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August 5, 2010

Report Number: 10C0805E1

- Engineering Report -

Engineering Analysis and Time Study of Installing
Cerro Advantage Press™ Tube

Client: Cerro Flow Products LLC
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Scope: Cerro Flow Products LLC (Cerro) is a manufacturer of copper tube for the plumbing, HVAC, refrigeration, and industrial piping industries. Cerro developed a new tube, called Advantage Press™ Tube, with an integral press connect fitting on one end. Julius Ballanco, P.E., President, JB Engineering and Code Consulting, P.C. was retained by Cerro to evaluate and to perform a time/motion study on the installation of the tube.

Product: Advantage Press™ Tube is Type L copper tube that has a press connect fitting formed on one end of the tube. The copper tube complies with ASTM B88 and is currently available in sizes ranging from ½ through 2 inch. The press connect end is formed in a separate secondary operation after the tube is produced.

The press connect end has a EPDM o-ring, which makes the seal after pressing the fitting end. The press connect fitting may be joined with any press tool approved for Viega Pro-Press or other commercially available copper press fittings.

Certifications and

Listings: Cerro copper tube is listed by NSF International as complying with NSF 61. The listing is for all seamless copper water tube from 1/8 inch through 8 inch in diameter.

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Advantage Press™ Tube is listed by IAPMO R&T, File 5955, as complying with IAPMO PS 117, with an integral press connect end on one end of the tube.

Plumbing Code

Approvals: **Uniform Plumbing Code:** The IAPMO Uniform Plumbing Code/2009 regulates water piping material in Table 6-4. One of the standards listed in the table is ASTM B88 for copper tube.

Section 604.1 requires all water piping material to comply with NSF 61. Section 301.1.1 requires all piping material to be listed by a third party agency.

Section 316.1.9 permits pressed fittings for joining copper tube. The fittings must have an o-ring to make the seal.

Advantage Press™ Tube complies with the requirements of the IAPMO Uniform Plumbing Code.

International Plumbing Code: The ICC International Plumbing Code/2009 regulates water distribution piping material in Table 605.4. One of the standards listed in the table is ASTM B88 for copper tube.

Section 605.4 requires all water piping material to comply with NSF 61. Section 303.4 requires all water piping material to be certified by a third party agency.

Advantage Press™ Tube complies with the requirements of the ICC International Plumbing Code.

National Standard Plumbing Code: The PHCC National Standard Plumbing Code/2009 regulates water distribution piping material in Table 3.4. One of the standards listed in the table is ASTM B88 for copper tube.

Section 3.4.3 requires all water piping material to comply with NSF 61.

Section 4.2.6 permits pressed fittings for joining copper tube. The fittings must have an o-ring to make the seal.

Advantage Press™ Tube complies with the requirements of the PHCC National Standard Plumbing Code.

Tube

Installation: Advantage Press™ Tube can be installed with continuous straight lengths

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without the need for a coupling to join lengths of pipe. One end is inserted into the next press connect end to join the two lengths of pipe in continuous runs without the need for end preparation. If a piece is cut to length, the cut piece must be prepared by deburring and chamfering the tube end. After aligning the tube, the joint is pressed to complete the connection.

When installing straight lengths of tube without a press connect end, both ends of the tube must be prepared by deburring and chamfering. A coupling must be placed and aligned between the two tubes. The coupling must then have both sides pressed to complete the installation.

Time Study: A time study was conducted at Naperville Central High School, Naperville, Illinois, to determine the time savings resulting from the use of Advantage Press™ Tube. Some copper tube was installed by using press connect couplings to join 20 foot straight lengths of tube. Advantage Press™ Tube was also installed. One 20 foot length of Advantage Press™ Tube was inserted into the next length of tube. Photos were taken of the copper tube installation. The photos appear in Appendix A.

The installation was observed to determine the difference in the joining techniques to ascertain the time savings of the installation. This information was used to evaluate the time savings using two standard methods of calculating the time for a plumbing installation: R.S. Means Mechanical Cost Data and PHCC Labor Calculator III.

Coupling Installation: During the installation of the straight length tube, the plumbing mechanics aligned the tube in the hangers that were installed. The ends of each tube were prepared by deburring and chamfering. (It should be noted that deburring would not be required if the tube had not been cut with a tube cutter.) A coupling was located on the cart of fittings and handed from one mechanic to the other doing the actual installation. The coupling was inserted into one end. The other end of the opposing tube was pulled into place and pushed into the coupling. The insert point of each coupling was marked with a black marker. The tube was checked for alignment after being placed together. The coupling was adjusted to be in proper alignment. The press tool was placed on each end and engaged to complete the connection. After removing the tool, a black “x” was placed on the tube to indicate that the fitting was pressed.

Advantage Press™ Tube Installation: During the installation of the Advantage Press™ Tube, the tube was placed in the hangers that were installed. The tube was pushed onto the end of the opposing tube. One end of the tube was

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chamfered. (The full length tube did not require reaming.) The insertion point was marked on the tube. There was no alignment or check for alignment when the tubes were pushed together. The tool was placed on the end connection and engaged to join the two tubes. After removing the tool, a black "x" was placed on the tube to indicate that the fitting was pressed.

Time

Analysis:

The evaluation of time required to join the Advantage Press™ Tube was compared to the published time factors for installing a coupling. Press connect fitting manufacturers have published a time savings, over the normal solder joint, as being 1/3rd the time. This value was used in the evaluation.

The joining of Advantage Press™ Tube was based on the time required for the contractor to joint the tube during the installation of the system at Naperville Central High School.

The high school installation was a union contractor installation. The more common method of determining time for a union project is R.S. Means. This was used as the basis for the time.

When evaluating these time factors, it should be noted that there was no determination of the validity of the 1/3 rd savings for press connect joints as published by the press fitting manufacturers.

R.S. Means publishes values for the installation of a 20 foot length of copper tube, including the hangers, with a coupling installed. These published values are for a soldered installation. The values can be adjusted for a press connect installation. The press connect values can be compared to the installation of Advantage Press™ Tube.

Table 1 identifies the time required to install a 20 foot length of tube by soldering, press connecting, and Advantage Press™ Tube . The percentage savings are based on a comparison between copper press connect and Advantage Press™ Tube. No comparison is shown between a solder installation and an Advantage Press™ Tube installation.

The PHCC Labor Calculator III does not provide time values for a complete installation of a 20 foot length of copper tube, including hangers, with a coupling installed. However, individual time factors can be considered to establish an equivalent value. Table 2 lists the equivalent time factors using the PHCC Labor Calculator III.

Table 1
Time Required To Install 20 Feet Copper Tube (R.S. Means)

Tube Size (In)	Means Time (Hr)			Percent Savings
	20 Ft Length Solder	20 Ft Length Press	Advantage Press™ Tube 20 Ft Length	
1/2	1.98	1.86	1.640	11.75%
3/4	2.10	1.97	1.744	11.59%
1	2.36	2.21	1.946	12.04%
1-1/4	2.76	2.60	2.320	10.86%
1-1/2	3.08	2.90	2.583	11.02%
2	3.80	3.60	3.226	10.26%

Installation Time Comparison (R.S. Means)

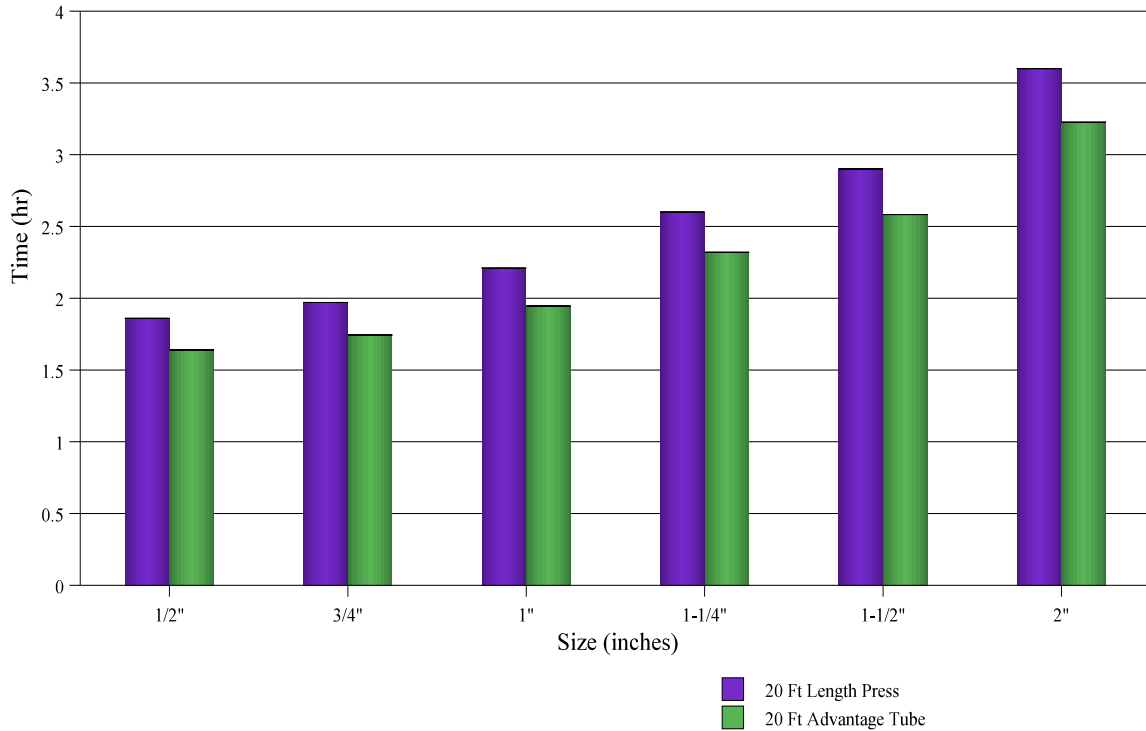
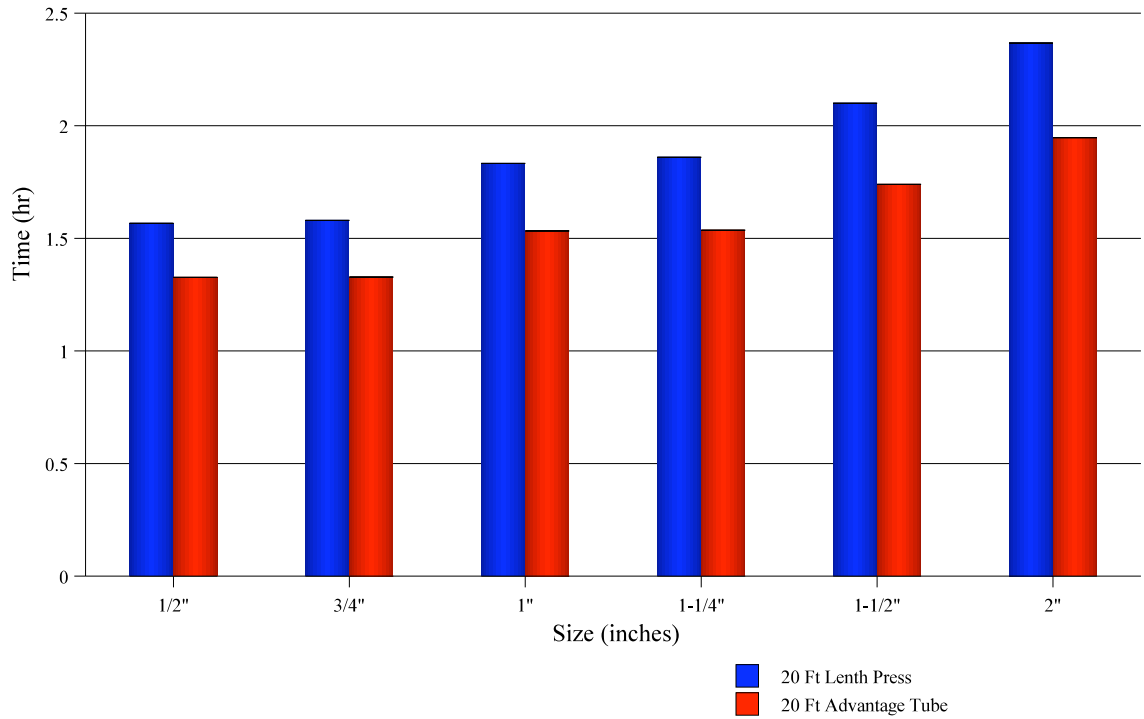


Table 2
Time Required To Install 20 Feet Copper Tube (PHCC)

Tube Size (In)	PHCC Labor Calculator III Time (Hr)			
	20 Ft Length Solder	20 Ft Length Press	Advantage Press™ Tube 20 Ft Length	Percent Savings
1/2	1.70	1.567	1.327	15.32%
3/4	1.72	1.580	1.328	15.95%
1	2.00	1.833	1.533	16.36%
1-1/4	2.04	1.860	1.536	17.42%
1-1/2	2.30	2.100	1.740	17.14%
2	2.60	2.367	1.947	17.75%

Installation Time Comparison (PHCC)



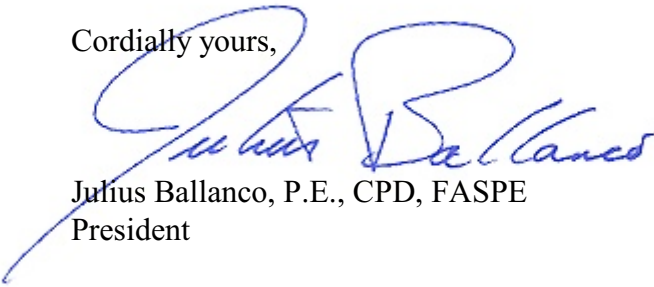
The time savings for installing a 20 foot length of copper tube with the use of Advantage Press™ Tube ranges from 10 to 17 percent when compared to installing the system using a copper press fitting.

Conclusions: In my professional engineering opinion, after observing the tube installation and reviewing the product and the test reports, with my engineering knowledge in this field, to a reasonable degree of engineering certainty, the following conclusions are listed:

1. Advantage Press™ Tube complies with the requirements of the IAPMO Uniform Plumbing Code, ICC International Plumbing Code, and PHCC-NA National Standard Plumbing Code for water distribution pipe.
2. The installation of Advantage Press™ Tube saves time when compared to installing copper tube with a press connect coupling. The savings vary based on the size of the tube.
3. The time savings to install a 20 foot length of copper tube using Advantage Press™ Tube as compared to copper tube with a press connect coupling ranges from 10.26 percent to 17.75 percent.
4. The installation of Advantage Press™ Tube results in less joints, and thus less press connections, in the piping system than an installation using straight lengths of tube with couplings to join the tube.
5. Advantage Press™ Tube reduces the potential for misalignment and deflection of the copper tube.

Certification: This report was prepared by Julius Ballanco, P.E., President, JB Engineering and Code Consulting, P.C., registered as a Professional Engineer in the State of Indiana, license number PE60900631. JB Engineering and Code Consulting, P.C. is a registered Engineering Professional Corporation in the State of Indiana, license number PC50910000.

Cordially yours,


Julius Ballanco, P.E., CPD, FASPE
President

