

## **Boot Canting Adjustment and Alignment**

### **Checking with a plumb bob, Simple tools**

#### **Always take picture and mark your current settings:**

You will need a friend

A level

A plumb bob with string

A marker

A Square

A Tape to use as marker background on boot

Flat Floor

Ski Boots

I used this to check and was set to prescribed limits.

The Model Tina Vindum is still active in fitness, has her own radio show.

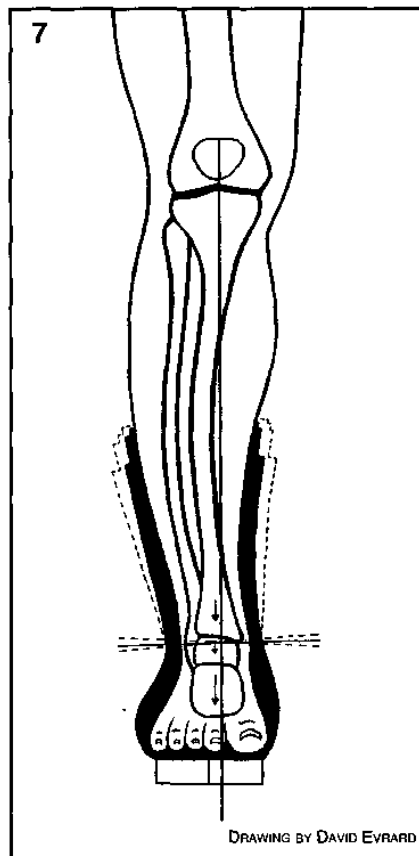
This comes from a book 1994 The Athletic Skier Warren Wetherill

## Chapter 6

# BOOT CUFF ADJUSTMENTS

The adjustable cuff has been a welcome addition to boot designs. It provides all skiers an additional tool in the bootfitting process. Unfortunately, the cuff has been widely advertised as a "canting device." In truth, it is a proper canting device for only a small number of skiers who have a particular foot and leg shape.

### CUFF ADJUSTMENT



For most skiers, the proper use of an adjustable cuff is to conform the boot cuff with the curve of their leg. This is the simplest part of the alignment process. (See drawing 7.)

The steps used to adjust the cuff are:

1. Remove liners from the boots.
2. Put the skier's footbeds or orthotics into the boots.
3. Have skier step into boots, and assume a natural skiing stance. (Be sure the footbed is in its proper location.)
4. Adjust the cuff so the space between the leg and shell is equal on both sides.
5. Re-assemble boots and proceed with canting the skier (as outlined in the next chapter).

There are two situations where we recommend using the cuff for canting. These are appropriate for 10–20 percent of skiers. The first is when a bow-legged person has a pronated foot, and lots of tibia vara (curvature of the tibia) low in the leg. Moving the cuff inward will both reduce pronation and properly align the knee.

*For most skiers the cuff should be adjusted so the leg is centered in the boot shaft. The foot and leg shown here are perfectly aligned, there is no pronation; and the knee is inside of center in the alignment that is most efficient for skiing. (See Chapter 7)*



# KNEE ALIGNMENT (WHEN BOOT SOLES ARE FLAT)

Knees Out

Knees  $1^{\circ}$  –  $2.5^{\circ}$  InsideKnees  $2.5^{\circ}$  + Inside

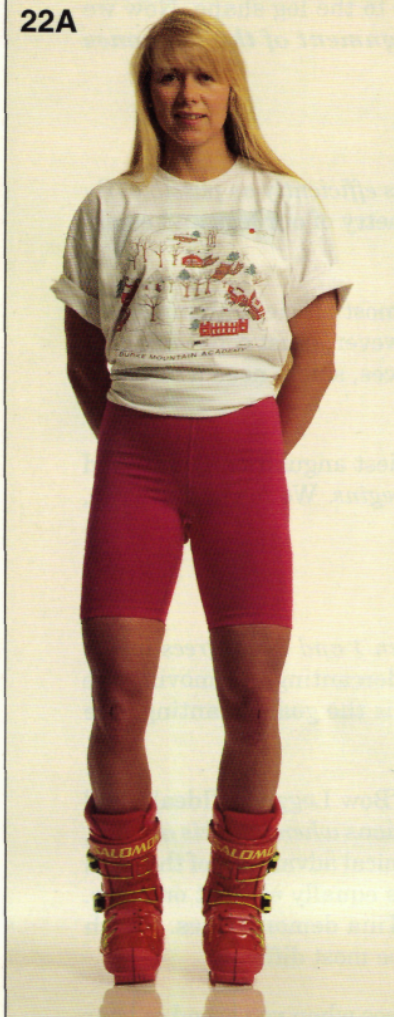
[1/4 – 3/4 inch]

Bow-Legged

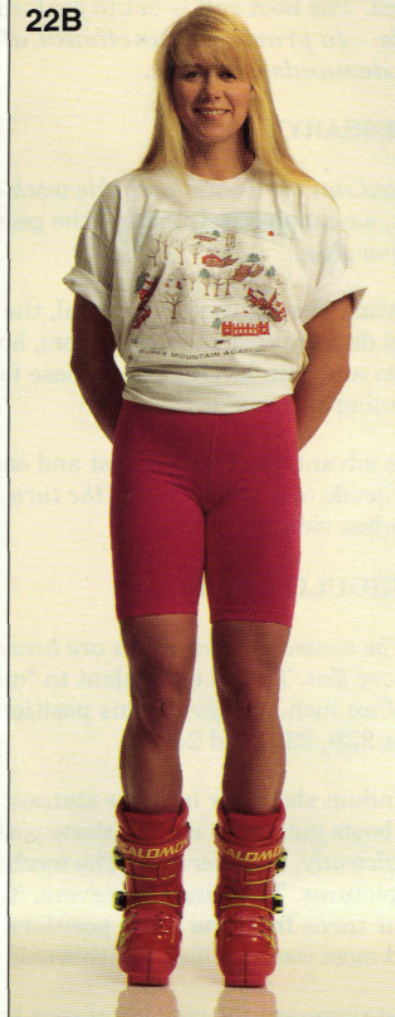
Slight Angulation

Knock-Kneed

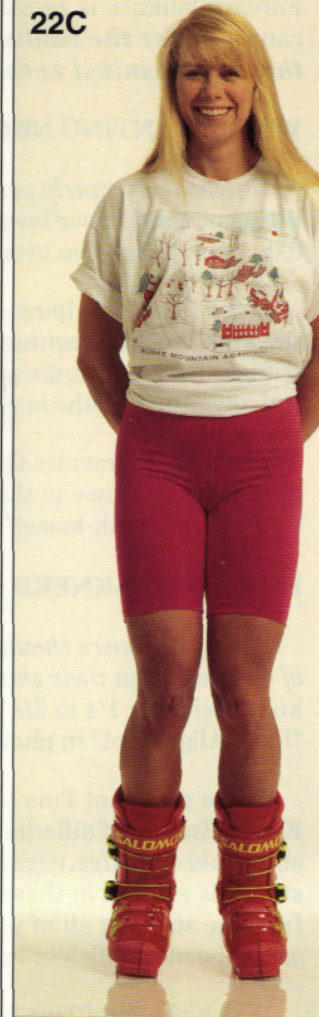
22A



22B



22C



E

OVER-CANTED

IDEAL ALIGNMENT

UNDER-CANTED



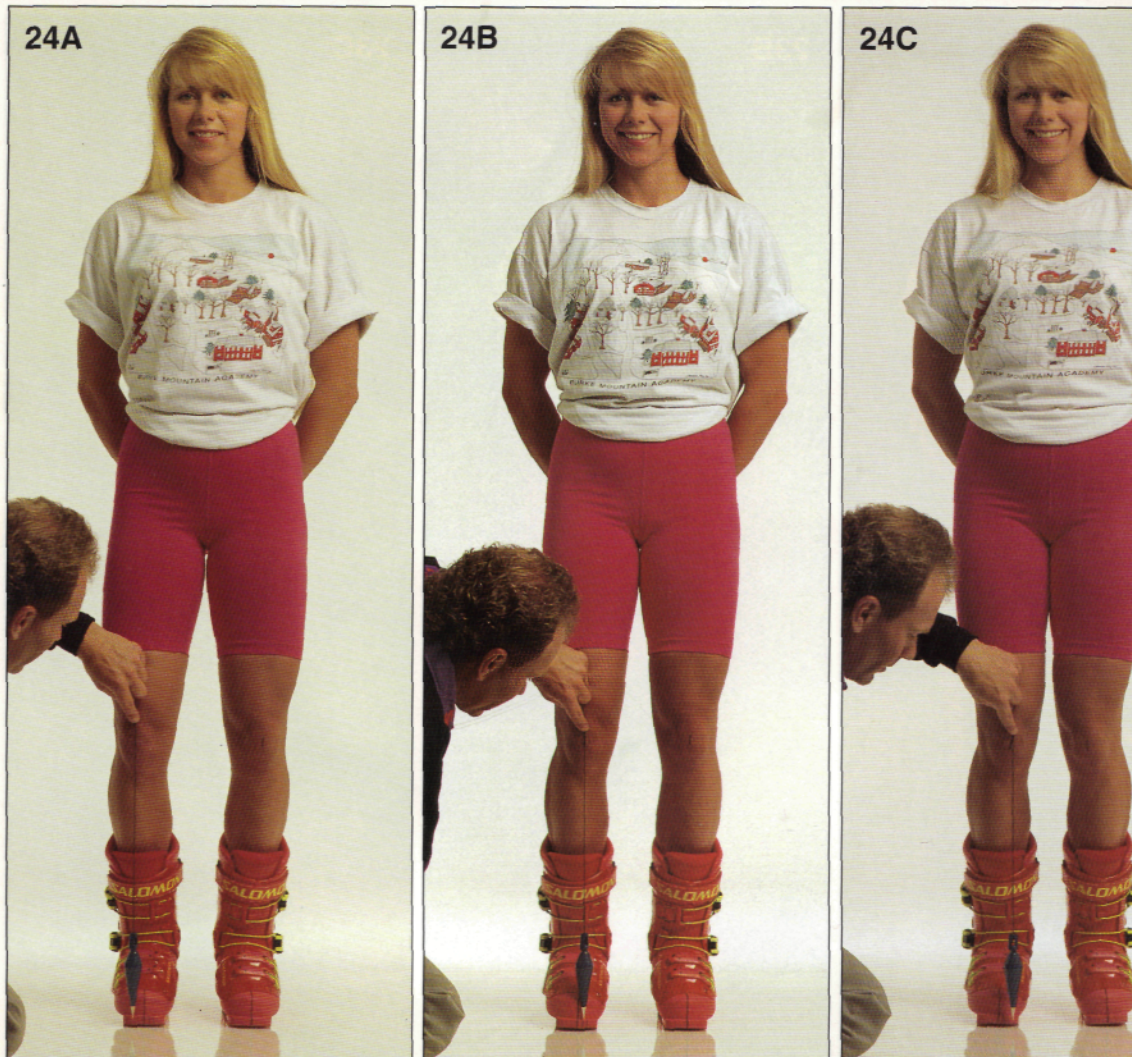


## KNEE ALIGNMENT (WHEN BOOT SOLES ARE FLAT)

Plumb-bob is  
outside of  
center line

Plumb-bob is  
 $1^{\circ} - 2.5^{\circ}$  inside of  
center line

Plumb-bob is  
more than  $2.5^{\circ}$  in  
of center line



OVER-CANTED

IDEAL ALIGNMENT

UNDER-CANTED

# TECHNICAL INDICATIONS FOR CANTING

<b>OVER-CANTED (Bow-legged)</b>	<b>IDEAL ALIGNMENT (1°-2.5° Inside)</b>	<b>UNDER-CANTED (Knock-kneed)</b>
Poor angulation. Head leans in. Hip stays outside.	<b>Uses Knee and hip angulation in natural proportion.</b>	Uses excessive knee angulation.
Turns begin with lateral push of ski, or a pronounced stem.	<b>Turns begin with minimum lateral push or skid of outside ski.</b>	Ski slides at beginning of turn. Loses edge hold and skids in sustained turns.
Skis are "grabby" and over-turn.	<b>Carving skills are easy and natural. Turns begin with edge and pressure.</b>	Skiers are limited to skidded turns. They have insufficient edge for carving.
Ski responds too quickly.	<b>Ski responds "delightfully."</b>	Ski responds too slowly.
Quickness and agility are limited by poor balance and muscle tension.	<b>Quickness and agility are enhanced by good balance, relaxation, and solid edge platform of carving ski.</b>	Quickness and agility are limited by skidding ski and lack of edge platform.
Downhill knee wobbles in and out.	<b>Harmony of angulation, edge angle, and balance reduces chattering and skidding.</b>	Knees always inside, often bang together. Skis slide on hard snow.
Tired quads. Muscles and joints are always under tension.	<b>Relaxed stance. Does not tire easily.</b>	Soreness and bruising on inside of knees.

Can you find a description of *your* skiing in this chart? Does it conform to your observed leg shape and knee alignment?

The photos of Bow-legged Mike and Knock-kneed Andy on the next two pages show how changing knee alignment affects technique.

The majority of skiers we observe on the hill or test in our laboratory are over-canted. They stand bow-legged when their skis are flat on the snow. To appreciate how this affects technique, try this simple exercise:

While sitting in a chair, relax and place your feet flat on the floor, about 6 inches apart. Move your knees 12 inches apart. Imagine you have skis and boots on. Now try to apply edge angle and pressure to the inside edge of your right ski. Is this an efficient movement?

It is difficult to pressure the inside edge when your knee is outside of vertical. Your knee must first rise and move inward until it passes over the top of its arc. Only when the knee reaches a position inside of vertical, can you effectively apply pressure *down* onto the inside edge.

Next, try the same exercise starting with your feet 6 inches apart and your knees 5 inches. From this slightly knock-kneed position, can you more easily apply pressure directly to the inside edge? Yes. When you are properly canted, you experience this same efficiency in your skiing.

The lateral position of the knee plays a major role in determining the amount of edge angle a skier has at all stages of a turn. *Proper canting assists in the smooth initiation of turns, and places a skier in the most balanced and powerful stance throughout a turn.*

***All errors in canting geometry are reflected in a skier's technique.*** Please study the chart on page 49; and look ahead to drawings 18 A, B, and C on pages 170–171.

In the “Technical Indications of Canting” chart, each column describes how people ski *because of their alignment*. ***For the bow-legged and knock-kneed stances, each “mistake” in skiing is not a failure of the skiers’ athleticism; it’s an error FORCED on skiers by their boots.***

Most readers will find accurate descriptions of their skiing somewhere on this chart. We hope it’s in the second column; but only a lucky few are skiing in this alignment. Let’s look at the three most common problems we see on the ski hill. All are in column one, and are caused by being over-canted, or over-edged.

1. **Poor angulation / Head leans in / Hip stays outside.** These body positions are especially evident in the initial phase of a turn; but they are seen through the belly of a turn as well. If a skier in this alignment were to use efficient knee angulation, his skis would be *over-edged*, and would turn too sharp. *The best instructor in the world can’t teach proper angulation to an over-canted skier.* If a good bootfitter provides proper alignment to this skier, then good angulation will occur naturally. ***Many technical problems are solved more easily in the boot shop than in ski school.*** Only after alignment needs are met, can instructors teach (or students learn) athletic skiing.



2. **Turns begin with a lateral push of the outside ski, or with a pronounced stem.** This skier cannot begin a turn with subtle and balanced knee angulation. The ski edges too much if the knee is moved inside. The ski must be pushed away from the body so the skier has more leverage against it and can better control the excess edge. This turn always begins with a heel push and skid.
3. **Downhill knee wobbles in and out.** We call this the “wobbly knee syndrome.” It’s most evident in the middle of a turn on hard snow. It is the surest sign of a skier whose downhill ski is too much on edge.

This skier tries to maintain knee angulation because that is the most comfortable, strong, and relaxed position for skiing. When the knee moves in, the ski is over-edged and turns too sharp. To take the ski off edge, the knee must move out. Thus, a constant battle is waged. The leg, trying to provide good balance, says: “Angulate.” The ski shouts: “Take me off edge, I’m over-turning.” And the poor, tired knee wobbles in and out looking for a harmony it can never find. At days end, the knee is sore and the supporting muscles are tired and stiff.

Do you see yourself in these descriptions? Or a friend you ski with? Who is to blame for the difficulties an improperly canted skier has to cope with? *Nearly all skiers blame themselves*—or their lack of technique and coordination.

### The Blame Game

It’s human nature to blame yourself for failure in sports. In baseball, if you swing at a pitch and miss, it’s your fault, not the bat’s. In basketball, if you shoot and miss, that’s your fault too. In skiing, if your turns are awkward or you’re not improving, it’s again human nature to blame yourself. This is humble, but not wise. We call it “*the blame game*.”

***Skiing is different from all other sports—because the boot determines so much of our balance and stance.*** Every indication of poor skiing on our technical chart is caused by poor alignment. Skiers who play “the blame game” will always be frustrated and handicapped. Those who change their alignment, like Bow-Legged Mike and Knock-Kneed Andy, will enjoy immediate and long term improvements in their skiing.

In a perfect world, all skiers will complete steps 1–4 on the alignment circle before addressing canting needs. Realistically, we know that many skiers haven’t the time or money to purchase orthotics or have other professional work done on their boots. For these skiers, *proper canting—done with whatever boots they have—provides large gains in skiing performance.*

There are two steps in canting. First, determine your canting need. Second, provide the necessary “fix.”

## HOW TO DETERMINE CANTING NEEDS

Follow these steps to determine canting needs.

(Fill in Canting Evaluation Form as you proceed.)

1. If you have orthotics or footbeds, be certain they are properly interfaced with your boot.
2. Remove from the boot any tape, padding, or shims previously installed to achieve a canting goal. Leave padding that improves fit.
3. If available, adjust boot cuff as described in Chapter 6.
4. Complete all other boot fitting procedures.
5. Make sure that bootsoles are perfectly flat, not warped or excessively worn. A simple test is to set a boot on a flat surface, tip it a few degrees on edge, and let it rock back to center. If the soles are flat and parallel, the boot settles quickly in place. If the boots are warped or worn, the boot rocks gently back and forth.

If necessary, true the soles with a belt sander or planer. This procedure requires special skills and equipment not widely available. We understand the difficulties; but we insist that flat soles improve both binding and ski performance. The ski industry must address this issue.

6. Wear shorts or other clothing that allows the knee to be exposed, and doesn't pull your skin in any direction.
7. With a pen, draw a vertical line **on the center of knee mass** on each knee. (See photo 13, page 23.) A discriminating eye and good judgement are required here. **Be precise.**
8. Assume a normal skiing stance, *with feet parallel*, on a *flat, hard, and level* floor. (Check it carefully with a carpenter's level). We suggest you identify a specific place in your shop that you are certain is level, and use this space for all canting evaluations. A marked grid makes it easy to keep boots parallel and to measure stance width. Record the distance between the skier's boots so you can duplicate it for subsequent evaluations. See recommended "Cant Evaluation Form" on opposite page.
9. Bend your knees until they move as far forward as the front of your boot sole. Then move each knee slightly left and right—rocking the boot sole from one edge to the other—until certain the soles are flat on the floor.

Hang a plumb-bob (available at hardware stores) from the knee center-line to the front edge of the boot sole. Mark the boot where the plumb-bob indicates. (See photo 14, page 27; and photos 24 A,B,C.)

**THE ATHLETIC SKIER**

SKI SHOP \_\_\_\_\_

**CANTING EVALUATION FORM**

Evaluuator \_\_\_\_\_

Customer:

Name: \_\_\_\_\_ Phone: \_\_\_\_\_

Address: \_\_\_\_\_

Boots: \_\_\_\_\_ Skis: \_\_\_\_\_

Bindings: \_\_\_\_\_ Footbeds \_\_\_\_\_

Orthotics: \_\_\_\_\_ Skier ability: \_\_\_\_\_

Are Orthotics or Footbeds properly interfaced with boots? Left \_\_\_\_\_ Right \_\_\_\_\_

Unusual body build or special needs: \_\_\_\_\_

Are boot soles flat? Left \_\_\_\_\_ Right \_\_\_\_\_ (If no, complete preliminary cant  
evaluation to determine which side of the boots should be ground to level the sole).

Grind Left Boot (inside edge \_\_\_\_\_) (outside edge \_\_\_\_\_).

Grind Right Boot (inside edge \_\_\_\_\_) (outside edge \_\_\_\_\_).

Width of Stance used for evaluation ( \_\_\_\_\_ ).

Knee Center-Line marked on (Patella \_\_\_\_\_) or (adjusted \_\_\_\_\_).

**SKIER'S RIGHT KNEE****SKIER'S LEFT KNEE***Outside    Neutral    Inside**Outside    Neutral    Inside*

←    -- \_\_\_\_\_ -----mm/inch- \_\_\_\_\_

←    -- -----degrees----- \_\_\_\_\_

CANT REQUIRED \_\_\_\_\_

CANT REQUIRED \_\_\_\_\_

Move Knee IN\_\_\_OUT\_\_\_\_\_

Move Knee IN\_\_\_OUT\_\_\_\_\_

TO MOVE KNEE IN — MOUNT WEDGE OR CANT THICK SIDE OUTSIDE!

TO MOVE KNEE OUT — MOUNT WEDGE OR CANT THICK SIDE INSIDE!

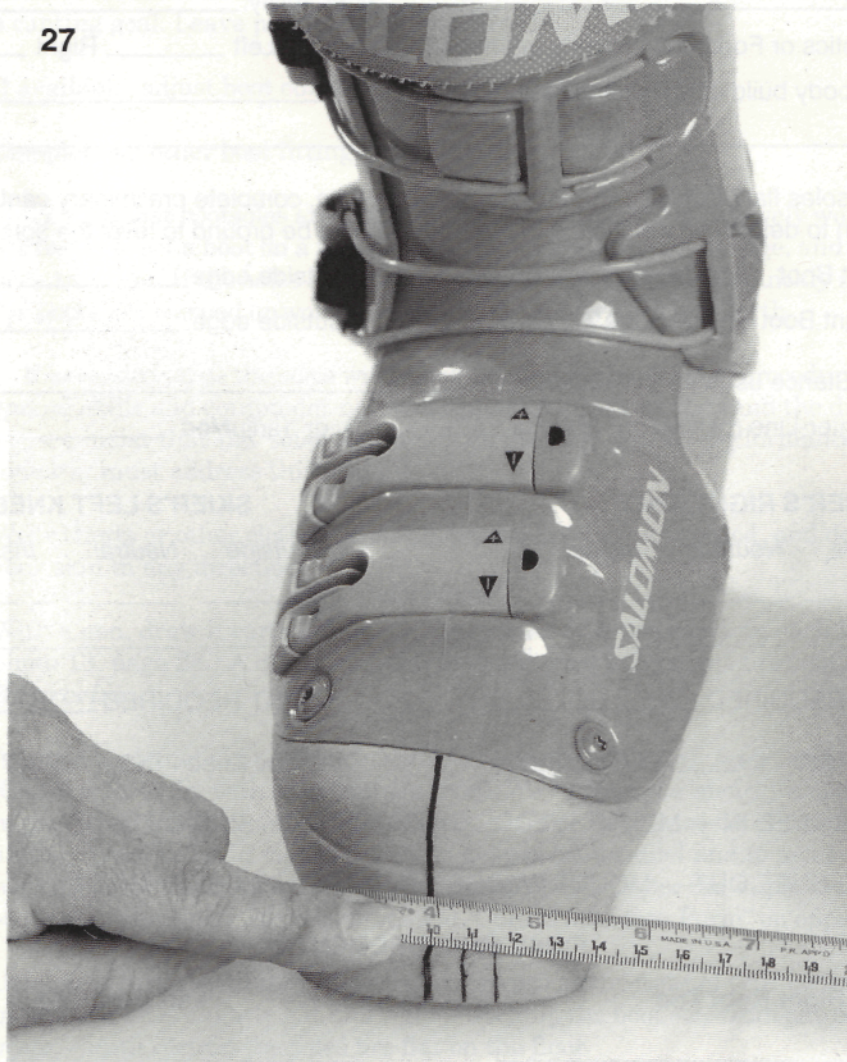
**FINAL MEASUREMENTS****Right Boot Toe****Left Boot Toe**

[Recommended Stance is between 1 and 2.5 degrees inside.] [Exception: extremely  
bow-legged skiers whose natural stance is more than 3° outside]

A carpenter's framing square can also be used. Place the short end flat on the floor and align its vertical long end with the mark on the knee center-line. Mark the boot where the vertical edge crosses the sole.

10. Measure the distance of this mark from the raised casting line that indicates the exact center of the boot sole. This measurement reveals how far inside or outside of vertical the knee is in a skiing stance. (See photo 27.) Use the Canting Conversion Chart (opposite) to convert distance measurements to degrees of cant.

27



ERIK ÖSTLING

Measure the distance the knee is displaced from the center-line; then use the **Canting Conversion Chart** to convert distance to degrees. Please note that leg length must be considered for all conversions.

## CANTING CONVERSION CHART

*(Distance Measure to Degrees)*

DEGREES OF CANT	1°	2°	3°	4°
Knee Displacement for knee height 16"	7 mm 1/4"	14 mm 9/16"	21 mm 13/16"	28 mm 1 1/8"
Knee Displacement for knee height 18"	8 mm 5/16"	16 mm 5/8"	24 mm 15/16"	32 mm 1 1/4"
Knee Displacement for knee height 20"	9 mm 11/32"	18 mm 11/16"	27 mm 1 1/16"	36 mm 1 3/8"
Knee Displacement for knee height 22"	10 mm 3/8"	20 mm 3/4"	30 mm 1 3/16"	40 mm 1 1/2"
Thickness of a wedge for bootsole 69 mm wide	1.2 mm	2.4 mm	3.6 mm	4.8 mm
Thickness of a wedge for binding 58 mm wide	1.0 mm	2.0 mm	3.0 mm	4.0 mm

WE RECOMMEND THE KNEES BE FROM 1° to 2.5° INSIDE FOR MOST SKIERS.

\*Measure from floor to knee with boots on.

There is no perfect angle of canting that can be established for any skier in the boot lab or ski shop. We recommend that bootfitters set most skiers 1.5 degrees inside. This provides a "functional and efficient stance" that is within one degree of optimum for skiers with "normal" legs. For performance skiers who require the utmost precision, final canting evaluations must be done on snow. Optimum canting for high performance skiing will vary slightly depending on individual body builds, skis used, boots used, the manner in which ski bases are prepared, snow conditions, and the specific task of the skier.





Most skiers will measure differently on their left and right legs. It is common to find a variance of 5 to 10 mm or 3/16 to 3/8 of an inch.

***If a knee is inside of vertical from 1 to 2.5 degrees (See photos of "Ideal Stance"), a skier is well aligned and can ski efficiently on that leg.***

If a knee is outside of center, or less than 1 degree inside (See photos of "Bow-Legged")

59

appropriately sized for cant thickness, cants placed under a binding do not affect binding release functions.

3. For racers and others who use multiple pairs of skis, sanding or planing the soles is the best option. Because this fix is a permanent part of the boot, a skier can select any pair of skis and always be perfectly canted. A full degree of cant is often achievable in this way as a part of flattening a warped boot sole. After boot soles are sanded, the top edge of the sole should be built up on the thin side until the original sole thickness is obtained. This assures the bootsole conforms to DIN standards. (Toe 19mm  $\pm$ 1; Heel 30mm  $\pm$ 1.)
4. To effect small canting changes (1 degree or less), it's easy to place plastic tape under one side of a binding. Loosen the binding screws. Apply tape (between the binding and the ski) in 3/4-inch width, and tighten binding. (See photo 71, page 188.) This does not in any way affect binding function or release settings. Six strips of Scotch Decorate and Repair Tape (available at office supply stores) will provide 1 degree of cant.
5. For skiers with the particular physiology discussed in Chapter 6, proper canting can be achieved by adjusting the boot cuff. For all other skiers, boot cuff adjustment is not the best way to meet canting needs. If the boot cuff has been used, check the final knee alignment by the same procedures listed in this chapter.

Proper canting improves skiing performance. It must become an accepted part of boot fitting. ***Canting is the final step in the alignment process that makes efficient and balanced skiing possible for all skiers.***

The steps presented here will place nearly all skiers within 1 degree of optimum alignment. Finer canting evaluations must be done by trial and error *on snow*. Readers who wish to proceed to the most precise canting adjustments, will find additional procedures in the special sections for instructors and racers.

Very good skiers, who are particularly sensitive to alignment needs, can feel changes as small as 1/8 of a degree. This is equivalent to an angle change created by a single piece of D and R tape. Racers should cant to this standard of accuracy. All good skiers who seek optimum performance should cant to an accuracy of 1/4 degree.

\*Note for extremely bow-legged skiers: The canting procedures and alignment goals presented here are effective for more than 90% of all skiers. Special considerations are required for bow-legged skiers whose canting needs are greater than 3 degrees. If this extreme morphology exists, it is often unwise to move the knees inside of center. For skiers in the 3°–4° range, about 50 percent can be canted by moving the knee in. For the other 50 percent, it is most helpful to mount the cant thick side inside and provide a flat ski when they stand in their normal bow-legged stance. This choice must be made based on joint spaces and flexibility in the knee. Individual analysis and expert guidance are recommended for people with this leg shape. It is often wise to consult an orthopedic specialist. Nearly all bow-legged skiers who require more than 4° of cant are best served by mounting the cant thick side inside and providing a flat ski. The advantages of skiing with the knees 1°–2.5° inside of center are not attainable for extremely bow-legged persons.

## Chapter 8

# 80/20 : 20/80

When you change your fore/aft balance or your canting—

***The first 80 percent of correction provides a 20 percent gain in performance.***

***The last 20 percent of correction provides an 80 percent gain in performance!***

If you are way in the back seat, and you move up to a little in the back seat, *you are still in the back seat*. Out of balance is out of balance. A little bit out of balance isn't much better than a lot.

If you are way over-canted, and you move to a little over-canted, *you are still over-canted*. You'll still push your skis at the start of a turn, and still lean in with your head.

In our first description of an athletic skier, we said our goal was *perfect balance*; and "good balance" was never good enough. The 80/20 equation explains why "perfect" balance is our goal. When we say this, we are not being "alignment fanatics" or techno-geeks. The 80/20 equation is the simple, practical truth of balance and alignment in skiing.

In gymnastics, on the balance beam, if you lose your balance just a little, you fall the same distance as when you lose it a lot. In skiing, if you are off balance just a little, your phantom foot prevents you from falling; but your skiing suffers a lot. Trust us. There are no shortcuts. Success requires precision.

This is a small chapter, but a big idea. You have to get it perfect. ***It's the last 20 percent that offers the greatest reward.***