



**NT FIRE & RESCUE
SERVICE**



Firefighter Recruitment

Preparing for the Beep Test

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Acronyms	Full form
NT	Northern Territory
NTFRS	Northern Territory Fire and Rescue Service

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Program Overview

The following information provided should be used as a general guideline for the physical preparation required of candidates preparing to (successfully) complete level 9.6 of the Beep Test. The following program will focus on developing/improving cardiovascular fitness (both aerobic endurance and power) consistent with the duties of an operational firefighter. It is important that you are adequately prepared for the Beep Test. Please note that there are 15m and 20m versions of the test available. Candidates will be tested on the 20m version. If you have any existing health conditions or are new to training it is recommended that you consult your General Practitioner prior to commencing the Beep Test Training Guide.

The Beep Test

The Beep Test is a multi-stage fitness test (MSFT) which is widely used to measure aerobic fitness by predicting maximum oxygen uptake (VO₂max) and performance. The test requires individuals to perform 20m shuttle runs (back and forth), whereby they must reach the end of the 20m grid before the next beep. The time recorded beep decreases each minute (stages reduce from 2 min to 1 min), forcing individuals to increase running speeds (initial running velocity is 8.5km/hr and increases 0.5km/hr each minute). The cumulative distance and time of the full test (Level 21.16) is 4.94km and 22min 51sec respectively. Northern Territory Fire and Rescue Service (NTFRS) requires candidates to successfully complete Level 9.6 which is 1.56km in distance and 9min 3sec in total time.

Aerobic Fitness

NTFRS have characterised aerobic fitness as an important indicator/requirement of an operational firefighter. Higher levels of aerobic or cardiovascular fitness have been associated with improved task performance and improved recovery times during periods of high physiological strain (i.e., fire suppression). Firefighting duties often involve periods of moderate to high intensity effort, placing an increased demand on the anaerobic energy system. However, these bouts are often coupled with extended periods of low intensity work, meaning the overall reliance of the aerobic system is greater and primarily responsible for promoting recovery during (i.e., from repeated bouts) or after (i.e., post exercise recovery).

Ways to improve aerobic fitness vary, although using a planned/structured aerobic conditioning program will greatly increase an individual's chance to improve their fitness/running performance. The physiological adaptations that occur from aerobic training are dependent upon several key factors/variables. These include:

- Exercise Frequency
- Exercise Intensity (i.e., Heart Rate Zone or RPE)
- Exercise Duration (i.e., time or distance)
- Program Length/Duration (i.e., 4 weeks verse 6 weeks)
- Initial Level of Fitness

Although the majority of these don't need to be explained, the following section will cover/focus specifically on exercise intensity (how hard you are training) as this factor is probably considered one the most important variables to monitor throughout the program. The two main methods for monitoring exercise intensity in the following program are Heart Rate Zones (HRZ) and Rate of Perceived Exertion (RPE).

Heart Rate (HR) Training consists of five "Training Zones" which are derived from both your resting heart rate (and minimum heart rate) and your maximum heart rate. Between these two values is what makes up the five training zones. Determining your maximum heart rate can be easily estimated using the value of 220 and subtracting your age (i.e., for a 30-year-old, $220 - 30 = 190$ bpm) and will be a relatively close estimate for the majority of the population. However, if you wish to seek out your true maximum HR value, you can get it clinically measured via cardiopulmonary exercise testing (CPET) or VO2 test. Although these can be expensive and are usually done under the supervision of an Exercise Scientist/Physiologist.

The table below illustrates the five HR training zones:

Zone	Intensity	Percentage% of HRmax
Zone 1	Very Light	50-60%
Zone 2	Light	60-70%
Zone 3	Moderate	70-80%
Zone 4	Hard	80-90%
Zone 5	Maximum	90-100%

Heart Rate Zone 1: 50-60% (Very Light) Zone 1 is the very low intensity zone and should be utilised to facilitate active recovery. This should be the equivalent to an easy walk or bike ride.

Heart Rate Zone 2: 60-70% (Light) Zone 2 is still a low intensity zone which would be the equivalent to an easy run that could continue at this intensity for an extended period. Think an easy jog while maintaining conversation. This zone is great for improving general endurance and will be considered as a "light" or "easy" training day.

Heart Rate Zone 3: 70-80% (Moderate) Zone 3 is where the training starts to get a bit tougher. This zone will start to utilise some aerobic pathways for energy, think longer distance easy intervals, fartlek training or even tempo runs.

Heart Rate Zone 4: 80-90% (Hard) Zone 4 is as it states "hard". Exercise in this zone means you will be breathing and working hard. This zone is utilised for hard tempo runs, hill repeats and high intensity interval running (i.e., Maximum Aerobic Speed (MAS)).

Heart Rate Zone 5: 90-100% (Maximum) Zone 5 is considered maximal effort and this level of intensity is usually only able to be maintained intensity for a few minutes. Ideally this sort of intensity would only be seen during high intensity interval training or during a very hard effort at the end of a race or up a long hill.

While heart rate zone training focuses on objective measurements, Rate of Perceived Exertion (RPE) is derived from subjective measures. If you don't have access to heart rate monitoring, then the use of subjective measures like RPE can serve as a very useful tool to gauge/monitor your exercise intensity. The RPE scale (Borg CR10) consists of ratings from 0-10, with 0 or 1 describing no effort being exerted or complete rest. As you move up the scale, intensity increases to 10 which represents maximal effort, meaning no more work can be done.

RPE Scale (Borg CR10 Scale)	
RPE 0	Rest
RPE 1	Very, Very Easy
RPE 2	Easy
RPE 3	Moderate
RPE 4	Somewhat Hard
RPE 5	Hard
RPE 6	-
RPE 7	Very Hard
RPE 8	-
RPE 9	-
RPE 10	Maximal

If you wish you can decide to use both methods combined. In fact, this is a very effective method to cover both objective and subjective feedback to effectively monitor your training. However, if you don't have access to equipment like heart rate monitors or smart watches, then utilising the RPE method will still help you understand the required intensities.

Types of Aerobic Training

Traditional aerobic conditioning is achieved mainly through either continuous or interval-based activity (running). Both methods will result in increased aerobic performance (VO2max), although evidence suggests that the incorporation/accumulation of training stimulus at higher intensities (90-100% of VO2max) via interval training may prove more beneficial. However, it is important to note that although higher intensity intervals may seem more effective, lower intensity continuous activities still produce effective changes and reduce the risks of injury.

The two main forms of interval-based training used in the following program are based on max aerobic speed (MAS) and Fartlek running. MAS training focuses on spending the majority of the training time above 100% (more specifically 120%) of an individual's max aerobic speed, which has been proven as a critical factor to improve aerobic power. There are multiple MAS methods/protocols, however they are all based around short intervals (15-30sec) at a good single speed, followed by an equal respite interval of passive rest and continuing for 5-10 minutes. There is a correct method in determining one's actual max aerobic speed (can be found here), but in order to keep things simple, this program will focus mainly on the interval work to rest ratio, distance and number of sets/repetitions along with the subjective measure of RPE.

Both these forms of training along with continuous steady state training will make up the bulk of the aerobic conditioning program. This allows for a variety of different training modalities that not only help keep things stimulating and enjoyable, but also easily distinguish “light/easy”, “moderate”, and “hard” training days. For example, Day 2 might be a moderate intensity day utilising Fartlek training method, while Day 3 is a high intensity day focusing on MAS running. The training program outlined below will consist of three days per week. It is up to the individual to decide on how much training is needed prior to completing the Beep Test. For this reason, there will be two opportunities within this program to test your Beep Test result. This is highly recommended and will not only allow you to practice and familiarise yourself with the test but give you realistic feedback on exactly where your fitness levels are at.

Tips for the Beep Test

Be prepared and fit

The number one tip/priority for the Beep Test is to be adequately prepared and fit enough to complete level 9.6. In fact, aiming to complete a higher level during your training prior to your testing day will build confidence and assurance you will pass the test. Practicing the test will not only help you get an indication of your abilities, but it will also familiarise yourself with the test’s timings and sounds.

Running/Shuttle technique

Running technique during a shuttle run is important. Pacing between the markers and into turns will ensure you don’t over or under shoot the distance. To conserve energy, it is worthwhile practicing your turns as the transition is where most of the momentum is lost.

Focus on yourself

Although you should have already practiced the test leading into the testing day, you may feel inclined to focus on the other individuals completing the test with you. Keep in mind nerves will be high and you may let others start to dictate your pace. The last thing you want to do is to start maintaining the pace of someone who is a lot fitter than yourself and run the risk of increasing unnecessary fatigue. Try to focus on what you have been training to do, think about what you are doing, not others around you.

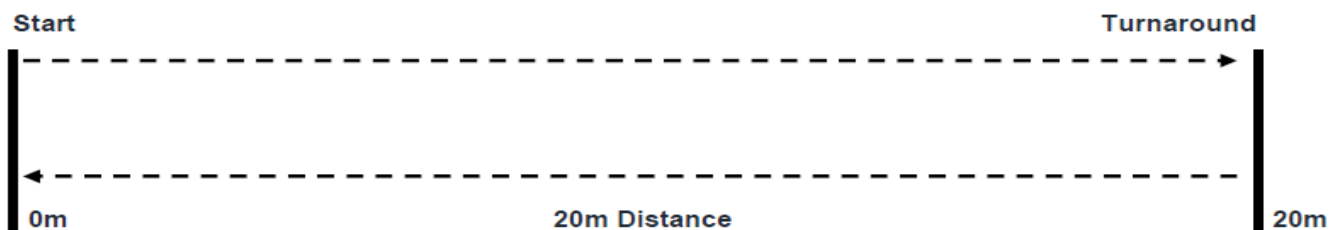
Recovery

Ensuring you are adequately recovered prior to testing day is very important. If you follow the training programs provided, they will be designed so that you are peaking during testing week and not carrying any residual fatigue. But a good rule is to ideally avoid any form of hard/strenuous activity 24 - 48hrs prior to the testing day.

Nutrition and Hydration

This is sometimes overlooked and often undervalued. Depending on the time of day you complete the test will obviously dictate what you eat prior, but ideally eating something that isn't too heavy which consists of carbohydrates and some protein. This should be consumed in conjunction with some fluids (ideally water). It is important that you don't eat something you wouldn't normally eat or try something different on the day as it could be a recipe for disaster. Best thing to do is trial some food options during your training periods to find your ideal combination.

Beep Test Conditioning Program



Week 1

Day 1	Day 2	Day 3
<p>Light/Easy HR Zone 2-3</p> <p>Walk 2-3min Light/Easy jog 10min Walk 2-3min</p>	<p>Hard HR Zone 4-5</p> <p>50-70 running Intervals 2 sets of 6 reps w/3min recovery 15sec run (RPE 8) : 15sec recovery</p>	<p>Moderate HR Zone 3-4</p> <p>Continuous Jog/run Cycle: Complete 2 sets w/2min recovery</p> <p>Easy/Light Jog 2min @RPE 4-5 Jog/run x 1 km @ RPE 6-7 Easy/Light Jog 2min @RPE 4-5</p> <p>Or</p> <p>Easy cycling 2min @ RPE 4-5 Cycle 1km @ RPE 6-7 Easy Cycling 2min @ RPE 4-5</p>

Week 2

Day 1	Day 2	Day 3
<p>Light/Easy HR Zone 2-3</p> <p>Walk 2-3min Light/Easy Jog 15min Walk 2-3min</p>	<p>Hard HR Zone 4-5</p> <p>50-70 running Intervals 2 sets of 8 reps w/3min recovery 15sec run (RPE 8) : 15sec recovery</p>	<p>Moderate HR Zone 3-4</p> <p>Continuous Jog/run Cycle: Complete 3 sets w/2min recovery</p> <p>Easy/Light Jog 2min @ RPE 4-5 Jog/run x 1 km @ RPE 6-7 Easy/Light Jog 2min @ RPE 4-5</p> <p>Or</p> <p>Easy cycling 2min @ RPE 4-5 Cycle 1km @ RPE 6-7 Easy Cycling 2min @ RPE 4-5</p>

Week 3

Day 1	Day 2	Day 3
<p>Light/Easy HR Zone 2-3</p> <p>Walk 2-3min Light/Easy Jog 15-20min Walk 2-3min</p>	<p>Hard HR Zone 4-5</p> <p>50-70 running Intervals 2 sets of 10 reps w/3min recovery 15sec run (RPE 8) : 15sec recovery</p>	<p>Moderate HR Zone 3-4</p> <p>Continuous Jog/run Cycle: Complete 3-4 sets w/2min recovery</p> <p>Easy/Light Jog 2min @ RPE 4-5 Jog/run x 1 km @ RPE 6-7 Easy/Light Jog 2min @ RPE 4-5</p> <p>Or</p> <p>Easy cycling 2mins @ RPE 4-5 Cycle 1km @ RPE 6-7 Easy Cycling 2mins @ RPE 4-5</p>

Week 4

Day 1	Day 2	Day 3
<p>Light/Easy HR Zone 2-3</p> <p>Walk 2-3min Light/Easy Jog 20min Walk 2-3min</p>	<p>Hard HR Zone 4-5</p> <p>50 - 70 running Intervals 2 sets of 12 reps w/3min recovery 15sec run (RPE 8) : 15sec recovery</p>	<p>Moderate HR Zone 3-4</p> <p>Continuous Jog/run Cycle: Complete 4-5 sets w/2min recovery</p> <p>Easy/Light Jog 2min @ RPE 4-5 Jog/run x 1 km @ RPE 6-7 Easy/Light Jog 2min @ RPE 4-5</p> <p>Or</p> <p>Easy cycling 2min @ RPE 4-5 Cycle 1km @ RPE 6-7 Easy Cycling 2min @ RPE 4-5</p>

Week 5 (Deload/Test Practice)

Day 1	Day 2	Day 3
<p>Light/Easy HR Zone 2-3</p> <p>Walk 2-3min Light/Easy Jog 10min Walk 2-3min</p>	<p>Hard HR Zone 4-5</p> <p>Practice Beep Test Record Level</p>	<p>Rest</p> <p>Or</p> <p>Easy Light Jog 2min @ RPE 4-5 Jog/run x 1 km @ RPE 5 Easy/Light Jog 2min @ RPE 4-5</p>

Week 6

Day 1	Day 2	Day 3
<p>Light/Easy HR Zone 2-3</p> <p>Walk 2-3min Light/Easy Jog 15min Walk 2-3min</p>	<p>Hard HR Zone 4-5</p> <p>60-80m running Intervals 2-3 sets of 6 reps w/3min recovery 15sec run (RPE 8) : 15sec recovery</p>	<p>Moderate HR Zone 3-5</p> <p>Warm up: Easy/Light Jog 2min @ RPE 4-5</p> <p>1 min Jog @ RPE 5-6 30sec run @ RPE 7-8 X 5 w/3min recovery (walk) Repeat x 3</p> <p>Cool Down: Easy/Light Jog 2min @ RPE 4-5</p>

Week 7

Day 1	Day 2	Day 3
<p>Light/Easy HR Zone 2-3</p> <p>Walk 2-3min Light/Easy Jog 15 - 20min Walk 2-3min</p>	<p>Hard HR Zone 4-5</p> <p>60-80m running Intervals 2-3 sets of 8 reps w/3min recovery 15sec run (RPE 8) : 15sec recovery</p>	<p>Moderate/Hard HR Zone 3-5</p> <p>Warm up: Easy/Light Jog 2min @ RPE 4-5</p> <p>1.30min Jog @ RPE 5-6 45sec run @ RPE 7-8 X 5 w/3min recovery (walk) Repeat x 3</p> <p>Cool Down: Easy/Light Jog 2min @ RPE 4-5</p>

Week 8

Day 1	Day 2	Day 3
<p>Light/Easy HR Zone 2-3</p> <p>Walk 2-3min Light/Easy Jog 20 - 25min Walk 2-3min</p>	<p>Hard HR Zone 4-5</p> <p>60-80m running Intervals 2-3 sets of 10 reps w/4min recovery 15sec run (RPE 8) : 15sec recovery</p>	<p>Moderate/Hard HR Zone 3-5</p> <p>Warm up: Easy/Light Jog 2min @ RPE 4-5</p> <p>2.00min Jog @ RPE 5-6 1.00min run @ RPE 7-8 X 5 w/3mins recovery (walk) Repeat x 3</p> <p>Cool Down: Easy/Light Jog 2min @ RPE 4-5</p>

Week 9

Day 1	Day 2	Day 3
<p>Light/Easy HR Zone 2-3</p> <p>Walk 2-3min Light/Easy Jog 20 - 25min Walk 2-3min</p>	<p>Hard HR Zone 4-5</p> <p>60-80m running Intervals 2-3 sets of 12 reps w/4min recovery 15sec run (RPE 8) : 15sec recovery</p>	<p>Moderate/Hard HR Zone 3-5</p> <p>Warm up: Easy/Light Jog 2mins @ RPE 4-5</p> <p>2.00min Jog @ RPE 5-6 1.30min run @ RPE 7-8 X 5 w/3mins recovery (walk) Repeat x 3</p> <p>Cool Down: Easy/Light Jog 2min @ RPE 4-5</p>

Week 10 (Deload/Test Practice)

Day 1	Day 2	Day 3
Light/Easy HR Zone 2-3 Walk 2-3min Light/Easy Jog 10min Walk 2-3min	Hard HR Zone 4-5 Practice Beep Test Record Level (ie 9.6 or greater)	Rest Day

References

1. Queensland Fire and Rescue Service, *Beep Test Training Program*