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HDPE PIPE BUTT WELDING PROCEDURES

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1.0 **OBJECTIVE**

This document describes the preparation and welding procedures of the HDPE pipe butt weld, it is to insure that the welded joint will perform equal to or greater than pipe.

2.0 **EQUIPMENT**

2.1 Mirror Welding Machine

2.1.1 Heating Plate

There are different types of heating plates and there are different types of heating techniques; either gas or electricity.

For HDPE pipe welding, the Mirror welding machine shall be heated by electricity since electric heating plates can maintain consistent fusion temperatures when provided with an adequate power source.

Electric heating plates for general fusion use shall be controlled thermostatically and capable of being adjusted over a temperature range from 150° to 300°C.

For welding of HDPE, the temperature thermostat shall be set according to manufacturer's recommendation.

The mirror (heating plate) shall be equipped with a thermometer or other built-in temperature-measuring device and shall also have sufficient area to adequately cover the ends of the pipe to be joined.

2.1.2 Alignment jig

The alignment jig shall consist of:

Two fixed and two moveable clamping blocks for holding the two parts to be fused in moveable axial alignment.

One shaver for simultaneously preparing the ends to be joined.

Appropriate adapters "inserts" for different pipe sizes.

The mirror welder used by VSL for this operation is McElroy equipment. Normally the diameter of stay pipe used on site determines the size of the welding machine required.

If another machine is to be used on site, it is important to have four clamps on the machine. On the market there are two clamp machines, but those are mainly used for pipes lying under ground (e.g. not aesthetically demanding pipes).

2.2 Shield for Mirror welding Assembly

The shield is a temporary structure that permits welding operation to continue regardless of weather condition. It also serves as a windbreaker to prevent rapid cooling of weld seam. The duration of cooling time has a significant influence on the quality of welds.

3.0 WELDING PROCEDURE

3.1 Welding Operation

The procedures stated below should be regarded as a general guideline only. The manufacturer of the HDPE pipe should be asked to supply specific recommendations for welding of their products or materials. Likewise, the welding machine supplier shall supply detailed welding procedure for their machines.

Heat fusion bonding is a combination of temperature and force resulting in two mating surfaces flowing together to produce a joint. Fusion bonding occurs when the joint cools below the melt temperature of the material. There is a temperature range within which any particular material may be satisfactorily joined. The specified temperature used requires consideration of the properties of the specific material, the fusion equipment being used and the welding environment.

The butt-welding is done in several phases and by using several parameters. The operations can be summarised as follows:

- The alignment of the pipe
- The shaving of the surfaces of the pipe ends
- Cold matching of the HDPE pipes
- Cleaning of surfaces
- Heating of surfaces
- Fusion of surfaces
- Cooling of weld joint

The parameters used during welding are:

- Bead-up pressure in bars or psi
- Bead-up height in mm or inches
- Heat soaking time in seconds

- Heat soaking pressure in bars or psi
- Transfer time in seconds
- Fusion pressure in bars or psi
- Cooling time in minutes

These parameters are for information only and shall be compared with the parameters given by the HDPE pipe manufacturer and the welding machine supplier.

3.2 Welding Preparation

The welding zone must be protected from unsuitable weather conditions (e.g. humidity effects, wind and temperatures below 0°C). The surfaces to be joined must be undamaged and free from impurities or loose particles.

3.3 Alignment of HDPE Pipes

The pipes must be aligned when they are clamped into the mirror welder in such a way that the surfaces are in the same plane (parallel) to each other. The HDPE pipes can be positioned directly into the welding machine. Install the correct adapter insert for the size of pipe diameter to be used and tighten them to the machine.

Position the pipe in a way that approx. 40mm is protruding behind the last clamp. By doing this, you will have approx. 10 to 15mm to shave from, and the remaining 25 to 30 mm should be sufficient for welding.

Once the pipe has been placed in position, the top clamps can be closed. It is important to tighten the top clamp nuts evenly in order to get a totally circular pipe, an even clamping pressure must be achieved. Then, make the first dry matching (press the two pipes to each other) and check the amount of shaving that will be required.

3.4 Shaving of Surface

After the dry matching is completed, open up the pipes and introduce the shaver. Turn the shaver on and adjust to suitable speed.

Press the two pipes together, and shave until a continuous strip of HDPE is peeling off on both sides of the shaver. Once constant peeling off is observed, release the pressure on the pipes and separate the pipes. Do not turn off the shaver until the pipes are apart. If the shaver is stopped during shaving, the shaver will create an end cut-mark and the shaving operation will have to be repeated.

Remove the shaver, match the pipes again, and check the pipe for proper alignment. Sometimes, even when continuous peeling off is achieved on each side of the shaver, the pipes do not match properly. This is normally due to the clamps, which are pressing on to the pipe with different pressures. Re-tightening the nuts slightly on either side is one solution. But, if this does not help, shimming normally does the job. Open up one clamp and insert a shim in between the jaws and the pipe. This shim will concentrate the pressure on to the pipe and move the pipe into alignment. It is important to remember that, if the clamp has been opened during operation, the shaving operation must be repeated.

Once the pipes are correctly aligned, separate the pipes again for cleaning. Remove chips inside the pipes on both sides, all chips scattered under the pipes, and also inside the machine. Otherwise, they will stick to the mirror (heat plate) later while re-heating. Remove the chips by using a brush or a small hook made out of a thin steel wire. Never put any dirty gloves inside the pipe or remove the chips with your hands. Do not touch the shaved pipe ends. To be on the safe side, always clean the surface with a clean rag and mineral spirits/alcohol before you introduce the mirror.

3.5 Heating of Surface

Before you introduce the mirror, you should have all parameters available for this operation. Also check the mirror temperature. Normally, the mirror has a yellow or red lamp, which tells you if the mirror has reached working temperature. To make sure there is no cold air flowing through the pipe, place some plastic bags on each end of the pipe, this will prevent the air from cooling the mirror on one side. You have now shaved the pipe into a good fit and removed the shaver and introduced the mirror.

Push the pipes together against the mirror and raise the pressure to the Bead-up pressure. This pressure needs to be maintained until the Bead-up height has been reached. The bead up height is the height of the bead, which is pressing up against the mirror.

As soon as the Bead up height has been reached, release the pressure down to the Heat Soak pressure.

Heat soak pressure is the pressure maintained during the Heat Soak time.

As soon as the heat soak time has elapsed, separate the pipes, remove the mirror, and then press together.

3.6 Fusion of Surfaces

This operation has to be done quite fast, since there is actually a time limit “Transfer time” from the removal of the mirror until the two pipes are pressed together and reached the Fusion pressure.

Fusion pressure is the pressure that shall reach during the Transfer time and maintained during the Cooling time.

3.7 Cooling of Joint

Cooling time is the time in which the pipe has to be left undisturbed. Under no circumstances shall the clamps be opened or the pressure released until the cooling time has elapsed.

3.8 Checks of Weld Seam

The mirror-welding machine, if coupled to a data log, will give a print out confirming the parameters used during welding of a specific seam and approval/rejection of the welded seam.