



## **Acclimatization to Fire Ground Training Weather Environments**

Fire Service Candidates (those on a Fire Department hiring list) need to seriously prepare and acclimatize themselves with the fire ground training weather environments found during those seasons. Fall Recruit Firefighter Programs typically begin in the late summer when heat and humidity can cause the heat index to reach extreme conditions. Spring Recruit Firefighter Programs typically begin mid-February when exposure to the cold and wind chill challenge firefighters abilities to stay warm and dry.

Why is this important?

### **Firefighter Work Capacity**

It has been said that firefighters expend as much energy during a major emergency as the players in a football game, if not more. This assertion is supported by many studies that demonstrate the need for and benefits of high levels of physical fitness in the fire service. This why we are often referred to as occupational athletes.

The sedentary hours firefighters may spend in the fire station may be as hazardous for them as fighting a fire. A major reason for firefighters high risk of heart attacks may be that they get little or no exercise while on-duty or neglect to perform while at home. The sudden, intense energy demand that is needed to fight a fire is what puts the firefighter who is not in good physical condition in grave danger. A firefighter's lack of physical fitness can be viewed as a matter of public safety as well as one's individual health.

A firefighter is just like an athlete-being they must be properly equipped, skilled at what they do, and fit for the demands of their jobs. Optimal fitness is a combination of lifestyle, nutrition and habits, but it cannot be reached without an appropriate level of physical fitness.

Recruits are expected to participate at their highest possible level in order to develop and demonstrate continuous improvement to the level of physical fitness, dexterity, flexibility and strength required for Firefighting Work Capacity related activities.

Acclimatization to weather conditions is an intricate component to physical readiness as that the ability to perform firefighter duties is required in all weather conditions.

### **Warm Weather Acclimatization**

Acclimatization is the beneficial physiological adaptations that occur during repeated exposure to a hot environment. These physiological adaptations include:

- Increased sweating efficiency (earlier onset of sweating, greater sweat production, and reduced electrolyte loss in sweat).
- Stabilization of the circulation.
- The ability to perform firefighter skills with lower core temperature and heart rate.
- Increased skin blood flow at a given core temperature.

Disadvantages of Not Acclimatizing to the heat include:

- Readily show signs of heat stress when exposed to hot environments.
- Difficulty replacing all of the water lost in sweat.
- Failure to replace the water lost will slow or prevent acclimatization.
- Difficulty of performing or completing required firefighter skills.

Candidates who generally work outside or who are exposed to heat during the day should gradually perform their physical fitness conditioning and increase their exposure time in hot environmental conditions over a 7-14 day period.



Candidates that do not generally work or are exposed to heat during the day will need more time to acclimatize than candidates who have already had some exposure.

#### Acclimatization schedule

- For candidates who have NO experience working out or performing physical conditioning in the heat, the schedule should be no more than a 20% exposure on day 1 and an increase of no more than 20% on each additional day.
- For candidates who have had previous experience with working out or performing physical conditioning in the heat, the acclimatization regimen should be no more than a 50% exposure on day 1, 60% on day 2, 80% on day 3, and 100% on day 4.

In addition, the level of acclimatization each candidate reaches is relative to the initial level of physical fitness and the total heat stress experienced by the individual.

### **Maintaining Warm Weather Acclimatization**

Candidates can maintain their acclimatization even if they are away from conditioning for a few days, such as weekends. However, if candidates are absent for a week or more then there may be a significant loss in the beneficial adaptations leading to acute dehydration, fatigue, and an increased likelihood of heat-related illness and a need to gradually re-acclimate to the hot environment prior to conducting firefighter training.

Additional information on maintaining acclimatization:

- It can often be regained in 2 to 3 days upon returning to a hot environment for conditioning.
- It appears to be better maintained by those who are physically fit.
- Seasonal shifts in temperatures may result in difficulties.
- Conditioning in hot, humid environments provides adaptive benefits which also apply in hot, desert environments, and vice versa.
- Air conditioning will not affect acclimatization.

### **Warm Weather Acclimatization Safety**

#### Avoid Heat Stress

When the body has difficulty in naturally cooling itself down, it begins to affect the nervous system and internal organs, sometimes in resulting in seizures, irrational behavior, confused consciousness and mental or emotional instability. Heat stress often presents with a combination of the following symptoms:

- *Dehydration*
- *Disorientation*
- *Loss of skin color*
- *Hot skin that is either wet with sweat or dry from lack of being able to sweat*
- *Elevated pulse*
- *Upset stomach, potentially accompanied with vomiting or diarrhea*
- *Muscle cramps*
- *Heavy breathing*

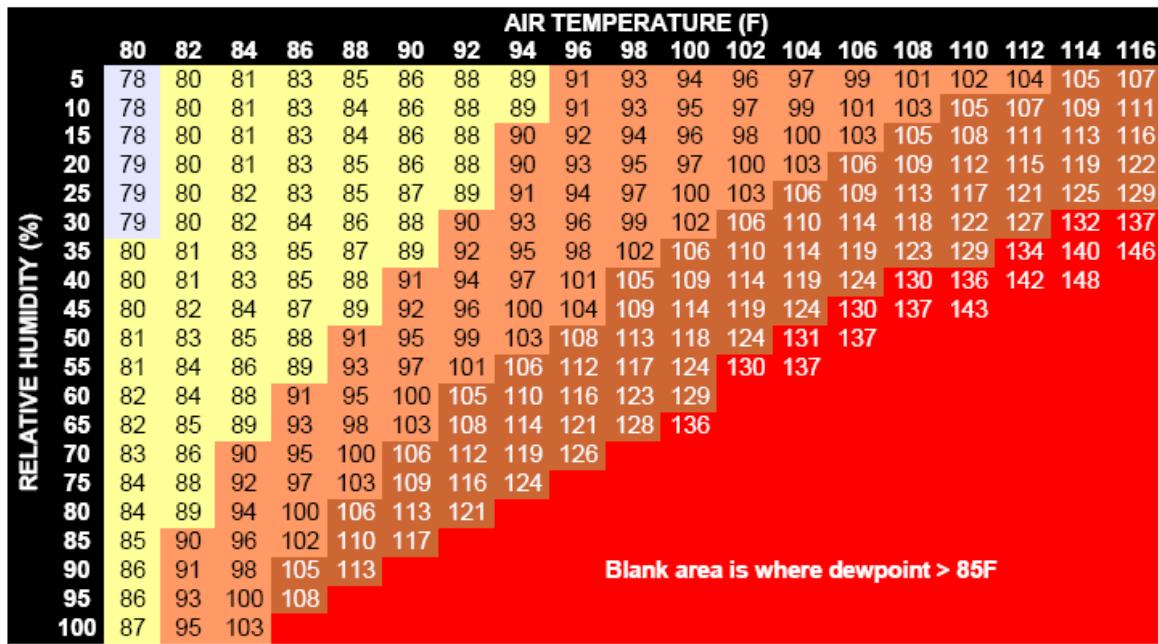


Consider the Conditioning / Mitigation Chart and the Heat Index to adjust conditioning to meet safe rest and hydration mitigation

**Conditioning / Mitigation Chart**

Heat Index	Health Risk	Moderate Conditioning / Mitigation		Strenuous Conditioning / Mitigation	
		Recommended Rest per Hour	Recommended Water or Electrolyte Intake per Hour	Recommended Rest per Hour	Recommended Water or Electrolyte Intake per Hour
Warm ≤ 79° F	Minimal Risk	5 Min.	½ Quart	15 Min.	¾ Quart
Very Warm 80° - 89° F	Low Risk	10 Min.	¾ Quart	20 Min.	¾ Quart
Hot 90° - 104° F	Moderate Risk	10 Min.	¾ Quart	20 Min.	1 Quart
Very Hot 105° - 129° F	High Risk	10 Min.	1 Quart	20 Min.	1 Quart
Extremely Hot ≥ 130° F	Extreme Risk	10 Min.	1 Quart	30 Min.	1 Quart

**Heat Index Chart**



**Safety Tips for Acclimating in the Heat**

- Consult with your Primary Medical Physician before conducting any Heat Acclimatization Conditioning if you are at risk or have a past medical history that can put you at risk.
- Properly hydrate before, during, and after each session and throughout the day.
- Alternate hydration between water and a sport/electrolyte replacement drink.
- Wear breathable clothing, clothing should be allowed to expel heat and sweat.
- Have cooling methods available during conditioning (cooler of ice and/or ice towels)
- DO NOT participate in more than one conditioning session per day for the first five days.
- DO NOT exceed more than 1 hour per initial sessions and gradually increase intensity over the course of a few weeks. DO NOT exceed more than 3 hours of conditioning per day.
- Allow time for warm-up and cool-down.
- Take breaks frequently to avoid your body from overheating.
- Avoid conditioning while sick.
- Get plenty of sleep while conditioning.



## **Cold Weather Acclimatization**

Cold weather is not usually a barrier to any conditioning activity, but training in the late fall and winter can expose the candidate at risk for cold injury. Environmental changes as simple as sunset, a rainstorm or an increase in wind speed can shift the body's thermal balance suddenly. As part or all of the body cools, there can be diminished exercise performance, frostbite and hypothermia.

## **Physiological Response to Cold**

Cold exposure produces peripheral vasoconstriction, decreasing peripheral blood flow, and decreasing convective heat loss from the body's core to its shell. Cold exposure also elicits increased heat production through skeletal muscle activity. This occurs through involuntary shivering (which can increase heat production six-fold) and through voluntary increased activity.

Candidates exposed to cold repeatedly can exhibit cold acclimatization, but this may take several weeks of moderate exposure. Compared to heat acclimatization, cold acclimatization is less pronounced, slower to develop and less effective in defending normal body temperature and preventing thermal injury.

## **Cold Injury**

Frostbite occurs when tissue freezes. Frostbite can be in exposed skin, e.g. nose, ears, cheeks, but also occurs in hands and feet, because vasoconstriction lowers peripheral tissue temperature significantly. Numbness or a "wooden" feeling is usually the first symptom of frostbite in the hands and feet. With frostbite to exposed facial skin, however, there can be a burning feeling. Freezing of the tissue is often relatively painless. Re-warming is accompanied by sharp, aching pain and persistent loss of light touch sensation.

The risk of frostbite increases as temperature decreases. With appropriate precautions, the risk of frostbite can be less than five percent when ambient temperature is above 5 degrees F. But increased caution is appropriate when the wind chill falls below minus 18 degrees F, since exposed facial skin then freezes in 30 minutes or less. At these temperatures, consideration should be given to postponing or shortening conditioning.

Hypothermia is core temperature below 35C (95F). In mild hypothermia, a candidate feels cold, shivers, is apathetic and withdrawn, and demonstrates impaired athletic and mental performance. The symptoms can be confused with concussion, hypoglycemia or drug use. As core temperature continues to fall, there is confusion, sleepiness, slurred speech and irrational thinking and behavior. Severe hypothermia causes cardiac arrhythmia and arrest.

## **Risk factors for Frostbite and Hypothermia**

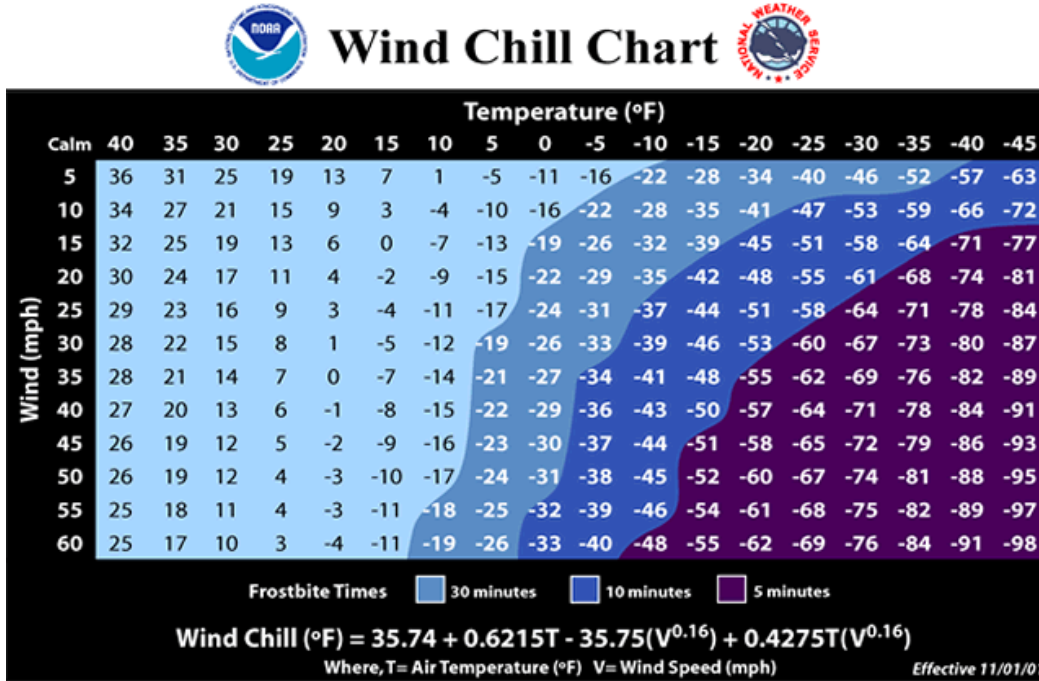
- Exercising in water, rain and wind. Evaporation from wet clothing in a cold environment increases heat loss four-fold.
- Lean athletes lack the insulation provided by fat and muscle mass and have more difficulty maintaining core temperature.
- Fatigue, energy depletion, sleep deprivation and many endocrine disorders produce hypoglycemia. Hypoglycemia impairs muscular activity and shivering, decreasing heat production.
- Physical fitness and strength training allow longer exercise at high intensity with prolonged heat production and maintenance of core temperature. Poor fitness thereby predisposes to cold injury.



**Preventing Cold Injuries**

Cold Weather Conditions

- Refer to the Nation Weather Service Wind Chill Chart to determine; the level of attainable conditioning, necessary clothing and if conditioning is safe to conduct.



Clothing

- Conditioning intensity and ambient temperature determine clothing (insulation) requirements during conditioning.
- Hats are useful, as up to 50 percent of heat loss at rest is from the head.
- Layering is dressing with an inner layer that wicks perspiration to the outer layers for evaporation, a middle insulating layer that allows moisture transfer, and an outer layer, worn when necessary, to repel wind and rain but capable of transfer of perspiration to the air. Layering allows adjustment in insulation to prevent overheating and sweating, while remaining dry in wet conditions.
- Glove liners provide wicking and insulation for the hands. Mittens provide significantly more insulation than gloves. Clothing that constricts fingers or toes predisposes to peripheral cold injury.
- Wet clothing should be removed quickly and replaced, including socks and gloves.

Food and Fluid Intake

- Exercise in cold environments increases energy expenditure and fluid loss. Insufficient carbohydrate reserves to maintain core temperature risks cold injury.
- Dehydration affects neither shivering nor vasoconstriction, but significant loss in circulating volume decreases perfusion.
- In cold as well as other temperatures, carbohydrate availability and dehydration are limiting factors in performance. Candidates can sustain exercise in cold by ingesting 6-12 percent carbohydrate beverages. Carbohydrate-rich foods are appropriate for prolonged exercise in the cold.

Cold-induced Bronchoconstriction

- Exercise-induced bronchoconstriction (EIB) or **Sports-Induced Asthma** is a transient narrowing of the airways that is provoked by exercise. Exposure to the cold is believed to increase EIB due to a combination of breathing dry air and reflex response to facial cooling. To prevent or reduce Cold Related EIB wear a winter face mask or Balaclava over your face and mouth while conditioning.



## Hydration

Water is the least expensive and most accessible fluid during conditioning. Sports drinks contain electrolytes, sugar, and water, which give candidates important nutrients during conditioning. While water is appropriate during all types of conditioning, sports drinks are recommended for use during intense conditioning that is greater than 60 minutes or during intense conditioning in the heat.

Candidates should hydrate:

### Before Conditioning

- Hydrate with 16-24 oz. of water or a sports drink

### During Conditioning

- Have unlimited access to water during conditioning/activity
- Be able to drink as much as you need
- Be able to drink for the entire break period if you wish
- Have access to sports drinks when conditioning is greater than 60 minutes or in conditioning is going to be intense and in the heat.

It is recommended that all conditioning sessions should have predetermined breaks approximately every 15 minutes. The timing and length of breaks should be dependent on the environmental conditions.

*Energy drinks contain a stimulant such as caffeine to give an energy boost and will contribute to dehydration. High levels of caffeine can lead to a number of symptoms, including palpitations, high blood pressure, nausea and vomiting.*

*Energy drinks (stimulant or caffeinated) are prohibited while training in a Recruit Firefighter Program. Candidates should reduce and limit tea or coffee consumption while conditioning.*

## Hydration Urine Color Chart

Urine color is usually only a symptom and not a health issue in and of itself.

The three main causes of abnormal urine color are:

1. Foods you have eaten
2. Drugs you have taken
3. Health issues

If you are concerned about a change in your normal urine color, stop and take a few notes to help determine if there is a serious issue. Ask yourself a few questions,

- **“My urine color is abnormal. How do I feel?”**
- **“What have I eaten recently that might affect my urine color? Have I been eating a food that I do not normally eat?”**
- **“What medications am I taking (prescription or over the counter)? Do I know the side effects of taking these drugs?”**
- **“Am I drinking enough water? Could I be dehydrated?”**



Remember, everyone is different. If you have any concerns about what could be causing your urine color to change, please see a medical professional immediately.