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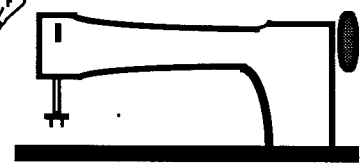
Dedicated to the Sport Balloon Home-Builder



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THE BALLOON BUILDERS' JOURNAL

Sept-Oct 1996

In This Issue

Tank Valve Jamming Problem

Aerostar has published Service Bulletin #135, July 15, 1996, noting several instances of tank valves jamming, resulting in little or no fuel delivery. The valves in question are Rego model 9107 and *replacement* bonnets in model 9101 valves. Only valves with a white, plastic-type valve seat have the problem. Valves with brass valve seats are not suspect.

Rego valves are widely used in the balloon industry. The 9101 valve, for example, is commonly found in Worthington 10 gallon fuel tanks. A limited number of these replacement bonnets were produced beginning in 1992 and may have been installed in older Worthington tanks.

Thus *balloon owners of other makes of balloons, beside Aerostar, may want to review this Service Bulletin.* Contact your local repair station for more details

The *BBJ* Editor will be at Albuquerque in October; I hope to see you there.

Component Testing by Homebuilders

By Bill Arras

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Introduction

In a past *BBJ* issue, Mike Gross expressed interest in hearing about testing that other homebuilders have performed. I have not done any significant advance testing of individual components or completed systems, but rely mainly upon component specs, existing designs and intuition.

So far I've been lucky with this method. Like many individual homebuilders, I lack the financial resources to afford the luxury of a comprehensive test program. The resulting risk to me is sometimes higher than I might prefer, but it's a level of risk I'm willing to accept.

But even in the best case, test results will only provide guidelines, not exact design parameters. Balloons are not like aerodynamic, steerable aircraft, where given conditions will cause a calculable force. There are simply too many variables with a balloon.

Static loads in a balloon are easy to calculate and to design for. Anyone can build a minimal balloon system which is capable of getting airborne, making a slow ascent, descent and landing in gentle conditions. The trick is to design and build for the maximum dynamic loads and stresses likely to be encountered in more demanding conditions and faster vertical maneuvers.

Manufacturers must design and build their balloons to withstand more stress than they will be exposed to in the most extreme of conditions. The result is that today's commercially manufactured balloons are very expensive, heavy and way overbuilt for average use. This has led to an increase in the interest in homebuilding. The goal of the homebuilder is to build a less expensive balloon that is more convenient and fun to fly, while still maintaining a reasonable margin of safety.

The reality is that anyone designing and building their own balloon will take on an increasingly higher degree of risk the more the design and materials differ from those used in commercially manufactured systems. Unfortunately, this could very well lead to injury or even death. All homebuilders should understand and respect the inherent risks involved when they become test pilots.

Having designed, built and tethered or flown a number of 'interesting' balloons, some of them very different than anything which had previously been built, I have learned quite a bit from field testing. Fortunately there have been no major disasters, admittedly sometimes only because of good luck.

Early Cable Break Experiences

The first basket I built (see *Figure 1*) was shown in the July-August [1995] issue of *BBJ*. It's a take-off on a Boland design, using chromolly tubing instead of aluminum. It's a very tough little basket that even the airlines haven't been able to damage. Initially, $^{1}/_{16}$" cables were used for the crossbracing on each side. On a rather firm short field landing (basically I vented hard at treetop level and dove into a hole in the trees on a flight that got wild and windy), I smacked into the ground hard enough to see stars and break two of the cables. Before the next flight I took a handful of aspirin and did a complete changeover to $^{3}/_{32}$" crossbrace cables. Using

Figure 1: This photo displays the construction used in Bill's first basket. The construction is similar to Brian Boland's products but utilizes aircraft grade chrome-moly steel rather than aluminum. The crossed steel cables which provide basket rigidity, and which have failed on a couple of occasions, are clearly visible. For more details about this basket read *BBJ* Issue #13 (July August 1995).

the heavier cables will cause an insignificant increase in weight and cost of a basket, but a significant increase in strength.

Since changing over to the heavier cables, I again whacked the ground hard enough to see stars and break two more cables. This time it was during an attempt to set a distance record in an AX-5. The GPS had me doing about 30 MPH at a couple hundred feet AGL. Wanting to drop an empty tank as gently as possible, I attempted to get to within a few feet of the ground to do so.

This was early in the flight and the balloon was heavily loaded. Seven full 10 gallon Worthingtons and one empty were hanging on the outside of the basket by single straps from the top rail, with only the tank I planned to use for landing secured at the bottom. The balloon was too heavily laden to recover in time from the descent. The basket augured in very hard and all but the one secured tank rebounded more quickly than the rest of the basket and made a heck of a noise as some of them banged together over my head. By the time I started to get my wits about me I was already a few hundred feet above ground and climbing fast from all the heating before impact.

Even with two broken cables the basket wasn't the least bit flexible. So I flew on until only half a tank of fuel was left and the surface wind had calmed. In retrospect, the basket has proven itself capable of surviving far more than I would have expected. The $^3/_{32}$" cables are plenty sufficient for normal use in small baskets.

Fuel Shutoff Considerations

Both of these hard ground contacts sparked my interest in having quick fuel shut-offs at all the tank values, or at least on the tank to be in use when landing. My concern is that the fuel system is more susceptible to damage when the tanks are outside of the basket. A reliable quick shut-off would allow a last minute blast of heat to flare before touching down with a simultaneous draining of fuel from the hoses, increasing the margin of safety substantially. At present, if the wind is strong enough to cause a rip-out landing I turn the fuel off at the tank values and empty the hoses completely before touching down. In a wide open field this is easy but is less than suitable to a small landing area. To date I have not researched what quick shut-off values might be used on Worthington tanks. Has anyone else?

Destructive Testing

This past December I had the good fortune of performing a perfect, even if unscheduled, destructive test on a complete experimental balloon system.

The event took place in Antarctica (read more about it in summer issues of *Ballooning* and *Balloon Life*). Especially lightweight, compact equipment was required for this expedition, so I designed and built a new basket and used an existing envelope. I had been led to believe, by nonballoonists, that an abundance of calm surface conditions would predominate at the flight location. That was not to be the case. Following is a description of the equipment and what happened.

The Balloon

The envelope was *Jimi* a 24 gore (transitioning to 12 suspension line attachment points), 54,000 cu. ft., vertical pattern made from F-111 1.1 oz. noncoated, calendered ripstop nylon with about 110 hours of flight time. The majority of the load tapes, with placement similar to the Aerostar Aurora S-49, were 7407-$^3/_4$" MIL-T-5038 Type III nylon tape with a minimum tensile strength of 400 lbs. Heavier 7408-$^3/_4$" MIL-T-5038 Type IV nylon tape with 750 lb. tensile was used on the mouth, the lower part of the vertical load tapes and the parachute opening.

The envelope rigging was a set of twelve $^3/_{32}$" 7x19 stainless steel cables which had been in use for 2 $^1/_2$ years. These same cables had been used in both of the previously mentioned hard ground contacts, had flown in three Nationals, one World Championship, a successful FAI world record flight and numerous other events and adventure flights in a wide range of conditions without any problem. The cables were divided into four groupings of three each, with a carabiner at the lower end of each set.

The basket frame was made of chromolly tubing. The main suspension lines were made from 2500 lb. polyester flat webbing attached to each of the bottom corners, running through guides at the respective top corners and on up to the burner ring (a floating burner).

The burner ring was made from an aluminum bicycle rim reinforced with a 1"x $^3/_{16}$" aluminum bar (more Boland influence), with four $^5/_{16}$" eyebolts evenly spaced around the outside edge. The envelope suspension cables were connected

by carabiner directly to the main suspension lines coming from the basket, with each carabiner also passing through an eyebolt. The eyebolts were not welded closed.

The Circumstances

The balloon was well anchored by heavy line to a block of wood deeply buried in the snow. This line was attached to only one of the eyebolts on the burner ring.

Immediately after hot inflation of the balloon, violent gusts whipped the envelope from side to side at the end of the tie-off line. Before I had a chance to pull the vent line, there was a loud snapping noise followed by a quick succession of more snapping and tearing noises until the balloon tore loose from its mooring. I was dragged a few hundred feet across the snow with the vent wide open.

The Damage

Inspection of the equipment showed that the tie-off line had held firm, but everything on the balloon that it was attached to had been damaged (See *Figure 2*). I can only speculate as to what failed first, but all the

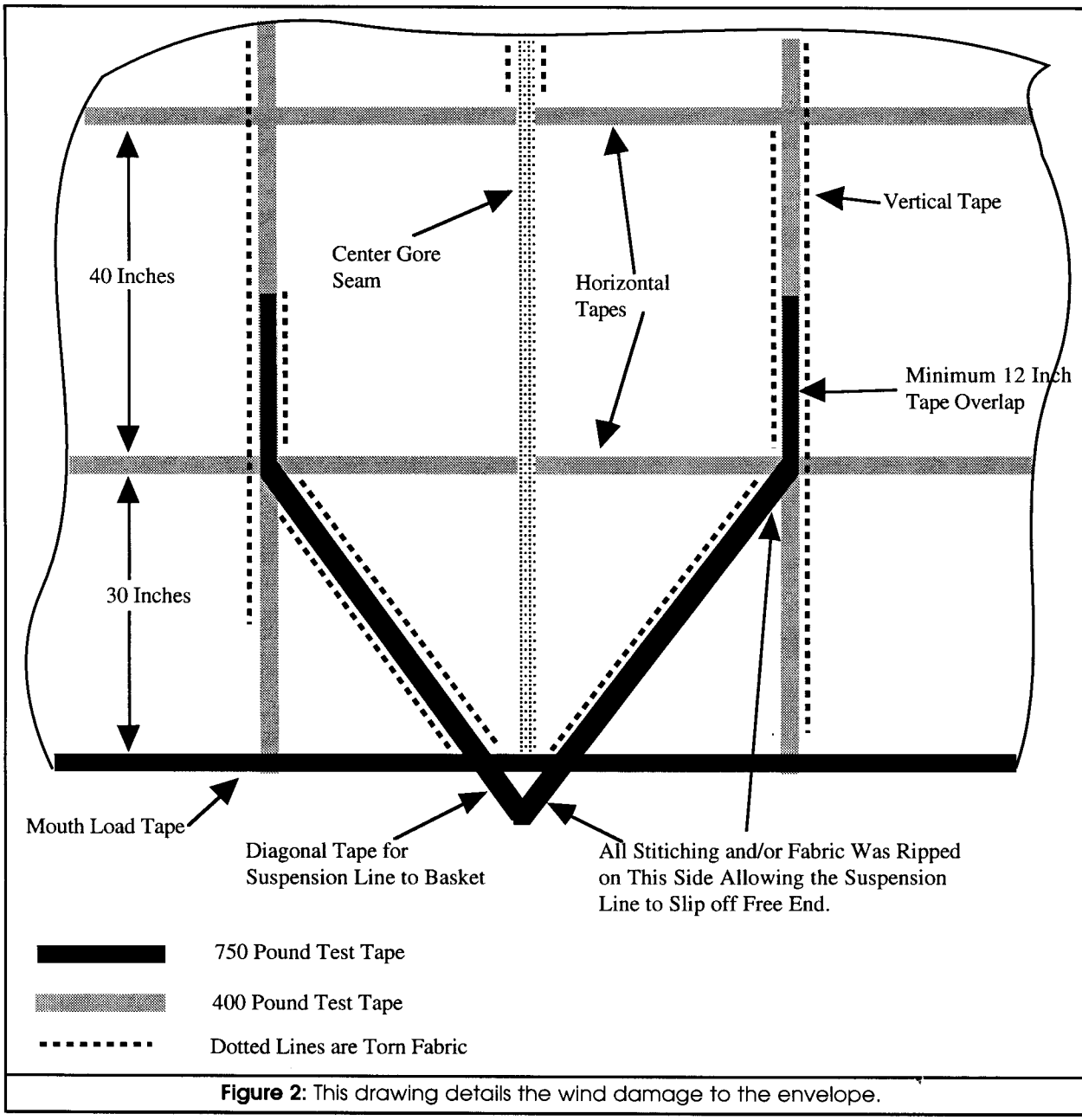


Figure 2: This drawing details the wind damage to the envelope.

parts which failed did so at a very similar loading. None of these parts would have failed during flight or landing, but the forces exerted on the balloon while anchored to the ground were far more than a balloon would normally be exposed to. The damage was very useful in pointing to areas which could use beefing up and in one case, brought attention to flaws which had existed for a long time.

The envelope was damaged starting where two of the suspension cables were attached. One area was minor, with a couple of small tears. The other area included failure of stitching used to splice load tapes and two large vertical tears, 14' and 28', adjacent to load tapes. Greater overlap will be used in the future when splicing load tapes.

The suspension line ends were cause for the most concern. Two of the swages securing the cable ends failed, (see *Figure 3*) allowing the ends to slip out. Later inspection showed that they and three others which hadn't failed had not been crimped completely! These five cables had been crimped with a tool in the store where the components were purchased. The proper crimping slot had been used, but the tool had been out of adjustment. At that time I did not know it was possible for the tool to be out of adjustment and I did not know that the crimp should be measured. I now have my own swaging tool and measuring device to insure proper crimps.

The eyebolt the tie-off line was attached to was pulled open. Although the failure of the eyebolt to stay closed was not a cause of any other damage, all eyebolts used in the future will be welded closed. More importantly, I will use a tie-off line system which will be fastened to two points (both the eyebolts on the upwind side) to decrease the amount of stress on any eyebolt, the suspension lines and fabric.

Figure 3: This photo shows the frayed ends of two cables which slipped from their swaged sleeves. The failures are attributed to improper compression of the sleeves. These cables had been in service for several years.

Once the envelope, suspension cables and burner frame had failed, the balloon started moving. But at this point the tie-off line was still connected to the main suspension webbing on that corner of the basket. When the strap pulled tight over the top rail of the basket, the chromolly tubing broke instantly. The jagged edge of the break sliced through the webbing and the balloon was free to sail away. No change is necessary to this part of the structure, as stress in this form was a fluke and should not (better not!) happen again after implementing the other changes.

Although I would have enjoyed making a flight that day in Antarctica, the knowledge gained through what happened was better than a hundred flights. It was the best nonflight I've ever had!

Closing

Like Mike Gross, I am also interested in knowing what testing other homebuilders have performed, whether in a shop or during the course of a flight.

In closing, I want to say that all of us subscribers to the BBJ owe Bob LeDoux a big THANK YOU for providing the perfect forum for the sharing of information pertaining to homebuilding. Within the tips and techniques that help us figure out the how and why of building a balloon, hopefully there will be enough information to help us build safe aircraft. Happy Landings!

Editor's Comment on Cable Fittings

Bill's cable fitting failures remind us that anyone can be caught by innocent assumptions which result in potentially serious consequences. Bill assumed that a marine supply store salesman was knowledgeable in the proper use of a cable tool. But too often we discover that such is not the case. Bill has taken a major step to insure that fitting failures will be a thing of the past by purchasing his own cable tool and test gauge and becoming knowledgeable in their use.

For those who use cables in their balloon systems, the most common cable end termination is an eye formed using a copper or aluminum sleeve which is squeezed into the cable. The most commonly used system, within the general aviation industry, was developed by the National Telephone Supply Company and is associated with the brand name Nicopress™. This system utilizes a brand name set of sleeves in different sizes for different size cables.

The Nicopress pliers resembles a compound action bolt cutter with squeezing rather than cutting dies. This is a precision made tool and it isn't cheap. A Nicopress pliers typically costs about $175. However, most aircraft repair stations, both balloon and airplane, keep these tools in stock. You may be able to borrow or rent the tool locally. Local Experimental Aircraft Association chapters (EAA) often keep the pliers in a club inventory, though it is sometimes only available in the $1/8$ inch cable diameter.

The drawing, *Figure 4,* shows the basic elements of the Nicopress system. The sleeve resembles a figure '8' with the cable inserted twice through it to create an eye. A thimble is often inserted in the eye for protection from abrasion. The tool is used to squeeze the sleeve around and into the cable surface. Depending on the cable diameter, either one or three compressions of the tool are required to complete each termination. One advantage to using $3/32$ inch diameter cable is that it is the largest size cable which requires a single compression, on the standard hand tool.

Once a cable end is completed it can be tested. The sleeve must be compressed to a specified minimum diameter in order to ensure the cable end achieves the rated strength. This standard is measured using a go-no-go gauge. If the gauge will not slip over the completed sleeve, the tool must be adjusted to squeeze the sleeve tighter. Also note that the direction of the gauge is also crucial. If the completed sleeve is turned sideways, the gauge may fit even when it is not properly completed thus allowing a 'pass test' conclusion to a weak fitting.

In addition to the Nicopress pliers there is a second style of low cost tool which is available for about $20. It makes use of the force generated by tightening bolts to compress the Nicopress sleeves. I would suggest being cautious about the use of these low cost tools. Some are poorly constructed with a great deal of play between the squeezing jaws. This can result in an asymmetric compression which does not provide the strength found when using the pliers. *Figure 5* displays one of these lower quality tools. I am reluctant to use this tool on any critical fittings.

If you don't have a test gauge for your Nicopress sleeves, you can set a micrometer to the following openings and use it as a test gauge:

$1/16$ sleeve	0.190"
$3/32$	0.265"
$1/8$	0.353"

It is important to make certain the sleeves are matched to the cables. Also make

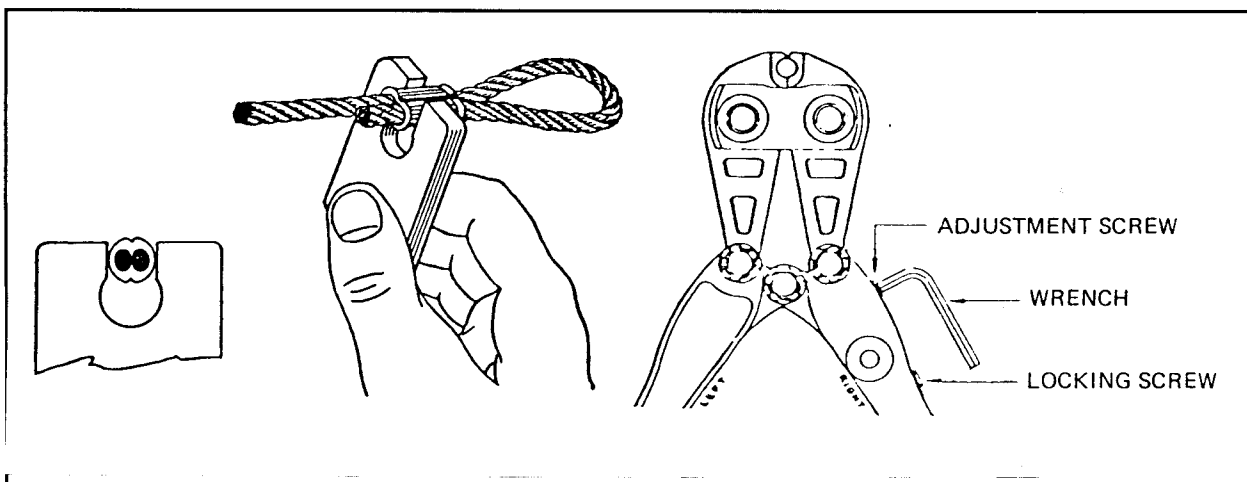


Figure 4: These instructions provided by the National Telephone Supply Company for the Nicopress™ tool show the use of the gauge and adjustment of the squeezing tool.

certain the sleeves are matched to the squeezing tool.

Metric size sleeves and cables are used in some factory balloons in the U.S. Mixing metric and English sized components is not a good idea.

When proper care is taken in the construction of Nicopress cable ends, the strength of the completed assembly is well established. However, the instructions which come with the Nicopress tool have the following recommendation:

"Proof testing is recommended whenever the possibility of personal injury or property damage exists."

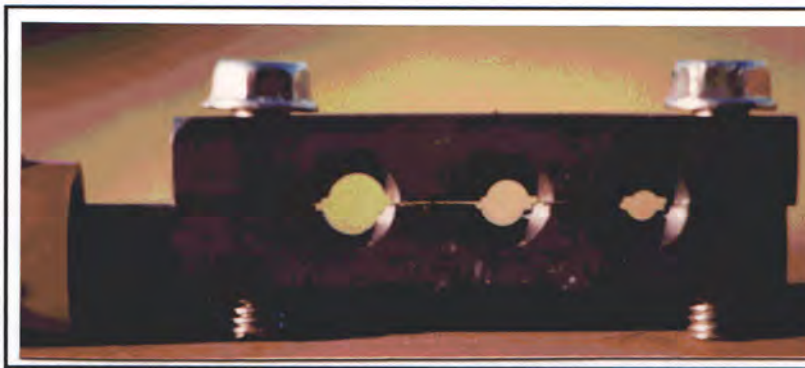


Figure 5: Low cost swaging tools can be purchased which utilize the compression of two bolts to compress cable sleeves. This particular model is designed to squeeze three popular American size sleeves. Note the poor indexing between the two tool halves. This results in an unevenly compressed cable fitting. While strength tests have not been performed on completed cable ends, the results do not generate confidence. There are better quality tools on the market, which are used by airplane mechanics to make cable repairs within confined spaces.

Phil MacNutt has been conducting some testing of Nicopress assemblies. He offered the following comment:

"I talked to an engineer at National Telephone Supply about the swaging tools. My question to him was: 'Is there is difference in quality in the finished swage as produced by the "bolt cutter" style swager, and the $20 economy model?'".

"His answer was: 'We do not manufacture the economy model, but I have seen and inspected one, and I will tell you that I would **not** trust a swage produced by this device. Our swager is MIL SPEC'd, and has been thoroughly tested to produce a finished swage that is **equal** to the rated strength of cable **when used with approved sleeves from us.**'"[Emphasis is Phil's].

"This engineer (I will keep his name quiet for now...) was very helpful, was not trying to lecture me or convince me of anything. He was simply stating facts based on engineering."

"At that moment I decided to order my own 'real' swager. In my opinion, $175 is insignificant compared to the risk involved when trying to save this money. My economy model (which has never been used for life carrying swages) is being retired!"

"I still plan on running my experiment on the fatigue tester using my prepared specimens (using the economy model) as well as samples prepared with my new 'real' swager."

Phil MacNutt

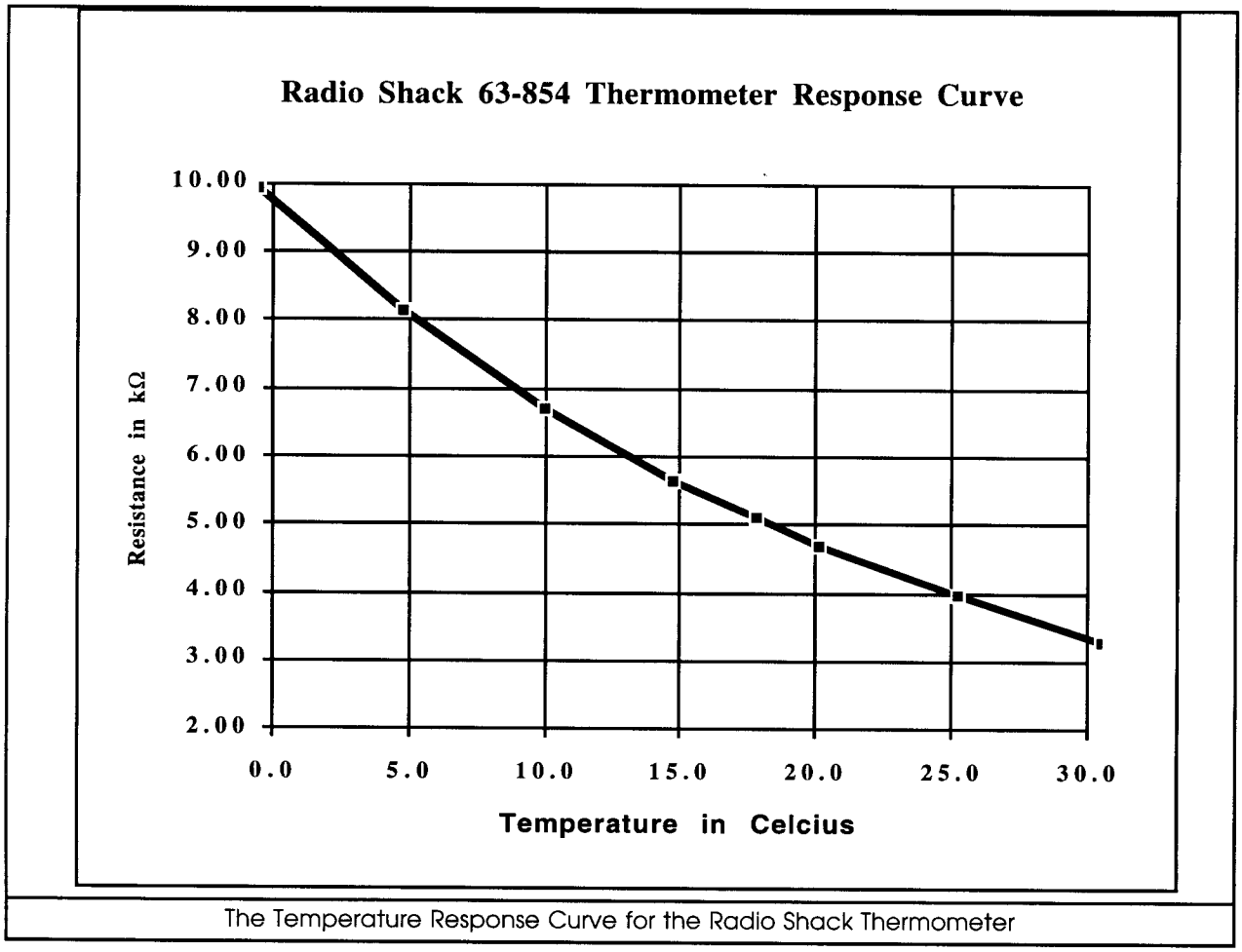
An Early Attempt at a Low-Cost Envelope Temperature Gauge

By Bob LeDoux, Editor

In our next issue, our feature article will discuss a fairly low-cost ($90) homebuilt envelope temperature gauge.

But I want to lead off with one of my earlier attempts to create a *very* low cost temperature gauge. My original idea was to take a low-cost electronic house thermometer and convert it to balloon use. While the idea has merit, there are some technical issues to resolve. I would like to lay out the concept here so one of our readers might still pursue this project. The benefit of this project would be an even less expensive temperature gauge.

The unit I originally chose was the *Radio Shack* model 63-854 indoor/outdoor thermometer with a retail cost of under $20, often on sale for about $13. This device comes with an external thermister for reading outside temperature and includes a switch to convert from Celsius to Fahrenheit range.



The Temperature Response Curve for the Radio Shack Thermometer

The outdoor range is capable of reading from -40°F to 122°F (-40°C to 50°C). In either scale the temperature is displayed in tenths of a degree, for example, 72.3°F. This unit samples the temperature every 15 seconds which may be a minor shortcoming.

The idea is simple in concept but may be a bit more complex to accomplish: Replace the thermister with a sensor unit which will convert the readout to a range for balloon use. Two possible ranges might be used:

- Readout 0.0°C to 30.0°C, or 0.0°F to 30.0°F as 0°F to 300°F (ignore the decimal point.)
- Readout 0.0°F to 122°F as a Celsius scale which provides an upper scale limit of about 250°F.

I have included the meter response curve from the thermometer. I generated this curve by removing the sensor from the reporting unit and replacing it with differing values of resistance, while noting the displayed temperature for each resistance. The graph displays the range from 0° to 30° C. The points on the chart represent my replacement resistor values, as measured on a digital VOM.

From my study of thermisters I find that most of these units are non-linear in their temperature response. Thus I would expect some reporting error when the scale is expanded out to 300°F. There are techniques for reducing this error. A thermister response curve can be 'linearized' by placing it in parallel with a resistor. The scale can be shifted by placing a resistor in series, a useful technique to shift the meter readout to display the temperature of the sensor. But when all is said and done there could still be a fair amount of error in the meter readout. In that case, it might be worthwhile to calibrate the meter at a critical temperature, like 250°F, or at the boiling point of water, and allow the error to increase at less critical points.

I lay this idea out for a reader who would like to take this on as a project.

Letters to the Editor and Other Bits of Information

Rego Bonnet O-Ring Problem-Followup

In the last issue of *Balloon Builders Journal* I, (your editor), reported on a problem with the bonnet on a Rego 7553T blast valve. Upon reassembling the valve, after annual replacement of the blast valve 'O' ring, the outer surface of the 'O' ring was sheared off creating a fuel leak. I must report that the problem has again occurred. After 16 hours of operation the blast valve developed a leak. Disassembly showed that a small ring had again been cut off the blast valve 'O' ring, apparently on assembly.

It would appear that my efforts to relieve the bore of the bonnet, as discussed in the last issue, were not successful. Discussions with a number of repair stations have offered little explanation for the problem.

I have chosen the wise course of action. The old bonnet has been removed from service and replaced with a new unit.

A Note to Computer Program Users

A couple of readers who have purchased the computer diskette from *BBJ* have asked for help with a problem: They would enter new numbers into the spreadsheet and nothing would happen.

My apologies to those who have had this problem. In my professional work I construct very large spreadsheets. Because of the time it takes for there these products to recalculate after numbers are changed, I set all my spreadsheets to 'manual recalculate.' This means the spreadsheet won't change until you hit the function key, generally F5 or F9 to perform the recalculation.

So, if your spreadsheet isn't working try hitting the 'manual recalc' key for your software. If this is an inconvenience, you can reset the spreadsheet to 'automatic recalculate,' check your spreadsheet manual for further instructions.

If you have other difficulties, contact the *BBJ* editor for assistance. -Editor

International Refueling Kit

Bob

The journal is excellent–please keep it up. One suggestion for a future feature or exchange of experiences would be the construction or obtaining of an international refueling kit. What connectors are needed in various countries, what bottled gas sources are available and what connector types are required?

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England
e-mail Peter.Kenington@bristol.ac.uk

Bally Ribbon Mills

8/2/96
Bob,

FYI, Bally Ribbon Mills has a new [telephone] area code, 610. I called them today and ordered my load tape. I ordered the 5038 $^3/_4$" and the 1" (for throat and vent).

New prices:

$^3/_4$" Type III	$.13 per yard
1" Type IV	$.325 per yard

Other interesting information:

The $^3/_4$" has a max weight specification of .2 oz. per linear yard. The 1" is max .5 oz. per linear yard. This information could help builders estimate the increase in weight to envelopes when calculating overall weight.

The load tape will add about 10 lbs. to my new 82K envelope . Breakdown is 8 lbs. for the $^3/_4$" and 2 lbs. for the 1".

Black is always available, but custom colors could make you wait quite a while, and even could incur a dye charge. I chose black...

Phil MacNutt
wmacnutt@carbomedics.com

I like Bally. Donna Swavely is my contact. Their phone is 610-845-2211. When I last ordered from them they had a $65 dye charge for a minimum order of 1,000 yards, or no dye charge on 2,000 yards. They have a wide variety of available colors including fluorescent shades. These bright shades are not guaranteed as to colorfastness when exposed to sunlight.

They did not assess a dye charge for existing stock. Thus I have been able to purchase color tapes by identifying a type, width, yardage and then asking them to list their current stock. By being flexible one can

add a dramatic touch which really sets an envelope off as a 'custom design' with little or no extra cost. -Editor

Mike Emich's New Envelope

Dear Bob

Hope things are well for you and Mari. Enclosed is a photo of my new 66,000 cubic foot envelope. The pattern is similar to the little 31,000 I made a few years ago. The photo shows a test inflation over an Aerostar Aurora basket. The top half plus 5 feet below the equator is 1.3 ounce silicone fabric and the bottom is F-111. The envelope weight is 80 pounds in the Cordura bag. I have a 30 by 40 inch basket half way complete, this will be a fold-up Boland style. I will try to send some detailed photos later.

Mike Emich
1595 Juniata Road
Akron, OH 44305

4-Point Envelope to 3-Point Basket

7/8/96

Hi Bob,

Have you had any experience (or know of anybody) with connecting a 4-point envelope (i.e. 20 gore) to a Barnes 3-point basket? I have a design in mind, but I'll bet this problem has already been solved by somebody.

Mike Emich's New Envelope

I am going to build an AX-7 this winter and I want to be able to fly it over my square basket as well as a Barnes 4.0 that I may buy.

Any ideas?

Phillip MacNutt
PMacnut@aol.com

I invite readers to offer suggestions on this question. My suggestion is as follows:

I would create two quick change cable arrangements, one for each basket. The cables would attach to the envelope at the envelope mouth, not the basket end, using rapid links (quick links).

Rapid links have the appearance of a single link of chain, but with a 'nut' on one side. By screwing this 'nut' an opening is created in the side. Once assembly is completed the nut can be tightened into the close position.

Cable measurements are simplest when the number of cable attach points on the envelope is evenly divisible by the number of attachment points on the basket. Thus a 4 corner basket is easiest to hook up to an envelope with 12, 16, 20, or 24 attachment points, while a 3 corner basket is easiest to hook up to a an envelope with 12, 15, 18, 21, or 24 attachment points. This simplicity is the result of each basket corner being a replica of the cable set from any other basket corner.

Measurements get more complex when a different number of cables go to different corners, such as occurs when attaching an 18 cable attachment point envelope to a 4 corner basket. This is because two of the basket corners have 4 cables and two of the basket corners have 5 cables. In this case more measurements are required to calculate the cable lengths.

Other than the measurement problem there appears to be no problems with the cable arrangement. Aerostar, for example, makes 13 and 14 gore Rally model balloons to achieve larger volume envelopes. These attach to 4 corner baskets.

The change between cable assemblies does take a few minutes, but it is a simple process. Using the rapid links also allows for simplified fabric repairs. Several factory balloons use these links on their products. -Editor

Some Ideas for Articles

Balloon Builders Journal is looking for articles of interest to our readers. While we can't pay for submissions, we do offer subscriptions for your contributions. You don't have to be a writer. We can tape record your ideas from a telephone call and create an article in that manner, subject to your final review and approval.

If you have additional ideas for articles, share those ideas with your editor.

Here are a few ideas for articles that would interest *BBJ* readers:

Personal Builder Stories and Project Reports: Many of our readers have not built a balloon. They enjoy reading about other builder's experiences, be they 'first timers' or experienced craftsmen. Reading about your project may be what it takes to get their project moving.

BBJ always makes space available for reports and photos on builder's projects. Feel free to submit details on your project for publication.

Unusual Systems: In the past we have reported on blimps, takedown baskets, double hulled envelopes, a takedown fuel tank, a homebuilt burner, just to name a few of the more interesting reader projects. If you are engaged in the unique or unusual, we would like to hear about it.

Unique Envelope Patterns: Builders are constantly on the lookout for new patterns for regular, natural shaped balloons. If you have a unique design, perhaps involving new geometric patterns or any other unusual composition, share the design with readers.

If you have experimented with new coloring techniques, like tie-dyeing or air brushing, be assured that other readers would be interested in your experiences.

Inflation Fan Construction and Prop Selection: Inflation fans have become an expensive item. If you have designed a fan that could be constructed by our readers, send us details.

Has anyone constructed an electric fan, perhaps running a 2 or 3 horsepower motor on 220 volts? One reader has constructed a bank of automobile radiator fans for a battery powered inflation tool. We'd like to hear more about this and how well it works.

Minor Envelope Construction Items: Envelope projects involve numerous simple constructions such as 'box-x', '3-point-w', '4-point-w', stickmen for attaching lines to the envelope surface, just to name a few. We would like to have an article on these construction details.

If you have developed new techniques to solve construction problems, that would also make for good reading matter.

How have you sized your deflation port or envelope mouth diameters? What basis do you use for sizing a parachute top and the placement of the attachment points in the envelope? These are just a few of the interesting topics we would like to publish.

Model Balloons: There is a growing interest in model and radio control (RC) balloons. These projects require specialized burner designs and unique servo controlled blast valves. If you have a design to share with readers, send us details.

If you have been successful in designing a simple hot air balloon that can be constructed by a grade school class, share the design with us.

Balloon Accessories: Design and Construction: Those little incidentals can be expensive to buy but constitute fun projects. We are looking for articles on simple tank covers, lightweight drop line assemblies, fire extinguisher bags, interior basket padding, details on constructing basket covers.

Do you have a design for a really good envelope bag?

Simple Special Shapes: Special shape balloons typically involve complex layout and cutout routines, often requiring scaled down models or CAD-CAM techniques. If you have constructed a special shaped envelope we'd like to hear more details.

Grading Fabric: Even first grade fabric is subject to missed, grading flaws. But most amateur builders purchase low cost 'seconds' which 'didn't make the grade' for some reason. Builders should have a basis to determine whether this fabric is acceptable or not. We at *BBJ* would very much like to publish an article on this topic.

We hope you get the idea. Our readers have a wide variety of talents and skills. We all benefit when others have the opportunity to share **your** unique set of experiences and knowledge.