Thermal Edge Inc.™

TEMPERATURE CONTROL SOLUTIONS FOR ELECTRICAL ENCLOSURES

THE ULTIMATE GUIDE TO ENCLOSURE COOLING FOR WATER TREATMENT

 | 888.580.0202

CONTENTS

INTRODUCTION

Electrical equipment that is used to operate water and wastewater treatment facilities must be protected from excess heat which may affect its performance, reliability, and lifespan. At the same time, it must be shielded from the harsh conditions commonly found in these locations.

Enclosures for this equipment require a cooling system that will maintain the interior temperature at or below the maximum allowable operating temperature for each component.

Choosing the right enclosure cooling solution, sizing it correctly, and maintaining it properly, will protect valuable equipment, save money, reduce downtime, and ultimately ensure the safety and purity of the clean water flowing from the plant.

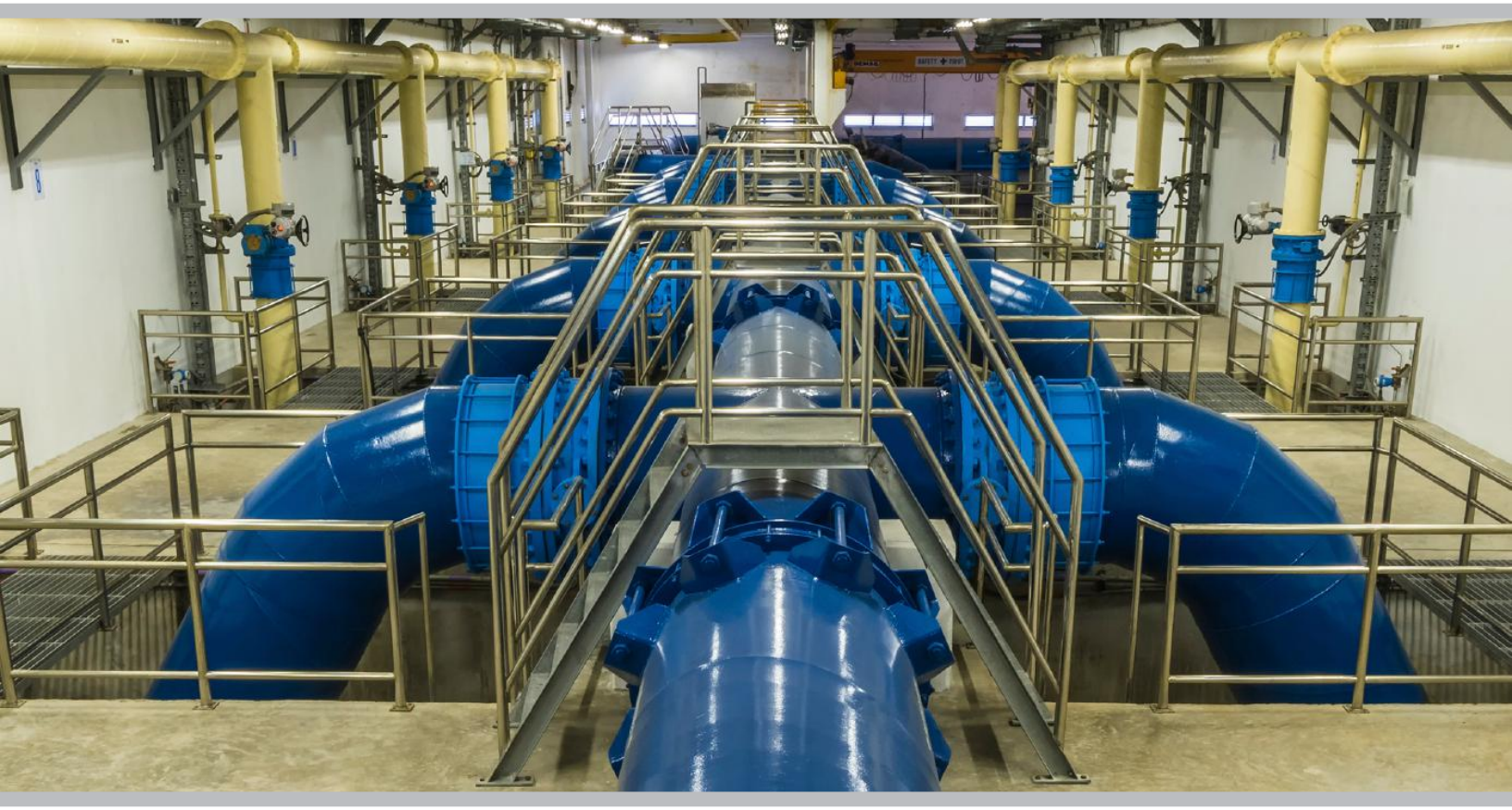
WHY ENCLOSURE COOLING IS IMPORTANT IN WATER TREATMENT

Water and wastewater treatment plants rely on mechanical and electrical equipment, such as pumps, blowers, motors, meters, and sensors for critical operations. Electrical controls for this equipment must be protected from a number of hazards.

Depending on the type and location of the facility, equipment may be exposed to corrosive vapors, cleaning fluids, chemical reagents, and contaminated water, as well as environmental dust and dirt, particulates from treatment chemicals, and inclement weather.

Protecting the equipment requires that it be confined inside protective enclosures. Unfortunately, waste heat given off by the equipment itself can be trapped inside the enclosure, raising the temperature by a significant amount. If the enclosure is situated near a source of heat, such as a boiler, or is located outdoors where it receives direct solar insolation, the amount of heat will be increased further.

Most electrical equipment is designed to operate within a defined temperature range, and will tend to lose efficiency above a maximum allowable temperature specified by the manufacturer. Components such as programmable logic controllers (PLCs), starters, transformers, and variable frequency drives (VFDs) will begin to suffer in performance, reliability, and lifespan if the temperature remains high for too long. As a result, equipment inside the enclosures needs additional protection from excess heat.



HOW TO SELECT THE RIGHT ENCLOSURE COOLING SOLUTION

Several types of electrical enclosure cooling technologies can be found on the market. The first step in selecting a cooling system is to determine the correct NEMA type for the enclosure.

NEMA, or the National Electrical Manufacturers Association, has specified different rating levels for protective electrical cabinets, based on the environment in which it will be located. Enclosure cooling systems fitted to these cabinets should have the same NEMA type rating.[1]

Examples of NEMA ratings include:

NEMA 3R: An outdoor enclosure which provides a degree of protection from falling dirt, as well as from rain, sleet, and snow, and from ice formed on the enclosure.

NEMA 4: Can be used either indoors or out for protection from falling dirt and windblown dust, water (including rain, snow, and ice, as well as splashing and sprayed water) and ice on the enclosure surface.

NEMA 12: An indoor enclosure providing protection from falling dirt and heavy particulates such as lint, fibers, and flyings, as well as from dripping or splashing water.

NEMA 4X: For indoor or outdoor use, providing protection from extreme weather and climate, and exposure to dust and corrosive materials. This type of enclosure is also watertight and designed to tolerate the high-pressure spray that occurs during the cleaning process. It is the ideal electrical enclosure type for applications that are subject to corrosion and wash-down.

Any of these NEMA types might be appropriate for different locations in and around water and wastewater treatment plants, but because of the harsh conditions often found in these facilities, electrical enclosures should typically be specified to meet the NEMA 4X standard.

[1] NEMA Enclosure Types. National Electrical Manufacturers Assoc., Nov. 2005. Web. 8 Jan. 2016. <https://www.nema.org/Products/Documents/nema-enclosure-types.pdf>.

NEMA 4X Enclosure Design

A NEMA 4X enclosure is suitable for use where equipment is washed down with water, cleaning solutions, or other sterilizing chemicals, and where high pressure cleaning equipment is utilized. Enclosures with a NEMA 4X rating are especially suitable for use in hot, humid environments, such as found in Florida, and in coastal marine environments—a typical location for desalination plants—where equipment may be exposed to salt water vapor and the corrosion rates of mild steel equipment are high.

NEMA 4X enclosures can be exposed to wash-down and spraying with high-pressure hoses and water or chemical solutions. Though they are sometimes referred to as waterproof, this is not entirely correct: a NEMA 4X enclosure cannot be submerged in water. However, it must be able to withstand a water jet of 65 gallons per minute from a one-inch diameter nozzle without allowing any water ingress through the sealed evaporator section.

To meet this requirement, seam-welded housings are standard for NEMA 4 or 4X enclosures. In addition, the gasket between the cooling system and the enclosure should be water tight, and the enclosure should not allow water to accumulate in places where mold could grow. The housing design should minimize accumulation of dust and mold and prevent liquid accumulations, typically with sloped housing roofs.

Protection from Corrosive Substances

In facilities where corrosive gases and vapors such as sulphur dioxide, chlorine solutions or salt spray are present, NEMA 4X enclosures offer some protection from contamination and harm. The NEMA 4X corrosion test requires exposure to salt spray for 200 hours, with no more evidence of corrosive pitting than exhibited by a currently run sample made of 304 stainless steel.

It's important to note that as the NEMA 4X corrosion test only includes certain conditions, the resistance of seals and the enclosure materials of construction to particularly aggressive chemicals should be verified before use. Additional corrosion protection may be required.

The NEMA 4X test conditions do not necessarily replicate actual site conditions in an environment where corrosive substances such as chlorine and other chemicals used for sterilizing water/ wastewater treatment facilities, are present. It's best to specify stainless steel construction and ensure that any exposed refrigeration tubing is protected with a corrosion resistant coating.

In addition, if the enclosure will be located in a marine environment, 316 stainless steel is preferable to 304 stainless steel, due to its increased corrosion resistance.

CHOOSING OPEN OR CLOSED LOOP COOLING

Once the NEMA type for an enclosure has been determined, an enclosure cooling system can be selected from one of two basic types: open loop or closed loop. An open loop cooling system is one that allows ambient air to circulate through the enclosure, for example with a forced air fan.

A closed loop cooling system is one in which air inside the electrical enclosure has no direct contact with outside air. Rather than blowing air into it, a closed-loop system transfers heat from inside to outside a sealed enclosure. This insures that the enclosure is not contaminated with ambient air, dirt, chemicals, dust, moisture or foreign matter, so that sensitive components are protected and are kept at the required operational temperature.

NEMA 4X enclosures—along with NEMA 12 and NEMA 4 types—must be sealed to prevent contaminants, corrosive gases, solids, or liquids, from reaching the electric components within. For this reason, closed loop cooling systems are required for these enclosures.

Types of Closed Loop Cooling Systems

Two basic types of closed loop cooling systems are the air conditioner and the air to air heat exchanger. Both have benefits and drawbacks to be considered when selecting an enclosure cooling system for a water/wastewater treatment plant.

In the case of an air conditioner, heated air from the electrical enclosure is drawn out, passed through an evaporator coil that cools it, and is then returned to the enclosure without ever encountering the outside air. The same method is used in the case of an air to air heat exchanger, except the heated enclosure air is passed over the evaporator side of a heat pipe.

AIR-TO-AIR HEAT EXCHANGERS

An air to air heat exchanger is a closed loop cooling solution with significant cooling capacity. When sized properly, a heat exchanger will cool an enclosure to a temperature slightly higher than the ambient temperature. Apart from air circulation fans, it contains no moving parts and energy consumption is extremely low, meaning annual running costs are low.

The heart of the air to air heat exchanger is a heat pipe that transfers heat from the enclosure to the ambient air. The heat pipe, fitted with aluminum fins to improve heat transfer, is evacuated and filled with a special refrigerant. The refrigerant is heated by the air circulating inside the enclosure, causing it to vaporize. This process absorbs heat from the air and causes the hot vapor to rise to the top of the pipe, where it's cooled by ambient air. The vapor then condenses, giving up its latent heat to the ambient air and flows back to the bottom of the pipe. This simple process continually repeats itself.

With a few limitations, an air to air heat exchanger is suitable for many cooling applications. Heat exchangers are available for cooling NEMA 12, 4, and 4X enclosures.

REQUIREMENTS FOR CHOOSING AN AIR TO AIR HEAT EXCHANGER

A heat exchanger is an economical solution for cooling an enclosure that must be sealed against dust, pollution, and water. However, because of the way it operates, a heat exchanger may not be an acceptable cooling solution for some water and wastewater treatment enclosures.

The thermal capacity of an air to air heat exchanger is related to its size and the temperature difference between the enclosure air and the ambient air. Heat exchangers act by removing heat from the enclosure and discharging this heat to cooler ambient air. This means that the enclosure will always be hotter than the ambient air.

This characteristic limits the use of a heat exchanger to those situations where the maximum ambient air temperature is low enough to ensure that the enclosure temperature is maintained at a temperature within the thermal limits of the equipment inside the electrical enclosure.

A heat exchanger can only approach the same temperature inside the enclosure as it is outside. An enclosure air conditioner is the only choice if the internal temperature in the enclosure must be lower than that of the ambient air.

ENCLOSURE AIR CONDITIONERS

An enclosure air conditioner represents an extremely effective method for cooling an enclosure and will work efficiently even if the ambient temperature is much higher than the enclosure's required air temperature. It will also control humidity much better than a heat exchanger, which can be helpful for reducing the humidity around electrical and electronic equipment that is sensitive to moisture.

Like heat exchangers, enclosure air conditioners use evaporation to reduce heat, but in a slightly different way. A refrigerant liquid, under pressure, is passed through an expansion device, creating a drop in pressure. The lower pressure causes the liquid to evaporate in the air conditioner's evaporator coil and absorb heat, cooling the air inside an enclosure. Then the hot evaporated gas is compressed and passed through a condenser coil, where the gas liquefies again, giving up its heat to the air outside the enclosure.

All air conditioners tend to produce water as a result of condensation on the cold evaporator coil. Water leakage from the unit may cause a safety hazard in nearby walkways. Some enclosure air conditioners include a condensate evaporation system which evaporates the water collected from inside a cabinet and is also designed to reduce the energy used by the compressor. This is the ideal setup for safety and efficiency.

Air conditioners are more effective than air to air heat exchangers at keeping electrical cabinets cool and dry, but they cost more to purchase and operate. The trade-off is that they can better keep vital equipment running efficiently, preventing unscheduled downtimes and maintenance, as well as complete equipment failure, which could be disastrous for critical water treatment systems.

SIZING A COOLING SYSTEM

Selecting a properly sized enclosure cooling system is critical for optimal operation and maximum efficiency of a water or wastewater treatment plant. If the system does not have a cooling capacity large enough to maintain the electrical equipment within its specified temperature range, the equipment will quickly begin to lose efficiency. For example, a study of electronic data center equipment showed that the lifespan of equipment is halved for every 18°F (10°C) above 70°F (21°C).[3]

On the other hand, specifying a cooling system that is too large will not only cost more than necessary, but can also cause problems because it will not run long enough to reduce the humidity in the air, causing problems with some electrical equipment. It may also shorten the equipment life and reduce efficiency by cycling off and on too frequently and causing wide temperature swings.

Determining the Heat Load

Sizing an air conditioner first requires calculating the total heat load of the enclosure. This heat may originate internally from inefficiencies in the electrical equipment itself, or may be absorbed through the cabinet walls from solar heat gain, from high ambient temperatures, or from other nearby equipment, such as boilers. At the same time, heat inside the enclosure will naturally radiate out through its walls, lowering the internal temperature by that amount.

NEMA 4X enclosures are designed for outdoor use in harsh climates and will be subject to solar radiation during summer. The cumulative heating may be significant and should be taken into account in the heat load calculations. However, it's worth noting that stainless steel has a much lower solar absorption ratio than painted steel, so stainless steel enclosures will absorb less heat from the sun.

[3] Temperature Management in Data Centers. University of Toronto, Dept. of Computer Science. Nosayba El-Sayed. 2012. Web 21 Jan. 2016. <http://www.cs.toronto.edu/~bianca/papers/temperature_cam.pdf>.

The final cooling system specification should take into consideration the exposed surface area of the enclosure (length, width, and height), the ambient temperature range (maximum, minimum), the enclosure material, color and insulation, and the air flow conditions in the location of the enclosure.

The combination of internal and external heat sources will help determine the heat load, or the amount of heat which must be removed from the system. The cooling solution must be able to remove the heat load from the enclosure, in order to protect the equipment inside. This amount of cooling is called the “capacity” of the system.

Calculate the Internal Heat Load

The internal heat load can be calculated by adding together the heat losses of each component inside the cabinet. The easiest method is to use the manufacturers’ manuals to find heat loss figures. If that information is not readily available, the loss can be estimated by multiplying a device’s power consumption by one minus the device’s efficiency.

However, electronic items such as VFDs, rectifiers, and PLC power supplies often generate a lot of heat and it’s possible to underestimate their contribution to the total heat load. For these components, the heat generated is directly related to the electrical load handled by the device and its efficiency.

Determine Maximum Temperature

The thermal limitations of the electrical equipment must be considered when evaluating electrical component cooling solutions. The optimal temperature setting for an enclosure depends purely on the nature of the electrical equipment inside it.

Not all electrical equipment has the same thermal capacity. Electrical contactors and circuit breakers are often able to tolerate relatively high temperatures without obvious damage, but other categories of electrical and electronic equipment must not be operated above their specified maximum operating temperature. Examples include VFDs, servo drives, and PLCs, which will malfunction, trip, or fail if allowed to overheat.

Establish the maximum allowable enclosure temperature by assessing the temperature limitations of the equipment in the enclosure and choose a slightly lower temperature that provides a reasonable safety factor. VFD drives typically are designed for operation below 104°F (40°C). Ideally enclosure air temperatures should be maintained closer to 95°F (35°C).

Determine Ambient Temperature

The ambient air temperature used in thermal calculations should be the peak temperature expected in the applicable location, allowing for temperature extremes. Subtract the peak ambient air temperature from the maximum allowed enclosure temperature. The result must be a positive number in order for an air to air heat exchanger to work properly.

The required cooling capacity of an air to air heat exchanger is simply calculated by dividing the total heat load in watts by this temperature difference. For example, assume a 20°F temperature difference between the maximum enclosure temperature and the ambient temperature, and a heat load of 800 watts:

800 watts ÷ 20°F = 40 W/°F

The air to air heat exchanger should be able to supply a cooling capacity of 40 watts per degree Fahrenheit.

If the peak ambient air temperature exceeds the maximum allowed enclosure temperature, an enclosure air conditioner will be required.

Calculating Required Cooling Capacity

An online Enclosure Temperature Management (ETM) calculator[2] can simplify the process of sizing an air to air heat exchanger or enclosure air conditioner. The calculator gathers information about a specific application and then calculates the required cooling capacity of a suitable air conditioner or heat exchanger.

An ETM calculator takes into account metrics such as:

- Enclosure dimensions
- Desired enclosure air temperature
- Ambient air temperature
- Internal heat load
- Enclosure material
- Enclosure color
- Location of the unit

With a correctly sized cooling capacity, an air conditioner or air to air heat exchanger should operate smoothly and efficiently for the life of the equipment.

[2] Enclosure Temperature Management Calculator. Thermal Edge Inc., 2016. Web. 1 Jan. 2016. <https://thermaledge.com/etm-calculator-3-0-1/>.

COOLING SYSTEM OPTIONS FOR WATER TREATMENT PLANTS

In addition to complying with NEMA 4X requirements, numerous options are available to manage an enclosure's internal environment so as to ensure electrical equipment remains cool and protected from corrosive gases and liquids.

In many cases, selection of 304 stainless steel (NEMA type 4X) models is strongly advised for wastewater treatment facilities. In marine environments, 316 stainless steel should be specified for the enclosure material.

Depending on the application, engineers and operators may want to include one or more of the following optional packages.

Filter Options

The aluminum filters that are standard in most types of enclosure air conditioners are not suitable for corrosive environments. The chlorine-based chemicals that are used for cleaning in wastewater treatment plants will eventually damage an aluminum filter and impact the performance of the cooling system. A stainless steel filter is a better choice when an enclosure is regularly exposed to chlorine.

In addition to offering better resistance to corrosion against chlorine, bleaching agents, and other strong chemicals, pleated stainless steel filters require less maintenance with their extended filter capacity.

For environments with airborne dirt, dust, oil, etc., air conditioners can be ordered with a 2-in. pleated extended surface area condenser filter.

Corrosion Protection

The copper tubing and aluminum fins used in an air conditioner refrigeration circuit are subject to damage in the presence of sulphur dioxide, chlorine, acids, solvents, salt, and other corrosive chemicals. Air conditioners can be specified with different corrosion protection packages for use in potentially harmful locations.

Condenser and evaporator coils and refrigeration tubing are available with optional electrostatically applied epoxy coating to prevent corrosion. This represents state-of-the-art corrosion resistance, particularly on thin edges, and can endure up to 3000 hours of salt spray protection as tested under ASTM B11. Copper tubing joints can also be brazed with high silver content so prevent corrosion.

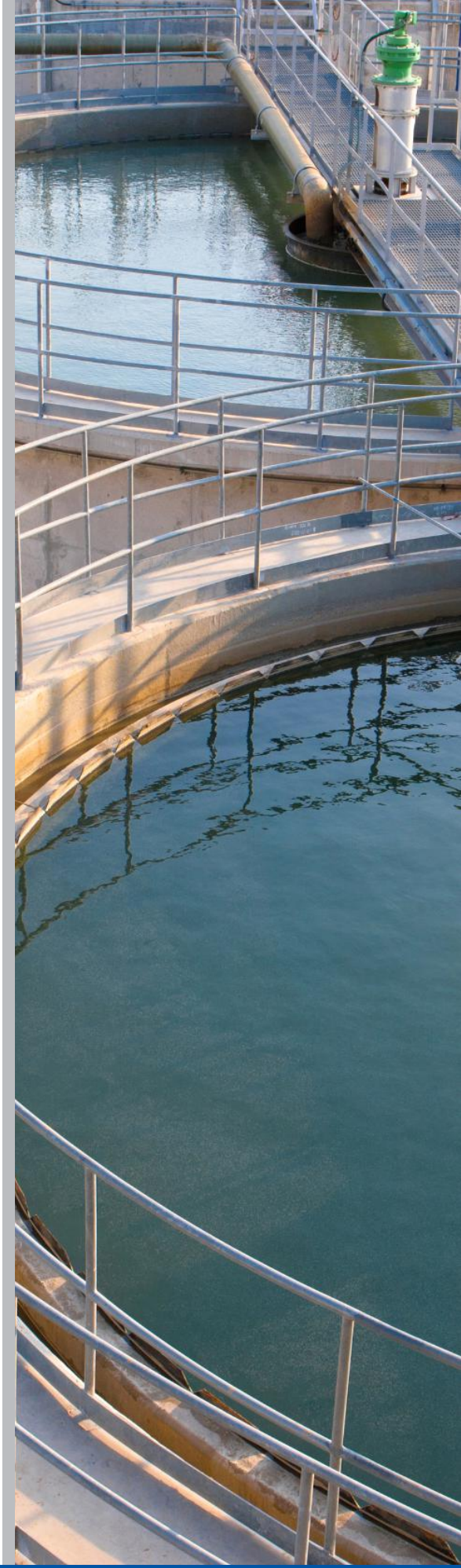
Ambient Temperature Protection

Many water and wastewater treatment plants, such as desalination plants in hot, dry areas, may be subjected to extreme ambient temperatures. Some manufacturers, including Thermal Edge, can provide customized ambient package options to protect the compressor and optimize the system for operation at high and low temperature extremes.

Critical Applications

For critical applications in which failure is not an option, such as desalination plants supplying a municipality with drinking quality, or sewage treatment plants which may overflow into nearby waterways, failure is not an option. In these situations, a customized redundant enclosure cooling system should be considered.

In this type of system, two self-contained air conditioners share the cooling load for the enclosure, and alternate operation so that efficient cooling is provided. In the event of failure of one air conditioner, the full cooling load can be borne by the remaining unit. If extra cooling becomes necessary, both air conditioners will operate.



Vibration Protection

To protect enclosure air conditioners in applications subject to heavy vibrations, such as those located in large-scale pump houses, consider investing in a vibration package, which replaces vulnerable refrigerant lines with flexible shock absorbing lines. In addition, rubber bushings are installed to reduce stress from vibration on copper joints.

Outdoor Security Options

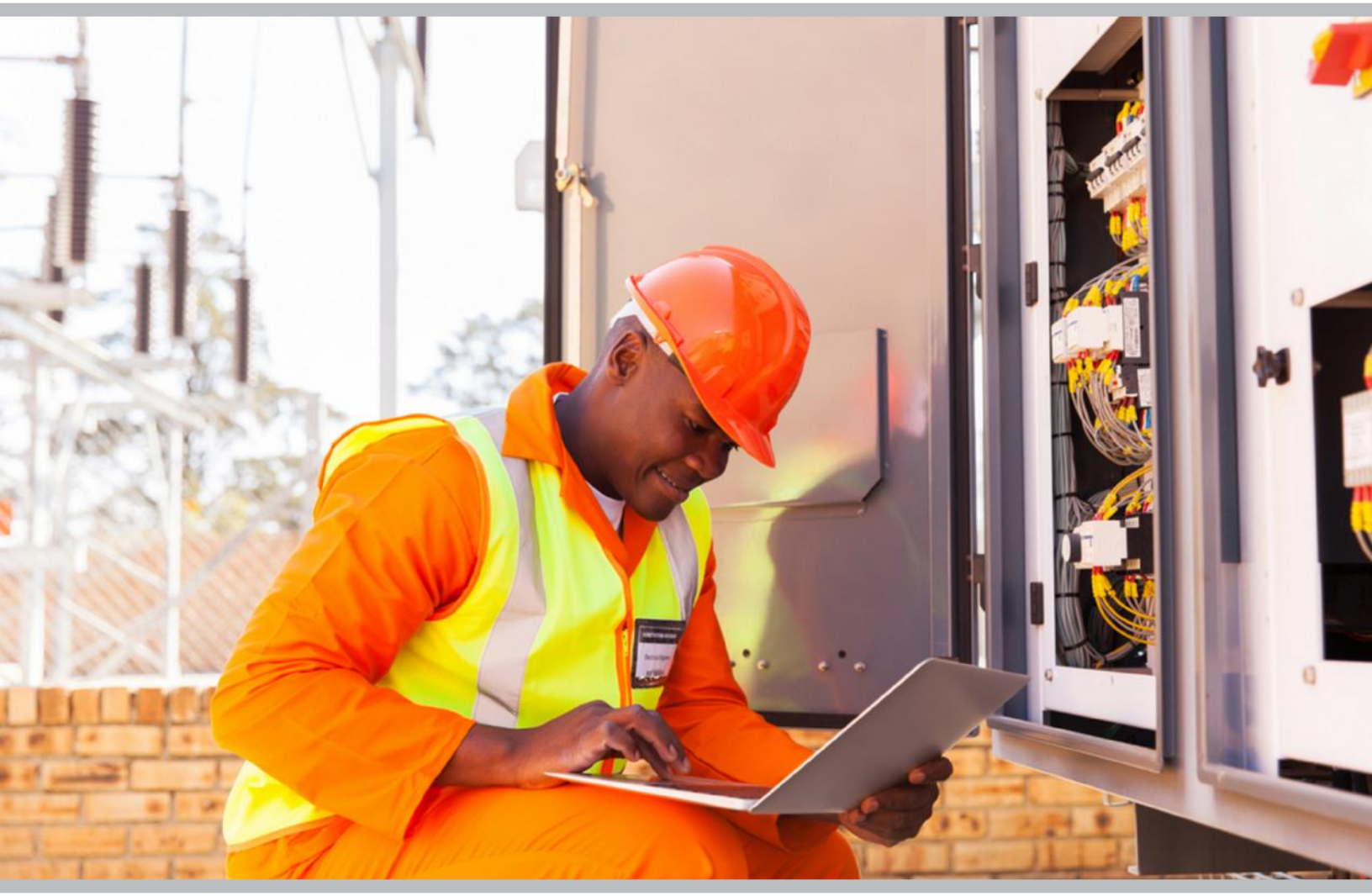
For remote outdoor locations such as neighborhood pump stations, some manufacturers offer an optional internally mounted controller to prevent theft and vandalism of programmable digital controllers located on the face of an enclosure cooling system. Security filter frames are also available, with protective louvers, which require removal of screws to access the filters, instead of the standard sliding filter frames.

COOLING SYSTEM MAINTENANCE TIPS

Enclosure air conditioners and air to air heat exchangers are industrial appliances consisting of electromechanical components that must be cleaned, maintained, and serviced periodically. Regular inspection of enclosure cooling equipment ensures reliable operation of critical operating equipment in water and wastewater treatment plants.

Poor unit maintenance or extreme operating conditions may cause components to fail before their maximum life expectancy. Not only will regular maintenance help prevent breakdowns, it helps maintain the treatment facility within its operating budget and keeps equipment warranties intact.

The frequency of equipment inspections should take into account environmental conditions and the criticality of the installation. When an enclosure air conditioner is located outdoors or in an environment that is not temperature controlled, it usually has to work harder in the summer months to maintain the desired internal temperature. Because it will be running more frequently than usual, it will need more regular maintenance to ensure proper operation.



Maintenance Checklist

Always follow the manufacturer's instructions for preventive maintenance. The following tips should be performed on a regular basis to ensure the enclosure cooling system continues to protect critical electrical equipment running water and wastewater treatment operations:

☑ ENCLOSURE DOOR SEALS

Enclosure cooling will be ineffective if the enclosure doors don't seal, so check that they close and seal securely. If an open door kill switch is installed, check that the air conditioner switches off when the door is opened.

☑ GENERAL CONDITION

Check the general condition of the unit, noting any loose wiring, signs of wear, damage, refrigerant oil leaks, or corrosion.

☑ INTERNAL TEMPERATURE

Check the internal temperature of the enclosure. With air to air heat exchangers it should be slightly above ambient, and with enclosure air conditioners it should be lower, provided the ambient temperature exceeds 75 °F. For air conditioners, check that the air going into the enclosure from the air outlet is at least 10 °F cooler than the air returning to the air inlet.

MOUNTING GASKETS

Visually check the condition of the cooling system mounting gasket and make sure the cooler is securely fastened to the enclosure. Look for telltale signs of air leakage.

AIR CIRCULATION

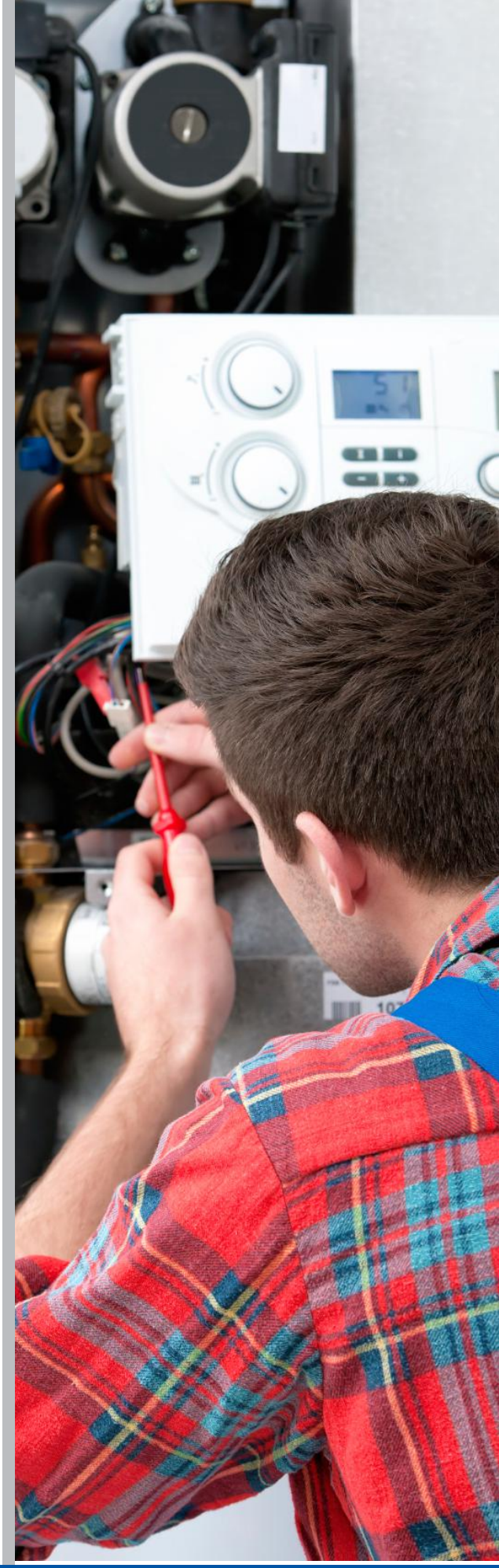
Make sure there are no obstructions to air circulating around the condenser area of the enclosure cooler. Air to air heat exchangers should have at least five inches of clear space at the condenser air supply and return, and enclosure air conditioners need at least three inches of space. Greater clearance is better.

CLEAN THE CONDENSER AIR INLET

Although closed loop technology will keep internal electronics clean, air conditioners and air to air heat exchangers need unrestricted flow of outside air through the condenser section of the unit. Restriction to the airflow due to excess dust or particulates will degrade the performance of the equipment, resulting in reduced cooling, and can damage the compressor. Keeping the condenser air inlet, condenser fan and heat transfer fins clean is the best way to ensure proper operation. The condenser air inlet should be cleaned with a soft water spray or compressed air not to exceed 90 psi.

REPLACE PARTS

All mechanical systems are subject to wear and tear. Although this is normal, if it causes equipment to break down it can be disruptive. Regularly replacing worn fans before they cause a problem is the best way to achieve uninterrupted service.



These last checks are only applicable to enclosure air conditioners:

TEMPERATURE ALARMS

Check to see if there are any alarms indicated on the temperature controller. If alarms are showing, record them and call a refrigeration technician to check and repair the air conditioner.

TEMPERATURE CONTROL

Record the actual temperature of the enclosure displayed on the controller. Check the controller set point by pressing the SET button and making sure the temperature is within a few degrees of this set point (Allow the system time to stabilize).

CHANGE OR CLEAN CONDENSER FILTERS

Clean condenser air inlet filters are an essential prerequisite to efficient air conditioner operation and performance. Dirty and clogged filters can interfere with normal operation and even damage the system. The overload switch in the compressor may cause the compressor to cycle if the compressor overheats due to air restriction.

A further safety feature is the refrigerant high pressure cut off switch which will stop the compressor if the condensing pressure becomes too high due restricted condenser air flow or some other cause. Restricted air flow due to neglecting a dirty filter will cause a unit to repeatedly turn off and then turn back on after it cools off. An operation in this safety cycling mode will eventually damage the equipment and void the warranty. Refer to Field Serviceable Parts section below for details on parts that can be changed to help increase the uninterruptable life of the air conditioner.

The frequency with which filters must be washed or replaced depends on the type of filter and the environment where the enclosure is located. Stainless steel filters, available as options for applications such as water and wastewater treatment plants, offer better resistance to corrosion against sulphur dioxide, chlorine, bleaching agents, and other heavy chemicals. Furthermore, they require less maintenance with their extended filter capacity. For dusty and heavily polluted environments, optional two-inch pleated filters, with 400 percent greater capacity than flat filters, increase the time between filter maintenance.

The lifespan of condenser filters depends on the methods used for washing and cleaning. Filters are fitted on the inlet to the condenser of enclosure air conditioners. Switch the unit off, and remove and check the filter. Washable filters should be cleaned as recommended in the equipment manual or, if not washable, replaced if they are blocked. Wash the filter often, if washable, using proper cleaning compound and back flush the dirt out, or replace if not washable, whenever it appears physically dirty. Dry thoroughly before replacing.

DO NOT operate the air conditioner without the air filter. Such operation will allow the condenser coil to become dirty and lose efficiency, causing overheating and diminished cooling capacity.

CLEAN CONDENSER COILS

If an electrical enclosure is located in a particularly dirty or harsh environment, or if the air conditioner was operated without a filter in place, the condenser coil may become dirty and cause the air conditioner to lose efficiency. This can lead to either overheating of the air conditioner or diminished cooling capacity inside the electrical enclosure.

Cleaning the condenser coils can extend the life of an air conditioner and keep the cooling capacity at top level.

Dirty condensing coils must be back-flush cleaned using proper commercial coil cleaning compounds and thorough back-flush rinsing. Refer to the manufacturer's directions on the cleaning compounds selected. The use of acid wash is highly discouraged because it will shorten the lifespan of the coils.

CONDENSATE OVERFLOW PIPE

Make sure no condensate is flowing out of the condensate overflow pipe.

CONDENSER AND EVAPORATOR FANS

Enclosure air conditioners use high efficiency, long life, sealed ball bearing fans engineered for optimum performance and require no maintenance. The fan blades, however, will need to be cleaned regularly for peak performance. Fans are removable and attached by plug in connections.

COMPRESSOR

The factory sealed compressors provided with air conditioners should be quiet and have low-vibration. A thermal overload protection device prevents damage due to overheating and short cycle faults. In the event the thermal overload device fails, the air conditioner should be returned for warranty repairs. Note that the rotary compressor runs with compressed refrigerant gas on the outer case and therefore is hot to the touch.

REFRIGERANT LINES

Enclosure air conditioners should be meticulously leak and run tested after assembly prior to shipping. If a leak should develop due to shipping damage or mechanical vibration, the leak must be detected, repaired and the refrigerant charge restored to the system by a qualified refrigeration professional.

Even though there are no preventative maintenance tasks to perform for some of the components in an air conditioner, it is important to keep everything properly cleaned. A well-maintained and clean electrical enclosure will operate as intended, and keep operating expenses low.

FIELD SERVICEABLE PARTS

The following air conditioner and air to air heat exchanger parts can be replaced by a qualified air conditioner technician at your facility. If a problem can be diagnosed to one of the faulty parts listed below, the repair can be done on-site to limit down-time.

- Digital Controller
- Low Pressure Switch
- Condenser Fan Cut-In Pressure Switch
- Temperature Probe
- Power Supply Board
- Thermal Expansion Valve
- Compressor
- Compressor Thermal Overload
- Gasket Installation Kit
- Evaporator Fan
- Condenser Fan
- Electrical Harness
- Power Cord
- Capacitor

TROUBLESHOOTING TEMPERATURE CONTROL PRODUCTS

When troubleshooting an enclosure cooling system, verify the system is running and check the enclosure temperature. If the temperature difference to the set point is more than 5 degrees, there may be a fault in the cooling system.

Troubleshooting Air-to-Air Heat Exchangers

The following troubleshooting guide provides a series of actions to identify a problem, determine the root cause and identify the needed correction for an enclosure air to air heat exchanger. Perform the checks in the order listed.

NOTE: To prevent damage to equipment, electrical panel and wiring, and to prevent personal injury, assure that the power source is compatible with the equipment before operating.

1. HEAT EXCHANGER NOT RUNNING

If unit is not running, check the following, in order:

- Connect power cord.
- Verify Power On/Off switch is On.
- Toggle On/Off switch then retry.
- Verify input power meets voltage requirements as shown on the UL label.
- If problem persists, contact technical support.

2. INSUFFICIENT COOLING

If unit has power but not cooling, check the following:

- Make sure condenser inlet is clean and clear of debris.
- Verify fan operation.
- If fan not working, replace.
- Check and clean condenser coil, if necessary.
- Verify a minimum of 5-in. air space for condenser air return and supply.
- If problem not resolved, contact technical support.

Troubleshooting Enclosure Air Conditioners

Check the cooling system controller for flashing alarm indicators. The air conditioner digital controller should have several alarm codes to indicate its status. The settings for these alarms can be changed from the programming interface of the digital controller.

For Thermal Edge controllers, for example, the codes P1 and P2 indicate enclosure probe and condenser probe failure. HA and LA are the maximum temperature and minimum temperature alarms. HA2 and LA2 are high and low temperature alarms for the condenser. CA indicates low refrigerant pressure in the evaporator coil.

If any of the critical control parameters exceed the limits set on the controller, the compressor will be turned off and an alarm condition indicated on the front panel. There are three main conditions that can shut the compressor down:

- In the event that the condenser coil overheats, a condenser high temperature alarm, HA2, will flash on the controller and the compressor will turn off after a 3 minute time delay.
- In the case that the evaporator coil ices up or there is a leak, an evaporator coil alarm, CA, will flash on the display. This may indicate a faulty fan or refrigerant leak. Look for signs of an oily deposit on piping to confirm a leak. The compressor will turn off after a 2 minute time delay.
- A thermal overload protects the compressor against faults. In the event that the status LED is not flashing on the display and the compressor is not running, an internal fault may have occurred on the cooling unit.

NOTE: Thermal Edge air conditioners are designed using an advanced refrigeration cycle and are equipped with a Condensate Removal System that changes the excess humidity liquid into a vapor which is then vented to the atmosphere. In the event of excess water vapor where the enclosure door has been left open there is an overflow hole on the bottom of every unit. Please contact Thermal Edge if you encounter excess water coming from your air conditioner.

TROUBLESHOOTING STEPS

It is always recommended to use a licensed air conditioner technician for internal diagnostics and repairs issues. The following troubleshooting guide provides a series of actions to identify a problem, determine the root cause and identify the needed correction. Perform the checks in the order listed.

NOTE: To prevent damage to equipment, electrical panel and wiring, and to prevent personal injury, assure that the power source is compatible with the equipment before operating.

1. AIR CONDITIONER NOT RUNNING

If the unit is not running, check the following:

- Power: Is the unit connected and is power applied? Has the circuit breaker or fuse blown?
- Power switch: Is the switch on?
- Correct voltage: Is the supply voltage correct for the model; check the voltage on the nameplate.

2. UNIT OVERHEATING

If there is a high temperature alarm (HA2) or signs of the air conditioner overheating, check the following:

- Air inlet: Is it blocked?
- Fans: Are they running?
- Condenser coil: Is it dirty?

3. UNIT HAS POWER BUT NOT COOLING

If the air conditioner has power but is not cooling, check the following:

- Set Point: Make sure the set point is below ambient temperature.
- Compressor is running: Check that the evaporator and condenser fans are running. If the low condenser pressure alarm (CA) is energized, there may be a refrigerant leak. Alternatively, poor cooling may be due to an excessive heat load.
- Compressor not running: Check that the compressor contactor coil is energized and the contactor operates. Inspect the thermal overload on the compressor. A compressor with power that's not running is usually faulty.

4. INTERMITTENT OPERATION

If the air conditioner is operating intermittently, check the following:

- Power supply: Make sure the fuse or circuit breaker is in good condition.
- Wiring: Look for a loose connection or short circuit.
- Compressor: A hot compressor may indicate a faulty unit that is running intermittently.
- For more information, refer to the Troubleshooting Guide in the User's Manual.

NEXT STEPS

The best way to select the proper enclosure cooling system for a specific application is to work with a qualified provider with experience in your industry. A vendor who understands the rigorous requirements of the environment will be able to provide the best possible service, and ensure that the system meets the minimum specifications required.

Thermal Edge works with water and wastewater treatment facilities and many other types of industries to provide enclosure air conditioners that are both reliable and efficient. We offer air conditioners and heat exchangers for a broad range of applications, including enclosures with all of the NEMA ratings discussed in this white paper.

The ETM Calculator on the Thermal Edge website has been designed to simplify the selection process. For more help selecting the right cooling system for your application, talk to the professionals at Thermal Edge. Our experts will work with you from beginning to end to ensure that you have the most cost-effective solution. We also work with engineers who design electrical enclosures to help determine the right temperature control solution early in the design process.

Get in touch with us to review case studies that are similar to your application, review product literature, or schedule a consultation. Request a Quote today.

Get a Quote for an Enclosure Cooling System

REQUEST A QUOTE

Thermal Edge Inc.™

TEMPERATURE CONTROL SOLUTIONS FOR ELECTRICAL ENCLOSURES