

Training Zones

Definition

Training zones refer to the intensity at which an athlete is training. Generally, for cross-country skiers, heart rates are used to set intensity. The U.S. Ski Team and most teams around the world use five zones which are numbered from one to five.

Naming Training Zones

It is generally convenient to give names to the training zones that describe what training is happening.

Zone 1 – *Easy Aerobic Endurance* – Long slow distance and easy recovery training.

Zone 2 – *Aerobic Endurance* – These are easy medium distance training sessions.

Zone 3 – *Speed Endurance* – These are medium natural intervals and fartlek training.

Zone 4 – *Threshold or Race Intensity* – The middle of this zone will be your lactate threshold. This is the interval training, time trials and races.

Zone 5 – *Anaerobic or Maximum* – This is used very sparingly and will not be used for training as a junior, and is usually reserved for peaking.

Setting Up Training Zones

Using lab tests

The best method to use for setting up training zones is to participate in a progressive intensity laboratory test using a protocol involving both the arms and legs. Such methods could be a treadmill test.

Using racing heart rate

If the right equipment is used, this can be a very effective method for setting up training zones. Athlete should wear a memory heart rate monitor during a race or time trial lasting 30-60 minutes. Your average heart rate should be very close to your lactate threshold. You can then set up your zones by using the chart below.

Max. Heart Rate	Zone 5
Ave. Race HR + 5	Zone 4
Ave. Race HR	Zone 4
Ave. Race HR – 5	Zone 4
Ave. Race HR – 20	Zone 3
Ave. Race HR – 40	Zone 1&2

Using perceived exertion

This method is probably the easiest and most often used method. Athletes need to learn to stay within training zones based on their perceived exertion. Simply follow the chart below.

Zone 1 – Very Easy	Can sing while training
Zone 2 – Easy to Mod.	Can talk easily while training
Zone 3 – Moderate	Can think clearly, limited talking
Zone 4 – Racing	Can only focus on task at hand
Zone 5 – Maximum	Maximum effort, hurting

Using these zones will generally provide all of the feedback that is necessary for an athlete to guide his/her training. It is important, however, that the perceived exertion is not harder than it should be.

Using maximum heart rate

If your maximum heart rate is known from doing a maximum test, or (you can take 220 minus your age) you can set up the approximate heart rate zones.

Zone 1 – 60% to 75% of max heart rate
Zone 2 – 70% to 85% of max heart rate
Zone 3 – 85% to 90% of max heart rate
Zone 4 – 90% to 95% of max heart rate
Zone 5 – 95% to 100% of max heart rate

Defining Your Training Zones

If possible, based on the above ideas, fill in your training zones here. Note they will vary some for different activities. The rule is to listen to your body and use common sense in your training. A heart monitor is only a tool.

Zone 1 _____ - _____

Zone 2 _____ - _____

Zone 3 _____ - _____

Zone 4 _____ - _____

Zone 5 _____ - _____

Training Levels 1-2

These training sessions are carried out at moderate training intensities: heart rates usually range between 120-170 beats per minute depending on the individual's maximum heart rate, age, level of fitness and altitude. The main goal of this type of training is to build up a larger stroke volume and to improve local capacities like oxidative enzymes and capillaries.

Definition

- The most common training intensity. Over half of the total training hours are in this area.
- % of max. heart rate:
 - Level 1: 60-70%
 - Level 2: 75-85%
- Blood lactate level:
 - Level 1: 2mmol
 - Level 2: 2-3mmol
- Speed: slow enough that you can talk as you train
- Modes of training: either ski specific or non-specific
- Energy systems:
 - Fat 50%
 - Glycogen 50%

Effects

- Increases the stroke volume because of the work with max stroke volume
- Increases aerobic capacities which allow you to work aerobically at higher intensities
- Increases the number of oxidative enzymes
- Increases capacities to use fat in aerobic energy production and enable the glycogen to last longer.
- Stimulates slow twitch muscle fibers
- Moves the aerobic threshold closer to VO₂ max so training can be done at higher heart rates
- Increases the area and number of mitochondria
- Increases blood volume and hemoglobin
- Increase capillaries and myoglobin
- Provides recovery from more intensive sessions
- Improves base endurance
- Gives you stronger ligaments, muscles, and skeletal systems

Training at Level 1-2

Distance work with low intensity: 60-85% of maximum heart rate

Normal session:

- Under 16 years – 45min to 1.5 hours
- Over 16 years – 1.5 hours to 2.5 hours

Over-distance:

- Under 16 years – 1.5 hours to 3 hours
- Over 16 years – 2.5 ours to 4 hours

Training Level 3 Threshold

Definition

- % of max heart rate: 85-95%
- Blood lactate: 3-6 mmol
- Training modes are preferably on skis or foot using large muscle groups
- Energy systems:
 - Fat 0%
 - Glycogen 100%

Effects

Mainly on the central system: lung and heart capacity

- Increases the heart's working capacity
- Increases ventilation capacity
- Increases the capacity of the blood to transport oxygen to the working muscles

Limits

- Heart volume + stroke volume + heart rate
- Lung volume
- Mobility of the muscles that are involved in breathing
- Blood volume and iron storage

Local effects

- Increase competition-specific speed endurance. That means you can ski faster in the area between aerobic and anaerobic energy production.
- Increases the muscle's capacity to use oxygen: the aerobic combustion capacity
- Increases the number of capillaries and also the size and number of the mitochondria
- Increases oxidative enzyme activity providing a higher and better combustion of fat
- The anaerobic threshold is moved meaning the capacity to eliminate lactate is increased
- Stimulates the growth of all types of muscle fibers
- Increases the muscle's ability to withstand, eliminate, and transport lactate

Training at Level 3

- Shorter distance work or interval sessions
- 85-95% of max heart rate
- Workout specifics:
 - Under 16 yrs.: 30 min. to 1 hr. that includes 10 to 25 minutes of level 3 work.
 - Over 16 yrs.: 45 min. to 1.5 hrs. that includes 20 – 40 minutes of level 3 work.
- Children can train level 3 by participating in many different sports or activities where they use big muscle groups, but as a junior or senior you should use more ski-specific activities.

Training Level 4

Definition

- % of max heart rate: 95%-100%
- Blood lactate: 6 mmol

Negative Effects

What happens to the body's systems during anaerobic work?

- The muscles' pH goes down, so the production of lactate is more than the body can eliminate
- Oxygen resources are reduced
- Negative effect on the enzyme system that is important for oxygen transport to the muscles

Positive Effects

- Improves the body's ability to work with high lactate levels
- Increases the speed of the lactate production
- Improves mental preparation for racing (coping with pain)
- Increases the body's ability to eliminate lactate

The capacity to produce as much energy as possible, as fast as possible, from the system depends on three factors:

1. Glycogen stores in the muscle
2. Increased ability to transport lactate from the working muscle fiber. This depends on the quality and number of enzymes
3. Capacity to use enzymes activators, which speeds up the enzyme's activity.

Training in Level 4

- Interval sessions and competitions
- 95-100% of maximum heart rate
- Intervals that reflect an athlete's race-pace, and often exceed that pace
- Short accelerations that is much faster than an athlete's race-pace.

Endurance, Strength and Periodization

Let's look at the endurance and strength, and how each are accomplished through the course of a training year. If we keep in mind the goal of each period, and how we accomplish those goals, endurance and strength can be simple issues.

Period 1 (Basic Endurance 1) Early May – Middle of July

Goals: To develop endurance and general strength

This period should be designed around basic endurance activities (specific or non-specific to skiing) that allow the athlete to incorporate activities they enjoy doing. Keep in mind that we will be doing more specific training in the following periods, so it is important that this period of training is not only mentally refreshing, but also good for building general strength. Approximately 70-80% of training volume throughout the course of a yearly training cycle is endurance training in zones 1 and 2. In this period we are going to establish the foundation for endurance and strength for the rest of the training period. We are trying to build a broad base for the pyramid.

Endurance activities

Activities include: running, hiking, canoeing, kayaking, biking, swimming, or any activity that can be sustained over time.

Duration of the activity is based upon the time of the year and the individual's training volume. Endurance activities are comprised of distance and over-distance sessions. A distance session for a particular junior athlete might only be 45 minutes long in the early summer. By the end of the summer, that same distance session could grow to 1-1.5 hours. That individual may start the summer with an over distance session of 2 hours and end of the summer with a similar session of 3-4 hours.

Strength activities

All cross-country skiers need to have a well-rounded base for strength. Each athlete needs to assess their strengths and weakness when it comes to strength training.

General strength

General strength for cross-country skiers is not about building "beach muscles." General strength might best be defined as the foundation or base for all strength. It is comprised of all non-specific activities and strength exercises. We generally think of strength as the body builder in the gym. Remember that we are endurance athletes, and we have to carry around any unnecessary muscle mass for long periods of time.

Activities for building general strength

Activities include: running, hiking, biking, swimming, pull-ups, push-ups, sit-ups, dips, leg squats, lunges, jumps, chopping wood, framing a house, mowing the lawn, washing windows, painting, pouring concrete, back-ups. I'm sure you get the picture.

The majority of the training sessions during this period are endurance activities. All of the endurance activities have a built in general strength component.

Period 2 (Basic Endurance 2) Mid July – Mid September

Goals: Continuation of endurance building, general strength maintenance, and building specific strength

This is a continuation of Period 1 with the incorporation of more ski-specific activities.

Endurance activities

Continue running, hiking, some biking, roller-skiing, and ski-imitation

Strength activities

Circuits designed around ski-specific motions and muscles that are utilized in skiing, ski-imitation, bounding, roller-board, etc.

Specific strength

Specific strength refers to the building of muscles that are critical for cross-country ski racing. It is important to remember that these muscles can not be effectively strengthened until the muscles of the core are built up.

Activities for building specific strength

Upper-body specific strength is built by double poling and single poling on skis and roller-skis, roller board, and or double pole machines/bungees. Ski walking and bounding, spenst, and ski-imitation exercises along with plyometrics build lower body specific strength.

3 sessions per week: 1 general strength session, and 2 specific strength sessions. The remainder of the sessions are distance and/or over-distance.

Period 3 (Pre-competition period) Mid September – Early November

Goals: Maintain endurance, building specific strength while maintaining general strength and some interval work.

During this period we will be dropping slightly in volume, compared to the Basic Endurance 2 training block and concentrating on ski-specific workouts. The focus is on specific strength, endurance strength, interval sessions, while maintaining endurance and general strength. In this period, use short technique repetitions (sprints) on both classic and skate roller-skis. These sprints should be maximum effort, but the skier needs to be in control of his/her movements. The goal of these sprints is to develop speed and power. Whenever this many ski-specific sessions are added together, it is critical that we have plenty of recovery. For example, an athlete should not double pole on roller-skis for 2 hours in the morning and then conduct an upper-body circuit session that afternoon, or even the next day. This creates too much upper-body fatigue without adequate time for the muscles to rebuild themselves. It is a good rule to spread out the intensity sessions with distance or recovery session in between.

Period 3.5 (Pre-competition period 2) Early November – Early December

Goals: Rebuild base endurance while making the transition on to snow.

Get on snow early in November, this period is designed to help make the transition on to snow easier, while building some endurance back into the system. Most of all the sessions are distance and over-distance on skis while maintaining specific and general strength.

Period 4 (Competition Period) Early December – Early April

Goals: Competition

As athletes you are in a full racing schedule. The training is built around racing. By this time of the season you should be involved in a program where you are supervised by a coach each and every day. The coach will work your training around the important races and train through the less important races.

Training Volumes for Cross Country Skiers

Long term planning yearly training plans should be based upon a systematic long-term plan for each athlete. For junior athletes, the initial development of a long-term plan is an important step in charting the athletes' development. An athlete must train systematically for 5-8 years to reach his or her potential. This does not necessarily mean overly hard training, but that the training volumes, intensity, and skill development are appropriate for each athlete's age. In order to reach an athletic peak at 20-25 years old, it is necessary to start systematic training at 14-16 years of age. At certain ages or periods of each individual physical and mental development different physiological systems, physical capacities and neuromuscular skills are optimally developed. Young athletes are characterized by vastly different rates of development in growth, physical maturity and neuromuscular skills. These variations become smaller with age, but training must be adjusted to fit each individual and their current state of development.

The hours listed below give an approximate guideline for each age group.

Training Hours

Age	USSA Class	Years/Training	Hours Men	Hours Women
13	JIII		275	250
14	JIII		300	250
15	JII	1	350	300
16	JII	2	400	350
17	JI	3	450	400
18	JI	4	500	450
19	OJ	5	550	500
20	OJ	6	625	550
21	Senior	7	700	600
22	Senior	8	750	650
23	Senior	9	750-900	650-750
24	Senior	10	750-900	650-750