

Chapter 1 Introduction

1-1. Purpose

This United States Army Corps of Engineers (USACE) Engineer Manual (EM) 1110-1-4008 provides information for the design of liquid process piping systems.

1-2. Applicability

Liquid process piping systems include all pipe and appurtenances which are used to convey liquids to, from and between pumping, storage and treatment units and which are not integral to any unit (i.e., piping that is furnished as a part of the unit). Plumbing is covered by TM 5-810-5, potable water piping is covered by TI 814-03, sewage piping is covered by TI 814-10, storm drainage, and fuel and lubricant supply piping are excluded.

1-3. References

Required and related references are listed in Appendix A.

1-4. Distribution

This manual is approved for public release; distribution is unlimited.

1-5. Scope

This manual includes criteria for the design of component parts and assemblies of liquid process piping systems. Compliance with these criteria requires only that fundamental design principles be followed. Materials and practices not prohibited by this manual or its basic references should also be considered. Where special conditions and problems are not specifically addressed in this manual, acceptable industry standards should be followed. Modifications or additions to existing systems solely for the purpose of meeting criteria in this manual are not authorized.

a. Cathodic Protection

All underground ferrous piping will be cathodically protected. TM 5-811-7 (Army) and MIL-HDBK-

1004/10 (Air Force) contain additional guidance pertaining to cathodic protection of underground pipelines.

1-6. Metrics

Both the International System of Units (SI) (the Modernized Metric System) and the Inch-Pound (IP) ("English") system of measurement are used in this manual. Pipe and appurtenances are provided in standard dimensions, either in International Organization for Standardization (ISO) sizes which are SI based, or in American National Standards Institute (ANSI) sizes which are IP based. Table 1-1 compares the standard sizes of the measurement systems. Standard sizes under the two systems are close, but not equivalent. A similar table is included in the Tri-Service CADD Details Library.

a. SI Design Requirement

In accordance with ER 1110-1-4, where feasible, all project designs for new facilities after 1 January 1994 must be developed using the SI system of measurement. The USACE metric conversion has been closely coordinated with that of the construction industry. Where the industry has committed to a "hard" metric product, USACE must specify and use that product in its designs. Where the industry is as yet undecided, IP products should be used with a "soft" conversion when design efficiency or architectural treatments are not compromised. The limited availability of some metric products may require additional investigation, may result in more complex procurement, and may alter scheduling during construction.

1-7. Brand Names

The citation in this manual of brand names of commercially available products does not constitute official endorsement or approval of the use of such products.

1-8. Accompanying Guidance Specification

This manual is intended to be used in conjunction with CECS 15200, Liquid Process Piping.

Table 1-1 Standard Pipe Dimensions					
ANSI		ISO			
Nominal Pipe Size (in)	Actual D _o (in)	Nominal Pipe Size		Actual D _o	
		(mm)	(in)	(mm)	(in)
c	0.405	6	(0.236)	10	(0.394)
¼	0.540	8	(0.315)	12	(0.472)
d	0.675	10	(0.394)	16	(0.630)
½	0.840	15	(0.591)	20	(0.787)
¾	1.050	20	(0.787)	25	(0.984)
1	1.315	25	(0.984)	32	(1.260)
1¼	1.660	32	(1.260)	40	(1.575)
1½	1.900	40	(1.575)	50	(1.969)
2	2.375	50	(1.969)	63	(2.480)
2½	2.875	65	(2.559)	75	(2.953)
3	3.500	80	(3.150)	90	(3.543)
4	4.500	100	(3.937)	110	(4.331)
5	5.563	125	(4.921)	140	(5.512)
6	6.625	150	(5.906)	160	(6.299)
8	8.625	200	(7.874)	225	(8.858)
10	10.75	250	(9.843)	280	(11.024)
12	12.75	300	(11.81)	315	(12.402)
14	14.00	350	(13.78)	356	(14.00)
16	16.00	400	(15.75)	407	(16.00)
18	18.00	450	(17.72)	457	(18.00)
20	20.00	500	(19.69)	508	(20.00)
--	--	550	(21.65)	559	(22.00)
24	24.00	600	(23.62)	610	(24.02)
--	--	650	(25.59)	660	(25.98)
28	28.00	700	(27.56)	711	(27.99)
30	30.00	750	(29.53)	762	(30.00)
32	32.00	800	(31.50)	813	(32.00)
--	--	850	(33.46)	864	(34.02)
36	36.00	900	(35.43)	914	(35.98)
40	40.00	1000	(39.37)	1016	(40.00)
--	--	1050	(41.34)	1067	(42.00)
44	44.00	1100	(43.31)	1118	(44.00)
48	48.00	1200	(47.24)	1219	(48.00)
52	52.00	1300	(51.18)	1321	(52.00)
56	56.00	1400	(55.12)	1422	(56.00)
60	60.00	1500	(59.06)	1524	(60.00)

Note: D_o = Outer Diameter

1-9. Manual Organization

Chapter 2 of this manual provides basic principles and guidance for design. Chapter 3 presents engineering calculations and requirements for all piping systems, regardless of construction material. Subsequent chapters address engineering requirements for specific materials of construction, valves, ancillary equipment, and corrosion protection.

a. Fluid/Material Matrix

Appendix B contains a matrix that compares pipeline material suitability for different process applications. Design for specific process applications should consider temperature, pressure and carrier fluid. The use of Appendix B is addressed in Chapter 3.