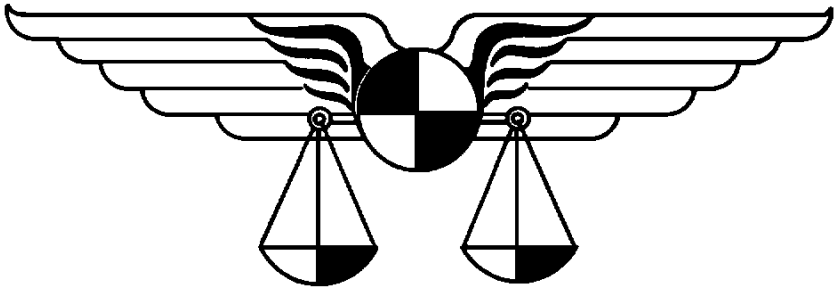
WEIGHT ENGINEER'S HANDBOOK

Society of Allied Weight Engineers, Incorporated

Serving the Aerospace - Shipbuilding - Land Vehicle and Allied Industries

Revised May 2008

S A W E



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Society of Allied Weight Engineers

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Revised, May 2008

Acknowledgements

This Handbook has been prepared by numerous individuals of the Society of Allied Weight Engineers for use as a ready reference in the weight engineering field. It contains a wide variety of data that are important to weight engineers, and general information pertaining to other related engineering fields.

We wish to express appreciation to those Society members and chapters who contributed to the complete revision of the Handbook in May 2002. In particular, the following individuals made significant contributions to the project:

Brett Anderson	LA
Richard Boynton	BO
Vic Filgueras	SL
Tony Gonzales	LA
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Jerry Pierson	TX
Robert Ridenour	SL
Tom Schultz	SL
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The major features of the February 2007 and May 2008 revisions are listed in the Revisions Section.

Every precaution has been taken to insure accuracy in the numerical values. Notification of any errors found in this document will be sincerely appreciated. Please send comments to:

SAWE Vice President – Technical Director
c/o Handbook Committee Chairman
www.sawe.org

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Acknowledgements

We are grateful for the kind permission to utilize the following sources of information in preparation of this Handbook:

Data Source	Principal Pages Using Data
"1965 Handbook" Automated Specialties, Inc. P. O. Box 888, Charlottesville, Virginia	1.4 through 1.11 10.9, 15.4
"Physical Data Constants and Conversion Factors" General Electric, Missile and Space Division Philadelphia, Pennsylvania	1.2
"1965 Aerospace and Defense Diary" General Electric, Defense Electronics Division Syracuse, New York	1.6
"1965 World Almanac" New York World-Telegram & Sun New York, New York	1.12
"National Aerospace Standard"	1.14 through 1.15
"Aerospace Propulsion Data Book" General Electric Flight Propulsion Division Cincinnati, Ohio	3.17 through 3.20 10.1 through 10.5 10.9, 11.7, 11.8
"Mechanical Engineers' Handbook", 6th Edition McGraw Hill Book Company New York, New York	3.15
"Engineering Materials Handbook" McGraw Hill Book Company New York, New York	3.10
"Pocket Data for Rocket Engineers" Bell Aerosystems Company Buffalo, New York	11.1 through 11.5 11.7 through 11.9
"Aeronautical Vest-Pocket Handbook" Pratt and Whitney Aircraft East Hartford, Connecticut	11.9

Acknowledgements

Data Source	Principal Pages Using Data
"Defense Electronics Databook" Westinghouse Defense Baltimore, Maryland	15.5 through 15.9 19.3 through 19.6
"Space Data", 1965 Edition TRW Space Technology Laboratories Redondo Beach, California	13.1, 13.2, 13.4
"Spacefacts" General Electric Missile and Space Division Philadelphia, Pennsylvania	13.4
"Westinghouse Aviation Pocket Handbook" Westinghouse Electric Corporation Pittsburgh, Pennsylvania	20.1, 20.2
"STL Space Data Space Technology Laboratories Redondo Beach, California	14.5

Revisions to the May 2002 Edition

Only pages that have been changed or added since the May 2002 revision have the "**Rev. February 2007"** date in the footer.

Page	Reason
Cover	Revised to reflect this revision date
1.6	"Angles" replaced by "Angular Measurement".
1.6	One "circle" now reads 6.283 radians, not 6,283.
1.9	Torque and Mass Moment of Inertia Conversion Factors moved out of Curvilinear Motion section.
1.10	"Acceleration of Gravity" replaced by "Acceleration due to Gravity".
1.13	Corrected decimal equivalent of 1/32 from .0133 to .0313.
2.8	Volume of a sphere equation was wrong at $2/3\ \pi\ r^3$ and now reads $4/3\ \pi\ r^3$
2.12	Corrected Solid Ogive surface area equation from $A=2\pi$ **R** $(h\text{-}D\ \sin^{-1}h/R)$ to $A=2\pi$ **r** $(h\text{-}D\ \sin^{-1}h/R)$
3.5	Removed the last two lines on this page
3.10	Revised "Strength Properties of Commercial Woods" to "Material Properties of Commercial Woods" for consistency.
3.10	Revised "Plywood" to "Plywood Unit Weights" for consistency.
3.15	Add JP-8 to table of fluid densities – same as JP-5, 6.80 lb/gal.
3.21	Revised "Miscellaneous Materials" to "Densities of Miscellaneous Materials".
3.22-3.24	Revised "Material Densities by Type from Mil Handbook 5" to "Material Densities by Type from DOT/FAA/AR-MMPDS-01"
3.25-3.26	Revised "Material Densities by Specification Number from Mil Handbook 5" to "Material Densities by Specification Number from DOT/FAA/AR-MMPDS-01"
3.27-3.29	New data added from Mil Handbook 17
4.10-4.14	Added component properties which had been left out of May 2002 revision.
5.46-5.48	Added a new page that replaces page 19.8 in the 1986 handbook. The original page had an incorrect designation for the units (lb/in/sec squared rather than lb-in-sec squared), the illustration was muddled with one wheel contacting the wrong place, and the equation was unnecessarily complicated and confusing.
6.18	Added "4.3" to the paragraph that starts, "Multiple Point Weighing Method."
6.31	Revised "Minimum MOI which can be measured" to "Minimum MOI that can be measured."
7.1	Revised entire page
10.1	Typo 31.1741 changed to 32.1741
10.5	this page revised – the typos and errors corrected were: In the formula for Aspect Ratio, the character before "b^2/Sw" should be an equal sign, not a dash. In the formula for b_{st}, cos $\lambda/4$ should be cos $\Lambda_{1/4.}$ In the formula for $b_{st}/2t_r$, cos $\lambda c/4$ should be cos $\Lambda_{1/4.}$ The minus signs in the formulas for C_{Di}, C_{Do}, and C_{Dtot} should be replaced with equal signs. The "$1/S_w$" in the formula for C_{Do} should say, "f/S_w", and the upper case "F" for Equivalent flat plate drag area should be a lower case "f". The "ε" in the formula for (L/D) max should be an "e". In the formula for Range, the division symbol needs to be not subscripted. The symbol for Air density ratio should be "σ" not "ρ". The symbol for taper ratio should be "λ" not "Λ". μ is the symbol for the coefficient of absolute viscosity, not absolute velocity. In many formulas it is not clear what symbols are all in the denominator, e.g. "D_i/S_wq" should say, "$D_i/(S_wq)$" or "$D_i/S_w/q$" so it is not confused to be "D_iq/S_w".
13.3	Revised "200 N.MI." to "200 nmi" to be consistent with the common abbreviation on page 1.1 of this same handbook in the lower chart.
13.3	In the lower chart, added the x-axis label that was dropped in the May 2002 revision.
16.5-16.6	Improved Error Analysis equations replaces the Error Analysis equations on the previous page 16.5. (The remainder of the pages (16.7-16.12) have been renumbered for this page insertion.

17.1-17.2	Reformatted pages		
17.14	Corrected following incorrect data and typos in table:		
1.	Concrete (plain), cured	density was .0300 lb/in^3	now .0868 lb/in^3
2.	Cork, compressed	density was .087 lb/in^3	now .0083 lb/in^3
3.	Slate	density was .1010 lb/in^3	now .1013 lb/in^3
4.	Talc	density was .1010 lb/in^3	now .1007 lb/in^3
17.24-31	Editorial Changes to Standard Pipe Weights table.		
17.32-17.47	Added Pipe Weight Equations, Refrigerant Weights, and HVAC Equipment Weights.		
19.3	Replaced the table.		

Revisions to the February 2007 Edition

Only pages that have been changed or added since the February 2007 revision have the "**Rev. May 2008"** date in the footer.

Page	Reason
Cover	Revised to reflect this revision date
ii-xvi	Revised and re-numbered pages for uniformity. Revised Table of Contents.
ii	Revised Acknowledgements for clarity.
v	Corrected typo in note for page 1.10, revised notes for pages 7.1 and 10.5.
3.5	Incorporated February 2007 item not previously incorporated.
3.9	Revised for clarity (added lines in table).
3.10	Incorporated February 2007 item not previously incorporated.
3.15	Incorporated February 2007 item not previously incorporated.
3.21	Incorporated February 2007 item not previously incorporated.
3.23-3.24	Shifted top of table to page 3.24.
5.47-5.48	Added pages to suit revision to page 5.46.
16.10	Corrected page reference note.
A.1-A.4	Revised Index to suit all above.

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