Dear ROCKET Team Member

## 1. BACKGROUND

Emergency medical care and medical rescue work, by nature are physically taxing, and place demands on the emergency care provider, both in terms of strength and endurance. If an emergency care provider expects to operate successfully in the emergency medical care and medical rescue environments, they need to possess certain minimum levels of occupational physical preparedness to undertake these physically taxing tasks. Emergency care work is a unique occupation as it is characterised by occasional bouts of high physical strain, such as the lifting and carrying of patients, in an otherwise predominantly sedentary job. It is, therefore, essential that emergency care providers have a sufficient level of physical fitness to cope with the extreme work demands, as and when these occur, without developing excessive fatigue. The physically demanding nature of the operational duties of emergency care providers also places them at risk for occupational injuries and illnesses. Poor physical preparedness has been shown to increase the risk of emergency care providers suffering an injury or developing an illness during the performance of their operational duties.

## 2. PHYSICAL PREPAREDNESS ASSESSMENT

Taking this background into consideration, the management team at ROCKET feel that it is important to ensure that the emergency care providers employed at ROCKET are physically prepared for their daily operational tasks. This will ensure that the values of ROCKET (excellence, reliability, safety, care, and sustainability) are achieved with every activation. Under the guidance of an expert in the domain of physical preparedness for emergency care providers, the physical preparedness assessment tool that will be utilized by ROCKET assesses four components of fitness which are deemed as important for emergency care providers engaging in the type of operational tasks you will be exposed to while on shift.

The components of fitness to be assessed are:

1) **Flexibility** – relates to the range of motion available within a joint

2) **Cardiovascular endurance** – relates to the ability of the cardiovascular and respiratory systems to provide oxygen during sustained physical activity
3) **Muscular endurance** – relates to the ability of muscles to continue functioning without fatigue
4) **Muscular strength** – relates to the ability of the muscles to exert force

**2.1 Flexibility**

*Selected Test:* Modified sit-and-reach test (MSR)

*Purpose:* This specific test (MSR) is an indirect measure of flexibility, and it is easily assessed and reported in centimetres. The test is utilised to assess lower back, hip and hamstring flexibility.

*Equipment required:* Sit-and-reach box with a ruler.

*Description of the test:* You will be required to remove your shoes and wear comfortable clothing that will not restrict your movement. You will sit on the floor with your back and head against a wall with your hip joint at a 90° angle. Your legs must be straight with your knees flat against the floor and your feet flat against the sit-and-reach box. The sit-and-reach box is then placed in position by the assistant. While remaining seated against the wall, you will place one hand over the other while keeping in contact with the wall. At this point, the assistant moves the measurement scale along the top of the box so that the zero point is at the tip of your fingertips. Once the zero point has been established, you will inhale and exhale slowly and whilst exhaling, slowly reach as far forward as you possibly can, while pushing the sliding measurement scale along the top of the box. It is critical that your knees do not lift off the ground during this movement. You may also not jerk or bounce to reach further. The full reach position must be held for a period of two seconds. At this point the assistant will capture your score in centimetres. This process is repeated three times.

*Scoring of the test:* The distance reached for the three attempts is recorded to the nearest centimetre, and your final score recorded is the average of the three attempts.

**2.2 Cardiovascular endurance**

*Selected Test:* 5km run test

*Purpose:* This test is utilized to assess aerobic capacity.

*Equipment required:* Suitable route on a road with limited elevation and a stopwatch.

*Description of the test:* You will line up at the starting point and wait for the start signal. You will run until you have completed the 5km distance (2 laps of the 2.5km route), and when you cross the finishing point, your time will be documented.

*Scoring of the test:* The time taken to complete the 5km run distance will be recorded in minutes and seconds.

**2.3 Muscular endurance**

*Selected Test:* Maximum push-up test

*Purpose:* This test assesses endurance of the upper body musculature (pectoralis major, anterior deltoids and triceps).

*Equipment required:* None.

*Description of the test:* You will attempt to complete as many push-ups as you can with no time limit, until failure. In the starting position for the push-up your body and legs must be in a straight line with your arms fully extended, shoulder width apart, fingers pointing forwards, elbows pointing backwards and toes touching the floor. Ensuring that your back and knees are kept straight, lower yourself down until your chest touches the clenched fist of an assistant which will result in a 90° angle at the elbows. Once this position is achieved, push back up into the starting position with your arms in full extension. The elbows must lock with each extension. This would equate to one repetition. This action is repeated without rest until you cannot perform any more push-ups, or your push-up form is no longer correct. You will be allowed two no-touch warnings, and on the third no-touch the test will be stopped. The push-up is performed with the same technique (no modifications) for both male and female participants.

*Scoring of the test:* The score is the number of repetitions completed as per the movement standards.

*Selected Test:* 7-stage abdominal strength test

*Purpose:* This test assesses abdominal muscular endurance, which is important in the context of core stability and back support. This test has replaced the one-minute sit-up test as, in a curl-up when the participant's feet are held, there is an increased involvement of the hip flexor muscles, which impacts the validity of the test to assess abdominal muscular endurance. The one-minute sit-up test also placed a lot of strain on the lower back.

*Equipment required:* 2.5kg and 5kg weight plate.

*Description of the test:* You will be required to lie supine on a flat surface with your knees flexed at right angles and your feet flat on the floor. You will attempt one complete sit-up at each of the different levels (Table 1) in the prescribed manner, starting at Level 1. A level is passed if you perform a single sit-up in the prescribed manner without your feet lifting off the floor. You are allowed up to three attempts at a level before the test is stopped.

*Scoring of the test:* The highest-level sit-up out of the eight levels which was correctly performed by the participant is captured.

**Table 1: Levels for the seven-stage abdominal strength test**

| Level | Description |
|---|---|
| **0** | Cannot perform Level 1 |
| **1** | With arms extended, the participant curls up so that their wrists reach their knees |
| **2** | With arms extended, the participant curls up so that their elbows reach their knees |
| **3** | With the arms held together across abdominals, the participant curls up so that their chest touches their thighs |
| **4** | With the arms held across the chest, holding the opposite shoulders, the participant curls up so that their forearms touch their thighs |
| **5** | With the hands held behind the head, the participant curls up so that their chest touches their thighs |
| **6** | As per Level 5 with a 2.5kg weight held behind the head, chest touching the thighs |
| **7** | As per Level 5 with a 5kg weight held behind the head, chest touching the thighs |

### 2.4 Muscular strength

*Selected Test:* Farmer carry/walk

*Purpose:* This test is utilised to measure grip strength as well as core stability.

*Equipment required:* 2 x 20kg kettlebells or dumbbells and a stopwatch

*Description of the test:* You will stand at the start line with the two kettlebells or dumbbells (totalling 40kg in weight) positioned on the ground on each side of you. On the "go" command, you will squat down and lift the two kettlebells or dumbbells and proceed to walk the 100m distance as quickly as possible. It is important to stay tall during the walk, maintaining an upright torso and avoiding any lateral bending of the spine. Small steps are recommended over large strides to ensure that you stay balanced and that the weight of the kettlebells or dumbbells does not start to swing and pull you off balance.

*Scoring of the test:* The time taken to complete the 100m distance will be captured in minutes and seconds as well as how many times you had to stop and re-grip the kettlebells or dumbbells.

### 2.5 Muscular strength & endurance

*Selected Test:* Flexed-arm hang test

*Purpose:* This test is a posture-specific isometric test and it is used to test arm and shoulder girdle strength, upper body muscular endurance and weight-relative muscular endurance. The underhand grip (chin up hand position) was selected over that of the overhand grip (pull up hand position), as this grip has been demonstrated to have a stronger relationship with relative strength.

*Equipment required:* Horizontal overhead bar, stopwatch and chair/step (optional)
*Description of the test:* The horizontal overhead bar must be higher than your standing height. You will be required to grasp the bar with an underhand grip (palms facing towards the body) wrapping your thumbs around the bar. With the assistance of spotters or the use of a chair/step, you will be raised to a height at which your arms are flexed and your chin is above, but not touching, the bar. Your legs must hang straight down, and you may not swing, bend your knees, or kick your feet. The stopwatch is started as soon as you are hanging in the correct position without any support. You are required to hang without support for as long as possible. The time will be stopped as soon as your chin touches, or drops below, the bar. Only one attempt is allowed.
*Scoring of the test:* The score is the total time in minutes and seconds which must be recorded.

## 3. EQUIPMENT REQUIREMENTS FOR THE ASSESSMENT

| Measurement | Equipment |
|---|---|
| **Modified sit-and-reach test** | Sit-and-reach box with a 30cm ruler |
| **5km run test** | Stopwatch |
| **Maximum push-up test** | Nil |
| **7-Stage abdominal strength test** | 2.5kg weight plate, 5kg weight plate<br>OR<br>2 x 2.5kg weight plates |
| **Farmer carry/walk** | 2 x 18kg kettlebells or dumbbells and stopwatch |
| **Flexed-arm hang test** | Horizontal overhead bar, stopwatch and chair |

## 4. RECOMMENDED ATTIRE FOR THE ASSESSMENT

It is recommended that you wear fitness attire that is appropriate for the different tests, e.g. shorts, a T-shirt and running shoes.

## 5. TESTING SEQUENCE & RECOVERY PERIOD BETWEEN TESTS

The assessment includes the modified sit-and-reach test as a test of flexibility. This test is performed first, prior to any of the other physical fitness tests. Once this test of flexibility is complete, you will move on to the tests which have been selected to assess muscular strength and muscular endurance. These tests are presented in rotational stations, and there is no need to rest between these different tests, as each test assesses a different muscle group (Figure 1). Once you have completed all the physical fitness tests of muscular strength and muscular endurance, you must have a rest period of at least 15 minutes. The selected physical

fitness tests focus on flexibility, muscular endurance, muscular strength and aerobic capacity, and there are no tests that focus on anaerobic capacity. Taking this into consideration, it is recommended that there is at least a 15-minute rest to allow for full recovery between the muscular strength and endurance tests and the aerobic capacity test. The rest period between tests can be longer than the prescribed 15 minutes if logistical arrangements require this, however, it is critical that the rest period is the same for all participants to ensure that all participants taking part in the physical preparedness assessment process have the same assessment experience. Once the mandatory 15-minute rest period is complete, you will complete the 5km run test as the test for aerobic capacity.

The fundamental principle behind the selected testing sequence is that one physical fitness test should not affect the performance of a subsequent test and the testing sequence should allow for optimal performance in each test. The least-fatiguing tests should be performed first, and the most-fatiguing tests should be performed last. Any performance test that fatigues the athlete will confound the results of subsequent tests. As an example, an endurance exercise which precedes strength training appears to significantly decrease strength expression. However, no detrimental effects on endurance performance have been noted when strength is tested first. A logical testing sequence would test in the following order: 1) non-fatiguing tests such as flexibility; 2) agility tests; 3) maximum power and strength tests; 4) sprint tests; 5) local muscular endurance tests; 6) fatiguing anaerobic capacity tests; and 7) aerobic capacity tests. Based on this, the testing sequence for the physical fitness tests which make up the physical preparedness assessment for the aspirant ROCKET team member is as follows:

1. Non-fatiguing test of flexibility (modified-sit-and-reach test)
2. Local muscular endurance and strength tests (flexed-arm hang test / maximum push-up test / 7-stage abdominal strength test / farmer carry or walk)
3. Aerobic capacity test (5km run test)

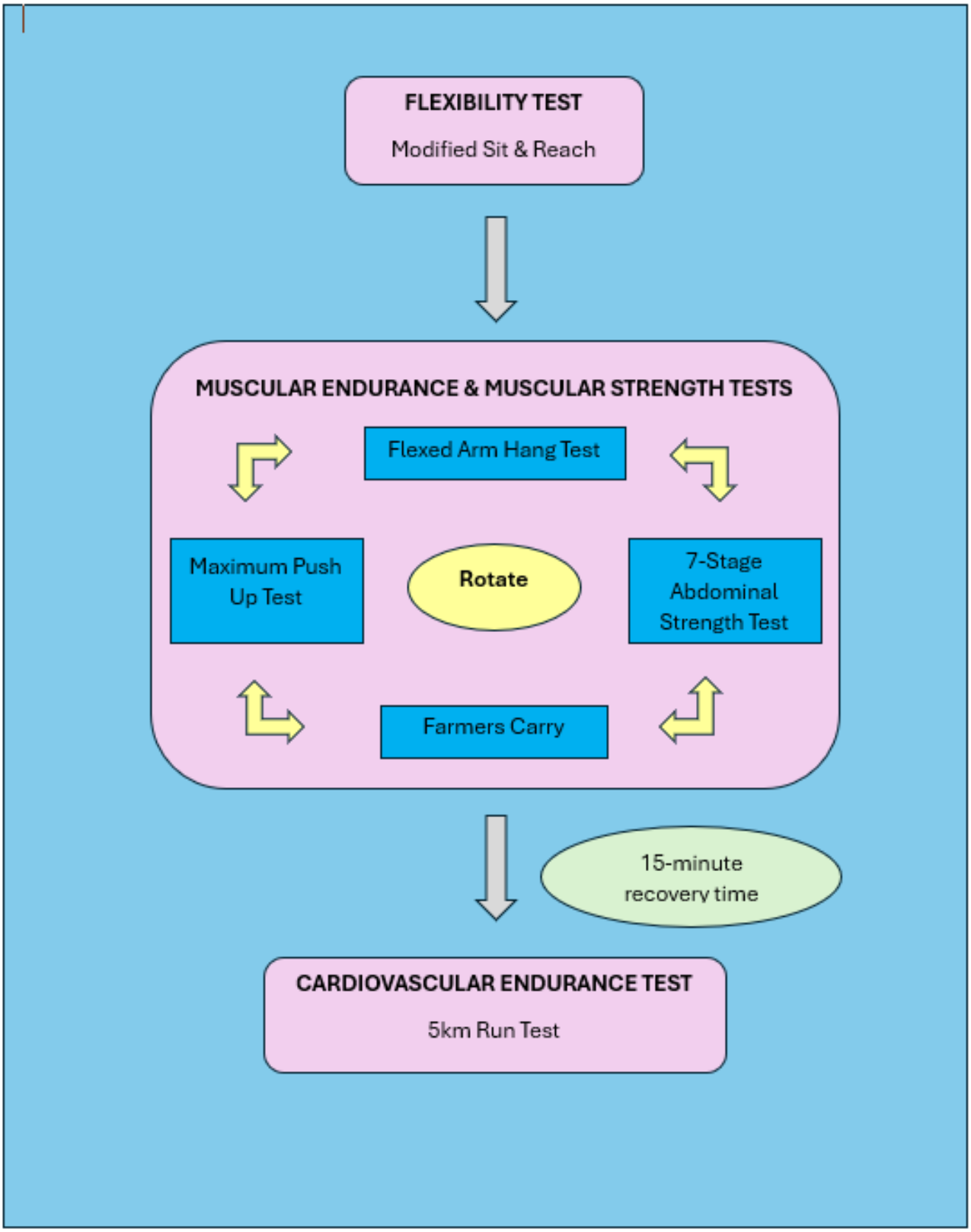


**Figure 1: Testing sequence**

## 6. STANDARDS FOR THE SELECTED PHYSICAL FITNESS TESTS

Differences in the physical characteristics of the sexes that relate to job performance in physically strenuous tasks include body composition, muscular strength, muscular endurance, and aerobic capacity. Based on these differences, age, and gender-based fitness norms were commonly utilised when setting standards for physical preparedness assessments as there was no data to suggest the use of an absolute standard. However, an important point to remember is that, despite these physical differences and performances in the different physical fitness tests, the male and female emergency care provider is required to perform the same essential, critical job-related tasks. This physical preparedness assessment represents the minimum level of fitness required to perform the associated job tasks and focuses on the essential components of fitness required for these tasks. Discrimination in the context of a physical employment standard (PES) for emergency care providers is permitted, provided job-relatedness has been established, as a certain standard needs to be met to ensure that the emergency care provider is able to perform the job-related tasks safely and efficiently.

Despite these differences in performance between the sexes in the different physical fitness tests, appropriate physical training can be utilised to improve performance during physically demanding job tasks in both males and females. Individualised intervention strategies that focus on exercise, conditioning and resistance should be considered and implemented in order to ensure that individuals are able to achieve the minimum physiological, fitness and strength profiles required of them in order to safely and efficiently execute the tasks associated with their operational role within ROCKET.

The determination of the normative standards for the different fitness tests will be determined by the employees at ROCKET, i.e. the employees at ROCKET will be responsible for setting the minimum pass requirements for each of the tests. Out of interest, I have included the results of a group of emergency medical care students for the different fitness tests where the mean age of the participants was 26.4 ± 6.7 years ranging from 19-44 years (Table 2). You will note that there is no score for the Farmers Carry as the students performed the grip strength test with use of a grip strength dynamometer.

**Table 2: Mean results and standard deviations (SDs) of a group of South African BHSc EMC students for the selected physical fitness tests**

| Variables | Combined | | Males | | Females | |
|---|---|---|---|---|---|---|
| | Mean ± SD | Range | Mean ± SD | Range | Mean ± SD | Range |
| **Modified Sit & Reach Test (centimetres)** | 30.3 ± 9.7 | 5.3–52.0 | 28.6 ± 9.3 | 5.3–44.7 | 32.7 ± 9.9 | 19.7–52.0 |
| **Flexed Arm Hang Test (seconds)** | 45.8 ± 19.1 | 7–93 | 51.5 ± 18.4 | 10-93 | 38.2 ± 17.6 | 7–70 |
| **Maximum Push Up Test (repetitions)** | 20.0 ± 14.8 | 1–61 | 26.7 ± 14.7 | 3-61 | 11.0 ± 9.3 | 1–33 |
| **7-Stage Abdominal Strength Test (level)** | 4.7 ± 2.3 | 0–7 | 4.2 ± 2.5 | 0-7 | 5.4 ± 1.7 | 0–7 |
| **5km Run Test (minutes/seconds)** | 28m59.6s ± 4m59.3 s | 20m30s–42m24s | 26m37s ± 3m41s | 20m30s–34m17s | 32m13s ± 4m46s | 24m09s–42m24s |

n = number of participants

SD = Standard deviation