



1. Training Sessions

1.1 Warm up

- Both from a physiological and training perspective it is crucial to warm up prior to training and matches as sports science research has demonstrated that a warm up enhances subsequent exercise performance. There are a number of different physiological reasons as to why this is and these revolve around an increase in muscle (and core) temperature and also an increase in blood flow, and in turn oxygen delivery, to the exercising muscles. Research has indeed consistently demonstrated that warm muscles perform better than cold muscles. This is relevant from both a performance enhancement and injury perspective.

- There should be 4 distinct phases to any warm up:

Phase 1: Cardiovascular warm up; this should ideally consist of 5-10 jogging, gradually building heart rate up to 85%HR_{max}

Phase 2: Dynamic mobility exercises performed over ideally a 16 m course, i.e., from the goal line to the penalty box. Exercises to include are:

- high knees ('skipping')
- heel raises ('biling')
- backwards jogging
- arms turning around together while hopping

- sideways shuffles
- grapevine or crossover shuffles ('lambada')
- tripling ('running forward while making a figure '8' with both feet')
- repeated fast skippings ('fast feet')

3-4 x for each exercise, jogging slowly back to the goal line in between

Phase 3: High speed activities to finish off, i.e., a series of 8-10 progressive accelerations followed by 4-6 short, sharp sprints

Phase 4: Individual dynamic stretching routines

As applied since the knock-out phase of the 2011-12 Champion's and Europa League, and the EURO 2012 Championship, there is now also a dedicated area for the match warm-up of the officials. A detailed description is posted both on FAME and on Topsportslab.

1.2. Low-intensity training (Low Int./LI)

- Low intensity running for the purpose of improving aerobic capacity and recovery; an easy to comfortable run (\pm 12 km/hr or 50-70% HR_{max}).

1.3. Medium-intensity training (Medium Int./MI)

- Medium intensity running for the purpose of improving aerobic capacity. The running pace is slower than it is for high intensity training, i.e., uncomfortable to stressful run, (\pm 15 km/hr or 76-85% HR_{max})



1.4. High-intensity training (High Int./HI)

For training sessions that consist of HI running, the following tips should be considered:

- The selected running pace should be $\frac{3}{4}$ pace or a 'tempo run' (± 18 km/hr or 86-93% HR_{max}). Therefore, the exercise intensity is close to maximal levels and the perceived exertion should be hard to very hard.
- If the running speed is too high, then the lactate producing energy system may also be highly stimulated for some periods of time so that the training overlaps to a given extent with the more anaerobic speed endurance training.
- Therefore, the referee fitness coach or the referees themselves should ensure that the exercise intensity during high-intensity training does not become so high that the training becomes exclusively anaerobic training. For example, if the intensity is too high, the referees will not be able to sustain a high enough work rate during subsequent work periods and the desired effect of this type of training will be lost. So it is a good idea to check regularly the target zone on your heart rate watch.
- For the same reason, it is essential that the recovery periods are determined according to the different fitness levels. Specifically, for the best runners, a recovery period can be used that is $\frac{1}{3}$ of the actual running time. For the intermediate fitness levels, the recovery period should still be less than the running time. Finally, for those referees whose fitness is not that outstanding, the recovery period should be as great or even greater than the running time.
- Finally, it is also important to perform all runs on a forgiving surface such as grass in order to help reduce the risk of injury that can occur from running on too hard a surface on a regular basis. Therefore, the interval HI exercises should ideally be carried out on a regular field, i.e., around the perimeter or along the diagonal line between the two penalty boxes (as indicated below). Alternatively, referees who don't have the opportunity to practice on a football field, can also do it in the forest, on an athletic track, or using a treadmill in a gymnasium.

1.5. Speed endurance training (Speed End./SE)

- Speed endurance training is basically interval running at high to maximal speeds, with incomplete recovery in between running bouts. The work:rest ratio should ideally be 1:3 for maintenance training and 1:10 for speed endurance production training, thus inducing cumulative fatigue as session progresses as there is not enough time for the body to recover completely. Therefore, this method of training improves the ability to tolerate fatigue during repeated bouts of maximal or near maximal sprinting.
- For speed endurance training sessions, it is difficult to express the running speed in terms of % HR_{max} . Therefore, the running speed is expressed as a percentage of the maximal speed (% SP_{max}); normally 100% of maximal speed for speed endurance production training, and >95% of maximal speed for speed endurance production training.

1.6. Speed training (Speed/SP)

- Speed training sessions involve sprints, i.e., runs performed at top speed (100% SP_{max}), followed by a full recovery. For training sessions that consist of maximal sprints, the following tips should be considered:



- To keep the sprints match specific they should ideally be preceded with a dynamic / moving start e.g. walking, jogging, backwards or sideways jogging.
- Perform each sprint maximally to gain the full training benefit from the work:rest ratio of 1:10 in between sprint repetitions as this work should be quality and non-fatiguing. Your HR should be back to 60-65% HR_{max} prior to each individual sprint. A very slow walk back to the start is usually a good way of determining your recovery time in between sprints.
- Ideally sprints should be initiated upon a visual signal as they are in a game. This signal can be given by the coach 1) who bounces a ball on the ground, or 2) who drops his whistle. Alternatively, it is also possible that referees work in pairs, changing who leads off in the sprints.
- It is important to decelerate smoothly after completing each sprint.
- There are also extended speed training sessions included within this training manual (Ext. Speed). On these sessions the work:rest ratio falls between that of conventional speed and speed endurance training sessions, i.e., 1:7. Thus the demands of these sessions are greater than normal speed sessions due to shorter recovery periods and also longer distance of sprints.

1.7. Agility training (Agility/AG)

- Agility training involves short sharp sprints, again of maximal effort. However, changes of direction are incorporated into the exercises. Thus training the ability to accelerate, decelerate, change direction and then accelerate away again.
- Practising other ball or team sports on a recreational basis (such as playing badminton, football, squash, tennis) may also result in an improved fitness level.

1.8. Repeated Sprint Ability (RSA)

- RSA training is important to maintain / develop your repeated sprint performance. Your goal is to perform multiple sprints at near-maximum speed with incomplete recovery.

1.9. Strength training (Strength/STR)

- Strength training is the use of weights or resistance exercises to build power and strength. This will be illustrated in a separate document that illustrates the main strength and injury prevention exercises.

1.10. Active Recovery training (Act. Rec./AR)

- Active recovery training is an important component of any training schedule and these sessions are scheduled the day after a match or intensive training sessions. In fact, compared with complete rest, low intensity recovery training facilitates the body to recover even faster and to a greater extent due to an increase in blood flow through the exercising muscles.



Example:

- 50' recovery session in a fitness centre, including
 - Part I: 10' warm up (walking & jogging on a treadmill between 6 & 13 km/hr, followed by mobilisation exercises)
 - Part II: 30' non-weight bearing exercises (70% HR_{max}), such as:
 - 10-12' cycling (80-90 cycles/min)
 - 8-12' rowing (25-30 cycles/min)
 - 10-12' gliding / stepping (60-70 cycles/min)
 - Part III: 10' extensive stretching, ideally followed by sauna, jacuzzi, massage

1.11. Rest

- So often, it is simply forgotten that rest is also an important training mode; improvements in fitness only occur during rest periods. Especially on non-training days, it is important for referees to try avoid doing excessive physical work and incorporate quality rest in their daily-life schedule.

1.12. Match play (Match)

- If referees have a group training session, then at the end of the training a 10' football match can be played. To avoid physical contact and to help prevent injury, it is recommended that the ball can only be touched twice ('control & pass'). If the game is not played fast enough, another restriction can be implemented, i.e. a goal can only be scored if all referees are over the midline. This discrete modification will speed up the game quite a bit!

1.13. Cool down

- The immediate cool down period following a match or a training session should follow immediately upon the termination of exercise. It provides an opportunity to return the body to its pre-exercise state. This is as critical for long term fitness as the warm up. Specifically, the physiological justification behind the cool down after physical activity is:
 - It makes it possible to attain a 'physiological balance' more quickly.
 - It slowly lowers heart rate, thus preventing any rapid and erratic changes.
 - It helps to reduce the levels of excess hormones generated during refereeing.
 - The muscle pump is continued during a cool down, aiding circulation, preventing dizziness and helping the removal of waste products.
 - It gradually lowers body and muscle temperature without overloading the cooling system.

Besides these points that serve to boost the rate of muscle recovery after matches and training sessions, the cool down may also be regarded as an opportunity to work upon an often neglected area of physical fitness, i.e. flexibility. Depending on the weather conditions, the stretching part can also be done inside.

Example:

- Part I: Cardiovascular cool down (5')
- Part II: Static stretching (15')

Do not underestimate the importance of stretching. Hold each stretch for 25-30", repeating each stretch 2-3 x per muscle group.



1.13. Running surfaces

- It is recommended that all running activities are performed on a forgiving surface such as grass to help reduce the risk of injury that can occur from running on too hard a surface on a regular basis.
- Therefore, the interval HI exercises should ideally be carried out on a regular field, i.e., along the diagonal line between the two penalty boxes.
- Alternatively, referees who don't have the opportunity to practice on a football field, can also perform the runs in the forest, on an athletic track, or using a treadmill in a gymnasium using a running speed that elicits the prescribed HR response, i.e., 85-90%HR_{max}.
- Most of the speed and speed endurance exercises are prescribed on a field of play. Given the relatively slow acceleration of treadmills and the safety concerns of running at very high speed (>20kph) on a treadmill it is recommended that all speed endurance and speed training sessions are performed on a field of play.

2. Heart rate control

2.1. Training zones

- During exercise, the frequency (beats per minute) at which the heart beats (heart rate, HR) increases in order to supply an increased amount of oxygen to the exercising muscles. The harder the body exercises, then the faster the heart beats.
- For the purpose of this e-learning platform, the prescription of training intensity will be based upon percentages of the maximal heart rate (% HR_{max}). However, for those who do not possess a heart rate monitor, the following subjective exercise intensity classifications can easily be used:

	Max. Eff.	High Int.	Med Int.	Act. Rec. Low Int.	Pas. Rec.
%HR_{max}	> 95%	90%	80%	70%	< 60%
Training zone	> 93%	86-93%	76-85%	60-75%	< 60%
Speed (km/h)	< 24.1	15.1-24	12.1-15	9-12	< 9
Perceived exertion	Maximal	Hard to very hard	Uncomfortable to stressful	Easy to comfortable	Very easy
Rate of Perceived Exertion (RPE)	7-8-9	5-6-7	3-4	2-3	0-1

2.2. Start of the training session

- As a rule, start each training session in the lower range of the selected heart rate zone, and increase heart rate towards the upper limit at the end of the session.



2.3. Illness or over-training

- Heart rate can be a sensitive indicator of illness or over-training. As soon as you perceive that your training is becoming harder than what your HR is actually reading, please contact your coach for advice.
- Alternatively, a sudden but consistent decrease or increase of your heart rate at rest (to be measured in the morning before getting-up) is an alarming signal for illness or over-training.
- In case any of these symptoms would occur please contact your coach for advice.

2.4. Stress

- Heart rate is increased by psychological stress or anxiety. Thus, your heart rates may be significantly greater during competition than during training.

2.5. External temperature

- Heart rate is affected by external temperature. As your heart rate training zones are only valid for training at external temperatures between 15 and 25°C, they should be adapted for training in more extreme environmental temperatures.
- When training below 15°C, the heart rate limits are to be reduced by 1bpm per degree Celsius below 15°C. Thus, a high intensity zone of 170 becomes 160 when training at 5°C.
- Conversely, at high environmental temperatures, heart rate increases particularly if the high temperatures are accompanied by dehydration due to sweating. The sensitivity of this heart rate 'drift' differs significantly amongst individuals. Therefore, when training at high temperature, increase your heart rate limits according to your 'perception' of training intensity.
- In addition, adequate fluid replenishment during training is then essential to avoid excessive increases of heart rate and thereby impairment of training quality.

3. Training planning

3.1. Supercompensation

- To induce the positive effects of training known as 'supercompensation', it is necessary that each training programme contains training sessions with a sufficient degree of variation, which are alternated with sufficient periods of rest. That is the reason why the enclosed training manual consists of training cycles of 6 weeks, during which the training load (both volume and intensity) is manipulated on a weekly basis.
- Each cycle starts with a priming week with moderate training volume and intensity. In week 5, there is a 'crash'-week, with very high training volume and intensity. Finally, there is a recovery week in which training intensity and volume are low.
- For the 2015-16 season, the competitive season is composed of the following macro-cycles:



Macrocycle I: Monday 8th of June – Sunday 19th of July
Macrocycle II: Monday 20th of July – Sunday 30th of August
Macrocycle III: Monday 31st of September – Sunday 11th of October
Macrocycle IV: Monday 12th of October – Sunday 22nd of November
Macrocycle V: Monday 23th of November – Sunday 3rd of January
Macrocycle VI: Monday 4th of January – Sunday 14th of February
Macrocycle VII: Monday 15th of February – Sunday 27th of March
Macrocycle VIII: Monday 28th of March – Sunday 8th of May
Macrocycle IX: Monday 9th of May – Sunday 22nd of May

3.2. Perception of training intensity

- To monitor the training planning, ratings of perceived exertion (RPE) have been widely used to assess exercise intensity and when the scale is used correctly, it is a very accurate method for monitoring exercise intensity. Furthermore, the RPE technique is consistent with objective physiological indices of exercise training such as heart rate measurements. The original RPE scale was a 20-point scale.

0	Rest
1	
2	Very, Very Easy
2.5	
4	Easy
4.5	
6	Comfortable
6.5	
8	Moderate
8.5	
10	Somewhat Hard
10.5	
12	Hard
12.5	
14	Very Hard
14.5	
16	Very, Very Hard
16.5	
18	Almost Maximal
18.5	
20	Maximal

- It is important to underline that any training programme may never eliminate the perception of training intensity. The individual perception of a given training load is indeed important. As a consequence, if signs of fatigue appear, the training programme must individually be modified. This should be done following a consultation with your fitness coach.

- In particular, high-intensity training is not to be performed in case where a referee perceives signals of abnormal fatigue.





Performance Training in Football Refereeing Training Advice


- Fatigue can be perceived as the result of a lack of training. In some particular cases this perception may be right indeed, yet in most referees the opposite is true. Some rest days or low intensity recovery training sessions often have a much better impact on fitness and performance level than an increased training load. Therefore, in cases when you feel you are unable to adapt to a prescribed training programme due to fatigue, please contact your referee fitness coach. If you don't do this, the training programme may be detrimental to your performance.

- As from the 2015-16 season on, we will monitor the well being of the referees during tournaments using the questionnaire that has been developed by McLean, Coutts, & Cormack in 2010.

	5	4	3	2	1	Record Score
FATIGUE	Very fresh	Fresh	Normal	More tired than normal	Always tired	
SLEEP QUALITY	Very restful	Good	Difficulty falling asleep	Restless sleep	Insomnia	
GENERAL MUSCLE SORENESS	Feeling great	Feeling good	Normal	Increase in soreness/tightness	Very sore	
STRESS LEVELS	Very relaxed	Relaxed	Normal	Feeling stressed	Highly stressed	
MOOD	Very positive mood	A generally good mood	Less interested in others &/or activities than usual	Snappiness at team-mates, family and co-workers	Highly annoyed/irritable/down	

 Total Score <14 or a '1' recorded at any component is considered 'high risk'

 Total Score 14-17 or a '2' recorded at any component is considered 'above normal risk'

 Total Score >17 is considered 'normal state'

3.3. Training history

- In relation to the training history (number of training sessions per week referees were used to), it is important to first increase the number of training sessions per week, and then the intensity and duration of training sessions.

3.4. Mid-week games

- For those referees who have a mid-week game, it is very important:

- 1) to do a recovery training the day after you refereed, and
- 2) to do a training session the day before the game including a good warm up, mobilisation exercises, stretching and speed exercises (as typically are planned at the end of the week).

This training session should ideally be done on a regular field of play. If this is not possible for any reason such as an international game, then it is advisable to plan this training two days before the game in the home country.



3.5. Training activities during the break in between seasons

- Cardio-respiratory endurance is best trained by specific endurance training, but it may also be challenged by non-specific endurance training, i.e., cross training. Specifically, this type of training refers to other endurance exercise modes and sports than just running. Non-specific endurance training is often neglected as a method to develop the fitness level of referees.
- In particular in between two competitive seasons, referees should be allowed to participate in other endurance exercise modes such as cross-country skiing, cycling, in-line skating, orienteering and swimming in order to fully develop the aerobic fitness level and to provide a break from running.
- In fact, because of the involvement of greater muscle mass, exercises like mountain biking, cross-country skiing or rowing are more effective to increase the maximal oxygen uptake than just running. Of course, it is well known that the genetic component of maximal oxygen uptake still is predominant. However, the impact of training may not be neglected. On the other hand, these kind of activities not only serve to better develop the fitness level of referees but, even more important, to mentally distract the referee from his 'addiction' to running and refereeing.

3.6. Nutrition and fluid intake

- Referees have to pay particular attention to adequate nutrition and fluid intake, not only during competition, but also during training periods and during actual training sessions.

A detailed powerpoint presentation on functional nutrition and fluid intake is posted both on FAME and Topsportslab.