METHYL FORMATE

MFM

CAUTIONARY RESPONSE INFORMATION

Common Synonyms	Liquid	Colorless	Pleasant odor
Formic acid, methyl ester	Mixes with water. Flammable, irritating vapor is produced. Boiling point is 88°F.		

Evacuate.
Keep people away.
Shut off ignition sources. Call fire department.
Notify local health and pollution control agencies.

Fire

FLAMMABLE.
Containers may explode in fire.
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Extinguish with dry chemicals, alcohol foam, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

Call for medical aid.

VAPOR
Irritating to eyes, nose and throat.
Harmful if inhaled.
Move victim to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Irritating to skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and have victim induce vomiting.
IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.

Water Pollution

Effect of low concentrations on aquatic life is unknown.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. CORRECTIVE RESPONSE ACTIONS

Dilute and disperse
Stop discharge

2. CHEMICAL DESIGNATIONS

2.1 CG Compatibility Group: Not listed.
2.2 Formula: $HCOOCH_3$
2.3 IMO/UN Designation: 3.1/1243
2.4 DOT ID No.: 1243
2.5 CAS Registry No.: 107-31-3
2.6 NAERG Guide No.: 129
2.7 Standard Industrial Trade Classification: 51374

3. HEALTH HAZARDS

3.1 Personal Protective Equipment: Goggles or safety glasses; self-contained breathing apparatus; rubber gloves.
3.2 Symptoms Following Exposure: Inhalation causes irritation of mucous membranes. Prolonged inhalation can produce narcosis and central nervous symptoms, including some temporary visual disturbance. Contact with liquid irritates eyes and may irritate skin if allowed to remain. Ingestion causes irritation of mouth and stomach and central nervous system depression, including visual disturbances.
3.3 Treatment of Exposure: INHALATION: move to fresh air and rest; if pulmonary edema develops, administer oxygen; call physician. EYES: irrigate with water for 15 min. SKIN: wash thoroughly with soap and water. INGESTION: do NOT induce vomiting; get medical attention.
3.4 TLV-TWA: 100 ppm
3.5 TLV-STEL: Not listed.
3.6 TLV-Ceiling: 150 ppm.
3.7 Toxicity by Ingestion: Grade 1; LD_{50} = 5 to 15 g/kg
3.8 Toxicity by Inhalation: Currently not available.
3.9 Chronic Toxicity: Currently not available
3.10 Vapor (Gas) Irritant Characteristics: Vapors are moderately irritating such that personnel will not usually tolerate moderate or high concentrations.
3.11 Liquid or Solid Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
3.12 Odor Threshold: Currently not available
3.13 IDLH Value: 4,500 ppm
3.14 OSHA PEL-TWA: 100 ppm
3.15 OSHA PEL-STEL: Not listed.
3.16 OSHA PEL-Ceiling: Not listed.
3.17 EPA AEGL: Not listed

4. FIRE HAZARDS

4.1 Flash Point: -26°F C.C.
4.2 Flammable Limits in Air: 5%-22.7%
4.3 Fire Extinguishing Agents: Dry chemical, alcohol foam, carbon dioxide
4.4 Fire Extinguishing Agents Not to Be Used: Water may be ineffective.
4.5 Special Hazards of Combustion Products: Not pertinent
4.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back.
4.7 Auto Ignition Temperature: 853°F
4.8 Electrical Hazards: Currently not available
4.9 Burning Rate: 2.5 mm/min.
4.10 Adiabatic Flame Temperature: Currently not available
4.11 Stoichometric Air to Fuel Ratio: 9.5 (calc.)
4.12 Flame Temperature: Currently not available
4.13 Combustion Molar Ratio (Reactant to Product): 4.0 (calc.)
4.14 Minimum Oxygen Concentration for Combustion (MOCC): N_2 diluent: 10.0-10.1%; CO_2 diluent: 12.5%

5. CHEMICAL REACTIVITY

5.1 Reactivity with Water: Slow reaction to form formic acid and methyl alcohol; reaction is not hazardous.
5.2 Reactivity with Common Materials: No reaction
5.3 Stability During Transport: Stable
5.4 Neutralizing Agents for Acids and Caustics: Not pertinent
5.5 Polymerization: Not pertinent
5.6 Inhibitor of Polymerization: Not pertinent

6. WATER POLLUTION

6.1 Aquatic Toxicity: Currently not available
6.2 Waterfowl Toxicity: Currently not available
6.3 Biological Oxygen Demand (BOD): Currently not available
6.4 Food Chain Concentration Potential: None
6.5 GESAMP Hazard Profile:
Bioaccumulation: 0
Damage to living resources: 1
Human Oral hazard: 1
Human Contact hazard: I
Reduction of amenities: X

7. SHIPPING INFORMATION

7.1 Grades of Purity: Technical, practical, and spectro grades: all 97.5+%
7.2 Storage Temperature: <85°F
7.3 Inert Atmosphere: No requirement
7.4 Venting: Pressure-vacuum
7.5 IMO Pollution Category: D
7.6 Ship Type: 2
7.7 Barge Hull Type: Currently not available

8. HAZARD CLASSIFICATIONS

8.1 49 CFR Category: Flammable liquid
8.2 49 CFR Class: 3
8.3 49 CFR Package Group: I
8.4 Marine Pollutant: No
8.5 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue).....	2
Flammability (Red).....	4
Instability (Yellow).....	0

8.6 EPA Reportable Quantity: Not listed.
8.7 EPA Pollution Category: Not listed.
8.8 RCRA Waste Number: Not listed
8.9 EPA FWPCA List: Not listed

9. PHYSICAL & CHEMICAL PROPERTIES

9.1 Physical State at 15° C and 1 atm: Liquid
9.2 Molecular Weight: 60.1
9.3 Boiling Point at 1 atm: 89.2°F = 31.8°C = 305°K
9.4 Freezing Point: –147.6°F = –99.8°C = 173.4°K
9.5 Critical Temperature: 417.2°F = 214°C = 487.2°K
9.6 Critical Pressure: 870 psia = 59.2 atm = 6.00 MN/m^2
9.7 Specific Gravity: 0.977 at 20°C (liquid)
9.8 Liquid Surface Tension: 25 dynes/cm = 0.025 N/m at 20°C
9.9 Liquid Water Interfacial Tension: Not pertinent
9.10 Vapor (Gas) Specific Gravity: 2.07
9.11 Ratio of Specific Heats of Vapor (Gas): 1.1446
9.12 Latent Heat of Vaporization: 202 Btu/lb = 112 cal/g = 4.69 X 10^5 J/kg
9.13 Heat of Combustion: –6,980 Btu/lb = –3,880 cal/g = –162 X 10^5 J/kg
9.14 Heat of Decomposition: Not pertinent
9.15 Heat of Solution: Not pertinent
9.16 Heat of Polymerization: Not pertinent
9.17 Heat of Fusion: Currently not available
9.18 Limiting Value: Currently not available
9.19 Reid Vapor Pressure: Currently not available

NOTES

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9.20 SATURATED LIQUID DENSITY

Temperature (degrees F)	Pounds per cubic foot
34	62.330
36	62.230
38	62.130
40	62.030
42	61.940
44	61.840
46	61.740
48	61.650
50	61.550
52	61.450
54	61.350
56	61.260
58	61.160
60	61.060
62	60.970
64	60.870
66	60.770
68	60.670
70	60.580
72	60.480
74	60.380
76	60.290
78	60.190
80	60.090
82	59.990
84	59.900

9.21 LIQUID HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
34	0.515
36	0.515
38	0.515
40	0.515
42	0.515
44	0.515
46	0.515
48	0.515
50	0.515
52	0.515
54	0.515
56	0.515
58	0.515
60	0.515
62	0.515
64	0.515
66	0.515
68	0.515
70	0.515
72	0.515
74	0.515
76	0.515
78	0.515
80	0.515
82	0.515
84	0.515

9.22 LIQUID THERMAL CONDUCTIVITY

Temperature (degrees F)	British thermal unit inch per hour-square foot-F
28	1.352
30	1.349
32	1.346
34	1.343
36	1.340
38	1.337
40	1.334
42	1.331
44	1.328
46	1.325
48	1.322
50	1.319
52	1.316
54	1.312
56	1.309
58	1.306
60	1.303
62	1.300
64	1.297
66	1.294
68	1.291
70	1.288
72	1.285
74	1.282
76	1.279
78	1.276

9.23 LIQUID VISCOSITY

Temperature (degrees F)	Centipoise
35	0.427
40	0.415
45	0.403
50	0.392
55	0.381
60	0.371
65	0.361
70	0.352
75	0.343
80	0.335
85	0.327

9.24 SOLUBILITY IN WATER

Temperature (degrees F)	Pounds per 100 pounds of water
68	30.000

9.25 SATURATED VAPOR PRESSURE

Temperature (degrees F)	Pounds per square inch
0	1.528
5	1.774
10	2.053
15	2.368
20	2.724
25	3.125
30	3.574
35	4.077
40	4.639
45	5.264
50	5.958
55	6.729
60	7.581
65	8.521
70	9.557
75	10.700
80	11.950
85	13.310
90	14.810
95	16.440

9.26 SATURATED VAPOR DENSITY

Temperature (degrees F)	Pounds per cubic foot
0	0.01861
5	0.02137
10	0.02447
15	0.02793
20	0.03180
25	0.03610
30	0.04087
35	0.04615
40	0.05197
45	0.05840
50	0.06545
55	0.07320
60	0.08167
65	0.09093
70	0.10100
75	0.11200
80	0.12390
85	0.13690
90	0.15090
95	0.16600

9.27 IDEAL GAS HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
0	0.237
20	0.244
40	0.252
60	0.259
80	0.266
100	0.273
120	0.280
140	0.286
160	0.293
180	0.299
200	0.306
220	0.312
240	0.318
260	0.324
280	0.330
300	0.336
320	0.342
340	0.348
360	0.353
380	0.359
400	0.364
420	0.369
440	0.375
460	0.380
480	0.385
500	0.390