USSPEEDSKATING

GUIDE FOR PHYSIOLOGICAL TESTING

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Introduction

The tests contained in this document are intended to be used by active US Speedskating members in good standing or as part of a US Speedskating event.

Physiological testing of athletes can be a great tool for coaches to measure improvement in addition to identifying and developing talent. The following guide is intended to help coaches, athletes, trainers and parents better understand where an athlete is making progress and where they need improvement. The tests contained in this document have been found to reliably assess and track muscular and cardiovascular status and development. These tests were specifically selected by the High Performance and Development Teams as key indicators to predict speed skating performance from a physiological perspective (without consideration for sport specific technique). It is also important to note that while these tests can be conducted on prepubescent athletes they not a reliable method for evaluation within this population. Skill development should be the primary focus at those ages.

Testing should always be done with a purpose and results should be tracked over time. Tests should be performed multiple times per training season to help coaches determine if appropriate adaptations within specific energy systems have been achieved or if adjustments are needed. It is recommended that the same tests are repeated throughout the training season with similar preparation preceding the test days (*for example testing is always done on "Day 1" of a new training cycle after a rest day*) for optimal interpretation of results..

These tests are designed to give a snap shot of each energy system along with skills needed for speed skating. It is recommended that you select one test from each energy system for your testing sessions. The areas we have identified are:

- Anerobic Power
- Anaerobic Capacity
- Aerobic Capacity (Endurance)

Results can be submitted to US Speedskating for long term tracking and for determining and evaluating against normative data.

**This document will be updated as research updates and or as new evaluations are identified.*

Preparation

Coaches should take time to inform athletes of the testing protocols and any necessary preparations in the days leading up to testing. Athletes should ensure they are physically ready to perform to the best of their ability by properly preparing themselves prior to the testing. Athletes should be properly nourished and hydrated in the days prior to testing. Athletes should be well rested and avoid heavy exercise for 12 to 24 hours before to testing. Additionally athletes should participate in a warm up routine that is appropriate for the modalities of the tests being conducted i.e., running for running tests, biking for biking tests, jumping for jumping tests and that warm up should be standardized for each round of testing.

Athletes should be medically cleared by a qualified physician prior to any fitness testing. Finally, athletes should be prepared with the appropriate equipment for the testing to be done, this includes wearing proper clothing and footwear. Coaches should ensure that the environment for testing is properly set up and all safety precautions are taken. This includes checking for properly working equipment, appropriate first aid kits, and establishing safety protocols.

American Development Model (ADM)

The US Speedskating ADM is a five stage development model for athletes, parents, coaches, and sport administrators to use as a guide for long term athlete development. The US Speedskating ADM is designed on chronological age however; technical, tactical, physical, cognitive, social and emotional development must all be considered when identifying what stage an athlete may be in.

Stage 1 Discover, Learn & Play (0-12 Years Old)

This stage is all about Fun and Fundamentals. Athletes need to learn how their body works before more complex movements can be introduced. Focus on creating a fun environment that keeps kids active and teach them how to skate before they can be introduced to more complex sport specific movements.

Stage 2 Develop & Challenge (10-16 Years Old)

Now that you have athletes who understand the fundamentals of the sport you can start to introduce more sport specific skill development but don't forget to teach total body movements and activities through off ice training and multi-sport activity.

Stage 3 Train & Compete (13-19 Years Old)

The focus starts to narrow, training sessions and programs become longer. Sport specific skill development and race simulation in practice are critical. Multi-sport activities should be geared toward cross training; running, cycling and structured strength training programs help set the stage for future development. Athletes should start to take ownership of their path.

Stage 4 Excel for High Performance or Participate and Succeed (15+ Years Old)

Stage 4 can find athletes making the choice between performance and participation. Both serve as important stages in athlete development. Performance minded athletes will start to fine tune physiology along with technical and tactical skills with year-long periodized programs and a heavy focus on taking ownership and accountability for their career. Participation minded athletes focus is on fitness, challenge and balance that will contribute to becoming a life-long athlete.

Stage 5 Thrive and Mentor (All Ages)

A life-long passion for speed skating is greatly rewarding. Through alumni events, masters competitions or volunteer activities, athletes stay involved in the sport. Coaching and officiating also utilize a wealth of knowledge developed from experience.

Anthropometrics

Anthropometrics refer to the measurement of the size and proportions of the human body. This section will cover basic anthropometric evaluations used by US Speedskating. Careful consideration should be given while collecting anthropometric data; the time of the day along with hydration and eating schedule can greatly impact the results. Every effort should be given to always capture this data at the same time of the day for consistency. Additionally anthropometric evaluations can be a sensitive area for athletes, care should be taken to keep data collected private and subjective evaluations of anthropometrics should be completely avoided.

Tracking athletes growth is important for many reasons. In addition to helping to interpret testing results long term tracking of height in adolescents can help to identify Peak Height Velocity (PHV) (Balyi, 2013). Identifying this helps coaches to understand the developmental age of the athlete and tailor training to accommodate their specific needs. A standing height growth chart can be found in the link below. More subjective evaluations can also be observed such as foot growth. Typically rapid foot growth precedes PHV.

Body Mass / Weight

Introduction

Body Mass is an important factor in the execution and interpretation of most of the tests prescribed in the US Speedskating Guide. Accurate measurement of body weight is critical for test interpretation and long term tracking, accordingly it should be conducted prior to all testing.

ADM Stage

Appropriate for all stages

Equipment Required:

- Scale; every effort should be made to ensure the reliability and consistency of the scale used.

Procedure:

Shoes and excess clothing should be removed and pockets emptied. The athlete should stand on the scale without moving until a reading is observed in accordance with the protocol of the particular scale you use.

Standing Height

Introduction

Standing height is a critical tool for measuring and monitoring athletes. Identifying a growth spurt can help a coach make appropriate training adjustments.

ADM Stage

Appropriate for all stages

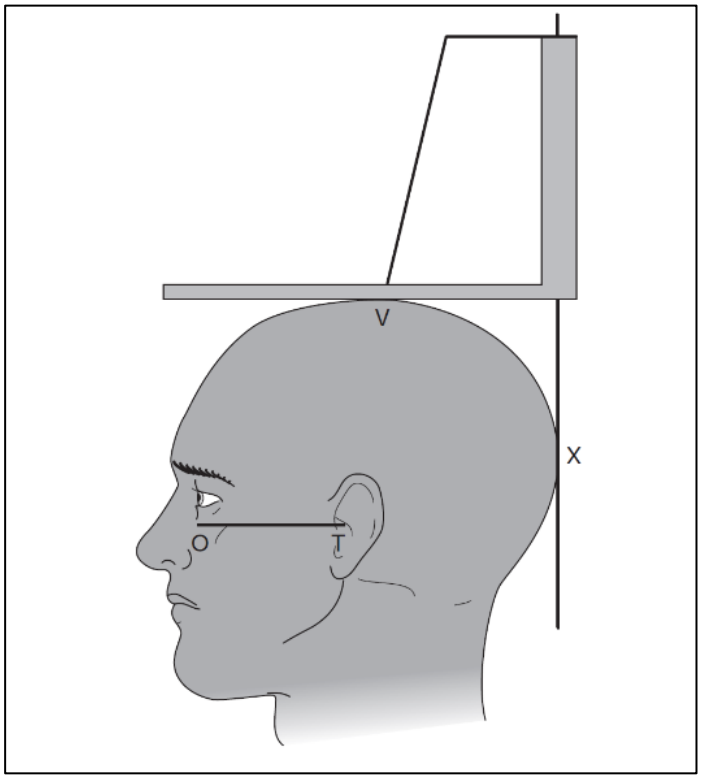
Equipment Required

- Stadiometer or Measuring Tape used with an object that has a 90 degree angle such as a hardcover book.

Procedure:

Footwear and headwear should be removed, feet should be together and arms by their sides. The athlete should be standing as tall as possible against the wall or stadiometer looking straight ahead so that the crown of their head is elevated. If using a stadiometer bring the measuring bar down to the crown of the head and have the athlete take a deep breath before the measurement is observed. If using an object with a 90 degree angle firmly place the object against the wall and bring it down to the crown of the athletes head then mark and observe the measurement. Results can be tracked and monitored using the chart in the link below.

Standing Height Growth Chart (.xlxs download)



Body Composition

Introduction

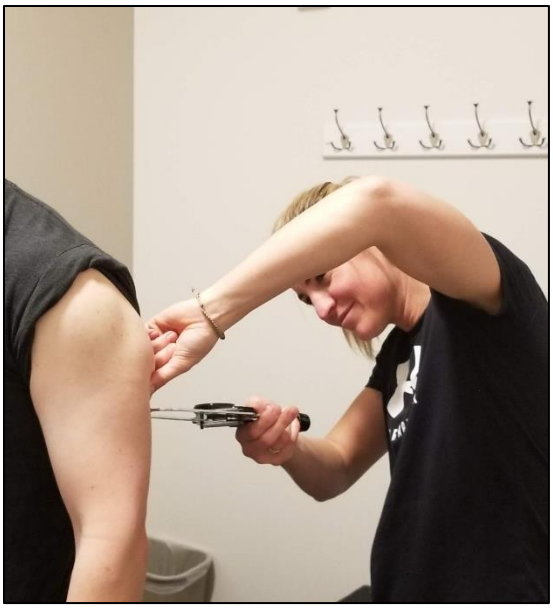
Body composition testing is an effective tool for long term tracking of athletes. US Speedskating recommends using the ISAK sum of skinfolds method for tracking of body composition. In this method the percentage of body fat is not factored. Instead, using the sum of skinfolds. This will provide results more specific and meaningful than an overall percentage of body fat.

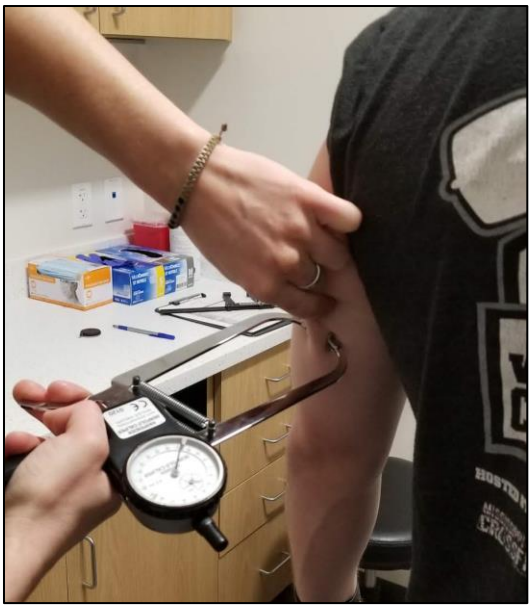
ADM Stage

This test should only be utilized on athletes in Stage 3 & 4b of the USS ADM.

Procedure

Body composition testing can only be conducted by a professional with an ISAK accreditation level 1 or higher. Click here for help finding a certified professional.





Power

Anaerobic power testing is a great tool for evaluating both talent and monitoring athletes preparedness to perform. This testing is often quick and athletes can recover rapidly afterwards. This makes power testing a great way to get frequent updates on an athletes physical state. These tests are appropriate for athletes of all ages, however athletes under the age of 10 should only participate tests that do not require specialized equipment. Furthermore the emphasis for athletes under 10 should be on developing the skill they are using like running or jumping and not on the result.

Vertical Jump

Vertical jump is a simple way to measure power in speed skaters. This test can be simply conducted using chalked fingers against a wall or with highly accurate instruments like a GymAware. Because of the nature of our sport we recommend a squat jump counter movement without an arm swing. This allows us to isolate the leg muscles as arm swings have been shown to boost vertical jump heights by up to 10%. Below we will describe three methods for measuring vertical jump.

Chalked Fingers

ADM Stage

This test can be utilized on athletes in Stage 2,3 & 4 of the USS ADM.

Equipment Required

- A wall tall enough to accommodate a vertical jump that is free from obstruction.
- Chalk that is in contrast to the color of the wall being used.
- Measuring tape.

Procedure:

Chalk should be liberally applied to the finger tips of the athletes dominant hand. Athletes will stand perpendicular to the wall with their dominant arm closest to the wall while raised in the air, their non-dominant hand should be on their hip. Instruct the athlete to reach and touch the wall while keeping their feet flat on the floor. A measurement should be taken from the floor to the top of the chalk mark (standing reach height). Next the athlete should resume the starting position with the dominant arm extended and the non-dominant arm on the hip. Instruct them to jump as high as possible while touching the wall at the peak of the jump (jump height). Subtract the standing height from the jump height for the vertical jump distance. This should be repeated three times with the best height recorded.

GymAware

Introduction

The GymAware is a Velocity Based Training (VBT) device that can be used for many purposes including measuring vertical jump. It works with a web app through an I-Pad that can record and archive results. This device is a specialized piece of equipment that produces very accurate results.

ADM Stage

This test can be utilized on athletes in Stage 3 & 4 of the USS ADM.

Equipment Required

- GymAware Device
- I-Pad running iOS 9.0 or up
- Broom Handle or Paint Stick

Procedure

For detailed directions on initial set up for this device please contact US Speedskating Sport Science Department or a US Speedskating Regional Training Center . After initial set up is complete select the athlete who will be testing using the GymAware app installed on your I-Pad. Select “Squat Jump Countermovement” as the exercise to be conducted. The athlete should place the stick across their shoulders as if they were about to conduct a back squat, this will remove arm swing from movement to ensure only leg power is measured. Attach the cable to the end of the stick and begin recording. Instruct the athlete to jump as high as they can. They should conduct three jumps with only enough time between the jumps to reset their feet. Once complete stop recording, the results will be logged through the app.

Standing Long Jump

ADM Stage

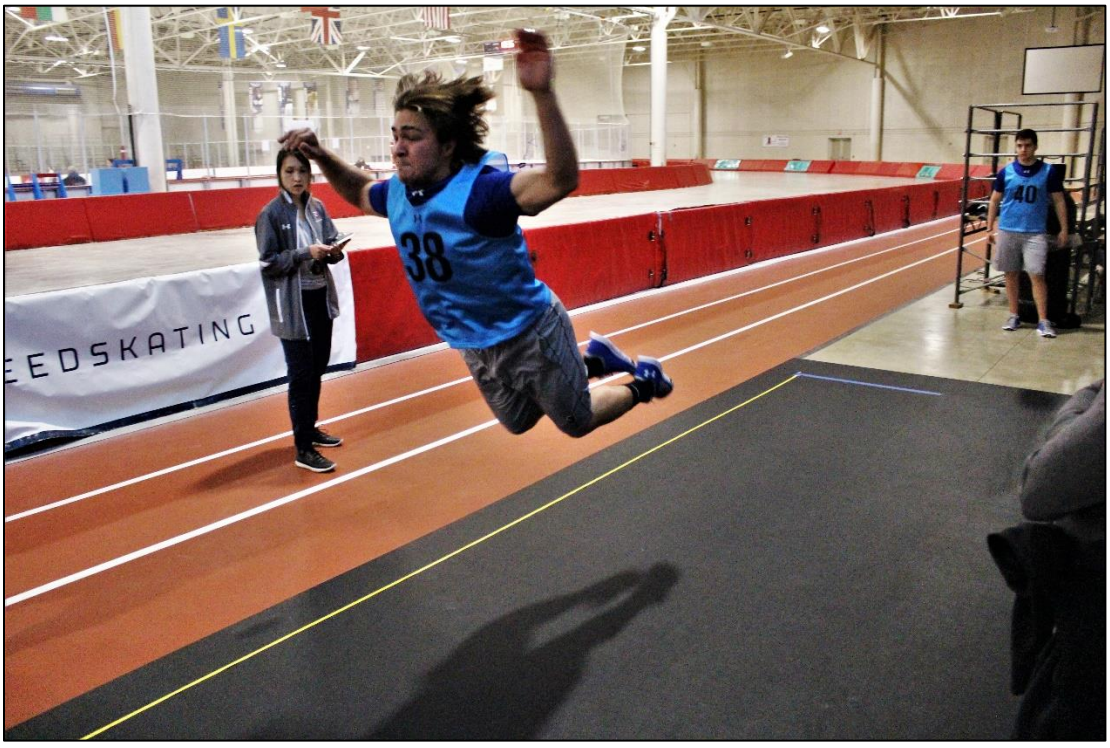
This test can be utilized on athletes in Stage 2,3 & 4 of the USS ADM.

Equipment Required

- Measuring tape
- Cones to mark starting line and target

Procedure

Instruct athletes to stand with their toes behind the starting line with their feet shoulder width apart. When they are ready they will jump forward as far as they can while taking off and landing on two feet. The athletes should remain at the landing spot until a measurement can be taken. A measurement is taken from the start line to the back of their heals at the landing spot. Two to three attempts can be made to get the best possible result.



40 Meter Sprint

Introduction

Sprint testing is a very easy and fun way to evaluate power in athletes. It requires very little equipment and is easy to set up almost anywhere.

ADM Stage

This test can be utilized on athletes in Stage 2,3 & 4 of the USS ADM.

Equipment Required

- Stopwatch
- Measuring Tape or Marked Track
- Cones

Procedure

A proper warm up is critical for this evaluation, it will greatly reduce the risk of injury and also ensure peak performance. A standardized warm up should be employed that includes aerobic activity, dynamic movements and a series of progressive sprints to prepare the athletes. The starting position and commands should be standardized for consistent results and athletes should conduct the test with maximal effort running completely through the finish line.

Peak Power Bike Test

Introduction

The Peak Power Bike Test is a 5-10 second maximal effort bike test that will measure the peak power you can produce on a bicycle. These tests require a specialized bicycle that is capable of performing the test. US Speedskating recommends the Wattbike Pro Trainer and the six second peak power protocol.

ADM Stage

This test can be utilized on athletes in Stage 3 & 4 of the USS ADM.

Equipment Required

- Wattbike Pro Trainer

Procedure

This test should only be conducted by a trained professional. Please consult with the US Speedskating Sport Science Department or a US Speedskating Regional Training Center for more information about the testing procedure.

Anaerobic Capacity

Anaerobic Capacity has been defined as “the maximal amount of adenosine triphosphate resynthesized via anaerobic metabolism (by the whole organism) during a specific mode of short duration maximal exercise” (Green and Dawson 1993, 312). In other words it is total amount of energy that can be produced by the anaerobic energy system. Anaerobic capacity is critical to speed skaters as the anaerobic energy system is the primary system used. The ability to create a lot of power over a long period of time has been shown to have strong correlations to on ice performance in elite speed skaters.

400 Meter Run Test

Introduction

The 400 Meter Run Test is a very simple way to evaluate Anaerobic Capacity in athletes.

ADM Stage

This test can be utilized on athletes in Stage 2,3 & 4 of the USS ADM.

Equipment Required

- 400 meter running track
- Stopwatch
- Cones

Procedure

Appropriate time and effort should be given in the weeks leading up to this test to incorporate running intervals at various distances (100m, 200m, 300m, 400m, etc.) into the training program to ensure athletes are able to properly pace themselves to exert maximal effort throughout the entirety of the evaluation. After an appropriate warm up period instruct the athletes to complete the 400 meter evaluation in the quickest possible amount of time. The starting position and commands should be standardized for consistent results and athletes should conduct the test with maximal effort running completely through the finish line. The final time should be recorded to the nearest tenth of a second and retained for comparison against future efforts.

Running Anaerobic Sprint Test (RAST)

Introduction

The RAST Test is an excellent way to measure anaerobic capacity with minimal specialized equipment.

ADM Stage

This test can be utilized on athletes in Stage 3 & 4 of the USS ADM.

Equipment Required

- Scale
- Stopwatch
- Measuring Tape
- Cones
- Flat Surface of at least 50 meters

Procedure

Athletes weight should be taken prior to testing (see Body Mass / Weight above) and recorded. Athletes will be required to complete six (6) **MAX EFFORT** 35 meter sprints with 10 seconds rest between each repetition. After the 10 second rest the athletes will begin the next effort from end of the track the prior effort finished on. The time of each effort will be recorded. The course is set up by placing cones 35 meters apart on the testing surface. Two timers are preferred, one to time the 10 second rest and one to time the 35 meter sprint. After an appropriate warm up period instruct athletes to complete the six (6) repetitions with 10 seconds rest between repetitions. The starting position and commands should be standardized and consistent ensuring that the next efforts begin exactly 10 seconds after the conclusion of the previous effort. Athletes should conduct each repetition with maximal effort running completely through the finish line.

Scoring

This evaluation can be scored across multiple variables outlined below, each can offer valuable insight into anaerobic capacity and adaptation to training. Results can be calculated using the chart in the link below.

- **Time** – The total time you spent running, the lower the number the better.
- **Max Power** (Watts) – The maximum output of energy during the test, the higher the number the better. Power for each effort is calculated using the following equation (Power = Weight x Distance^2 / Time^3)
- **Average Power** (Watts) – The average output of energy during the test, the higher the number the better. Average power is calculated using the following equation (Power = Weight x 1225 / Time^3)
- **Fatigue Index** – The decrease in power over the course of the test measured in watts per second. Fatigue index is calculated using the following equation ((Max Power – Min Power) / Total Time for the 6 Sprints)

Running Anaerobic Sprint Test Scoring (.xlxs download)

30 Second Wingate Test

Introduction

The 30 second Wingate test is an excellent measure of anaerobic capacity that is used by both the USS National and Junior National Teams. It requires specialized equipment and a trained evaluator to execute the test. It is recommended that this test be run 8-10 minutes after executing a peak power test.

ADM Stage

This test can be utilized on athletes in Stage 3 & 4 of the USS ADM.

Equipment

- Wattbike Pro Trainer

Procedure

This test should be conducted by a trained professional. Please consult with the US Speedskating Sport Science Department or a US Speedskating Regional Training Center for more information about the testing procedure.

Aerobic Capacity

Aerobic capacity is the body's ability to take in, transport, and convert oxygen to energy during exercise (Cooper 2014). We measure aerobic capacity in the volume of oxygen the body can take in and use during exercise, also known as VO_2 Max. Aerobic capacity is an important measure for speed skating because of the large aerobic demands that come with longer events and from day to day training requirements. In a periodized training program or during sensitive periods of athlete development the establishment and monitoring of an aerobic base will be critical to both long and short term athlete development.

Cooper 1.5 Mile Run

Introduction

The Cooper 1.5 mile run is an evaluation developed to measure aerobic capacity and predict $V0_2$ Max. It is an easy to execute evaluation that can be run on multiple athletes at one time.

ADM Stage

This test can be utilized on athletes in Stage 2,3 & 4 of the USS ADM.

Equipment Required

- 400 meter running track
- Stopwatch

Procedure

Appropriate preparation should be given prior to conducting this test to ensure athletes are capable of completing a 1.5 mile run at a high intensity. This can be done by including running workouts into the training program that focus both on short and high intensity intervals along with long and low intensity workouts. After an appropriate warm up athletes will complete 1.5 miles around a running track (6 laps around the innermost lane of a standard 400 meter track) in as short a period of time as possible. Time should be recorded to the second.

Scoring

The recorded time can be used as a marker to track progress over time, and it can also be used to calculate estimated $V0_2$ Max using the formula below.

- Convert the total time from minutes and seconds to minutes and tenths of seconds
    - For example; 14 minutes and 30 seconds (30 / 60 = .5) would equal 14.5
- The formula for estimating $V0_2$ max is: $V0_2$ Max = (483 / Time) + 3.5
    - Using the example above
        - 483 / 14.5 = 33.31
        - 33.31 + 3.5 = 36.81
        - Estimated $V0_2$ Max = 37

Cooper 1.5 Mile Run Scoring (.xlxs download)

20 Meter Multistage Fitness Test (Beep Test)

Introduction

The Beep Test is a test widely used evaluation to measure aerobic capacity by estimating $V0_2$ Max.

ADM Stage

This test can be utilized on athletes in Stage 2,3 & 4 of the USS ADM.

Equipment Required

- A flat non-slip surface of at least 30 meters in length and wide enough to accommodate the athletes being tested as a whole or split into groups
- Measuring tape of at least 20 meters
- Cones to mark the test area
- Audio recording of the beep test
- Audio device and connected speaker(s) capable of broadcasting the audio recording to the entire test area
- Recording Sheet
- Enough staff to observe and record the amount of athletes participating.

Procedure

Ensure all audio components have been checked prior to starting the test. Mark the test area by placing cones 20 meters apart from each other. Athletes will run from one end of the test area to the other end with the goal of reaching the opposite side in sync with an audible “Beep”. The beeps will start off quite slow but will increase in speed as the test progresses. Athletes should do their best to run in sync with the beeps and not faster, if an athlete reaches the cone before the beep they must wait until the beep to continue. Upon missing their first beep athletes are given a warning, and given the opportunity to catch up. The test will end when the athlete has missed two consecutive beeps after being given a warning. The athletes score will be the last **completed** level and number of shuttles (this is communicated throughout the audio recording).

Scoring

- The athletes score will be the completed number of levels and shuttles within each level
    - For example; Level 10 shuttle 3
- Results can be calculated using the chart in the link below.

20 Meter Multistage Fitness Test Instruction (.m4a audio download)

20 Meter Multistage Fitness Test (.m4a audio download)

20 Meter Multistage Fitness Test Scoring (.xlxs download)

V02 Max Test

- A $V0_2$ Max test should be conducted by trained professionals in a laboratory using a Metabolic Cart. This test can be done in a variety of modalities and protocols. Please contact US Speedskating Sport Science for more information.

ADM Stage

- This test can be utilized on athletes in Stage 3 & 4 of the USS ADM.

Results

Testing results can be submitted to US Speedskating Sport Science for evaluation and interpretation. Individual results will be returned with comparison to normative data when applicable. Group results can also be produced along with long term tracking reports for groups and individuals.