

MEPNN Supplier Scouting Opportunity Synopsis

Section 1: General Information

Scouting Number	2024-285
Item to be Scouted	Variable Frequency Drives
Days to be scouted	30
Response Due By	10/18/2024
Description	<p>For the construction of the new Energy and Minerals Research Facility (EMRF) for the U. S. Geological Survey (USGS) at the Colorado School of Mines (Mines), 1000 18th Street, Golden, Colorado 80401, provide packaged Variable Frequency Drives (VFDs) delivered to the EMRF construction site. This project is federally funded by the President Joe Biden's Bipartisan Infrastructure Law (BIL). Therefore, the material used for construction is required to be compliant with the Build America, Buy America Act (BABAA). This NIST MEP Supplier Report seeks a BABAA compliant equipment that meets or exceeds the basis of design.</p> <p>The basis of design are ABB, Inc. VFDs described herein (including additional information). The basis of design equipment meets or exceeds the design requirements including the strict technical requirements, maximum size requirements, maximum delivery schedule, and the maximum cost parameters enclosed. See also the requirements stated in the enclosed specifications, drawings, dimension and performance requirements, and other documents including warranty requirements. Packaged VFDs and associated components and accessories include, but are not limited to, the following:</p> <p>1. VFD Description: NEMA ICS 2, pulse-width-modulated, variable frequency controller; listed and labeled as a complete unit and arranged to provide variable speed of an NEMA MG 1, Design B, 3-phase, induction motor by adjusting output voltage and frequency. 2. The VFD package as specified herein and defined on the VFD schedule shall be enclosed in a UL Type enclosure (enclosures with only NEMA ratings are not acceptable), completely assembled and tested by the manufacturer in an ISO9001 facility. 3. See additional accessories, enclosures, and requirements in the enclosed information and specifications.</p>
Notify Requester Immediately	
State item to be used in	Colorado

Section 2: Technical Information

Type of supplier being sought	Manufacturer
Reason	BABA
Describe the manufacturing processes (elaborate to provide as much detail as possible)	Electronic and mechanical assembly.
Provide dimensions / size / tolerances / performance specifications for the item	See information provided.
List required materials needed to make the product, including materials of product components	Various, see information provided.
Are there applicable certification requirements?	Yes
Certification(s) required	UL
Details	See the enclosed specifications for applicable certification, regulations, requirements, and other safety requirements, including but not limited to, UL listing, NFPA requirements, NEMA, IEEE, etc.

Are there applicable regulations?	No
Are there any other standards, requirements, etc.?	Yes
Details	See above. See the enclosed specification requirements including spare parts, warranty, manufacturer qualifications, delivery, storage, and handling.
NAICS 1	335314 Relay and industrial control manufacturing
NAICS 2	
Additional Technical Comments	See enclosed specification section and the ABB Inc. basis of design information.

Section 4: Business Information

Estimated potential business volume	Limited to one set of equipment AND the quantities of the equipment for different models are include. See the basis of design information.
Estimated target price / unit cost information (if unavailable explain)	Total combined cost is a maximum of \$123,390. This includes 48 VFDs, NEMA 1 Construction. Costs include shipping, start up services including commissioning and coordinating with Building Automation System, and required minimum manufacturer's warranty (see specifications). Costs also include providing approved submittal paperwork required in the specifications.
When is it needed by?	VFD lead time is 15 weeks but no later than 2:00 pm local time the on-site 6/21/2025. If the schedule has delivery prior to the date above, the cost of holding equipment until the project can receive the equipment will not be allowed. Provide written manufacturer's submittal at least 90 days before they are required by manufacturer for review and approval.
Describe packaging requirements	Crate and package equipment and components for secure and undamaged transportation and delivery.
Where will this item be shipped?	Shipping will be to Golden, Colorado 80401, at the construction site address listed above.

Additional Comments

Is there other information you would like to include?	<p>This project is federally funded by the President Joe Biden's Bipartisan Infrastructure Law (BIL). Therefore, the material used for construction is required to be compliant with the Build America, Buy America Act (BABAA). This NIST MEP Supplier Report seeks a BABAA compliant equipment that meets or exceeds the basis of design.</p> <p>Point of Contact information for questions including BABA/Buy American compliance:</p> <p>The Energy and Minerals Research Facility (EMRF) facility for the U. S. Geological Survey (USGS) is at the Colorado School of Mines (Mines) Robert Lee rlee@mines.edu</p> <p>Please copy scouting@nist.gov on all correspondence.</p>
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**SECTION 23 05 14
ENCLOSED MOTOR CONTROLLERS FOR HVAC**

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes AC, enclosed controllers rated 600 V and less, of the following types:
 - 1. Across-the-line, Manual and Magnetic Motor Controllers (Motor Starters).
 - 2. Variable Frequency Drive Controllers (VFD's).

1.2 RELATED REQUIREMENTS

- A. Drawings, all other Sections of Division 23 and General Provisions of the Contract, including General and Supplementary Conditions, as well as Division 01 Specification Sections, apply to this Section.
- B. All materials, equipment, fabrication and installation of the entire system shall meet and comply with all adopted current codes, regulations, standards, etc. as applicable to the product(s) specified in the section, as scheduled on the drawings as well as Division 01 and Division 23 related documents whether called for or not.

1.3 DEFINITIONS

- A. ANSI: American National Standards Institute
- B. NEMA: National Electrical Manufacturers Association
- C. NFPA: National Fire Protection Association
- D. NEC: National Electrical Code
- E. UL: Underwriters Laboratory
- F. ICS: Industrial Control & Systems
- G. IGBT: Insulated Gate Bi-Polar Transistor.
- H. SPD: Surge Protection Device.
- I. NETA: InterNational Electrical Testing Association.
- J. BTL: BACnet Testing Laboratories.

1.4 REFERENCES

- A. IEEE 519-2014: Recommended Practice and Requirements for Harmonic Control in Electric Power Systems.
- B. NFPA 70: National Electrical Code (NEC).
- C. NEMA FU1: Low Voltage Cartridge Fuses.

- D. UL 248-1: Low Voltage Fuses: General Requirements.
- E. UL 248-12: Low Voltage Fuses: Class R Fuses.
- F. NECA 1: Standard for Good Workmanship in Electrical Construction.
- G. NEMA 250: Enclosures for Electrical Equipment.
- H. UL 489: Molded Case Circuit Breakers.
- I. NEMA ICS 2: Industrial Control Devices, Controllers, and Assemblies.
- J. NEMA ICS 6: Enclosures for Industrial Controls and Systems.
- K. NEMA ICS 7: Industrial Control and Systems: Adjustable-Speed Drives.
- L. NEMA KS 1: Enclosed Switches.

1.5 REGULATORY REQUIREMENT

- A. Conform to requirements of NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

1.6 APPLICATIONS

- A. Select features of each enclosed controller to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; duty cycle of motor, controller, and load; and configuration of pilot device and control circuit affecting controller functions.
- B. Select horsepower rating of controllers to suit motor controlled.

1.7 SUBMITTALS

- A. Product Data: For each type of enclosed controller. Include dimensions and manufacturer's technical data on features, performance, electrical characteristics, ratings, and finishes, including controller size, ratings and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.
- B. Wiring Diagrams: Power, signal, and control wiring.
- C. It is the sole responsibility of the motor controller manufacturer(s) specified within this section to supply controllers suitable for the intended application and use. This includes, but is not limited to, coordinated electrical characteristics as indicated on the electrical drawings and as specified in Division 26, as well as the compatibility with the motor it serves, with regard to in-rush current, torque, project altitude, environment conditions of the controller location including weather, water intrusion, ice, heat and low temperature, as well as areas defined by the NEC hazardous/explosive environments for both type and class as applicable.

- D. All shop drawing submittals shall include acknowledgement of complying with the extended warranties where specified within this section. Shop drawing submittals without the acknowledged acceptance of the warranty as specified will be rejected and deemed non-compliant with the contract documents, regardless of any named manufacturer without exception.
- E. Shop drawings for variable frequency drives shall include manufacturer's warranty against any and all damage to the motor, being served by the drive. Any modifications or changes to the motor specification that might be required in order to apply a VFD; shall be the sole responsibility of the drive manufacturer and subject to review by the Engineer as to acceptance of any changes to the motor specification.
- F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.
- G. Field quality-control test report forms.
- H. Operation and Maintenance Data: For enclosed controllers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - 1. Routine maintenance requirements for enclosed controllers and all installed components.
 - 2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 100 miles of Project site, a service center capable of providing training, parts, and emergency maintenance and repairs.
- B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
 - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- C. Source Limitations: Obtain enclosed controllers of a single type through one source from a single manufacturer.
- D. Electrical Components, Devices, and Accessories shall be listed and labeled as defined in NFPA 70, Article 100, by Underwriters Laboratories, Inc, and marked for intended use.
- E. Comply with all NFPA 70 requirements.

- F. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed controllers, minimum clearances between enclosed controllers, and for adjacent surfaces and other items. Comply with indicated maximum dimensions and clearances.
- G. Limit Total Harmonic Distortion and Total Demand Distortion at the Point of Common Coupling with IEEE 519.
- H. Perform work in accordance with NECA Standard of Installation.

1.9 EXTENDED WARRANTIES

- A. Reduced-Voltage Controllers: Including Part-Winding, Wye-Delta, Auto-Transformer & Solid State Type:
 - 1. The manufacturer shall include in their bid an extended warranty for not less than 24 months after the Owner has received beneficial occupancy. The warranty shall include all parts, materials and labor without any additional costs to the Owner.
 - 2. Manufacturers that do not comply with this warranty requirement are automatically unapproved to submit and bid on the project.
- B. Variable Frequency Drive Controllers (VFD's).
 - 1. The manufacturer shall include in their bid an extended warranty for not less than 36 months after the Owner has received beneficial occupancy. The warranty shall include all parts, materials and labor without any additional costs to the Owner.
 - 2. Manufacturers that do not comply with this warranty requirement are automatically unapproved to submit and bid on the project.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Store enclosed controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.
- B. Do not store controllers in locations subject to weather; cover enclosed controllers to protect them from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside controllers; install electric heating of sufficient wattage to prevent condensation.
- C. Variable frequency drives and soft starters shall be protected and wrapped with three layers of shrink wrap at the factory and at all times during construction. Controllers shall be kept wrapped except for when actual wiring termination activity is occurring and kept closed-up until factory start-up.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- ~~A. ~~Across-The-Line Enclosed Motor Manual and Magnetic Controllers (Motor Starters) Manufacturers. Subject to compliance with requirements, provide products by one of the following:~~~~

- ~~1. General Electric~~
- ~~2. Cutler Hammer~~
- ~~3. Allen-Bradley Co.; Industrial Control Group.~~
- ~~4. Furnas Controls.~~
- ~~5. Square D.~~

- B. Variable Frequency Drives. Subject to compliance with requirements, provide products by one of the following:
1. ABB Power Distribution, Inc.; ABB Control, Inc. Subsidiary.
 2. Danfoss Inc.; Danfoss Electronic Drives Div.
 3. Toshiba International Corporation
 4. Schneider Electric

2.2 ENCLOSURES

- A. Description: Flush- or surface-mounting cabinets as indicated. NEMA 250, Type 1, unless otherwise indicated to comply with environmental conditions at installed location.
1. Outdoor Locations: NEMA 250, Type 3R.
 2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
 3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 4. Indoor use in hazardous (classified) locations classified as Class I, Division 1, Groups A, B, C, or D as defined in NFPA 70: NEMA Type 7.
 5. Indoor or outdoor use in hazardous (classified) locations classified as Class I, Division 01, Groups A, B, C, and D as defined in NFPA 70: NEMA Type 8.
 6. Indoor use in hazardous (classified) locations classified as Class II, Division 1, Groups E, F, or G as defined in NFPA 70: NEMA Type 9.
 7. Indoor Oil-tight: NEMA Type 12.

2.3 ACCESSORIES

- A. Devices shall be factory installed in controller enclosure, unless otherwise indicated.
- B. Push-Button Stations, Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty type.
- C. Stop and Lockout Push-Button Station: Momentary-break, push-button station with a factory-applied hasp arranged so padlock can be used to lock push button in depressed position with control circuit open.
- D. Control Relays: Auxiliary and adjustable time-delay relays.
- E. Elapsed Time Meters: Heavy duty with digital readout in hours.
- F. Meters: Panel type, 2-1/2-inch minimum size with 90- or 120-degree scale and plus or minus 2 percent accuracy. Where indicated, provide transfer device with an off position. Meters shall indicate the following:
1. Ammeter: Output current, with current sensors rated to suit application.
 2. Voltmeter: Output voltage.
 3. Frequency Meter: Output frequency.

- G. Multifunction Digital-Metering Monitor: Listed and labeled by an NRTL acceptable to authorities having jurisdiction, microprocessor-based unit suitable for three- or four-wire systems and with the following features:
1. Inputs from sensors or 5-A current-transformer secondary's, and potential terminals rated to 600 V.
 2. Switch-selectable digital display of the following:
 - a. Phase Currents, Each Phase: Plus or minus 1 percent.
 - b. Phase-to-Phase Voltages, Three Phase: Plus or minus 1 percent.
 - c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 1 percent.
 - d. Three-Phase Real Power: Plus or minus 2 percent.
 - e. Three-Phase Reactive Power: Plus or minus 2 percent.
 - f. Power Factor: Plus or minus 2 percent.
 - g. Frequency: Plus or minus 0.5 percent.
 - h. Integrated Demand with Demand Interval Selectable from 5 to 60 Minutes: Plus or minus 2 percent.
 - i. Accumulated energy, in megawatt hours (joules), plus or minus 2 percent; stored values unaffected by power outages for up to 72 hours.
 3. Mounting: Display and control unit flush or semi-flush mounted in instrument compartment door.
- H. Phase-Failure and Under-voltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connection. Provide adjustable under-voltage setting.
- I. Current-Sensing, Phase-Failure Relays for Bypass Controllers: Solid-state sensing circuit with isolated output contacts for hard-wired connection; arranged to operate on phase failure, phase reversal, current unbalance of from 30 to 40 percent, or loss of supply voltage; with adjustable response delay.

2.4 FACTORY FINISHES

- A. Finish: Manufacturer's standard paint applied to factory-assembled and tested enclosed controllers before shipping.
- B. Provide factory supplied paint for repair of scratches or other damage to finish.

2.5 FRACTIONAL HORSEPOWER MANUAL MOTOR CONTROLLER:

- A. Fractional Horsepower Manual Motor Controller for 1/2 HP or smaller: The starter shall be NEMA ICS 2, Class A, manually operated have a quick-make/quick-break toggle mechanism. The controller shall have overload shall full-voltage controller overload element, with field adjustment allowing up to +/- 10% variance in ratings of the nominal heater value. Include LED red pilot light, with both a N.C. and N.O. auxiliary contact.

~~2.6 ACROSS-THE-LINE ENCLOSED MOTOR CONTROLLERS (MOTOR STARTERS)~~

- ~~A. Magnetic Controller: NEMA ICS 2, Class A, full voltage, non-reversing, across the line, for induction motors rated in horsepower unless otherwise indicated.~~
- ~~B. Coil: Be of encapsulated type.~~

- ~~C. Size: NEMA rated for motor HP.~~
- ~~D. Contacts: Totally enclosed, double-break, silver-cadmium-oxide power contacts. Contact inspection and replacement shall be possible without disturbing line or load wiring.~~
- ~~E. Wiring: Straight-through wiring with all terminals clearly marked.~~
- ~~F. Overload Relay:
 - ~~1. NEMA ICS Melting Alloy: One-piece thermal unit construction. Thermal units shall be interchangeable. Overload relay control circuit contact shall be replaceable. Thermal units shall be required for starter to operate.~~
 - ~~2. Solid State: Trip current rating will be established by selection of overload relay and shall be adjustable (3 to 1 current range). The overload shall be self-powered, provide phase loss and phase unbalance protection, have a permanent tamper guard, and be ambient insensitive. It will also be available in Trip Class 10 or 20 and have a mechanical test function.~~
 - ~~3. Outputs: Unit will be designed for addition of either a normally open or normally closed auxiliary contact and be field convertible.~~
 - ~~4. Reset: Unit shall provide both manual reset and remote reset using an external module.~~~~
- ~~G. Enclosure: ANSI/NEMA ICS 6~~
- ~~H. Control Power Transformers: 120 volt secondary, sufficiently sized for service intended, in each motor starter. Provide fused primary and secondary, and bond unfused leg of secondary to enclosure.~~
- ~~I. Auxiliary Contacts: NEMA ICS 2, (2) two normally open and (2) two normally closed, field convertible contacts in addition to seal-in contact.~~
- ~~J. Cover Mounted Pilot Devices: NEMA ICS 2, heavy duty, oil tight type.~~
- ~~K. Pilot Device Contacts: NEMA ICS 2, Form Z, rated A150.~~
- ~~L. Push Buttons: Recessed type.~~
- ~~M. Indicating Lights: LED type.~~
- ~~N. Selector Switches: Rotary type.~~
- ~~O. Relays: NEMA ICS 2~~

2.7 VARIABLE FREQUENCY DRIVES

- A. Description: NEMA ICS 2, pulse-width-modulated, variable frequency controller; listed and labeled as a complete unit and arranged to provide variable speed of an NEMA MG 1, Design B, 3-phase, induction motor by adjusting output voltage and frequency. The VFD shall have a minimum turndown ratio of 8:1. Drive Features. All options, accessories and/or features shall be UL Listed by the drive manufacturer as a complete assembly and carry a UL508 label.
- B. The VFD package as specified herein and defined on the VFD schedule shall be enclosed in a UL Type enclosure (enclosures with only NEMA ratings are not acceptable), completely assembled and tested by the manufacturer in an ISO9001 facility.

- C. Design and Rating: Match load type such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.
- D. Drive Voltage: Refer to equipment schedules on drawings.
- E. Minimum Short Circuit Interrupting Capacity: 65,000 Amps.
- F. Protection: Provide surge protection, phase loss protection, and under-voltage protection. Include internal MOV devices for phase-to-phase and phase-to-ground voltage surge protection.
- G. General Characteristics:
 - 1. Rectifier: Full wave type.
 - 2. 6-pulse utilizing IGBT technology.
 - 3. Harmonic Mitigation:
 - a. AC Line Reactor: Five percent (5%) impedance located within the drive enclosure,
 - b. DC-link Reactor: Equivalent to five percent (5%) AC line reactor.
- H. Unit Operating Requirements:
 - 1. Input ac voltage tolerance at full rated output: for 208 V, + / - 5 %, for 380 to 500 V, + / - 10 %, and continue to operate without faulting from a line of +30% to -35% of nominal voltage.
 - 2. Input frequency tolerance of 50/60 Hz, plus or minus 6 percent.
 - 3. Minimum Efficiency: 96 percent at 60 Hz, full load.
 - 4. Minimum Displacement Primary-Side Power Factor: 96 percent.
 - 5. Overload Capability: 1.1 times the base load current for 60 seconds; 2.0 times the base load current for 3 seconds.
 - 6. Starting Torque: 100 percent of rated torque or as indicated.
 - 7. Speed Regulation: Plus or minus 1 percent.
- I. VFD's shall be capable of continuous full load operation under the following environmental operating conditions:
 - 1. -15 to 40° C (5 to 104° F) ambient temperature.
 - 2. Project Altitude: The VFD shall be rated for full NEMA rated motor horsepower at the altitude of the project.
 - 3. Humidity less than 95%, non-condensing.
- J. All VFD's shall have the following standard features:
 - 1. Integral Disconnecting Means: NEMA AB 1, instantaneous-trip circuit breaker with lockable handle.
 - 2. All circuit boards shall be coated to protect against corrosion.
 - 3. Self-Protection and Reliability Features:
 - a. Under- and overvoltage trips; inverter over-temperature, overload, and overcurrent trips.
 - b. Motor Overload Relays: Compensated for variable frequency drive application, adjustable and capable of withstanding a motor overload of 150% of the full rated current when the motor is initially at its normal operating temperature, designed to trip and disconnect the motor from its power source within 2 minutes.

- c. Notch filters to prevent operation of the controller-motor-load combination at a natural frequency of the combination. Notch filters shall be utilized to attenuate emissions that cause interference to specific frequency bands used by local radio operations, and shall be in accordance with FCC 47 CFR requirements.
 - d. Instantaneous line-to-line and line-to-ground overcurrent trips.
 - e. Loss-of-phase protection.
 - f. Reverse-phase protection.
 - g. Short-circuit protection.
 - h. Motor over-temperature fault.
4. Automatic Reset/Restart: Attempts three restarts after controller fault or on return of power after an interruption and before shutting down for manual reset or fault correction. Restarting during deceleration shall not damage controller, motor, or load.
 5. Power-Interruption Protection: Prevents motor from re-energizing after a power interruption until motor has stopped.
 6. Multiple-Motor Capability: Controller suitable for service to multiple motors and having a separate overload relay and protection for each controlled motor. Overload relay shall shut off controller and motors served by it when overload relay is tripped.
 7. All VFD's shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating. The keypad shall be removable, capable of remote mounting and allow for uploading and downloading of parameter settings as an aid for start-up of multiple VFD's.
 8. The keypad shall include Hand-Off-Auto selections and manual speed control. The drive shall incorporate "bump-less transfer" of speed reference when switching between "Hand" and "Auto" modes. There shall be fault reset and "Help" buttons on the keypad. The Help button shall include "on-line" assistance for programming and troubleshooting.
 9. There shall be a built-in time clock in the VFD keypad. The clock shall have a battery backup with 10 years minimum life span. The clock shall be used to date and time stamp faults and record operating parameters at the time of fault. VFD programming shall be held in non-volatile memory and is not dependent on battery power.
 10. The VFD's shall utilize pre-programmed application macros specifically designed to facilitate start-up. The Application Macros shall provide one command to reprogram all parameters and customer interfaces for a particular application to reduce programming time. The VFD shall have two user macros to allow the end-user to create and save custom settings.
 11. The VFD shall have cooling fans that are designed for easy replacement. The fans shall be designed for replacement without requiring removing the VFD from the wall or removal of circuit boards. The VFD cooling fans shall operate only when required, based on the temperature of and run command to the drive. VFD protection shall be based on thermal sensing and not cooling fan operation.
 12. The VFD shall be capable of starting into a coasting load (forward or reverse) up to full speed and accelerate or decelerate to set point without tripping or component damage (flying start).

13. The VFD shall have the ability to automatically restart after an over-current, over-voltage, under-voltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between attempts shall be programmable.
 14. The overload rating of the drive shall be 110% of its normal duty current rating for 1 minute every 10 minutes, 130% overload for 2 seconds every minute. The minimum FLA rating shall meet or exceed the values in the NEC/UL table 430.250 for 4-pole motors.
 15. VFD's through 200 HP shall have internal swinging (non-linear) chokes providing impedance equivalent to 5% to reduce the harmonics to the power line. Swinging choke shall be required resulting in superior partial load harmonic reduction. Linear chokes are not acceptable. 5% impedance may be from dual (positive and negative DC bus) chokes, or 5% swinging AC line chokes. VFD's with only one DC choke shall add an AC line choke.
 16. The input current rating of the VFD shall not be greater than the output current rating. VFD's with higher input current ratings require the upstream wiring, protection devices, and source transformers to be oversized per NEC 430.122. Input and output current ratings must be shown on the VFD nameplate.
 17. The VFD shall include a coordinated AC transient surge protection system consisting of 4 MOV's (phase to phase and phase to ground), a capacitor clamp, 1600 PIV Diode Bridge and internal chokes. The MOV's shall have a minimum 125 joule rating per phase across the diode bridge. VFD's that do not include coordinated AC transient surge protection shall include an external Surge Protection Device (SPD).
 18. The VFD shall provide a programmable loss-of-load (broken belt / broken coupling) Form-C relay output. The drive shall be programmable to signal the loss-of-load condition via a keypad warning, Form-C relay output, and / or over the serial communications bus. The loss-of-load condition sensing algorithm shall include a programmable time delay that will allow for motor acceleration from zero speed without signaling a false loss-of-load condition.
 19. The VFD shall include multiple "two zone" PID algorithms that allow the VFD to maintain PID control from two separate feedback signals (4-20mA, 0-10V, and / or serial communications). The two zone control PID algorithm will control motor speed based on a minimum, maximum, or average of the two feedback signals. All of the VFD PID controllers shall include the ability for "two zone" control.
 20. If the input reference is lost, the VFD shall give the user the option of either (1) stopping and displaying a fault, (2) running at a programmable preset speed, (3) hold the VFD speed based on the last good reference received, or (4) cause a warning to be issued, as selected by the user. The drive shall be programmable to signal this condition via a keypad warning, Form-C relay output and / or over the serial communication bus.
 21. The VFD shall have programmable "Sleep" and "Wake up" functions to allow the drive to be started and stopped from the level of a process feedback signal.
- K. All VFD's to have the following adjustments:

1. Three (3) programmable critical frequency lockout ranges to prevent the VFD from operating the load continuously at an unstable speed. The lockout range must be fully adjustable, from 0 to full speed.
2. Two (2) PID Set point controllers shall be standard in the drive, allowing pressure or flow signals to be connected to the VFD, using the microprocessor in the VFD for the closed-loop control. The VFD shall have 250 ma of 24 VDC auxiliary power; and be capable of loop powering a transmitter supplied by others. The PID set point shall be adjustable from the VFD keypad, analog inputs, or over the communications bus. There shall be two independent parameter sets for the PID controller and the capability to switch between the parameter sets via a digital input, serial communications or from the keypad. The independent parameter sets are typically used for night setback, switching between summer and winter set points, etc.
3. There shall be an independent, second PID loop that can utilize the second analog input and modulate one of the analog outputs to maintain the set point of an independent process (i.e. valves, dampers, etc.). All set points, process variables, etc. to be accessible from the serial communication network.
4. Two (2) programmable analog inputs shall accept current or voltage signals.
5. Two (2) programmable analog outputs (0-10 V or 4-20 mA). The outputs may be programmed to output proportional to Frequency, Motor Speed, Output Voltage, Output Current, Motor Torque, Motor Power (kW), DC Bus voltage, Active Reference, Active Feedback, and other data.
6. Six (6) programmable digital inputs for maximum flexibility in interfacing with external devices. All digital inputs shall be programmable to initiate upon an application or removal of 24VDC.
7. Three (3) programmable, digital Form-C relay outputs. The relay outputs shall include programmable on and off delay times and adjustable hysteresis. The relays shall be rated for maximum switching current 8 amps at 24 VDC and 0.4 A at 250 VAC; Maximum voltage 300 VDC and 250 VAC; continuous current rating of 2 amps RMS. Outputs shall be true Form-C type contacts; open collector outputs are not acceptable. Drives that have only two (2) relay outputs must provide an option card that provides additional relay outputs.
8. Run permissive circuit - There shall be a run permissive circuit for damper or valve control. Regardless of the source of a run command (keypad, input contact closure, time-clock control, or serial communications), the VFD shall provide a dry contact closure that will signal the damper to open (VFD motor does not operate). When the damper is fully open, a normally open dry contact (end-switch) shall close. The closed end-switch is wired to a VFD digital input and allows VFD motor operation. Two separate safety interlock inputs shall be provided. When either safety is opened, the motor shall be commanded to coast to stop and the damper shall be commanded to close. The keypad shall display "start enable 1 (or 2) missing". The safety input status shall also be transmitted over the serial communications bus.

9. The VFD control shall include a programmable time delay for VFD start and a keypad indication that this time delay is active. A Form C relay output provides a contact closure to signal the VAV boxes open. This will allow VAV boxes to be driven open before the motor operates. The time delay shall be field programmable from 0 – 120 seconds. Start delay shall be active regardless of the start command source (keypad command, input contact closure, time-clock control, or serial communications), and when switching from drive to bypass.
 10. Seven (7) programmable preset speeds.
 11. Two independently adjustable accel and decel ramps with 1 – 1800 seconds adjustable time ramps.
 12. The VFD shall include a motor flux optimization circuit that will automatically reduce applied motor voltage to the motor to optimize energy consumption and reduce audible motor noise. The VFD shall have selectable software for optimization of motor noise, energy consumption, and motor speed control.
 13. The VFD shall include a carrier frequency control circuit that reduces the carrier frequency based on actual VFD temperature that allows higher carrier frequency settings without derating the VFD.
 14. The VFD shall include password protection against parameter changes.
- L. The Keypad shall include a backlit LCD display. The display shall be in complete English words for programming and fault diagnostics (alpha-numeric codes are not acceptable). All VFD faults shall be displayed in English words. The keypad shall include a minimum of 14 assistants including:
1. Start-up assistant
 2. Parameter assistants:
 - a. PID assistant
 - b. Reference assistant
 - c. I/O assistant
 - d. Serial communications assistant
 - e. Option module assistant
 - f. Panel display assistant
 - g. Low noise set-up assistant
 - h. Maintenance assistant
 - i. Troubleshooting assistant
 - j. Drive optimizer assistants
- M. All applicable operating values shall be capable of being displayed in engineering (user) units. A minimum of three operating values from the list below shall be capable of being displayed at all times. The display shall be in complete English words (alpha-numeric codes are not acceptable):
1. Output Frequency
 2. Motor Speed (RPM, %, or Engineering units)
 3. Motor Current
 4. Motor Torque
 5. Motor Power (kW)
 6. DC Bus Voltage
 7. Output Voltage

- N. The VFD shall include a fireman's override input. Upon receipt of a contact closure from the fire / smoke control station, the VFD shall operate in one of two modes: 1) Operate at a programmed predetermined fixed speed ranging from - 500Hz (reverse) to 500Hz (forward). 2) Operate in a specific fireman's override PID algorithm that automatically adjusts motor speed based on override set point and feedback. The mode shall override all other inputs (analog/digital, serial communication, and all keypad commands), except customer defined safety run interlocks, and force the motor to run in one of the two modes above. "Override Mode" shall be displayed on the keypad. Upon removal of the override signal, the VFD shall resume normal operation, without the need to cycle the normal digital input run command.
- O. Serial Communications:
1. The VFD shall have an EIA-485 port as standard. The standard protocols shall be provided compatible with the Building Automation System (BAS) specified in Section 23 09 00, the use of third party gateways and multiplexers is not acceptable. Each individual drive shall have the protocol in the base VFD. All protocols shall be "certified" by the governing authority (i.e. BTL Listing for BACnet). Use of non-certified protocols is not allowed.
 2. Serial communication capabilities shall include, but not be limited to; run-stop controls, speed set adjustment, and lock and unlock the keypad. The drive shall have the capability of allowing the BAS to monitor feedback such as process variable feedback, output speed / frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), and drive temperature. The BAS shall also be capable of monitoring the VFD relay output status, digital input status, and all analog input and analog output values. All diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote VFD fault reset shall be possible.
 3. The VFD shall include an independent PID loop for customer use. The independent PID loop may be used for cooling tower bypass valve control, chilled water valve / hot water valve control, etc. Both the VFD PID control loop and the independent PID control loop shall continue functioning even if the serial communications connection is lost. As default, the VFD shall keep the last good set point command and last good DO & AO commands in memory in the event the serial communications connection is lost and continue controlling the process.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and surfaces to receive enclosed controllers for compliance with, with NEC requirements, manufacturer's installation and service clearances, project site altitude, and other conditions affecting performance.
1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PROJECT CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
 - 1. Notify Owner no fewer than twenty-one calendar days in advance of proposed interruption of electrical service.
 - 2. Submit a Method of Procedure (MOP), no fewer than fourteen days in advanced for the Owner's review. Include detail, step-by-step activities for interruption of service, protection of existing systems, emergency back-up plan and contingency plans to reduce risk to the Owner's operation and facility.
 - 3. Indicate method of providing temporary utilities.
 - 4. Do not proceed with interruption of electrical service without Owner's written permission.

3.3 COORDINATION

- A. Coordinate layout and installation of enclosed controllers with other construction trades including conduit, piping, equipment, and adjacent surfaces. Maintain required code clearance requirements, and required workspace clearances for equipment access doors and panels.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03 Section "Cast-in-Place Concrete." Verify structural requirements with structural engineer.
- C. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."
- D. Coordinate features of enclosed controllers and accessory devices with pilot devices and control circuits to which they connect.
- E. Coordinate features, accessories, and functions of each enclosed controller with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and load.

3.4 INSTALLATION

- A. Any controller with damage to the enclosure or visual signs of having internal water intrusion shall be replaced, no exceptions.
- B. On-Site Physical Protection: Throughout the entire construction of the project, all motor starters and VFD's shall be protected from construction dust, dirt, debris and any form of contamination with a minimum of triple layer of shrink wrap.
 - 1. Wrap shall not be removed except when completing installation of electrical terminations.
 - 2. Maintain air-tight shrink wrap at all other times until the manufacturer's representative has formally on-site and ready to complete start-up activities.

3. No work shall be performed inside of enclosures when any of the following activities are taking place in the same space or open to adjacent spaces including but not limited to: Sheet rock sanding and finishing, concrete work provides dust, e.g. saw cutting, woodwork creating sawdust, etc.
 4. If VFD's are start-up and/or operated prior to completion of the project acceptance by the Owner, the Contractor shall be responsible to protect all enclosures from any contamination after factory start-up is completed.
- C. For control equipment at walls, bolt units to wall or mount on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Division 26 Section "Hangers and Supports for Electrical Systems."
 - D. Concrete Bases: Install freestanding equipment on concrete bases. Coordinate size and location of concrete bases.
 - E. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration Controls for Electrical Systems."
 - F. Enclosed Controller Fuses: Install fuses in each fusible switch. Comply with requirements in Division 26 Section "Fuses."
 - G. Provide galvanized sheet metal drip pan overhead of motor starters and VFD's where piping runs directly above any piping service including steam or liquids. The drip pan shall be fabricated to slope or pitch to drain away from VFD or provided with a 3/4" condensate drain piped overhead and down to the nearest floor drain.
 - H. Where line filter equipment is provided, install and connect control wiring from the line filter's terminals for "disconnect filter/capacitors" to the drive's terminals for "low-load and no-load" conditions.
- 3.5 IDENTIFICATION
- A. Identify enclosed controller, components, and control wiring according to Division 26 Section "Identification for Electrical Systems."
- 3.6 CONTROL WIRING INSTALLATION
- A. Install wiring between enclosed controllers according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
 - B. Bundle, train, and support wiring in enclosures.
 - C. Connect Hand-Off-Automatic switch and other automatic-control devices where applicable.
 1. Connect selector switches to bypass only manual- and automatic-control devices that have no safety functions when switch is in hand position.
 2. Connect selector switches with enclosed controller circuit in both hand and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.7 CONNECTIONS

- A. Conduit installation requirements are specified in other Division 26 Sections. Drawings indicate general arrangement of conduit, fittings, and specialties.
- B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- C. Where there is means of a disconnect downstream of VFD output, the Electrical Contractor shall provide an interlock circuit between the drive and the disconnect to prevent the drive from operating when the switch is open with no load.

3.8 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
 - 1. Test insulation resistance for each enclosed controller element, bus component connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to perform start-up services for the following equipment:
 - 1. All Reduced Voltage Starters, regardless of type.
 - 2. All Variable Frequency Drives, regardless of HP rating size.
 - 3. Across the line Motor Starters larger 60 HP.
- C. Prior to any start-up, the manufacturer's representative shall complete on-site inspection of each electronic enclosure for both internal and external cleanliness. The representative shall clean both inside and outside of enclosure to non-visible dust/contaminate condition, including removal of metal chards, loose fasteners, wiring material, etc. returning the entire electrical enclosure assembly to new factory clean conditions.
- D. All factory field start-up services shall include but not limited to inspection of controllers, wiring, pre-testing, final adjustments, components, connections, adjustment to the controller and the equipment installation in accordance with manufacturers own recommendations.
 - 1. Manufacturer representative shall provide a written report for each controller including certification the drive has been thoroughly tested, check and certification it is operating correctly and it complies with all aspects and requirements of the contract documents. These reports shall be included in the O & M manuals.

3.9 ADJUSTING

- A. Set field-adjustable switches and circuit-breaker trip ranges.
- B. Touch-up controller enclosures where finish has been scratched or marred with manufacturer's recommended paint.

3.10 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers. Refer to Division 01 Section "Demonstration and Training."

Energy & Mineral Research Facility
Building Package
PR 08/Conformed Set

Perkins&Will
222302.000
6 June 2024

END OF SECTION

ENCLOSED MOTOR CONTROLLERS FOR HVAC
23 05 14 - 17

EMRF ABB Variable Frequency Drives
NIST MEP Submittal

Products: Various Variable Frequency Drives manufactured by ABB of Switzerland.

Performance Criteria: Models and performance based on heat pumps as required.
See attached.

Submittal Schedule

This schedule includes the products supplied as part of this submittal.

Schedule			Motor Data ¹			Drive Data			
Item	Qty	Tag	HP	FLA	Volts	Product ID	HP	Amps	Volts
1	4	BCHP PUMPS	30	40	460 VAC	ACH580-PCR-044A-4	30	44	
2	2	CCHP PUMPS	5	7.6	460 VAC	ACH580-PCR-07A6-4	5	7.6	
3	2	PCSP PUMPS	15	21	460 VAC	ACH580-PCR-023A-4	15	23	
4	3	HSP PUMPS	40	52	460 VAC	ACH580-PCR-052A-4	40	52	

Notes: 1. AC motor data is per National Electrical Code Table 430.250 for typical motors used in most applications. It is provided as typical data only. DC motor data is per typical industry standards. Actual motor data may vary

** Pump VFDs shown in submittal only*

Quotation Bill of Material

Item	Qty	Product Information
1	4	<p>ACH580-PCR-044A-4 <i>ACH580 6-Pulse drive package rated UL (NEMA) Type 1. Provided with Main Input Circuit Breaker. Rated for 44 amps (30 HP) at 480 VAC three phase.</i></p> <p>Equipment Tag: BCHP PUMPS</p>
2	2	<p>ACH580-PCR-07A6-4 <i>ACH580 6-Pulse drive package rated UL (NEMA) Type 1. Provided with Main Input Circuit Breaker. Rated for 7.6 amps (5 HP) at 480 VAC three phase.</i></p> <p>Equipment Tag: CCHP PUMPS</p>
3	2	<p>ACH580-PCR-023A-4 <i>ACH580 6-Pulse drive package rated UL (NEMA) Type 1. Provided with Main Input Circuit Breaker. Rated for 23 amps (15 HP) at 480 VAC three phase.</i></p> <p>Equipment Tag: PCSP PUMPS</p>
4	3	<p>ACH580-PCR-052A-4 <i>ACH580 6-Pulse drive package rated UL (NEMA) Type 1. Provided with Main Input Circuit Breaker. Rated for 52 amps (40 HP) at 480 VAC three phase.</i></p> <p>Equipment Tag: HSP PUMPS</p>

Terms:

- **FOB ABB Factory**
- **Proposal valid for 30 days from quotation date**
- **ABB Inc. Standard Terms and Conditions of Sale apply**
- **Proposal based upon acceptance of Clarifications and Exceptions to Specifications and Terms provide later in this quotation**

Submittal Schedule Details for BCHP PUMPS

Item	Tag / Equipment ID	Product ID
1	BCHP PUMPS	ACH580-PCR-044A-4

Item Description
<p>Input Voltage: 480 VAC Three Phase Rated Output Current: 44A Enclosure: UL (NEMA) Type 1 Nominal Horsepower: 30 HP Frame Size: R3 Input Disconnecting Means: Circuit Breaker Bypass: None Input Impedance: 5% equivalent impedance Short Circuit Current Rating: 100 kA Communication Protocols: Johnson Controls N2, Modbus RTU, BACnet (MS/TP) Other Options:</p>

Drive Input Fuse Ratings	
Fuse Class	Amps (600 V)
Class J	60

Wire Size Capacities of Power Terminals		
Input Wiring	Output Wiring	Ground Wiring
#14...#1/0 5.2 lbf-ft	#20...#2 2.6 lbf-ft	#14...#2 #14...#10: 2.9 lbf-ft; #6...#4: 3.8 lbf-ft; #2: 4.1 lbf-ft

Dimensions and Weights			
Height <i>in</i> (<i>mm</i>)	Width <i>in</i> (<i>mm</i>)	Depth <i>in</i> (<i>mm</i>)	Weight <i>lbs</i> (<i>kg</i>)
34.8 (885)	8.4 (213)	13.2 (336)	39 (17.8)

Heat Dissipation & Airflow Requirements			
Power Losses		Airflow	
BTU/Hr	Watts	CFM	CM/Hr
2,210	648	105	178.4

Submittal Schedule Details for CCHP PUMPS

Item	Tag / Equipment ID	Product ID
2	CCHP PUMPS	ACH580-PCR-07A6-4

Item Description
<p>Input Voltage: 480 VAC Three Phase Rated Output Current: 7.6A Enclosure: UL (NEMA) Type 1 Nominal Horsepower: 5 HP Frame Size: R1 Input Disconnecting Means: Circuit Breaker Bypass: None Input Impedance: 5% equivalent impedance Short Circuit Current Rating: 100 kA Communication Protocols: Johnson Controls N2, Modbus RTU, BACnet (MS/TP) Other Options:</p>

Drive Input Fuse Ratings	
Fuse Class	Amps (600 V)
Class T	15

Wire Size Capacities of Power Terminals		
Input Wiring	Output Wiring	Ground Wiring
#14...#1/0 5.2 lbf-ft	#24...#10 0.8 lbf-ft	#14...#2 #14...#10: 2.9 lbf-ft; #6...#4: 3.8 lbf-ft; #2: 4.1 lbf-ft

Dimensions and Weights			
Height <i>in</i> (<i>mm</i>)	Width <i>in</i> (<i>mm</i>)	Depth <i>in</i> (<i>mm</i>)	Weight <i>lbs</i> (<i>kg</i>)
24.6 (625)	6.4 (163)	12.4 (316)	18 (8.2)

Heat Dissipation & Airflow Requirements			
Power Losses		Airflow	
BTU/Hr	Watts	CFM	CM/Hr
396	116	25	42.5

Submittal Schedule Details for PCSP PUMPS

Item	Tag / Equipment ID	Product ID
3	PCSP PUMPS	ACH580-PCR-023A-4

Item Description
<p>Input Voltage: 480 VAC Three Phase Rated Output Current: 23A Enclosure: UL (NEMA) Type 1 Nominal Horsepower: 15 HP Frame Size: R2 Input Disconnecting Means: Circuit Breaker Bypass: None Input Impedance: 5% equivalent impedance Short Circuit Current Rating: 100 kA Communication Protocols: Johnson Controls N2, Modbus RTU, BACnet (MS/TP) Other Options:</p>

Drive Input Fuse Ratings	
Fuse Class	Amps (600 V)
Class T	30

Wire Size Capacities of Power Terminals		
Input Wiring	Output Wiring	Ground Wiring
#14...#1/0 5.2 lbf-ft	#20...#6 1.2 lbf-ft	#14...#2 #14...#10: 2.9 lbf-ft; #6...#4: 3.8 lbf-ft; #2: 4.1 lbf-ft

Dimensions and Weights			
Height <i>in</i> (<i>mm</i>)	Width <i>in</i> (<i>mm</i>)	Depth <i>in</i> (<i>mm</i>)	Weight <i>lbs</i> (<i>kg</i>)
28.5 (725)	6.4 (163)	12.6 (321)	22 (10)

Heat Dissipation & Airflow Requirements			
Power Losses		Airflow	
BTU/Hr	Watts	CFM	CM/Hr
1,159	340	59	100.3

Submittal Schedule Details for HSP PUMPS

Item	Tag / Equipment ID	Product ID
4	HSP PUMPS	ACH580-PCR-052A-4

Item Description
<p>Input Voltage: 480 VAC Three Phase Rated Output Current: 52A Enclosure: UL (NEMA) Type 1 Nominal Horsepower: 40 HP Frame Size: R4 Input Disconnecting Means: Circuit Breaker Bypass: None Input Impedance: 5% equivalent impedance Short Circuit Current Rating: 100 kA Communication Protocols: Johnson Controls N2, Modbus RTU, BACnet (MS/TP) Other Options:</p>

Drive Input Fuse Ratings	
Fuse Class	Amps (600 V)
Class J	80

Wire Size Capacities of Power Terminals		
Input Wiring	Output Wiring	Ground Wiring
#10...250MCM 10.3 lbf-ft	#20...#1 3 lbf-ft	#14...#2 #14...#10: 2.9 lbf-ft; #6...#4: 3.8 lbf-ft; #2: 4.1 lbf-ft

Dimensions and Weights			
Height <i>in</i> <i>(mm)</i>	Width <i>in</i> <i>(mm)</i>	Depth <i>in</i> <i>(mm)</i>	Weight <i>lbs</i> <i>(kg)</i>
40.6 (1032)	8.4 (213)	14.3 (362)	60 (27.2)

Heat Dissipation & Airflow Requirements			
Power Losses		Airflow	
BTU/Hr	Watts	CFM	CM/Hr
2,991	877	25	42.5

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ACH580-01/-31

The ACH580 drive sets new standards in both simplicity and reliability, and ensures smooth, energy-efficient operation of your HVAC systems in normal and mission-critical situations.

ACH580-01, wall-mounted base drives

The ACH580-01 wall-mounted drives are available from 1 to 100 HP at 208/240 V, 1 to 350 HP at 480 V, and 2 to 250 HP at 575 V. The ACH580-01 drives are available in UL (NEMA) Type 1 and 12 configurations. In standard installations, the drive is mounted directly onto a wall and uses the provided conduit box. Conduit openings are provided for bottom conduit entry & exit. For mounting in a customer-supplied cabinet, the conduit box may be removed. The drive has a 100 kA SCCR rating when paired with appropriately sized upstream fuses.

ACH580-31, ultra low harmonic wall-mounted base drives

The ACH580-31 wall-mounted drives are available from 5 to 75 HP @208/230v and 5 to 400 HP @ 480 V. The ACH580-31 are available in UL (NEMA) Type 1 and 12 configurations. In standard installations, the drive is mounted directly onto a wall and uses the provided conduit box. Conduit openings are provided for bottom conduit entry and exit. For mounting in a customer-supplied cabinet, the conduit plate may be removed.

Features for HVAC

The ACH580 comes standard with an intuitive control panel used to configure, control, and monitor the drive. An optional Bluetooth control panel allows the drive to be configured via the control panel or the DriveTune app.

A robust HVAC firmware package provides drive, motor, and application protection features. Examples of drive protection features include undervoltage, overvoltage, overcurrent, and ground fault protection. The ACH580 also has a variety of motor protection features including overload and stall protections.

Application specific features, such as accepting four separate start interlocks (safeties), along with broken belt detection, are also included. The drive includes BACnet MS/TP, Modbus RTU, and Johnson N2 as standard. Additional protocols, such as BACnet/IP and LonWorks , are available with optional fieldbus adapters.

Technical specifications

Product compliance (complete list on following page)

ACH580-01/-31 CE, UL, cUL, and EAC

Supply connection

Input voltage (U _i)	
ACH580-xx-xxxA-2	208/230V
ACH580-xx-xxxA-4	480V
ACH580-xx-xxxA-6	600V
Input voltage tolerance	+10% / -15%
Phase	3-phase (1-phase, 240 V)
Frequency	48 to 63 Hz
Line Limitations	Max ±3% of nominal phase to phase input voltage
Power Factor (cos φ) at nominal load	
ACH580-01	0.98
ACH580-31	1.0
Efficiency at rated power	
ACH580-01	98.0%
ACH580-31	96.5%
Power Loss	Approximately 2% of rated power

Motor connection

Supported motor control	Scalar and vector
Supported motor types	Asynchronous motor, permanent magnet motor (vector), SynRM (vector)
Voltage	3-phase, from 0 to supply voltage
Frequency	0 to 500 Hz
Short Term Overload Capacity Variable Torque	110% for 1 min/10min
Peak Overload Capacity Variable Torque	1.35 for 2 second (2 sec / 10 min)
Switching Frequency	2, 4, 8 or 12 kHz Automatic fold back in case of overload
Acceleration/Deceleration Time	0 to 1800 s
Short Circuit Current Rating (SCCR)	100 ka with fusing

Inputs and outputs (drive)

2 analog inputs	Selection of Current/Voltage input mode is user programmable.
Voltage reference	0 (2) to 10 V, R _{in} > 200 kΩ
Current reference	0 (4) to 20 mA, R _{in} = 100 Ω
Potentiometer reference value	10 V ±1% max. 20 mA
2 analog outputs	AO1 is user programmable for current or voltage. AO2 current
Voltage reference	0 to 10 V, R _{load} : > 100 kΩ
Current reference	0 to 20 mA, R _{load} : < 500 Ω
Applicable potentiometer	1 kΩ to 10 kΩ
Internal auxiliary voltage	24 V DC ±10%, max. 250 mA
Accuracy	+/- 1% full scale range at 25°C (77°F)
Output updating time	2 ms
6 digital inputs	12 to 24 V DC, 10 to 24 V AC, Connectivity of PTC sensors supported by a single digital input. PNP or NPN connection (5 DIs with NPN connection).

	Programmable
Input Updating Time	2 ms
3 relay outputs	Maximum switching voltage 250 V AC/30 V DC. Maximum continuous current 2 A rms. Programmable, Form C
Adjustable filters on analog inputs and outputs	
All control inputs isolated from ground and power	
Operation	
Air temperature	0 to -15 °C (32 to 5 °F). -15 to +50 °C (5 to 122 °F): No frost allowed. Output derated above +40 °C (104 °F)
Installation site altitude	0 to 4000 m (13123 ft) above sea level Output derated above 1000 m (3281 ft)
Relative humidity	5 to 95% No condensation allowed Maximum relative humidity is 60% in the presence of corrosive gasses
Atmospheric pressure	70 to 106 kPa (10.2 to 15.4 PSI) 0.7 to 1.05 atmospheres
Vibration	Risk category IV Certified (IBC 2018)
Environmental protections	
Chemical Gasses	Class 3C2
Solid Particles	Class 3S2 No conductive dust allowed
Pollution degree (IEC/EN 61800-5-1)	Pollution degree 2
Product compliance	
Standards and directives	Low Voltage Directive 2006/95/EC EMC Directive 2004/108/EC 60721-3-3: 2002 60721-3-1:1997 Quality assurance system ISO 9001 and Environmental system ISO 14001 CE, UL, cUL, and EAC approvals Galvanic isolation according to PELV RoHS2 (Restriction of Hazardous Substances) EN 61800-5-1: 2007; IEC/EN 61000-3-12; EN61800-3: 2017 + A1: 2012 Category C2 (1st environment restricted distribution); Safe torque off (EN 61800-5-2) BACnet Testing Laboratory (BTL) Seismic (IBC, OSHPD) Plenum (ACH580-01 only)
EMC (according to EN61800-3)	ACH580-01 and ACH580-31 class C2 (1st environment restricted distribution)

Storage (in Protective Shipping Package)

Air Temperature	-40 to +70 °C (-40 to +158 °F)
Relative Humidity	Less than 95% No condensation allowed Maximum relative humidity is 60% in the presence of corrosive gasses
Chemical Gasses	Class 1C2
Solid Particles	Class 1S2 Contact ABB regarding Class 1S3
Atmospheric pressure	70 to 106 kPa 0.7 to 1.05 atmospheres
Vibration (ISTA) R1...R4	In accordance with ISTA 1A
R5...R9	In accordance with ISTA 3E

Transportation (in Protective Shipping Package)

Air Temperature	-40° to 70°C (-40° to 158°F)
Relative Humidity	Less than 95% No condensation allowed Maximum relative humidity is 60% in the presence of corrosive gasses
Atmospheric Pressure	60 to 106 kPa (8.7 to 15.4 PSI) 0.6 to 1.05 atmospheres
Free Fall	R1: 76 cm (30 in) R2: 61 cm (24 in) R3: 46 cm (18 in) R4: 31 cm (12 in) R5: 25 cm (10 in)
Chemical Gasses	Class 2C2
Solid Particles	Class 2S2
Shock/ Drop (ISTA) R1...R4	In accordance with ISTA 1A
R5...R9	In accordance with ISTA 3E
Vibration (ISTA) R1...R4	In accordance with ISTA 1A
R5...R9	In accordance with ISTA 3E

Feature overview

Communication

Protocols as standard (EIA-485): BACnet MS/TP, Modbus RTU, Johnson Controls N2
Available as plug-in options: BACnet/IP, Modbus TCP, PROFIBUS-DP, DeviceNet, EtherNet/IP, LonWorks (coming 2019)

Application functions

Start interlock
Delayed start
Run permissive (damper monitoring)
Override operation mode
Real-time clock (scheduling)
PID controllers for motor and process
Motor flying start
Motor preheating
Energy optimizer and calculators
Timer
2 or 3 wire start/stop
Ramp to stop
2 independent adjustable accel/decel ramp

Protection functions

Overvoltage controller
Undervoltage controller
Motor earth-leakage monitoring
Motor short-circuit protection
Motor overtemperature protection
Output and input switch supervision
Motor overload protection (UL508C)
Phase-loss detection (both motor and supply)
Under load supervision (belt loss detection)
Overload supervision
Stall protection
Loss of reference
Panel loss
Ground fault
External events
Overcurrent
Current limit regulator
Transient/Surge protection (MOV and choke)

Panel functions

First start assistant
Primary settings for HVAC applications
Hand-Off-Auto operation mode
HVAC quick set-up
Includes Day, Date and Time
Operator Panel Parameter Backup (read/write)
Full Graphic and Multilingual Display for Operator Control,
Parameter Set-Up and Operating Data Display:

- Output Frequency (Hz)
- Speed (RPM)
- Motor Current
- Calculated % Motor Torque
- Calculated Motor Power (kW)
- DC Bus Voltage
- Output Voltage
- Heatsink Temperature
- Elapsed Time Meter (resettable)
- kWh (resettable)
- Input / Output Terminal Monitor
- PID Actual Value (Feedback) & Error Fault Text
- Warning Text
- Three (3) Scalable Process Variable Displays
- User-Definable Engineering Units

Motor control features

Scalar (V/Hz) and vector modes of motor control
V/Hz shapes

- Linear
- Squared

Energy optimization
IR compensation
Slip compensation
Three (3) Critical Frequency Lockout Bands

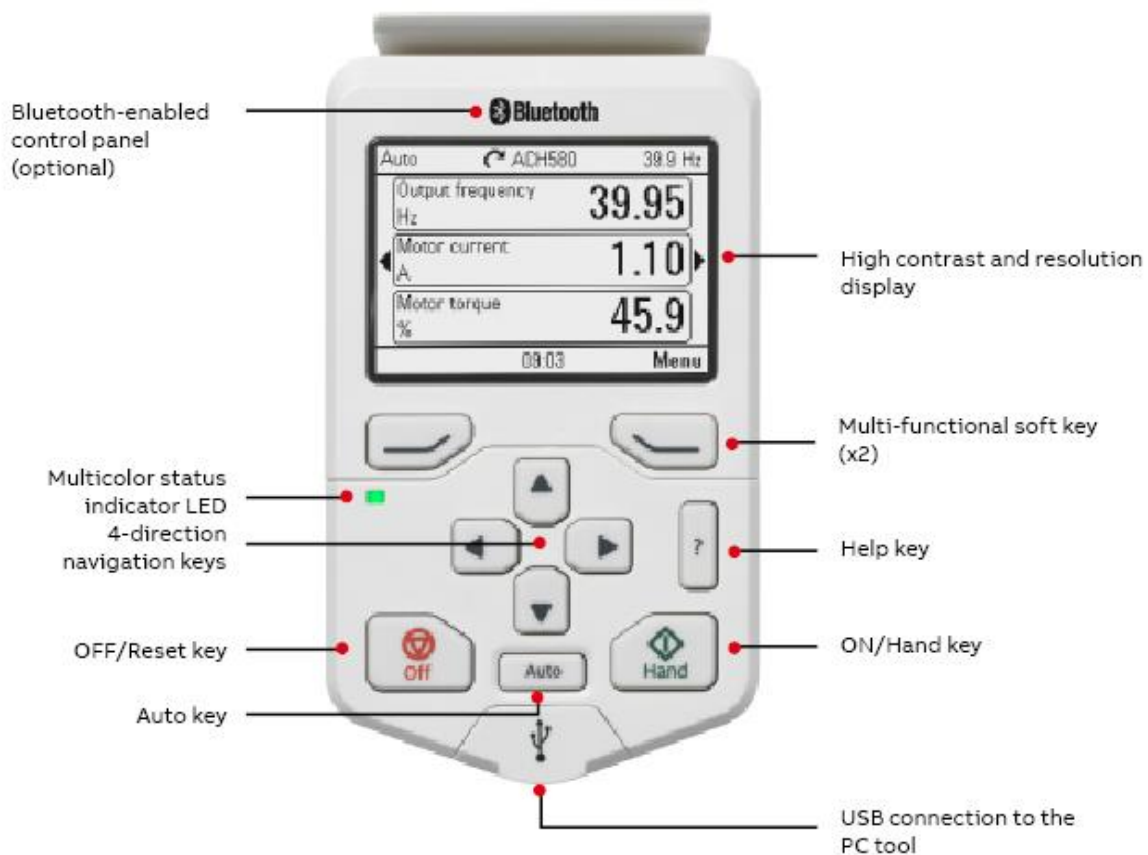
PID control

One (1) Process PID
Four (4) Integral Independent Programmable PID Setpoint Controllers (Process and External)
External Selection between Two (2) Sets of Process PID Controller Parameters
PID Sleep/Wake-Up

Control panel features

The ACH580 Assistant Control Panel features:

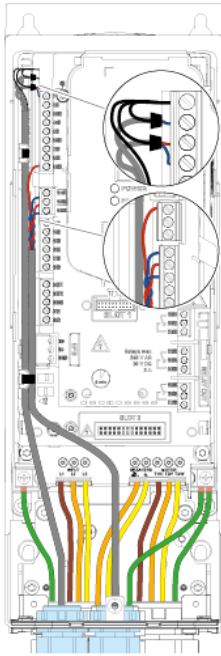
- Intuitive to operate
- Primary Setting menu to ease drive commissioning
- Real-time clock
- Diagnostic and maintenance functions
- Full-graphic display, including chart, graph, and meter options
- 21 editable home views
- USB interface for PC and tool connection as standard
- Parameters are alpha-numeric
- North American version supports 14 languages as standard
- Dedicated "Help" key
- 4 user sets
- Parameters are stored in control panel memory for later transfer to other drives or for backup of a particular system
- Back-up and restore parameters and/or motor data
- Automatic back-up 2 hours after parameter change
- Modified parameter display
- Creates unique short menu
- Shows parameters that differ from the default
- Bluetooth connectivity for use with mobile device (requires +J429 option)



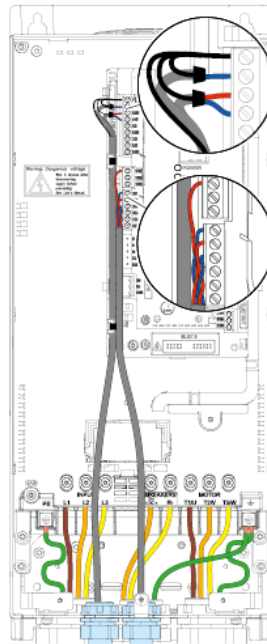
Cable connections

The following illustrations show the ACH580-01 and ACH580-31 cable connection points for the base drive. The illustrations indicate the location of input and output power connections as well as equipment and motor grounding connection points.

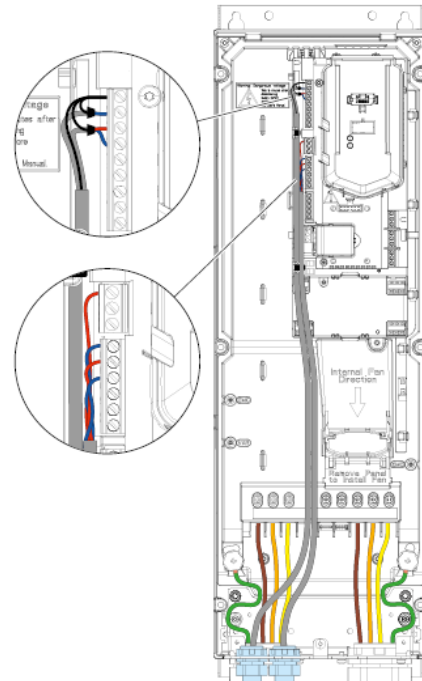
ACH580 drives are configured for wiring access from the bottom only. At least three separate metallic conduits are required, one for input power, one for output power to the motor and one for control signals.



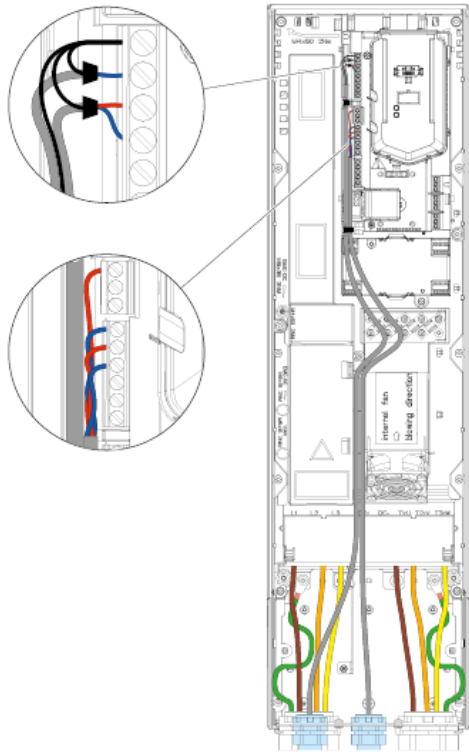
ACH580-01, R1-R2, UL (NEMA) Type 1 and 12



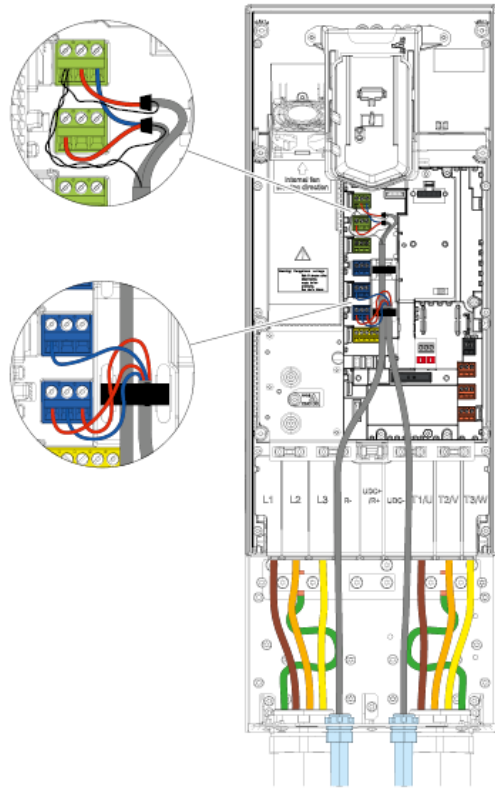
ACH580-01, R3, UL (NEMA) Type 1 and 12



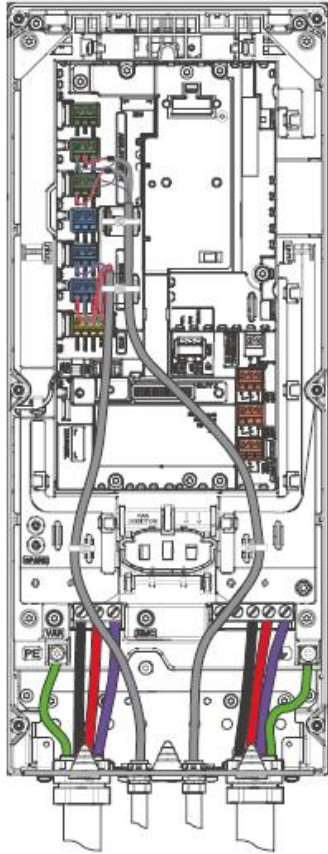
ACH580-01, R4, UL (NEMA) Type 1 and 12



ACH580-01, R5, UL (NEMA) Type 1 and 12



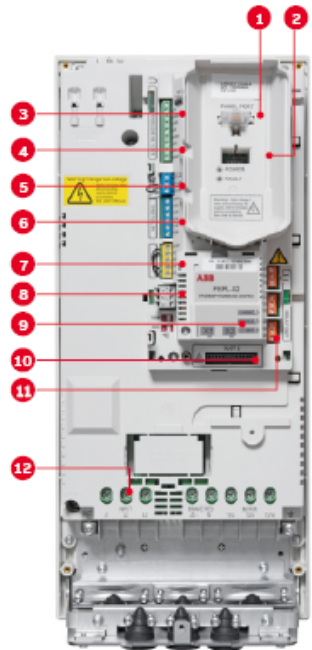
ACH580-01, R6-9, UL (NEMA) Type 1 and 12



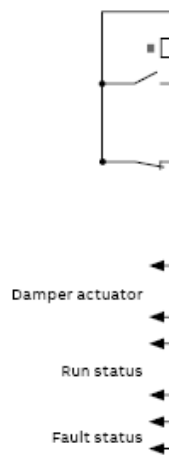
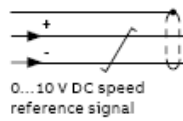
ACH580-31, R3, UL (NEMA) Type 1 and 12

Control connections

Default control connections



1. Panel port (PC tools, control panel)
2. ABB drive customizer port for programming the drive without mains
3. Analog inputs (2 × AI)
4. Analog outputs (2 × AO)
5. 24 V DC output
6. Digital inputs (6 × DI)
7. Safe torque off (STO)
8. Embedded fieldbus
9. Communication options (fieldbuses)
10. Analog and digital I/O extensions
11. Relay outputs (3 × RO)
12. Mains connection



Terminal	Meaning	Default macro connections	
X1 Reference voltage and analog inputs and outputs			
1	SCR	Signal cable shield (screen)	
2	AI1	Output frequency/speed reference: 0 to 10 V	
3	AGND	Analog input circuit common	
4	+10 V	Reference voltage 10 V DC	
5	AI2	Actual feedback: 0 to 20 mA	
6	AGND	Analog input circuit common	
7	AO1	Output frequency: 0 to 10 V	
8	AO2	Motor current: 0 to 20 mA	
9	AGND	Analog output circuit common	
X2 & X3 Aux. voltage output and programmable digital inputs			
10	+24 V	Aux. voltage output +24 V DC, max. 250 mA	
11	DGND	Aux. voltage output common	
12	DCOM	Digital input common for all	
13	DI1	Stop (0)/Start (1)	
14	DI2	Not configured	
15	DI3	Constant frequency/speed selection	
16	DI4	Start interlock 1 (1 = allow start)	
17	DI5	Not configured	
18	DI6	Not configured	
X6, X7, X8 Relay outputs			
19	RO1C	Damper control 250 V AC/30 V DC 2 A	Energize damper 19 connected to 21
20	RO1A		
21	RO1B		
22	RO2C	Running 250 V AC/30 V DC 2 A	Running 22 connected to 24
23	RO2A		
24	RO2B	Fault (-1) 250 V AC/30 V DC 2 A	Fault condition 25 connected to 26
25	RO3C		
26	RO3A		
27	RO3B		
X5 Embedded fieldbus			
29	B+	Embedded fieldbus, EFB (EIA-485)	
30	A-		
31	DGND		
54	TERM	Termination switch	
55	BIAS	Bias resistors switch	
X4 Safe torque off			
34	OUT1	Safe torque off. Factory connection. Both circuits must be closed for the drive to start. See chapter <i>The Safe torque off function</i> in the <i>hardware manual</i> of the drive.	
35	OUT2		
36	SGND		
37	IN1		
38	IN2		
X10 24 V AC/DC			
40	24 V AC/DC+ in	R6-R11 only: Ext. 24V AC/DC input to power up the control unit when the main supply is disconnected.	
41	24 V AC/DC- in		

Notes:

- Connected with jumpers at the factory.
- Only frames R6-R11 have terminals 40 and 41 for external 24 V AC/DC input.

ACH580 Packaged Drives with Disconnect

The ACH580 drive sets new standards in both simplicity and reliability, and ensures smooth, energy-efficient operation of your HVAC systems in normal and mission-critical situations.

The ACH580 Packaged Drive is an ACH580 Variable Frequency Drive enclosed with either an input disconnect switch and fast acting fuses (ACH580-PDR) or an input circuit breaker (ACH580-PCR). The ACH580 Packaged Drive provides a door-mounted input disconnect operator (padlockable in the OFF position), electronic motor overload protection, a door mounted control panel with graphical display for local control, provisions for external control connections, and serial communications capability.

UL (NEMA) Type 1 and 12 Packaged Drive units are available from 1 to 100 HP at 208/230V, 1 to 550 HP at 460V, and 2 to 150 HP at 575V. UL (NEMA) Type 1 and 12 units are wall mounted from 1 to 200 HP and floor mounted from 250 to 550 HP.

For outdoor applications, UL (NEMA) Type 3R Packaged Drive units are available from 1 to 100 HP at 208/230V, 1 to 350 HP at 460V and 2 to 150 HP at 575V. Construction is sheet steel with a tough powder coat paint finish for corrosion resistance. A thermostatically controlled space heater and forced ventilated air cooling system are standard.

Features for HVAC

The ACH580 comes standard with an intuitive control panel used to configure, control, and monitor the drive. An optional Bluetooth control panel allows the drive to be configured via the control panel or the DriveTune app.

A robust HVAC firmware package provides drive, motor, and application protection features. Examples of drive protection features include undervoltage, overvoltage, overcurrent, and ground fault protection. The ACH580 also has a variety of motor protection features including overload and stall protections.

Application specific features, such as accepting four separate start interlocks (safeties), along with broken belt detection, are also included. The drive includes BACnet MS/TP, Modbus RTU, and Johnson N2 as standard. Additional protocols, such as BACnet/IP and LonWorks (coming 2019), are available with optional fieldbus adapters.

Technical specifications

Product compliance (complete list on following page)

ACH580-PxR

UL508A

Supply connection

Input voltage (U_1)	
ACH580-xx-xxxA-2	208/240V
ACH580-xx-xxxA-4	480V
ACH580-xx-xxxA-6	600V
Input voltage tolerance	+10% / -15%
Phase	3-phase (1-phase, 240 V)
Frequency	48 to 63 Hz
Line Limitations	Max $\pm 3\%$ of nominal phase to phase input voltage
Power Factor ($\cos \phi$) at nominal load	
ACH580-PxR	0.98
Efficiency at rated power	
ACH580-PxR	98.0%
Power Loss	Approximately 2% of rated power

Motor connection

Supported motor control	Scalar and vector
Supported motor types	Asynchronous motor, permanent magnet motor (vector), SynRM (vector)
Voltage	3-phase, from 0 to supply voltage
Frequency	0 to 500 Hz
Short Term Overload Capacity Variable Torque	110% for 1 min/10min
Peak Overload Capacity Variable Torque	1.35 for 2 second (2 sec / 10 min)
Switching Frequency	2, 4, 8 or 12 kHz Automatic fold back in case of overload
Acceleration/Deceleration Time	0 to 1800 s
Short Circuit Current Rating (SCCR)	
	240V 480V 600V
-PCR	100kA 100kA ≤ 60 Hp: 25 kA ≥ 75 Hp: 10 kA
-PDR	100kA 100kA 100kA

Technical specifications

Inputs and outputs (drive)	
2 analog inputs	Selection of Current/Voltage input mode is user programmable.
Voltage reference	0 (2) to 10 V, $R_{in} > 200 \text{ k}\Omega$
Current reference	0 (4) to 20 mA, $R_{in} = 100 \Omega$
Potentiometer reference value	10 V $\pm 1\%$ max. 20 mA
2 analog outputs	AO1 is user programmable for current or voltage. AO2 current
Voltage reference	0 to 10 V, $R_{load} > 100 \text{ k}\Omega$
Current reference	0 to 20 mA, $R_{load} < 500 \Omega$
Applicable potentiometer	1 k Ω to 10 k Ω
Internal auxiliary voltage	24 V DC $\pm 10\%$, max. 250 mA
Accuracy	+/- 1% full scale range at 25°C (77°F)
Output updating time	2 ms
6 digital inputs	12 to 24 V DC, 10 to 24 V AC, Connectivity of PTC sensors supported by a single digital input. PNP or NPN connection (5 DIs with NPN connection). Programmable
Input Updating Time	2 ms
3 relay outputs	Maximum switching voltage 250 V AC/30 V DC. Maximum continuous current 2 A rms. Programmable, Form C
Contact material	Silver Tin Oxide (AgSnO_2)
PTC, PT100 and PT1000	Any of the analog inputs, or digital input 6, are configurable for PTC with up to 6 sensors.
Adjustable filters on analog inputs and outputs	
All control inputs isolated from ground and power	
Operation	
Air temperature	0 to -15 °C (32 to 5 °F). -15 to +50 °C (5 to 122 °F): No frost allowed. Output derated above +40 °C (104 °F)
Installation site altitude	0 to 1000 m (3281 ft) above sea level Output derated above 1000 m (3281 ft)
Relative humidity	5 to 95% No condensation allowed Maximum relative humidity is 60% in the presence of corrosive gasses
Atmospheric pressure	70 to 106 kPa (10.2 to 15.4 PSI) 0.7 to 1.05 atmospheres
Siesmic	Risk category IV Certified (IBC 2018)

Feature overview

Communication

Protocols as standard (EIA-485): BACnet MS/TP, Modbus RTU, Johnson Controls N2

Available as plug-in options: BACnet/IP, Modbus TCP, PROFIBUS-DP, DeviceNet, EtherNet/IP

Application functions

Start interlock

Delayed start

Run permissive (damper monitoring)

Override operation mode

Real-time clock (scheduling)

PID controllers for motor and process

Motor flying start

Motor preheating

Energy optimizer and calculators

Timer

2 or 3 wire start/stop

Ramp to stop

2 independent adjustable accel/decel ramp

Protection functions

Overvoltage controller

Undervoltage controller

Motor earth-leakage monitoring

Motor short-circuit protection

Motor overtemperature protection

Output and input switch supervision

Motor overload protection (UL508C)

Phase-loss detection (both motor and supply)

Under load supervision (belt loss detection)

Overload supervision

Stall protection

Loss of reference

Panel loss

Ground fault

External events

Overcurrent

Current limit regulator

Transient/Surge protection (MOV and choke)

Panel functions

First start assistant

Primary settings for HVAC applications

Hand-Off-Auto operation mode

HVAC quick set-up

Includes Day, Date and Time

Operator Panel Parameter Backup (read/write)

Full Graphic and Multilingual Display for Operator Control,

Parameter Set-Up and Operating Data Display:

- Output Frequency (Hz)
- Speed (RPM)
- Motor Current
- Calculated % Motor Torque
- Calculated Motor Power (kW)
- DC Bus Voltage
- Output Voltage
- Heatsink Temperature
- Elapsed Time Meter (resettable)
- kWh (resettable)
- Input / Output Terminal Monitor
- PID Actual Value (Feedback) & Error Fault Text
- Warning Text

- Three (3) Scalable Process Variable Displays
- User-Definable Engineering Units

Motor control features

Scalar (V/Hz) and vector modes of motor control

V/Hz shapes

- Linear
- Squared

Energy optimization

IR compensation

Slip compensation

Three (3) Critical Frequency Lockout Bands

PID control

One (1) Process PID

Four (4) Integral Independent Programmable PID

Setpoint Controllers (Process and External)

External Selection between Two (2) Sets of Process

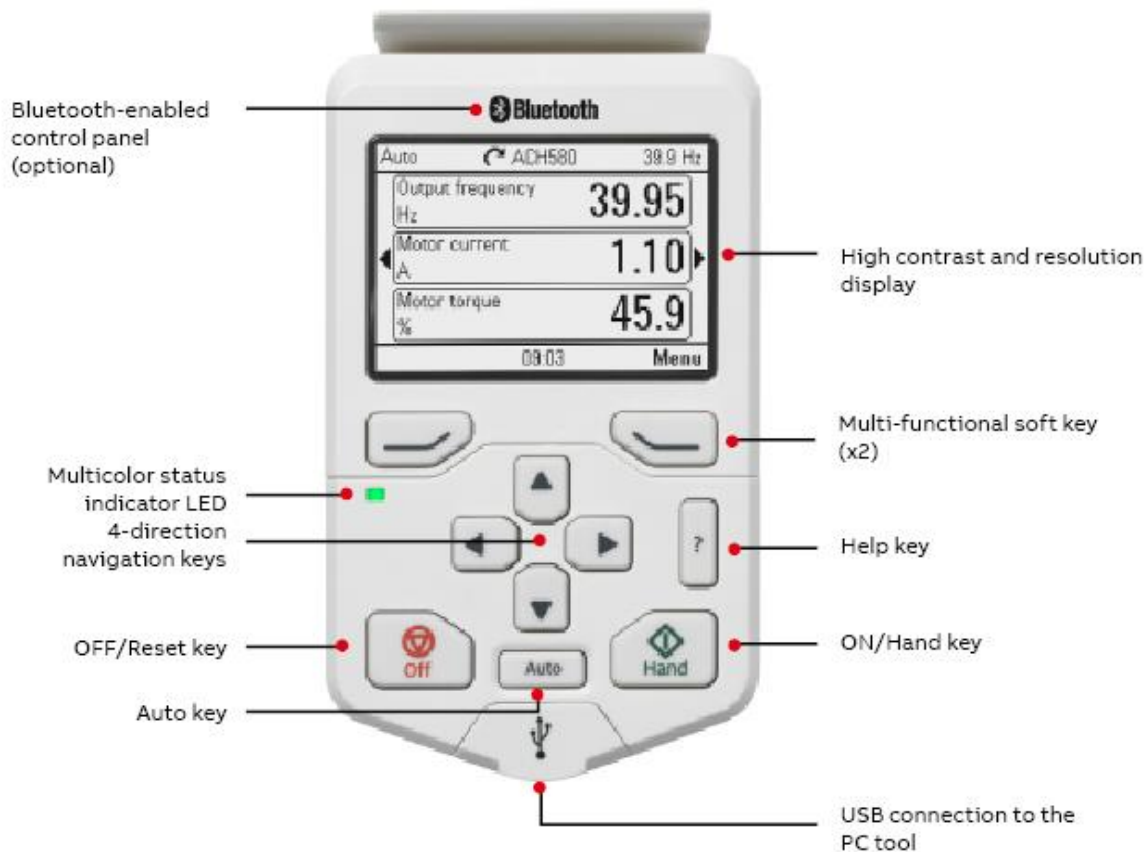
PID Controller Parameters

PID Sleep/Wake-Up

Control panel features

The ACH580 Assistant Control Panel features:

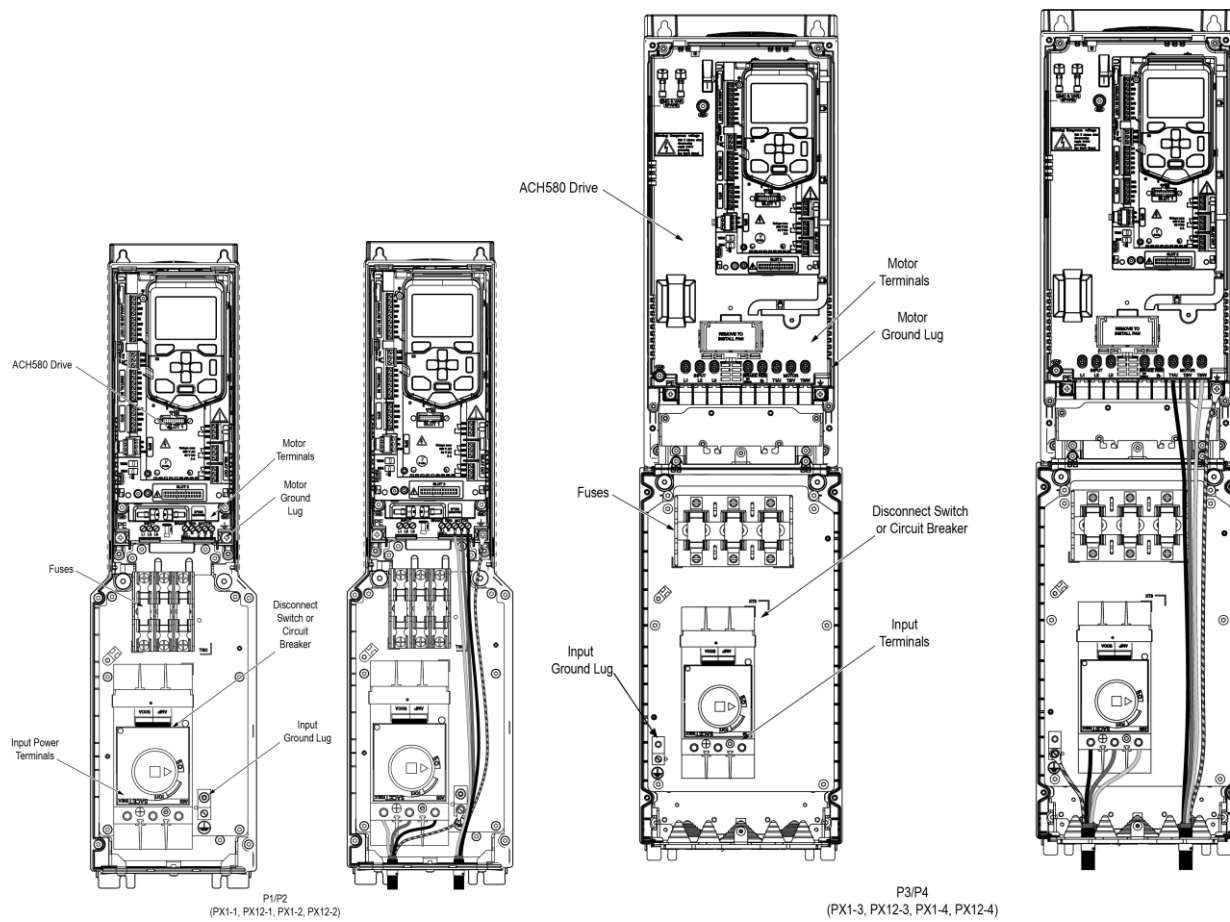
- Intuitive to operate
- Primary Setting menu to ease drive commissioning
- Real-time clock
- Diagnostic and maintenance functions
- Full-graphic display, including chart, graph, and meter options
- 21 editable home views
- USB interface for PC and tool connection as standard
- Parameters are alpha-numeric
- North American version supports 14 languages as standard
- Dedicated "Help" key
- 4 user sets
- Parameters are stored in control panel memory for later transfer to other drives or for backup of a particular system
- Back-up and restore parameters and/or motor data
- Automatic back-up 2 hours after parameter change
- Modified parameter display
- Creates unique short menu
- Shows parameters that differ from the default
- Bluetooth connectivity for use with mobile device (requires +J429 option)



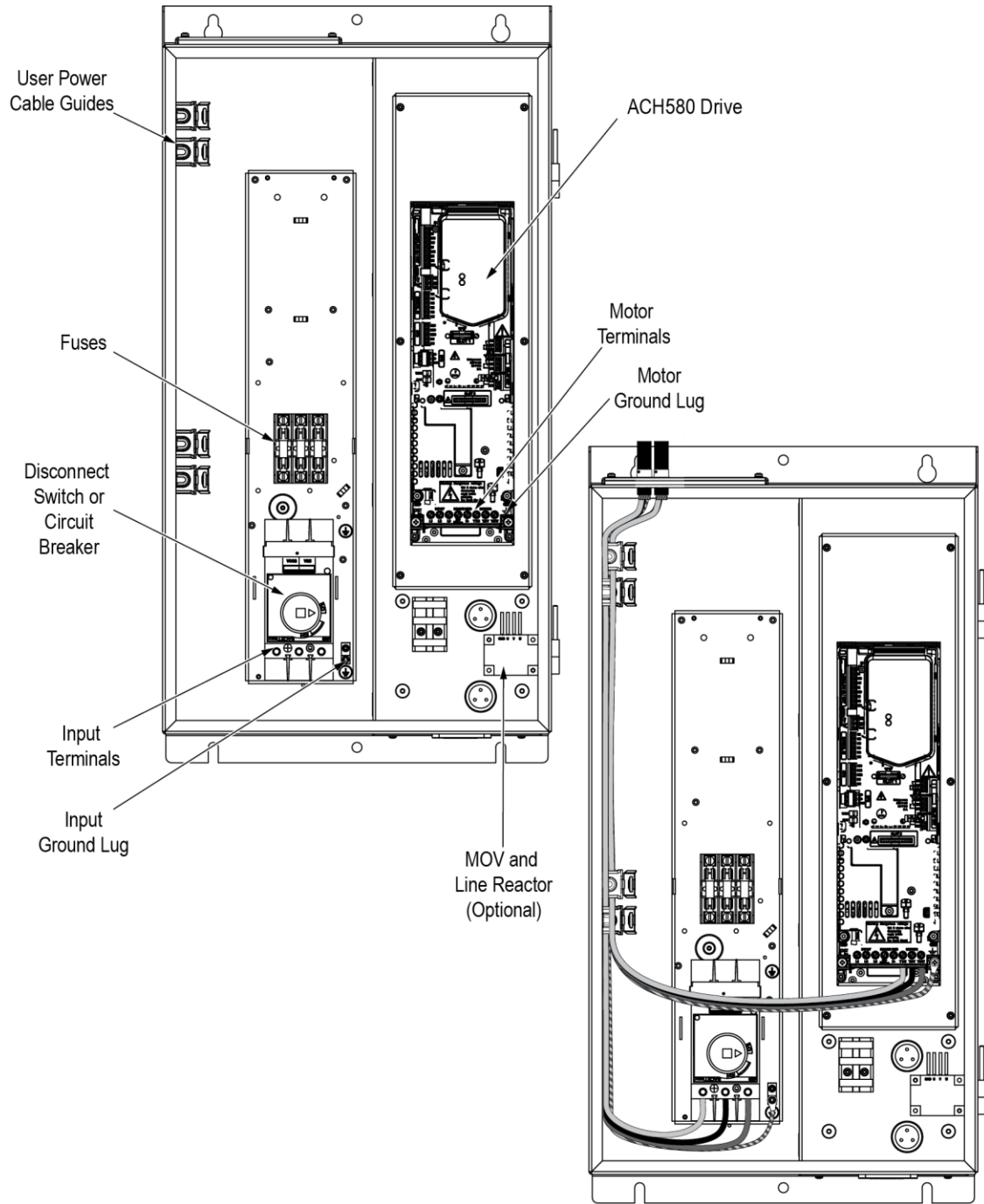
Cable connections

The following illustrations show the ACH580 Packaged Drive cable connection points for the various enclosure styles. The illustrations indicate the location of input and output power connections as well as equipment and motor grounding connection points.

ACH580-PCR and PDR packages are configured for wiring access from the bottom only on vertical wall mount units and from the top only on UL (NEMA) Type 1 and 12 standard wall mount units. UL (NEMA) Type 3R enclosures are configured for bottom access. At least three separate metallic conduits are required, one for input power, one for output power to the motor and one for control signals.

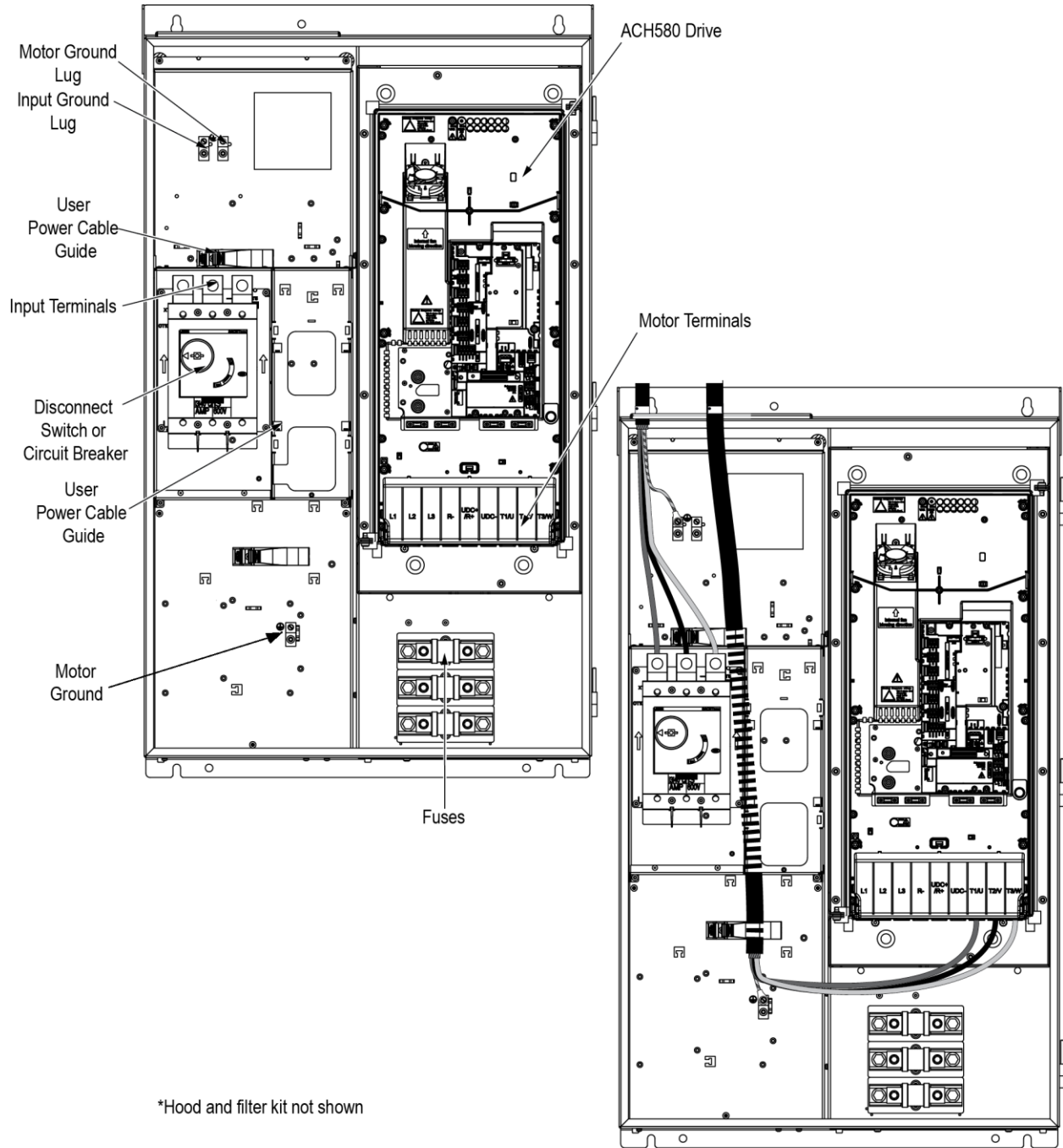


Cable connections



P1/P2
(PX1-1, PX12-1, PX1-2, PX12-2)

Control connections

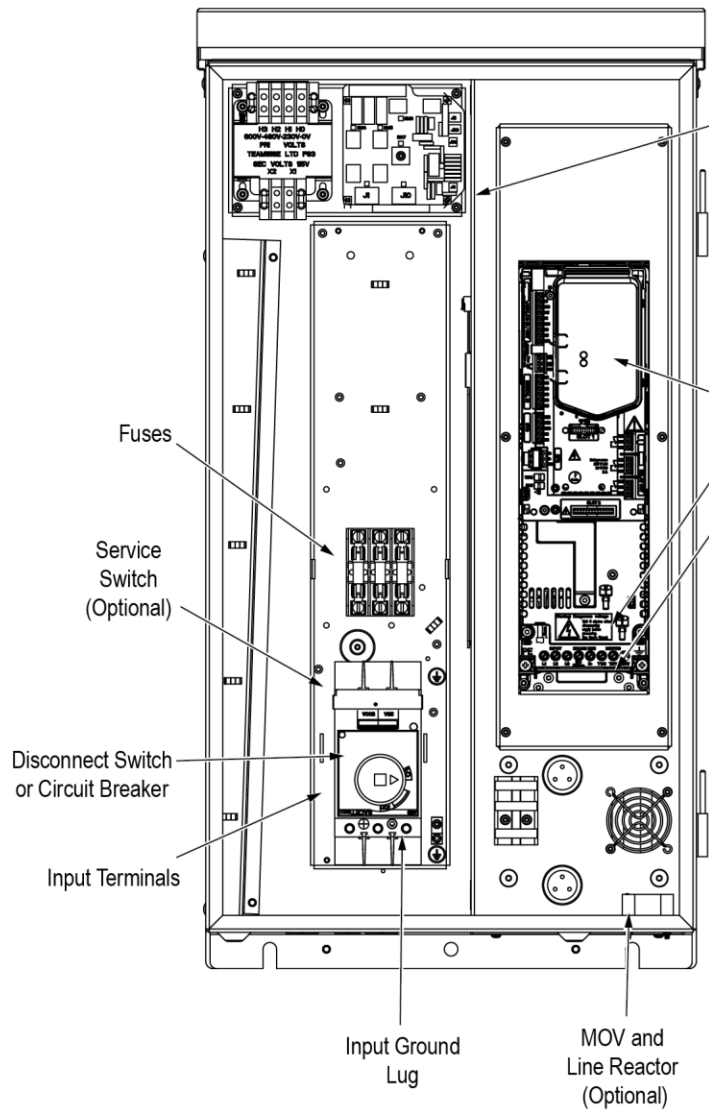


*Hood and filter kit not shown

PB3
 (PXB1-3, PXB12-3*)



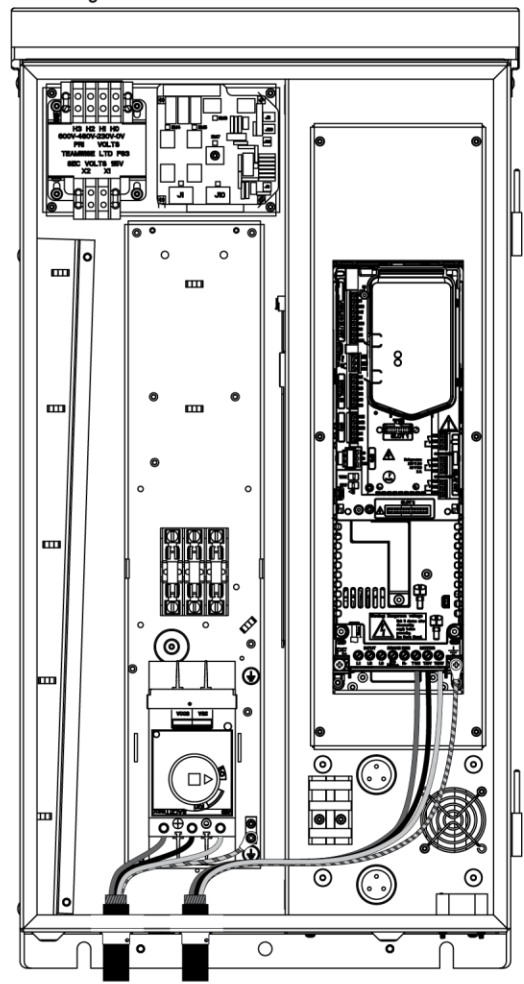
Cable connections



RHTR Temperature HI/LO Jumper (X1)	Heater ON Temperature	Heater OFF Temperature
Default Setting (X1 jumper in LO position)	14.4 °C 58 °F	21.4 °C 70.5 °F
Alternate Setting (X1 jumper in HI position)	17.8 °C 64 °F	24.4 °C 76.5 °F

The alternate (HI) setting further reduces the likelihood of condensate in high humidity environments.

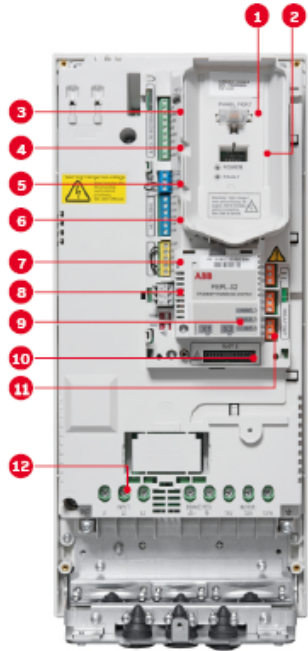
- ACH580 Drive
- Motor Terminals
- Motor Ground Lug



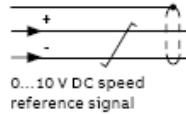
PB1/PB2
(PXB3R-1, PXB3R-2)

Control connections

Default control connections



1. Panel port (PC tools, control panel)
2. ABB drive customizer port for programming the drive without mains
3. Analog inputs (2 × AI)
4. Analog outputs (2 × AO)
5. 24 V DC output
6. Digital inputs (6 × DI)
7. Safe torque off (STO)
8. Embedded fieldbus
9. Communication options (fieldbuses)
10. Analog and digital I/O extensions
11. Relay outputs (3 × RO)
12. Mains connection



Terminal	Meaning	Default macro connections	
X1 Reference voltage and analog inputs and outputs			
1	SCR	Signal cable shield (screen)	
2	AI1	Output frequency/speed reference: 0 to 10 V	
3	AGND	Analog input circuit common	
4	+10 V	Reference voltage 10 V DC	
5	AI2	Actual feedback: 0 to 20 mA	
6	AGND	Analog input circuit common	
7	AO1	Output frequency: 0 to 10 V	
8	AO2	Motor current: 0 to 20 mA	
9	AGND	Analog output circuit common	
X2 & X3 Aux. voltage output and programmable digital inputs			
10	+24 V	Aux. voltage output +24 V DC, max. 250 mA	
11	DGND	Aux. voltage output common	
12	DCOM	Digital input common for all	
13	DI1	Stop (0)/Start (1)	
14	DI2	Not configured	
15	DI3	Constant frequency/speed selection	
16	DI4	Start interlock 1 (1 = allow start)	
17	DI5	Not configured	
18	DI6	Not configured	
X6, X7, X8 Relay outputs			
19	RO1C	Damper control 250 V AC/30 V DC 2 A	Energize damper 19 connected to 21
20	RO1A		
21	RO1B		
22	RO2C	Running 250 V AC/30 V DC 2 A	Running 22 connected to 24
23	RO2A		
24	RO2B		
25	RO3C	Fault (-1) 250 V AC/30 V DC 2 A	Fault condition 25 connected to 26
26	RO3A		
27	RO3B		
X5 Embedded fieldbus			
29	B+	Embedded fieldbus, EFB (EIA-485)	
30	A-		
31	DGND		
54	TERM	Termination switch	
55	BIAS	Bias resistors switch	
X4 Safe torque off			
34	OUT1	Safe torque off. Factory connection. Both circuits must be closed for the drive to start. See chapter <i>The Safe torque off function</i> in the <i>hardware manual</i> of the drive.	
35	OUT2		
36	SGND		
37	IN1		
38	IN2		
X10 24 V AC/DC			
40	24 V AC/DC+ in	R6-R11 only: Ext. 24V AC/DC input to power up the control unit when the main supply is disconnected.	
41	24 V AC/DC- in		

Notes:

- Connected with jumpers at the factory.
- Only frames R6-R11 have terminals 40 and 41 for external 24 V AC/DC input.

Engineering Data Summary

Replacement Fuses

Drive input fuses are recommended to disconnect the drive from power in the event that a component fails in the drive's power circuitry. Recommended drive input fuse specifications are listed in the *Submittal Schedule Details* and in the *Fuse Ratings Table*. Fuse rating information is provided for customer reference.

Item	Catalog Number	Drive Input Fuse Ratings	
		Amps (600V)	Bussmann Type
1	ACH580-PCR-044A-4	60	Class J
2	ACH580-PCR-07A6-4	15	Class T
3	ACH580-PCR-023A-4	30	Class T
4	ACH580-PCR-052A-4	80	Class J

Terminal Sizes / Cable Connection Requirements

Power and motor cable terminal sizes and connection requirements are shown in the *Submittal Schedule Details* and in the *Terminal Sizes / Cable Connection Requirements Table*. The information provided below is for connections to input power and motor cables. These connections may be made to an input circuit breaker or disconnect switch, a motor terminal block, overload relay, and/or directly to bus bars and ground lugs. The table also lists torque that should be applied when tightening terminals and spacing requirements where multiple mounting holes are provided in the bus bar.

Item	Catalog Number	Input Wiring	Output Wiring	Ground Wiring
1	ACH580-PCR-044A-4	#14...#1/0 5.2 lbf-ft	#20...#2 2.6 lbf-ft	#14...#2 #14...#10: 2.9 lbf-ft; #6...#4: 3.8 lbf-ft; #2: 4.1 lbf-ft
2	ACH580-PCR-07A6-4	#14...#1/0 5.2 lbf-ft	#24...#10 0.8 lbf-ft	#14...#2 #14...#10: 2.9 lbf-ft; #6...#4: 3.8 lbf-ft; #2: 4.1 lbf-ft
3	ACH580-PCR-023A-4	#14...#1/0 5.2 lbf-ft	#20...#6 1.2 lbf-ft	#14...#2 #14...#10: 2.9 lbf-ft; #6...#4: 3.8 lbf-ft; #2: 4.1 lbf-ft
4	ACH580-PCR-052A-4	#10...250MCM 10.3 lbf-ft	#20...#1 3 lbf-ft	#14...#2 #14...#10: 2.9 lbf-ft; #6...#4: 3.8 lbf-ft; #2: 4.1 lbf-ft

Heat Dissipation Requirements

The cooling air entering the drive must be clean and free from corrosive materials. The *Submittal Schedule Details* and the *Heat Dissipation Requirements table* below give the heat dissipated into the hot air exhausted from the drives. If the drives are installed in a confined space, the heat must be removed from the area by ventilation or air conditioning equipment.

Item	Catalog Number	Watts	BTU/Hr
1	ACH580-PCR-044A-4	648	2,210
2	ACH580-PCR-07A6-4	116	396
3	ACH580-PCR-023A-4	340	1,159
4	ACH580-PCR-052A-4	877	2,991

Dimensions and Weights

Dimensions and weights of the drives provided are given in the *Submittal Schedule Details* and in the *Dimensions and Weights* Table. The table also lists the applicable dimension drawings that include additional detail. Dimension drawings may be provided in the back of this submittal.

Item	Catalog Number	Height mm (in)	Width mm (in)	Depth mm (in)	Weight kg (lbs)
1	ACH580-PCR-044A-4	885 (34.85)	213 (8.39)	336 (13.23)	17.8 (40)
2	ACH580-PCR-07A6-4	625 (24.61)	163 (6.42)	316 (12.45)	8.2 (19)
3	ACH580-PCR-023A-4	725 (28.55)	163 (6.42)	321 (12.64)	10 (23)
4	ACH580-PCR-052A-4	1032 (40.63)	213 (8.39)	362 (14.26)	27.2 (60)

Free Space Requirements, Standalone

Free Space Requirements for standalone mounting.

Item	Catalog Number	Standalone, Above mm (in)	Standalone, Below mm (in)	Standalone, Sides mm (in)
1	ACH580-PCR-044A-4	200 (7.88)	53 (2.09)	150 (5.91)
2	ACH580-PCR-07A6-4	150 (5.91)	86 (3.39)	150 (5.91)
3	ACH580-PCR-023A-4	150 (5.91)	86 (3.39)	150 (5.91)
4	ACH580-PCR-052A-4	53 (2.09)	200 (7.88)	150 (5.91)

Free Space Requirements, Side by Side

Free Space Requirements for side by side mounting.

Item	Catalog Number	Side by Side, Above mm (in)	Side by Side, Below mm (in)	Side by Side, Sides mm (in)
1	ACH580-PCR-044A-4	200 (7.88)	200 (7.88)	0 (0.01)
2	ACH580-PCR-07A6-4	200 (7.88)	200 (7.88)	0 (0.01)
3	ACH580-PCR-023A-4	200 (7.88)	200 (7.88)	0 (0.01)
4	ACH580-PCR-052A-4	200 (7.88)	200 (7.88)	0 (0.01)

Product Short Circuit Current Rating

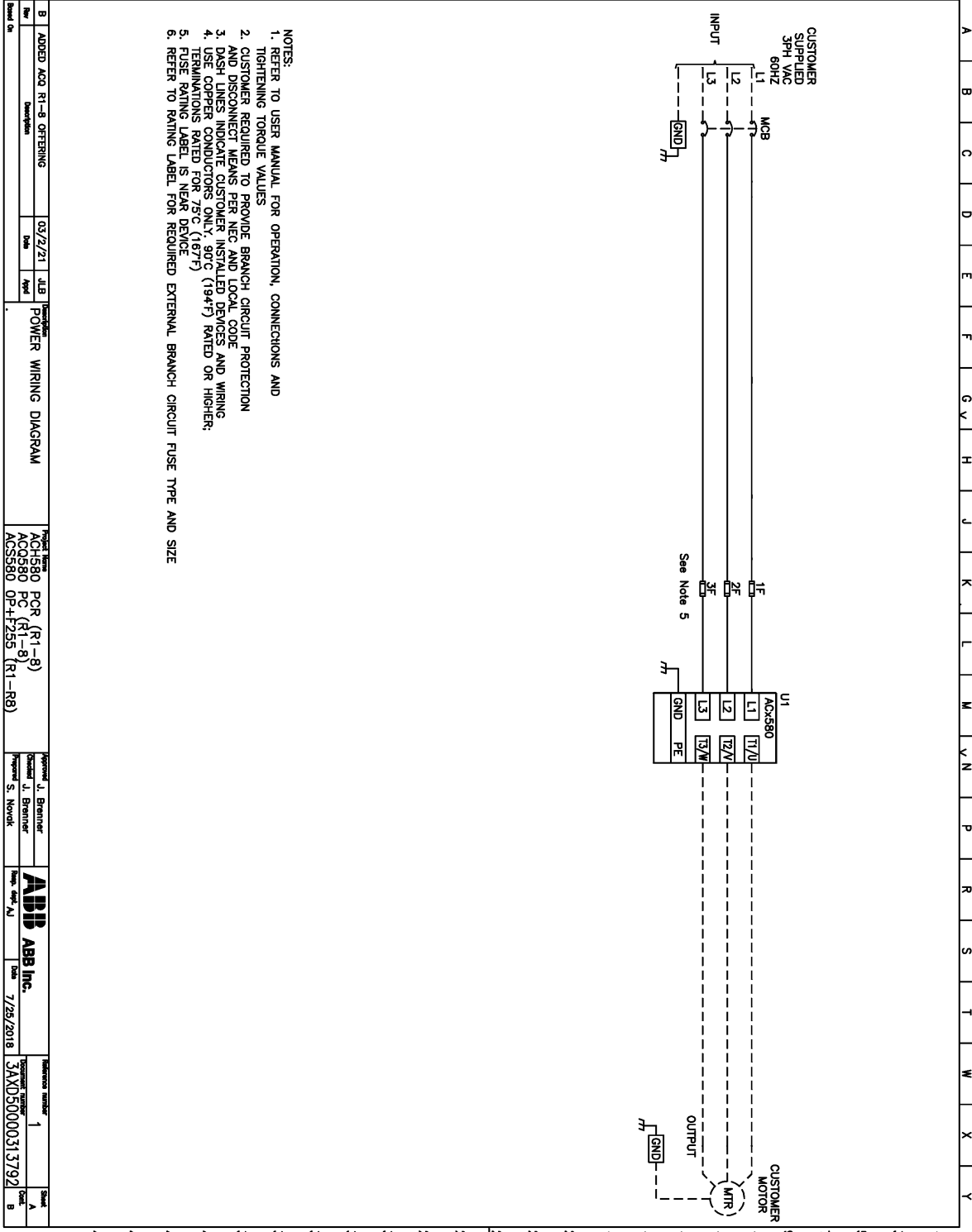
Short circuit ratings shown below are as show on the device rating label.

Item	Catalog Number	Short Circuit Current Rating
1	ACH580-PCR-044A-4	100 kA
2	ACH580-PCR-07A6-4	100 kA
3	ACH580-PCR-023A-4	100 kA
4	ACH580-PCR-052A-4	100 kA

Item 1	Part Number ACH580-PCR-044A-4	Customer Designation BCHP PUMPS
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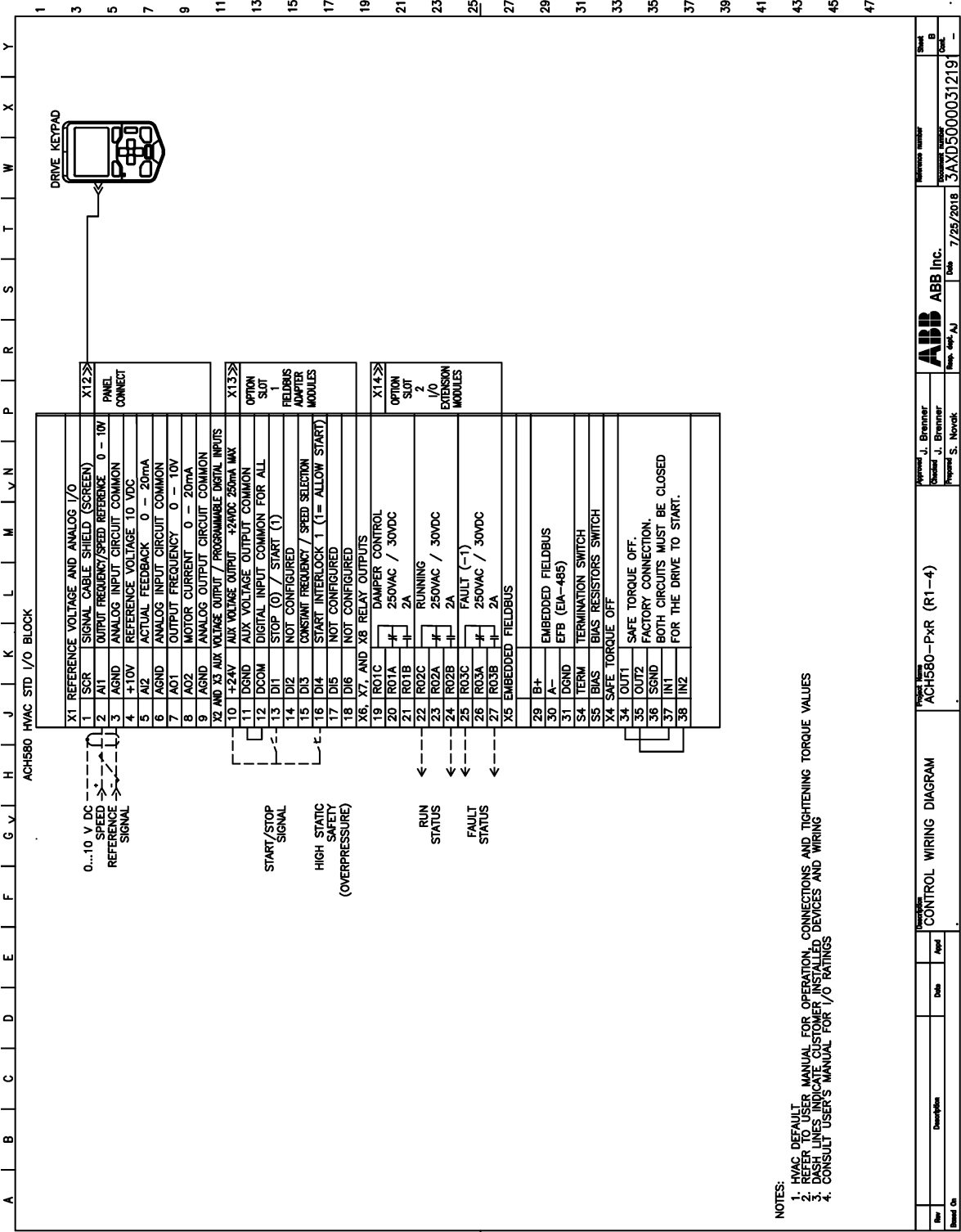


- NOTES:**
1. REFER TO USER MANUAL FOR OPERATION, CONNECTIONS AND TIGHTENING TORQUE VALUES
 2. CUSTOMER REQUIRED TO PROVIDE BRANCH CIRCUIT PROTECTION AND DISCONNECT MEANS PER NEC AND LOCAL CODE
 3. DASH LINES INDICATE CUSTOMER INSTALLED DEVICES AND WIRING
 4. USE COPPER CONDUCTORS ONLY, 90°C (194°F) RATED OR HIGHER; TERMINATIONS RATED FOR 75°C (167°F)
 5. FUSE RATING LABEL IS NEAR DEVICE
 6. REFER TO RATING LABEL FOR REQUIRED EXTERNAL BRANCH CIRCUIT FUSE TYPE AND SIZE

Rev	Description	Date	App'd	Project Name	Author	Scale	Project	Drawn	Date	Reference number	Sheet
B	ADDED A01 R1-8 OPENING	03/2/21	JLB	ACH580 PC (R1-8)	J. Brenner		ACH580 PC (R1-8)	S. Novak	7/25/2018	3AXD50000313792	1 of 1
<p>POWER WIRING DIAGRAM</p> <p>Project Name: ACH580 PC (R1-8) PC (R1-8) OP+255 (R1-R8)</p> <p>Author: J. Brenner Scale: J. Brenner Project: S. Novak</p> <p>Drawn: S. Novak Date: 7/25/2018</p> <p>Reference number: 3AXD50000313792</p> <p>Sheet: 1 of 1</p>											

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Item 1	Part Number ACH580-PCR-044A-4	Customer Designation BCHP PUMPS
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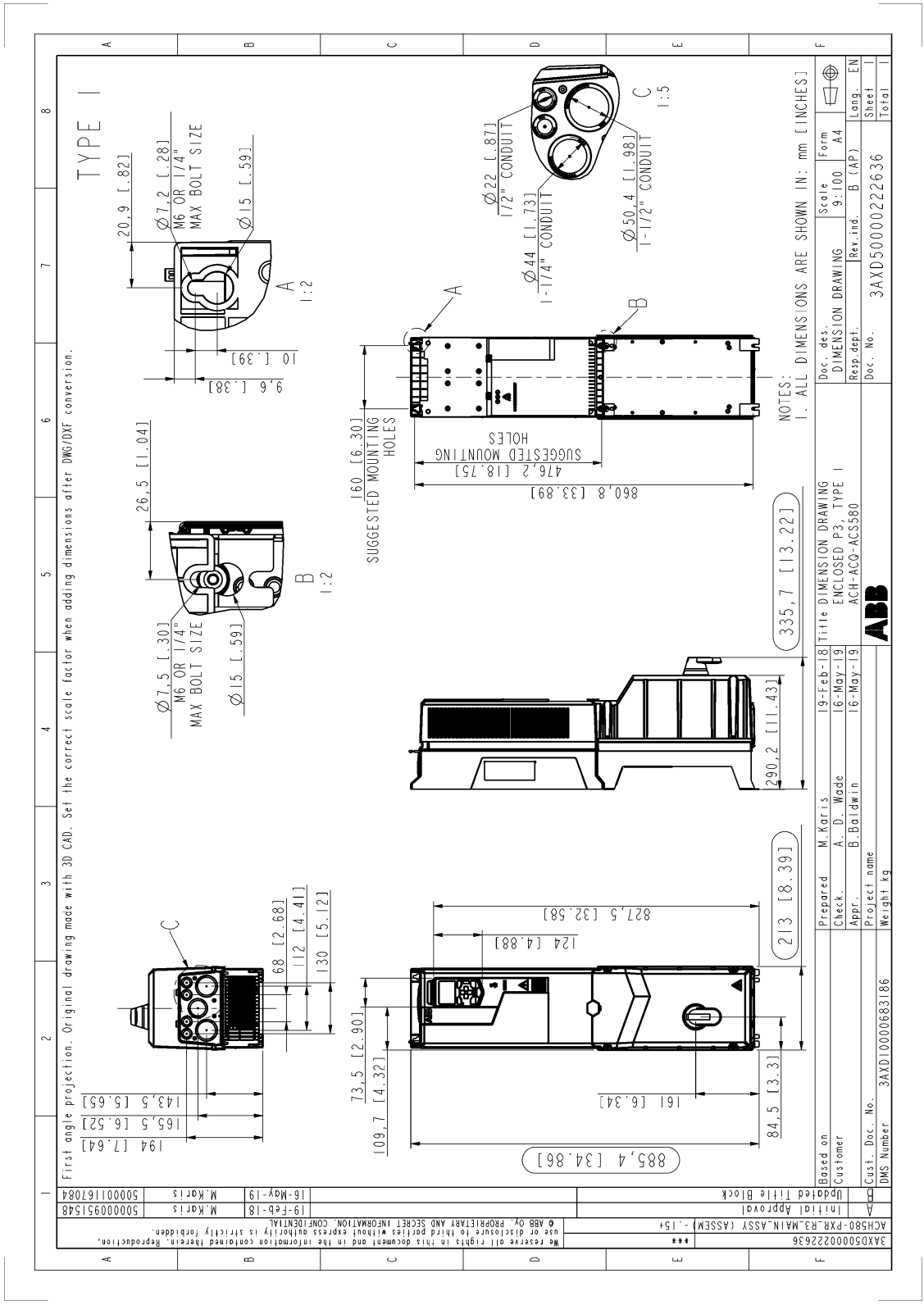


NOTES:
 1. HVAC DEFAULT MANUAL FOR OPERATION, CONNECTIONS AND TIGHTENING TORQUE VALUES
 2. REFER TO USER MANUAL FOR OPERATION, CONNECTIONS AND TIGHTENING TORQUE VALUES
 3. LINES INDICATE CUSTOMER INSTALLED DEVICES AND WIRING
 4. CONSULT USER'S MANUAL FOR I/O RATINGS

Rev	Description	Date	App'd
CONTROL WIRING DIAGRAM			
Project Name ACH580-PxR (R1-4)		Release number ABB ABB Inc.	Sheet 0
Project Manager Harold J. Brenner		Date 7/25/2018	Doc 3AXD50000312191
Designer Dexter J. Brenner		Rev. desc. AJ	
Prepared Robert S. Novak			

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Item 1	Part Number ACH580-PCR-044A-4	Customer Designation BCHP PUMPS
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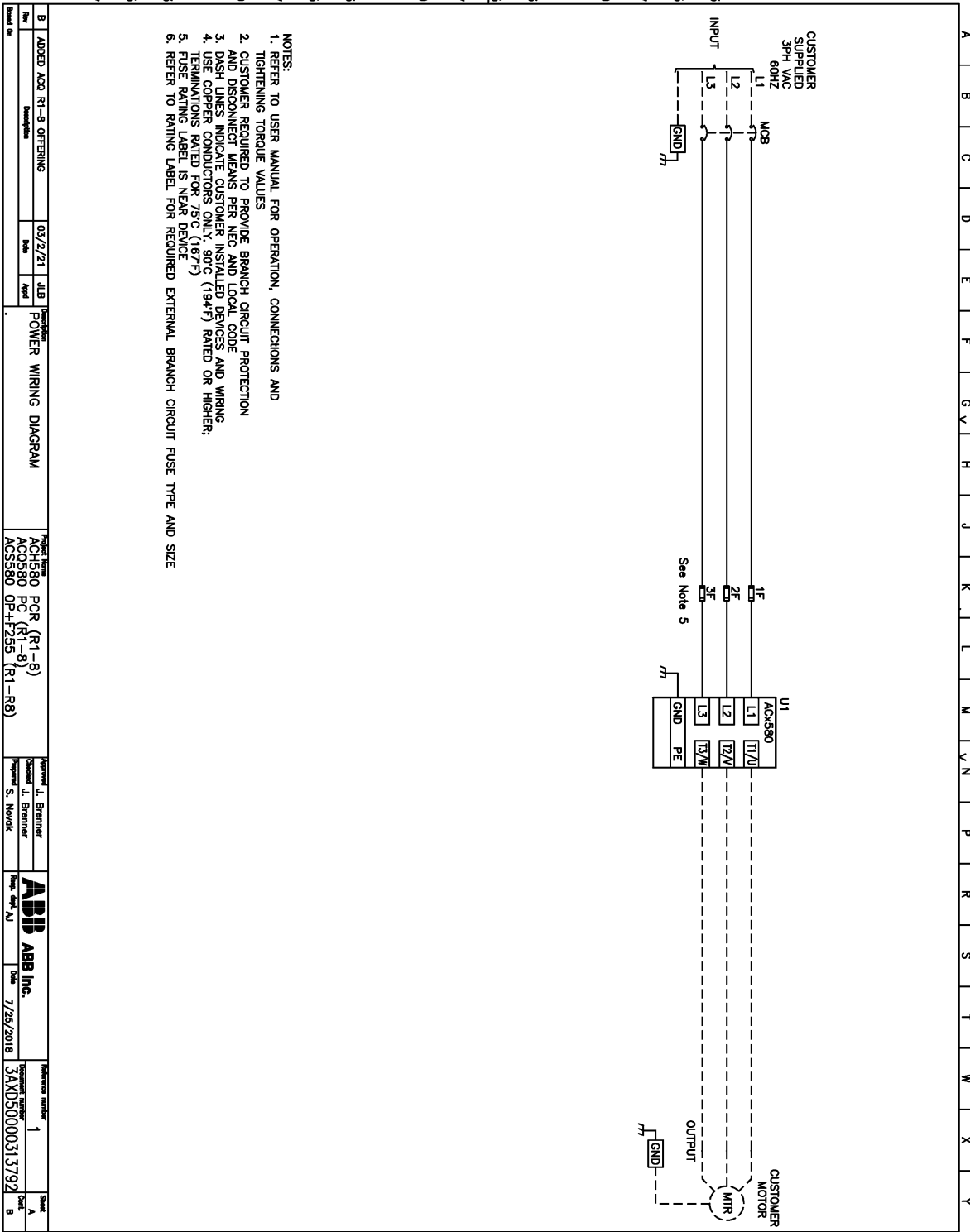


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Item 2	Part Number ACH580-PCR-07A6-4	Customer Designation CCHP PUMPS
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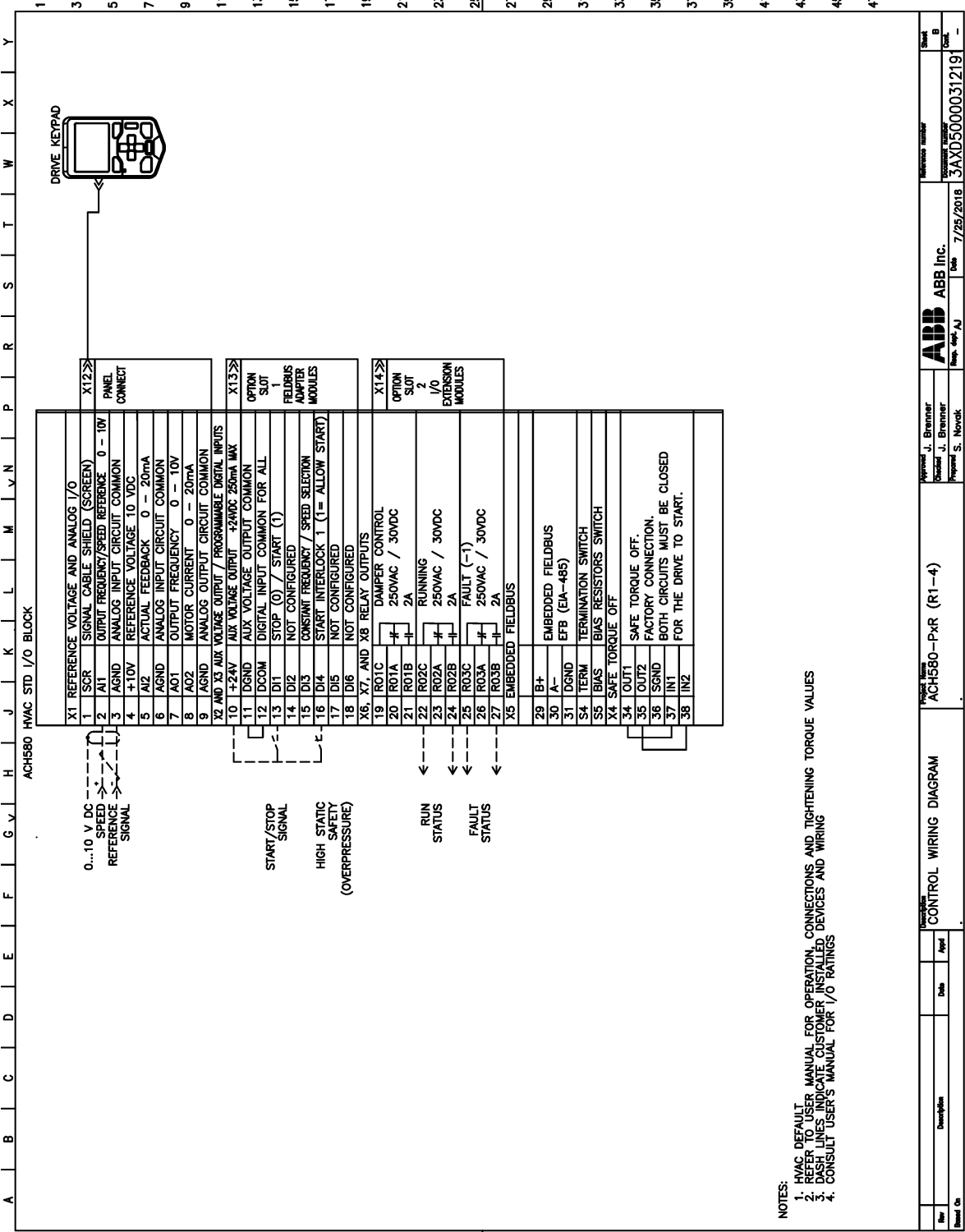


- NOTES:
1. REFER TO USER MANUAL FOR OPERATION, CONNECTIONS AND TIGHTENING TORQUE VALUES
 2. CUSTOMER REQUIRED TO PROVIDE BRANCH CIRCUIT PROTECTION AND DISCONNECT MEANS PER NEC AND LOCAL CODE
 3. DASH LINES INDICATE CUSTOMER INSTALLED DEVICES AND WIRING
 4. USE COPPER CONDUCTORS ONLY, 90°C (194°F) RATED OR HIGHER; TERMINATIONS RATED FOR 75°C (167°F)
 5. FUSE RATING LABEL IS NEAR DEVICE
 6. REFER TO RATING LABEL FOR REQUIRED EXTERNAL BRANCH CIRCUIT FUSE TYPE AND SIZE

Item	Description	Date	Appr.	Revision	Project Name	Approved	Company	Issue Date	Revision Number	Sheet
B	ADDED ACH R1-B OPENING	03/22/21	ALB	1	POWER WIRING DIAGRAM	J. Brenner	ABB Inc.	7/25/2018	3AXD50000313792	8
Revised On	Description	Date	Appr.	Revision	Project Name	Approved	Company	Issue Date	Revision Number	Sheet
					ACH580 PCR (R1-B)	J. Brenner	ABB Inc.	7/25/2018	3AXD50000313792	A
					ACH580 PC (R1-B)	S. Novak	ABB Inc.	7/25/2018	3AXD50000313792	B
					ACH580 OP+255 (R1-R9)					

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Item	Part Number	Customer Designation
2	ACH580-PCR-07A6-4	CCHP PUMPS

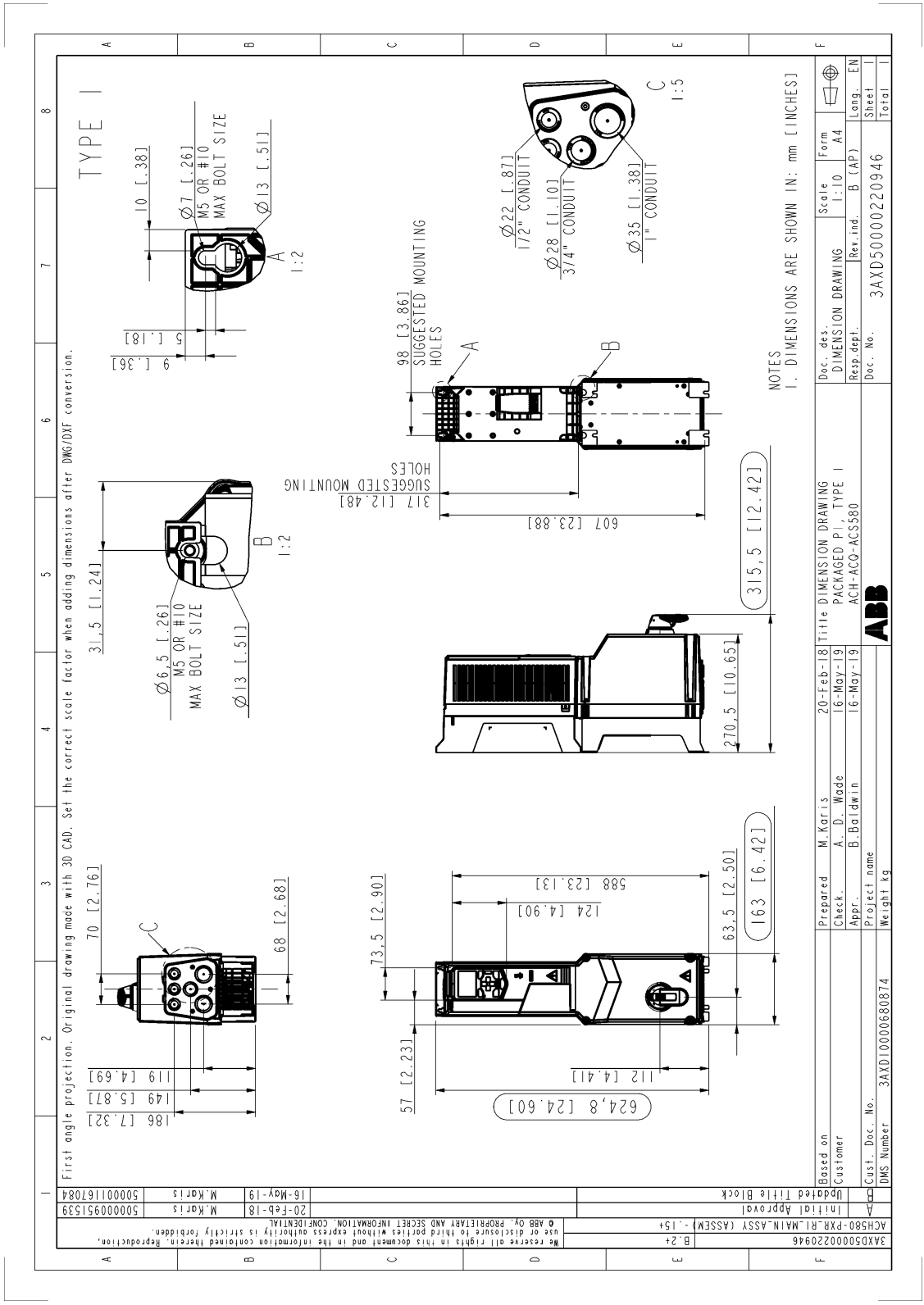


NOTES:
 1. HVAC DEFAULT USER MANUAL FOR OPERATION, CONNECTIONS AND TIGHTENING TORQUE VALUES
 2. REFER TO USER MANUAL FOR OPERATION, CONNECTIONS AND TIGHTENING TORQUE VALUES
 3. LINES INDICATE CUSTOMER INSTALLED DEVICES AND WIRING
 4. CONSULT USER'S MANUAL FOR I/O RATINGS

Rev	Description	Date	App'd
CONTROL WIRING DIAGRAM			
Project Name		ACH580-PxR (R1-4)	
Project Manager			
Project Engineer			
Project Designer			
Project Checker			
Project Approver			
Project Date		7/25/2018	
Project Number		3AXD50000312191	
Project Title			
Project Location			
Project Status			
Project Version			
Project Revision			
Project Change			
Project Comment			
Project Note			
Project Detail			
Project Sheet			
Project Page			
Project Total			

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Item 2	Part Number ACH580-PCR-07A6-4	Customer Designation CCHP PUMPS
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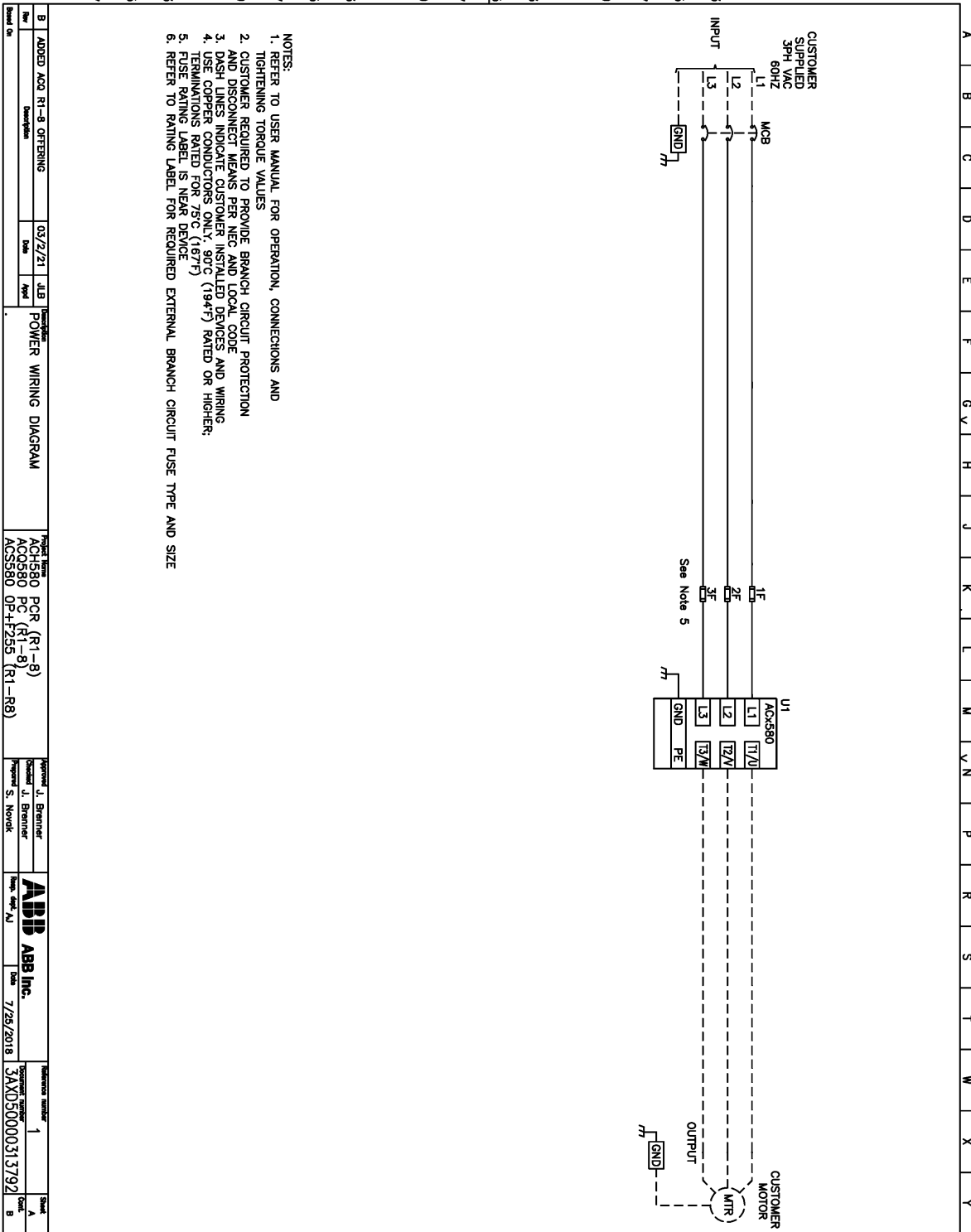


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Item 3	Part Number ACH580-PCR-023A-4	Customer Designation PCSP PUMPS
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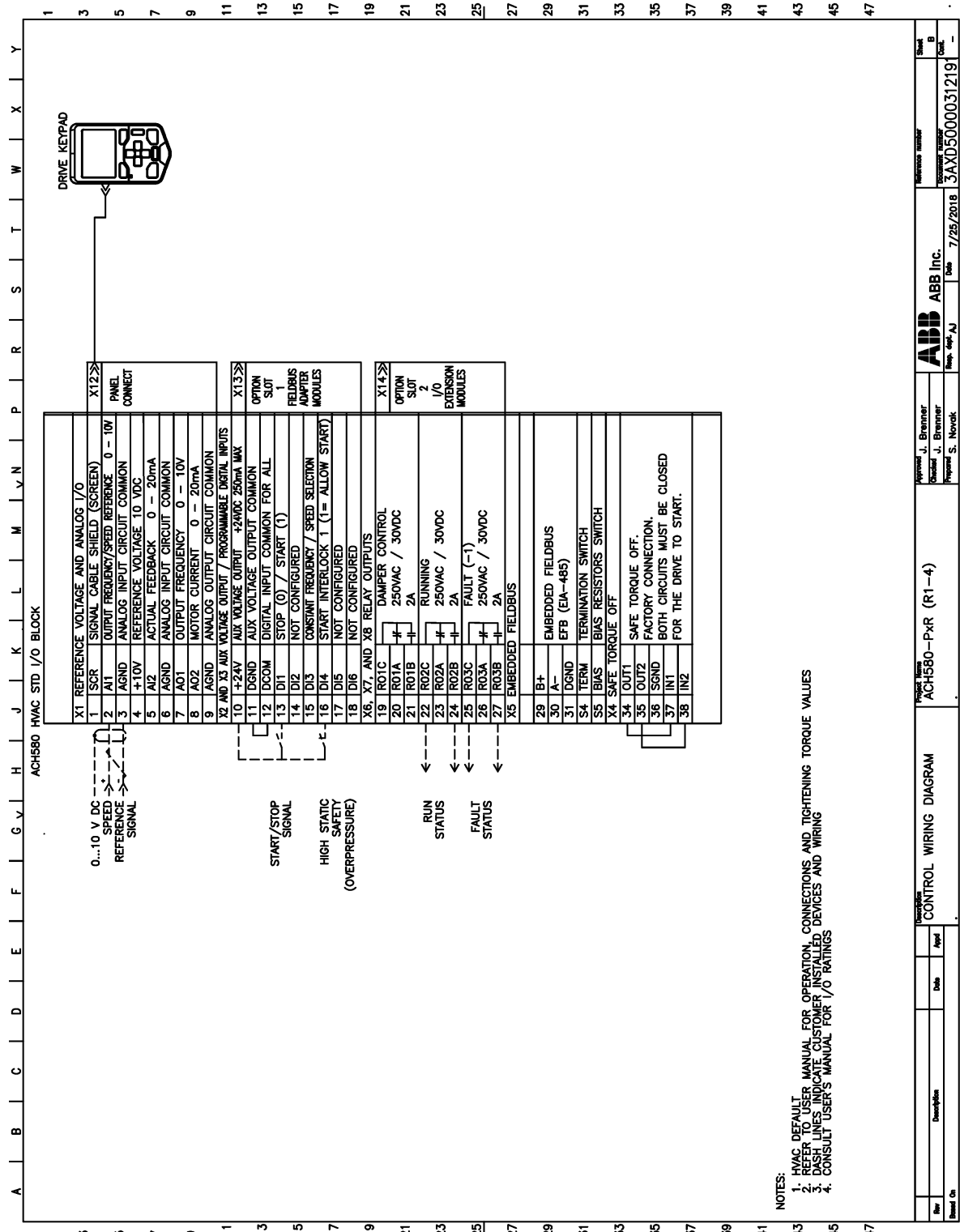


- NOTES:
1. REFER TO USER MANUAL FOR OPERATION, CONNECTIONS AND TIGHTENING TORQUE VALUES
 2. CUSTOMER REQUIRED TO PROVIDE BRANCH CIRCUIT PROTECTION AND DISCONNECT MEANS PER NEC AND LOCAL CODE
 3. DASH LINES INDICATE CUSTOMER INSTALLED DEVICES AND WIRING
 4. USE COPPER CONDUCTORS ONLY, 90°C (194°F) RATED OR HIGHER; TERMINATIONS RATED FOR 75°C (167°F)
 5. FUSE RATING LABEL IS NEAR DEVICE
 6. REFER TO RATING LABEL FOR REQUIRED EXTERNAL BRANCH CIRCUIT FUSE TYPE AND SIZE

Item B	Added ACH580 PC (R1-8)	Description POWER WIRING DIAGRAM	Date 03/22/21	By JLB	Project Name ACH580 PC (R1-8) ACS580 OP+255 (R1-R8)	Approved By J. Brenner	Approved Date 7/25/2018	Revision Number 1	Sheet A
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Item 3	Part Number ACH580-PCR-023A-4	Customer Designation PCSP PUMPS
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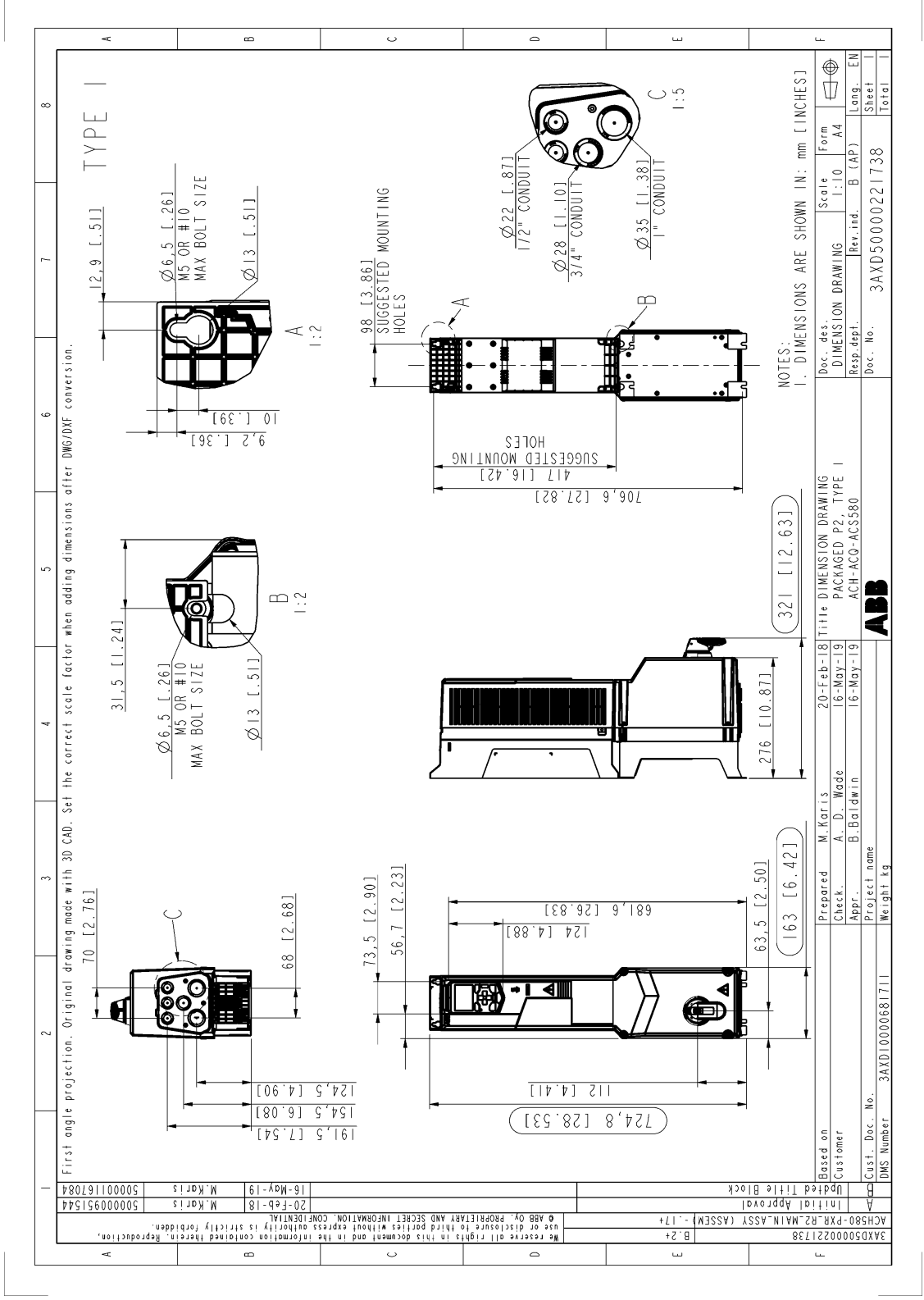


NOTES:
 1. HVAC DEFAULT USER MANUAL FOR OPERATION, CONNECTIONS AND TIGHTENING TORQUE VALUES
 2. REFER TO USER MANUAL FOR OPERATION, CONNECTIONS AND TIGHTENING TORQUE VALUES
 3. LINES INDICATE CUSTOMER INSTALLED DEVICES AND WIRING
 4. CONSULT USER'S MANUAL FOR I/O RATINGS

Revised On	Revised By	Revised Title	Revised Date	Revised App'd
		ACH580-PxR (R1-4)		
CONTROL WIRING DIAGRAM				
Prepared By	Checked By	Released By	Released Date	Released For
Prepared S. Novak	Checked J. Brenner	Released J. Brenner	Released 7/25/2018	Released 3AXD50000312191
ABB ABB Inc.				
Reference number: 3AXD50000312191				

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Item 3	Part Number ACH580-PCR-023A-4	Customer Designation PCSP PUMPS
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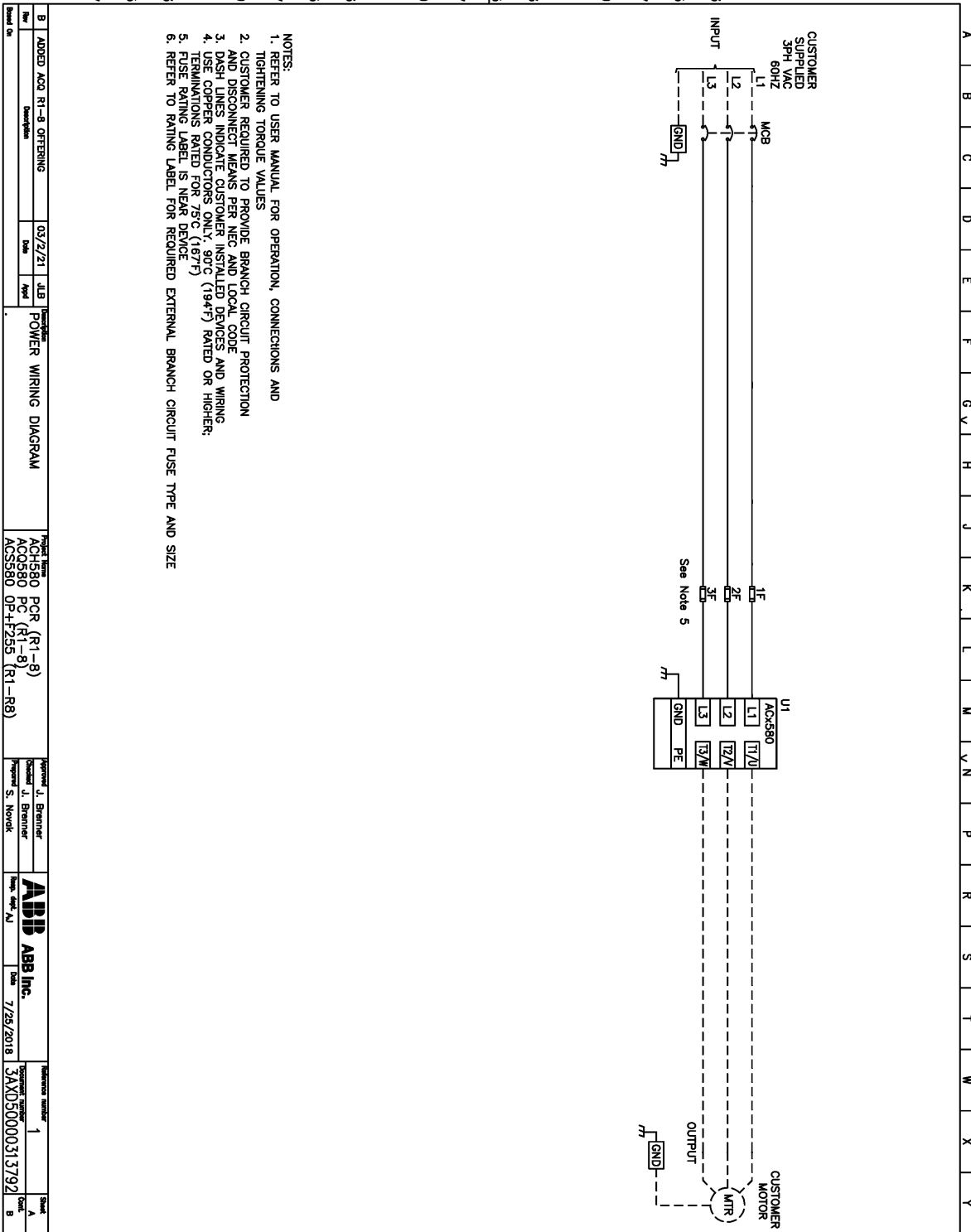


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Item 4	Part Number ACH580-PCR-052A-4	Customer Designation HSP PUMPS
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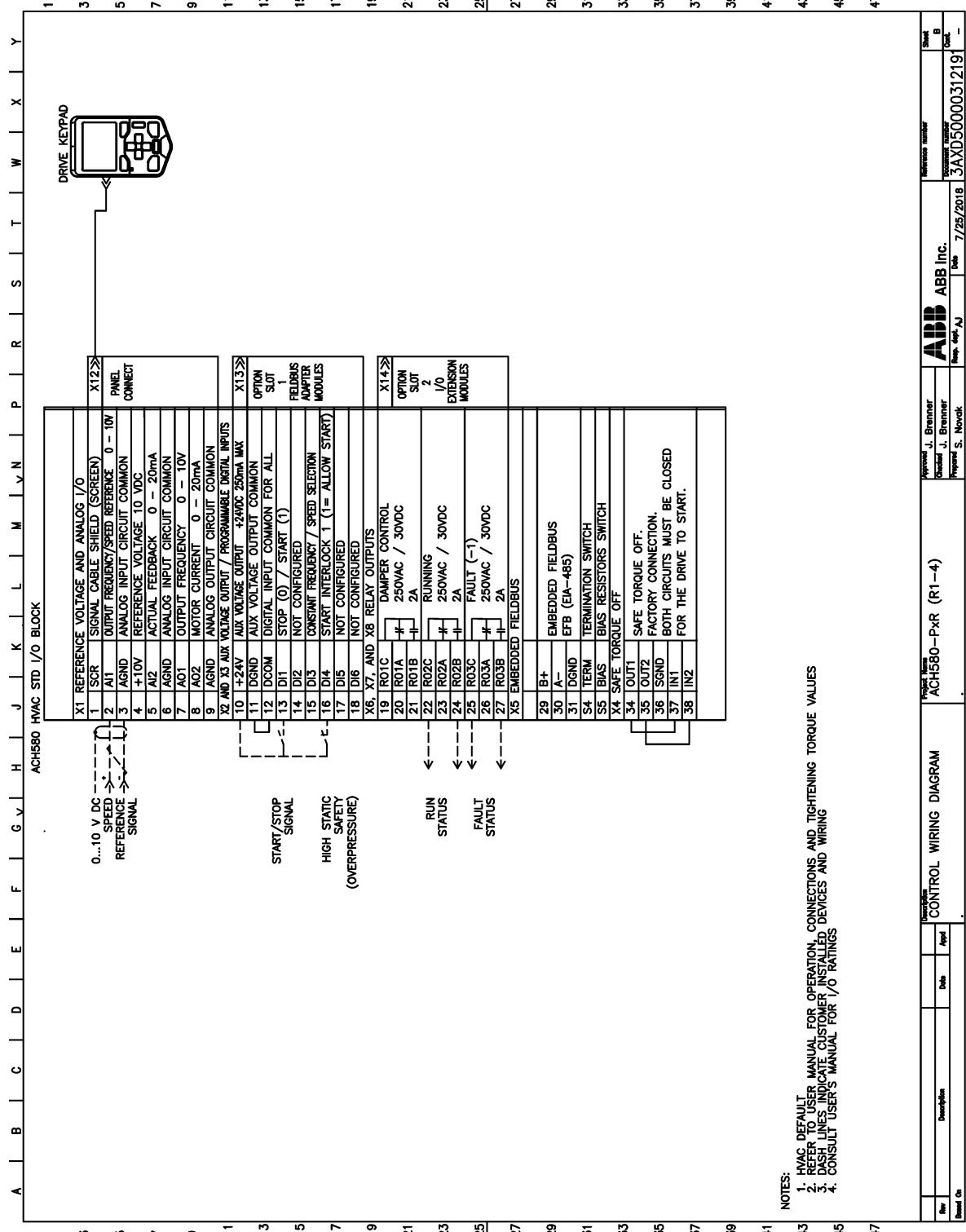


- NOTES:**
1. REFER TO USER MANUAL FOR OPERATION, CONNECTIONS AND TIGHTENING TORQUE VALUES
 2. CUSTOMER REQUIRED TO PROVIDE BRANCH CIRCUIT PROTECTION AND DISCONNECT MEANS PER NEC AND LOCAL CODE
 3. DASH LINES INDICATE CUSTOMER INSTALLED DEVICES AND WIRING
 4. USE COPPER CONDUCTORS ONLY, 90°C (194°F) RATED OR HIGHER; TERMINATIONS RATED FOR 75°C (167°F)
 5. FUSE RATING LABEL IS NEAR DEVICE
 6. REFER TO RATING LABEL FOR REQUIRED EXTERNAL BRANCH CIRCUIT FUSE TYPE AND SIZE

Item	Description	Date	Appr.	Project Name	Approved By	Date	Revision	Sheet
B	ADDED ACH R1-B OPENING	03/22/21	ALB	POWER WIRING DIAGRAM	J. Brenner	7/25/2018	1	A
					J. Brenner			
					S. Novak			B

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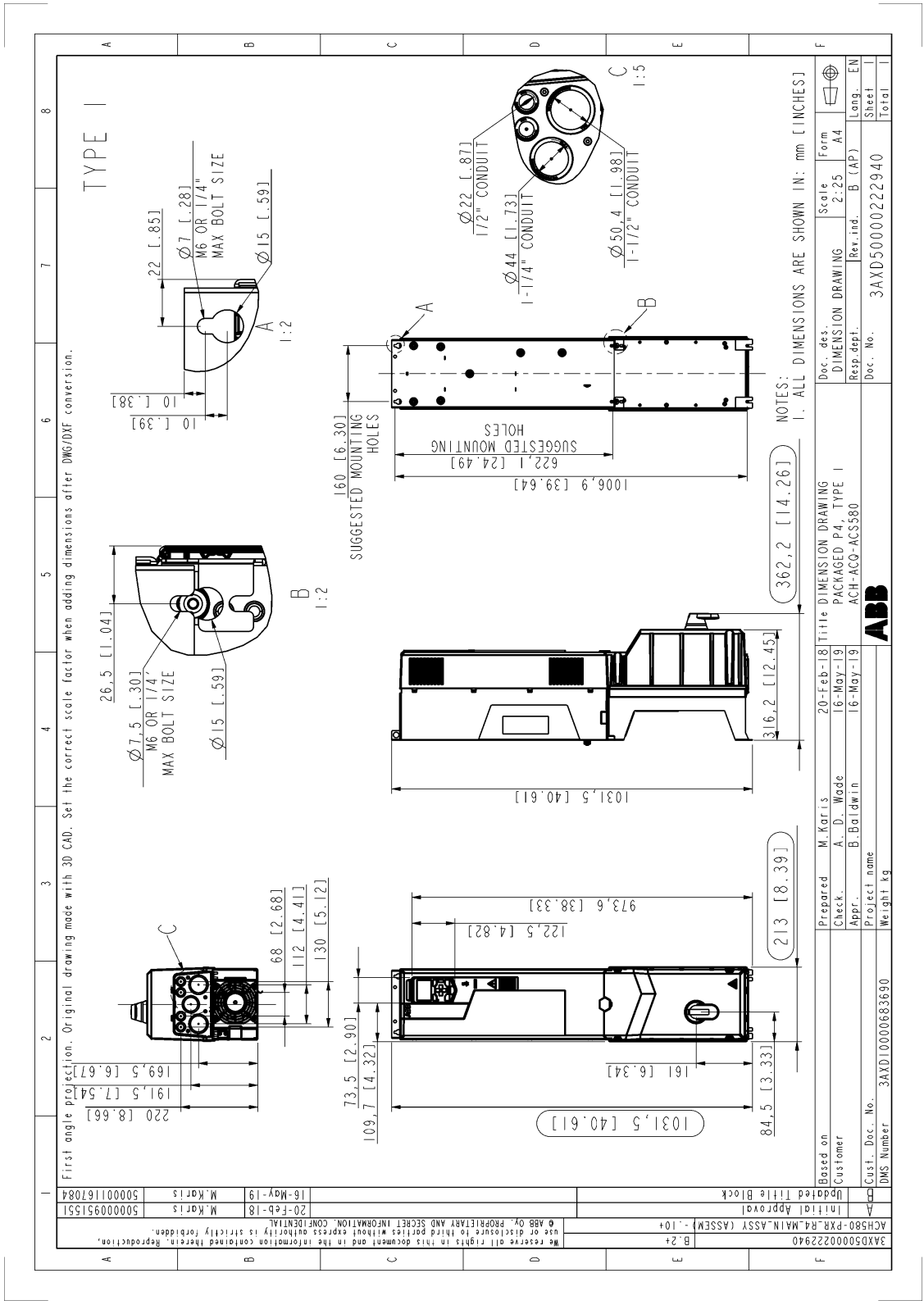
Item	Part Number	Customer Designation
4	ACH580-PCR-052A-4	HSP PUMPS



Revised On	Drawn By	Checked By	Date	App'd
CONTROL WIRING DIAGRAM				
ACH580-PxR (R1-4)				
Prepared By: J. Brenner Checked By: J. Brenner Approved By: S. Novak			Release Number: 3AXD50000312191	
Release Date: 7/25/2018			Release Number: 3AXD50000312191	

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Item 4	Part Number ACH580-PCR-052A-4	Customer Designation HSP PUMPS
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