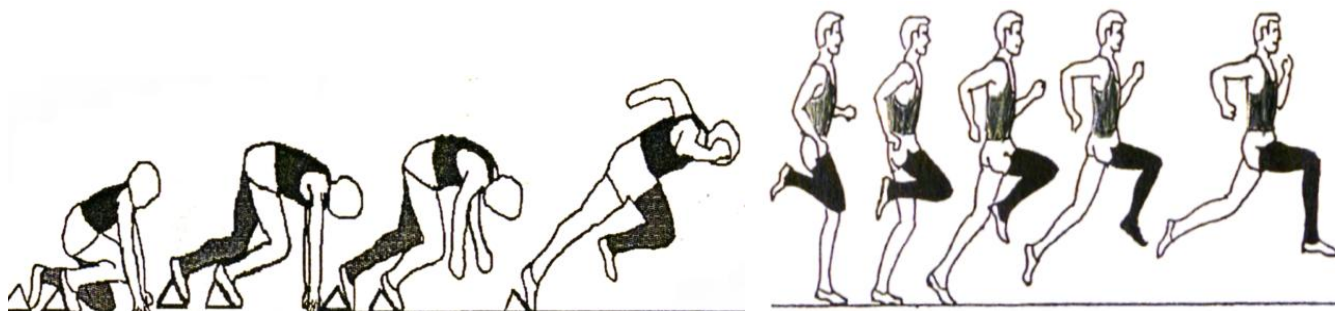
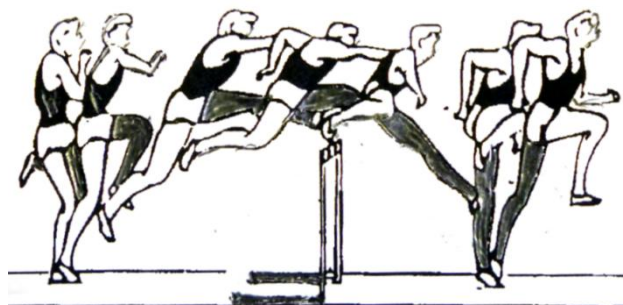


Sprints, Hurdles and Relays

Basic Coaching Manual



Compiled and written by **Steve Rautenbach**

Contents

1.	Energy systems.....	4
2.	Basic mechanical principles in track and field.....	8
3.	Running efficiency	11
4.	Sprinting: Medium Start.....	15
5.	Acceleration	19
6.	How to finish the race	19
7.	Sprints: Specific tests	20
8.	Training components.....	22
9.	Speed	25
10.	Strength Training.....	26
11.	Jumps as functional power exercises to improve speed.....	30
12.	Endurance Training	33
13.	Sprint fault analysis and corrections	35
14.	Training Programme	39
15.	The 400m.....	44
16.	IAAF Rules (2014-2015) Rules 161 to 166	49
17.	Hurdles	49
18.	Common faults in clearing the hurdles	55
19.	The 400m Hurdles (200m- and 300m Hurdles)	56
20.	Common faults in clearing in the 400m hurdle.....	57
21.	Hurdle technique drills	58
22.	IAAF Rules (2014-2015) Rule 168 - Hurdles.....	61
23.	Relays	61
24.	The IAAF Rule 170 – 4 X 400m.....	66
25.	Conclusion.....	67
26.	Bibliography.....	68
27.	Appendix A - Analysis sheet for 100m hurdles	69

Preface

Racing short distances has been part of competitive play of every civilization. One of the main advantages of athletics, particular sprinting, is that it caters for and can be enjoyed by men, women and children at the same meeting. Considering the long and detailed history of sprinting, it is somewhat surprising that sports scientists has virtually ignored this area of research. For many years it was accepted that sprinters were "**born and not made**".

Sprint training methods have been left almost entirely based on the observation and experiment of the sprint coaches. Fortunately lately speed development methods and components have been extensively documented and provides useful general knowledge how to improve speed.

For the sprint coach to achieve success he/she must believe that like in any other event the speed of an athlete can be improved with the correct technique, correct physiological conditioning, strength training, psychological preparation and planning. It is also important to understand the relevant coaching theory because:

**the person who knows how will always have a job,
but the person who knows why , will always be his boss.**

Taking the above in consideration it is very important that the most efficient way of running as well the best conditioning and strength training programs should be available to sprint coaches.

Remember: **“Knowledge is Power”**

The success of the modern athlete (even in sprinting) is greatly dependent on an interaction between technical knowledge, experience, and science. To deny the role of science will be irresponsible, more important, it might prevent good sprint coaches and athletes from becoming great coaches and athletes.

1. Energy systems

Fitness can be defined as:

the body's ability to cope with a specific task under specific conditions.

In layman's terms it is often said that there is more than one type of "fitness". For instance, the "fitness" of an endurance runner differs from the "fitness" of a sprinter and it would be incorrect to say that one is "more fit" than the other.

These different types of fitness exist because every sport has specific physical demands.

All sports can essentially be distinguished on the basis of two factors:

Intensity and **D**uration

Intensity and duration is inversely related – low intensity activity can continue for prolonged periods while high intensity activity cannot be sustained for long periods before exhaustion interrupts it. Whatever the specific physical demand of the sport, an athlete's ability to perform is based on his/her ability to gain the energy needed for movement execution.

Energy can be defined as:

the ability or capacity to perform work and is a necessary prerequisite for the performance of movement.

The human body caters for the energy demands of the different types of "fitness" by utilizing three different, but overlapping energy systems:

1. Aerobic
The low-intensity, long-duration system (also called oxidative system)
2. Anaerobic alactic System (ATP-CP)
The high-intensity, short-duration system
3. Anaerobic lactic System
The medium-intensity, medium-duration system (also called the anaerobic glycolytic system)

The first system relies on the availability of oxygen for energy production. The last two systems do not rely on oxygen to produce energy, hence the term "anaerobic" in both titles.

It is important to remember that all three energy systems are active at a given time.

The extent to which each energy system contributes to the body's energy demand at a given time is dependent on primarily the intensity and secondarily the duration of the activity.

All three the energy systems contribute at the start of an exercise but the contribution will depend on the individual, the effort applied and the rate at which energy is needed.

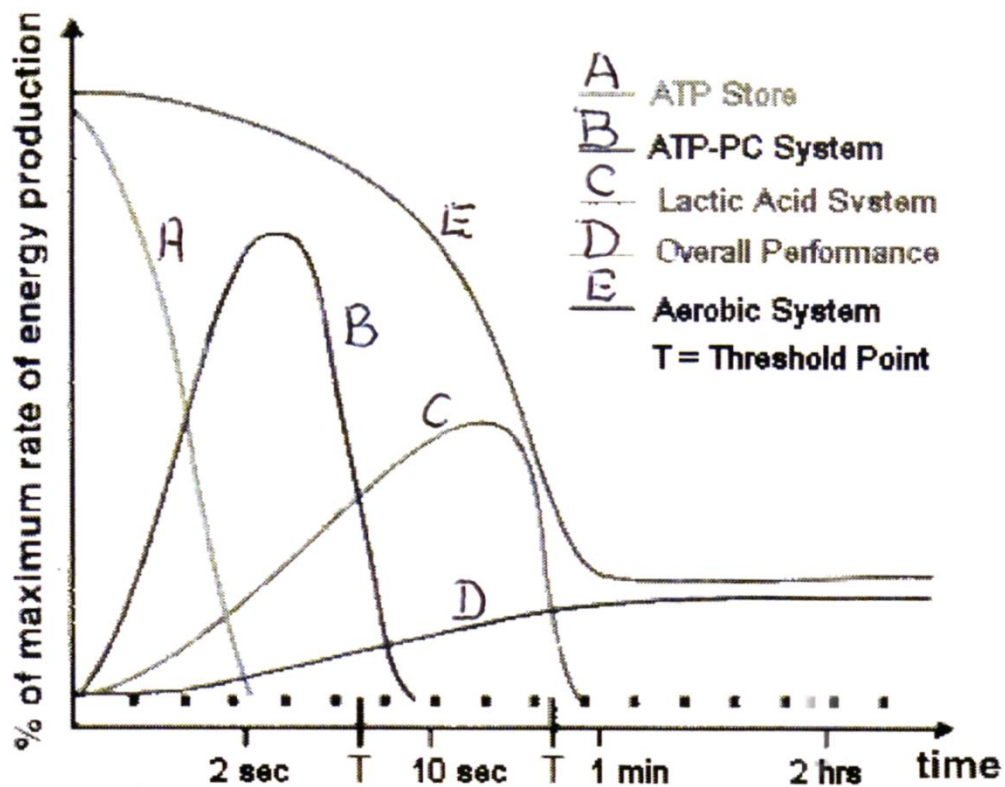
1.1 Aerobic system

The low-intensity, long-duration (oxidative) system

The oxidative system involves the use of oxygen and provides the muscle with a continuous supply of ATP under conditions of both rest and exercise. The oxidative system uses both carbohydrates (glucose) and stored body fat (fatty acids) as substrates, which means that its fuel reserves are far more extensive than those of the other two energy systems. This makes the oxidative system the primary source of ATP during rest and low-intensity exercise and a significant contributor to the supply of ATP in more intensive activities when it is used in conjunction with the two anaerobic systems.

The oxidative system is also very important in oxidizing excessive lactic acid that was produced by the lactic acid system during high intensity work. An aerobic base for the purposes of recovery in anaerobic sports does not have to and in fact **SHOULD NOT** be gained through conventional endurance activities like slow distance running. Interval training with short rest periods will be more appropriate to create a base of cardiovascular endurance in these athletes.

The Physiological Basis of Physical Education and Athletics



Source: Matthews, D. & Fox, E. (1992). The Physiological Basis of Physical Education and Athletics

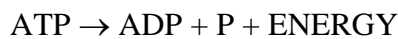
1.2 Anaerobic alactic system

The high-intensity, short-duration (ATP-CP) system

ATP (adenosine triphosphate) is a high-energy compound stored in muscle cells in limited amounts. ATP is immediately available to muscle to meet the energy needs of fast and powerful movements.

During high-intensity short-duration activities and at the start of all exercise (regardless of intensity) ATP will be broken down into adenosine diphosphate (ADP) + phosphate (P) with the release of energy for muscle contraction.

Since only a small amount of ATP can be stored in muscle cells, energy depletion will occur rapidly. An increase in ADP concentration will activate the breakdown of creatine phosphate (CP), which is also stored in the muscle cell, into creatine (C) and phosphate. The CP thus supplies a phosphate group that combines with ADP to resynthesize ATP.



These reactions provide energy at a high rate, but because ATP and CP are stored in small amounts, this energy system cannot supply energy for continuous, long duration activities (not longer than 6 to 10 seconds). This system is the main energy source for very quick and explosive activities, like a 100-m sprint, jumping and throwing events. The body will always attempt through restoration, to recover and replenish the energy stores to pre-exercise conditions. Post-exercise phosphagen restoration occurs quite rapidly. Within 3-5 minutes ATP appears to be completely resynthesized and complete CP resynthesis can occur within 8 minutes. During this stage lactic acid does not play a role.

1.3 Anaerobic lactic system

The medium-intensity, medium-duration (lactic acid) system

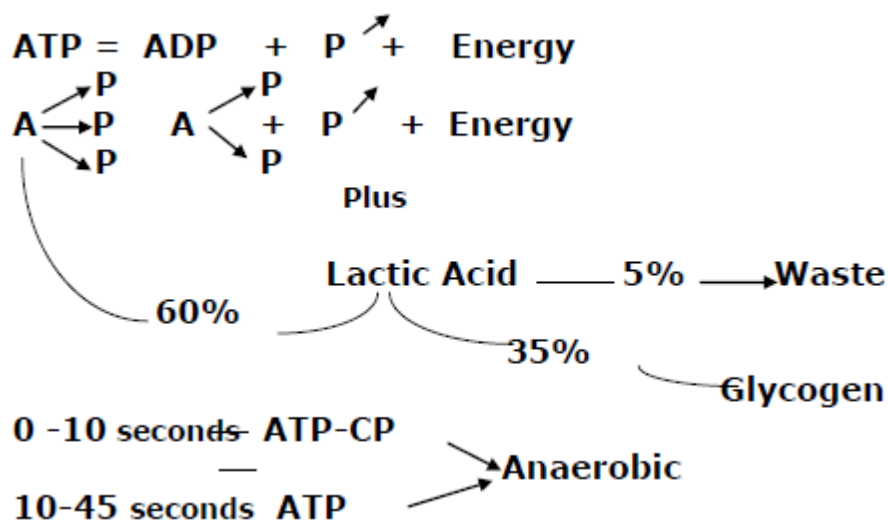
This system involves anaerobic glycolysis – the breakdown of glucose into pyruvic acid and ATP in the absence of oxygen. (All carbohydrates in ingested food are eventually transformed to glucose). Because of reduced oxygen availability pyruvic acid is reduced to lactic acid. At rest and during low-intensity exercise blood lactate levels are low and fairly stable. At a certain level of exercise intensity blood lactate will be produced at a faster rate than that it can be removed and blood lactate levels will increase abruptly above the baseline concentration. This point has been termed the blood lactate threshold. The lactate threshold is lower for untrained individuals (between 50% and 60% of maximal oxygen uptake vs. between 70% and 80% of maximal oxygen uptake for trained individuals).

As lactic acid builds up, the hydrogen ion concentration increases, leading to a decrease in muscle and blood pH. The acidity of muscles after intense exercise and during certain sports (i.e. a 800-m race or sprinting) will affect the muscle's ability to maintain force production at high power outputs. In order to return to homeostasis (pre-exercise levels) accumulated blood lactate has to be removed. Blood lactate can be converted back to glucose during extended exercise and recovery and blood lactate

concentrations normally returns to pre-exercise levels within an hour after the activity. Lactate removal can be facilitated by light activity during the post-exercise period. Fitness level also affects recovery. Athletes have higher lactate clearance rates than untrained individuals.

It is important to remember that a physical tolerance for high intensity exercise has to be developed, especially with regards to training protocols and sports that accumulate high lactic acid concentrations. Some evidence suggests that regular training at intensities near or above the lactate threshold will delay the onset of blood lactate accumulation. Thus the athlete will be able to work at higher exercise intensities without as much lactate accumulation in the blood.

Another important training effect is the ability to tolerate the acidic conditions in the muscle brought about by increased concentrations of lactic acid (as in sprinting). The blood and muscle buffering capacities are increased with anaerobic training so that the body buffers a greater amount of the acid produced and muscles perform more effectively.



The following tables from “Essentials of Strength Training and Conditioning”, the manual from the National Strength and Conditioning Association from the US, will be useful to the coach:

TABLE 1: Effect of Event Duration on Primary Energy System Used

Duration of Event	Intensity of event	Classification	Energy system
1 to 4 seconds	Very intense	Anaerobic -Alactic	ATP in muscle
4 to 10 seconds	Very intense	Anaerobic- Alactic	Phosphagen - ATP +CP
10 to 45 seconds	Intense	Anaerobic- Lactic	Phosphagen + Fast glycolysis
45 to 2 minutes	Heavy	Anaerobic- Lactic	Fast Glycolysis
2 to 4 minutes	Moderate	Aerobic +Anaerobic	Fast Glycolysis & Oxidative system
More than 4 min	Light	Aerobic	Oxidative system

TABLE 2: Energy systems needed for different events

Event	Aerobic	Anaerobic Lactic	Anaerobic Alactic
100m	2%	13%	85%
200m	3%	17%	80%
400m	10%	50%	40%
800m	30%	50%	20%
1500m	50%	40%	10%
5000m	70%	25%	5%
Marathon	95%	5%	

2. Basic mechanical principles in track and field

All track and field techniques have a basis in simple mechanics. Mechanics deals with the inter relations of force, matter and motion. Mechanics can help coaches decide what is an efficient and what an inefficient movement is. It helps to evaluate and analyze a technique and correct faults. Always remember that style or technique or mechanics is just one facet of coaching.

The following definitions will help to understand the practical application in the different events.



Gravity: Is the force which causes all bodies to move vertically downwards.

Center of gravity (CG): That part of any object through which the sum of the force of gravity act, is called the center of gravity.

In the "set" position the **CG** is in front of front foot



Velocity: It is the time it takes to cover a certain distance in a certain direction. In athletics also called speed (no direction) - measured in meter/second.

Acceleration: This is the rate that velocity increases e.g. the time it takes to get to top speed.



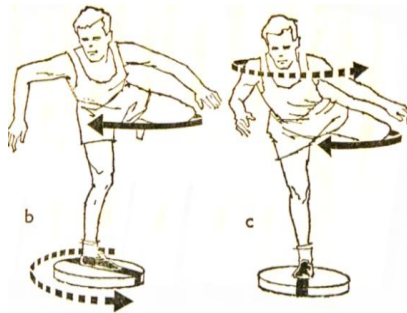
From the start the sprinter drives hard and uses the arms in order to gain maximum velocity.

Deceleration: Velocity continually decreases.

Linear motion: The whole body moves in the same forward direction which per definition should be straight forward.

Angular motion: Whereas linear motion is forward, angular motion is rotational by nature and is more common in athletics as pure linear motion.

Angular Velocity and Linear Velocity: When a body is rotating at a constant speed it is said to have an angular velocity.



Angular Velocity: When a body is rotating at a constant speed it is said to have an angular velocity. In hurdling if the rear left leg moves forward, the right arm should move forward and to the left to absorb the reaction of the rear leg.

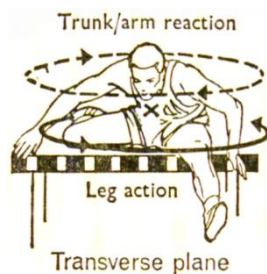


Figure A

The action of the hurdler's lower limbs twists his upper body towards the trailing leg (Fig. A); in a frontal plane it also tilts it down in the direction of this leg (Fig. B); and in a sagittal plane (right and left sides) the reaction rotates him.

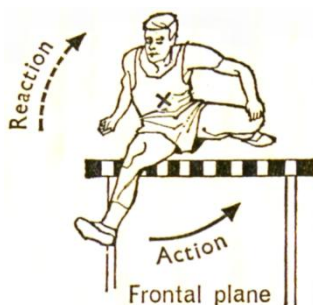


Figure B

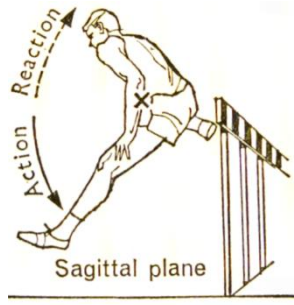
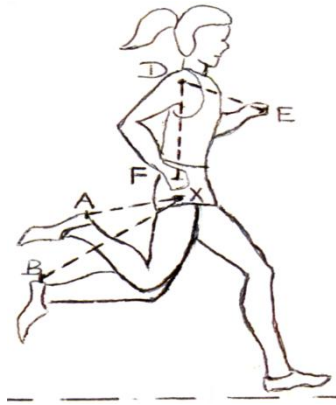


Figure C

Angular momentum: is moment of inertia times angular velocity. In all three planes, clockwise motion produces simultaneous counter clockwise reaction, and vice versa; in each case angular momenta are equal but opposite.

Inertia: The tendency of a body that is moving to keep on moving in the direction it started and to resist change, or, the tendency of a motionless body to remain motionless. To produce change requires the application of more force, (e.g. the sprinter in the set position uses gravity plus muscular force to overcome his inertia). Also, the curve sprinter uses inward body lean and a cross action of his outside arm to drive himself back on to the curve.



Moment of inertia: The mass (weight) or a rotating body multiplied by the length of its moment arm squared. The smaller the moment of inertia, the easier it is for a force applied to overcome it. In sprinting we can shorten the arm action and thus reduce the moment of inertia. This makes arm movement faster. This also applies for the movement (lift) of the heel. Arm action DE shorter than DF. DE position faster. Heel action: AX shorter than BX. AX position faster.

Force: This is what we commonly call push or pull. Apart from gravity the forces in athletics are produced by the muscles of the body. More force is available only by increasing strength or size.

Momentum: This is the weight of a body multiplied by its Velocity and measured in kg.m/sec.

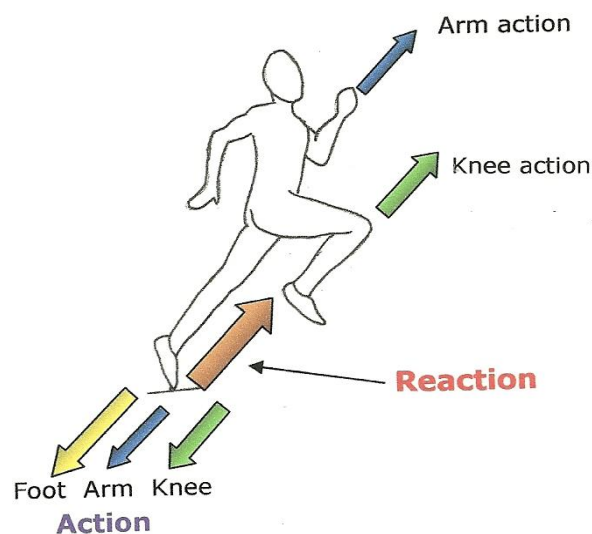
Sketches source: Dyson, D. The mechanics of Athletics. Sixth edition 1973.

2.1 Newton's laws

First law: The law of inertia. A body will remain at rest, or in uniform motion in a straight line, unless acted on by some force to change that state.

Second law: The law of acceleration. When a force acts upon a body the acceleration produced is proportional to the force and takes place in the direction of the force applied.

Third Law: The law of interaction. For every action (or force) there is an equal and opposite reaction.



Sprinting is a very good example of Newton's Third law. Not only the feet on the ground creates an action reaction, but also the arms and the knee moving explosively forward will create the same movement in the opposite direction that will increase the force against the ground. According to Dyson (1973), running is brought about by a combination of forces.

Internally: muscular force, producing a change in ground reaction, as well as overcoming resistance due to muscle viscosity, the tension of fascia, ligaments and tendons.

Externally: the force of gravity, resistance of the air and the forces exerted by the ground on the runners shoes.

These laws are considerable important in athletics, especially with force on the ground but also with movement in the air. These forces should be effectively utilised in coaching to make it easier for the coach and athlete to perform.

3. Running efficiency

Although it is generally accepted that speed is inborn, the speed factor of all athletes can be improved. It is a fact that many components of speed are inborn but fortunately there are just as many (if not more) other components of speed that can be developed. One of the biggest problems of most athletes is that they **THINK** that they are slow - they can't believe that they can run any faster.

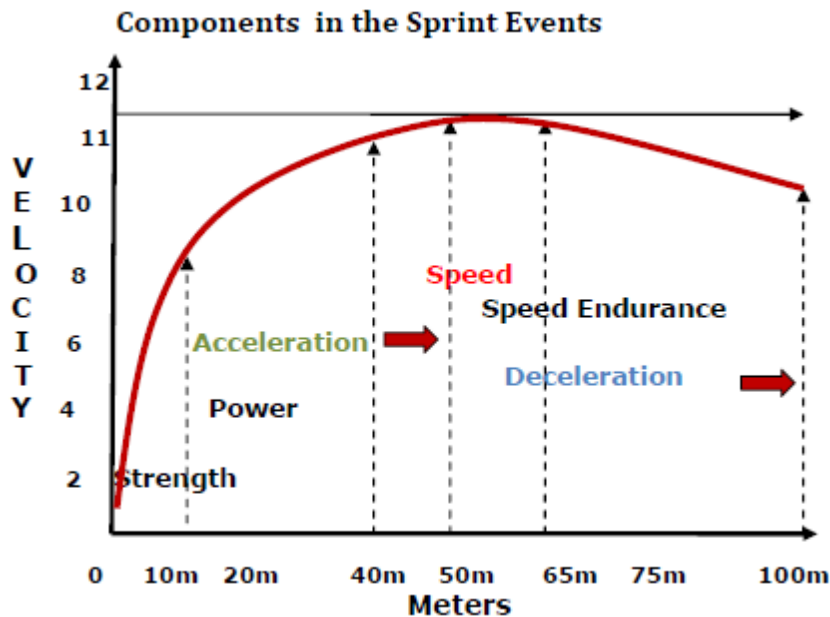
It is not necessarily the "fastest" person who wins the race, but rather the one who runs the furthest in the same time - the one who keeps his speed the best - **Optimum Speed**.

Maximum speed can only be kept for a maximum of 20 meter. Usain Bolt, during his world record (9.58), kept his maximum speed for less than 20m.

Six components in sprinting

The following components must be taken in consideration when drawing up the training program for the sprinter:

- Reaction time
- Block clearance
- Acceleration from the blocks to 80% of maximum speed (0 to 20m)
- Acceleration to maximum velocity - (20 to 50m) -distance depends on individual
- Maximum Speed maintenance - relax, don't try to increase speed (50 to 70m)
- Speed endurance or Deceleration -depends on running mechanics and endurance



3.1 Components that improve running efficiency

The following components improve running efficiency and improve speed:

Cadence - The number of times that the feet can touch the ground in fixed time.
 Leg speed - this is mostly inborn.

A good cadence varies between 4½ and 5½ per second.

Stride length - This will be influenced by length of the legs, mobility of the joints, efficient running and strength.

Rhythm - Position of the head, coordination and relaxation.

$$\text{Speed} = \text{Cadence} + \text{Stride length} + \text{Rhythm}$$

It is important to make sure that cadence, stride length and rhythm be developed.

Rhythm will keep cadence and stride length synchronized.

Cadence

Cadence is an inborn factor which should not be neglected. It is important to maintain the cadence as long as possible.

The following should be developed:

- Speed endurance (ability to keep cadence)
- Hip strength
- Suppleness - especially the hips
- Develop back-, stomach and leg muscles

Training methods to improve cadence

- Pull the athlete with a car or motorbike
- Run on a treadmill
- Run downhill - not too steep 5°- 10°
- Correct arm action
- Vertical jumping exercises
- Count number of touch downs in 10 seconds

- Run with high knees on the beat of fast music
- Do acceleration runs and concentrate to put the feet down quickly
- Ladder running - 10 to 12 markers + 40cm apart - make sure the glutes work

Stride length

The length of the legs, hip suppleness, the efficient working of the hips and the strength of muscles will determine the stride length (stride length should thus be improved without reducing stride frequency - cadence). Stride length should not be improved with an over stride. The front foot should still land under the body. The improvement of muscle endurance will help to keep a good stride length. In improving the stride length it is important to maintain a good cadence.

Training methods to improve stride length

- Efficient use of the feet (a full extension over the ankle)
Lift the knees (power runs and stomach exercises should help)
- Run straight - run on a line
- Correct arm action & relax the shoulders - angle on the backward movement bigger but never straight
- Hand never passes the elbow
- Improve hip suppleness and hip strength - especially the glutes
- Strengthen the ankles and the feet - barefoot running is very important
- Ladder running- 12 to 15 markers -gradually further apart - lift knees and drive
- Pull a tire.
- Run uphill (concentrate on the correct arm action)
- Run steps
- Power runs
- Horizontal jumping (bounding)
- Run further with the same number of strides
- Hill bounding

How to improve rhythm

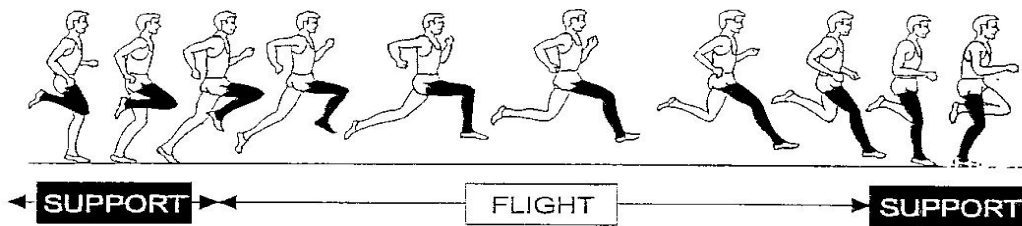
- Rhythm is the factor that keeps the cadence and length of stride synchronized
- Rhythm improves speed
- Running efficiency
- Stay relaxed - a relaxed muscle is faster
- Enjoy running
- Keep mouth slightly open and relax the shoulders
- Run with a 15cm broomstick in each hand
Improve coordination - think of one thing at a time
- Play games - helps to improve coordination
- Music - do exercises on the beat of music

Remember

Apart from cadence, stride length and rhythm ... all three, the following aspects will also influence the running speed.

- weather conditions (wind, rain, etc.).
- running surface (grass, tartan, etc.).
- the competition.
- the mental attitude of the athlete.
- the WILL to WIN

3.2 How to coach efficiency in Sprinting



Linfred Christie Wins 100m at Olympic Games in Barcelona 1992



Photo A

Photo B

Photo C

Photo D

Photo E

1. The head:
Photo A ,B, C, D and E
Must be kept still
Must look forward
Mouth must be open-to relax
2. Arm action:
Photo B
Hands stay relax
Hand moves towards chin
Small angle in front
Bigger angle back
Hand never passes the elbow
Elbow must be pulled back
3. Knees:
Photo A and B
Knee up – toe up – heel up or,
Toe up -heel up -Quickly down

- 4. Run tall: Photo D and B
Foot lands under the body
Hips forward
- 5. Drive: Photo B
Do 1, 2, 3 and 4 but drive harder
Use the ground –Newton’s 3 Law
- 6. Cadence: Do 1, 2, 3, 4 and 5
Move legs faster

Speed = Cadence + Stride length + Rhythm

4. Sprinting: Medium Start

An efficient start allows an athlete to accelerate out of the blocks and reach maximum velocity as soon as possible. The starting position must be comfortable and mechanically correct in both the 'on your marks' and 'set' positions to allow a sprinter or hurdler to move fast into the sprint action, and at the same time to get maximum impulse (force x time) from driving off the blocks.

The medium start has been proven superior over both the bullet and elongated starting positions. It is advisable to learn the technique of the crouch start at a young age, even if starting blocks are not used.

The start itself has two components:

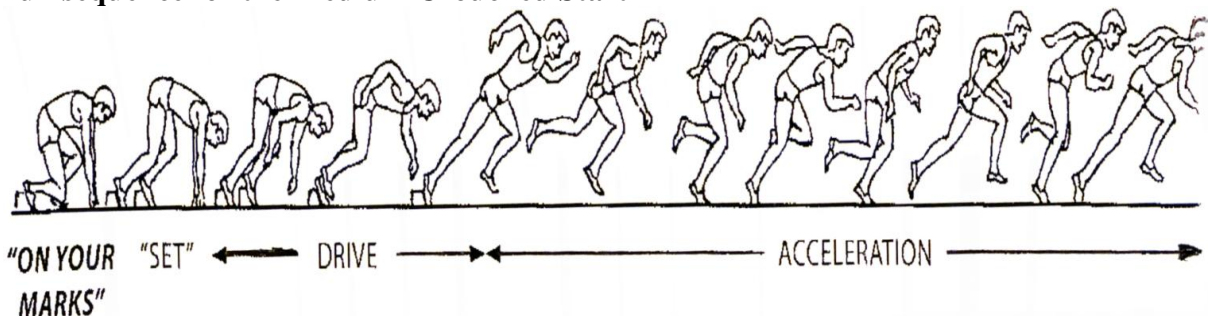
Firstly the reaction time to the gun.

The athlete should concentrate on the forthcoming movement and not the sound of the gun. The gun simply releases the actions of sprinting.

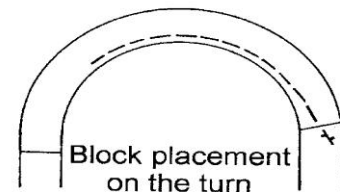
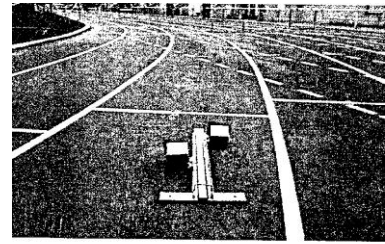
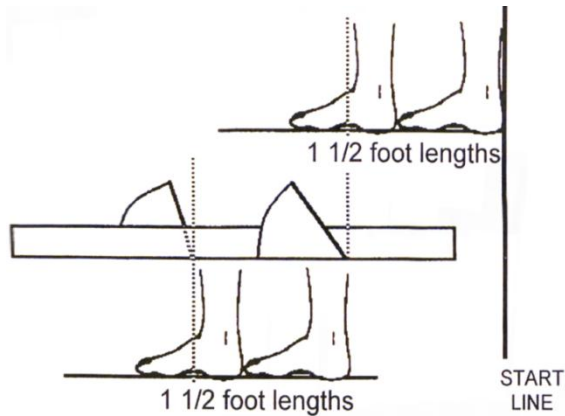
Reaction times may vary between 0.12 (world class) to 0.225 (beginners) and should be rehearsed as a separate skill.

Secondly, the movement and acceleration time from the blocks.

Full sequence for the Medium Crouched Start



Block placement to suite the sprinter's size and ability



Front block is placed 1½ foot lengths behind the starting line.

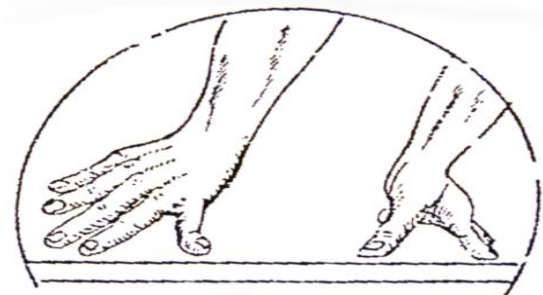
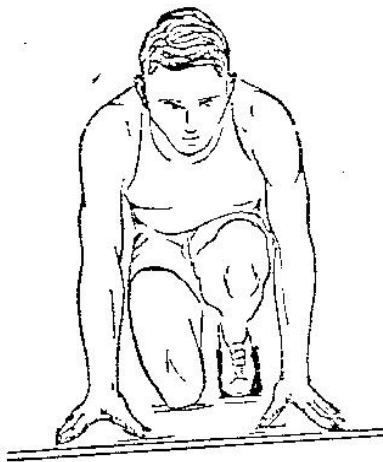
Rear block is placed 1½ foot lengths behind the front block - 3 feet from starting line.

Front block and back block is usually set between 35° and 45°.

In the 150m, 200m and 400m the blocks must be placed at an angle to enable the athlete to run the first 6m to 10m in a straight line.

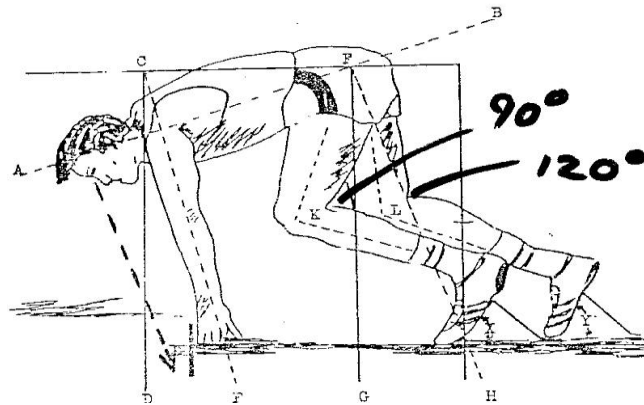
In the 200m and 400m the athlete must, especially around the bends, run as close to the line as possible.

4.1 On your marks



- Body weight evenly distributed between the hands. The back knee is resting on the ground.
- The arms are placed shoulder-width apart and straight. Fingers, turned outward, and thumbs, turned inward, form bridges to support the arms.
- Shoulders are in line with the hands and the head is looking down.

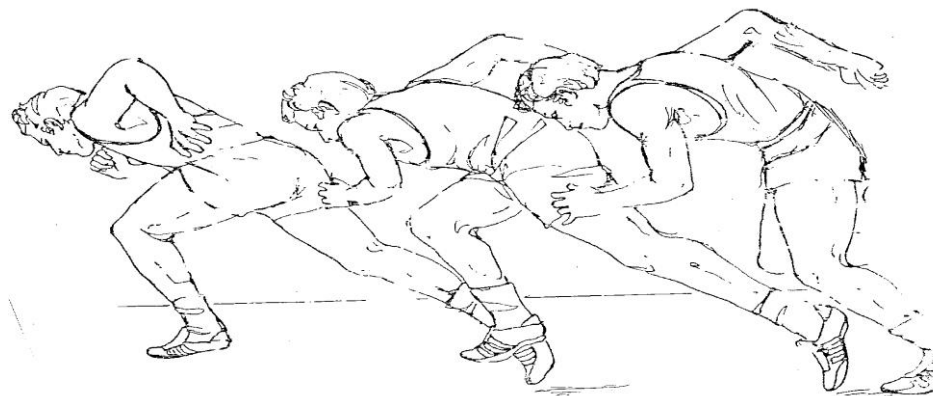
4.2 "Set"



- Hips raised slightly higher than shoulders.
- The head and the back in straight line.
- Both legs are bent at the most efficient angles to drive from the blocks. This means about 90° at the front and 120° at the back knee. The coach will ensure that the lower legs (tibia) are parallel.
- Heels press backwards.
- The shoulders are kept over the hands - not too much forward.
- The athlete looks at the starting line.

4.3 The sound of the gun

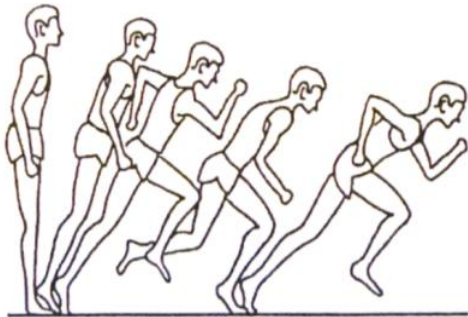
The gun has been fired and there is an immediate reaction in the drive from the blocks to achieve rapid acceleration. All movements initiated on the gun must be forcefully carried out through a full range of movement to get maximum impulse. Although, initially there is an equal drive from both feet against the blocks. The rear leg when it drives vigorously forward from the blocks, creates an equal opposite reaction backwards. The front foot must have enough time to use the block.



Although the trunk is raising the drive is forward, not upward. The drive from the front block continues, assisted by a vigorous arm action.

The athlete looks forward the moment he /she leaves the blocks. The athlete stays low with a virtually straight line from the head down to the driving foot. A good forward drive with a correct body angle and knee lift.

4.4 Training methods that will improve the start



"Stick drill"

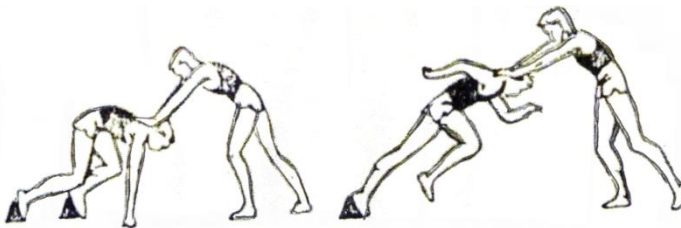
stand with feet together hands on side.

1. Fall straight forward and run forward
2. Fall straight forward and drive with both feet
3. Fall straight forward , drive with both feet and work the arms

Do number 3 but look forward from the first movement.

Partner drill

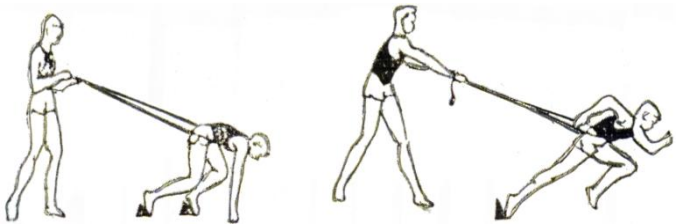
A partner stands in front of the starter with the hands on the shoulder to apply resistance
At the start the partner moves back as far as possible



Harness drill

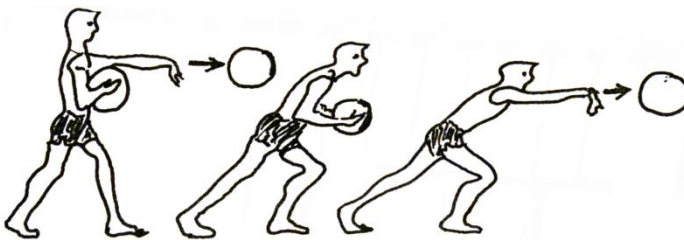
A partner holds an elastic band or a bicycle tube which is around the hips of the starter

At the start the partner gives resistance as far as possible



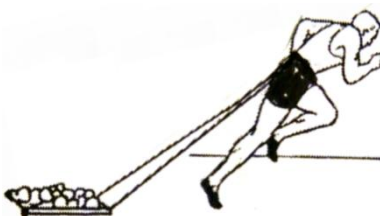
Medicine ball

Hold the ball through it forward
Follow the ball
Helps to drive better



Pull sledge or tire

Starts with a sledge or tire on a rope or bicycle tube attached to the starters hips can also be used



A start on a slight (3° to 5°) slope will help to increase the speed.

Reaction to the gun

Training helps establish the correct patterns of movement the athlete requires.

Consequently the athlete reacts more efficiently through training.

The athlete's central nervous system spends less time selecting the correct course of action to a signal. Reaction practices can improve reaction speed. Consequently, it can be said that reaction time can be improved. Don't think of the sound, think of movement.

1. Clap hands
2. Play "crabs and crows"
3. Command games
4. Move leading leg and opposite arm
5. Stand then run 4 - 6m at the blow of a whistle (or any other sound)

5. Acceleration

The main aim of a good crouch start is to create optimally large horizontal components of accelerating forces in the shortest possible time and to maintain the frequency of the applied forces after leaving the block. Train to increase velocity and to make an efficient transition to the running action. Stride length and stride frequency should increase with each stride. The athlete keeps on working hard. Trunk straightens gradually to efficient position. Run tall.

Remember, good acceleration is the result of a good start.

6. How to finish the race



- Drive through the finish line as if the finish were 10m beyond, while maintaining form.
- Don't jump or dive.
- Train when to "dip" at the finish line.
- Lean forwards right at the tape and throw only one shoulder into the tape. In the case of a close race, it is easier to see a shoulder than an entire torso.
- It is important to maintain form and stay relaxed.

7. Sprints: Specific tests

An efficient training program can only be drawn up if you know who you work with. It is very important to know all aspects of the person that you work with. It is also important to know the training age, maturity and training experience which will have an influence on the training load of the athlete.

What support system is available?

Is the athlete a member of a club?

Are training facilities available?

Does the school give support?

What about parent support?

Does the athlete compete in any other sport or activities like art or drama?

What do they do if they don't do athletics?

A complete medical and sport injury history should also be available.

It is very important that a complete medical examination should be done regularly - at least twice a year.

7.1 Physical evaluation

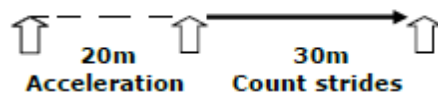
Anthropomorphic characteristics such as leg length and physical stature can provide significant advantage to the sprinter. Cardio-vascular capacity and the ability to make use of alactic anaerobic energy and the ratio of fast twitch muscle fibres will also influence the ability to run fast. It is not so important what we've got, but what do we do with what we've got.

Simply stated, train like a sprinter, and slow twitch fibres may begin to respond like fast twitch muscles fibres. General health conditions will also play an important part in the performances of the athlete. A daily routine of activity, rest and sleep as well as a well-balanced diet should also be part of the program.

7.2 Field tests

The following tests can be used:

Measuring stride length



Let the athlete have a flying start of 20m to gain speed, then continue for another 30m. Count the number of strides over the last 30m. Divide 30 by the number of strides to get the average stride length e.g. 14 strides - $30/14 = 2.14\text{m}$.

The above can also be called a "flying 30m" test.

Measuring stride frequency

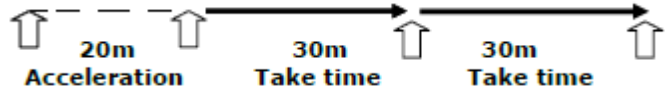
The time can also be taken for the 30 m that was run e.g. 4.2 sec. Then the stride frequency will be $14/4.2 = 3.3$ strides per second, or you can take the time for ten strides e.g. 3.0sec for 10 strides $10/3.0=3.3$ strides/sec.

Maximum velocity

By using the information above the maximum velocity over 30m can also be calculated by dividing 30m by the time over 30m e.g. $30/4.2 = 7.14\text{m per sec}$. The fastest men will register more or less 12m per sec and women 10m per sec. Boys register more or less 9.5 m per sec and girls 7,5 m per sec.

Measuring speed endurance

First method



The time is taken from the start of first 30m to the end of second 30m (for 60m). Also take a split time after the first 30m. Work out the velocity of both 30m's. The variation between the 30m velocities will give an indication of the speed endurance over 80m.

Second Method

Let the athlete run a 150m from a crouched start. Take time e.g. 22sec. Work out the velocity $150\text{m}/22\text{sec} = 6.81\text{m/sec}$.

The objective is to narrow the gap between the average and the maximum velocity values.

Other tests that can be done:

Time crouched starts over 10m, 20m, 30m, 40m and 50m.

Count number of strides from crouch start over 10m, 20m, 30m, 40m and 50m.

See how far can be run in 8 seconds.

See how far can be run in 20 sec, 25 sec and 30 seconds.

Start at 200m run 150m - take time, rest 10seconds run 50m, added times = predicted 200m time.

Elastic strength: Distance for a vertical jump

Standing long jump

Standing triple jump

Elastic power:

Distance for a five stride bounding

Distance for overhead backward shot put throw

Take time to run 8 to 10 flight of steps

Use formula:
$$\frac{\text{mass of athlete} \times \text{total vertical displacement}}{\text{time}}$$

7.3 Summary

Tests must be standardised - ensure that everything stays the same

Recovery time before and after testing must be the same.

It is important that record is kept of all test results

Tests must be done regularly in order to evaluate progress

Regular testing helps to draw up a more specific training program

The experienced coach who has developed a coaching eye will evaluate the athlete at every session and will not wait for the planned test day before the program is changed.

8. Training components

Understand the rules of training before you attempt to break them.

Different needs in order to develop sprinting

- Different muscle groups needed in running and starting must be developed
- The energy systems needed in sprinting must be developed
- The different training components needed in sprinting must be developed
- The bio motor skill of sprinting and muscular coordination needed must be developed
- Must train to limit deceleration

8.1 General principles

The following general principles must be taken in consideration when training:

- To sprint fast you have to train fast
- Maximum velocity is not necessarily the same as a large effort
- High intensity effort is of maximal or near maximal levels from the start
- "Working smarter" is more effective than "working harder"
- Less volume with higher intensity more frequently is better
- As soon as the quality drops so does the benefit
- Remember different components of training are not isolated
- Running efficiency and better conditioning will also help to prevent injuries
- Speed training should be conducted at the beginning of a training session
- Start at slower speeds to correct technical errors (this will enable the athlete to "feel" what is happening to their body and to make adjustments if needed)
- Movements must be done correctly before starting with strength training.
- To be able to do a specific movement, mobility, stability and basic strength is needed (thus each athlete will need basic conditioning)
- Exercises should complement each other in order to develop the agonist as well as the antagonist muscles
- It is also important to strengthen the joints
- Maximum speed is not more than 10% of a race
- Make sure there is optimum recovery at least 1:15 e.g. run 6 seconds recover 90 sec.

8.2 Sessions

Sessions consists of one or several training units.

Each session should consist of:

- a warm up
- a brief (explaining what should be done)
- a skill unit
- a fitness unit
- a cool down
- a debrief (getting information of the value of the session)

8.3 Warm up

Warm up prepares the sprinter physiologically and psychologically for the specific demands of the upcoming training session or competition. In the warm up you want to focus on drills that teach and benefit acceleration mechanics, glute activities, force application, low heel recovery, mobility and drills which develop dominant qualities inherited to sprinting technique. For this reason dynamic warm up is recommended before a training session where speed is involved.

Dynamic Warm up

Effective dynamic warm up incorporates a variety of training methods and movements specifically assembled and organized to enhance the sprinters performance while simultaneously reducing the likelihood of injury. Dynamic warm up is general and specific movement associated with increased nervous system conduction. Dynamic warm up must be done with the correct posture- correct execution with fast and efficient ground contact.

Examples: Mach Drills source "Hurdles ..a basic and advanced Technical model"
Brent McFarland Published in Track Technique Summer 1994.

A's Position (High knee lift)

A march (1 or 2 legs)

A skip (1 or 2 legs)

A sprint (1 or 2 legs)

High knee lifts (single or alternate) can be done in marching, skipping, or running forms. Stress the perfection of the exercise, hip tall, stretched tall body position, active landing of feet (use the glutes) short and straight arm swing.

Can also be done over the hurdles or over the side of the hurdles.



B's Position

B march (1 or 2 legs)

B skip (1 or 2 legs)

B sprint (1 or 2 legs)

Combinations of A's, B's

A+B march (use both legs)

A+B skip (use both legs)

A+B sprint (use both legs)

High knee lift with fore leg extension (single or alternate legs) done in marching, skipping or running forms. Use same technique as in A's. Can also be done with hurdles or over the side of hurdles.



C's Position

(Trail leg action in hurdles)

C march (1 or 2 legs)

C skip (1 or 2 legs)

C sprint (1 or 2 legs)

Combinations with Trail leg (lead leg and trail leg)

A+C march, skip, sprint

A+B march, skip, sprint

Remember the human body is like a computer. It must be fed the correct information. To re-model or correct the hurdler's basic technical model all skills must be practiced perfectly.



More dynamic warm up exercises

- Do the following exercises over 30 to 40 meters - repeat 2 to 3 x.
- Skip swing the arms across the body - forward
- Skip swing arms up and down
- Skip with high knees - forward and backward
- Ankling - step over ankle
- Ankling - step over shins
- Ankling - step over knees
- Karioci
- But kicks -(this is not a technique drill)
- Run backwards
- Straight legs forward feet dorsiflex
- Straight legs forward feet dorsiflex - pull feet back under body
- Walk on heels, - on toes, - on side of foot, - with toes inside, - with toes outside
- Walk: pull right knee with right hand to chest
- Walk: pull left knee with left hand to chest
- Walk: push elbow to opposite knee -continue left and right
- Walk: swing straight leg up-touch toe with opposite hand both feet
- Lunges forward and backward on the spot
- Lunges- walk forward and walk backward
- Hold onto hurdle or other object and swing leg sideways left and right as well as forward and backward - do it with both legs
- Sprint running technique drills
- Toe up- knee up - heel up
- Toe up - heel up higher than knee - quickly down (heel up to touch buttocks - short distance)

Sprint running technique drills part of dynamic warm up

Toe up- knee up - heel up

Toe up - heel up higher than knee - quickly down (heel up to touch buttocks - short distance)

Static warm up

Static stretching is normally too slow and does not benefit fast movement

Static stretching can be done after the training session

With young children bone growth is more than tendon and muscle development - this is one of the reason why young children must still do static stretching.

Remember

It is important that sprint drills be done correctly.

It is important that the Central Nerve System (CNS) and the neuromuscular system operate faster and efficiently in order to apply the most force possible in the shortest time on the ground.

The function and efficiency of the muscular system can be increased through proper training and continuous effort.

9. Speed

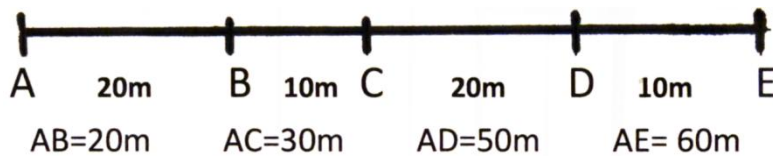
9.1 Technique

Always work on running efficiency

9.2 Speed training

Remember speed training is less than 60m

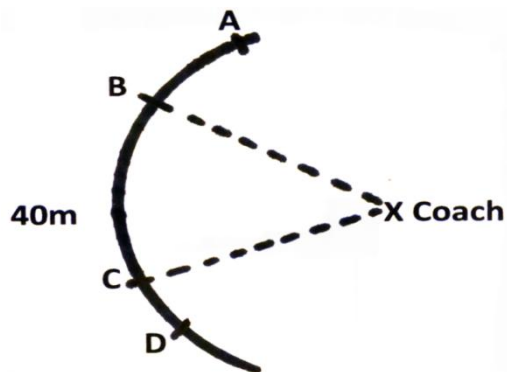
1. 60m rest 1min 30m Rest 2-3min Repeat Rest 8-10min 8min Repeat 2x
2. 2x50m rest 30sec in between each Rest 5-8min 3x
3. 20m fast walk 20m , 40m fast walk 40m , 60m fast walk 60m; rest 10 min Repeat
4. 3x30m rest 1min in between Rest 8min 3x40m rest 1min in between; rest 8-10min 2x 60m
5. Run 60m from a start. Take times at B , C, D and E Repeat 4-6 x



This 60m will give the coach the following information:

- Time from a start for 20m, 30m , 50m and 60m
- Acceleration for 10m in the beginning BC and speed endurance for 10m DE
- A flying 20m CD which can be compared with the 20m from the start AB

6. 20m, 30m 40m and 50m on the bend; rest 2-3min in between; rest 10min; repeat



Flying 40m time

Athlete starts to run at A

Coach stands on the inside of track

Starts stopwatch at B

Stops watch at C

Athlete stops at D

Important note:

- Only do one of the above on a day
- At least 2 days rest between speed sessions
- Always a good dynamic warm up before a speed session
- Do not do a speed session when tired or injured

10. Strength Training

Strength training must be an integral part of a sprinters training program. The main aim of strength training for the sprinter is to stimulate and develop the athlete's neuromuscular recruitment capacity, rather than to build up strong massive muscles.

According to Alessandro Donati instead of the long weight training sessions, emphasis should rather be placed on faster exercises using mainly body weight as resistance. Weight training is useful in building a foundation of muscular strength but do not develop the ability to recruit the maximum possible number of fast twitch muscle fibres and to activate as many motor units as possible. To stimulate and develop the neuromuscular recruitment capacity the sprinter must adapt to quickly recruiting fast twitch fibres.

A strength development program must:

- Be systematic and progressive. Always plan and stick to the plan
- Know what the goal of the training session is
- Develop training phases with adequate rest
- Adapt to the physical needs of the individual
- Primary lifts are always performed first
- Power or explosive lifts is done before strength or slow lifts
- Always use the correct lifting technique
- Make sure that sufficient rest is taken between sets
- Adapt to the facilities and equipment available
- Change the workouts to cope with different situation

10.1 Maximum Strength

Maximum strength indicates an athlete's strength potential and can be defined as the greatest force a muscle or group of muscles can exert in a single maximum voluntary contraction.

In most events performance does not depend on the ability to produce maximum force, as many sporting actions happens so fast that it is impossible to recruit enough muscle fibres to generate maximum force.

10.2 Explosive Strength

Explosive strength or power can be defined as the ability to apply force rapidly or has the ability to generate the greatest amount of force in the shortest possible time.

It can be formulated as follows:

Power = Force (strength) x Velocity (speed)

Though explosive strength or power always involves a combination of the above two components, the nature of the specific sport will determine where the emphasis will be. Sports or activities involving light or no external resistance place more emphasis on speed, whereas sports or activities involving heavier external resistance place more emphasis on strength (throwing a javelin vs. putting a shot). Explosive strength or power can be increased by either increasing the strength or speed of muscular contraction, or both.

10.3 Strength endurance

Strength-endurance can be defined as the ability to produce a certain minimum force for a prolonged period.

Three different types of strength-endurance can be distinguished:

1. **Static strength endurance** – the ability to hold a given position or posture
2. **Dynamic strength endurance** – the ability to maintain cyclic activities (e.g. running) at different intensities
3. **Explosive strength endurance** – the ability to repetitively execute explosive movements. Strength is an essential component of sprints and hurdles and its formal development can no longer be neglected in the preparation. An athlete will need strength training for both structure and function. The main focus of his/her strength training program will be determined by the athlete's needs and their phase of training.

Examples of the strength sessions that can be used:

Circuit training	Power hill running	Gymnasium
Body weight exercises	Working in pairs	Pull a sledge or tyre
Jumps	Plyometrics	Use medicine balls

10.4 Functional strength

1. Pull tire 40m - stop - pick up 20cm iron rods run 40m back –stop; sprint 40m back -stop - jog + 200m Repeat 4x Rest 10min Repeat 2x
2. Run 10-15 20cm high steps (walking steps)3x
Run 8-10 40cm high steps (seats) 3x
Run 8-10 40cm diagonally one way walk down; repeat in opposite direction Repeat both direction 3x
3. Do different jumps on the spot for 10sec. -count the jumps in 10sec repeat 3x
4. Do "bounding" for 20m and immediately sprint 10m Repeat 3-5x
5. Take time and count number of foot contacts for 20m bounding 3-5x

10.5 How to work out a Circuit Training session

Circuit training is a very popular training modality in commercial gyms as it claims to develop strength, cardiovascular fitness and muscular endurance while lowering body fat.

Circuit training is recognized as a useful means of both developing general conditioning as well as stimulating specific muscle groups. Circuit training refers to series of exercises arranged and done in consecutive order at different training stations. An athlete performs a number of repetitions of an exercise and then moves on (runs) to the next station in the circuit. After completing all the exercises in the circuit one series (set) has been completed.

Number of training stations

- The number of training stations will be determined by the need, (normally between 8 and 12)
- The stations are arranged to fit the available space
- When selecting the exercises ensure that all the major muscle groups are developed

Examples of exercises

Using only the athlete's body weight:

Stomach starts, squad jumps, push-ups, sit ups, back extension, arm-dips, stomach exercise, lunges, Jack knife, depth jumps, pull-ups, etc.

Using implements or apparatus:

Exercises with a medicine ball, bench stepping, hurdle jumping, gymnasium apparatus, weights, weighted jackets, elastic bands, pulleys, etc.

Number of repetitions:

The number and intensity of the reps can vary

Maximum number of repetitions:

How many can be done in 30 seconds if the exercise is very difficult or in 45 seconds if the exercise is easier and in 60 seconds if the exercise is very easy.

Training number of repetitions:

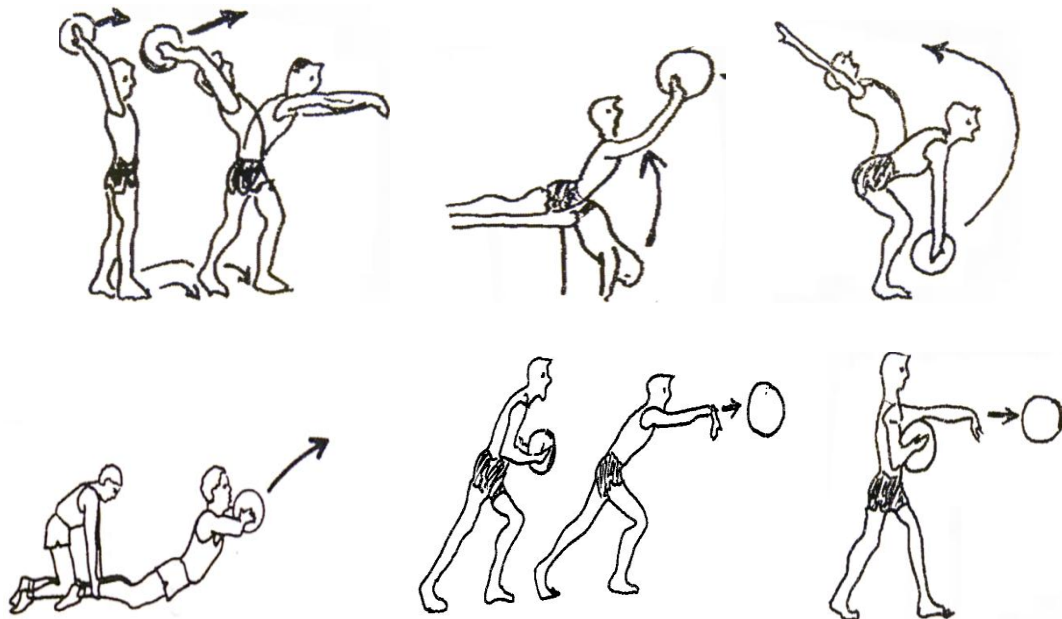
A certain % of the maximum is used e.g. half of the maximum.

Number of series (sets) that must be done:

1, 2 or 3 sets will depend on the fitness

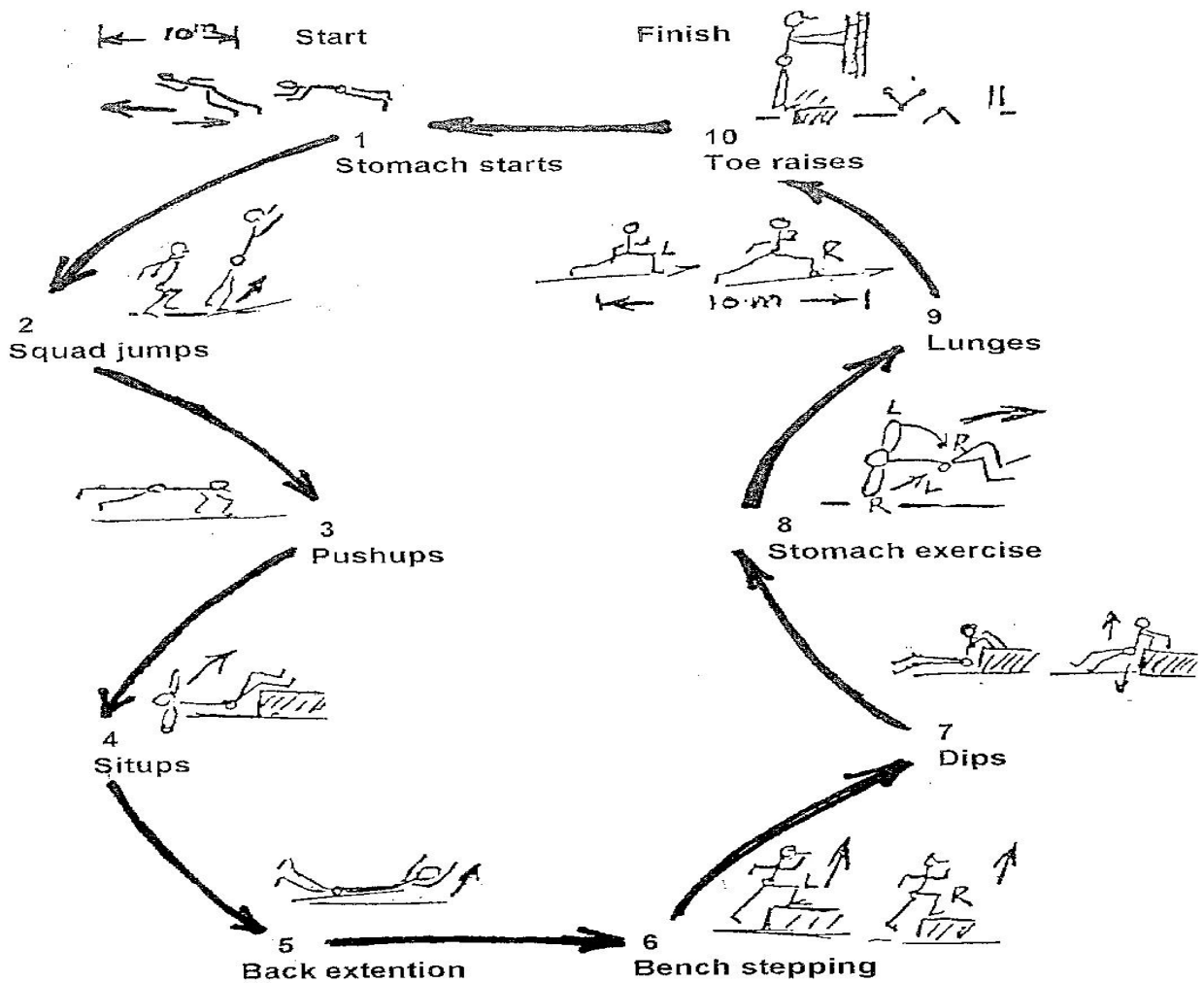
Take the time to complete the total number of sets - also take the pulse of the athlete.

This gives a good indication whether the athlete is improving.



Medicine balls exercises

Examples of exercises



Examples for General Circuit training taken from:
Bompa, Tudor: Periodization training for sport. 2005

Circuit A (own body weight)

1. Half squats
2. Push-ups
3. Bent-knee sit-ups
4. Two-legged low hops on Spot
5. Back extensions
6. Pull-ups
7. Burpees

Circuit B (own body weight; combination of two

Phase I

1. Half squats
2. Push-ups
3. Bent-knee sit-ups
4. Two-legged low hops on Spot

Phase 2

5. Back extensions
6. Pull ups
7. Burpees
8. Abdominal rainbows

11. Jumps as functional power exercises to improve speed

The secret to success in any sports event is the ability to meet the requirements of the event, the effective use of the relevant parts of the body and the economical application of power.

The main tasks in improving elevation are:

1. Development of specific jumping capacities (particularly on explosive and coordinated take off)
2. Efficient use of the feet
3. Coordinated use of the arms
4. Development of speed (reaction time and acceleration)
5. Development of functional strength (with jumping power in mind)
6. Improvement of general physical performance with emphasis on coordination and rhythm.
7. By including jumping exercises in the training program will not only improve leg power, more explosiveness and better force-velocity relationship during take-off but will also improve performance in competitive sprinting.

11.1 Safety precautions

1. Pre-adolescent boys and girls should be very careful when using jumping as an exercise because of greater susceptibility to injury prior to puberty.
2. Jumping exercises should be postponed for athletes who do not have a sufficient strength base.
3. Precede jumping workouts with general warm up.
Use foot wear with good ankle and arch support.
Boxes should be sturdy and have a non-slip top.
4. Depth jumping from objects that are too high increases the risk of injury.

11.2 Technique

Jumping exercises improve speed strength - power.

The ability to generate maximum force in the shortest time - to instantaneously recruit as many muscle fibers as possible.

Use the feet and arms· in the jump - pull the toes slightly up on each jump.

When landing the feet must be under the body with the knees slightly bent -elbow's to the sides with hands in front of the body and thumbs facing forward.

The exercises should be performed at speed.

11.3 Volume

Number of repetitions per workout

Taking too few jumps is better than taking too many

Young beginners (younger than 14 years), must not exceed 50 foot contacts

Older beginners between 80 and 100 foot contacts

Intermediate - level between 100 and 120 foot contacts

Advanced - senior athletes between 130 and 160 foot contacts

11.4 Intensity

Refers to the amount of stress placed upon the muscles, the connective tissue and joints. e.g. skipping movements provide a minimum stress - low intensity, hurdle jumps and depth jumping - high intensity.

11.5 Recovery

Adequate rest between repetitions, sets, and workouts is required

11.6 Plyometric exercises

Plyometric exercises basically involve some form of jump training for the lower extremities and medicine ball exercises for the upper extremities.

11.7 Jumps on the spot

The jump is completed by landing in the same spot as where the jump started. Jumps-in place are done one after another, with a short amortization phase. They are relatively low in intensity, but they provide the stimulus for developing a shorter amortization phase by requiring the athlete to rebound quickly after each jump. A set normally consists of 10 repetitions.

Standing jumps

Standing jumps require a single maximal effort. The jump may be repeated several times, but full recovery should be allowed between each effort. Examples are vertical, standing long, triple and lateral jumps.

Multiple hops and jumps

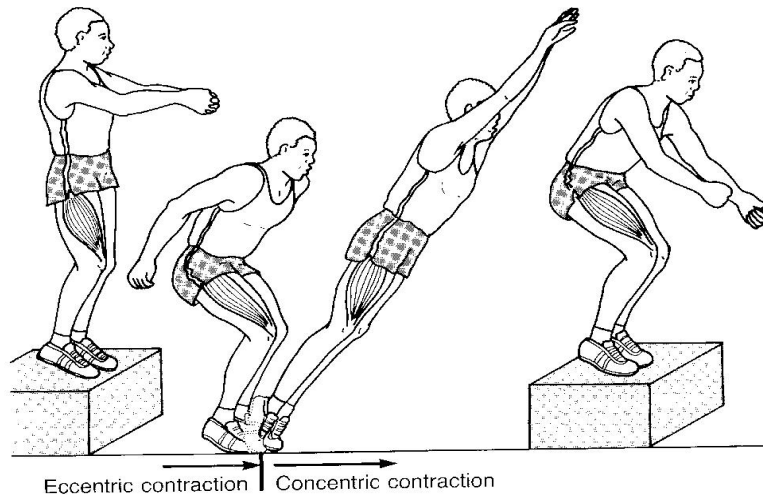
These drills combine the skills developed by jumps-in-place and standing jumps. They are not maximal in effort and are repeated over a specific distance or for a certain number of repetitions (normally 10). Multiple hops and jumps can be done with or without barriers like cones. Examples are single leg hops and double leg zigzag hops.

Bounding

Bounding exercises exaggerate normal running stride and are used to improve stride length and frequency. Bounding are typically performed for distances greater than 30m, but may be performed as repetitions for maximum distance.

11.8 Box drills

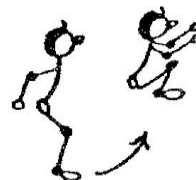
These drills combine multiple hops and jumps with depth jumps. It can vary in intensity from medium to high, depending on the height of the boxes used, and incorporate both horizontal and vertical components for successful completion. Examples are multiple box to-box jumps and split squat jumps with front foot on box.



Sketch source: Thompson,P: Introduction to coaching theory. IAAF 1991

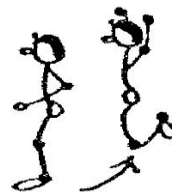
11.9 Example of jumps

1. 10 x left leg, 10 x right leg, 10 x landing on both feet (3x)
2. x left leg, 5 x right leg. 5 x landing on both feet (6x)
3. 2 x left leg, 2 x right leg, 4 x left-right (repeat over 50m)
4. Standing long jumps
5. Standing triple jumps
6. 5 x landing on both feet
7. Time how long it takes to hop 25m on one foot
8. Jump and lift take-off foot 5 to 10 times
9. Jog forward, knees high, kick out with the lower leg
10. Jog forward, knees high bringing feet down to the ground as fast as possible
11. Jumps on steps e.g. one step up, one down, two steps up, one down, three steps up and one down
12. Jump and lift knees as high as possible (see A1)



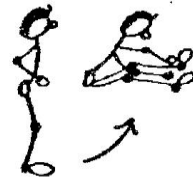
A1

13. Jump and kick the heels up behind (see A2)



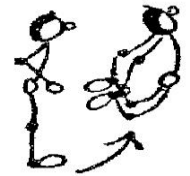
A2

14. Jump and try to touch feet in front of body (see A3)



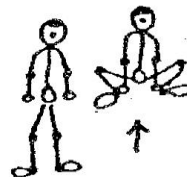
A 3

15. Jump and try to touch feet behind body (see A4)



A 4

16. Jump and try to catch feet underneath body - knees bent (see A5)



A 5

17. Count the number of high knee strides over any distance between 50 - 100m
18. Bounding over any distance between 50 - 100m
19. Any combination of jumps for 10, 15, 20, 25 or 30 seconds

12. Endurance Training

Athletes are only able to maintain maximum speed for less than 20 meter. After this point, due to insufficient time for force application, all sprinters will enter the deceleration phase of sprinting. Speed endurance develops the athlete's ability to produce high quality performance despite the by-products of anaerobiosis.

Speed endurance training is important because it improves the autonomy of the nervous system, making it easier to maintain high speed for a longer time. Speed endurance will help the sprinters when reaching optimum speed to 'feel' and control their body as it moves. Fading can also be due to the inability to relax and focus on what they do best. Trying harder is not always the answer at this stage, because increased effort often leads to tighter, shorter movement patterns.

12.1 Development of Endurance

Both aerobic and anaerobic endurance can be developed with interval type training. The variables in interval training are:

Intensity

Speed or velocity of the repetitions. This may expressed as a percentage of maximal speed or effort - the exact time is better

Duration

Length of time or distance of one repetition

Recovery

Time of intervals between repetitions and sets

Recovery activity

Normally a low intensity movement such as a walk or jog

Repetitions

Total number of repetitions in a session, these may be divided into sets

Effect of event duration and primary energy system used

Duration of Event	Intensity of event	Classification	Energy system
1 to 4 seconds	Very intense	Anaerobic - Alactic	ATP in muscle
4 to 10 seconds	Very intense	Anaerobic - Alactic	Phosphagen - ATP +CP
10 to 45 seconds	Intense	Anaerobic - Lactic	Phosphagen + Fast glycolysis
45 to 2 minutes	Heavy	Anaerobic - Lactic	Fast Glycolysis
2 to 4 minutes	Moderate	Aerobic + Anaerobic	Fast Glycolysis & Oxidative system
more than 4 min	Light	Aerobic	Oxidative system

The table above gives an indication of the different energy systems that is needed in the different events and helps to select what should be trained.

12.2 Muscle Endurance

Is the pure aerobic component. It consists of continuous runs of 20 to 40 minutes in duration at a steady relaxed pace. Although less than 5% aerobic training is needed in the sprint the athlete must also train aerobically to improve recovery in between higher intensity efforts. The following exercises will help the 400m to improve muscle endurance:

Workout examples:

1. 30minute steady run
2. 30-40 minute fartlek; (play with speed - sprinter decides the number, intensity and duration of the training loads)
3. 2 x 800m on track with 3 minute recovery
4. 3 x 600m not very fast - steady relaxed pace, with 3 min rest in between
5. 3 x 500m with 3 min. rest steady relaxed pace
6. 5 x 400m with 2 min. rest, steady relaxed pace
7. 8 x 200m with 1½ min rest steady relaxed pace
8. 12 x 150m with 1 min rest steady relaxed pace
9. 15 x 100m with 45 sec rest steady relaxed pace

12.3 Speed Endurance

After approximately 6-10 seconds of the race, the runner's body has run out of its initial energy supply (ATP-CP) and must begin a process known as Anaerobic Glycolysis (Lactic Acid) which now becomes the primary energy system in the speed events. This is the ability to maintain speed in a state of high oxygen debt and lactic acid build-up. This component is the crux of sprint training. The distances run vary from 100m to 600m. No more than 6 repetitions are run in a workout. Recovery should be full- at least 10 minutes-so that the quality of the runs can be maintained. (Also called "Tempo Running").

This type of training develops the lactic acid energy system. When training speed endurance the velocity should be faster than the longer event that the athlete runs.

For example:

The athlete running 200m in 24, 0 sec the 150m time should be faster than 18.0 seconds

The athlete running 400m in 60, 0 sec the 300m time should be faster than 45.0 seconds

The velocity at which athletes run the different distances will change for each individual

12.4 Examples of speed endurance workouts:

1. 10 x 100m; rest 1min in between; rest 10 min; repeat
2. 3 x 150m; rest 2-3 min in between; rest 10 min; repeat
3. 3 x 200m; rest 2-3 min in between; rest 10 min; repeat
4. 2 x 300m; rest 2-3 min in between; rest 10 min; repeat
5. 200m; rest 1min; 300m rest 10min; 500m; rest 10min; 300m rest 1min; 200m 150m; rest 1min; 150m; rest 10min; 300m; rest 10min; 200m; rest 1 min; 100m
6. 250m; rest 10 sec; 150m; rest 10min; repeat
7. 150m; rest 10 sec; 50m; rest 10min; repeat 2x
8. 1 x 150m or 1x 120m or 1x 110m; very fast (optimum speed); rest 8min; repeat 3x
9. 3 x 150m; rest 2½ - 3min in between each; rest 10min; repeat
10. 2 x 150m; rest 1 min in between; rest 2-3 min; 1x 150m; rest 10 min; repeat
11. 2 x 100m; rest 10 sec in between; rest 10min; repeat 2x
12. 2 x 50m; rest 2-3 min; 3x 50m; rest 3-4 min; 4x 50m; rest 5 sec in between
13. 20m; rest 20 sec; 40m; rest 30 sec; 60m; rest 10min; repeat 2x
14. 3 x 150m; rest 3-4 min; rest 10 min; 2x 150m; rest 3-4 min; rest 10 min; 1x 150m (optimum speed)
15. 1 x 150m; rest 10sec; 50m (200m pace); rest 10 min; repeat 2x
16. 2 x 200m; rest 15 sec; 200m (400m pace); rest 10 min; repeat

13. Sprint fault analysis and corrections

Each sprint athlete has a particular and personal running style which has been adjusted to his or her build, strength, coordination, mobility and rhythm. Fault analysis should not change too much of the individual running style. Only faults that contradict the biomechanical principles should be changed. The next discussion is based on the ideal and efficient sprinting technique according to the biomechanical principles. The coach must decide if the change will improve the sprinting time.

The following positions can be used when evaluating the running style:

Position A + 5m behind the athlete.

Position B + 10m away from track opposite the start.

Position C + 20m in front of the athlete.

Position D + 10m away from track and + 15m in front of athlete.

13.1 Faults at the start

The athlete does the medium crouched start with the left foot in front. NB The right foot is the most efficient or skilled foot that always wants to move first.

13.1.1 Athlete runs to the left out of blocks - Position A

Possible Corrections:

- Drive with both feet - left foot did not drive
- Blocks not straight
- Feet not firmly against the blocks

13.1.2 Athlete runs to the right out of blocks - Position A

Possible Corrections:

- Drive with both feet - right foot did not drive
- Blocks not straight
- Feet not firmly against the blocks

13.1.3 Athlete's back foot moves away from blocks - Position A & B

Possible Corrections:

- Feet not firmly against the blocks
- Adjust block spacing
- not balanced in the set position

13.1.4 Athlete's calves (tibia) are not parallel - Position B

Possible Corrections:

- Hips not high enough
- Adjust block spacing
- Move shoulders slightly forward - over the hands

13.1.5 Athlete stumbles at the start - Position A, B & C

Possible Corrections:

- The arms did not work
- Adjust block spacing
- Test for the efficient foot. Change feet around

13.1.6 Athlete is up too soon after the start - Position A, B, C & D

Possible Corrections:

- Both legs did not drive
- Adjust block spacing
- Athlete lifted the head on "set"
- Place centre of gravity forward

13.1.7 Athlete hesitates after the gun - Position A, B, C & D

Possible Corrections:

- Do reaction drills
- Think of movement - not the sound
- Athlete lifted the hips too soon on "set"
- Athlete came on the "set" position too slow

13.1.8 Athlete's arms are bent on "set" - Position C

Possible Corrections:

- Arms are too wide apart
- Fingers are not strong enough

13.1.9 Athlete's centre of gravity is behind front foot on "set" - Position C

Possible Corrections:

- Adjust block spacing
- Place centre of gravity forward
- Lift hips higher and forward
- Fingers are not strong enough

13.1.10 After 20 to 30m of the start the athlete runs slower - Position B &D

Possible Corrections:

- Do not only drive with the back leg
- Keep on working -driving - to accelerate longer
- Don't only train 10m or 20m when starting -also 40 -50m

13.2 Faults during the race

13.2.1 Back leg - driving leg did not work - Position D

Possible Corrections:

- Work more effectively against the ground
- Develop leg (glutes and hamstring) strength
- Get hips forward - run tall
- Pull tires or sledge

13.2.2 Knees don't lift - Position C & D

Possible Corrections:

- Work more on efficient running style
- Develop leg (glutes and hamstring) strength
- Get hips forward - run tall
- Pull tires or sledge, run steps and uphill running
- Develop trunk muscles- especially stomach muscles

13.2.3 The head is pulled back - Position C & D

Possible Corrections:

- Keep chin down and look forward
- Don't lift knees too high
- Focus on arm action

13.2.4 Body lean is too forward - Position C & D

Possible Corrections:

- Get front foot quickly down
- Land foot under the centre of gravity
- Lift knees higher
- Focus on running tall
- Move hand forward towards the chin

13.2.5 Athlete is very tense in shoulders and neck - Position C & D

Possible Corrections:

- Run with mouth slightly open
- Pull chin down
- Make the angle in the arm bigger in backward movement
- Run with 15cm broomsticks in each hand when training
- Focus on running tall
- Smile when you run

13.2.6 Athlete runs with no rhythm - Position C & D

Possible Corrections:

- Work on running efficiency
- Run with mouth slightly open
- Make the angle in the arm bigger in backward movement
- Run with 15cm broomsticks in each hand when training
- Do more coordination work - train with music
- Focus on relaxation
- Don't run harder run smarter

13.2.7 Athlete runs with feet moving to the side - Position A & D

Possible Corrections:

- Work on running efficiency
- Run tall - foot lands under the body
- Do power runs - move knees forward
- Run on a straight line

13.2.8 Athlete runs with arms moving to the side - Position A & D

Possible Corrections:

- Work on running efficiency
- Run with 15cm broomsticks in each hand when training
- Run with thumbs slightly turned in
- Do power runs - focus on arms moving forward
- Run on a straight line- focus on arm action

13.2.9 Athlete's left arm works more than the right arm - Position A & D

Possible Corrections:

- Work on running efficiency
- Do more bend running in the opposite direction
- Run around the track in opposite direction

13.3 Faults near the winning line

13.3.1 Athlete's fades or runs slower on the last 20 to 30m - Position D

Possible Corrections:

- Do more speed endurance work
- Work on running efficiency
- Stay relaxed and do more rhythm work
- Don't run harder run smarter

13.3.2 Athlete "dips" too soon - Position D

Possible Corrections:

- Train when to "dip" at winning post
- Run past the winning post - don't dive
- Stay relaxed

13.3.3 Athlete stops to immediately after the winning line - Position D

Possible Corrections:

- Gradually run slower

14. Training Programme

It is impossible to be in top condition at all times. Peak condition and performance must be planned to occur at the championship meets. Working out a training programme is the most complex part of coaching. The goal of sprint coaching is a combination of developing the sprinting technique, making use of the athlete's anatomy and using the biomechanical principles to run as economical and efficiently as possible. It is also important to know which muscles are involved in the different movements.

By doing exercises to develop these muscles and doing the correct drills to get the different muscles to work together will create a motor programme. The speed of movement will depend on how the central nerve system is involved. All the above has to be combined with the energy system that is needed in sprinting. The periodization or planning of the training phase (what to do, when to do, how to do and how much to do), is a science in itself.

14.1 Developing the sprint components

1. Reaction time
2. The start
3. Acceleration from 0.2 seconds to 2.0 seconds
4. Keep on accelerating from 2.0 to 5.0 seconds
5. Maintaining maximum speed 5 to 7 seconds as well as 77 on the relaxation in fast running in order to keep the speed
6. Preventing deceleration from 7 to 12 seconds

When working out the daily training units it is always important to take the following in consideration:

Training load - the intensity

Higher intensities can only be achieved if a sound technique is used.

It is important that technical stability be re-established after increasing speed.

Training volume

The training volume will depend on the maturity and training age as well as the strength, endurance and fitness level of the athlete. This means to make the right decision on intensity (training times or effort), volume (distances, number of repetitions and sets) and recovery between each repetition as well as between sets.

Identify individual differences / Problems

- Typical is the unbalanced strength development of different muscle groups and a poor leg power level effecting the start and acceleration phase
- Looking for immediate success rather than future development
- Running high mileage with extremely low intensity, speed training completely ignored
- Carefully adjusted training load and intensity is required
- Potential speed limit is not achieved
- Lack of planning - with no diaries of what was done
- Athletes and coaches must understand sprinting

Training hints

If an athlete is to derive maximum benefits from a training program he must have a strong belief in himself and his abilities, a strong belief in the program, and a willingness to work with consistency.

Some philosophical considerations behind the program are:

1. Training must be fun and enjoyable
2. There must be a plan and it must be flexible
3. Stay focused but relaxes when training
4. Improve endurance first, and then move to speed development
5. The training for sprints the emphasis should be geared to anaerobic activities
6. The training plan is set up in 2-3 week cycles
7. Athletes should leave the practice session with a feeling of accomplishment. but not exhaustion
8. Never train when ill or with an injury
9. As the season progresses, you will do less but faster work

14.2 Important information needed to draw up a programme

To be able to work out a training program the following information of the individual is necessary:

1. Who - Male or female, age, event, best performances as well as goals. It is also important to take note of any health or injury problems.
2. Test the fitness level of the athlete for each component needed for the event. Results must be recorded and evaluated.
3. Compile the training program so that each component is improved.
4. Monitor the progress and adjust the program when needed. Normally after 2-3 weeks for juniors and after 5-6 weeks for senior athletes.

It is important that each session in the program has:

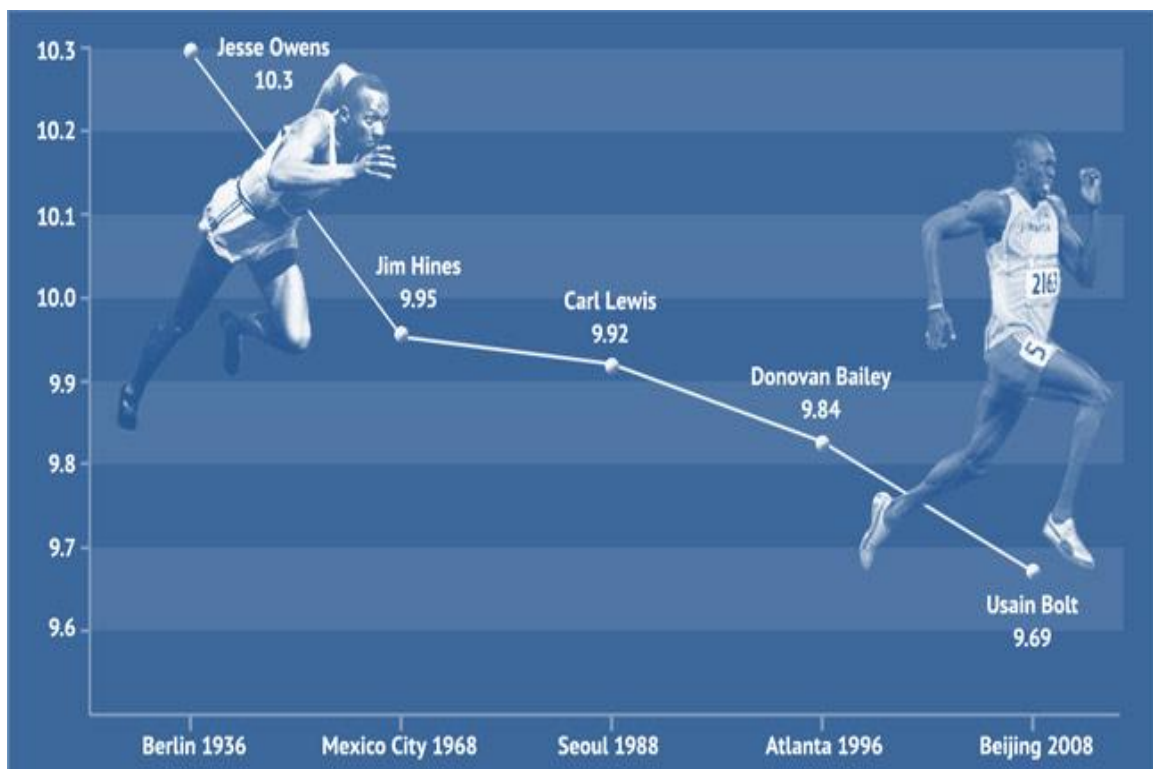
- a goal what must be developed on a session e.g. speed endurance
- what activity must be done e.g. 150m's
- volume how many 150m's e.g. 3 x 150m; rest 10 min; repeat (total 6 150m's)
- intensity how fast must the 150m's be e.g. 3 x 150m (18,0 sec)
- rest how long the rest between each 150m and the rest after the set of 3 e.g. 3 x 150m (18, 0); rest 3min between each; rest 10 min; repeat

Outcome Goals, Process Goals and Performance Goals all need to be SMARTER:

- S**pecific - make them as precise and detailed as possible
- M**easurable - a method by which you can quantify or rate your current position and then determine the amount of improvement required
- A**ccepted - goals need to be shared and negotiated with all others involved
- R**ealistic - the goal is realistic yet challenging
- T**ime phased - date is set for when the goal is to be achieved by
- E**xciting - goal motivates the individual
- R**ecorded - the goal and progress towards it are recorded

The secret of coaching is to obtain the correct balance between volume, intensity and rest during the different phases of training for each individual.

It is important to understand that the following programmes are only examples. Every programme will have to be adjusted according to the needs of the individual.



14.3 Example: Preparation 1 - 100m and 200m program

The program is for a person aiming at 100m 12, 3 sec and 200m 25,2sec.

Two or three mornings: Jog 2 to 3 km very relaxed. Concentrate on deep breathing.

Afternoon: Walk or jog ½ to 1 km relaxed. Dynamic stretching as well as 4 - 6 x 60m-80m very relaxed. Concentrate on running style - get the feet on the ground and stay tall.

It is important to do stabilizing exercises and/or trunk exercises at least 3x per week.

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Week 1	1x250m(33,0) rest 3 min 1x150 (19,2) Rest 10 min 1x 200 (26,2) rest 3 min. 1x150 (19,2)	Circuit training 3x or Gymnasium ----- 50m high knees 50m jog 50m bounding 50m jog 50m backward 50m fast feet 50m race walk 50m jog or Gymnasium	Rhythm e.g.10x100m Focus on running style Get foot under body -push hip forward Stay tall	1x150 (18,8) rest 3 -4min 1x 110m (13,6) rest 10 min 1x 80m (9.6) rest 3-4 min 1x60m (7,2) rest 3-4min 50m (6.0)	Select any exercise from Tuesday or Rest	60m(7.2) rest 3 min 50m(6.0) rest 3min 30m (3.6) Rest 10min Repeat
Week 2	----- 3x150 (19,0) rest 3-4 min rest 10 min 2x150m(18,9) rest 10min 1x150 (18,8)	----- 50m high knees 50m jog 50m bounding 50m jog 50m backward 50m fast feet 50m race walk 50m jog or Gymnasium	----- - the same	----- 1x 80m (9.6) rest 3-4 min 1x 60m (7.2) rest 3-4min 1x 50m (6.0) Rest 10 min Repeat	----- the same	----- 60m(7.2) rest 1-1½ m 30m(3,6) rest 4-5min 60m(7,2) rest 1-1½ m 30m(3.6) Rest 10min Repeat
	Muscle Endurance	Strength	Rhythm Running Efficiency	Speed Endurance	strength	Speed

Sunday: Rest

Remember rest is also a very important part of the training programme. In this period the focus is more on running mechanics and running efficiency. It is also important to keep record of the times as well as the volume. During this phase all the physical components are given attention.

14.4 Example: Preparation 2 - 100m and 200m program

The program is for a person aiming at 100m 12, 0 sec and 200m 24,8sec

Two or three mornings: Jog 2 to 3 km very relaxed. Concentrate on deep breathing.

Afternoon: Walk or jog ½ to 1 km relaxed. Dynamic stretching plus 4-6 x60m-80m very relaxed. Concentrate on running style - get the feet on the ground and stay tall.

It is important to do stabilizing exercises and/or trunk exercises at least 3x per week.

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Week 1	1x250m(31,0) rest 10 min 1x150 (18,6) Rest 10 min 1x150 (18,6) rest 10min. 1x150 (18,5)	Starts 3x20m 3x30m 2x40m 1x50m Plus Jumps 80 to 100 foot contacts or Gymnasium	Rhythm e.g.10x100m Focus on running style Get foot under body -push hip forward Stay tall	1x110 (13, 3) rest 4 -5min 1x 80m (9,4) rest 10 min 1x 60m (7.1) rest 4-5 min 1x50m (5,8)	REST or Good Warm up	60m(7.0) rest 3 min 50m(5.8) rest 3min 30m (3.5) Rest 10 min Repeat or Competition
Week 2	----- 2x150 (18,6) rest 3-4 min rest 10 min 1x150m(18,5) rest 10min 1x150 (18,5)	Starts 3x20m 3x30m 2x40m 1x50m Plus Pull sledge 4x40m or Gymnasium	----- - the same	----- 1x 80m (9.4) rest 3-4 min 1x 60m (7.1) rest 3-4min 1x 50m (5.8) Rest 10 min Repeat	----- the same	----- 2x50m(5,8 rest 1-1½ m Rest 5 min 2x50m(5,8 rest 1-1½ m Rest 10min Repeat or Competition
	Speed Endurance	Strength Power	Rhythm Running Efficiency	Speed	Recover	Speed

Sunday: Rest

In this period the volume becomes less and the intensity higher

It is also important to keep record of the times as well as the volume.

During this phase all the physical components are evaluated.

Remember rest is even more important during this phase.

15. The 400m

The 400m is a controlled and highly specialized sprint which requires a great deal of endurance, determination and patience to deal with the many variables of the race. Consequently there is need to work on a most controlled pattern of run consistent with a sound distribution of effort and energy over the distance.

It is a thinking man's sprint.

According to Vern Gambetta the 400m is an oxygen deficit event, that is, the level of oxygen consumption is below that which is necessary to supply the ATP required. The 400m relies mainly on the two anaerobic systems: ATP-PC and Lactic Acid. Training emphasis should be on maximizing use and development of these two systems.

The key in the 400m race is utilizing speed and distributing the effort over the entire distance... No athlete is capable to run the 400m at top speed from start to finish. Pace judgment, and effort distribution is very important.

Prediction: Fred Wilt recommends the following:

2x athlete's best 200m time plus 3.5 seconds = potential 400m time.

15.1 How to run the 400m

The 400m is not a pure sprint, but good speed over 100m and 200m is a prerequisite to run good 400m. Ideally the pattern of the race should be a smooth acceleration over the first 100m. Due to the transition from a curve to a straight the second 100m is usually the fastest. Float the back straight, stay relaxed without losing speed. It is the third 100m where the races are won or lost. Increase the effort in the turn of the third 100m in order to use the momentum to run the final 100m.

In the last 100m, the runner must be able to adjust pace, keep rhythm and stay relaxed. It is also important to know where the finish is. The runner should also take into account the stagger and lane assignment and where the main opposition will be. Sometimes it helps to take a deep breath but the emphasis should be on arm action. Avoid over striding. Strive to keep rhythm, sprinting form and relax. Particularly pay attention to maintain leg speed. Perhaps the most important mental attribute a runner can have toward the 400m is one of aggressiveness. The runner who is afraid of going out will not succeed.

15.2 Training for the 400m

The 400m should also incorporate the two principles of training that the 400m is most concerned with-specificity and overload. That is, the specific energy systems necessary to run the 400m (mainly the ATP-PC and Lactic Acid Systems) must be worked at above normal levels in order to have a training effect.

A key concept of 400m training is that of rhythm and coordination leading to speed. Neuromuscular coordination is more important than strength. The importance of this all 400m workouts it would be advisable to maintain a constant emphasis on rhythm and relaxation. Workouts should be run as fast as possible without straining.

The basic concept behind training for the 400m is the same as training for any sprint. It is impossible to be in top condition at all times. Peak condition and performance must be planned to occur at the championship meets.

The training program is based on three factors:

1. The competitive schedules
2. The runner's previous training background
3. Seasonal and long-term goals

Training should incorporate the physiological basis of the event discussed earlier. It should also incorporate the two principles of training that the 400m is most concerned with specificity and overload. That is, the specific energy systems necessary to run the 400m (mainly the ATP-PC and Lactic Acid Systems) must be worked at above normal levels in order to have a training effect.

A key concept of training for 400m training is that of rhythm and coordination leading to speed. Neuromuscular coordination is more important than strength. The importance of this cannot be over emphasized. Therefore, throughout all 400m workouts it would be advisable to maintain a constant emphasis on rhythm and relaxation. Workouts should be run as fast as possible without straining.

Success in the 400m is highly dependent upon a very high ability to produce energy via anaerobic glycolysis, with the accompanying lactate acidosis. The anaerobic capacity of the athlete is the main determinant of superior ability to run the 400m. More successful 400m runners are characterized by superior sprint speed. Those who are faster over shorter distances tend to also be faster in the 400m. Training methods that most effectively increase the athlete's alactic anaerobic power and capacity and the capacity of the lactic anaerobic energy system will produce the fastest times.

15.3 Training Components for 400m

Speed

This consists of all out running at distances ranging from 20m to 100m. Speed work should be done on both the straight and the curve. Rest is generally long between runs. Repetitions are discontinued when the athlete can no longer produce maximum performance. This component emphasizes use of the ATP-PC system.

Repetitions

The total number of repetitions in a session. The total number may be divided into sets.

Maximum speed maintenance phase

The maximum speed maintenance phase is kept for very short time. Most experts agree that you can maintain maximum speed for less than 20 meters. After this point, due to insufficient time for force application, all sprinters will enter the deceleration phase of sprinting. "Optimum speed" will have to be developed.

Deceleration Phase

The Deceleration Phase-after going through the above mentioned acceleration and maintenance phases all sprinters will slow down to the tape. It is the person who slows

down (decelerates) the least who appears to be pulling away from his opponents and ends up winning the race.

This ability to minimize deceleration should be a primary concern for sprinters who compete in the 400m, 200m, and to a lesser degree the 100m races. In order for a sprinter to slow down less than his competitors, it is necessary that he trains an attribute known to exercise physiologists as speed endurance.

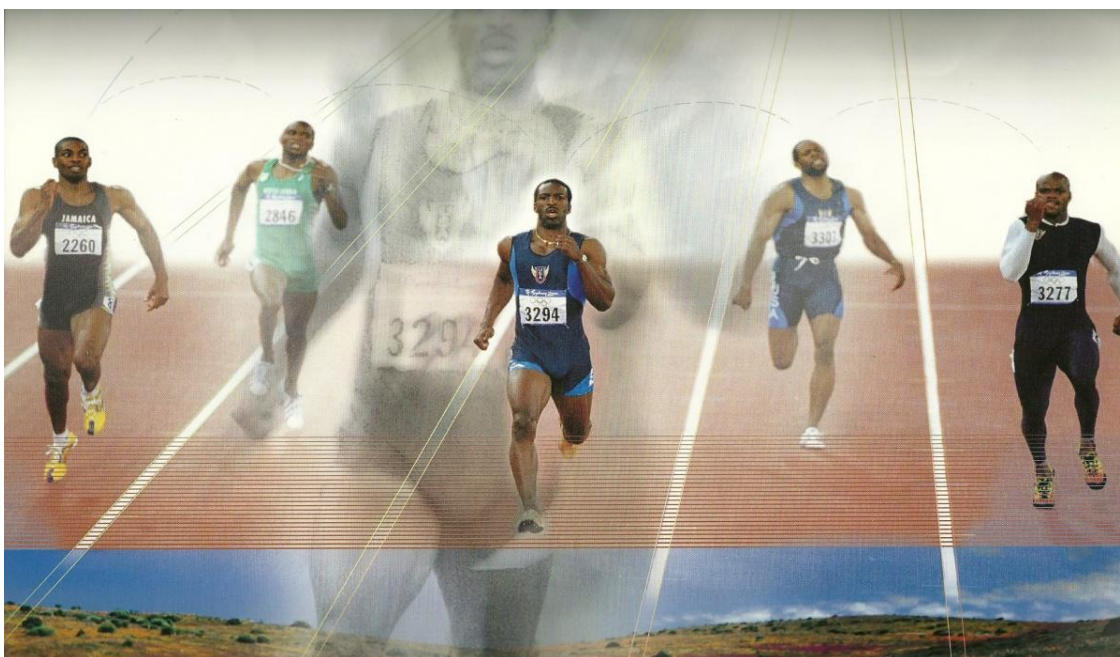
Speed Endurance

After approximately 6-10 seconds of the race, the runner's body has run out of its initial energy supply (ATP-CP) and must begin a process known as Anaerobic Glycolysis (Lactic Acid) which now becomes the primary energy system. However, the by-product of this energy system is lactic acid which interferes with the contractile mechanisms of the muscles.

Fortunately, the body is capable of being trained to adapt to high levels of lactic acid without having it effect the body in such a drastic manner. When the athlete has obtained this level of conditioning he will be better able to combat the fatigue associated with lactic acid and decelerate less through the end of the race to the tape.

By decelerating less, he will appear to be pulling away from his competitors and win the race easily. Thus, this attribute known as speed endurance will determine the result of the race if the speed is the same. This is of great importance to the longer sprints. (200m and 400m)

Trained sprinters achieve their highest velocities slightly further into the sprint than do untrained sprinters and are able to maintain this maximum velocity over a greater distance and thus extend the point at which they begin to decelerate less than untrained sprinters.



15.4 Example: Preparation 2 - 200m and 400m program

The program is aiming 200m; aim: 22, 5 100; aim: 10, 75 400m; aim: 52, 8

Two or three mornings: Jog 2 to 3 km very relaxed. Concentrate on deep breathing.

Afternoon: Walk or jog ½ to 1 km relaxed. Dynamic stretch plus 4-6 x60m-80m very relaxed. Concentrate on running style - get the feet on the ground and stay tall.

It is important to do stabilizing exercises and/or trunk exercises at least 3x per week.

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Week 1	300m (40,0) rest 3-4min 200m (26) rest 10min 200m(25) rest 3-4min 150m (18) Rest 3-4min 150m(17.9)	Circuit training 3x 12 to 15min Rest 8 min Stabilising exercises Or gymnasium Or steps 4 sets plus 80 jumps or hill running 1x200m 3x 150m 4x100m ----- The same	Rhythm e.g.10x100m Focus on running style Get foot under body -push hip forward Stay tall	3 x 150m(17,8) rest 3-4min rest 10 min 2x150m(17,7) rest 3-4min Rest 10 min 1x150m(17,6)	Run 3-5km relaxed or Repeat Tuesday	150m(17.5) rest 3-4 min 110m(12.5) Rest 10min 110m(12.4) rest 3-4min 80m(8.8) -----
Week 2	----- 250m(39,5) rest 3-4 min 200m (26.5) rest 10min 250m (33) Rest 3-4 min 150m (17,8)	----- 80 jumps or hill running 1x200m 3x 150m 4x100m ----- The same	----- - The same or 10x200m (32) rest 30sec	----- Start on 200m 3x 150m (17,8) rest 2-3 min Rest 10 min Repeat but start on 150m mark 3 x 150m(17,8) rest 3-4min rest 10 min 2x150m(17,7) rest 3-4min Rest 10 min 1x150m(17,6)		110m(12.4) rest 3-4min 80m(8.7) rest 3-4 min 50m(5.8) Rest 10 min Repeat
	Speed Endurance	Strength Power	Rhythm Running Efficiency	Speed	Recover	Speed

Sunday: Rest

In this period the volume becomes less and the intensity higher. It is also important to keep record of the times as well as the volume. During this phase all the physical components are evaluated.

NB: * Running efficiency - RUN TALL

* Enjoy the competition Focus on relaxation.

* Winners work hard to be successful.

* If you want to achieve something you have never achieved, you have to become someone you have never been.

* Go further than the limit.

15.5 Example: Competition - 400m program

The program is aiming 400m 51, 8

Two or three mornings: Jog 2 to 3 km very relaxed. Concentrate on deep breathing.

Afternoon: Walk or jog ½ to 1 km relaxed. Dynamic stretching plus 4-6 x60m-80m very relaxed. Concentrate on running style - get the feet on the ground, stay tall. It is important to do stabilizing exercises and/or trunk exercises at least 3x per week.

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Week 1	300m(38) rest 30 sec 100m(13) rest 10 min 200m(24,8) Rest 4-5min 150m(18,5)	Circuit training 3x or Steps + 100 Jumps	Rhythm e.g.10x100m Focus on running style Do starts 2x30m 3x40m 1x50m 1x60m	2x 150m(17,8) rest 2-3min Rest 10 min 1x 150 (17,7) Rest 10 min 1x150m(17,6)	Good warm up or Relax	110m(12,2) 80m(8.7) 60m(6.9) rest 2-3min in between Rest 10min Repeat
Week 2	----- 250m(30,5) rest30 sec 150m(19,5) rest 10min 200m(24,5) rest 5min 150m(18,0) -----	- Do starts 2x30m 3x40m 1x50m 1x60m -----	- Rhythm Running drills eg. 5-7x 100m -----	2x150m Around bend 50m fast 50m faster 50m relax rest 2-3min Rest 10 min Repeat Repeat	Same	----- 80m(8.7) rest 4-5min Rest 10min Repeat Or Competition -----
Week3	Warm up	400m Heat 1 Stay focused	400m Semi Final Your best is good enough	400m Final You can if you think you can	Relax Enjoy	-----
	Speed Endurance	Strength Power	Rhythm Running Efficiency	Speed	Recover	Speed

Sunday: Rest

16. IAAF Rules (2014-2015) Rules 161 to 166

1. Starting blocks shall be used for all races up to and including 400m.
2. In races up to 400m a crouch start and the use of starting blocks are compulsory.
3. After the "On your marks" command both hands and at least one knee shall be in contact with the ground and both feet in contact with the foot plates of the starting blocks.
4. At the "Set" command, an athlete shall immediately without delay rise to his final starting position.
5. An athlete shall not commence his start until after receiving the report of the gun.
6. Any athlete responsible for a false start shall be disqualified.
Note: In practice, when one or more athletes make a false start may result in more than one athlete being warned or disqualified.
7. In the 200m and 400m races, the starts are staggered.
8. Athletes must stay in their lanes throughout the race.
9. The Timekeepers shall be placed at least 5m from the outside lane of the track.
10. The time shall be taken to the moment at which any part of the body of an athlete (i.e. torso as distinguished from the head, neck, arms, legs, hands or feet) reaches the vertical plane of the nearer edge of the finish line.
11. For all hand-timed races on the track, unless the time is an exact 0.1 second, the time shall be converted and to the next longer 0.1 second, e.g. 10.11 shall be recorded as 10.2.
12. With hand times, at least three timekeepers are needed for first place in case of a record. For official records at provincial level or higher, a fully automatic electrical timing device must be used.
13. Times for all finishers shall be recorded.

17. Hurdles

Hurdling is because of its technical and energy demands an exciting and challenging event.

Hurdling is in essence a sprint ... but over barriers in which the athlete's skill is measured in terms of time. The technical component of hurdling is clearly much greater than sprinting. Because it is a sprint, optimum speed (horizontal velocity) is the primary consideration in running to, over and between each barrier.

The emphasis must be on speed between the hurdles rather than clearing the hurdle.

The sprint hurdle race can be broken up into four stages with the number of strides taken in each phase shown in brackets:

1. Start and approach to first hurdle (8)
2. Movement over hurdles (10)
3. Running between hurdles-3 strides (27)
4. Sprint from last hurdle to finish (6)

All hurdlers take virtually the same given number of strides in a race. The hurdler with the highest rate of stride frequency, given a reasonably proficient degree of technical efficiency, will win. However, no matter how efficient the hurdler is technically, cannot succeed unless he or she possess good sprint ability.

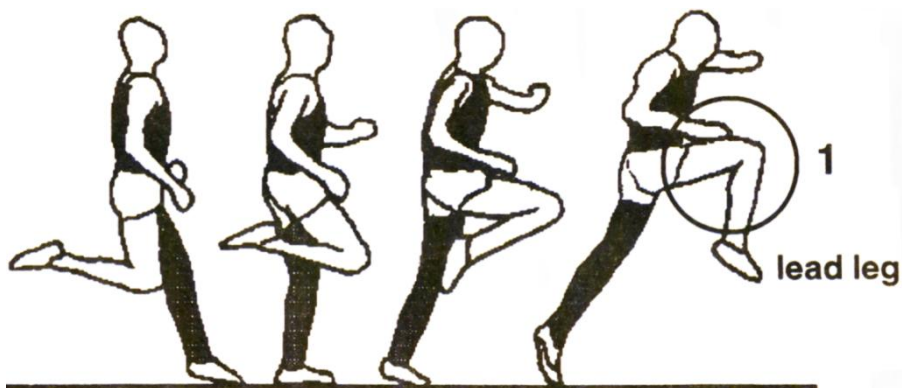
17.1 Hurdle Technique

Clearing a hurdle in a manner that least interferes with an athlete's speed and direction is one of the more difficult accomplishments in athletics. The repeated clearing of hurdles also presents one of the most graceful pictures in sports. The difficulty, coupled with the smooth, flowing, yet powerful movement, qualifies hurdling as an art form. In order to successfully negotiate the clearance of a hurdle the athlete is required to perform simultaneously, or in rapid succession, a series of movements which are neither typical nor necessarily natural. He or she has to control both arms, both legs, both feet, the body, and the head; all of which may be performing different functions and attempting to go in different directions at the same time. Like anything else in sports, hurdling can be reduced to basic elements and must be taught or learned.



17.2 Hurdle Clearance

The sketches as well as the technique explanation source are from "Run. Jump. Throw." The Official IAAF Guide to teaching Athletics. Level 1 Spring 2000. The hurdle technique can be broken down into take-off, clearance and landing. In the clearance the hurdler tries to minimise the time in the air and prepares for the next running stride.



Run tall with a high body position in order to "attack" the hurdle.

Run 'into' the hurdle, do not jump.

The hurdle technique starts with the knee going up'

The knee must be picked up in line with the vertical centre line of the body.

Thigh of the lead leg swings rapidly to the horizontal position.

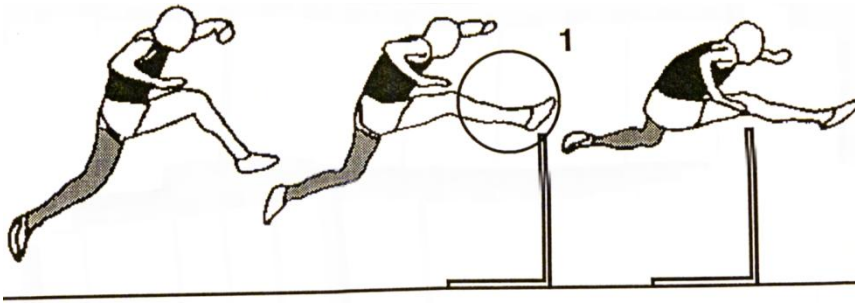
Concentrate on lifting the knee, not leg-foot, this helps to drive forward rather than upwards.

Raising their centre of gravity only a little more than in a normal sprint action.

The take-off leg (foot on the ground) drives forward into the hurdle.

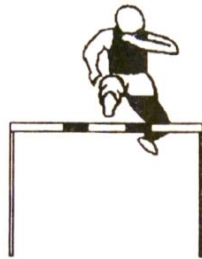
Hip, knee and ankle joints of the support leg are full extended. This ensures that a fast and effective drive can be made over the hurdle.

There should be no tendency for the knee to be pulled across the body or for the lower leg to go out and round.



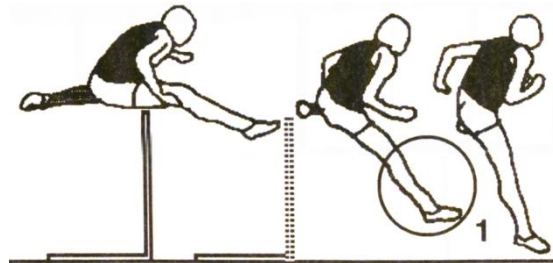
Foot of the lead

leg is flexed (1) to allow faster up and down movement of the leg. There is no necessity for the lead leg to be straight over the top of the hurdle. A bend leg is shorter than a straight leg and therefore faster to force down than a straight leg. This action will keep the hips (centre of gravity) in front of the foot on touchdown.



As the lead leg is lifted and extended towards the hurdle, the lead arm (opposite arm) is brought forward, slightly flexed in front of the chest, and then allowed to extend of its own accord. Shoulders remain parallel to the hurdle and facing forwards.

Lower part of the lead leg is actively extended forwards and then downwards in the direction of running. Foot of the lead leg is flexed. As the heel of the lead leg passes the barrier it must be pulled down and back to land under the body See [1].

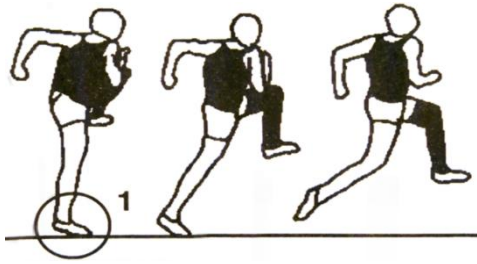


The heel of the trail leg must remain as close to the buttocks as possible until it crosses the hurdle, at which time it is pulled by the high knee to the under-arm position.

As the trail leg comes forward, the lead arm must be pulled backward to keep the shoulders square throughout the flight and landing.

The trailing knee is pulled up rather than forward to assist the lead leg with a faster downward movement.

The faster that the lead leg is pulled to the ground the faster the trail leg will move forward.

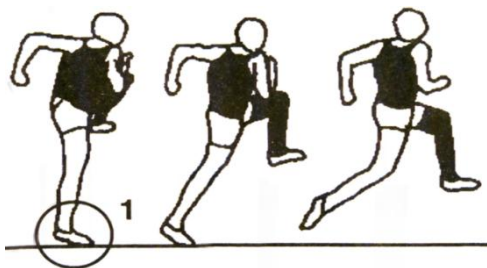


Landing leg is 'stiff'. Landing is on the ball of the foot. (1) Body should not lean backwards on landing. Trail leg stays tucked until touchdown then it pulls quickly and actively forwards.

Contact with the ground is brief, the first stride is aggressive.

To assist the downward movement of the leg, the trunk must be brought upright after clearing the hurdle, but avoid leaning back.

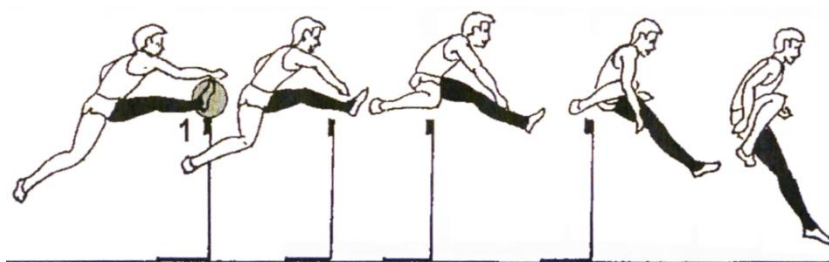
Contact with the ground is brief, the first stride is aggressive. To assist the downward movement of the leg, the trunk must be brought upright after clearing the hurdle, but avoid leaning back.



The knee of the trailing leg must be pulled through high over the hurdle. The follow-up stride after landing behind the hurdle, will be too short if the trailing knee is allowed to drop during the pull-through stage.

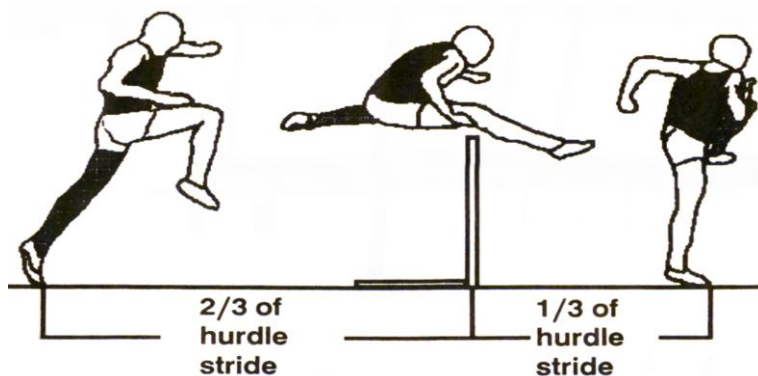
For the lower hurdles, the trailing knee can be brought through lower. Land with foot under the centre of gravity of the body and keep the ankle firm on landing. Active re-entry into running.

17.3 Lead leg

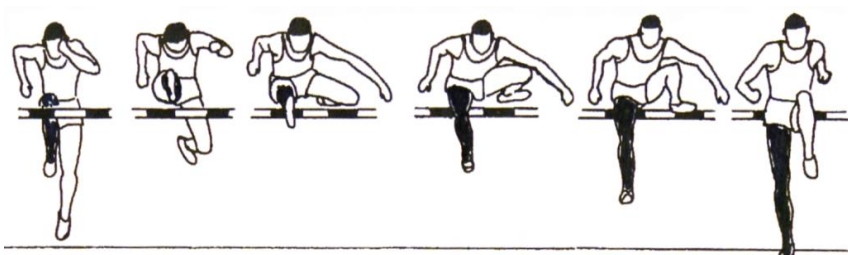


Lower part of the lead leg is actively extended forwards and then downwards in the direction of running. Foot of the lead leg is flexed. (1)

The lean forward of the trunk is more pronounced for 'higher' (relative to athlete's height) hurdles, and only what is necessary for 'lower' hurdles. Shoulders remain parallel to the hurdle and facing forwards.



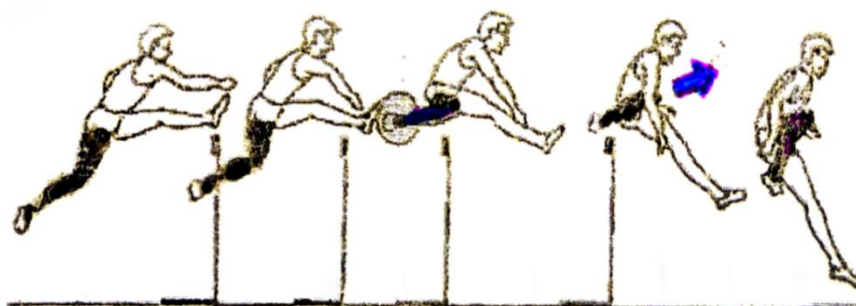
Take off is well in front of the hurdle from the ball of the foot (two thirds of the overall hurdle stride). Lead leg is actively lowered as quickly as possible after the hurdle. Landing is active and on the ball of the foot (no heel contact at touchdown).



Lead leg

17.4 Trail leg

Lower part of the lead leg is actively extended forwards in the direction of running. Foot of the lead leg is flexed (1). Trunk is well bent for higher hurdles, bending is less exaggerated for lower hurdles. Shoulders remain parallel to the hurdle.

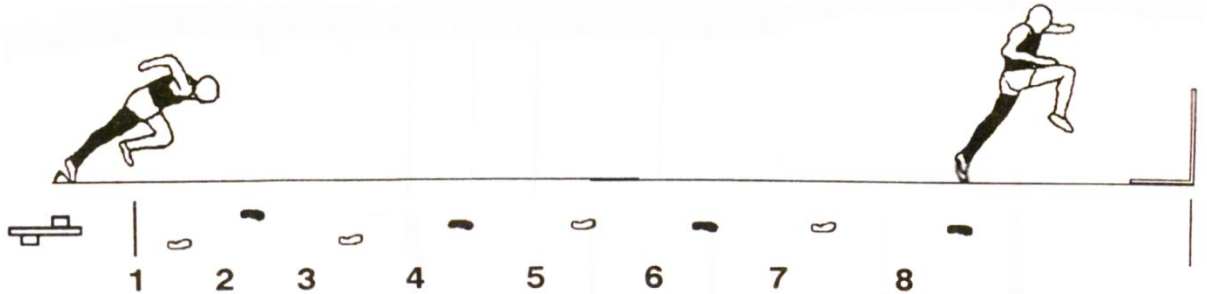


Trail leg

Trail leg is drawn alongside the body.
Thigh of the trail leg is roughly parallel to the ground at clearance.
Angle between the thigh and lower leg is about 90° or less.
Ankle of the trail leg is markedly dorsiflexed.
Toe is tilted upward.
Knee of the trail leg is kept high as it pulls through.

17.5 Arm Action

As in sprinting, the arms act to balance the body and counter the rotations produced by the legs. The arm opposite to the lead leg actually leads the action into the hurdle and pushes/dives forwards as the lead leg rises. The other arm should be taken back in a normal sprinting action. As the trail leg comes round the leading arm swings back and wide to counter the rotation of the trail leg



Start to first hurdle

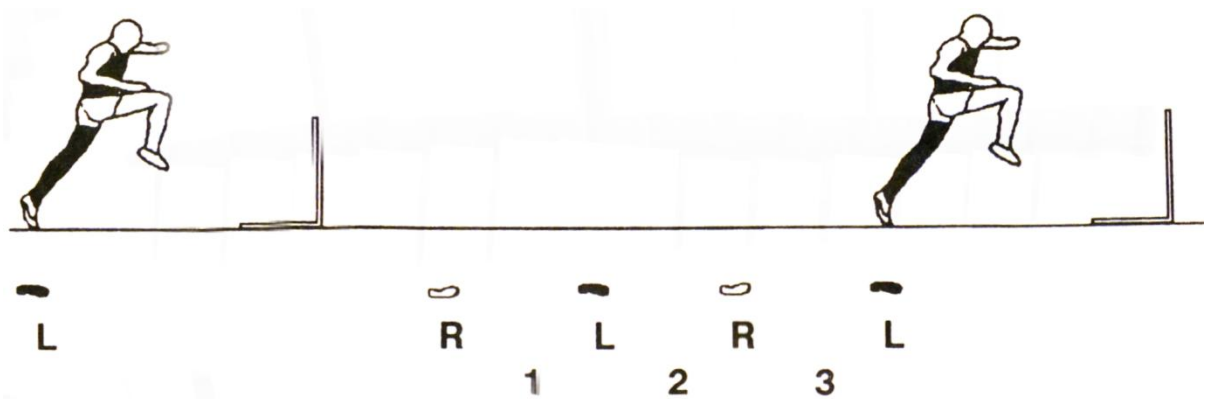
The start of the hurdler is the same as for the sprinter.

The lead leg is on the back position in the starting blocks.

Eight strides to the first hurdle will ensure that the lead leg goes over the hurdle.

Upright body position is achieved earlier than in a sprint start.

Any correction must be done on the first 4 or 5 strides.



17.6 Running Between Hurdles

The emphasis is now on fast stride frequency and working hard between the hurdles rather than over striding. Three strides are used to cover the ground between the hurdles. To achieve this, the athlete has to modify his sprinting technique to make it fit the gap. A fast leg cadence and a shorter stride length is needed. The athlete may have to use a lower knee lift than in normal sprinting with an emphasis on leg speed. The correct range of movement and speed can be achieved by training over hurdles that are slightly closer together than normal. Run with the hips high. High body position (hips high) between the hurdles.

17.7 Finishing the race

Having cleared the last hurdle, attention is directed towards the remaining distance to the finish line. To help, athletes could count their strides and dip on the last stride.

17.8 Safety

Hurdling is dangerous on wet grass or any other slippery surface. It is also dangerous for children to run over hurdles in the opposite way to the correct running direction i.e. with the feet of the hurdles on the far side. It is important to help the athletes in the learning situation, by using adapted equipment, lowering the hurdles and altering the distance between hurdles.

18. Common faults in clearing the hurdles

When analysing mistakes it is assumed that the hurdle technique is correct.

Fault: The take-off is too far from the first hurdle

Corrections: 1. Drive harder from the blocks
2. Sprint strides during initial acceleration from the blocks are too short

Fault: The take-off is too close to the first hurdle

Corrections: 1. Put the feet down faster at the start
2. Sprint strides during initial acceleration will be shorter

Fault: The clearance is too high over the hurdle

Corrections: 1. The athlete is too close to the hurdle at take-off
2. Maintain sprint acceleration posture longer
3. Make the take-off step active and on the front of the foot

Fault: The leading leg moves to the side over the hurdle

Corrections: 1. The athlete is too close to the hurdle at take-off
2. Take off little further from hurdle to be able to lead with knee
3. Make the take-off step active and drive into the hurdle

Fault: The arms swing to the side in clearance

Corrections: 1. Ensure that the leg movements are correct
2. Focus on arm action as in efficient sprinting

Fault: The trail leg is too slow

Corrections: 1. Ensure that the lead leg moves faster to the ground
2. Drive more with take-off foot into the hurdle

Fault: The athlete cannot get the three pace rhythm between hurdles

Corrections: 1. Ensure that hurdle technique is correct
2. Work harder in between hurdles
3. Work on speed and speed endurance
4. If the above does not work, make use of four paces - alter lead leg

19. The 400m Hurdles (200m- and 300m Hurdles)

Like the high (or short) hurdles sprint, intermediate (or long) hurdling is a rhythmic sprinting event. Speed and speed endurance are basic requirements, but the ability to express these in a rhythmic pattern is more important.

The first lesson to learn is that clearing a hurdle takes only an elongated sprinting stride, with as little deviation. The 400m hurdles are arguably the most demanding of all events in the sprints and hurdles group. To be successful, the athlete must be able to run a fast 400m flat time, possess stamina at distances of 600-800m, possess flexibility and agility, and have a good hurdling technique.

The 400m hurdler must determine the number of strides to use between the hurdles, and then master that stride pattern. He or she must be able to maintain a consistent rhythm for 10 hurdles. A definite stride pattern is necessary but will be different for each athlete, e.g. the junior women novice 400m hurdler may take 24 or 25 strides to the first hurdle; 17 or 18 strides up to the 5th hurdle; 18 or 19 strides to the 8th hurdle; 19-20 strides to the 10th hurdle and 24 strides to finish.

As the athlete becomes stronger, the strides between the hurdles will be less, e.g. 22 or 23 strides to first hurdle; 16 or 17 strides to 6th hurdle, to 17 or 18 strides to 10th hurdle and 20 or 22 strides to finish.

The ability to hurdle with either leg is a safety valve if the chosen stride pattern does not work and it allows the hurdler to change the stride pattern during a race due to the weather, track surface, lane assignment, or poor hurdle clearance. It is recommended that the athlete pace himself in such a way that he will lead with the left leg in the bend in order to run closer to the inside line. There is also less chance of disqualification. When leading around the bend with the right leg, the left leg tends to trail alongside the hurdle instead of over the hurdle.

The hurdler must be able to judge the pace. External factors such as weather, track surface, lane draw, endurance and poor hurdle clearance will influence the stride pattern. The athlete must be able to adjust pace as needed, during the race. Decide as quickly as possible after clearing a hurdle which leg will be the lead leg at the next hurdle. Don't stop but run "into" the hurdle. When approaching a hurdle in the bend, move away from the inside line and pass over the middle of the hurdle in order to run in a straight line.

The difference in the time of a 400m flat race and 400m hurdles race could be 4-6 sec. depending on the age, gender and level of fitness.

19.1 The start and sprint approach to the first hurdle

The acceleration and stride pattern to the first hurdle are of vital importance as they establish the hurdler's rhythm through the first few hurdles.

The amount of strides for a beginner long hurdler to the first hurdle in
200m Hurdles will be 7-9 strides distance to first hurdle of 16m
300m Hurdles will be 24-27 strides distance to first hurdle of 50m
400m Hurdles will be 23-25 strides distance to first hurdle of 45m

The number of strides to the first hurdle is predicated by the athlete's speed and strength and by which lead leg they prefer to use at the first hurdle. Most hurdlers will use the left leg for hurdles on the curve, as this allows them to run on the inside of the lane without fear of pulling the trail leg over the inside of the hurdle during clearance. The athlete leaves the blocks and must accelerate the same as for the 400m. Settle into a pace, which allow slight acceleration before the hurdle. Adjusting strides before the hurdle has a negative effect on the rhythm between the hurdles.

19.2 200m- , 300m- and 400m Hurdle technique

Good 400m hurdle technique allows the athlete to negotiate the hurdle with minimum deviation from normal running technique. Going into the hurdle, the hurdler must lead with the knee of the lead leg, because by doing so the most efficient body position for attacking the hurdle is provided. The approach run for the long sprint hurdles is slower and more controlled than the short sprint hurdles. Less body lean over the hurdle. Hurdler technically needs less skill than the short sprint hurdler. Hips must stay tall and maintain the running rhythm.

19.3 Running between the hurdles

Focus on good hurdle technique with the hips directly above or ahead of the leading foot on touchdown. Stride rhythm should not be disturbed and less energy will be used to get back into rhythm.

Get into a stride pattern as soon as possible after each hurdle. Count the strides in between the hurdles. In the case of even numbers e.g. 18 strides between hurdles the athlete will lead with alternating legs over the hurdles.

19.4 Run to the finish line

Hurdle races are often won or lost between the touchdown after the last hurdle and the finish line. At that point, most competitors are fatigued. A high level of anaerobic speed endurance in the training program is the key to a fast run-in from the last hurdle to the finish. If in a position to win, the hurdler who first returns to sprint form and attacks the finish line, has the best chance of victory. Concentrate on good running technique as the athlete approach the straight, e.g. don't think of running faster, think of getting the feet on the ground, keep on breathing and relax. Maintain concentration and stride rhythm.

20. Common faults in clearing in the 400m hurdle

According to Winkler (2000), the following faults seem to be most frequent:

- Fault: The take-off is too far from the first hurdle
- Corrections: 1. The athlete lacks the contractive strength necessary to drive from the blocks with sufficient stride length
2. Sprint strides during initial acceleration from the blocks are too short

Fault: The clearance is too high over the hurdle
Corrections: 1. The athlete is too close to the hurdle at take-off
2. Maintain sprint acceleration posture longer
3. Make the take-off step active and on the front of the foot

Fault: The athlete hits his or her trail knee on the hurdle
Correction: 1. Focus on an active take-off step and the force application of the trail leg should not be rushed
2. The lead leg and opposite arm should be driven inward and parallel to the running direction
3. Work on trail leg mechanics

Fault: The athlete hits hurdles late in the race
Corrections: 1. Focus on rhythm.
2. Make eye contact with the next hurdle at least 15m away.
3. Keep concentration.

21. Hurdle technique drills

Most of the following hurdle drills were taken from "Hurdles ... a basic and advanced technical model" Brent Farlane published in Track Technique Summer 1994



Place obstacles or hurdles 7-8.5 m apart.
Use different heights for lead and trail legs.
Clear with either lead or trail leg.
Use hurdles of moderate height 7-8 m apart.
Run alongside hurdles in 3-stride rhythm.
Clear the hurdle with either lead or trail leg.



- Place obstacles or hurdles 7-8.5 m apart.
- Use different heights for lead and trail leg
- Run with lead leg over the low hurdle and the trail leg over the high hurdle (see athlete on the left)



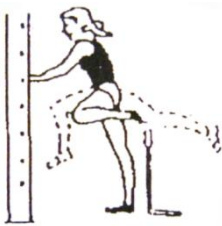
Anisimova drill

- Face the side of the hurdle
- The lead foot clears back and forth over the edge of the hurdle
- Stand on the toes
- Keep the leading foot curled upwards (flexed)
- Keep the hips high
- 'A' skip crossing over side of hurdle



Wall attack drill

- Stand on the toes
- Fall forward and lift the lead leg at the knee
- Throw the lower leg out just before hitting the wall while blocking with the opposite arm at the same time.
- "Karate" kick
- Keep the toes flexed

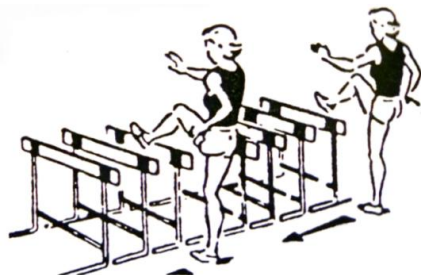


Trail leg drill

- Put a hurdle 1 meter away from the wall
- The height must be 8 cm lower than race height
- Lean against the wall with shoulders square, chest high, and the lead foot on the ground in front of the hurdle
- Bring the trail leg forwards and backwards across the hurdle in a vertical half-circular motion

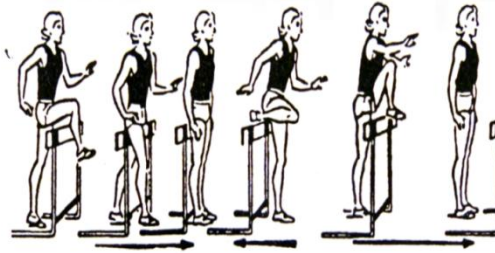
Trail leg drill

- The coach stands in front of athlete
- Holds the hands and pulls the athlete slightly forward to bring trail leg over the hurdle



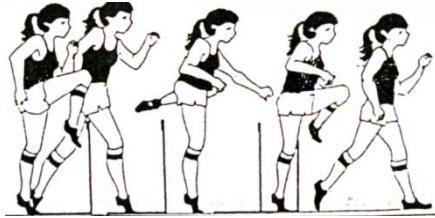
Hip and Trail leg

- Hop on one leg (right leg in sketch)
- Pull a bent other leg (left leg) over, over the hurdle
- Continue over all the hurdles



Hip drill

- Walk over the hurdles with right leg -one step
- Immediately step over next hurdle with left leg
- Continue over all the hurdles



Trail leg drill

- Run on the right side of the hurdle if you lead with the right leg
- Imitate lead leg movement placing right foot quickly down forward of the hurdle
- The trail leg (left leg) goes over the hurdle
- Continue over all the hurdles



Lead leg drill

- Run on the right side of the hurdle if you lead with the left leg
- Imitate lead
- Leg movement - lift left knee and put foot quickly down the hurdle
- Continue over all the hurdles

21.1 Five basic principles when coaching hurdles

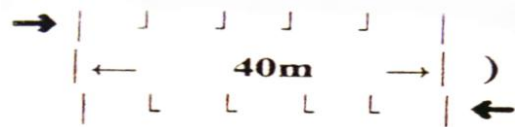
1. Run "tall" - knees high - drive with feet; same as a good and efficient sprint technique.
2. Lead the movement with the knee and use driving leg to thrust the hip forward.
3. The moment the foot is over the hurdle it must be pulled down quickly. Keep the ankle firm when landing the foot under the body - be "tall", and make an active re-entry into running.
4. Pick up the trail leg as a result of the drive rather than just 'pulling it off' the ground. Shorten flight time by keeping low over the hurdle. Pull trail leg high up and forward in running direction. Keep shoulder line parallel with the hurdle. Don't over emphasize the "dip" into the hurdle.
5. Use a three stride rhythm and use both arms. Work hard and fast in between the hurdles.

21.2 Some specific hurdle sessions

Use the event distances. e.g. 80m Hurdles

1. Hurdle technique drills
2. 2x 2 hurdles (take time when foot lands over 2nd hurdle); rest 1-2min in between
2x3 hurdles (take time when foot lands over 3rd hurdle); rest 2-3min in between
2x4 hurdles (take time when foot lands over 4th hurdle); rest 3-4min in between
2x5 hurdles (take time when foot lands over 5th hurdle); rest 4-5min in between

3. 1x6 hurdles (take time when foot lands over 6th hurdle); rest 2-3min in between
1x5 hurdles (take time when foot lands over 5th hurdle); rest 2-3min in between
1x4 hurdles (take time when foot lands over 4th hurdle); rest 2-3min in between
1x3 hurdles (take time when foot lands over 3rd hurdle); rest 2-3min in between
4. 3 x 40m forward and 40m back with hurdles



5. To improve leg speed distances in between hurdles can be less
6. Any combination of distances

22. IAAF Rules (2014-2015) Rule 168 - Hurdles

1. All rules applicable to sprinters are also applicable to hurdlers.
2. All races shall be run in lanes and each athlete shall keep to his own.
3. Each hurdle shall be placed on the track so that the feet shall be on the side of the approach by the competitor.
4. A force at least equal to the weight of 3.6 kg applied horizontally to the centre of the top edge of the top bar is required to tilt it.
5. Each athlete shall run each hurdle in his or her lane.
6. Knocking down of hurdles shall not result in disqualification unless, in the opinion of the Referee, it was deliberately knocked down e.g. knocking over a hurdle with your hand leads to disqualification.
7. Athlete must run over the hurdle e.g. trailing a leg outside and below the level of the top leads to disqualification.
8. For a Record, all hurdles must comply with the specification.

23. Relays

23.1 The Non - visual exchange - 4 x 100m

The relay races are the events that offer the competitors and the spectators some of the greatest thrills there are in track and field. They offer opportunity for the average athlete to succeed at the highest level of competition.

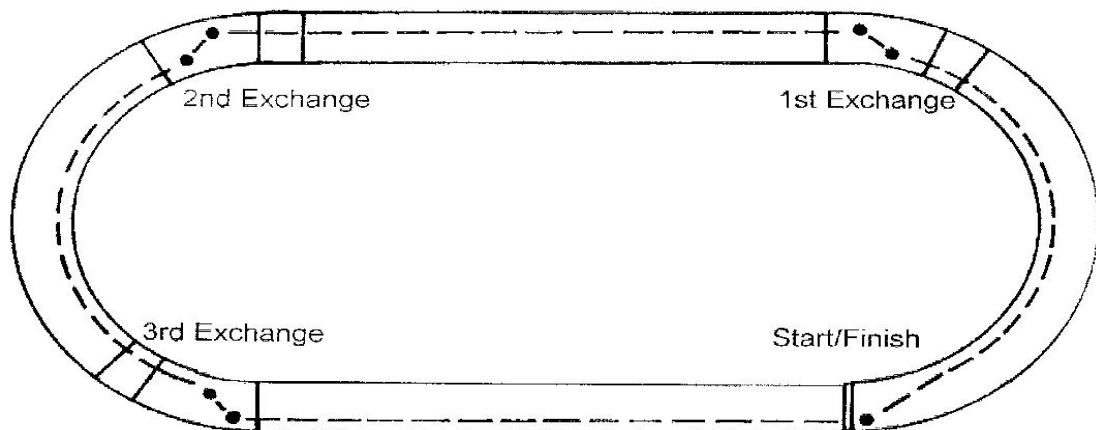
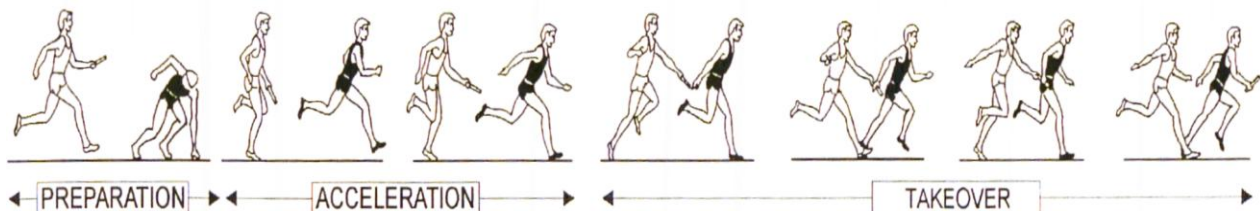
Successful relay running requires speed, speed endurance, efficient baton changing technique and teamwork. The following aspects should be taken in consideration when selecting the method of changeover:

- The relay rules
- Sprinting ability of the team members
- Running order of the team
- The speed and accuracy of each changeover
- The motivation and acceptance of the responsibility of each team member

23.2 The rules of relay - IAAF Rule 170

The aim in the 4 x 100m is to carry the baton from the start to the finish as quickly as possible.

1. Takeover zone shall be 20m long
2. Relay Race is being run in lanes
An athlete may place one check-mark on the track within his own lane, by using adhesive tape, maximum 5cm x 40cm, of a distinctive color
No other check-mark may be used.
3. The baton shall be carried by hand throughout the race
Athletes are not permitted to wear gloves
If dropped, the baton shall be recovered by the athlete who dropped it
4. The baton shall be passed within the takeover zone. Passing of the baton outside the takeover zone shall result in disqualification
5. Assistance by pushing or by any other method shall result in disqualification
6. Each member of a relay team may run one leg only
7. Only two additional athletes may be used as



23.3 The Non - visual exchange

The non-visual exchange is divided into three phases

Preparation, Acceleration and Takeover

A specific aim in the relays is for the outgoing runner to accumulate speed before the baton is handed over, so that the changeover occurs "fluently." The higher the running speed at the moment of the baton exchange, the more effective is the changeover.

All efforts to improve the changeover technique are therefore directed to avoid, within the necessary safety, as much as possible a drop in the baton speed. This can be achieved, above all, when: the incoming runner, in spite of preparations for the baton change, can maintain the running speed; the outgoing runner has already reached a high speed before the changeover.

23.4 The changeover

There are mainly three different non-visual changeover techniques: the upsweep, the down-sweep and the push technique.

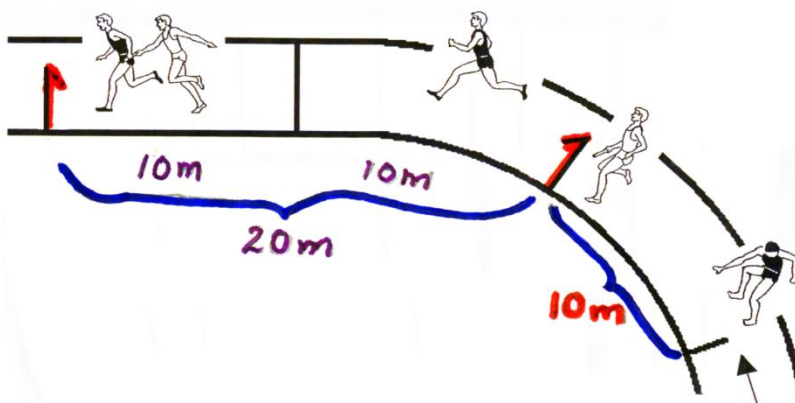
It is clear that even at world level there is not universal agreement on the baton exchange technique. However, because athletes are frequently switched, it is clearly expedient that a team must agree to use a common exchange technique.

Down-sweep offers an advantage in free distance but it is a more difficult technique to control. It is, of course, possible to mix the methods but this is dangerous. When selecting a technique the following advantages and disadvantages should be considered:

- The safety factors of the changeover
- The path of the runners in the changeover zone (particularly in the curve)
- Tactical calculations - free distance gained or error of judgment
- Replacement runner if an athlete is injured

23.5 The ultimate use of the Zone

According to the competition rules the changeover must take place in a 20m zone. The outgoing runner is allowed to start another 10m further back. In order to have the longest possible acceleration distance at the disposal of the outgoing runner, the changeover should preferably take place in the second half of the zone. Excellent changeovers therefore occur close to the end line of the zone.

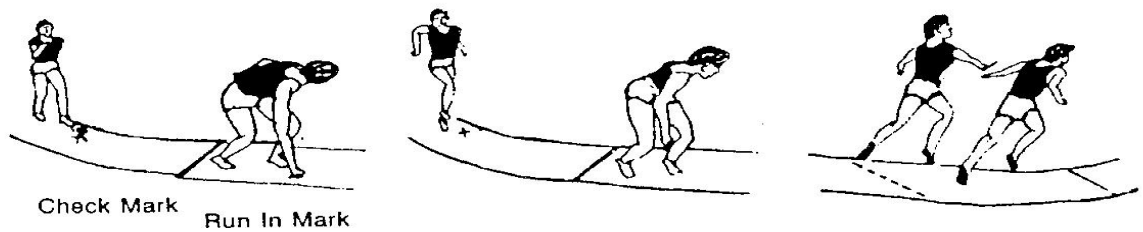


23.6 Check mark

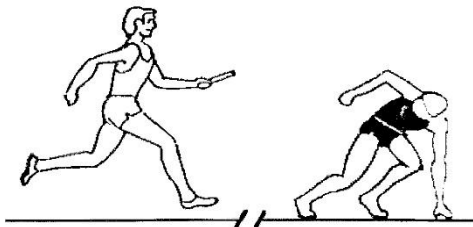
A suitably established check mark and an efficient starting position that decides a correctly timed and powerful start of the outgoing runner. It is important to establishment the precise mark. It is relatively difficult for the outgoing runner to catch the exact moment the incoming runner reaches the check mark. Even experienced sprinters, under the emotional strain of the race, make mistakes.

A check mark signifies the spot where the outgoing runner starts when the mark is reached by the incoming runner. The distance of the mark is established individually taking into consideration:

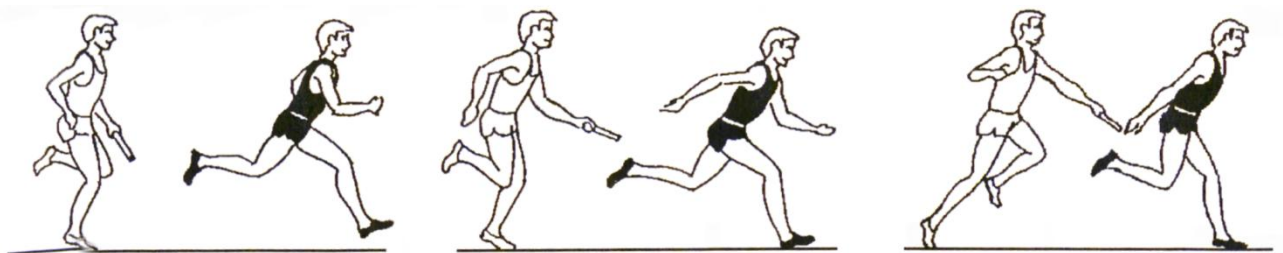
- The running speed of the incoming runner
- The reaction and acceleration capacity of the outgoing runner



- The incoming runner approaches at maximum speed.
- The outgoing runner looks over the left shoulder if he/she wants to receive the baton in the left hand.



- Outgoing runner looks at the check mark and starts when incoming runner reaches it.
- This outgoing runner wants to receive the baton in his right hand.
- The outgoing runner never looks back again.



It is the responsibility of the outgoing runner to accelerate

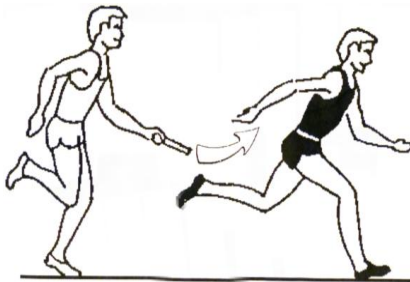
- The outgoing runner must reach the highest possible rate of acceleration.
- Incoming runner gives a verbal command for the outgoing runner to receive the baton as the exchange distance is approached.
- Outgoing runner extends the receiving arm backwards (according to the exchange technique used) and the incoming runner reaches forwards.



It is the responsibility of the incoming runner to give the baton safely

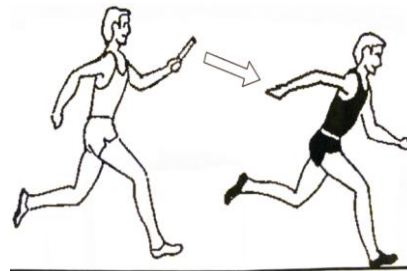
- Incoming runner focuses on the outgoing runner's hand.
- Incoming runner pushes the baton into the outgoing runner's hand.
Outgoing runner grips the baton as soon as contact is felt.
- Both runners stay on their side of the lane during the takeover.
Incoming runner must stay in the lane until all exchanges are completed.

23.7 Passing Techniques



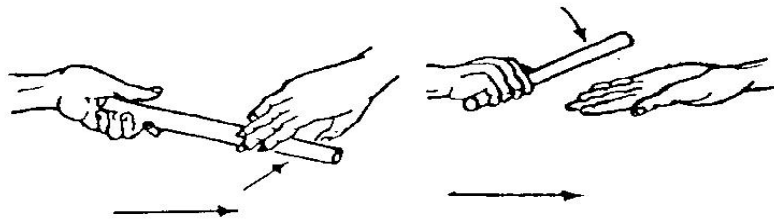
Up-sweep

A relatively safe technique
Disadvantage: baton gets shorter



Down-sweep

Used by experienced and trained runners
Disadvantage: cannot recover if there



23.8 How to make the best use of the runners in the team

Make use of the rules

Distances		Minimum	Maximum
A	First leg	92m	108m
B	Second leg	84m	116m
C	Third leg	84m	116m
D	Fourth leg	92m	108m

The above can help to select the order of your runners

Example of how to select the running order.

Result Girls U/18

- | | | |
|--------------------|-------------|-------------------------------------|
| 1. First: | Athlete A | 12, 2 – was 3rd at 50m |
| 2. Second: | Athlete B | 12, 3 – was second from beginning |
| 3. Third: | Athlete C | 12, 4 – very short |
| 4. Fourth: | Athlete D | 12, 5 – was 1st at 60m |
| Position in relay: | First leg D | Second leg B Third leg C Last leg A |

23.9 Visual Exchange 4 x 400m

In the 4 x 400 m relay race the so-called visual method of baton passing is used.

The responsibility here rests with the receiver who must see that he receives the baton as soon as possible from his exhausted incoming team mate.

23.10 The technique

In the visual method the receiver must keep his eye on the baton until he has it in his hand.

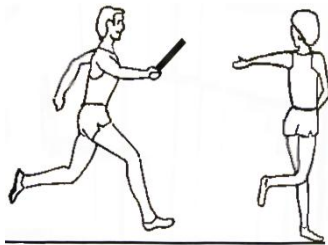
The receiver stretches his left arm backward with the palm upwards.

Outgoing runner faces the inside of the track, looks over the left shoulder and holds the left arm out to receive the baton.

Outgoing runner accelerates to match the speed of the incoming runner.

Incoming runner holds the baton upright with the right hand and reaches towards the outgoing runner.

Outgoing runner takes the baton with the left hand and changes it immediately to the right hand.



24. The IAAF Rule 170 – 4 X 400m

1. The first leg run in lanes.
2. Athletes are not allowed to stand outside the 20m takeover zone.
3. The second leg is also run in lanes until the end of the first bend, where he is allowed to cut in towards the inside lane.
4. The third and fourth athlete wait in the exchange zone and place themselves in their waiting position in the same order (inside to out) as the order of their respective team members as they enter the last bend.
5. Should the baton fall, the runner who dropped it should recover it.

25. Conclusion

The main criterion of an effective change over is to transport the baton in the shortest time possible inside the available changeover zone with optimal safety. Each member of the team must do speed training sessions. Every member in the team must be willing to work and train regularly.

Training will improve the technical ability to handle the exchange efficiently, judge the distance and speed of the teammate. Make use of the strong points of each team member e.g. who prefers to run the bend, who prefers to start, who can accept a challenge and who is always prepared to do anything for the team.



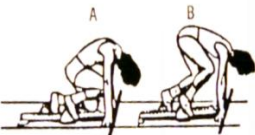
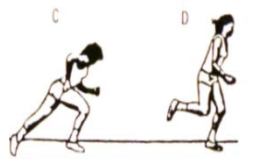

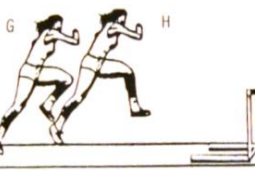
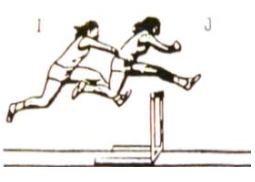
Remember relay is Teamwork

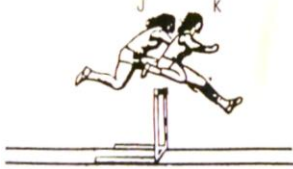


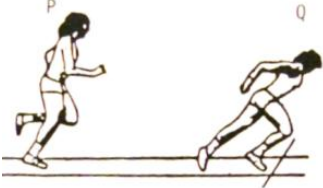
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27. Appendix A - Analysis sheet for 100m hurdles

Johannes Hücklekempes. IAAF New Studies in Athletics Dec 1990

100m Hurdles	Phase	Reference	Criteria Assessment
	Hurdles start	A On your mark, position B "Set" position	- foot of trail leg is on the back block - as in the flat sprint
	Acceleration to the first hurdle	C Sprint C acceleration D running posture	- with 8 strides to the first hurdle - early straightening of the body from the 4th/5th stride onward - high hurdle posture in front of the hurdle - continuous increase
	Take-off Preparation	E 10 take-off point EF touchdown F CG F lead leg	- optimal distance to hurdle: 1.5m-2m - take-off from the ball of the foot - below CG
	Take -off	G trail leg drive G lead leg knee up G hip forward	-take-off foot extension of the leg up to the hip - high knee, thigh horizontal - upward and forward - attacking the hurdle
	Flight Hurdle clearance	J lead leg foot down I trail leg knee up	- Lead leg fast relaxed. actively upward and forward - In a straight line to the hurdle - Trail leg foot and knee are turned outward bent at the knee and ankle

			<p>(almost right-angled) - front arm is moved around the trail leg In bent position</p>
	<p>Landing</p>	<p>L. Lead leg under body LM Trail leg high up forward M Ready to run again</p>	<ul style="list-style-type: none"> - be tall with CG high - landing on the ball of the foot - high knee lead (upward and forward)- no forward swinging - optimally 0.9 to 1m behind hurdle - fast transition to sprinting
	<p>Sprint between Hurdles</p>	<p>N Upright posture NO Be tall with O Drive hard O Work with arms</p>	<ul style="list-style-type: none"> - Efficient sprinting - active work on ground - high stride rate - powerful first stride and slightly shortened third stride
	<p>Run to the finish line</p>	<p>P. Stay relaxed P. Run to the finish Q. Run over the finish line</p>	<ul style="list-style-type: none"> - Keep on working - Keep rhythm - pronounced forward dip