

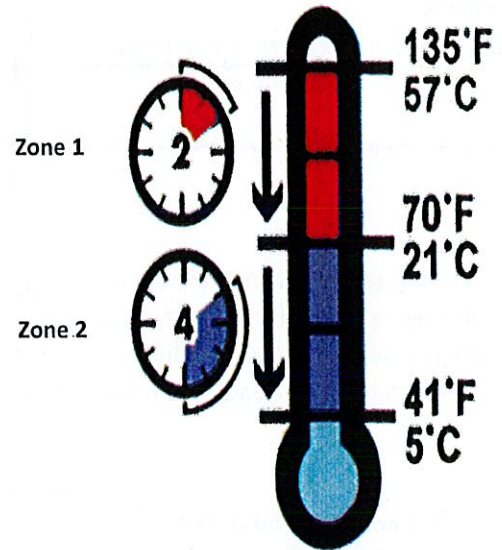
A Guide to the Cooling Rate Equation

Cooling from Hot

Once foods reach 135°F, it must cool to 70°F within 2 hours (Zone 1). It then has to cool even further to 41°F within an additional 4 hours (Zone 2). Meaning food must be cooled completely in a total of 6 hours. Checking temperatures during the cooling process is necessary to ensure that cooling rates stay in compliance. Below is the formula that can be used to help track cooling rates. A base rate is the minimum cooling rate. This rate is the number that must be met or exceeded.

Base Rates:
Zone 1 Formula: 135°F-70°F= 65°F 65°F/120 minutes (2hrs) = .54°F/min (or above)
Zone 2 Formula: 70°F-41°F=29°F 29°F/240 mins (4hrs) = .12°F/min (or above)

Formula to get cooling rate: $\frac{(\text{Temp 1} - \text{Temp \#2})}{(\text{time in mins between the 2 temps})}$
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When cooling, take one temperature of cooling food when immediately found. Record temperature and time. Give at least 15 to 20 minutes and take another temperature. Record the temperature and time. Then use the above formula to get your cooling rate.

Example 1: Correct Cooling Rate (Zone 1)

Item		Time	Temperature
Chicken	1st temp	11:00am	185°F
	2nd temp	12:30pm	100°F

Calculation

Time passed (minutes)= 90 minutes
 Degrees dropped: 185°F-100°F = 85°F
 $85^\circ\text{F}/90 \text{ mins} = .94^\circ\text{F}/\text{min}$
 This is above the base rate of .54°F/min

Example 2: Incorrect Cooling Rate (Zone 1)

Item		Time	Temperature
Hamburger	1st temp	10:30am	135°F
	2nd temp	11:00am	122°F

Calculation

Time passed (minutes)= 30 mins
 Degrees dropped: 135°F-122°F = 13°F
 $13^\circ\text{F}/30 \text{ mins} = .43^\circ\text{F}/\text{min}$
 This is below the base rate of .54°F/min

Example 3: Incorrect Cooling Rate (Zone 2)

Item		Time	Temperature
Pasta	1st temp	1:00pm	65°F
	2nd temp	2:00pm	50°F

Calculation

Time passed (minutes)= 60 mins
 Degrees dropped: 65°F-50°F = 15°F
 $15^\circ\text{F}/60 \text{ mins} = .25^\circ\text{F}/\text{min}$
 This is above the base rate of .12°F/min

Example 4: Incorrect Cooling Rate (Zone 2)

Item		Time	Temperature
Meat Sauce	1st temp	1:25pm	65°F
	2nd temp	2:00pm	60°F

Calculation

Time passed (minutes)= 35 mins
 Degrees dropped: 65°F-62°F = 3°F
 $3^\circ\text{F}/35 \text{ mins} = .08^\circ\text{F}/\text{min}$
 This is below the base rate of .12°F/min

A Guide to the Cooling Rate Equation

Cooling from Room Temperature

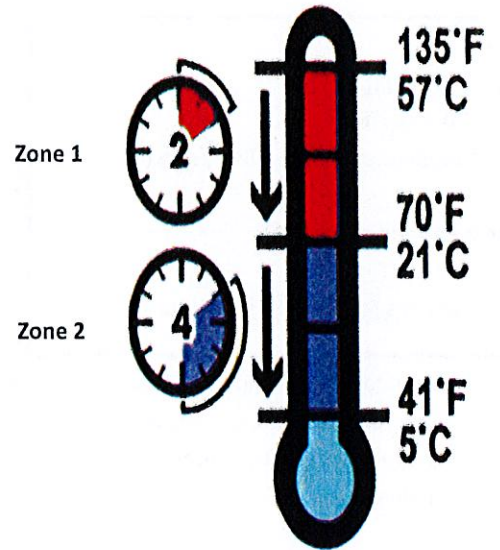
When Cooling food from ambient temperatures, cooling rate changes. Foods must be cooled from **room temperature to 41F in 4 hours total**. A base rate is the minimum cooling rate. This rate is the number that must be met or exceeded.

Base Rates:

$$\frac{\text{Ambient Room Temperature (ART)} - 41^{\circ}\text{F}}{240 \text{ minutes}}$$

Formula to get cooling rate:

$$\frac{(\text{Temp 1} - \text{Temp \#2})}{(\text{time in mins between the 2 temps})}$$



When cooling, take one temperature of cooling food when immediately found. Record temperature and time. Give at least 15 to 20 minutes and take another temperature. Record the temperature and time. Then use the above formula to get your cooling rate. The base rate may be different for each situation.

Example 1: Correct Cooling Rate

Item		Time	Temperature
Cut tomato	Ambient		75°F
	1st temp	11:00 am	73°F
	2nd temp	11:45pm	60°F

Calculation Ambient Rate:

Ambient Rate: $75^{\circ}\text{F} - 41^{\circ}\text{F} = 34^{\circ}\text{F}$
 $34^{\circ}\text{F} / 240 \text{ minutes} = .14^{\circ}\text{F}/\text{min}$

Calculation Cooling Rate:

Time passed (minutes) = 45 mins
 Degrees dropped: $73^{\circ}\text{F} - 60^{\circ}\text{F} = 13^{\circ}\text{F}$
 $13^{\circ}\text{F} / 45 \text{ mins} = .28^{\circ}\text{F}/\text{min}$

This is above the base rate of $.14^{\circ}\text{F}/\text{min}$

Example 2: Incorrect Cooling Rate

Item		Time	Temperature
Salad	Ambient		80°F
	1st temp	11:20 am	78°F
	2nd temp	12:00 pm	74°F

Calculation Ambient Rate:

Ambient Rate: $80^{\circ}\text{F} - 41^{\circ}\text{F} = 39^{\circ}\text{F}$
 $39^{\circ}\text{F} / 240 \text{ minutes} = .16^{\circ}\text{F}/\text{min}$

Calculation Cooling Rate:

Time passed (minutes) = 40 mins
 Degrees dropped: $78^{\circ}\text{F} - 74^{\circ}\text{F} = 4^{\circ}\text{F}$
 $4^{\circ}\text{F} / 40 \text{ mins} = .1^{\circ}\text{F}/\text{min}$

This is below the base rate of $.16^{\circ}\text{F}/\text{min}$