

Warm-Up Structure in Competitive Snow Sports

The structure of warm-up in competitive snow sports is guided by a single overarching goal: **achieving readiness**. This requires a dynamic, multi-faceted approach that integrates physical and mental components and adapts to the unique contextual factors of the sport.

Warm-Up Structure and Routine

Warm-up activities are organised into routines, which are considered key to compliance and consistency. Elite athletes and support staff describe following a **reliable warm-up routine, typically lasting 15–30 minutes** immediately before the performance.

Timing and Location

A structured warm-up right before the runs on the slope, combined with two to three warm-up runs on snow, are the most important measures for achieving readiness. The warm-up unfolds across two distinct settings.

- Off-Snow**
 - The structured routine should ideally be performed indoors (e.g., a mountain lodge or sheltered area) where athletes can wear training shoes. Ski boots hinder proper activation of the feet, ankles, and knees.
 - This phase encompasses perfusion, sport-specific mobility, neuromuscular activation, and post-activation potentiation (PAP).
- On-Snow**
 - Active warm-up activities on snow should be simple and require minimal additional equipment.
 - The warm-up runs on the slope serve as sport-specific activities to progress skill level and intensity, adapt to snow conditions and equipment, and mentally prepare for competition.
 - These runs are an efficient way to bridge off-snow preparation and on-snow performance readiness.

- Transition** • Long transition times after warm-up should be avoided.
- Time** • The time between the structured off-snow warm-up and the on-snow warm-up runs should be kept as short as possible to prevent the loss of readiness.

Dynamic Adaptation and Flexibility

Warm-up must be flexible and dynamically adapted. Snow sports involve unique challenges such as cold weather, variable conditions, and interrupted schedules that **demand a context-sensitive approach**.

Individualisation

At the elite level, warm-up routines are highly individualised based on the athlete's injury history, weaknesses, preferences, psychological disposition, and what they need to reach readiness. Support staff, including physiotherapists, strength and conditioning coaches, and sport psychologists, provide input to compose and refine these individual routines.

Task and Environment Adaptation

Warm-up must be adapted based on factors such as course setup, environmental conditions (wind, cold, snow quality), competition schedule, and waiting times. No two competition days are identical, and the warm-up should reflect that.

Re-Warm-Up

Athletes repeat warm-up (or parts of it) after waiting times, especially during competitions with multiple runs. After a training or competition interruption of more than 15 minutes, another warm-up may be indicated. Re-warm-up is particularly necessary after long transition times such as lift rides to ensure readiness is restored. Support staff often assist by carrying coats or blankets for passive re-warm-up during waiting periods.

The overall implementation process is a **continuous cycle**: warm-up strategies should be reflected upon and refined over time to optimise their personal effectiveness. This iterative approach, particularly the emphasis on the RAMP structure and the dual focus on physical and mental preparation, ensures athletes meet the demands of competitive snow sports.

The Crucial Role of Passive Warm-Up and Environment

Given the cold environment of snow sports, physical readiness requires external measures to be maintained once achieved.

Maintaining Temperature

Muscle temperature is a critical factor for musculoskeletal readiness, as increased muscle temperature is needed for power production. In cold conditions, temperature can drop rapidly after active warm-up, making maintenance not just beneficial, but necessary.

Passive Strategies

Additional passive warm-up strategies, such as overcoats, blankets, or heated garments, should be used to keep key muscles warm after active warm-up, especially **during cold temperatures and transition or waiting times**. Long lift rides, for instance, signal a clear need for passive strategies and re-warm-up upon arrival.

Off-Snow Location

The structured warm-up should ideally be performed off-snow in training shoes, as ski boots hinder proper activation of **the feet, ankles, and knees**. This logistical consideration has a direct impact on the quality of activation and mobility exercises.

Ultimately, the goal of this structured approach is to ensure that all physical and mental systems are activated, allowing the athlete to **exploit their potential to 100%** and reduce the risk of injury. In this sense, warm-up is best viewed as a mini training session, one that not only prepares for the immediate demands of competition but also develops long-term athletic qualities such as strength, agility, and balance.