

Infrared Thermometer Emissivity tables

Understanding an object's emissivity or its characteristic "radiance" is a critical component in the proper handling of infrared measurements. Concisely, emissivity is the ratio of radiation emitted by a surface or blackbody and its theoretical radiation predicted from Planck's law. $[W(L,T)=C1/(L^5*(exp(C2/LT)-1)]$ A material's surface emissivity is measured by the amount of energy emitted when the surface is directly observed. There are many variables that affect a specific object's emissivity, such as the wavelength of interest, field of view, the geometric shape of the blackbody, and temperature. However, for the purposes and applications of the infrared thermometer user, a comprehensive table showing the emissivity at corresponding temperatures of various surfaces and objects is displayed.

The table below can be used to adjust the emissivity of any of the listed I.R. thermometers:

- [IR /Thermocouple Professional Thermometer, IR -60C to +500C](#)
- [Food Inspector I.R. with combo Infrared & Fixed Thermocouple Probe](#)
- [F150 HACCP Auditor I.R.](#)
- [F151P HACCP Auditor I.R. Plus](#)

All have variable emissivity in order to improve the accuracy of the readings.

For further assistance please contact us at Scigiene Corp. www.scigiene.com

416-261-4865 and we will be happy to assist.

Non-Metal Emissivity table

Material(Non-Metals)	Temp degF(degC)	Emissivity
Adobe	68 (20)	0.9
Asbestos		
Board	100 (38)	0.96
Cement	32-392 (0-200)	0.96
Cement, Red	2500 (1371)	0.67
Cement, White	2500 (1371)	0.65
Cloth	199 (93)	0.9
Paper	100-700 (38-371)	0.93
Slate	68 (20)	0.97
Asphalt, pavement	100 (38)	0.93
Asphalt, tar paper	68 (20)	0.93
Basalt	68 (20)	0.72
Brick		
Red, rough	70 (21)	0.93
Gault Cream	2500-5000 (1371-2760)	.26-.30
Fire Clay	2500 (1371)	0.75
Light Buff	1000 (538)	0.8
Lime Clay	2500 (1371)	0.43
Fire Brick	1832 (1000)	.75-.80
Magnesite, Refractory	1832 (1000)	0.38
Grey Brick	2012 (1100)	0.75
Silica, Glazed	2000 (1093)	0.88
Silica, Unglazed	2000 (1093)	0.8
Sandlime	2500-5000 (1371-2760)	.59-.63
Carborundum	1850 (1010)	0.92

Material(Non-Metals)	Temp degF(degC)	Emissivity
Ceramic		
Alumina on Inconel	800-2000 (427-1093)	.69-.45
Earthenware, Glazed	70 (21)	0.9
Earthenware, Matte	70 (21)	0.93
Greens No. 5210-2C	200-750 (93-399)	.89-.82
Coating No. C20A	200-750 (93-399)	.73-.67
Porcelain	72 (22)	0.92
White Al ₂ O ₃	200 (93)	0.9
Zirconia on Inconel	800-2000 (427-1093)	.62-.45
Clay		
	68 (20)	0.39
Fired	158 (70)	0.91
Shale	68 (20)	0.69
Tiles, Light Red	2500-5000 (1371-2760)	.32-.34
Tiles, Red	2500-5000 (1371-2760)	.40-.51
Tiles, Dark Purple	2500-5000 (1371-2760)	0.78
Concrete		
Rough	32-2000 (0-1093)	0.94
Tiles, Natural	2500-5000 (1371-2760)	.63-.62
Brown	2500-5000 (1371-2760)	.87-.83
Black	2500-5000 (1371-2760)	.94-.91
Cotton Cloth	68 (20)	0.77
Dolomite Lime	68 (20)	0.41
Emery Corundum	176 (80)	0.86
Glass		
Convex D	212 (100)	0.8
Convex D	600 (316)	0.8
Convex D	932 (500)	0.76
Nonex	212 (100)	0.82
Nonex	600 (316)	0.82
Nonex	932 (500)	0.78
Smooth	32-200(0-93)	.92-.94
Granite	70 (21)	0.45
Gravel	100 (38)	0.28
Gypsum	68 (20)	.80-.90
Ice, Smooth	32 (0)	0.97
Ice, Rough	32 (0)	0.98
Lacquer		
Black	200 (93)	0.96
Blue, on Al Foil	100 (38)	0.78
Clear, on Al Foil (2 coats)	200 (93)	.08-.09
Clear, on Bright Cu	200 (93)	0.66
Clear, on Tarnished Cu	200 (93)	0.64
Red, on Al Foil (2 coats)	100 (38)	.60-.74
White	200 (93)	0.95
White, on Al Foil (2 coats)	100 (38)	.69-.88
Yellow, on Al Foil (2 coats)	100 (38)	.57-.79
Lime Mortar	100-500 (38-260)	.90-.92

Material(Non-Metals)	Temp degF(degC)	Emissivity
Lacquer - continued		
Limestone	100 (38)	0.95
Marble, White	100 (38)	0.95
Smooth, White	100 (38)	0.56
Polished Grey	100 (38)	0.75
Mica	100 (38)	0.75
Oil on Nickel		
0.001 Film	72 (22)	0.27
0.002 "	72 (22)	0.46
0.005 "	72 (22)	0.72
Thick "	72 (22)	0.82
Oil, Linseed		
On Al Foil, uncoated	250 (121)	0.09
On Al Foil, 1 coat	250 (121)	0.56
On Al Foil, 2 coats	250 (121)	0.51
On Polished Iron, .001 Film	100 (38)	0.22
On Polished Iron, .002 Film	100 (38)	0.45
On Polished Iron, .004 Film	100 (38)	0.65
On Polished Iron, Thick Film	100 (38)	0.83
Paints		
Blue, Cu ₂ O ₃	75 (24)	0.94
Black, CuO	75 (24)	0.96
Green, Cu ₂ O ₃	75 (24)	0.92
Red, Fe ₂ O ₃	75 (24)	0.91
White, Al ₂ O ₃	75 (24)	0.94
White, Y ₂ O ₃	75 (24)	0.9
White, ZnO	75 (24)	0.95
White, MgCO ₃	75 (24)	0.91
White, ZrO ₂	75 (24)	0.95
White, ThO ₂	75 (24)	0.9
White, MgO	75 (24)	0.91
White, PbCO ₃	75 (24)	0.93
Yellow, PbO	75 (24)	0.9
Yellow, PbCrO ₄	75 (24)	0.93
Paints, Aluminium	100 (38)	.27-.67
10% Al	100 (38)	0.52
26% Al	100 (38)	0.3
Dow XP-310	200 (93)	0.22
Paints, Bronze	Low	.34-.80
Gum Varnish (2 coats)	70 (21)	0.53
Gum Varnish (3 coats)	70 (21)	0.5
Cellulose Binder (2 coats)	70 (21)	0.34
Paints, Oil		
All colours	200 (93)	.92-.96
Black	200 (93)	0.92
Black Gloss	70 (21)	0.9
Camouflage Green	125 (52)	0.85

Material(Non-Metals)	Temp degF(degC)	Emissivity
Paints, Oil - continued		
Flat Black	80 (27)	0.88
Flat White	80 (27)	0.91
Grey-Green	70 (21)	0.95
Green	200 (93)	0.95
Lamp Black	209 (98)	0.96
Red	200 (93)	0.95
White	200 (93)	0.94
Quartz, Rough, Fused	70 (21)	0.93
Glass, 1.98 mm	540 (282)	0.9
Glass, 1.98 mm	1540 (838)	0.41
Glass, 6.88 mm	540 (282)	0.93
Glass, 6.88 mm	1540 (838)	0.47
Opaque	570 (299)	0.92
Opaque	1540 (838)	0.68
Red Lead	212 (100)	0.93
Rubber, Hard	74 (23)	0.94
Rubber, Soft, Grey	76 (24)	0.86
Sand	68 (20)	0.76
Sandstone	100 (38)	0.67
Sandstone, Red	100 (38)	.60-.83
Sawdust	68 (20)	0.75
Shale	68 (20)	0.69
Silica,Glazed	1832 (1000)	0.85
Silica, Unglazed	2012 (1100)	0.75
Silicon Carbide	300-1200 (149-649)	.83-.96
Silk Cloth	68 (20)	0.78
Slate	100 (38)	.67-.80
Snow, Fine Particles	20 (-7)	0.82
Snow, Granular	18 (-8)	0.89
Soil		
Surface	100 (38)	0.38
Black Loam	68 (20)	0.66
Plowed Field	68 (20)	0.38
Soot		
Acetylene	75 (24)	0.97
Camphor	75 (24)	0.94
Candle	250 (121)	0.95
Coal	68 (20)	0.95
Stonework	100 (38)	0.93
Water	100 (38)	0.67
Waterglass	68 (20)	0.96
Wood	Low	.80-.90
Beech Planed	158 (70)	0.94
Oak, Planed	100 (38)	0.91
Spruce, Sanded	100 (38)	0.89

Metal Emissivity table

Material(metal)	Temp degF (degC)	Emissivity
Alloys		
20-Ni, 24-CR, 55-FE, Oxid.	392 (200)	0.9
20-Ni, 24-CR, 55-FE, Oxid.	932(500)	0.97
60-Ni, 12-CR, 28-FE, Oxid.	518 (270)	0.89
60-Ni, 12-CR, 28-FE, Oxid.	1040 (560)	0.82
80-Ni, 20-CR, Oxidised	212 (100)	0.87
80-Ni, 20-CR, Oxidised	1112 (600)	0.87
80-Ni, 20-CR, Oxidised	2372 (1300)	0.89
Aluminium		
Unoxidised	77 (25)	0.02
Unoxidised	212 (100)	0.03
Unoxidised	932 (500)	0.06
Oxidised	390 (199)	0.11
Oxidised	1110 (599)	0.19
Oxidised at 599degC(1110degF)	390 (199)	0.11
Oxidised at 599degC(1110degF)	1110 (599)	0.19
Heavily Oxidised	200 (93)	0.2
Heavily Oxidised	940 (504)	0.31
Highly Polished	212 (100)	0.09
Roughly Polished	212 (100)	0.18
Commercial Sheet	212 (100)	0.09
Highly Polished Plate	440 (227)	0.04
Highly Polished Plate	1070 (577)	0.06
Bright Rolled Plate	338 (170)	0.04
Bright Rolled Plate	932 (500)	0.05
Alloy A3003, Oxidised	600 (316)	0.4
Alloy A3003, Oxidised	900 (482)	0.4
Alloy 1100-0	200-800 (93-427)	0.05
Alloy 24ST	75 (24)	0.09
Alloy 24ST, Polished	75 (24)	0.09
Alloy 75ST	75 (24)	0.11
Alloy 75ST, Polished	75 (24)	0.08
Bismuth, Bright	176 (80)	0.34
Bismuth, Unoxidised	77 (25)	0.05
Bismuth, Unoxidised	212 (100)	0.06
Brass		
73% Cu, 27% Zn, Polished	476 (247)	0.03
73% Cu, 27% Zn, Polished	674 (357)	0.03
62% Cu, 37% Zn, Polished	494 (257)	0.03
62% Cu, 37% Zn, Polished	710 (377)	0.04
83% Cu, 17% Zn, Polished	530 (277)	0.03
Matte	68 (20)	0.07
Burnished to Brown Colour	68 (20)	0.4
Cu-Zn, Brass Oxidised	392 (200)	0.61
Cu-Zn, Brass Oxidised	752 (400)	0.6
Cu-Zn, Brass Oxidised	1112 (600)	0.61

Material(metal)	Temp degF (degC)	Emissivity
Brass - continued		
Unoxidised	77 (25)	0.04
Unoxidised	212 (100)	0.04
Cadmium	77 (25)	0.02
Carbon		
Lampblack	77 (25)	0.95
Unoxidised	77 (25)	0.81
Unoxidised	212 (100)	0.81
Unoxidised	932 (500)	0.79
Candle Soot	250 (121)	0.95
Filament	500 (260)	0.95
Graphitized	212 (100)	0.76
Graphitized	572 (300)	0.75
Graphitized	932 (500)	0.71
Chromium	100 (38)	0.08
Chromium	1000 (538)	0.26
Chromium, Polished	302 (150)	0.06
Cobalt, Unoxidised	932 (500)	0.13
Cobalt, Unoxidised	1832 (1000)	0.23
Columbium, Unoxidised	1500 (816)	0.19
Columbium, Unoxidised	2000 (1093)	0.24
Copper		
Cuprous Oxide	100 (38)	0.87
Cuprous Oxide	500 (260)	0.83
Cuprous Oxide	1000 (538)	0.77
Black, Oxidised	100 (38)	0.78
Etched	100 (38)	0.09
Matte	100 (38)	0.22
Roughly Polished	100 (38)	0.07
Polished	100 (38)	0.03
Highly Polished	100 (38)	0.02
Rolled	100 (38)	0.64
Rough	100 (38)	0.74
Molten	1000 (538)	0.15
Molten	1970 (1077)	0.16
Molten	2230 (1221)	0.13
Nickel Plated	100-500 (38-260)	0.37
Dow Metal	0.4-600 (-18-316)	0.15
Gold		
Enamel	212 (100)	0.37
Plate (.0001)
Plate on .0005 Silver	200-750 (93-399)	.11-.14
Plate on .0005 Nickel	200-750 (93-399)	.07-.09
Polished	100-500 (38-260)	0.02
Polished	1000-2000 (538-1093)	0.03
Haynes Alloy C,		
Oxidised	600-2000 (316-1093)	.90-.96

Material(metal)	Temp degF (degC)	Emissivity
Haynes Alloy 25,		
Oxidised	600-2000 (316-1093)	.86-.89
Haynes Alloy X,		
Oxidised	600-2000 (316-1093)	.85-.88
Inconel Sheet	1000 (538)	0.28
Inconel Sheet	1200 (649)	0.42
Inconel Sheet	1400 (760)	0.58
Inconel X, Polished	75 (24)	0.19
Inconel B, Polished	75 (24)	0.21
Iron		
Oxidised	212 (100)	0.74
Oxidised	930 (499)	0.84
Oxidised	2190 (1199)	0.89
Unoxidised	212 (100)	0.05
Red Rust	77 (25)	0.7
Rusted	77 (25)	0.65
Liquid	2760-3220 (1516-1771)	.42-.45
Cast Iron		
Oxidised	390 (199)	0.64
Oxidised	1110 (599)	0.78
Unoxidised	212 (100)	0.21
Strong Oxidation	40 (104)	0.95
Strong Oxidation	482 (250)	0.95
Liquid	2795 (1535)	0.29
Wrought Iron		
Dull	77 (25)	0.94
Dull	660 (349)	0.94
Smooth	100 (38)	0.35
Polished	100 (38)	0.28
Lead		
Polished	100-500 (38-260)	.06-.08
Rough	100 (38)	0.43
Oxidised	100 (38)	0.43
Oxidised at 1100	100 (38)	0.63
Gray Oxidised	100 (38)	0.28
Magnesium	100-500 (38-260)	.07-.13
Magnesium Oxide	1880-3140 (1027-1727)	.16-.20
Mercury	32 (0)	0.09
Mercury	77 (25)	0.1
Mercury	100 (38)	0.1
Mercury	212 (100)	0.12
Molybdenum	100 (38)	0.06
Molybdenum	500 (260)	0.08
Molybdenum	1000 (538)	0.11
Molybdenum	2000 (1093)	0.18
Molybdenum Oxidised at 1000degF	600 (316)	0.8
Molybdenum Oxidised at 1000degF	700 (371)	0.84

Material(metal)	Temp degF (degC)	Emissivity
Lead - continued		
Molybdenum Oxidised at 1000degF	800 (427)	0.84
Molybdenum Oxidised at 1000degF	900 (482)	0.83
Molybdenum Oxidised at 1000degF	1000 (538)	0.82
Monel, Ni-Cu	392 (200)	0.41
Monel, Ni-Cu	752 (400)	0.44
Monel, Ni-Cu	1112 (600)	0.46
Monel, Ni-Cu Oxidised	68 (20)	0.43
Monel, Ni-Cu Oxid. at 1110degF	1110 (599)	0.46
Nickel		
Polished	100 (38)	0.05
Oxidised	100-500 (38-260)	.31-.46
Unoxidised	77 (25)	0.05
Unoxidised	212 (100)	0.06
Unoxidised	932 (500)	0.12
Unoxidised	1832 (1000)	0.19
Electrolytic	100 (38)	0.04
Electrolytic	500 (260)	0.06
Electrolytic	1000 (538)	0.1
Electrolytic	2000 (1093)	0.16
Nickel Oxide	1000-2000 (538-1093)	.59-.86
Palladium Plate (.00005 on .0005 silver)	200-750 (93-399)	.16-.17
Platinum	100 (38)	0.05
Platinum	500 (260)	0.05
Platinum	1000 (538)	0.1
Platinum, Black	100 (38)	0.93
Platinum, Black	500 (260)	0.96
Platinum, Black	2000 (1093)	0.97
Platinum Oxidised at 1100	500 (260)	0.07
Platinum Oxidised at 1100	1000 (538)	0.11
Rhodium Flash (0.0002 on 0.0005 Ni)	200-700 (93-371)	.10-.18
Silver		
Plate (0.0005 on Ni)	200-700 (93-371)	.06-.07
Polished	100 (38)	0.01
Polished	500 (260)	0.02
Polished	1000 (538)	0.03
Polished	2000 (1093)	0.03
Steel		
Cold Rolled	200 (93)	.75-.85
Ground Sheet	1720-2010 (938-1099)	.55-.61
Polished Sheet	100 (38)	0.07
Polished Sheet	500 (260)	0.1
Polished Sheet	1000 (538)	0.14
Mild Steel, Polished	75 (24)	0.1
Mild Steel, Smooth	75 (24)	0.12
Mild Steel,liquid	2910-3270 (1599-1793)	0.28
Steel, Unoxidised	212 (100)	0.08

Material(metal)	Temp degF (degC)	Emissivity
Steel - continued		
Steel, Oxidised	77 (25)	0.8
Steel Alloys		
Type 301, Polished	75 (24)	0.27
Type 301, Polished	450 (232)	0.57
Type 301, Polished	1740 (949)	0.55
Type 303, Oxidised	600-2000 (316-1093)	.74-.87
Type 310, Rolled	1500-2100 (816-1149)	.56-.81
Type 316, Polished	75 (24)	0.28
Type 316, Polished	450 (232)	0.57
Type 316, Polished	1740 (949)	0.66
Type 321	200-800 (93-427)	.27-.32
Type 321 Polished	300-1500 (149-815)	.18-.49
Type 321 w/BK Oxide	200-800 (93-427)	.66-.76
Type 347, Oxidised	600-2000 (316-1093)	.87-.91
Type 350	200-800 (93-427)	.18-.27
Type 350 Polished	300-1800 (149-982)	.11-.35
Type 446, Polished	300-1500 (149-815)	.15-.37
Type 17-7 PH	200-600 (93-316)	.44-.51
Type 17-7 PH Polished	300-1500 (149-815)	.09-.16
Type C1020,Oxidised	600-2000 (316-1093)	.87-.91
Type PH-15-7 MO	300-1200 (149-649)	.07-.19
Stellite, Polished	68 (20)	0.18
Tantalum, Unoxidised	1340 (727)	0.14
Tantalum, Unoxidised	2000 (1093)	0.19
Tantalum, Unoxidised	3600 (1982)	0.26
Tantalum, Unoxidised	5306 (2930)	0.3
Tin, Unoxidised	77 (25)	0.04
Tin, Unoxidised	212 (100)	0.05
Tinned Iron, Bright	76 (24)	0.05
Tinned Iron, Bright	212 (100)	0.08
Titanium		
Alloy C110M,Polished	300-1200 (149-649)	.08-.19
Oxidised at 538degC(1000degF)	200-800 (93-427)	.51-.61
Alloy Ti-95A,Oxidised at 538degC(1000degF)	200-800 (93-427)	.35-.48
Anodized onto SS	200-600 (93-316)	.96-.82
Tungsten		
Unoxidised	77 (25)	0.02
Unoxidised	212 (100)	0.03
Unoxidised	932 (500)	0.07
Unoxidised	1832 (1000)	0.15
Unoxidised	2732 (1500)	0.23
Unoxidised	3632 (2000)	0.28
Filament (Aged)	100 (38)	0.03
Filament (Aged)	1000 (538)	0.11
Filament (Aged)	5000 (2760)	0.35
Uranium Oxide	1880 (1027)	0.79

Material(metal)	Temp degF (degC)	Emissivity
Zinc		
Bright, Galvanised	100 (38)	0.23
Commercial 99.1%	500 (260)	0.05
Galvanised	100 (38)	0.28
Oxidised	500-1000 (260-538)	
Polished	100 (38)	0.02
Polished	500 (260)	0.03
Polished	1000 (538)	0.04
Polished	2000 (1093)	0.06



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