SKI & SNOWBOARD AUSTRALIA

FITNESS TESTING PROTOCOL

U12, U14, U16, U18, Open

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February 2016

ANTHROPOMETRICAL TESTING

Tests of anthropometry include testing for height, weight and body composition.

(1)HEIGHT

Materials required: Measuring tape
Unit measured in: Centimeters to the nearest .5cm
Procedure:

- athlete stands against a wall **without shoes**
- heels, buttocks, shoulders and back of the head are all in contact with the wall
- bend measuring tape to 90 degrees; at a right angle with the wall and the highest point of the head; not hair
- athlete should take in a deep breath and then step away from the wall while the height is recorded

(2a) WEIGHT

Materials required: Scale
Unit measured in: Kilograms to the nearest decimal place (multiply by 2.2 for lbs)
Procedure:

- record the athlete's body weight in kilograms
- athletes should be dressed in **minimal clothing without shoes**

***** Height & weight should be recorded at approximately the same time for each testing session, as both height and weight can vary throughout the day***

MEDICAL ASSESSMENT-Open, U21, U18, U16 only

(2b) Blood Pressure/Resting HR

This test measures the Systolic and diastolic (mmHg)
Materials required: Electronic blood pressure monitor
Component tested: Blood pressure, Resting Heart Rate
# of attempts: Two; the best result shall be counted
Procedure:

- Athlete sits upright with arm on table (elbow at heart height) using the left arm, assessed arm slightly bend resting on table!
- This test takes place before warm up. Subject must be rested and relaxed (15min or longer)

(3) Body Composition

This test measures the Systolic and diastolic (mmHg)

Materials required: Harpenden (or similar) Skinfold Calipers, Steel Tape Measure Unit measured in:mm

Component tested: A sum o measurement of 7 skinfolds sites is used to determine body composition. The sites used are schown below (without Iliac Crest)

Click on the image will take you to description. With thanks to Topend sports Website

 Triceps	 Biceps	 Subscapular	 Thigh
 Iliac Crest	 Supraspinale	 Abdominal	 Calf

TESTING PROCESS

WARM Up

Fitness testing will begin with a twenty (20) minute warm up period consisting of ten (10) minutes aerobic warm up, five (5) minutes active warm up and five (5) minutes active stretching.

WARM DOWN

Fitness Testing should wind up with a progressive twenty (20) minute warm down consisting of:

- 10 minutes light jog or spin (+ / -; situational)
- Coach supervised flexibility session

FLEXIBILITY

(4) SIT & REACH

This test is to assess flexibility for hamstrings, gluteus and lower back.

Materials required: Sit and reach board or tape measure
Component tested: Hamstring flexibility
# of attempts: Two
Unit measured in: Centimeters
Sit and reach board: The usual scale used for this test has the zero mark at 23cm before the feet, thus if the subject can reach their toes, their score is 23cm!

Procedure:

- Athlete sits with their feet up against the sit and reach box (any box will do)
- Reach forward with both hands while keeping their knees completely locked.
- Athlete then holds this position for the **two (2)** seconds
- Measure to the **nearest decimal** and record the **best** of **two (2)** results

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UPPER-BODY STRENGTH & MUSCULAR ENDURANCE

(5) UPPER ABDOMINAL TEST 7 stage: **Seven (7) Stage Abs for U16 and older–U12,U14 (5) stage**

In the
This test measures the relative strength of the upper abdominal (core) muscles. Core Strength is measured by a single maximal contraction; critical for stability & balance.

Materials required: One (1) 5lbs (2.4kg and 10lbs (4.8kg) weight
Component tested: Relative core strength
# of attempts: Two; the best result shall be counted
Procedure:

- The athlete lies flat on their back, hands at side, knees bend at 90degrees, the feet remaining on the floor at all times and completed with CONTROL-no jerking movements.
- The levels and a descriptor are listed below.

Stage1	with arms extended, the athlete curls up so that the wrists reach the knees
Stage2	with arms extended, the athlete curls up so that the elbows reach the knees
Stage3	with the arms held together at 90degrees at the elbow across abdominals, the athletes curls up so that the chest touches the thighs. Elbows must remain against the body
Stage4	with the arms held across chest, hands holding the back of the opposite shoulders and elbows on the chest, the athlete curls up so that the forearms touch the thighs. Elbows must remain against the body
Stage5	with the elbows held behind head and hands reaching as far down the back as possible, the athlete curls up so that the chest touches the thighs. Elbows must remain behind the head
Stage6	as per level 5, with a 2.4 kg weight held behind head, chest touching the thighs
Stage7 U16 and older	as per level 5, with a 4.8 kg weight held behind head, chest touching the thighs

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(6) Maximum Push Up in 60 sec all age groups

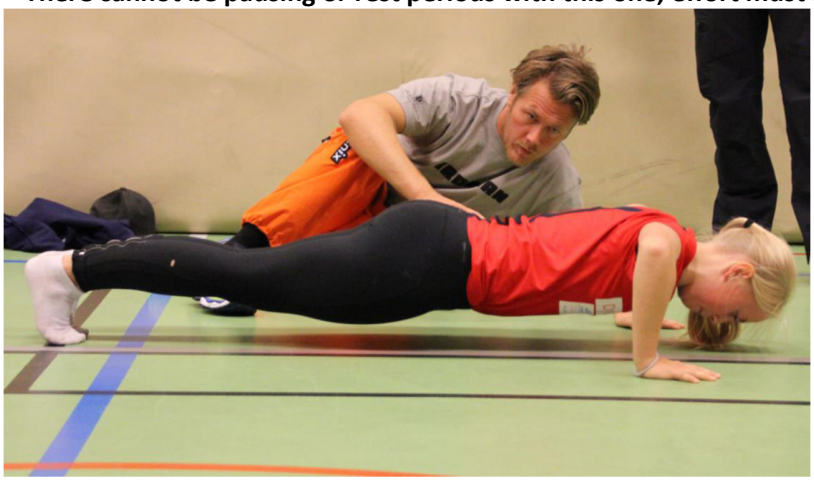
This test is designed to measure relative muscle strength and endurance of the chest and arm muscles. Ensure that the athlete focuses on good breathing and a steady rhythm.

Materials required: One (1) roll of duct tape or ten (10) mini cones
Component tested: Relative strength & endurance of the upper body (chest, posterior shoulder, triceps, core stabilizers,
# of attemps: One (1)
Duration: 60 sec
Procedure:

- The athlete lies on prone on the ground with their hands off the ground, ready to complete a pushup

- On the signal to start, the athlete puts their hands on the ground and presses to lift their chest, hips, thighs off the ground simultaneously to a full extension of the arms position. The body must maintain this "rigidity" throughout the test
- The athlete then lowers their body down until the whole body is again in contact with the ground and the hands are off the ground (back to the start position)
- This counts as 1 repetition.
- The athlete continues the method for 60sec
- Only correctly completed full pushups are counted in the total

*** There cannot be pausing or rest periods with this one; effort must be continuous**



(7a)1 RM Max Bench press-Open,U21,U18,U16

This test should be performed as a sub-max test to ensure safety. The 1 RM option is only suitable for very experienced athletes.
The test is designed to measure maximum muscle strength of chest and arm muscle.
Ensure spotter is ready to support and weights are secure-head and lower back well supported.

Submax bench press- determine 1RM

Materials required:	Bench and barbell
Component tested:	Upper body (chest, front shoulders, arms-triceps)
Measured in:	Repetition max – repetition to failure – no more reps possible
# of attempts:	Determine between 3 and 10 Reps max. After warm up athlete should have an idea what weight to choose to achieve 3-10 Reps max. Record weight and no of reps.
Duration:	Not applicable

Procedure:

- Athlete face up on bench – head and lower back well supported.
- Spotting person necessary to spot with last repetition
- **Index finger positioned on the marker of the Olympic bar (Olympic bar is 20kg)**
- As completed repetition counts a full range extension from just above chest (nipple line) to near full extension
- Speed is 2-3 sec concentric and 2-3 sec eccentric- controlled speed of movement
- Failure means if athlete is not able to complete extension on his/her own

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(7b)3 RM Max Bench press –For National team members only

The test is designed to measure maximum muscle strength of chest and arm muscle.
Ensure spotter is ready to support and weights are secure-head and lower back well supported.

3RM bench press- determine 1RM- National team 18 and older

Materials required: Bench and barbell
Component tested: Upper body (chest, front shoulders, arms-triceps)
Measured in: 3 Repetition max (3RM) – repetition to failure – no more reps possible
# of attempts: After warm up athlete should have an idea what weight to choose to achieve 3 Reps max. Record weight and no of reps.
Duration: Not applicable
Procedure:

- Athlete face up on bench – head and lower back well supported.
- Spotting person necessary to spot with last repetition
- **Index finger positioned on the marker of the Olympic bar (Olympic bar is 20kg)**
- As completed repetition counts a full range extension from just above chest (nipple line) to near full extension
- Speed is 2-3 sec concentric and 2-3 sec eccentric- controlled speed of movement
- Failure means if athlete is not able to complete extension on his/her own
- Start with a warm-up and a light weight you can easily handle for 10-15reps.
- Rest two minutes.
- Increase the weight by 10-20 percent and do a second warm-up set of 5-8 reps.
- Trial and error establishing your score within 5 lifts. After each attempt, increase or decrease the load by 2.5 to 5 kilograms depending on the outcome of the attempt. Remember to take three to four minutes rest between attempts.
- Repeat this process until only 3 repetitions can be performed with proper technique. Always rest three to four minutes between attempts.

(8) Max Chin-Ups-Palms facing away (pronated grip)

Build Muscle. Chin-ups force you to lift your own bodyweight. This stresses your body, building the muscles of your arms & back. Upper back strength is needed to support spine and core muscles. This protection is very important for an alpine athlete.

Grapping Strength. Chin-ups help any sport which involves gripping, grappling & pulling- better starting ability- pole handling/planting

Materials required: Chin-up bar
Component tested: Upper body strength (upper back, shoulder, arms-biceps, hand grip
Measured in: Repetition
# of attempts: As many as able to failure-
Duration: Not applicable
Procedure

- athlete starts grapping the bar –palms facing away – elbows fully extended,
- **RECORD as one repetition when athlete passes the bar with chin.**
- The athlete then performs as many repetitions as able to failure.
- Elbows need to be fully extended.

LOWER BODY STRENGTH – EXPLOSIVE POWER - STABILITY

(9) VERTICAL JUMP – double legged

The purpose of this test is to measure the explosive force (power) in the lower limb. This is the amount of power (strength & speed) an athlete can generate.

Materials required: Tape measure, masking tape or chalk (sharpie)
Component tested: Lower body power and explosiveness
Measured in: Centimeters
# of attempts: Two (2) per side; best score on each side to be used
Duration: Not applicable
Procedure:

- athlete starts facing sideways to the wall (with right shoulder, or left shoulder against the wall)
- Standing erect with feet flat on the floor, they reach as high as possible on the wall and in line with the body and inhale.
- **RECORD THE ARM HEIGHT** (**total reach**, baseline) in centimeters
- The athlete then performs a jump by sinking down to approximately ninety (90) degree knee angle and then jump as high as possible while 'marking' the height of their jump with the supplied tape, chalk or sharpie.
- Record the total height of the jump only. The 'total reach' measurement will be subtracted from the 'total jump' measurement to give us the 'vertical leap'
- Two (2) jumps recorded per side. The best jump on each side shall be recorded.

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(10) VERTICAL JUMP – single legged

The purpose of this test is to measure the explosive force (power) in the lower limb. This is the amount of power (strength & speed) that an athlete can generate with one leg.

Materials required: Tape measure, masking tape or chalk (sharpie)
Component tested: Lower body power and explosiveness
Measured in: Centimeters
# of attempts: Two (2) per side; best score on each side to be used
Duration: Not applicable
Procedure:

- athlete starts facing sideways to the wall (with right shoulder, or left shoulder against the wall)
- Standing erect with feet flat on the floor, they reach as high as possible on the wall and in line with the body and inhale.
- **RECORD THE ARM HEIGHT** (**total reach**, baseline) in centimeters
- The athlete then performs a jump by sinking down to approximately ninety (90) degree knee angle and then jump as high as possible with one leg while 'marking' the height of their jump with the supplied tape, chalk or sharpie. (color fingertips with chalk)

- Record the total height of the jump only. The 'total reach' measurement will be subtracted from the 'total jump' measurement to give us the 'vertical leap'
- Two (2) jumps recorded per side. The best jump on each side shall be recorded.

(11) BROAD JUMP (Single Jump)

Purpose: to measure the explosive power of the legs

This test is conducted by measuring out a distance of approximately 3 meters (this should be sufficient distance for most athletes). Mark a 2m line (masking tape) for easy measure.

Materials required: Tape measure, meter stick and masking tape
Component tested: Lower body power and stability
Measured in: Meters and centimeters
# of attempts: Two (3)
Procedure:

- Athletes start with both toes behind the line
- The athlete performs one (1) single jump with maximal effort.
- The athlete must land solidly with good stability. Final measurement is taken from the big **toe of the hindmost foot** (ideally the feet should be at the same length).
- The better of three (3) attempts will be scored

(12) PENTA JUMP (5 Consecutive Jumps)

The Penta Jump measures lower body power and stability. The purpose of this test is to measure coordination and explosive power through a series of 5 consecutive jumps.

This is a useful tool to observe how an athlete absorbs and uses energy. Athletes with more control and stability (knee, ankle) will perform better.

This test is conducted by measuring out a distance of 20 meters
Materials required: Tape measure, meter stick and duct or masking tape
Component tested: Lower body power and stability
Measured in: Meters and centimeters
# of attempts: Two (2) per both legs, right leg and left leg. Record the best for each.
Procedure:

- **Two** legged jumps. Athletes start with both toes behind the line (against a box or wall).

- The athlete performs five (5) consecutive jumps in a continuous motion (rhythm).
- The athlete must land solidly with good stability. Final measurement is taken from the big **toe of the hindmost foot** (ideally the feet should be at the same length). If the athlete loses balance forward or backwards, the test result will not count and should be repeated.
- The better of two (2) attempts will be scored
- Repeat as above for right and left legs.

Common dysfunctions during the penta jump include:

1. Inward movement of a knee or both knees (dynamic valgus) –poor VMO support
2. Thoracic collapse=poor core stability and control
3. Toeing out (external rotation) poor gluteus strength.
4. Loss of neutral spine position = poor upper body strength

At this particular test it is important to observe technique and confidence in jumping.
Typically, penta jump scores between legs that differ by 50 cm indicate significant strength, power and coordination differences between sides. As a result, there is a greater risk of injury.

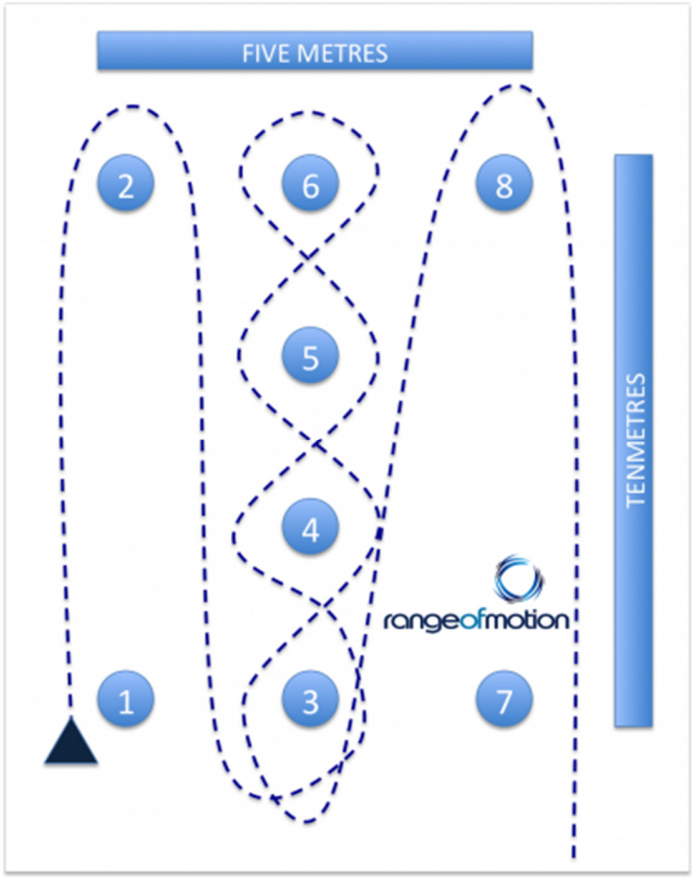
AGILITY & SPEED

(13a) ILLINOIS AGILITY RUN

The objective of the Illinois Agility Run is to monitor the development of the athlete's agility and directional quickness. The course is 10m in length and 5m in width

***Materials required*:** Eight (8) pylons, stop watch and sufficient width (5 track lanes)
Component tested: Agility, directional quickness and coordination
Measured in: Seconds
***# of attempts*:** Two (2); one attempt in each direction; left & right
Procedure:

- The athlete lies face down on the floor at the start point
- On the starter's command (Ready, Set, GO!) the athlete jumps to their feet and negotiates the course around the cones to the finish – **IMPORTANT** –Athlete is always running forward
- Conduct two trials one starting from left to right (start –finish) and the other right to left (finish – start) Note: use cones as turning point
- one (1) restart is given if necessary: use your discretion and give the athlete the benefit of the doubt



(13b) Hexagonal Obstacle

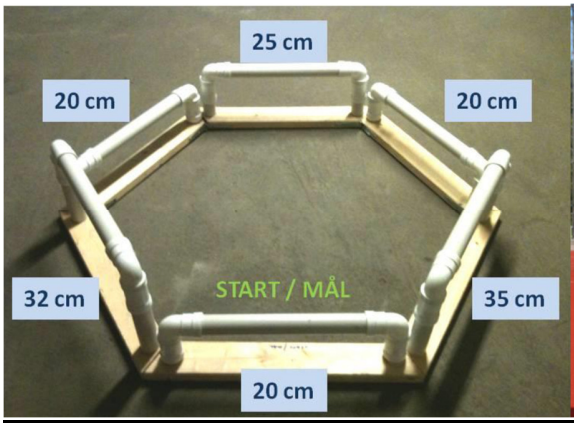
The objective of Hexagonal Obstacle jump is to monitor the development of the athlete's agility and directional quickness. The Hexagon is 65cm each length and has different heights as seen in figure 1 below

Materials required: Hexagon build with pipes (appendix 3)
Component tested: Agility, directional quickness and coordination
Measured in: Seconds – The sum of the fastest clockwise and counterclockwise times is recorded as a score.
# of attempts: Max three(3) min two (2); in each direction; left & right
Procedure:

- The goal is to jump through the obstacle as quickly as possible. Start position is inside the barrier beside the 20 cm rear which is between 32 and 35 cm hedges (see diagram).

Start command is " READY ... GO ! " The athlete and Timing starts at " GO ! " . At the start signal, the athlete jumps back and forth over each hurdle as fast as possible, using two footed jumps and facing the direction of travel. Each athlete performs at least two trials in each of the clockwise and counterclockwise directions. An attempt consists of 3 labs and the clock is stopped when the athlete lands with both feet back in the middle of the obstacle after the last jump either the 32 or 35 cm hedge, depending on the direction.

If an obstacle is knocked over during a trial, the trial is repeated. Each athlete is given maximum three attempts, with a two to three minute rest between trials, to achieve their fastest time in each directions. The sum of the fastest clockwise and counterclockwise times is recorded as the score.



(14) 40m SPRINT

This test is designed to measure pure linear speed and explosiveness. Running is a fundamental building block for any athlete.

Materials required: Stop watch, **60m** track & pylons, cones
# of attempts: Two (2); best time to be used
Measured in: Seconds
Duration: Not applicable
Procedure:

- have the athlete start from a stationary and ready position at the starting line with one or two hands on the line
- On the 'Ready, Set, GO!' command, the athlete sprints the **40m** distance as fast possible. The athlete should decelerate over the remaining **20m**
- The timer should start the watch on the first movements of the athlete's hand and stop the watch as the athletes crosses the **40m** line
- The athlete will have two (2) chances with a three (3) minute rest in between attempts. Measure to the nearest .1's taking the best attempt as the score.

LOWER BODY STRENGTH

(15a) Single Leg Squat (all age groups)

Squat down at full range. Keep back straight as possible and supporting knee pointed same direction as foot supporting. Raise body back up to original position until knee and hip of supporting leg is straight. Return and repeat. Continue with opposite leg

***Materials required*:** High box/bench (ensure bench is well secured and stable -60-80cm

Component tested: Entire leg strength including gluteus, ankle and knee stability, ROM
# of attempts: As many as able
Measured in: *# of full range single leg squats*
Duration: Not applicable
Procedure:

- Supporting knee should point same direction as foot throughout movement. Hip knee and big toe in alignment. Speed of movement is controlled speed,
- 1 minute rest between legs
- Failure is considered if speed of movement can't be controlled, if full range is not achieved, if balance can't be maintained, if knee buckles inward, if ankle stability can't be maintained.

(15b) 3RM Squat test- for Open, U21, U18 athletes only

Equipment required: Barbells, Spotter is necessary
Disadvantages: ***It is only for advanced athletes who have good technique.***

Component tested: Entire leg strength including gluteus, ankle, Core and knee stability, ROM
# of attempts: 3-5 until 3RM determined
Measured in: *# of repetition and weight lifted*
Duration: Not applicable
Procedure:

1. The participant should place their feet shoulder width apart with weight equally spread on both feet and barbell placed on shoulder (padding) below neck.
2. Each squat requires the thigh to go to parallel to floor or below, while the subject maintains a neutral lumbar spine.
3. Do not bounce at the bottom of the movement or stop during the assessment.
4. If a squat is considered incomplete, then this is instructed to the subject and that squat is not counted.

- Start with a warm-up and a light weight you can easily handle for 10-15reps.
- Rest two minutes.
- Increase the weight by 10-20 percent and perform a second warm-up set of 6-8 reps.

- Trial and error establishing your score within 4 lifts. After each attempt, increase or decrease the load by 2.5 to 5 kilograms depending on the outcome of the attempt. Remember to take three to four minutes rest between attempts.
- Repeat this process until only 3 repetitions can be performed with proper technique. Always rest three to four minutes between attempts.

Conversion: 1RM-3 and 5 RM – click on link below

http://www.sportsscience.co/tools/1-rep-max-1rm-calculator/

(15c) 1RM Squat test- for open and U21, U18 athletes only

Due to safety issues this test will be performed as a sub-max test and then converted into 1RM

The aim is to complete between 4 and 10 repetitions max.

Equipment required: Barbells, Spotter is necessary
Disadvantages: ***It is only for advanced athletes who have good technique.***

Component tested: Entire leg strength including gluteus, ankle, Core and knee stability, ROM
# of attempts: 3-5 until 1RM determined/or 4-10 Reps max for sub max testing
Measured in: *# of repetition and weight lifted*
Duration: Not applicable
Procedure:

1. The participant should place their feet shoulder width apart with weight equally spread on both feet and barbell placed on shoulder (padding) below neck.
2. Each squat requires the thigh to go to parallel to floor or below, while the subject maintains a neutral lumbar spine.
3. Do not bounce at the bottom of the movement or stop during the assessment.
4. If a squat is considered incomplete, then this is instructed to the subject and that squat is not counted.

- Start with a warm-up and a light weight you can easily handle for 10-15reps.

- Rest two minutes.
- Increase the weight by 10-20 percent and perform a second warm-up set of 6-8 reps.
- Trial and error establishing your score within 4 lifts. After each attempt, increase or decrease the load by 2.5 to 5 kilograms depending on the outcome of the attempt. Remember to take three to four minutes rest between attempts.
- Repeat this process until only 1 repetitions (or in sub max 4-10 reps)can be performed with proper technique. Always rest three to four minutes between attempts.

Conversion: 1RM-3 and 5 RM – click on link below

http://www.sportsscience.co/tools/1-rep-max-1rm-calculator/

AEROBIC / AN-AEROBIC THRESHOLD & ENDURANCE

(16) BOX TEST

- *60 seconds for U12, U14 athletes*
- *90 seconds for U16, U18, U21/Open athletes*

***Materials required*:** Stopwatch and box
20cm for U12; 2 pieces
30cm for U14; 3 pieces
40cm U16,U18,U21/Open; 4-5 pieces

Component tested: Anaerobic lactic endurance, agility and quickness

# of attempts: One (1)

Measured in: *# of touches on the box with both feet*

Duration: Sixty (60) for U12/U14; ninety (90) seconds for U16 and older

Procedure:

- the athlete will start behind the box on whichever side they are most comfortable starting on; i.e.: left shoulder beside the box
- On the command (Ready, Set, GO!) the athlete jumps laterally onto the box and then down off the other side. This is done continuously for sixty (60) seconds (U14,U12): ninety (90) seconds for U16 and older.
- The recorder shall count one (1) for each time the athlete's feet touch the box. It is imperative that both feet touch the box together, or at the same time.
- The timer starts the watch on the 'GO!' command. The timer will call out the time lapsed for every fifteen (15) seconds during the test. As the timer calls out thirty seconds, the counter shall shout out the total # of touches for the first thirty (30) seconds while recording the total number of touches for the first thirty (30) in the 'Box 30' column and the final # of touches in the 'Box 60' column. One extra step for juniors.
- The athlete then has exactly three (3) minutes to recover prior to heading to the 'Balance Test' (if balance test is performed).
- If the athlete fails to complete jumps in a **coordinated** and **safe** manner (avoid risk of injury) the test will be **terminated** and correctly completed jumps so far recorded.

Both feet must work in unison; only those touches where the feet take off and land at the same will be counted. We should attempt to have spotters for this test in the event that an athlete falls (which isn't uncommon). Two spotters should be covering the athlete on each side for the duration of the test.

(17) BALANCE TEST

- to be exactly three (3) minutes right after the 'Box Test'

This test is to be performed exactly three (3) minutes after completing the box test.
Balance is tested under fatigued conditions, where it is most critical.

Materials required: Balance board and stopwatch
Component tested: Balance, recovery balance
# of attempts: One (1)
Measured in: *# of touches*
Duration: One (1) minute
Procedure:

- The athlete will gain balance by holding onto one of the coaches / other athletes, the athletes have five (5) seconds to gain his / her balance before the test begins.
- The goal of the test is to have the board touch the floor as few times as possible in one (1) minute.
- The recorder shall record the # of touches in one (1) minute

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(18) 20M SHUTTLE RUN (Beep Test)

The 'beep test' is designed to measure VO2 max (estimate) without the use and cost of lab equipment. The 'beep test' will measure the athlete's ability to take in and utilize oxygen. Each stage of the test is assigned a number which is correlated to a predictive estimate of VO2 max; it is important that the athletes push themselves to the absolute limit. The VO2 max is a predictive measure of an athlete's aerobic capacity and power (endurance).

Materials required: Pylons, CD player, Leger Boucher CD
Component tested: Aerobic endurance; predictive VO2 max
# of attempts: One (1)
Measured in: Stage and level achieved
Procedure:

- pylons or masking tape is set in two (2) parallel line exactly 20m apart
- play the explanation portion of the disc (track #2) for the athletes
- play the test portion of the disc (track #3) after the athlete's line up on the line
- If the athlete loses pace with the disc, they are issued a warning to maintain the pace. If an athlete falls short of the line twice in a row, the test is terminated for that athlete.

- The last stage completed shall be recorded for the athlete. The athlete should attempt to reach the highest possible stage as the predictive VO2 value is based upon maximal effort.

This test goes by many names, though you need to be careful as the different names also may signify that these are different versions of the test. Therefore you need to be wary when comparing results or comparing to norms.

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(19) Cooper test VO2Max

The Cooper Test [Cooper, KH. "A means of assessing maximal oxygen intake". JAMA. 203:201-204, 1968] is used to monitor the development of the athlete's aerobic endurance and to obtain an estimate of their VO2max.

Materials required: 400m track, stop watch, whistle and support person
Component tested: Aerobic endurance; predictive VO2 max
# of attempts: One (1)
Measured in: Distance over 12min duration
Procedure:

- This test requires the athlete to run as far as possible in 12 minutes
- The athlete warms up for 10 minutes
- The assistant gives the command “GO”, starts the stopwatch and the athlete commences the test
- The assistant keeps the athlete informed of the remaining time at the end of each lap (400m)
- The assistant blows the whistle when the 12 minutes has elapsed and records the distance the athlete covered to the nearest 10 metres

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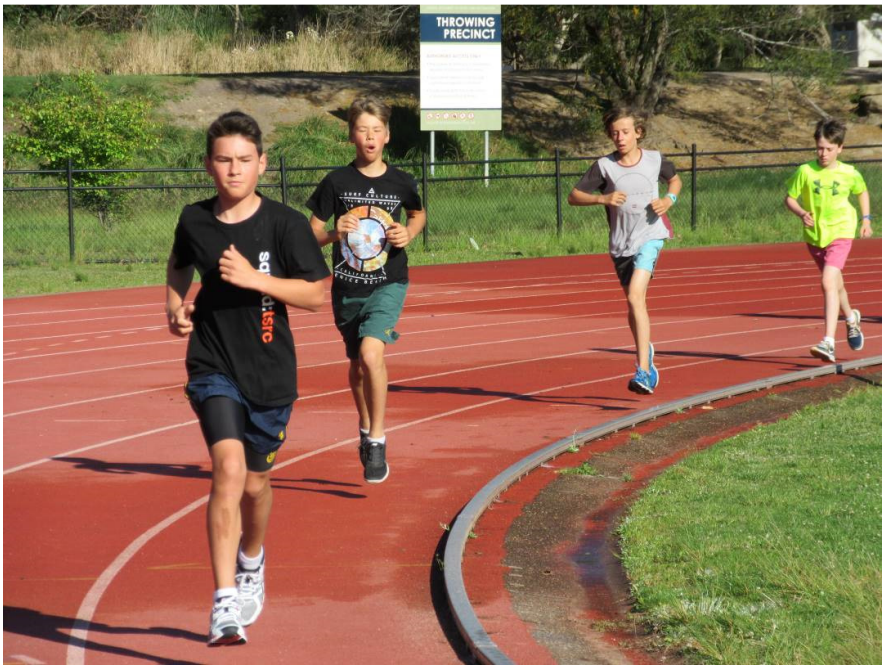
VO2max

Conversion rate see below
http://www.brianmac.co.uk/gentest.htm

An estimate of your VO2max can be calculated as follows:

- (Distance covered in metres - 504.9) ÷ 44.73



Materials required for testing day:

	Material	Supplied by	Status

- clipboards x 5
- pens & pencils
- crayons and chalk (sharpie)
- testing worksheets and paper
- duct tape
- masking tape
- meter stick x2
- measuring tape x4;
- box
- scale
- balance board
- 1 x 5 lbs weight
- Blood pressure cuff
- Pylons and volcano cones
- Soccer ball x2

References:

1) Docherty, D. Measurement in Pediatric Exercise Science, CSEP, 1996
2) Baechle, T. R. Essentials of Strength Training and Conditioning, 1994.
3) Agility- Delorme. A, 2002
4) CAST national team protocol 2000, Calgary Human Performance Center
5) NWHT testing protocol 2003, Calgary Human Performance Center
6) AOA fitness challenge May 2003.
7) ASC, Physiological tests for elite athletes, 2000.
8) Norris, S. Personal communication, 2003.
9) Foran, B. High-Performance Sport Conditioning. Human Kinetics:Champaign, Ill. 2001.

10) AOA Fitness Testing Protocol 2004.05
11) BC Alpine Fitness Testing Protocol 2002.03
12) Norwegian Institute of Sport

Appendix 1

Testing result interpretation

NORMETIVE DATA

(2b) Blood Pressure/Resting HR

Blood pressure: Systolic below 140, diastolic below 85: Resting HR below 72 (Australian average norm) usually the lower the better. Best performers are cyclists = as low as 30 Heart beats/min

(3) Anthropometry (Sum7)

Male Athletes

Age	Excellent	Very good	Average	Below Average	Poor
U18	<49	50-54	55-69	70-89	90+
U21	<49	50-54	55-69	70-89	90+

FM Athletes

Age	Excellent	Very good	Average	Below Average	Poor
U18	<56	57-64	65-79	80-99	100+
U21/Open	<56	57-64	65-79	80-99	100+

(4) SIT & REACH (If subject reaches toes=23cm)

Male Athletes

Age	Excellent	Very good	Average	Below Average	Poor
U 12	19+	14-18	7-13	-3- 6	<-4
U14	26+	18-25	9-17	-1- 8	<-1
U16	30+	22-29	14-21	3-13	<3
U18	33+	27-32	17-26	6-16	<6
>U21,Open	33+	27-32	17-26	6-16	<6

FM Athletes

Age	Excellent	Very good	Average	Below Average	Poor
U12	29+	20-28	9-19	2-11	<2
U14	33+	24-32	14-23	4-13	<4
U16	35+	27-34	17-26	8-16	<8
U18	35+	27-34	17-26	8-16	<8
U21/Open	35+	27-34	17-26	8-16	<8

(5) UPPER ABDOMINAL TEST; Five (7) Stage U16 and older, (5) Stage–U12 and U14

Male Athletes Abs

Age	Excellent	Very good	Average	Below Average	Poor
U12	5	4	3	1-2	<1
U14	5	4	3	2	<2
U16	7	6	5	3-4	<3
U18	7	6	5	4	<4
U21/Open	7	6	5	4	<4

Female Athletes

Age	Excellent	Very good	Average	Below Average	Poor
U12	5	4	3	1-2	<1
U14	5	4	3	2	<2
U16	7	6	5	3-4	<3
U18	7	6	5	4	<4
U21/Open	7	6	5	4	<4

(6) Maximum Push Up 60 sec (All age groups)

Male Athletes Push up

Age	Excellent	Very good	Average	Below Average	Poor
U12	26+	20-25	12-19	6-11	<5
U14	40+	30-39	20-29	10-19	<10
U16	50+	40-49	30-39	20-29	<20
U18	55 +	50-54	36-49	25-35	<25
U21/Open-	60 +	55-59	40-54	30-39	<30

Female Athletes

Age	Excellent	Very good	Average	Below Average	Poor
U12	18+	12-17	8-11	4-7	<4
U14	23+	17-22	13-16	8-12	<8
U16	30+	23-29	15-22	9-14	<9
U18	40+	30-39	17-29	10-17	<10
U21/Open not tested	48+	36-47	21-35	12-20	<12

(7a)1 RM Max Bench press-sub max test

Male Athletes – BW= Bodyweight of one RM

Age	Excellent	Very Good	Average	Below Average	Poor
U16	1.0BW+	0.8BW+	0.7BW+	>0.6BW+	<0.6BW
U18	1.4+	>1.0+	>0.8+	>0.7 +	<0.7 BW

FM Athletes

Age	Excellent	Very Good	Average	Below Average	Poor
U16	1.0BW+	0.7BW	0.6BW+	0.5BW+	< 0.5BW
U18	1.2+	1.0+	0.8+	0.6+	<0.6

(7b)3 RM Max Bench press-U16/U18sub max test

Male Athletes – BW= Bodyweight of 3 RM

Age	Excellent	Very Good	Average	Below Average	Poor
U16	0.94BW+	0.75BW+	0.65BW+	0.55BW+	<0.55BW
U18	1.3+	0.94+	0.75+	0.65 +	<0.65
U21/Open					
60kg BW	97.5	87.5	67.5	62.5	<52.5
70kg BW	107.5	95.0	72.5	67.5	<57.5
80kg BW	115.0	102.5	80.0	72.5	<60.0
90kg BW	122.5	110.0	85.0	77.5	<65

FM Athletes

Age	Excellent	Very Good	Average	Below Average	Poor
U16	0.94 BW+	0.65BW+	0.55BW+	0.45BW+	< 0.45BW
U18	1.15 +	0.93+	0.75+	0.65+	<0.65
U21/Open					
50kg BW	37.5	42.5	47.5	55.0	75.0
60kg BW	42.5	47.5	52.5	62.5	82.5
70kg BW	45.0	50.0	57.5	67.5	90.0
80kg BW	47.5	55.0	60.0	72.5	97.5

(8) Max Chin-Ups-Palms facing away (pronated grip)

Male Athletes

Age	Excellent	Very Good	Average	Below Average	Poor
U12	6+	5-6	3-4	1-2	<1
U14	9+	7-8	5-6	3-4	<3
U16	12+	10-11	7-9	4-6	<4
U18	16+	11-15	8-10	5-7	<5
U21/Open	17+	12-16	9-11	6-8	<6

FM Athletes

Age	Excellent	Very Good	Average	Below Average	Poor
U12	>4	3	2	1	<1
U14	5+	4	3	2	<2
U16	9+	6-8	4-5	3	<3
U18	12+	8-11	6-7	4-5	<4
U21/Open	14+	10-13	7-9	4-6	<4

(9) VERTICAL JUMP – double legged

Male Athletes V jump cm

Age	Excellent	Very good	Average	Below Average	Poor
U12	40+	31-39	21-30	16-20	<16
U14	56+	40-55	33-39	22-32	<22
U16	60+	48-59	39-47	26-38	<26
U18	65+	50-64	45-49	30-41	<30
U21/Open	70+	64-69	56-63	40-55	<40

FM Athletes

Age	Excellent	Very good	Average	Below Average	Poor
U12	40+	30-39	20-29	16-19	<16
U14	48+	38-47	30-37	20-29	<20
U16	53+	45-52	35-44	23-34	<23
U18	57+	49-56	40-48	26-39	<26
U21/Open	60+	50-59	46-51	30-45	<30

(10) VERTICAL JUMP – single legged (look at difference between left and right leg

Male Athletes

Age	Excellent	Very good	Average	Below Average	Poor
U12					
U14					
U16					
U18					
U21/Open					

FM Athletes

Age	Excellent	Very good	Average	Below Average	Poor
U12					
U14					
U16					
U18					
U21/Open					

(11) BROAD JUMP (Single Jump)

Male Athletes cm

Age	Excellent	Very good	Average	Below Average	Poor
U12	205+	185-204	165-184	135-164	<135
U14	255+	230-254	210-229	165-209	<165
U16	270+	255-269	235-254	195-234	<194
U18	285+	265-284	240-264	220-239	<220
U21/Open	300+	270-299	250-269	230-249	<230

Female Athletes

Age	Excellent	Very good	Average	Below Average	Poor
U12	205+	185-204	165-184	135-164	<135
U14	235+	205-234	190-204	165-189	<165
U16	255+	230-254	210-229	185-209	<185
U18	260+	235-259	220-234	200-219	<200
U21/Open	280+	245-279	225-244	210-224	<210

(12a) PENTA JUMP (5 Consecutive Jumps) double legged

Male Athletes m

Age	Excellent	Very good	Average	Below Average	Poor
U12	10.6+	9.0-10.59	8.0-8.99	7.1-7.99	<7.1
U14	11.7+	10.6-11.69	9.4-10.59	8.0-9.39	<8.0
U16	12.7+	11.4-12.69	10.2-11.39	8.7-10.19	<8.7
U18	13.2+	11.7-12.19	10.5-11.69	9.0-10.49	<9.0
U21/Open	14.0+	12.2-13.99	11.0-12.19	9.7-10.99	<9.7

Female Athletes

Age	Excellent	Very good	Average	Below Average	Poor
U12	10.6+	9.0-10.59	8.0-8.99	7.1-7.99	<7.1
U14	11.7+	10.2-11.69	8.8-10.19	7.2-8.79	<7.2
U16	12.0+	10.8-11.99	9.2-10.79	7.7-9.19	<7.7
U18	12.4+	11.2-12.39	9.8-11.19	8.2-9.79	<8.2
U21-Open	12.9+	11.7-12.89	10.3-11.69	9.3-10.29	<9.3

(12b) PENTA JUMP (5 Consecutive Jumps) single legged

Male Athletes

Age	Excellent	Very good	Average	Below Average	Poor
U12	8.6+	7.5-8.5	6.2-7.5	5.4-6.1	<5.4
U14	9.9+	8.5-9.8	7.6-8.4	6.2-7.5	<6.2
U16	10.7+	9.2-10.6	8.2-9.1	7.2-8.1	<7.2
U18	11.2+	9.7-11.1	8.7-9.6	7.7-8.6	<7.7
U21/Open	11.9+	10.4-11.8	9.4-10.3	8.2-9.3	<8.2

Female Athletes

Age	Excellent	Very good	Average	Below Average	Poor
U12	8.6+	7.5-8.5	6.2-7.5	5.4-6.1	<5.4
U14	9.9+	8.5-9.8	7.6-8.4	6.2-7.5	<6.2
U16	10.2+	8.9-10.1	7.9-8.8	6.9-7.8	<6.9
U18	10.7+	9.6-10.6	8.5-9.5	7.4-8.4	<7.4
U21/Open	11.2+	10.2-11.1	9.1-10.1	8.0-9.0	<7.9

(13a) ILLINOIS AGILITY RUN

Male Athletes | Illinois

Age	Excellent	Very good	Average	Below Average	Poor
U12	<16.9	17.7-17.0	18.7-17.8	20-18.5	>20
U14	<16.4	17.1-16.5	18.09-17.2	19.5-18.1	>19.5
U16	<15.99	16.7-16.0	17.5-16.8	18.5-17.6	>18.5
U18	<15.5	16.4-15.6	17.09-16.5	17.9-17.1	>17.99
U21/Open	<15.2	15.8-15.3	16.4-15.9	17.4-16.5	>17.5

Female Athletes

Age	Excellent	Very good	Average	Below Average	Poor
U12	<16.9	17.7-17.0	18.7-17.8	20-18.5	>20
U14	<16.7	17.5-16.8	18.4-17.6	19.4-18.5	>19.5
U16	<16.4	17.1-16.5	18.1-17.2	18.9-18.2	>19.0
U18	<15.9	16.7-16.0	17.5-16.8	18.5-17.6	>18.6
>21/Open	<15.5	16.4-15.6	17.3-16.5	18.2-17.4	>18.3

13b) HEXAGONAL JUMP

Male Athletes

Age	Excellent	Very good	Average	Below Average	Poor
U18					
U21/Open	29	30	31	34	>36

Female Athletes

Age	Excellent	Very good	Average	Below Average	Poor
U18					
>21/Open	30	32	33	34	>36

(14) 40m SPRINT

Male Athletes

Age	Excellent	Very good	Average	Below Average	Poor
U12	<6.1	6.9-6.2	7.9-7.0	9.1-8.0	>9.2
U14	<5.9	6.7-6.0	7.7-6.8	8.4-7.8	>8.5
U16	<5.7	6.5-5.8	<7.3-6.6	7.9-7.4	>8.0
U18	<5.4	6.1-5.5	6.9-6.2	7.6-7	>7.7
U21/Open	<4.9	5.5-5.0	<6.4-5.6	7.3-6.5	>7.4

Female Athletes

Age	Excellent	Very good	Average	Below Average	Poor
U12	<6.1	6.9-6.2	7.9-7.0	9.1-8.0	>9.2
U14	<5.9	6.7-6.0	7.7-6.8	8.4-7.8	>8.5
U16	<5.8	6.6-5.9	<7.3-6.7	7.9-7.4	>8.0
U18	<5.7	6.4-5.8	7.1-6.5	7.7-7.2	>7.8
U21/Open	<5.3	5.7-5.4	<6.4-5.8	7.5-6.5	>7.6

(15a) Single Leg Squat (all ages)

Male Athletes

Age	Excellent	Very Good	Average	Below Average	Poor
U12	11+	7-10	4-6	1-3	<1
U14	13+	9-12	5-8	2-5	<2
U16	17+	13-16	9-12	5-8	<5
U18	27+	22-27	16-21	10-15	<10
U21/Open	35+	28-34	20-27	13-19	<13

Female Athletes

Age	Excellent	Very Good	Average	Below Average	Poor
U12	11+	7-10	4-6	1-3	<1
U14	13+	9-12	5-8	2-5	<2
U16	17+	13-16	9-12	5-8	<5
U18	25+	17-24	13-16	8-12	<8
U21/Open	30+	23-29	17-22	12-16	<12

(15b)3 RM Max Squat

Male Athletes – BW= Bodyweight of 3 RM

Age	Excellent	Very Good	Average	Below Average	Poor
U18	>1.15BW	>0.95BW	>0.75BW	>0.65BW	<0.65BW
U21/Open					
60kg BW	97.5	87.5	67.5	62.5	52.5
70kg BW	107.5	95.0	72.5	67.5	57.5
80kg BW	115.0	102.5	80.0	72.5	60.0
90kg BW	122.5	110.0	85.0	77.5	65

FM Athletes

Age	Excellent	Very Good	Average	Below Average	Poor
U18	>0.95 BW	>0.65BW	>0.55BW	>0.45BW	< 0.45BW
U21/Open					
50kg BW	75.0	55.0	47.5	42.5	<37.5
60kg BW	82.5	62.5	52.5	47.5	<42.5
70kgBW	90.0	67.5	57.5	50.0	<45.0
80kgBW	97.5	72.5	60.0	55.0	<47.5

(15c)1 RM Max Squat (or sub max test with conversion)

Male Athletes – BW= Bodyweight of one RM

Age	Excellent	Very Good	Average	Below Average	Poor
U18	>1.2BW	>1.0BW	>0.8BW	>0.7BW	<0.7BW

Female Athletes

Age	Excellent	Very Good	Average	Below Average	Poor
U18	>1.0 BW	>0.7BW	>0.6BW	>0.5BW	< 0.5BW

(16) BOX TEST (note difference in box height)

Male Athletes

Age	Excellent	Very good	Average	Below Average	Poor
U12	76+	65-75	50-64	35-49	<35
U14	84+	70-83	57-69	37-56	<37
U16	95+	80-94	65-79	39-64	<39
U18	101+	85-100	70-84	45-69	<45
U21/Open	111+	90-110	75-89	55-74	<55

Female Athletes

Age	Excellent	Very good	Average	Below Average	Poor
U12	76+	65-75	50-64	35-49	<35
U14	84+	70-83	57-69	37-56	<37
U16	90+	76-89	60-75	39-59	<39
U18	95+	80-94	65-79	41-64	<40
U21/Open	100+	86-99	70-85	42-69	<42

(17) BALANCE TEST

Age	Excellent	Very good	Average	Below Average	Poor
U12	0	1-3 touch	4-7touch	8-11touc	12+
U14	0	1-3 touch	4-5 touch	6-8touch	9+
U16	0	1-2 touch	3-4 touch	5-7touch	8+
U18	0	1 touch	2-3touch	4-6touch	7+
U21/Open	0	1 touch	2-3 touch	4-6touch	6

Female Athletes

Age	Excellent	Very Good	Average	Below Average	Poor
U12	0	1-3 touch	4-7touch	8-11touc	12+
U14	0	1-3 touch	4-5 touch	6-8touch	9+
U16	0	1-2 touch	3-4 touch	5-7touch	8+
U18	0	1touch	2-3touch	4-6touch	7+
U21/Open	0	1touch	2-3 touch	4-6touch	6

(18) 20M SHUTTLE RUN (Bleep Test) –shuttle number/Vo2max

Male Athletes | shuttle

Age	Excellent	Very Good	Average	Below Average	Poor
U12	9.1+	7.4+	6.1+	4.4+	<4.4
U14	11.5+	9.3+	8.1+	5.6+	<5.6
U16	12.8+	11.5+	9.4+	7.4+	<7.4
U18	13.10+	11.8+	9.8+	8.7+	<8.7
U21/Open	15.8+	14.8+	12.8+	10.1+	<9.8
VO2Max	70	65	60	55	52

Female Athletes Stage/VO2 Max

Age	Excellent	Very Good	Average	Below Average	Poor
U12	9.1+	7.4+	6.1+	4.4+	<4.4
U14	10.2+	8.3+	6.4+	5.1+	<5.1
U16	11.5+	9.4+	8.1+	6.6+	<6.6
U18	11.9+	10.1+	8.5+	7.1+	<7.1
U21/Open	12.5+	11.5+	10.1+	8.1+	<8.1
VO2Max	58	55	52	49	45

(19) Alternative Cooper test VO2Max –distance in meters

Male Athletes

Age	Excellent	Very Good	Average	Below Average	Poor
U12	2600+	2300	2000+	1700+	<1700
U14	2800+	2500	2300+	2000+	<2000
U16	3100+	2800	2500+	2200+	<2250
U18	3150+	2900+	2600+	2350+	<2350
U21/Open	3400+	3250+	3000+	2700+	<2700
VO2Max	70	65	60	55	52

Female Athletes

Age	Excellent	Very Good	Average	Below Average	Poor
U12	2500+	2200+	1900+	1700+	<1750m
U14	2600+	2400+	2050+	1900+	<1900m.
U16	2850+	2450+	2300+	2050+	<2050m
U18	2900+	2600+	2450+	2200+	<2200m
U21/Open	3100+	2950+	2750+	2500+	<2500m
VO2Max	58	55	52	49	45

VO2max

An estimate of your VO2max can be calculated as follows:

- (Distance covered in metres - 504.9) ÷ 44.73

Appendix 1
General information

Sport	Age	Male	Female
Baseball	18-32	48-56	52-57
Basketball	18-30	40-60	43-60
Cycling	18-26	62-74	47-57
Canoeing	22-28	55-67	48-52
Football (USA)	20-36	42-60	
Gymnastics	18-22	52-58	35-50
Ice Hockey	10-30	50-63	
Orienteering	20-60	47-53	46-60
Rowing	20-35	60-72	58-65
Skiing alpine	18-30	57-68	50-55
Skiing Nordic	20-28	65-94	60-75
Soccer	22-28	54-64	50-60
Speed skating	18-24	56-73	44-55
Swimming	10-25	50-70	40-60
Track & Field - Discus	22-30	42-55	
Track & Field - Running	18-39	60-85	50-75
Track & Field - Running	40-75	40-60	35-60
Track & Field - Shot	22-30	40-46	
Volleyball	18-22		40-56
Weight Lifting	20-30	38-52	
Wrestling	20-30	52-65	

Tables adapted from: Wilmore JH and Costill DL. (2005) Physiology of Sport and Exercise: 3rd Edition. Champaign, IL: Human Kinetics

Athlete's Vo2max Scores

The following are the Vo2max scores for a selection of the top female and male athletes.

VO2max (ml/kg/min)	Athlete	Gender	Sport/Event
96.0	Espen Harald Bjerke	Male	Cross Country Skiing
96.0	Bjorn Daehlie	Male	Cross Country Skiing
92.5	Greg LeMond	Male	Cycling
92.0	Matt Carpenter	Male	Marathon Runner
92.0	Tore Ruud Hofstad	Male	Cross Country Skiing
91.0	Harri Kirvesniem	Male	Cross Country Skiing
88.0	Miguel Indurain	Male	Cycling
87.4	Marius Bakken	Male	5K Runner
85.0	Dave Bedford	Male	10K Runner
85.0	John Ngugi	Male	Cross Country Runner
73.5	Greta Waitz	Female	Marathon runner
71.2	Ingrid Kristiansen	Female	Marathon Runner
67.2	Rosa Mota	Female	Marathon Runn

The following table can be used with experienced athletes:

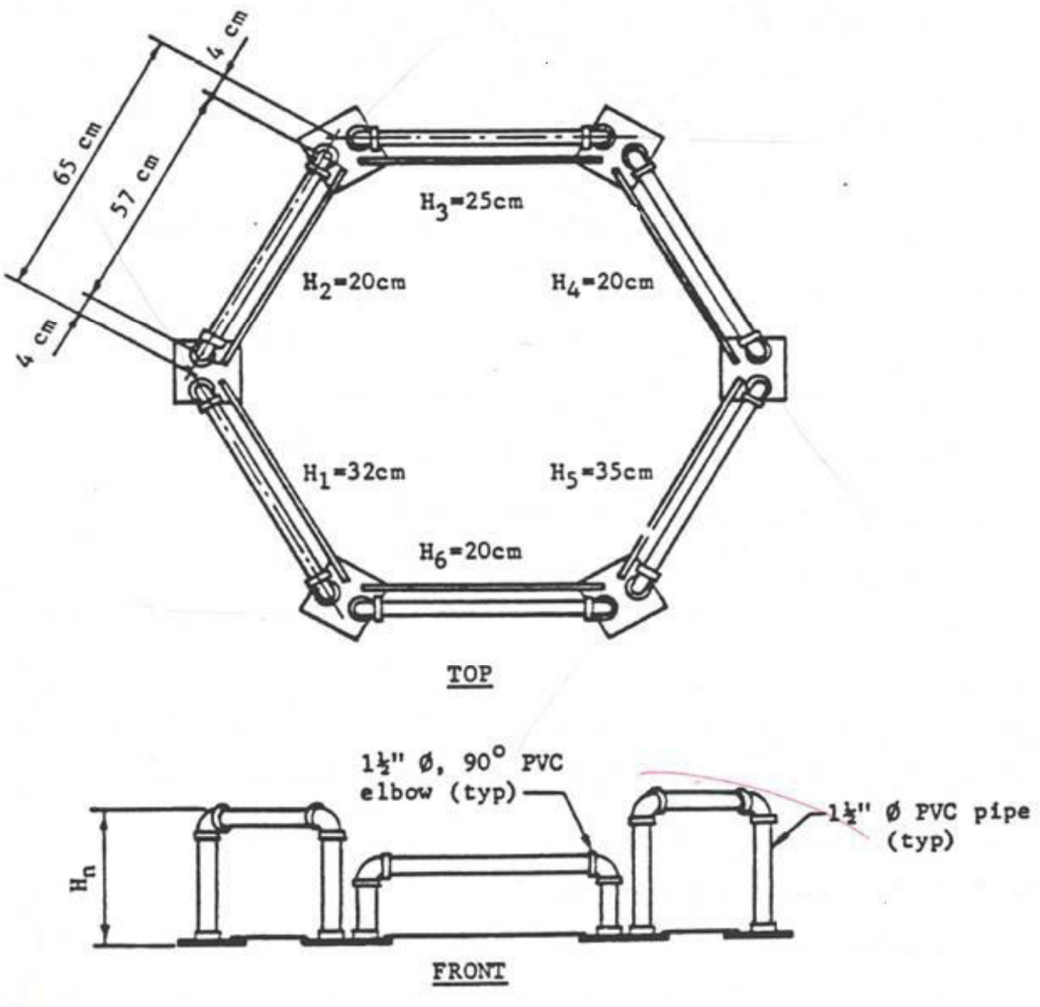
Gender	Excellent	Above Average	Average	Below Average	Poor
Male	>3700m	3400-3700m	3100-3399m	2800-3099m	<2800m
Females	>3000m	2700-3000m	2400-2999m	2100-2399m	>2100m

Appendix 2

Age division

Season 2016/17	Alpine Ski Racing age divisions								
	Open	U21	U18	U16	U14	U12	U10	U8	U6
	95 and older	96/97/98	99/00	01/02	003/04	05/06	07/08	09/10	11/12

Appendix 3



Appendix 4

The world record for the Broad Jump (single jump) is currently held by Arne Tvervaag (Norwegian) who, in 1968, jumped 3.71m