



voltimum



Mendes' Mind

Termografia Aplicada às Instalações Elétricas

André Mendes

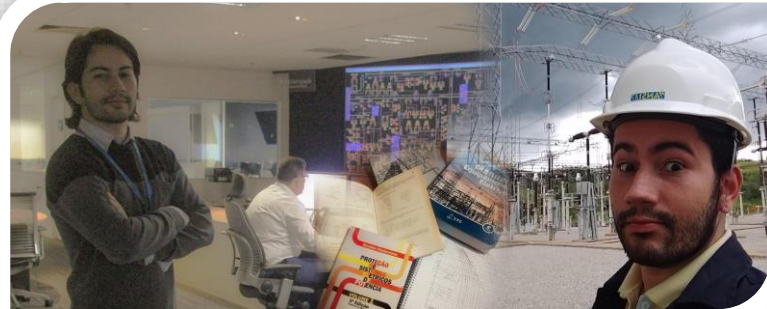
20 de março de 2023

Olá...



J. ROMA, Lda

Fundada em 1919



 **AES**
Eletropaulo

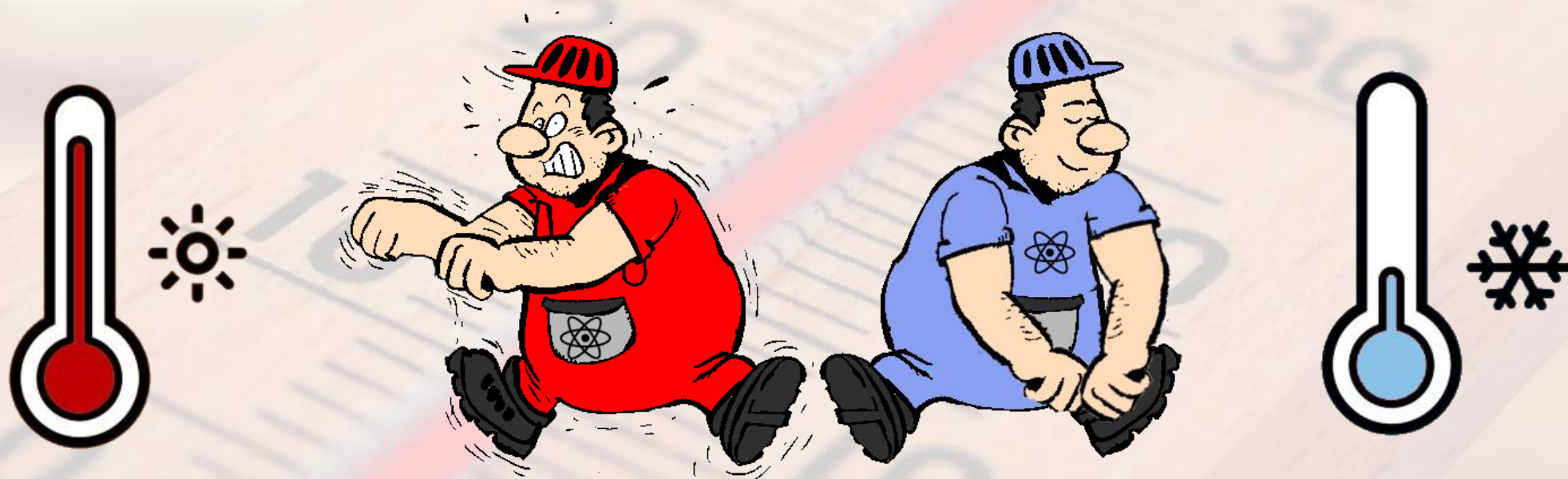
 **ANSI 87**



 **DCS Norway AS**



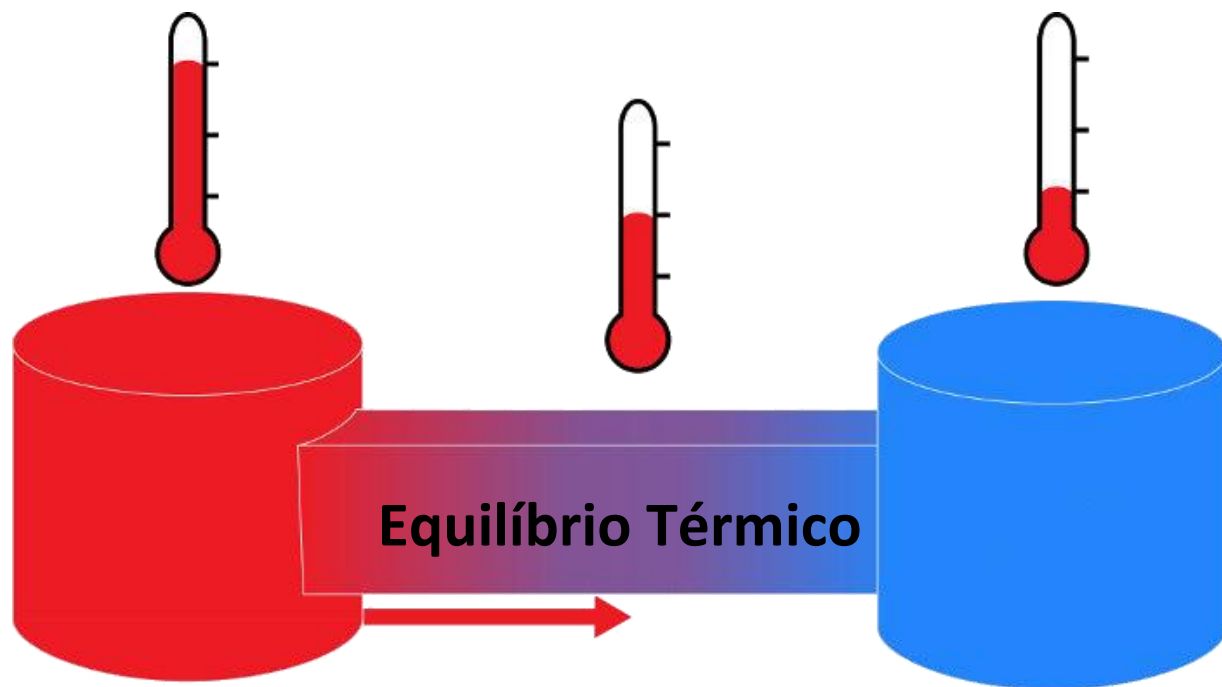
Temperatura é o grau (médio) de **agitação** das moléculas.



$$E = \frac{m \cdot v^2}{2} = \frac{3}{2} k \cdot T$$



Calor é fluxo de energia térmica em **movimento**.



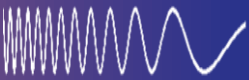
2ª Lei da Termodinâmica

entropia

Transferência de Calor / Transf. Energia Térmica



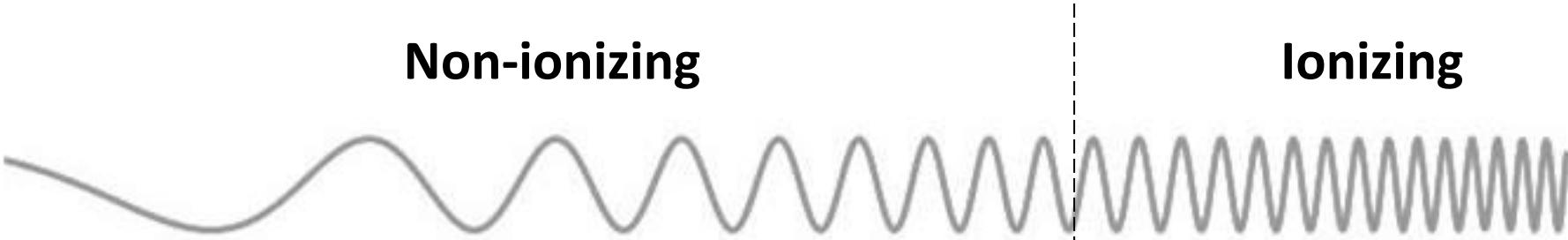
Espectro Eletromagnético



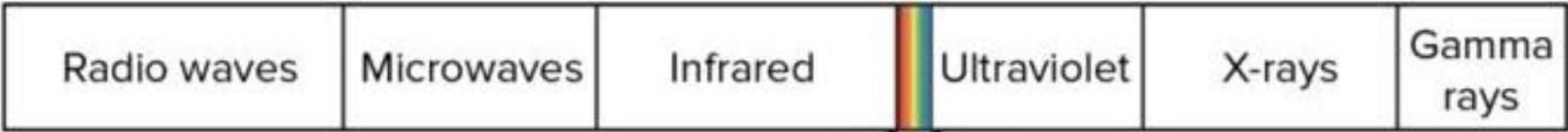
Non-ionizing

Ionizing

Frequency



Radiation type



Wavelength (approximate)

30 mm 1 mm 10 nm 0.01 nm

Visible light



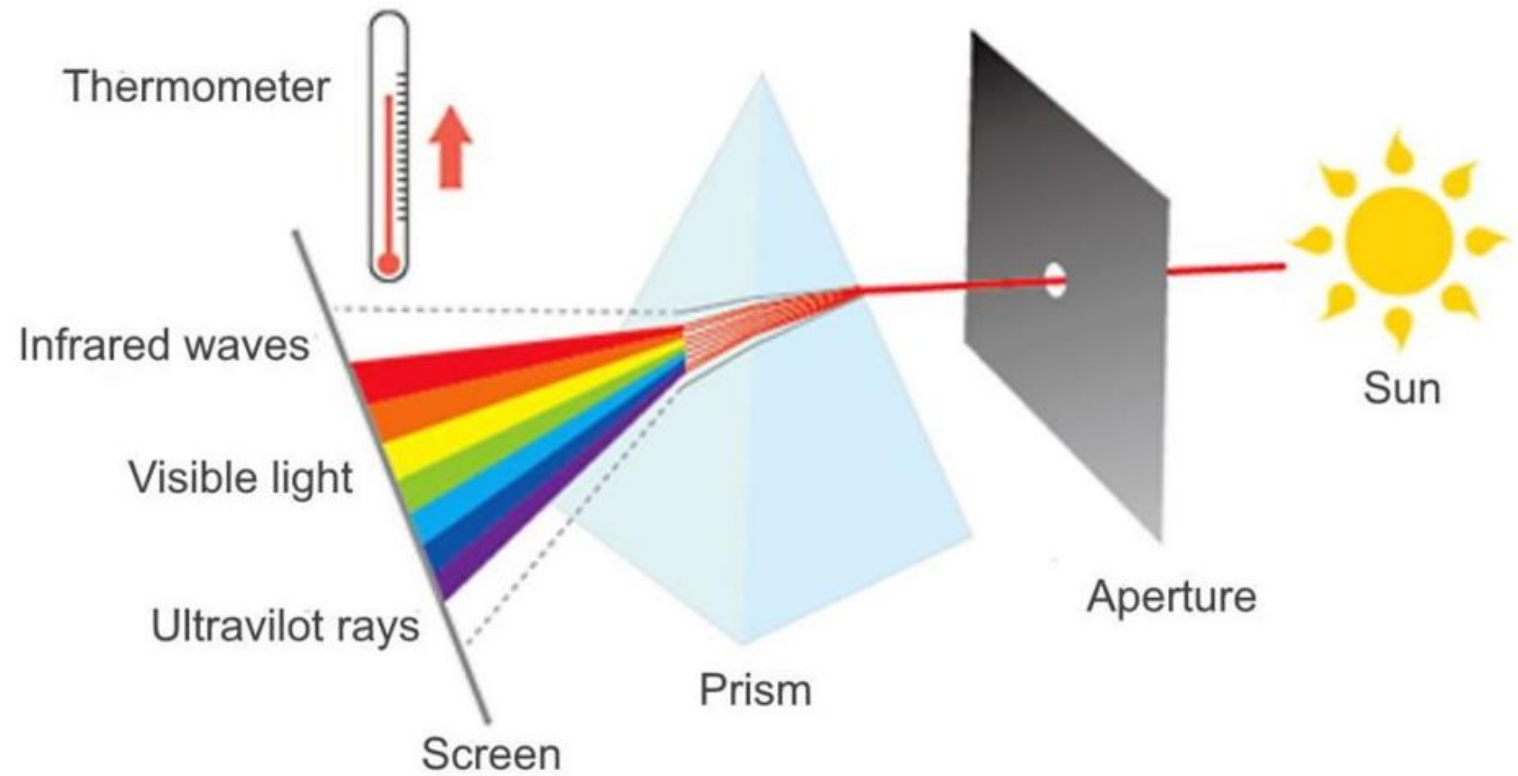
700 nm 600 nm 500 nm 400 nm

Longer wavelength → Shorter wavelength
Lower energy → Higher energy

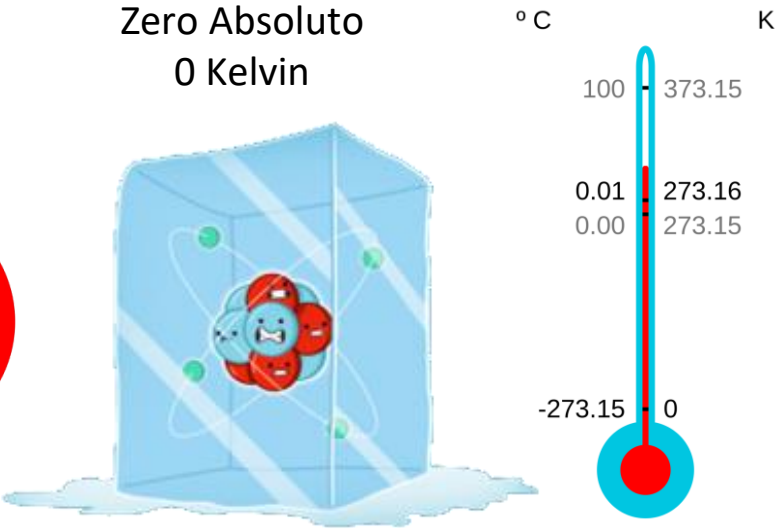
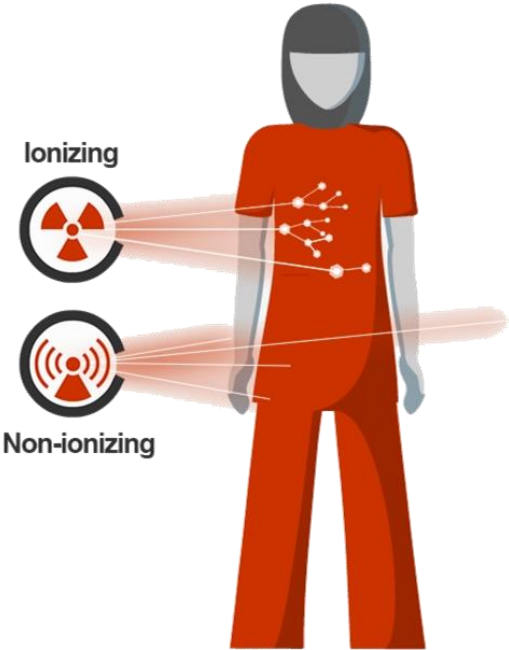
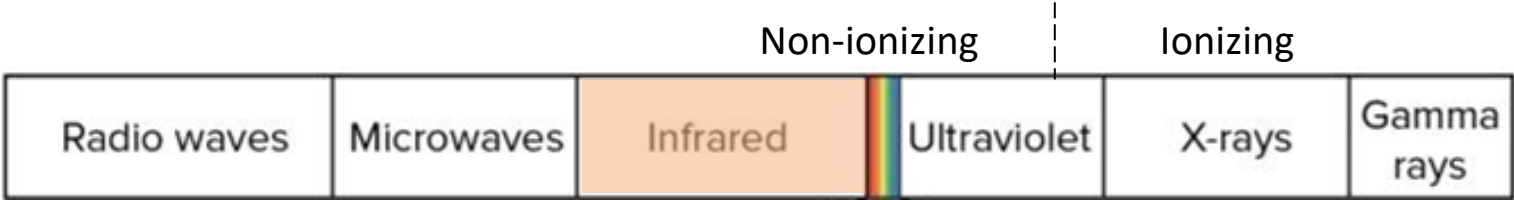
Infravermelho



*Sir. William
Herschel*
séc. XVIII



Infravermelho



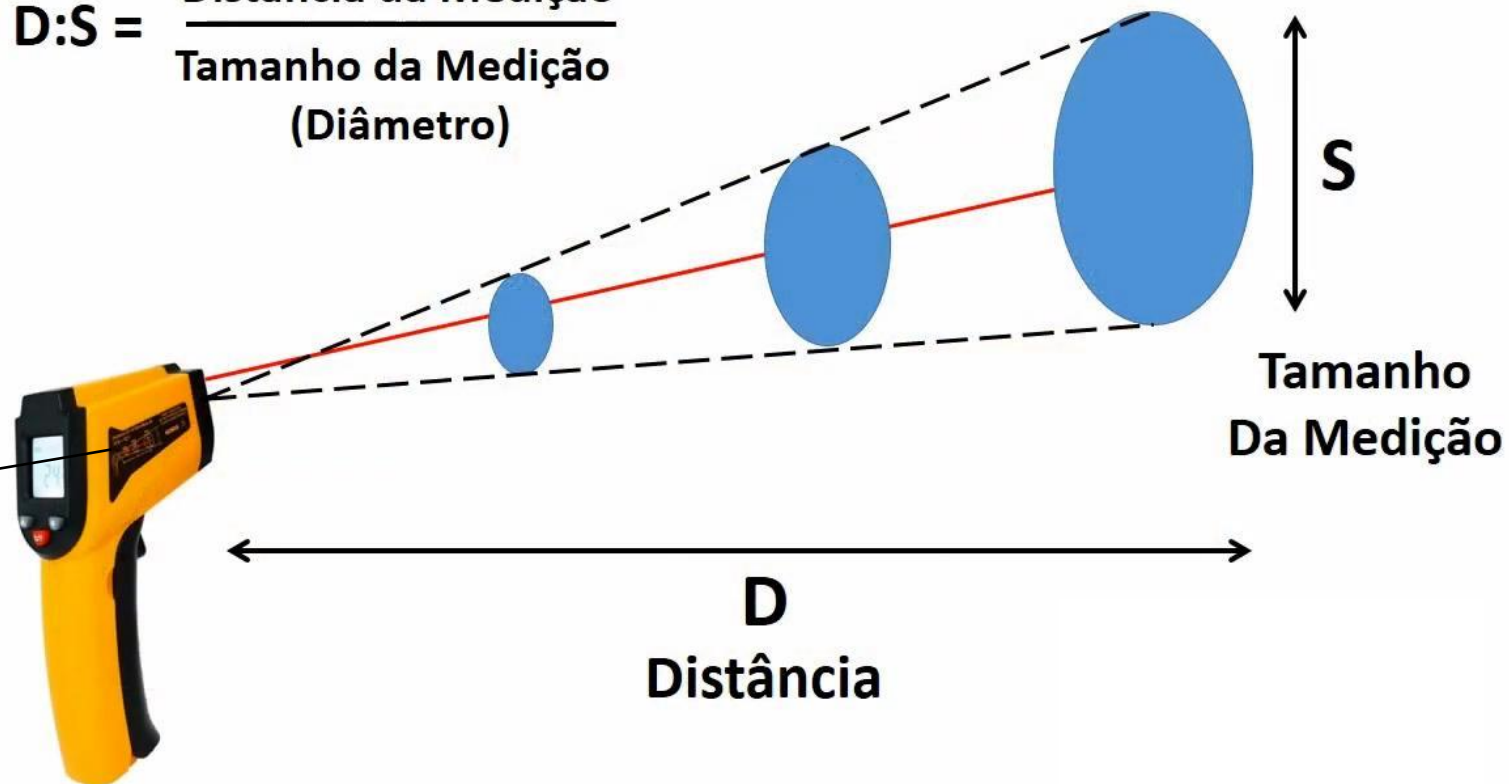
Termômetros IR – Pirômetros



BONUS



$$D:S = \frac{\text{Distância da Medição}}{\text{Tamanho da Medição (Diâmetro)}}$$



Termografia



***“Termografia**, do grego THERME, calor; e GRAFIA, escrita.”*

***“Termografia** é o termo usado para descrever o processo de tornar (essas) radiações térmicas visíveis (...) e utiliza a banda espectral dos infravermelhos.”*

Alberto Caramalho



Termografia



*“**Termografia** é o **Registro** gráfico das **Temperaturas** de diversos pontos em simultâneo por meio da radiação **Infravermelha**, isto é, através do **Calor** emitido pela matéria.”*

André Mendes



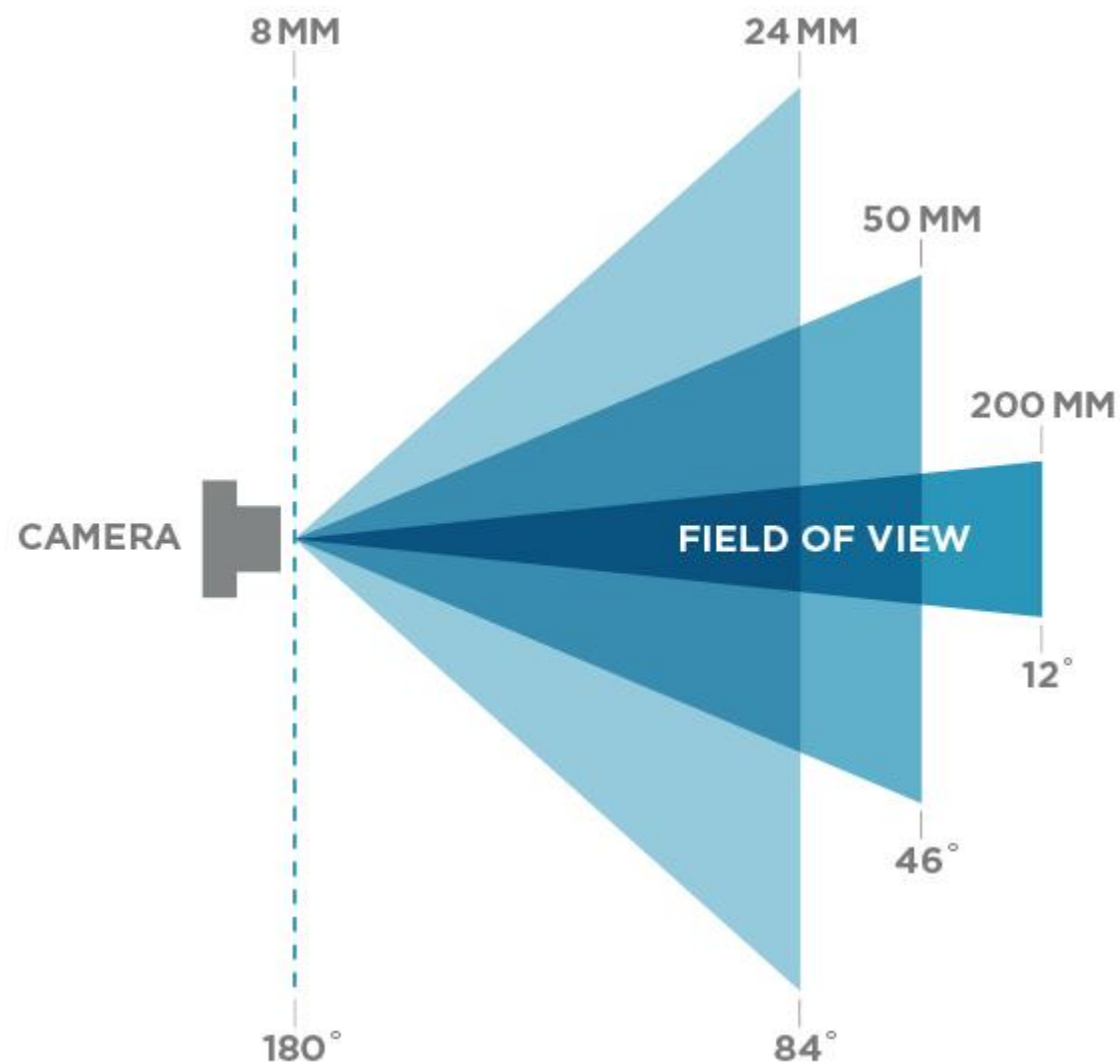
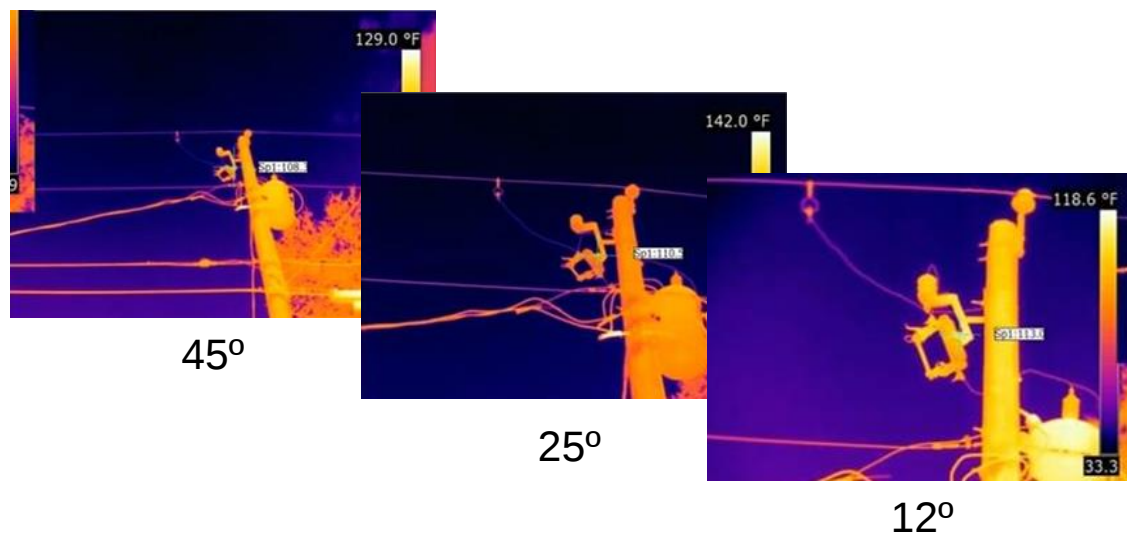
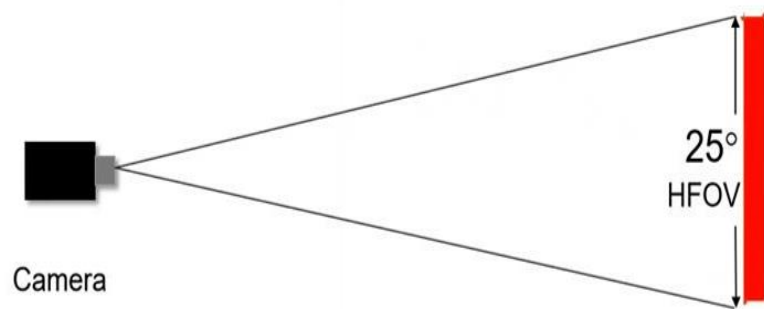


Câmeras Termográficas



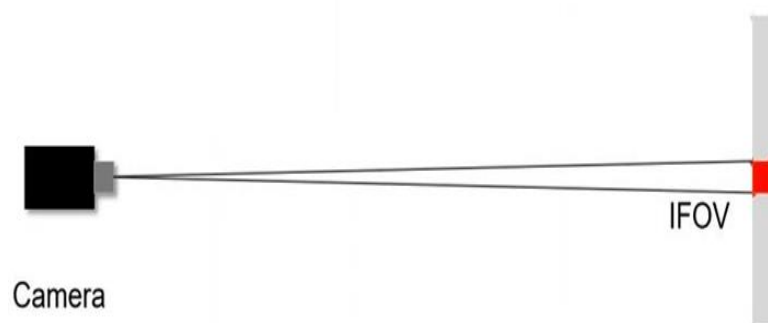


FOV (Campo de Visão)

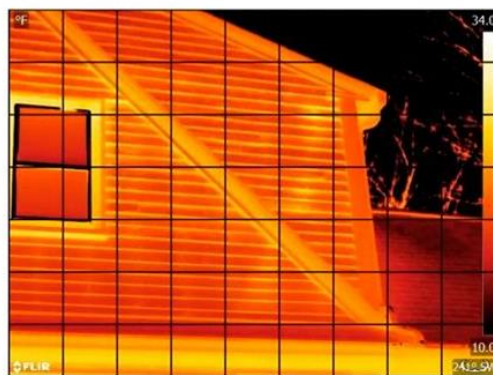




IFOV (Campo de Visão Instantâneo)

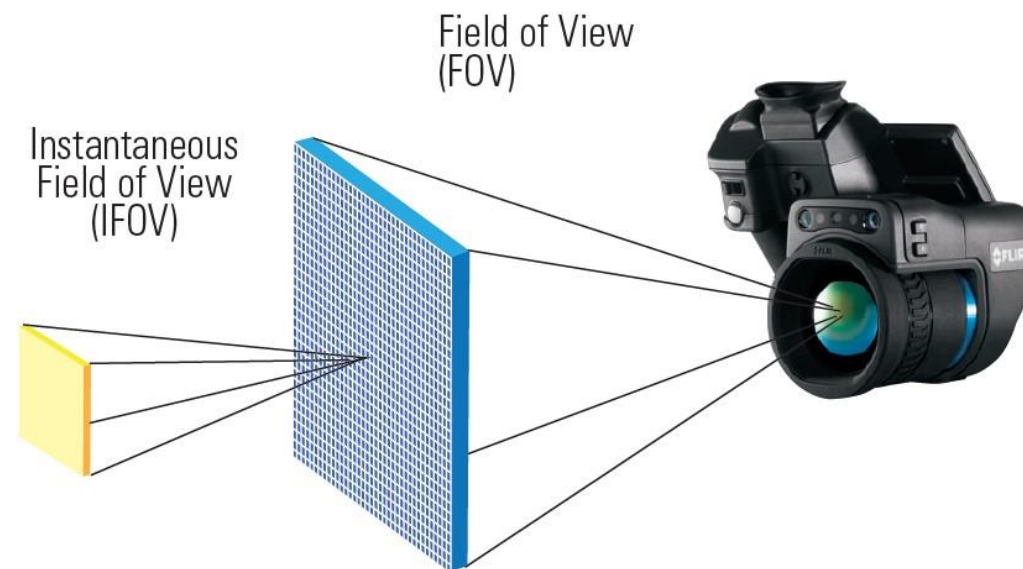


25° Lens



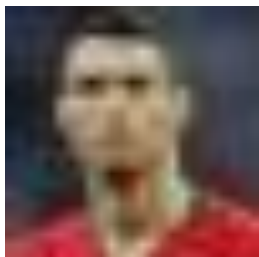
12° Lens

IFOV é uma projeção angular de apenas um dos pixels da câmera termográfica na imagem IR.





Resolução



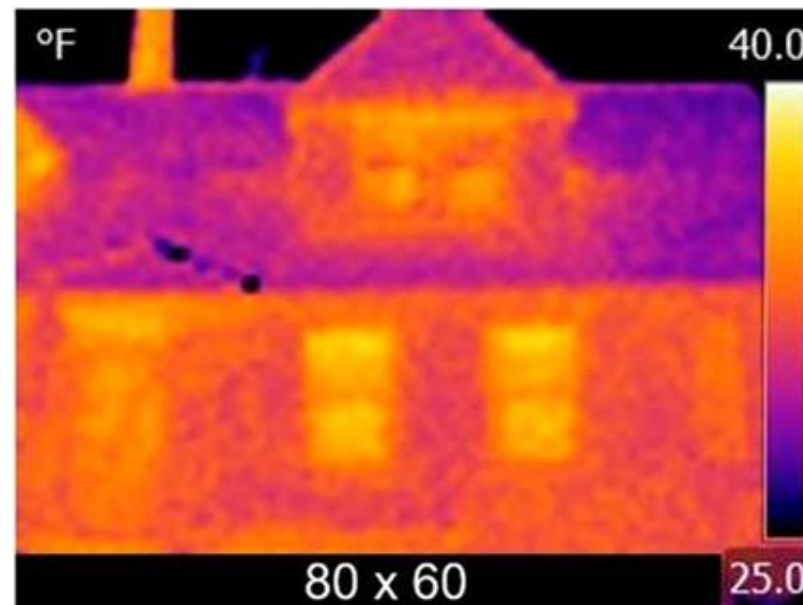
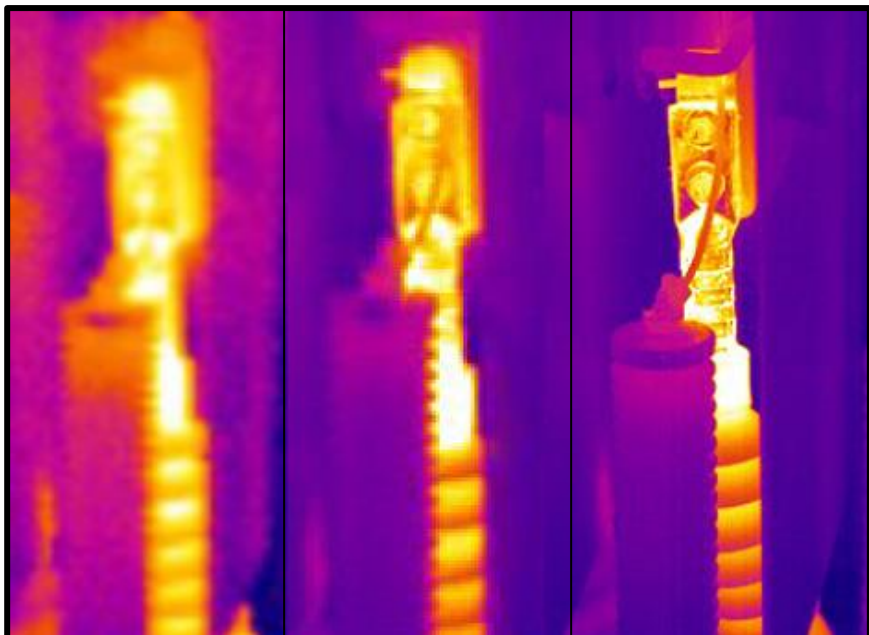
625 pixels
25 x 25



4.225 pixels
65 x 65



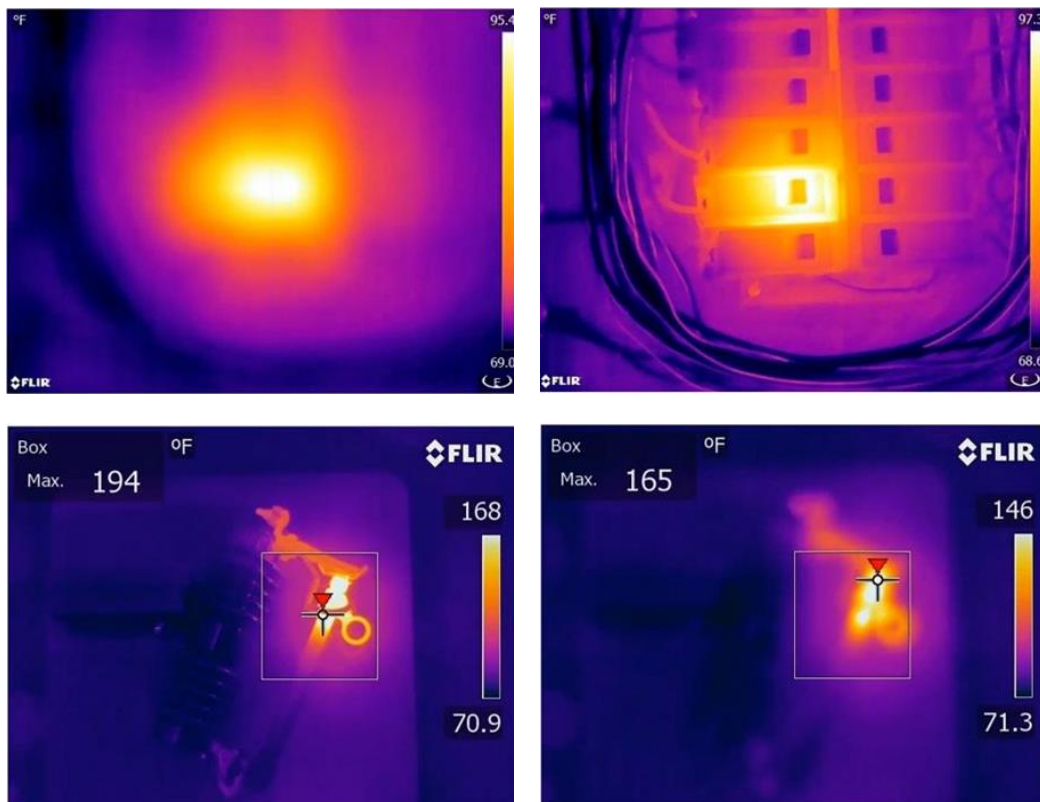
360.000 pixels
600 x 600



Câmeras Termográficas



Foco



X Sp1: 3,39°C

Sp1: 14,61°C



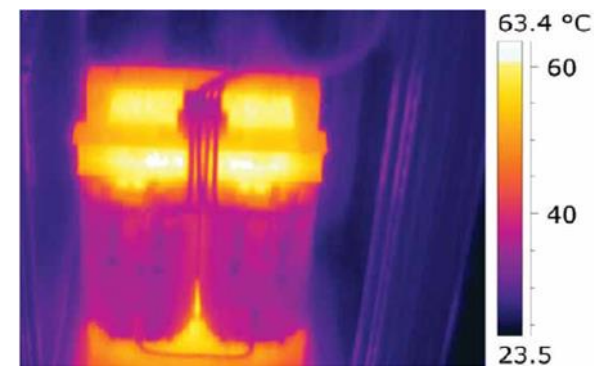
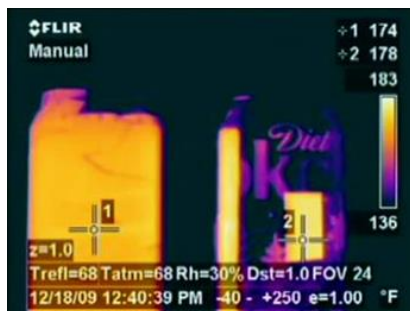
Temp. ambiente: 13,89°C





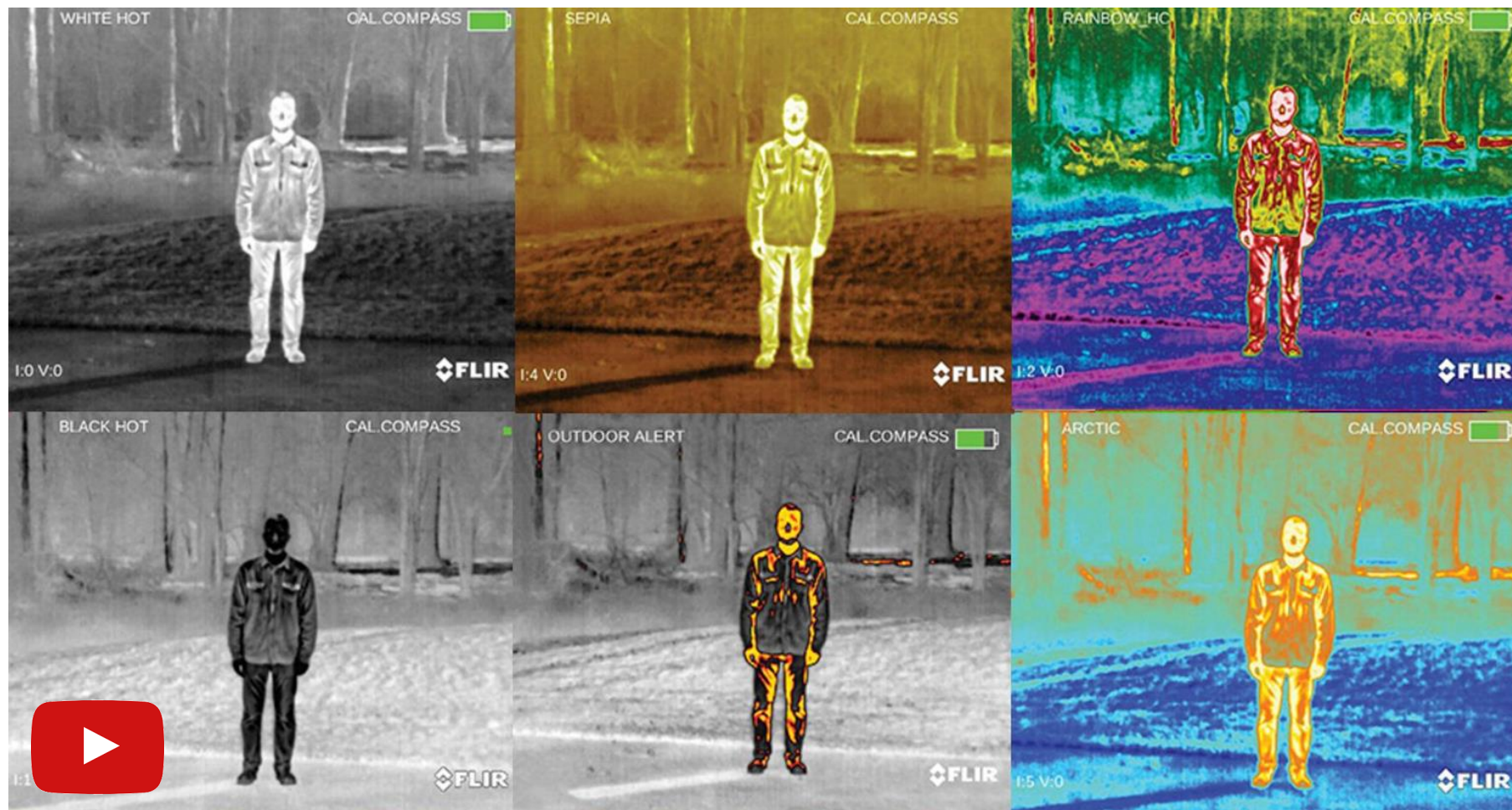
Emissividade

$$0 < \varepsilon \leq 1$$



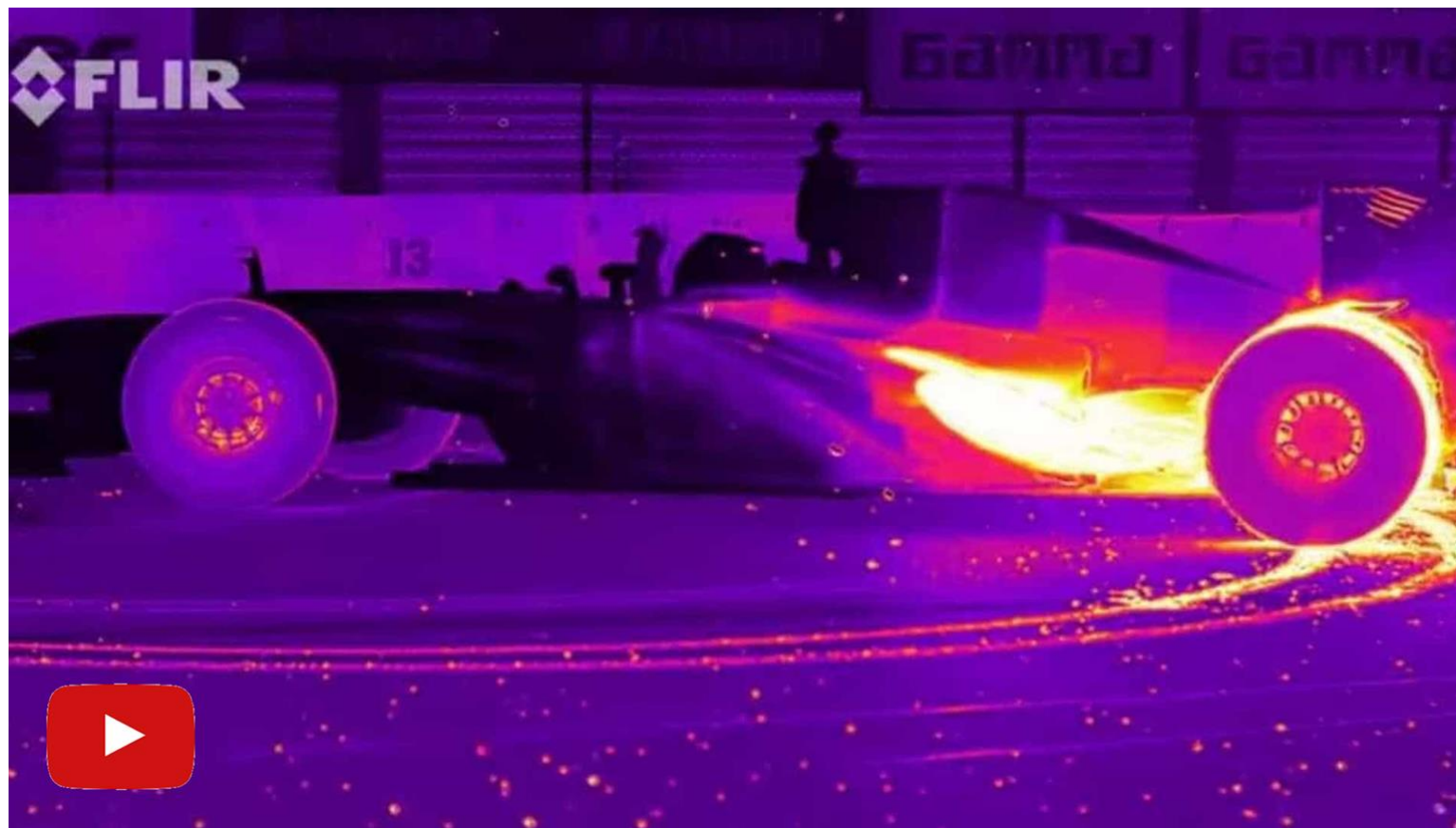
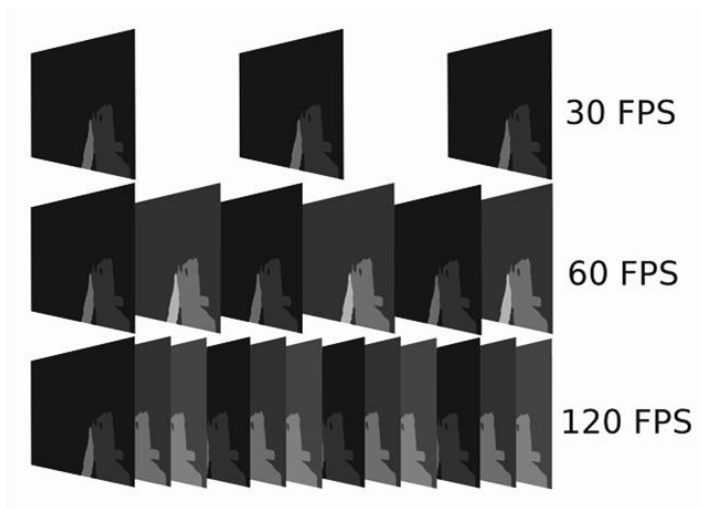


Paleta de Cores





Frame Rate



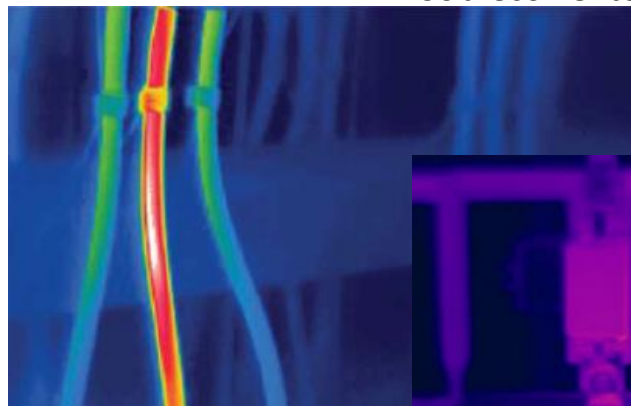


Aplicações Elétricas

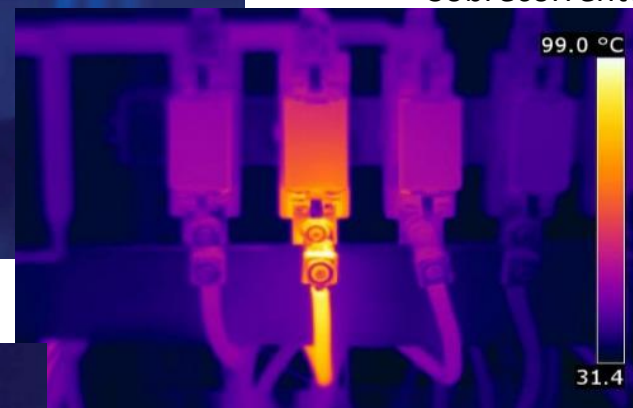
$$Q = i^2 \cdot R \cdot t \quad [\text{Joule}]$$

$$P = i^2 \cdot R \quad [\text{Watts}]$$

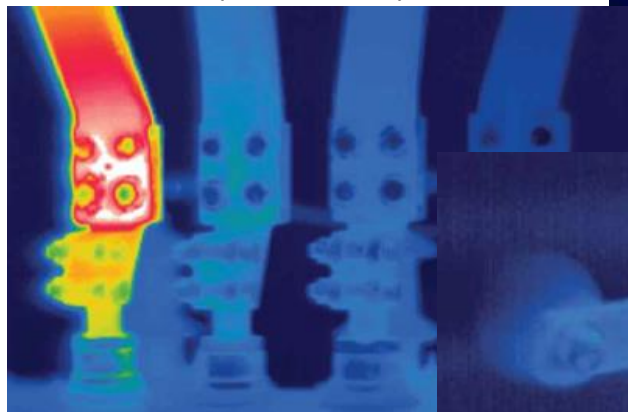
Sobrecorrente



Sobrecorrente



Mau contato (Resistência)

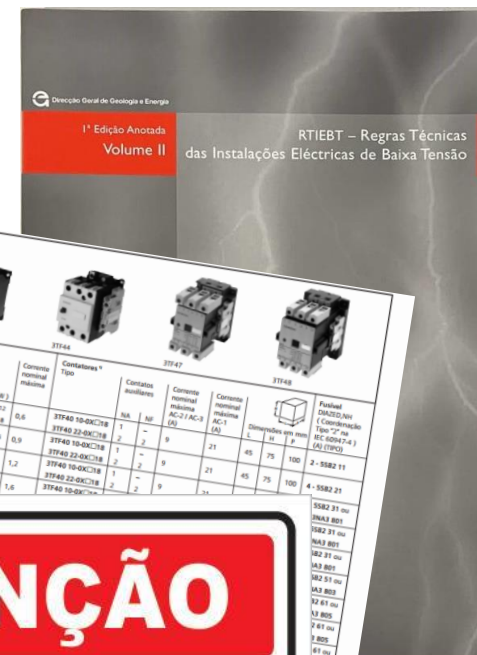


Mau contato (Resistência)



TMA - Temperatura Máxima Admissível

Temperatura Máxima Admissível



ATENÇÃO

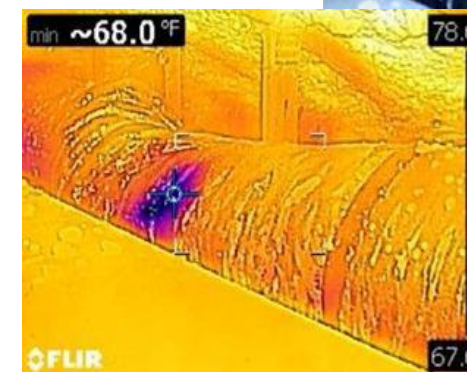
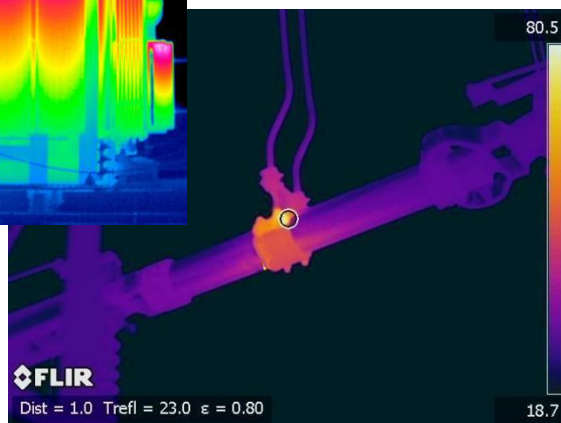
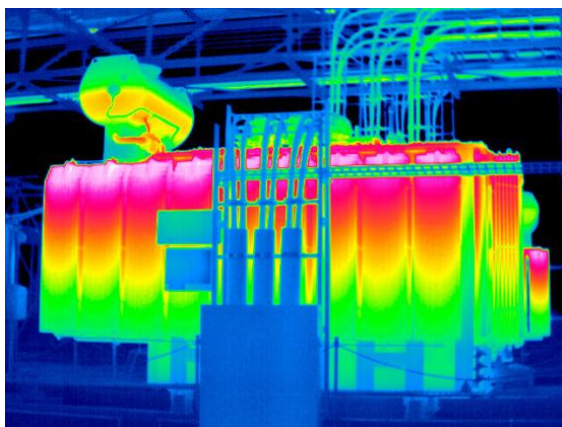
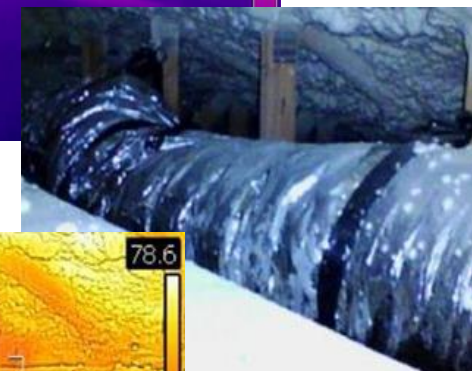
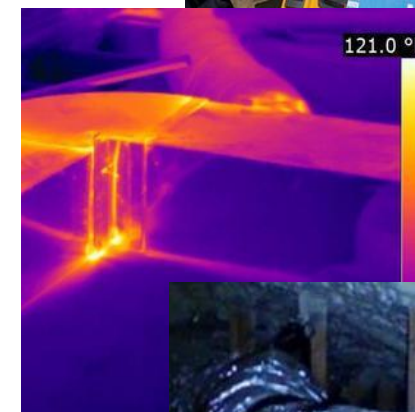
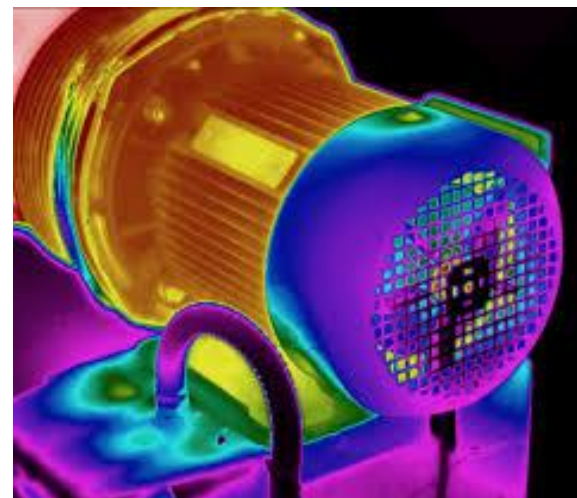
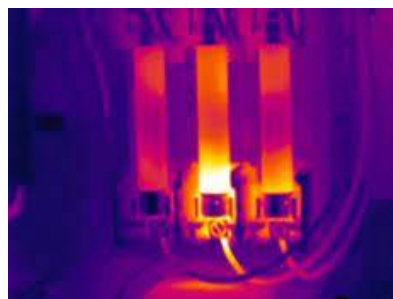
**LEIA O
MANUAL DE
INSTRUÇÕES**



Câmeras Termográficas

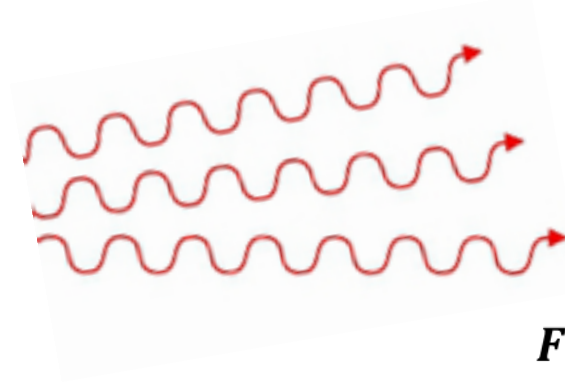
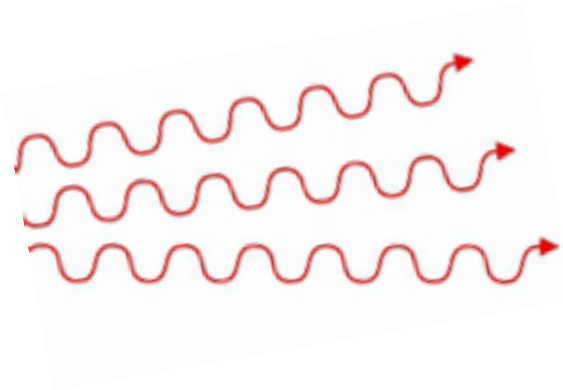


Aplicações Elétricas





Calor $\neq$ Temperatura



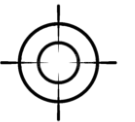
160 x 120

FPS



FOV

ϵ



$$Q = i^2 \cdot R \cdot t \quad [\text{Joule}]$$



Muito Obrigado!



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Referencial teórico

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