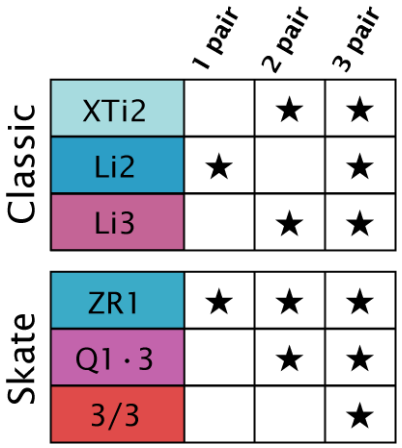
BOULDERNORDICSPORT Stone Grinding Menu 09-10

BNS Simple Grind Menu

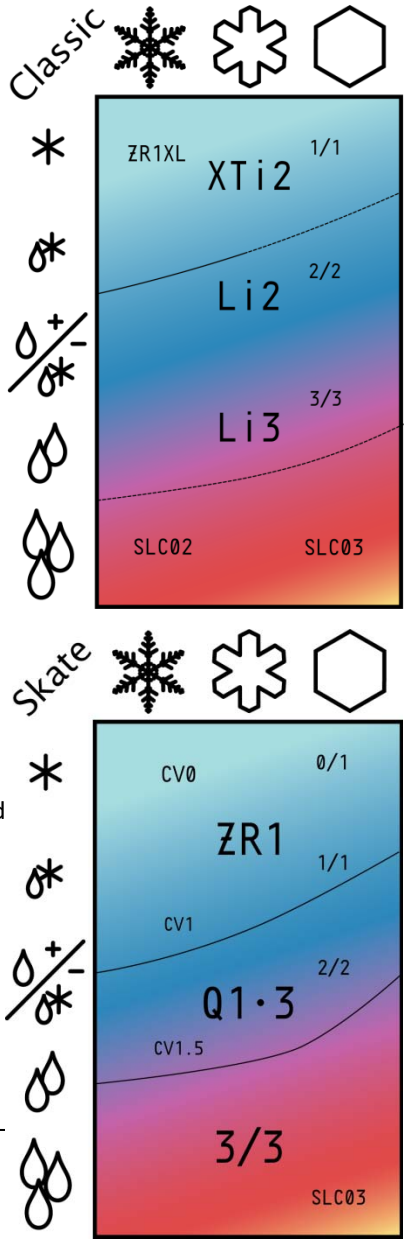


All grinds $75, except LL26 $60

K.I.S.S. stands for "Keep It Simple, Stupid" – a message we get often from our less geeky customers. In the spirit of KISS we recommend these core grinds as the starting point for everyone. These broad-range structures provide a solid foundation to handle every condition, whether you have one pair of skis or twenty.

Different regions experience different prevalent conditions. Skiers in the high Rockies will want to adjust toward the colder end of the menu, while skiers in the Northwest might consider heading toward the warmer end of the spectrum. We are always happy to consult with individuals or teams and can make recommendations to keep your life simple but ensure that you get the best of what we have to offer.

BNS Expanded Racing Menu



Give us an inch and we'll offer you 15 different structures. The reality is that snow conditions vary wildly, and we often need specific solutions to complement our broad-range core grinds. The grind development process is ongoing and we make it our business to keep you up to date. We list what's new on this page and then continue with a structure primer (pp. 2-4) and our detailed full grind menu in the following pages (pp. 5-9).

All grinds $75, except LL26 $60.

New for 2009-2010

Li2 & Li3 – Our standby classic linear structures, LJ02 and LJ03, were given to us by Lars Svensson along with our first Tazzari machine in 2002. Over time we've tinkered with these grinds, but we have always come back to these simple linear structures. In the past two years as part of the Olympic testing project we have done extensive testing with the production parameters on these structures and have developed a superior surface texture. These structures are an evolutionary step from the LJ grinds. But these are, well, better.

XTi2 – XTi2 is like our old XC02 but with bands of structure removed, providing "bridges" to keep the structure above the surface of the snowpack. More flat base material and superior aeration means better cold snow performance.

0/1, 1/1, 2/2 & 3/3 – This line of structures has been adapted from US Ski Team World Cup structures to be more applicable to North American conditions. These are multi-pass compound structures with a relatively shallow but faceted texture. In North America these grinds particularly shine in **older crystals** or **manmade snow**.

CV Series – Our new "Callaghan Valley" series grinds have been developed as part of the Olympic project in response to the uniquely challenging **new snow** conditions that we regularly face in North America. Compared to Europe our snow demands finer grinds and smoother textures. The CV series saw plenty of racing action on the Nor Am circuit and the Eastern Collegiate circuit last season with excellent results. While the CV0 is less established than the ZR1 we're confident that it will assume a central role as a go-to cold structure.

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Structure Primer

There are many, many factors governing the design and choice of structures. While the only way to be sure you've got things right is to test on snow, a good understanding of contributing factors can help you make informed choices. Additionally, an understanding of our working vocabulary and development concepts can equip you to provide better feedback to us as we improve our offerings.

Frictional Considerations

Structure design is an exercise is balancing strategies for dealing with two different types of friction.

Mechanical Friction – The result of the physical interface between the base and the snowpack. In general finer and smoother grinds produce less mechanical friction.

Adhesion/Cohesion – Commonly referred to as "suction" (a misnomer), the result of moisture trapped between two very smooth surfaces is best demonstrated by putting a drop of water between two sheets of glass. In general, heavier structures produce less "suction". Adhesion is caused by electrochemical bonds be

Snow Characteristics

Snow crystals come in a bewildering array of shapes and configurations. Snow crystal formation is largely dependent on temperature. Specific locations and typical weather system may produce "typical" but unique local snowfall. As soon as snow is formed it begins to transform. Transformation is aided by mechanical work (wind, grooming, etc) and by temperature change. The more transformed snow becomes the more similar it becomes to other transformed snow. "New" snow (snow that hasn't undergone extensive transformation) carries many of the characteristics of its original crystal formation, and given the unbelievable array of different types of snow crystals it's easy to understand why new snow can present such a unique set of challenges to structure design.

New Snow – While snow crystals can have varying degrees of sharpness at formation, in general new snow is quite sharp with fine points. New crystals typically have a lot of potential for change and transformation. This means that they can absorb a lot of energy without releasing moisture. Typically new snow requires finer and smoother grinds as well as harder waxes.

Old Snow – Snow that has been on the ground for while, groomed a number of times, beaten by wind and exposed to solar energy, will undergo transformation. Even without going through a freeze-thaw cycle these crystals will be duller and more prone to releasing moisture than new snow. Old snow can often get "greasy", even in quite cold conditions. In general old snow requires more aggressive structure.

Transformed Snow – Fully transformed snow tends to become more granular than crystalline. The individual grains will be duller and less capable of absorbing energy or excess moisture. Heavier structures and softer waxes are required.

Regional Considerations

In general North American snow is quite different from European snow. We tend to require milder and finer structures than what runs well throughout most of Europe. This is why the factory grinds on most race skis, which have been developed for broad-range application in Europe, are generally too aggressive for racing application in North America.

Leaving aside the general differences between North American and Europe, we see significant regional differences throughout North America. We have significant regional expertise in several areas of the continent, but depend on the feedback of our customer base for much of our information. We always welcome the feedback and criticism of

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our customers as improved regional understanding gives us the tools to develop better regional solutions and provide better recommendations.

Eastern US
New England is renowned for its variable conditions. The boundary between moist, warm maritime air and cold continental air tends to follow the path of the jetstream which whips back and forth over the Eastern seaboard. Occasionally a big slug of arctic air will drop in from Canada and bring true cold. Broad-range grinds are required, and a good understanding of hand-structure tools is a big help. Most of our grind menu was originally developed in New England and is well suited to the conditions in that region.

Upper Midwest, Ottawa Valley, Quebec
This entire region is characterized by extreme cold and relatively dry continental air. The prevalent snow-producing system is the Alberta Clipper – a cyclonic system that spawns where the jetstream bends south over interior BC or Alberta, and then heads East across the plains. Alberta Clippers don't have a lot of moisture to work with and squeeze out available moisture at very cold temps, meaning that snow crystals form at very low temps. Additionally, the cyclonic action of a clipper system will almost always draw a mass of polar air down behind it, resulting in windy and extremely dry and cold conditions. All of this combines to create some of the sharpest, driest and slowest snow anywhere. Colder structures are required. QR0 and QR1 were designed for this range of conditions. Throughout this region snowfall can be quite light, and skiers are often skiing on the same cold snowpack for weeks at a time. As the snow ages it tolerates and requires more structure.
The other more localized phenomenon in this region is the possibility of lake-effect snow which can provide frequent and plentiful snowfall under certain wind conditions until the lakes freeze over.

Rocky Mountains
Topographic complexity means a lot of micro-climates and the potential for very locally specific conditions. In general snow forms due to orographic lifting and is on the dry and powdery side. Dry air combined with high levels of solar energy encourage sublimation of the snowpack, meaning that the crystalline structure of the snowpack is slower to transform than in other areas. In warmer periods the potential for very low dew-points can mean cold overnight temperatures and extensive recrystallization of transformed snow. In general the Rockies demand new-snow grinds targeting a colder range than one would expect in a similar temperature found at lower elevation. The Canadian Rockies are in this category, and tend toward colder temperatures because of their latitude.

Western Interior
Large parts of interior BC and the Western Plains don't have the high altitude specifics of the Rockies or the extremely dry snow of the Upper Midwest or the Ottawa Valley. These areas can be quite cold and have relatively little snowfall leading to a scenario similar to the Midwest where the same snow gets regroomed and skied many times. They tend to respond similarly to the cold end of the range of Eastern conditions.

Northwest & BC Coast Range
The Northwest is characterized by extremely plentiful snowfall and very high moisture. Local conditions exist, for sure, but in general the challenge is one of balancing the very high moisture and relatively warm temperatures with the frequent occurrence of new and falling snow. The new crystals demand light structure, but the rapid transformation and potential for warm temperatures demand good moisture management capacity. The CV series grinds were developed in this environment at the 2010 Olympic Venue and are well suited to handling the new snow of the Northwest.

Sierra
Similar to the Northwest in terms of the potential for huge snowfall, but less prone to getting caught in a conveyor-belt of constant moisture delivery. The Sierra can have a massive snowpack that is quite well refrigerated from below. Daytime warmth hastens transformation more quickly than in the Rockies, and we generally find that

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warmer grinds do well. Q1.3 or 3/3 for skate skis and LJ03 for classic will get used a lot. The problem is that new snow will require finer grinds. A really good place to have two or more pairs of skis!

Alaska
Anchorage and coastal Alaska provide more similar conditions to Europe than any other region of North America. Even in colder conditions this snow requires larger and more aggressive structures. Z20 and the Universal Compound series (0/1, 1/1, 2/2, 3/3) are very well suited to this environment. Interior Alaska is more similar to Western interior regions.

Technique-Specific Structure Demands

Classic Skis – Classic ski glide performance is all about straight-ahead speed. The snow in a classic track is almost always somewhat glazed, and therefore more prone to developing "suction" and less prone to developing mechanical friction. On classic skis we can focus more heavily on managing adhesion/cohesion and allow for somewhat more mechanical friction. Therefore, structures can be quite aggressive and directional steering of the ski with heavy linear structures is not an issue.

Skate Skis – In skating the skis leave the snow in motion – in fact at near peak velocity. As a result, the release of the structure from the snowpack is critical to the success of a grind on skate skis. Skate grinds tend to be finer and smoother than classic grinds. Because the ski doesn't follow a track an overly-aggressive linear structure can "steer" the ski in an incredibly annoying way.

Grind Characteristics and Parameters

The number and variety of structures that can be made is, in practical terms, unlimited. In order to understand the design and function of structures it's important to understand the parameters that we're working with. The working variables on the grinder are less important than the results we end up with on the base surface.

Depth – On the ski grind depth generally falls in a range of 0.01mm to 0.06mm. Deeper grinds are more aggressive.

Frequency - On any cut of the stone the frequency is the spacing of the lines that are cut. Line frequencies run from about 7 lines/cm to about 40 lines/cm, resulting in line spacing between about 1.4mm and 0.25mm. Depending on the grind, line frequency generally needs to be tuned to crystal size and shape for optimal results.

Pattern - Each time the stone is cut, the diamond traverses the stone while the stone spins, resulting in a thread pattern being cut into the stone. Multiple thread patterns cut into the same stone will create interference patterns that are often clearly visible on the ski. Pattern is one of the easiest elements of structure to see. As a working variable grind pattern can be confounding – sometimes testing shows that big differences in interference pattern make no meaningful difference on the snow, while other times very minor frequency ratio variations make extremely large differences. The rule with patterns is that what works, works, and it can be surprising what works. Anybody who proposes hard and fast rules on what patterns are good and what patterns are bad hasn't spent enough time with skis on the snow.

Texture – This is the most difficult element of structure to define, the most difficult to control, the most difficult to reproduce and the most difficult to understand. It's also the most important, by far. Patterns are defined by interruptions, but those interruptions have shape and character that can vary widely. Texture is the three-dimensional reality of what ends up on the base, and it's possible to take the same cut on the same stone and make vastly different textures on the ski by varying drive speed and pressure. Compound or layered structures, built of multiple passes over the stone, create additional layers of subtlety. Depth and frequency can be measured with a surface roughness measuring machine. Patterns can be defined mathematically. But texture is created by hand and eye and is where art meets science in the development and reproduction of grinds.

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Full Grind Menu

This is a nearly-comprehensive list of the structures that we currently make on customers skis. In the past year we tested 75 different structures on snow, and that number does not include most of the grinds on this list which were developed and tested earlier. Most of what goes on snow is just a step toward something better, and the development process is quite time consuming. This list reflects the grinds that have emerged from that process. There are far too many grinds on this list and there is far too much overlap for this list to be considered one menu. This begs the question; why bother with the list?

While many of our customers want to have simple choices, others want to have more complete information. Everybody should understand that there is no single structure answer (if we're going to speak honestly) for a given range of conditions. In the past we have tried to provide a large set of options that was simple enough to be accessible to everybody. This year we're trying a different approach – a truly simplified simple menu, a more comprehensive menu for a larger fleet of skis, and this full listing of our current working grinds for the real nerds out there. Enjoy.

Our core/expanded menu grinds are labeled with the logo.

L-Series

Very broad range- excellent for classic skis.

Our L-series grinds are, for the most part, basic linear structures. This means that they are cut using a single pass of the diamond over the stone, resulting in a thread pattern that gets imparted to the ski. All basic linear structures actually cross the ski at somewhat of an angle. Using the numeric-controlled capability of the Tazzari machines we have testing true-linear structures that run truly parallel with the axis of the ski, but we have never found these true linear structures to work as well as a basic thread pattern, except as underlayers in our Z-series grinds. We have concluded that the somewhat diagonal nature of the thread pattern is an important structural element.

We have made some changes to our basic L-series grinds for this season. These are primarily textural changes – adjustments made both in the way we dress the stone and the way we apply the structure to the ski. These changes grew out of our first year of testing at the Callaghan Valley during which we focused on basic structural elements such as frequency and depth. It was during this testing that we came to a more complete understand of the importance of texture in grind performance, and our new linear structures reflect our learning in that area.

LL26 – Universal recreational grind

For optimal performance there is no such thing as a truly universal grind. LL26 is a pretty good shot at a universal structure, and it will occasionally even win a structure test. On the whole it is a relatively shallow grind with fine-snow frequency but texture better suited to wetter snow. It's almost always in the game, and is a good choice if "good enough" is good enough.

XTi2 – Fine crystals, -5C to -25C

Updated version of XC02 with bands of flat base to hold the structure out of the snowpack. Dedicated cold-snow classic skis.

Li2 – Fine Crystals, 0C to -15C

The updated version of our standby LJ02. Universal grind for classic hardwax skis.

Li3 – Coarse Crystals, +2C to -12C

The updated version of our standby LJ03. Universal grind for classic klister skis. Also works well in higher moisture new snow.

Li4 – Refrozen Granular Snow, +3C to -10C

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A very open-frequency linear structure with excellent performance on classic skis in refrozen transformed snow. A really good choice if you happen to have a dedicated cold universal klister ski. Will run well into springtime thawing conditions.

L25 – Wet Snow, +3C to -8C
The L25 has a very different texture from the Li series, and is best in higher moisture conditions. It's a bit like a wetter version of the LL26.

Z-Series

Layered grinds designed for light feel and easy release on skate skis.

The Z40 was the first proprietary grind that Zach designed – introduced at US Nationals in Rumford 2003. It swept the podium in the US Nationals men's sprint in 2004, thanks to its adoption by the US Ski Team. Since then the Z-series grinds have been the most popular grinds in our menu.

The concept behind the series is that a light true-linear underlayer can provide some aeration and a release from the glaze-induced "suction" that occurs with too little structure on a snowpack inclined toward glazing to a solid surface. While this underlayer causes very little additional mechanical friction it can provide added moisture management capability to a very light and efficient crossing structure.

ZR1 – Fine Snow, -2C to -22C
ZR1 is the second generation "go-to" cold grind, introduced in the 2005/2006 season. Nathan did some of the most extensive early testing of this grind in cold Colorado snow prior to the 2006 US Nationals. Over time ZR1 has proven to have a remarkable range, running from near freezing to extreme cold. It has its best performances in snow with a tendency to glaze. Particularly at the cold end of the range it like some moisture.

ZR1XL – Fine Snow, +1C to -10C
The "XL" has a heavier true linear channel, and there are more of them, providing additional moisture management capacity. This structure often gets used as a "universal" cold skate grind, but is at its best as a cold new snow classic grind.

ZR2 – Fine Granular Snow, +1C to -5C
The ZR2 uses the XL channels and the same pattern in the crossing structure as the ZR1, but at twice the depth. The added depth makes it a much more aggressive grind. This structure has its fans, but the range is too narrow to be as useful as we hoped when we created it. Like the ZR1XL it is at its best on classic skis, and can be a real asset in glazed tracks.

Z40 – Old Fine-Grained Snow, 0C to -20C
The original "Z" grind. This one was introduced at US Nationals in 2003 and named by US Ski Team service technicians to differentiate it from the "R" grinds that they had made in Sweden. Z40 was soundly beaten by ZR1 as a universal cold new snow grind, but it still has its days in older cold snow. By comparison, the crossing structure on a Z40 is finer and deeper than a ZR1.

Z40XL – Old Fine Grained Snow, +1C to -10C
The "XL" channels were created at the request of Chris Hall, who also provided the name for the new, higher-moisture grind. Z40XL continues to show up by request in most of our batches.

Z20 – Anchorage Cold, 0C to -15C
The Z20 is very similar to standby European cold structures, and works really badly in most of North America. The major exception is Anchorage, which this grind tends to run well. It has its days in Canmore as well.

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Q- Series

Layered grind targeting higher moisture than the Z-series grinds.

The success of the Z-series grinds in the colder temperatures encouraged us to pursue the same concept of a heavier moisture management layer covered by a lighter grind for enhanced release and "feel" for a warmer range of conditions. It took two years of testing to get a wide enough range out of the concept to be useful, but the result has been worthwhile.

Q0•3 – Cold Conditions, -3C to -20C

The coldest version of the Q-series, this grind competes very well with ZR1 as a universal cold structure. It's very difficult to reproduce with good consistency, and so we don't push it too hard.

Q1•3 – Wide Range of Snow Types, +2C to -10C

The Q1.3 is the most refined of the Q grinds, and offers perhaps the widest range of any of our structures. Tolerant of a wide range of snow types and temperatures. The addition of a 2.0mm rill will allow this grind to handle full slush.

Q1 – Transformed High Moisture Snow, +2C to -4C

Nathan raced the first Q1 to 6th place in the US National 30K Championship in 2006. It wasn't the race that he was looking for, but after finishing he informed Zach that he would be keeping those skis. While it has its moments, the Q1 tends to engage the crystals a little too aggressively, while failing to manage moisture aggressively enough to be truly useful. But the story about the skis at 2006 Nationals makes it worth listing here. It was another year before Q1.3 solved the issues with Q1.

Q3 – Wet Snow, +degrees

Q3 was designed to handle those Spring days that start with several inches of new snow with the sun shining and the temperature poised to skyrocket. It does pretty well at that. But in true slush it loses out to SLC03

Q3•1 – Saturated Falling Snow, +degrees

By selectively de-tuning the underlayer of the Q3 we were able to make it significantly faster in new crystals. In the kind of snow that turns to ice-water within seconds of sticking to your jacket this grind is great. It's also very expensive to make. $135.

QR – Series

Extreme Cold

We developed the QR series grinds by special request for the Ottawa Valley. Most of the testing of these structures has been done by Wayne Johannson of Gatineau Nordique Sport in Chelsea, QC. These grinds combine the pattern elements of the Q series with the textural approach of the ZR1 (but the grinds have no channels). Wayne produces a lot of these grinds on his RP-23 machine for customers in the Ottawa Valley.

QR0 – Cold, Sharp Snow, -10C to -30C

Cold. Really Cold. Squeaky Cold. Colder than you think.

QR1 – Cold Snow, -8C to -20C

The QR0 will beat this in the very coldest conditions. QR1 lives somewhere between QR0 and ZR1 on the spectrum, and is the most common choice for a single pair of skis in the Ottawa region. A good choice in the coldest regions of the upper Midwest.

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SLC- Series

Compound grinds for old, transformed or manmade snow
Compound structures are created when two or more cuts on the stone are combined to create a new pattern. They are different from layered grinds in that layered grinds are passed through the grinder multiple times each with a different structure. Layered grinds retain most of their independent characteristics at different depths on the ski. Compound structures generally leave very little flat or unmodified base material, and are quite faceted and textural. The texture of a compound grind can vary depending on the component grinds and their application, but it's generally best suited to managing moisture and rounded crystals.

SLC02 – Transformed Fine or Manmade Snow, +2C to -5C
The SLC02 was a name selected by Nat Brown for a grind introduced to both of us by Lars Svensson at the 2002 Salt Lake City Olympics. This grind was used very successfully by the German team during the second week of the games.

SLC03 – Transformed Saturated Corn Snow, +10C to -2C
The SLCO3 was never used during the 2002 Olympics – it didn't get warm enough. But it is the scaled-up version of the SLC02, and has been a standby winner for corn snow conditions. It continues to win tests in saturated transformed snow, and remains among the grinds on the Olympic menu for the Callaghan Valley.

SLC03.1 – Transformed Corn Snow, +10C to -9C
This modification of the SLC03 was created by selectively detuning the SLC03 to make it more tolerant of sharp refrozen granular snow during a freeze-thaw cycle where warm temperatures are assured later in the day. It is also made symmetrically on the ski to eliminate the "steering" effect that some heavy grinds can have in sharp refrozen snow. The additional steps make it a more expensive grind to produce. $90.

Universal Compound Grinds

All conditions aside from new snow
These grinds are a modification of structures used extensively by the US Ski Team on the World Cup. They have been adjusted to make them more applicable to North American conditions. These grinds are much milder and more tolerant of sharp crystals than the SLC-series grinds.

0/1 – Very Fine Old Snow, -5C to -25C
An extremely fine compound structure suited to dull but aggressive crystals and manmade snow.

1/1 – Fine Old Snow, -1C to -15C
Requires higher moisture or duller crystals than the 0/1. Excellent universal cold grind for old snow and manmade snow. Definitely not a new-snow grind in North America.

2/2 – Transformed Cold Snow, 0C to -10C
This grind is best in crystals that have been through a full transformation. Very broad range.

3/3 – Wet Snow, +3C to -3C
This is probably our most successful universal wet snow grind, and is our current favorite for hairies conditions. It has remarkable tolerance for high moisture new snow and is also excellent in slush.

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CV – Series **Grinds developed to handle very sharp new snow crystals**

"CV" stands for Callaghan Valley. These grinds were developed for the constant new snow at the 2010 Olympic venue where it's common to ski on snow that has only been through one grooming cycle, and is often enough coming out of the air while you ski. These grinds have been remarkably successful in a broad range, and have surprised in their versatility. We expect one or two of these will become very popular core structures in our menu.

CV0 – New and Fine Grained Snow, -1C to -20C
CV0 saw a lot of snow-time last year, and won a lot of tests. It showed excellent promise throughout the early season in Nor Am competition, and continued to test well all year in new snow conditions at the Callaghan Valley.

CV1 – High Moisture New Snow, +1C to -10C
Considering how close the CV1 is to the CV0 it's remarkable how different it is on snow. This grind is fairly specialized on skate skis. A good all-around new snow choice on classic skis.

CV1.5 – Plus/Minus New Snow, +3C to -2C
A fairly specialized grind which handles high moisture in very sharp new crystals quite well. During development we anticipated that this grind would have a colder range than it does. Some of our most reliable testers have reported success with this grind in a relatively limited range of plus/minus conditions around the continent.

CV1.5+ - Plus/Minus Fine Grained Snow, +3C to -2C
The addition of a textural layer adds a little air to the interface on this grind, making it more versatile than the CV1.5 in snow that has been through a few days of freeze/thaw. More testing required of this grind to nail-down its range outside of the Callaghan Valley.

C – Series **Old snow grinds**

These grinds have a very open diamond-shaped crossing structure to reduce surface area contact with the snow and increase aeration. They have tested well but have a limited range, especially in colder snow.

C44 – Old Cold Snow, -4C to -20C
The first of the C-series grinds, C44 has had tremendous success in any cold snow that had been windblown, groomed a bunch, skied a bunch, or just generally worked over. It has a very similar range to the 0/1 structure, but is harder to make well.

C40 – Fine Manmade Snow and Glazing Snow, 0C to -15C
C40 has done extremely well on manmade snow in Canmore. Similar range to 1/1. We've also made it with channels for classic skis – making a C40Z.

C25 – Wet Snow, +4C to -5C
We've never pushed the C25, but it has had some of our most encouraging competition results. We're still testing a couple of versions of this grind, but expect to see it stick around and take a more central position as a wet grind with a particularly broad range of application on classic skis. A version of this grind will most likely displace the L25 altogether as it simply works better most of the time.

C22 – Saturated Wet Snow, +8C to -2C
This is the first structure we have tested that has beat SLC03 when SLC03 was good. We'll be testing it further and floating it out on select competition skis in the meantime.

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