YASKAWA

SUBMITTAL DRAWINGS FOR APPROVAL

TO:
ATTN:

Date: 3/17/2025

Quote #:
Job Name:

The enclosed drawings are submitted for approval.

A SIGNED COPY OF THIS COVER SHEET MUST BE RETURNED TO YASKAWA TO RELEASE UNITS TO PRODUCTION

Via Email: - insidesales@yaskawa.com

Via Fax: - 800-541-0940

Via Mail: - Yaskawa America, Inc.
2121 Norman Drive South
Waukegan, IL 60085
Attn: Inside Sales

Please contact your Inside Sales Rep for estimated delivery after submittals are signed, approved, and returned.

Engineering, mechanical, electrical drawings, and equipment shipping schedules are based on receipt of customer signed drawings. Any delay in approval, modifications to original contract and/or specifications, or drawing changes made during or after “print approval” could result in a price increase and extension of any previously mentioned schedules.

CUSTOMER APPROVAL: _____ **DATE:** _____

(Signature Represents Drawing Approval)

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Submittal Schedule Details

Details, Features and Reference Drawings	H6BPB027PMB
Horsepower (HP)	20
Voltage (V)	480
Amperage (A)	27
Quantity	1
Enclosure	UL Type 1
Input Impedance (%)	5
Circuit breaker (100k) inc. Input Fusing	✔
3 Contactor Bypass	✔
SCCR (kA)	100
Dimensions (H" x W" x D")	45.20 x 6.90 x 14.70
Weight (lbs)	65.0
Specification	**SG.H6BPQW.10**
Print Size	8.5" x 11.0"
Submittal Page	4
Electrical Schematic	**DS.H6BP.01**
Print Size	17.0" x 11.0"
Submittal Page	11
Wiring Requirements	**UDE00526**
Print Size	11.0" x 17.0"
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Outline Drawing	**DD.HB.1.W2.01**
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Variable Frequency Drive (VFD)
HV600 Bypass Mechanical Specification Submittal
For Narrow Bypass UL Type 1 Rated (H6BP) Packages

GENERAL

The HV600 is a high performance PWM (pulse-width-modulated) AC drive. Three-phase input line power is converted to a sine-coded, variable frequency output, which provides optimum speed control of any conventional squirrel cage induction motor. The use of IGBTs (Insulated Gate Bipolar Transistors), with a carrier frequency range of 2 kHz to 12.5 kHz, permits quiet motor operation.

This drive has one control logic board for all horsepower ratings. Printed circuit boards employ surface-mount technology, providing both high reliability, and small physical size of the printed circuit assemblies. The microprocessor delivers the computing power necessary for complete three-phase motor control in building automation systems.

Operating Principle: Input three-phase AC line voltage is first rectified to a fixed DC voltage. Using pulse width modulation (PWM) inverter technology, the DC voltage is processed, to produce an output waveform in a series of variable-width pulses. Unique firmware algorithms optimize motor magnetization through control of voltage, current, and frequency applied to generate a nearly sinusoidal output waveform.

STANDARDS

UL 508A (Industrial Control Panels)
BTL Listed
UL, cUL listed
CBC, IBC, ASCE7, ICC-ES 156
HCAI (OSHPD)

ENVIRONMENTAL & SERVICE CONDITIONS

Ambient service temperature: Narrow Bypass UL Type 1: -10°C to 40°C

Ambient storage temperature: Narrow Bypass UL Type 1: -20°C to 70°C

Humidity: 0% to 95%, non-condensing

Altitude: to 1,000 meters (3,300 feet); higher by derating

Service factor: 1.0

RoHS 2 Compliant

QUALITY ASSURANCE

In-circuit testing of all printed circuit boards is conducted to ensure proper manufacturing.

Final printed circuit board assemblies are functionally tested via computerized test equipment.

All fully assembled controls are computer tested with induction motor loads to assure unit specifications are met.

The average MTBF (Mean Time Between Failure) is 28 years.

CONSTRUCTION

Input Section of the VFD - VFD power input stage converts three-phase AC line power into a fixed DC voltage via a solid-state, full-wave diode rectifier with MOV (Metal Oxide Varistor) surge protection. An internal 5% split choke built in both positive and negative DC bus reduces harmonics for cleaner power.

Intermediate Section of the VFD - DC bus maintains a fixed DC voltage with filtering and short circuit protection as a DC supply to the VFD output section. It is interfaced with the VFD diagnostic logic circuit to continuously monitor and protect the power components.

Output Section of the VFD - Insulated Gate Bipolar Transistors (IGBTs) convert DC bus voltage to a variable frequency and voltage, utilizing a PWM sine-coded output to the motor. Motor noise at 60 Hz is less than 2 dB above the motor noise from across-the-line operation when measured at a distance of one meter.

POWER AND CONTROL ELECTRONIC HOUSINGS

UL Type 1 wall-mounted enclosure: 208 V, 0.5 through 25 HP; 480 V, 0.75 through 60 HP

Microprocessor-based control circuit

Non-volatile memory (EEPROM); all programming memory is saved when the VFD is disconnected from power.

Digital operator keypad and display provide local control and readout capability:

- Hand/Off/Auto commands
- Speed Reference command
- Reset command

Easy to remove heat sink cooling fan with programmable on/off control.

USB mini-B port for quick and easy PC connection

PROTECTION

Output current overload rating of 110% for 60 seconds, 140% for 2 seconds, 175% instantaneous

Output short circuit protection

Current limited stall prevention (overload trip prevention) during acceleration, deceleration, and run conditions

Optically isolated operator controls

Fault display

“Hunting” prevention logic

Electronic ground fault protection

Electronic motor overload relay protects the motor while operating in drive and bypass mode

Motor current display in both drive and bypass modes of operation as well as verification that the motor is running

Proof of flow/loss of flow detection in both drive and bypass modes

DC bus charge indication

Heatsink overtemperature protection

Cooling fan operating hours recorded

Input/output phase loss protection

Line voltage sensors to monitor for brownout and blackout conditions with adjustable fault levels to ensure the proper settings pursuant to each application.

Reverse prohibit selectability

Short circuit withstand rating of 100 KA RMS with customer provided branch circuit protection.

Multiple emergency override modes (across-the-line or speed selectable via the drive)

OPERATION

Output frequency and speed display can be programmed for other speed-related and control indications, including: RPM, CFM, GPM, PSI, in WC, % of maximum RPM, or custom.

Power loss ride-through (2 seconds capable)

Time delay on start; peak avoidance for smooth generator switchover

VFD accepts either a direct acting or a reverse acting speed command signal.

Bi-directional “Speed Search” capability to start into a rotating load. Two types: current detection and residual voltage detection

DC injection braking, to prevent fan “windmilling”

Remote Run/Stop command input

Eight programmable HVAC specific application presets

Over 100 programmable functions, resettable to factory HVAC presets

User parameter initialization to re-establish project specific parameters

Ramp-to-stop or coast-to-stop selection

Auto restart capability: 0 to 10 attempts with adjustable delay time between attempts

One custom selectable Volts/Hertz pattern and multiple preset Volts/Hertz patterns

Auto speed reference input signal, adjustable for bias and gain

While the VFD is running, operational changes in control and display functions are possible, including:

Acceleration time (0 to 6000 seconds)
Deceleration time (0 to 6000 seconds)
Frequency reference command
Hand/Off/Auto commands
Monitor display
Removable digital operator

Automatic energy saving, reduced voltage operation in VFD mode

PRODUCT FEATURES

Displacement power factor of .98 throughout the motor speed range

Internal EMI/RFI filter complies with IEC 61800-3 restricted distribution for first environment

Built-In real time clock for time and date stamping events along with timer functions for starting, stopping and speed changes without the need for external controls

Voltmeter, ammeter, kilowatt meter, elapsed run time meter, and heatsink temperature monitoring functions

Drive internal PI closed-loop control with selectable engineering units

Independent PI control for use with external device

Differential PID feedback feature

Direct or reverse acting speed signal

Sleep function in both closed loop and open loop control

Feedback signal low pass filter

Feedback signal loss detection and selectable response strategy

Feedback signal inverse and square root capability

24 VDC, 150 mA transmitter power supply

Eight programmable multi-function input terminals (24 VDC) providing 36+ programmable features, including:

Customer Safeties
BAS / Damper Interlock
Emergency Override – BAS interlock mode
min/max speed setting
16 preset speeds
PI control enable / disable

Two programmable 0 to 10 VDC or 4-20 ma analog outputs on VFD control board, proportional to drive monitor functions including output frequency, output current, output power, PI feedback, output voltage and others

Four programmable multi-function output relays (Form C rated 2 amps @ 250 VAC & 30 VDC) providing 29+ functions, including: “Motor Run,” “Damper Control,” “Auto Transfer,” “Drive Run,” “Hand Mode,” “Auto Mode,” “System Fault,” “Bypass Run,” ”Serial Com Run,” “Ready/Run/Fault status,” and numerous other options.

Input and output terminal status indication

Analog input speed reference on bypass printed circuit board

Nine preset speeds

Diagnostic fault indication

VFD efficiency: 96% at half-speed; 98% at full-speed

“S-curve” soft start / soft stop capability

Run/Fault output contacts

SG.H6BPQW.10

Serial communication loss detection and selectable response strategy

Controlled speed range of 40:1

Critical frequency rejection capability: three selectable, adjustable bandwidths

140% starting torque capability, available from 3 Hz to 60 Hz

Adjustable carrier frequency, from 2 kHz to 12.5 kHz

Analog/Digital Virtual I/O – internally sends an output to an input (no wiring needed)

Dynamic noise control for quiet motor operation

Programmable security code

Cloud service (Yaskawa Drive Cloud) for product registration and parameter storage

Store up to four additional parameter sets in keypad

Integrated PLC (DriveWorks EZ)

Rotational as well as Stationary motor auto-tuning

Temperature controlled fans

LCD keypad with Hand/Off/Auto and Copy keypad functions

Motor preheat function

Self-regulating lead/lag control for multiple drives (up to 4)

Drive/motor alternation control (share motor run time for lead drive/motor)

Up to four PID setpoints

Draw down level selection for PID setpoint

Anti-no-flow control for deadhead protection

Pre-charge pump functionality

Low city alarm digital input

State/de-state control – add/remove drive based on feedback or output frequency

Single phase foldback

Flash upgradeable firmware

Heatsink overtemperature speed fold-back feature

“Bumpless” transfer between Hand and Auto modes

Emergency override can be used as “smoke purge” function

Fan failure detection and selectable drive action

Programming and firmware upgrade without three-phase main power using DriveWizard HVAC software tool

Bypass and drive are factory assembled.

Input disconnect switch with a lockable, through-the-door operating mechanism

SG.H6BPQW.10

Drive output and Bypass contactors are both electrically and software interlocked.

BACnet, Siemens APOGEE FLN, Metasys N2, and Modbus RTU communication protocols as standard, with the ability to configure controller parameters, view controller monitors, control I/O, clear faults, and view controller status in both drive and bypass modes. EtherNet/IP, Modbus TCP/IP and LonWorks are optionally available.

BACnet Health monitors including Net Health, Tokens Received/Transmitted, Messages Received/Transmitted, Next/Previous Node Address, Max/Min Master Found, number of Nodes on Network, COV, MSTP Loop Time, CRC Errors, MSTP Tokens Lost/Retry, Deadtime Average.

Door mounted control keypad with HOA LCD display for “Control Power,” “Drive Ready,” “Drive Run,” “Drive Selected,” “Drive Fault,” “Drive Test,” “Bypass Selected,” “Bypass Run,” “Motor OL”, ”Safety Open” “BAS Interlock,” “Auto Run”, Auto Transfer,” “Emergency Override,” “Hand Mode,” “Off Mode”, and “Auto Mode.”

Damper control circuit with end-of-travel feedback capability including two adjustable wait time functions. One is a run delay time, where the drive will operate at a preset speed before the damper opens to pressurize the system. The other time function is an interlock wait time, so if the damper has not fully opened within the specified time, a fault will be declared.

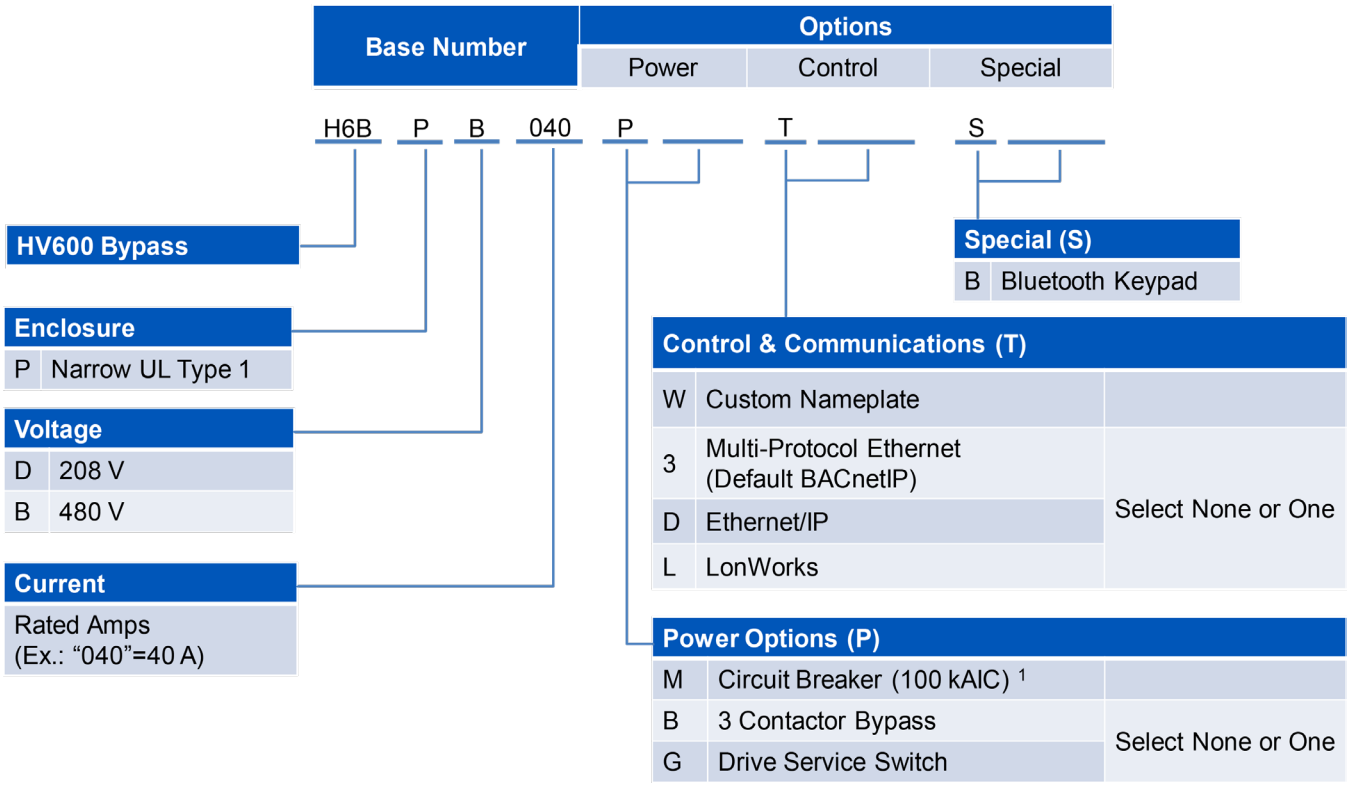
Selectable energy savings and harmonic reduction mode. Drive automatically switches to Bypass (across-the-line) when motor is running 60 Hz for a set time and automatically switches back when frequency reference changes.

Green Contactor mode when enabled will keep unneeded contactors from being closed when not needed.

Model Number Configuration (H6BP)

Step 1. Complete the Base Number for the voltage and current rating.

Step 2. Add the Option Code letter for each required option. If an option is not wanted, no character is inserted in that position.



ENCLOSURE TYPE

[P] Narrow Bypass UL Type 1 Package

VOLTAGE

[D] 208 volt model for nominal, 200 or 208 VAC (+10/-15%); 60 or 50 Hz (+/-5%) systems

[B] 480 volt model for nominal, 380, 400, 415, 440, 460 or 480 VAC (+10/-15 %); 60 or 50 Hz (+/-5%) systems

[P] POWER OPTIONS

MAIN INPUT DISCONNECT *(Default)*

Input disconnect switch with a lockable, through-the-door operating mechanism, no branch short circuit protection.

[M] Circuit Breaker Option is a 100 kAIC rated circuit breaker with fuses. When option (M) is specified, the configured drive package will be rated at 100 kAIC.
(Replaces default input disconnect)

[P] POWER OPTIONS (Continued)

One or None:

[B] Three-Contactor Bypass, (Replaces Standard Two-Contactor Bypass)

[G] Drive Input Service Switch

[T] CONTROL & COMMUNICATION OPTIONS

[W] Engraved nameplate

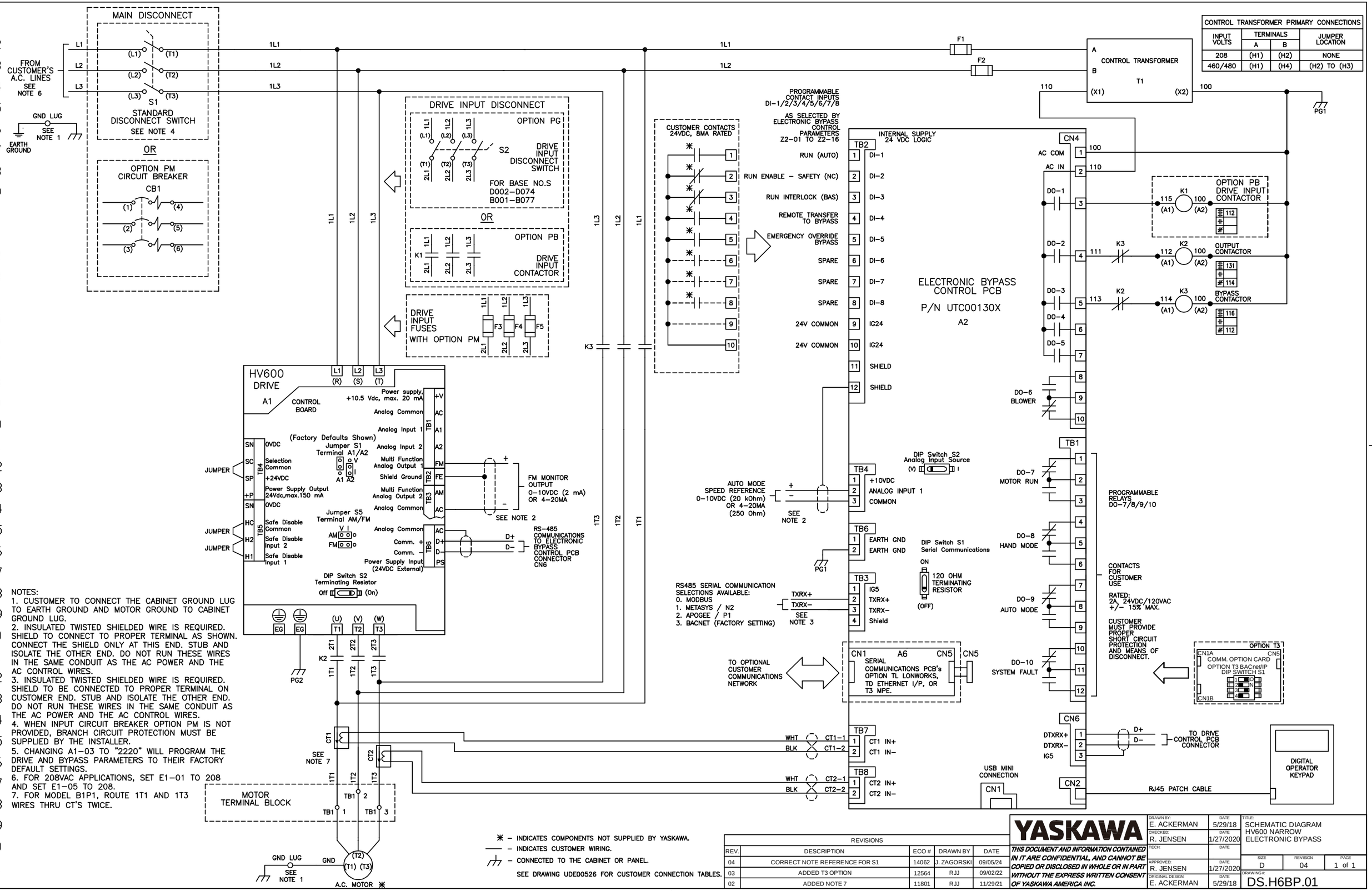
One or None:

[3] Multi-Protocol Ethernet (Default BACnetIP)

[D] Ethernet/IP
[L] LonWorks

[S] Special

[B] Bluetooth Keypad



NOTES:
1. CUSTOMER TO CONNECT THE CABINET GROUND LUG TO EARTH GROUND AND MOTOR GROUND TO CABINET GROUND LUG.
2. INSULATED TWISTED SHIELDED WIRE IS REQUIRED. SHIELD TO CONNECT TO PROPER TERMINAL AS SHOWN. CONNECT THE SHIELD ONLY AT THIS END. STUB AND ISOLATE THE OTHER END. DO NOT RUN THESE WIRES IN THE SAME CONDUIT AS THE AC POWER AND THE AC CONTROL WIRES.
3. INSULATED TWISTED SHIELDED WIRE IS REQUIRED. SHIELD TO BE CONNECTED TO PROPER TERMINAL ON CUSTOMER END. STUB AND ISOLATE THE OTHER END. DO NOT RUN THESE WIRES IN THE SAME CONDUIT AS THE AC POWER AND THE AC CONTROL WIRES.
4. WHEN INPUT CIRCUIT BREAKER OPTION PM IS NOT PROVIDED, BRANCH CIRCUIT PROTECTION MUST BE SUPPLIED BY THE INSTALLER.
5. CHANGING A1–03 TO "2220" WILL PROGRAM THE DRIVE AND BYPASS PARAMETERS TO THEIR FACTORY DEFAULT SETTINGS.
6. FOR 208VAC APPLICATIONS, SET E1–01 TO 208 AND SET E1–05 TO 208.
7. FOR MODEL B1P1, ROUTE 1T1 AND 1T3 WIRES THRU CT'S TWICE.

✳ – INDICATES COMPONENTS NOT SUPPLIED BY YASKAWA.
—— – INDICATES CUSTOMER WIRING.
⏚ – CONNECTED TO THE CABINET OR PANEL.

SEE DRAWING UDE00526 FOR CUSTOMER CONNECTION TABLES.

REVISIONS				
REV.	DESCRIPTION	ECO #	DRAWN BY	DATE
04	CORRECT NOTE REFERENCE FOR S1	14062	J. ZAGORSKI	09/05/24
03	ADDED T3 OPTION	12564	RJJ	09/02/22
02	ADDED NOTE 7	11801	RJJ	11/29/21

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DRAWN BY: E. ACKERMAN	DATE 5/29/18	TITLE: SCHEMATIC DIAGRAM HV600 NARROW ELECTRONIC BYPASS	
CHECKED: R. JENSEN	DATE 1/27/2020		
TECH:	DATE		
APPROVED: R. JENSEN	DATE 1/27/2020	SIZE D	REVISION 04
ORIGINAL DESIGN: E. ACKERMAN	DATE 5/29/18	DRAWING # DS.H6BP.01	PAGE 1 of 1

CUSTOMER WIRING REQUIREMENTS

• FOR 0 TO 100 AMPS, USE A MINIMUM OF 60 °C - 75 °C COPPER WIRE. (USE COPPER CONDUCTORS ONLY)

• FOR ABOVE 100 AMPS, USE A MINIMUM OF 75 °C COPPER WIRE. (USE COPPER CONDUCTORS ONLY)

TABLE 1		A.C. LINE WIRING							
HV600 NARROW BYPASS MODEL NO. BASE NUMBER H6BPXXXX		WITH OPTION PM CIRCUIT BREAKER CB1				STANDARD NON-FUSED INPUT DISCONNECT SWITCH S1			
208V	480V	MFG. PART NUMBER	CURRENT RATING (AMPS)	WIRE SIZE RANGE (AWG)	TIGHTENING TORQUE (LB.-IN.)	MFG. PART NUMBER	CURRENT RATING (AMPS)	WIRE SIZE RANGE (AWG)	TIGHTENING TORQUE (LB.-IN.)
	B1P1	H_ _36015	15	14 - 10 OR 8 - 3/0	50 OR 120	V0	20	14 - 8	19
D002	B001								
D003	B002								
D004	B003								
	B004								
D006	B007	H_ _36020	20						
D007									
D010	B011	H_ _36025	25						
	B014	H_ _36035	35						
D016		H_ _36040	40						
	B021	H_ _36050	50			V3	45	10, 8, OR 6 - 2	35, 40, OR 50
D024	B027	H_ _36060	60						
D030	B034	H_ _36070	70			V4	63		
	B040	H_ _36080	80						
D046	B052	H_ _36110	110			V5	100	8 - 2/0	200
D059		H_ _36125	125						
	B065	H_ _36150	150						
D074						V6	115		
	B077					H_ _36000S15	150	8 - 3/0	120

TABLE 2		A.C. MOTOR WIRING			EARTH GROUND WIRING		CONTROL WIRING					
HV600 NARROW BYPASS MODEL NO. BASE NUMBER H6BPXXXX		STANDARD MOTOR TERMINAL BLOCK TB1			GROUND LUG		A1 TERMINAL BLOCKS TB1,TB3-TB6		A1 TERMINAL BLOCK TB2 (FE)		A2 TERMINAL BLOCKS TB1-TB4 AND TB6	
208V	480V	MFG. PART NUMBER	WIRE SIZE RANGE (AWG)	TIGHTENING TORQUE (LB.-IN.)	WIRE SIZE RANGE (AWG)	TIGHTENING TORQUE (LB.-IN.)	WIRE SIZE RANGE (AWG)	TIGHTENING TORQUE (LB.-IN.)	WIRE SIZE RANGE (AWG)	TIGHTENING TORQUE (LB.-IN.)	WIRE SIZE RANGE (AWG)	TIGHTENING TORQUE (LB.-IN.)
	B1P1	NDN111A-WH	14 - 2	32	14 - 10, 8, 6 - 4, OR 2	35, 40, 45, OR 50	24 - 16	4.4 - 5.3	24-18	8.85-10.62	26-14	4
D002	B001											
D003	B002											
D004	B003											
D006	B004											
D007	B007											
D010	B011											
D016	B014											
D024	B021											
D030	B027											
D046	B034				14 - 10, 8, 6 - 4, OR 2	35, 40, 45, OR 50						
D059	B040											
	B052											
	B065											
D074	B077	MPDB63153	6 - 2/0	120	2- 1/0	50						

REVISIONS				
REV.	DESCRIPTION	ECO #	DRAWN BY	DATE
02	ADDED 0.5HP, 480V, MODEL H6BPB1P1	11801	RJJ	11/1/21
01	CHANGED THE A1 TERMINAL BLOCK TB2 (FE) WIRE RANGE TO 24-18 AWG	10627	EAA	6/8/20
00	INITIAL RELEASE	--	EAA	2/3/20

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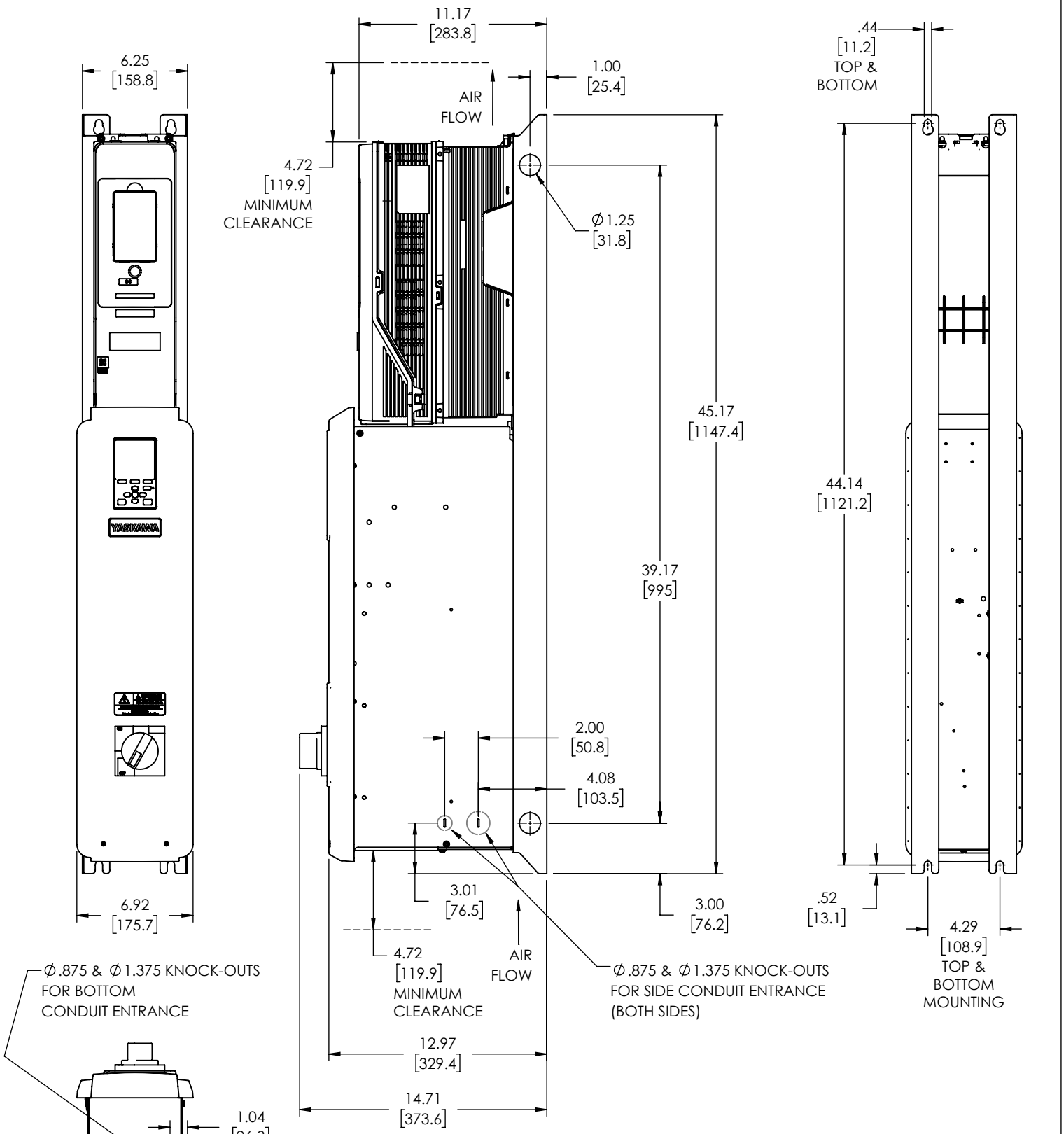
DRAWN BY: E. ACKERMAN	DATE: 5/13/18	TITLE: CUSTOMER CONNECTION HV600 BYPASS NARROW TYPE 1
CHECKED: R. JENSEN	DATE: 2/3/20	
TECH:	DATE:	
APPROVED: R. JENSEN	DATE: 2/3/20	SIZE: C / REVISION: 02 / PAGE: 1 of 1
ORIGINAL DESIGN: E. ACKERMAN	DATE: 5/13/18	DRAWING #: UDE00526



NOTES:

A. FOR REFERENCE UNLESS PROPERLY ENDORSED. FOR ADDITIONAL DETAILS AND SPECIFICATIONS, CONSULT YASKAWA AMERICA, INC.

B. DIMENSIONS ARE IN INCHES[MILLIMETERS].

C. USE APPROPRIATE TYPE RATED HUBS OR FITTINGS TO MAINTAIN ENCLOSURE RATING.

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ORIGINAL DESIGN: **D. Dahlman**	DATE: **08/21/2018**	TITLE: **DIMENSION DRAWING, HV600, O/U, BYPASS, W2**	
DRAWN: **D. Dahlman**	DATE: **01/22/2020**		
CHECKED: **D. Guckenberger**	DATE: **01/23/2020**	SIZE: **A**	REVISION: **00**
APPROVED: **K. Flierl**	DATE: **01/30/2020**	PAGE: **1** OF **1**	
UNITS: **INCHES**	SCALE: **NONE**	DRAWING #: **DD.HB.1.W2.01**	