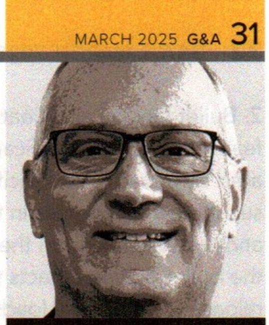
Understanding variances in reloading manuals.



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DATA CONFUSION

ANYONE WHO HAS RELOADED AMMUNITION for any length of time probably has several reloading guides, and has referred to numerous websites while searching for load data. Often, after looking up load data, one may be left feeling confused. There can be significant differences in the maximum loads listed across various sources for the same propellant and load. Some have asked, "Why are there such big discrepancies?" and "What do I use for load data?"

Let me preface with this: If you stick to sources that are members of or follow Sporting Arms and Ammunition Manufacturers' Institute (SAAMI) standards and test protocols, there is considerable care and effort put into what is published for reloading data. SAAMI established test barrel and cartridge specifications and tolerances for the industry, as well as standardized equipment and methods for testing ammunition. These standards ensure that everyone following them is playing from the same sheet of music. SAAMI goes through each major ammunition manufacturer to load and distribute reference ammunition for a range of cartridges. The ammunition is used to calibrate test barrels and pressure transducers, ensuring that all members have equipment that meets the standards. The following is a list of reloading data sources (that I'm aware of), that are members of SAAMI or follow and use SAAMI standards for establishing reloading data: Alliant, Barnes, Hodgdon, Hornady, Lyman, Nosler, Sierra, Speer and Winchester. If you stick to these sources, the data is reliable and credible.

For an example of the disparity in data, let's focus on a common load: .308 Winchester with a 165-grain bullet. I chose to evaluate this with IMR 4064 because it is a popular propellant used to make .308 rounds, and it is listed by many of the sources referenced above. **Table 1** shows a list of loads from selected sources.

As you can see in the table, there are considerable differences in the maximum loads listed for the same weight bullet in the same cartridge. What gives? As with a lot of technical things, details matter. I will discuss reasons why there are differences in the reloading data from various sources, and also provide the reloader with a basis for variables that affect a given load's pressure and what the sensitivities are. I offer up the often-repeated warning in reloading: "Follow the recipe given in the data source, or follow it as closely as possible."

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PRESSURE FACTORS

To start this discussion, I am going to make some statements about factors that affect the pressure of a load and rank order them from greatest to least. I don't have room in a column to provide you with data to support this, but I assure you what I am writing is based on years of testing, experimenting and specifically exploring these factors with the above-mentioned SAAMI specification equipment.

1. **Case Capacity** Case capacity is the most dominant factor in determining what the pressure of a load is, as well as the specific load of a propellant to achieve a certain pressure. Two things play in to this: The actual capacity/internal volume of the cartridge case, and the seating depth or case intrusion of the bullet. **Table 2** shows the case capacity in grains and cubic centimeters (cc) of water of every manufacturer of .308/7.62 cases I had in inventory. As you can read, there are significant differences in case capacity. Incidentally, the range of bulk/loading density of rifle propellants is about .88 to 1.00 grams/cc or 13.56 to 15.42 grains of propellant per cc. This provides you with a good idea of the differences in cases. There is a 2.6- to 2.9-grain difference in case propellant capacity of these cases, depending on the propellant.

You should check the capacity of the case lot you have because it may vary depending on the wear in the tooling when the cases were made.

2. Bullet Design and Seating Depth The bullet has several features that can significantly affect the pressure generated by a load. The specific design of the bullet can cause substantial differences in the bullet length, bearing surface and the distance from the cartridge case to the rifling where the bullet ogive contacts the rifling. Every source listed for reloading data show loads that are at or within the SAAMI maximum cartridge overall length (COL). This ensures the load will fit inside the magazine and prevent the bullet from hitting the rifling in a SAAMI minimum specification throat. Doing this forces them to have a fixed maximum load length, so for bullets with more blunt ogives the load will need to be shorter than the maximum COL.

TABLE 1

.308 WIN. 165-GR. LOAD DATA

SOURCE	MAXIMUM CHARGE (GRAINS)
Barnes	46.0
Hodgdon	46.0
Hornady	43.1
Lyman	44.5
Nosler	44.5
Speer	45.0

TABLE 2

.308 WIN. CASE CAPACITY

MANUFACTURER	CASE CAPACITY (GRAINS H_2O/CC)
Federal	53.5 / 3.48
Hornady	54.7 / 3.56
LC 63	53.4 / 3.48
LC 72 Match	53.4 / 3.48
Remington	54 / 3.52
Winchester	56.3 / 3.67
WW 61	54.2 / 3.53

TABLE 3

.308 165-GR. BULLET LENGTH

MANUFACTURER	LENGTH (IN.)
Barnes TSX BT	1.320
Barnes MRX BT	1.315
Barnes BND Spitzer	1.410
Hodgdon (Horn. 165 SP)	1.160
Hornady SP	1.160
Hornady SST	1.270
Hornady ELD-M	1.270
Hornady CX	1.420
Lyman (Nosler Partition)	1.150
Speer SP BT	1.190
Speer Grand Slam	1.100
Speer Hot Core	1.170

The extremes of bullet designs range from the classic flat-base soft-point to newer monolithic copper bullets. There are notable variations in the overall lengths of the bullets, as well as in bearing surface length and ogive shape. These variations result in substantial differences in load length and case intrusion that, in turn, significantly affect case capacity amongst the bullet designs. The bearing surface will play a lesser role in affecting pressure. However, all things being the same, significant differences in bullet bearing surface will cause variations in pressure, but not to the extent of case capacity. Table 3 lists the bullets shown in the corresponding manuals along with the lengths. Most of these manufacturers lump all the types of bullets together with one set of loading data for the bullet weight, not type. When this happens, the worst-case bullet for case intrusion is used or data is developed and checked to make high pressure doesn't result from it.

It is commonly stated that the jump to the rifling is a significant factor in raising pressure. That is contrary to my findings. If the powder load is constant, seating the bullet out of the case farther and closer to the rifling will actually drop pressure because the increase in case capacity overwhelms any effects of less jump to the rifling. This held true even to the point of touching the rifling.

3. Primers As long as you stay within the class of primer recommended for the cartridge, primers will have a relatively small effect on pressure. You will see variations in pressure with primers, but they aren't huge. As an example, there are differences in the brisance or violence of the output of different primers. There are no real absolutes here, but in general a Federal 210 primer is not as brisant as a Remington 9½ primer. You will see pressure differences in a fixed load between these primers, but it's not a significant difference. If you go from a standard large rifle primer to a magnum large rifle primer, you will see substantially higher pressure with the magnum primer. I don't recommend this unless you have no choice. If you have to do this, back off a grain or so and load to the same velocity produced by the standard primer.

4. Crimp If you are using the usual seating die roll crimp, various amounts of crimp will not affect pressure greatly. In fact, if you roll crimp too much, you will drop pressure because the excessive roll crimp begins to bulge the case neck and reduces neck tension and bullet pull. If you happen to be using something like a Lee factory crimp die, higher levels of this type of crimp will increase pressure.

LOAD DATA: .308 WINCHESTER, 165-GR., IMR 4064 TABLE 4

SOURCE	BULLET	CASE	PRIMER	COL (IN.)	CASE INTRUSION (IN.)	MAX LOAD (GR.)
Barnes	TSX BT	Win.	Fed. 210	2.810	0.515	46.0
Barnes	MRX BT	Win.	Fed. 210	2.785	0.535	46.0
Barnes	BND Spitzer	Win.	Fed. 210	2.810	0.605	46.0
				Avg.: 2.802	Avg.: .552	
Hodgdon	Hornady SP Interlock	Win.	Fed. 210 M	2.750	0.415	46.0
Hornady	SP Interlock	Horn.	Fed. 210	2.750	0.415	43.1
Hornady	SST	Horn.	Fed. 210	2.750	0.525	43.1
Hornady	ELD-M	Horn.	Fed. 210	2.800	0.470	43.1
Hornady	CX	Horn.	Fed. 210	2.750	0.675	43.1
				Avg.: 2.763	Avg.: .521	
Lyman	Nosler Partition	Rem.	Rem. 9 1/2	2.780	0.375	44.5
Speer	SP BT	IMI (com)	CCI 200	2.800	0.395	45.0
Speer	Grand Slam	IMI (com)	CCI 200	2.685	0.420	45.0
Speer	Hot Core	IMI (com)	CCI 200	2.800	0.375	45.0
				Avg.: 2.762	Avg.: .397	

RELOADING DATA DISPARITY

Let's consider data from several sources for the .308 Winchester with a 165-grain bullet loaded with IMR 4064 propellant. Table 4 is a sampling of data showing case, primer, bullet type, COL, case intrusion and maximum load of 4064. Refer to Table 2 for measured case capacity and Table 3 for bullet lengths. As I stated, details matter.

Hornady shows the

lowest charge weight at 43.1 grains. When looking at the data, the Hornady case is in the middle of the case capacity range, but Hornady bullets are rather long and close to the Barnes monolithics for length. The Hornady CX bullet is the longest bullet shown. This isn't a bad thing, it's just what it is. Hornady also generally seats its bullets a little deeper than everyone else. Three of the four loads are loaded below maximum COL of 2.810 inches. Ogives either contact the rifling if seated out farther, or they are seating to the cannelure.

Barnes and Hodgdon show the highest charge weight at 46.0 grains. They are using a Winchester case that has significantly greater case capacity than any other case. The Hornady SP Interlock that Hodgdon loads is one of the shortest bullets in the list, and is on the low side of case intrusion. Barnes is also loading several of its bullets to the maximum COL allowed to reduce case intrusion. Look at the case intrusion of the Hornady CX versus the Barnes loads. The Barnes loads have a little less to quite a bit less case intrusion as compared to the comparable Hornady CX bullet. Again, not a bad thing; it just shows why there are differences. Case intrusion makes a difference. Barnes further compensates for its long bullets with the four cannelures, which dramatically reduce the bearing surface. Barnes uses a Winchester case that has .11-cc greater case capacity, along with its bullets being shorter than the comparable CX bullet, so seating them to a longer COL explains the differences in the data.

Speer is behind Hodgdon and Barnes at 45.0 grains for charge weight. I have no IMI commercial cases, so I can't comment on case capacity, but Speer bullets coupled with the COL have significantly less case intrusion than everyone else. Lyman is next in line at 44.5 grains. It is using a Remington case that is getting on the lower end of case capacity. However, the Nosler Partition bullet they load has a shorter ogive and somewhat long bearing surface that results in a short bullet with low case intrusion with the COL being used. This compensates for the lower capacity Remington case. Details matter. Load as close to the recipe and components listed in the manuals.

There are important lessons in this column for handloaders. If you want to maximize the performance of your loads, you need to maximize case capacity. This is especially true when loading long-for-the-weight monolithic bullets. Measure the water capacity of the cases and use ones with the highest capacity. Seat the bullets as far out of the case as possible while ensuring they fit in your magazine. If you do this, make sure to check that the bullet isn't being driven into the rifling. You don't want to be out hunting, need to eject the round and leave the bullet in the throat with powder spilled. If you've never had that happen, you don't want to — it's very aggravating. G&A