PIA Technical Standard TS-104
Parachute Industry Association Publications
July 1, 1987

Canopy Study

Background

In January 1985 at the annual winter meeting of the Parachute Industry Association, the Technical Committee proposed a comprehensive study of currently manufactured parachutes. This study would involve the volume, weight, and for squares, the area of the canopy according to PIA standards. The purpose of the study was to update the volume chart originally developed by the Jump Shack several years previously.

National Parachute Industries had developed a volume chamber that they had been using with a high degree of success in obtaining consistent relative volume measurements. They volunteered the use of this chamber in order to conduct this study.

The original proposal for the study was made by Sandy Reid, then of Westgaard Parachute. It was felt that Westgaard, not being a canopy manufacturer, would be able to conduct the study in their certified Parachute Loft under controlled conditions with a high degree of impartiality. This was accepted by the membership with the study to start as soon as the facilities were in place and samples provided by the manufacturers. It was originally thought that the initial study would be completed in a three month period.

Disclaimer

See latest test results in Attachment I

Test Procedures

Volume

1. Canopies are stripped of all extraneous items such as risers, steering toggles, deployment bags, etc. Deployment devices that are permanently attached to the canopy such as diapers are included as are connector links and sliders on ram- air canopies.

2. Fluff the canopy.

3. Place the canopy into the chamber with the lines on top. Square canopies are placed into the cylinder tail first and round canopies are placed in apex first so that the air has a chance to escape. As you place the canopy into the chamber, distribute the material as evenly as possible.

4. Insert the piston into the cylinder.

5. Apply the weights to the top of the cylinder and compact the canopy to squeeze as much air out as possible. With this cylinder, which has a surface area of 70 square inches, we apply 210 lbs to compact the canopy for 30 seconds. This gives you a compression factor of 3 PSI.

6. Remove 140 lbs from the cylinder and let the remaining 70 lbs stabilize for 30 seconds. This gives you 1 PSI. Measure the height of the displaced volume from the bottom plate to the bottom surface of the piston. Measure to the nearest 1/16".

7. Repeat steps 2 - 6. Run 5 tests on each canopy. Throw out the high and low measurements and average the other three for your final volume. Round off to the nearest whole number.

Canopy Area-Chord

1. Lay the canopy flat on the floor. Smooth out one of the end cell end panels in order to measure the chord.

2. Anchor the trailing edge firmly in place. Grasp the bottom seam at the leading edge of the canopy and apply slight tension to the seam. Smooth out the airfoil section paying particular attention to the forward point of the airfoil.

3. Using a tape measure, measure from the furthest point aft at the trailing edge to the furthest point forward at the point of the airfoil section (the mean chord).

4. Measure to the nearest 1/2".

Canopy Area-Span

1. Lay the canopy flat on the floor.

2. Using an appropriately sized straight edge, measure the upper surface of each cell individually. Measure from seam to seam at a point 6" back from the leading edge.

Canopy Weight

1. A UPS shipping scale accurate to 2 ounces is used to determine canopy weight.

Current Study Results

As of July 1, 1987, 17 canopy manufacturers had cooperated in the study. To date 148 representative samples of 126 different models have been tested. Included are 22 samples of canopies manufactured within the last 12 months that are suspected to be suffering from "MBC" - Mystery Bulk Condition.

Mystery Bulk Condition

In the latter part of 1986, certain canopies were delivered that exhibited signs of increased pack volume. This "MBC" was first noticed by Riggers in the field when packing reserve canopies into certain sizes of containers. The fabric in these canopies had a distinctly different appearance from before. The finish appeared heavier, shinier, and even had a sound to it. It tended to crackle when crumpled.

An investigation was launched to determine what was causing this condition. At the January PIA meeting discussion was held concerning the problem. According to Para Flite, the basic specifications for the fabric were still the same. The weight, porosity, strength and thread count remained constant. That left only the finish.

Further investigation showed that in July of 86, Putnam Hertzel, the company that did most of the finishing of the fabric had gone out of business. The finishing process was shifted to two other companies, Duro and Kenyon. In speaking to these companies, it was revealed that the finish was different because the machinery used to finish the fabric used different processes. The Putnam machinery was an old European design and that at Duro and Kenyon were newer US designs. After having determined that there definitely was a difference in the old and new fabrics, it remained only to find out what the difference was.

In testing the 22 samples that were manufactured in recent months, the increases ranged from 7.11% to 19.53% with the overall average being 13.92%.

Conclusion

This MBC has been brought to the attention of the fabric brokers and finishers who are in turn working on a solution to the problem. At present there are no quick fix solutions. The type of equipment itself may preclude ever returning to the identical fabric as before. However the finishers feel that they may be able to minimize the condition.

While some of the manufacturers and their customers may not be too happy over these events, there is presently nothing they can do about it. This condition currently affects all of the sport canopy manufacturers so they are all in the same boat. The area that there is a problem with is determining compatibility of canopy to harness and container.

Several of the container manufacturers have had problems with sizing lately and customers who were unhappy with what they have received. There is no easy answer for this situation. The container manufacturers are going to have to closely monitor the situation and build their systems with enough margin in them to cope with this increase. In regards to the main containers, the "window" of volume for a given container size is usually large enough to handle the increase unless the old canopy volume was at the very top of the window. In that case the canopy should then fit in the next size up. With reserve containers, however, the increase in volume may mandate the next size up container because the reserve containers generally have a smaller window for sizing. This may in turn result in incompatibility of volumes between the main and reserve containers.

There are two other items to be addressed. The first is that there is a feeling from at least one manufacturer that this condition goes away or is reduced after a number of jumps. With this premise in mind we measured a Para Flite Nimbus when new. That volume was 626 cu in. We measured the same canopy after it had 40 jumps and the volume was 605 cu in., so there may be some validity to this premise.

The second item is more complex. It would appear that with the properties of the new fabric and the random "stuffing" of the canopies into the volume chamber, that we experience the increases presently documented. However, when the canopies are laid out and the material smoothed out and folded for normal packing, that some of the increase is negated. This would help explain why some of the canopies, even though they should pack up bigger, continue to fit in the same size containers as before. More study needs to be done in both of these areas before we come up with further answers.

Note: See Attachment I - Test results 104.13, accepted 02/09/95.