



SKI & SNOWBOARD

SkillsQuest - Fitness



INTRODUCTION	3
Composite Score	5
LOGISTICS AND TEST ADMINISTRATION	6
Athlete Group Size and Flow	7
Equipment and Space	8
Equipment List:	8
Facility Considerations	8
TEST PROTOCOLS	11
Anthropometry – (Stretch-stature Height and Weight)	12
SkillsQuest-Fitness Warm-Up	13
Australian Institute of Sport 20m Shuttle-Run	14
Standing Long Jump and Standing Triple Jump	16
Standing Long Jump Protocol	16
Standing Triple Jump Protocol	17
20m Sprint	19
Strict Tempo Pull-Up	20
Strict Tempo Single Leg Squat – '15 in 15'	22
Strict Tempo 90 Degree Push-Up	24
60s Repeated Jumps	26
60s Repeated Lateral Box Jumps	26
60s Repeated Lateral Hurdle Jumps	27
REFERENCES AND RECORDING	30
References	31
AIS 20m Shuttle Conversion Chart and Printable Group Score Sheets	32
SCORING DETAILS	35
CONTACT INFORMATION	36

INTRODUCTION

The development of general physical fitness is a necessary component for elite ski and snowboard athletes. Establishment of efficient fundamental movement patterns, coordination in a variety of situations and positions, and developing general strength, power, and endurance are critical neuromuscular and physiological qualities. These capacities will contribute directly to long-term sporting success. Specifically, an athlete’s fitness level will either support or inhibit technical skill development by greatly influencing their ability to tolerate the training volumes required across different phases of development. The assessment and quantification of these qualities by using **SkillsQuest-Fitness (SQ-F)** can help to identify potential performance deficits, as well as track long-term performance trends. As U.S. Ski & Snowboard collects data and builds normative trends for each gender, sport, and phase of development, SQ-F will help to identify target areas for later development and success as elite athletes.

The U.S. Ski & Snowboard Athletic Development System (ADS) focuses on the appropriate application of stage-specific variables through the developmental stages.



The early focus in an athlete’s career should be on building the fundamental qualities and skills that will be necessary for higher levels of ski and snowboard competition. Without adequate levels of general fitness and fundamental skills, later “sport-specialized” or “high-performance” training will be limited in effect, and there will be a limited foundation for progressing to any advanced training strategies.

SQ-F will provide useful information about the current status of the athlete across the multiple physical domains of the athletic development system.

Growth and Maturation	Coordination	Speed	Strength	Endurance	Flexibility	Nutrition, Hydration, Recovery
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SkillsQuest-Fitness Test	Physical Fitness Component(s) Assessed
Anthropometry	Growth and Maturation, Age at Peak Height Velocity
20m Shuttle Run	Aerobic Endurance, Coordination
Standing Long Jump	Lower Body Strength, Power, and Coordination
Standing Triple Jump	Lower Body Strength, Power, and Coordination
20m Sprint	Speed, Coordination, Strength
Strict Tempo Pull Ups	Upper Body Strength, Endurance, and Coordination
Strict Tempo Single Leg Squats - '15 in 15'	Lower Body Strength, Coordination, Endurance, and Mobility
Strict Tempo 90 Degree Push Ups	Upper Body Strength, Endurance, and Coordination
60s Repeated Jumps	Anaerobic Endurance, Speed, Strength, and Coordination

A coach can use the data gathered from each test in SQ-F to more accurately determine an athlete's "starting point" in the developmental and physical fitness stages and track subsequent progress through re-evaluation. This will allow the construction of an appropriate training program that serves the needs of the athlete, in the context of their sport or event and in a manner that is appropriate for the athlete's capabilities.

The effective administration of each test is detailed within this manual. A coach or administrator should consider the following when administering each test, which are provided in this manual:

- Rationale
- Equipment needed (calibration and maintenance required for accuracy)
- Methodology and protocols
- Preparation (warm-up)
- Scoring and recording
- Recovery time

Through the consistent administration of the tests and the consideration of their components, both validity and reliability of SQ-F will be improved. Effective and appropriate test administration and recording is crucial for reporting accurate data that will benefit both athletes and coaches. Keep in mind that all data should be regarded with individual relevance for the athlete to whom it belongs, i.e. age, gender, and sport.

When implemented and interpreted correctly, SQ-F will be an important assessment of the overall process of athlete development. By identifying an athlete's existing abilities in the following tests, the appropriate foundations can be built upon. This will promote greater effectiveness of the sport-specific and high-performance strategies to come, which will subsequently support and enhance performance throughout the athlete's career.

Composite Score

From a practical standpoint, the information provided by the eight SQ-F tests individually will be the primary drivers of any specific training program intervention or physical performance target. Looking at a test result in isolation will provide valuable information on an athlete's current fitness status in that specific "capacity", which can lead to a more informed training prescription from coaches. However, U.S. Ski & Snowboard understands the value in providing the illustration of an athlete's "Overall Fitness" level, and the power of a universal or "Composite" fitness score. This composite score encompasses all the components of fitness measured in SQ-F and is a representation of the athlete's overall level of athletic output.

U.S. Ski & Snowboard has developed a composite scoring system where each "absolute" test score will render a specific points total. The points total for each individual test will then be combined together to provide an Overall Score (similar to Track and Field - Decathlon).

Because not all fitness components are of equal importance to skiing and snowboarding, U.S. Ski & Snowboard has developed a weighting system that maximizes the points scored in fitness tests that are more important to skiing and snowboarding performance and training needs, and minimizes the points scored in fitness tests that are likely to be less relevant to skiing and snowboarding specifically, but have important relevance to overall fitness. Every test will contribute to the overall points total.

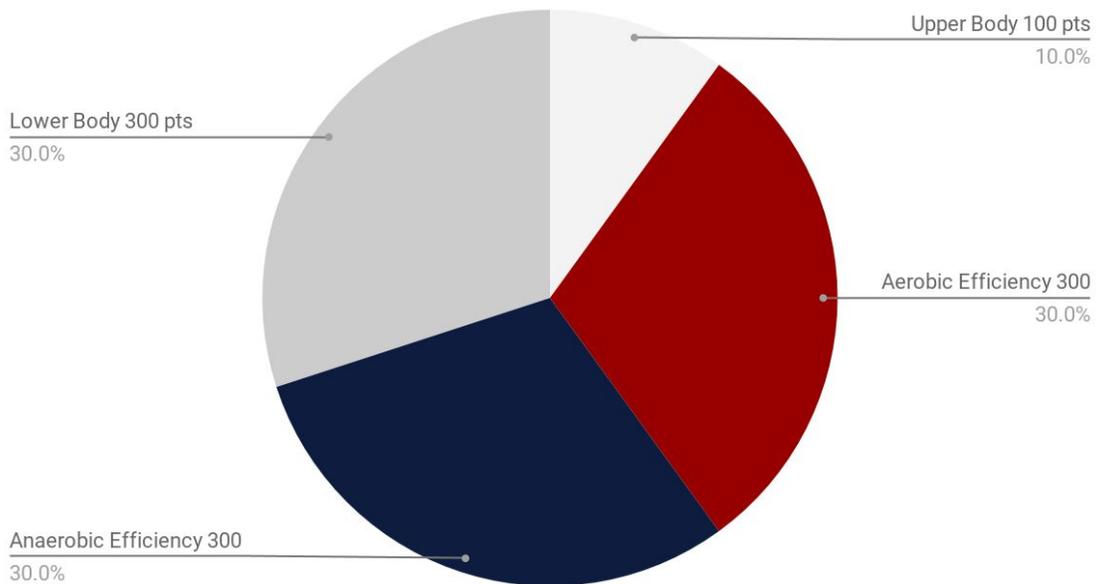
The following scoring system is used for all athletes (both male and female, regardless of age):

SkillsQuest-Fitness Test	Points**	Max SQ-F Score**
20m Shuttle Run	300 Points / 30%	Level 15.4 / 65ml.kg.min*
Standing Long Jump	100 Points / 10 %	330cm
Standing Triple Jump	100 Points / 10%	990cm
20m Sprint	50 Points / 5%	2.8s
Strict Tempo Pull Up***	50 Points / 5 %	20
Strict Tempo Single Leg Squats (R & L)	25 Points / 2.5% (per leg)	15
Strict Tempo 90 Degree Push Up	50 Points / 5 %	50
60s Repeated Jumps***	300 Points / 30%	90
Total	1000 Points / 100%	

*Ski & Snowboard adjusts the Est. VO₂max established from the 20m Shuttle Run test up by 3.15% for each 500m above sea level that the test takes place (Wehrli & Hallén, 2006). No other tests are adjusted for altitude).

[**Score to Points Conversions](#)

***Bar Hang and Hurdle Jump tests are for younger athletes and are not included as part of the scoring system.

Points Total by Percentage (total = 1000 points)**Score Weighting**

(Chart above – Points total by percentage)

LOGISTICS AND TEST ADMINISTRATION

The SkillsQuest-Fitness test battery is designed to be implemented from start to finish in its entirety. National Team testing, as well as any nationally “validated” testing, will be run in this way to ensure consistency and standardization. This will help to promote the collection of valid data, systematic analyses of the data, as well as accurate tracking of performance improvement.

The use of proper equipment, protocols, planning and set-up are critical components to running successful SkillsQuest-Fitness testing projects. The setting of athlete group size, organization of space, number of support staff/coaches involved, and timing and scheduling of large groups of athletes for effective management and scoring are all critical considerations that should accompany the planning process.

The ideal logistical preparation will allow for a 1:1 ratio of “scorer” to “athlete being scored.” This becomes more challenging with multi-athlete tests such as the 20m Shuttle run, where multiple athletes are completing the test at the same time and will require careful planning. But in general, if two athletes are participating in the test at one time, there should be two scorers, or one for each athlete. The goal is to avoid one scorer having to observe more than one athlete at a time, leading to ineffective scoring and evaluation. In a group setting (with more athletes per group than testers), athletes should rotate through test performance sequentially, allowing the tester to score each athlete individually. For example, a group of ten athletes and only one tester will require more time than a group of ten athletes with two testers at each testing station, as two athletes can perform the tests at a time.

The exception to this rule is the 20m Shuttle test, in which all athletes of a group can, and should, perform the shuttle at the same time, with multiple testers/scorers available for assessment (see examples in the “Equipment and Space” section.) The 20m Shuttle can be thought of as the “rate-limiting step” or “funnel” for

multiple athlete group testing – as it will be the longest test performed, including the recovery time. More will be explained about this in the test protocols section.

Athlete Group Size and Flow

Athlete group size should be kept manageable within the constraints of staff, space, and time. The ideal group size will depend on the above factors, but in general, within U.S. Ski & Snowboard we maintain an athlete group size of less than or equal to 10 athletes per group to ensure scoring accuracy and group management.

It is common that multiple groups of athletes will need to be accommodated for large scale testing. Proper organization of space, timing, and staff allocation/station judging is critical to ensuring valid scoring in tests. It is recommended that staggered group starts be used, with each station being scored by an adequate number of coaches to athletes performing the test. Below you will find an example layout of testing flow and staffing requirements for running multiple groups of athletes through the tests.

SkillsQuest-Fitness Testing Example Structure and Flow Layout (5 groups)						
<i>Test</i>	**Personnel Req. (#)	<i>*Timing- start and test times</i>				
		Group 1	Group 2	Group 3	Group 4	Group 5
Height & Weight	1	8:50	9:10	9:20	9:40	10:00
Warm Up	1	9:00	9:20	9:40	10:00	10:20
20m Shuttle Test	4+	9:15	9:35	9:55	10:15	10:35
Standing Long Jump	1	9:45	10:05	10:25	10:45	11:05
Standing Triple Jump	1 <i>can be same staff</i>	9:55	10:15	10:35	10:55	11:15
20m Sprint	1	10:00	10:20	10:40	11:00	11:20
Strict Pull Ups	1 : 1 <i>(athlete : tester)</i>	10:15	10:35	10:55	11:15	11:35
SL Squat	1 : 1	10:25	10:45	11:05	11:25	11:45
90 Degree Push Up	1 : 1	10:35	10:55	11:15	11:35	11:55
60 sec Box Jump	1 : 1	10:45	11:05	11:25	11:45	12:05
Totals	12+ (rec. 16)	115 min	115 min	115 min	115 min	115 min
Total Session Time		3 hrs, 15 min				
*Time needed will depend highly on Staff and athlete number						
**Personnel requirements will be affected by number of athletes testing at the same time at the 1 : 1 stations						
Ideally 8-10 athletes are tested per group, unless greater staff numbers are available for support						

(Image above – sample logistic layout of SkillsQuest-Fitness Testing schedule)

Equipment and Space

The SQ-F battery will require some fundamental equipment to ensure that the tests are run appropriately. It is imperative that each test be administered according to the directions (laid out in the Test Protocols section) and utilizes the listed equipment for valid data and accurate evaluation and scoring (for example – using a

laser timer instead of a stopwatch for the 20m sprint test). Failure to use proper equipment will lead to a disqualification of any scores submitted.

Equipment List

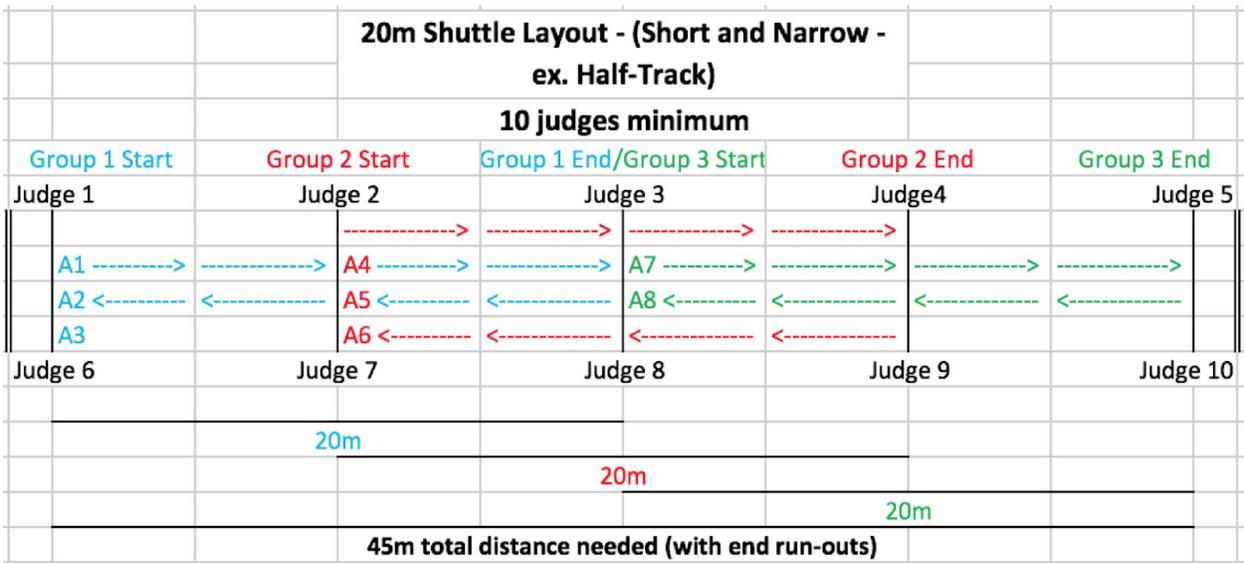
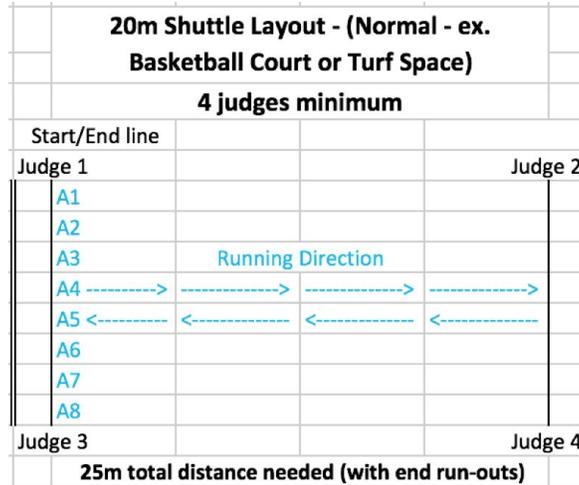
- Scale and stadiometer (or measuring tape affixed to wall)
- Flat, non-slip/stick surface for running tests, recommended **minimum** 30m long, 30m wide
- Stack of cones (minimum 10)
- Metric tape measure at least 20m in length
- Laser/Beam Timing system with stands
- Stopwatch
- U.S. Ski & Snowboard Push Up audio file
- U.S. Ski & Snowboard 20m Shuttle Run Test audio file
- Audio device (iPhone, Tablet, Computer)
- Up to three (3) Portable (or) In-built speaker systems to play audio files
- 1 (or more) Pull-up bar
- 1 (or more) pair(s) of 6x18 inch hurdles (6 inches high, 18 inches wide) (15x45 cm)
- At least one (1) stable box, surface, or platform 60cm high (or higher)
- At least one (1) solid/hard (wood) Box 40cm (height) x 40cm (width) x 40-50cm (length) and one (1) 30cm x 40cm x 40-50cm (see box dimensions in '60s Repeated Jumps' section)

Facility Considerations

When administering the tests, an effort should be made to access a facility that provides adequate space for not only test performance, but entry/registration, circulation and transition of athletes and test administrators, test flow, and flexible/adjustable logistics. Planning should account for easy access and maneuverability of testing equipment (such as boxes, timing gates, and pull up bars), travel pathways, and allow for multiple athletes to perform tests at the same time in a safe environment.

The most space intensive tests are the running tests (the 20m Shuttle Beep Test and 20m Sprint Tests). It is recommended that an area of at least 25m x 25m (length x width) is available for the 20m Shuttle Beep Test to test multiple athletes, and at least 30m x 6m (length x width) for the 20m Sprint. An indoor basketball gym or turf training area is an ideal example of adequate space that can be managed for both tests. Below are a few illustrations of different layouts for the 20m shuttle run depending on the size and shape of the space available.

Example Shuttle Run Layouts with 8 Athletes





TEST PROTOCOLS



Anthropometry – (Stretch-stature Height and Weight)

Rationale for Inclusion:

To monitor the timing and duration of important growth and maturation events that may influence training abilities (such as Peak Height Velocity and Age at Peak Height Velocity).

Equipment:

- Stadiometer (or a metric tape measure securely affixed to wall and a ruler, in a pinch)
- Digital Scale

Calibration:

Follow the scale and stadiometer manufacturer's calibration protocols prior to use.

Methodology:

Measurements should be taken in the morning prior to activity, before food ingestion, and after voiding.

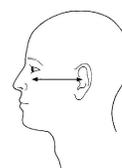
**If possible, collect biological parent height for each athlete (mother and father). This can be used to estimate age at peak height velocity and early, on-time, or late development trends.*

Height:

- **(If using a tape)** - Measuring tape is secured with the "0 cm" mark anchored to the floor and then fastened securely to the wall, perpendicular to the floor (straight up and down), with the measurement values in **ascending order**.
- The athlete is instructed to remove shoes and stand with their back to the wall with the feet together.
- Heels, glutes, and upper back should be in contact with the wall or back of the stadiometer.
- Head should remain in a neutral position, [Frankfort Plane](#) (6), with the bottom of the orbital socket aligned with the top of the ear canal opening.
- A ruler or flat object is placed level on top of the athlete's head, aligned with the corresponding mark on the measuring tape.
- "Stretch-stature" height is measured when the athlete stretches the top of their head upwards, without the heels leaving the ground, to measure maximal standing height.
- Record height to the nearest millimeter (e.g. 164.5 cm).

Weight:

- Digital scale is **zeroed** and calibrated following the manufacturer's guidelines.
- The athlete removes shoes, phone/accessories and any heavy clothing (shorts and t-shirt are preferred) before stepping on the scale.
- Record weight to the nearest tenth of a kilogram (e.g. 65.5 kg).



(Images above - height collection with both a stadiometer or tape and ruler; Below - Frankfurt Plane).

SkillsQuest-Fitness Warm-Up

Rationale for Inclusion:

To ensure consistency across the preparation of all athletes participating in SkillsQuest-Fitness, enhance subsequent test performances, and limit the risk of injury to athletes performing the tests. *Note: the warm-up included in this manual is simply an option. Coaches may use their own warm-up in place of that provided in this manual.*

Equipment:

- Flat surface, (i.e. ground, turf, court, or other flooring) recommended minimum 30m long, width of the area is determined by how many athletes are warming up at the same time. Use the same surface for testing if possible.
- Ensure the athlete is wearing appropriate, clean testing footwear (athletic shoes).
- Adequate cones to mark off warm-up area.
- Stopwatch or timing device.

Methodology:

- Begin with a **general warm-up**, **gradually ramping** into more **dynamic movements** and higher speeds. Athletes should be **prepared to sprint, jump, cut**, and perform **upper body** activity by the end of the warm-up.
- **1.) General Warm-up:**
 - 5 minutes of low intensity active movement; walking, riding, rowing or other low-impact exercise
- **2.) Preparation Trunk Circuit:**
 - 30s Plank on forearms – isometric Hold
 - 30s Lateral plank – isometric Hold – each side
 - 30s Hip bridge - isometric Hold
- **3.) Dynamic Flexibility/Mobility:**
 - Deep forward lunge stretch – 4 each leg
 - Hand walk/inch worm – 4 reps
 - Lateral lunge stretch – 4 each leg
 - Crossover lunge stretch – 4 each leg
 - Standing leg cradle – 4 each leg
 - Bear crawl forward and backward – 10m each
 - Body weight deep squat – hands behind head – 8 reps
 - Plank with shoulder tap – 8 reps each arm
- **4.) Movement Preparation:**
 - High knees march to run – forward – 10m
 - High knees march to run – backward – 10m
 - Lateral shuffle – high – 10m each way
 - Lateral shuffle – low – 10m each way
 - Carioca – 10m each way
 - Forward Skip Series – 10m
 - Backward Skip Series – 10m
 - Lateral Skip Series – 10m each way
 - Forward power skip for height – 20m

Australian Institute of Sport 20m Shuttle-Run

Rationale for Inclusion:

Measurement of aerobic capacity (13).

Equipment:

- Flat, even surface (i.e. turf, court, or other flooring), recommended minimum 30m long, surface width is determined by how many athletes are running at the same time.
- U.S. Ski & Snowboard 20m Shuttle Run [audio file](#).
- Smartphone or other device to play audio file.
- Speakers (loud enough to hear the audio for the full length of the test in the space being used).
- Cones, marker chalk, or tape to clearly mark the turning points.
- Tape measure 20m or longer to determine the turning points.

Calibration/Maintenance:

Follow the calibration instructions prior to every test and modify the running distance according to the table provided.

Test should be conducted on the same surface (flat) and in the same environment consistently (ideally in a climate controlled area) to ensure accurate comparisons between testing sessions.

20m Shuttle Protocol:

- Follow the audio directions for the correct protocol.
- Mark out two lines, 20m apart on a flat surface – preferably an indoor court or turf surface.
- Check that the athlete has good footwear and that the surface/footwear is not excessively slick.
- The test starts on the first beep. The athlete runs along the 20m space and gets to the **opposite line in time with the beep**, and **waits for the following beep** (if necessary). The athlete then turns and runs back, getting back to the **first line in time with the next beep**.
- The beeps get closer together as the test progresses, requiring the athlete to run faster each stage. The test is a maximal test and the athlete is encouraged to run in time with the beeps for as long as possible.
- The athlete **must touch or cross the threshold of the line** marking the 20m distance.
- When the athlete **falls behind the beep**, or they do **not touch or cross the 20m threshold**, a verbal **warning is given**. If they **do not make it back before the subsequent beep**, the athlete is asked to stop and their score is recorded. The score recorded will be the **last level that the athlete successfully achieved in time with the beep**.
- The athlete may miss the beep multiple times as long as they cross the opposite line on the next beep. **Missing two consecutive beeps ends the test**.
- It is important that the **athlete run in time with the beep and do not run ahead of it**. Running ahead of the beep gives the athlete extra time to make the subsequent beep, and can cause additional fatigue.

Specific Warm-up:

- Athlete should use the first 5-10 shuttles of the first level to gain familiarity with the procedure and timing of the MP3 audio.
- Lenience can be allowed during the first level to allow athletes to practice.

Scoring:

- Record the level **last completed** by the athlete and convert to a VO₂. If the athlete misses two consecutive beeps before exiting the test, be careful to record the **last completed** level.
 - For example (athlete makes beep at 11.3; misses 11.4; misses 11.5 – then **11.3** is recorded)

Recovery:

- Allow a minimum 10 min. to maximum 15 min. recovery after the 20m Shuttle before continuing.



(Images above - 20m Shuttle Run sequence from top left to right - athletes must meet the timing of the “Beep”).



(Images above; Left - in green, a line “Make”/crossing the cone threshold; Right - in red, a line “Miss”).

Standing Long Jump and Standing Triple Jump

(Coaches may use discretion for completing only SLJ or also STJ with younger athletes)

Rationale for Inclusion:

A test of lower extremity power and coordination utilizing a simple, safe, and common movement pattern (14). The standing triple jump is included to assess strength-speed, agility, balance, and skill (9, 10, 14-16).

Equipment:

A tape measure or other measuring device as well as a safe, flat jumping and landing surface of approximately 10m.

Warm-up:

This test has a potential for injury and thereby requires a thorough and focused warm-up. If not performing after the SQ-F Warm-up and 20m shuttle test, athletes should perform 5-10 minutes of vigorous exercise including running, skipping, hopping, arm and leg swings and so forth before the SLJ/STJ tests. Pre-test trials should be performed with each athlete performing at least one practice jump at increasing intensity (for example practice attempts at 50%, 75% and 90% of maximal effort). This should take place regardless of the warm-up performed.

Standing Long Jump Protocol

- Start by taping or otherwise securing a measuring tape or similar measuring device to the ground in a straight line for ease of testing. Typically, 10m is long enough for both the SLJ and STJ tests.
- The athlete stands with their **toes** level at 0cm. Hands can be in a self-selected position.
- The athlete jumps as far forward as possible.
- The coach will mark the jump distance at the **heels** of the landing position. If the feet land staggered, measure the distance of the heel that is **closest to the start line**. Only measure a repetition that displays a controlled landing (no additional step greater than the length of the foot or fall forward or backward).
- Athletes are given **two trials**, with both trials recorded. The **mean of the two trials** is calculated and used for further analyses. (Three trials can only be performed if necessary for two scores.)
- A **“No-rep”** will be given if:
 - The athlete lands with feet contacting the ground at **different times** (“Gallop”).
 - The athlete lands with feet in a **“split position”** with a space **greater than the length of the athlete’s foot** between feet.
 - The athlete places a **hand (or other body part) in contact** with the ground for stability upon landing.
 - The athlete **“double-contacts” upon take-off** of the jump (leaving the ground to elicit a pre-stretch prior to jumping).

Scoring:

- The **mean** of the two jumps will be calculated and recorded to the nearest centimeter (example 267cm).
- Three trials can be performed if necessary for two scores.
- If only one successful trial is completed, that trial will be used for scoring.
- If the athlete is not successful in three trials, no score will be recorded.

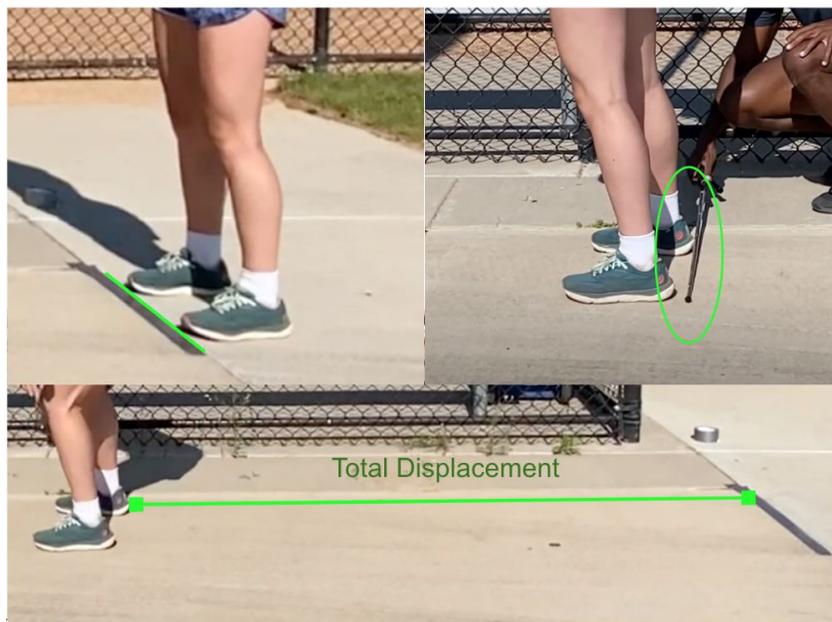
Standing Triple Jump Protocol

- Start by taping or otherwise securing a tape measure or similar measuring device to the ground for ease of testing.
- The athlete stands with the **toes** level at 0cm. Hands can be in a self-selected position.
- The athlete jumps as far forward as possible, and as soon as the feet land (simultaneously), they rebound straight into a second long jump, followed immediately by a third, sticking the final landing without moving the feet. **Feet must contact the ground simultaneously** each jump and landing.
- The coach will mark the jump distance at the **heels** of the landing position, following the same landing and scoring criteria as the standing long jump.
- Athletes are given **two trials**, with both trials recorded. The mean of the two trials is calculated and used for further analyses. (Three trials can **only** be performed if necessary for two scores.)
- A “**No-rep**” will be given if:
 - The athlete **does not connect the three jumps** with continuous, forward momentum between jumps (if the athlete halts the natural momentum to reset between reps).
 - The athlete lands with **feet contacting the ground at different times** (“Gallop”) either upon landing or between jumps.
 - The athlete lands with feet in a “**split position**” with a space **greater than the length of the athlete’s foot**.
 - The athlete **places a hand (or other body part) in contact with the ground** for stability either upon landing or between jumps.
 - The athlete “**double-contacts**” **upon take-off** of the jump (leaving the ground to elicit a pre-stretch prior to jumping).

Scoring:

- The **mean** of the two triple jumps will be calculated and recorded to the nearest centimeter (example 867cm).
- If only one successful trial is completed, that trial will be used for scoring.
- If the athlete is not successful in three trials, no score will be recorded.

(Images below; Top Left - start position for SLJ and STJ; Top Right - landing measurement).



Standing Long Jump Sequence



Standing Triple Jump Sequence



Standing Long Jump and Triple Jump No-Reps

No-Rep - Staggered Landing/Step Forward



No-rep - Step/Fall Backward

No-rep - Hand Touch/Fall



20m Sprint

Rationale for Inclusion:

The 20m sprint test is an assessment of the athlete's speed, power, and coordination.

Equipment:

- Flat non-slip surface, recommended **minimum** of 30m long.
- Tape measure 20m or longer
- Electronic/beam timing gates for accurate, validated times
- Cones, marker chalk, or tape to clearly mark the start & end points

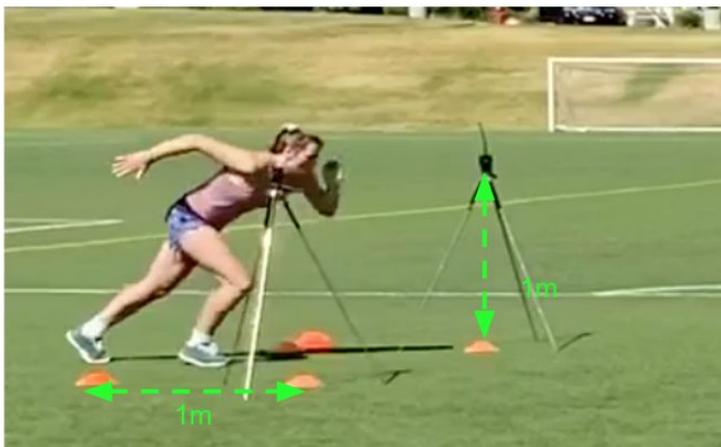
20m Sprint Protocol:

- **This test should be measured by laser timing.**
- Check that the athlete has good footwear and that the surface/footwear is not excessively slick.
- Recommended Warm-up: 1-2 runs through 20m at 50% and 75% effort + 1 maximum 5-10m effort (with a jog/fly-out through 20m).
- Mark out two lines, 20m apart on a non-slip surface – preferably an indoor court, track, or turf surface. (athletes should be given a minimum distance of 2m from any wall for a start position).
- Align the electronic timing gates at the **20m start** and **end lines** at a height of **1m**.
- **Mark an additional line 1m (100cm) back from the 20m start line** (this will ensure that the timing gate light beam isn't broken by mistake)
- The athlete verbally ensures that the coach/timing system is ready for measurement.
- With a staggered stance where the **toes of the front foot** are on the **1m (100cm) line** (before the 20m start line), when ready, the athlete accelerates as fast as he or she can through the timing gates (remember to tell the athlete to continue sprinting all the way through the finish line).
- The test is completed when the athlete breaks both beams sequentially and time is stopped.
- Athletes will be given **two trials** and both will be recorded. The mean of the two trials is calculated and used for further analyses (Three trials can **only** be performed if necessary for two scores).

Scoring:

- The **mean** of the two sprint times will be calculated and recorded to the nearest hundredth of a second (example 3.41s).

(Images below; Top Left - 20m Sprint Set-up (gates at 1m height) and good start position at the 1m line; Top Right - poor 20m sprint start position; Bottom - 20m sprint through the last gate).



Strict Tempo Pull-Up

Rationale for Inclusion:

The strict tempo pull up test is an assessment of upper body coordination, relative strength, rhythm, and control.

Equipment:

- A pull-up bar high enough for the tallest athletes to hang from (without touching the ground with their feet pulled behind them at minimum).
- Audible Metronome set to 20 BPM.
- Speakers.

Strict Tempo Pull-Up Protocol:

- The athlete grips the bar in a self-selected width (recommended just outside of shoulder width) with an **overhand grip**.
- The athlete begins the test from a “dead hang” – body motionless, arms completely extended, and shoulders, hips, knees and ankles in a line.
 - The athlete may request to start with the feet tucked behind in a “hook position”, crossed ankles, etc. – this is acceptable as long as they **remain in this position for the duration of the rep and no change in the relative hip, knee, and torso angle** occurs.
 - Athletes **can reset position in between reps**, as long as they stay on tempo and complete strict repetitions.
- The coach will start the metronome, instructing the athlete to begin when ready, on the beep.
- The athlete will begin on a self-selected beep, keeping the shoulders, hips, knees and ankles in line, pulling the body up until the height of the chin exceeds the height of the bar.
- The athlete will lower the body down to full extension between each rep (elbows must fully straighten and be without bend).
- Begin next pull-up on the next beep. (Metronome set to 20bpm).
- Once started, the athlete **cannot skip a metronome beep**.
- This tempo requires that one correct pull-up be performed every 3 seconds.
- The **athlete can lower at a self-directed pace**, as long as the next rep is started on the beep and **completed before** the subsequent beep.
- A “**No-Rep**” will be given if:
 - Any **break in the starting hip/knee/ankle line** occurs that **assists with leverage or changes kinematics** of the rep (i.e. hips tucking forward toward a ‘pike’, back arching excessively).
 - The athlete **fails to pull to the proper height** (chin above bar).
 - The athlete utilizes a **swinging motion** or any other **momentum** to complete the rep.
- Athletes will continue performing pull-ups until they can no longer complete reps within the criteria, on tempo, or until they drop from the pull-up bar.
- The test will end if the athlete cannot complete the pull-up(s) on the tempo, raising in time with the metronome (1 every 3 seconds).

Scoring:

- Count/tally the total number of pull-ups completed within the criteria prior to the athlete failing, dropping from the bar, and/or being stopped.
- Subtract any “No-reps” from the total counted.
- Record the resultant number.

If the athlete cannot perform a single pull-up, he or she will switch to the bar-hang protocol.

***Bar-Hang Protocol – (Used if the athlete is unable to complete 1 strict tempo pull-up)**

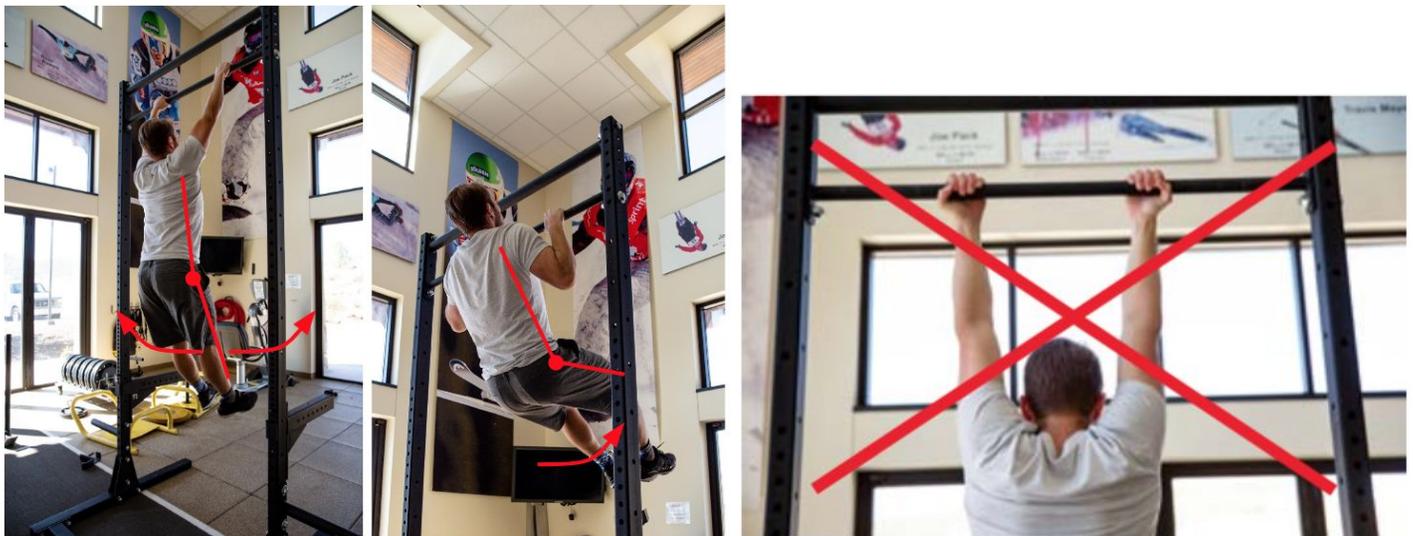
- Grasp the bar just outside of shoulder width with an overhand grip.
- Using a box, bench, or other means, jump or be assisted to get the chin over the bar.
- Keeping the lower body motionless and straight (as in the pull-up test), hold the chin over the bar for as long as possible, without the neck or chin contacting the bar.
- The test concludes when the athlete’s chin drops below the bar.

Scoring:

- Record the total time the athlete holds his or her chin over the bar.
- **The bar-hang protocol does not contribute to an athlete’s points in the composite score.**



(Image above - successful Pull-up positions, left - normal, right - hook hang).



(Image above - No-rep Pull-up positions/attempts; Left - swinging/momentum assist; Middle - breaking straight line; Right - underhand/“chin-up” grip)).

Strict Tempo Single Leg Squat – '15 in 15'

Rationale for Inclusion:

The strict tempo single leg squat is designed to assess total body coordination and relative strength, strength endurance, rhythm, balance, and control.

Equipment:

- A stable box, surface, or platform at least 75cm tall (tall athletes will likely require something higher).
- Push-up [audio file](#).
- Speakers and device to play the audio file.

Single Leg Squat Protocol:

- The athlete starts by standing on the top of the box or platform. They should adjust so that the standing foot is toward the side edge of the box and the opposite foot is hanging off the side of the box.
- An athlete can be given **practice** reps prior to testing for **depth and tempo** (limit these to avoid fatigue).
- The single leg squats are done to the Push-up audio file/tempo, with each squatting and standing motion **performed on command**, and are **continued until all 15 reps are completed** or the athlete cannot continue at the required pace.
- The athlete must wait and **begin the downward squatting** movement on the first **'Down' Command**.
- The athlete must then wait and **begin the upward standing** movement on the **'Up' Command**.
- The athlete continues the squats on tempo, waiting for the command (up or down) for a **maximum of 15 reps**.
- Complete each single leg squat reaching a position where **the crease of the hip is below or level to the most superior (top) aspect of the patella bone**, while **keeping the other foot off the ground and not touching the box**.
 - *Generally cueing athletes to squat lower than parallel is best.*
- The athlete will attempt a total of **15 reps in series, on tempo**, while maintaining proper technique.
- The athlete **must wait** for the tempo commands before movement can occur (wait for "Down" to begin descent, wait for "Up" to begin ascent.)
- A **"No-Rep"** will be given if:
 - The **non-squatting foot touches the box** at any time.
 - The **athlete's hip crease does not travel below or level to the knee**.
 - The athlete completes a squat **off tempo (either ahead of, or behind the command)**.
 - The athlete **"bounces"** out of the bottom of the squat.
 - The athlete **cycles, kicks, swings, or otherwise uses arms or non-stance leg to generate momentum** during the movement.
- If an athlete misses **three consecutive reps** in a row due to a lack of depth or missing tempo, the **test is ended** and the number of satisfactory reps up to that point is recorded.
- If an athlete loses balance during the test to the extent that it causes them to place **both feet on top** of the box or to **fall off the box**, the **test is ended** and the number of satisfactory reps up to that point is recorded.

Scoring:

- The **total number of satisfactory reps** will be counted for each leg **out of 15**. When the athlete **reaches 15 reps**, he or she has reached the **test maximum** and **no further reps** will be recorded.
- **Scoring** is recorded as **the number of correct repetitions, subtracting any "No-reps"** out of fifteen (e.g. If an athlete squats 11 reps correctly and misses 4 throughout the test, his or her score would be 11/15).



(Image above - satisfactory squat positions; Left - full extension at top, Right - hip crease below knee in bottom).



(Image above - No-rep squats; Left - lack of depth and excessive foot swing for momentum; Right - foot touch for stability (solid arrow) and loss of balance/falling off of box (dotted arrow)).

Strict Tempo 90 Degree Push-Up

Rationale for Inclusion:

The strict tempo push-up test is designed to assess upper extremity strength, endurance, coordination and control.

Equipment

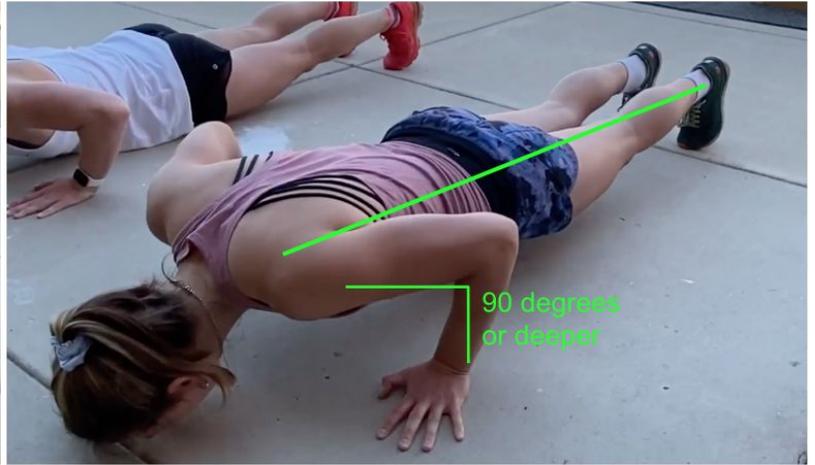
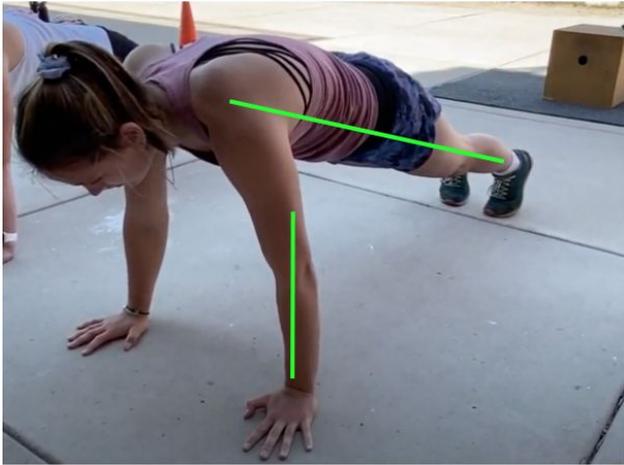
- Push-up Audio file.
- Speakers and device to play the audio file.
- Flat surface.

Push Up Protocol:

- The athlete starts in the “top” of a push-up position, with hands on ground in a self-selected position (recommended hands under shoulders or just outside shoulder width), arms straight, fingers pointed forward, and legs straight, parallel and slightly apart (2-4 inches) with the toes positioned under the heel.
 - For injury considerations, an athlete may choose to perform the test on knuckles/fists if necessary.
- The push-ups are done to the audio file, with one push-up completed every three seconds (1.5s on the way down and 1.5s on the way up), and are continued until the athlete cannot continue at the required pace.
- At the top, the athlete must **begin downward movement** on the ‘**Down**’ Command (push-up Audio File).
- At the bottom, the athlete must **begin the upward movement** on the ‘**Up**’ Command (push-up Audio File).
- The athlete must lower the body until the **inside edges of the upper arm and forearm create a 90 degree angle of the elbow** (deeper than 90 degrees is acceptable, as long as no other part of the body contacts the floor).
- The body should **remain straight** (shoulder, hips and knees aligned) during each rep, and the elbows must fully “lock” straight at the top.
- Continue push-ups on tempo, waiting for the command (up or down) until failure.
- The coach counts and records the number of satisfactorily completed 90 degree push-ups.
- A “**No-Rep**” will be given if:
 - An athlete **fails to match/maintain the cadence**.
 - An athlete **fails to maintain a straight line** between the shoulders, hips, and heels.
 - An athlete **fails to achieve a 90 degree angle** (or deeper) of the elbows in the bottom position.
 - An athlete **touches any part of the body to the floor** other than the hands or toes.
 - An athlete **fails to extend the arms fully** at the top.
- The athlete completes as many satisfactory reps as possible.
- If an athlete **misses three consecutive reps in a row** due to a lack of depth, alignment criteria, or missing tempo, the **test is ended** and the number of satisfactory reps up to that point are tallied.
- If an athlete **purposefully skips** a rep in order to “rest”, the **test is ended**.

Scoring:

- Tally the total number of satisfactory push-ups completed within the criteria, prior to the athlete failing and/or being stopped.
- Subtract any “No-reps” from the total counted.
- Record the resultant number.



(Images above - satisfactory push-up positions, Left - Top position, elbows locked and body straight; Right - Bottom position, 90 degree angle of inside edge of elbow and body straight).

60s Repeated Jumps

60s Repeated Lateral Box Jumps

Rationale for Inclusion:

The 60 second repeated jump test is a measure of speed, power, anaerobic endurance, and coordination specific to snowsports.

Equipment:

- Flat, non-slip surface..
- At least one (1) Enclosed Box: 40cm high x 40-50cm long x 40cm wide.
- At least one (1) Enclosed Box: 30cm high x 40-50cm long x 40cm wide (for shorter athletes).
- Stopwatch
- A minimum of 2 spotters per box

Calibration/Maintenance:

Check the integrity of the boxes prior to each test day.

Specific Warm-up:

The Athlete should perform 2-3 trials at increasing intensity prior to performing this test, doing 3-4 jumps each time.

Protocol:

- The test is performed as 60 seconds of maximum jumping.
- A 30 or 40cm box is chosen depending on which is closer to the **height of the athlete's tibial tuberosity without being above it.**
- Two spotters sit on the floor with **feet against the box to ensure stability** of the box during the test.
- To start, the **athlete stands on top of the box**, waiting for a count-down from 3 to 1.
- The **timer shouts "go" and starts the stopwatch simultaneously.**
- The athlete jumps to the ground on one side of the box, **keeping the feet within the box footprint.**
- The athlete jumps laterally back and forth over the box, landing on the middle of the box and facing the same way (forward) for the duration of the test.
- Each time the athlete lands on **top of the box, one jump is counted.**
- **Feet** should stay **side-by-side** during the test, not "splitting" or offsetting.
- Athletes should be **facing forward and in line with the box upon every landing.** Any excessive turning of the feet, knees, or torso will invalidate the rep.
- A **"No-rep"** will be given if:
 - The athlete **lands with the balls of the feet behind (or in front) of the box footprint.**
 - The athlete **turns feet, hips, or body more than 45 degrees.**
 - The athlete **offsets the feet, splitting them from a side-by-side position to a stagger.**
 - The athlete **lands on the box with only one foot or "gallops"** upon landing on the box, with one foot striking at a different time than the other.
 - The athlete **"double contacts" the ground** between box reps.

Scoring:

- Coach(es) will count while the athlete jumps.
- Tally the total number of satisfactory jumps completed in 60 seconds within the criteria.
- Subtract any "No-reps" from the total counted.
- Record the resultant number.

60s Repeated Lateral Hurdle Jumps

(recommended for younger athletes)

Rationale for Inclusion:

The 60 second repeated jump test is a measure of speed, power, anaerobic endurance, and coordination specific to snowsports.

Equipment:

- Flat non-slip surface.
- 2 Hurdles: 15x45cm (15cm/6in high, 45cm/18in long).
- Tape measure 1m or longer to determine the width between hurdles.
- A stopwatch.
- A minimum of 2 spotters

Calibration/Maintenance:

Check the integrity of the hurdles prior to each test day.

The test is performed as 60 seconds of maximum jumping.

Hurdle Jump Protocol:

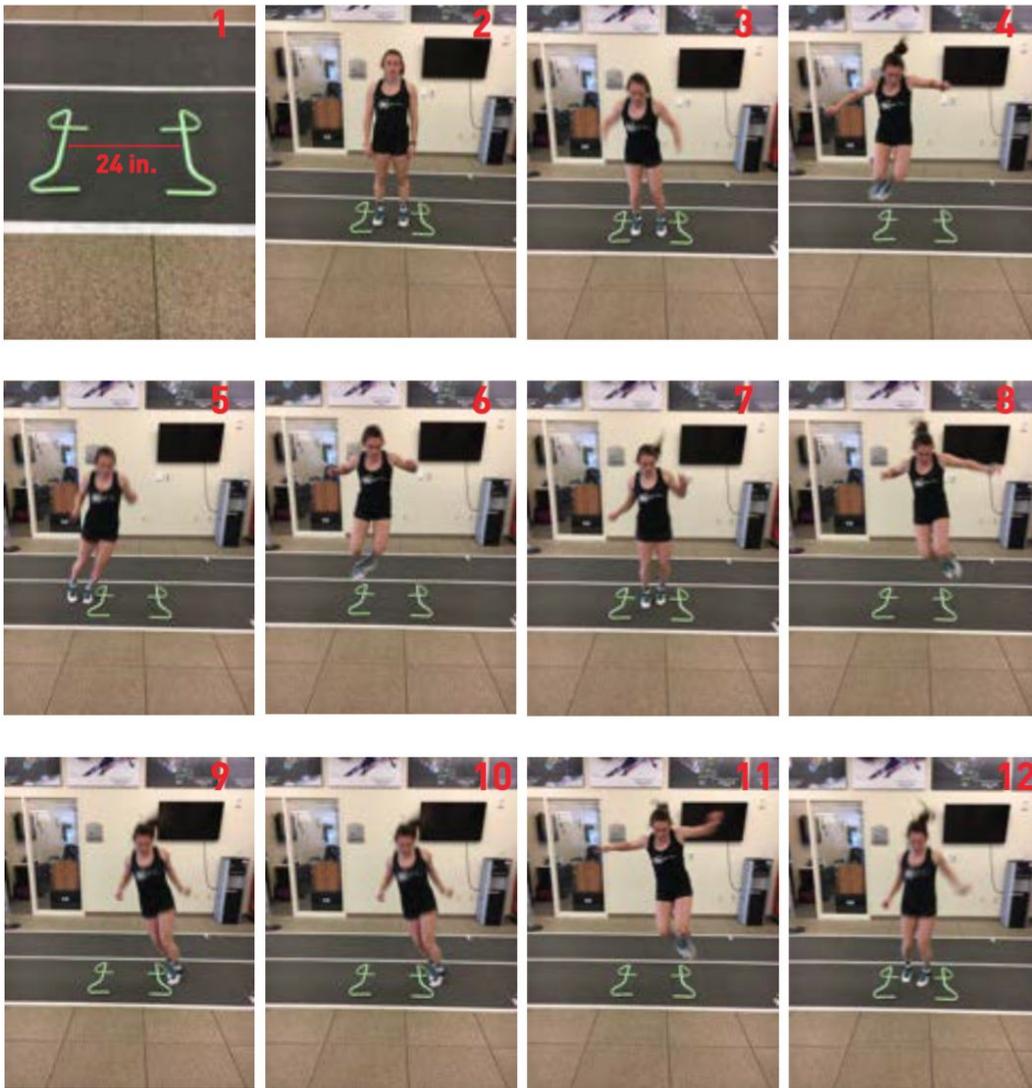
- The test is performed as 60 seconds of maximum jumping.
- The two 15x45cm hurdles are placed parallel to one another 61cm (24 inches) apart.
- One spotter stands behind each hurdle (two in total) to ensure they remain upright and in place throughout the test.
- To start, the athlete stands in the **middle of the hurdles**, waiting for a count-down from 3 to 1.
- The **timer shouts “go” and starts the stopwatch simultaneously.**
- The athlete jumps over one hurdle, and then laterally back and forth over both hurdles in each direction.
- The athlete **lands in the middle of the hurdles each time** and faces the same way for the entire duration of the test.
- Each time the **athlete lands in the middle**, between the two hurdles, **one jump is recorded.**
- **Feet** should stay **side-by-side** during the test, not “splitting” or offsetting.
- Athletes should be **facing forward and in line with the hurdle** upon every landing. Any **excessive turning of the feet, knees, or torso will invalidate the rep.**
- A **“No-rep”** will be given if:
 - The athlete does not **clear the hurdle** cleanly, the jump does not count.
 - The hurdle is **knocked over or moved by the jumper.** (The spotters should replace the hurdle as soon as possible before the athlete attempts to clear again).
 - The athlete lands with the **ball of the foot behind (or in front) of the hurdle footprint.**
 - The athlete **offsets the feet, splitting them from a side-by-side position to a stagger.**
 - The athlete **turns feet, hips, or body more than 45 degrees.**
 - The athlete lands in **between the hurdles with only one foot.**
 - The athlete **“gallops”** upon landing between the hurdles, with one foot striking at a different time than the other.
 - The athlete **“double contacts”** the ground between reps.

Scoring:

- Tally the total number of satisfactory jumps completed in 60 seconds within the criteria.
- Subtract any “No-reps” from the total counted.
- Record the resultant number.



(Image above - Box Jump sequence; each box contact counts as one "rep" after initiation)



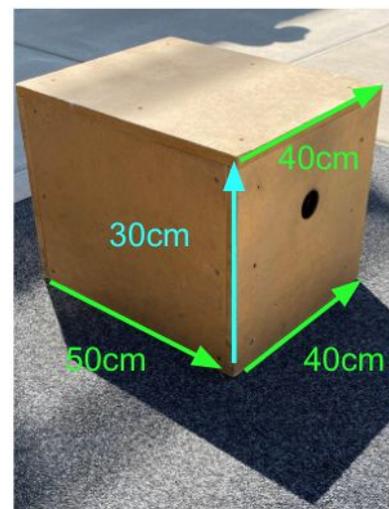
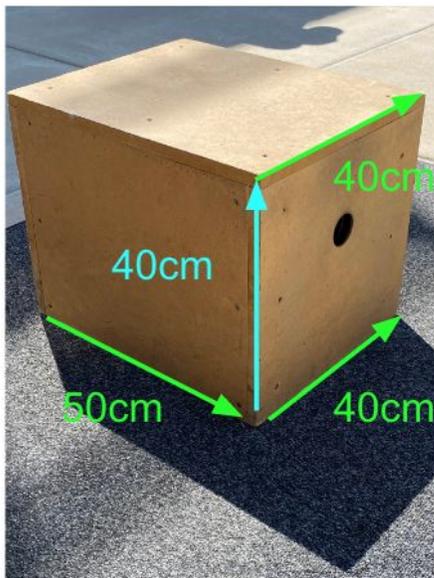
(Image above - hurdle jump sequence; each contact with the center counts as one "rep")



(Images above - satisfactory reps in which balls of feet stay in line with the box).

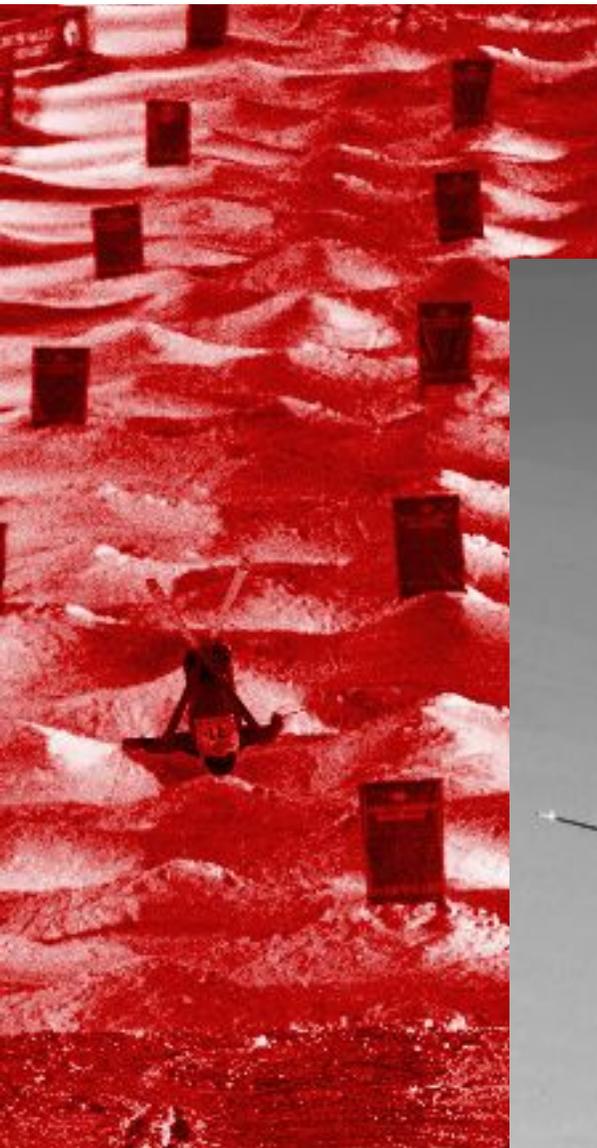


(Images above - No-rep box jumps; Left - turn greater than 45 degrees; Middle - uneven box contact “gallop”; Right - feet ‘splitting’ moving from side-by-side position to staggered position)



(Image above - standard box dimensions; Left - for athlete's with a tibial tuberosity 40cm or taller; Right - for athlete's with a tibial tuberosity below 40cm)

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AIS 20m Shuttle Conversion Chart and Printable Group Score Sheets

AIS 20m Shuttle VO2 Conversion Chart

Level	Shuttle	VO2 Max												
4	2	26.8	8	1	40.2	11	1	50.5	14	2	61.1	20	2	81.8
4	3	27.2	8	2	40.5	11	2	50.8	14	4	61.7	20	4	82.2
4	4	27.6	8	3	40.8	11	3	51.1	14	6	62.2	20	6	82.6
4	5	28.0	8	4	41.1	11	4	51.4	14	8	62.7	20	8	83
4	6	28.3	8	5	41.5	11	5	52.2	14	10	63.2	20	10	83.5
4	7	28.7	8	6	41.8	11	6	51.9	14	13	64	20	12	83.9
4	8	29.1	8	7	42.1	11	7	52.2	15	2	64.6	20	14	84.3
4	9	29.5	8	8	42.4	11	8	52.5	15	4	65.1	20	16	84.8
5	1	29.9	8	9	42.6	11	9	52.8	15	6	65.6	21	2	85.2
5	2	30.2	8	10	42.8	11	10	53.1	15	8	66.2	21	4	85.6
5	3	30.6	8	11	43.3	11	11	53.4	15	10	66.7	21	6	86.1
5	4	31.0	9	1	43.6	11	12	53.7	15	13	67.5	21	8	86.5
5	5	31.4	9	2	43.9	12	1	54.0	16	2	68	21	10	86.9
5	6	31.8	9	3	44.2	12	2	54.3	16	4	68.5	21	12	87.4
5	7	32.4	9	4	44.5	12	3	54.5	16	6	69	21	14	87.8
5	8	32.7	9	5	44.9	12	4	54.8	16	8	69.5	21	16	88.2
5	9	32.9	9	6	45.2	12	5	55.7	16	10	69.9			
6	1	33.3	9	7	45.5	12	6	55.4	16	12	70.5			
6	2	33.6	9	8	45.8	12	7	55.7	16	14	70.9			
6	3	34.0	9	9	46.3	12	8	56.0	17	2	71.4			
6	4	34.3	9	10	46.6	12	9	56.2	17	4	71.9			
6	5	34.7	9	11	46.8	12	10	56.5	17	6	72.4			
6	6	35.0	10	1	47.1	12	11	56.8	17	8	72.9			
6	7	35.4	10	2	47.4	12	12	57.1	17	10	73.4			
6	8	35.7	10	3	47.7	12	13	57.2	17	12	73.9			
6	9	36.1	10	4	48.0	13	1	57.4	17	14	74.4			
6	10	36.4	10	5	48.4	13	2	57.6	18	2	74.8			
7	1	36.8	10	6	48.8	13	3	57.9	18	4	75.3			
7	2	37.1	10	7	49.0	13	4	58.2	18	6	75.8			
7	3	37.5	10	8	49.3	13	5	58.5	18	8	76.2			
7	4	37.8	10	9	49.8	13	6	58.7	18	10	76.7			
7	5	38.2	10	10	49.8	13	7	59.0	18	12	77.2			
7	6	38.5	10	11	50.2	13	8	59.3	18	15	77.9			
7	7	38.5	10	12	50.4	13	9	59.6	19	2	78.3			
7	8	39.2				13	10	59.8	19	4	78.8			
7	9	39.6				13	11	60.0	19	6	79.2			
7	10	39.9				13	12	60.2	19	8	79.7			
						13	13	60.6	19	10	80.2			
									19	12	80.6			
									19	15	81.3			

SCORING DETAILS

SkillsQuest-Fitness Abridged Points Table - Top Score Through "0"

20m Shuttle Run Scores	
Raw VO2	Points
65	300
62.5	282.5
60	265
57.5	247.5
55	230
52.5	212.5
50	195
47.5	177.5
45	160
42.5	142.5
40	125
37.5	107.5
35	90
32.5	72.5
30	55
29.5	51.5
29.4	0

Standing Long Jump	
Raw Distance (cm)	Points
330	100
315	92
300	85
285	77
270	70
255	62
240	55
225	47
210	40
195	32
180	25
165	17
150	10
135	3
132	1
131.9	0

Standing Triple Jump	
Raw Distance (cm)	Points
990	100
960	94
930	88
900	82
870	76
840	70
810	64
780	58
750	52
720	46
690	40
660	34
630	28
600	22
570	16
540	10
510	4
495	1
494.9	0

20m Sprint	
Time (s)	Points
2.8	50
2.85	48.5
2.9	47.5
2.95	46
3	45
3.05	43.5
3.1	42.5
3.15	41
3.2	40
3.25	38.5
3.3	37.5
3.35	36
3.4	35
3.5	32.5
3.6	30
3.7	27.5
3.8	25
3.9	22.5
4.1	17.5
4.3	12.5
4.6	4.5
4.77	0

Strict Tempo Pull Ups	
Pull Ups (#)	Points
20	50
18	45
16	40
14	35
12	30
10	25
8	20
6	15
5	12.5
4	10
3	7.5
2	5
1	2.5
0	0

Strict Tempo Single Leg Squats (15/15)	
Squats (# ea. leg)	Points (ea. leg)
15	25
14	22.5
13	20
12	17.5
11	15
10	12.5
9	11.5
8	10.5
7	9.5
6	8.5
5	7.5
4	6.5
3	5.5
2	4.5
1	3.5
0	0

Strict Tempo Push Ups	
Push Ups (#)	Points
50	50
45	45
40	40
35	35
30	40
25	25
20	20
15	15
12	12
10	10
8	8
5	5
3	3
1	1
0	0

60s Repeated (Box) Jumps	
Jumps (#)	Points
90	300
85	282.5
80	265
75	247.5
70	230
65	212.5
60	195
55	177.5
50	160
45	142.5
40	125
35	107.5
30	90
25	72.5
20	55
15	37.5
10	20
5	2.5
4	0

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Thank you!

