



**SQUASH CANADA
TECHNICAL AND FITNESS TESTING
PROTOCOL MANUAL**

Revised April 2010



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Introduction to Squash Canada

Squash Canada is the national sport organization responsible for providing quality, player-centered development services to Canadian squash athletes. All Squash Canada personnel are employed to facilitate the achievements of the association's objectives and are required to operate within the policies and legal obligations of Squash Canada as established by its elected Board of Directors and Committees. The association receives financial contributions from the Ministry of Heritage – Sport Canada, and it is accountable for the management and disbursement of these funds according to published terms and conditions. In addition, Squash Canada establishes an annual operating budget within which programs and activities must operate. Association staff members are responsible for administering and managing the organization's financial activity, and the National Office, located in Ottawa, is responsible for providing administrative support for all organizational activities, including sport science initiatives.

Need for Technical & Fitness Testing Protocols

The training regimens of our squash athletes are designed to foster the long-term development of their different playing capacities so they can reach their full athletic potential over time. As our Canadian players progress through Squash Canada's Long-Term Player Development (LTPD) model, they are engaged in training and lifestyle practices that affect their fitness, technical skills, tactical awareness, mental capacities and nutrition, to name only a few areas. To maximize the efficacy of their training, coaches and technical staff need to evaluate the affects and outcomes of training on a regular basis through rational player testing protocols.

Testing and evaluation provides coaches and athletes with feedback that can be used to identify player weaknesses and adjust training regimens as necessary. Without this feedback, an athlete may continue training ineffectively and fail to develop the fitness, skills, tactical awareness and other capacities needed for competitive success. Accordingly, the Squash Canada *Technical and Fitness Testing Protocol Manual* has been developed to help club, provincial and national coaches monitor the development of their athletes for this purpose. (Note: club administrators and coaches can obtain additional copies of this manual by contacting Squash Canada.)

The *Manual* is also useful as a means to establish Canada-wide norms and performance measures which Squash Canada can use in its talent identification program. As these norms are published and made accessible to athletes, coaches and administrators, athletes can be compared at the same LTPD stage and talent identified according to individual performance relative to these norms.



Long Term Player Development (LTPD)

Long Term Player Development (LTPD) is a systematic approach to the delivery of all key facets of the game of squash. LTPD is designed to maximize every participant's performance potential and long-term involvement in the game by providing an overarching vision and substantial guide to programming content. Squash Canada's LTPD framework aims to define optimal training, competition and recovery for players throughout their careers, enabling them to reach their full potential as squash players specifically, athletes in general, and healthy active Canadians overall.

The LTPD model is split into sequential stages that reflect the progressive physical, mental and emotional maturation of players. Accordingly, as players grow and mature from children to adulthood, they move from simple to more complex skills, and from general sport skills to squash-specific skills. For example, beginning players may start by learning basic swinging actions and associated footwork. Once these skills have been mastered, they progress to more advanced skills.

Based on phases of human maturation, the stages of LTPD are:

- Active Start: 0-6 males and females
- Fundamentals: 6-9 males, 6-8 females
- Learning to Train: 9-12 males, 8-11 females
- Training to Train: 12-16 males, 11-15 females
- Training to Compete: 16-23 +/- males, 15-21 +/- females
- Training to Win: 19 +/- males, 18 +/- females
- Active for Life: Any age

Beginning Testing

Squash Canada's testing protocol will generally begin with the Training to Train stage. The focus at this level is on skill development, aerobic capacity and general muscle endurance – three areas which can be evaluated with the protocols described in this manual. At this stage, players are developing their base of skills and fitness. Accurate and timely evaluation of their skills and fitness will provide players with objective feedback, which will enable them to adjust their skills and fitness training as necessary to make steady improvements in performance.

A key challenge is accurately determining when athletes are in each LTPD stage. The difficulty is that each stage is based on maturation, not chronological age (i.e. calendar birth date), and rates of maturation vary widely between individuals. One way to track the maturation levels of players and



identify their LTPD stage is to keep a record of their height and weight at regular intervals. A form for recording player height and weight has been provided in the appendix of this manual. For more information on the LTPD stages and how to track an athlete's stage of maturation, please refer to Squash Canada's LTPD master document, *Beyond the Nick*.

Reporting to Squash Canada

Squash Canada's vision for this manual is to have club, provincial and national coaches across the country utilize the following tests with their players and provide the results to Squash Canada. Squash Canada will then create a database of this information and make it available to all provincial/territorial partners for use in talent identification for provincial squads and Canada Games teams.

These tests should be completed at regular intervals during the squash season. Ideally, athletes will perform these tests at the beginning, middle and end of the season. As coaches collect results from these tests, Squash Canada asks that you send your results to the Squash Canada national office. All test results should be submitted on the test results recording sheets (found in the appendix of this manual) to Jamie Hickox, Squash Canada's High Performance Director at performance@squash.ca



Fitness Testing Protocols

Squash Canada utilizes several generic and squash specific fitness tests in order to evaluate the fitness level of its national squad athletes. All these tests require minimal equipment and no set up costs. The generic tests include: 5 kilometre run, Incremental Treadmill test, and the 20 metre multi-stage fitness test. The squash-specific test used is the 6 point test.

5 Kilometre Run

The 5 km run is used by many team and individual sports to evaluate aerobic fitness and leg muscle endurance in athletes. Squash Canada's current standard for the 5 km run is under 21 minutes for men and under 23 minutes for women. To provide some perspective, for the 2009 Ottawa marathon (Canadian marathon championships), runners were required to meet a standard time of 14:25 for men and 16:30 for women to be considered "elite runners" for the 5 km event.

Testing Protocol

Equipment: stopwatch and 400 m track (12 ½ laps equals 5 km). If 400 m track is not available, a flat out-and-back course is preferred (2.5 km out and 2.5 km back). If neither is available the test may be run on a treadmill.

Procedure: The aim of this test is to complete the 5 km course in the shortest possible time. At the start, all participants line up behind the starting line. On the command "ready, start," the clock will start, and the athletes begin running at their own pace, completing the 5 km route as fast as possible without stopping.

A recording sheet for this test can be found in the Appendices of this manual.

Scoring: The total time to complete the course is recorded for each participant, in minutes and seconds.

Advantages: Large groups of athletes can be tested at once. If the test is conducted on a 400 m running track, all the athletes will be in view throughout the test.

Disadvantages: Practice and pacing is required, and performance on this test can be affected greatly by motivation.



Incremental Treadmill Test

The Incremental Treadmill test makes athletes produce their maximum heart rate and thereby provides a measure of their aerobic fitness. The Heart rate is determined by the number of heartbeats per unit of time, typically expressed as beats per minute (BPM). The maximum heart rate of athletes indicates how strong their hearts are: the lower their max heart rate, the stronger their heart muscles.

The stronger your heart muscle, the more blood (and oxygen) it can pump per beat. In addition to providing a current measure of the heart's strength, a max heart rate test also provides athletes with a comparative or baseline value of their max heart rate which they can use for training purposes. For example, the cardiovascular system is best strengthened through aerobic exercise at 65% - 85% of your max heart rate. An individual athlete's max heart rate may be predicted using the formula $220 - \text{age}$, but this formula has been shown to produce variations of up to 25 beats per minute when groups of athletes the same age on the same team were tested.

Max. Heart Rates: Comparisons

The average max heart rate for Squash Canada's Senior Women's National Squad between August 2007 and March 2009 was 191. The average max heart rate from a 2008 Espoir Men's National Squad Camp was 183.

Testing Protocol

Equipment: Treadmill with adjustable speeds and grades, and a heart rate monitor.

Procedure: Start the treadmill off at a workload of 5 miles per hour for women and 6 miles per hour for men. Each workload lasts 1 minute. At the end of one minute, increase the work load by 0.5 miles per hour until 10 miles per hour is reached for women and 11 miles per hour for men.

After 10 miles per hour is reached for women and 11 miles per hour for men, increase the workload by grade rather than speed. Increase the grade by 2 degrees each minute until the athlete reaches exhaustion. Exhaustion will likely occur soon after the grade increments begin.

For example, a very fit woman will likely reach 10 miles per hour and 4 degrees incline. At exhaustion, the athlete should grab the handrails, straddle the belt, and an assistant should turn off the treadmill. (A spotter should be on hand as the athlete nears exhaustion in case the athlete stumbles, and the spotter should ensure the treadmill is quickly turned off at exhaustion).



A recording sheet for this test can be found in the Appendices of this manual.

Scoring: The athlete's maximum heart rate and the last workload completed should be recorded at the end of the test. The athlete's heart rate should also be recorded at the end of each workload reached.

Advantages: Provides a more reliable maximum heart rate than the 220-age formula. It also provides feedback to athletes about the fitness of their cardiovascular system, in that the higher the workload reached, the more fit their system is.

Disadvantages: Is not a true indicator of maximum heart rate. A true max heart rate test requires an athlete to do a specific protocol while hooked up to an EKG in a lab. Using this protocol is expensive and not practical for testing countrywide as not all coaches/athletes will have access to a lab.



20 Meter Multistage Fitness Test (beep test)

The 20 meter Multistage Fitness Test, commonly referred to as the Beep Test, is designed to evaluate an athlete's predicted V_{O2} max. V_{O2} max is the maximum capacity of an individual's body to transport oxygen during exercise. Each V_{O2} max measurement reflects the athlete's overall physical fitness. The average V_{O2} max measurement of non-athletes between the ages of 10 to 19 years is 47 – 56 ml/kg/min for males and 38 – 46 ml/kg/min for females. For racquetball between the ages of 20 to 35 years, the average V_{O2} max is 55 – 62 ml/kg/min for males and 50 – 60 ml/kg/min for females. Some of the highest recorded V_{O2} max measurements are in cross country skiers, where males have an average of 65 – 94 ml/kg/min.

At present, Squash Canada has very limited data on V_{O2} max for Canadian squash players, but the current range for our Senior Women's National Squad (4 athletes between 2007 – 2009) is 42 – 52 ml/kg/min and the range for our Espoir Men's National Squad (10 athletes in Sept 2008) is 50 – 62 ml/kg/min.

Testing Protocol

Equipment: Flat non-slip surface, marking cones, 20 metre measuring tape, beep test CD, CD player, recording sheets.

Protocol: This test involves continuous running between two lines 20 metres apart in time to recorded beeps. That is, they must reach each line in synchronization with each beep. For this reason, the test is also often called the "Beep" or "Bleep Test."

The test subjects stand behind one of the lines facing the second line, and begin running when instructed by the CD. At the start of the test, the time intervals between the beeps are long, so test subjects are able to run relatively slowly at low intensity.

The subjects continue running between the two lines, turning at each line according to the beeps. After about one minute, a sound indicates an increase in speed, and the beeps will be closer together. The speed is increased in this manner each minute (each representing a new level).

If the testing subject does not reach the next line in time with the beep, the subject must still run to the line, turn, and try to catch up with the pace within 2 more beeps. If the testing subject reaches the line before the beep sounds, the subject must wait until the beep sounds before continuing.

The test is stopped if the subject fails to reach the line (within 2 meters) for two consecutive ends. The complete test consists of 21 levels.

A recording sheet for this test can be found in the Appendices of this manual.



Scoring: The athlete's score is the level and number of 20 metre shuttles reached. Record the last level completed (do not count incomplete levels). Using the level achieved, calculate the athlete's V02 max by visiting: <http://www.topendsports.com/testing/beepcalc.htm>.

Advantages: The test can be performed with large groups of individuals, and the cost to run the test is low. Test requires athletes to continue until maximal exertion.

Disadvantages: Scoring can be subjective since it is the test administrator who decides if an athlete is out or not. Practice and motivation can also affect the test score achieved.



6 Point Test

The 6 point test is currently the only squash-specific test Squash Canada uses with its National Squad athletes. The 6 point test is designed to evaluate the athlete's fitness level in a squash-specific situation. In order to complete the 6 point test, the athlete must first know their maximum heart rate. The 6 point test evaluates an athlete's fitness by comparing the athlete's heart rate at the end of the test to their max heart rate, calculating the ratio as a percentage, and assigning the percentage to a score. The current Squash Canada fitness standards call for National Squad athletes to achieve a score of 60.9.

Testing Protocol

Equipment: Squash court, 6 coloured targets to be placed on court walls, 6 point test CD, CD player, heart rate monitor.

Protocol: An international size squash court is to be used with six targets marked. Targets are placed in each front and back corner on the side wall 33 inches (3 times the length of a sheet of standard letter paper) above the floor, and 33 inches from the front and back walls respectively. The other two targets are placed on each side wall at the T line 33 inches above the floor.

Starting and returning to the center T each time, the athletes must touch these targets with the head of their racquet in the following order:

- 1) Right wall
- 2) Right front corner
- 3) Right wall repeated three times
- 4) Right back wall

Without stopping, the athlete continues the same procedure using the targets on the left side of the court. The pace required of the athlete is 34 seconds per lap (or 17 seconds per side). During the test, assessors can tell athletes to slow down, speed up, or that their pace is OK. Ten laps are to be completed in 5:40, with HR recorded immediately upon completion and after 90 seconds of a walking recovery.

For elite level athletes, the test can be performed with a required pace of 30 seconds per lap (or 15 seconds per side).

A recording sheet for this test can be found in the Appendices of this manual.

Scoring: The athlete's heart rate and percentage of maximal heart rate are recorded. The percentage of max heart rate corresponds to a score, and a table of comparative scores can be found on the 6 point test results guide in the Appendices of this manual.



Advantages: Provides a squash-specific test for athletes to evaluate their fitness. Mimics the movements required in an actual match.

Disadvantages: Practice and motivation affect performance. It is important that athletes stay on pace, and testing assessors must keep athletes on pace, thus test results are dependent on the test being administered properly.



Technical Testing Protocols

When players graduate to senior level squash, they will not be successful if they only have 1 or 2 strong technical areas: they will require a well-rounded set of skills. Regular testing of player technical abilities through their youth development is intended to reveal their skill levels across a spectrum of technical areas so training can be adjusted to address any deficiencies.

Competition results alone are not a reliable measure of technical ability and player development in general. For instance, in a competitive match between two junior squash players, one of them may be strong enough in one particular technical area that they are able to win the match, but they may in fact be very weak in other areas. Conversely, players who do not win matches at a junior level may be very talented in technical aspects of their game but lack an attribute such as physical strength, a quality that will come with physical maturity. Without technical assessments, some “weaker” players may be deemed “not good enough” when in fact they are simply lacking physical maturation as opposed to the skills to perform at a higher level.

Squash Canada utilizes two types of technical testing to measure skills: subjective testing and objective testing. Together, all of the subjective and objective technical testing protocols form the basis of the Squash Canada talent identification system.

Subjective Testing: Talent ID Evaluation

Subjective evaluation of player technical abilities is done with the Talent ID Evaluation Form. Using the Evaluation Form, coaches can score players during match play in each of the identified areas required for elite squash. The areas include physical (fitness, strength, etc.), technical (drives, drops serves, etc.), tactical (creativity, court awareness, etc.) and mental (ability to adapt, temperament, etc.).

To perform an evaluation, a coach observes players during match competition (likely at major tournaments). It is important that the coaches do not evaluate their own players: to provide some measure of objectivity, they should evaluate players who are coached by other coaches. The coach provides a score in each section for each player and then submits the form to Squash Canada.

Squash Canada uses the Talent ID Evaluation information to develop a database of player scores that will in turn help to establish performance norms, from squad players to beginners. When Squash Canada selects squads, it will use the Talent ID Evaluation information to provide a clear picture of each player’s abilities beyond simply relying on each athlete’s tournament results.

A copy of the evaluation form can be found in the Appendices of this manual.



Objective Testing: Technical Tests

Squash Canada's technical tests are objective tests that any coach can do with their athletes. The intention of the technical test is to gain an understanding of each player's technical ability with the variety of shots required in squash. These include forehand and backhand drives and volleys. The test can be set up for use with athletes at every developmental stage.

Protocol:

The first test focuses on drives and is completed on the forehand and backhand from 3 different positions on the wall: the shortline, back of the service box, and floor then glass.

Within a 2-minute time span, players count how many hits they can make. Coaches can set the target width according to the level of each of their players. Currently the Junior Women's National Squad starts with a target width of 6 boards and works towards narrowing the target to 2 boards. Depending on the level of the player, the time duration and target width may be modified.

The following are averages obtained by the Junior Women's National Squad as of March 2009:

Drives within 2 minutes – 6 boards:

Forehand Shortline – 71	Backhand Shortline - 64
Forehand Service box – 53	Backhand Service box - 53
Forehand floor then glass – 42	Backhand floor then glass – 42

The second test focuses on volleys and is completed on the forehand and backhand from the shortline. The test has three parts:

- 1) The athlete faces the wall on the shortline and continually hits volleys for a period of 3 minutes. Coaches evaluate the player's control and accuracy.
- 2) The athlete faces the wall and hits as many consecutive volleys as possible in a period of 1 minute. Coaches evaluate the player's speed and concentration.
- 3) The athlete stands on the "T" hitting figure-eight volleys, switching from forehand to backhand. As with the first test above, the time duration can be varied according to the level of each athlete. The following are averages obtained by the Junior Women's National Squad as of March 2009:

Volleys – 3 minutes total

Forehand – 154
Backhand – 141



Volleys – 1 minute consecutive

Forehand – 34
Backhand – 26

Figure Eight Volleys – 3 minutes total – 139
Figure Eight volleys – 1 minute consecutive - 32

A copy of the recording form for these tests can be found in the Appendices of this manual.

Scoring: For test 1, the total number of hits in the 2 minute period is recorded. For part 1 of test 2, the total number of volleys in the 3 minute period is recorded. For part 2 of test 2, the number of consecutive volleys in 1 minute is recorded.



Appendices

Appendix A – 5 km run recording sheet

Appendix B – Incremental Treadmill test recording sheet

Appendix C – 20 meter shuttle run recording test recording sheet

Appendix D – 6 point test recording sheet

Appendix E – Talent ID Form

Appendix F – Technical test recording sheet

Appendix G – Height and weight recording sheet