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COMPETITIVE LARGE RIFLE PRIMER ANALYSIS

Factors affecting the sensitivity of the primers in competitive 30.06 ammunition (Remington, Winchester, and Federal) and in competitive large rifle primers for the trade (Remington #9½, Winchester #8½-120, Federal #21, CCI #200 and CCI #250 Magnum) were investigated to determine if significant differences existed.

None of the factors studied provided information that would make either the primer characteristics or individual differences to be the cause of firing problems.

Actual analysis, chemical and physical, of Remington's brass primer cup strip stock was within specifications in all aspects (Table I).

Physical measurements (see attached tables) such as cup head thickness (Table II), cup diameter (Table III), cup eccentricity (Table IV), head contour, hardness (Table V), and light blow firing pin indent (Tables VI and VII) did not reveal any significant differences except for the Federal primers.

The Federal primers have a domed head instead of a flat head that all of the others tested have. Also the Federal cups apparently have been either annealed or produced from softer strip stock since these cups are much softer than the others tested (Table V).

Light blow drop test indent tests caused either primer reseating or cup head deformation in the Federal primers only. The latter is the more probable because of both their metal softness and their domed contour. The combination of indent and primer head movement (above) was about 25% greater in the Federal primed cases than the indent in either Remington or Winchester primed cases.

No primers fired at either of the light blow conditions of 4" or 2" drop heights with a 2 oz. ball.

Drop test data (Table VIII) did not provide sufficient differences in the primer sensitivities that would answer the subject problem. The domed head and softer primer cup metal in the Federal primers apparently combined to produce an $\bar{x}$ sensitivity consistent with the others tested. The CCI primers were the most sensitive.

Finally the primer pocket diameters in 10 each of the 3 competitive shells tested did not reveal any difference either between the three manufacturers or within a product line.

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TABLE I

Primer Metal (Cups)
Copper Alloy No. 260 Rem. Spec. S-2000 No. ^{sh.}

Copper 70% $\pm 1.5\%$ Lead 0.07% Bismuth .006% Max.
Zinc 30% $\pm 1.5\%$ Iron 0.05% Mercury .0001% "
Total Elements other than Cu & Zn 0.150% Max.

Thickness: .0095"-.029" incl. $\pm .0005$ "
Width Tolerance $\pm .01$ "
Grain Size: Desired .050 mm. Min. .035 mm. Max. .070 mm.

Actual Test Results: .027 x $1\frac{5}{32}$ "
G.S. .040, .045, .040, .040, .045, .040, .045, .050, .060, .050 mm.

Edge 1	Edge 2	Grain	Width	
.0279	.0272	.0272	1.156	11-2-70
.0273	.0270	.0271	1.157	
.0272	.0270	.0271	1.155	
.0271	.0270	.0270	1.157	2-11-71
.0267	.0266	.0266	1.158	
.0266	.0268	.0268	1.157	

All Chem. Analyses have been within
Spec. limits.

[Signature]

TABLE II

Cup Head Thickness (*)

	Min		Max		Avg. (**)	
Observer	<u>1</u>	<u>2</u>	<u>1</u>	<u>2</u>	<u>1</u>	<u>2</u>
Remington	.0262	.0261	.0270	.0270	.02661	.02663
Federal	.0265	.0265	.0268	.0267	.02655	.02654
Winchester	.0270	.0270	.0275	.0275	.02728	.02728
CCI #200	.0262	.0262	.0266	.0266	.02640	.02640
CCI #250	.0260	.0260	.0267	.0267	.02641	.02641

*Loose primers with mixture removed

**The same 10 cups in each product were tested by each observer

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TABLE III

Cup Diameters*

	<u>Min.</u>	<u>Max.</u>	<u>Avg.</u>
Remington	.2098	.2113	.21052
Federal	.2100	.2118	.210765
Winchester	.2101	.2116	.210935
CCI #200	.2099	.2108	.210385
CCI #250	.2098	.2114	.210185

*The same 10 cups on each sample from Table II.

TABLE IV

Cup Eccentricity*

	<u>Min.</u>	<u>Max.</u>	<u>Avg.</u>
Remington	.0000	.0010	.00063
Federal	.0003	.0012	.00069
Winchester	.0002	.0009	.00041
CCI #200	.0002	.0004	.00035
CCI #250	.0002	.0008	.00031

*The same 10 cups on each sample from Table II and III.

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TABLE VI

Light Blow Indent
Cal. 30.06 Primed Cases
4" Drop, 2 oz Ball

	<u>Federal</u> <u>Seating</u>			<u>Before</u>	<u>Winchester</u> <u>Seating</u>		
	<u>After</u>	<u>Move- ment</u>	<u>Indent Depth</u>		<u>After</u>	<u>Move- ment</u>	<u>Indent Depth</u>
25	-.0055	-.00125	-.00525	-.006	-.00625	-.00025	-.00475
5	-.00575	-.00125	-.00475	-.006	-.006	000	-.00475
75	-.0065	-.00175	-.00525	-.006	-.006	000	-.005
5	-.0055	-.001	-.005	-.007	-.007	000	-.0045
	-.005	-.001	-.005	-.006	-.006	000	-.005
	-.005	-.001	-.004	-.006	-.006	000	-.005
25	-.00525	-.001	-.005	-.006	-.006	000	-.005
	-.006	-.002	-.004	-.006	-.006	000	-.00425
	-.00525	-.00025	-.0055	-.006	-.006	000	-.005
125	-.00525	-.001	-.00575	-.006	-.006	000	-.005
135	-.0055	-.00115	-.00495	-.0061	-.0061	000	-.00482

TABLE VII

Light Blow Indent
Cal. 30.06 Primed Cases
2" Drop, 2 oz ball

<u>Federal Seating</u>			<u>Winchester Seating</u>			
<u>After</u>	<u>Move- ment</u>	<u>Indent Depth</u>	<u>Before</u>	<u>After</u>	<u>Move- ment</u>	<u>Indent Depth</u>
---	---	---	.006	-.006	.000	-.004
-.00475	-.0005	-.0035	-.00625	-.00625	.000	-.0035
-.00425	-.00025	-.00375	-.006	-.006	.000	-.00375
-.00425	-.00025	-.00375	-.006	-.006	.000	-.004
-.005	-.00025	-.00375	-.00625	-.00625	.000	-.00325
-.005	-.0005	-.00375	-.006	-.006	.000	-.00375
-.00575	-.00075	-.0035	-.006	-.006	.000	-.0035
-.00475	-.00025	-.003	-.0065	-.0065	.000	-.00325
-.005	-.00025	-.0035	-.006	-.006	.000	-.00350
-.0045	-.00025	-.00375	-.0065	-.0065	.000	-.004
-.00480	-.00036	-.00358	-.00615	-.00615	.000	-.00365

TABLE VIII

Drop Test
2 oz Ball

	<u>Clearance Height</u>	<u>$\bar{X}$</u>	<u>σ</u>
Remington	13"	8.78	1.95
Federal	14"	9.62	2.10
Winchester	13"	9.98	1.24
CCI #200	11"	7.78	1.00
CCI #250	11"	7.50	1.17