SNOWSPORT ENGLAND

SSE ALPINE SQUAD 2016/2017

Capacity Evaluation (ACE)

March 2016 v2

BACKGROUND TO ACE

Although the original design of ACE was purely to be a tool to assess ongoing progress the senior coaches in British skiing are clear that its use in the context of a National Squad should also include a pass/fail test for entry.

This pass/fail element of the test will include three of the exercises:

Plank

150m decrement test,

Hex test

The criteria for pass/fail are included in section 3 below and expanded further in section 5.

Contents:

INTRODUCTION - AN UPDATED ATHLETIC CAPACITY EVALUATION (ACE) MODEL

The updated ACE aims to provide a profile of the athletic capabilities that are applicable to alpine skiers. This profiling provides an assessment of an individual skier's athletic attributes which can be compared against benchmarks (which have been set in accordance with research with other Alpine ski groups as well as the data gathered over the past couple of years by British Ski and Snowboard).

Whilst this benchmarking allows for peer to peer comparison, ultimately the profiling of the athlete's abilities should be used to provide a gauge of an individual's progress and to direct their physical training so as to maximise their athletic and, ultimately, their skiing potential.

The selection criteria for athletic tests to be included in the ACE were;

- Does the athletic quality being assessed relate to skiing performance?
- Is the method of collection of data/assessment reliable? To meet this criterion the method of collection of the data must be objective and the technology used must be verified by research to have acceptable margins of error. As such "manual" (hand held stop watch) tests failed on this criteria.
- Does the test allow for a meaningful stratification of results to produce a reliable ranking of performance and a reliable measure of improvement?
- Does the manner in which these qualities are assessed reflect the demands of alpine skiing?

THE UPDATED ATHLETIC CAPACITY EVALUATION

The tests that are outlined below are those that make up the updated ACE. They are presented in the order that represents best practice from a physiological point of view, with those requiring the greatest neuromuscular power performed first (power and strength testing) whilst those requiring greatest aerobic and anaerobic energy demands are performed last (hexagon jump test & 150m decrement). Logistics may dictate a different order to facilitate a high number of athletes performing the testing on a given day, however, physiological requirements will be taken into account to ensure a standardisation of process to allow a highly reliable comparison to be performed test to test.

Countermovement Jump (CMJ), Squat Jump (3 second pause) & Eccentric Utilisation Ratio

The countermovement jump, squat jump (performed with a 3 second pause) and the eccentric utilisation ratio (calculated from the two jump tests) provide an assessment of an athlete's lower body power and their individual power generating characteristics. (sayers, 1999; McGuigan, 2006)

Both jumps are performed with hands on hips throughout the jumps (to ensure the measure is purely of lower body power). An Optajump© is used to measure the height of the jump (extrapolated from the flight time). All athletes perform 3 jumps of each type of jump.

For a CMJ

The athlete starts standing with their hands of their hips (where they stay throughout).

1. The athlete dips their hips to a self-selected depth and immediately explodes upwards, performing a jump.
2. The athlete lands, bending knees to ensure a safe landing.

For the CMJ the athlete should be instructed to simply jump as high as possible. Over the three attempts athletes will usually self-select the best depth to drop too, to generate the greatest power for that athletes biomechanics and strength qualities. However, if an athlete repeatedly drops their hips too low (to parallel to the floor) they may be instructed to not drop so low.

For a Squat Jump

1. The athlete starts standing with their hands of their hips (where they stay throughout).
2. The athlete dips their hips to a self-selected depth and holds that position for 3s, this allows for any stored elastic energy to dissipate.
3. On the count of "3" the athlete explodes upwards jumping as high as possible.
4. The athlete lands, bending knees to ensure a safe landing.

For the Squat Jump the athlete should be instructed to pause in the bottom position for 3s and the assessor should provide a "3 count" out loud. On hearing the "3" the athlete should explode straight up, no "re-dipping" of the hips should occur to utilise the stretch shortening cycle (the body's method of utilising elastic energy). If this is done a "no jump" should be recorded.

The Eccentric Utilisation ratio (EUR) calculation is show below;

$$\frac{CMJ\ height\ (cm)}{Squat\ Jump\ height\ (cm)} = \text{Eccentric utilisation ratio}$$

The EUR should always be greater than 1, this is because the elastic energy which can be utilised with a CMJ should permit the athlete to jump higher than when performing a squat jump, where the 3second pause nullifies the elastic energy generated by the countermovement of the jumping action.

A high EUR suggests that the athlete utilises the stretch shortening cycle greatly, versus a lower number which suggests the athlete generates more power from the concentric muscle action, which the squat jump with a 3 second pause relies heavily upon.

Unilateral 15cm Drop Jump test

The unilateral 15cm drop jump test provides an assessment of an athlete's unilateral lower body reactive strength. A comparison of left to right sided results also provides an indication of any unilateral imbalances that may lead to injury.

An Optajump© is used to measure the height of the jump, the flight time and the contact time, from these two last outputs a Reactive Strength Index is calculated (shown below). All athletes perform 3 jumps on each side.

$$\frac{flight\ time\ (seconds)}{contact\ time\ (seconds)} = \text{Reactive strength index}$$

For the unilateral 15cm drop jump;

1. Athlete starts on top of a 15cm step, hands on hips (where they remain throughout) on one foot, the foot that they are standing on is the foot to drop down and jump, so for a left sided drop jump assessment the athlete would stand on their left foot.
2. The athlete drops off the step landing on the selected foot only and immediately jumps back off the floor, landing safely back down on one foot.
3. This is repeated for the right side.

Video footage of the test will also be taken to assess quality of movement, whilst there is no pass/fail for this test, it should be noted that the video footage more highlight qualitative issues that need to be addressed regardless of the scoring of the actually unilateral 15cm drop jump.

Back Squat

The back squat represents, firstly, a mobility assessment. Athletes should be able to squat to full depth (hip crease below top of knee at the bottom position of a squat, with both heels on the ground and neutral spine maintained throughout). Secondly it represents an assessment of lower body strength. Once correct technique has been displayed an athlete can progressively load a barbell until finding a repetition maximum. The individual athlete's level of weight-lifting experience will determine which rep max (RM) test is performed (either 5,3, or 2RM). If an athlete has no experience then the range of movement marker is only taken.

Athlete's performing a weighted RM test should use 4-8 sets to warm up depending on experience level and the repetition maximum being performed (heavier weight or less repetitions being performed, the greater number of warm up sets should be used to ensure the test is carried out safely).

To perform back squat;

1. Place barbell on back (start with wooden dowel for test of range of movement, once passed progress to weighted bar, 15kg for women, 20kg for men).
2. Brace spine, and set a neutral spinal posture.
3. Simultaneously bend at the hips and knees to descend hips, whilst keeping heels of feet on the floor at all times.
4. Hips should descend until hip crease is at least below top of the knee.
5. Spine should still be neutral, chest up, no back rounding.
6. Athlete should push back up, keeping heels on the floor until return to starting position.

Those aged Under 16 with weightlifting experience (6 months at least of a planned programme) should perform a 5 repetition maximum (RM), Under-18 3RM, Under-21 2RM. If weightlifting experience allows, on a case-by-case basis these RM maybe used at younger ages.

The RM scores will be used to calculate a predicted 1RM using the below Epley Formula;

$$1\text{ RM} = weight\ lifted\ x\ \left(1 + \frac{number\ of\ repetitions}{30}\right)$$

Pull Up

The pull up assesses upper body pulling strength. Whilst not as strongly correlated to skiing performance as the other tests, the pull up does indicate an athlete's general athletic qualities and greater upper body strength has also been shown to decrease upper body injury risk.

To perform the pull up;

1. Athletes should start hanging from the bar, hands outside shoulder width, palms facing away with a pronated grip. The elbow should be fully extended.
2. Athlete should pull chest towards the bar, maintaining a "big chest".
3. A repetition is successfully completed when the chin rises above the bar.
4. The athlete should descend under control back to full extension of the elbow before attempting the next repetition.

No swinging is allowed, legs should remain straight throughout, no kipping or kicking of the legs is permitted.

Hexagon Jump test

The hexagon jump test represents a measure of the athlete's ability to perform repeated bouts of lower body power, in multiple directions whilst maintaining balance and control.

A hexagon is marked out on the floor

Each side of the hexagon should be 24 inches.

To perform the Hexagon jump test;

1. Athlete starts in the middle of the hexagon.
2. On a verbal signal ("Go") from the assessor the athlete jumps out of the hexagon forwards with both feet, lands and then jumps back in to the middle, immediately the athlete jumps back out crossing the next side of the hexagon once again landing outside and immediately jumping back to the middle.
3. The athlete continues in this manner around the hexagon until three full repetitions of the hexagon have been completed, with the timer stopping when the athlete returns to the middle of the hexagon for the final time.
4. The athlete is permitted two attempts at each direction (clockwise and counter clockwise). The best from each direction is taken as the score.

Any jumps that are inaccurate (on a line) are recorded and penalty marks are given so a score of 18s with 3 penalties is given, for instance. A penalty immediately makes the score worse in comparison to peers, so a 12s 1 penalty score is worse than a 18s no penalty score.

150 meter Decrement running Test.

The 150m Decrement running test provides a measure of an athlete's aerobic and anaerobic abilities providing an assessment of the state of an athlete's energy systems.

To complete the 150m Decrement Running Test

Cones should be laid out at 0,5m,10m,15m,20m,25m (as shown below). The athletes start on "0" on a verbal cue they run out to the 5m cone, turn and run back to zero, they repeat to the 10,15,20,25m trying to cover as much distance as possible in 30 seconds. Athletes must stop on the whistle, marking the end of the 30 seconds. The distance covered is marked to the nearest 5m cone. The athletes rest 30 seconds and then start again on "0" repeating the same test for 6 repetitions in total.

0 5 10 15 20 25

X-----X-----X-----X-----X-----X

Three measures are taken from the test; firstly an overall output measure, the total distance covered over the 6 repetitions, this represents the total output of the athlete, those who achieve higher scores will have well developed aerobic and anaerobic systems. Secondly the highest output of the 6 repetitions represents the peak power out of the athlete, that is the maximum one off effort the athlete is capable of. Finally the decrement from first to final effort provides a snapshot of the athlete's ability to complete multiple outputs over a short space of time.

Trunk

The trunk assessment comprises of 3 tests; plank hold, back extension hold and side bridge (left and right sided). As well as absolute scores certain ratios must also be attained. As these three assessments measure the ability of an athlete to maintain a correct posture for as long as possible the technical execution of these exercises must be perfect. As well as outlining correct technique, common faults have also been outlined below.

The Plank -

1. Athlete holds body off of the floor, with toes and elbows and forearms the only parts of the body in contact with the floor.
2. The abdominals and gluteal muscles should be braced to maintain a neutral spine. The spine should remain long and neutral throughout. A straight line should be able to be envisaged from ankle, knee, hip, shoulder and ear, running the length of the body.

Common faults

- Hunched upper back, often accompanied with a tucked chin.
- Sunken hips, turning the spine in to a shallow "u" shape.
- Hips high, thrust up in to the air.
- Excessive pelvic tilt, if abdominals are not pulled tight the pelvis may tilt excessively, squeezing of gluteal muscles should address this.

The timer is stopped when the athlete is unable to maintain the correct posture, they can receive two warnings regarding technical failure before they are stopped and the time of the third warning is taken.

Back Extension Hold

1. Set up with feet in back extension apparatus, so that the pad is pressed against the back of the calf, just above the ankle.
2. Lying face down the apparatus pad should sit just below hips, ¼ down the thigh.

3. Athlete should hold posture ensuring an imaginary straight line can be drawn from ear, shoulder, hip, knee and ankle.

Common faults

- Tucked chin and upper back rounding. Shoulder blades should be pulled back and down.
- Excessive pelvic tilt, gluteal muscles must be engaged with a neutral pelvic position.

The timer is stopped when the athlete is unable to maintain the correct posture, they can receive two warnings regarding technical failure before they are stopped and the time of the third warning is taken.

Side Bridge

1. Athlete lies on their side, with a straight line from ear, shoulder, hip, knee and ankle.
2. The athlete lifts hips off of floor, with only the elbow (directly under the shoulder) and the side of the foot in contact with the ground.

Common Faults

- Shoulders should be back, especially the top one, the arm on the top of the body should be place along the length of the body, and this should help to keep the shoulder back.
- Hips should not dip; the midline of the body should stay straight, dissecting the eyes, shoulders, hips, and falling between both knees and ankles.

These trunk tests and standards are what are expected of a normal person from the general population (McGill, 2000) therefore they should be viewed as a starting point. Once achieved the emphasis should be placed on the athlete's trunks ability to handle rotational forces, in terms of generating and absorbing force.

The above testing battery will provide a clear picture of an athlete's overall abilities. To perform well in all tests will require the alpine skier to have developed into a well-rounded athlete, with a specific slant towards those abilities that are most relevant to alpine skiing.

Amended 12/05/2016

PASS OR FAIL ACHIEVEMENT

Achievement of the below tests is required to pass the ACE (ones in yellow)

- Plank
- 150m Decrement test
- Hex Test

DEVELOPMENTAL STAGES FOR COMPONENTS OF ACE PROGRAMME

DEVELOPMENTAL	Under 14	Under 16	Under18	Under 21
Countermovement Jump (cm)	Male 30cm Female 25cm	Male: 35cm Female: 30cm	Male: 40cm Female: 35cm	Male: 45m Female: 40cm
Squat Jump (cm)	M:24cm F: 20cm	M: 28cm F: 24cm	M: 32cm F: 28cm	M: 36cm F: 32cm
Unilateral 15cm depth jump (U15DJ) Reactive Strength Index	1.0	1.2	1.5	2.00
U15DJ – L/R Difference	A tolerance on 0.2 RSI between Left/Right is tolerable, any greater highlights a discrepancy			
Hexagon Test (s)	M:17 F:19	M:15 F:17	M:13 F:15	M:11 F:13
Pull Ups (no. of reps)	M: 3 F:1	M:5 F:2	M:7 F:3	M:8 F:4
Back Squat • Competency of movement (pass/fail)	Hip crease below top of knee with neutral spine, heels on floor.			
Back Squat – Predicted 1RM	Bodyweight on bar	Bodyweight on bar	1.25 x BW	1.5 x BW
150m Decrement Running Test				
• Power (1st Rep m)	100	110	120	130
• Output (total m)	M:610 F:600	M:620 F:610	M:640 F:630	M:660 F:650

• Plank	M:3m20s F:3m	M:3m40s F:3m20s	M:4m F:3m40s	M:4m20s F:4m
Back Extension	1m45s	2min	2m30s	3m
Side Bridge	70s	75s	90s	2m