Nordic Ultra-Tune Update

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Spring Edition, 2004 ***Volume 6, Number 3***

New Shipping Prices & Spring Specials, etc.

Beginning as of now, *I am changing the price structure for return-shipping* of skis. Once again, FedEx has raised prices, but the new structure will not only help me to absorb this price increase, but also make the shipping of two or more pairs of skis cheaper for customers: from now on, return shipping on one pair will be $15.00, but subsequent pairs will be only $8.00; thus, while one pair will cost $1.50 more, two pairs will actually be $2.00 cheaper, three pairs will be $9.50 cheaper than was previously the case. I believe this will be more equitable for all.

Now is the time to "summerize" your skis, and to repair damage done over the racing season. Skis must be stored with a good coat of wax on them to protect the bases, and no matter how careful we have been, bases will have accumulated scratches, been partly sealed from dirt and repeated ironings, and will need attention before you put them away for the summer. *Have them ground now!* - and not only will they be ready to hit snow as soon as it flies next season, but they will also be protected for summer storage.

Spring Special:

As of March 15 all skis will receive ***free hotboxing*** with Swix base wax; this is not only an excellent base wax in itself, but being a bit harder as well as heavily dyed, it makes an excellent summer storage wax for superior base protection. Actual hotbox time will be increased to a minimum of 1 hour, not possible during early winter rush time. (Extended hotbox time will be available at an extra charge next season).

All repairs will be free of charge: I normally give skis a quick look-over for minor repairs, but this will include any major repairs that customers bring to my attention which may require extra time and gluing, filling, etc. Be sure to check your bindings to be certain they are firmly mounted; if not, we can fill and re-mount, or even plug screw holes and re-drill.

Orders of four pairs or more will be at the 15% Team Discount rate, through the end of June.

I will be on vacation March 25 – April 6; during that time skis may be shipped via the Papagaio Bar and Grill on St. Maarten. During this period, all complaints should be addressed to Peter Hale.

Nordic UltraTune will remain open until June 1, but we will be on Spring Schedule after April 1: that is, I will only grind when ten pairs have accumulated; customers will note that it is simply uneconomic to run the machinery for fewer pairs, though I am always will to do so in an emergency. We will close June 1, and re-open in the first week of September.

Grind "Prints" – Towards Finer Structure

Zach Caldwell has a new grind out, called the Z40, for new, cold snow. With thanks to Zach, UltraTune customers will be able to order this grind from me (starting in the fall) Z40 was extremely successful at National Championships this year, and seems to be working over a broad range of temperatures in snow that is starting to change (i.e.: lose some of its sharpness; for aggressive, sharp snow, I continue to recommend xc02). Cost will be $72.

Zach and I have spoken a lot about the new grinds, and I've had some very interesting discussions with Vesa Suomalainen, who has been experimenting with a very high-tech riller he bought in Finland. Vesa's machine does very fine work, but does not seem to create as fast a base as stone grinding. I believe now that the reason may lie with the width of the actual individual rill, or the "print" of the riller.

What we are starting to come to a consensus on, is that finer structure seems to be more effective than the coarser structures we have seen in the past, and perhaps have come to expect.

This idea goes back to when I was developing the "R" series grinds. The first versions had a much wider "print" (I use the word to describe the actual single "rill" or "scratch" – the single mark left in the base by the passage of the stone) by almost 100%. In case after case, I found that a narrower print was not only faster, but also, in cases of the coarsest grinds, quieter. In retrospect, it seems clear that if something was creating noise, the noise must have been caused by some kind of friction, and that the grind in question must have been slower.

What we are coming up with then, is that the finer grinds "leave the snow alone." Messing with the snow, so to speak, causes friction. Put another way, a structure which does not allow the snow crystal to penetrate into the print will not allow the snow to slow the ski. Hence, a narrower print will glide faster.

In the early 90's I was doing skis for the US and Slovene Ski Teams at Junior World Championships in Vuokatti, Finland. We had one of the wettest weeks I have ever seen, and at one point the fire department was actually pumping out the stadium. I tested structure after structure – this was before there was much stone grinding available, and found two things:

1) The cross-structures worked best of the rilled structures: by putting down a coarse rill with a finer rill over it, we were inadvertently creating a cross, or interrupted structure, where the two different-sized rills unavoidably crossed over eachother (it's impossible to make a riller go absolutely straight). In retrospect, I realize this was because interrupted structure – what you get with a stone grinder – breaks suction, while true linear structure simply passes water along, without breaking suction. (NB: true linear can sometimes be good as an over- or under-layer for interrupted structure. See below.)

2) But better still was structure created with the now-defunct Swix steel brush, fondly referred to as the "barbecue brush" and rumored to be excellent in hand-to-hand combat. The reason this structure worked so surprisingly well (I was certainly surprised) was that it created many fine, interrupted "prints" which not only broke suction because they were interrupted, but did it better because they were so many: lots of small prints all over, as opposed to bid, deep, wide ones spread out wider.

This seems to be another reason: with the finer "print" we are able to have more prints per square inch, or say 40 lines per centimeter with a fine print, as opposed to 20 or 30 with a coarser print. While the

actual print may be smaller, there will thus be more of them, which seems to move the water layer more efficiently – which is why the seemingly fine tail of the R2.3 and R3.3 grinds actually work so well: efficiency.

With this in mind, several avenues of experimentation open up. I'm not going to go into these in any detail here –this is a competitive field after all! – but by the end of the season, or sooner, we may well have some further refinements on the "R" series, I should have the Z40 available very soon,. perhaps by the time you receive this.

(Note: in really wet snow, try putting a medium rolled, or interrupted, rill into the base with the Jenex or the Toko rolling riller. Then go over this structure, in the last third of the ski, with a .75 rilling bar or Swix Super Riller. The interrupted structure will break suction, but create "lakes"; the liner over-lay will drain the "lakes". To fine tune this structure: put only a fine linear rill .5 mm, on the front ¼ of the ski, then the rolled structure down the full length, then the over-lay at the tail.)

More on Grinds

The following is a letter which Zach Caldwell wrote as a contribution to an inquiry about the methodology of developing new structures which I had answered and passed on to Zach. Thanks to Zach for letting me use it here; I have shortened it a bit to eliminate a few extraneous topics that were under discussion.

I think that there are uncountable (and unidentifiable) variables that stand in your way in trying to model the perfect grind. While Nat and I do most of our work empirically it's not for lack of a theoretical model, but for lack of the ability to control and eliminate variables in a real-world setting.

As you note, grinds vary with speed and temperature. On any given ski course a skier will encounter a wildly diverse range of speeds and snow conditions. In addition, we all know that ski selection is as large a part of the equation as grind selection. A great pair of skis doesn't do a skier much good if the grind on them is only good for one set of conditions at one speed range.

This is why the "Holy Grail" is to find structures that are as good as we can make them over as broad a range of conditions as possible.

If you've looked at grinds then you're aware that the structure that we impart is by all definitions Macro structure. You note that structure of a resolution less than the size of a molecule of water is not going to do much. Well, never fear. The structures that both Nat and I inherited from Sweden are on the order of 20-30 lines/cm at a depth of 0.02 to 0.04 mm – a good ways larger than the molecular scale. These structure were all developed based on matching the frequency, shape and depth of the structure to the snow crystal size and shape, and the moisture content of the snow pack. A good deal of the way they work has to do with their ability to "organize" the snow pack mechanically.

What Nat and I have been working on are structures that leave the snow pack alone and operate on the fluid layer at the ski/snow interface. Nat's R2.3 appears to do this on the wet end of the spectrum while my Z40 appears to do it on the dry end. So, we're getting quite a lot smaller in our scope, but still a long ways from the molecular level, and still very much what I would consider macrostructural in approach. I'm working on a method to apply a microstructural texture as an additional layer, but even that is on the order of 0.01-0.05mm.

As I've noted, in terms theoretical modeling, I think the number of variables is too great to control without reverting to empirical testing. Consider, for instance, the role that the pressure distribution of the ski and the

local pressure at the interface might play in the heat/fluid model. Or consider the resonant frequencies of a given ski and the effect those might have on the relationship between structure and speed. These are variables that I'm currently working on quantifying and controlling, and which I think may have a vastly much larger effect than structure alone on modeling ski speed.

The other thing you need to be aware of is the number of variables involved with actually grinding a ski. Assume that you're working with the best machinery available (as Nat and I are). You still have to understand that the range of structures you're able to make depends largely on the shape of the diamond and the quality of the grindstone that you're using. So simply designing a grind based on a theoretical model doesn't guarantee your ability to make it. So, when you say that once you figure out what a good grind is the problem is actually making it is understating the situation.

In point of fact, you can't determine what a good grind is unless you know the parameters of the machinery you're using. I would argue that a grind pattern doesn't exist in some theoretical sense. Some of the modern machines are driven by computers which are supposed to help the operator by showing them what certain machine settings will produce. Well, I'd contend that if the operator doesn't already know what the machine settings will produce they haven't achieved a sufficient understanding of the way the machinery works to be able to expect reproducible results.

I ought to mention that the same stone will sometimes produce measurably different structure on a different type of base material. There is another variable to consider.

To change tack somewhat abruptly - I'm not sure that I agree that the frictional elements of a grind have much to do with the local heat generation necessary to form a fluid layer in moisture deficit conditions. My understanding of the generation of heat at the interface is that it has to do with crystal penetration and shearing. This is based on some extensive conversations with ice engineers at the Thayer school of engineering who are working on developing electric skis. The model that those guys talk about rings truer to my experience than a model in which the mechanical frictional forces of the grind operating on the snow have anything to do with generating a fluid layer.

Nat and I have both played with using heavier, more aggressive structure on the tip of a ski in cold conditions to try to generate the heat necessary to for a sufficient fluid layer. Our results have been poor. Conceptually, the points of contact between the snow pack and the ski base in very dry conditions are so few and far between and the extent of the fluid layer that forms is so minimal (a few molecules at best) that I have an easier time accepting a crystal shear model.

This minor side-track on ski/snow interface theory brings me to another point - the identification of snow-type. Depending on the types of grinds you're working on, there are a whole lot of variable at play here as well. One of the things that bothers me the most is the lack of a good way to describe conditions. Temperature and humidity surely come up way short of painting a complete picture. As we work on developing structures that work efficiently at the interface rather than mechanically on the snow we can start to eliminate some variables. But the big one for me is the identification of the break point between dry friction and wet friction (suction). In fact, I consider there to be three states:

1. *Moisture Deficit*: too dry - need friction to create fluid at the interface
2. *Moisture Balance*: just right - no need to create additional fluid, but no need to clear it away either

3. *Moisture Surplus*: too much fluid - need to improve efficiency at the interface

From my point of view these break points are moving targets if you're going to base them on temperature and humidity. I feel that the best way to measure these factors would be to measure the way the snow pack acts under pressure - literally. An instrument that would measure the fluid layer and shear friction at a known PSI would surely help a great deal. But failing that, I don't know of a way to quantify snow conditions satisfactorily enough to predict a grind.

At US Nationals last year Nat and I worked together to test structures. Early in the week an XC03 was the best, followed by an LJ03 (same 22 line/cm frequency) followed by an XC02 and an LJ02. Mid-week it swapped. Conditions were the same as far as temperature and humidity were concerned. There was no new snow. It just changed.

Well, I hope I haven't been too discouraging. Ski tuning is my profession and there's nothing I'd rather discuss, except my brand new baby boy. If I'm telling you a lot of stuff you already know -well, no offense intended. I just wanted to warn you of some of the pitfalls I foresee in undertaking the project you've got on your plate. When I was in the conceptual stages of setting up my operation I envisioned coming up with the ability to model conditions and produce a grind recipe for a given day based on known variables (temperature, humidity, snow type on one side and grind characteristics on the other).

A short few years of experience have shown that to be sheer folly. The more testing I do, the more I understand the need for testing in order to determine what's going to work in a given set of conditions. I'm pretty comfortable asserting that there aren't any shortcuts.

Application of HelX

The following was sent to me by Ian Harvey, a former Olympian and now working for Toko. Thanks, Ian, for the update:

HelX is the fastest Toko glide wax. More can be learned about HelX at this link: http://www.tokous.com/Manuals/Helx%20Manual.pdf. Here are instructions on how to apply it:

Method 1
Best used when there is lots of time and a warm dry wax room.

1. Apply the base and HF wax layers of the day scraping and brushing between each layer.

2. Using the Dual Pad (which comes with the HelX), scrub the base with the yellow side which cleans the base on a microscopic level for the wax.

3. Liberally spray HelX on the base making sure that the entire base is completely wet.

4. Let the ski sit until the base is completely dry. This could take from 20-40 minutes depending on the room conditions.

5. Polish the HelX well with the white side of the dual pad.

Method 2
Best used when outside or in a hurry. This method requires more skill.

1. Apply the base and HF wax layers of the day scraping and brushing between each layer.

2. Using the Dual Pad (which comes with the HelX), scrub the base with the yellow side which prepares the base on a microscopic level for the wax.

3. Liberally spray HelX on the base making sure that the entire base is completely wet.

4. Using a roto cork at full rpms and corking “into” the ski base, cork the HelX until it is dry (and there is a waxy residue on the base).

5. Using a Nylon Polishing Brush, brush the HelX out of the structure of the base.

6. Polish the HelX well with the white side of the dual pad.

When done properly, either of these methods will yield the same result. The issue is how much time the waxer has and under what conditions the wax is being applied. If there is not enough time to allow the HelX to dry completely or if outdoors, then the best application method is using the rotocork.

A Word on Fluoros

I received the following letter from David Plamondon:

I am interested to know why some of them leave sparkling trails behind the iron while others don't. It also seems like certain fluoros tend to stick to the iron and some do not. Do different companies put additives in their fluoros? If so what could it be? I am also curious as to what makes a fluoro work better in cold/hot temperatures. I am guessing that it has to do with particle sizes though I am not sure. On a different note, wouldn't fluoros with a smaller particle size have better penetration inside the ski base and therefore last longer? Which leads to my final question: what size are the "holes" in the structure of a ski base. I am assuming that differs greatly depending on the material but a general idea is what I am looking for.

I can't tell you why some fluoros make a "light show" and others don't. I assume it relates to the actual chemical content, because what you are seeing is putting aerosols into the air. A few years ago, someone way up in the industry (was it at Swix? I just don't remember) told me that the sparkle means some of the chemicals are actually "leaving" the base, or that in other words, the heat is changing the content of the fluoro. With this in mind, we did a lot of research on corking in fluoros, rather than heating them. In every case, the corked fluoros were faster, especially when wet brushed - that is, brushed after spraying water on the base of the ski (which also limits aerosols due to brushing.) Part of the reason for this, I was told by someone who uses fluoros in industrial contexts, is that fluorocarbons align in a more uniform manner when applied in the presence of water or high humidity - some industrial applications are performed at close to 100% humidity, with this in mind. Another part, according to the head chemist at Star, is that corking stretches the fluorocarbon membrane, making it more even and regular.

I've done very little with "endurance" in corking. In longer races we iron very quickly - not much of a light show - then cork.

Different companies use very different fluoros, and put very different things into them, from some paraffin to graphite. A great deal of research is done, which is far beyond me, and as the various companies are highly competitive, it's a bit like toothpaste - each company claiming to have the best product. They're all good, and I think it's best to ignore the ads, and stick to one brand.

Fluoros work well for four reasons:

1) *They are tough*, so they out-last paraffins in long races and/or abrasive conditions.
2) As a sub-set of the above, *they reject dirt better than paraffin*, which absorbs it, so there is less wear, and less grit on the base of the ski (so less drag).
3) *They are highly "slippery"* and so form a dry-lubricated base.
4) *They are hydrophobic*. A waxed ski, like a waxed car, makes the water bead

up. Fluoros are even more this way, so the water "beads" up even more, into little balls (spray a fluoro'd base with a fine mist and you will see this in action) and a) the ski glides on little ball-bearings of water, and b) the water is thus also more easily dispersed, which results in less suction.

Thus, fluoros are at their best in warm snow which has more water in it, and at higher humidities. Some companies, such as Star, make cold weather fluoros, such as F3 (which can't be corked), which work well in cold, higher-humidity conditions (as well as resisting wear).

The particle size of fluoros is irrelevant, as the particles do not penetrate the base: you "smear" a membrane of fluoro onto the base (see below). For this reason, solid fluoros are possible. I prefer to use these, as there is lest waste and they are easier to put on evenly. Some feel that powders go on thicker, and may be better in longer races. I don't know.

Fluoros will only adhere to fluoros. They don't really penetrate the base - in fact, bases repel fluoros! This is why we use fluoroparaffins, which are a double-ended molecule, as a sub-layer under pure fluoros: the paraffin end of the molecule, being very similar to polyethylene, go into the base, leaving the fluoro end outside (think ostrich). To achieve good adhesion of pure fluoros, therefore, we put down a fluoroparaffin as a base, or anchor, *then* a pure fluoro.

The base doesn't really have "holes" or "pores". Bases are ground-up polyethylene which is pressed and heated into a sort of sponge. The wax penetrates the "amorphous" part of the base, as well as the "holes" between the polyethylene "hunks". It's a sort of chemical absorption, as well as "filling the pores". Think of a sponge, then ad in the water actually bonding to part of the material of the sponge, in addition to filling the holes, and you have a pretty good analogy.

I don't know how large the "holes" are, but they are varied and variable, depending on sintering, heat (melting), other materials present (graphite, dirt, etc.).

Letters

Mixing Waxes

I have read for years that mixing waxes from different companies can lead to disaster Any thoughts if this is true? Is putting a LF Swix on top of some old Toko or LF dominator really a big deal for gliders? Is there a safe fallback so when n I travel to various ski areas if I run out of Star, can I use a little Toko or other brands typically sold at the Nordic centers?

FYI, I had a good friend over who is an elite wave man at the Birkie checking out my skis, he was blown away how good they look where you have stone ground them.

Hope Nordic UltraTune continues to thrive!
- Dick Sadler

I try not to mix wax brands. I don't think it's necessarily bad. Certainly in Ski Team days, we'd use whatever wax was running, which meant skis had a pretty broad range of brands in them. And we had fast skis.

In theory though, the ingredient that makes Brand X so fast *may* cancel out, or even disagree with, the ingredient that makes Brand Y go. Even within some brands, there is sometimes a caution not to mix wax B with wax A; Star, for example, used to say not to mix Eclipse yellow with Eclipse red.

On the other hand, one of our Old Time really fast combos was Briko violet over Swix Speed Powder (red); in short races, it'd beat Cera - so I think the "Don't Mix" thing

is probably a good (small) precaution, but not necessarily a Big Deal.

More important, I think, is to stick to one good brand. The top brands, Star, Swix, Toko - spend a lot of time and money on research and development, and are highly competitive at the top level. If you hear that this team or that uses a certain brand, it may be true, but is more likely to be because they have a good relationship with that company, work with their R&D, etc. With all this in mind, I strongly believe that the best policy is to pick one brand, and stick with it. This way, you avid the risks - however small - of mixing - and far more important, you learn how to manipulate - pick, mix, apply - that brand. If you know a brand, you can generally get better results with it, even when some other brand may have a wax on the given day that is a fraction faster.

"Hair"

Part of my normal waxing procedure is to use a bronze brush, light "razor blade" scrape, and light Fibertex before each waxing. I learned this from Toko who suggest that rewaxing without this procedure will reheat micro fibers into the base and essentially seal it to a certain degree. My question is: what do you think of this process both in terms of its efficacy as well as how it might affect the longevity of your grinds. - Tim Inch

If the wax rep was speaking of microfibers caused through abrasion while skiing, it may be a good idea to eliminate them for the reasons you mention, but a good brushing with a bronze brush should take care of this, or with a Fibertex or Omniprep pad.

The skis that come out of the Tazzari do not have "hair". Hair is caused by factory grinding, which simply can't do as good or meticulous a job as a custom grind: I frequently re-dress my stone, grind cold (around 5 - 10 C), etc. Due to the sharp stone and cold/rigid base, there are no hairs. In spite of this, after grinding, all skis are chemically cleaned, then buffed with a special soft/fine steel roto brush (to the best of my knowledge these are not generally available), then waxed. So there is absolutely no need either to bronze brush or to razor scrape the bases, unless you want to "age" the grind - which can be good in certain older snows.

Aggressive scraping will shorten the life of the grind, by eliminating structure. After a ski has been ground, I do suggest putting on a layer of something very hard (I prefer one with some graphite/moly in it) and then scraping it with a *sharp* plastic scraper. If hair is present, this will "pop" it off, and it will at any rate harden up the base a bit, and make it more wear-resistant.

All you really need is a sharp plastic scraper and some brushes to get wax out of the bottom of the structure.

The information from the Toko rep is good, but it applies to factory grinds (and then not all the time - the factories are getting better and better), and it at least partially a result of "tradition": skis used to be very hairy after factory sanding/grinding.

In fact, you can race skis right off the Tazzari - at the Olympics, etc. we often grind the night before, wax the heck out of them and then test or go with them.

Scratches

I had my Rossi skate skis stone ground by you. Question- I got a little anxious and went out when conditions were not optimal. To my dismay I put a few scratches/gouges in my skis. They run length ways from tip to tail. I am not a elite level skier(at least not yet). Should I worry about the scratches or just wait until next stone grind? - Dan Truesdale

That's too bad! But in fact, linear scratches will make very little, if any, difference. I'd maybe go over them with Fibertex or Omniprep, and minimize the edges of the

scratches, but no more - no steel scraping. If there are any curls sticking up, get rid of those of course. -- I did skis at the Olympics that had scratches that'd make your head spin - still fast skis. Ditto some really old one's of Josh Thompson's that look as if they'd been used in the Battle of the Bulge, but are still very, very fast.

Don't fill scratches with P-tex: the patch will not absorb wax, and the heat from patching will seal some of the base around the patch.

Wish I could tell you to spend a lot of money re-grinding them...

Hotbox temperatures

Thanks for including me in your newsletter. I built a wax box for less than a $75. It works great! After reading your newsletter I have two question. I keep the box at 140 degrees when in use. However, several years ago Steve Poulin wrote a article in Master Skier stating the base material will not except wax until it reaches a temp of 220 degrees for several minutes. So why does 140 degrees work in the box?

Secondly, I've read Start green and blue waxes are plastic. Does this mean putting this type of wax in the box for several hours is a moot point, or is it better to shortly adhere it to the base and scrape warm?

- Douglas Diehl

Thanks for the note. I'm glad to hear you were able to build a box so cheaply - now you've got money left over for gold knobs, or something. Peter Hale (Madshus) suggests I add a tanning bed to mine...

I translated an article a few years ago from research done by the Norwegian Sports institute (alas, I had a computer melt-down, and lost it, or I'd send you a copy) which underlined what I've found by practical experience, and Zach Caldwell has shown as well: that wax is absorbed even at low heat, when it is not fully molten.

The Norwegian research showed that wax is absorbed by time / temperature. The lower the temp, the longer the time needed. Wax continues to be absorbed into the amorphous part of the base, at astonishingly low temperatures, because even though waxes seem hard - especially the cold ones - they are plastic, and do migrate, if the word can be used.

My personal experience was that even at circa 60 C (or perhaps a bit higher - I have lost the records) Rex Green was absorbed so well that after a week of skiing in very abrasive snow at -20˚ C, I was the only person on the team with almost no "white spots" on the base. Everyone else was re-waxing daily. I'd ironed it on, then left it over-night in the box, in a *non-molten* state. (Melting Rex green in the box would ruin the bases, and delaminate the skis.)

I spread the wax on with the iron, *never* over 130 C, and usually at 120, moving the iron *very* fast and over a *thick* layer of wax (rubbed on, then dripped on), then pop them in the box. That's all. I do not think there is any reason to think that skis need to be heated higher at the start. The Toko portable heat blanket is also at a very low temp.

I keep my hotbox at 155-157º C.

Picking a wax in rising temps & long races, antistatic, “all purpose” grinds

When choosing a glide wax for an important 50 km race, and when the anticipated temperature and snow conditions for the start of the race call for a harder wax than what will work better for the second half of the race as the air warms and the tracks get glazed, how do you choose which wax to use? Should I err on the side of the earlier colder conditions or on the side of the later softer conditions (assume for the sake of argument that exactly 1/2 of the race will be colder conditions and 1/2 softer conditions)? Is it better to wax too cold or too soft? Or am I obsessing over a silly detail and I should just accept that "when it

comes to glide wax close enough is usually fine."

Do antistatic wax layers, such as Swix graphite waxes, really "replenish" graphite bases?

Finally, I have a pair of skis that work great in it seems all conditions but I'm thinking about sending them to you for stone grinding after this current ski season is over as they are now into their third year and starting to show their age with some cosmetic nicks and scratches and some areas of the base, while not oxidized, seem to be loosing their initial glossy black luster (could this be due to loss of graphite from the base?). If I had to choose one grind for this "all purpose" ski do you feel that the LJ03 is the way to go? - Erik Baker

For longer races, go for the harder wax if you have to make this sort of choice. The softer wax will be slow at the start (comparatively), but more important, softer wax will both wear faster and pick up more dirt. If the harder wax is not optimum at the end of the race, you will at least normally have more of it left - harder being more abrasion resistant - and it will have picked up less dirt. At any rate, the difference between the right wax and almost the right wax is often very small, and modern waxes have very wide temp ranges - so by using the harder wax, you won't be far off, and it will last better.

As to graphite- and moly- based waxes, they do three main things: they renew the graphite/moly in the base, which does slowly leech out; they help the base to dump static build-up, which attracts dirt and hence increases wear; and they help form a self-lubricated base in case the wax wears off. They do work, often quite dramatically. As above, when picking which one to use, I tend to go to a harder wax, as the harder matrix carrying the moly or graphite will harden the base, making it more wear-resistant. The head chemist at Star told me that he advises anti-static waxing about every 4 or 5 waxings. I also recommend Toko Dibloc LF gray as a very good "all-purpose" base wax. (Patrick McGownd and I are working with Toko on some harder-matrix moly base wax; we'll keep you posted.)

The LJ03 is the best all-round grind I have. It will work acceptably as low as –15˚C, and it's easy to "wet up" with a riller or combination of rillers (see the note at the end of "Grind Prints," above)

Second-hand skis

I've been thinking! I've been happy with the work that you did on my skis. Everything looks good. What has been different this winter is the fact we have lots of nice fresh snow and the temps have been cold. Not the best conditions from the grinds that I had you put on the ski bases. No snow transformation yet!

I've been in some local races and have done average. Skies are keeping up with the group but nothing blazing yet. Again, no snow transformation. I think the answer is more skis, with more grinds.

Do you get skies that some folks want to get rid of and no longer need? One's that are still in fairly good shape and could be made great with a little friendly grind treatment.
- - Ken Kuehn

Well, you see where thinking gets you...

I have always maintained that the ski is several times more important than the grind or the wax - unless those are way off. I've seen super skis that are fast in almost ALL conditions, and some that wouldn't move if you dropped them out of an airplane. So I think you're right on target (the grinds have won enough races that I'm confident of them, though I do make a mistake once in a while).

The best way to get good skis, I think, is first, to stay with one brand. I know

Madshus well now, so I can say that I want such-and-such a flex, regardless of what the charts and what-not may say. Pick a brand, and stick with it. All the major brands make good skis, so I don't think there is much need to worry about exactly which ski you go with..

Next is to get skis that FIT - that fit both you and the conditions. Working with one brand and one shop or rep will help a lot with this.

So rather than toss the dice with a 2nd hand pair - unless you know it to be a good pair - I think you're better off getting a new pair somewhere that you know will pick good skis.

The best time to get new skis is in the fall - or even to order in advance. By this time of the year, the ski selection is way down, so you may end up with "any old ski".

So if I may offer some advice, it would be to wait until the season is over, then place an order with one of the names I mentioned above, or with a good shop where you know they do good work.

By the way, you can have new skis shipped directly to me for binding installation (you provide the bindings) and grinding.

Does this all make sense? I think you're on the right track with looking for a better ski.

Compliments

"The plan of the newspapers is good – if you can't get a compliment any other way, pay yourself one." – Mark Twain

Hi Nat,

I've been having great luck with the R2.3 grind you did for me this year. I think I've already raced on them 3 times. Yesterday at a local race, they were even fast in some pretty cold old snow.

Thanks again for your help!

Sarah Konrad

Nat what did you do to my skis!

PSIA clinic yesterday with Don Portman (I was in Robs group) I was on the brake's most for the time in the group ski's these dam skis are so fast I keep rear ending everyone or have to bail off the track into the soft snow to slow down! What can I do to make them go slower? - Mike Power

Just a quick note to thank you for the superb quality grind you did on my skis. I've been logging some k's on both pair, and it is scary (in a positive way) to see how well they run *outside* their optimal temperature/RH. Yikes! The problem is, I don't want to advertise you much, as most of the folks I ski with are my competitors!!

- Dave Carley

I got my ski's last night, raced on the pair that had the R2.3 Grind at Super Tour today at Soldier Hollow. The glide tests showed these ski's were superior to anything else I had, more importantly
I had college skiers, factory team guys passing me in the race as they are more than half my age, on the downhills I caught them and passed them back. The skis I was on are 6 years old and now very fast for the right conditions in this case transformed snow about 32F.

More skis to send no doubt!

Torbjorn, Gordon Lange & John Allberg wanted to look at my ski's after the race - Thanks! - David Knoop

Useful Websites

An extremely valuable website is to be found at http://www.xcskiworld.com/ - comment, sometimes controversial –which is good – and always interesting, plus a fund of workout ideas, information, resources….

Go have a look at J. D. Downing's *xcski world!*

Have a look at http://www.onthesnow.com/news/nordic/- Jonathan's Wiesel's excellent and informative website about matters nordic.

Jonathan Wiesel is a nordic guide, instructor, and ski area planner, who has written for over 120 magazines and newspapers on three continents. He wrote *Cross-Country Ski Vacations,* a guide to the great destinations of North America. He lives near Boulder, Colorado. For more info on Jonathan, click to JonathanWiesel.com.

Another interesting website was referred to me by Vesa Suomalianen. For good on-line instructional and race video, have a look at http://avari182.mt.luth.se/index.html

Just about the best place I've ever skied,, for track preparation, warm atmosphere and knowledgeable help in all areas: **Forbush Corner**: http://www.forbushcorner.com/

Some very interesting things are going on at: http://www.xcoregon.org/index.htm

Product information, waxing help, from **Toko** at: http://www.tokous.com/

One of the *great* ski shops (I never leave without spending a lot!), and the gateway to Washington's amazing Methow Valley, at **Winthrop Mountain Sports**: http://www.winthropmountainsports.com/

Leavenworth Mountain Sports: http://www.leavenworthmtnsports.com/

The Master Skier - http://www.masterskier.com/

I'm losing some messages owing to my SPAM filters. If I don't answer a message within 24 hours or so (during the season, and not counting weekends) try my alternate address. My two e-mail addresses are: natxcgrind@yahoo.com - that's where most correspondence should go. The other address is - this is mostly for this newsletter, and has the highest level of SPAM filtration.

Please pass this newsletter on to a friend! – It helps!