As a check on the sizes of hot-water mains, Table 8 will give safe sizes for gravity systems fed from roof tanks set not less than 20 ft. from the water line in tanks to the highest fixtures.

TABLE 10. SIZES OF HOT WATER MAINS

GALLONS PER MAXIMUM HOUR	SIZE OF HOT WATER MAIN, INCHES
500	2
750	2½
1000	2½
1250	3
1500	3
1750	3½
2000	3½
2500	4
3000	4

TABLE 11. HOT WATER REQUIREMENTS FOR HOSPITALS

	HOT WATER Per Patient	HOT WATER Per Fixture
Gallons used per average day	82	48
Gallons used per maximum day	127	65
Average maximum rate of flow for 15 min. in gallons per hour	11	7
Maximum rate of flow for 15 min. in gallons per hour	19	8

Note.—The above values are based on Utility Demands of a Modern Hospital by Larson, Nelson and Rose. See JOURNAL, AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, January 1928.

Note.—The hot water used is 25 per cent of total water requirements. The above requirements are for a hospital without a laundry.

TABLE 12. WATER REQUIREMENTS FOR HOSPITALS†

	TOTAL WATER	TOTAL WATER USED EXCLUSIVE OF AMOUNT USED IN TOILETS, SLOP SINKS, SOFTENER FLUSHING AND REFRIGERATION COOLING		COLD WATER USED EXCLUSIVE OF AMOUNT USED IN TOILETS, SLOP SINKS, SOFTENER FLUSHING AND REFRIGERATION COOLING	
	Per Patient*	Per Fixture	Per Patient	Per Fixture	Per Patient
Gallons used per average day	366	77	275	104	193
Gallons used per maximum day	527	116	423	174	296
Average maximum rate of flow for 15 min. in gallons per hour	29	7	25	8	14
Maximum rate of flow for 15 min. in gallons per hour	50	12	44	16	30

†The values given are based on Utility Demands of a Modern Hospital by Larson, Nelson and Rose. See JOURNAL, AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, January 1928. (No laundry included.)

*The items in this column, include water used for flushing softeners and refrigeration condenser.

The total water used per patient day was 366 gal. and exclusive of softener flushing and refrigeration condenser requirements was 308 gal. On the latter basis, the water used per occupant day was 127 gal. Laundry requirements would be in addition to above amounts.

CHAPTER XXI

PIPE AND FITTINGS

Standard Dimensions, Composition of Material, Copper and Brass, Roughing-In Dimensions, Design of Fittings.

DURING the past 20 years in particular there has been a remarkable development in the wrought tubular industry, including the tonnage used, the capacity of mills, diversity of pipe service, and improvements in the material itself.

The factors which control the characteristics and properties, and thus produce the modern improvement in various tubular materials, are the facilities of the manufacturer; the special processes employed; the availability and quality of raw materials and the ideals and skill of the men in the organization.

Among modern improvements none have received greater attention than the efforts to produce a uniform quality of wrought pipe. To secure and maintain uniformity, necessitates complete control of all materials and manufacturing operations—from ore to finished product. This practice of producing uniform skelp and its fabrication into finished tubular products is supplemented by a mechanical process of roll-knobbing, to make the metal more uniformly dense when there is any tendency to physical irregularity in this respect.

Another condition which gives rise to electrolytic centers and pitting is the presence of irregular areas of heavy welding-scale on the surface of the finished product, caused by oxidation at the high temperature of welding. This scale is strongly electro-negative to iron, like copper, and should therefore be removed in the interest of preventing corrosion.

Other advantages of having the scale removed from pipe are: its clean, smooth surfaces present an ideal base for the adherence of a galvanizing coating, full working capacity is assured (the interior being free from any obstructions tending to reduce the flow), troubles caused by the deposit of scale in valves, strainers, and other apparatus, are practically eliminated and pitting by corrosion is materially reduced.

Scale removal, where accomplished in the process of manufacture, is done by passing the oversize pipe through a series of finishing rolls (after its temperature has been reduced to about 1800 deg. fahr.) which rolls reduce it to the proper size and also crack the hardened welding-scale from both the inside and the outside of the pipe. The loose scale is then washed or blown off. While with such expedients considerable improvement has been attained, the fact still remains that the life of pipe is governed largely by installation conditions, and no matter how well made

Material for this Chapter was prepared especially by S. E. Dibble, Thomas Dugan, James Ashton and G. Schneider.