JOHNS-MANVILLE AEROSPACE PRODUCTS
22 EAST 40th ST., NEW YORK, N.Y. 10016

Contains one
Johns-Manville
AEROSPACE INSULATION SELECTOR



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Johns-Manville AEROSPACE INSULATION SELECTOR

Johns-Manville insulating materials... wherever there's need for heat control!

Johns-Manville
22 East 40th Street • New York, N.Y. 10016
Aerospace Department

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MEAN TEMPERATURE F

SET ONLY AT 100 DEGREE INTERVAL MARKS → 900

GLASS FIBER INSULATION		DENSITY PCF	THERMAL CONDUCTIVITY
MICRO-FIBERS (475) TEMP LIMIT 900F (E) TEMP LIMIT 1200F		4.0	.69
		6.0	.61
MICROLITE® (Phenolic) TEMP LIMIT 400F	AA	0.6	—
		1.0	—
	B	0.6	—
		1.0	—
MICROLITE® (Silicone) AA TEMP LIMIT 750F		0.6	—
		1.0	—
UNBONDED "B" TEMP LIMIT 850F		1.5	—
		3.0	—
		4.5	—
MICRO-QUARTZ® TEMP LIMIT 2000F		3.0	.82
		3.5	.74
		6.0	.63
DYNA-QUARTZ® TEMP LIMIT 2750F		6.2	.68
		12	.61
REFRACTORY FIBER INSULATION			
THERMOFLEX® TEMP LIMIT 2300F & DYNA-FLEX® TEMP LIMIT 2700F		3	1.07
		4	.93
		6	.79
		8	.73
		10	.69
		12	.66
		14	.65
		16	.63
		18	.63
		20	.62
		22	.61
		24	.61

MIN-K INSULATION		DENSITY PCF	THERMAL CONDUCTIVITY
MOLDED TYPE 503 TEMP LIMIT 500F		15	—
MOLDED TYPE 1301 TEMP LIMIT 1300F		20	.26
		25	.36
		30	.47
		35	.65
MOLDED TYPE 2000 TEMP LIMIT 1800F		20	.29
		25	.26
		30	.31
		35	.41
FLEXIBLE STANDARD TEMP LIMIT 500F+*	THICKNESS		
	1/8"	16	.29
	3/16"	16	.28
	1/4"	16	.28
	3/8"	16	.28
	1/2"	16	.27
FLEXIBLE HIGH TEMPERATURE TEMP LIMIT 1800F	1/8"	16	.34
	3/16"	16	.31
	1/4"	16	.30
	3/8"	16	.29
	1/2"	16	.29
FLEXIBLE LIGHT WEIGHT TEMP LIMIT 500F+*	1/4"	8	.42
	3/8"	8	.42
	1/2"	8	.41
	1/4"	10	.39
	3/8"	10	.39
	1/2"	10	.40
FLEXIBLE TAPE TEMP LIMIT 500F+*	SIZE	TYPE	
	1" x 1/8"	108	.31
	1" x 3/16"	103	.30
	1" x 1/4"	104	.30
	1½" x 1/8"	158	.30
	1½" x 3/16"	153	.29
	1½" x 1/4"	154	.28
	2½" x 1/4"	254	.28

THERMAL CONDUCTIVITY

THERMAL CONDUCTIVITY

From Johns-Manville for the Aerospace Industry . . . only the best!

- **RESEARCH:** World's largest insulation laboratory in Manville, N.J.
- **PRODUCTION:** Factories on both coasts for constant source of supply.
- **SERVICE:** J-M engineers available to help solve insulation problems.

NOTES:

Thermal Conductivity — k = BTU In./Hr. Ft.² F.

The thermal conductivity of Min-K® insulation is greatly reduced at decreased pressures. The following may be subtracted from the k shown for all mean temperatures and all types of Min-K.®

Absolute Pressure, mm Hg	Equivalent Altitude, feet	k Reduction
351	20,000	.05
140	40,000	.07
54	60,000	.09
vacuum	—	.13

Temperature Limit — Maximum continuous service temperature. Higher for transients.

Mean Temperature — Half the sum of hot and cold face temp.

*The temperature limits of the core material in Flexible Min-K® — Standard, Light Weight, and Tape — are 1800, 1200, and 1300F respectively. See J-M data sheets IN-526A, IN-675A, and IN-562A for application above the 500F temperature limit shown. Densities shown are for insulation core.

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CONVERSION DEGREES F TO DEGREES C

F	C	F	C	F	C	F	C	F	C
−459.7	−273.2	−60	−51.1	75	23.9	525	273.9	1550	843.3
−440	−262.2	−50	−45.6	80	26.7	550	287.8	1600	871.1
−420	−251.1	−40	−40.0	85	29.4	575	301.7	1650	898.9
−400	−240.0	−30	−34.4	90	32.2	600	315.6	1700	926.7
−380	−228.9	−20	−28.9	95	35.0	650	343.3	1750	954.4
−360	−217.8	−10	−23.3	100	37.8	700	371.1	1800	982.2
−340	−206.7	0	−17.8	125	51.7	750	398.9	1850	1010.0
−320	−195.6	5	−15.0	150	65.6	800	426.7	1900	1037.8
−300	−184.4	10	−12.2	175	79.4	850	454.4	1950	1065.6
−280	−173.3	15	−9.4	200	93.3	900	482.2	2000	1093.3
−260	−162.2	20	−6.7	225	107.2	950	510.0	2050	1121.1
−240	−151.1	25	−3.9	250	121.1	1000	537.8	2100	1148.9
−220	−140.0	30	−1.1	275	135.0	1050	565.6	2150	1176.7
−200	−128.9	32	0.0	300	148.9	1100	593.3	2200	1204.4
−180	−117.8	35	1.7	325	162.8	1150	621.1	2250	1232.2
−160	−106.7	40	4.4	350	176.7	1200	648.9	2300	1260.0
−140	−95.6	45	7.2	375	190.6	1250	676.7	2350	1287.8
−120	−84.4	50	10.0	400	204.4	1300	704.4	2400	1315.6
−100	−73.3	55	12.8	425	218.3	1350	732.2	2450	1343.3
−90	−67.8	60	15.6	450	232.2	1400	760.0	2500	1371.1
−80	−62.2	65	18.3	475	246.1	1450	787.8	2550	1398.9
−70	−56.7	70	21.1	500	260.0	1500	815.6	2600	1426.7

$F = 9/5C + 32$ $\quad C = 5/9\ (F-32)$

$R = F + 459.7$ $\quad K = C + 273.2$

CONVERSION FACTORS

1 BTU = 252 Calories
1 BTU = 778 Ft. Lbs.
1 Cal./Gm = 1.80 BTU/Lb.
1 In. = 2.54 Cms
1 Horse Power = .7457 Kilowatts
1 Horse Power Hour = 2,547 BTU
1 Kilowatt Hour = 3,413 BTU
1 Lb. = 453.6 Gms = 7000 Grains
1 Micron = 10^{-6} Meters
1 Micron = .0000394 Ins.
Specific Heat 1 Cal/GmC = 1 BTU/Lb. F

BOILING POINTS (F) AT ATMOSPHERIC PRESSURE

AIR	−317.6	ARGON	−302.3
HELIUM	−452.0	NITROGEN	−320.4
HYDROGEN	−422.9	OXYGEN	−297.2

THERMAL CONDUCTIVITY OF GASES
k – BTU In./Sq. Ft. Hr. F

TEMP. F	AIR	HYDROGEN	HELIUM	CARBON DIOXIDE
−100	.124	.88	.80	—
0	.154	1.08	.94	.073
100	.186	1.28	1.07	.120
200	.216	1.46	1.16	.155
300	.244	1.66	1.26	.190
400	.270	1.83	1.36	.225
500	.294	1.99	1.46	.255
600	.318	2.16	1.54	.280
700	.340	2.32	1.62	.305
800	.364	2.49	1.70	.330
900	.386	2.66	1.78	.350
1000	.408	2.72	1.85	.370

SPECIFIC HEAT BTU/Lb. F

	TEMPERATURE F								
	200	400	600	800	1000	1200	1400	1600	1800
MIN-K 503	.21	.23	.25	.27	.28	.29	.30	.30	.31
MIN-K 1301	.21	.23	.24	.25	.26	.27	.27	.27	.28
MIN-K 2000	.20	.22	.24	.25	.26	.26	.27	.28	.28
FIBER GLASS	.21	.24	.26	.27	.28	.29	—	—	—
MICRO-QUAR.	.20	.23	.25	.26	.27	.28	.29	.29	.29
DYNA-QUARTZ	.20	.23	.25	.26	.27	.28	.29	.29	.29
THERMO-FLEX	.20	.22	.23	.24	.25	.26	.27	.27	.27
DYNA-FLEX	.20	.22	.23	.24	.25	.26	.27	.27	.27

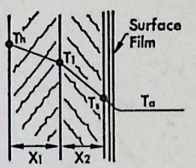
THERMAL DIFFUSITY $\alpha = 2.32 \times 10^{-5}\ k/\rho Cp$

α = Ft.²/Sec.
k = BTU In./Ft.² Hr. F
ρ = Lb./Ft.³
Cp = BTU/Lb. F

VARIATION OF ATMOSPHERIC PRESSURE WITH ALTITUDE

ALTITUDE FEET	PRESSURE mm-Hg	ALTITUDE FEET	PRESSURE mm-Hg
0	760	8×10^4	20.6
1×10^4	524	9×10^4	12.8
2×10^4	351	1×10^5	8.15
3×10^4	226	1.1×10^5	5.26
4×10^4	140	1.2×10^5	3.43
5×10^4	86.9	1.3×10^5	2.28
6×10^4	54.4	1.4×10^5	1.54
7×10^4	33.3	1.5×10^5	1.06

HEAT FLOW THROUGH THERMAL INSULATION



$$Q = \frac{T_h - T_a}{\frac{X_1}{k_1} + \frac{X_2}{k_2} + \ldots + r_s}$$

$$Q\left(\frac{X_1}{k_1} + \frac{X_2}{k_2} + \ldots + r_s\right) = \Delta T_{X1} + \Delta T_{X2} + \ldots \Delta T_s = T_h - T_a$$

Q = BTU/Sq. Ft. Hr.
T_h = Hot face temp. F
T_a = Ambient temp. F
T_1, T_2 = Inner face temp. F
T_s = Surface temp. F
X_1, X_2 = Insulation thickness Ins.
k_1, k_2 = Thermal conductivity BTU In./Ft.² Hr. F
r_s = Surface film resistance, Ft.² Hr. F/BTU

Ts – Ta	SURFACE RESISTANCE r_s (Still Air)		
F	FABRIC	ALUMINUM	STAINLESS STEEL
0	.54	.90	.81
100	.46	.80	.72
200	.38	.71	.64
300	.32	.62	.56
400	.26	.54	.48
500	.20	.46	.41
600	.15	.39	.34
700	.11	.33	.28

ON SLIDE

ADDITIONAL DATA

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