HDPE Contractor and Fusion Operator Qualification Specification

Water and Wastewater

Contractor and Fusion Operator Qualification Specification

In order to ensure a smooth and successful HDPE piping project, it is of paramount importance to select an experienced HDPE contractor whose operators and technicians are properly trained in HDPE pipe fusion procedures, using industry-approved standard protocols, fittings, and equipment. The specification as set forth in this document is useful for municipalities and consulting engineers when creating a contractor pool or selecting a contractor for the installation of high-density polyethylene (HDPE) pipe. The following information provides guidance for all aspects of HDPE contractor selection.

This specification covers:

- Background
- Definitions and Acronyms
- Qualified Fusion Contractor
- Qualified Fusion Operator
- Fusion Records
- Data Logging – Butt fusion and Electro fusion
- References

Background

In order to create a leak free, monolithic, HDPE piping system for your potable and wastewater applications, you and your contractor should understand and follow proper fusion and related procedures. When we discuss fusion of HDPE pipe, all approved methods of fusion are included. Such methods include:

- Butt Fusion
- Saddle Fusion
- Socket Fusion
- Electrofusion

In order for a contractor's technician to perform any of the aforementioned types of fusions, personnel require formal training specific to the size and dimension ration (DR) of the piping system. Although each of the various fusion procedures and methodologies is similar to the others, the key difference between them is in operating

a specific type or size of fusion equipment and understanding the methodologies for handling the pipe or fitting itself.

Approved fusion procedures are well-documented in the Plastics Pipe Institute's (PPI) technical reports, notes, and its *Handbook of Polyethylene Pipe* (PPI, 2008, 2012, 2013). Other sources for fusion procedures include documentation from the American Society for Testing and Materials (ASTM) (ASTM, 2013) and from manufacturers' literature. Working with fusion technicians that understand HDPE and the importance of adherence to such procedures will help ensure a leak-free and monolithic system that will provide long service life to the water or wastewater piping system.

Definitions and Acronyms

Butt Fusion - A method of joining HDPE pipe where two pipe ends are heated and rapidly brought together under pressure to form a homogeneous bond. It is estimated that at least 90% of the fusions in the HDPE pipe industry are butt fusion welds.

Ductile Iron Pipe Sizing (DIPS) – DIPS is used for HDPE pipe when HDPE pipe is OD controlled. DIPS pipe OD is larger than IPS pipe OD by almost half an inch.

Iron Pipe Sizing Convention (IPS) – IPS is used for HDPE pipe when HDPE pipe is OD controlled. IPS pipe OD is always smaller than DIPS pipe OD.

Example - An 8" DR11 IPS pipe features an 8.6" average OD and a .78" minimum wall with a 7.0" average ID; an 8" DR11 DIPS pipe features a 9.1" average OD and minimum wall of .82" with an average ID of 7.3"

Dimension Ratio (DR) - The ratio of pipe diameter to wall thickness, where DR= outer diameter divided by the minimum wall thickness.

$$DR = \frac{OD}{t_{MIN}}$$

Electrofusion (EF) – A heat fusion joining process where the heat source is an integral part of the fitting.

High Density Polyethylene (HDPE) or Polyethelyne (PE) – HDPE pipe or fitting.

IPS – Iron Pipe Sizing convention used for PE pipe. HDPE pipe is an OD controlled piping system designed to fit into existing systems, thus IPS and DIPS sizing.

Pressure Rating - Estimated maximum internal pressure allowed with a high certainty that failure of the pipe will not occur. HDPE can handle as a part of its design occasional surges to 2 times its pressure rating and 1.5 times for recurring surges.

Standard Dimension Ratio (SDR) - A specific ratio of the average specified outside diameter to the minimum specified wall thickness for outside diameter-controlled plastic pipe. Common reference is DR. DR and SDR are the same and used interchangeably.

Thermoplastic - A plastic, such as PE, that can be repeatedly softened by heating and hardened by cooling through a temperature range characteristic of the plastic and that in the softened state can be shaped by molding or extrusion.

Qualified HDPE Fusion Contractor

Contractors and their personnel conducting and performing HDPE pipe fusions in the field must be formally trained and have experience related to the pipe size and equipment required for the job. The contractor must have experience with the type of fusion being conducted and knowledge of best handling practices in the field to reduce potential damage or future problems related to the installation.

Appropriate record keeping and documentation is also highly recommended to track technician experience and abilities and to provide traceable evidence to ensure proper procedures and methodologies were followed. Electronic data collection, such as data logging and written logs, serve the dual purposes of procedure verification as well as documentation of contractor history and experience.

Documentation should be provided showing current and up-to-date qualification (i.e. a qualification card not older than 24 months) of training obtained to fuse HDPE pipe in the appropriate sizes and equipment types for the job. This type of training is readily available from the fusion equipment manufacturer and distribution companies that sell

polyethylene products. Accountability for the entirety of the fusion and proper installation of a polyethylene piping system lies with the installer.

A **Qualified Fusion Contractor** (QFC) is a contracting company that has managed, either as the prime contractor or the fusion subcontractor, two or more HDPE fusion projects similar to the project being considered by the owner within the last 36 months. Contractors who are qualified may also have served as a subcontractor handling the slip-lining, pipe bursting, or horizontal directional drilling elements of an HDPE project. Because many jobs find HDPE as a part of a larger pipeline job, instances may also occur where a contractor is handling both HDPE and another material. These projects should also assist in qualifying a contractor.

The owner should understand that a QFC may be qualified to operate fusion equipment, but may not have experience in the installation method necessary to use the HDPE. Thus, the qualified contractor must not only demonstrate qualification in fusion, but s/he should also demonstrate experience in the construction method required to fulfill the project requirements.

The QFC's project history that meets the 36-month criteria must be of similar type. For example, if the owner is proposing a 24" open cut HDPE job, the QFC's experience must be open cut and must have included work with equipment capable of the same size range.

If the project is a slip-lining job, the QFC must have HDPE slip-lining experience using pipes of a similar diameter. If the project is a pipe-bursting job, a QFC must have experience with pipes bursting at any diameter. In those cases where a contractor has limited experience with pipe bursting or drilling operations but proposes the use of technicians with training from the manufacturers of equipment used in such operations, a contractor shall be considered as a qualified.

Qualified HDPE Fusion Operator (QFO)

Using approved manufacturers of HDPE pipe and associated equipment, the QFC, as described above, shall ensure that personnel performing heat fusion and related operations are qualified to perform such procedures. To ensure that all practices of pipe handling and fusing meet or exceed manufacturers' specifications and recommendations, only qualified technicians shall be permitted to fuse and install HDPE pipe. A QFO is an individual who:

(i) is competent and knowledgeable in heat fusion procedures;

(ii) is qualified and has proof of qualification within the last 24 months via a manufacturers recognized training facility and/or program;

(iii) has received training in heat fusion procedures according to ASTM F2620 for Butt Fusion and ASTM F1055 for Electro Fusion;

(iv) has received training in the equipment being used to perform fusion procedures;

(v) has received training in accordance for the size of installation (e.g., small diameter (1/2" CTS to 6" DPS (16 mm to 180 mm)); medium diameter (2" IPS to 20" OD (63 mm to 500 mm)); or large diameter (20" IPS to 74" OD (225 mm to 1600 mm));

(vi) has received training in handling and testing methods;

(vii) understands the effects of changing conditions in the surrounding environments and adjusts or checks fusion parameters to avoid negative impacts on the fusions (e.g., weather changes – cold or wet, wind and dust, bend radius, etc.)

(viii) has documented prior experience (logs) in performing HDPE pipe installations, heat fusion procedures, and testing methods.

The required training and experience described above shall also be consistent with published guidance (current PPI literature, ASTM, American Water Works Association (AWWA), CSA etc). The QFC is required to maintain records of personnel training and experience and said records shall be made available for inspection.

Fusion Records and Marking

Central to competency as a QFC in the HDPE world is record keeping. Paper or electronic records of appropriate joint fusion procedure details shall be kept for all HDPE pipes fusions. Data logger information and drawings showing locations shall be submitted for review and recordation purposes before final approval of the contract. Electrofusion records should be printed or downloaded and saved to maintain a record log of EF. Note that fusion locations and fusion placement could be two separate locations. Using Global Positioning System (GPS) coordinates can help pinpoint the location of a specific fusion. All fusions regardless of where they are actually fused should be marked on the pipe for reference to when they are located in or above ground.

Data loggers and EF machines do NOT capture certain aspects of fusion. Such aspects should be recognized and verified by the QFO to ensure proper protocols and procedures were followed and include the following:

(i) *Pipe preparation* – ensure the pipe ends are free of contaminants that could negatively affect fusion. The only cleaner recommended is 95% or greater purity isopropyl alcohol using lint free, white, non-synthetic paper towels or cloths.

a. Dirt, mud or dust, water or moisture, chainsaw oils and grease or any oils, facing shavings or facing tags, lint from non-lint free clothes, etc.

(ii) *Pipe alignments* – confirm the pipes are properly aligned prior to heating and fusion steps. If adjustments to the machine are made, the pipes should be refaced and checked again.

(iii) *Machine and heater operation checks* – ensure a clean and balanced heating surface. Ensure heater surface temperatures are within the specified range, and heater faces are clear of contaminates and build up.

(iv) *Visual inspections* - study pipe prior to and after unloading (gouging, scratching, notching, etc.) inside and outside surfaces. Inspect the OD of pipe after it has been handled or moved in the field to insure that scratches of no greater than 10% of the wall thickness have occurred.

The permanent type markers, such as the, "Sharpie," (e.g. Sharpie brand, permanent, silver metallic) and "Magic Marker" by Avery are adequate for marking light colored pipe. Fast drying paint pens, such as those manufactured by PENTEL and Faber Castell, also work well and are available in colors that will show well on black pipe; it is sometimes necessary to allow for drying when using paint type pens. A wax based "China Marker," although not permanent, works well for marking black pipe. We have found no advantage of one type of marker, permanent or paint, over the other.

Such labels are still considered temporary markings because they will wear off over time unless they are not protected or covered. These marking should include as a minimum:

(i) Date/time;

(ii) Operator Name or Company;

(iii) Fusion identification (ID) number assigned (link to data logger); and

(iv) Project number.

An example of the minimum typical information to be given is shown in Figure 1. Follow all guidelines and recommendations provided by data logger manufacturers to ensure that quality is maintained.

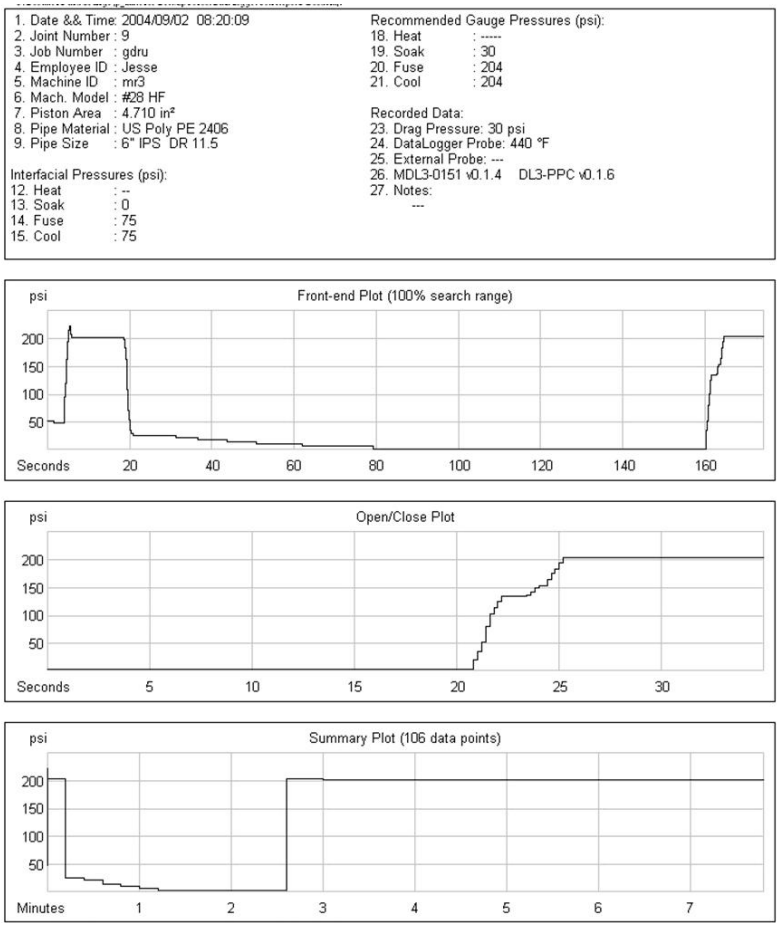

Figure 1. Example of a heat fusion joint record output for a McElroy Data Logger

(Colorado Springs Utilities, 2014)

REFERENCES

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