

# Hansen Multisport

## Running Biomechanics

### Outcome of Proper Running Biomechanics:

- The athlete should first and foremost be able to run faster and more economical.
- To perform a greater amount of work more effectively and safely.
- To be able to recover from run training more rapidly.
- An increased ability to train sooner and more often.

### Six Fundamental Running Skills:

- Strength - the capacity to generate forceful muscle contractions.
- Power - the ability to generate those forceful muscle contractions quickly. By developing strength and power, runners can counteract the stresses on the body caused by the running stride and become better equipped to maintain fast paces, endure muscle fatigue, and avoid injury.
- Coordination - the skill of sequencing and timing muscle contractions for efficient movement.
- Mobility - the ability to move joints and muscles through a full range of motion, which is important for maximum extension, proper body alignment, and possibly injury prevention.
- Balance – the skill that leads to joint and posture stability.

Agility – the skill that enables one to change direction quickly. Balance and agility are especially important for cross country runners, as both skills come into play when athletes react to destabilizing movements and confront sharp turns and uneven terrain.

## Drills Training to Improve Running Biomechanics

### Running Drills - Why Drills?

To understand why drills are important lets go back to the crux of why we train so hard, quite simply put, it is to improve our performance i.e. to go faster, to get more speed. And in running there is a very simple formula for speed

Speed = Stride Length x Stride Frequency

From a biochemical perspective if you want to go faster you either have to increase your stride length and / or stride frequency, preferably both! There are some very simple drills which can help you improve both of these and when combined with your regular training program, can help you to run faster.

The information below outlines four drills outlined, two that will primarily help with improving stride frequency and two that will help with your stride length. They will also help you improve your basic technique.

Doing these drills will also make you think about the way you run, making you concentrate on your technique and breaking down some of the key elements of your stride. This in itself is a good thing even if the drills provide no other benefit.



## The Drills

### 1) High Knee Running / Quick Feet Drill

The aim of this drill is to increase leg turnover and improve your hip and knee flexion patterns bring your knee high but at the same time bring the heel into your glute.

Start off jogging slowly, when you hit the point where you want to start your drill, increase your stride rate 180 steps per minute and so that you take as many steps as possible over about 20 meters or so with a high knee action. You should be bringing your knee up, and the heel into your glut while maintaining a nice upright posture. The aim is not to drive the knee and lower leg out in front of you and to move forward quickly. Rather, maximize the height of the knee and foot and the number of steps that you take; remember this drill is about leg turnover not stride length. You should feel fatigue from this drill in the front of you hip flexors.



#### **Technique Tip:**

A good way to figure out how high your legs should be coming up is to do this drill a couple of times with your elbows at your side and your forearms at 90 degrees to your body, palms facing down. Your knees should come up and hit the palm of your hands. **This drill can also be done leaning into a wall for control.**

Variation: perform this drill running in place with a partner holding a thick there band around your waist. You try to drive forward just slightly while your partner provides resistance with the thereband, not allowing forward movement.



### 2) Butt Kickers

Butt Kickers have a very similar objective to the high knee running drill, to increase leg turnover. This drill however emphasis the hamstrings and the recovery stage of your stride. The hamstrings are often overlooked by triathletes who have strong thighs from cycling so this one is good for getting a bit if balance back.

Once again begin by jogging slowly towards the spot where you want to start your drill and increase you stride rate, concentrating on getting you feet moving as quickly as you can and getting your lower leg to swing up behind you. Your heel should literally be hitting your butt. Continue on for about 20 meters.

You will feel the fatigue in your hamstrings so jog out of each repetition. Stretch gently if things are feeling a bit tight.

#### **Technique Tip:**

With this drill, your upper leg should remain reasonably still and you should be aiming to bring your leg up to your butt, not the other way around. This is important, otherwise you will sag and not be able to maintain good upright body position.

### 3) High Skips

A form exercise that develops powerful push-offs and greater knee lift; trains the body to use the elastic energy stored in the muscles and tendons; and develops strength, power, and endurance of the quads, hamstrings, and glutes



#### Instructions:

- Jump powerfully off one leg, while lifting the opposite thigh to a position parallel to the ground.
- Drive the arms up powerfully in opposition to the legs.
- Alternating arms and legs, continue the exaggerated skipping motion down a straightaway.

#### Technique Tips

- Straighten the ankle, knee, and hip joints of the driving leg quickly as the foot pushes off the ground to get maximum height.
- After take-off, bring the lead foot directly up under the butt.
- Bring the thigh parallel to the ground at maximum height.
- Flex the raised foot toward the shins so the foot is parallel to the ground at maximum height.
- Land on the balls of the feet.
- Drive the arms straight up without twisting motions and don't let the torso twist during the skips.
- Keep the back straight, head up, and eyes forward.
- Balance power and control. If the body is twisting out of alignment with the force of the skip, jump with less power and more control.
- Focus on skipping as high as possible, not reaching the finish line as quickly as possible.

#### Training Specifics:

Duration / Reps:

- Beginners: 3-5 repetitions over 15-30 meters
- Advanced Runners: 5 repetitions over 50 meters

### 4) Straight Leg

This is a strange looking drill but very effective to develop a mid foot strike. The goal with this drill is to develop the timing and responsiveness of your foot striking the ground. The straight-leg bound drill also increases your ability to generate power from the hips, hamstrings and glutes. The motion emphasized in this drill will help improve explosive power during the running stride.



Going from a walk in a nice upright position extend your leg out in front of you keep the knee straight and then snap your leg down to contact the ground in a powerful fashion. As your foot contacts the ground, drive your leg up again always keeping the knee straight and repeat. The goal is to minimize the amount of time the forefoot stays in contact with the ground. Complete 30 meters each repetition concentrating on your form. Complete 3-6 reps of 30 meters. Start with 3 reps and 1 rep each week peaking at 6. See video of the drill: <https://www.youtube.com/watch?v=08IfQnN9JiE>

#### Technique Tips:

- Stay on the balls of the feet.
- Push off the ground rapidly and powerfully to move with a quick springy leg action.
- Keep the legs straight and move them only in front of, not behind, the body.

- Keep the elbows bent at about 90 degrees and swing the arms in opposition to the legs without crossing the midline of the body.
- Swing the arms from the shoulders, not the elbows.

### Training Specifics:

Complete these drills once a week when you are fresh (preferably during a run interval or speed session) and at the beginning of your session

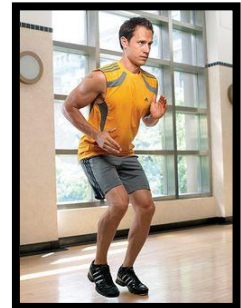
Start off doing two repeats of each drill per session and work your way up to doing four repeats of each drill over a slightly longer distance. Remember that if you feel your form is going, shorten the repeat and jog back, recover and start again with good form. You only want to practice good technique.

### 5) Foot Fire

A form exercise that promotes running on the balls of the feet and quick turnover

#### Instructions:

Tell your runners to imagine they are standing on a hot stove. To avoid burning themselves, they'll have to lift and lower their feet very quickly. Control the stove's temperature and your runners' turnover rates by calling out "hotter" or "colder." When you call "Foot Fire!" your runners should move as fast as possible, staying at top speed until you cool the temperature and eventually "put the fire out."



#### Technique Tips:

- Keep the feet about hip width apart with the knees and toes facing forward.
- Stay on the balls of the feet and land softly and quietly.
- Lift the feet straight up and down with no backward kicking motion.
- Don't lift the feet too high, but make sure they come off the ground rather than just shift weight from one foot to the other.
- Maintain upright posture with the head up; avoid squatting or leaning far forward.
- Swing the arms and in sync with the opposite leg; otherwise, just use the arms for balance.
- Breathe and keep the non-active muscles, such as those in the neck and face, relaxed.

### Training Specifics:

Duration / Reps:

Do the exercise 3-4 times with 1-2 minutes of rest between rounds. One round should last 3-4 minutes. Call "Foot Fire" 3-5 times per round. Each "Foot Fire" interval should last 15-25 seconds.



### Advanced Drill - Bounding

Bounding is the more difficult of the drills but also the most fun and beneficial. Bounding will help you to develop your leg power and strength, therefore increasing your stride length.

Again beginning from a slow jog bound forward and upwards with a high knee lift. Land on your other leg and repeat the movement. Continue alternating legs. Concentrate on holding good form, keep your head up and drive with your arms, as this will help you keep the whole

movement together. Repeat for 8 to 10 steps on each leg. Jog out of each repetition. As this is a very ballistic movement heavier runners and people who have not done this drill before should take things easy and not try to drive too far or too high with each stride. If you find it hard or your form deteriorates you are better off to do a smaller number of bounds on each leg, rest, and then repeat.

**Technique Tip:**

Try to make sure that you land straight and with your legs in line with your body, this will keep you balanced and ready to power off on your next bound. Once you get really good you can try bounding further with each step or bounding up inclines.

**Misc Dynamic Warm up Drills:**

- Forward and Back arm swings while walking, running or skipping
- Forward and Backward arm swings with both arms together while walking, running or skipping
- Heel and high toe walks

**Corrective Drills Part 2:**

The following is a list of additional drills that help to naturally develop good form. A minimum of a single weekly session of formal drills is suggested. A partial session should be added as part of the warm-up for each quality run workout session.

All of the exercises should be performed with plenty of recovery between each.

- Harness Work - build from 3x7-15 seconds to 2-3 sets of 4x30 seconds
- Tire (sled) Work - build from 4x30-50 meters to 2-3 sets of 4x100 meters
- Harness Releases - build from 4 (with a 20-30 meters run out) to 10
- Uphill Repeats – moderate gradient, 50-60 meters, 3-9 reps. High knees, big arm drive and slight forward lean
- Dumbbell Work - (use 1-4 pound weights) 12-30 swings per set:
- Running Arm Swings - broad base (wide stance), then narrow base (one foot behind the other), majority of the weight on the front foot. 12-30 swings per set:
- Brick and Feathers – run heavy, plodding, slumped then switch to running tall, upright, midfoot strike. Alternate 20-40 meters between the two forms for 2-3 minutes.
- Skip Drills - 20-30 meters, 2-3 sets each
  - Regular soft, quick steps skips
  - High knee, rapid foot down skips (thigh parallel)
  - Butt Skips (draw heel straight up to glutes)
  - Backward Skips
  - Skip for Height
  - Side Skips
- Half High Knee (must be correctly executed - a driving motion to load and bounce the leg, not a lifting of the knees)

**Forms Cues:** The following images may prove helpful when addressing form anomalies.

- Canted Tube - In order to help feel the forward lean, the athletes imagine being in a tube that is leaning slightly forward.



- Laser Pointer - The athletes imagine a laser pointer on the temples of their sunglasses pointing to a spot some 35 feet ahead of them on the ground, and they are looking at those spots and running along like a donkey following a carrot.
- Pounding Drums - drop the arms to the side so that the forearms brush, or almost brush the sides of the chest. Pretend there are drums on your hips with the drum face pointing forward. As you run focus on the pinky slapping the drum face on each arm swing.
- Pushing - This drill refers to the sense an athlete gets when pushing the leg towards the surface to apply the foot, rather than thinking 'lift the knee', a highly counterproductive move.
- Running On Thin Ice - The athletes run lightly and do not hammer the surface or rely on the cushioning from their shoes, but rather applying their foot to the ground like loading a spring.
- Run Quiet- A sign of effective running is often the softness of the athlete's foot fall, indicating correct loading and timing.
- Roll - The athletes feel like their legs are cycling beneath them like a wheel, rather than a lifting and falling motion.
- Straw – imagine holding a straw between your finger tips as your arms are bent at 90 degrees and handouts out in front of you. This is the closest the hands should come to the center of the body. This prevents excessive upper body rotation and avoid the dreaded torso disconnect (the upper body working against the pelvis rather than with it).

### **Sample workout**

See below for specific guidance with regards to putting to use the information about run drills and strengthening exercises, I provided you. I recommend doing the following sample moderate easy runs 2 x week that incorporate the appropriate drills:

- Run 1/2 mile as a warm up
- Do 4 x 75 yard strides - start at 70% effort finish the last 20 yards at 90% effort. Focus on good form at the faster speeds.
- 4 x 50 yards of high knee skip (25 skip - 25 run). Focus on high knee drive and opening the angle between the forward and trail leg.
- Run usual distance and effort