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

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INTRODUCTION

Adhering to these guidelines may help reduce the risk of injuries resulting from improper mechanical functioning of releasable alpine binding systems. Skiing involves inherent risks and injury can result from simply falling down, impact with an object, or from many other actions. Many injuries are unrelated to ski/binding/boot system function and a properly functioning system cannot protect the skier in all situations. Compliance with these guidelines in no way guarantees that injury will be prevented.

1. Scope

1.1 This practice provides procedures for inspection and adjustment of alpine ski/binding/boot systems, including ski binding systems designated as multi-norm bindings and those compatible with “improved walking soles.”

1.2 This practice should be followed for all ski/binding/boot systems, whether newly mounted or previously mounted, when 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 This standard is not applicable to ski/binding/boot rental systems, including incomplete systems, except when a customer intends to use his or her own skis/bindings with the shop’s boots (as provided in Subsection 7.3 of Practice F1064). For more information on ski/binding/boot rental shop practices, for both complete and incomplete systems, consult Practice F1064.

1.4 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

¹ This practice is under the jurisdiction of ASTM Committee F27 on Snow and Water Sports and is the direct responsibility of Subcommittee F27.50 on Shop Procedures (Retail and Rental).

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2. Referenced Documents

2.1 *ASTM Standards:*²

F504 Test Method for Measuring the Quasi-Static Release Moments of Alpine Ski Bindings

F939 Practice for Selection of Release Torque Values for Alpine Ski Bindings

F1061 Specification for Ski Binding Test Devices

F1064 Practice for Sampling and Inspection of Complete and Incomplete Alpine Ski/Binding/Boot Systems in Rental Applications

3. Terminology

3.1 *Definitions:*

3.1.1 *system*—a group of interacting components, usually comprised of a ski, binding, and boot.

3.1.2 *incomplete system*—applies when a skier provides one of the components of a ski/binding/boot system to a rental shop, such as his or her own boots.

3.1.2.1 *Discussion*—For these systems, consult Practice F1064.

3.1.3 *release/retention values (also release settings and release/retention settings)*—release torques of the ski/binding/boot system in twist (M_z) and forward lean (M_y) as defined in Test Method F504.

3.1.3.1 *measured release value*—release torque value determined by the use of a testing device of the type defined in Annex A1.

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard’s Document Summary page on the ASTM website.

3.1.3.2 *test result*—the middle quantitative measured release value of three repetitions of the same test.

3.1.4 *visual indicator setting*—the setting displayed on the binding’s release/retention adjustment scale that corresponds to the release/retention values of a ski/binding/boot system.

3.1.5 *release preference*—(previously *skier type*) classification of I, II, or III that is selected by the skier and corresponds to the balance between release and retention of the ski/binding/boot system.

3.1.5.1 *Type I*—designation that provides lower release/retention values; corresponds to an increased risk of inadvertent binding release in order to gain releasability in a fall; also applies to entry level skiers uncertain of their release preference.

3.1.5.2 *Type II*—designation that provides release/retention values appropriate for most recreational skiing; applies to skiers not classified as in I or III.

3.1.5.3 *Type III*—designation that provides higher release/retention values; corresponds to decreased releasability in a fall in order to gain a decreased risk of inadvertent binding release.

3.1.5.4 (*/*)—a symbol that separates release preference designations, used when, as a result of troubleshooting, different release preferences have been selected for determining twist (M_z), and forward lean (M_y) release/retention values; shown in the order (twist/forward lean) or (T/H) to denote toe piece (T) and heel piece (H) of this ski binding. Other conventions may be used to record different release preferences for twist and forward lean when required by the documentation.

3.1.6 *skier code*—letter code derived from the binding manufacturer’s adjustment chart, based on a skier’s parameters (height, weight, age, and release preference).

3.1.7 *discretionary settings*—visual indicator settings higher or lower than the normal setting range:

(1) (–)—a symbol, that when placed to the left of release preference I (see 3.1.5.1), provides release/retention values lower than release preference I, corresponds to a further increase in the risk of inadvertent binding release in order to gain increased releasability in a fall.

(2) (+)—a symbol, that when placed to the right of release preference III (see 3.1.5.3), provides release/retention values higher than release preference III, corresponds to a further decrease in releasability in a fall in order to gain a decreased risk of inadvertent binding release.

3.1.8 *reference torque value*—nominal release torque value derived from a document compatible with Practice F939, such as Annex A2, or information supplied by the binding or test device manufacturer.

3.1.8.1 *Discussion*—When an algorithm or table is used to provide a value, either may be used (differences may be insignificant).

3.1.9 *initial visual indicator setting*—visual indicator setting corresponding to reference torque value that is derived from the binding manufacturer’s adjustment chart.

3.1.10 *inspection range*—accepted difference between the reference torque value(s) and the test result(s), 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 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 of both.

3.1.10.1 *Discussion*—When an algorithm or table is used to provide a value, either may be used (differences may be insignificant).

3.1.11 *in-use range*—accepted difference between the reference torque value(s) and the test result(s), 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.

3.1.11.1 *Discussion*—In the absence of an applicable manufacturer’s chart, use Annex A2. This range is used as the upper and lower limit for determining if system release/retention values are acceptable for in-use or in-service purposes, after the ski/binding/boot system has been released to the customer; values in this range are considered acceptable. This limit is derived from the in-use range found in Practice F1064, 3.1.8 that is (± 16 to 30 %, or two horizontal rows up or down from the selected reference torque value). It is used as the upper and lower limit for readjustment of the binding.

3.1.11.2 *Discussion*—When an algorithm or table is used to provide a value, either may be used (differences may be insignificant).

3.1.12 *clean versus lubricated tolerance*—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).

3.1.13 *clockwise versus counterclockwise tolerance*—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.

3.1.14 *corrective action*—procedures other than readjustment of the visual indicator setting (see 3.1.4) to include repair or replacement of system components.

3.1.15 *limit for readjustment*—accepted difference between the reference torque value (see 3.1.8) and test result(s) (see 3.1.3.2), 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).

3.1.15.1 *Discussion*—For a reference torque value of 8 Nm in twist and 29 Nm in forward lean (Skier Code A in Annex A2), the limit for readjustment is one row up or two rows down on the adjustment chart. The limit for readjustment is used as the upper and lower limit for troubleshooting (see 3.1.17) – bindings beyond this cannot be adjusted for use by the customer.

3.1.16 *readjustment value*—value that shall be added or subtracted from the initial visual indicator setting to bring the test result within the inspection tolerance.

3.1.17 *troubleshooting*—binding manufacturer’s recommendations or procedures of analyzing system failure.

4. Significance and Use

4.1 The purpose of this practice is to aid in providing the end user with an appropriately functioning ski/binding/boot system with appropriate release/retention values.

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

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/retention values (see [Appendix X4](#)). In all procedures requiring a measured release value, the system testing device should meet Specification [F1061](#) 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, boot-binding compatibility (see [6.3](#)), 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, shall be inspected with 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 [F939](#). Reference torque values above the upper limit specified by Practice [F939](#) 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 ensure the boot 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 displacement of 5 mm measured at the toe or heel (as appropriate) should be used and the test should be performed by any device or method capable of displacing the boot the necessary distance.

6.2 *Test for Symmetrical Release*—The system should be tested for twist release in both the clockwise and counterclockwise directions with a device of the type specified in [Annex A1](#).

6.3 *Test of Boot/Binding Compatibility*—Used as a diagnostic inspection 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; the boot (and, if changeable, the boot sole components) must be marked with the appropriate standards for use with the binding, as provided by the 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 performed to determine the difference in test results between a clean, dry boot/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, ensure that overspray does not contaminate other systems.

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

7. Release Torque Inspections

7.1 *Tests for Twist Release*—A test should be performed to determine the torque required to release the binding in twist (M_z) about an axis perpendicular to the plane of the boot sole. This test should be performed using a device of the type described in [Annex A1](#) and should be performed in both clockwise and counterclockwise directions of release. Test results should be within the appropriate inspection range. Units that exceed the inspection range should be readjusted to test within the inspection range. When an initial visual indicator setting is used (see [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.

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 range. Units that exceed the inspection range should be readjusted to within the inspection range. When an initial indicator setting is used (see [3.1.9](#) and [Appendix X4](#)), readjustment should not be attempted if test result(s) exceed the limit for readjustment (see [3.1.15](#)) without first taking corrective action as specified by the binding manufacturer.

7.2.1 If no independent means are provided to adjust the forward lean release, this test should be used to ensure 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 *Binding Preconditioning*—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 1—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.

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 principle, 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,
- 9.1.3 Pass/fail result of the system inspection, and
- 9.1.4 Any other information as recommended by the binding manufacturer.

10. Miscellaneous

10.1 Some other functional inspections that may be considered in diagnostic procedures are described in [Appendix X1](#) and [Appendix X2](#).

11. Keywords

- 11.1 retail standard; ski, binding, boot system testing

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 [F1061](#).

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.

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 See Appendix X1 through X3 in Practice F939.

APPENDIXES

(Nonmandatory Information)

X1. EXAMPLE OF TEST METHOD FOR REPRODUCIBILITY AMONG OPERATORS

X1.1 Scope

X1.1.1 This test method covers procedures that may be supplied by the test device manufacturer to the user for the purpose of evaluating reproducibility among operators.

X1.2 Procedure

X1.2.1 Select a ski/binding/boot system typical of equipment in use and adjust the visual indicator setting until the measured release value falls within the approximate middle of the range of release for the test device.

X1.2.2 Randomly order a series of tests in which each operator performs five repetitions of the test (see example, Fig. X1.1).

X1.2.3 Designate one person to make all observations. The observer should not perform any tests.

X1.2.4 Conduct all training recommended by the test device manufacturer.

X1.2.5 Conduct all tests in the order determined in X1.2.2.

X1.2.6 Do not allow the operators to observe each other or the results of any tests.

X1.2.7 Observe and record the test results to the resolutions specified by the test device manufacturer.

X1.2.8 Perform tests in only one direction of release. Repeat the entire procedure for other directions as appropriate.

X1.3 Calculation

X1.3.1 Determine the test result for each operator.

X1.3.2 Determine the range of operator medians and express it as a percentage of the median for all operators.

Operator Name	_____	_____	_____	_____	_____	a
	A	B	C	D	E	
	(3) _____	(4) _____	(5) _____	(1) _____	(2) _____	b
	(7) _____	(10) _____	(8) _____	(9) _____	(6) _____	c
	(11) _____	(12) _____	(14) _____	(15) _____	(13) _____	d
	(20) _____	(18) _____	(16) _____	(17) _____	(19) _____	e
	(24) _____	(21) _____	(22) _____	(23) _____	(25) _____	f
Operator Medians (Line b through Line f)	_____	_____	_____	_____	_____	g
		Highest	Line g	_____	_____	h
		Median	Line g	_____	_____	i
		Lowest	Line g	_____	_____	j
		Range =	Line h – Line j =	_____	_____	k
		Variability =	$\frac{\text{Line k}}{\text{Line i}} \times 100 =$	_____ %		
Observer's Name	_____				Date	____/____/____

NOTE 1—(B) denotes test sequence.

FIG. X1.1 Data and Calculation Sheet for Multiple-Operator Reproducibility Test

X1.4 Evaluation

X1.4.1 Variability among operators of more than 15 % should prompt continued training and retesting.

X1.5 Other Uses for This Test Method

X1.5.1 This test method may be used to evaluate multiple observers of the test device scale using a single operator.

X1.5.2 This test method also may be modified to evaluate multiple observers of other scales such as the visual indicator setting scale of the binding. These other test methods may require criteria for evaluation different from X1.4.1.