Technical Data **TD156001EN** Effective October 2015

Harmonic correction unit (HCU2)

Harmonic correction units (HCU2)

Contents

Powering Business Worldwide

Product description

Eaton's HCU2 active harmonic filters are engineered to provide dynamic harmonic correction by actively injecting the required currents into an electrical distribution system to cancel the entire spectrum of harmonic currents at the point of connection.

Advantages

- Can be sized to meet specific levels of harmonic correction, providing compliance with IEEE® 519 recommended levels
- Engineered to prevent overloading
- Scalable design can be expanded without impacting performance
- Broad spectrum of cancellation for robust protection (2nd to 51st harmonic)
- Helps improve power factor to maximize efficiency
- Easier and less expensive installation than passive filters, as active filter design reduces the need for detailed engineering studies
- HMI provides comprehensive control through icon-driven interface

Features, benefits, and functions

- Fast action
- UL® 508/ CSA® C22.2 No. 14 listed
- 380–480 V ±10%, 600 V and 690 V with autotransformer
- 50/60 Hz ±3 Hz frequency
- Operating temperature range 0 °C to +40 °C
- NEMA® 1, NEMA 2, NEMA 12, IP31, IP54, and chassis mount versions available:
  - Wallmount (NEMA 1 designs)
  - Floor-standing (NEMA 2, NEMA 12, IP31, and IP54)
- Output capacity—self limited to 100% rated current
- Corrective capability— <5% TDD and near unity displacement power factor

Note: Requires at least 3% series input line reactor ahead of each non-linear load.

- Color HMI touchscreen display
- Heat losses have been minimized. This results in lower operating costs and reduced requirements for equipment room cooling

Catalog numbering system

Table 1. HCU2 harmonic correction unit

HCU2 060 D5 N2

Equipment type
HCU2 = Harmonic correction unit

Ampere rating
380–480 V only
060 = 60 A **120** = 120 A **200** = 200 A **300** = 300 A
600 V only
047 = 47 A **094** = 94 A **157** = 157 A **235** = 235 A
690 V only
040 = 40 A **080** = 80 A **133** = 133 A **200** = 200 A

Voltage	
D5 = 380–480 V **D6** = 600 V	**D7** = 690 V

Enclosure type
IP00 = Chassis mount **N1** = NEMA 1 wall mount **N2** = NEMA 2 floor mount **N12** = NEMA 12 floor mount **IP31** = IP31 floor mount **IP54** = IP54 floor mount

Sizing and product selection

Table 2. Harmonic correction unit ratings

Voltage	Frequency (Hz)	Total current amperes (rms)	Watt losses (kW)	HCU2 enclosure type	Version	Cable entry	Integral disconnect	Unit weight lb (kg)	Figure number	Model
380–480	50/60	60	1.3	Wallmount NEMA 1	UL/CSA	Bottom	No	220 (100)	8	**HCU2060D5N1**
380–480	50/60	120	2.8	Wallmount NEMA 1	UL/CSA	Bottom	No	268 (122)	9	**HCU2120D5N1**
380–480	50/60	200	5.4	Wallmount NEMA 1	UL/CSA	Bottom	No	409 (184)	10	**HCU2200D5N1**
380–480	50/60	300	7.1	Wallmount NEMA 1	UL/CSA	Bottom	No	504 (229)	11	**HCU2300D5N1**
380–480	50/60	60	1.3	Chassis mount	UL/CSA	Bottom	No	198 (90)	12	**HCU2060D5IP00**
380–480	50/60	120	2.8	Chassis mount	UL/CSA	Bottom	No	248 (113)	13	**HCU2120D5IP00**
380–480	50/60	200	5.4	Chassis mount	UL/CSA	Bottom	No	385 (175)	14	**HCU2200D5IP00**
380–480	50/60	300	7.1	Chassis mount	UL/CSA	Bottom	No	484 (220)	15	**HCU2300D5IP00**
380–480	50/60	60	1.3	Floor mount IP31	CE	Top or bottom	Yes	609 (277)	16	**HCU2060D5IP31**
380–480	50/60	120	2.8	Floor mount IP31	CE	Top or bottom	Yes	631 (287)	16	**HCU2120D5IP31**
380–480	50/60	200	5.4	Floor mount IP31	CE	Top or bottom	Yes	873 (397)	17	**HCU2200D5IP31**
380–480	50/60	300	7.1	Floor mount IP31	CE	Top or bottom	Yes	928 (422)	17	**HCU2300D5IP31**
380–480	50/60	60	1.3	Floor mount NEMA 2	UL/CSA	Top or bottom	Yes	609 (277)	16	**HCU2060D5N2**
380–480	50/60	120	2.8	Floor mount NEMA 2	UL/CSA	Top or bottom	Yes	631 (287)	16	**HCU2120D5N2**
380–480	50/60	200	5.4	Floor mount NEMA 2	UL/CSA	Top or bottom	Yes	873 (397)	17	**HCU2200D5N2**
380–480	50/60	300	7.1	Floor mount NEMA 2	UL/CSA	Top or bottom	Yes	928 (422)	17	**HCU2300D5N2**
380–480	50/60	60	1.3	Floor mount NEMA 12	UL/CSA	Top or bottom	Yes	609 (277)	16	**HCU2060D5N12**
380–480	50/60	120	2.8	Floor mount NEMA 12	UL/CSA	Top or bottom	Yes	631 (287)	16	**HCU2120D5N12**
380–480	50/60	200	5.4	Floor mount NEMA 12	UL/CSA	Top or bottom	Yes	873 (397)	17	**HCU2200D5N12**
380–480	50/60	300	7.1	Floor mount NEMA 12	UL/CSA	Top or bottom	Yes	928 (422)	17	**HCU2300D5N12**
380–480	50/60	60	1.3	Floor mount IP54	CE	Top or bottom	Yes	609 (277)	16	**HCU2060D5IP54**
380–480	50/60	120	2.8	Floor mount IP54	CE	Top or bottom	Yes	631 (287)	16	**HCU2120D5IP54**
380–480	50/60	200	5.4	Floor mount IP54	CE	Top or bottom	Yes	873 (397)	17	**HCU2200D5IP54**
380–480	50/60	300	7.1	Floor mount IP54	CE	Top or bottom	Yes	928 (422)	17	**HCU2300D5IP54**
600	50/60	47	1.8	Floor mount IP31	CE	Top or bottom	Yes	1012 (460)	18	**HCU2047D6IP31**
600	50/60	94	3.9	Floor mount IP31	CE	Top or bottom	Yes	1096 (498)	18	**HCU2094D6IP31**
600	50/60	157	7.2	Floor mount IP31	CE	Top or bottom	Yes	1437 (653)	19	**HCU2157D6IP31**
600	50/60	235	9.9	Floor mount IP31	CE	Top or bottom	Yes	1665 (757)	19	**HCU2235D6IP31**
600	50/60	47	1.8	Floor mount NEMA 2	UL/CSA	Top or bottom	Yes	1012 (460)	18	**HCU2047D6N2**
600	50/60	94	3.9	Floor mount NEMA 2	UL/CSA	Top or bottom	Yes	1096 (498)	18	**HCU2094D6N2**
600	50/60	157	7.2	Floor mount NEMA 2	UL/CSA	Top or bottom	Yes	1437 (653)	19	**HCU2157D6N2**
600	50/60	235	9.9	Floor mount NEMA 2	UL/CSA	Top or bottom	Yes	1665 (757)	19	**HCU2235D6N2**
600	50/60	47	1.8	Floor mount IP54	CE	Top or bottom	Yes	1036 (471)	18	**HCU2047D6IP54**
600	50/60	94	3.9	Floor mount IP54	CE	Top or bottom	Yes	1115 (507)	18	**HCU2094D6IP54**
600	50/60	157	7.2	Floor mount IP54	CE	Top or bottom	Yes	1485 (675)	19	**HCU2157D6IP54**
600	50/60	235	9.9	Floor mount IP54	CE	Top or bottom	Yes	1694 (770)	19	**HCU2235D6IP54**
600	50/60	47	1.8	Floor mount NEMA 12	UL/CSA	Top or bottom	Yes	1036 (471)	18	**HCU2047D6N12**
600	50/60	94	3.9	Floor mount NEMA 12	UL/CSA	Top or bottom	Yes	1115 (507)	18	**HCU2094D6N12**
600	50/60	157	7.2	Floor mount NEMA 12	UL/CSA	Top or bottom	Yes	1485 (675)	19	**HCU2157D6N12**
600	50/60	235	9.9	Floor mount NEMA 12	UL/CSA	Top or bottom	Yes	1694 (770)	19	**HCU2235D6N12**
690	50/60	40	2.1	Floor mount IP31	CE	Top or bottom	Yes	1063 (483)	18	**HCU2040D7IP31**
690	50/60	80	4.5	Floor mount IP31	CE	Top or bottom	Yes	1173 (533)	18	**HCU2080D7IP31**
690	50/60	133	8.2	Floor mount IP31	CE	Top or bottom	Yes	1558 (708)	19	**HCU2133D7IP31**
690	50/60	200	11.4	Floor mount IP31	CE	Top or bottom	Yes	1817 (826)	19	**HCU2200D7IP31**
690	50/60	40	2.1	Floor mount NEMA 2	UL/CSA	Top or bottom	Yes	1063 (483)	18	**HCU2040D7N2**
690	50/60	80	4.5	Floor mount NEMA 2	UL/CSA	Top or bottom	Yes	1173 (533)	18	**HCU2080D7N2**
690	50/60	133	8.2	Floor mount NEMA 2	UL/CSA	Top or bottom	Yes	1558 (708)	19	**HCU2133D7N2**
690	50/60	200	11.4	Floor mount NEMA 2	UL/CSA	Top or bottom	Yes	1817 (826)	19	**HCU2200D7N2**
690	50/60	40	2.1	Floor mount IP54	CE	Top or bottom	Yes	1087 (494)	18	**HCU2040D7IP54**
690	50/60	80	4.5	Floor mount IP54	CE	Top or bottom	Yes	1192 (542)	18	**HCU2080D7IP54**
690	50/60	133	8.2	Floor mount IP54	CE	Top or bottom	Yes	1606 (730)	19	**HCU2133D7IP54**
690	50/60	200	11.4	Floor mount IP54	CE	Top or bottom	Yes	1846 (839)	19	**HCU2200D7IP54**
690	50/60	40	2.1	Floor mount NEMA 12	UL/CSA	Top or bottom	Yes	1087 (494)	18	**HCU2040D7N12**
690	50/60	80	4.5	Floor mount NEMA 12	UL/CSA	Top or bottom	Yes	1192 (542)	18	**HCU2080D7N12**
690	50/60	133	8.2	Floor mount NEMA 12	UL/CSA	Top or bottom	Yes	1606 (730)	19	**HCU2133D7N12**
690	50/60	200	11.4	Floor mount NEMA 12	UL/CSA	Top or bottom	Yes	1846 (839)	19	**HCU2200D7N12**

Table 3. Current transformer ratings—dimensions in inches (mm)

Ratio	Type	Nominal window size	Model
300/5 to 3000/5	Split	4.00 x 7.00 (101.6 x 177.8)	**TX2**
500/5 to 4000/5	Split	5.00 x 7.00 (127.0 x 177.8)	**TX4**
500/5 to 5000/5	Split	4.00 x 11.00 (101.6 x 279.4)	**TX5**

Notes:

- Two current transformers are required for three-phase loads
- Three current transformers are required when single-phase loads are present
- CT rating based on service entrance ampacity
- Startup and commissioning by factory trained personnel is recommended
- Additional CTs required if power factor correction capacitors are being used in conjunction with the active harmonic filter
- See Eaton publication IL157001EN for more information on the TX2, TX4, and TX5 current transformers

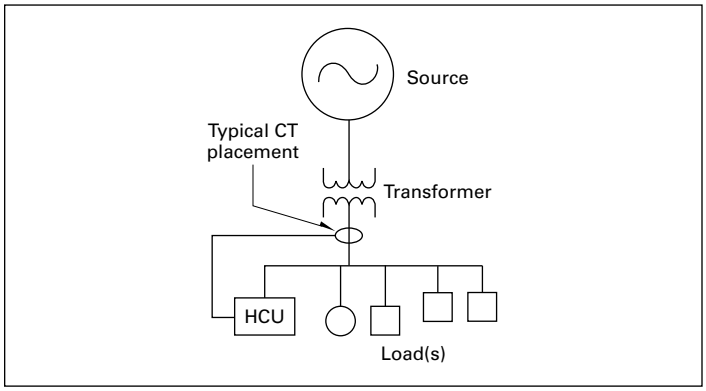


Figure 1. Installation diagram

Table 4. Eaton HCU2 specifications

Description	Specification
Technical specifications	
Standard rms output current ratings	60 A, 120 A, 200 A, 300 A at 380 Vac to 480 Vac 47 A, 94 A, 157 A, 235 A at 600 Vac 40 A, 80 A, 133 A, 200 A at 690 Vac
Nominal frequency	50/60 Hz, ±3 Hz auto sensing
Number of phases	Three-phase
Topology	Digital harmonic FFT Digital reactive power
Losses	To 480 Vac <3%; to 690 VCA <5%
CT VA loading	1.0 VA (5 A CT secondary)
Spectrum cancellation	2nd to 51st, discrete; fully selectable per harmonic order (amplitude and on/off)
Control basis	Closed loop (for new installations) Open loop compatible for retrofit applications
Harmonic attenuation	Closed Loop: <3% THD(i); max 20:1 THD(i) reduction with load harmonic current above 50% of Eaton HCU2 rating Open Loop: <5% TDD Requires 3% or higher inductive impedance per nonlinear load
Harmonic operational features	% THDi set point % THDv set point
Harmonic avoidance	Output at specific harmonic order turned off if resonance or lack-of impedance detected; or manually turned off
Parallel operation	Up to 10 units per set of CT (to 51st order), any size combination Backward compatibility with Eaton HCUE operated in parallel Contact Eaton for applications of more than 10 units
Parallel operation options	Master/master (masters receive mains CT) Master/slave Multi-master/multi-slave Same as Eaton HCUE for retrofits
Parallel sequence options	Lead/lag with unit rotation: one unit operates to full capacity before next unit turns on; timed rotation Load share: All operating units function at the same output percentage
Parallel HMI control	Any unit permits viewing and changing parameter settings of complete system or any other unit in parallel system
Parallel communications	Proprietary COM bus between operating units
Power factor correction	Optimized unity PF, leading (capacitive) or lagging (inductive) power factor (Cos f) to target
Control response time	25 µs
Harmonic correction time	2 cycles
Reactive correction time	1/4 cycle
Display	144 mm QVGA TFT 64k-color touchscreen
Display parameters	Hundreds of parameters are available. Examples include THDi, THDv, oscilloscope for viewing many selected parameters, phasor diagrams, load power, measured currents for I_h, I_s, I_f, I neg seq, PF (Cos ø), injected currents for I_h, I reactive, I neg seq, etc.
Communications capability	Modbus® RTU, Modbus TCP/IP
Discrete input/outputs	4 input and 4 output dry contacts; assignable
Noise level (ISO3746)	<70 dB at one meter from unit surface
Earthing (grounding) systems	EMC filter ground switch for Isolated Terra, high resistance ground or corner grounded systems

Table 4. Eaton HCU2 specifications (continued)

Description	Specification
Environmental conditions	
Operating temperature	0 °C to 40 °C
Relative humidity	0–95%, noncondensing
Seismic rating	Complies with IBC and ASCE7
Operating altitude	1000 m, (derate 1%/100 m above), maximum 4800 m
Automatic rollback of output	Occurs whenever heatsink temperature sensor exceeds temperature limit
Ambient temperature protection	Absolute shutdown if air inlet temperature reaches 51 °C
Preset output limits (rms)	Programmable set limit due to altitude or ambient temperature—becomes fixed output limit
Storage (in original shipping container)	Temperature: –20 °C to 60 °C Relative humidity: to 95%, noncondensing Clean, dry, and protected No conductive particles permitted
Contaminant levels—operating (IEC 60721-3-3)	Chemical Class 3C2 Mechanical Class 3S2 No conductive particles permitted
Contaminant levels—transport and storage (IEC 60721-3-3)	Chemical Class 3C3 Mechanical Class 3S3 When stored in original shipping container No conductive particles permitted
Reference standards	
Design	CE EMC Certification IEC/EN 60439-1, EN 61000-6-4 Class A, EN 61000-6-2
Protection (enclosure)	IP00, IP20, IP31, IP54, UL Type 1, UL Type 2, UL Type 12, UL Type Open
Standards compliance/certification	cULus (UL 508 , CSA 22.2 No. 14) CE Certified, ABS, Lloyds, other local standards
Installation	
Wallmount	IP00 (UL Type open) and IP20 (NEMA 1) configurations
Free-standing	IP31, IP54, NEMA 2 and NEMA 12
Circuit protection	NEMA 1 and chassis mount—external means required Free-standing enclosures—incoming circuit breaker with mechanical door interlock
AIC rating (input circuit breaker)	To 415 Vac—200 kA cULus; 125 kA IEC To 480 Vac—200 kA cULus; 75 kA IEC To 600 Vac—100 kA cULus; 100 kA IEC To 690 Vac—No cULus; 100 kA IEC
Cable entry	Wallmount and chassis mount—bottom only Free-standing—top and bottom entry through gland plates
PCBA protection	Conformal coating on all PCBs Pollution Degree 2
Cooling configuration	Separate air plenums for heat sink section and control section: Heatsink (high heat plenum) input from bottom and exhaust out top All components in high heat plenum rated IP54 or better ≥ no filtering required Control section air supply must be clean and dry (filtering may be required) No conductive particles permitted
Air supply	60 A to 480 Vac: 570 m3/h, 335 cfm; to 690 Vac: 920 m3/h, 541 cfm 120 A to 480 Vac: 1030 m3/h, 606 cfm; to 690 Vac 1380 m3/h, 812 cfm 200 A to 480 Vac: 2100 m3/h, 1236 cfm; to 690 Vac: 2850 m3/h, 1677 cfm 300 A to 480 Vac: 2100 m3/h, 1236 cfm; to 690 Vac: 2850 m3/h, 1677 cfm
Service provisions	
HMI	Plain language output (without cryptic codes) USB port for upload of new software and download of operational records
Service port	USB port: commission, program, or diagnostics via a laptop computer when power is on or off; laptop provides power to control board when no unit power is present
Commissioning	On-board step-by-step process; CT automatic sizing, phase rotation, and polarity; external transformer ratio and phase shift; heat test, and more

CT connection schematics

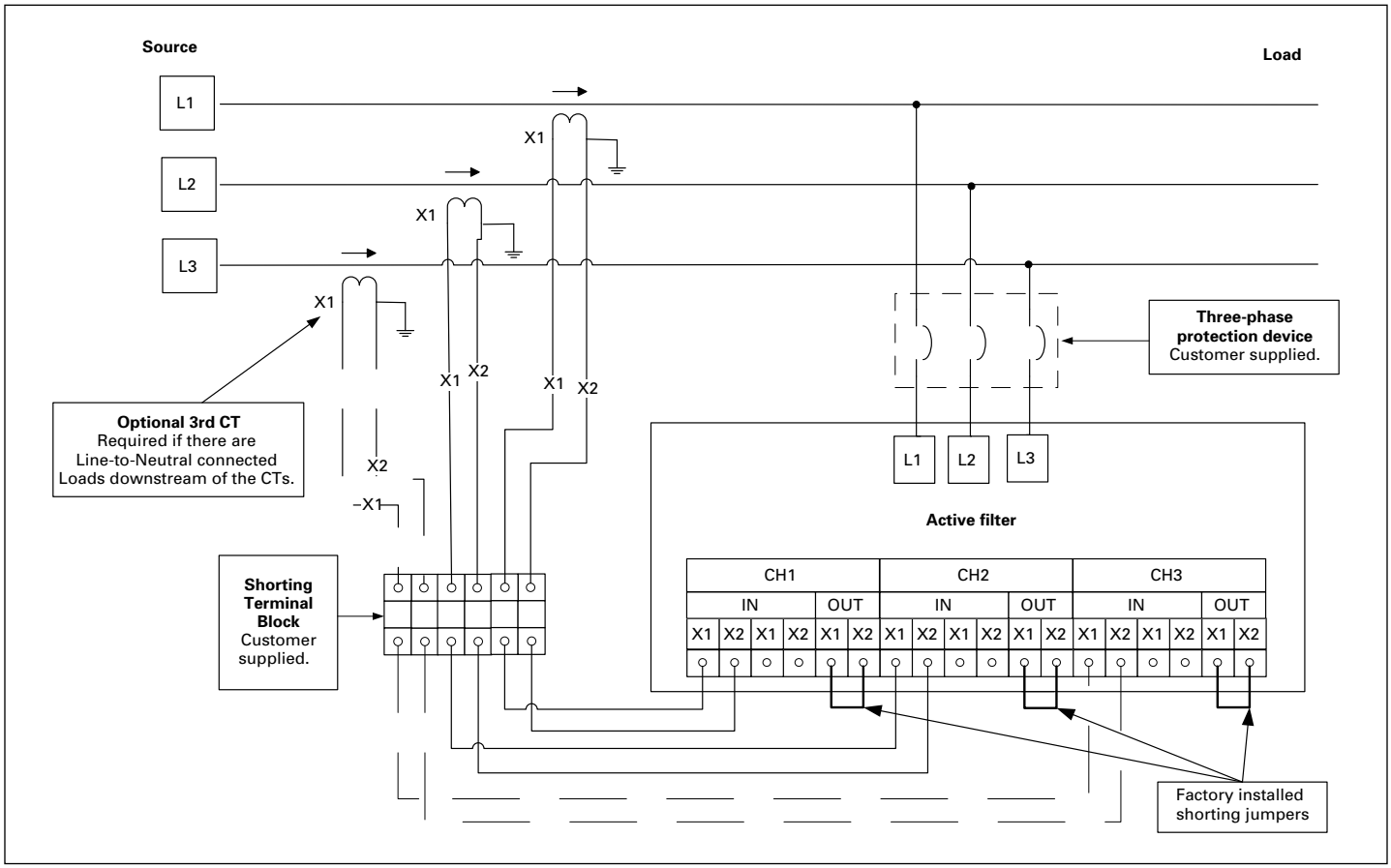


Figure 2. Typical CT configuration for one unit

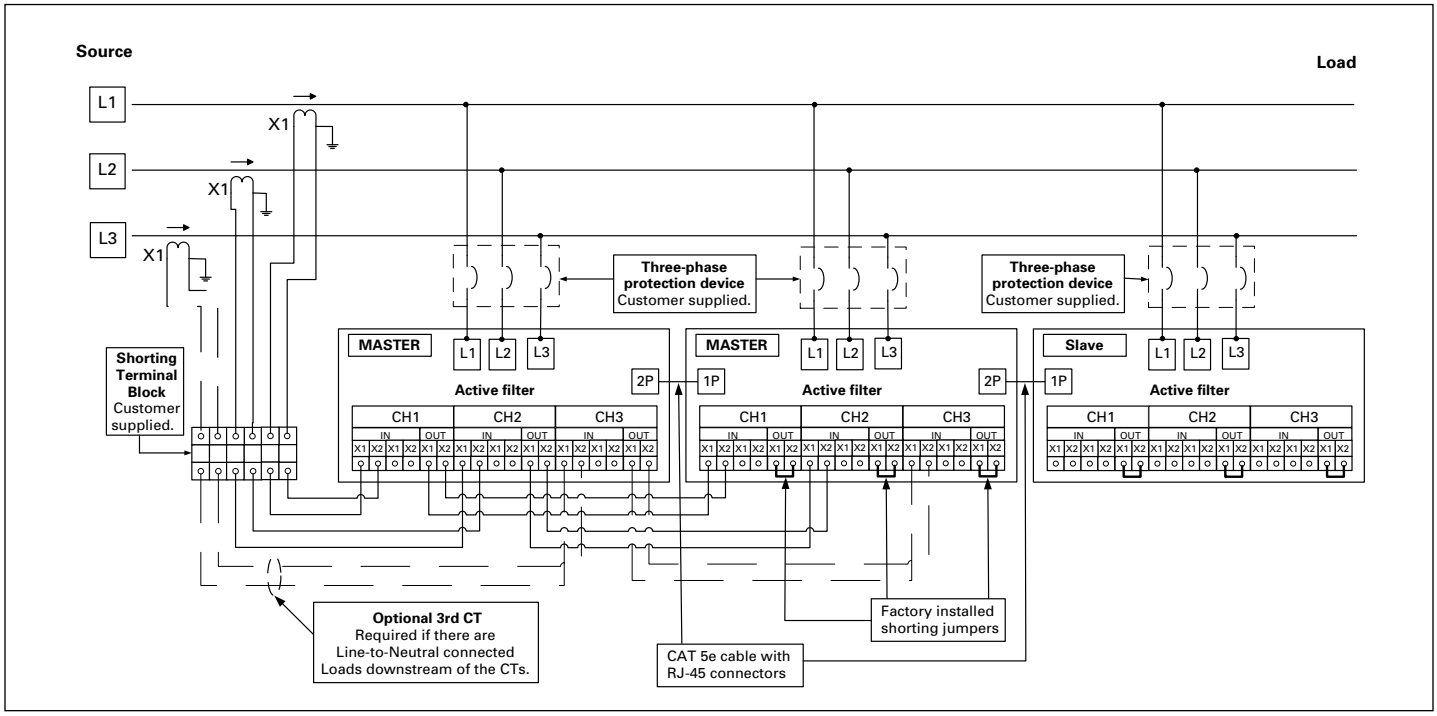
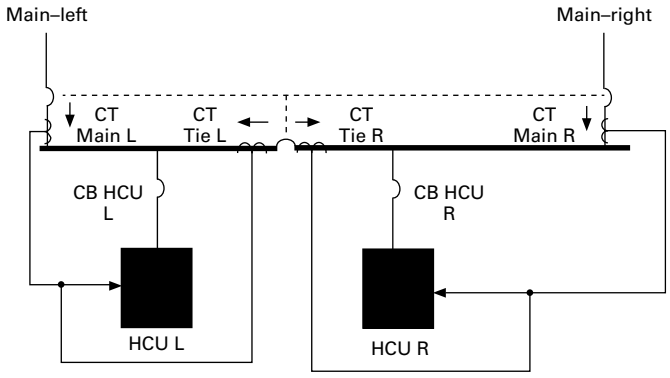
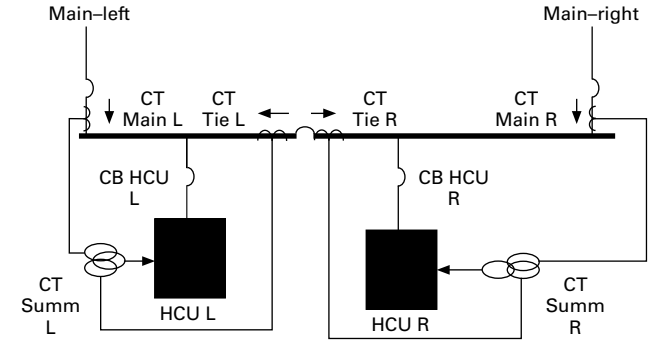


Figure 3. Typical CT configuration for multiple units in parallel



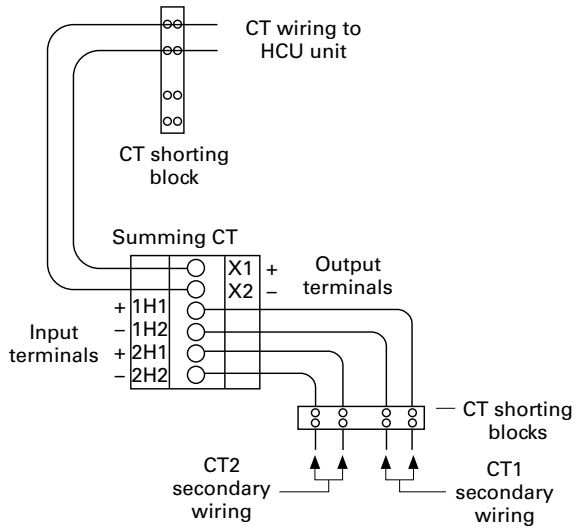
Note: This configuration provides individual HCU operation per side regardless of breaker positions. Please follow the CT polarities per the arrows. CTs should be installed on the A phase.

Figure 4. Typical current transformer scheme for main-tie-main configuration without parallel operation



Note: This configuration provides individual HCU operation per side regardless of breaker positions. Please follow the CT polarities per the arrows. CTs should be installed on the A phase.

Figure 5. Typical current transformer scheme for main-tie-main configuration with parallel operation



Note: Summing CT and shorting blocks are typically installed external to the HCU unit.

Figure 6. TX SUM-2 summing CT

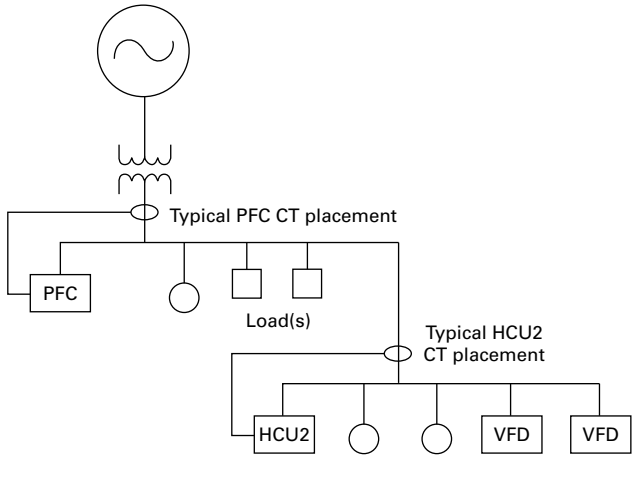


Figure 7. Typical scheme with passive detuned PFC filter and HCU2

Drawings—NEMA 1 wallmounted enclosures

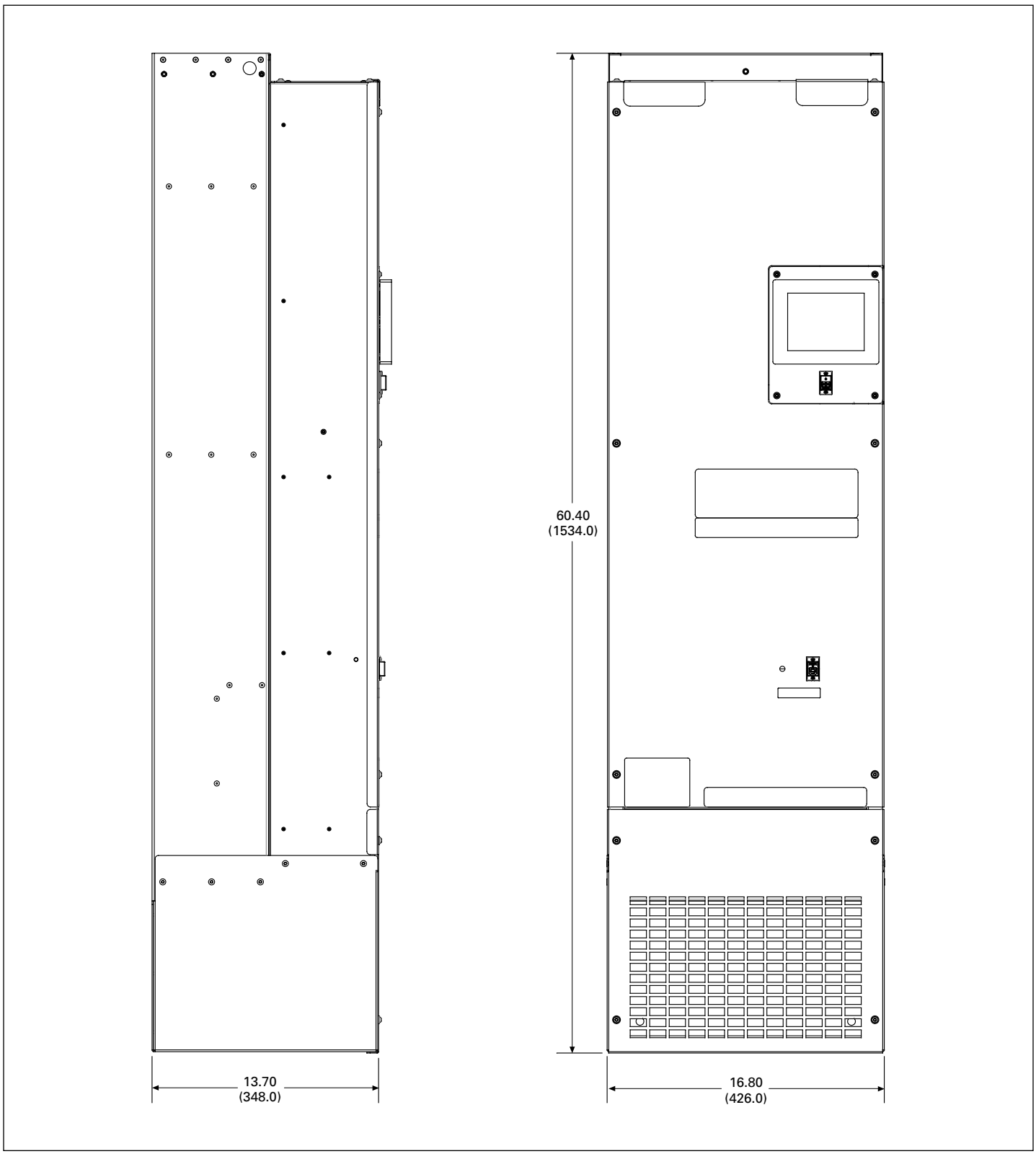


Figure 8. NEMA 1, 60 A—dimensions in inches (mm)

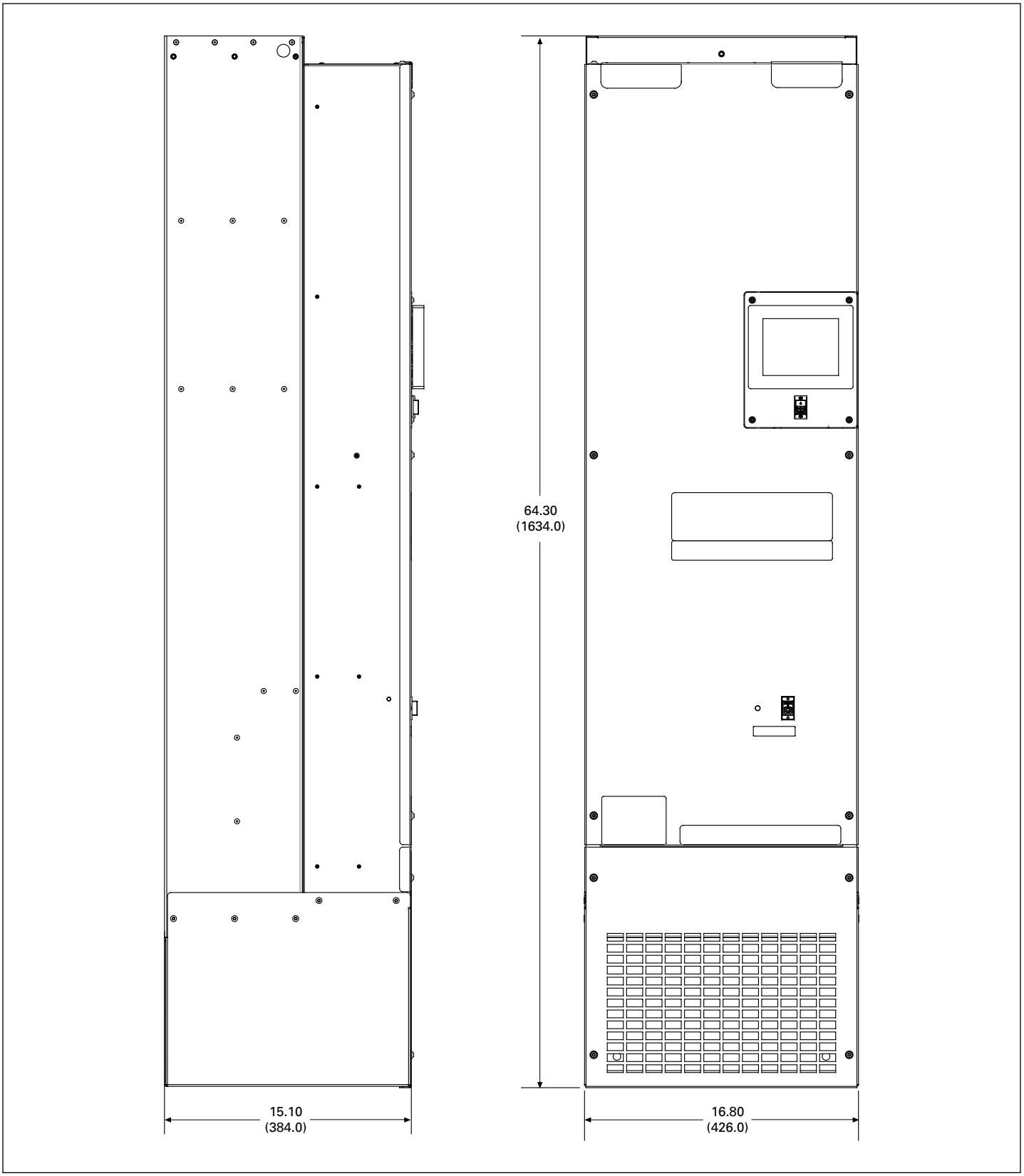


Figure 9. NEMA 1, 120 A—dimensions in inches (mm)

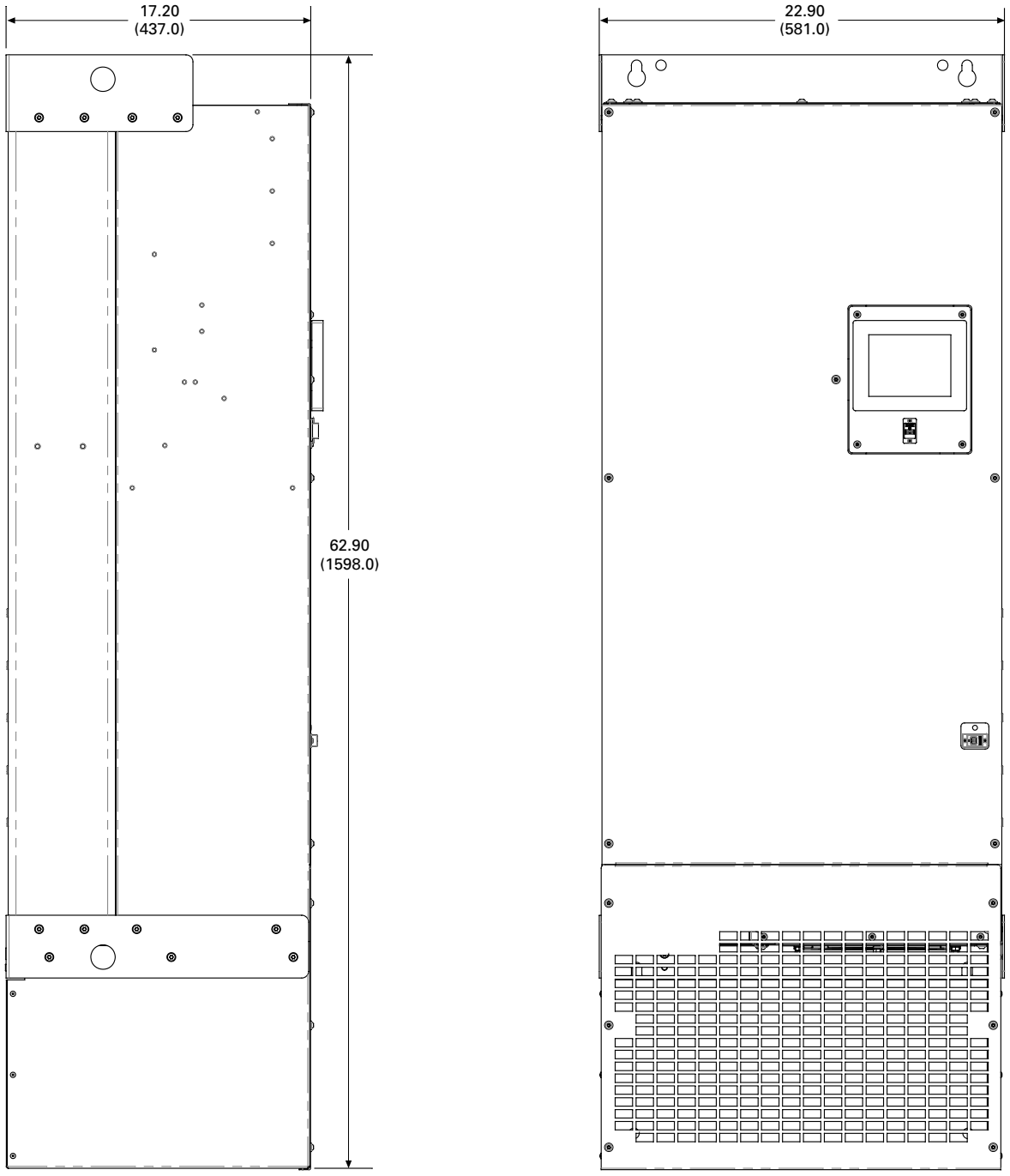


Figure 10. NEMA 1, 200 A—dimensions in inches (mm)

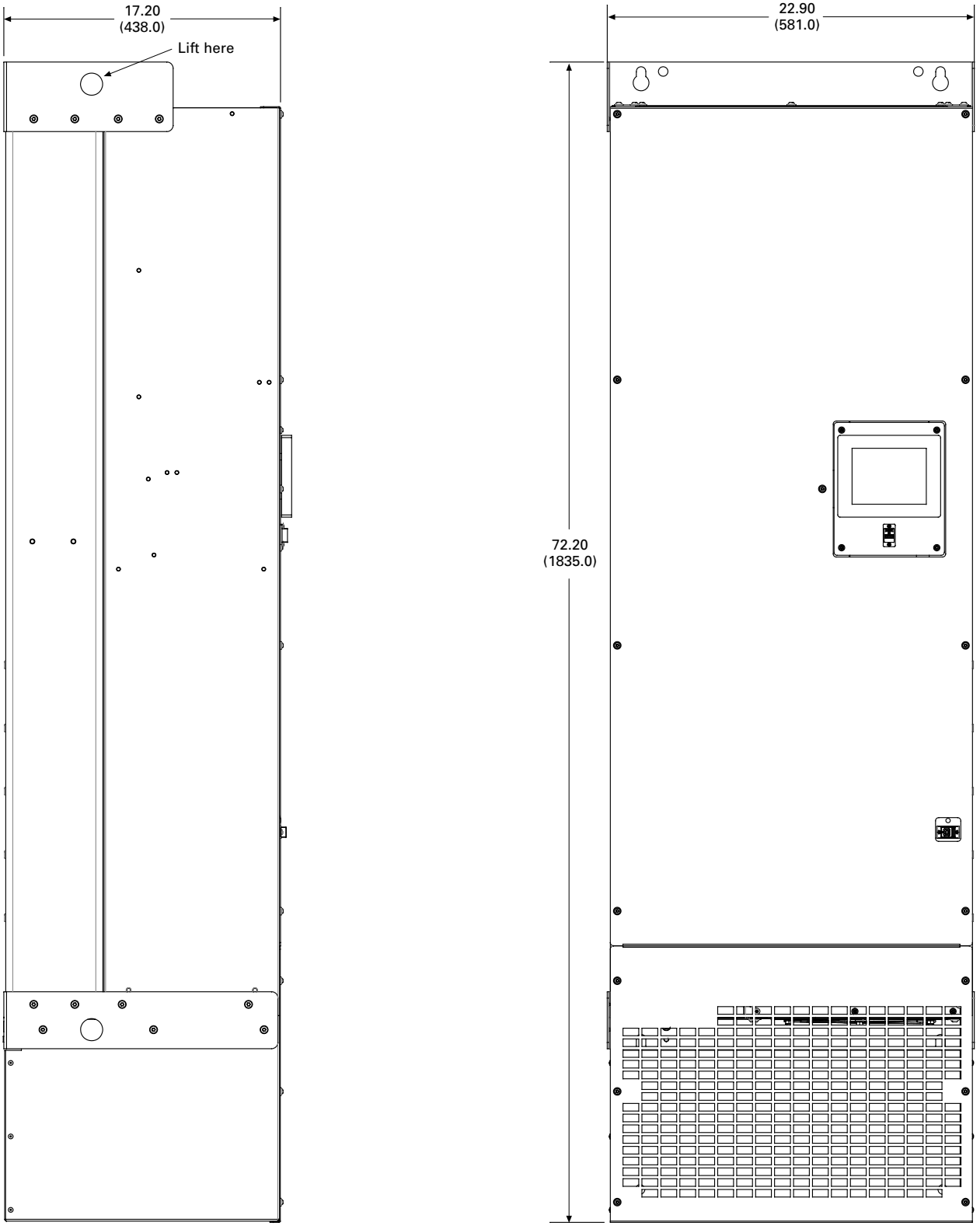


Figure 11. NEMA 1, 300 A—dimensions in inches (mm)

Drawings—chassis-mounted units

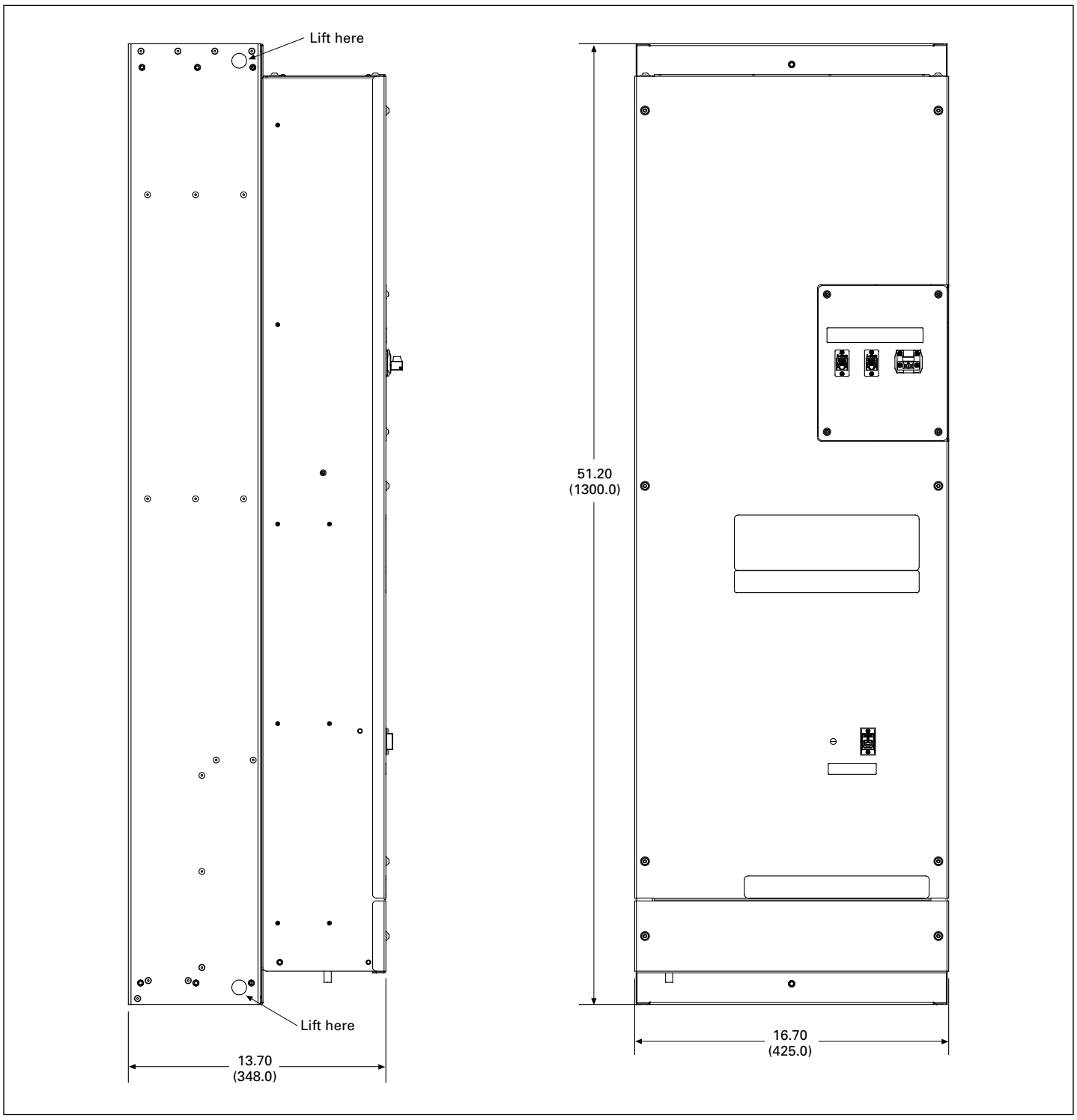


Figure 12. Chassis mount 60 A—dimensions in inches (mm)

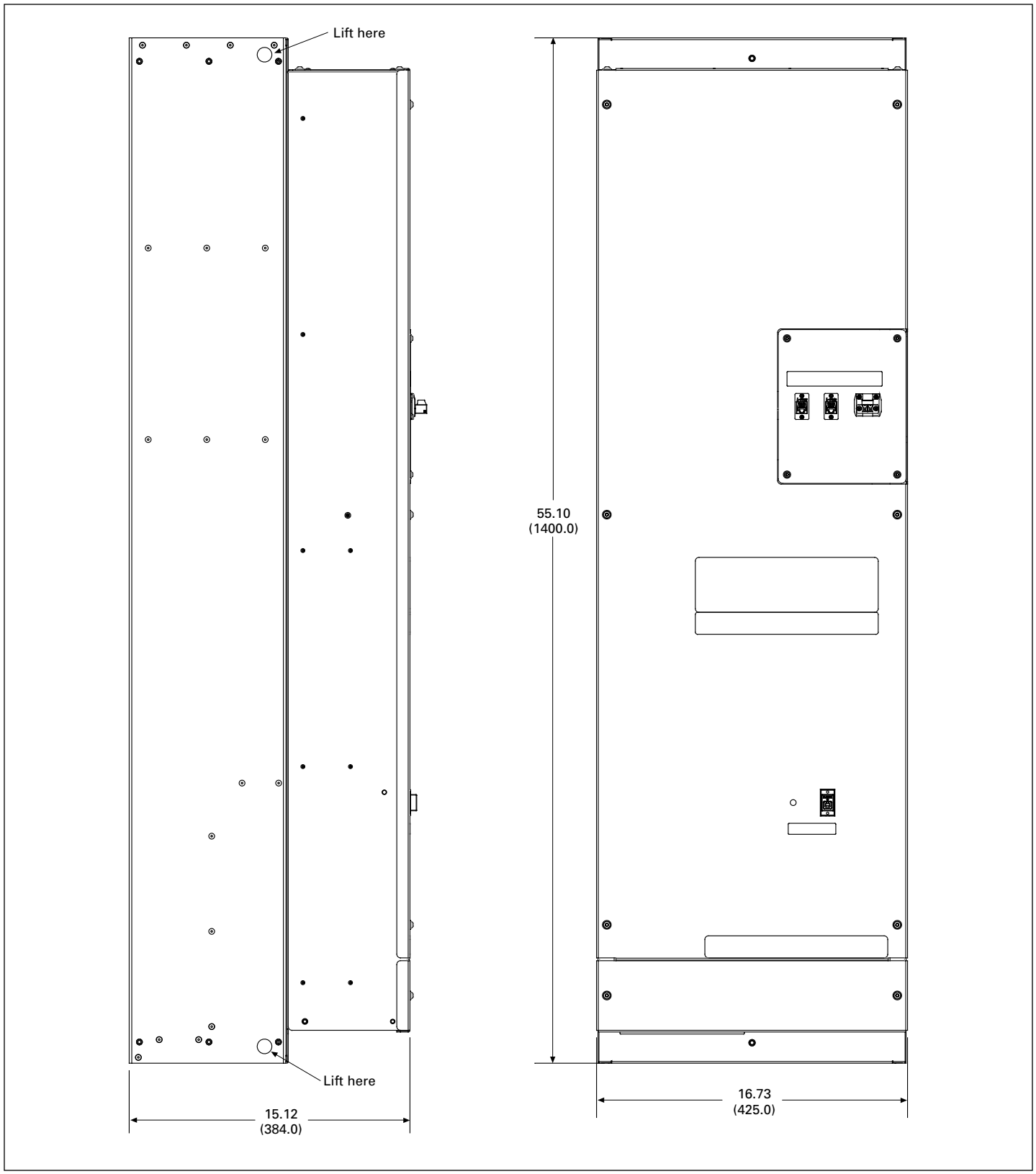


Figure 13. Chassis mount 120 A—dimensions in inches (mm)

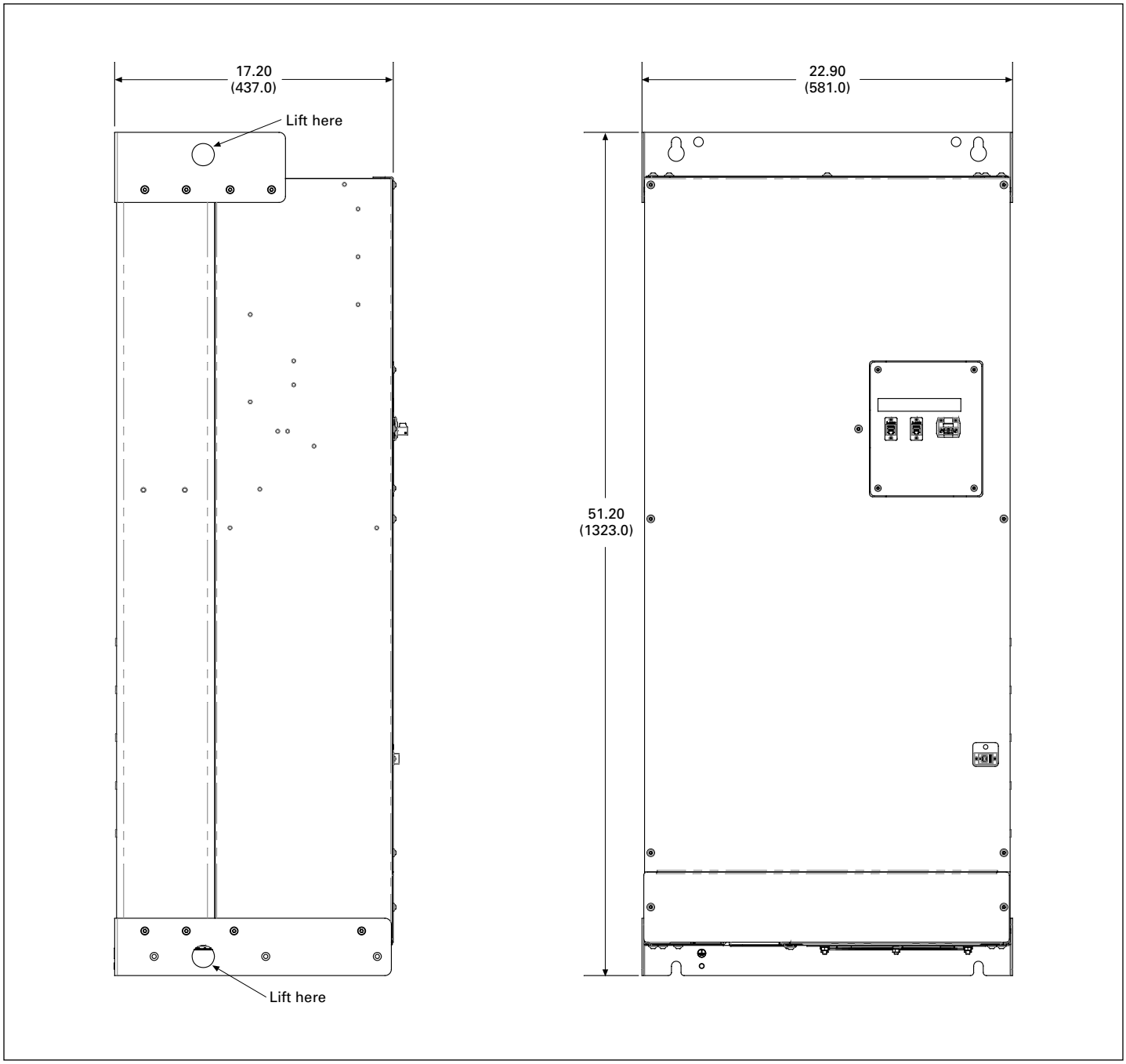


Figure 14. Chassis mount 200 A—dimensions in inches (mm)

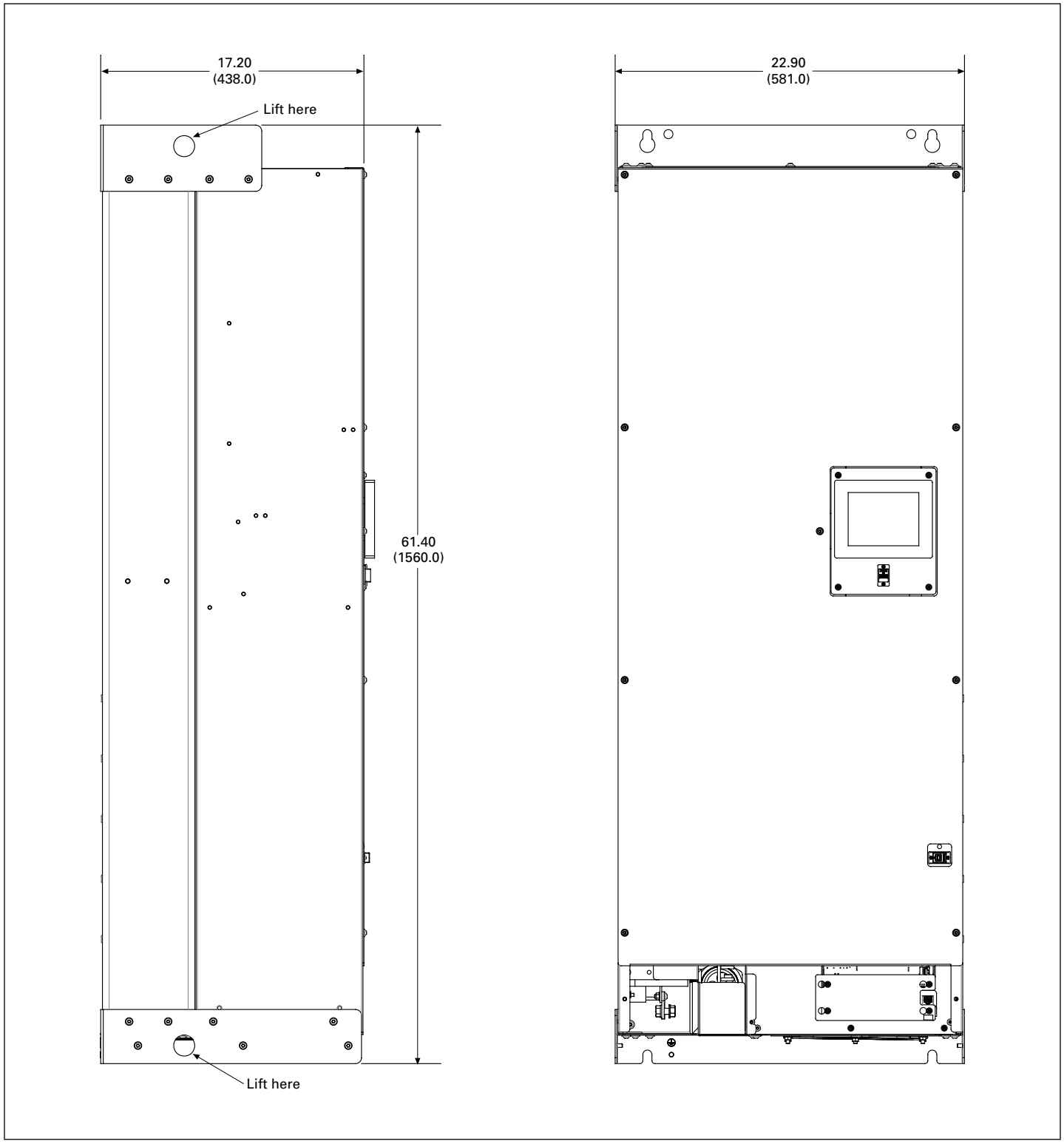


Figure 15. Chassis mount 300 A—dimensions in inches (mm)

Drawings—380–480 V, NEMA 2, NEMA 12, IP31 and IP54 units

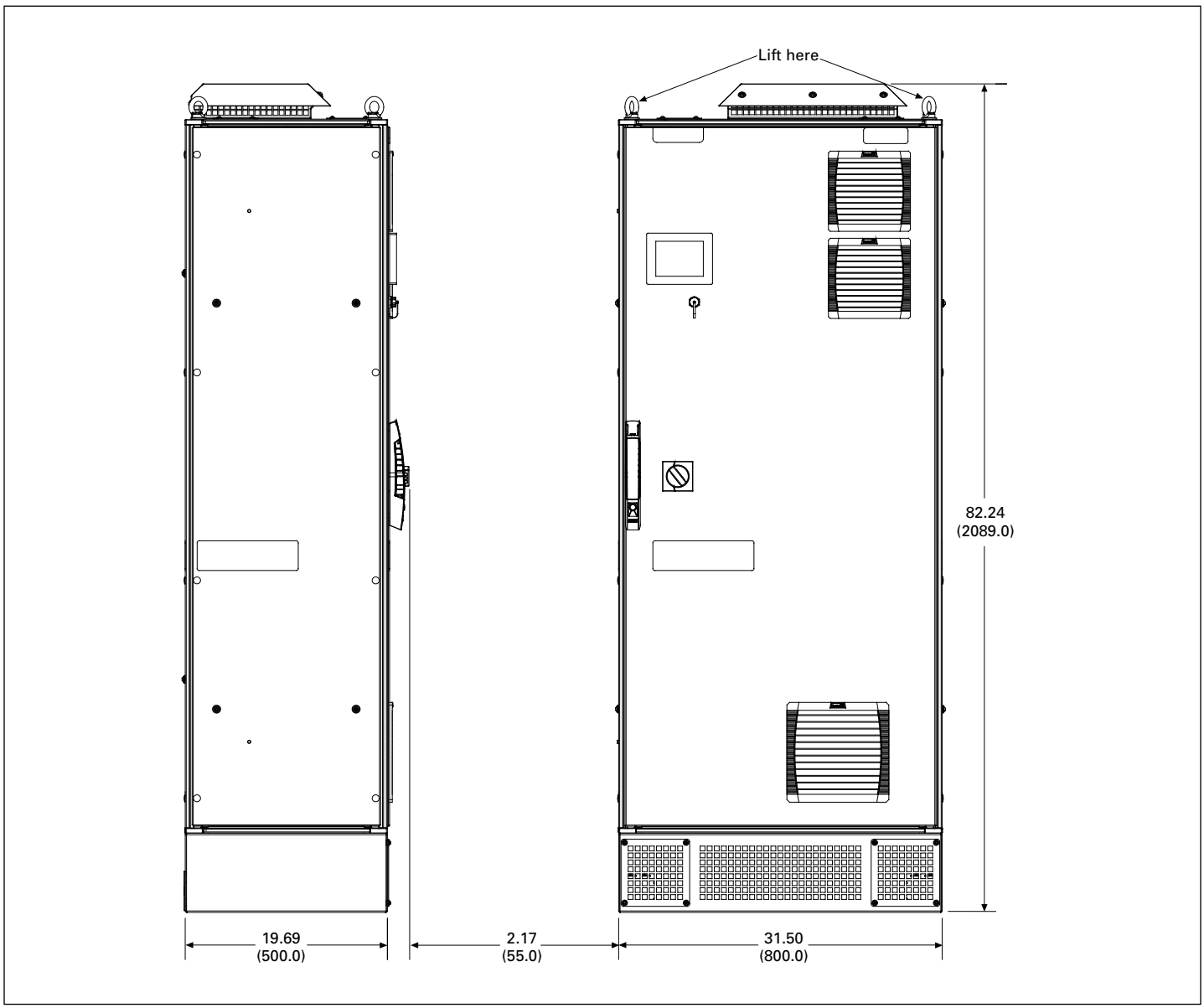


Figure 16. 60 A and 120 A, 380–480 V, NEMA 2, NEMA 12, IP31 and IP54 units—dimensions in inches (mm)

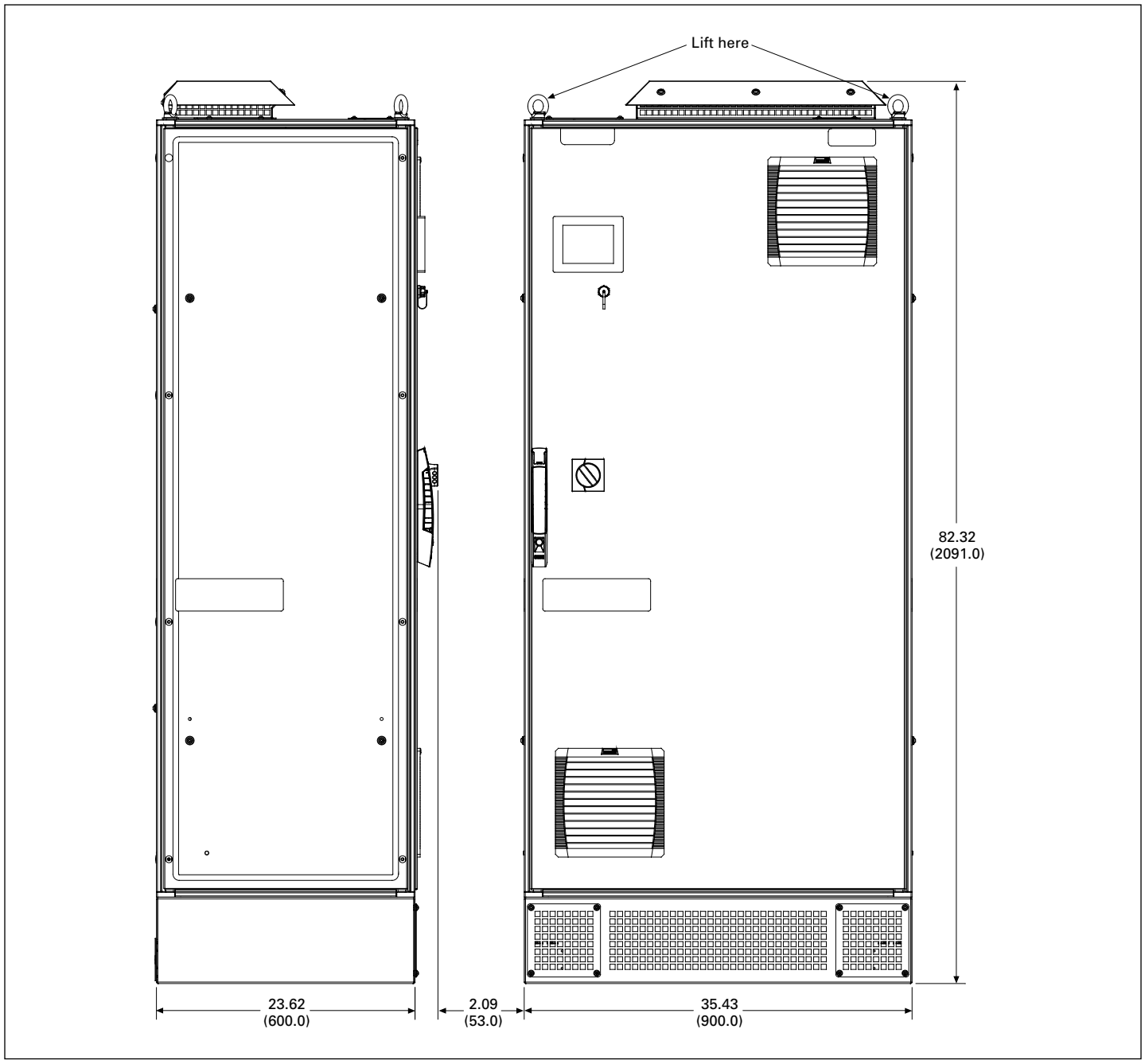


Figure 17. 200 A and 300 A, 380–480 V, NEMA 2, NEMA 12, IP31 and IP54 units—dimensions in inches (mm)

Drawings—600 V and 690 V units

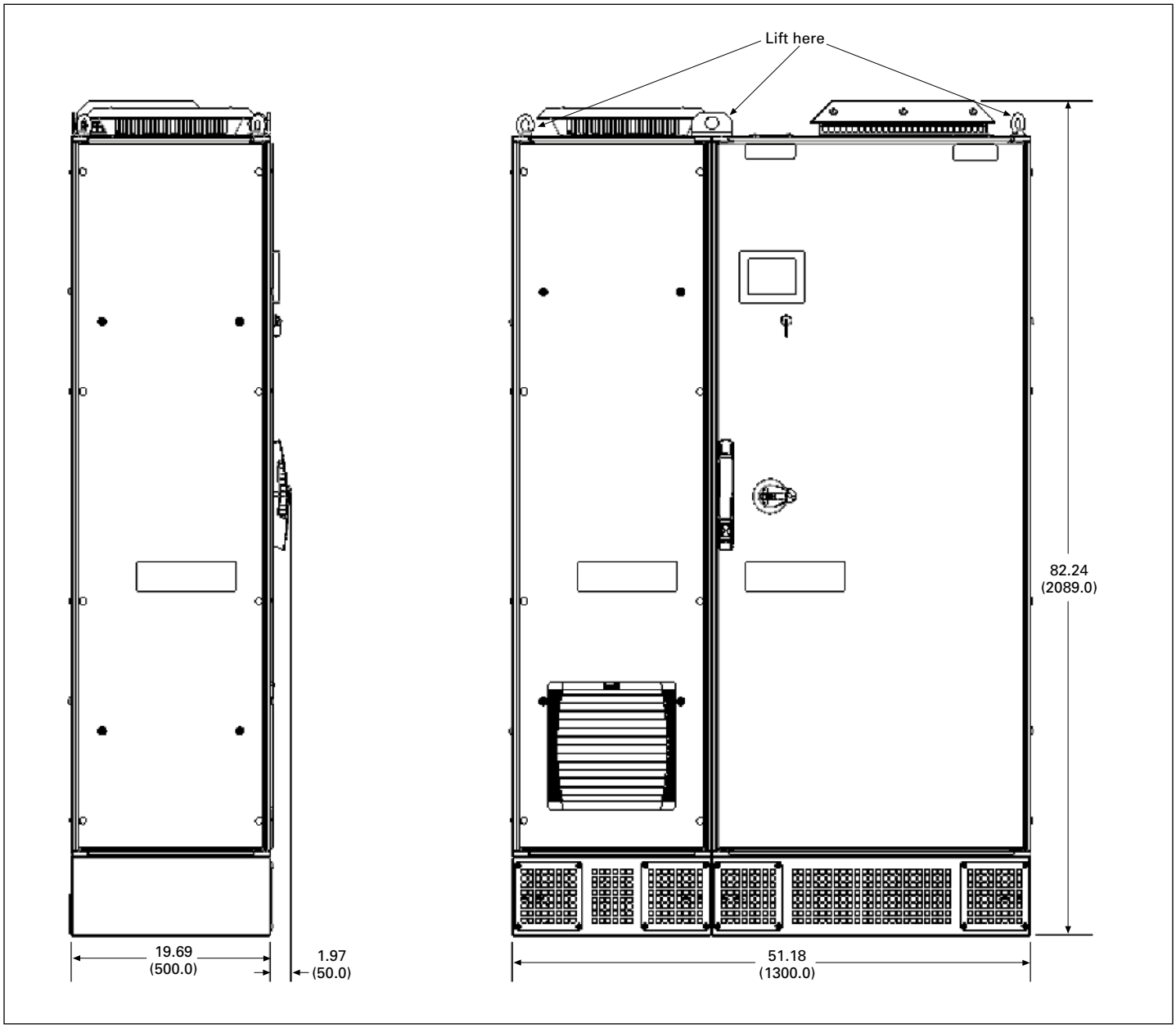


Figure 18. 600 V and 690 V units, 40–94 A—dimensions in inches (mm)

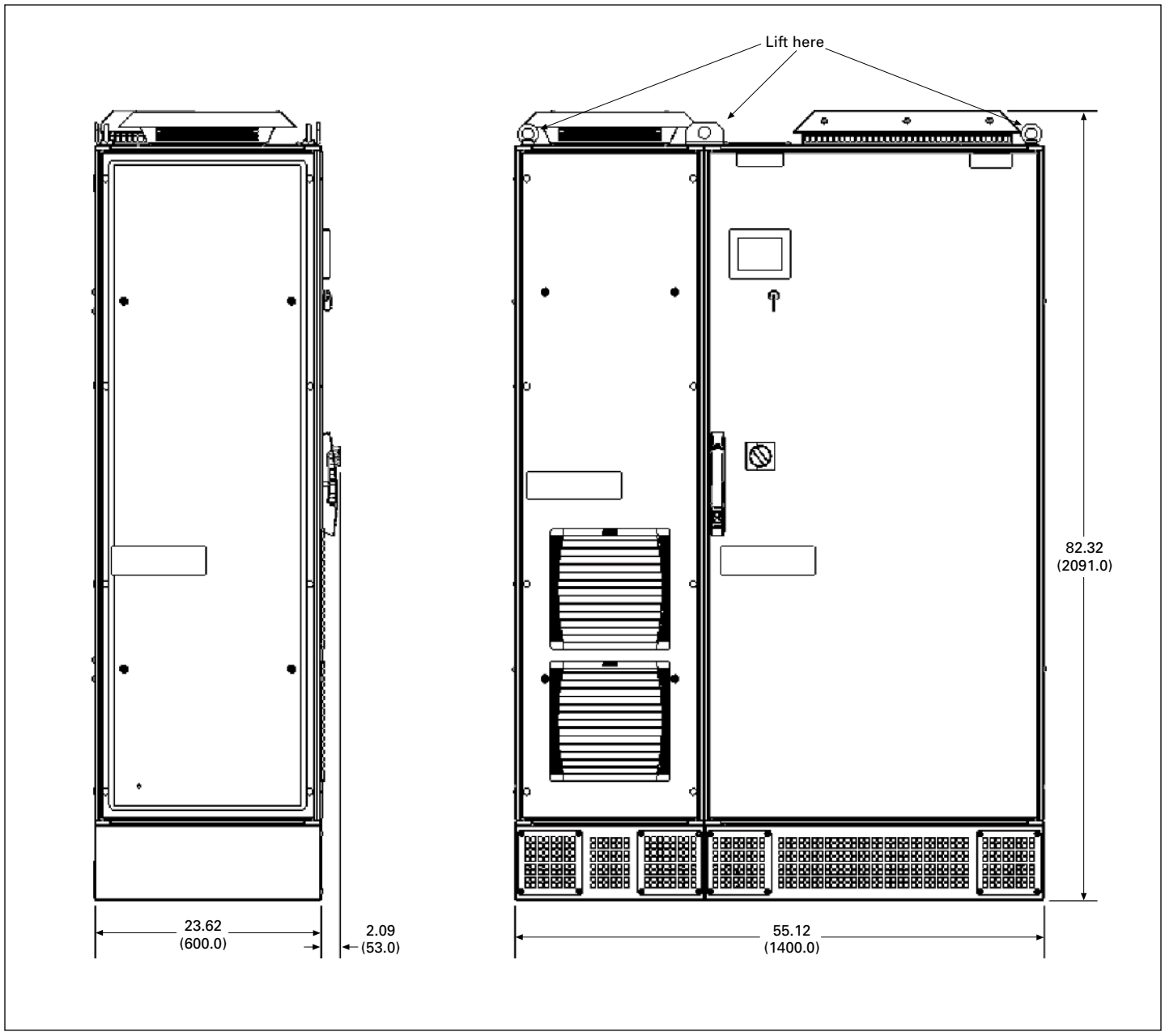


Figure 19. 600 V and 690 V units, 133–235 A—dimensions in inches (mm)

Warranty

Standard warranty is 1 year, parts only, against manufacturing defects. Optional 2-year warranty coverage, parts only, against manufacturing defects is included with EESS commissioning, per Eaton Selling Policy 25-000. Optional 3-year warranty is available with EESS commissioning and service agreement.

For product support, please contact Eaton's Technical Resource Center (TRC) power factor application engineers at **1-800-809-2772**, choose option #4, then option #2.
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