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Technical Reference

Capstone MicroTurbine Installation and Permitting Guidelines

Introduction

The Capstone MicroTurbine is designed and manufactured in accordance with a variety of national and international standards.

Since the Capstone MicroTurbine produces electricity up to 528 volts AC (defined by NEC as low voltage having 600V or less), and is a gas-powered device, installation frequently requires one or more permits from local regulatory agencies.

The following checklists and questions have been generated as a result of researching Electric, Plumbing, Mechanical, Fuel Gas, and Building Code books. Since there is great variation in these documents, this document attempts to alert the reader to issues that are commonly referred to in codebooks or have been issues in past installations. In no way is this document meant to replace code requirements or specify their content, but to provide helpful information to aid in the permitting and installation process. The reader must still refer to local codes and perform the calculations to ensure conformance with requirements. If you cannot find the information you require, please contact Capstone Technical Support at (818) 407-3600.

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General Installation

The information provided in this section applies to the entire MicroTurbine. Information related to fuel and electrical service, inlet air, and exhaust are discussed later.

Permit Checklist

Table 1. Permit Checklist

Requested	Item	Complete
☐	Installation per National Electric Code	☐
☐	Copy of the electrical license	☐
☐	Copy of this Installation/Permitting Guideline	☐
☐	Plot of survey with location of generator and footprints	☐
☐	Electrical application from local agency	☐
☐	General application from local agency	☐
☐	$10,000 Bond or $_____ Bond	☐
☐	Certification of Insurance	☐
☐	Manufacturer specifications, Spec Sheet	☐
☐	All contractors must be registered and bonded	☐
☐	Installation instructions	☐
☐	Transfer switch wiring diagram	☐
☐	Information on the generator	☐
☐	1 Line drawing of gas system	☐
☐	1 Line drawing of electric system	☐
☐		☐
☐		☐

Certifications

- **UL and cUL – Underwriters Laboratories Inc.**

  Several of the Capstone MicroTurbine models are UL Listed to UL 2200 for both the United States and Canada.

- **NFPA – National Fire Protection Association**

  The Capstone MicroTurbines meet applicable NFPA requirements. There are additional NFPA requirements that must be met regarding the installation.

- **NEC – United States National Electric Code (NFPA 70/1996)**

  The Capstone MicroTurbines as manufactured meet all applicable NEC requirements. The MicroTurbine installation must meet all applicable NFPA 70 requirements.

- **NEMA – National Electrical Manufacturers Association**

  The Capstone MicroTurbines conform to NEMA 250-1997 pertaining to the system enclosure weather resistance rating.

- **IEEE – Institute of Electrical and Electronic Engineers**

  At rated output, the Capstone MicroTurbines fully comply with IEEE 519.

Data

Table 2. General Installation Factors

Factor	C30	C60
Package weight (Stand Alone)	816 kg (1800 lb)	1133 kg (2500 lb)
Dimensions (including exhaust stack)	0.762 W, 1.52m L, 2.08 m H (30” W, 60”L, 82”H)	0.762m W, 1.96m L, 2.08 m H (30” W, 77”L, 82”H)
Sound (without optional silencer)	65 dB at 10 meters	70 dB at 10 meters

Items to Think About

- Provide proper service clearance per Capstone guidelines and local codes. Close packing of MicroTurbines may be possible with the use of the optional Roll Out Option (wheel) kit and flexible fuel lines and conduit.
- Provide proper mounting and support considering wind loading, seismic, and weight requirements.
- The MicroTurbine can be moved using a forklift, pallet jack or overhead crane provided the equipment is rated for the load. Note when using a pallet jack, the wheels must be placed correctly so as to not damage the base of the unit. When using a crane, cables shall not exceed 30° angles from vertical.

- If the unit is going to be welded to a platform, use great caution and follow these guidelines: The key issue is to have any external connections removed during welding. This includes RS232 cables, modems, power cables, grounding cables, I/O connections to the UCB, and any other conceivable connection. Instruct the welder to attach his return cable to the platform side of the weld, not the MicroTurbine side. Start the weld melt on the platform and then move the melt to the MicroTurbine base. This assures that grounding is made before the arc comes in contact with the MicroTurbine.
- Provide sufficient doorway and passageway access, width and height. Access requirements in Mechanical codes are dependent upon equipment type, size, and power.
- Be aware of outside surface temperature of the MicroTurbine unit, especially the exhaust pipe.
- Do not block access to forklift slots.
- Do not alter package or remove eyebolts if used in an exterior application because rain will be able to enter the package. When using a silencer or changing the eye bolts to some other hardware, use an outdoor rated sealant to keep water out of the package.

Inlet Air

In the process of producing power, the MicroTurbine produces heat, both in the engine and the electronics. In general, the electronics produce more heat as the generator produces more power. The generator produces more power, as the compressor inlet air gets cooler. Even though the increased power creates more heat in the electronics, this is balanced by the fact that the cooler air will keep the electronics from overheating. The key factors are to provide air that is the same temperature to the engine and electronics and to not restrict that air flow.

Data

Table 3. Inlet Air Factors

Factor	C30	C60
Engine combustion air	600 cfm	900 cfm
Electronics cooling air	970 cfm *	900 cfm
Cooling air max pressure drop	0.2 mmHg (0.1" H2O)	0.9 mmHg (0.2" H2O)
Duct area for electronics or engine	.13 m^2 (200 in^2) each	.13 m^2 (200 in^2) each
Air temperature	-20 to 50°C (-4 to 122°F)	-20 to 50°C (-4 to 122°F)
Heat loss of each unit, neglecting loss from exhaust pipe walls	5 kW	10 kW

* Low pressure NG, Stand Alone configuration

Items to Think About

- Engine air cannot be more than 2° C cooler than the electronics cooling air to prevent the electronics from overheating. For example, do not air condition the engine inlet and have the electronics draw on ambient air.
- It is not recommended to supply electronics and engine air via the same duct. If air is coming from a common area, divide the electronics and engine air all the way to the ambient free air. There are ways of common ducting but they require forced air systems and properly sized and located ducting to prevent the engine from pulling air away from the electronics causing overheating. Note the max pressure drop requirements in the table above.
- Silencing of inlet air can be done but pressure drop to electronics must be minimal, less than 0.1 inch of water. Using ducts that are lined with foam and a length over diameter (L/d) ratio over 8 can provide good silencing with lower pressure drop. Make sure to follow above guidelines regarding no common ducting.
- Air can come from either inside a building or from outside as long as temperature and pressure drop requirements are met.
- Inlet air duct may need to be sloped per Mechanical Codes.
- If the MicroTurbines are located in a closed room, several items must be considered.

- The best location to provide the cooling air is low in the enclosure in front of the MicroTurbine. This helps push the hot air up and out of the enclosure, eliminating areas of stagnant, hot air and keeps the units from ingesting hot air.
- It is usually better to cool a room by pulling the air out of the room and discharging it to the outside. Fresh air is drawn in via vents. The fresh air can come from either the outside or interior air. Keep in mind that the MicroTurbines have an upper temperature limit. If the outside air can reach 100° F on a hot day, it leaves very little margin to the upper limit. Therefore it may be advantageous to use cooler interior air as long as it is provided to both the engine and electronics.
- Air feeding the room may need to be provided using a fan. By using a thermostatically controlled fan for the room, one may be able to reduce the room temperature and hence the engine inlet temperature thus increasing engine power output.

Fuel Service

The Capstone MicroTurbine requires clean, dry fuel of the appropriate pressure. Fuel preparation is not a trivial matter, though. There are many permitting and code issues as well as fuel requirements of the MicroTurbine.

Gaseous fuel must have appropriate dew point suppression and be delivered such that proper flow and pressure is maintained throughout the operating range.

Liquid fuel must have particulate matter removed and be delivered at the proper pressure. The following information should provide practical help to meet the requirements.

Data

Table 4. Fuel Piping Factors

Factor	C30	C60
Fuel flow, 1000 Btu/scf	200 slpm (7 scfm)	400 slpm (14 scfm)
Fuel flow, 600 Btu/scf	530 slpm (12 scfm)	NA
Fuel flow, 350 Btu/scf	930 slpm (21 scfm)	NA
Fuel temperature *	50°C (122°F) Max	50°C (122°F) Max
Fuel pressure, LP *	103 kPa (15 psig) Max	NA
Fuel pressure, HPNG **	414 kPa (60 psig) Max	552 kPa (80psig) Max

*Refer to Fuel Requirements Technical Reference Document, (410002) for all details regarding fuel minimum and maximum pressure and temperature, contamination, calorific value, etc.

**This value is higher for the low Btu fuel. See the Fuel Requirements Technical Reference Document (410002).

Items to Think About

Refer to Fuel Technical Reference Documents 410002 for information regarding fuel minimum and maximum pressure and temperature, contamination, calorific value, etc.

- Fuel piping size should be determined considering the length and pressure drop. Fuel pressure requirements apply at the entrance to the MicroTurbine while the system is running.
- Provide pressure regulation for **each** MicroTurbine. This is especially important in MultiPac installations where the pressure may change from unit to unit.
- If there is any condensate forming at the inlet of the MicroTurbine, the last chance filter is useful to see if there are any liquids making it through the upstream filters. This can be done by installing Capstone external fuel kits on all high pressure microturbine systems. Sour gas kits are required for biogas and sour gas applications. Sour gas kits offer valves and other components in stainless steel that may be required for some installations (i.e. in the oil industry), even if the fuel gas does not have sulfur content.

- The pressure regulator in the Capstone high-pressure external fuel kit must have at least 103 kPa (15 psig) pressure drop across it in order to hold a steady pressure as the upstream pressure fluctuates. This requirement is higher for low Btu systems at higher pressures. Check with the manufacturer and follow their guidelines. This requirement in turn dictates the compressor design point.
- Liquid knockout tanks upstream of the compressor may not have enough pressure to automatically purge through a float valve. A pump may be required to remove condensate.
- Biogas systems and other applications with wet gas should provide a gas/liquid separator immediately downstream of the compressor, and a refrigerated dryer/chiller to meet the Capstone fuel dew point specification: "Water vapor content must be at a minimum of 10ºC (18ºF) above its dew point anywhere within the fuel connections and the system between the Capstone Microturbine fuel inlet and the fuel manifold block" (410002)
- The use of existing pipe in a building is sometimes permitted, but it may be necessary to perform pressurized leak checks that use pressures that are higher than the normal service pressure.
- Beware of maximum line pressures allowed within buildings per Plumbing Codes.
- Copper and brass pipe or fittings must not be used if the gas contains a particular level of H_2S. See local Plumbing and Fuel Gas codes for allowable level.
- PVC fuel lines may not be allowed depending on local codes and fuel type.
- When using black pipe it is best to paint the pipe after the installation is complete to reduce corrosion and stains on the surrounding surfaces.
- Also, if black pipe is used for biogas installations additional particulate filtration will be required upstream of the compressors and/or refrigerated dryer.
- Flexible fuel lines may have code restrictions on length, location of service, protection, pressure, fuel type, end fitting type and material.
- Fuel service to MicroTurbine location may come underground, above ground, supported from ceiling, or attached to wall, per local codes, but note the following:
    - The depth that pipes must be buried changes based on whether the pipe is under a building, parking lot or concrete of different thicknesses.
    - Where wet gas exists, a drip trap shall be provided at any point in the line of pipe where condensate could collect. Drips must be provided with ready access to permit cleaning or emptying. For example, do not bury a gas line that contains wet gas. It will condense liquids in the cool earth and draining is difficult.
    - Slope fuel lines such that condensate will drain into a serviceable vessel or area, note local codes for disposal.
    - Adequate support and protection must be provided for all piping, per local codes.
    - Ensure that piping supplying the unit is well protected from foot traffic or equipment.

Electrical Service

When installed properly, the Capstone MicroTurbine is a reliable source of clean power. The primary issue with power connection is proper grounding following the Electrical Installation Technical Reference document (410009). The information here is intended to help avoid common mistakes and highlight possible permitting issues.

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Table 5. Electrical Connection Factors

Factor	C30	C60
Output voltage*	3-phase 528 VAC Max	3-phase 528 VAC Max
Max steady state output current* (rate at 1.25x)	46 Amps RMS per phase Max	100 Amps RMS per phase Max
Output kVA (@ 480 Volts)	38.2 kVA	83.0 kVA
Frequency	50/60 Hz	50/60 Hz

* Refer to Electrical Technical Reference Documents 410000 and 410001 and Electrical Installation Technical Reference Document 410009 for details.

Items to Think About

Refer to Electrical Technical Reference Documents 410000 and 410001 and Electrical Installation Technical Reference Document 410009 for information regarding operating modes, grid and transformer connection methods, switchgear wiring, etc.

- A single earth ground is mandatory. Grounding must be made in such a manner that is consistent with Electrical Installation Technical Reference Document (410009) and local codes. Sheet metal screws are generally not permitted to attach ground leads or lugs to equipment.
- Follow the typical rates for circuit breaker and wire sizing as presented in document 410009, or in accordance with the National Electric Code.
- Perform load-profiling analysis to determine a customer's demand and power quality (for Stand Alone systems, especially).
- A power transformer (minimum of 45 kVA for a C30 or 90 kVA for a C60) will be required for some installations. Refer to 410009.
- If the MicroTurbine is a Stand Alone configuration, it incorporates a battery pack. The battery is a gel cell lead acid sealed battery. There is no maintenance or venting.
- Conductor size and insulation type must be determined based on total maximum MicroTurbine units and installation conditions.
- Rigid, EMT, or weather-tight flex conduit may be used per local codes. Flexible conduit may have restrictions on length, location of service, protection, voltage, current, end fitting type and material.
- Service access requirements vary based on location, surrounding material, and grounding properties.

- Service access may be reduced if the MicroTurbine can be rolled out for service.
- Access passage (doorways and hallways) to the service access area may be defined based on voltages, currents and size of unit per Mechanical codes.
- Electrical service to the MicroTurbine location may come underground, above ground, supported from ceiling, or attached to wall, per local codes but note the following:
    - The depth that conduits must be buried changes based on whether the conduit is under a building, parking lot or concrete of different thicknesses.
    - Above equipment conduit runs are subject to height and support requirements per NEC and Mechanical codes.
    - Frequency of support or attachment and proximity to nearest endpoint varies depending on conduit type, per NEC.

Exhaust System

The exhaust from the MicroTurbine is hot, about 300 °C (500-600°F). As such, proper care should be taken in the rejection of this heat, whether that rejection is in the form of heat recovery in a heat exchanger or simple exhaust to the ambient air. In either case, the main objective is to transfer the hot exhaust to an acceptable area with minimal pressure drop or flow restriction.

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Table 6. Exhaust Factors

Factor	C30	C60
Exhaust temperature	275 °C (530 °F)	305 °C (580 °F)
Exhaust flow	17 m^3/minute (600 scfm)	25m^3/minute (900 scfm)
Engine exhaust duct dia.	127mm (5")	203 mm (8")
Exhaust heat energy	327,000 kJ/hr (310,000 Btu/hr)	571,000 kJ/hr (541,000 Btu/hr)
Exhaust mass flow	0.31 kg/s (0.68 lbm/s)	0.48 kg/s (1.06 lbm/s)

Items to Think About

- Note that the exhaust flow is in "standard" cfm, so it must be corrected for temperature. The real flow is almost twice the value and must be used for duct sizing and backpressure calculations.
- Ducting multiple units' exhaust requires backflow dampers. If one unit is down while others are operating, one must prevent hot gasses from being expelled through the non-operational unit. In some instances, MicroTurbines feeding a common exhaust manifold may require an interlock to prevent exhaust backflow into non-operating systems.
- The exhaust ducting must be removed for service and maintenance work so the ducting must be installed in such a way that is supported and separable. The duct cannot be welded to the engine or upper stack. If interlocking ducting, such as Metalbestos, is used make sure to use a collar at the base that when removed can allow the upper stack coming out of the top of the MicroTurbine package to raise up 2 inches.
- Duct diameter and length must be designed such that backpressure at the MicroTurbine is less than 15 mm Hg, 0.289 psi (8 inches of water column). Ducting needs to be supported and designed to allow for removal and servicing of the MicroTurbine. The insulation may need to be removed near the coupling with the MicroTurbine exhaust pipe.
- As a "medium heat" device, be aware of requirements regarding penetration through roofs and walls of combustible and non-combustible material. Double walled chimneys may be required. If these penetrations are designed and stamped by an engineer, the building departments are usually satisfied, allowing wall penetrations in multistory buildings.

- Ensure that chimney material and thickness meets local codes.
- Allow for condensation drainage if burning fuel or air containing H_2S, per Fuel Gas codes.
- Ducting may need to be sloped, especially if burning fuel or air containing H_2S.
- Silencers or baffles may be used, but consideration must be made for pressure drop and temperature rise. Pressure should be checked by placing a pressure sensor in a sampling port in the exhaust pipe above the MicroTurbine. Measure actual pressure to ensure that it is below the specified maximum.
- If the MicroTurbines are located in a closed room, several items must be considered.
    - The engine exhaust and room air exhaust will need to be ducted to the outside via separate ducts to prevent backflow from the engine into the room.
    - It is best to route each MicroTurbine's exhaust to the outside in its own duct. If a single duct is used, backflow dampers are required on each MicroTurbine.
    - The exhaust discharge should be located away from the air inlet to the room to prevent hot air from getting re-ingested.
    - Insulating the engine exhaust ducts will decrease the heat loss to the room air and hence the room ambient air temperature.

Service Access

The standard service areas for MicroTurbines, compressors, and heat exchangers are noted on the respective Outline and Installation Drawings. Typically they are 914 mm (36 inches) on all sides, except for the front clearance on a C60 Stand Alone, which is 1651 mm (65 inches). The purpose of this section is to give more information to help the contractor, customer, or installer have greater understanding into the service requirements.

For the purposes of this discussion, the right and left sides of the equipment is as viewed while standing in front of the unit looking at its control panel.

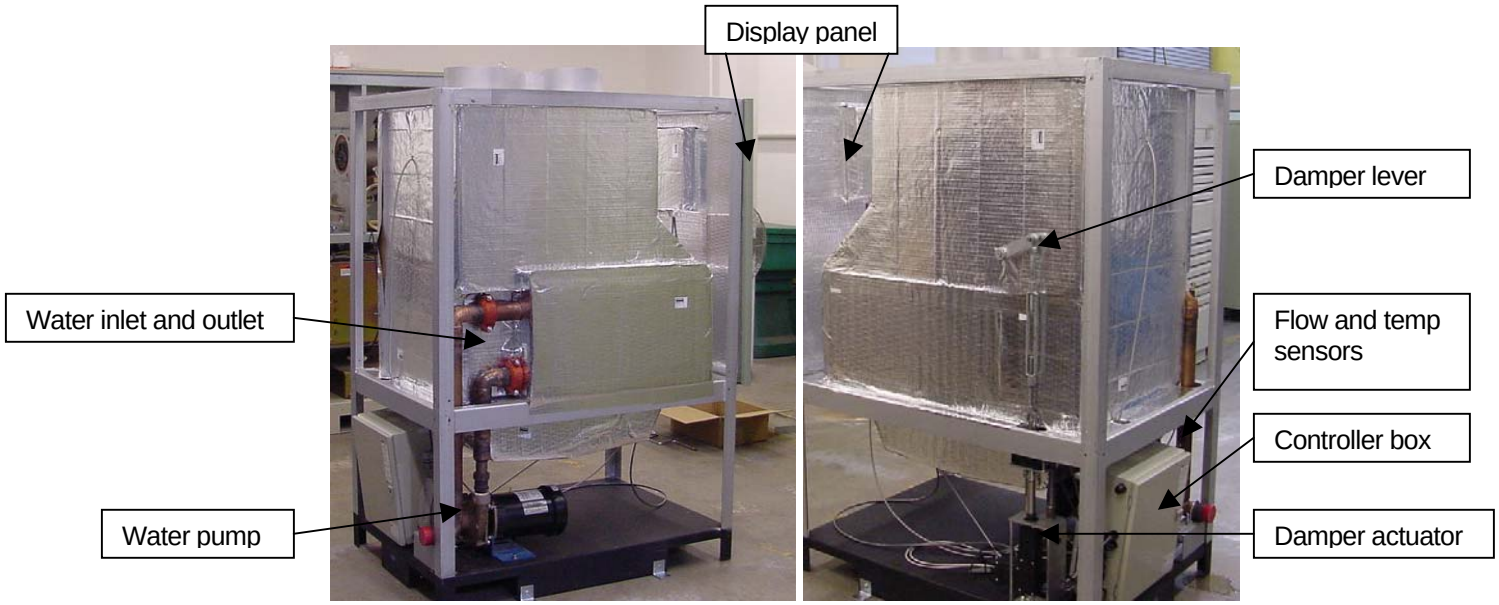
Data

- Refer to the Outline and Installation drawings for standard service clearance areas.

Items to Think About

- Standard times for removal or replacement have been calculated based on the service areas specified on the O&I drawings. When those areas are violated in order that an installation is made possible, the customer, even under warranty, must pay for the additional time required for service. Sometimes this is an acceptable trade to increase future service and maintenance costs in order that the MicroTurbines and other equipment may be fit into a location, but this must be considered when designing the installation.
- Not only is room required to physically get to an item, but if that component needs to be removed there needs to be adequate room for the equipment and the necessary people to lift the equipment out. Many modules weigh several hundred pounds each and require multiple people or a crane to remove.
- Always allow enough room for socket wrenches on all the external panel fasteners. Even better is to allow room for power drivers. This is especially important when the corners of the package are in close proximity with other units or heat exchangers or walls or support structure.
- All panels are removed with bolts and lift up and away from the package before they can be moved side to side or up and down unless otherwise noted. Allow 5 cm (2 inches) of motion away from the package and wrench clearance for all panels.
- First, it may be helpful to understand the general layout of the components in the equipment.
    - C30—has fuel and electrical components that may require access for troubleshooting on all sides. Some of these components weigh as much as 102 kg (225 lbs), in the case of the battery or 70 kg (153 lbs) for the main controller box. Usually most troubleshooting can occur without removing the components, so it is helpful to have enough room to sit on the floor and probe with a multimeter on all sides. The battery is removed from the right side of the package. Low Pressure units have onboard compressors on the left side of the package. Air filter access is from the front by removing the upper front panel with 4 bolts. The User Connection Bay on the rear of the package is where the electrical connections are made. High power, large diameter wire is connected in the left bay and smaller diameter communications and dc power connections are made in the right bay.

- C60—has the fuel system above the turbine deck, under the engine and all the electronics are below the turbine deck in large enclosures. Every C60 has an Engine Control Module and a Load Control Module and they are located on either side of the package. Therefore, there is not a side that requires less access. For Stand Alone applications, the C60 has a 295 kg (650 lb) battery that is removed out the front and a Battery Control Module that is just under the turbine deck on the right side of the package. The electronics boxes weigh between 68 to 113 kg (150 and 250 lbs) each and are 1245 mm (49 inches) long by 381 mm (15 inches) high by 241.3 mm (9.5 inches) deep. Usually most troubleshooting can occur without removing the components, so it is helpful to have enough room to sit on the floor and probe with a multimeter on all sides. Air filter and battery breaker access is from the front. The front of the C60 swings open on left hinges and the door is the full 762 mm (30 inches) wide. The User Connection Bay on the rear of the package is where the electrical connections are made. High power, large diameter wire is connected in the left bay and smaller diameter communications and dc power connections are made in the right bay.
- Copeland compressor—contains a compressor and oil separation equipment with cooling fans and controls. Most components can be reached by lifting off the roof, but removing any components requires access with a wrench from the sides. The front and rear doors swing open on hinges that are mounted on the left edge.
- Unifin heat exchanger—has most serviceable items low in the package. The water pump is behind the water inlets on the left side. The linear actuator for the bypass damper is on the right side, near the rear.



Ways to Make It Work

Below are some ideas to help an installation fit into an existing space. Keep in mind that varying from the standard clearance probably will incur additional service costs. Please contact Capstone for any other information or discuss any site-specific details.

- C30
    - Sides—Not much latitude here. Both sides need access for all configurations. One may be able to reduce the side clearance to 762 mm (30 inches) if there is adequate area front and rear. Electrical connections with the main controller are near the front and the engine is near the middle, so support structure or plumbing should be kept clear of the sides. In some installations the customer requires all units to be packed closely together and rolled forward for all service. This means that for every blown fuse or simple troubleshooting that the fuel, electric, communication, and exhaust connections must be broken unless flexible service loops are employed. Frequently these service loops are not permitted by local jurisdictions for safety concerns. Also, the unit must be connected to power to perform troubleshooting. This type of installation will cost more to service, but if space is more important than service cost it is possible with the rolling option kits, available through Capstone.
    - Front—For units outfitted with the standard panels and not the optional door, the front of the C30 is removed with 4 bolts in the corners of each upper and lower panel. Also, the air inlets cannot be blocked as mentioned in the section about Inlet Air. A support column or other structure could be in front of the package provided that there is still access to the panel fasteners.
    - Rear—The upper panel and hood is removed by removing the 4 bolts in the corners of the panel. The lower panel is not removable, but UCB requires sufficient access. Also, the fuel enters the package through the lower panel. A support column or other structure could be in back of the package at the corners provided that there is still access to the panel fasteners, UCB, and fuel inlet. Stand Alone units have a battery breaker that is accessed through the rear panel under the UCB. Clearance area must be provided to meet local codes.
- C60
    - Sides—Both sides need access for all configurations. One may be able to reduce the side clearance to 762 mm (30 inches) if there is adequate area front and rear. Electrical connections with the main controllers are near the front and rear of each module and the engine is near the middle, so support structure or plumbing should be kept clear of the sides. In some installations the customer requires all units to be packed closely together and rolled forward for all service. This means that for every blown fuse or simple troubleshooting that the fuel, electric, communication, and exhaust connections must be broken unless flexible service loops are employed. Frequently these service loops are not permitted by local jurisdictions for safety concerns. Also, the unit must be connected to power to perform troubleshooting. This type of installation will cost more to service, but if space

is more important than service cost it is possible with the rolling option kits, available through Capstone.

- Front of Grid Connect unit—All units are outfitted with the standard door, so they swing about a left hinge with a 762 mm (30 inch) radius. Also, the air inlets cannot be blocked as mentioned in the section about Inlet Air. A support column or other structure cannot be in front of the package.
- Front of Stand Alone unit—Besides the information above, the C60s that have batteries for Stand Alone or Dual Mode operation have additional clearance requirements. The main battery is removed by pulling it straight out the front of the package. It cannot be rotated on its way out and it weighs about 295 kg (650 lbs). There are lifting and pulling features on the front of the battery and it is usually extracted with a winch or come-along strap. The standard service area does not include area for the equipment needed to pull the battery, but just for the battery. Once the battery is pulled out onto a pallet, it can be pulled sideways on a pallet jack. Keep this in mind when thinking about the concrete slab, floor-mounted plumbing, or other support structure. The entire area in front and to the side of the Stand Alone package cannot be violated. Unlike the other electrical modules that are usually serviced at the board level, the batteries are not field serviced and are replaced as one module. Also, the battery breaker is located on the front of the battery that is accessed by opening the door. The area in front of the door must be clear to meet local codes.
- Rear—The upper panel and hood is removed by removing the 4 bolts in the corners of the panel. The lower panel is not removable, but UCB requires sufficient access. Also, the fuel enters the package through the lower panel. A support column or other structure could be in back of the package at the corners provided that there is still access to the panel fasteners, UCB, and fuel inlet.

- Copeland Compressor
  - Put it outside. It is fairly quiet, like a home air conditioner compressor. It is rated for outdoor use. It produces 30,000 Btu of heat at 1000 cfm so it is best to have outdoors and not heating the turbine inlet air or enclosure.
  - Top—Most important access panel, so do not stack these compressors on shelves.
  - Front—Control panel and inlet air do not usually require removal, but clearance is required for airflow and possible replacement of controller.
  - Rear—Electrical connections and air outlet require clearance for access and airflow.
  - Sides—The right side provides access to most components and fittings. The left side is less vital and could have less access if required. Again, consider locating the compressors outside and have the fuel option kits near the MicroTurbines.
- Unifin heat exchanger
  - Front—The display panel is attached to the front panel, so if replacement is required, the front panel must be removed.

- Right side—The damper actuator and link are on this side of the package and they have been known to stick. Allow enough clearance to remove panel and crawl under the heat exchanger if necessary to reach the water pump on the left side.
- Left side—The water pump is here but could be accessed from the rear and right side.
- Rear—The main control box lives in the back, so clearance should be provided to remove the panel and service the controller.

Notifying Capstone Technical Support

Be sure to refer to and complete the Capstone MicroTurbine Commissioning Checklist (460006).

If questions or problems arise regarding electrical or fuel interconnections for your Capstone MicroTurbine, please contact Capstone Technical Support for assistance and information.

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