



West Yorkshire  
Fire & Rescue Service

# PHYSICAL FITNESS GUIDE



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# INTRODUCTION

The role of a firefighter can be physically demanding, and consequently firefighters are required to maintain good general levels of physical fitness throughout their careers.

The following information is designed to provide GENERAL GUIDELINES on physical fitness including those applicants intending to undertake the National Firefighter Selection Tests (NFSTs).

It is important to note that good exercise training advice should be highly specific to you as an individual, and will depend upon your general health, age, current fitness level, previous training history, lifestyle and ultimate fitness goals.

Ideally you should seek advice from a qualified fitness professional who will help you design, undertake and evaluate a physical training programme that is specific to your needs.

## ARE YOU READY?

You can easily determine your current level of aerobic fitness by performing your best effort 1.5 mile (2413 m) run: you should only be planning to adopt the 12 week training programme recommended here if you can **run 1.5 miles in approximately 12-14 min\* or reach levels 5 to 7 on the Multi-Stage Shuttle Run Test**. If you are not within these suggested starting levels, do not be put off. The programme is still applicable to you, it may just take longer than 12 weeks to achieve your final goal and you will need to progress much more gradually. If you are not yet able to achieve these starting aerobic fitness levels, you would be best advised to seek professional guidance on physical training from a qualified fitness instructor, who will be able to assess your specific needs and plan a longer and more detailed training programme for you.

\*More muscular individuals (80+ kg) can afford to be at the lower end of this suggested aerobic fitness starting level whilst smaller individuals (50-65 kg) should aim to be at the higher end.

# IMPORTANT SAFETY INFORMATION

- If you are in any doubt about your health or physical ability to exercise, you should consult your Doctor before commencing any physical training programme. This is especially important if you are (or think you might be) pregnant, if your health status has recently changed, or have not exercised for the last six-months or have had a recent illness or injury.
- Remember there are no quick ways to develop good general fitness levels. You must progress slowly and gradually by following a structured training programme to reach your goal. It is better to do too little than too much during the early stages of any fitness programme!
- You must wear appropriate clothing during your training. This is especially important with regards to footwear. A good training shoe designed to match your physical characteristics is essential to minimize your chance of injury. A podiatrist will be able to advise you on which type of shoe will meet your training needs.
- Always begin your training sessions with a thorough warm-up and cool-down afterwards.
- The warm-up and cool-down will be discussed in more detail later on.
- Do not train if you are unwell or injured. It is better to rest than train through an illness or injury. Think long term and not just to the next one or two training sessions.

# WHAT IS PHYSICAL FITNESS?

Optimum physical fitness for firefighters translates into being able to carry out firefighting activities successfully and without undue fatigue.

The key fitness components for firefighting are:

## LONG-TERM AEROBIC ENDURANCE

Aerobic Endurance allows you to continue to exercise for prolonged periods of time (> 3 minutes) at low to moderate/high intensity. Typical aerobic activities include hiking, running/jogging, cycling, rowing, swimming or skating.

## MUSCULAR STRENGTH

Muscular Strength allows you to lift, lower, pull, push and carry heavy objects over very short distances/periods of time (e.g. lifting a 13.5 m ladder back on to an appliance).

Best trained using resistance training. It is important to remember that weight training will not necessarily make you look overly muscular.

Lifting light weights to start with until you have mastered the correct technique is essential.

Seek professional fitness advice on this aspect of training.

## MUSCULAR ENDURANCE

Muscular Endurance is closely linked to both aerobic endurance and muscular strength, but allows you to continue to lift, lower, pull, push and carry heavy objects for more prolonged periods of time (e.g. carrying a light portable pump (~ 33 kg) from an appliance across a field to an external water source). Muscular endurance is best trained using more moderate resistances over a more prolonged period of activity, such as circuit training using your own body weight as the resistance.

## FLEXIBILITY

Flexibility refers to your ability to move your limbs and joints into specific positions at the end of their normal range of movement. Flexibility is important as it will allow your body to work in cramped positions without unduly stressing the muscles, tendons and ligaments (e.g. crawling through small spaces or openings whilst searching the floor space for a casualty in a house fire) and may reduce the risk of injury.

Flexibility is best developed using slow controlled stretching exercises.

# HOW TO DEVELOP AND MAINTAIN PHYSICAL FITNESS

Improving physical fitness requires some self-discipline and efficient use of time, as an effective exercise routine needs to be completed on a regular basis (at least 3 days per week). Your training should be gradual and progressive, starting gently and building up the intensity over time. This will produce an improvement in your fitness by placing greater demands on your body.

Any physical training programme has 4 key components that can be manipulated to produce the desired training effect. These are:

- the mode of exercise (the type of exercise) e.g. cycling, running, swimming, etc.,
- the training intensity (how hard you are exercising),
- the training duration (how long you are exercising) and
- the training frequency (how often you are exercising).

By specifically modifying these 4 components of training, you will be able to develop and maintain aerobic endurance, muscular strength, muscular endurance and flexibility.

The mode, frequency and duration of exercise are easy to plan and monitor with a notebook and stopwatch. Setting the correct exercise intensity for muscular strength and endurance training is usually done by counting the number of repetitions that you are able to perform on a particular exercise.

As a good general overall level of fitness is required to undertake firefighter training and good fitness levels cannot be acquired overnight, you should only undertake this programme if you already have a basic general level of aerobic fitness. The gains in aerobic fitness over a structured 8-12 week training programme are highly individual specific, but typically average about 10-15%. Therefore, you will need to start with a reasonable level of aerobic fitness to meet the required NFST's physical standards with only 8 weeks of training.

## **GENERAL EXERCISE GUIDANCE**

The role of a fire fighter can at times be physically demanding. Therefore the entry selection tests are designed to reflect and assess the physical tasks that firefighters are required to perform. Firefighters are required to be aerobically fit, have good all-round body strength and local muscular endurance. Good exercise training advice is highly specific to the individual. It should be understood, therefore that the advice provided here can only be general; prospective applicants who require further information are advised to seek individual advice, specific to their needs, from a qualified fitness professional.

## **SAFETY POINTS**

If you are in any doubt about your health or physical ability to exercise, you should consult a doctor before commencing any physical training programme. This is especially important if you are (or think you might be) pregnant, if your health status has recently changed, you have not exercised for the last six-months or have had a recent illness or injury. Always warm up before commencing any exercise. Wear the correct clothing and footwear; do not train if you are unwell or injured.

# PREPARING FOR EXERCISE (WARM UP)

Performing a warm up prepares the body for the activity about to be undertaken. The length of time needed to warm up correctly depends on many factors; however, you should allow at least 10 minutes for this very important activity. In order to reduce the risk of injury in the warm up period, a number of steps should be followed:

## BE SPECIFIC

Make sure your warm up session is geared towards the activity that you intend to perform. Cardiovascular workouts, for example running, you should start with a brisk walk leading into a light jog. For weight training workouts it is important to warm up the joints and muscles that are involved in the resistance exercise. This will increase blood flow to the muscles which will be utilised during the exercise and activate the nervous system prior to any additional stress being placed on them.

## START SLOWLY

At the start of your workout your muscles will be relatively cold. Start exercising slowly and build up the intensity throughout the warm up period. This will increase your muscle temperature steadily and keep the risk from injury to a minimum.

## KEEP WARM

If you are exercising in a cold environment, wear additional clothing during the warm up period and try not to stand still for too long.

## STRETCHING

For many years it was thought that stretching immediately prior to exercise would prevent injuries. However, there is new research with practical application that suggests that this may not prevent muscle or tendon injury. Any form of flexibility or stretching activity should be performed following a warm up period or an exercise session.



# DEVELOPING AND MAINTAINING AEROBIC ENDURANCE

Depending on your current aerobic fitness standard, you will need to follow the below guidelines to improve your aerobic fitness.

## **Frequency of training**

3-5 days per week

## **Intensity of training**

Heart rate monitors ensure that you train at the right intensity. If you have access to a heart rate monitor you can calculate your desired training intensity by using the following equation:

*Heart rate percentage of 55-90% of Predicted Maximum Heart Rate (PMHR)*

*Calculated by:  $220 - \text{Age} = \text{Predicted Maximum Heart Rate (PMHR)}$*

*$\text{PMHR} \times 0.7$  (for 70 %)  $0.8$  (for 80%) etc. = heart rate %*

*or,*

*Level 10-17 on your Rating of Perceived Effort (RPE) scale*

## RPE SCALE

Level 6	20% effort	rest
Level 7	30% effort	very, very light
Level 8	40% effort	
Level 9	50% effort	very light—gentle walking
<b>Level 10</b>	<b>55% effort</b>	
Level 11	60% effort	
Level 12	65% effort	
Level 13	70% effort	moderately hard
Level 14	75% effort	
Level 15	80% effort	hard
Level 16	85% effort	
<b>Level 17</b>	<b>90% effort</b>	very hard
Level 18	95% effort	
Level 19	100% effort	very, very hard
Level 20	Exhaustion	

### Type of activity

Any activity that uses large muscle groups, which can be maintained continuously, and is rhythmical and aerobic in nature, e.g., walking, hiking, running-jogging, cycling, cross-country skiing, aerobic dance/ group exercise, rope skipping, rowing, stair climbing, swimming, skating, and various endurance game activities or some combination thereof.

## Specificity

To maximize the efficiency of your training you should focus on exercises that are similar to those in the test. These include running-jogging, stepping, stair climbing and other weight bearing activities.

## GENERAL HEART RATE TRAINING

Heart Rate monitors are devices which are basically designed to measure the individual beats of the heart (bpm) using electrodes located in the chest strap and transfers this information to the wrist watch. A common and well known method for identifying what the maximum theoretical heart rate an individual could achieve during exercise is simply;

$$\text{HR max} = 220 - \text{your age}$$

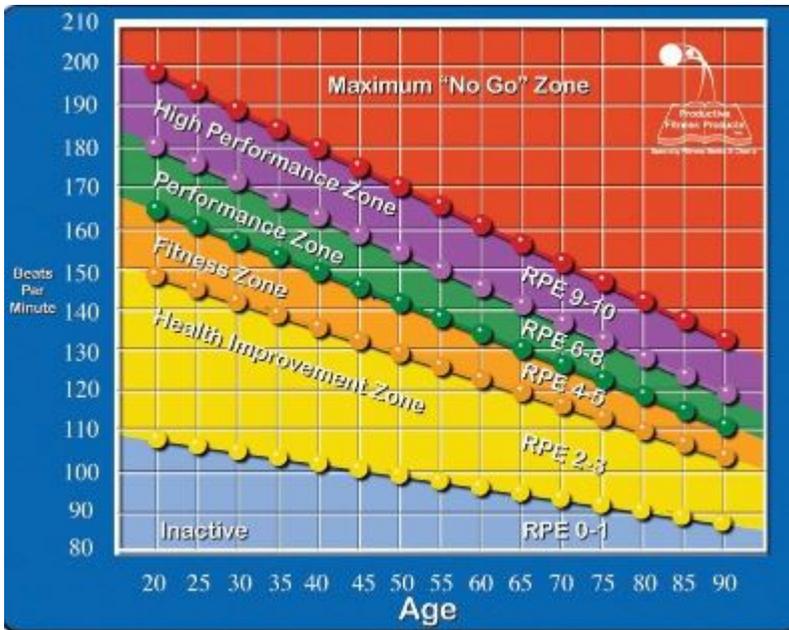
Maximum Heart rate (HR max) is the maximum number of times in one minute, that the heart can contract when exercising. The maximum heart rate achievable is variable it can be approximately 10 to 20 bpm higher or lower than predicted. For example, a 40 year old could achieve a theoretical heart rate of 180 bpm;

$$\text{i.e. } 220 - 40 = 180 \text{ bpm}$$

A heart rate monitor indication of 144 bpm for that same 40 year old individual during exercise indicates that they are working at approximately 80% HR max as shown in the table below;

bpm	% HR max
180	100%
162	90%
144	80%
126	70%
108	60%
90	50%

Once familiar with individual Heart Rates, then the level or *intensity* of training to be undertaken can be identified and monitored to suit individual requirements. These levels of intensity are usually divided into training zones and are as follows:



## MODERATE ZONE BEGINS AT 50% HR MAX

Primarily for the sedentary person previously undertaking very little physical activity. It is a level which most people will be able to maintain for an extended period of time, hence providing increased fitness gains, without risking injury. This is the first step to improvement for an inactive person.

## **WEIGHT MANAGEMENT ZONE (TRAINING ZONE) 60 - 70% HR MAX**

Often termed the “fat burning” zone. Mainly used for relatively low fitness levels or people wanting to control weight. The intensity level is such that most people can comfortably exercise for a long period and be able to use fat stored in the body as the main fuel for energy. This zone is the next step for a previously sedentary person after the moderate zone.

## **AEROBIC FITNESS ZONE 70 - 80% HR MAX**

This is the recommended zone for the improvement of cardiovascular health and fitness. This is also called the aerobic training or aerobic sensitive zone, after a few weeks of training you should be aware of a training effect, i.e. the work will feel easier and effort will decrease. This is a vigorous and challenging level for most people.

## **PEAK AEROBIC PERFORMANCE 80 - 95% HR MAX**

This is the highest level and is only recommended for very well trained individuals. This zone is primarily to increase speed, pace and to train to competitive levels. The main adaptation seen at this level is an increase to the anaerobic threshold with a greater resistance to fatigue while working at maximum capacity.

# DEVELOPING AND MAINTAINING MUSCULAR STRENGTH AND ENDURANCE

In order to improve your strength and/or muscular endurance you will need to exercise against a resistance. This resistance can be your body weight, for example a press up, or the use of specifically designed equipment such as dumbbells, barbells or resistance machines. Resistance training should be progressive in nature, individualised, and provide a stimulus to all the major muscle groups that is sufficient to develop and maintain muscular strength and endurance. You should follow the subsequent guidelines to improve your muscular strength and endurance.

## **Frequency**

2-3 days per week\*

## **Exercises**

At least one set (8-15 repetitions) of 8-10 exercises that condition the major muscle groups of the body. Multiple-set sessions may provide greater benefits if time allows. The effect of exercise training is specific to the area of the body being trained. For example, training the legs will have little or no effect on the arms, shoulders, and trunk muscles, and vice versa. Therefore a whole body approach should be adopted. Muscles should also be worked in balance and as such the following exercises are recommended; chest press, seated row, shoulder press, lat pull down, squats, lunges, step up's, abdominal crunch, back extensions.

## REST

If performing multiple sets, adequate rest should be given to allow the muscles to recover before performing another 'set'.

*\*Individuals should not perform the same resistance exercise on consecutive days. At least 24 hours rest should be allowed before repeating the exercise.*

## CHEST PRESS

Whilst lying flat on the bench with feet planted firmly on the floor either side of the bench with your arms extended. Slowly lower the weight to chest level. Push the weight back to the start position.



## SEATED ROW

From a seated position, with arms extended in front of the body and knees slightly flexed, draw the hands into the abdominal area squeezing the shoulder blades together.



## SHOULDER PRESS

From an upright position, with dumbbells overhead, slowly lower the weight to shoulder level. Push the weight back up to the start position.



## LAT PULL DOWN

From a seated position, grasp the overhead bar just wider than shoulder width. Lean back slightly and draw the elbows in towards the side of the body so that the bar rests at the top of the chest.



## SQUAT

From a standing position with feet between hip and shoulder width apart, bend at the knees and flex at the hip until your thighs are parallel with the floor. Push through the heels to return to the standing position.



# LUNGE

From a split leg position, with one foot in front of the other, lower the back knee towards the floor so that the front thigh is almost parallel with the ground. Push off the front leg to return to the start position.



## ABDOMINAL CRUNCH

Lie face up on a soft surface, bend knees and bring feet close to the buttocks. Fold your arms across your chest, or place the hand lightly behind the head. Draw your belly button towards your spine by contracting your lower abdominal muscles. Whilst holding this contraction with normal breathing, slowly raise your shoulders towards your thighs while keeping the lower back on the floor.



## BACK EXTENSION

Lie on your stomach on a mat. Place your arms at your sides so that your hands are by your hips. Raise your head and shoulders off the mat as high as comfortably possible. Hold for 1-2 seconds. Lower the head and shoulders.



# DEVELOPING AND MAINTAINING FLEXIBILITY

Flexibility exercises should be incorporated into the overall fitness programme sufficient to develop and/or maintain range of motion (ROM). These exercises may also reduce the likelihood of injury, reduce muscle soreness following exercise and may enhance muscular performance. These exercises should stretch the major muscle groups of the body. There are a number of forms of stretching techniques. However those without specific up-to-date knowledge in this area are advised to adhere to the following guidelines.

## **Frequency**

2-3 days per week.

## **Duration**

Hold the stretch 1-3 times in a static (still) position for 10-30 seconds.

## **Exercises**

Here are some recommended stretching exercises that should be performed:

## TRICEPS AND UPPER BACK STRETCH

1. Sit or stand upright with one arm flexed, raised overhead
2. with your elbow next to your ear, and your hand resting on your opposite shoulder blade.
3. Grasp your elbow with the opposite hand.
4. Inhale and pull your elbow behind your head.
5. Hold and stretch and relax.
7. You should feel the stretch in the back of the arm.



## REAR DELTOID AND UPPER BACK STRETCH

1. Sit or stand with one arm straight.
2. With the other hand grasp the elbow of the straight arm.
3. Inhale and pull the elbow across the chest and in towards the body.
4. Hold the stretch and relax.
5. You should feel the stretch in the back of the shoulder and upper back.



## ADDUCTOR STRETCH



1. Sit upright on the floor with your legs flexed and straddle and feet flat against one another.
2. Grasp your feet or ankles and pull them as close to your groin as possible.
3. Exhale; rest your elbows on your knees, pushing them down floor.
4. Hold the stretch and relax.
5. You should feel the stretch in the inside of the thighs.

## CALF STRETCH

1. Stand upright (use a wall if necessary).
2. Bend one leg forward and keep the opposite leg straight.
3. Keep the heel of your rear foot down, sole flat on the floor and feet pointing straight forward.
4. Exhale, and flex your forward knee toward the wall
5. Hold the stretch and relax.
6. After 10-15 seconds slightly flex the knee of the back leg keeping the heel of the foot down.
7. Hold the stretch and relax.
8. You should feel the stretch in the back of the lower leg.



## BUTTOCKS AND HIP STRETCH

1. Lie flat on your back with one leg crossed over the knee of the straight leg.
2. Inhale flexing the uncrossed leg off of the floor in towards the body ensuring that your head shoulders and back remain on the floor.
3. Hold the stretch and relax.
4. Feel the stretch in your buttocks and back



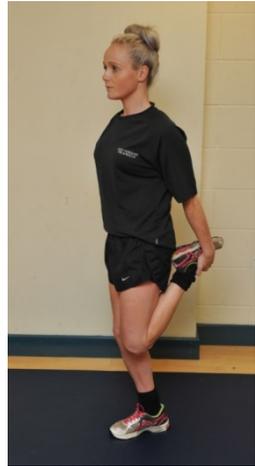
## PECTORAL AND UPPER BACK STRETCH

1. Kneel on the floor facing a bench or chair.
2. Extend your arms above your head with your hands side by side and bend forward to rest your hands on the bench or chair with your head in its natural position.
3. Exhale and let your head and chest sink towards the floor.
4. Hold the stretch and relax.
5. You should feel the stretch in your chest and upper back.



## QUADRICEPS STRETCH

1. Stand upright with one hand against a surface for balance and support.
2. Flex the opposite knee to the hand that is outreached and raise your heel to your buttocks.
3. Slightly flex the supporting leg.
4. Exhale, reach behind, and grasp your raised foot with the other hand.
5. Pull your heel towards your buttocks.



## HAMSTRING STRETCH

1. Sit upright on the floor with both legs straight.
2. Bend from the waist and try and touch your toes.
3. Exhale, and while keeping the extended leg.
4. Hold the stretch and relax.



# A GENERAL 8 WEEK PHYSICAL FITNESS PROGRAMME

Week	Sessions	Duration	Intensity	Times p/w
1	Steady pace run	20 mins	55-90% of PMHR or RPE level 10-17	2
	Weights	1-2 sets 12-15 reps		2
	Fartlek	20 mins		1
	Flexibility	10-30 seconds		2
2	Steady pace run	20 mins	55-90% of PMHR or RPE level 10-17	2
	Weights	2 sets 12-15 reps		2
	Fartlek	20 mins		1
	Flexibility	10-30 seconds		2
3	Steady pace run	20 mins	55-90% of PMHR or RPE level 10-17	2
	Weights	2 sets 12-15 reps		2
	Fartlek	20 mins		1
	Flexibility	10-30 seconds		2
4	Steady pace run	25 mins	55-90% of PMHR or RPE level 10-17	2
	Weights	3 sets 10-12 reps		2
	Fartlek	20 mins		1
	Flexibility	10-30 seconds		2
5	Steady pace run	25 mins	55-90% of PMHR or RPE level 10-17	2
	Weights	1-2 sets 12-15 reps		2
	Fartlek	20 mins		1
	Flexibility	10-30 seconds		2
6	Steady pace run	30 mins	55-90% of PMHR or RPE level 10-17	2
	Weights	2 sets 12-15 reps		2
	Fartlek	20 mins		1
	Flexibility	10-30 seconds		2
7	Steady pace run	30 mins	55-90% of PMHR or RPE level 10-17	2
	Weights	2 sets 12-15 reps		2
	Fartlek	20 mins		1
	Flexibility	10-30 seconds		2
8	Steady pace run	30 mins	55-90% of PMHR or RPE level 10-17	2
	Weights	3 sets 10-12 reps		2
	Fartlek	20 mins		1
	Flexibility	10-30 seconds		2

# THE PHYSICAL DEMANDS OF THE FIREFIGHTER SELECTION TESTS

## AEROBIC FITNESS TEST

This is an aerobic fitness test undertaken on a Chester Treadmill. An aerobic fitness of 42.3ml.kg.min VO2 max is the current aerobic standard for a firefighter. It is a multi-staged test so every 2 minutes there is an increase in the rate of the step. You are not allowed to use the handles on the treadmill for support.

## LADDER EXTENSION TESTS

Using a ladder simulator we can replicate the movement and weight required to extend and lower a 10.5 and 13.5m ladder. One test will involve extending the equivalent weight (28kg) of a 10.5m ladder to its full height; this must be done in 14.5 seconds or less, then lower under control. The second test involves one single pull of 42kg to simulate extending to lower the 13.5m ladder and lowering under control. Both tests are done in full firefighting PPE including leather firefighting gloves.

The lat pull down machine will be very useful in training for this test. Using a single rope attachment on the lat pull down machine, if you can lift 28kg for 23 reps or more and can lift 60kg or more for at least 1 rep you have an excellent chance of being able to pass both ladder extension tests.

## LADDER LIFT TEST

The ladder lift test simulates the individual physical demands of running under a 13.5m ladder. A total load of ~30 kg, lifted to a height of 1.90 m (or arm fully extended, whichever is first) is required to successfully complete this test.

The shoulder press will be very useful when training for this test. As a benchmark, if you can lift 35kg or more on a seated strict barbell shoulder press you have an excellent chance of being able to pass the Ladder lift test.

## LADDER CARRY TEST

The test consists of carrying a weighted 135 ladder heel bar over a distance of 25 meters using one hand and then completing the task using the alternative hand, this is repeated over two cycles. The other end of the heel bar is carried by an instructor during this test. To pass you must be able to complete each 25m walk without putting the ladder down.

This is very demanding on your grip strength, adding in static holds with dumbbells, shrugs and farmers walks into your workouts will help train for this test.

## RURAL SIMULATION TEST (EQUIPMENT CARRY TEST)

This is a practical test designed to simulate common rural firefighting tasks. You will be dressed in full firefighting clothing and will undertake the elements below. You will need to complete the exercise in 5 minutes and 37 seconds.

You will (performing along a 25m shuttle) drag a hose reel from the appliance for 25m, jog back 25 m, pick and carry 2 x 70 mm coiled hoses dropping them at 100m, run out the one dropped hoses (25 m), jog back 75m to appliance, pick up and carry 100mm suction hose and basket 100m, jog back 100m to appliance, pick up and carry LPP simulator 100m. You must complete this test inside 5 minutes 37 seconds to pass.

The test will challenge all aspects of your fitness (aerobic endurance, muscular endurance and muscular strength). Therefore, you must adopt a whole body approach to your training that develops these specific aspects of fitness. High intensity interval training and circuit training involving weights for developing aerobic and muscular endurance and the static bar

hold and/or hand grip exercises for developing grip strength are particularly relevant.

## **CASUALTY DRAG (CASUALTY EVACUATION TEST)**

This tests your ability to rescue a casualty. It tests upper body/back/leg strength.

In full firefighting kit you will drag a 55kg casualty walking backwards whilst guided by the assessor around a 30m (3x10m) course. You must complete this test inside 37.4 seconds to pass.