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### **Snowmaking Density Testing**

Snowmaking density testing is important for volumetric snow measurements. Snow density will vary according to the type and manufacturer of the snowmaking equipment. There will be additional variance to density depending on the snow quality. Snow quality cannot be used as a common factor in determining snow density or vice versa due to the different size spectrum of snow crystals produced by the various snowmaking equipment types.

A simple and reliable procedure for measuring snow density requires the following hardware:

- 1) 1 ½" diameter brass/chrome tailpiece 6" length (common plumbing fixture).
- 2) Gram scale weight measuring device accurate to 0.1 grams (this can be a laboratory electronic scale or triple beam balance).
- 3) Small Ice scraper

Calculate the volume of the tailpiece in cubic centimeters using precision calipers. The volume calculation is as follows:

$$\text{Volume (cc)} = (\text{Inner Diameter Tailpiece mm})^2 \times (\text{Tailpiece Length mm}) \times 3.142 / 4,000.$$

**Example: Volume (cc) = (36.83 mm)<sup>2</sup> x (151.1) x 3.142 / 4,000 = 161.0 cubic centimeters.**

The slight flair on one end of the tailpiece will introduce a very small error that can be considered as negligible to the overall measurement.

- 1) The volume measurement is then directly converted to grams by multiplying by 0.9991. 161.0 cc x 0.9991 gm/cc = 160.8 grams. This is the weight of water that would fill the tube.
- 2) Weigh the tailpiece in grams and note weight for later reference.

### **Density Measurement**

- 1) Obtain snow sample and weigh it on the scale.
- 2) Subtract weight of tailpiece to obtain snow sample weight.
- 3) Take snow sample weight and divide by the above calculated water weight. This will yield the density ratio.
- 4) Take the density ratio and multiply by 62.37 lbs/ft<sup>3</sup> (60 degrees F reference) to obtain snow density – the snow density ratio will vary from approximately 0.38 to 0.48 for good quality manmade snow.

### **Snow Sampling Procedure**

- 1) Allow new snow to accumulate to a depth at least 4" and using the ice scraper, gently dig out a trough that has a vertical sidewall. For repeatability use a consistent good quality snow – over the years the most repeatable results have been obtained with snow that will form a crumbly snowball.
- 2) Take the sampling tube and slowly insert into trough sidewall in a horizontal direction about an inch below snow surface. Gently push sample tube with scraper until snow core starts to come out of tube end. Gently scrape away excess until flush with tube end.

- 3) Dig a trough on the other buried end of the sampling tube and scrape away snow to buried end. Gently scrape away excess until flush with tube end. **Do not pack** snow into sampling tube, if the first attempt does not work repeat the entire procedure.
- 4) Clean off any excess snow from sample tube, ensure that both ends of the tube have a smooth snow sample surface and then weigh sample.
- 5) Snow density should be taken in at least two locations within the snow deposition zone.

**Tips for Consistent Measurements**

- 1) Spray inside and outside surfaces of sampling tube with a silicone or teflon lubricant – allow to dry.
- 2) Do not allow sampling tube to get above freezing while getting density sample – snow will melt and then refreeze to tube. Sampling tube should be kept cold!
- 3) After weighing snow sample immediately discard – wipe away any moisture on sampling tube surfaces.
- 4) Try the snow sampling procedure several times to gain familiarity with the technique.
- 5) Do not use this sampling procedure if it is snowing. Natural snow will change the density readings!
- 6) Take snow density samples only in fresh manmade snow. Previously compacted snow will give an erroneous measurement.

