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**MANUFACTURERS GUIDE SPECIFICATION by Cerro Flow Products LLC**

**Please enjoy this “Cerro Flow Products - Plumbing Division” Manufacturer’s Guide Specification.**

**This guide specification contains standards related to the manufacture of copper and copper alloy piping systems products and materials, the sizes, tempers and configurations available, and common technologies for joining the tube and fittings. Copper's superior thermal and electrical conductivity, combined with its 100% recyclability make copper a truly green material perfect for building a sustainable world.**

**A qualified design professional should review and edit this document to suit the project requirements and local codes. This guide specification includes descriptive, performance, reference standard and proprietary specification information necessary for you to evaluate substitutions during the submittal process.**

**For more information contact Cerro Flow Products Plumbing Division, P.O. Box 66800 St. Louis, MO 63166-6800** [**www.cerroflow.com/plumbing**](http://www.cerroflow.com/plumbing) **P: 888-237-7611 or 618-337-6000 or email sales@cerroflow.com**

**SECTION 22 11 16 – Domestic water piping**

**NOTES TO EDITOR:**

**Editor Notes** are in red font. Delete from final document.

Revise this Section to meet Project’s specific requirements. It is up to the designer to select the type of copper tube for use in a particular application. Strength, formability and other mechanical factors often determine the choice. Plumbing and mechanical codes govern what types may be used.



Copper water tube is a seamless, almost pure copper material manufactured to the requirements of ASTM B 88 - Standard Specification for Seamless Copper Water Tube, of three basic wall thickness dimensions designated as types K, L, and M.

Type K is the thickest and type M is the thinnest with type L being of intermediate thickness. All three types of tube are manufactured from copper alloy C12200 having a chemical composition of a minimum of 99.9% Copper (Cu) and Silver (Ag) combined and a maximum allowable range of Phosphorous (P) of 0.015 % - 0.040 %.

Seamless copper water tube is manufactured in sizes ¼" through 12" nominal. Types K and L are manufactured in drawn temper (hard) ¼" through 12" and annealed temper (soft) coils ¼" through 2" while type M is only manufactured in drawn (hard) temper ¼" through 12".

Seamless copper water tube of drawn temper is required to be identified with a color stripe that contains the manufacturer's name or trademark, type of tube and nation of origin. This color stripe is green for type K, blue for type L and red for type M. In addition to the color stripe the tube is incised with the type of tube and the manufacturer's name or trademark at intervals not in excess of 1½ ft.

Annealed (soft) coils or annealed straight lengths are not required to be identified with a color stripe.

Copper Types K, L, M are designated by ASTM standard sizes, with the actual outside diameter always 1/8-inch larger than the nominal tube size. Each type has different wall thicknesses. Type K tube has thicker walls than Type L, and Type L walls are thicker than Type M, for any given diameter. Thus actual inside diameters depend on tube size and wall thickness.

"Temper" describes the strength and hardness of the tube. In the piping trades, drawn temper tube is often referred to as "hard" tube and sold in straight lengths and annealed as "soft" tube and sold in coils.

Tube in both the hard and soft tempers can be joined by press connect fittings. Press fittings allow assembling of tube without a soldering or brazing heat source.

Copper and copper alloys have an effective and intrinsic antimicrobial property. For example, copper is the only solid surface material registered by the U.S. Environmental Protection Agency to continuously kill 99.9% of bacteria within two hours that pose a threat to human health. No other touch surface material has this kind of registration. Copper aids in reducing infection-causing bacteria on touch surfaces in hospitals, schools, offices and other public establishments.

PART 1 - GENERAL

1. SUMMARY
	1. Work includes plumbing for domestic water within the building envelope:

Piping - Copper.

Piping Fittings - Solder Joint Pressure Fittings – Copper.

Piping Fittings - Brazed Joint Pressure Fittings - Copper.

Piping Fittings - Press-Connect Pressure Fittings – Copper.

Piping Fittings - Threaded Fittings – Copper.

Piping Fittings - Flared Fittings – Copper.

Piping Fittings - Dielectric Fittings.

Piping Fittings - Adapter Transition Fittings – Copper to PEX.

Hangars and Support.

Encasement and Protection for piping.

NOTE TO EDITOR: This Guide Spec does not include “Push Connect” Fittings, “Rolled Groove” Couplings, Nail Connections, nor mechanically formed, field brazed tee branch leg connections.

1. RELATED SECTIONS

NOTE TO EDITOR: Delete specification sections from list below that are not specified on this project.

* 1. 00 54 36 Building Information Modeling Exhibit
	2. 21 11 00 Facility Fire-Suppression Water-Service Piping
	3. 22 05 16 Expansion Fittings and Loops for Plumbing Piping
	4. 22 05 17 Sleeves and Sleeve Seals for Plumbing Piping (for piping penetrations of walls, ceilings, floors, and concrete walls and slabs.)
	5. 22 05 18 Escutcheons for Plumbing Piping (for escutcheons for piping penetrations of walls, ceilings, and floors.)
	6. 22 05 19 Meters and Gauges for Plumbing Piping (for pressure gauges, and thermometers on inlet and outlet piping from each water heater.)
	7. 22 05 29 Hangers and Supports for Plumbing Piping and Equipment
	8. 22 05 48 Vibration and Seismic Controls for Plumbing Piping and Equipment’ (for seismic-restraint devices.)
	9. 22 05 53 Identification for Plumbing Piping and Equipment.
	10. 22 11 13 Facility Water Distribution Piping (for water-service piping and water meters outside the building from source to the point where water-service piping enters the building.)
	11. 22 11 17 Gray-Water Piping
	12. 22 11 19 Domestic Water Piping Specialties (for drain valves and strainers, pressure-reducing valves.)
	13. 22 11 23 Domestic Water Pumps (for thermostats in hot-water circulation piping)
	14. 22 14 19 Sump Pump Discharge Piping
	15. 22 51 13 Swimming Pool Piping
	16. 22 52 13 Fountain Piping
	17. 23 21 13 Hydronic Piping
	18. 23 21 13.13 Underground Hydronic Piping
	19. 31 20 00 Earth Moving
1. DEFINITIONS
	1. ANSI: American National Standards Institute
	2. ASME: American Society of Mechanical Engineers
	3. ASDWA: The Association of State Drinking Water Administrators \*
	4. ASTM Int’l: Formerly known as American Society for Testing and Materials
	5. AWS: American Welding Society
	6. AWWA: American Water Works Association Research Foundation (now known as the Water Research Foundation WRF) \*
	7. BSP: British Standard Pipe
	8. CDA: Copper Development Association
	9. COSHEM: The Conference of State Health and Environmental Managers (formerly known as CSSE Conference of State Sanitary Engineers) \*
	10. CSA: Canadian Standard Association
	11. EPDM: Ethylene propylene diene monomer
	12. FM: Factory Mutual
	13. IAPMO: The International Association of Plumbing and Mechanical Officials
	14. ICC: International Code Council
	15. IPC: International Plumbing Code by ICC
	16. IMC: International Mechanical Code by ICC
	17. MSS: Manufacturers Standardization Society
	18. NPT: National Pipe Thread, otherwise known as American standard thread.
	19. NPS: Nominal Pipe Size ( Imperial Standard) and DN - Diametre Nominal (SI Metric)
	20. NSF Int'l: National Sanitation Foundation founded in 1944 changed to NSF International in 1990 and expanded services beyond sanitation and into global markets. The letters NSF do not represent any specific words today.
	21. NSPC: National Standard Plumbing Code Illustrated maintained by IAPMO
	22. SCC: Standards Council of Canada
	23. SDWA: Safe Drinking Water Act
	24. UPC: Uniform Plumbing Code by IAPMO
2. REFERENCES – Current versions at Bid Date

NOTE TO EDITOR: These are the most common standards related to the manufacture of copper and copper alloy piping system products and materials. Delete reference standards from the list below that are not required.

* 1. ASME A13.1 Scheme for the Identification of Piping Systems
	2. ASME B1.20.1 Pipe Threads, General Purpose (Inch)
	3. ASME B16.15: Cast Copper Alloy Threaded Fittings: Classes 125 and 250
	4. ASME B16.18: Cast Copper Alloy Solder Joint Pressure Fittings
	5. ASME B16.22: Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
	6. ASME B16.24 Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500, and 2500
	7. ASME B16.26: Cast Copper Alloy Fittings for Flared Copper Tube
	8. ASME B16.29: Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings – DWV (Drain Waste Vent)
	9. ASME B16.50 Wrought Copper and Copper Alloy Braze Joint Pressure Fittings
	10. ASME B16.51 Cast and Wrought Copper and Copper Alloy Press-Connect Pressure Fittings
	11. ASME B31.9 Building Services Piping (and valves) prescribes requirements for the design, materials, fabrication, installation, inspection, examination, and testing of piping systems for building services.
	12. ASTM B 32: Solder Metal
	13. ASTM B 88: Standard Specification for Seamless Copper Water Tube
	14. ASTM D2000-12: Standard Classification System For Rubber Products In Automotive Applications
	15. ASTM B 32 : Standard Specification for Solder Metal (lead-free alloys)
	16. ASTM B 813: Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube (water flushable)
	17. ASTM B 828 Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings
	18. ANSI/AWS A5.8 Specification for Filler Metals for Brazing. (BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.)
	19. ANSI/AWS A5.31 Specification for Fluxes for Brazing and Braze Welding
	20. ANSI/AWS B2.2 Standard for Brazing Procedure and Performance Qualification
	21. ANSI/AWS C3.4 Specification for Torch Brazing
	22. AWWA C651-05 Standard for Disinfecting Water Mains
	23. CDA Copper Tube Handbook.
	24. IAPMO PS 117 Press and Nail Connections
	25. MSS-SP-58 Pipe Hangers and Supports - Materials, Design and Manufacture
	26. MSS-SP-69 Pipe Hangers and Supports - Selection and Application
	27. MSS-SP-89 Pipe Hangers and Supports - Fabrication and Installation Practices
	28. MSS SP-104: Wrought Copper Solder Joint Pressure Fittings
	29. MSS SP-106: Class 150-Cast Copper Flanges meeting requirements of MSS SP-106 for workmanship and dimensional limits of Federal Spec. WW-F-406 ASME B16.24
	30. MSS SP – 106: Class 125 Bronze Pipe Flanges and Flanged Fittings
	31. MSS SP – 109: Welded Fabricated Copper Solder Joint Pressure Fittings
	32. MSS SP-123: Non-Ferrous Threaded and Solder-Joint Unions for Use with Copper Water Tube
	33. NSF / ANSI Standard 372 Drinking Water System Components – Health Effects: (Lead Content.)
	34. NSF / ANSI 61 Annex G: Drinking Water System Components – Health Effects.

NOTE TO EDITOR: The procedures for determining the lead content of drinking water system components were removed from NSF / ANSI 61 annex G in Oct 2013 having been previously established in NSF / ANSI 372 adopted in 2010. “G” product still indicates compliance with NSF/ANSI 61 Annex G, NSF/ ANSI 372 and conforms to lead requirements for “lead-Free” plumbing as defined by California, Vermont, Maryland and Louisiana state laws and the US Safe Drinking Water Act in effect as of Jan 2014.

* 1. [UPC Uniform Plumbing Code] [IPC the International Plumbing Code] [NSPC the National Standard Plumbing Code] [NPC National Plumbing Code of Canada]

NOTE TO EDITOR:

Plumbing Codes vary by State and City. For a listing of codes adopted by state see:

<https://www.tests.com/State-Plumbing-Codes-License>

To purchase a copy of the UPC and NSPC codes maintained by IAPMO, see:

<http://www.iapmo.org/publications/read-uniform-codes-online/>

To purchase a copy of the IPC code maintained by the ICC, see:

<https://shop.iccsafe.org/2018-international-plumbing-coder.html>

1. ACTION SUBMITTALS
	1. Comply with provisions of Section 01300.
	2. Product Data:
		1. Manufacturer's product data sheets with performance limits.
		2. Storage and handling requirements and recommendations.
		3. Installation methods.
		4. Quality control and testing recommendations.
	3. Shop Drawings/Coordination Drawings: Details of construction and relationship with adjacent construction. Indicate location of building movement joints. Use [Autodesk Revit] [x].
	4. Sustainable Design Submittals:
		1. Environmental Product Declarations (EPD).
		2. Compliance with California Prop 65
		3. Certification by NSF / ANSI Standard 372
	5. Warranty:
		1. Manufacturer’s [10 year] [50 year] Warranty when installed in accordance with Manufacturer’s installation instructions, applicable Reference Standards and Codes.
		2. Manufacturer’s warranty to state tubing and fittings are free from defects and conform to designated standards.

NOTE TO EDITOR: In addition to a Warranty, you may want to define required insurance from plumbing subcontractor. Should you elect to require Underwriters Insurance Coverage with A rating, include specification sections:

00 00 00 Procurement and Contracting Requirements

00 62 16 Certificate of Insurance Form

00 45 13 Bidder's Qualifications

00 73 00 Supplementary Conditions

00 73 16 Insurance Requirements

1. INFORMATIONAL SUBMITTALS
	1. Qualification Data:
	2. Manufacturer's installation training class certificate-of-attendance for installers of press-connect copper fittings:
	3. Contractor’s license within project jurisdiction
	4. List minimum three similar projects performed by Contractor within previous three years.
	5. NSF Certification for fittings in contact with drinking water.
	6. System purging and disinfecting activities report.
	7. Field quality control reports: Piping inspections and pressurized piping tests. Submit separate test report for each test indicating complete map of piping segment tested. Include proposed corrective action.
	8. Drinking water alkalinity test report.
	9. Coordination Drawings: Plumbing system, drawn to scale [with Autodesk Revit], which is coordinated with:
	10. Fire Protection piping.
	11. Compressed air piping.
	12. HVAC hydronic piping.
	13. Items penetrating finished ceiling include the following:
	14. Lighting fixtures.
	15. Air outlets and inlets.
	16. <Insert item>.
2. DELIVERY, STORAGE, AND HANDLING
	1. Store products in manufacturer's unopened original packaging until ready for installation.
	2. Store products in dry area with temperature maintained between 50 deg F (10 deg C) and 85 deg F (29 deg C)
	3. Protect stored products from moisture and dirt. Elevate above grade.
	4. Protect products during shipping and handling. Unload, handle, and store with reasonable care to prevent damage.
	5. Do not exceed structural capacity of suspended floor.
	6. Protect fittings, flanges, and piping specialties from moisture and dirt.
3. FIELD CONDITIONS
4. Notify [Architect] [Construction Manager] [Owner] if drinking water supply is less than pH 6.5 which requires corrosion control to limit leaching of copper into the drinking water.
5. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
6. Notify [Architect] [Construction Manager] [Owner] no fewer than [two] [x] days in advance of proposed interruption of water service.
7. Do not interrupt water service without [Architect's] [Construction Manager's] [Owner's] written permission

1.9 QUALITY ASSURANCE

* 1. Product Qualifications: NSF Certified
	2. Codes: Install domestic water distribution system in conformance with [ICC IPC] [IAPMO UPC] [IAPMO NSPC][State Code].
	3. Installer Qualifications: Minimum [5] [3] years installing copper press joint systems. Licensed within the project jurisdiction.
	4. Qualify soldering processes, procedures, and solderers for copper and copper alloy pipe and tube in accordance with ASTM B 828.
	5. Qualify brazing processes for copper and copper alloy pipe and tube according to ANSI/AWS C3.4. Qualify brazing procedures and brazer performance in accordance with Section IX of the ASME Boiler and Pressure Vessel Code, or AWS B2.2.
1. PRE-INSTALLATION CONFERENCE: Conduct conference at [Project site] [Off site address][two weeks prior to start of installation].
	1. Coordinate Contract Document Requirements, manufacturer recommendations, installer’s recommendations
	2. Attendance required by: Mechanical Engineer, General Contractor, Mechanical Subcontractor, Manufacturer’s Representative.
	3. Objective of conference is:
		1. Review methods and procedures.
		2. Tour job site representative area and coordinate protection of work from damage by other trades.
		3. Review and finalize construction schedule.
		4. Review required inspections, testing, certifications, material usage procedures.
		5. Review environmental restrictions and forecasts.
		6. Review BIM and VDC Modeling and resolve conflict with other trades.
		7. Confirm press connect fittings comply with local building codes.
		8. Record content of conference including attendance and topics.
	4. Furnish record of pre-installation conference to attendees.

PART 2 – PRODUCTS

1. MANUFACTURER PIPING AND FITTINGS
	* 1. Basis of Design: Cerro Flow Products LLC P.O. Box 66800 St. Louis, MO 63166-6800 [www.cerroflow.com/plumbing](http://www.cerroflow.com/plumbing) P: 888-237-7611 or 618-337-6000
		2. Substitutions: [Not permitted.][ Requests for substitutions considered in accordance with Section 01600]
2. PIPING MATERIAL
3. Comply with requirements in Piping Schedule Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

NOTE TO EDITOR:

The U.S. Safe Drinking Water Act (SDWA) effective on January 4, 2014 re-defined “lead-free” down from 8 percent to 0.25 percent weighted average maximum lead content. This brought the SDWA into alignment with NSF/ANSI 61 special provision “Annex G”. Section 3.5 of NSF/ANSI 61 requires that all drinking water products comply with SDWA’s lead-limit requirements.

In 2010, NSF/ANSI 61 Annex G Evaluation Procedures were moved to NSF/ANSI 372: Drinking Water System Components – Lead Content. Although in 2013 Annex G was retired from NSF/ANSI 61, NSF continues to support the “-G” certification mark. All products certified by NSF as compliant with Annex G are also compliant with NSF/ANSI 372.

NSF/ANSI 372 establishes a standardized methodology for determination and verification of product compliance with maximum weighted average lead content requirement of 0.25 percent. This level is consistent with U.S. state and federal laws redefining “lead-free” plumbing.

In 2018, forty-nine states have legislation, regulations or policies requiring drinking water system components to comply with or be certified to NSF/ANSI 61.

In 2018, eight states reported requirements for compliance with NSF/ANSI 372. Two additional states have regulations or legislation requiring certification or conformance to a 0.25 percent weighted average lead content for products conveying or dispensing drinking water.

1. Comply with NSF 61 Annex G and NSF 372. Include marking NSF 61-G or NSF 372 on piping which verifies wetted surfaces of pipes, pipe fittings, plumbing fitting and fixtures meet weighted average lead content of no greater than 0.25 percent.

NOTE TO EDITOR: Copper alloys are identified by the Unified Numbering System (UNS) which categorizes families of alloys based upon their elemental make-up



\*Excerpt from the Copper Development Association’s “The Copper Advantage”.

UNS C12200 Cu-DHP with a nominal composition of 99.9 % minimum copper and 0.02 % phosphorus is the most widely used copper for tube. Cu-DHP exhibits better ductility than Cu-ETP (electrical applications) and DHP is adaptable for progressive drawing operations requiring few or no intermediate anneals. A major advantage of Cu-DHP for copper water tubing is the freedom from hydrogen embrittlement susceptibility.

Pipe and pipe fittings as used in this specification also refer to tube and tube fittings.

1. Copper tube and fitting: UNS C12200 certified by NSF International to NSF/ANSI 61 for use in drinking water supplies of pH 6.5 and above. Drinking water supplies less than pH 6.5 may require corrosion control to limit leaching of copper into the drinking water.
2. Copper tube to be minimum 99.9 percent pure copper deoxidized with phosphorus. Copper to be UNS C12200 Phosphorus deoxidized, high residual phosphorus with designation DHP Copper.
3. PIPING TYPE

NOTE TO EDITOR: The following chart is included for your convenience. Delete chart after determining suitability of product for your application. Plumbing and mechanical codes govern what types of products may be used for applications. Consult local codes for requirements.

**Typical uses include:**

Type M: above ground residential and light commercial uses. (Sizes range from 3/8" - 8" diameter)

Type L: residential and commercial uses. (Sizes range from ¼" - 8" diameter)

Type K: underground residential, commercial and industrial uses. (Sizes range from 1-1/4" - 8" diameter)

Type DWV - ASTM B306: Used for drainage, waste and vents



1. Basis of Design: Cerrotube**™** by Cerro Flow Products LLC
2. Hard Copper Tube: ASTM B 88 (ASTM B 88M) [Type K] [Type L] [Type M] water tube, drawn temper.
3. Soft Copper Tube: ASTM B 88 (ASTM B 88M) [Type K] [Type L] [Type M] water tube, annealed temper.
4. PIPE FITTINGS GENERAL REQUIREMENTS
5. Same size as pipes to be joined.
6. Pressure rating at least equal to pipes to be joined.
7. Project pressure rating [125 psi] [x]
8. Continuous operating temp less than [250 deg] [x]
9. End connections compatible with pipes to be joined

NOTE TO EDITOR: BSPT (British Standard Pipe Thread) is similar to NPT except for one important difference. The angle across the flanks of threads (if you sliced the fitting in half long-ways and measured the angle from root to crest to root) BSPT is 55 degrees and NPT is 60 degrees.

1. PIPE FITTINGS - SOLDER

NOTE TO EDITOR: Solders, Brazes, and Fluxes having greater than 0.20-percent lead (pb) content are prohibited from use in potable water systems. The use of brazing flux is not necessary if the components being joined are wrought copper tube, wrought copper fittings and the filler metal being used is of the BCuP series.

The difference between soldering and brazing: They are very similar joining techniques, both involving the melting of a filler metal to join two or more components without melting the base material of the components. The melting point of copper (Cu) alloy UNS C12200 is 1,981°F/1082°C. The American Welding Society (AWS) defines brazing as such a process which involves a filler metal which has a liquidus above 842°F / 450°C Soldering, on the other hand, involves filler metals with a liquidus of 842°F / 450°C or below. This temperature is much more important than just an arbitrary definitional threshold. It is important because 700°F / 371°C is the temperature at which copper begins to anneal, or be changed from hard temper (rigid) to annealed temper (soft). While a brazed joint is demonstrably stronger than a solder joint, the Rated Internal Working Pressure (the 24/7 allowable working pressure of the system) is lower for annealed tube. Thus brazed system working pressures must conform to the allowable limits of annealed tube.

Soldering, in addition to having a lower processing temperature, typically results in a lower-strength joint than a brazed joint. For many applications, this is suitable and even desirable. Brazed joints are generally used to achieve higher joint strength or fatigue resistance. The shear strength of brazed joints typically exceeds that of soldered joints by a factor of five.

1. Cast-Copper, Solder-Joint Pressure Fittings: ASME B16.18
2. Wrought-Copper, Solder-Joint Pressure Fittings: ASME B16.22
3. Solder Filler Metals: ASTM B 32, having 0.10% maximum Lead (Pb) content alloys.
4. Flux: ASTM B 813, liquid or paste type and water flushable.
5. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing.
6. PIPE FITTINGS - PRESS-CONNECT PRESSURE FITTINGS
7. Basis of Design: Cerropress**™** by Cerro Flow Products LLC.
8. Cast and Wrought Copper and Copper Alloy Press-Connect Pressure Fittings: ASME B16.51
9. Sizes NPS 2 (DN 50) and smaller: Wrought-copper with EPDM O-ring seals in ends.
10. Sizes NPS 2-1/2 (DN 65) and larger: Stainless steel grip rings and EPDM O-ring seals in ends.
11. O-Ring operating temperature rated -20 deg F to 250 deg F.
12. Minimum 200-psig (1379-kPa) working-pressure rating at max 250 deg F (121 deg C).
13. Fitting burst pressure 600 psi passed IAPMO PS 117.
14. O-Ring design to allow un-pressed joints to leak during quality control pressure test.
15. PIPE FITTINGS – UNIONS
16. Basis of Design: Cerropress™ by Cerro Flow Products LLC.
17. MSS SP-123 Ball and Socket, metal-to-metal seating surfaces
18. Cast copper alloy, hexagonal-stock body.
19. Press-connect ends
20. PIPE FITTINGS - DIELECTRIC UNIONS
21. Basis of Design: Cerropress**™** by Cerro Flow Products LLC.
22. General Requirements: Assembly of copper alloy and ferrous materials with separating non-conductive insulating material. End connections compatible with pipes to be joined.
23. Standard: ASSE 1079.
24. Pressure Rating: [125 psig (860 kPa) minimum at 180 deg F (82 deg C)] [150 psig (1035 kPa)] [250 psig (1725 kPa)] [Insert value].
25. End Connections: Press-connect copper alloy and threaded ferrous.
26. PIPE FITTINGS - THREADED CONNECTIONS
27. Pipe Threads: ASME B1.20.1 American Standard Tapered Pipe Threads for factory-threaded pipe and pipe fittings.
28. HANGARS
	1. Compliant with MSS-SP-58 Pipe Hangers and Supports - Materials, Design and Manufacture
29. ENCASEMENT FOR PIPING
30. Standard: ASTM A 674 or AWWA C105/A21.5
31. Form: [Sheet] [or] [tube].
32. Color: [Black] [or] [natural] [Insert color].

PART 3 – EXECUTION

1. EXAMINATION
	1. Examine copper tubing and fittings for debris, defects, sand-holes (cast fittings) and cracks. Reject damaged tubing and fittings
	2. Confirm tubing and fittings have incise marks (manufacturers engraving) and these marks are not deep.
	3. Ensure press-connect fitting O-Rings in place and free of damage.
	4. For press-connect fittings 2 ½ inch and larger, ensure O-Rings and stainless steel grip rings in place and free of damage.
2. EARTHWORK
3. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling
4. PREPARATION
	1. Cut tubing with wheeled tubing cutter or manufacturer approved cutting tool.
	2. Remove scale, slag, dirt, debris from inside and outside of tubing and fittings before assembly.
	3. Wipe tubing clean and dry.
	4. Deburr tubing to prevent damage to O-ring.
5. PIPING INSTALLATION
6. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
7. Locate piping to allow space for press-connect fitting tool and crimp verification gauge. Allow one inch minimum space between press-connect fittings.
8. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
9. Install piping at indicated slope. Install domestic water piping [level] [with 0.25 percent slope downward toward drain] and plumb.
10. Install components with pressure rating equal to, or greater than system operating pressure.
11. Install piping free of sags, bends, and kinks.
12. Install underground copper tube in PE encasement according to ASTM A 674 and AWWA C105/A21.5.
13. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."
14. Install shutoff valve immediately upstream of each dielectric fitting.
15. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."
16. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
17. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."’
18. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
19. Install exposed piping and piping in equipment rooms and service areas at right angles and parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
20. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
21. Install piping with access to maintain valves.
22. Install nipples, unions, special fittings, and valves with equal pressure ratings or higher than system pressure rating.
23. Install fittings for changes in direction and branch connections.
24. Install unions in copper tubing at final connection to each piece of equipment, machine and specialty.
25. Install pressure gauges on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gauges in Section 220519 "Meters and Gauges for Plumbing Piping."
26. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 221123 "Domestic Water Pumps."
27. Install thermometers on [inlet and] outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."
28. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
29. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
30. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."
31. JOINT CONSTRUCTION
32. Ream ends of pipes and tubes and remove burrs.
33. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
34. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter. Fabricate brazed joints with well-developed fillet "cap" of filler metal between the tube and fitting.
35. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 and CDA's "Copper Tube Handbook." The temperature of the joint during soldering not to exceed maximum temperature limitation of flux. Maintain minimum distance from brazed and soldered joints to press-connect fittings to prevent O-Ring damage.
36. Press-connect copper fittings:
	* 1. Mechanically clean and ream remove all burrs (interior and exterior) and restore full inside diameter and smooth, chamfered exterior surface prior to joining.
		2. Measure and mark insertion depth on tubing.
		3. Join copper tube and press connect fittings using proper tool, actuator, jaws, and rings per press-connect fitting manufacturer’s instructions.
		4. Allow press tool to reach operating temperature.
		5. Fully insert tube into fitting and tubing insertion depth mark. Check fitting alignment to ensure tubing is fully inserted into fitting.
		6. Leave insertion depth marks on pipe after assembly.
37. Adapter Dielectric Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.
38. Threaded Joints: Ream threaded pipe ends to remove burrs and restore full inside diameter. Apply pipe joint compound or teflon tape to male pipe threads (unless dryseal threading is indicated). Tighten joint with wrench and backup wrench as required. Do not use pipe or pipe fittings having threads that are corroded or damaged.
39. DIELECTRIC FITTING INSTALLATION
40. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
41. Dielectric Fittings for [NPS 2 (DN 50)] <Insert pipe size> and Smaller: Use dielectric [couplings] [couplings or nipples] [nipples] [unions].
42. Dielectric Fittings for [NPS 2-1/2 to NPS 4 (DN 65 to DN 100)] <Insert pipe size range>: Use dielectric [flanges] [flange kits] [nipples].
43. Dielectric Fittings for [NPS 5 (DN 125)] <Insert pipe size> and Larger: Use dielectric flange kits.
44. Dielectric Flanged Joints: Use asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9

NOTE TO EDITOR: Hanger spacing and rod size requirements taken from MSS-SP-69. Consult the local plumbing, mechanical or building code for required hanger spacing requirements.

1. INSTALLATION OF HANGERS AND SUPPORTS

Install hangers for horizontal piping to meet MSS-SP-58 and with maximum spacing and minimum rod sizes shown in schedule:.

Nominal Tube Size Copper Tube Max. Span Min. Rod Diameter

(Inches) (Feet) (Inches)

Up to 3/4 5 3/8

1 6 3/8

1-1/4 7 3/8

1-1/2 8 3/8

2 8 3/8

2-1/2 9 1/2

3 10 1/2

3-1/2 11 1/2

4 12 1/2

5 13 1/2

6 14 5/8

8 16 3/4

10 18 3/4

12 19 3/4

1. Hangars and supports designed with dielectric insulator.
2. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
3. Comply with requirements for hangers, supports, and anchor devices in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
4. Install hangers for copper tubing with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
5. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
6. Support horizontal piping within [12 inches (300 mm)] [Insert dimension] of each fitting.
7. Support vertical runs of copper tubing and piping to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
8. Vertical Piping: MSS Type 8 or 42, clamps. Support vertical tubing at each floor.
9. Individual, Straight, Horizontal Piping Runs:
10. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
11. Longer than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
12. Longer than 100 Feet (30 m) if Indicated: MSS Type 49, spring cushion rolls.
13. Base of Vertical Piping: MSS Type 52, spring hangers.
14. CONNECTIONS
15. Drawings indicate general arrangement of piping, fittings, and specialties.
16. Install piping with space for service and maintenance when adjacent to equipment and machines.
17. Connect domestic water piping to exterior water-service piping.
18. Use transition adapter fitting to join dissimilar piping materials.
19. Connect domestic water piping to water-service piping with shutoff valve.
20. Extend and connect piping to:
21. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
22. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
23. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
24. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 (DN 65) and larger.
25. IDENTIFICATION
26. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."
27. Label pressure piping with system operating pressure.
28. Identify copper tubing systems with requirements of ASME A13.1.
29. FIELD QUALITY CONTROL
30. Perform Piping Inspections:
31. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
32. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
33. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
34. Final Inspection: Arrange for authorities having jurisdiction to observe piping tests and ensure compliance with requirements.
35. Re-inspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for re-inspection.
36. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
37. Perform Piping Tests:
38. Test new piping and parts of existing piping that have been altered, extended, or repaired.
39. Air test copper tubing system for joint tightness.
40. Pressurize piping system to system maximum design pressure and to code required length of time.
41. Observe and report pressure loss. Repair defects and re-test.
42. Water test copper tubing system for joint tightness.
43. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
44. Cap and subject piping to static water pressure of [50 psig (345 kPa)] above operating pressure, without exceeding pressure rating of piping system materials.
45. Isolate test source and allow it to stand for four hours. Observe and report leaks and loss in test pressure. Repair defects and re-test.
46. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
47. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
48. Prepare test and inspection reports including corrective action to repair defects.
49. Prepare separate report for each pressure test, with map of piping segment tested.
50. Domestic water piping will be considered defective if it does not pass tests and inspections.
51. ADJUSTING
52. Perform adjustments before putting drinking water system into service:
53. Close drain valves, hydrants, and hose bibbs.
54. Open shutoff valves to fully open position.
55. Open throttling valves to proper setting.
56. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
57. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
58. Adjust calibrated balancing valves to flows indicated.
59. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
60. Remove and clean strainer screens. Close drain valves and replace drain plugs.
61. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
62. Check plumbing specialties and verify proper settings, adjustments, and operation.
63. CLEANING POTABLE WATER SYSTEMS

NOTE TO EDITOR: Extensive cleaning of water system is required with flux and solder systems. Depending on jobsite conditions, and discussion with mechanical engineer and code officials, using press connections may minimize need for extensive cleaning. Should stagnant water be left in system after field system pressure test, cleaning prior to system being put into service is always required.

1. Clean and disinfect potable domestic water piping:
2. Purge new piping and parts of existing piping that have been altered, extended, or repaired prior to putting into service.
3. Use purging and disinfecting procedures prescribed by authorities having jurisdiction. If methods are not prescribed, use procedures described in AWWA C651 and AWWA C652 including:
4. Flush piping system with clean, potable water until dirty water does not appear at outlets.
5. [Fill system with water/chlorine solution with minimum 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.]
6. [Fill system or part thereof with water/chlorine solution with at least 200 ppm (200 mg/L) of chlorine. Isolate and allow to stand for three hours.]
7. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
8. Repeat procedures if biological examination shows contamination.
9. Submit water samples in sterile bottles to authorities having jurisdiction.
10. CLEANING NON-POTABLE WATER SYSTEMS
11. Clean non-potable domestic water piping.
12. Purge new piping and parts of existing piping that have been altered, extended, or repaired prior to putting into service.
13. Use purging procedures prescribed by authorities having jurisdiction. If methods are not prescribed, flush piping system with clean, potable water until dirty water does not appear at outlets.
14. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
15. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.
16. Clean interior of domestic water piping system. Remove dirt and debris as work progresses
17. PIPING SCHEDULE
18. Use fittings with pressure ratings equal to or greater than piping pressure rating.
19. Use flanges and unions for aboveground piping joints unless otherwise indicated.
20. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
21. Under-building-slab, domestic water, building-service piping, [NPS 3 (DN 80) and smaller] <Insert pipe size range>, shall be[one of] the following:
	* 1. Soft copper tube, [ASTM B 88, Type K (ASTM B 88M, Type A)] [ASTM B 88, Type L (ASTM B 88M, Type B)]; [wrought-copper, solder-joint fittings; and brazed] [copper pressure-seal fittings; and pressure-sealed] joints.
		2. PP, [SDR 7.4] [SDR 11] socket fittings; and fusion-welded joints.
22. Under-building-slab, domestic water, building-service piping, [NPS 4 to NPS 8 (DN 100 to DN 200) and larger] <Insert pipe size range>, shall be[ one of] the following:
	* 1. Soft copper tube, [ASTM B 88, Type K (ASTM B 88M, Type A)] [ASTM B 88, Type L (ASTM B 88M, Type B)]; wrought-copper, solder-joint fittings; and brazed joints.
		2. Mechanical-joint, ductile-iron pipe; [standard-] [or] [compact-]pattern, mechanical-joint fittings; and mechanical joints.
		3. PP, [SDR 7.4] [SDR 11] socket fittings; and fusion-welded joints.
23. Under-building-slab, combined domestic water, building-service, and fire-service-main piping, [NPS 6 to NPS 12 (DN 150 to DN 300)] <Insert pipe size range>, shall be[ one of] the following:
	* 1. Mechanical-joint, ductile-iron pipe; [standard-] [or] [compact-]pattern, mechanical-joint fittings; and mechanical joints.
24. Under-building-slab, domestic water piping, [NPS 2 (DN 50) and smaller] <Insert pipe size range>, shall be[ one of] the following:
	* 1. [Hard] [or] [soft] copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); [wrought-copper, solder-joint fittings; and brazed] [copper pressure-seal-joint fittings; and pressure-sealed] joints.
		2. PP, [SDR 7.4] [SDR 11] socket fittings; and fusion-welded joints.
25. Aboveground domestic water piping, [NPS 2 (DN 50) and smaller] <Insert pipe size range>, shall be[ one of] the following:
	* 1. Hard copper tube, [ASTM B 88, Type L (ASTM B 88M, Type B)] [ASTM B 88, Type M (ASTM B 88M, Type C)]; [cast-] [or] [wrought-]copper, solder-joint fittings; and [brazed] [soldered] joints.
		2. Hard copper tube, [ASTM B 88, Type L (ASTM B 88M, Type B)] [or] [ASTM B 88, Type M (ASTM B 88M, Type C)]; copper pressure-seal-joint fittings; and pressure-sealed joints.
		3. Hard copper tube, [ASTM B 88, Type L (ASTM B 88M, Type B)] [or] [ASTM B 88, Type M (ASTM B 88M, Type C)]; copper push-on-joint fittings; and push-on joints.
		4. ASTM F 1807, metal insert and copper crimp rings.
		5. ASTM F 1960, cold expansion fittings and reinforcing rings.
		6. PP, [SDR 7.4] [SDR 11] socket fittings; and fusion-welded joints.
26. Aboveground domestic water piping, [NPS 2-1/2 to NPS 4 (DN 65 to DN 100)] <Insert pipe size range>, shall be[ one of] the following:
	* 1. Hard copper tube, [ASTM B 88, Type L (ASTM B 88M, Type B)] [ASTM B 88, Type M (ASTM B 88M, Type C)]; [cast-] [or] [wrought-]copper, solder-joint fittings; and [brazed] [soldered] joints.
		2. Hard copper tube, [ASTM B 88, Type L (ASTM B 88M, Type B)] [or] [ASTM B 88, Type M (ASTM B 88M, Type C)]; copper pressure-seal-joint fittings; and pressure-sealed joints.
		3. Hard copper tube, [ASTM B 88, Type L (ASTM B 88M, Type B)] [or] [ASTM B 88, Type M (ASTM B 88M, Type C)]; grooved-joint, copper-tube appurtenances; and grooved joints.
		4. PP, [SDR 7.4] [SDR 11] socket fittings; and fusion-welded joints.
27. Aboveground domestic water piping, [NPS 5 to NPS 8 (DN 125 to DN 200)] <Insert pipe size range>, shall be[ one of] the following:
	* 1. Hard copper tube, [ASTM B 88, Type L (ASTM B 88M, Type B)] [ASTM B 88, Type M (ASTM B 88M, Type C)]; [cast-] [or] [wrought-]copper, solder-joint fittings; and [brazed] [soldered] joints.
		2. Hard copper tube, [ASTM B 88, Type L (ASTM B 88M, Type B)] [or] [ASTM B 88, Type M (ASTM B 88M, Type C)]; grooved-joint, copper-tube appurtenances; and grooved joints.
		3. Aboveground, combined domestic water-service and fire-service-main piping, [NPS 6 to NPS 12 (DN 150 to (DN 300)] <Insert pipe size range>, shall be[ one of] the following:
		4. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.
		5. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.
		6. Galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.
		7. Stainless-steel [Schedule 10] [Schedule 40] pipe, grooved-joint fittings, and grooved joints.
28. VALVE SCHEDULE
29. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
30. Shutoff Duty: Use ball or gate valves for piping NPS 2 (DN 50) and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
31. Throttling Duty: Use ball or globe valves for piping NPS 2 (DN 50) and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
32. Hot-Water Circulation Piping, Balancing Duty: [Calibrated] [Memory-stop] balancing valves.
33. Drain Duty: Hose-end drain valves.
34. Use check valves to maintain correct direction of domestic water flow to and from equipment.
35. CLEANUP
36. PROTECTION
	1. Thermal expansion and contraction: Wrap copper and copper alloy tube passing through a wall, floor, ceiling or partition with tape or pipe insulation. [Install tube through an appropriately sized sleeve to allow for thermal movement.]
	2. Protect against abrasion where copper and copper alloy tube contacts building materials. Wrap tube with tape, pipe insulation or suitable method of isolation.
	3. Maintain fire rating when penetrating fire resistant rated assemblies.
	4. Backfill trench and excavations with clean fill which contains no ashes, cinders, refuse, stones, boulders or other materials which can damage piping or promote corrosive action.
	5. Where excessive moisture is anticipated, wrap piping and support hanger with tape to prevent dissimilar metals galvanic corrosion of supporting member.

END OF SECTION 221116