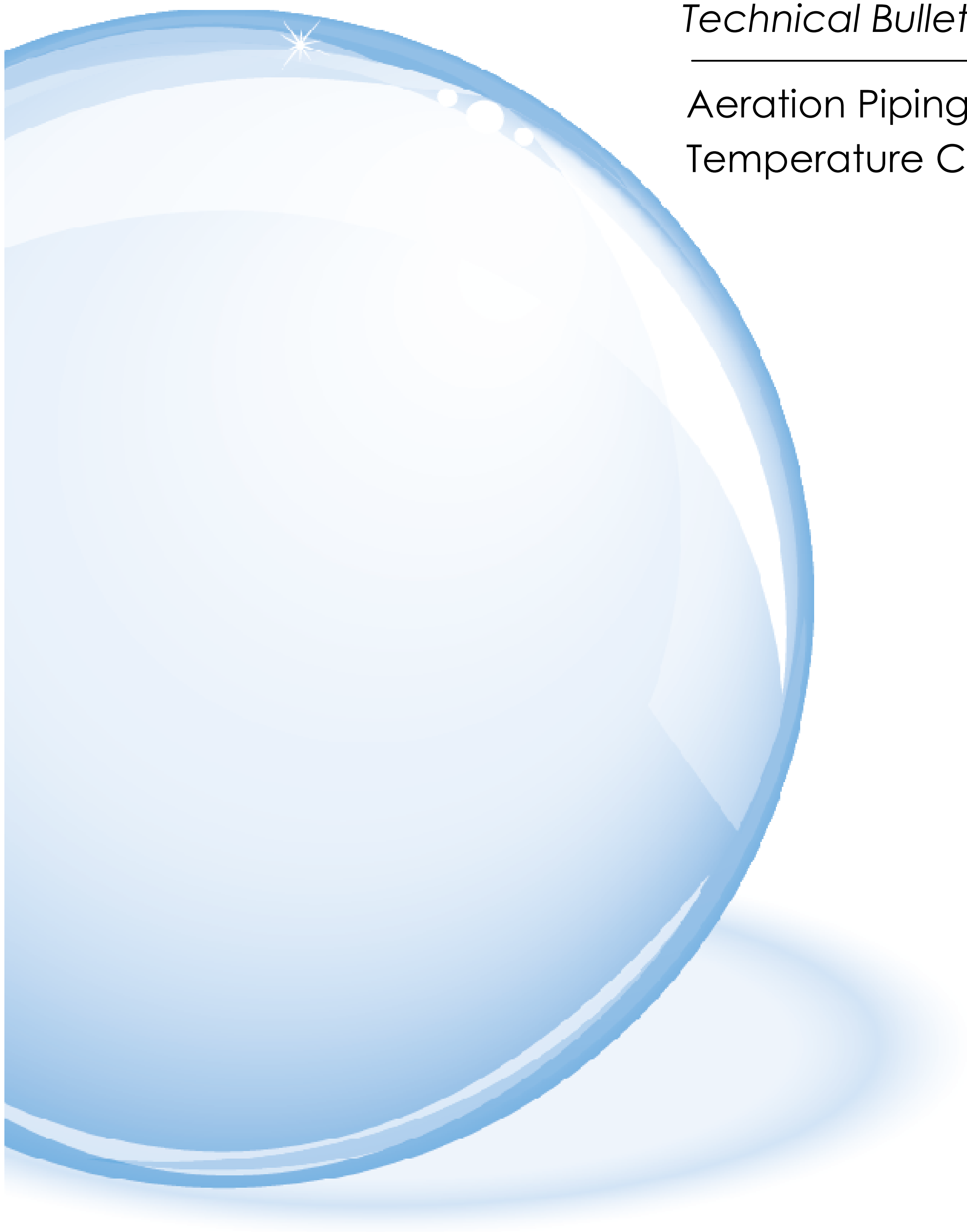

Technical Bulletin 147

Aeration Piping and Diffuser Temperature Considerations

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TECHNICAL BULLETIN 147 – AERATION PIPING AND DIFFUSER TEMPERATURE CONSIDERATIONS

An item often overlooked in the design of aeration system is the temperature of air and the temperature of water, which will affect the materials of construction for the diffuser units and the piping that is supporting those diffusers. This is a critical item as the systems get more complex and basins get deeper in their construction. Compressed air temperatures from the heat of compression are rising dramatically and causing design issues for the selection of materials of both the diffusers and the piping itself.

To offer a guideline of material selection and considerations, EDI has prepared a table of typical materials of construction for Advanced Technology Diffuser Systems. Using this chart provides guidelines on the selection of proper materials for the service. Clearly if the temperature of the air can be controlled so there are no issues of the temperature on the plastic materials, standard UPVC items can be employed satisfactorily. Tradition in the industry is to use UPVC and it should be noted this material has an operating temperature limit of 140℉ (60℃) Mean Wall Temperature. For most applications, UPVC is going to be a satisfactory product for water depths up to approximately 5 to 6 meters. At that point, it is important the overall thermal load on the piping and diffuser system be reviewed and engineered to assure long-term system performance.

Everyone is aware that the temperature of air coming out of blowers can be very hot. This temperature from adiabatic compression is going to be a function of water depth over the diffusers and ambient temperature. It is also a function of pressure losses in the system and the efficiency of the blower unit itself. As a result, it is important to know maximum exit temperature from the blowers in order to do a proper thermal design on the piping and diffuser system. For those cases where the temperature is being evaluated it is helpful to know the capabilities of different plastic materials. Metal piping is of no issue in any application therefore only plastic items need to be considered.

In the application of plastic pipe, the temperature criteria is based on the Mean Wall Temperature. If the plastic piping is immersed in liquid that is one input for the temperature. The hot air that is being applied to the inside of the pipe is the other input for the temperature. The average of these two inputs is the Mean Wall Temperature. Table 1 shows the maximum allowable Mean Wall Temperature for the materials typically used for diffuser systems. The UPVC materials at 140℉ (60℃) can be used as an example.

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Example: If you have liquid temperature of 30℃, then the maximum temperature of the air allowable to the PVC piping would be 90℃. Mean Wall Temperature is calculated as 90℃ for the air plus the 30℃ for the water divided by 2 for an average of 60℃ maximum.

Please note that the numbers in Table 1 are maximum values and if exceeded can likely result in long-term damage or failure of the system.

Table 2 shows the recommended design values for each of the materials typically used in the industry.

Table 1. Mean Wall Temperature Limits

Material	℉	℃
ABS Saddle	190	88
ABS Pipe	180	82
CPVC	221	105
PVC	140	60
Glass Filled Polypropylene	280	138

Table 2. EDI Suggested Mean Wall Design Limits

Material	℉	℃
ABS Saddle	180	82
ABS Pipe	170	77
CPVC	211	99
PVC	130	54
Glass Filled Polypropylene	270	132

From Table 1 above you can see there are variations in allowable temperature for the types of plastic selected. EDI routinely engineers system materials to perform at an optimum level on the project at lowest cost or best value for the customer. The temperature limits in Table 1 are guidelines. Each of these materials have multiple resins that could have slightly varying characteristics and the values shown are typical values for the industry or those values that are typically employed by EDI products.

Use of the table:

Mean Wall Temperature has been described previously. This should be considered as the maximum allowable temperature for satisfactory operation.

Design of a system must consider the variations and variables that can occur on a job site. Dirty air filters drive the temperature of a blower to a higher level than was considered during the design. This could affect the piping.

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Increased water temperature could have negative effects on the Mean Wall Temperature as those water temperatures may be variable during different seasons of the year or operating conditions.

Operation of the plant where valves may be closed or opened could impact the operating pressure of the system and again the pressure on the blowers and the exit air temperature from the blowers.

The calculations of heat loss (from radiation and convection) are best estimates based on typical materials and site conditions such as wind, temperature and assume clean water, and other variables.

As a result of inability to consistently control all of the variables at a plant, EDI recommends a 10°F or a 6°C safety factor for design of mean wall temperature in systems to accommodate these variables and assure long-term performance.

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