

FM 3-34.471 (FM 5-420)

**PLUMBING, PIPE FITTING,
AND SEWERAGE**

HEADQUARTERS, DEPARTMENT OF THE ARMY

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Plumbing, Pipe Fitting, and Sewerage

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Preface

This manual is a guide for engineer personnel responsible for conducting plumbing and pipe fitting operations. This manual provides information on water, waste, and heating systems and basic plumbing techniques. Use this guide to help repair fixtures, leaky pipes, and valves; to make pipe joints; to install water, waste, and heating systems; and to test and service these systems.

Plumbers install and repair water systems, waste systems, and fixtures; cut, ream, thread, and bend pipes; and caulk, solder, and test joints or systems for leaks.

Users of this manual should be familiar with the tools used by the construction military occupational specialty (MOS) in career management field (CMF) 51. This manual provides information on utility plans and drawings to include bill of materials (BOM) and standard plumbing and heating symbols; plumbing materials and procedures; sewerage, water supply, and heating installation; insulation material; and pumps. The entire pattern for soldiers in CMF 51 is described in Department of the Army (DA) Pamphlet 611-21.

Appendix A contains an English to metric measurement conversion chart.

The proponent of this publication is Headquarters (HQ), United States (US) Army Training and Doctrine Command (TRADOC). Send comments and recommendations on DA Form 2028 directly to Commandant, US Army Engineer School, ATTN: ATZT-DOT-DD, Fort Leonard Wood, Missouri 65473-6650.

Unless this publication states otherwise, masculine nouns and pronouns do not refer exclusively to men.

Chapter 1

Plumbing Systems

Plumbing is a system of piping, apparatus, and fixtures for water distribution and waste disposal within a building. This chapter covers the basic water supply and water distribution systems, the theater of operations (TO) water supply and water distribution systems, and the sewerage system. Plumbing also includes the installation and maintenance of these systems. When architects design a building, they prepare a set of prints and a set of specification sheets detailing the types and quality of materials to be used. Plumbers use the prints and specifications to layout and plan the project.

SECTION I - BASIC WATER SUPPLY AND WATER DISTRIBUTION SYSTEMS

1-1. A water supply system receives, treats, and moves water to a water distribution system. Water may come from a stream or lake, a deep or shallow well, or a reservoir which collects surface water. The water supply system purifies and pumps the water into a storage tank. After the water is purified, it is released into the distribution system. The distribution system is an arrangement of connected pipes (called a *run*) that carries the water to its destination. This system usually has a means of heating some of this water.

PLANS

1-2. See *Appendix B* for information on construction plans, prints, drawings, and plumbing and heating symbols.

WATER SUPPLY AND WATER DISTRIBUTION PLANS

1-3. A plumber should be able to install a complete water supply system by using a plan together with standard and special detail drawings and a BOM. A standard detail drawing will show the water heater and standard storage-tank connections. The plan will show the type of piping by size and fittings (see *Appendix B*).

UTILITY- AND BUILDING-WASTE SYSTEM PLANS

1-4. For more information on utility- and building-waste system plans, see *Appendix B*.

UNIT-CONSTRUCTION AND PACKAGE-UNIT PRINTS

1-5. Prints are used for structures and equipment in water supply and water distribution systems. The type of print depends on whether the unit is constructed or if it is a package unit to be assembled in the field (see *Appendix B, paragraph B-8*).

BOM

1-6. The designer (architect) or draftsman usually prepares a BOM (DA Form 2702) when preparing the original drawings. However, if no BOM accompanies the field prints, the plumber must compile it. *Appendix C* gives instructions for preparing a BOM.

WATER SUPPLY LINES AND BRANCHES

1-7. The main water supply system provides potable cold water at the main at a pressure that meets National Plumbing Code standards. The water service main for the plumbing installation Ts into the main water supply. The plumbing system must provide enough water for normal use at each outlet.

1-8. Fixture supply risers take water from the main supply to the fixtures on each floor level. Each fixture supply riser must have a diameter large enough to supply water to all the fixtures it connects. The size is determined by the design load for the riser (refer to *Appendix D, Tables D-3 or D-4*).

PIPE SELECTION

1-9. Cold-water systems may use galvanized-iron or galvanized-steel pipe, copper tubing, plastic pipe, brass, cast iron, galvanized, wrought iron, or other approved material. The material used depends on the—

- Amount of water to be supplied.
- Water pressure.
- Corrosion factor for different types of pipe in different temperatures.
- Cost.
- Availability.

PIPE SIZE

1-10. The size of water supply piping depends on the—

- Water pressure and friction loss through the length of the pipe.
- Number and kinds of fixtures installed (fixture demand).
- Number of fixtures in use at a given time (factor of simultaneous use).
- Type of flushing devices (refer to *Chapter 4*).

Friction Loss

1-11. When a liquid flows through a pipe, layers move at different speeds, with the center layer moving fastest. This resistance to flow (called *friction loss*) varies with different types of pipe. Pipe friction, in turn, causes a drop in water pressure. In a small pipe, this friction loss is overcome by increasing the