

D. Operation keys and indicator lights

Table 5: Legend to Section D

13	[Hand On]: Starts the motor and enables control of the drive via the LCP.
	<div>NOTICE</div> <p>[2] <i>Coast inverse</i> is the default option for <i>parameter 5-12 Terminal 27 Digital Input</i>. If there is no 24 V supply to terminal 27, [Hand On] does not start the motor. Connect terminal 12 to terminal 27.</p>
14	[Off/Reset]: Stops the motor (Off). If in alarm mode, the alarm is reset.
15	[Auto On]: The drive is controlled either via control terminals or serial communication.

4.2 Automatic Motor Adaptation (AMA)

Via running AMA in VVC+ mode, the drive builds a mathematical model of the motor to optimize compatibility between drive and motor, and thus enhances the motor control performance.

Procedure:

1. Set motor data according to the motor nameplate.

2. If needed, set motor cable length in *parameter 1-42 Motor Cable Length*.

Select [1] *Enable Complete AMA* or [2] *Enable Reduced AMA* in *parameter 1-29 Automatic Motor Adaption (AMA)*, and press [Hand On] to activate the AMA function. After a normal sequence, the display shows: Press [OK] to finish AMA.

Press [OK], then the drive is ready for operation.

5 Troubleshooting

Table 6: Warnings and Alarms

Fault number	Warning/alarm bit number	Fault text	Warning	Alarm	Trip locked	Cause of problem
2	16	Live Zero Error	X	X	–	Signal on terminal 53 or 54 is less than 50% of the value set in <i>parameter 6-10 Terminal 53 Low Voltage</i> , <i>parameter 6-12 Terminal 53 Low Current</i> , <i>parameter 6-20 Terminal 54 Low Voltage</i> , or <i>parameter 6-22 Terminal 54 Low Current</i> . See also <i>parameter group 6-0* Analog I/O Mode</i> .
3	15/72	No motor	X	X	–	No motor is connected to the output of the drive.
4	14	Mains Ph. Loss	X	X	X	Missing phase on the supply side or too high voltage imbalance. Check the supply voltage. See <i>parameter 14-12 Function at Mains Imbalance</i> .
7	11	DC overvolt	X	X	–	DC-link voltage exceeds the limit.
8	10	DC undervolt	X	X	–	DC-link voltage drops below voltage warning low-limit.
9	9	Inverter Overld.	X	X	–	More than 100% load for a long time.
10	8	Motor ETR Overld.	X	X	–	Motor is too hot due to more than 100% load for a long time. See <i>parameter 1-90 Motor Thermal Protection</i> .
11	7	Motor Th. Overld.	X	X	–	Thermistor or thermistor connection is disconnected. See <i>parameter 1-90 Motor Thermal Protection</i> .
13	5	Over Current	X	X	X	Inverter peak current limit is exceeded.
14	2	Earth Fault	X	X	X	Discharge from output phases to ground.
16	12	Short Circuit	–	X	X	Short circuit in motor or on motor terminals.
17	4	Ctrl.Word TO	X	X	–	No communication to drive. See <i>parameter group 8-0* General Settings</i> .
18	42	Start Failed	–	X	–	Running speed is not reached within a specified time. A possible reason is a blocked rotor. Set <i>parameter 1-78 Compressor Start Max Speed [Hz]</i> and <i>parameter 1-79 Compressor Start Max Time to Trip</i> to adjust the speed and time expected.
24	50	Fan Fault	X	X	–	The heat sink cooling fan is not working.
30	19	U phase loss	–	X	X	Motor phase U is missing. Check the phase. See <i>parameter 4-58 Missing Motor Phase Function</i> .
31	20	V phase loss	–	X	X	Motor phase V is missing. Check the phase. See <i>parameter 4-58 Missing Motor Phase Function</i> .
32	21	W phase loss	–	X	X	Motor phase W is missing. Check the phase. See <i>parameter 4-58 Missing Motor Phase Function</i> .
36	24	Mains Failure	X	X	–	This warning/alarm is only active if the supply voltage to the drive is lost and <i>parameter 14-10 Mains Failure</i> is not set to [0] <i>No Function</i> .
38	17	Internal Fault	–	X	X	Contact the local supplier.
44	48	Earth Fault DESAT	–	X	X	Discharge from output phases to ground, using the value of <i>parameter 15-31 InternalFaultReason</i> if possible.
46	33	Gate drive Voltage Fault	–	X	X	Control voltage is low. Contact the local supplier.
47	23	24 V Supply Low	X	X	X	24 V DC supply may be overloaded.
50	–	AMA calibration	–	X	–	Contact the local supplier.
51	15	AMA Unom/Inom	–	X	–	The setting of motor voltage, motor current, and motor power is wrong. Check the settings.
52	–	AMA low Inom	–	X	–	The motor current is too low. Check the settings.
53	–	AMA big motor	–	X	–	The motor is too big to perform AMA.
54	–	AMA small mot	–	X	–	The motor is too small to perform AMA.
55	–	AMA par. range	–	X	–	The parameter values found from the motor are outside the acceptable range.
56	–	AMA interrupt	–	X	–	The AMA has been interrupted by the user.

Table 6: Warnings and Alarms (continued)

Fault number	Warning/alarm bit number	Fault text	Warning	Alarm	Trip locked	Cause of problem
57	–	AMA timeout	–	X	–	Try to start the AMA again a number of times, until the AMA is carried out.
58	–	AMA internal	–	X	–	Contact the local supplier.
59	25/57	Current Limit	X	X	–	The current is higher than the value in <i>parameter 4-18 Current Limit</i> .
60	44	External Interlock	–	X	–	External interlock has been activated. To resume normal operation, apply 24 V DC to the terminal programmed for external interlock and reset the drive (via serial communication, digital I/O, or by pressing the [Reset] key on the LCP).
69	1	Pwr. Card Temp	X	X	X	The temperature sensor on the power card exceeds the upper or lower limits.
70	36	Illegal FC config	–	X	X	The control card and power card are not matched.
79	–	Illegal PS config	X	X	–	Internal fault. Contact the local supplier.
80	29	Drive Initialized	–	X	–	All parameter settings are initialized to default settings.
87	47	Auto DC Braking	X	–	–	The drive is auto DC braking.
92	37	No Flow	X	X	–	A no-flow condition has been detected in the system. <i>Parameter 22-23 No-Flow Function</i> is set for alarm.
93	38	Dry Pump	X	X	–	A dry-pump condition has been detected in the system. <i>Parameter 22-26 Dry Pump Function</i> is set for alarm.
94	39	End of Curve	X	X	–	An end-of-curve condition has been detected in the system. <i>Parameter 22-50 End of Curve Function</i> is set for alarm.
95	40	Broken Belt	X	X	–	Torque is below the torque level set for no load, indicating a broken belt. See <i>parameter group 22-6* Broken Belt Detection</i> .
99	54	Locked Rotor	–	X	–	The rotor is blocked.
101	47	Flow/Pressure info missing	–	X	–	Sensorless-pump table is missing or wrong. Download sensorless-pump table again.
126	–	Motor Rotating	–	X	–	High back EMF voltage. Stop the rotor of the PM motor.
127	61	Back EMF too High	X	–	–	This warning applies to PM motors only. When the back EMF exceeds 90% x Uinvmx (overvoltage threshold) and does not drop to normal level within 5 s, this warning is reported. The warning remains until the back EMF returns to a normal level.
159	36	Check Valve Failure	X	–	–	When the drive is not in operation, a broken check valve leads to the motor runs in reverse. <i>Parameter 22-04 Check Valve Monitor</i> is set for warning.
200	–	Fire Mode	X	–	–	Fire mode has been activated.
202	–	Fire Mode Limits Exceeded	X	–	–	Fire mode has suppressed 1 or more warranty voiding alarms.
203	42	Multi Motor Underload	X	–	–	Missing motor in a multi-motor system, refer to <i>parameter group 24-9* Multi-Motor Funct</i> .
204	43	Multi Motor Overload	X	–	–	Locked rotor in a multi-motor system, refer to <i>parameter group 24-9* Multi-Motor Funct</i> .
250	35	New Sparepart	–	X	X	The power or switch mode power supply has been exchanged. Contact the local supplier.
251	34	New Typecode	–	X	X	The drive has a new type code. Contact the local supplier.

6 Specifications

Table 7: Mains Supply 3x200Y/115–240Y/139 V AC, 0.25–11 kW (0.33–15 hp)

Drive	PK25	PK37	PK75	P1K5	P2K2	P3K7	P5K5	P7K5	P11K
Typical shaft output [kW]	0.25	0.37	0.75	1.5	2.2	3.7	5.5	7.5	11
Typical shaft output [hp]	0.33	0.5	1.0	2.0	3.0	5.0	7.5	10	15
Protection rating IP20/Open Type	H1	H1	H1	H1	H2	H3	H4	H4	H5
Maximum cable size in terminals (mains, motor) [mm² (AWG)]	4 (10)	4 (10)	4 (10)	4 (10)	4 (10)	4 (10)	16 (6)	16 (6)	16 (6)
Output current 40 °C (104 °F) ambient temperature									
Continuous (3x200–240 V) [A]	1.5	2.2	4.2	6.8	9.6	15.2	22	28	42
Intermittent (3x200–240 V) [A]	1.7	2.4	4.6	7.5	10.6	16.7	24.2	30.8	46.2
Maximum input current									
Continuous (3x200Y/115–240Y/139 V) [A]	1.1	1.6	2.8	5.6	8.6/7.2	14.1/12	21/18	28.3/24	41/38.2
Intermittent (3x200Y/115–240Y/139 V) [A]	1.2	1.8	3.1	6.2	9.5/7.9	15.5/13.2	23.1/19.8	31.1/26.4	45.1/42
Weight enclosure protection rating IP20 [kg (lb)]	2.0 (4.4)	2.0 (4.4)	2.0 (4.4)	2.1 (4.6)	3.4 (7.5)	4.5 (9.9)	7.9 (17.4)	7.9 (17.4)	9.5 (20.9)
Output current 50 °C (122 °F) ambient temperature									
Continuous (3x200–240 V) [A]	1.5	1.9	3.5	6.8	9.6	13	19.8	23	33
Intermittent (3x200–240 V) [A]	1.7	2.1	3.9	7.5	10.6	14.3	21.8	25.3	36.3

Table 8: Mains Supply 3x380Y/220–480Y/277 V AC, 0.37–22 kW (0.5–30 hp)

Drive	PK37	PK75	P1K5	P2K2	P3K0	P4K0	P5K5	P7K5	P11K	P15K	P18K	P22K
Typical shaft output [kW]	0.37	0.75	1.5	2.2	3.0	4.0	5.5	7.5	11	15	18	22
Typical shaft output [hp]	0.5	1.0	2.0	3.0	4.0	5.0	7.5	10	15	20	25	30
Protection rating IP20/Open Type	H1	H1	H1	H2	H2	H2	H3	H3	H4	H4	H5	H5
Maximum cable size in terminals (mains, motor) [mm² (AWG)]	4 (10)	4 (10)	4 (10)	4 (10)	4 (10)	4 (10)	4 (10)	4 (10)	16 (6)	16 (6)	16 (6)	16 (6)
Output current 40 °C (104 °F) ambient temperature												
Continuous (3x380–440 V) [A]	1.2	2.2	3.7	5.3	7.2	9.0	12	15.5	23	31	37	42.5
Intermittent (3x380–440 V) [A]	1.3	2.4	4.1	5.8	7.9	9.9	13.2	17.1	25.3	34	40.7	46.8
Continuous (3x441–480 V) [A]	1.1	2.1	3.4	4.8	6.3	8.2	11	14	21	27	34	40
Intermittent (3x441–480 V) [A]	1.2	2.3	3.7	5.3	6.9	9.0	12.1	15.4	23.1	29.7	37.4	44
Maximum input current												
Continuous (3x380Y/220–440Y/254 V) [A]	1.2	2.1	3.5	4.7	6.3	8.3	11.2	15.1	22.1	29.9	35.2	41.5
Intermittent (3x380Y/220–440Y/254 V) [A]	1.3	2.3	3.9	5.2	6.9	9.1	12.3	16.6	24.3	32.9	38.7	45.7
Continuous (3x441Y/255–480Y/277 V) [A]	1.0	1.8	2.9	3.9	5.3	6.8	9.4	12.6	18.4	24.7	29.3	34.6
Intermittent (3x441Y/255–480Y/277 V) [A]	1.1	2.0	3.2	4.3	5.8	7.5	10.3	13.9	20.2	27.2	32.2	38.1
Weight enclosure protection rating IP20 [kg (lb)]	2.0 (4.4)	2.0 (4.4)	2.1 (4.6)	3.3 (7.3)	3.3 (7.3)	3.4 (7.5)	4.3 (9.5)	4.5 (9.9)	7.9 (17.4)	7.9 (17.4)	9.5 (20.9)	9.5 (20.9)
Output current 50 °C (122 °F) ambient temperature												
Continuous (3x380–440 V) [A]	1.04	1.93	3.7	4.85	6.3	8.4	10.9	14	20.9	28	34.1	38
Intermittent (3x380–440 V) [A]	1.1	2.1	4.07	5.4	6.9	9.2	12	15.4	23	30.8	37.5	41.8
Continuous (3x441–480 V) [A]	1.0	1.8	3.4	4.4	5.5	7.5	10	12.6	19.1	24	31.3	35
Intermittent (3x441–480 V) [A]	1.1	2.0	3.7	4.8	6.1	8.3	11	13.9	21	26.4	34.4	38.5

Table 9: Mains Supply 3x200Y/115–240Y/139 V AC, 15–45 kW (20–60 hp)

Drive	P15K	P18K	P22K	P30K	P37K	P45K
Typical shaft output [kW]	15	18.5	22	30	37	45
Typical shaft output [hp]	20	25	30	40	50	60
Protection rating IP20/Open Type	H6	H6	H7	H7	H8	H8
Maximum cable size in terminals (mains, motor) [mm² (AWG)]	35 (2)	35 (2)	50 (1)	50 (1)	95 (0)	120 (4/0)
Output current 40 °C (104 °F) ambient temperature						
Continuous (3x200–240 V) [A]	59.4	74.8	88	115	143	170
Intermittent (3x200–240 V) [A]	65.3	82.3	96.8	126.5	157.3	187
Maximum input current						
Continuous (3x200Y/115–240Y/139 V) [A]	52.7	65	76	103.7	127.9	153
Intermittent (3x200Y/115–240Y/139 V) [A]	58	71.5	83.7	114.1	140.7	168.3
Weight enclosure protection rating IP20 [kg (lb)]	24.5 (54)	24.5 (54)	36 (79.4)	36 (79.4)	51 (112.4)	51 (112.4)
Output current 50 °C (122 °F) ambient temperature						
Continuous (3x200–240 V) [A]	41.6	52.4	61.6	80.5	100	119
Intermittent (3x200–240 V) [A]	45.8	57.6	67.8	88.6	110.1	130.9

Table 10: Mains Supply 3x380Y/220–480Y/277 V AC, 30–90 kW (40–125 hp)

Drive	P30K	P37K	P45K	P55K	P75K	P90K
Typical shaft output [kW]	30	37	45	55	75	90
Typical shaft output [hp]	40	50	60	75	100	125
Protection rating IP20/Open Type	H6	H6	H6	H7	H7	H8
Maximum cable size in terminals (mains, motor) [mm² (AWG)]	35 (2)	35 (2)	35 (2)	50 (1)	95(0)	120 (250MCM)
Output current 40 °C (104 °F) ambient temperature						
Continuous (3x380–440 V) [A]	61	73	90	106	147	177
Intermittent (3x380–440 V) [A]	67.1	80.3	99	116	161	194
Continuous (3x441–480 V) [A]	52	65	80	105	130	160
Intermittent (3x441–480 V) [A]	57.2	71.5	88	115	143	176
Maximum input current						
Continuous (3x380Y/220–440Y/254 V) [A]	57	70	84	103	140	166
Intermittent (3x380Y/220–440Y/254 V) [A]	62.7	77	92.4	113	154	182
Continuous (3x441Y/255–480Y/277 V) [A]	49.2	60.6	72.5	88.6	120.9	142.7
Intermittent (3x441Y/255–480Y/277 V) [A]	54.1	66.7	79.8	97.5	132.9	157
Weight enclosure protection rating IP20 [kg (lb)]	24.5 (54)	24.5 (54)	24.5 (54)	36 (79.4)	36 (79.4)	51 (112.4)
Output current 50 °C (122 °F) ambient temperature						
Continuous (3x380–440 V) [A]	48.8	58.4	72	74.2	102.9	123.9
Intermittent (3x380–440 V) [A]	53.7	64.2	79.2	81.6	113.2	136.3
Continuous (3x441–480 V) [A]	41.6	52	64	73.5	91	112
Intermittent (3x441–480 V) [A]	45.8	57.2	70.4	80.9	100.1	123.2

7 Ambient Conditions

Table 11: Operating Environment Specifications

Protection rating	IP20/Open Type
Temperature during operation	H1–H5: -20 °C to +50 °C (-4 °F to +122 °F) H6–H8: -10 °C to +50 °C (14 °F to +122 °F)
Temperature during storage/transport	-30 °C to +65/70 °C (-22 °F to +149/158 °F)
Relative humidity	5–95% (IEC 60721-3-3; Class 3K3 (non-condensing) during operation)
Altitude	Maximum altitude above sea level without derating: 1000 m (3281 ft) Maximum altitude above sea level with derating: 3000 m (9843 ft)
Contamination level	Aggressive environment (IEC 60721-3-3) Coated enclosure sizes H1–H8 Class 3C3 Non-coated enclosure sizes H6–H8 Class 3C2

8 Mounting Clearance

Table 12: Clearance Required for Cooling

Enclosure size	Enclosure	3x200Y/115–240Y/139 V	3x380Y/220–480Y/277 V	Clearance above/below [mm (in)]
H1	IP20/Open Type	0.25–1.5 (0.33–2.0)	0.37–1.5 (0.5–2.0)	100 (3.9)
H2	IP20/Open Type	2.2 (3.0)	2.2–4.0 (3.0–5.0)	100 (3.9)
H3	IP20/Open Type	3.7 (5.0)	5.5–7.5 (7.5–10)	100 (3.9)
H4	IP20/Open Type	5.5–7.5 (7.5–10)	11–15 (15–20)	100 (3.9)
H5	IP20/Open Type	11 (15)	18.5–22 (25–30)	100 (3.9)
H6	IP20/Open Type	15–18.5 (20–25)	30–45 (40–60)	200 (7.9)
H7	IP20/Open Type	22–30 (30–40)	55–75 (75–100)	200 (7.9)
H8	IP20/Open Type	37–45 (50–60)	90 (125)	225 (8.9)

9 EMC Compatibility and Motor Cable Length

- For drives of enclosure size H1–H5:
- The drive fulfills EN61800-3 Category C4 for conducted & radiated emissions.
 - For optimum performance, use unshielded motor cables no longer than 50 m (164 ft) with this drive.
 - The RFI screw is mounted from the factory and has no impact on EMC performance.

- For drives of enclosure size H6–H8:
- The drive meets EN61800-3 Category C3 for conducted and radiated emissions; Categories C1 and C2 are achievable with optional filters.

10 Fuses

The recommended fuses in *Table 13 Fuses* are suitable for use on a circuit capable of delivering 100,000 Arms (symmetrical), 240 V or 480 V depending on the drive voltage rating. With the proper fusing, the drive Short Circuit Current Rating (SCCR) is 100,000 Arms.

Table 13: Fuses

FC 101		UL Compliance (UL61800-5-1) Short Circuit Current Ratings (SCCR) 5kA and 100kA: 0–37 kW/0–50 hp; 10kA and 100kA: 45–90 kW/60–125 hp			CE Compliance 5 kA and 10 kA ⁽³⁾
Enclosure size	Power rating [kW (hp)]	Listed Fuse RK5/RK1 ⁽¹⁾ /J/T/CC Amperes ratings (A)	Test cabinet size ⁽²⁾ [Height x Width x Depth] [mm (in)]	Minimum Cabinet volume [L]	gG Amperes ratings (A)
3x200Y/115–240Y/139 V					
H1	0.25–1.5 (0.33–2.0)	10	500 x 400 x 260 (19.7 x 15.7 x 10.2)	52	gG-10
H2	2.2 (3.0)	15			gG-16
H3	3.7 (5.0)	25			gG-25
H4	5.5–7.5 (7.5–10)	50	800 x 400 x 300 (31.5 x 15.7 x 11.8)	96	gG-50
H5	11 (15)	80			gG-65
H6	15–18.5 (20–25)	100	— ⁽⁴⁾	–	gG-125
H7	22–30 (30–40)	150	800 x 600 x 400 (31.5 x 23.6 x 15.7)	192	gG-160
H8	37–45 (50–60)	200	1200 x 600 x 500 (47.2 x 23.6 x 19.7)	360	gG-200
3x380Y/220–480Y/277 V					
H1	0.37–1.5 (0.5–2.0)	10	500 x 400 x 260 (19.7 x 15.7 x 10.2)	52	gG-10
H2	2.2–4.0 (3.0–5.0)	15			gG-16
H3	5.5–7.5 (7.5–10)	25			gG-25
H4	11–15 (15–20)	50	800 x 400 x 300 (31.5 x 15.7 x 11.8)	96	gG-50
H5	18.5–22 (25–30)	80			gG-65
H6	30 (40)	125	— ⁽⁴⁾	–	gG-80
H6	37 (50)	125			gG-100
H6	45 (60)	125			gG-125
H7	55 (75)	200	800 x 600 x 400 (31.5 x 23.6 x 15.7)	192	gG-150
H7	75 (100)	200			gG-200

Table 13: Fuses (continued)

FC 101		UL Compliance (UL61800-5-1) Short Circuit Current Ratings (SCCR) 5kA and 100kA: 0–37 kW/0–50 hp; 10kA and 100kA: 45–90 kW/60–125 hp			CE Compliance 5 kA and 10 kA ⁽³⁾
Enclosure size	Power rating [kW (hp)]	Listed Fuse RK5/RK1 ⁽¹⁾ /J/T/CC Amperes ratings (A)	Test cabinet size ⁽²⁾ [Height x Width x Depth] [mm (in)]	Minimum Cabinet volume [L]	gG Amperes ratings (A)
3x380Y/220–480Y/277 V					
H8	90 (125)	250	1200 x 600 x 500 (47.2 x 23.6 x 19.7)	360	gG-250

Note:
(1) RK1 and RK5 fuses are not allowed for H6–H8 drives.
(2) H1–H8 drives meet UL 61800-5-1 certification based on the drive being mounted within a larger enclosure (approximately 1.5x the drive) and being centered on the back panel of the larger enclosure. See *illustration 8* to *illustraion 11* for dimensions and allowed vent openings and cable entry points for the tested units. To maintain UL 61800-5-1 certification and to provide the required shielding for vented enclosures, ensure that the spatial relationship between the drive and the vent openings in the larger enclosure is maintained, at a minimum. Larger enclosures can use greater distances to openings. For more information, contact Danfoss support.
(3) For drives above 37 kW (50 hp), it is 10 kA for CE compliance.
(4) Cabinet is not required for H6 drives if type 1 kit is used. For H6 drives without type 1 kit installed, normal cabinet rules apply.

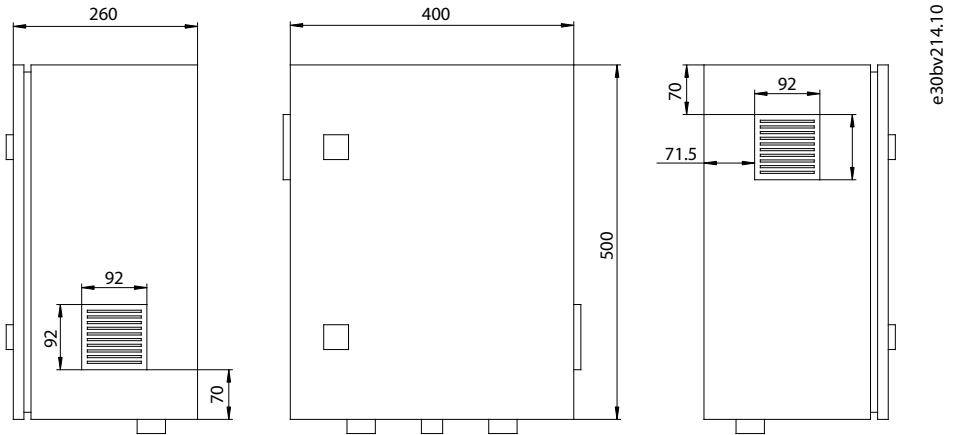


Illustration 8: Allowed Ventilation Openings for H1–H3 Enclosures as Tested for UL61800-5-1 Compliance

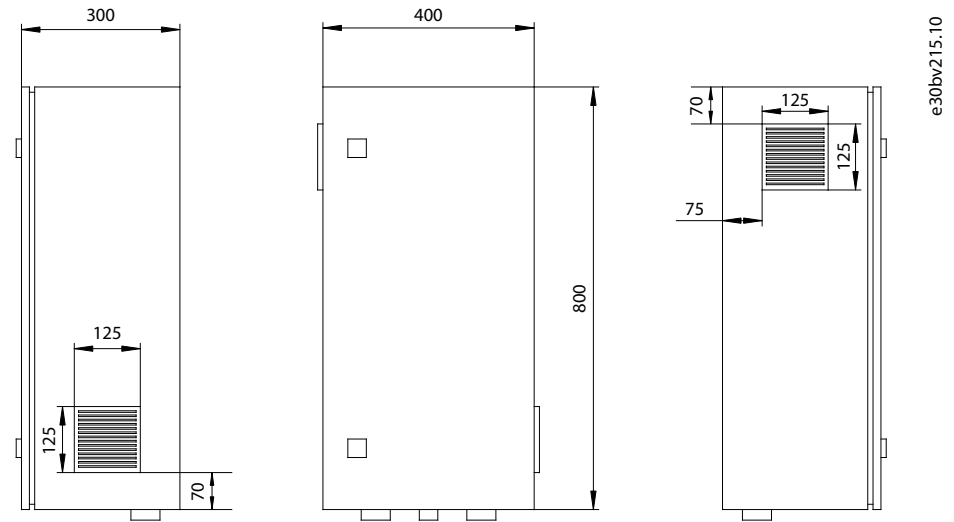


Illustration 9: Allowed Ventilation Openings for H4–H5 Enclosures as Tested for UL61800-5-1 Compliance

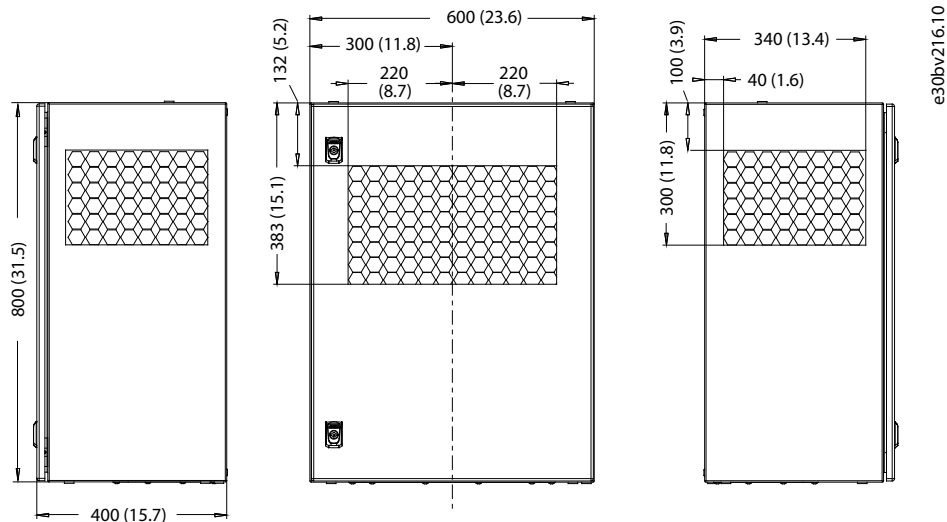


Illustration 10: Allowed Ventilation Openings for H7 Enclosures as Tested for UL61800-5-1 Compliance

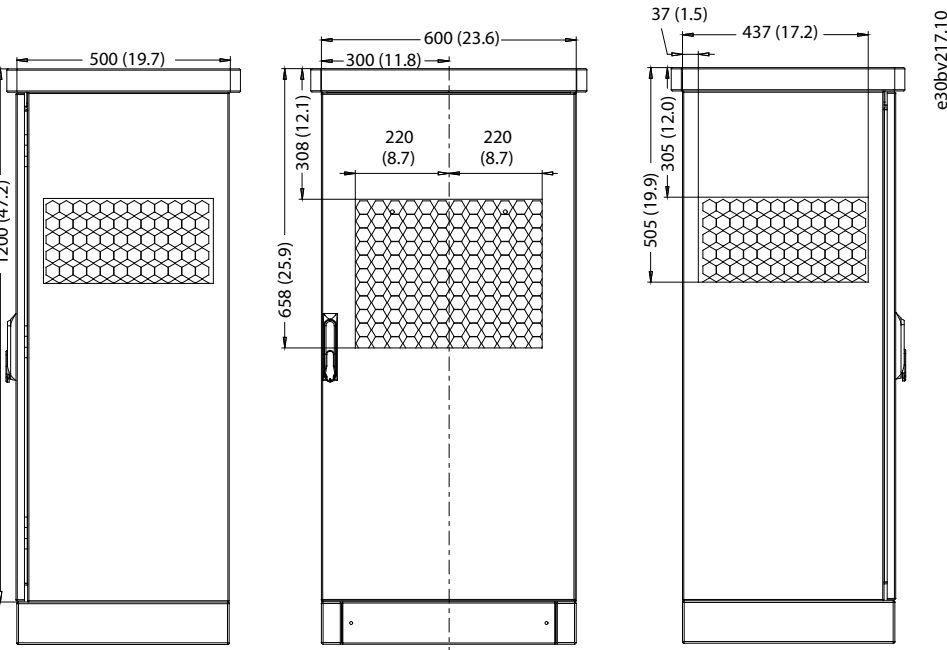


Illustration 11: Allowed Ventilation Openings for H8 Enclosures as Tested for UL61800-5-1 Compliance

11 Accessories and Spare Parts

Table 14: Accessories and Spare Parts

Accessories	Code number
VL™ Control Panel LCP 31	132B0200
VL™ Control Panel LCP 32	132B9221
VL™ Mains-Free Interface	132B9222
LCP RJ 45 Plug Converter	132B0203
Mounting kit for LCP incl. fasteners, 3 m cable and gasket	132B0201

12 Other Resources

Other resources are available to understand advanced drive functions and programming.

- The VL™ HVAC Basic Drive FC 101 Programming Guide provides information on how to program and includes complete parameter descriptions.
- The VL™ HVAC Basic Drive FC 101 Design Guide provides all technical information about the drive. It also lists options and accessories.

The technical documentation is available in electronic form online at www.danfoss.com.

