

**WHAT WILL CHANGE AND
WHAT WILL STAY THE SAME?
Part I**

This is the first part of a twopart summary of salient metric conversion issues discussed by the Construction Metrication Council to date.

DRAWINGS

What will change

- Units from feet and inches to millimeters for all building dimensions and to meters for large site plans and civil engineering drawings; meters are always carried to one, two, or three decimal places.
- Drawing scales from inch fractions to feet (e.g. 1/2" = 1'0") to true ratios (e.g., 1:20).
- Drawing sizes to the ISO "A" series A0 (1189 x 841 mm, 46.8 x 33.1 inches); A1 (841 x 594 mm, 33.1 x 23.4 inches); A2 (594 x 420 mm, 23.4 x 16.5 inches); A3 (420 x 297 mm, 16.5 x 11.7 inches); A4 (297 x 210 mm, 11.7 x 8.3 inches). Of course, metric drawings can be made on any size paper.

What will stay the same

- Drawing contents

Never use dual units (both inchpound and metric) on drawings. It increases dimensioning time, doubles the chance for errors, makes drawings more confusing, and delays the learning process. Centimeters are not used in construction.

SPECIFICATIONS

What will change

- Units of measure from feetinches to millimeters for linear dimensions, from square feet to square meters for area, and from cubic yards to cubic meters for volume (except use liters for fluid volumes).

What will stay the same

- Everything else

Do not use dual units in specifications except when the use of an inchpound measure serves to clarify an otherwise unfamiliar metric measure; then place the inch-pound unit in parentheses after the metric. For example, "7460 W (10 horsepower)." All unit conversions should be **checked by a professional** to ensure that rounding does not exceed allowable tolerances.

FLOOR LOADS

What will change

- Floor load designations from "psf" to kilograms per square meter (kg/m²) or kilonewtons per square meter (kN/m²).

What will stay the same

- Floor load requirements

In common practice, kilograms per square meter are used for floor loads because many live and dead loads (furniture, filing cabinets, construction materials, etc.) are measured in kilograms. However, kilonewtons per square

meter (kN/m²) or their equivalent, kilopascals (kPa), are used for structural calculations.

CONSTRUCTION PRODUCTS

About 95% of construction products won't change size since they are not modular or panelized. They simply will be "soft converted" relabeled in metric. A 23/4 x 41/2 inch wall switch face plate will be relabeled 70 x 115 mm and a 30 gallon tank, 114 L. Modular products will undergo "hard conversion" their dimensions will change to new rounded metric numbers as shown below.

"2BY4" STUDS AND OTHER "2BY" FRAMING (both wood and metal)

What will change

- Spacing from 16" to 400 mm, and 24" to 600 mm

What will stay the same

- Cross sections

"2by4s" may keep their nominal name, or perhaps they'll be relabeled a nominal 50 x 100 mm or a more exact size.

DRYWALL, PLYWOOD, AND RIGID INSULATION

What will change

- Width from 4'0" to 1200 mm
- Height from 8'0" to 2400 mm, 10'0" to 3000 mm

What will stay the same

- Thicknesses, so fire, acoustic, and thermal ratings won't have to be recalculated

Metric drywall is readily available, but with a possible cost penalty for small orders. Metric plywood and rigid insulation may not be available at this time.

BATT INSULATION

What will change

- Width from 16" and 24" nominal to 400 mm and 600 mm nominal **or** no change there just will be more of a "friction" fit

What will stay the same

- Thickness, so thermal ratings won't have to be recalculated

DOORS

What will change

- Height from 6'8" to 2050 or 2100 mm and from 7'0" to 2100 mm
- Width from 2'6" to 750 mm, from 2'8" to 800 mm, from 2'10" to 850 mm, from 3'0" to 900 or 950 mm, and from 3'4" to 1000 mm.

What will stay the same

- Door thicknesses
- Door materials and hardware

For commercial work, doors can be ordered in any size since they are normally customfabricated.

CEILING SYSTEMS

What will change

- Grids and layin ceiling tile, air diffusers, and lighting fixtures from 2' x 2' to 600 x 600 mm and from 2' x 4' to 600 x 1200 mm

What will stay the same

- Grid profiles, tile thicknesses, air diffuser capacities, florescent tubes, and means of suspension

RAISED FLOOR SYSTEMS

What will change

- Grids and layin floor tilefrom 2' x 2' to 600 x 600 mm

What will stay the same

- Grid profiles, tile thicknesses, and means of support

HVAC CONTROLS

What will change

- Temperature unitsfrom Fahrenheit to Celsius

What will stay the same

- All other parts of the controls

Controls are now digital so temperature conversions can be made with no difficulty.

***Part II will be published
in the next issue***

**FEDERAL METRIC PROJECTS
KEEP GROWING**

The **Army Corps of Engineers** has over \$50 million in pilot projects under way and more largescale projects are about to be announced. Corps metric overseas projects total about \$525 million.

The **General Services Administration** now has about \$1.5 billion in metric projects in the planning, design, or construction stages. All work designed after January 1994 will be in metric.

Most of the **Department of Energy's** \$8.2 billion Super Collider project is being constructed in metric.

Two new **Smithsonian Institution** facilities with a total cost of over \$150 million will be built in metric.

The **Air Force, Office of the Secretary of Defense, NASA,** and the **Public Health Service** are conducting over \$30 million in metric pilot projects with significantly more work in planning. All Air Force work designed after January 1994 will be in metric.

The \$400-\$500 million **Defense Medical Facilities** program for FY 95 is scheduled to be in metric.

Indications are that the massive \$1 billion **Pentagon** renovation will be conducted in metric.

The **Department of State** continues to build in metric with current projects totaling \$275 million.

METRIC RESOURCES

- Available from the Publications Department, National Institute of Building Sciences, 1201 L St., N.W., Washington DC 20005; phone 202-289-7800 (bulk orders are available at a discount):

Metric Guide for Federal Construction (34 pg, \$15). Written specifically for the construction industry and reviewed by metric experts throughout the country. Includes a 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 listing of current metric construction references.

GSA Metric Design Guide, second draft edition (78 pg looseleaf, \$8, \$5 if ordered with above guide). Interim design guide developed by 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.

- Available from the AIA Bookstore, 1735 New York Ave., Washington, DC 20006; phone 202-626-7475:

Nufert Architect's Data, 2d International Edition (\$52). The European equivalent to the **AIA Graphic Standards**. All measurements in metric.

The Architect's Studio Companion; Technical Guidelines for Preliminary Design (\$44.95). Includes dual units.

- **Wiley Engineer's Desk Reference** (\$54.95). John Wiley & Sons, Professional Reference and Trade Group, 605 Third Ave., New York N.Y. 10158; phone 1-800-225-5945, Ext. 2497. Includes dual units.

- **Metric Practice Guide for Surveying and Mapping** (\$10). American Congress of Surveying and Mapping, 5410 Grosvenor Lane, Suite 100, Bethesda, Md. 20814; phone 301-493-0200.

- Available for \$114 each; American Society of Heating, Refrigeration, and AirConditioning Engineers, 1791 Tullie Circle, N.E., Atlanta GA 30329; phone 404-636-8400: **ASHRAE 1991 Handbook-HVAC Applications**, SI Edition; **1989 Handbook Fundamentals**, SI Edition; **1990 Refrigeration Handbook**, SI Edition; **1992 Handbook-HVAC Systems and Equipment**. All with dual units.

- **ACI 318M89/318RM89, Building Code Requirements for Reinforced Concrete and Commentary** (\$70). American Concrete Institute, Box 19150, Detroit MI 48219; phone 313-532-2600. Metric edition of ACI 318.

- Available in draft form for \$10 each; American Institute of Steel Construction, Metric Publications, AISC, One E. Wacker Dr., Suite 3100, Chicago, Illinois 60601-2001; 312-670-5414:

Metric Properties of Structural Shapes with Dimensions According to ASTM A6M (92 pg). Metric version of Part 1 of the **Manual of Steel Construction**.

Metric Conversion: Load and Resistance Factor Design Specification for Structural Steel Buildings (159 pg). Metric version of the September 1, 1986 **LRFD Specification**.

- **MetricX**. Orion Development Corporation, phone 1-800-992-8170; single user copies \$24.95; site/network copies available, discounts for bulk orders. Metric conversion software for use with IBMcompatible computers.

ConvertFile Conversion Utility. Vidtrak Technologies Co., phone 216-762-5141; \$29.95. Metric conversion software for use with IBMcompatible computers.

- **1992 Means Building Construction Cost Data**, Metric Edition (\$65). R. S. Means Company, Box 800, Kingston MA 02364; phone 6175857880). Prototype metric edition of Means' cost estimating handbook. Complete metric edition for 1993 should be available this fall. Means also offers metric cost estimating seminars.

- **All About Metric** (\$500) MMEI Corp., 2247 Lexington Pl., Livermore CA 94550; phone 510-449-8992. Threetape video training package by the U.S. Metric Association and MMEI Corp. 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.

- **SI Metric for the Workplace** (\$2195). Workplace Training, 520 North Arm Dr., Orono MN 55364; phone 612-472-2564. Sixtape video/workbook courseware.

Provides indepth metric training for business and industry professionals. Includes an introduction to metric, units of measure, reading/writing rules, limits/fits/tolerances, metric conversion.

Metric poster. Blackhawk Metric Supply Inc., phone 815-389-2850. Attractive wall poster that shows common metric measures. \$8 each; discounts for bulk orders.

METRIC FACTS: Volume

How much does it hold? In metric, the unit for volume is the cubic meter (m^3). Cubic meter is a multiple of the base metric unit, meter. The cubic meter is the volume enclosed by a cube with 1 meter sides. This is a large volume, equal to 35.3 cubic feet. The more popular metric unit for fluid capacity is the liter (1 liter = 1.06 US quarts). A liter is equal to exactly 1 cubic decimeter. A milliliter is equal to a cubic centimeter.

In technical work, the cubic millimeter (mm^3) should be used for small volumes. One $m^3 = 10^9 mm^3$ and $16.387 mm^3 = 1 in^3$.

Problem: A rectangularly shaped tank measures 6 ft x 7 ft x 4 ft. How many cubic meters of liquid will it hold when filled?

Solution: $(6 ft) \times (7 ft) \times (4 ft) \times 1 m^3/35.3 ft^3 = 4.75 m^3$

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CONSTRUCTION METRICATION COUNCIL

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Metric in Construction is a bimonthly newsletter published by the Construction Metrication Council to inform the building community about metrication in U.S. construction. The Construction Metrication Council was created by the National Institute of Building Sciences to provide industrywide, public and private sector support for the metrication of federal construction and to promote the adoption and use of the metric system of measurement as a means of increasing the international competitiveness, productivity, and quality of the U.S. construction industry.

The National Institute of Building Sciences is a nonprofit, nongovernmental organization authorized by Congress to serve as an authoritative source on issues of building science and technology.

The Council is an outgrowth of the Construction Subcommittee of the Metrication Operating Committee of the federal Interagency Council on Metric Policy. The Construction Subcommittee was formed in 1988 to further the objectives of the 1975 *Metric Conversion Act*, as amended by the 1988 *Omnibus Trade and Competitiveness Act*. To foster effective private sector participation, the activities of the subcommittee were transferred to the Council in April 1992. The Council is supported by funds from contributing federal agencies.

Membership in the Council is open to all public and private organizations and individuals with a substantial interest in and commitment to the Council's purposes. The Council meets monthly in Washington, D.C.; publishes the *Metric Guide for Federal Construction* and this bimonthly newsletter; and coordinates a variety of industry metrication task groups. For membership information, call the Council at the above phone number.

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