

# ***Infrared Guide***

Interesting facts about  
infrared radiation and  
infrared thermal cabins,  
including their use  
and mode of operation.

***saunalux<sup>®</sup>***

***Thermal Cabins  
Royal and Classic***

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# **1. Infrared radiation**

## **Discovery of infrared radiation**

In the year 1800, the English astronomer Sir William Herschel discovered the existence of infrared radiation energy as a heating effect in the long wave range above the spectrum of visible light. In this long wave range, light can no longer be perceived by the naked eye. Herschel decided to study the heating effect of the sun. He therefore let sunlight shine through a prism in order to visualise a colour spectrum. By moving a glass thermometer in this colour spectrum, he was then able to determine the heating effect for each colour, starting from the blue colour right up to the red colour. It then became clear that the heating effect increased in the course of an upward movement from blue to red. By coincidence, he discovered that the heating effect continued to increase beyond the red end of the visible spectrum. This led to the discovery of the infrared radiation range (formerly, ultrared) in the electromagnetic spectrum.

## **What is infrared radiation?**

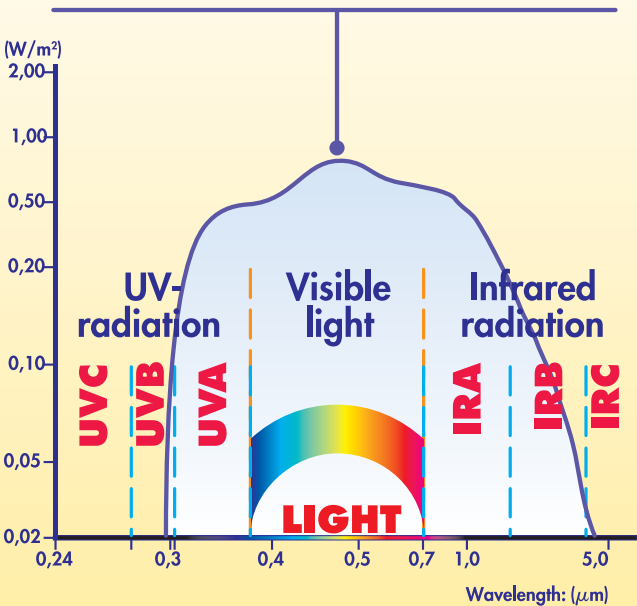
In the extension of the ultraviolet range (0.01 - 0.38  $\mu\text{m}$ ), visible light (0.38 - 0.78  $\mu\text{m}$ ) comes first and then the infrared spectrum (0.78 - 1000  $\mu\text{m}$ ) – see diagram (solar spectrum). In contrast to the first two types of radiation, infrared radiation possesses a greater wavelength. Infrared radiation therefore consists of electromagnetic waves with wavelengths ranging from 0.78 -1000  $\mu\text{m}$  that are emitted from the atoms. In the infrared range, rays impinge on the surfaces of objects, and the energy these rays contain is then released in the form of heat. Most of the infrared radiation is included in the non-visible range. The shorter the wavelength, the greater the energy of the radiation will be. This is why a clear distinction is made, in accordance with DIN 5031, between near infrared A (0.78 - 1.4  $\mu\text{m}$ ), intermediate infrared B (1.4 - 3.0  $\mu\text{m}$ ), and far infrared C (3.0 - 1000  $\mu\text{m}$ ).

This means that infrared A possesses the largest amount of energy and infrared C the smallest amount (see diagram 2).

The wavelength of the radiation says something about the type of radiation or about the form in which the energy is present. The radiation intensity, however, says something about the total amount of energy over a period of time (wattage). Basically, every object with a temperature above absolute zero ( $0\text{ °K} = -273\text{ °C}$ ) emits electromagnetic thermal radiation. Here the vibration of the atoms is proportional to the temperature of the object. The radiation intensity increases proportional to the vibration of the atoms in the object.

# Solar spectrum

40° solar altitude (Germany)



*Global radiation of the sun*  
according to Schulze

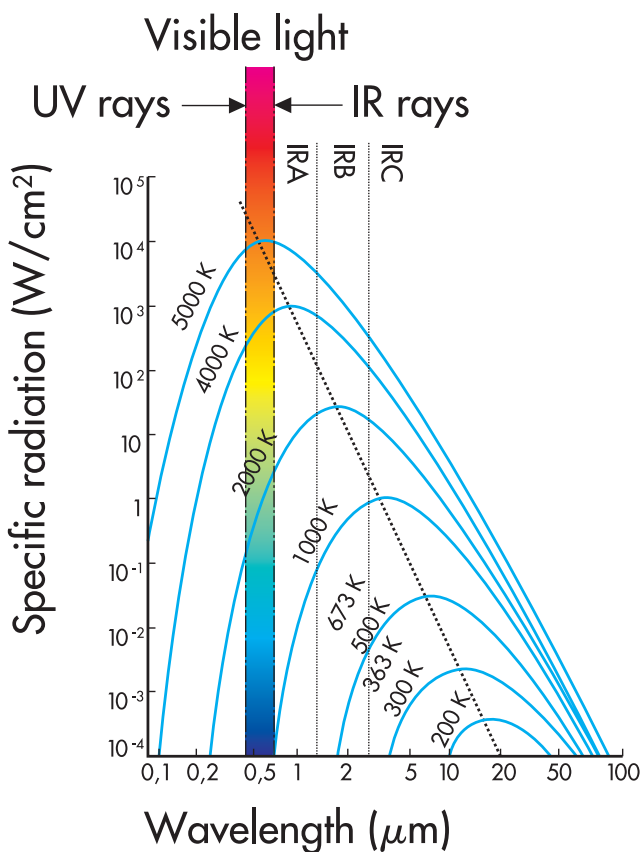


Diagram 2

### ***Infrared radiation in nature***

In nature, infrared radiation is an essential type of heat transfer. Let's take the sun as a very good example: The sun produces an enormous amount of energy as a result of nuclear fusion. The sun emits this energy in various wavelengths. This radiation spectrum includes, among others, ultraviolet radiation, visible light, and infrared radiation. After travelling approx. 8 minutes at a speed of 1,080,000,000 kilometres per hour through outer space, the rays of the sun impinge on the earth's surface. The earth's surface is heated to a considerable extent by the infrared share of the sun's rays as a factor of the angle of insolation, which, in turn, depends on the

oscillating motion of the earth's axis (winter/summer). At night, the earth cools off by emitting heat in the form of infrared radiation again. Whenever infrared rays impinge on a surface, the radiation energy is absorbed by the surface atoms depending on the temperature of the air. This is why winter sport enthusiasts can take a wonderful sunbath and also enjoy pleasant heat at the same time.

## ***2. Heating principle of an infrared heating system***

### ***General***

According to the first law of thermodynamics, heat always flows away from high temperatures toward low temperatures. The heat transfer takes place by conductivity, convection or radiation. Here the driving force is the temperature difference.

The heat transfer mechanisms, i.e. convection and radiation, must be applied in the case of space heating. In contrast to convection, no transfer medium is required for heat transfer by IR radiation. In the case of infrared heating, the heat is given off directly to objects, and then the objects give off heat to the ambient air.

### ***Heating by radiation***

Heating by radiation is a heating mechanism whereby the radiation energy heats objects and persons directly. The infrared rays heat the skin, and then the heat is distributed throughout the human body due to the circulation of blood. This is why, due to the radiation intensity, it is possible to feel pleasantly warm even at low air temperatures.

### ***Heating by convection***

In the industrial sector engaged in the construction of heating systems or saunas, most of the heating methods are based on the use of convection, i.e. the ambient air is heated and an air current created. To compensate the loss of insulation caused by the air current, the air temperature must be higher.

### **3. Well-being climate**

#### **General**

A comfortable climate is created with infrared heating. The feeling of comfort arises whenever the temperature of the human body and the temperature of its environment are in equilibrium. Here the heat absorbed, produced and given off by the human body are in equilibrium.

#### **Advantages of infrared heating**

In comparison with convection heating, infrared heating possesses several obvious advantages. Infrared radiation (IR) impinging on the skin is immediately converted into heat. Since the skin anticipates the temperature rise at this point, the circulation of blood in the skin is stimulated. Due to the optimum circulation of blood in the skin, heat is absorbed by the human body, and the infrared deep heat then develops as a result of molecular oscillations in the tissue of the human body. The air conditions are homogeneous, and a stable air moisture and relatively low air temperatures of 40-50 °C provide the basis for stress-free sweating. Since there is very little air flow, there is also considerably less circulation of dust.



## 4. Physiological effects due to infrared heating

### Sweating is necessary

Sweating is a natural process in the human organism. The human body uses the formation of sweat to regulate external influences of heat. Accordingly, the human body thus functions like an air-conditioning system. Approximately 3 million sweat glands in the skin react to external heat or physical exertion and discharge not only water but also poisonous substances and fats during the sweating process. This is why sweating is a vital process with a significant effect on our own good health.

### Sweating due to infrared heating

The infrared radiation impinging on the human body creates a deep heat that activates the water molecules in the human body. Cells are vitalised, the flow of blood is increased, the metabolism is activated, and the oxygen supply is improved. The sweating process achieved in this manner differs from the sweating process in the sauna due to the fact that the sweat volume is larger because of the depth factor and also because the non-aqueous shares are higher. The deep heat achieved is dependent on the wavelength of the infrared radiation (see diagram 3).

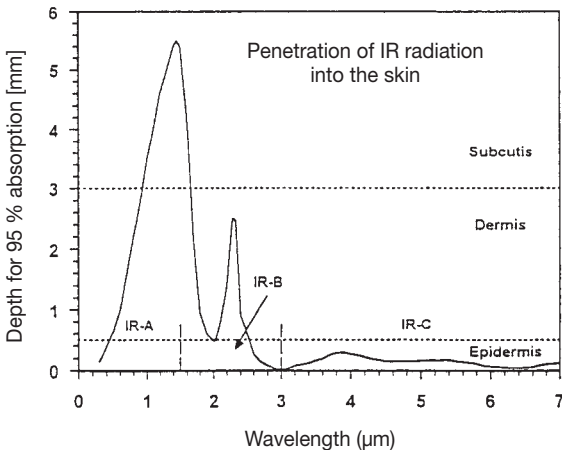


Diagram 3

## ***Scientific studies***

Scientists and physicians all over the world have been working on the subject of infrared heating of the human body for some time. We all certainly remember the infrared (red-light) lamp, which has been used in the field of medicine for many decades. Infrared thermal cabins, however, have only been available for a relatively short period of time, approx. 20 years. Tests carried out in Japan, the USA, and Germany have provided very positive results in the application of these types of thermal cabins.

A scientific study carried out by Prof. Dr. Meffert and Dr. Piazena at the Humboldt University (Charité) in Berlin deals very intensively with the subject of infrared radiation. Diagram 4 is an extract from this scientific study and presents examples of present-day utilisation of infrared radiation and includes the underlying physiological effects depending on the selection of the spectral quality of thermal radiation.

As you can see in the table on the next page, the infrared A radiation is only used in the medical sector. Equipment units that work with infrared A radiation are medical products and only belong in the hands of specialised physicians and properly trained medical personnel.

***Physiological effects and utilisation of infrared radiation for various forms of the spectral quality of thermal radiation***

Typ	Physiological effect	Utilisation
Finnish sauna  All IR devices	Temperature rise of the interior of the human body Pulse frequency increase Blood pressure reduction	Cardiac and cardiovascular training Sweat formation Purification (cellulitis) Increase of blood circulation in the skin Stimulation of metabolism Conditioning Vascular training Reduction of susceptibility to infections
IR-B/C device	Primary heating in the epidermis Gradual, slight temperature rise of the interior of the human body	Purification (high concentration of non-aqueous shares in the sweat) Therapy of inflammations Blood pressure reduction due to distension of the blood vessels

**MEDICAL TECHNOLOGY**

IR-A device (selective, moderate power)	Primary heating into the subcutis Quick body temperature rise (mild form) Quicker, transient rise of heart rate and blood pressure amplitude Decrease of systolic blood pressure with reduction of IR-A power accompanied by lasting reduction of diastolic blood pressure	Rheumatism therapy Therapy of inflammations (e.g. arthritis) Therapy of various infections Therapy of systemic scleroderma Experimental therapy of arterial hypotonia
IR-A device (selective, high power)	Primary heating into the subcutis Quick temperature rise of the interior of the human body (intensive application)	Cancer therapy

## ***5. Infrared thermal cabins made by Saunalux***

### ***Royal and Classic – top quality in duet***

Our ROYAL and CLASSIC product series represent a complete range of high-quality infrared cabins. In their various sizes and equipment features, these cabins are perfectly tailored to suit the individual needs and specific requirements of our customers.

Technically unique: Even when the individually set internal temperature has been reached, intensive infrared radiation is still guaranteed in the case of the ROYAL and CLASSIC cabins due to the fact that some of the IR elements always remain activated.

Selected timbers, a perfectly thought-out technology, quality assurance at the highest level, and the quality work performed by expertly trained skilled workers guarantee that even the most demanding requirements are fulfilled. Guaranteed safety standards are verified by VDE/GS and constantly inspected at our manufacturing plant in Grebenhain/Hesse. All our cabins are "made in Germany", and we give a five-year guarantee on all parts in case of private use.

### ***Royal and Classic – The differences***

Two different heating systems, different cabin structures, and different selections of wood provide numerous arrangement possibilities. But the aim is still the same: infrared heating of the cabin users.

### ***Royal – The original***

In the case of the ROYAL cabins, we decided to use the exquisite and fragrant cedar wood for the interior. The deep heat bath then turns into a wonderful experience for all the senses. The wall and ceiling construction is provided in tried-and-tested element design. The attractive beech decor on the sides as well as the hemlock door frames give the ROYAL cabin its cosy, special flair.

ROYAL is the original made by saunalux, since it is the first infrared cabin in which high-quality fabricated infrared foils are included in the walls, thus ensuring efficient, completely pleasant deep heat.

Especially the technology with the internal infrared foil, which was specifically developed by Saunalux, makes this cabin a unique thermal cabin for gentle heat radiation. The selected cedar wood of the interior stores the heat and gives it off as gentle infrared radiation in an infrared C wavelength range of 8  $\mu\text{m}$  (see diagram 5) to the user. At the same time, the air temperature is increased to a maximum of 50 °C. The infrared foils included all the way round in the walls thus ensure evenly distributed thermal radiation in the cabin.

### ***Classic - The variable***

CLASSIC is the thermal cabin with attractive charm and natural design. Internally and externally, the ceilings and walls are constructed in element design using 12.5 mm Polar Spruce Softline profiles and give the CLASSIC thermal cabin its unique character. Special feature: These cabins are also available on an optional basis in other types of high-quality wood and genuine wood panels.

The variety of interior and exterior design options as well as the possibility of being able to make constructional modifications gives the CLASSIC thermal cabin the attribute "variable".

Radiant heat: the infrared technology

Depending on the radiator size, 4, 5 or 6 ceramic radiators in the rear wall and in the front wall ensure the emission of well-balanced, efficient deep heat.

Provided with a magnesium filling and flocked protection against accidental contact, these high-quality ceramic radiators give off infrared C radiation in the wavelength range of 4 - 5  $\mu\text{m}$ . (see diagram 5)

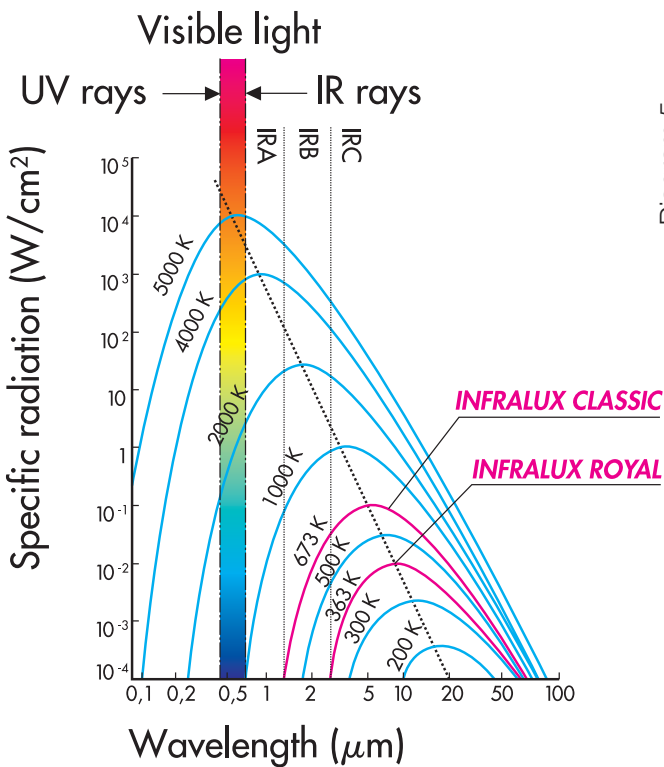


Diagram 5

### ***Which one should I choose?***

Here, in particular, individuality is the decisive factor. Find out what is more important to you – the heating system or the design. The advantages of the Royal radiant heating system clearly have to do with the uniform distribution of heat in the cabin. However, if you would rather heat your body at precise points, then the Classic provides a clear advantage. The variety of layout possibilities speak for the Classic cabin, whereas the Royal possesses the more exquisite materials. But no matter which cabin you finally choose – with both cabins you always receive a quality product made by Saunalux.

## **6. Application of infrared thermal cabins**

### ***Bathing rules***

In the section below, we will give you a recommendation for the bathing procedure in an infrared thermal cabin (see "Bathing rules"). You will, however, determine the ideal procedure for you, and you should also let yourself be guided by your own feelings.

## ***Bathing rules***

- 1. Bathing time approx. 60 min.***
- 2. Pre-clean your body***
- 3. Dry off your body***
- 4. Bathing session approx. 20 - 30 min.***
- 5. Temperature approx. 40 - 50 °C***
- 6. Use seat pad***
- 7. Sit or lie relaxed***
- 8. Regular change of posture***
- 9. Take a warm shower afterwards***
- 10. Rest for 10 - 20 min.***
- 11. Thirst quencher:  
beverages containing minerals***
- 12. Good supplement: massage***
- 13. Good supplement: move fresh air***
- 14. 1 - 3 weekly applications***

### ***Useful information***

For each bathing session, you should always use a towel for the bench pad and a towel for drying off your body. Whenever you lean against the walls without a backrest, use a towel here too.

***In case of any complaints regarding your health, consult your physician before using the thermal cabin for the first time.***

## **7. Final consideration**

With this infrared guide we would like to make the subject of infrared radiation and infrared thermal cabins somewhat more accessible to you. There are certainly many more other physical characteristics regarding the subject of infrared radiation but including them would have gone far beyond the scope of this guide. Should you decide or have already decided to purchase a Saunalux product, we assure you that you will receive a tested quality product "made in Germany".

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