ISSUE 68

APOGEE

PEAK OF FLIGHT

NEWSLETTER

Pressure Relief Holes

By Tim Van Milligan

I got a question from a customer about pressure relief holes. I thought that this might make a good newsletter article.

What is a "Pressure Relief Hole," and why might your rocket need one?

The reason for the hole (called a vent hole) is to allow the pressure inside the rocket to equalize to the external atmospheric pressure. This is important because the atmospheric pressure decreases as you go up in altitude. At sea level, it is 14.7 psi, and in space, it is near zero.

If the pressure inside the rocket is significantly greater than the external pressure, it can eject the nose cone of the rocket. A lot of times, this can happen while the rocket is still traveling at a high rate of speed. Then the rocket tube can be zippered by the shock cord; or the rocket could turn sideways and crack in half; or the fins could snap off; or the parachute could be ripped to shreds. After all is said and done, only bad things happen if the nose cone comes off while the rocket is still moving upward.

If you only fly small model rockets, you've probably never experienced a nose popping off prematurely. The reason is that the diameter of the rocket is small, so the pressure forces trying to pop it off the tube are fairly small. Usually, the friction forces on the shoulder of the nose cone are sufficient enough to hold the nose cone on.

But on big diameter rocket, the forces are much greater.

Here's how to determine the forces trying to pop the nose cone off the rocket.

First, use RockSim to predict the peak altitude of the flight of the rocket. For this little example, I'll assume we're flying a 4 inch diameter model that reaches an altitude of 2000 feet.

In RockSim, you can find the atmospheric pressure of the rocket at 2000 feet - which is: 94466.458 N/m^2

The pressure at launch elevation is: 101299.762 N/m^2, so the difference between launch and apogee is: 6,833.31 N/m^2

Converting that to PSI is done by dividing it by 6894.75 (N/m^2/psi)

So the difference is .991 psi.

The total force is then the pressure difference multiplied by the base area of the nose cone. The area of a 4 inch nose cone is 12.566 square inches. So the total force is 12.4 lb.

Now 12 pounds doesn't sound like much, but it is plenty more than is needed to push off a nose cone. Without a vent hole, the friction fit of the nose cone is all that is available, and it would have to hold back this force. And that may not be enough.

For example - since ejection charges can be a bit weak, a lot of modelers like a fairly loose fit on the nose cone. So they don't put a lot of tape on the shoulder of the nose to make a good tight friction fit. So 12 lbs can easily push that nose off.

And it gets even worse as the diameter increases. If you increase the diameter, the forces goes up as a square factor. Double the diameter, the force goes up FOUR times! So for an 8 inch diameter rocket, the force is now 49.8 lbs. So you really have to watch out if you are flying big diameter rockets.

The vent hole doesn't have to be really big. I've seen holes as small as 1/8 inch diameter in the sides of tubes. But most times, they are about 1/4 inch diameter. I'd try to keep them as small as possible so that the ejection charge can still pressurize the tube to deploy the parachute.

But if you're rocket is going to be traveling extremely fast; I'd probably go with a slightly larger diameter hole. I've seen some nose cones come off at pretty low altitudes because the air inside the tube couldn't escape fast enough.

The location for the vent hole isn't that critical. But I'd recommend that you put it in the parachute bay, and just below the base of the nose cone's shoulder.

Interesting tidbit:

Did you know that all big rockets contain pressure relief holes? If the cargo bay of the Space Shuttle didn't have the

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vents, the doors of the cargo bay would pop off while the rocket was ascending into orbit. Obviously, that wouldn't be good.

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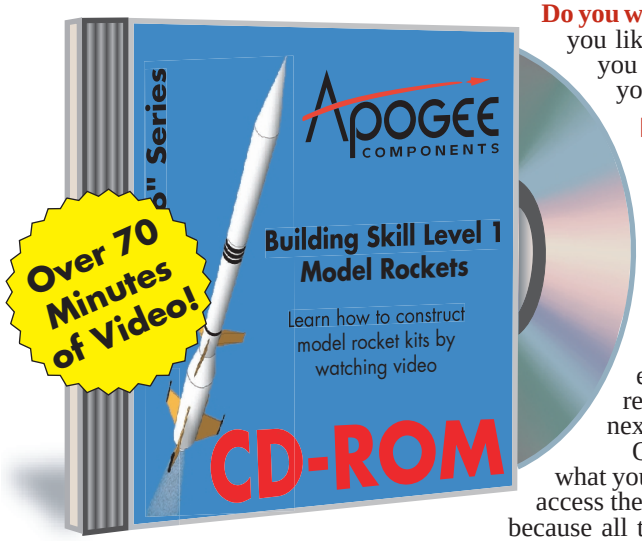
How To Make Better Looking Rockets:

Discover The Secret Techniques Used By Master Craftsmen



"The use of videos imbedded into the text made the lessons easy and fun to read. Even my girls could understand!" -- Craig Christenson

Do you want to "really" know how to build better looking rockets? Would you like stronger rockets? Do you want your rockets to fly higher? Are you pressed for time and looking for ways to build rockets faster? If you answered 'yes' to any of these questions, please read on.

No More Confusion -Your Brain "Gets" This Material Instantly

If you wanted to learn piano, karate, or even business, calculus, or computer programming -- wouldn't you find it easier to learn in a classroom, with a teacher, than at home with a book? Go ahead and try explaining how to tie your shoe to someone without actually showing them. Do you see my point?

It's the same with building and flying model rockets. When you see a master craftsman assemble a rocket right before your eyes, the techniques and proceedures crystallize in your brain. This really is the closest thing to having me in your workshop sitting right next to you at your workbench.

Once you watch a video you just pause it and then you go do exactly what you saw me do. If you have a question, just hit "rewind" and instantly access the information you need. You can go at your own pace (fast or slow) because all the information is right at your fingertips. You'll find this video-book indispensable for all your rocket project, both easy and complex. Go to the Apogee web site, and order you copy today! For just $12.95, you won't find any better rocket education. (**www.ApogeeRockets.com/skill_level_1_video.asp**)

Note: The CD-ROM is not a DVD disk. It is an ordinary computer CD-ROM. It works on both Macintosh and Windows computers. Requires Adobe Acrobat Reader, which can be downloaded free from the Adobe website.

Building Skill Level 1 Rockets (CD-ROM)
P/N 1065 *$12.95*

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