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MILITARY STANDARD

TABLE OF DIFFERENTIAL PRESSURE IN RELATION TO CALIBRATED AIRSPEED

FSC 6610

DEPARTMENT OF DEFENSE
WASHINGTON, D. C. 20301

Table of Differential Pressure in Relation to Calibrated Airspeed

MIL-STD-1524

1. This Military Standard is approved for use by all Departments and Agencies of the Department of Defense.

2. Recommended corrections, additions, or deletions should be addressed to the 4950th Test Wing (TZSA), Wright-Patterson Air Force Base, Ohio 45433.

CONTENTS

1. SCOPE

1.1 This standard presents differential pressures in inches of mercury and inches of water for values of calibrated airspeed in knots.

2. REFERENCED DOCUMENTS

2.1 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

National Aeronautics and Space Administration

Technical Note D822 Tables of Airspeed, Altitude, and Mach Number Based on Latest International Values for Atmospheric Properties and Physical Constants

(Application for copies should be addressed to the National Aeronautics and space Administration, Washington, D. C. 20546.)

U. S. Standard Atmosphere 1962

(Request for copies should be addressed to the Superintendent of Documents, Government Printing Office, Washington, D. C. 20402.)

Airplane Aerodynamics, 1967 (Dommash et al)

(Application for copies should be addressed to the Pitman Publishing Corporation, 20 East 46th Street, New York, New York 10017.)

3. DEFINITIONS

CALIBRATED AIRSPEED (V_c) - Calibrated airspeed is the indicated airspeed corrected for installation (position) errors, instrument errors, errors in the pitot-static system, and errors induced by the attitude of the aircraft.

INDICATED AIRSPEED - The reading in knots of an airspeed indicator without any correction.

4. GENERAL REQUIREMENTS (Not applicable)

5. DETAIL REQUIREMENTS

5.1 Formulae and symbols. The equations listed in 5.1.1 are derived from the classical form of Bernoulli's equation for compressible flow in the subsonic case and the Raleigh-Pitot formula in the supersonic case. These equations may be found in NASA technical Note D822 or Airplane Aerodynamics. For a detailed discussion of the calculation of calibrated airspeed, Airplane Aerodynamics or a similar text on aircraft dynamics should be consulted.

5.1.1 Formulae. The formulae relating to calibrated airspeed, V_c, and differential pressure, Q_c, shall be as follows:

a. For $V_c \leq A_o$

(1) $$Q_c = P_o \left[\left(1 + \frac{(\gamma-1)}{2\gamma} \frac{\rho_o}{P_o} V_c^2 \right)^{\frac{\gamma}{\gamma-1}} - 1 \right]$$

(2) $$Q_c = 29.9213 \left[(1.000 + .457090 \times 10^{-6} V_c^2)^{7/2} - 1.000 \right]$$

b. For $V_c > A_o$

(1) $$Q_c = \frac{(1+\gamma)}{2} \left(\frac{V_c}{A_o} \right)^2 P_o \left[\frac{(\gamma+1)^2}{4\gamma - 2(\gamma-1)(A_o/V_c)^2} \right]^{\frac{1}{\gamma-1}} - P_o$$

(2) $$Q_c = .820610 \times 10^{-4} V_c^2 \left[\frac{5.760 V_c^2}{5.600 V_c^2 - 35.003913 \times 10^4} \right]^{5/2} - 29.92126$$

5.1.2 Symbols. Symbols shall be as follows:

a. P_t: Total pressure or ram pressure (in. Hg)

b. P_s: Static pressure (in. Hg)

c. P_o: Static atmospheric pressure at sea level (in. Hg)

d. Q_c: Differential pressure, $P_t - P_s$ (in. Hg)

e. ρ_o: Mass density of dry ambient air at sea level (P_o = 29.92126) and standard temperature of 15°C

f. V_c: Calibrated air speed (knots)

g. A_o: Speed of sound at sea level and 15°C (knots)

h. γ: Ratio of specific heats of air (dimensionless).

5.1.3 Alternate formulae and symbols. The following alternate formulae and symbols may be used to permit the use of units other than inches Hg:

a. Alternate formulae

(1) For $V_c \leq A_o$

(a) $$Q_c = P_o \left[(1 + 0.2 \left(\frac{V_c}{A_o} \right)^2)^{7/2} - 1 \right]$$

(2) For $V_c > A_o$

(a) $$Q_c = P_o \left[\frac{166.92158 \left(\frac{V_c}{A_o}\right)^7}{\left(7\left(\frac{V_c}{A_o}\right) - 1\right)^{5/2}} - 1 \right]$$

b. Alternate symbols

(1) P_T: Total pressure or ram pressure

(2) P_S: Static pressure

(3) P_o: Static atmospheric pressure at sea level

(4) Q_C: Differential Pressure $P_T - P_S$

(5) V_C: Calibrated airspeed

(6) A_o: Speed of sound at sea level.

5.2 Constants. The following constants are derived from the U.S. Standard Atmosphere, 1962:

a. $\rho_o = .0023769$ lb-sec^2-ft^{-4}

b. $\gamma = 1.400$

c. $A_o = 661.4746$ knots

d. $P_o = 29.92126$ in. Hg, 2116.2170 lb-ft^{-2}

e. Nautical mile = 6,076.1155 feet.

5.3 Differential pressure. Differential pressure (Q_c) in relation to calibrated airspeed (V_c) shall be in accordance with table I.

6. International standardization agreements. Certain provisions, table I, of this standard are the subject of international standardization agreements Stanag 3636 and ASCC Air Standard 10/46. When amendment, revision, or cancellation of this standard is proposed which will affect or violate the international

Table I. Differential Pressure

Calibrated Airspeed (V_c)	Differential Pressure	
Knots	In. Hg	In. Water at 25°C
0.	0.0000	0.
5.0	0.0012	0.0163
10.0	0.0048	0.0653
15.0	0.0108	0.1469
20.0	0.0192	0.2611
25.0	0.0299	0.4081
30.0	0.0431	0.5877
35.0	0.0587	0.8001
40.0	0.0767	1.0452
45.0	0.0970	1.3232
50.0	0.1198	1.6340
55.0	0.1451	1.9778
60.0	0.1727	2.3545
65.0	0.2027	2.7642
70.0	0.2352	3.2071
75.0	0.2701	3.6832
80.0	0.3075	4.1925
85.0	0.3473	4.7352
90.0	0.3895	5.3113
95.0	0.4342	5.9209
100.0	0.4814	6.5642
105.0	0.5311	7.2413
110.0	0.5832	7.9522
115.0	0.6379	8.6972
120.0	0.6950	9.4763
125.0	0.7546	10.2896
130.0	0.8168	11.1373
135.0	0.8815	12.0196
140.0	0.9488	12.9366
145.0	1.0186	13.8884
150.0	1.0910	14.8752
155.0	1.1659	15.8972
160.0	1.2345	16.9546
165.0	1.3236	18.0475
170.0	1.4064	19.1762
175.0	1.4918	20.3408
180.0	1.5799	21.5415
185.0	1.6706	22.7785
190.0	1.7640	24.0520
195.0	1.8601	25.3623
200.0	1.9589	26.7096

Table I. Differential Pressure (Cont)

Calibrated Airspeed (V_c)	Differential Pressure	
Knots	In. Hg	In. Water at 25°C
205.0	2.0604	
210.0	2.1647	
215.0	2.2718	
220.0	2.3816	
225.0	2.4943	
230.0	2.6097	
235.0	2.7280	
240.0	2.8492	
245.0	2.9732	
250.0	3.1002	
255.0	3.2300	
260.0	3.3628	
265.0	3.4986	
270.0	3.6370	
275.0	3.7792	
280.0	3.9240	
285.0	4.0719	
290.0	4.2229	
295.0	4.3770	
300.0	4.5343	
305.0	4.6947	
310.0	4.8583	
315.0	5.0252	
320.0	5.1953	
325.0	5.3687	
330.0	5.5454	
335.0	5.7254	
340.0	5.9088	
345.0	6.0957	
350.0	6.2859	
355.0	6.4796	
360.0	6.6769	
365.0	6.8776	
370.0	7.0820	
375.0	7.2900	
380.0	7.5015	
385.0	7.7168	
390.0	7.9357	
395.0	8.1585	
400.0	8.3850	
405.0	8.6153	

Table I. Differential Pressure (Cont)

Calibrated Airspeed (V_c)	Differential Pressure	
Knots	In. Hg	In. Water at 25°C
410.0	8.8496	
415.0	9.0877	
420.0	9.3297	
425.0	9.5758	
430.0	9.8259	
435.0	10.0801	
440.0	10.3384	
445.0	10.6008	
450.0	10.8674	
455.0	11.1383	
460.0	11.4135	
465.0	11.6931	
470.0	11.9770	
475.0	12.2654	
480.0	12.5583	
485.0	12.8557	
490.0	13.1577	
495.0	13.4643	
500.0	13.7756	
505.0	14.0917	
510.0	14.4126	
515.0	14.7383	
520.0	15.0689	
525.0	15.4045	
530.0	15.7451	
535.0	16.0908	
540.0	16.4417	
545.0	16.7977	
550.0	17.1590	
555.0	17.5256	
560.0	17.8976	
565.0	18.2750	
570.0	18.6579	
575.0	19.0465	
580.0	19.4406	
585.0	19.8404	
590.0	20.2461	
595.0	20.6575	
600.0	21.0749	
605.0	21.4982	
610.0	21.9276	

Table I. Differential Pressure (Cont)

Calibrated Airspeed (V_c)	Differential Pressure	
Knots	In. Hg	In. Water at 25°C
615.0	22.3631	
620.0	22.8048	
625.0	23.2528	
630.0	23.7071	
635.0	24.1678	
640.0	24.6351	
645.0	25.1089	
650.0	25.5893	
655.0	26.0765	
660.0	26.5705	
665.0	27.0714	
670.0	27.5792	
675.0	28.0937	
680.0	28.6148	
685.0	29.1425	
690.0	29.6767	
695.0	30.2173	
700.0	30.7642	
705.0	31.3173	
710.0	31.8766	
715.0	32.4421	
720.0	33.0135	
725.0	33.5910	
730.0	34.1744	
735.0	34.7637	
740.0	35.3587	
745.0	35.9596	
750.0	36.5662	
755.0	37.1785	
760.0	37.7964	
765.0	38.4199	
770.0	39.0489	
775.0	39.6835	
780.0	40.3235	
785.0	40.9690	
790.0	41.6199	
795.0	42.2762	
800.0	42.9378	
805.0	43.6048	
810.0	44.2770	
815.0	44.9545	

Table I. Differential Pressure (Cont)

Calibrated Airspeed (V_c)	Differential Pressure	
Knots	In. Hg	In. Water at 25°C
820.0	45.6373	
825.0	46.3252	
830.0	47.0184	
835.0	47.7167	
840.0	48.4201	
845.0	49.1287	
850.0	49.8423	
855.0	50.5610	
860.0	51.2849	
865.0	52.0138	
870.0	52.7476	
875.0	53.4865	
880.0	54.2304	
885.0	54.9792	
890.0	55.7330	
895.0	56.4918	
900.0	57.2554	
905.0	58.0240	
910.0	58.7975	
915.0	59.5759	
920.0	60.3591	
925.0	61.1473	
930.0	61.9402	
935.0	62.7380	
940.0	63.5407	
945.0	64.3481	
950.0	65.1604	
955.0	65.9775	
960.0	66.7993	
965.0	67.6259	
970.0	68.4573	
975.0	69.2935	
980.0	70.1344	
985.0	70.9801	
990.0	71.8305	
995.0	72.6856	
1000.0	73.5454	

agreements concerned, the preparing activity will take appropriate reconciliation action through international standardization channels including standardization offices, if required.

Custodians:
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Navy - AS
Air Force - 11

Review activities:
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Navy - AS
Air Force - 71

Preparing activity:
Air Force - 11

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☐ YES ☐ NO IF "YES", IN WHAT WAY?

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