

# Aquatherm Technical Bulletin

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## Fusion of Aquatherm Pipe in Weather Extremes

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### Cold Weather Handling

Aquatherm pipes have reduced impact resistance in sub-freezing conditions. It is imperative, therefore that the pipe be handled carefully when the weather get cold. Avoid dropping, handling the pipe roughly or stepping on the pipe. Avoid unnecessary impacts.

Use caution when cutting the pipe in cold weather conditions. Don't use power cutters on the pipe if the pipe is colder than 40oF (4oC). Cold pipe can crack or split if cut with power cutters. Always warm the pipe ends before cutting with motorized or power cutters.

### Preparation for Fusion Joining\*

**Wind and Precipitation**—while attempting the fusion procedure during foul weather the heating tool should be shielded in an insulated container to prevent excessive heat loss. Shield the pipe fusion area and fusion tools from wind, snow, blowing dust, and rain by using a canopy or similar device.

**Pipe and Fitting Surface Preparation**—The pipe and fitting surfaces to be “joined” or held in clamps should be dry and clean and free of ice, frost, snow, dirt, and other contamination. Regular procedures for preparation of surfaces to be joined, such as facing for butt fusion should be followed as directed by the installer manual and equipment manufacturer's instructions. After preparation, protect the surfaces from contamination until joined. Contamination of the area to be fused will likely cause incomplete fusion. Frost and ice on the surfaces of the pipe to be clamped in the fusing equipment may cause slippage during fusion. Remove all ice, snow and frost from the pipe where the pipe is to be inserted in the jaws of the fusing equipment.

**Heating**—Work quickly once pipe and fitting have been separated from the heating tool, so that melt heat loss is minimized, but still take time (no more than 3 s) to inspect both melt patterns. Keep the heater dry at all times. Check the temperature of the heating tool regularly with a surface temperature measuring device. Keep the heating tool in an insulated container between fusions, unless directed otherwise by the heater manufacturer<sup>1</sup>. **Do not increase heating tool temperature above the specified temperature setting for proper fusing.**

At colder temperatures the pipe and fittings contract, thus the pipe slips more easily into the heating tool. At very cold outdoor temperatures the pipe may barely contact the tool heating surfaces. Longer heating times are used so that the pipe first expands (from tool heat) to properly contact the heating tool, then develops complete melt. The length of time necessary to obtain a complete melt pattern will depend not only on the outdoor (pipe) temperature but wind conditions and operator variation. See the Installer manual for these adjusted heating times due to colder weather.

If the tables in the installer manual do not result in adequate fusion due to the temperatures in which you are working, the following may be of help. To determine the proper time for any particular condition, make a melt pattern on a scrap piece of pipe, using the heating time as instructed by the pipe manufacturer. If the pattern is incomplete, try a 3 s longer cycle on a fresh (cold) end of pipe. If the melt pattern is still not completely around the pipe end, add an additional 3 s and repeat the procedure. Completeness of melt pattern is the key. Keep the heater dry at all times. Check the temperature of the heating tool regularly and keep the heating tool in an insulated container between fusions.

### **Butt Fusion**

**Joining** - Be aware of ambient weather conditions during the butt fusion of Aquatherm PP-R pipe and fittings and be ready and capable to make adjustments to the fusion procedure if ambient weather conditions change significantly.

The fusion procedure should provide suitable measures for adjustment of fusion parameters, in particular the heating time, when the ambient temperature changes or during windy conditions. When the ambient temperature becomes colder, it will require a longer heating time to develop an indication of melt and the final bead size. The pipe wall thickness and pipe diameter are primary factors to consider when determining the necessary heating cycle time.

The changing of the fusion procedure due to the changes in ambient conditions requires validation by making test fusions and visually inspecting the results to assure good quality fusions are possible at the given conditions.

### **Do not exceed recommended heating plate temperatures to accommodate cold weather conditions.**

The fusion pressure must be maintained until a slight melt is observed around the circumference of the pipe or fitting before releasing pressure for the heat soak.

**NOTE** — Check for pipe slippage in the fusion machine in cold weather applications. The pipe is stiffer in cold temperatures and the OD of the pipe will shrink slightly, increasing the potential for slippage in the jaws.

### **Do not apply additional pressure during the heat soak to accommodate cold weather conditions.**

Follow the minimum heat soak time for the wall thickness of pipe to be fused per the installer manual and the equipment manufacturer's instructions. The melt beads formed against the heater surface during the heating soak should be in accordance with the installer manual. It is critical that the melt bead sizes specified in the installer manual be achieved.

When the specified heat soak time and melt bead size has been achieved, the pipe and heater shall be separated in a rapid, snap-like motion. The melted surfaces shall then be joined as soon as possible, within the maximum times allowed in the installer manual, so as to minimize cooling of the melted pipe ends. Cool the joint per the installer manual.

Inspection guidelines for fusion joints that are made under cold weather conditions are the same as for fusion joints made at warmer ambient temperatures. Key concerns affecting the quality of cold weather fusion joints are:

- Incorrect heating times
- Application of pressure during heating soak
- Moisture contamination
- Slippage of clamps on jigs or butt fusion equipment due to reduction in pipe OD and/or snow, ice, or water on the pipe

Any of the above possibilities could generate a weak fusion joint. Therefore, strict adherence to the butt fusion guidelines and adequate butt fusion process controls are the primary means to minimize this probability.

**Cold Ambient Temperatures Below 32°F (0°C)** — Butt, fusion outlet or Socket, Fusion is generally not recommended below -4°F (-20°C) without special provisions such as a portable shelter or trailer or other suitable protective measures with auxiliary heating. When making a butt fusion joint when the ambient temperature is below 3°F(-16°C), the pipe ends should be pre-heated using a heating blanket or warm air device to elevate the pipe temperature to improve the heating starting condition. With pipe mounted in the fusion machine, an alternate method of pre-heating is to stop the pipe ends within 0.25 - 0.50 inches (6.4-12.7mm) of the heater plate face to allow the pipe ends to warm for 30 seconds to 2 minutes, depending on the pipe size and wall thickness. The direct application of open flame devices, such as torches, for heating Aquatherm PP-R pipe is definitely not recommended due to the lack of adequate heating control and the possibility of damage to the pipe ends.

When fusing pipe in adverse cold weather or in windy field conditions with blowing dust is required, the provision of portable shelters or trailers with heating should be considered and are recommended to provide more consistent and acceptable working conditions. Completed joints shall be allowed to cool to ambient temperature before any stress is applied. When working inside an open building structure under these conditions, temporary walls and roofs or other means of shelter should be constructed and used.

**Wind**— Exposure of the fusion heater plate and pipe to wind can result in unacceptable temperature variations during fusion welding and possible joint contamination. When extreme wind conditions exist, the provision of a suitable shelter is highly recommended to protect the pipe and fusion heater plate. Wind conditions can develop through the pipe bore and cause unacceptable temperature variations at the heater plate and the heated pipe ends during the heating process. Therefore, open pipe ends may require plugs or covers to prevent this condition.

***Note:** Although wind conditions, during cold weather butt fusion, are the primary concern, wind conditions can affect butt fusion quality at all ambient temperatures by chilling the heated pipe surfaces during the heat soak. This increases the heat soak time needed to obtain the bead size against the heater surface.*

*\*For additional information, see ASTM D2657 – Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings*

1. Revised 13 January 2015