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Standard Practice for Functional Inspections and Adjustments of Alpine Ski/Binding/Boot Systems¹

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INTRODUCTION

The intent of this practice is to provide guidelines for performing functional inspections and adjustments of Alpine ski/binding/boot systems. Adhering to these guidelines may help to reduce the risk of injuries resulting from improper mechanical functioning of releasable binding systems. However, skiing involves inherent and other risks. Injury can result from simply falling down, impact with an object, or from many other actions. Many injuries are unrelated to system function. Furthermore, even a properly functioning system cannot protect the skier in all situations. Therefore, it is to be clearly understood that compliance with these guidelines in no way guarantees that injury can be prevented.

1. Scope

1.1 This practice covers the functional and release inspection of ski/binding/boot systems.

1.2 This practice should be followed for systems, whether newly mounted or used, whenever work is performed on the system that may affect its release function, unless otherwise specified by the binding manufacturer in non-rental applications.

1.3 Nonapplicability of this function and release inspection practice to rental shop operations is based upon the existence of applicable ASTM practices.

NOTE 1—Refer to Practice F 1064 for equivalent procedures and tolerances for complete and incomplete rental systems.

2. Referenced Documents

2.1 ASTM Standards:

E 456 Terminology Relating to Quality and Statistics²

F 473 Specification for Binding Mounting Area Dimensions on Alpine Skis and Bindings³

F 504 Test Method for Measuring the Quasi-Static Release Moments of Alpine Ski Bindings³

F 939 Practice for Selection of Release Torque Values for Alpine Ski Bindings³

F 944 Specification for Properties of Adult Alpine Ski Boots³

F 1061 Specification for Ski Binding Test Devices³

F 1062 Test Method for Verification of Ski Binding Test Devices³

F 1064 Practice for Sampling and Inspection of Complete Alpine Ski/Boot/Binding Systems in Rental Applications³

2.2 ISO Standards:⁴

5355 Ski Boots (Size Greater than 220 mm) for Ski Bindings for Downhill Skiing Interfaces

8061 Method for the Selection of Release Torque Values

8614 Ski Binding—Vocabulary

9462 Alpine Ski Binding Safety Requirements and Test Methods

11088 Assembly, Adjustment, and Inspection of an Alpine Ski-Binding-Boot (S-B-B) System

3. Terminology

3.1 Definitions:

3.1.1 *clean versus lubricated tolerance, n*— the accepted difference between clean and lubricated test results, defined as not more than 20 % of the clean test, used whenever a functional test for binding-boot compatibility is required (see 6.3).

3.1.2 *corrective action, n*—procedures other than readjustment of the visual indicator setting to include repair or replacement of system components.

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² *Annual Book of ASTM Standards*, Vol 14.02.

³ *Annual Book of ASTM Standards*, Vol 15.07.

⁴ Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

3.1.3 *deviation, n*—the difference between the test result and the selected reference torque value, usually expressed as a percentage of the selected reference torque value.

3.1.4 *in use tolerance, n*—the accepted difference between the reference torque value (see 3.1.11) and the test result(s) (see 3.1.14), defined as $\pm 30\%$ of the reference torque value, or ± 6 Nm for twist and 20 Nm for forward lean, whichever is greater, or two horizontal rows up or down from the selected reference torque value determined on the binding manufacturer's adjustment chart. In the absence of an applicable manufacturer's chart, use Annex A2. For non-rental applications, this tolerance is used as the upper and lower limit for determining if system release values are acceptable for in-use or in-service purposes, after said system has been released to the customer. This limit is derived from Practice F 1064, 3.1.1 *Class 1 deviation*. This deviation (± 16 to 30% , or two horizontal rows up or down from the selected reference torque value) is defined as a minor deviation that does not require corrective action for equipment that is in-use or in-service, in rental applications.

3.1.5 *initial visual indicator setting, n*—the visual indicator setting derived from the binding manufacturer's adjustment chart.

3.1.6 *inspection tolerance, n*—the accepted difference between the reference torque value and the test result. Defined as $\pm 15\%$ of the reference torque value, or ± 3 Nm for twist and ± 10 Nm for forward lean, whichever is greater, or one horizontal row up or down from the selected reference torque value determined on the binding manufacturer's adjustment chart, (see Annex A2). It is used as the criteria for prompting consultation of the binding manufacturer's troubleshooting procedures or readjustment of the binding, or a combination thereof.

3.1.6.1 *Discussion*—In the case when an algorithm or table is used to provide a value, either may be used (differences may be insignificant).

3.1.7 *inward versus outward tolerance, n*—the accepted difference between test results about an axis perpendicular to the plane of the ski, usually from the toe piece component, and defined as within the inspection tolerance (see 3.1.6).

3.1.8 *limit for readjustment, n*—the accepted difference between the reference torque value (see 3.1.11) and test result(s) (see 3.1.14), defined as $\pm 30\%$ of the reference torque value, or ± 5 Nm for twist and 20 Nm for forward lean, whichever is greater, or two horizontal rows up or down from the selected reference torque value determined on the binding manufacturer's adjustment chart (see Annex A2). Used as the upper and lower limit for readjustment of the binding.

3.1.9 *measured release value, n*—release torque value determined by the use of a testing device of the type defined in Annex A1 (see 3.1.13).

3.1.10 *readjustment value, n*—the value that must be added or subtracted from the initial visual indicator setting to bring the test result within the inspection tolerance.

3.1.11 *reference torque value, n*—the nominal release torque value derived from a document compatible with Practice F 939, such as Annex A2, or information supplied by the binding or test device manufacturer.

3.1.12 *skier code, n*—the letter code derived from the binding manufacturer's adjustment chart, based on a skier's parameters (height, weight, age, and type).

3.1.13 *system, n*—a group of interacting components, usually comprised of a ski, binding, and boot (S-B-B).

3.1.14 *test result, n*—the middle quantitative value of three repetitions of the same test.

3.1.15 *troubleshooting, n*—the binding manufacturer's recommendations or procedures of analyzing system failure.

3.1.16 *visual indicator setting, n*—the setting displayed on the binding's release adjustment scale.

4. Significance and Use

4.1 The purpose of this practice is to aid in providing the end user with an appropriately functioning system and appropriate release torque setting.

4.2 The definitions and tolerances defined in this practice do not necessarily apply to procedures incorporating an inspection interval or schedule, where such procedures are specified by the binding manufacturer. This practice is not intended to be a method for evaluating equipment design.

NOTE 2—Refer to Practice F 1064 for definitions and tolerances pertaining to the evaluation of equipment once in use.

5. Procedure

5.1 *Inspections*—Two types of inspection procedures are described in this practice: (1) procedures to check the system for appropriate function, and (2) procedures to check the system for appropriate release torque calibration (see Appendix X4). In all procedures requiring a measured release value, the system testing device should meet Specification F 1061 and be checked by the method described in Annex A1.

5.1.1 *Functional Inspections*—These inspections shall include inspection of all boot-to-binding adjustments and clearances, appropriate elastic travel (see 6.1), symmetry of torsional release (see 3.1.7), boot-binding compatibility (see 6.3 and 3.1.1), and other inspections recommended by the equipment manufacturers (see Appendix X4).

5.1.2 *Release Torque Value Inspections*—The release torque value of the system, as assembled for use, should be inspected with the use of a system testing device (see Annex A1). A description of release torque value inspections and tolerances is included in this practice (see Section 7 and Appendix X4).

5.2 *Reference Torque Value Selection*—Reference torque values for release torque may be selected using Annex A2 or tables supplied by the binding manufacturer or system testing device manufacturer, which are in accordance with Practice F 939. Reference torque values (see 3.1.11) above the upper limit specified by Practice F 939 or above the binding manufacturer's recommendations should not be used. Values below the lower limit or below the binding manufacturer's recommendations may be used unless the binding manufacturer recommends against such procedures.

6. Functional Inspections

6.1 *Test for Elastic Travel and Recentering*—The system should be exercised to check that the boot or plate can travel a distance specified by the manufacturer and return freely to within 2 mm of the original position. This test should be made

in all directions of release and in a manner specified by the binding manufacturer. If no displacement is specified, then 5 mm measured at the toe or heel (as appropriate) should be used and the test made by any device or method capable of displacing the boot or plate the necessary distance.

6.2 Test for Symmetrical Release—The system should be tested for twist release in both the inward and outward directions with a device of the type specified in **Annex A1** (see **3.1.5** and **3.1.6**).

6.3 Test of Boot/Binding Compatibility—Used as a diagnostic inspection, whenever specified by the binding manufacturer or when necessary for determining the compatibility of a boot and binding used in a system. The boot should be of a shape, composition, construction, and condition acceptable to the binding manufacturer. Functional inspections specified by the binding manufacturer to determine the compatibility of the boot and binding should be performed. If no functional inspection procedures are specified by the binding manufacturer, a functional inspection should be made to determine the difference in test results between a clean, dry boot and binding system and the same system after lubrication of all boot-binding interfaces. This functional inspection should be made in all directions of release specified by the binding manufacturer, using a device of the type specified in **Annex A1** (see **5.1**).

6.3.1 The lubricant used for this test should be applied in a thin film and may be of any type specified by the boot or binding manufacturer. If unspecified, a liquid detergent or soap or a lubricant of a type normally accepted in the maintenance of the binding, such as a grease or silicone spray lubricant, may be used. If a spray lubricant is used, take care that overspray does not contaminate other systems in the vicinity.

6.3.2 If there is reason to believe that the boot-binding interface or system has been contaminated with a lubricant prior to the clean tests, a common dishwashing soap or detergent solution may be used to help clean the system, provided all surfaces are flushed with clean water afterward.

7. Release Torque Inspections

7.1 Tests for Twist Release—A test should be made to determine the torque required to release the binding in twist about an axis perpendicular to the plane of the boot sole. This test should be made using a device of the type described in **Annex A1** and should be made in both inward and outward directions of release. Torsional release test results should meet the inspection tolerance. Units that exceed the inspection tolerance should be readjusted to within the inspection tolerance. When an initial indicator value is used (see **3.1.5** and **Appendix X4**), readjustment should not be attempted if test result(s) exceed the limit for readjustment without first taking corrective action as specified by the binding manufacturer (see **3.1.1** and **3.1.6**).

7.2 Tests of Forward Lean Release—A test should be made to determine the torque required to release the binding in forward lean. This test should be made using a device of the type described in **Annex A1**. Test result(s) should be within the

inspection tolerance. Units that exceed the inspection tolerance should be readjusted to within the inspection tolerance. When an initial indicator setting is used (see **3.1.5** and **Appendix X4**), readjustment should not be attempted if test result(s) exceed the limit for readjustment without first taking corrective action as specified by the binding manufacturer (see **3.1.1** and **3.1.6**).

7.2.1 If no independent means are provided to adjust the forward lean release, this test should be used to check that the ratio of forward lean to twist release is as specified by the manufacturer.

7.3 Other Release Tests—Tests of the type in **7.1** and **7.2** should be made in any other direction specified by the binding manufacturer.

8. Test Conditions

8.1 Visual Indicator Setting for Functional Inspections—All functional inspections should be performed at a setting provided by the binding manufacturer. If no manufacturer recommendations are provided, all functional inspections should be performed at the setting selected for the skier.

8.2 Release Adjustment for Validating Visual Indicator Setting—Tests to validate the visual indicator setting should be made in accordance with the procedures specified by the binding manufacturer.

8.3 Preconditioning Binding—The binding should be cycled at least once in all directions prior to calibration of the release/retention value or validation of the visual indicator setting. Once all functional inspections have been completed on the system, a lubricant may be used on the boot-binding interfaces, unless otherwise specified by the binding manufacturer.

NOTE 3—The use of a lubricant is not intended to improve the performance of the system in use but to reduce the boot-binding friction.

8.4 Temperature—Tests should be performed at temperatures between 10 and 25°C (55 and 80°F).

8.5 Load Rate—Tests should be performed at a load rate specified by the manufacturer of the testing device or in accordance with the binding manufacturer's recommendations. If no recommendations are provided, the load required to release the boot or plate from the binding should be applied smoothly in such a way that the time to achieve release is between 1 and 5 s.

9. Report/Workshop Ticket

9.1 In principal, a report/workshop ticket is generated by the ski shop and delivered to the user. It shall contain at least the following information:

- 9.1.1** Skier parameters,
- 9.1.2** Visual indicator settings, and
- 9.1.3** Pass/fail result of the system inspection.

10. Miscellaneous

10.1 Some other functional inspections that may be considered in diagnostic procedures are described in **Appendix X1** and **Appendix X2**.



ANNEXES

(Mandatory Information)

A1. TESTING DEVICE INSPECTION REQUIREMENTS

A1.1 Definition

A1.1.1 For the purposes of this practice, a testing device is defined as any piece of equipment capable of indicating the torque or force required to release the boot or plate.

A1.1.2 Testing equipment should be of a type that conforms to Specification **F 1061**.

A1.2 Inspection Schedule

A1.2.1 The test device is inspected prior to preseason testing and at least once during the skiing season or whenever it is apparent that the device is not performing as intended, or both.

A1.3 Inspection

A1.3.1 The test device is inspected in accordance with all procedures recommended by the manufacturer of the test device or by the manufacturer of the system to be tested (if appropriate).

A1.3.2 The calibration of the test device is checked by a procedure recommended by either the test device manufacturer or system manufacturer. A dead weight may be used as a loading method.

A1.3.3 The calibration is checked at three points over the range in which the test device is intended to be used or as specified by the test device manufacturer.

A1.3.4 The test device is corrected by means of an adjustment to the indicator, if necessary, to read within $\pm 5\%$ or ± 2.5 Nm, whichever is greater, of the desired value.

A1.3.5 If a dead weight is used, its weight should be known to be accurate within $\pm 2\%$.

A1.3.6 Calibration of the testing device may also be made with respect to a reference binding if recommended by the manufacturer.

A1.3.7 A reference boot or binding, if used, is as recommended by the manufacturer for that purpose and tested with all surfaces lubricated unless otherwise specified in the manufacturer's procedures.

A2. RELEASE TORQUE SELECTION PROCEDURES

A2.1 Skier Code Selection Instruction

A2.1.1 Using **Table A2.1**, determine the skier code that corresponds to the skier's weight and the skier code that corresponds to the skier's height (for more information consult Practice **F 939**).

A2.1.2 If these skier codes are different, select the code closest to the top of the table (lower torque values).

A2.1.3 To correct for skier type (see **Table A2.2**):

A2.1.3.1 *Type I*—No correction is necessary.

TABLE A2.2 Skier Type Selection^{A, B, C}

NOTE—The use of these definitions in determining the release setting may be inappropriate for some types of competition skiing or competition training.

Type I	Type II	Type III
Cautious skiing on smooth slopes of gentle to moderate pitch		Fast and aggressive skiing on slopes of moderate to steep pitch
Applies to entry-level skiers uncertain of their classification	Skiers not classified as in Type I or Type III	Receive higher than average release/retention settings
Receive lower than average release/retention settings		Decreased releasability in a fall in order to gain a decreased risk of inadvertent binding release
	Increased risk of inadvertent binding release	

^ASkiers who desire release/retention settings lower than Type I may designate themselves (I-).

^BSkiers who desire release/retention settings higher than Type III may designate themselves (III+).

^CSkiers may select skier type designations that are different for twist and forward lean. In such cases, the selection shall be indicated by a slash separating twist and forward lean selections, in that order (for example, *T/H*).

A2.1.3.2 *Type II*—Move down the table one skier code.

A2.1.3.3 *Type III*—Move down the table two skier codes.

A2.1.3.4 *Type I-* —Move up the table one skier code.

A2.1.3.5 *Type III+* —Move down the table three skier codes.

A2.1.4 To correct for age, move up the table one skier code for skiers 50 years of age and over.

TABLE A2.1 Release Torque Selection

Skier Weight, lb	Skier Height, ft, in.	Skier Code	Reference Torque	
			Twist	Forward Lean
			5	18
22 to 29		A	8	29
30 to 38		B	11	40
39 to 47		C	14	52
48 to 56		D	17	64
57 to 66		E	20	75
67 to 78		F	23	87
79 to 91		G	27	102
92 to 107		H	31	120
108 to 125	4, 10 or less	I	37	141
126 to 147	4, 11 to 5, 1	J	43	165
148 to 174	5, 2 to 5, 5	K	50	194
175 to 209	5, 6 to 5, 10	L	58	229
210 or greater	5, 11 to 6, 4	M	67	271
	6, 5 or greater	N	78	320
		O	91	380
			105	452