This is a YANMAR Energy Systems' manufacturer-specific product specification using the proprietary method of specifying applicable project and master guide specifications. Trade/brand names with appropriate product model numbers styles and types are used in the specification text article titled 'Acceptable Material'.

This YANMAR Guide Specification pertains to packaged Micro Combined Heat and Power (mCHP) systems as manufactured by YANMAR Energy Systems Co., LTD. This YANMAR Guide Specification is subject to revision or update, and Dealer should periodically refer to [www.yanmar-es.com] for the most current version.

[Adopting in principle the guidelines of CSI Section: 263000]

SECTION 263000
FACILITY ELECTRICAL POWER GENERATION AND STORING EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Electrical and mechanical requirements of the mCHP system and all related manufacturer's and third party ancillary accessories for the installation of the Cogeneration Package.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate work of this section with the work of other trades for proper timing and sequence to avoid construction delays.

B. Sequencing: Sequence work of this section in accordance with written recommendations for sequencing construction operation.

C. Scheduling: Schedule work of this section in accordance with.

1.04 ACTION SUBMITTALS

A. General: Submit listed submittals in accordance with Contract Conditions.

B. Product Data : Submit for specified YANMAR products as follows:
1. Manufacturer's product data, including manufacturer's technical data sheet(s).
2. Catalog pages illustrating products to be incorporated into the project.

C. Shop Drawings: Indicate information on shop drawings as follows:
1. Layout indicating location(s) of all equipment and accessories.
2. Dimensions
3. Installation details
4. Electrical wiring diagrams
5. Mechanical diagrams
6. Manufacturer's recommendations for accessories.

1.05 INFORMATION SUBMITTALS

Specifier note: Specify submittals in accordance with Contract Conditions

A. General: Submit listed submittals in accordance with Contract Conditions.

B. Test and Evaluation Reports:
   1. Certified test reports showing compliance with specified performance characteristics and physical properties.
   2. Documentation verifying product UL, EPA, CSA listing and any additional regulatory documents that may be required for project completion.

C. Manufacturer's Instructions: Submit manufacturer's storage and installation instructions.

D. Source Quality Control: Submit documentation verifying that the components and materials specified in this section are from a single manufacturer.

E. Qualification Statements:
   1. Submit letter of verification for Ancillary Accessory Manufacturer's Qualifications.

1.06 CLOSEOUT SUBMITTALS

A. General: Submit listed submittals in accordance with Contract Conditions.

B. Operation and Maintenance Data:
   1. Submit operation and maintenance data for installed products Include:
      a) YANMAR CP35D1-TNUG or CP35D1Z-TNUG Operations Manual.
      b) YANMAR System Controller Operations Manual.
      c) YANMAR log on instructions to the RESS system.
      d) Maintenance requirements documentation for the CP35D1-TNUG or CP35D1-TNUG.

C. Warranty Documentation: Submit specified warranty documents.

D. Extended Warranty Documentation: Submit all extended warranty options allowable for the project.

1.07 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer:
      a) (10) years of experience manufacturing mCHP components meeting or exceeding requirements for this project.
      b) Having sufficient capacity to produce and deliver required materials without causing delay in work.
      c) Capable of providing field service representation during construction.

   2. Installer(s): Certified by manufacturer, experienced in performing work in this section and having specialized in installation of work similar to that required for this project.

1.08 DELIVERY, STORAGE & HANDLING

A. Delivery and Acceptance Requirements:
   1. Deliver material in accordance with manufacturer's written instructions.
   2. Deliver materials in manufacturer's original packaging with the identification labels intact and in sizes to suit project.

B. Storage and Handling Requirement:
   1. Store materials in an area protected from exposure to harmful weather conditions and at temperatures recommended by the manufacturer's written instructions.

C. Packaging Waste Management:

1. Recommend to separate waste materials for (reuse) and (recycling).
2. Recommend to remove packaging materials from the site and dispose of them at appropriate recycling facilities.
3. Recommend to collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packing material in appropriate onsite bins for recycling.
4. Recommended to fold metal and plastic banding, flatten and place in a designated area for recycling.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer: YANMAR America Energy Systems.
   1. Contact: 101 International Parkway, Adairsville, Ga. 30103; Telephone: (770)877-9894, (770)877-7810, Fax: (770)877-7572; E-mail: ESmarketing@yanmar.com; Website: us.yanmar.com
   2. Single Source Responsibility: Provide components and materials specified in this section from a single manufacturer.
   3. Substitution Limitations:
      a) Substitutions: In accordance with Contract Conditions (no substitutions permitted).

Specifier note: Two types of system's installations are listed below in this section. The first is the standard system, which will shut down when there is a loss in Utility Grid Power. The second type is the Blackout Start Model (BOS); this type will run with a loss in Utility Grid Power. Refer to the manufacturer's technical data sheets.

2.02 STANDARD NATURAL GAS MICRO COMBINED HEAT & POWER SYSTEM

A. YANMAR Supplied Materials:

   1. YANMAR CP System (Natural Gas):
      a) CP35D1 CP system: Furnish packaged-type micro Cogeneration Package (CP). Each package shall consist of an internal combustion engine for use with natural gas and a permanent magnet generator rated at 35 kW for continuous operation. The CP shall have a combined engine and exhaust heat recovery capacity of 204,040 btu/hour at a maximum return temperature of 190ºF when furnished with a natural gas supply of 370.2 cubic feet per hour at a delivery pressure of 8 to 10 inches water column (w.c.). The unit will have an overall efficiency of 88% when using LHV of natural gas (983/scf). Each unit shall contain necessary internal piping, controls and equipment ready for final connections to be made by the contractor to the building's fuel system and cooling water loop.
      b) Each CP unit shall be approximately 78.7 inches wide, 76.9 inches high and 31.5 inches deep and weigh no more than 3153 lbs.

   2. Grid Connectable Inverter:
      a) Furnish built in grid connectable inverters. Each inverter shall consist of a fan-cooled enclosure. The inverter shall be capable of producing 35 kW at 208V standard voltage for continuous duty operation.

B. General Requirements

   1. Regulatory Requirements:
      a) EPA Compliant
      b) CSA Compliant
      c) NEC Compliant

d) Local utility interconnection regulations.

2. Compatibility:
   a) Verify that components and materials are compatible with specified accessories and adjacent materials.

3. Performance Criteria:
   a) UL 2200
   b) UL 1741
   c) Seismic Forces Rating: ASCE/SEI-7
   d) Steady state operating range shall be 1 to 35 kW.
   e) Total noise shall be no more than 64dBA at 1 m (3.3 ft) in a free field with no customer heat recovery.
   f) Voltage harmonics shall meet the requirements of IEEE 519.

Specifier Note: Standard operation of the mCHP system by YANMAR America Corp. is via built-in Control Board operation. Remote System Controller operation is also available as an option. Refer to the manufacturer's product information and technical data, and retain or delete bracketed information below to suit project requirements.

4. Operation:
   a) Operator: Steady State Microprocessor Main Control Board
      1) Voltage: 208V AC, 60 Hz
      2) Amperage: 117A AC maximum

   b) Electrical System(s): Supplied by others
      1) Install in accordance with manufacturers requirements.
      2) Receptacle: Prewired 120V AC grounded duplex type.
      3) Line voltage wiring in accordance (NEC) National Electric Code.
      4) Low Voltage Control (LVC) system: Communication wiring in accordance with (NEC).
      5) 1 150 Amp. breaker: Inverter and system main power

   c) Optional Control systems provided as project requires
      1) [Emergency stop: Push button type]
      2) [Owner's BMS system connection]
      3) [Step up/Step down transformer]

* mCHP system is rated under these conditions: 0m altitude, 40ºF temperature, 10% relative humidity.

Specifier Note: 208V, 60 Hz operation is standard. Retain proper voltage to suit project requirements.

   d) Mechanical System(s): Supplied by others
      1) Installation in accordance with manufacturers' recommendation.
      2) 43 GPM: m-CHP in piping +-5% Maximum 44.8 GPM in accordance manufacturers' recommendation.
      3) Water piping with a flow rate of 6.6 ft/sec. or less required for max 200ºF.
      4) Set mCHP water inlet pressure: 71 psi or less.
      5) R1.5 check valve mCHP outlet.
      6) 2 flexible water piping R1.5 (24 in. minimum).
      7) Assorted R1.5 pipe fittings or the like.
      8) Proper hot water insulation in accordance manufacturers' recommendation.

   e) Optional Control systems provided as project requires
      1) [Thermostat(s)]
      2) [Shut off valves]

3) [Air bleed valves]
4) [Pressure relief valves]

f) Fuel Gas Piping:
1) Installation in accordance with manufacturer recommendation
2) 1.5 in. NPT Flexible piping (36 in. minimum.)
3) Gas shut off valve within reach (gas cock)
4) Fuel gas pressure 8 -10 in. w.c.
5) ½ psi or less.

g) Flue Gas Exhaust: Indoor Installation
1) Installation in accordance with manufacturer recommendation.
2) Back pressure 31.3 lb/ft² or less.
3) Back pressure above 4.2 lb/ft², use a completely welded flue gas exhaust system.
4) Piping should be of 2 ½ in. minimum.

h) mCHP Ventilation: Indoor Installation
1) Manufacturer's instructions: CP35D1 Installation Manual.
2) Maximum room temperature of 104ºF.

5. Materials: Provide mCHP mount constructed of the following
a) Concrete Padding
1) Manufacturer's instructions: CP35D1 Installation Manual.
2) Reinforcing bar (re-bar) every 12 in.
3) 6 in. depth or more depending on seismic requirements.
4) Horizontal seismic coefficient of 0.6.

6. Finish: Powder Coated Paint Munsell 5Y7.5/1.

7. Accessories:
a) Key Locking Cover: Hinged cover door with stainless steel finish for keyed access to main system control board.

b) System Controller: Remote onsite mCHP system start - stop operation, 1 year calendar setting function, multiple on/off settings per day, multi-unit operation, error code recording, onsite graphs, system operation status display and mCHP operation stage.

c) Remote Monitoring Adaptor: Offsite monitoring of the mCHP system; 1 space available for the external transducer kit for grid monitoring and 1 space available for the gas meter for monitoring gas usage. Both inputs should be pulse, minimum pulse width: 100 ms. Requires 24V DC power supply.

d) Anti-Vibration Mount: Required for rooftop and/or mechanical room that is located above the main conditioned spaces.
1) Surface must be hot dip galvanizing.
2) 6 coil spring isolators.
3) Required seismic coefficient: Horizontal (2.0), Vertical (1.0).
4) All vibration mount accessories should be hot dip galvanized.
5) Should include manufacturer's instruction manual for proper on site construction.

e) Radiator Exhaust Air Direction Adjuster: Installation under overhangs with less than 80 in. of clearance.
1) Material should be stainless steel (1 mm thick).
2) Screws for attaching duct should be included.

f) Heater Kit: Installation is required when installing in an outdoor area where the average outdoor temperature is at or below 40ºF.
   1) Install the drain heater under the generator using the installation kit provided: heater requirements 250W X 2.
   2) Install the block heater on the front side of the engine: heater requirements 200W X 1.
   3) Wire heaters as required in the instruction manual.

g) Anti-Salt Paint Coating: Coating is required when the installation is within a ½ mile from salt water.
   1) Addition of powder polyester coating (60-80µ) to the interior base of the CP35D1.
   2) Addition of vinyl chloride coating (7µ) to the radiator fins.

2.03 NATURAL GAS BLACKOUT START (BOS) MICRO COMBINED HEAT & POWER SYSTEM

A. YANMAR Supplied Materials:

1. YANMAR CP System (Natural Gas):
   a) CP35D1Z-TNUG CP system: Furnish packaged-type micro Cogeneration Package (CP). Each package shall consist of an internal combustion engine for use with natural gas, and a permanent magnet generator rated at 35 kW for continuous operation. The CP shall have a combined engine and exhaust heat recovery capacity of 204,040btu/hour at a maximum return temperature of 190ºF when furnished with a natural gas supply of 307.2 cubic feet per hour at a delivery pressure of 8 to 10 inches w.c. The unit will have an overall efficiency of 88.5% when using LHV of natural gas (983/scf). Each unit shall contain necessary internal piping, controls and equipment ready for final connections to be made by the contractor to the building's fuel system and cooling water loop.
   b) Each CP unit shall be approximately 78.7 inches wide, 76.9 inches high and 31.5 inches deep and weigh no more than 3196 lbs.

2. Inverter:
   a) Furnish built in grid inverters for each CP35D1Z required to meet project size. Each inverter shall consist of a fan-cooled enclosure containing an inverter with multi-tap transformer to supply 35 kW at 208V standard voltage for continuous duty operation. During black out mode the fan-cooled enclosure supplies 33.1kVA at 208V standard output voltage for continuous duty operation.

3. Battery:
   a) Battery is installed into the CP35D1 for black out starting of the CP system. Battery is 12V

4. Transformer:
   a) Transformer shall have a primary side voltage of 208VAC Delta and a secondary side of 208/120 Y.
   b) Transformer shall be 60Hz.
   c) 220ºC insulation class with a Temperature rise 150ºC. There should be a maximum impedance of 6%.
   d) Minimum transformer efficiency shall be no less than 98.4% at 35% load.
   e) Transformer shall be tested to meet UL 1561

B. General Requirements

1. Regulatory Requirements:
   a) EPA Compliant
   b) CSA Compliant
   c) NEC Compliant
   d) Local utility interconnection regulation

2. Compatibility:
   a) Verify that components and materials are compatible with specified accessories and adjacent materials.

3. Performance Criteria:
   a) UL 2200
   b) UL 1741
   c) Seismic Forces Rating: ASCE/SEI-7.
   d) Steady state operating range shall be 1 to 10 kW
   e) Total noise shall be no more than 56dBA at 1 m (3.3 ft) in free field with no customer heat recovery.
   f) Voltage harmonics shall meet the requirements of IEEE 519.

Specifier Note: Standard operation of the mCHP system by YANMAR America Corp. is via built-in Control Board operation. Remote System Controller operation is also available as an option. Refer to the manufacturer's product information and technical data, and retain or delete bracketed information below to suit project requirements.

4. Operation:
   a) Operator: Steady State Microprocessor Main Control Board
      1) Voltage: 208V AC, 60Hz.
      2) Amperage: 135V AC maximum

   b) Electrical System(s): Supplied by others
      1) Install in accordance with manufacturer recommendation.
      2) Receptacle: Prewired 120V AC grounded duplex type.
      3) Line voltage wiring in accordance with manufacturer recommendation.
      4) Low Voltage Control (LVC) System: Communication wiring in accordance with Section 26 05 23 Control-Voltage Electrical Power Cables.
      5) 1 208VAC Load Center: Breaker spots will vary due to site load; site load should be rated less than the (1) off-grid inverters. In accordance with manufacturer recommendation.
      6) 2 150 Amp. double pole breakers: Inverters
      7) 1 main utility disconnect: See site drawing for proper sizing in accordance with 26 18 00 Medium-Voltage Circuit Protection Devices.
      8) 1 Automatic Transfer Switch (ATS): Must meet UL 50 standard for electrical enclosures; must meet UL 1008, minimum time delay for disconnecting from the utility power source to the off-grid power source; time delay on reconnect from off-grid power source back to the utility power source in accordance with local utility requirements.

   c) Optional Control systems provided as project requires
      1) [Emergency stop: Push button type]
      2) [Owners BMS system connection]
      3) [Step up/step down transformer]

Specifier Note: 208V, 60 Hz operation is standard. Retain proper voltage to suit project requirements.

   d) Mechanical System(s): Supplied by others
      1) Installation in accordance with manufacturers' recommendation.
      2) 43 GPM: m-CHP in piping +-5% Maximum 44.8 GPM in accordance manufacturers' recommendation.
      3) Water piping with a flow rate of 6.6 ft/sec. or less required for max 200ºF.
      4) Set mCHP water inlet pressure: 71 psi or less.
      5) R1.5 check valve mCHP outlet.

6) 2 flexible water piping R1.5 (24 in. minimum).
7) Assorted R1.5 pipe fittings or the like.
8) Proper hot water insulation in accordance manufacturers' recommendation.

e) Optional Control systems provided as project requires.
1) [Thermostat(s)]
2) [Shut off valves]
3) [Air bleed valves]
4) [Pressure relief valves]

f) Fuel Gas Piping:
1) Installation in accordance with manufacturer recommendation.
2) 1.5 in. NPT flexible piping (36 in. minimum).
3) Gas shut off valve within reach (gas cock).
4) Fuel gas pressure 8 - 10 in. w.c.
5) ½ psi or less.

g) Flue Gas Exhaust: Indoor Installation
1) Installation in accordance with manufacturer recommendation.
2) Back pressure 31.3 lb/ft² or less.
3) Back pressure above 4.2 lb/ft², use a completely welded flue gas exhaust system.
4) Piping should be of 2 ½ in. minimum.

h) mCHP Ventilation: Indoor Installation
1) Manufacturer's instructions: CP35D1 Installation Manual.
2) Maximum room temperature of 104ºF.

5. Materials: Provide mCHP mount constructed of the following
a) Concrete Padding
1) Manufacturer's instructions: CP35D1 Installation Manual.
2) Reinforcing bar (re-bar) every 12 in.
3) 6 in. depth or more depending on seismic requirements.
4) Horizontal seismic coefficient of 0.6.

6. Finish: Powder Coated Paint Munsell 5Y7./1.

7. Accessories:
a) Key Locking Cover: Hinged cover door with stainless steel finish for keyed access to main system control board.

b) System Controller: Remote onsite mCHP system start - stop operation, 1 year calendar setting function, multiple on/off settings per day, multi-unit operation, error code recording, onsite graphs, system operation status display and mCHP operation stage.

c) Remote Monitoring Adaptor: Offsite monitoring of the mCHP system; 1 space available for the external transducer kit for grid monitoring and 1 space available for the gas meter for monitoring gas usage. Both inputs should be pulse, minimum pulse width: 100 ms. Requires 24V DC power supply.

d) Anti-Vibration Mount: Required for rooftop and or mechanical room that is located above the main conditioned spaces.
1) Surface must be hot dip galvanizing.
2) 6 coil spring isolators.
3) Required seismic coefficient: Horizontal (2.0), Vertical (1.0).
4) All vibration mount accessories should be hot dip galvanized.

5) Should include manufacturer's instruction manual for proper on site construction.

e) Radiator Exhaust Air Direction Adjuster: Installation under overhangs with less than 80 in. of clearance.
1) Material should be stainless steel (1 mm thick).
2) Screws for attaching the duct should be included.

f) Heater Kit: Installation is required when installing in an outdoor area where the average outdoor temperature is at or below 40ºF.
1) Install drain heater under the generator using the installation kit provided: heater requirements 250W X 2.
2) Install the block heater on the front side of the engine: heater requirements 200W X 1.
3) Wire heaters as required in the instruction manual.

g) Anti-Salt Paint Coating: Coating is required when the installation is within a ½ mile from salt water.
1) Addition of powder polyester coating (60-80µ) to the interior base of the CP35D1.
2) Addition of vinyl chloride coating (7µ) to the radiator fins.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Verify that conditions of substrates previously installed under other sections or contracts are acceptable for product installation in accordance with the manufacturer's instructions prior to CP35D1 installation.

1. Inform [Owner] [Architect] [Consultant] [YANMAR] of unacceptable conditions immediately upon discovery.

2. Proceed with installation only after unacceptable conditions have been remedied.

3. Verify that electrical power is installed to meet mCHP electrical requirements in accordance with manufacturer recommendation.
a) Verify type and location of power supply.

3.02 PREPERATION

A. Verify that the mounting surface is capable of properly supporting the mCHP load and meets all seismic requirements.

B. Remove mCHP and all accessories from carton(s), and verify that there are no damaged or missing parts.

C. Surface preparation: Prepare [surface] [area] [site] in accordance with manufacturer's written recommendations, and coordinate with manufacturer recommendation.

3.03 INSTALLATION

A. Coordinate installation of the mCHP system in accordance with manufacturer's installation instructions and reviewed shop drawings at location and site as indicated.

B. Coordinate mCHP installation work with other trades for proper timing and sequence to avoid construction delays.

C. Install mCHP and all accessories plumb and level to supporting substrate.

D. Accurately fit, align securely fasten and install CP35D1 system and all accessories free from distortion and defects.

E. Allow for proper maintenance space in accordance with manufacturer's written requirements.

F. Properly secure hot water piping in accordance with manufacturer's written recommendations.

G. Properly insulate hot water piping in accordance with manufacturer's written recommendations.

H. Accurately fit, align and securely fasten all electrical conduit free from distortion and defects.

I. Accurately channel and securely fasten all electrical wiring in accordance with manufacturer's written recommendations in the interior of the mCHP system.

3.04 FIELD QUALITY CONTROL

Specifier Note: Specified requirements for the manufacturer or its assigned representative are to provide field quality control to onsite personnel for instruction or supervision of product installation, application, erection or construction. Manufacturers' field reports are included under PART1.06; Closeout Submittals.

A. Manufacturer's Services: (Manufacturer Representative)

1. Coordinate manufacturer's or its representative's services with manufacturer recommendation Have manufacturer or its representative review work involved in handling, installation/application and protection and cleaning of product[s], and submit written reports in acceptable format to verify compliance of work with contract and in accordance with the manufacturer's written requirements.

2. Manufacturer's or its Representative's Field Services: Provide field services consisting of product use recommendations and periodic site visits for product installation inspection in accordance with manufacturer's instructions.

3. Schedule site visits to review work at stages listed

a) After delivery and storage of products and when preparatory work which this section depends on is complete, but before installation begins.

b) Twice during progress of work at approximately 25% and 60% complete.

c) Upon completion of installation work, after cleaning is carried out.

d) Completion of commissioning and site review in accordance with manufacturer requirements.

4. Complete reports within three days of review and submit immediately to [Owner] [Architect] [Consultant].

3.05 ADJUSTING

A. Adjust components and systems for correct function and operation in accordance with the manufacturer's written instructions.

1. Verify controls, limit switches and other components function as designed, and meet project requirements.

2. Adjust pumps, controls and components to allow for smooth, unobstructed operation.

3.06 CLEANING

A. Perform cleanup in accordance with manufacturer recommendation.

B. Upon completion, remove surplus materials, rubbish, tools and equipment in accordance with manufacturer recommendation.

C. Waste Management:

1. Recommended to recycle of waste materials.

2. Recommended to collect recyclable waste and dispose of or recycle field generated construction waste created during demolition, construction or final cleaning.

3. Recommended to remove recycling containers and bins from site.

3.07 PROTECTION

A. Protect installed products from damage during construction in accordance with manufacturer recommendation.

3.08 ATTACHMENTS

A. Schedules
1. Product delivery
2. Installation Schedule
3. Inspection Schedule
4. Utility Interconnection Schedule
5. Limited warranty and (or) YES Product Protection Plans

Specifier Note: Installation, local inspection and utility inspection Schedules. Include all Schedules that indicate item/element/product/equipment location and other coordinating data.

END OF GUIDE SPECIFICATION