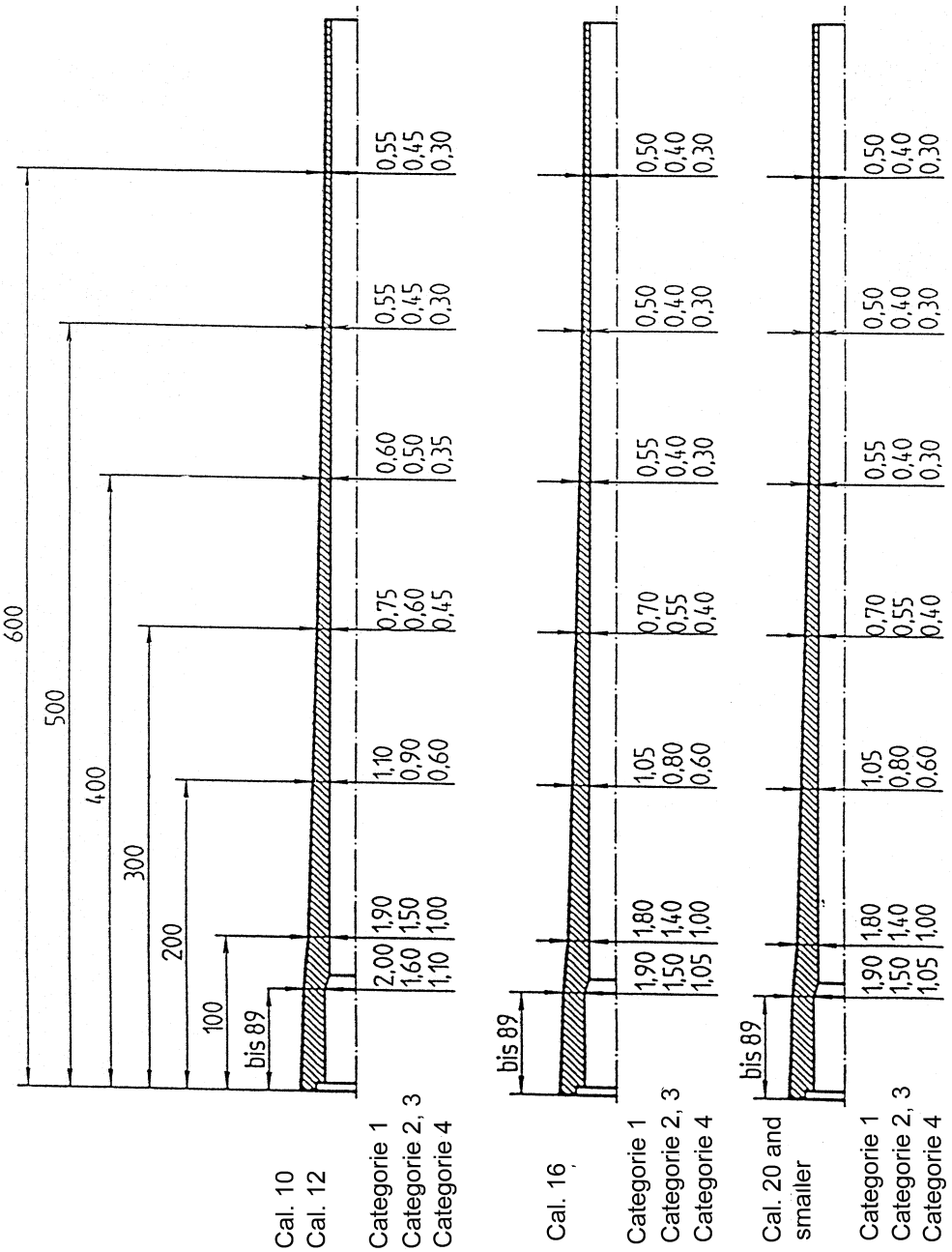
Annex 2

STEEL CATEGORIES [Minutes XVII]

Category	Elastic limit N/mm^2	Tensile strength N/mm^2	Brinell hardness HB	`Structure	Example (according to ISO 683)
1	450 to 549	700 to 849	200 to 249	Perlite + Ferrite	XVIII - c 45 ea
2	550 to 699	800 to 1099	250 to 319	Perlite + Ferrite	XVIII - c 60 ea
3	700 to 999	850 to 1099	250 to 319	Martensite anneale Sorbite	IV - 3a
4	≥ 1000	≥ 1100	≥ 320	Martensite anneale Sorbite	VIII - 6a

Annex 3

MINIMUM WALL THICKNESS OF THE BARREL FOR SHOTGUNS
Not applicable in the zone of the choke)
[Minutes XXIII]



Annex 4

MINIMUM WALL THICKNESS OF BARRELS RIFLED WEAPONS [Minutes XXIII]

1. Rimfire cartridges

Calibres	PCrmax bar Crusher	P1 mm	R1 mm	Minimum wall thickness s mm			
				Cat. 1 mm	Cat. 2 mm	Cat.3 mm	Cat.4 mm
5 mm Rem. Mag.	2550	6,63		2,00	1,80	1,70	1,30
22 Short	1300	5,75		1,20	1,20	1,20	1,20
22 Long	1000	5,76		1,20	1,20	1,20	1,20
22 Long Rifle	1900	5,76		1,20	1,20	1,20	1,20
22 Extra Long	1400	5,78		1,20	1,20	1,20	1,20
22 Ex. LR.	1800	5,86		1,20	1,20	1,20	1,20
22 Long Shot	1400	5,78		1,20	1,20	1,20	1,20
22 Long Rifle Shot C.	1500	5,80		1,20	1,20	1,20	1,20
22 Rem. Auto	1600	6,31		1,20	1,20	1,20	1,20
22 Win. Auto	1000	6,55		1,20	1,20	1,20	1,20
22 Win. R.F. e.t 22 Rem.	1150	6,25		1,20	1,20	1,20	1,20
22 Win. Mag. R.F.	1900	6,20		1,20	1,20	1,20	1,20

2. Rimless cartridges

Calibres	PTmax bar Transducer	P1 mm	R1 mm	Minimum wall thickness s mm			
				Cat. 1 mm	Cat. 2 mm	Cat.3 mm	Cat.4 mm
5,6 x 50 Mag.	3800		9,64	3,90	3,30	3,20	2,30
5,6 x 57	4400		12,00	-	5,20	4,90	3,50
5,6 x 61 SE v. H.	4550		12,25	-	5,50	5,30	3,70
6 x 62 Freres	4300		12,10	-	4,90	4,70	3,40
6,5 x 54 Mauser	3050		11,85	3,30	2,90	2,80	2,20
6,5 x 54 M. Sch.	3650		11,57	4,40	3,80	3,60	2,70
6,5 x 55 SE	3800		12,23	4,90	4,20	4,00	3,00
6,5 x 57	3900		12,00	5,10	4,30	4,20	3,10
6,5 x 58 Mauser	3550		11,85	4,20	3,70	3,50	2,70
6,5 x 64	4300		12,00	-	4,90	4,70	3,40
6,5 x 64 Brenneke	4300		12,04	-	4,90	4,70	3,40
6,5 x 65 RWS	4150		12,07	-	4,70	4,60	3,30
6,5 x 68	4400		13,05	-	5,70	5,40	3,90
7 x 57	3900		12,15	5,10	4,40	4,20	3,10
7 x 64	4150		12,00	-	4,70	4,60	3,20
7 mm SE v. H.	4400		13,05	-	6,00	5,70	4,10
7,5 x 55 GP 31	3800		12,70	5,10	4,40	4,30	3,10
7,62 x 39	3550		11,37	4,20	3,70	3,50	2,70
7,65 x 53 Arg.	3900		12,13	5,10	4,40	4,20	3,10
7,92 x 33 kurz	3400		12,00	4,10	3,50	3,40	2,60
8 x 51 (Mauser K)	3400		12,00	4,10	3,50	3,40	2,60
8 x 56 M-Sch.	3200		11,90	3,50	3,10	3,00	2,30
8 x 57 J	3800		12,00	4,80	4,20	4,10	2,90
8 x 57 JS	3900		12,00	5,10	4,30	4,20	3,10
8 x 60	4050		12,00	5,30	4,50	4,40	3,20
8 x 60 S	4050		12,00	5,30	4,50	4,40	3,20
8 x 64	4050		12,00	5,30	4,50	4,40	3,20
8 x 64 S	4050		12,05	5,30	4,50	4,40	3,20
8 x 68 S	4400		13,05	-	5,70	5,40	3,90
8 x 75 S	4400		11,95	-	5,10	4,90	3,50
8,5 x 63	4300		12,04	-	4,90	4,70	3,40
9 x 57	2800		12,00	3,00	2,60	2,50	2,20
9,3 x 62	3900		12,00	5,10	4,40	4,20	3,10
9,3 x 64 Brenneke	4400		12,65	-	5,50	5,20	3,70
10,75 x 68	3300		12,62	3,90	3,50	3,40	2,50
17 Rem.	4250		9,66	-	3,90	3,80	3,70
22 PPC-USA	4050		11,32	5,20	4,40	4,30	3,10
22-250 Rem.	4050		12,09	5,4	4,6	4,4	3,2
215	3800		10,05	4,2	3,6	3,5	2,6
220 Swift	4300		12,27	-	4,9	4,8	3,4
222 Rem.	3700		9,66	3,6	3,1	3	2,2
222 Rem. Mag.	4050		9,63	4,2	3,6	3,5	2,6
223 Rem.	4300		9,66	-	3,9	3,8	2,7
243 Win.	4150		12,03	-	4,70	4,60	3,30
244 Rem.	4250		12,14	-	4,80	4,70	3,40
6 mm PPC	4050		11,20	5,20	4,40	4,30	3,10
6 PPC-USA	4050		11,32	5,20	4,40	4,30	3,10
6 mm Rem.	4300		12,14	-	4,90	4,80	3,40

2. Rimless cartridges (suit)

Calibres	PTmax bar Transducer	P1 mm	R1 mm	Minimum wall thickness s mm			
				Cat. 1 mm	Cat. 2 mm	Cat.3 mm	Cat.4 mm
25-06 Rem.	4500		12,04	-	5,20	4,90	3,50
250 Savage	3650		12,14	4,60	4,00	3,80	2,80
256 Mag. Gibbs	3400		12,14	4,10	3,50	3,40	2,60
257 Roberts	3550		12,13	4,30	3,70	3,60	2,70
270 Win.	4300		12,04	-	4,90	4,70	3,40
275 H.V. Rigby	3200		12,12	3,70	3,30	3,10	2,40
7 mm - 08 Rem.	4150		12,03	5,50	4,70	4,60	3,30
280 Rem.	4050		12,06	5,40	4,50	4,40	3,20
7 mm Exp. Rem.	4050		12,06	5,40	4,50	4,40	3,20
280 Riml. N.E. Ross	3250		14,27	4,40	3,80	3,70	2,80
284 Win.	4400		12,81	-	5,50	5,20	3,60
30 - Carbine	3200		9,40	3,50	3,00	2,90	2,20
30 Court	3650		9,40	3,40	2,90	2,80	2,10
30 Rem.	2800		10,80	2,70	2,40	2,30	2,00
30-06 Spring	4050		12,04	5,30	4,50	4,40	3,20
300 Lapua Mag.	4700		15,03	-	7,50	6,00	5,00
300 Savage	3650		12,07	4,50	3,90	3,80	2,80
308 Win.	4150		12,03	-	4,70	4,60	3,30
318 Riml. N.E.	3300		11,94	3,70	3,30	3,20	2,40
32 Rem.	2950		10,80	2,80	2,50	2,40	2,00
333 Riml. N.E.	3300		13,84	4,30	3,80	3,70	2,80
338 Lapua Mag.	4700		15,03	-	7,50	6,00	5,00
35 Rem.	2750		11,78	2,80	2,50	2,40	2,10
350 Mag. Rigby	3100		13,41	3,80	3,40	3,30	2,60
358 Win.	4050		12,03	5,40	4,50	4,40	3,20
404 Riml. N.E.	3650		13,84	5,20	4,50	4,30	3,20
416 Rigby	3250		15,04	4,60	4,00	3,90	2,90
505 Mag. Gibbs	2700		16,31	3,80	3,30	3,20	3,00

3. Rimmed cartridges

Calibres	PTmax bar Transducer	P1 mm	R1 mm	Minimum wall thickness s mm			
				Cat. 1 mm	Cat. 2 mm	Cat.3 mm	Cat.4 mm
5,6 x 35 R	2700	7,58		1,80	1,60	1,50	1,40
5,6 x 50 R Mag.	3400	9,62		3,30	2,80	2,70	2,10
5,6 x 52 R	3300	10,65		3,30	2,90	2,80	2,10
5,6 x 57 R	4400	11,97		-	5,20	4,90	3,50
5,6 x 61 R SE v.H.	3800	12,25		4,90	4,30	4,10	3,00
6 x 50 R Scheiring	4150	9,62		4,20	3,60	3,50	2,60
6 x 62 R Freres	4300	12,14		-	4,90	4,70	3,40
6,5 x 50 R	3650	9,62		3,60	3,10	3,00	2,20
6,5 x 51 R Arisaka	2950	11,48		3,20	2,80	2,40	2,30
6,5 x 52 R	2450	10,63		2,10	1,90	1,80	1,60
6,5 x 57 R	3300	11,95		3,70	3,30	3,20	2,40
6,5 x 58 R	2800	11,13		2,70	2,40	2,40	2,00
6,5 x 65 R RWS	3800	12,11		4,80	4,20	4,00	3,00
6,5 x 68 R	3900	13,37		5,60	4,80	4,70	3,40
6,5 x 70 R	2800	9,03		2,50	2,10	1,80	1,70
7 x 50 R	3650	9,62		3,60	3,10	3,00	2,20
7 x 57 R	3400	12,08		4,10	3,50	3,40	2,60
7 mm Mag. Fl. H.&H.	3300	11,71		3,70	3,20	3,10	2,30
7 x 65 R	3800	11,92		4,80	4,10	4,00	2,90
7 x 72 R	2800	10,88		2,70	2,40	2,30	2,00
7 x 75 R SE v.H.	4150	11,93		-	4,70	4,50	3,30
7,62 x 53 R	3900	12,45		5,20	4,50	4,30	3,20
7,62 x 54 R	3900	12,48		5,20	4,50	4,30	3,20
8 x 50 R	3550	12,64		3,30	2,90	2,90	2,30
8 x 56 R M30	3400	13,88		5,20	4,50	3,80	3,20
8 x 56 R M30S	3550	12,60		3,30	2,90	2,90	2,30
8 x 57 R 360	2450	11,03		2,20	2,00	1,90	1,70
8 x 57 JR	3200	11,95		3,50	3,10	3,00	2,30
8 x 57 JRS	3300	11,95		3,70	3,30	3,20	2,40
8 x 58 R	2200	11,80		2,10	1,90	1,80	1,60
8 x 60 R	3400	12,06		4,10	3,50	3,40	2,60
8 x 60 RS	3400	12,06		4,10	3,50	3,40	2,60
8 x 65 R	3900	11,98		5,10	4,30	4,20	3,10
8 x 65 RS	4050	12,02		5,30	4,50	4,40	3,20
8 x 72 R	2800	10,88		2,70	2,40	2,30	2,00
8 x 75 RS	3800	11,93		4,80	4,20	4,10	2,90
8,15 x 46 R	1650	10,77		1,90	1,70	1,60	1,30
8,5 x 63 R	3450	11,92		4,80	4,20	4,10	2,90
9 x 57 R	2800	12,00		3,00	2,60	2,60	2,20
9,3 x 72 R	2000	10,93		2,00	1,80	1,70	1,50
9,3 x 74 R	3400	11,93		4,00	3,50	3,40	2,50
10,3 x 60 R/Nr. 270	2700	13,93		3,20	2,90	2,80	2,50
11,15 x 60 R	2800	13,13		3,40	3,10	2,70	2,50
218 Bee	3200	8,90		2,60	2,30	2,30	1,70
219 Zipper	2850	10,74		2,70	2,40	2,30	2,00
22 Hornet	3200	7,62		2,30	2,00	1,90	1,50
22 Savage	3300	10,80		3,40	3,00	2,90	2,20
225 Win.	3900	10,80		4,60	3,90	3,80	2,80
240 Fl. N.E.	3200	11,71		3,50	3,10	3,00	2,30
25-20 Win.	2700	8,90		2,10	1,80	1,80	1,60
25-35 Win.	3050	10,74		3,00	2,70	2,60	2,00
256 Win.Mag.	3500	9,70		3,40	2,90	2,80	2,10

3. Rimmed cartridges (cont.)

Calibres	PTmax bar Transducer	P1 mm	R1 mm	Minimum wall thickness s mm			
				Cat. 1 mm	Cat. 2 mm	Cat.3 mm	Cat.4 mm
7-30 Waters	3150	10,75		3,30	2,90	2,80	2,10
280 Fl. N.E.	2950	13,72		3,60	3,20	3,10	2,50
30 Fl. N.E. Purdey	3200	11,76		3,50	3,10	3,00	2,30
30 Super Fl. H.&H.	3200	13,16		3,90	3,50	3,30	2,50
30 R Blaser	4050	12,23		5,40	4,70	4,60	3,30
30-30 Win.	3200	10,75		3,20	2,80	2,70	2,10
30-40 Krag	3250	14,10		3,60	3,20	3,10	2,30
300/295 Rook Rifle	1200	8,13		1,50	1,30	1,20	1,20
300 Sherwood	1400	8,15		1,50	1,30	1,20	1,20
303 British	3650	11,74		4,40	3,80	3,70	2,70
303 Savage	2700	11,33		2,60	2,30	2,30	2,10
307 Win.	4150	12,01		-	4,70	4,60	3,30
310 Cadet Rifle	1100	9,04		1,60	1,40	1,30	1,20
32 Win. SL	1550	9,05		1,60	1,40	1,30	1,20
32 Win. spez.	3050	10,74		3,00	2,90	2,60	2,00
32-20 Win.	2100	9,00		1,60	1,40	1,30	1,20
32-40 Win.	2350	10,79		2,10	2,00	1,90	1,70
33 Win.	3050	12,97		3,60	3,20	3,10	2,40
348 Win.	3200	14,07		4,20	3,70	3,60	2,70
35 Win.	3050	11,76		3,30	2,90	2,80	2,20
35 Win. SL	2400	9,77		1,90	1,80	1,70	1,50
350 No2 Rigby	3300	11,99		3,70	3,30	3,20	2,40
351 Win. SL	3650	9,86		3,80	3,30	3,10	2,30
356 Win.	4150	12,01		-	4,70	4,60	3,30
360 N.E. 2"1/4	2450	10,95		2,20	2,00	1,90	1,70
369 N.E. Purdey	3050	13,77		3,80	3,40	3,30	2,50
375 Fl. N.E. 2"1/2	2200	11,68		2,10	1,90	1,80	1,60
375 Fl. Mag. N.E.	3250	13,16		4,00	3,50	3,40	2,60
375 Win.	4400	10,74		-	5,10	4,00	3,50
38-40 Win.	1150	11,96		2,00	1,80	1,70	1,50
38-55 Win.	2400	10,73		2,10	1,90	1,80	1,60
380 Long Rifle	950	9,68		1,70	1,50	1,30	1,20
40-82 Win.	1650	12,95		2,40	2,20	2,00	1,80
400/350 N.E.	2800	11,99		3,00	2,60	2,60	2,20
401 Win. SL	2450	11,13		2,20	2,00	1,90	1,70
405 Win.	2450	11,76		2,40	2,20	2,10	1,90
408 Win.	4100	11,39		5,20	4,40	4,30	3,10
44-40 Win.	1100	11,98		2,20	2,00	1,90	1,70
444 Marlin	3550	11,98		4,20	3,70	3,50	2,70
45-70 Govt.	2200	12,91		2,40	2,20	2,10	1,80
450 N.E. 3"1/4	3050	13,87		3,80	3,40	3,30	2,50
450/400 N.E. 3"	2800	13,94		3,40	3,00	3,00	2,60
450/400 Mag.N.E. 3"1/4	2950	13,87		3,60	3,20	3,20	2,50
470 N.E.	2700	14,58		3,40	3,00	2,90	2,70
475 No2 N.E. 3"1/2	2750	14,76		3,50	3,20	3,00	2,70
500 N.E. 3"	2800	14,61		3,60	3,20	3,10	2,70
500/465 N.E.	2450	14,61		2,90	2,70	2,60	2,40
577/450 Sld. Mart. H.	1750	17,09		3,10	2,90	2,80	2,60
577 N.E. 3"	2450	16,84		3,40	3,10	3,00	2,80
577 Sld. Snider	1500	16,92		3,10	2,90	2,80	2,60
600 N.E.	2450	17,81		3,60	3,20	3,10	2,90
700 H.H. N.E.	2750	19,89		4,30	3,90	3,90	3,20

4. Magnum cartridges

Calibres	PTmax bar Transducer	P1 mm	R1 mm	Minimum wall thickness s mm			
				Cat. 1 mm	Cat. 2 mm	Cat.3 mm	Cat.4 mm
224 Weath. Mag.	4400		10,97	-	5,00	3,90	3,40
240 Belt. Riml. N.E.	3300		12,17	3,60	3,20	3,10	2,30
240 Weath. Mag.	4400		12,07	-	5,20	4,90	3,50
244 H.&H. Mag.	4350		13,59	-	5,50	5,20	3,80
257 Weath. Mag.	4400		13,56	-	5,60	5,30	3,90
6,5 mm Rem. Mag.	4350		13,59	-	5,50	5,20	3,80
264 Win. Mag.	4300		13,59	-	5,30	5,10	3,70
270 Weath. Mag.	4400		13,56	-	5,60	5,30	3,90
275 Belt. N.E.	4150		13,59	-	5,20	5,00	3,60
7 mm Rem. Mag.	4300		13,59	-	5,30	5,10	3,70
7 mm Weath. Mag.	4400		13,56	-	5,60	5,30	3,90
7 x 61 Super	4050		13,56	-	5,10	4,90	3,50
300 H.&H. Mag.	4300		13,59	-	5,30	5,10	3,70
300 Weath. Mag.	4400		13,56	-	5,60	5,30	3,90
300 Win. Mag.	4300		13,59	-	5,30	5,10	3,70
308 Norma Mag.	4400		13,75	-	5,60	5,30	3,90
8 mm Rem. Mag.	4600		13,59	-	6,20	5,80	4,10
338 Win. Mag.	4300		13,59	-	5,30	5,10	3,70
340 Weath. Mag.	4400		13,56	-	5,60	5,30	3,90
350 Rem. Mag.	4300		13,59	-	5,30	5,10	3,70
358 Norma Mag.	4400		13,75	-	5,60	5,30	3,90
375 H.&H. Mag.	4300		13,59	-	5,30	5,10	3,70
375 Weath. Mag.	4400		13,56	-	5,60	5,30	3,90
378 Weath. Mag.	4400		15,39	-	6,40	6,00	4,40
416 Rem. Mag.	4300		13,59	-	5,30	5,10	3,70
416 Weath. Mag.	4400		15,39	-	6,40	6,00	4,40
458 Win. Mag.	4300		13,59	-	5,30	5,10	3,70
460 Weath. Mag.	4400		15,39	-	6,40	6,00	4,40

MINIMUM WALL THICKNESS AT LOCATION OF THE EXTRACTOR AND SOLDERING DISTANCES OF BARRELS
[Minutes XXIII]

1. Rimfire cartridges

Calibres	PCrmax bar Crusher	P1 mm	R1 mm	Minimum wall thickness w or b mm			
				Cat. 1 mm	Cat. 2 mm	Cat.3 mm	Cat.4 mm
5 mm Rem. Mag.	2550	6,63		1,50	1,40	1,30	1,00
22 Short	1300	5,75		1,00	1,00	1,00	1,00
22 Long	1000	5,76		1,00	1,00	1,00	1,00
22 Long Rifle	1900	5,76		1,00	1,00	1,00	1,00
22 Extra Long	1400	5,78		1,00	1,00	1,00	1,00
22 Ex. LR.	1800	5,86		1,00	1,00	1,00	1,00
22 Long Shot	1400	5,78		1,00	1,00	1,00	1,00
22 Long Rifle Shot C.	1500	5,80		1,00	1,00	1,00	1,00
22 Rem. Auto	1600	6,31		1,00	1,00	1,00	1,00
22 Win. Auto	1000	6,55		1,00	1,00	1,00	1,00
22 Win. R.F. e.t 22 Rem.	1150	6,25		1,00	1,00	1,00	1,00
22 Win. Mag. R.F.	1900	6,20		1,00	1,00	1,00	1,00

2. Rimless cartridges

Calibres	PTmax bar Transducer	P1 mm	R1 mm	Minimum wall thickness w or b mm			
				Cat. 1 mm	Cat. 2 mm	Cat.3 mm	Cat.4 mm
5,6 x 50 Mag.	3800		9,64	3,00	2,60	2,50	1,80
5,6 x 57	4400		12,00	-	4,00	3,80	2,70
5,6 x 61 SE v. H.	4550		12,25	-	4,20	4,00	2,90
6 x 62 Freres	4300		12,10	-	3,80	3,60	2,60
6,5 x 54 Mauser	3050		11,85	2,50	2,30	2,20	1,70
6,5 x 54 M. Sch.	3650		11,57	3,30	2,90	2,80	2,10
6,5 x 55 SE	3800		12,23	3,70	3,30	3,10	2,30
6,5 x 57	3900		12,00	3,90	3,30	3,20	2,40
6,5 x 58 Mauser	3550		11,85	3,30	2,90	2,70	2,10
6,5 x 64	4300		12,00	-	3,60	3,50	2,50
6,5 x 64 Brenneke	4300		12,04	-	3,60	3,50	2,50
6,5 x 65 RWS	4150		12,07	-	3,60	3,50	2,50
6,5 x 68	4400		13,05	-	4,40	4,20	3,00
7 x 57	3900		12,15	3,90	3,40	3,30	2,40
7 x 64	4150		12,00	-	3,60	3,50	2,50
7 mm SE v. H.	4400		13,05	-	4,60	4,30	3,10
7,5 x 55 GP 31	3800		12,70	3,90	3,40	3,20	2,40
7,62 x 39	3550		11,37	3,30	2,90	2,70	2,10
7,65 x 53 Arg.	3900		12,13	3,90	3,40	3,30	2,40
7,92 x 33 kurz	3400		12,00	3,10	2,70	2,60	2,00
8 x 51 (Mauser K)	3400		12,00	3,10	2,70	2,60	2,00
8 x 56 M-Sch.	3200		11,90	2,70	2,40	2,30	1,80
8 x 57 J	3800		12,00	3,70	3,20	3,00	2,30
8 x 57 JS	3900		12,00	3,90	3,30	3,20	2,40
8 x 60	4050		12,00	4,10	3,50	3,30	2,40
8 x 60 S	4050		12,00	4,10	3,50	3,30	2,40
8 x 64	4050		12,00	4,10	3,50	3,30	2,40
8 x 64 S	4050		12,05	4,10	3,50	3,30	2,40
8 x 68 S	4400		13,05	-	4,40	4,20	3,00
8 x 75 S	4400		11,95	-	4,00	3,70	2,70
8,5 x 63	4300		12,04	-	3,60	3,50	2,50
9 x 57	2800		12,00	2,30	2,00	2,00	1,70
9,3 x 62	3900		12,00	4,10	3,50	3,40	2,40
9,3 x 64 Brenneke	4400		12,65	-	4,30	4,00	2,90
10,75 x 68	3300		12,62	3,00	2,70	2,60	2,00
17 Rem.	4250		9,66	-	3,00	2,90	2,80
22 PPC-USA	4050		11,32	3,90	3,30	3,20	2,30
22-250 Rem.	4050		12,09	4,10	3,50	3,40	2,50
215	3800		10,05	3,30	2,80	2,70	2,00
220 Swift	4300		12,27	-	3,80	3,70	2,60
222 Rem.	3700		9,66	2,80	2,40	2,30	1,70
222 Rem. Mag.	4050		9,63	3,30	2,80	2,70	2,00
223 Rem.	4300		9,66	-	3,00	2,90	2,10
243 Win.	4150		12,03	-	3,60	3,50	2,50
244 Rem.	4250		12,14	-	3,70	3,60	2,60
6 mm PPC	4050		11,20	3,90	3,30	3,20	2,30
6 PPC-USA	4050		11,32	3,90	3,30	3,20	2,30
6 mm Rem.	4300		12,14	-	3,80	3,70	2,60

2. Rimless cartridges (cont.)

Calibres	PTmax bar Transducer	P1 mm	R1 mm	Minimum wall thickness w or b mm			
				Cat. 1 mm	Cat. 2 mm	Cat.3 mm	Cat.4 mm
25-06 Rem.	4500		12,04	-	4,00	3,80	2,70
250 Savage	3650		12,14	3,50	3,10	2,90	2,20
256 Mag. Gibbs	3400		12,14	3,10	2,70	2,60	2,00
257 Roberts	3550		12,13	3,30	2,90	2,70	2,10
270 Win.	4300		12,04	-	3,80	3,60	2,60
275 H.V. Rigby	3200		12,12	2,90	2,50	2,40	1,80
7 mm - 08 Rem.	4150		12,03	4,10	3,50	3,40	2,50
280 Rem.	4050		12,06	4,10	3,50	3,40	2,50
7 mm Exp. Rem.	4050		12,06	4,10	3,50	3,40	2,50
280 Riml. N.E. Ross	3250		14,27	3,40	2,90	2,80	2,20
284 Win.	4400		12,81	-	4,20	4,00	2,90
30 - Carbine	3200		9,40	2,70	2,30	2,20	1,70
30 Court	3650		9,40	3,00	2,60	2,50	1,80
30 Rem.	2800		10,80	2,00	1,80	1,80	1,50
30-06 Spring	4050		12,04	4,10	3,50	3,40	2,40
300 Lapua Mag.	4700		15,03	-	5,60	4,50	3,80
300 Savage	3650		12,07	3,50	3,00	2,90	2,20
308 Win.	4150		12,03	-	3,60	3,50	2,50
318 Riml. N.E.	3300		11,94	2,90	2,50	2,50	1,90
32 Rem.	2950		10,80	2,20	1,90	1,90	1,50
333 Riml. N.E.	3300		13,84	3,30	3,00	2,90	2,10
338 Lapua Mag.	4700		15,03	-	5,60	4,50	3,80
35 Rem.	2750		11,78	2,20	2,00	1,90	1,70
350 Mag. Rigby	3100		13,41	3,00	2,60	2,50	2,00
358 Win.	4050		12,03	4,10	3,50	3,40	2,40
404 Riml. N.E.	3650		13,84	4,00	3,50	3,30	2,50
416 Rigby	3250		15,04	3,60	3,10	3,00	2,30
505 Mag. Gibbs	2700		16,31	2,90	2,60	2,50	2,30

3. Rimmed cartridges

Calibres	PTmax bar Transducer	P1 mm	R1 mm	Minimum wall thickness w or b mm			
				Cat. 1 mm	Cat. 2 mm	Cat.3 mm	Cat.4 mm
5,6 x 35 R	2700	7,58		1,40	1,20	1,20	1,10
5,6 x 50 R Mag.	3400	9,62		2,50	2,20	2,10	1,60
5,6 x 52 R	3300	10,65		2,60	2,30	2,20	1,70
5,6 x 57 R	4400	11,97		-	4,00	3,80	2,70
5,6 x 61 R SE v.H.	3800	12,25		3,80	3,30	3,10	2,30
6 x 50 R Scheiring	4150	9,62		3,30	2,80	2,70	2,00
6 x 62 R Freres	4300	12,14		-	3,80	3,60	2,60
6,5 x 50 R	3650	9,62		2,80	2,40	2,30	1,70
6,5 x 51 R Arisaka	2950	11,48		2,40	2,10	1,80	1,70
6,5 x 52 R	2450	10,63		1,70	1,50	1,40	1,20
6,5 x 57 R	3300	11,95		2,90	2,60	2,50	1,90
6,5 x 58 R	2800	11,13		2,10	1,90	1,80	1,60
6,5 x 65 R RWS	3800	12,11		3,80	3,30	3,10	2,30
6,5 x 68 R	3900	13,37		4,30	3,70	3,60	2,60
6,5 x 70 R	2800	9,03		1,90	1,60	1,40	1,30
7 x 50 R	3650	9,62		2,80	2,40	2,30	1,70
7 x 57 R	3400	12,08		3,10	2,70	2,60	2,00
7 mm Mag. Fl. H.&H.	3300	11,71		2,80	2,50	2,40	1,80
7 x 65 R	3800	11,92		3,70	3,20	3,00	2,30
7 x 72 R	2800	10,88		2,00	1,80	1,80	1,50
7 x 75 R SE v.H.	4150	11,93		-	3,60	3,50	2,50
7, 62 x 53 R	3900	12,45		3,90	3,40	3,20	2,40
7,62 x 54 R	3900	12,48		3,90	3,40	3,20	2,40
8 x 50 R	3550	12,64		2,60	2,30	2,20	1,80
8 x 56 R M30	3400	13,88		3,90	3,40	2,90	2,40
8 x 56 R M30S	3550	12,60		2,60	2,30	2,20	1,80
8 x 57 R 360	2450	11,03		1,70	1,60	1,50	1,20
8 x 57 JR	3200	11,95		2,80	2,50	2,40	1,80
8 x 57 JRS	3300	11,95		2,90	2,60	2,50	1,90
8 x 58 R	2200	11,80		1,80	1,60	1,50	1,30
8 x 60 R	3400	12,06		3,10	2,70	2,60	2,00
8 x 60 RS	3400	12,06		3,10	2,70	2,60	2,00
8 x 65 R	3900	11,98		3,90	3,30	3,20	2,40
8 x 65 RS	4050	12,02		4,10	3,50	3,40	2,40
8 x 72 R	2800	10,88		2,00	1,80	1,80	1,50
8 x 75 RS	3800	11,93		3,70	3,20	3,00	2,30
8,15 x 46 R	1650	10,77		2,00	1,80	1,70	1,40
8,5 x 63 R	3450	11,92		3,70	3,20	3,00	2,30
9 x 57 R	2800	12,00		2,30	2,00	2,00	1,70
9,3 x 72 R	2000	10,93		1,50	1,30	1,20	1,00
9,3 x 74 R	3400	11,93		3,10	2,70	2,60	2,00
10,3 x 60 R / Nr. 270	2700	13,93		2,50	2,20	2,20	2,00
11,15 x 60 R	2800	13,13		2,50	2,30	2,00	1,90
218 Bee	3200	8,90		2,00	1,80	1,80	1,30
219 Zipper	2850	10,74		2,10	1,90	1,80	1,50
22 Hornet	3200	7,62		1,70	1,60	1,50	1,10
22 Savage	3300	10,80		2,60	2,30	2,20	1,70
225 Win.	3900	10,80		3,50	3,00	2,90	2,10
240 Fl. N.E.	3200	11,71		2,70	2,40	2,30	1,70
25-20 Win.	2700	8,90		1,60	1,40	1,40	1,30
25-35 Win.	3050	10,74		2,30	2,00	2,00	1,50
256 Win.Mag.	3500	9,70		2,60	2,30	2,20	1,60

3. Rimmed cartridges (cont.)

Calibres	PTmax bar Transducer	P1 mm	R1 mm	Minimum wall thickness w or b mm			
				Cat. 1 mm	Cat. 2 mm	Cat.3 mm	Cat.4 mm
7-30 Waters	3150	10,75		2,60	2,30	2,20	1,70
280 Fl. N.E.	2950	13,72		2,80	2,50	2,40	1,90
30 Fl. N.E. Purdey	3200	11,76		2,70	2,40	2,30	1,70
30 Super Fl. H.&H.	3200	13,16		3,00	2,70	2,60	1,90
30 R Blaser	4050	12,23		4,10	3,50	3,40	2,40
30-30 Win.	3200	10,75		2,50	2,20	2,10	1,60
30-40 Krag	3250	14,10		2,80	2,40	2,30	1,80
300/295 Rook Rifle	1200	8,13		1,20	1,00	1,00	1,00
300 Sherwood	1400	8,15		1,40	1,20	1,10	1,00
303 British	3650	11,74		3,40	2,90	2,80	2,10
303 Savage	2700	11,33		2,00	1,80	1,80	1,60
307 Win.	4150	12,01		-	3,60	3,50	2,50
310 Cadet Rifle	1100	9,04		1,20	1,00	1,00	1,00
32 Win. SL	1550	9,05		1,40	1,20	1,10	1,00
32 Win. spez.	3050	10,74		2,30	2,00	2,00	1,50
32-20 Win.	2100	9,00		1,30	1,10	1,00	1,00
32-40 Win.	2350	10,79		1,60	1,50	1,40	1,20
33 Win.	3050	12,97		2,80	2,50	2,40	1,80
348 Win.	3200	14,07		3,20	2,90	2,80	2,10
35 Win.	3050	11,76		2,50	2,20	2,20	1,70
35 Win. SL	2400	9,77		1,50	1,40	1,30	1,10
350 No2 Rigby	3300	11,99		2,90	2,60	2,50	1,90
351 Win. SL	3650	9,86		2,90	2,50	2,40	1,80
356 Win.	4150	12,01		1)	3,50	3,40	2,50
360 N.E. 2"1/4	2450	10,95		1,70	1,50	1,40	1,20
369 N.E. Purdey	3050	13,77		2,90	2,60	2,60	1,90
375 Fl. N.E. 2"1/2	2200	11,68		1,70	1,50	1,40	1,20
375 Fl. Mag. N.E.	3250	13,16		3,10	2,70	2,60	2,00
375 Win.	4400	10,74		1)	3,80	3,00	2,60
38-40 Win.	1150	11,96		1,40	1,20	1,10	1,00
38-55 Win.	2400	10,73		1,60	1,50	1,40	1,20
380 Long Rifle	950	9,68		1,20	1,00	1,00	1,00
40-82 Win.	1650	12,95		1,90	1,70	1,60	1,40
400/350 N.E.	2800	11,99		2,30	2,00	2,00	1,70
401 Win. SL	2450	11,13		1,70	1,60	1,50	1,30
405 Win.	2450	11,76		1,80	1,70	1,60	1,40
408 Win.	4100	11,39		4,00	3,40	3,30	2,40
44-40 Win.	1100	11,98		1,80	1,60	1,50	1,30
444 Marlin	3550	11,98		3,30	2,90	2,70	2,10
45-70 Govt.	2200	12,91		1,80	1,60	1,50	1,30
450 N.E. 3"1/4	3050	13,87		3,00	2,60	2,60	2,00
450/400 N.E. 3"	2800	13,94		2,60	2,30	2,30	2,00
450/400 Mag.N.E. 3"1/4	2950	13,87		2,80	2,50	2,40	2,00
470 N.E.	2700	14,58		2,60	2,30	2,30	2,10
475 No2 N.E. 3"1/2	2750	14,76		2,70	2,40	2,30	2,10
500 N.E. 3"	2800	14,61		2,80	2,50	2,40	2,10
500/465 N.E.	2450	14,61		2,30	2,10	2,00	1,80
577/450 Sld. Mart. H.	1750	17,09		2,30	2,10	2,00	1,80
577 N.E. 3"	2450	16,84		2,60	2,40	2,30	2,10
577 Sld. Snider	1500	16,92		2,30	2,10	2,00	1,80
600 N.E.	2450	17,81		2,70	2,50	2,40	2,20
700 H.H. N.E.	2750	19,89		3,20	2,90	2,90	2,70

4. Magnum cartridges

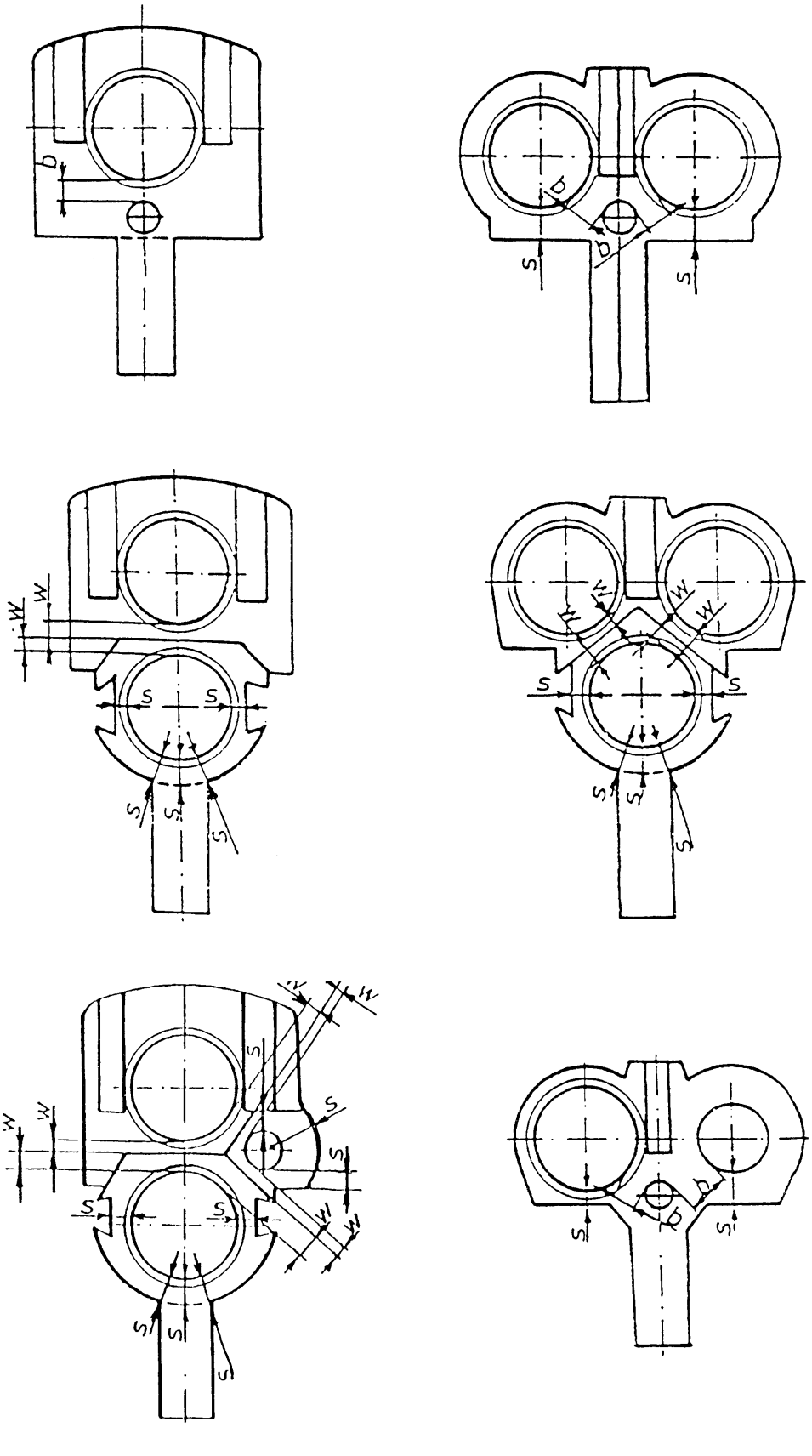
Calibres	PTmax bar Transducer	P1 mm	R1 mm	Minimum wall thickness w or b mm			
				Cat. 1 mm	Cat. 2 mm	Cat.3 mm	Cat.4 mm
224 Weath. Mag.	4400		10,97	-	3,80	3,00	2,60
240 Belt. Riml. N.E.	3300		12,17	2,80	2,50	2,40	1,80
240 Weath. Mag.	4400		12,07	-	3,90	3,70	2,60
244 H.&H. Mag.	4350		13,59	-	4,20	4,00	2,90
257 Weath. Mag.	4400		13,56	-	4,30	4,10	3,00
6,5 mm Rem. Mag.	4350		13,59	-	4,20	4,00	2,90
264 Win. Mag.	4300		13,59	-	4,10	4,00	2,80
270 Weath. Mag.	4400		13,56	-	4,30	4,10	3,00
275 Belt. N.E.	4150		13,59	-	4,00	3,80	2,70
7 mm Rem. Mag.	4300		13,59	-	4,10	4,00	2,80
7 mm Weath. Mag.	4400		13,56	-	4,30	4,10	3,00
7 x 61 Super	4050		13,56	-	3,90	3,70	2,90
300 H.&H. Mag.	4300		13,59	-	4,10	4,00	2,80
300 Weath. Mag.	4400		13,56	-	4,30	4,10	3,00
300 Win. Mag.	4300		13,59	-	4,10	4,00	2,80
308 Norma Mag.	4400		13,75	-	4,30	4,10	3,00
8 mm Rem. Mag.	4600		13,59	-	4,80	4,50	3,20
338 Win. Mag.	4300		13,59	-	4,10	4,00	2,80
340 Weath. Mag.	4400		13,56	-	4,30	4,10	3,00
350 Rem. Mag.	4300		13,59	-	4,10	4,00	2,80
358 Norma Mag.	4400		13,75	-	4,30	4,10	3,00
375 H.&H. Mag.	4300		13,59	-	4,10	4,00	2,80
375 Weath. Mag.	4400		13,56	-	4,30	4,10	3,00
378 Weath. Mag.	4400		15,39	-	4,90	4,60	3,40
416 Rem. Mag.	4300		13,59	-	4,20	4,00	2,90
416 Weath. Mag.	4400		15,39	-	4,90	4,60	3,40
458 Win. Mag.	4300		13,59	-	4,10	4,00	2,80
460 Weath. Mag.	4400		15,39	-	4,90	4,60	3,40

5.Shot gun cartridges

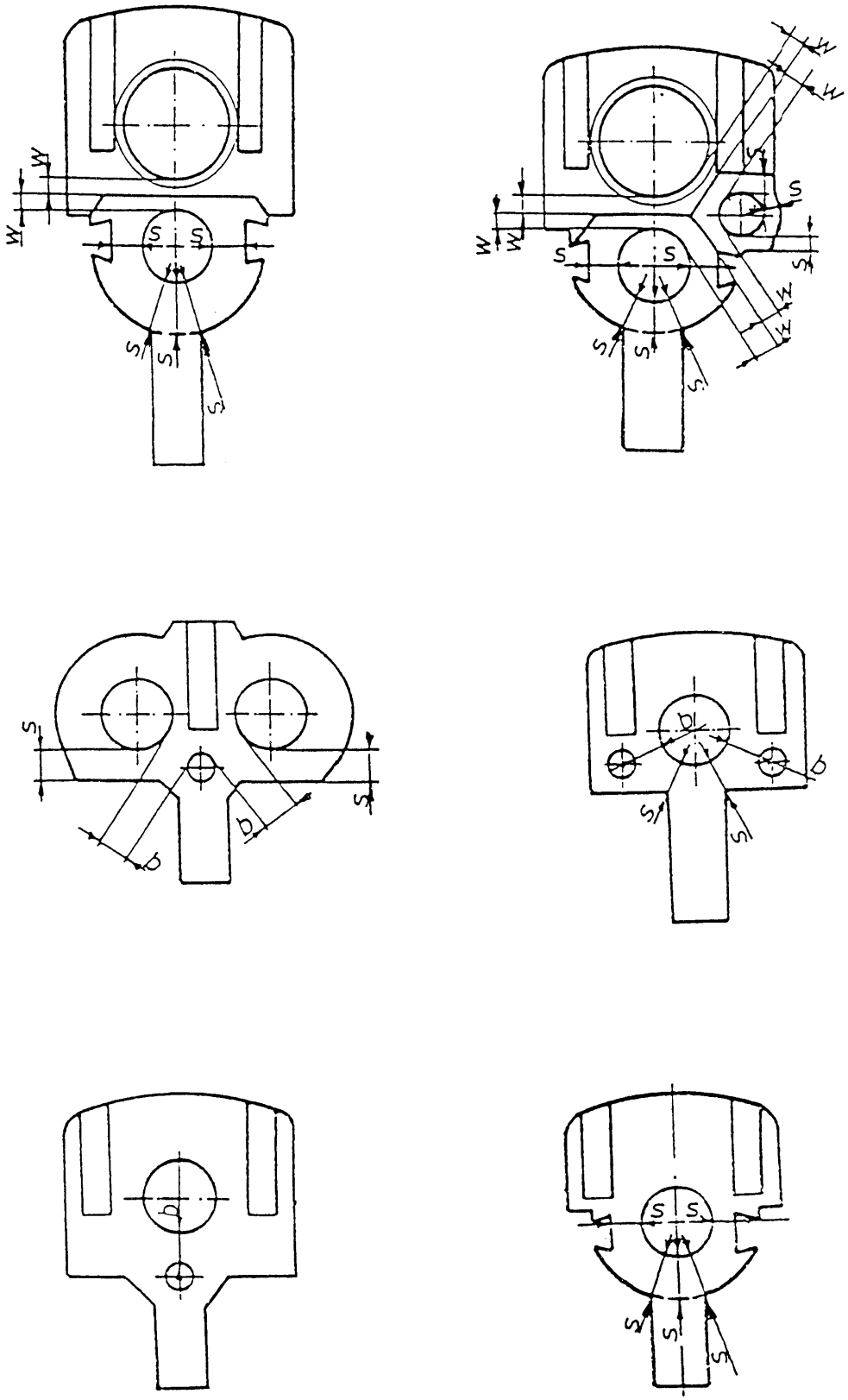
Calibres	PTmax bar Transducer	Dmax mm	Minimum wall thickness w or b mm			
			Cat. 1 mm	Cat. 2 mm	Cat.3 mm	Cat.4 mm
10	740	21,85	1,60	1,40	1,30	1,00
12	740	20,75	1,60	1,40	1,30	1,00
14	740	19,80	1,60	1,40	1,30	1,00
16	780	19,05	1,60	1,40	1,30	1,00
20	830	17,85	1,60	1,40	1,30	1,00
24	830	16,90	1,60	1,40	1,30	1,00
28	830	16,00	1,60	1,40	1,30	1,00
32	830	14,70	1,60	1,40	1,30	1,00
36/410	830	12,15	1,60	1,40	1,30	1,00
9 mm	830	10,00	1,60	1,40	1,30	1,00

Annex 5

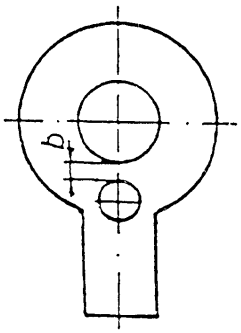
Examples

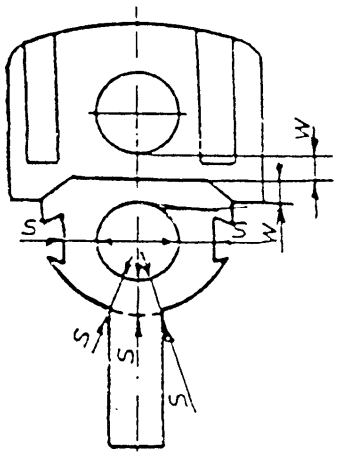


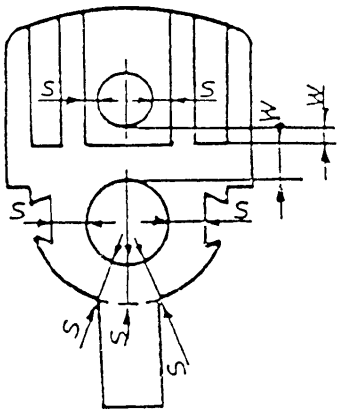
Examples (cont.)

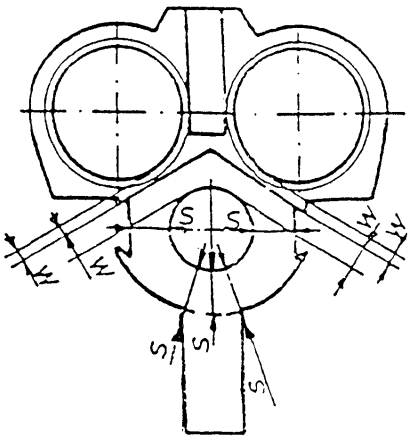


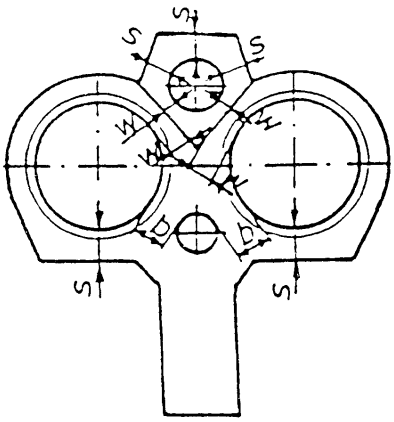
Examples (cont.)

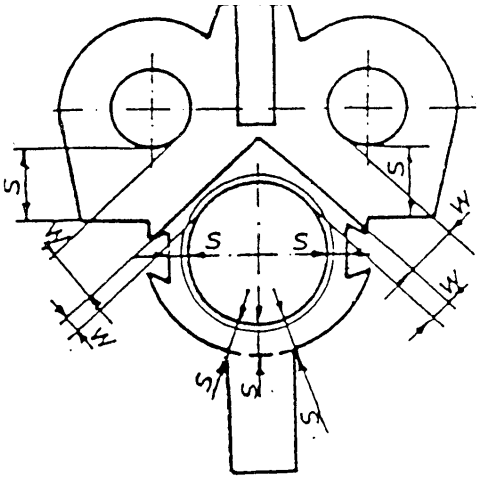












Examples (cont.)