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A Review of Skiing Related Consensus Standards

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Consensus standards are documents describing test methods, test procedures, design requirements, classifications and definitions. The purpose of consensus standards is to unify the technology of an industry with the intent of improving the

product or service of that industry. Consensus standards are developed by agreement of several factions of an industry such as producers, sellers, consumers and other interested parties. The participation of all factions of an industry in the standard development process adds to the validity of the standard since everyone has had the opportunity to contribute.

In the ski industry, standards are being developed at a rapid pace. The American Society for Testing and Materials (ASTM) is actively pursuing several standards related to skiing equipment. Outside the United States of America, organizations such as International Standards Organization (ISO) and DIN are also developing standards relating to skiing technology.

This article reviews ASTM standards developed for the ski industry. An up-to-date knowledge of industry standards can help the ski instructor better inform students on the progress of skiing technology.

ASTM STANDARDS

Several ASTM standards regarding skiing equipment have been published to date. The following is a brief review of each standard and what it means.

ASTM Standard F472

Standard Definitions of Terms Related to Skiing

One of the first jobs tackled by the ASTM F27 committee was to come up with standard definitions of skiing terms so that everyone will be "singing from the same sheet of music." Appendix A is a list of these definitions which were taken out of ANSI/ASTM standard F472-76. ANSI/ASTM means that this is an ASTM standard that meets the requirements of ANSI (The American National Standards Institute), a coordination body for all the standard development organizations in the United States.

In Appendix A we see several ski characteristics definitions that may or may not be familiar. These terms should be part of a ski instructor's vocabulary. In past discussions with ski instructors some confusion has resulted in identical

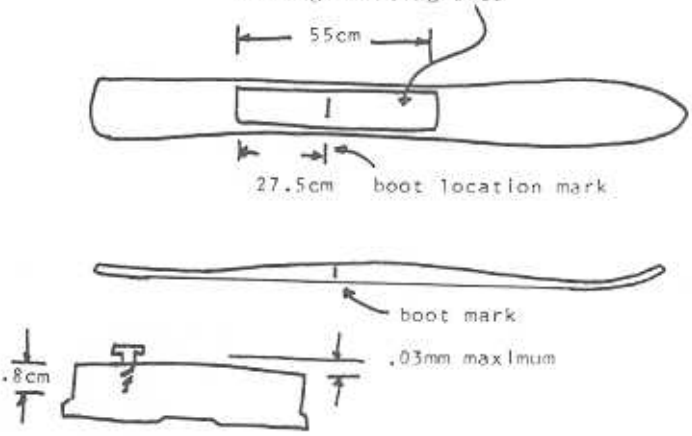

Figure 1 Binding mounting specifications

interpretations of two different terms such as side cut and side camber. A working knowledge of this standard helps avoid confusion between instructors discussing highly technical aspects of skiing as well as helping deliver accurate information to students.

ASTM F473

Binding Mounting Area on Alpine Skis

ASTM Standard F473 deals with defining areas on the skis for mounting bindings. This allows ski manufacturers to place appropriate structural reinforcement in this area of the ski. The standard is also responsible for dimensional characteristics of the mounting surface along with the requirement of a boot positioning line as shown in Figure 1.

ASTM F474

Standard Screw-Retention Strength of Binding Mounting Area On Alpine Skis

This specification classifies skis according to their ability to retain screws mounted in the binding area. Screw retention has often been a concern of the more advanced skier who gives equipment a work-out. The skis are tested with the apparatus shown in Figure 2 to determine how much force is required to pull out a standard screw. The ski is then classified according to screw retention strength as follows:

CLASS A — Skis with a high screw-retention strength, minimum allowable load per pair of screws 3100N.

CLASS B — Skis with intermediate screw-retention strength, minimum allowable load per pair of screws 2600N.

CLASS C — Skis with acceptable screw-retention strength, minimum allowable load per pair of screws 2200N.

This test procedure yields information to the ski manufacturer on the tendencies of the screws to pull out, delamination and stripping of threaded areas in the ski.

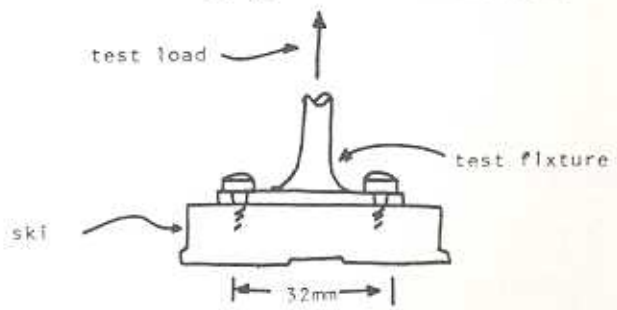

Figure 2 Screw-retention strength test fixture

ASTM F475

Test Screw Used in Screw-Retention Test of Binding Mounting Area on Alpine Skis

In order to perform the screw pull out test (ASTM F474), a standard screw should be used and is described in this standard. Screw pull-out force is obviously a function of screw size so in order to reduce test variability due to test apparatus, this standard specifies the standard test screw shown in Figure 3.

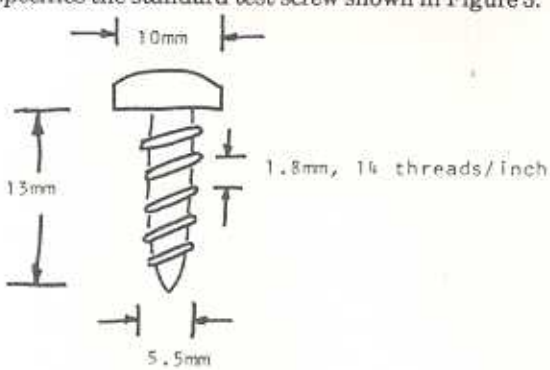

Figure 3 Standard test screw

ASTM F498

Center Spring Constant and Spring Constant Balance Of Alpine Skis

This standard is a procedure for quantifying the stiffness in *Skiing Magazine* over the years. The following four parameters are determined from the test:

CENTER SPRING CONSTANT — The force required to deflect the middle of the ski a unit distance (Figure 4a)

FOREBODY SPRING CONSTANT — the force required to deflect the tip of the ski a unit distance (Figure 4b)

AFTER BODY SPRING CONSTANT — the force required to deflect the tail of the ski a unit distance (Figure 4c)

SPRING CONSTANT BALANCE — the ratio of the afterbody spring constant to the forebody spring constant.

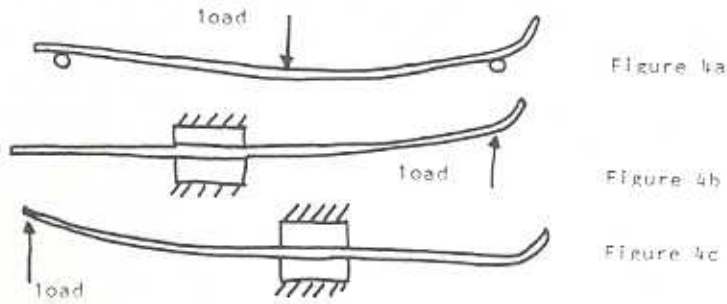

Figure 4 Spring constant deflection modes

The data obtained from this test is useful in predicting how the ski behaves while skiing various types of terrain and performing various maneuvers.

ASTM F504

Release Moments of Adult Alpine Ski Bindings

This standard involves a method used by laboratories to determine the release moments (torques) of adult ski bindings for research and development purposes. This method is NOT applicable to ski shops and rental operations. A shop practices ASTM document is being prepared presently by ASTM but is not available at this time. ASTM F504 is a complex standard and requires a test frame and load measuring devices as shown in Figure 5. This test helps manufacturers investigate new binding concepts and generate data useful to the ski binding technology.

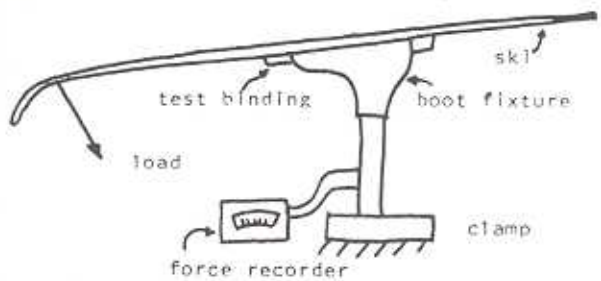

Figure 5 Laboratory release test apparatus

ASTM F779

Test for Torsional Characteristics of Alpine Skis

This test method is similar to F498 in that the torsional spring constants are measured as shown in Figure 6. Two major parameters are measured when using this test method. They are:

FOREBODY TORSIONAL SPRING CONSTANT — the amount of torque required to twist the forebody of the ski one degree of rotation.

AFTERBODY TORSIONAL SPRING CONSTANT — the amount of torque required to twist one degree of rotation of the afterbody of the ski. The data from this test compliments that from ASTM test F498 and further defines the structural characteristics of skis.

ASTM F780

Test for Linear Deformation and Breaking Strength Of Alpine Skis

This standard helps ski manufacturers determine the

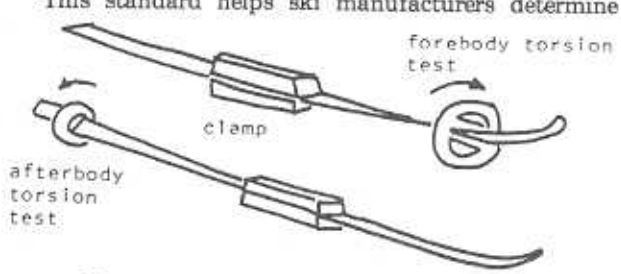

Figure 6 Torsional testing apparatus

resistance of a ski to permanent deformation and breaking. The ski is mounted in a fixture shown in Figure 7 and a load is applied. A graph is generated showing the load versus deflection which is characteristic of the particular ski design.

Other ASTM Standards Being Developed

Several other standards are being developed by ASTM and should be released in the near future. Some of these future standards deal with the following topics:

a. Moments of inertia of alpine skis
b. Fatigue characteristics of alpine skis
c. Retention devices and ski brakes
d. Vibration and shock characteristics of skis
e. Boot sole dimensional standards
f. Ski shop practices

Consensus standard development is a lengthly process because of the many interested parties in an industry. Because of the detailed review of each standard, they are usually well thought out and provide a unity to the development of an industry technology.

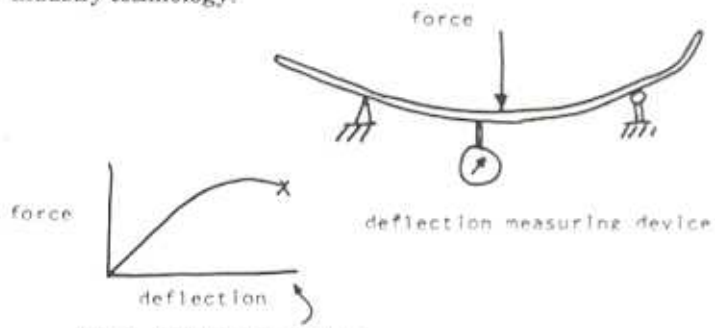

Figure 7 Breaking strength test procedure

FOREIGN STANDARDS

There are several foreign standards organizations active in the area of skiing technology. The German standards organization DIN (the same organization that indicates the film speed on photographic film) has developed the DIN 7880 boot standard that we often see imprinted on boot soles (Figure 8). Also in Figure 8 we see ON 4035 on the boot sole which is the Austrian boot sole standard. This standard deals with the dimensional characteristics of boots in the attempt to make sure

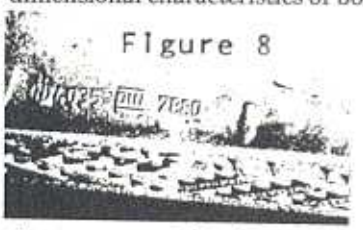
Figure 8

Figure 9

that every set of bindings will be compatible with every pair of boots manufactured under the standard. The familiar binding adjustment scale (Figure 9) is the DIN standard 7882 and indicates the release torque setting of the binding in DaNM (deca-newton meters). The International Standards Organization (ISO) coordinates standards development between countries and holds meetings throughout the year during which delegates from each country discuss developments in equipment related standards.

Several skiing related standards have been discussed. In the near future the number of these equipment related standards may double. The ASTM standards reviewed help unify the way an industry performs its service and develops its product. The ski instructor is one of the primary teachers of the public regarding skiing equipment and how to utilize it to ski more effectively. The skiing public is more knowledgeable than ever concerning skiing equipment. A working knowledge of industry standards helps the ski instructor deliver the quality ski instruction required by the public.

APPENDIX A
ANSI/ASTM F472-76
STANDARD GEOMETRIC TERMS AND DEFINITIONS FOR ALPINE SKIS

SKI SIZE,xpl — the projected length, with the ski body pressed against a flat surface, measured between the ski tail and the ski tip, commonly referred to as chord length. The developed or material length is the length from tip to tail along the bottom contour of the ski (See Figure A).

SKI TAIL,T — the extreme rear edge of the ski.

SKI TIP,S —the extreme forward point or edge of the ski.

TAIL TURN-UP LENGTH,lt — the projected length of the tail turn-up, measured from the ski tail to the contact point where a 0.5mm feeler gage intersects the running surface with the ski body pressed against a flat surface.

SHOVEL LENGTH,ls — the projected length of the forward turn-up, measured from the tip to the contact point where a 0.5mm feeler gage intersects the running surface with the ski body pressed against a flat surface.

CONTACT LENGTH,lc — the difference between the projected length xpl and the sum of lt plus ls, or lc = xpl—(lt+ls).

TAIL HEIGHT,ht — the height of the underside of the tail from a flat surface with the center of the ski body pressed against the surface.

TIP HEIGHT,hs — the height of the underside of the tip from a flat surface with the center of the ski body pressed against the surface.

WEIGHTED BOTTOM CAMBER,hb — the height of the running surface from a flat surface, measured at the highest point, with only the influence of the ski weight.

FREE BOTTOM CAMBER,hf — the height of the running surface from a flat surface, measured at the maximum point, with the ski held on edge, free from the effect of the ski weight.

HEEL (of the ski),bh — the widest part of the ski in the tail section of the ski.

WAIST (of the ski),bm — the narrowest point of the ski body between the heel and shoulder.

SHOULDER (of the ski),bv — the widest point of the ski in the shovel section of the ski.

xbh, xbm, xbv — the x coordinates for the location of these respective widths of the ski measured in centimeters from the tail of the ski.

CONTACT SURFACE AREA — the product of the average width times the contact length expressed quantitatively as follows: Ac=[(bh+2bm+bv)/4](lc).

TAIL SURFACE AREA — that surface from the tail contact point aft. The tail's contact point is located lt from the tail.

SHOVEL SURFACE AREA — that surface forward of the shovel contact point. The shovel contact point is located at ls from the tip.

RUNNING SURFACE — the entire bottom surface of the ski bordered by side geometry.

SIDE GEOMETRY — the configuration of the curve bordering the running surface and defined by the bottom edge.

SIDE CUT — that line describing the curved portion of the ski contour limited by lines at the bh and bv dimensions, and defined by the bottom edge.

SIDE CAMBER,w — the maximum distance from a line drawn between the widest points of the ski and the side of the ski.

CENTER OF THE SKI BODY — point 0, which is located at a distance of (lc/2)+lt from the tail of the ski.

FOREBODY (of the ski) — that portion forward of point 0, a distance of lc/2.

AFTERBODY (of the ski) — that portion of the ski aft of *point 0, a distance of lc/2.*

SKI BODY — that portion of the ski within the dimensions of lc.

TAPER,v — half of the difference between bv and bh or (bv-bh)/2. ■

Errata: Mr. Roberts' note on "A Review of Skiing Related Concensus Standards" in the September '83 issue of *JPSI* contains a reference to "figure A" which was inadvertantly omitted.

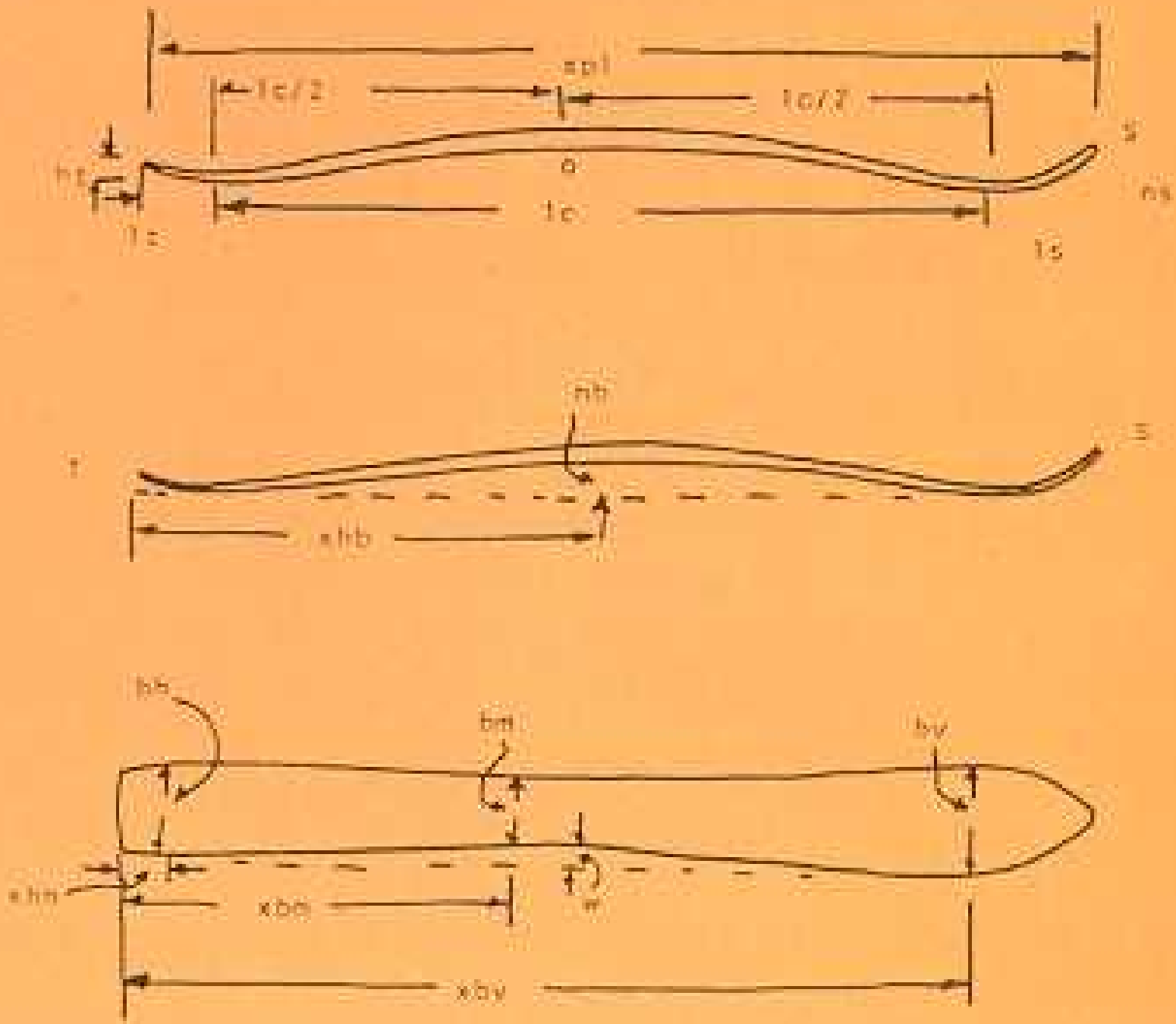

Figure A Ski dimensions