

### METRIC RESOURCES

Metric conversion is largely a paper--and software--change. Codes, standards, handbooks, manufacturers' literature, advertising, and software are being prepared in metric. Here are some of the most requested metric resources.

#### Metric Construction Guides

**National Institute of Building Sciences** (Publications Department, 1201 L St., N.W., Suite 400, Washington DC 20005; phone 202-289-7800):

- *Metric Guide for Federal Construction*. Written by NIBS specifically for the construction industry and reviewed by metric experts throughout the country. Includes background on the federal metric laws; facts on metric in construction; an introduction to metric units; a primer on metric usage for architects, engineers, and the trades; requirements for metric drawings and specifications; guidance on metric management and training; and a list of current metric construction references. 34 pp. \$15.00 (including shipping and handling).

- *GSA Metric Design Guide*. Interim design guide developed by the General Services Administration (GSA) for use by federal project managers and their A/Es. Contains practical architectural, civil, structural, mechanical, and electrical design information; a list of available "hard" metric products; sample drawings; and related reference information. 77 pp. \$8.00; \$5.00 if ordered with the above *Metric Guide for Federal Construction*.

#### General Metric Information

**American National Metric Council** (Washington, DC; phone 410-727-0882 for publications):

- *ANMC Metric Editorial Guide*. \$5.00; bulk discounts available.
- *SI Metric Training Guide*. \$5.00.
- *Metrication and the Consumer*. \$5.00.
- *Metrication for the Manager*. \$15.00.

**Society of Automotive Engineers** (400 Commonwealth Dr., Warrendale, PA 15096-0001; phone 412-776-4841):

- *Metric (SI) in Everyday Science and Engineering*. A well written, concise, and very practical guide to understanding metric in depth. By Stan Jakuba. 1993. \$26.00.

**U.S. Metric Association** (10245 Andasol Ave., Northridge, CA 91325; phone 818-363-5606):

- *Style Guide to the Use of the Metric System*. \$3.00; bulk discounts available.
- *SI Metric Style Guide for Written and Computer Usage*. \$2.00; bulk discounts available.
- *Freeman Training/Education Metric Materials List*. \$38.00.
- *Metric Vendor List*. \$28.00.

**Blackhawk Metric Supply Inc.** (Box 543, South Beloit, IL 61080; phone 815-389-2850):

- *Metric poster*. Attractive four-color chart that shows common metric units and their logical relationships. \$8 each; discounts for bulk orders.

### **Design**

**American Institute of Architects** (AIA Bookstore, 1735 New York Ave., N.W., Washington, DC 20006; phone 202-626-7475. All but the *AIA Pocket Metric Guide* are published by John Wiley & Sons, Professional Reference and Trade Group, 605 Third Ave., New York, NY 10158; phone 1-800-225-5945, ext. 2497):

- *AIA Pocket Metric Guide*. Available in June 1993.
- *Architectural Graphic Standards*. A metric edition is not due for several years, but current editions include a comprehensive section on metric conversion.
- *The Architect's Studio Companion: Technical Guidelines for Preliminary Design*. By Edward Allen and Joseph Iano. Includes dual units. 468 pp. 1989. \$52.95.
- *Architectural Detailing: Function, Constructability, and Aesthetics*. By Edward Allen. Includes dual units. 1993. Available with *Architect's Studio Companion* as a set for \$87.50.
- *Fundamentals of Building Construction: Materials and Methods*. By Edward Allen. Includes dual units. \$59.95.
- *Neufert Architect's Data*. Ernst Neufert. Second International (metric) Edition (Germany). 433 pp. 1980. \$52.50.
- *Wiley Engineer's Desk Reference*. By S. I. Heisler. Includes dual units. 566 pp. 1984. \$54.95.

### **Cost Estimating**

**R. S. Means Company** (Box 800, Kingston, MA 02364; phone 617-585-7880):

- *Means Building Construction Cost Data, 1993*. Metric edition. \$94.95.

### **Specifications**

**American Institute of Architects** (1735 New York Ave., N.W., Washington, DC 20006; phone 1-800-424-5080):

- *AIA MASTERSPEC* will contain dual units by late this summer.

**Construction Specifications Institute** (601 Madison St., Alexandria, VA 22314-1791; phone 703-684-0300):

- *CSI SPECTEXT* contains dual units. All other CSI publications contain dual units or are being converted now.

### **Building Codes**

**Building Officials and Code Administrators International** (4051 W. Flossmoor Rd., Country Club Hills, IL 60477-5795; phone 312-799-2300):

- *BOCA National Building, Fire Prevention, Mechanical, and Plumbing Codes*. All editions are published with dual units.

**International Conference of Building Officials** (5360 South Workman Mill Rd., Whittier, CA 90601; phone 310-699-0541):

- *Uniform Building, Fire, Mechanical, and Plumbing Codes*. The 1994 editions will be published with dual units.

**National Fire Protection Association** (1 Batterymarch Park, Box 9101, Quincy, MA 02269-9101; phone 1-800-344-3555):

- NFPA 101, *Life Safety Code*. All NFPA documents are published with dual units. 1991. \$33.75

**Southern Building Code Congress International, Inc.** (900 Montclair Rd., Birmingham, AL 35213-1206; phone 205-591-1853):

- *Standard Building Code*. The 1991 edition is published with dual units. The *Standard Fire, Plumbing, and Mechanical Codes* will be published with dual units in 1994.

### **Standards**

**American National Standards Institute, Inc.** (11 W. 42nd St., New York, NY 10036; phone 212-642-4900):

- ANSI/IEEE 268, *American National Standard Metric Practice*. 1992. \$52.50.
- ANSI/AWS A1.1, *Metric Practice Guide for the Welding Industry*. \$20.00.
- ANSI/IEEE 945, *Preferred Metric Units for Use in Electrical and Electronics Science and Technology*. \$45.00.
- ISO 1000, *SI Units and Recommendations for the Use of Their Multiples and Certain Other Units*. \$48.00.
- Many other ANSI standards are available in metric; check with ANSI.

**American Society for Testing and Materials** (1916 Race St., Philadelphia, PA 19103; phone 215-299-5585):

- ASTM E380, *Standard Practice for Use of the International System of Units (SI)*. 35 pp. 1992. \$23.00.
- ASTM E621, *Standard Practice for the Use of Metric (SI) Units in Building Design and Construction*. 37 pp. 1984. \$23.00.
- ASTM E713, *Guide for Selection of Scales for Metric Building Drawings*. 3 pp. \$15.00.
- ASTM E577, *Guide for Dimensional Coordination of Rectilinear Building Parts and Systems*. \$15.00.
- ASTM E835, *Guide for Dimensional Coordination of Structural Clay Units, Concrete Masonry Units, and Clay Flue Linings*. \$15.00.
- All other ASTM standards are published in metric or with dual units.

**Underwriters Laboratories, Inc.** (333 Pfingston Rd., Northbrook, IL 60062; phone 708-272-8800):

- Virtually all UL standards contain dual units.

### **Civil**

**American Congress on Surveying and Mapping** (5410 Grosvenor Lane, Suite 100, Bethesda, MD 20814; phone 301-493-0200):

- *Metric Practice Guide for Surveying and Mapping*. 11 pp. 1978. \$10.00.

**American Association of State and Highway Transportation Officials** (444 N. Capital St., N.W., Suite 225, Washington DC 20001; phone 202-624-5800):

- *Guide to Metric Conversion*. Available in mid-May 1993.
- *Standard Specifications for Transportation Materials*. Two-volume set. Includes dual units. \$115.00.

#### **Wood**

**American Forest and Paper Association** (formerly National Forest Products Association; 1250 Connecticut Ave., N.W., Washington, DC 20036; phone 202-463-2700):

- *Lumber and Wood Products Metric Planning Package*. 1978. Currently being revised.

**National Particleboard Association** (18928 Premiere Ct., Gaithersburg, MD 20879; phone 301-670-0604):

- Metric units currently are being added to the APA/ANSI standards for particleboard and medium-density fiberboard.

**Hardwood Plywood Manufacturers Association** (Box 2789, Reston, VA 22090-2789; phone 703-435-2900):

- *Interim Voluntary Standard for Hardwood and Decorative Plywood*. Includes dual units. 24 pp. 1992. \$10.00.

#### **Steel**

**American Institute of Steel Construction** (Metric Publications, 1 E. Wacker Dr., Suite 3100, Chicago, IL 60601-2001; phone 312-670-5414):

- *Metric Properties of Structural Shapes with Dimensions According to ASTM A6M*. Metric version of Part I of the *Manual of Steel Construction*. \$10.00.
- *Metric Conversion: Load and Resistance Factor Design Specification for Structural Steel Buildings*. \$10.00.
- *Manual of Steel Construction, Metric Edition*. To be published in 1994.

**American Welding Society** (550 N.W. LeJeune Rd, Box 35104, Miami, FL 33135; phone 305-443-9353):

- All AWS standards include dual units.

**Industrial Fasteners Institute** (1105 East Ohio Building, 1717 E. 9th St., Cleveland, OH 44114; phone 216-241-1482):

- *Metric Fastener Standards*. \$60.00.

#### **Concrete**

**American Concrete Institute** (Box 19150, Detroit, MI 48219; phone 313-532-2600):

- ACI 318M-89/318RM-89, *Building Code Requirements for Reinforced Concrete and Commentary*. Metric edition of ACI 318-89/318R-89. \$70.00.

- ACI 318.1M-89/318.1RM-89, *Building Code Requirements for Metric Structural Plain Concrete and Commentary*. Metric edition of ACI 318.1-89/318.1R-89. \$11.50.

### **Mechanical and Electrical**

**American Society of Heating, Refrigerating, and Air-Conditioning Engineers** (1791 Tullie Circle, N.E., Atlanta, GA 30329; phone 404-636-8400):

- *SI for HVAC&R*. 1986. 11 pp. Free on request.
- *Psychrometric Charts SI*. Charts 1 through 7. \$10.00.
- *1991 Handbook -- HVAC Applications*. SI edition. \$114.00.
- *1989 Handbook -- Fundamentals*. SI edition. \$114.00.
- *1990 Refrigeration Handbook*. SI edition. \$114.00.
- *1992 Handbook -- HVAC Systems and Equipment*. SI edition. \$114.00.
- All ASHRAE standards are published in metric or with dual units. ASHRAE plans to discontinue the use of inch-pound units by the year 2000.

**American Society of Mechanical Engineers** (22 Law Dr., Box 2300, Fairfield, NJ 07007; phone 1-800-843-2763 ext. 426):

- SI-1, *Orientation and Guide for Use of SI (Metric) Units*. 1982. \$12.00.
- SI-2, *SI Units in Strength of Materials*. 14 pp. 1976. \$12.00.
- SI-3, *SI Units in Dynamics*. 20 pp. 1976. \$12.00.
- SI-4, *SI Units in Thermodynamics*. 55 pp. 1976. \$12.00.
- SI-5, *SI Units in Fluid Mechanics*. 36 pp. 1976. \$12.00.
- SI-6, *SI Units in Kinematics*. 14 pp. 1976. \$12.00.
- SI-7, *SI Units in Heat Transfer*. 36 pp. 1977. \$12.00.
- SI-8, *SI Units in Vibration*. 13 pp. 1976. \$12.00.
- SI-9, *Guide for Metrication of Codes and Standards Using SI (Metric) Units*. 33 pp. 1980. \$13.00.
- SI-10, *Steam Charts, SI (Metric) and U.S. Customary Units*. Edited by J. H. Potter. 128 pp. 1976. \$28.00.
- All other ASME standards, except the *Boiler and Pressure Vessel Code*, are published either in separate SI editions or with dual units.

**National Environmental Balancing Bureau** (1385 Piccard Dr., Rockville, MD 20850; phone 301-977-3698):

- *Fundamentals, Air Systems, and Hydronic Systems* guides. Available in metric editions.

**National Fire Protection Association** (1 Batterymarch Park, Box 9101, Quincy, MA 02269-9101; phone 1-800-344-3555):

- NFPA 13, *Installation of Sprinkler Systems*. Includes dual units. 1991. \$24.50.
- ANSI/NFPA 70, *National Electrical Code*. Includes dual units. 1993. \$32.50.
- All other NFPA standards are published with dual units.

**Sheet Metal and Air Conditioning Contractors National Association** (4201 Lafayette Center Dr., Chantilly, VA 22021; phone 703-803-2980):

- All SMACNA publications are being converted to dual units.

**Water Environment Federation** (601 Wythe St., Alexandria, VA 22314; phone 703-684-2400):

- Manual of Practice No. 6, *Units of Expression for Wastewater Treatment Management*. 47 pp. \$15.00.

### **Product Manufacturing**

**Association for Manufacturing Technology, The** (7901 Westpark Dr., McLean, VA 22102-4269; phone 703-893-2900):

- *Guidelines for Metric Conversion in Machine Tool and Related Industries*. \$15.00.

### **Dual Unit Tape Measures**

Dual unit tape measures are all that will be needed for most job-site work. They are readily available at larger hardware stores or directly from **Stanley Tools** (1-800-262-2161), **Lufkin** (912-362-7511), or **U.S. Tape** (703-256-1500).

### **Metric Scales and Templates**

Metric scales are available from graphic arts supply stores. Popular models are **Staedtler-Mars** 987-18-1, **Alvin** 117 PM, and **Charvoz** 30-1261. A metric plumbing template is available from **American Standard**; call Ms. Barbara Munson at 703-841-9585.

### **Metric Calculator**

**Sharp Instrument Company** (Van Schaack Premium Group, 4747 W. Peterson, Chicago, IL 60646; phone 312-736-5600):

- *Sharp Model EL-344G Metric Calculator*. Converts linear dimensions, areas, volumes, liquids, pressures, and masses with two keystrokes. Very handy for simple conversions. Under \$20.00.

### **Metric Conversion Software**

**Orion Development Corporation** (Box 2323, Merrifield, VA 22116-2323; phone 1-800-992-8170):

- *Metric-X*. Metric conversion software for use with any IBM-compatible computer. Single user copies \$24.95; site/network copies available; discounts for bulk orders.

**Vidtrack Technologies Co.** (540 S. Main St., Suite 941, Akron, OH 44311-1010; phone 216-762-5141):

- *ConvertFile Conversion Utility*. Metric conversion software for use with IBM-compatible computers. \$29.95.

**MCB Enterprises** (Box 6563, Huntington Beach, CA 92615-6563; phone 714-647-5534):

- *Metric Calc!* Metric conversion software in both DOS and Windows versions. \$49.95.

### **CAD and Engineering Software**

The two largest CAD vendors, **Autodesk** and **Intergraph**, allow the user to work in either inch-pound or metric units. Many structural and mechanical design

programs have metric capability, too. Before you purchase any new computer software, **make sure it has provisions for metric.**

### **Metric Videotapes**

**Workplace Training** (520 N. Arm Dr., Orono, MN 55364; phone 612-472-2564):

- *SI Metric for the Workplace.* Six-tape video/workbook courseware. Provides in-depth metric training for business and industry professionals. Includes an introduction to metric, units of measure, reading/writing rules, limits/fits/tolerances, and metric conversion. \$2195.

**MMEI Corporation** (2247 Lexington Pl., Livermore, CA 94550; phone 510-449-8992):

- *All About Metric.* Three-tape video training package that covers the background of the metric system, government/industry transition, everyday metric units, and rules for metric usage. Accompanying reference manual includes conversion tables and other information. Instructor's manual contains lesson tips, test questions, illustrations suitable for use as masters for overhead projector transparencies. \$500. Also available through the U.S. Metric Association (see page 1).

Many other metric resources are available. Help speed the conversion process by promoting metric in the organizations to which you belong. Remember: English is the international language of business and metric is the international language of measurement. So let's all pitch in and "go metric."

**Facts:** Linear Acceleration How long will it take to get up speed? The opposite of linear acceleration is, of course, a reduction in speed. In metric, both are expressed in meters/second/second ( $m/s^2$ ). Acceleration is easily understood if it is thought of as the rate of change of velocity. When a body is accelerating, it is adding units of velocity each second. The most commonly observed display of linear acceleration is that of a falling object which accelerates due to the force of gravity. The international standard acceleration of gravity (as defined by the 1901 General Conference on Weights and Measures) is  $9.806 m/s^2$ , which in customary units is  $32.17 ft/sec^2$ , so the conversion factor is 3.281.

**Problem:** A machine part goes from a standstill to 50 ft/sec in 3 seconds. What is its average acceleration expressed in metric units?

**Solution:**  $50 ft/sec \times 1/3s \times m/3.281 ft = 5.08 m/s^2$  By Oscar Fisher; used with the permission of the American Society of Mechanical Engineers.

### **\$9 BILLION**

**This is the current amount of federal construction in the planing, design, and construction stages.**

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