



NORDIC ULTRATUNE UPDATE

News & Notes from NORDIC ULTRATUNE

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News and Notes

Wow, it's already February.

The winter of 2010/11 has been the busiest ever at Nordic Ultratune. More stone grinding work, more new skis, more visits from friends at the shop. All in all, it has been super.

As always, it is very gratifying to see the Ultratune grinds on skis of racers at the top level. Podium places have been part of every SuperTour event and National Championship event, with some victories in there, too. I'm always so proud of the skiers – they're the ones who make it happen through years of hard work and dedicated training.

This year I've been making time to get more hours on snow for myself. Margaret and I will be travelling to Norway for the Birkebeiner in March. It's the grand-daddy of the big ski races – a 55km classic event. I don't get enough training to be competitive in my age group – not by any means – but I intend to fully enjoy the event.

Note that Nordic Ultratune will be closed during the span of March 10 – March 21 while we're away at the Norwegian Birkebeiner. So get your skis in early! However, if skis arrive while we're gone, they'll be safe – FedEx and UPS will continue to deliver during our absence.

Meanwhile, stone grinding is going full speed, and great new skis continue to be picked, prepped, and shipped.

And there are a lot of great skis here in the shop if you decide you'd like a pair.

Thank you for reading the Ultratune newsletter.

We're well into the 6th season in Winthrop, WA, and our success is due to our focus on high quality work, and also due to our loyal customers who spread the word of their fast skis to friends.

Thanks!

-Mark Waechter

Follow the news.

Ultratune has a blog. Check it out at:
<http://blog.ultratune.net>

And our web site, of course!
<http://www.ultratune.net>



Schedule

During fall and winter, regular hours are Thurs, Fri, Sat, Sun, Mon, 11-5. Stop in and say hello! Most days I'm in the shop earlier, but those hours are a sure thing. Usually Tuesday and Wednesday of every week are reserved for ski testing (when the snow arrives) and a little time off.

In This Issue

- Why not use isotropic surface structures?
- Weighing in on Wing Wedges
- Respiratory Muscle Training – Part 3
- Grind Menu Notes & New Skis

Why Not Use Isotropic Surface Structures?

by Mark Waechter

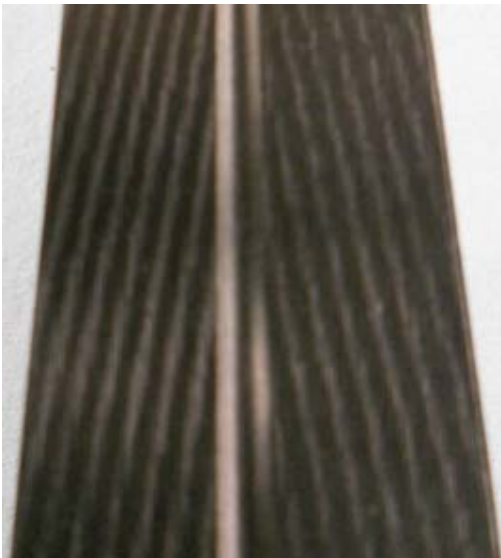
I am occasionally asked why ski bases don't have random or non-directional structures. Typically the question is posed with the addition of "...like a golf ball!"



The idea of random isotropic surface structures seems attractive at first. Something simple, elegant, and maybe even something easy to apply to a ski. Imagine a surface finish on a ski that could be sprayed on! Perhaps smooth indentations on the ski base from a shot-peen gun, or cuts from an abrasive sandblasting apparatus. That seems simple and relatively inexpensive. But would it work?

Golf balls travel through the air, spinning, without a set orientation to the travel direction (imagine having to line up the golf ball *just so* on the tee...!).

Additionally, the axis of spin can translate while the ball is flying through the air. So a non-directional isotropic arrangement of the dimples is best.



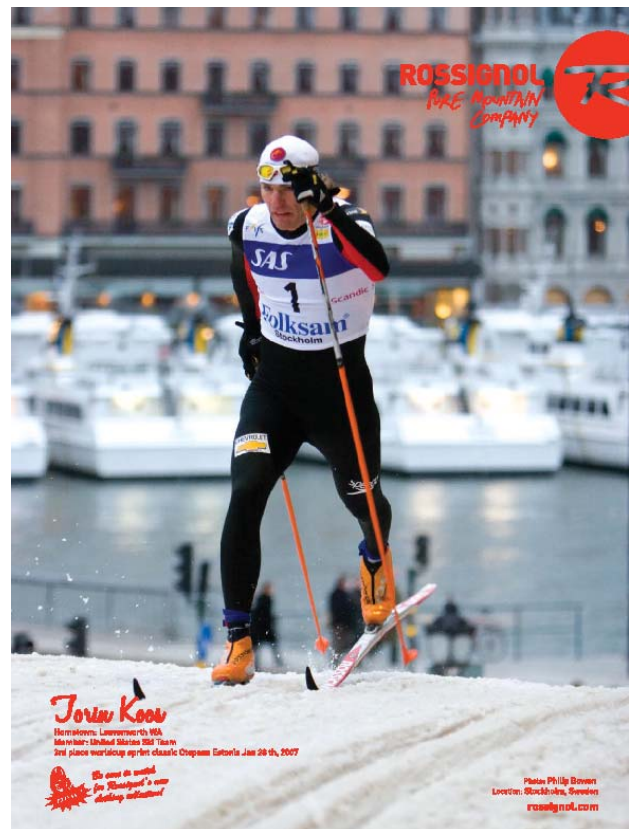
A structured ski: Linear elements organized with an angled pattern.

But a ski doesn't travel randomly; it doesn't behave the same in all directions. Cross country skis travel in a straight line, and always work through the snow tip-to-tail. For this reason, the base structures are optimized to maximize the benefits, and minimize any negatives. Structures and base finishes need to take into account the motion of the ski against the frictional interface.

Note that while skating there is typically a bit of torsional force and movement of the ski in the snow. Additionally, skate skis usually slide through less transformed snow than a ski in a set (classic) track. So skate skis and classic skis are sometimes treated differently.

Skate ski structures are tending toward broken patterns, which have easier separation and less stickiness in the ski release. Long, straight, continuous linear structures with continuous frets tend to track well but have a stickier release or separation from the snow. Broken structures with linear elements, but with angled interference patterns are proving to work very well on both skate and classic skis.

So, skis don't get the simple isotropic base structures, but rely on lengthwise oriented patterns. The ski structure designs utilize depth, spacing, orientation, and pattern to optimize the ski speed through the snow in various conditions. ■



Weighing in on Wing Wedges

by Mark Waechter

There has been a bit of buzz about the 60mm wedges that can be used with Pilot bindings.

Officially called the SNS Wedge 60, the "wing wedges" have been seen on the World Cup for the past 3 seasons. I first saw them on Atomic skis while working at the World Cup events during the winter of 2008/2009. There has been plenty of experimenting and tweaking in the past couple of years to give the manufacturer confidence that they have some merit. And finally they've made it to the consumer so that anyone can give it a try.



The intent of the wings or outriggers is to provide an extended platform under the forefoot, providing better control of the ski. This has been the premise of the NNN binding design since 1998 when they introduced their wide platform R3 skate binding, and it has shown over the past decade that it's a good idea.

Wings provide a wider base of support under the forefoot.

The overall width at the widest point is 60mm. The widest spot coincides with the wide part of the average boot. The wing wedges provide a space for the Pilot binding to sit down in a channel so that the wings are at the same surface level as the foot platform of the Pilot binding.

Because of the inset dimensions, the wedges work very, very nicely with the Pilot but are not compatible with any other version of Salomon binding. It's not intended for use with the Profil, ProPulse, or Pilot Classic binding.

The wings - the lateral support extensions - seem pretty obvious and intuitive in their benefit, yet the idea of a wedge that lifts the toes by 5mm seems less clear-cut. While some marketing articles claim that the ski will spurt forward like a wet bar of soap (??) if you simply add this wedge, I find that the effect is subtle. It has 5mm lift over a length of 300mm. Sharpen your pencil: that's about a 1 degree angle.



With the toe-lifting wedge, I think there is some initial accentuation of the sensitivity to fore/aft foot pressure on the ski. But competent skate skiers will adapt quickly and really won't notice much difference in feel after a few days on the skis. The wedge component of the setup seems to have received a mixed reception - whether it helps or doesn't - but the consensus is that at least it doesn't harm performance.

My opinion after testing skis with the wing wedge, and without them, is that the wings definitely improve the feel of the skis. The wedge (toe lift) aspect, to me, is somewhat inconsequential.

Sharpen your pencil: 5mm lift over a length of 300mm. That's about a one degree angle.

The wing wedges are not an expensive item; they're less than \$20/pr and include longer screws to replace the front-end screws on the Pilot binding. If you're retrofitting skis, the changeover is simple and quick and doesn't require any drilling - you can use the same holes as long as you don't mess anything up when removing the bindings.



At the relatively modest price, and with such minimal impact on the ski setup, it's something that anyone could try themselves and make their own decision on whether wing wedges are a benefit or not. ■



“Grind over the weekend” for 2010/11



Ultratune’s “Grind over the weekend” schedule is intended to minimize turn-around time for ski service.

Batches of skis start the grind process each Thursday, and are shipped out on the following Monday. That will be our standard schedule again for the 2010/2011 ski season.

Here’s why it works so well:

If you’re an out-of-town skier, you can ski on Sunday, pack up your skis and ship them to Ultratune on Monday with delivery in time for the Thursday batch. They’ll be back on the FedEx truck at the beginning of the week (4 days later), and you’ll receive them on Thursday. If you work this out, you’ll see that you miss only one weekend of skiing on your favorite boards.

To avoid missing any ski races, you can send your skis early. ■



Casey Smith of Winthrop, WA at 2011 World Jr/Youth Biathlon Championships in Nova Mesto.
Photo by Judy Geer



Lars Berger gets long glide

Late Winter Stone Grinding Schedule

You’ve been training through the fall and winter to get the most from your skiing, so make sure your skis aren’t a limiter.

Prepare all of your skis to run their best with a fresh grind and hotbox service. At Nordic Ultratune, a grind batch starts every Thursday and those skis are ready for shipping on the following Monday -- just 4 days later.

Return shipping is FedEx Express Saver, which is 3rd day delivery. So, skis that are shipped out on Monday will arrive back to you on Thursday.

Here’s the upcoming service schedule at Nordic Ultratune. Use these dates to make sure you get your skis ready before your most important races.

- Skis in by Feb 3rd 4th will ship out on Feb 7th and arrive by the 10th.
- Skis in by Feb 10th will ship out on Feb 14th and arrive by the 17th.
- Skis in by Feb 17 will ship out on Feb 21 and arrive by the 24th.
- Skis in by the 24th will ship out on Feb 28 and arrive by March 3rd.
- Skis in by March 3 will ship out on March 7 and arrive to you by March 10th.
- **Nordic Ultratune will be closed from March 10th through March 21 while travelling to the Norwegian Birkebeiner**

You can see that there are still a couple of service batches scheduled before the big marathon races. There is still time to get a fast grind on your skis before the season kicks off! But don’t delay. Fast boards are a joy to ski on, and they’re a real advantage. ■

Part 3: Exercise-Induced Arterial Hypoxemia (EIAH)

By Margaret Waechter, M.S.

Ed Note: This is the 3rd part of a 4 article series. These articles originally appeared in the 2006/07 editions of the Nordic Ultratune Newsletter, and are being reprinted after several requests.

About the author:

Margaret Waechter has an M.S. in Exercise Science, and is an ACSM Registered Clinical Exercise Physiologist®. She runs the cardio-pulmonary rehab center at Okanogan-Douglas Community Hospital. No stranger to elite XC-Skiing, Margaret was a Canadian National Cross Country Ski Team member in the 1980's.

Exercise-induced Arterial Hypoxemia (EIAH)

Introduction

It is becoming clear that the healthy pulmonary system may not be as overbuilt as once imagined. While healthy sedentary people may not tax the limits of their pulmonary system at maximal exertion levels, this may not be the case for the fit endurance athlete. During exercise, the pulmonary system may limit performance in two ways: the first due to respiratory muscle fatigue, and the second through exercise-induced arteriolar hypoxemia (EIAH). In the first two articles on respiratory training I focused largely on respiratory muscle fatigue. In this article I will address another pulmonary limitation evident during exercise – that being EIAH.

What is EIAH?

The oxygenation of arterial blood during exercise is quantified using measurements of PO₂, HbO₂ saturation, and O₂ content. PaO₂ is determined by the amount of alveolar ventilation at a given workload, and the efficiency of oxygen exchange between the gas in the alveoli and arterial blood [(A-a)DO₂]. Typically SaO₂ levels follow PaO₂ levels, but these can also be modified by O₂ dissociation shifts due to changes in temperature, metabolic acidosis, and P_{CO2} - the Bohr effect (Dempsey & Wagner, 1999). EIAH is said to exist when the arterial partial pressure of oxygen (PaO₂) is reduced by 10 mmHg during exercise, or arteriolar oxygen saturation levels (SaO₂), measured non-invasively with a pulse oximeter, persistently drop more than 4% from baseline values in an incremental progressive exercise test (Prefaut, Durand, Mucci, & Caillaud, 2000). Other studies have defined EIAH as an exercise SaO₂ < 91%. "Levels" of EIAH have also been suggested.

An absolute SaO₂ of 93-95% is mild EIAH, moderate EIAH at an SaO₂ of 88-93%, and severe EIAH at SaO₂ levels < 88% (Dempsey & Wagner).

Many highly trained endurance athletes exhibit EIAH that appears to indicate problems in gas exchange. EIAH has been consistently found in endurance athletes with absolute VO_{2max} values above 4.5 L/min (Prefaut et al., 2000). It appears that highly trained endurance athletes can exceed the limits of the cardiovascular system, so that failure of the respiratory system can appear in the form of arterial hypoxia. I have consistently observed this when testing endurance athletes in our Health Science Lab in Winthrop, and thought I'd poke around in the research and try and understand this phenomenon.

Does EIAH Impact Performance?

The research would suggest that this is so. Athletes who exhibited significant reductions in SaO₂ at sea level (3-9%) showed decreases in VO_{2max} of 1% per 1% drop in SaO₂, while work output was reduced about 5% in highly trained cyclists who de-saturated below 87%. Likewise when SaO₂ levels are brought back up to 95% in "de-saturators" their average VO_{2max} values increase significantly. Romer and Dempsey (2005) suggest that exercise-induced oxygen de-saturation does negatively impact performance in part due to fatigue in the muscles of locomotion. When EIAH was prevented the absolute level and rate of rise of arterial blood lactate was reduced, the rate of rise of effort perception was reduced, and force output of locomotor muscles increased. Hmmmmm.

Sex and Age Differences

EIAH seems to occur in women at a lower VO_{2max} compared with aged-matched men, and more may be more susceptible to this phenomenon of arterial de-saturation. The adult female typically has a smaller vital capacity, reduced airway diameters, and a smaller diffusion surface relative to males. Flow-limited females appear to have the most EIAH (Dempsey & Wagner, 1999; Sheel, Richards, Foster, & Guenette, 2004). Arterial hypoxemia with exercise has also been observed in master's athletes with lower VO₂'s ranging from 32-59 ml/kg/min, leading researchers to suggest that age may potentiate EIAH (Prefaut et al., 2000).

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Mechanisms

A number of sometimes inter-related mechanisms appear to be involved in EIAH. A very short description of each mechanism is outlined below.

1. **Relative hypoventilation** may help explain EIAH in trained endurance athletes. Hypoventilation is alveolar ventilation at a rate less than metabolism requires to maintain arterial blood gases in the normal range. At moderate levels of exercise EIAH may be associated with a small increase in PaCO_2 and level alveolar-arterial difference $[(A-a)\text{DO}_2]$. As the intensity increases the reduction in PaO_2 is associated with a widening $[(A-a)\text{DO}_2]$, or insufficient increases in PAO_2 . Pulmonary gas exchange appears to be impaired with a lack of hyperventilatory response to a widening alveolar-arterial difference. Researchers have recorded higher levels of arterial partial pressure of CO_2 in younger and older highly trained athletes and a positive correlation between PaCO_2 and SaO_2 with relative levels of ventilation as defined by VE/VO_2 (the ratio of minute ventilation to oxygen consumption). Basically we are seeing a reduced ventilatory response to submaximal exercise intensities for a set work load. It has been suggested that reduced acidosis in the elite athlete may lead to less compensatory hyperventilation, or that a decrease in carbohydrate oxidation at moderate exercise intensities may slow ventilation (Dempsey & Wagner, 1999; Prefaut et al., 2000, Sheel et al., 2004). At maximal exercise levels athletes with high minute ventilations may simply exceed the mechanical limits of the lung. Drops in SaO_2 observed with a pulse oximeter are also further impacted by the rightward shift of HbO_2 (remember the Bohr effect!!!) dissociation due to metabolic acidosis and increased temperature.
2. **Ventilation perfusion (V_A/Q) mismatching** may also help explain EIAH. V_A/Q is defined as the ratio of pulmonary minute ventilation to cardiac output. The mismatching of ventilated alveoli with gas exchange units having adequate blood supply explains the widening of the alveolar-arterial difference $[(A-a)\text{DO}_2]$ up to 60% of $\text{VO}_{2\text{max}}$. Some of this "mismatching" may be attributable to the

release of inflammatory mediators such as histamines during exercise. The remaining explanation for a widening $[(A-a)\text{DO}_2]$ appears attributable to diffusion limitations (Dempsey & Wagner, 1999; Prefaut et al., 2000).

3. **Diffusion limitations** across the alveolar membrane can be quantified by DLCO (or pulmonary diffusion capacity for carbon monoxide). DLCO decreases have been measured after both arm and leg exercise. There is an increase in diffusion distances due to the accumulation of extra-vascular fluid. Hydrostatic edema, permeability edema and mechanical stress failure may all be contributing to this process. Histamines which increase the permeability of vascular membranes may mediate this inflammatory response (Prefaut et al., 2000). Can pulmonary capillaries be damaged during severe exercise?
4. **Blood viscosity** has been shown to increase during intense exercise, which may increase the resistance of lung vasculature. Furthermore the intensity and duration of exercise may impact the deformity of red blood cells, which negatively effects resistance in the lung vasculature, and decreases pulmonary O_2 diffusing capacity.

Implications

The intensity and duration of exercise may negatively effect lung function, and therefore exercise performance. The cumulative effects of intensity and duration of exercise on lung function and overall endurance performance have not been well explored. In general, coaches and athletes have not considered pulmonary function when optimizing the volumes and the intensities of exercise we perform. The trend in North America seems to be towards blocks of daily, and sometimes twice daily high intensity interval sessions. Perhaps the ability of our pulmonary system to adapt and recover from this transient but repetitive hypoxemia, now performed in very intense "blocks" (particularly for older master's athletes, and expiratory flow-limited females), should be considered along with the more common central and peripheral adaptations currently monitored. Should we be modifying our training prescriptions to limit the adverse effects of EIAH in those athletes who are adversely affected?

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In addition, the ability to optimize lung function when training and racing at altitude, where EIAH is obviously more prevalent, could improve performance.

Dempsey, J. A., Wagner, P. D. (1999). Exercise-induced arterial hypoxemia. *Journal of Applied Physiology*, 87(6) 1997-2005).

Prefaut, C., Durand, F., Mucci, P., & Caillaud, C. (2000). Exercise-induced arterial hypoxia in athletes. *Sports Medicine*, 30(1), 47-61.

Romer, L. M. Dempsey, J. A. (2005) effects of exercise-induced arterial hypoxemia on limb muscle fatigue and performance. *Proceedings of the Australian Physiological Society*, 36, 71-75.

Sheel, W. Richards, J., Foster, G. E., Guenette, J. A. (2004). Sex differences in respiratory exercise physiology. *Sports Medicine*, 34(9), 567-579. ■

Team Service

If your team or club wants to save some money, you can get a **team discount** at Ultratune.

Who Qualifies?

Your group can be considered a "team" if you can gather 15 pairs of skis or more. If you and your training buddies can gather 15 pairs, you're a team!

The skis should all be sent (or delivered) as a single group, and return shipping will be to a single address. Typically, with team service, work is done at a flat package rate, with all grinds at the same price for simplicity. No "separate checks" – a single "group payment" is recommended.

Call 509.996.4145 or email xcgrind@ultratune.net for further details. ■



The Mantec Grinder at Nordic Ultratune

The Updated Grind Menu

With the addition of the new Mantec grinding machine last season, and also as a result of collaboration with serviceman Stefano Vuerich of Val diFiemme, Italy, the grind menu was updated with new offerings during the 2009/2010 season.

I've been working at World Cup events since 2005. Through these channels I first became familiar with the quality of the base structures produced by the Mantec equipment. It was Gianluca Marcolini who suggested that I get in touch with Stefano Vuerich, the leading World Cup ski serviceman who grinds a big percentage of all the skis on the World Cup circuit.

The Mantec Ski Numericontrol 140 arrived in October 2009, and along with the machine are some of the successful World Cup grinds from Europe.

Updated World Cup Structures:

- M1D - warm, wet, transformed conditions. Skate or classic klistar grind.
- D5 - universal layered cross structure; typically 0C to -5C
- i5 - angle-biased structure for medium conditions, typically -1C to -10C
- S2 - fine, symmetrical pattern for colder conditions; typically -3C to -20C
- S1 – very fine, symmetrical pattern for new snow, and cold, fine, dry conditions; typically -5 to -20C

Linear Structures from Ultratune will remain unchanged:

- LJ03 - linear grind for temps near 0C.
- MVL - general purpose linear grind for classic skis, finer than LJ03
- XC02 - for cold & dry snow; linear grind with a secondary polishing stage

The grinds on the menu are proven structures that are fast and very versatile. The new World Cup structures are good on classic skis as well as skate skis. These structures are all grinds that I've used and tested on the World Cup and at the Olympics, and the performance data and race results attest to their quality.

Download a [workorder form](#), and send some skis! Spring and summer is a great time to get the skis prepared for the coming season. ■

The Nordic Ultratune Hand Picked Ski Program

The hand-picked ski program continues for the 2010/2011 season. You get the skis you want, picked from the best possible selection, and they arrive before the snow flies.

Atomic, Madshus, and Rossignol all have significant upgrades to their skis (and new graphics, too).

For the upcoming season, the following models are available:

Skate skis:

- Atomic Featherlight Skate - \$549
- Madshus Nanosonic Skate - \$599
- Rossignol Xium WCS Skate - \$599

Classic Skis:

- Atomic WorldCup Classic - \$549
- Madshus Nanosonic Classic - \$599
- Rossignol Xium C2 Classic - \$599

Specialty Classic Skis

- Atomic WorldCup Multi/Rubber - \$549
- Madshus Nanosonic Zero - \$599
- Rossignol Xium C2 Rubber - \$599

I work closely with the ski companies, knowledgeable world cup skiers, coaches, and servicemen to get the best possible information on ski fitting for each brand and model that Ultratune sells.



*Precise
tools for
measuring
camber
and flex.*

All skis are selected using the Ultratune Digital Flex Press in our shop. Some will be pre-selected at the ski warehouse, but they'll always be tested and flex verified in our shop.

Whether you choose a ski from Atomic, Madshus, or Rossignol, the performance will depend on fit and finish. A well fitted ski with a fast base finish will result in great performance.

You get a ski with correct flex, picked for the intended use, with a great Ultratune base grind for the intended conditions. They're saturated with wax in our hotbox and delivered to you.

If you would like a pair of skis, send a request. ■

Send an email to xcgrind@ultratune.net with information:

Your Name

Weight – how much do you weigh with your ski clothes on?

Height– how tall are you?

Ski type – skate ski or classic ski?

Which ski? If you know the model and size that you want, tell me. If you have questions about the skis, ask. I usually reply to emails in less than a day, even in the summer.

A short description of what you're looking for. This can be as simple as "an all-around ski", or as specific as you can describe. Will the skis be your one-and-only pair, are the skis intended to fill in a specific purpose among many pairs of race skis. The more information you provide, the better able I am to choose the right skis for you.

Stone Grinding. If you know the base grind you'd like, then include that. Don't worry - I can help with the choices.

A phone number. At some point, we'll need to talk, so send a number.

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Stone Grind Your Skis!

Skis are subject to damage every time you ski on them, wax them, or just leave them sitting around. Abrasive skiing conditions, heat from wax irons, and exposure to air all degrade your ski bases. The performance of your skis is greatly affected by the condition of the P-Tex and the surface condition of your skis.

If your skis have base damage, they can be improved with a fresh grind. Any of these symptoms can be remedied with a new base finish from Nordic Ultratune:

- *No structure remaining*
- *No longer flat – convex or concave*
- *Skis just aren't fast as they used to be...*
- *Surface scratches*
- *Skis won't hold wax*
- *Over-heated, oxidized, dried out*

In addition, you can choose the base structure that you need – whether it's an all-around structure for your one-and-only pair of skis, or a special purpose grind for specific snow conditions. ■



The stone & drive wheel on the Mantec Grinder

Hotbox Services at Nordic Ultratune

I routinely get emails asking for clarification of our Hotbox services. Here's what we offer:

Hotbox Basic - In our basic Hotbox process, skis are waxed with a warm paraffin wax and placed in the Hotbox for 90 minutes for thorough wax penetration. **At \$15 it's a bargain.**

Hotbox Deluxe - With the Hotbox Deluxe process, the skis receive an antistatic treatment using a special process, followed by warm paraffin, then Hotboxed for 3 hours, providing super-saturation. The Hotbox Deluxe is highly recommended for all stone-ground skis, especially if you plan to race very soon after receiving your skis from the grinder. ■



Let's Be Specific!

Skis intended for specific conditions need to be structured for the best possible performance. Nordic Ultratune can help you choose the best base structures for your needs. Get rid of excuses by getting the skis prepared for top speed, right away.

It is certainly true that the p-tex bases on new skis are better than they were in the past. But it's very likely that your new skis have been sitting in a warehouse for the better part of a year. Often new skis have dried-out, oxidized base material. **It's also common for new skis to have a relatively aggressive structure on the base which can be slow for all but wet or icy conditions.** Sometimes new skis have scratches and often brand-new skis aren't perfectly flat.

Naturally, you want fast skis. A grind and hotbox will have them race ready. ■



Please clean your skis - don't send them looking like this!

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2010/2011 SEASON - WORK ORDER FORM & PRICE LIST

(Please attach one copy of this form to each pair of skis)

INSTRUCTIONS:

- Please: we must have a fully completed order form to begin work on your skis!
- A personal check or charge card info (Visa/Mastercard) must accompany your skis.
- Remove all wax from skis - there will be a \$5.00 surcharge for removing wax from skis.
- Tie skis together with rubber bands or tape - ski ties will not be returned.
- Include this form with your skis. One work order form per pair.

SHIP SKIS TO:

**NORDIC
ULTRATUNE**
134 Riverside Ave
Winthrop, WA 98862

UPDATED WORLD CUP STRUCTURES!

| | <u>Prices in US\$</u> |
|---|-----------------------|
| D5 - universal layered cross-structure for skate or classic skis; typically 0 to -5C | \$ 64.00 |
| i5 - angle bias cross-structure for medium conditions, typically -2 to -10C | \$ 64.00 |
| S2 - fine, symmetrical interference pattern for cold conditions; typically -5 to -20C | \$ 64.00 |
| S1 - fine, symmetrical interference pattern for very cold, dry, new and fine snow conditions; | \$ 64.00 |
| M1D - warm, wet, transformed conditions. Skate, or warm klistler grind for classic skis | \$ 64.00 |

LINEAR STRUCTURES

| | |
|--|----------|
| LJ03 - linear grind for temperatures near 0C. | \$ 64.00 |
| MVL - general purpose linear grind for classic skis in colder conditions | \$ 64.00 |
| XC02 - for very cold & dry snow; linear grind with a secondary polishing stage | \$ 72.00 |

Waxing (add to the above price):

| | |
|--|----------|
| Hot Box Basic - paraffin wax with 90 minute hotbox soak | \$ 15.00 |
| Hot Box Deluxe - anti-static treatment followed by paraffin wax & 3 hour hotbox soak | \$ 25.00 |

Additional Services (add to the above price):

| | |
|---|----------|
| Minor edge damage repair | \$ 8.00 |
| Binding Installation (specify boot size _____) | \$ 12.00 |
| Ultratune Flex Analysis | \$ 20.00 |
| Rush order and overnight shipping (please call in advance for pricing and scheduling) | |

Subtotal: \$ _____

Washington residents add 7.7% sales tax: \$ _____

Packaging, Shipping & Insurance: \$25.00 first pair, \$15.00 subsequent pairs \$ _____

Total: \$ _____

SHIPPING ADDRESS

| | | | |
|-------------|----------|-----|--|
| NAME | | | |
| ADDRESS | | | |
| APT / SUITE | | | |
| CITY | | | |
| STATE | | ZIP | |
| TELEPHONE | () | | |
| EMAIL | | | |

CHARGE CARD PAYMENT INFORMATION

| | | | |
|--------------|--|--------|---|
| NAME ON CARD | | | |
| VISA / M.C. | | EXP | / |
| SIGNATURE | | V-Code | |

SKI INFO

| | | | |
|--------------------------------|--------------------------|---------|--------------------------|
| BRAND | | | |
| LAST 4 DIGITS OF SERIAL NUMBER | | | |
| SKATE | <input type="checkbox"/> | CLASSIC | <input type="checkbox"/> |

SKIER INFO FOR FLEX ANALYSIS

| | | | |
|--------------|--|--------|--|
| SKIER HEIGHT | | WEIGHT | |
|--------------|--|--------|--|

NOTES

| | | | |
|------|---|---|--|
| DATE | / | / | |
|------|---|---|--|

