ACS550

User's Manual
ACS550-01 Drives (0.75...160 kW)
ACS550-U1 Drives (1...200 hp)

Diagnostics

WARNING! Do not attempt any measurement, parts replacement or other service procedure not described in this manual. Such action will void the warranty, may endanger correct operation and increase downtime and expense.

WARNING! All electrical installation and maintenance work described in this chapter should only be undertaken by qualified service personnel. The safety instructions in chapter *Safety* on page *5* must be followed.

Diagnostic displays

The drive detects error situations and reports them using:

- the green and red LED on the body of the drive
- the status LED on the control panel (if an Assistant Control Panel is attached to the drive)
- the control panel display (if a control panel is attached to the drive)
- the Fault Word and Alarm Word parameter bits (parameters 0305 to 0309). See *Group 03: FB ACTUAL SIGNALS* on page *108* for the bit definitions.

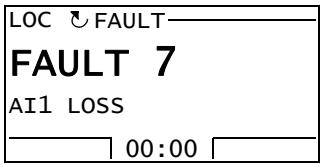
The form of the display depends on the severity of the error. You can specify the severity for many errors by directing the drive to:

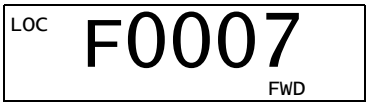
- ignore the error situation
- report the situation as an alarm
- report the situation as a fault.

Red – Faults

The drive signals that it has detected a severe error, or fault, by:

- enabling the red LED on the drive (LED is either steady on or blinking)
- showing the steady red status LED on the control panel (if attached to the drive)
- setting an appropriate bit in a Fault Word parameter (0305 to 0307)
- overriding the control panel display with the display of a fault code in the Fault mode (figures on the right)
- stopping the motor (if it was on).





The fault code on the control panel display is temporary. Pressing any of the following keys removes the fault message: MENU, ENTER, UP, or DOWN key.

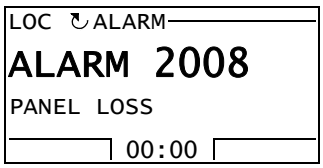
The message reappears after a few seconds if the control panel is not touched and the fault is still active.

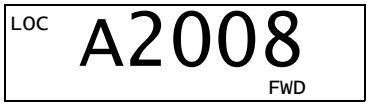
Flashing green – Alarms

For less severe errors, called alarms, the diagnostic display is advisory. For these situations, the drive is simply reporting that it had detected something "unusual." In these situations, the drive:

- flashes the green LED on the drive (does not apply to alarms that arise from control panel operation errors)
- flashes the green LED on the control panel (if attached to the drive)
- sets an appropriate bit in an Alarm Word parameter (0308 or 0309). See *Group 03: FB ACTUAL SIGNALS* on page *108* for the bit definitions
- overrides the control panel display with the display of an alarm code and/or name in the Fault mode (figures on the right).

Alarm messages disappear from the control panel display after a few seconds. The message returns periodically as long as the alarm condition exists.





Correcting faults

The recommended corrective action for faults is:

- Use the table in section *Fault listing* below to find and address the root cause of the problem.
- Reset the drive. See section *Fault resetting* on page *259*.

Fault listing

The following table lists the faults by code number and describes each. The fault name is the long form shown in the Fault mode of the Assistant Control Panel when the fault occurs. The fault names shown (for Assistant Control Panel only) in the Fault Logger mode (see page *57*) and the fault names for parameter 0401 LAST FAULT may be shorter.

Fault code	Fault name in panel	Description and recommended corrective action
1	OVERCURRENT	Output current is excessive. Check for and correct: • Excessive motor load. • Insufficient acceleration time (parameters 2202 ACCELER TIME 1 and 2205 ACCELER TIME 2). • Faulty motor, motor cables or connections.

Fault code	Fault name in panel	Description and recommended corrective action
2	DC OVERVOLT	Intermediate circuit DC voltage is excessive. Check for and correct: • Static or transient overvoltages in the input power supply. • Insufficient deceleration time (parameters 2203 DECELER TIME 1 and 2206 DECELER TIME 2). • Undersized brake chopper (if present). • Verify that overvoltage controller is ON (using parameter 2005).
3	DEV OVERTEMP	Drive heatsink is overheated. Temperature is at or above limit. R1…R4: 115 °C (239 °F) R5, R6: 125 °C (257 °F) Check for and correct: • Fan failure. • Obstructions in the air flow. • Dirt or dust coating on the heat sink. • Excessive ambient temperature. • Excessive motor load.
4	SHORT CIRC	Fault current. Check for and correct: • A short-circuit in the motor cable(s) or motor. • Supply disturbances.
5	RESERVED	Not used.
6	DC UNDERVOLT	Intermediate circuit DC voltage is not sufficient. Check for and correct: • Missing phase in the input power supply. • Blown fuse. • Undervoltage on mains.
7	AI1 LOSS	Analog input 1 loss. Analog input value is less than AI1 FAULT LIMIT (3021). Check for and correct: • Source and connection for analog input. • Parameter settings for AI1 FAULT LIMIT (3021) and 3001 AI<MIN FUNCTION.
8	AI2 LOSS	Analog input 2 loss. Analog input value is less than AI2 FAULT LIMIT (3022). Check for and correct: • Source and connection for analog input. • Parameter settings for AI2 FAULT LIMIT (3022) and 3001 AI<MIN FUNCTION.
9	MOT OVERTEMP	Motor is too hot, based on either the drive's estimate or on temperature feedback. • Check for overloaded motor. • Adjust the parameters used for the estimate (3005…3009). • Check the temperature sensors and *Group 35: MOTOR TEMP MEAS* parameters.
10	PANEL LOSS	Panel communication is lost and either: • Drive is in local control mode (the control panel displays LOC), or • Drive is in remote control mode (REM) and is parameterized to accept start/stop, direction or reference from the control panel. To correct check: • Communication lines and connections. • Parameter 3002 PANEL COMM ERR. • Parameters in *Group 10: START/STOP/DIR* and *Group 11: REFERENCE SELECT* (if drive operation is REM).

Fault code	Fault name in panel	Description and recommended corrective action
11	ID RUN FAIL	The Motor ID Run was not completed successfully. Check for and correct: • Motor connections. • Motor parameters 9905…9909.
12	MOTOR STALL	Motor or process stall. Motor is operating in the stall region. Check for and correct: • Excessive load. • Insufficient motor power. • Parameters 3010…3012.
13	RESERVED	Not used.
14	EXT FAULT 1	Digital input defined to report first external fault is active. See parameter 3003 EXTERNAL FAULT 1.
15	EXT FAULT 2	Digital input defined to report second external fault is active. See parameter 3004 EXTERNAL FAULT 2.
16	EARTH FAULT	Possible ground fault detected in the motor or motor cables. The drive monitors for ground faults while the drive is running and while the drive is not running. Detection is more sensitive when the drive is not running and can produce false positives. Possible corrections: • Check for/correct faults in the input wiring. • Verify that motor cable does not exceed maximum specified length. • A delta grounded input power supply and motor cables with high capacitance may result in erroneous error reports during non-running tests. To disable response to fault monitoring when the drive is not running, use parameter 3023 WIRING FAULT. To disable response to all ground fault monitoring, use parameter 3017 EARTH FAULT. **Note:** Disabling earth fault (ground fault) may void the warranty.
17	OBSOLETE	Not used.
18	THERM FAIL	Internal fault. The thermistor measuring the internal temperature of the drive is open or shorted. Contact your local ABB representative.
19	OPEX LINK	Internal fault. A communication-related problem has been detected on the fiber optic link between the control and OINT boards. Contact your local ABB representative.
20	OPEX PWR	Internal fault. Exceptionally low voltage detected on the OINT power supply. Contact your local ABB representative.
21	CURR MEAS	Internal fault. Current measurement is out of range. Contact your local ABB representative.
22	SUPPLY PHASE	Ripple voltage in the DC link is too high. Check for and correct: • Missing mains phase. • Blown fuse.

Fault code	Fault name in panel	Description and recommended corrective action
23	ENCODER ERR	The drive is not detecting a valid encoder signal. Check for and correct: • Encoder presence and proper connection (reverse wired = channel A connected to terminal of channel B or vice versa, loose connection or short circuit). • Voltage logic levels are outside of the specified range. • A working and properly connected Pulse Encoder Interface Module, OTAC-01. • Wrong value entered in parameter 5001 PULSE NR. A wrong value will only be detected if the error is such that the calculated slip is greater than 4 times the rated slip of the motor. • Encoder is not being used, but parameter 5002 ENCODER ENABLE = 1 (ENABLE).
24	OVERSPEED	Motor speed is greater than 120% of the larger (in magnitude) of 2001 MINIMUM SPEED or 2002 MAXIMUM SPEED. Check for and correct: • Parameter settings for 2001 and 2002. • Adequacy of motor braking torque. • Applicability of torque control. • Brake chopper and resistor.
25	RESERVED	Not used.
26	DRIVE ID	Internal fault. Configuration Block Drive ID is not valid. Contact your local ABB representative.
27	CONFIG FILE	Internal configuration file has an error. Contact your local ABB representative.
28	SERIAL 1 ERR	Fieldbus communication has timed out. Check for and correct: • Fault setup (3018 COMM FAULT FUNC and 3019 COMM FAULT TIME). • Communication settings (*Group 51: EXT COMM MODULE* or *Group 53: EFB PROTOCOL* as appropriate). • Poor connections and/or noise on line.
29	EFB CON FILE	Error in reading the configuration file for the embedded fieldbus.
30	FORCE TRIP	Fault trip forced by the fieldbus. See the fieldbus User's Manual.
31	EFB 1	Fault code reserved for the embedded fieldbus (EFB) protocol application. The meaning is protocol dependent.
32	EFB 2	
33	EFB 3	
34	MOTOR PHASE	Fault in the motor circuit. One of the motor phases is lost. Check for and correct: • Motor fault. • Motor cable fault. • Thermal relay fault (if used). • Internal fault.
35	OUTP WIRING	Possible power wiring error detected. When the drive is not running it monitors for an improper connection between the drive input power and the drive output. Check for and correct: • Proper input wiring – line voltage is NOT connected to drive output. • The fault can be erroneously declared if the input power is a delta grounded system and motor cable capacitance is large. This fault can be disabled using parameter 3023 WIRING FAULT.

Fault code	Fault name in panel	Description and recommended corrective action
36	INCOMPATIBLE SW	The drive cannot use the software. • Internal fault. • The loaded software is not compatible with the drive. • Call support representative.
37	CB OVERTEMP	Drive control board is overheated. The fault trip limit is 88 °C. Check for and correct: • Excessive ambient temperature. • Fan failure. • Obstructions in the air flow. Not for drives with an OMIO control board.
38	USER LOAD CURVE	Condition defined by parameter 3701 USER LOAD C MODE has been valid longer than the time defined by 3703 USER LOAD C TIME.
101… 199	SYSTEM ERROR	Error internal to the drive. Contact your local ABB representative and report the error number.
201… 299	SYSTEM ERROR	Error in the system. Contact your local ABB representative and report the error number.
-	UNKNOWN DRIVE TYPE: ACS550 SUPPORTED DRIVES: X	Wrong type of panel, i.e. panel that supports drive X but not the ACS550, has been connected to the ACS550.

Faults that indicate conflicts in the parameter settings are listed below.

Fault code	Fault name in panel	Description and recommended corrective action
1000	PAR HZRPM	Parameter values are inconsistent. Check for any of the following: • 2001 MINIMUM SPEED > 2002 MAXIMUM SPEED. • 2007 MINIMUM FREQ > 2008 MAXIMUM FREQ. • 2001 MINIMUM SPEED / 9908 MOTOR NOM SPEED is outside proper range (> 50). • 2002 MAXIMUM SPEED / 9908 MOTOR NOM SPEED is outside proper range (> 50). • 2007 MINIMUM FREQ / 9907 MOTOR NOM FREQ is outside proper range (> 50). • 2008 MAXIMUM FREQ / 9907 MOTOR NOM FREQ is outside proper range (> 50).
1001	PAR PFC REF NEG	Parameter values are inconsistent. Check for the following: • 2007 MINIMUM FREQ is negative, when 8123 PFC ENABLE is active.
1002	RESERVED	Not used.
1003	PAR AI SCALE	Parameter values are inconsistent. Check for any of the following: • 1301 MINIMUM AI1 > 1302 MAXIMUM AI1. • 1304 MINIMUM AI2 > 1305 MAXIMUM AI2.
1004	PAR AO SCALE	Parameter values are inconsistent. Check for any of the following: • 1504 MINIMUM AO1 > 1505 MAXIMUM AO1. • 1510 MINIMUM AO2 > 1511 MAXIMUM AO2.

Fault code	Fault name in panel	Description and recommended corrective action
1005	PAR PCU 2	Parameter values for power control are inconsistent: Improper motor nominal kVA or motor nominal power. Check for the following: • 1.1 ≤ (9906 MOTOR NOM CURR · 9905 MOTOR NOM VOLT · 1.73 / P_N) ≤ 3.0 where: P_N = 1000 · 9909 MOTOR NOM POWER (if units are kW) or P_N = 746 · 9909 MOTOR NOM POWER (if units are hp, e.g. in US)
1006	PAR EXT RO	Parameter values are inconsistent. Check for the following: • Extension relay module not connected and • 1410…1412 RELAY OUTPUTS 4…6 have non-zero values.
1007	PAR FIELDBUS MISSING	Parameter values are inconsistent. Check for and correct: • A parameter is set for fieldbus control (e.g. 1001 EXT1 COMMANDS = 10 (COMM)), but 9802 COMM PROT SEL = 0.
1008	PAR PFC MODE	Parameter values are inconsistent – 9904 MOTOR CTRL MODE must be = 3 (SCALAR:FREQ), when 8123 PFC ENABLE is activated.
1009	PAR PCU 1	Parameter values for power control are inconsistent: Improper motor nominal frequency or speed. Check for both of the following: • 1 ≤ (60 · 9907 MOTOR NOM FREQ / 9908 MOTOR NOM SPEED ≤ 16 • 0.8 ≤ 9908 MOTOR NOM SPEED / (120 · 9907 MOTOR NOM FREQ / Motor Poles) ≤ 0.992
1010/ 1011	RESERVED	Not used.
1012	PAR PFC IO 1	IO configuration is not complete – not enough relays are parameterized to PFC. Or, a conflict exists between *Group 14: RELAY OUTPUTS*, parameter 8117 NR OF AUX MOT and parameter 8118 AUTOCHNG INTERV.
1013	PAR PFC IO 2	IO configuration is not complete – the actual number of PFC motors (parameter 8127, MOTORS) does not match the PFC motors in *Group 14: RELAY OUTPUTS* and parameter 8118 AUTOCHNG INTERV.
1014	PAR PFC IO 3	IO configuration is not complete – the drive is unable to allocate a digital input (interlock) for each PFC motor (parameters 8120 INTERLOCKS and 8127 MOTORS).
1015	RESERVED	Not used.
1016	PAR USER LOAD C	Parameter values for the user load curve are inconsistent. Check that the following conditions are met: • 3704 LOAD FREQ 1 ≤ 3707 LOAD FREQ 2 ≤ 3710 LOAD FREQ 3 ≤ 3713 LOAD FREQ 4 ≤ 3716 LOAD FREQ 5. • 3705 LOAD TORQ LOW 1 ≤ 3706 LOAD TORQ HIGH 1. • 3708 LOAD TORQ LOW 2 ≤ 3709 LOAD TORQ HIGH 2. • 3711 LOAD TORQ LOW 3 ≤ 3712 LOAD TORQ HIGH 3. • 3714 LOAD TORQ LOW 4 ≤ 3715 LOAD TORQ HIGH 4. • 3717 LOAD TORQ LOW 5 ≤ 3718 LOAD TORQ HIGH 5.

Fault resetting

The ACS550 can be configured to automatically reset certain faults. Refer to parameter *Group 31: AUTOMATIC RESET*.

WARNING! If an external source for start command is selected and it is active, the ACS550 may start immediately after fault reset.

Flashing red LED

To reset the drive for faults indicated by a flashing red LED:

- Turn the power off for 5 minutes.

Red LED

To reset the drive for faults indicated by a red LED (on, not flashing), correct the problem and do one of the following:

- Press RESET from the control panel.
- Turn the power off for 5 minutes.

Depending on the value of 1604 FAULT RESET SEL, the following could also be used to reset the drive:

- digital input
- serial communication.

When the fault has been corrected, the motor can be started.

History

For reference, the last three fault codes are stored into parameters 0401, 0412, 0413. For the most recent fault (identified by parameter 0401), the drive stores additional data (in parameters 0402…0411) to aid in troubleshooting a problem. For example, parameter 0404 stores the motor speed at the time of the fault.

The Assistant Control Panel provides additional information about the fault history. See section *Fault Logger mode* on page *57* for more information.

To clear the fault history (all of the *Group 04: FAULT HISTORY* parameters):

1. Using the control panel in the Parameters mode, select parameter 0401.
2. Press EDIT (or ENTER on the Basic Control Panel).
3. Press UP and DOWN at the same time.
4. Press SAVE.

Correcting alarms

The recommended corrective action for alarms is:

- Determine if the alarm requires any corrective action (action is not always required).
- Use the table in section *Alarm listing* below to find and address the root cause of the problem.

Alarm listing

The following table lists the alarms by code number and describes each.

Alarm code	Display	Description
2001	OVERCURRENT	Current limiting controller is active. Check for and correct: • Excessive motor load. • Insufficient acceleration time (parameters 2202 ACCELER TIME 1 and 2205 ACCELER TIME 2). • Faulty motor, motor cables or connections.
2002	OVERVOLTAGE	Overvoltage controller is active. Check for and correct: • Static or transient overvoltages in the input power supply. • Insufficient deceleration time (parameters 2203 DECELER TIME 1 and 2206 DECELER TIME 2).
2003	UNDERVOLTAGE	Undervoltage controller is active. Check for and correct: • Undervoltage on mains.
2004	DIR LOCK	The change in direction being attempted is not allowed. Either: • Do not attempt to change the direction of motor rotation, or • Change parameter 1003 DIRECTION to allow direction change (if reverse operation is safe).
2005	IO COMM	Fieldbus communication has timed out. Check for and correct: • Fault setup (3018 COMM FAULT FUNC and 3019 COMM FAULT TIME). • Communication settings (*Group 51: EXT COMM MODULE* or *Group 53: EFB PROTOCOL* as appropriate). • Poor connections and/or noise on line.
2006	AI1 LOSS	Analog input 1 is lost, or value is less than the minimum setting. Check: • Input source and connections. • Parameter that sets the minimum (3021). • Parameter that sets the alarm/fault operation (3001),
2007	AI2 LOSS	Analog input 2 is lost, or value is less than the minimum setting. Check: • Input source and connections. • Parameter that sets the minimum (3022). • Parameter that sets the alarm/fault operation (3001).
2008	PANEL LOSS	Panel communication is lost and either: • Drive is in local control mode (the control panel displays LOC), or • Drive is in remote control mode (REM) and is parameterized to accept start/stop, direction or reference from the control panel. To correct check: • Communication lines and connections. • Parameter 3002 PANEL COMM ERR. • Parameters in *Group 10: START/STOP/DIR* and *Group 11: REFERENCE SELECT* (if drive operation is REM).

Alarm code	Display	Description
2009	DEVICE OVERTEMP	Drive heatsink is hot. This alarm warns that a DEVICE OVERTEMP fault may be near. R1…R4: 100 °C (212 °F) R5, R6: 110 °C (230 °F) Check for and correct: • Fan failure. • Obstructions in the air flow. • Dirt or dust coating on the heat sink. • Excessive ambient temperature. • Excessive motor load.
2010	MOTOR TEMP	Motor is hot, based on either the drive's estimate or on temperature feedback. This alarm warns that a MOT OVERTEMP fault trip may be near. Check: • Check for overloaded motor. • Adjust the parameters used for the estimate (3005…3009). • Check the temperature sensors and *Group 35: MOTOR TEMP MEAS*.
2011	RESERVED	Not used.
2012	MOTOR STALL	Motor is operating in the stall region. This alarm warns that a MOTOR STALL fault trip may be near.
2013 (Note 1)	AUTORESET	This alarm warns that the drive is about to perform an automatic fault reset, which may start the motor. • To control automatic reset, use *Group 31: AUTOMATIC RESET*.
2014 (Note 1)	AUTOCHANGE	This alarm warns that the PFC autochange function is active. • To control PFC, use *Group 81: PFC CONTROL* and the *PFC macro* on page *80*.
2015	PFC I LOCK	This alarm warns that the PFC interlocks are active, which means that the drive cannot start the following: • Any motor (when Autochange is used). • The speed regulated motor (when Autochange is not used).
2016/ 2017	RESERVED	Not used.
2018 (Note 1)	PID SLEEP	This alarm warns that the PID sleep function is active, which means that the motor could accelerate when the PID sleep function ends. • To control PID sleep, use parameters 4022…4026 or 4122…4126.
2019	ID RUN	Performing ID Run.
2020	RESERVED	Not used.
2021	START ENABLE 1 MISSING	This alarm warns that the Start Enable 1 signal is missing. • To control Start Enable 1 function, use parameter 1608. To correct, check: • Digital input configuration. • Communication settings.
2022	START ENABLE 2 MISSING	This alarm warns that the Start Enable 2 signal is missing. • To control Start Enable 2 function, use parameter 1609. To correct, check: • Digital input configuration. • Communication settings.

Alarm code	Display	Description
2023	EMERGENCY STOP	Emergency stop activated.
2024	ENCODER ERROR	The drive is not detecting a valid encoder signal. Check for and correct: • Encoder presence and proper connection (reverse wired, loose connection,or short circuit). • Voltage logic levels are outside of the specified range. • A working and properly connected Pulse Encoder Interface Module, OTAC-01. • Wrong value entered in parameter 5001 PULSE NR. A wrong value will only be detected if the error is such that the calculated slip is greater than 4 times the rated slip of the motor. • Encoder is not being used, but parameter 5002 ENCODER ENABLE = 1 (ENABLE).
2025	FIRST START	Signals that a the drive is performing a First Start evaluation of motor characteristics. This is normal the first time the motor is run after motor parameters are entered or changed. See parameter 9910 ID RUN for a description of motor models.
2026	RESERVED	Not used.
2027	USER LOAD CURVE	This alarm warns that the condition defined by parameter 3701 USER LOAD C MODE has been valid longer than half of the time defined by 3703 USER LOAD C TIME.
2028	START DELAY	Shown during the Start delay. See parameter 2113 START DELAY.

Note 1. Even when the relay output is configured to indicate alarm conditions (e.g. parameter 1401 RELAY OUTPUT 1 = 5 (ALARM) or 16 (FLT/ALARM)), this alarm is not indicated by a relay output.

Alarm codes (Basic Control Panel)

The Basic Control Panel indicates control panel alarms with a code, A5xxx. The following table lists the alarm codes and descriptions.

Code	Description
5001	Drive is not responding.
5002	The communication profile is incompatible with the drive.
5010	The panel's parameter backup file is corrupted.
5011	Drive is controlled from another source.
5012	Rotation direction is locked.
5013	Button is disabled, because start is inhibited.
5014	Button is disabled, because drive is faulted.
5015	Button is disabled, because local mode lock is on.
5018	Parameter default value can't be found.
5019	Writing a non-zero value is prohibited (can only write a zero value).
5020	Group or parameter does not exist or parameter value is inconsistent.
5021	Group or parameter is hidden.
5022	Group or parameter is write protected.
5023	Modification is not allowed while the drive is running.

Code	Description
5024	Drive is busy, try again.
5025	Write is not allowed while upload or download is in progress.
5026	Value is at or below low limit.
5027	Value is at or above high limit.
5028	Value is invalid – doesn't match any values in the discrete values list.
5029	Memory is not ready, try again.
5030	Request is invalid.
5031	Drive is not ready, e.g due to low DC voltage.
5032	Parameter error was detected.
5040	Selected parameter set can't be found in the current parameter backup.
5041	Parameter backup doesn't fit into memory.
5042	Selected parameter set can't be found in the current parameter backup.
5043	No start inhibit was granted.
5044	Parameter backup versions do not match.
5050	Parameter upload was aborted.
5051	File error was detected.
5052	Parameter upload attempt has failed.
5060	Parameter download was aborted.
5062	Parameter download attempt has failed.
5070	Panel backup memory write error was detected.
5071	Panel backup memory read error was detected.
5080	Operation is not allowed, because the drive is not in local mode.
5081	Operation is not allowed, because a fault is active.
5083	Operation is not allowed, because parameter lock is not open.
5084	Operation is not allowed, because drive is busy, try again.
5085	Download is not allowed, because drive types are incompatible.
5086	Download is not allowed, because drive models are incompatible.
5087	Download is not allowed, because parameter sets do not match.
5088	Operation failed, because a drive memory error was detected.
5089	Download failed, because a CRC error was detected.
5090	Download failed, because a data processing error was detected.
5091	Operation failed, because a parameter error was detected.
5092	Download failed, because parameter sets do not match.

Maintenance

WARNING! Read chapter *Safety* on page *5* before performing any maintenance on the equipment. Ignoring the safety instructions can cause injury or death.

Maintenance intervals

If installed in an appropriate environment, the drive requires very little maintenance. This table lists the routine maintenance intervals recommended by ABB.

Maintenance	Interval	Instruction
Heatsink temperature check and cleaning	Depends on the dustiness of the environment (every 6…12 months)	See *Heatsink* on page *265*.
Main cooling fan replacement	Every six years	See *Main fan replacement* on page *266*.
Internal enclosure cooling fan replacement (IP54 / UL type 12 drives)	Every three years.	See *Internal enclosure fan replacement* on *268*.
Capacitor reforming	Every year when stored	See *Reforming* on page *269*.
Capacitor replacement (frame sizes R5 and R6)	Every nine years	See *Replacement* on page *269*.
Replace battery in the Assistant Control Panel	Every ten years	See *Battery* on page *269*.

Consult your local ABB Service representative for more details on the maintenance. On the Internet, go to www.abb.com/drive and select *Drive Services – Maintenance and Field Services*.

Heatsink

The heatsink fins accumulate dust from the cooling air. Since a dusty heatsink is less efficient at cooling the drive, overtemperature faults become more likely. In a "normal" environment (not dusty, not clean) check the heatsink annually, in a dusty environment check more often.

Clean the heatsink as follows (when necessary):

1. Remove power from the drive.
2. Remove the cooling fan (see section *Main fan replacement* on page *266*).
3. Blow clean compressed air (not humid) from bottom to top and simultaneously use a vacuum cleaner at the air outlet to trap the dust.

Note: If there is a risk of the dust entering adjoining equipment, perform the cleaning in another room.

4. Reinstall the cooling fan.
5. Restore power.

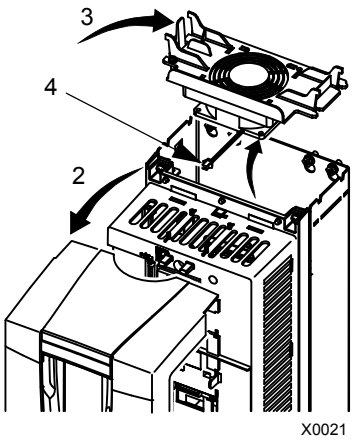
Main fan replacement

The drive's main cooling fan has a life span of about 60 000 operating hours at maximum rated operating temperature and drive load. The expected life span doubles for each 10 °C (18 °F) drop in the fan temperature (fan temperature is a function of ambient temperatures and drive loads).

Fan failure can be predicted by the increasing noise from fan bearings and the gradual rise in the heatsink temperature in spite of heatsink cleaning. If the drive is operated in a critical part of a process, fan replacement is recommended once these symptoms start appearing. Replacement fans are available from ABB. Do not use other than ABB specified spare parts.

Frame sizes R1...R4

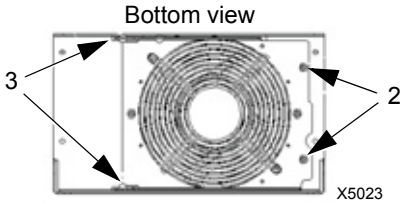
To replace the fan:



1. Remove power from the drive.
2. Remove drive cover.
3. For frame size:
   - R1, R2: Press together the retaining clips on the fan cover sides, and lift.
   - R3, R4: Press in on the lever located on the left side of the fan mount, and rotate the fan up and out.
4. Disconnect the fan cable.
5. Reinstall the fan in reverse order.
6. Restore power.

Frame size R5

To replace the fan:



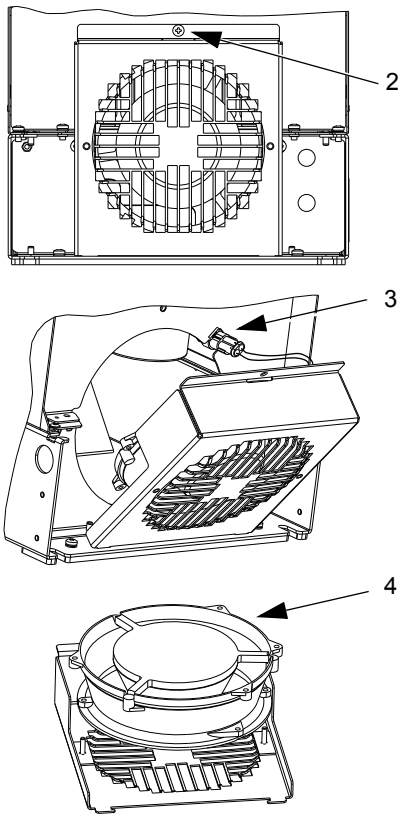
1. Remove power from drive.
2. Remove the screws attaching the fan.
3. Remove the fan: Swing the fan out on its hinges.
4. Disconnect the fan cable.
5. Reinstall the fan in reverse order.
6. Restore power.

Arrows in the fan show the directions of the rotation and air flow.

Frame size R6

To replace the fan:

1. Remove power from the drive.
2. Remove the screw attaching the fan casing and let the casing lean down against the limiters.
3. Slide out the cable connector and disconnect it.
4. Take off the casing and replace the fan onto the casing's pins.
5. Reinstall the casing in reverse order.
6. Restore power.



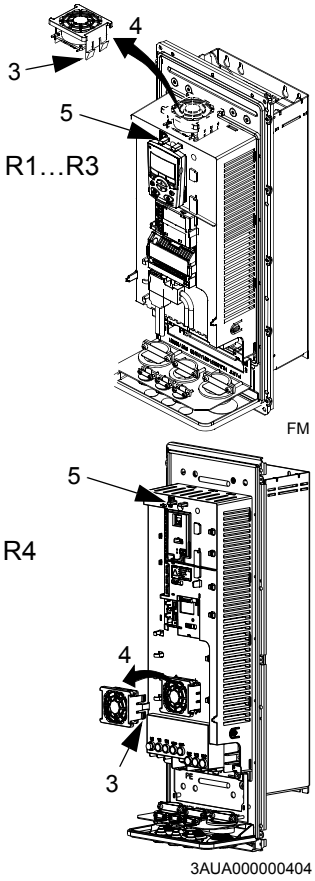
Internal enclosure fan replacement

IP54 / UL type 12 enclosures have an additional internal fan to circulate air inside the enclosure.

Frame sizes R1…R4

To replace the internal enclosure fan in frame sizes R1 to R3 (located at the top of the drive) and R4 (located in front of the drive):

1. Remove power from the drive.
2. Remove the front cover.
3. The housing that holds the fan in place has barbed retaining clips at each corner. Press all four clips toward the center to release the barbs.
4. When the clips/barbs are free, pull the housing up to remove from the drive.
5. Disconnect the fan cable.
6. Install the fan in reverse order, noting that:
   - The fan air flow is up (refer to the arrow on fan).
   - The fan wire harness is toward the front.
   - The notched housing barb is located in the right-rear corner.
   - The fan cable connects just forward of the fan at the top of the drive.



Frame sizes R5 and R6

To replace the internal enclosure fan in frame sizes R5 or R6:

1. Remove power from the drive.
2. Remove the front cover.
3. Lift the fan out and disconnect the cable.
4. Install the fan in reverse order.
5. Restore power.

Capacitors

Reforming

The drive DC link capacitors need to be reformed (re-aged) if the drive has been non-operational for more than one year. Without reforming, capacitors may be damaged when the drive starts to operate. It is therefore recommended to reform the capacitors once a year. See section *Serial number* on page *13* for how to check the date of manufacture from the serial number shown on the drive labels.

For information on reforming the capacitors, refer to *Guide for Capacitor Reforming in ACS50, ACS55, ACS150, ACS310, ACS320, ACS350, ACS550 and ACH550* (3AFE68735190 [English]), available on the Internet (go to www.abb.com and enter the code in the Search field).

Replacement

The drive intermediate circuit employs several electrolytic capacitors. Their life span is from 35 000...90 000 hours depending on drive loading and ambient temperature. Capacitor life can be prolonged by lowering the ambient temperature.

It is not possible to predict a capacitor failure. Capacitor failure is usually followed by a input power fuse failure or a fault trip. Contact ABB if capacitor failure is suspected. Replacements for frame size R5 and R6 are available from ABB. Do not use other than ABB specified spare parts.

Control panel

Cleaning

Use a soft damp cloth to clean the control panel. Avoid harsh cleaners which could scratch the display window.

Battery

A battery is only used in Assistant Control Panels that have the clock function available and enabled. The battery keeps the clock operating in memory during power interruptions.

The expected life for the battery is greater than ten years. To remove the battery, use a coin to rotate the battery holder on the back of the control panel. Replace the battery with type CR2032.

Note: The battery is NOT required for any control panel or drive function, except the clock.

Technical data

Ratings

By type designation, the table below provides ratings for the ACS550 adjustable speed AC drive, including:

- IEC ratings
- NEMA ratings (shaded columns)
- frame size.

Ratings, 208…240 V drives

Abbreviated column headers are described in section *Symbols* on page *273*.

Type	Normal use			Heavy-duty use			Frame size
ACS550-x1- see below	I_{2N} A	P_N kW	P_N hp	I_{2hd} A	P_{hd} kW	P_{hd} hp	
Three-phase supply voltage, 208…240 V							
-04A6-2	4.6	0.75	1	3.5	0.55	0.75	R1
-06A6-2	6.6	1.1	1.5	4.6	0.75	1	R1
-07A5-2	7.5	1.5	2	6.6	1.1	1.5	R1
-012A-2	11.8	2.2	3	7.5	1.5	2	R1
-017A-2	16.7	4	5	11.8	2.2	3	R1
-024A-2	24.2	5.5	7.5	16.7	4	5	R2
-031A-2	30.8	7.5	10	24.2	5.5	7.5	R2
-046A-2	46.2	11	15	30.8	7.5	10	R3
-059A-2	59.4	15	20	46.2	11	15	R3
-075A-2	74.8	18.5	25	59.4	15	20	R4
-088A-2	88.0	22	30	74.8	18.5	25	R4
-114A-2	114	30	40	88.0	22	30	R4
-143A-2	143	37	50	114	30	40	R6
-178A-2	178	45	60	150	37	50	R6
-221A-2	221	55	75	178	45	60	R6
-248A-2	248	75	100	192	55	75	R6

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Derating

The load capacity (current and power) decreases for certain situations, as defined below. In such situations, where full motor power is required, oversize the drive so that the derated value provides sufficient capacity.

For example, if your application requires 15.4 A of motor current and a 8 kHz switching frequency, calculate the appropriate drive size requirement as follows:

The minimum size required = 15.4 A / 0.80 = 19.25 A

Where: 0.80 is the derating for 8 kHz switching frequency (see section *Switching frequency derating* on page *274*).

Referring to I_{2N} in the ratings tables (starting from page *271*), the following drives exceed the I_{2N} requirement of 19.25 A: ACS550-x1-023A-4, or ACS550-x1-024A-2.

Temperature derating

In the temperature range +40 °C...50 °C (+104 °F...122 °F), the rated output current is decreased 1% for every 1 °C (1.8 °F) above +40 °C (+104 °F). Calculate the output current by multiplying the current given in the rating table by the derating factor.

Example If the ambient temperature is 50 °C (+122 °F), the derating factor is 100% - 1%/°C · 10 °C = 90% or 0.90.
The output current is then 0.90 · I_{2N} or 0.90 · I_{2hd}.

Altitude derating

In altitudes 1000...4000 m (3300...13,200 ft) above sea level, the derating is 1% for every 100 m (330 ft). If the installation site is higher than 2000 m (6600 ft) above sea level, please contact your local ABB distributor or office for further information.

Single phase supply derating

For 208…240 V series drives, a single phase supply can be used. In that case, the derating is 50%.

Switching frequency derating

When using the 8 kHz switching frequency (parameter 2606),

- derate all rated currents and powers (including drive's overload currents) to 80%.

When using the 12 kHz switching frequency (parameter 2606),

- derate all rated currents and powers (including drive's overload currents) to 65% (to 50% for 600 V, R4 frame sizes, that is for ACS550-U1-032A-6 … ACS550-U1-062A-6),
- derate ambient temperature maximum to 30 °C (86 °F).
- Note: The continuous maximum current is limited to I_{2hd}.

Note: Setting parameter 2607 SWITCH FREQ CTRL = 1 (ON) allows the drive to reduce the switching frequency if/when the drive's internal temperature exceeds 80 °C (with 12 kHz switching frequency) or 90 °C (with 8 kHz switching frequency). See the parameter description for 2607 for details.

Input power connections

WARNING! Do not operate the drive outside the nominal input line voltage range. Overvoltage can result in permanent damage to the drive.

Input power specifications

Input power (mains) connection specifications	
Voltage (U_1)	208/220/230/240 V AC 3-phase (or 1-phase) -15%…+10% for ACS550-x1-xxxx-2. 380/400/415/440/460/480 V AC 3-phase -15%…+10% for ACS550-x1-xxxx-4. 500/525/575/600 V AC 3-phase -15%…+10% for ACS550-U1-xxxx-6.
Prospective short-circuit current (IEC 629)	Maximum allowed prospective short-circuit current in the supply is 100 kA providing that the input power cable of the drive is protected with appropriate fuses. US: 100 000 AIC.
Frequency	48…63 Hz
Imbalance	Max. ± 3% of nominal phase to phase input voltage
Fundamental power factor (cos phi$_1$)	0.98 (at nominal load)
Cable temperature rating	90 °C (194 °F) rating minimum

Disconnecting device for isolation

Install a hand-operated input disconnecting device (disconnecting means) between the AC power source and the drive. The disconnecting device must be of a type that can be locked to the open position for installation and maintenance work.

- **Europe**: To meet the European Union Directives, according to standard EN 60204-1, Safety of Machinery, the disconnecting device must be one of the following types:
  - a switch-disconnector of utilization category AC-23B (EN 60947-3)
  - a disconnector having an auxiliary contact that in all cases causes switching devices to break the load circuit before the opening of the main contacts of the disconnector (EN 60947-3)
  - a circuit breaker suitable for isolation in accordance with EN 60947-2.
- **Other regions**: The disconnecting device must conform to the applicable safety regulations.

Fuses

Branch circuit protection must be provided by the end user and sized per national and local electric codes. The following tables provide fuse recommendations for short circuit protection on the drive's input power.

The rated fuse currents given in the tables are the maximums for the mentioned fuse types. If smaller fuse ratings are used, check that the fuse rms current rating is larger than the input current.

Check that the operating time of the fuse is below 0.5 seconds. The operating time depends on the fuse type, the supply network impedance as well as the cross-sectional area, material and length of the supply cable. In case the 0.5 seconds operating time is exceeded with the gG or T fuses, ultra rapid (aR) fuses will in most cases reduce the operating time to an acceptable level.

Fuses, 208…240 V drives

ACS550-x1- see below	Input current A	Input power (mains) fuses		
		IEC 60269 gG (A)	UL Class T (A)	Bussmann type
-04A6-2	4.6	10	10	JJS-10
-06A6-2	6.6			
-07A5-2	7.5			
-012A-2	11.8	16	15	JJS-15
-017A-2	16.7	25	25	JJS-25
-024A-2	24.2		30	JJS-30
-031A-2	30.8	40	40	JJS-40
-046A-2	46.2	63	60	JJS-60
-059A-2	59.4		80	JJS-80
-075A-2	74.8	80	100	JJS-100
-088A-2	88.0	100	110	JJS-110
-114A-2	114	125	150	JJS-150
-143A-2	143	200	200	JJS-200
-178A-2	178	250	250	JJS-250
-221A-2	221	315	300	JJS-300
-248A-2	248		350	JJS-350

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Fuses, 380…480 V drives

ACS550-x1- see below	Input current A	Input power (mains) fuses		
		IEC 60269 gG (A)	UL Class T (A)	Bussmann type
-03A3-4	3.3	10	10	JJS-10
-04A1-4	4.1			
-05A4-4	5.4			
-06A9-4	6.9			
-08A8-4	8.8		15	JJS-15
-012A-4	11.9	16		
-015A-4	15.4		20	JJS-20
-023A-4	23	25	30	JJS-30
-031A-4	31	35	40	JJS-40
-038A-4	38	50	50	JJS-50
-045A-4	45		60	JJS-60
-059A-4	59	63	80	JJS-80
-072A-4	72	80	90	JJS-90
-078A-4	77		100	JJS-100

ACS550-x1- see below	Input current A	Input power (mains) fuses		
		IEC 60269 gG (A)	UL Class T (A)	Bussmann type
-087A-4	87	125	125	JJS-125
-097A-4	97			
-125A-4	125	160	175	JJS-175
-157A-4	157	200	200	JJS-200
-180A-4	180	250	250	JJS-250
-195A-4	205			
-246A-4	246	315	350	JJS-350
-290A-4	290			

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Fuses, 500…600 V drives

ACS550-U1- see below	Input current A	Input power (mains) fuses		
		IEC 60269 gG (A)	UL Class T (A)	Bussmann type
-02A7-6	2.7	10	10	JJS-10
-03A9-6	3.9			
-06A1-6	6.1			
-09A0-6	9.0	16	15	JJS-15
-011A-6	11			
-017A-6	17	25	25	JJS-25
-022A-6	22			
-027A-6	27	35	40	JJS-40
-032A-6	32			
-041A-6	41	50	50	JJS-50
-052A-6	52	60	60	JJS-60
-062A-6	62	80	80	JJS-80
-077A-6	77		100	JJS-100
-099A-6	99	125	150	JJS-150
-125A-6	125	160	175	JJS-175
-144A-6	144	200	200	JJS-200

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Emergency stop devices

The overall design of the installation must include emergency stop devices and any other safety equipment that may be needed. Pressing STOP on the drive's control panel does NOT:

- generate an emergency stop of the motor
- separate the drive from dangerous potential.

Input power cables/wiring

Input wiring can be any of:

- a four conductor cable (three phases and ground/protective earth). Shielding is not required.
- four insulated conductors routed through conduit.

Size wiring according to local safety regulations, appropriate input voltage and the drive's load current. In any case, the conductor must be less than the maximum limit defined by the terminal size (see section *Drive's power connection terminals* on page *280*).

The table below lists copper and aluminium cable types for different load currents. These recommendations apply only for the conditions listed at the top of the table.

IEC					**NEC**	
Based on: • EN 60204-1 and IEC 60364-5-2/2001 • PVC insulation • 30 °C (86 °F) ambient temperature • 70 °C (158 °F) surface temperature • cables with concentric copper shield • not more than nine cables laid on cable ladder side by side.					Based on: • NEC Table 310-16 for copper wires • 90 °C (194 °F) wire insulation • 40 °C (104 °F) ambient temperature • not more than three current-carrying conductors in raceway or cable, or earth (directly buried) • copper cables with concentric copper shield.	
Max. load current A	**Cu cable mm²**		**Max. load current A**	**Al cable mm²**	**Max. load current A**	**Cu wire size AWG/kcmil**
14	3×1.5		Aluminium cable cannot be used with frame sizes R1…R5 because of its lower capacity.		22.8	14
20	3×2.5				27.3	12
27	3×4				36.4	10
34	3×6				50.1	8
47	3×10				68.3	6
62	3×16				86.5	4
79	3×25				100	3
98	3×35		91	3×50	118	2
119	3×50		117	3×70	137	1
153	3×70		143	3×95	155	1/0
186	3×95		165	3×120	178	2/0
215	3×120		191	3×150	205	3/0
249	3×150		218	3×185	237	4/0
284	3×185		257	3×240	264	250 MCM or 2 × 1
330	3×240		274	3× (3×50)	291	300 MCM or 2 × 1/0
			285	2× (3×95)	319	350 MCM or 2 × 2/0

Ground connections

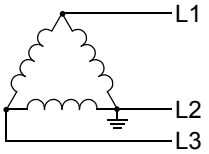
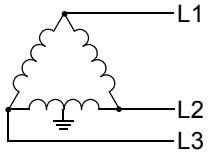
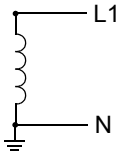
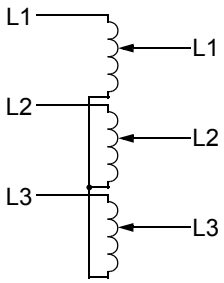
For personnel safety, proper operation and reduction of electromagnetic emission/ pick-up, the drive and the motor must be grounded at the installation site.

- Conductors must be adequately sized as required by safety regulations.
- Power cable shields must be connected to the drive PE terminal in order to meet safety regulations.
- Power cable shields are suitable for use as equipment grounding conductors only when the shield conductors are adequately sized as required by safety regulations.
- In multiple drive installations, do not connect drive terminals in series.

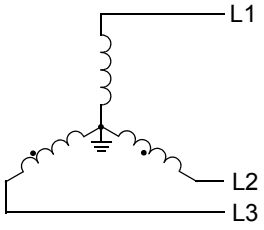
Corner grounded TN systems

WARNING! Do not attempt to install or remove the EMC filter screws EM1, EM3, F1 or F2 while power is applied to the drive's input terminals.

Corner grounded TN systems are defined in the following table. In such systems, disconnect the internal ground connection through the EMC filter capacitors (do this also if the grounding configuration of the system is unknown), see section *Disconnecting the internal EMC filter* on page *23*.

Corner grounded TN systems – EMC filter must be disconnected			
Grounded at the corner of the delta		Grounded at the mid point of a delta leg	
Single phase, grounded at an end point		Three phase "Variac" without solidly grounded neutral	

The EMC filter capacitors make an internal ground connection that reduces electro-magnetic emission. Where EMC (electro-magnetic compatibility) is a concern, and the system is symmetrically grounded, the EMC filter may be connected. For reference, the diagram on the right illustrates a symmetrically grounded TN system (TN-S system).



IT systems

WARNING! Do not attempt to install or remove the EMC filter screws EM1, EM3, F1 or F2 while power is applied to the drive's input terminals.

For IT systems (an ungrounded power system or a high-resistance-grounded [over 30 ohm] power system):

- Disconnect the ground connection to the internal EMC filter, see section *Disconnecting the internal EMC filter* on page *23*.
- Where EMC requirements exist, check for excessive emission propagated to neighboring low voltage networks. In some cases, the natural suppression in transformers and cables is sufficient. If in doubt, use a supply transformer with static screening between the primary and secondary windings.
- Do NOT install an external RFI/EMC filter. Using an EMC filter grounds the input power through the filter capacitors, which could be dangerous and could damage the drive.

Drive's power connection terminals

The following table provides specifications for the drive's power connection terminals.

Frame size	U1, V1, W1 U2, V2, W2 BRK+, UDC+ terminals						Earthing PE terminal			
	Minimum wire size		Maximum wire size		Tightening torque		Maximum wire size		Tightening torque	
	mm²	AWG	mm²	AWG	N·m	lb·ft	mm²	AWG	N·m	lb·ft
R1[1]	0.75	18	10	8	1.4	1	10	8	1.4	1
R2[1]	0.75	18	10	8	1.4	1	10	8	1.4	1
R3[1]	2.5	14	25	3	2.5	1.8	16	6	1.8	1.3
R4[1]	6	10	50	1/0	5.6	4	25	3	2	1.5
R5[1]	6	10	70	2/0	15	11	70	2/0	15	11
R6[2]	95[3]	3/0[3]	240	350 MCM	40	30	95	3/0	8	6

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[1] Aluminium cable cannot be used with frame sizes R1…R5 because of its lower capacity.

[2] Aluminium cable cannot be used with type ACS550-01-290A-4 because of the terminal size.

[3] See section *Power terminal considerations – R6 frame size* on page *281*.

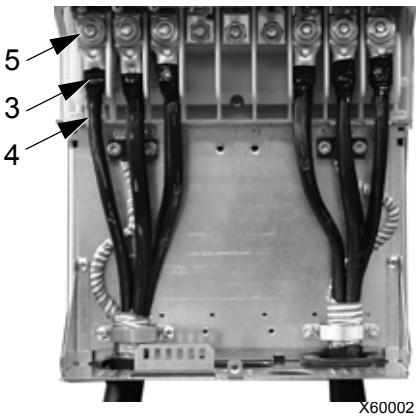
Note: See the recommended cable sizes for different load currents in section *Input power cables/ wiring* on page *278*.

Power terminal considerations – R6 frame size

WARNING! For R6 power terminals, if screw-on terminal lugs are supplied, they can only be used for wire sizes that are 95 mm^2 (3/0 AWG) or larger. Smaller wires will loosen and may damage the drive. They require crimp-on ring lugs as described below.

Crimp-on ring lugs

On the R6 frame size, if screw-on terminal lugs are supplied but the cable size used is less than 95 mm^2 (3/0 AWG), or if no screw-on terminal lugs are supplied at all, use crimp-on ring lugs according to the following procedure.



1. Select appropriate ring lugs from the following table.
2. Remove the screw-on terminal lugs, if supplied.
3. Attach the ring lugs to the drive end of the cables.
4. Isolate the ends of the ring lugs with insulating tape or shrink tubing.
5. Attach the ring lugs to the drive.

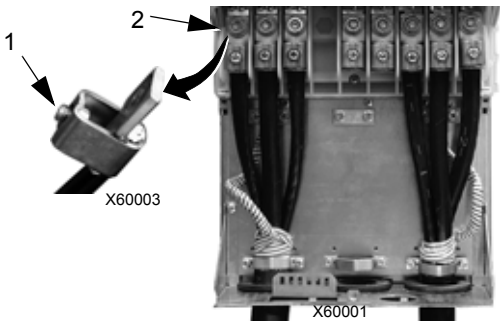
Wire size		Manufacturer	Ring lug	Crimping tool	No. of crimps
mm^2	kcmil/ AWG				
16	6	Burndy	YAV6C-L2	MY29-3	1
		Ilsco	CCL-6-38	ILC-10	2
25	4	Burndy	YA4C-L4BOX	MY29-3	1
		Ilsco	CCL-4-38	MT-25	1
35	2	Burndy	YA2C-L4BOX	MY29-3	2
		Ilsco	CRC-2	IDT-12	1
		Ilsco	CCL-2-38	MT-25	1
50	1	Burndy	YA1C-L4BOX	MY29-3	2
		Ilsco	CRA-1-38	IDT-12	1
		Ilsco	CCL-1-38	MT-25	1
		Thomas & Betts	54148	TBM-8	3
55	1/0	Burndy	YA25-L4BOX	MY29-3	2
		Ilsco	CRB-0	IDT-12	1
		Ilsco	CCL-1/0-38	MT-25	1
		Thomas & Betts	54109	TBM-8	3

Wire size		Manufacturer	Ring lug	Crimping tool	No. of crimps
mm^2	kcmil/ AWG				
70	**2/0**	Burndy	YAL26T38	MY29-3	2
		Ilsco	CRA-2/0	IDT-12	1
		Ilsco	CCL-2/0-38	MT-25	1
		Thomas & Betts	54110	TBM-8	3
95	**3/0**	Burndy	YAL27T38	MY29-3	2
		Ilsco	CRA-3/0	IDT-12	1
		Ilsco	CCL-3/0-38	MT-25	1
		Thomas & Betts	54111	TBM-8	3
95	**3/0**	Burndy	YA28R4	MY29-3	2
		Ilsco	CRA-4/0	IDT-12	1
		Ilsco	CCL-4/0-38	MT-25	2
		Thomas & Betts	54112	TBM-8	4

Screw-on terminal lugs

Use the following procedure to attach cables if screw-on terminal lugs are supplied and the cable size is 95 mm^2 (3/0 AWG) or larger.

1. Attach the supplied screw-on lugs to the drive end of the cables.
2. Attach screw-on lugs to the drive.



Motor connections

WARNING! Never connect line power to the drive output terminals: U2, V2 or W2. Line voltage applied to the output can result in permanent damage to the drive. If frequent bypassing is required, use mechanically interlocked switches or contactors.

WARNING! Do not connect any motor with a nominal voltage less than one half of the drive's nominal input voltage.

WARNING! Disconnect the drive before conducting any voltage tolerance (Hi-Pot) test or insulation resistance (Megger) test on the motor or motor cables. Do not conduct these tests on the drive.

Motor connection specifications

<table>
<tr><th colspan="2">Motor connection specifications</th></tr>
<tr><td>Voltage (U_2)</td><td>0…U_1, 3-phase symmetrical, U_{max} at the field weakening point</td></tr>
<tr><td>Frequency</td><td>0…500 Hz</td></tr>
<tr><td>Frequency resolution</td><td>0.01 Hz</td></tr>
<tr><td>Current</td><td>See section Ratings on page 271.</td></tr>
<tr><td>Field weakening point</td><td>10…500 Hz</td></tr>
<tr><td>Switching frequency</td><td>Selectable. See the availability in the table below.
<table>
<tr><th></th><th>1, 2, 4 and 8 kHz</th><th>12 kHz</th></tr>
<tr><td>208…240 V</td><td>All types</td><td>Frame sizes R1…R4 in scalar control mode</td></tr>
<tr><td>380…480 V</td><td>All types</td><td>Frame sizes R1…R4 (except ACS550-01-097A-4) in scalar control mode</td></tr>
<tr><td>500…600 V</td><td>All types</td><td>Frame sizes R2…R4 in scalar control mode</td></tr>
</table></td></tr>
<tr><td>Cable temperature rating</td><td>90 °C (194 °F) rating minimum.</td></tr>
<tr><td>Maximum motor cable length</td><td>See section Motor cable lengths on page 283.</td></tr>
</table>

Motor cable lengths

Maximum motor cable lengths for 400 V and 600 V drives are given in the sections below.

In multimotor systems, the calculated sum of all motor cable lengths must not exceed the maximum motor cable length given in the appropriate table below.

Motor cable length for 400 V drives

The table below shows the maximum motor cable lengths for 400 V drives with different switching frequencies. Examples for using the table are also given.

Maximum cable length for 400 V drives																		
Frame size	EMC limits												Operational limits					
	Second environment (category C3[1])						First environment (category C2[1])						Basic unit				With du/dt filters	
	1 kHz		4 kHz		8 kHz		1 kHz		4 kHz		8 kHz		1/4 kHz		8/12 kHz			
	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft
R1	300	980	300	980	300	980	300	980	300	980	300	980	100	330	100	330	150	490
R2	300	980	300	980	300	980	300	980	100	330	30	98	200	660	100	330	250	820
R3	300	980	300	980	300	980	300	980	75	245	75	245	200	660	100	330	250	820
R4	300	980	300	980	300	980	300	980	75	245	75	245	200	660	100	330	300	980
R5	100	330	100	330	100	330	100	330	100	330	100	330	300	980	150[2]	490[2]	300	980
R6	100	330	100	330	[3]	[3]	100	330	100	330	[3]	[3]	300	980	150[2]	490[2]	300	980

[1] See the new terms in section *IEC/EN 61800-3 (2004) Definitions* on page *305*.

[2] 12 kHz switching frequency is not available.

[3] Not tested.

Sine filters further extend the cable lengths.

Under heading "Operational limits", the "Basic unit" columns define the cable lengths with which the basic drive unit works without problems within the drive specification, without installing any further options. Column "With du/dt filters" defines the cable lengths when an external du/dt filter is used.

The columns under heading "EMC limits" show the maximum cable lengths with which the units have been tested for EMC emissions. The factory guarantees that these cable lengths meet the EMC standard requirements.

If external sine filters are installed, longer cable lengths can be used. With sine filters the limiting factors are the voltage drop of the cable, which has to be taken into account in engineering, as well as the EMC limits (where applicable).

The default switching frequency is 4 kHz.

WARNING! Using a motor cable longer than specified in the table above may cause permanent damage to the drive.

Examples for using the table:

Requirements	Checking and conclusions
R1 frame size, 8 kHz fsw, Category C2, 150 m (490 ft) cable	Check operational limits for R1 and 8 kHz -> for a 150 m (490 ft) cable a du/dt filter is needed. Check EMC limits -> EMC requirements for Category C2 are met with a 150 m (490 ft) cable.

Requirements	Checking and conclusions
R3 frame size, 4 kHz fsw, Category C3, 300 m (980 ft) cable	Check operational limits for R3 and 4 kHz -> a 300 m (980 ft) cable cannot be used even with a du/dt filter. A sine filter must be used and the voltage drop of the cable must be taken into account in the installation. Check EMC limits -> EMC requirements for Category C3 are met with a 300 m (980 ft) cable.
R5 frame size, 8 kHz fsw, Category C3, 150 m (490 ft) cable	Check operational limits for R5 and 8 kHz -> for a 150 m (490 ft) cable the basic unit is sufficient. Check EMC limits -> EMC requirements for Category C3 cannot be met with a 300 m (980 ft) cable. The installation configuration is not possible. An EMC plan is recommended to overcome the situation.
R6 frame size, 4 kHz fsw, EMC limits not applicable, 150 m (490 ft) cable	Check operational limits for R6 and 4 kHz -> for a 150 m (490 ft) cable the basic unit is sufficient. EMC limits do not need to be checked as there are no EMC requirements.

Motor cable length for 600 V drives

The table below shows the maximum motor cable lengths for 600 V drives with different switching frequencies. As the 600 V drives are not CE approved, cable lengths for EMC limits are not given.

Maximum cable length for 600 V drives				
Frame size	Operational limits			
	1/4 kHz		8/12 kHz	
	m	ft	m	ft
R2	100	330	100	330
R3…R4	200	660	100	330
R6	300	980	150[2]	490[2]

[2] 12 kHz switching frequency is not available.

WARNING! Using a motor cable longer than specified in the table above may cause permanent damage to the drive.

Motor thermal protection

According to regulations, the motor must be protected against thermal overload and the current must be switched off when overload is detected. The drive includes a motor thermal protection function that protects the motor and switches off the current when necessary. Depending on a drive parameter value (see parameter 3501 SENSOR TYPE), the function either monitors a calculated temperature value (based on a motor thermal model, see parameters 3005 MOT THERM PROT … 3009 BREAK POINT FREQ) or an actual temperature indication given by motor temperature sensors (see *Group 35: MOTOR TEMP MEAS*). The user can tune the thermal model further by feeding in additional motor and load data.

The most common temperature sensors are:

- motor sizes IEC180…225: thermal switch (e.g. Klixon)
- motor sizes IEC200…250 and larger: PTC or PT100.

Ground fault protection

ACS550 internal fault logic detects ground faults in the drive, motor, or motor cable. This fault logic:

- is NOT a personal safety or fire protection feature
- can be disabled using parameter 3017 EARTH FAULT

  Note: Disabling earth fault (ground fault) may void the warranty.
- could be tripped by leakage currents (input power to ground) associated with long high capacitance motor cables.

Grounding and routing

Motor cable shielding

Motor cables require shielding using conduit, armored cable or shielded cable.

- Conduit – When using conduit:
  - Bridge joints with a ground conductor bonded to the conduit on each side of the joint.
  - Bond conduit run to the drive enclosure.
  - Use a separate conduit run for motor cables (also separate input power and control cables).
  - Use a separate conduit run for each drive.
- Armored cable – When using armored cable:
  - Use six-conductor (3 phases and 3 grounds), type MC continuous corrugated aluminium armor cable with symmetrical grounds.
  - Armored motor cable can share a cable tray with input power cables, but not with control cables.
- Shielded cable – For shielded cable details, see section *Motor cable requirements for CE & C-Tick compliance* on page *287*.

Grounding

See section *Ground connections* on page *279*.

For CE compliant installations and installations where EMC emissions must be minimized, see section *Effective motor cable shields* on page *288*.

Drive's motor connection terminals

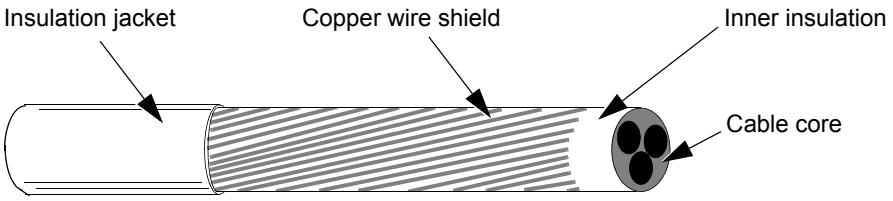
The drive's motor and input power terminals have the same specifications. See section *Drive's power connection terminals* on page *280*.

Motor cable requirements for CE & C-Tick compliance

The requirements in this section apply for CE or C-Tick compliance.

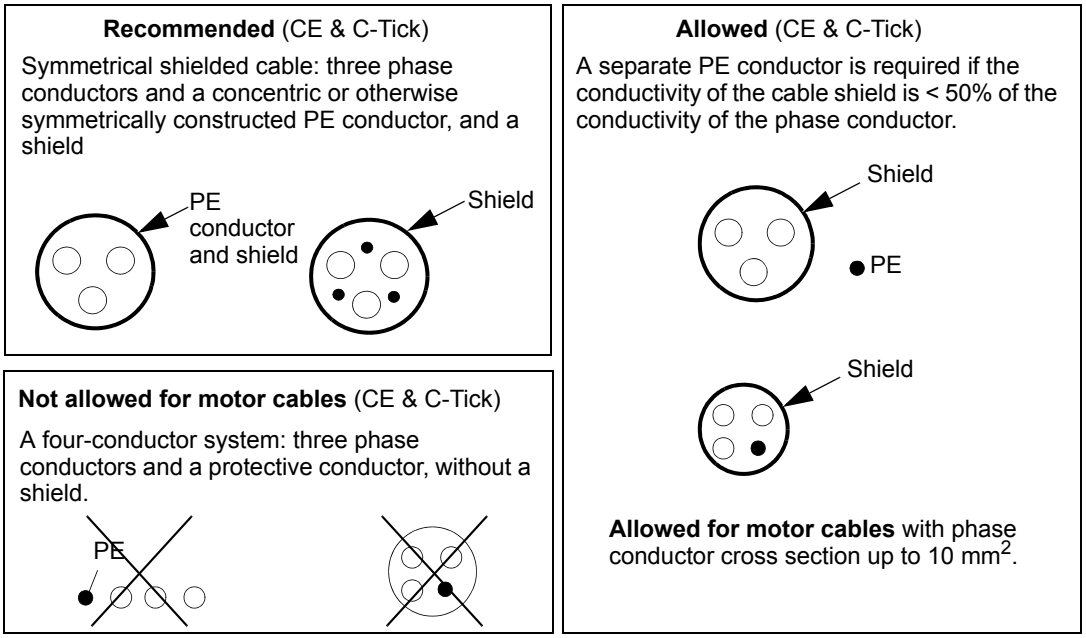
Minimum requirement (CE & C-Tick)

The motor cable must be a symmetrical three conductor cable with a concentric PE conductor or a four conductor cable with a concentric shield, however, a symmetrical constructed PE conductor is always recommended. The following figure shows the minimum requirement for the motor cable shield (for example, MCMK, Draka NK Cables).



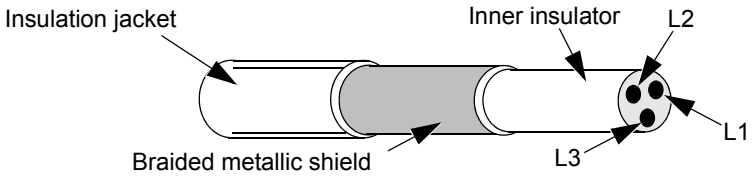
Recommendation for conductor layout

The following figure compares conductor layout features in motor cables.



Effective motor cable shields

The general rule for cable shield effectiveness is: the better and tighter the cable's shield, the lower the radiated emission level. The following figure shows an example of an effective construction (for example Ölflex-Servo-FD 780 CP, Lappkabel or MCCMK, NK Cables).



EN 61800-3 compliant motor cables

The most efficient EMC filtering can be achieved by following these rules:

- Motor cables must have an effective shield as described in section *Effective motor cable shields* on page *288*.
- Motor cable shield wires must be twisted together into a bundle (pig-tail) – the bundle length must be less than five times its width – and connected to the terminal marked ⏚ (at the bottom right-hand corner of the drive).
- At the motor end, the motor cable shield must be earthed 360 degrees with an EMC cable gland, or the shield wires must be twisted together into a bundle (pig-tail) not longer than five times its width and connected to the PE terminal of the motor.
- See section *Motor cable length for 400 V drives*, columns "*EMC limits*" on page *284* to check the maximum motor cable lengths and the need for filters for 400 V drives for IEC/EN 61800-3 compliance.

WARNING! Do not use RFI/EMC filters on IT systems.

Brake components

Availability

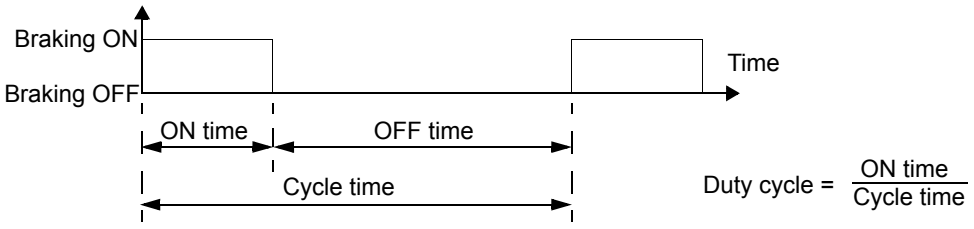
Braking availability for ACS550 drives, by frame size is:

- R1 and R2 – a built-in brake chopper is standard equipment. Add appropriate resistor, as determined using the following section. Resistors are available from ABB.
- R3…R6 – does not include an internal brake chopper. Connect a chopper and a resistor, or a brake unit to the DC link terminals on the drive. Contact your ABB representative for appropriate parts.

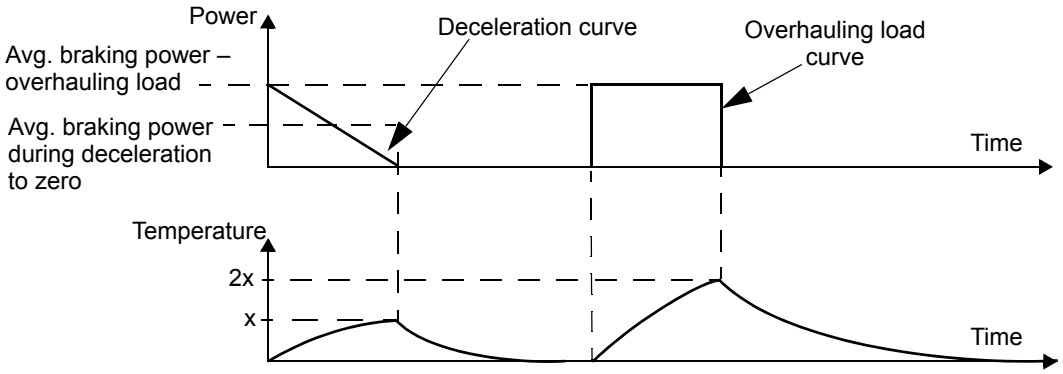
Selecting the braking resistors (frame sizes R1 and R2)

Braking resistor must meet three requirements:

- Resistance must be always higher than the minimum value R_{MIN} defined for the drive type in the following tables. Never use resistance below this value.
- Resistance must be low enough to be able to produce the desired braking torque. To achieve the maximum braking torque (the larger of 150% of heavy duty or 110% of nominal duty), the resistance must not exceed R_{MAX}. If maximum braking torque is not necessary, resistor values can exceed R_{MAX}.
- The resistor power rating must be high enough to dissipate the braking power. This requirement involves many factors:
  - the maximum continuous power rating for the resistor(s)
  - the rate at which the resistor changes temperature (resistor thermal time constant)
  - maximum braking time ON – If the regeneration (braking) power is larger than the resistor rated power, there is a limit to the ON time, or the resistor overheats before the OFF period begins.
  - minimum braking time OFF – If the regeneration (braking) power is larger than the resistor rated power, the OFF time must be large enough for the resistor to cool between ON periods.



  - the peak braking power requirement
  - type of braking (deceleration to zero vs. overhauling load) – During deceleration to zero, the generated power steadily decreases, averaging half of the peak power. For an overhauling load, the braking is countering an external force (gravity for example) and the braking power is constant. The total heat generated from an overhauling load is double the heat generated from deceleration to zero speed (for the same peak torque and ON time).



The many variables in the last requirement above are most easily dealt with using the following tables.

- First, determine your maximum braking time ON (ON_{MAX}), minimum braking time OFF (OFF_{MIN}) and load type (deceleration or overhauling load).
- Calculate duty cycle:

$$\text{Duty cycle} = \frac{ON_{MAX}}{(ON_{MAX} + OFF_{MIN})} \cdot 100\%$$

- In the appropriate table, find the column that best matches your data:
  - $ON_{MAX} \leq$ column specification and
  - Duty cycle $\leq$ column specification
- Find the row that matches your drive.
- The minimum power rating for deceleration to zero is the value in the selected row/column.
- For overhauling loads, double the rating in the selected row/column, or use the "Continuous ON" column.

208…240 V drives

Type ACS550-01/U1- see below	Resistance		Resistor[1] minimum continuous power rating				
			Deceleration-to-zero rating				P_{rcont} Continuous ON > 60 s ON > 25% Duty
	R_{MAX}	R_{MIN}	P_{r3} ≤ 3 s ON ≥ 27 s OFF ≤ 10% Duty	P_{r10} ≤ 10 s ON ≥ 50 s OFF ≤ 17% Duty	P_{r30} ≤ 30 s ON ≥ 180 s OFF ≤ 14% Duty	P_{r60} ≤ 60 s ON ≥ 180 s OFF ≤ 25% Duty	
	ohm	ohm	W	W	W	W	W
Three-phase supply voltage, **208…240 V**							
-04A6-2	234	80	45	80	120	200	1100
-06A6-2	160	80	65	120	175	280	1500
-07A5-2	117	44	85	160	235	390	2200
-012A-2	80	44	125	235	345	570	3000
-017A-2	48	44	210	390	575	950	4000
-024A-2	32	30	315	590	860	1425	5500
-031A-2	23	22	430	800	1175	1940	7500

[1] Resistor time constant specification must be ≥ 85 seconds.

380…480 V drives

Type ACS550-01/U1- see below	Resistance		Resistor[1] minimum continuous power rating				
			Deceleration-to-zero rating				P_{rcont} Continuous ON > 60 s ON > 25% Duty
	R_{MAX}	R_{MIN}	P_{r3} ≤ 3 s ON ≥ 27 s OFF ≤ 10% Duty	P_{r10} ≤ 10 s ON ≥ 50 s OFF ≤ 17% Duty	P_{r30} ≤ 30 s ON ≥ 180 s OFF ≤ 14% Duty	P_{r60} ≤ 60 s ON ≥ 180 s OFF ≤ 25% Duty	
	ohm	ohm	W	W	W	W	W
Three-phase supply voltage, **380**…**480 V**							
-03A3-4	641	120	65	120	175	285	1100
-04A1-4	470	120	90	160	235	390	1500
-05A4-4	320	120	125	235	345	570	2200
-06A9-4	235	80	170	320	470	775	3000
-08A8-4	192	80	210	400	575	950	4000
-012A-4	128	80	315	590	860	1425	5500
-015A-4	94	63	425	800	1175	1950	7500
-023A-4	64	63	625	1175	1725	2850	11000

[1] Resistor time constant specification must be ≥ 85 seconds.

500…600 V drives

Type ACS550-U1- see below	Resistance		Resistor[1] minimum continuous power rating				
			Deceleration-to-zero rating				P_{rcont} Continuous ON > 60 s ON > 25% Duty
	R_{MAX}	R_{MIN}	P_{r3} ≤ 3 s ON ≥ 27 s OFF ≤ 10% Duty	P_{r10} ≤ 10 s ON ≥ 50 s OFF ≤ 17% Duty	P_{r30} ≤ 30 s ON ≥ 180 s OFF ≤ 14% Duty	P_{r60} ≤ 60 s ON ≥ 180 s OFF ≤ 25% Duty	
	ohm	ohm	W	W	W	W	W
Three-phase supply voltage, **500…600 V**							
-02A7-6	548	80	93	175	257	425	1462
-03A9-6	373	80	137	257	377	624	2144
-06A1-6	224	80	228	429	629	1040	3573
-09A0-6	149	80	342	643	943	1560	5359
-011A-6	110	60	467	877	1286	2127	7308
-017A-6	75	60	685	1286	1886	3119	10718

[1] Resistor time constant specification must be ≥ 85 seconds.

WARNING! Never use a brake resistor with a resistance below the minimum value specified for the particular drive. The drive and the internal chopper are not able to handle the overcurrent caused by the low resistance.

Symbols

R_{MIN} – Minimum allowed resistance of the braking resistor.

R_{MAX} – Maximum resistance allowed if maximum braking torque is necessary.

P_{rx} – Duty-cycle based resistor power rating in deceleration braking, where "x" is ON_{MAX} time.

Installing and wiring resistors

All resistors must be installed outside the drive module in a place where they can dissipate heat.

WARNING! The surface temperature of the resistor is very high, and air flowing from the resistor is very hot. Materials near the brake resistor must be non-flammable. Provide protection from accidental contact with the resistor.

To ensure that the input fuses protect the resistor cable, use resistor cables with the same rating as used for the power input to the drive.

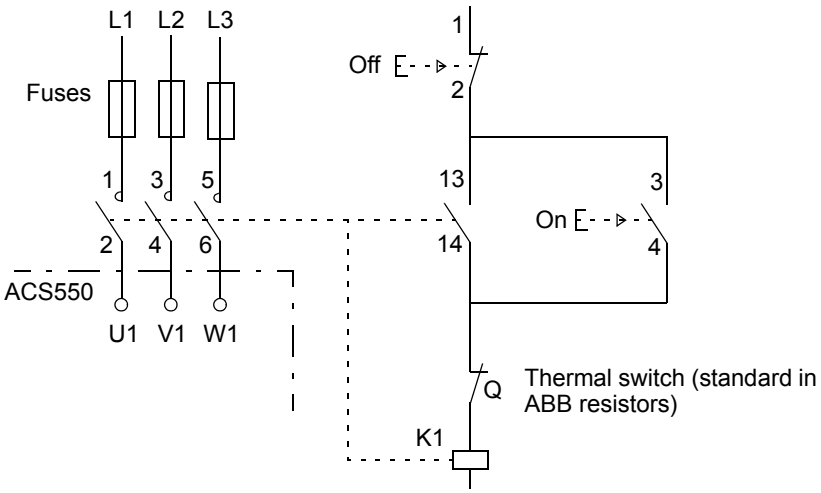
The maximum length of the resistor cable(s) is 10 m (33 ft). See section *Power connection diagrams* on page *21* for the resistor cable connection points.

Mandatory circuit protection

The following setup is essential for safety – it interrupts the main supply in fault situations involving chopper shorts:

- Equip the drive with a main contactor.
- Wire the contactor so that it opens if the resistor thermal switch opens (an overheated resistor opens the contactor).

Below is a simple wiring diagram example.



Parameter set-up

To enable dynamic braking, switch off the drive's overvoltage control [Set parameter 2005 = 0 (DISABLE)].

Note: Never mix 24 V DC and 115/230 V AC signals in the same cable.

Analog cables

Recommendations for analog signal runs:

- Use double shielded, twisted pair cable.
- Use one individually shielded pair for each signal.
- Do not use a common return for different analog signals.

Digital cables

Recommendation for digital signal runs: A double shielded cable is the best alternative, but single-shielded, twisted, multi-pair cable is also usable.

Control panel cable

If the control panel is connected to the drive with a cable, use only Category 5 Patch ethernet cable. The maximum length that is tested to meet EMC specifications is 3 m (9.8 ft). Longer cables are susceptible to electromagnetic noise and must be user-tested to verify that EMC requirements are met. Where long runs are required (especially for runs longer than about 12 m [40 ft]), use a RS232/RS485 converter at each end and run RS485 cable.

Drive's control connection terminals

The following table provides specifications for the drive's control terminals

Frame size	Control			
	Maximum wire size [1]		Tightening torque	
	mm^2	AWG	N·m	lb·ft
All	1.5	16	0.4	0.3

[1] Values given for solid wires.
For stranded wires, the maximum size is 1 mm^2.

Efficiency

Approximately 98% at nominal power level.

Cooling

Cooling specifications	
Method	Internal fan, flow direction from bottom to top.
Requirement	Free space above and below the ACS550 drive: 200 mm (8 in). Free space is not required on the drive's sides – ACS550 drives can be mounted side-by-side.

Air flow, 208…240 V drives

The following table lists heat loss and air flow data for 208…240 V drives.

Drive		Heat loss		Air flow	
ACS550-x1-	**Frame size**	**W**	**BTU/hr**	**m^3/h**	**ft^3/min**
-04A6-2	R1	55	189	44	26
-06A6-2	R1	73	249	44	26
-07A5-2	R1	81	276	44	26
-012A-2	R1	118	404	44	26
-017A-2	R1	161	551	44	26
-024A-2	R2	227	776	88	52
-031A-2	R2	285	973	88	52
-046A-2	R3	420	1434	134	79
-059A-2	R3	536	1829	134	79
-075A-2	R4	671	2290	280	165
-088A-2	R4	786	2685	280	165
-114A-2	R4	1014	3463	280	165
-143A-2	R6	1268	4431	405	238
-178A-2	R6	1575	5379	405	238
-221A-2	R6	1952	6666	405	238
-248A-2	R6	2189	7474	405	238

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Air flow, 380…480 V drives

The following table lists heat loss and air flow data for 380…480 V drives.

Drive		Heat loss		Air flow	
ACS550-x1-	**Frame size**	**W**	**BTU/hr**	**m^3/h**	**ft^3/min**
-03A3-4	R1	40	137	44	26
-04A1-4	R1	52	178	44	26
-05A4-4	R1	73	249	44	26
-06A9-4	R1	97	331	44	26
-08A8-4	R1	127	434	44	26
-012A-4	R1	172	587	44	26
-015A-4	R2	232	792	88	52
-023A-4	R2	337	1151	88	52

Drive		Heat loss		Air flow	
ACS550-x1-	**Frame size**	**W**	**BTU/hr**	**m^3/h**	**ft^3/min**
-031A-4	R3	457	1561	134	79
-038A-4	R3	562	1919	134	79
-045A-4	R3	667	2278	134	79
-059A-4	R4	907	3098	280	165
-072A-4	R4	1120	3825	280	165
-078A-4	R4	1295	4423	250	147
-087A-4	R4	1440	4918	280	165
-097A-4	R4	1440	4918	280	165
-125A-4	R5	1940	6625	350	205
-157A-4	R6	2310	7889	405	238
-180A-4	R6	2810	9597	405	238
-195A-4	R6	3050	10416	405	238
-246A-4	R6	3260	11134	405	238
-290A-4	R6	3850	13125	405	238

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Air flow, 500…600 V drives

The following table lists heat loss and air flow data for 500…600 V drives.

Drive		Heat loss		Air flow	
ACS550-U1-	**Frame size**	**W**	**BTU/hr**	**m^3/h**	**ft^3/min**
-02A7-6	R2	52	178	88	52
-03A9-6	R2	73	249	88	52
-06A1-6	R2	127	434	88	52
-09A0-6	R2	172	587	88	52
-011A-6	R2	232	792	88	52
-017A-6	R2	337	1151	88	52
-022A-6	R3	457	1561	134	79
-027A-6	R3	562	1919	134	79
-032A-6	R4	667	2278	280	165
-041A-6	R4	907	3098	280	165
-052A-6	R4	1117	3815	280	165
-062A-6	R4	1357	4634	280	165
-077A-6	R6	2310	7889	405	238
-099A-6	R6	2310	7889	405	238
-125A-6	R6	2310	7889	405	238
-144A-6	R6	2310	7889	405	238

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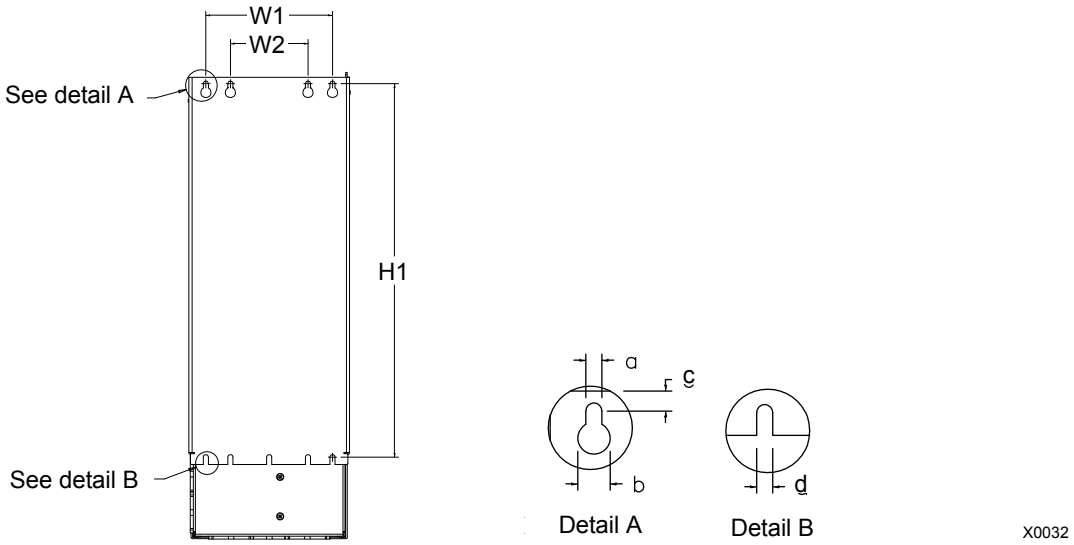
Dimensions and weights

The dimensions and mass for the ACS550 depend on the frame size and enclosure type. If unsure of the frame size, first, find the "Type" designation on the drive labels (see sections *Type designation* on page *13* and *Drive labels* on page *12*). Then look up that type designation in the rating tables (see chapter *Technical data*, page *271*), to determine the frame size.

Mounting dimensions



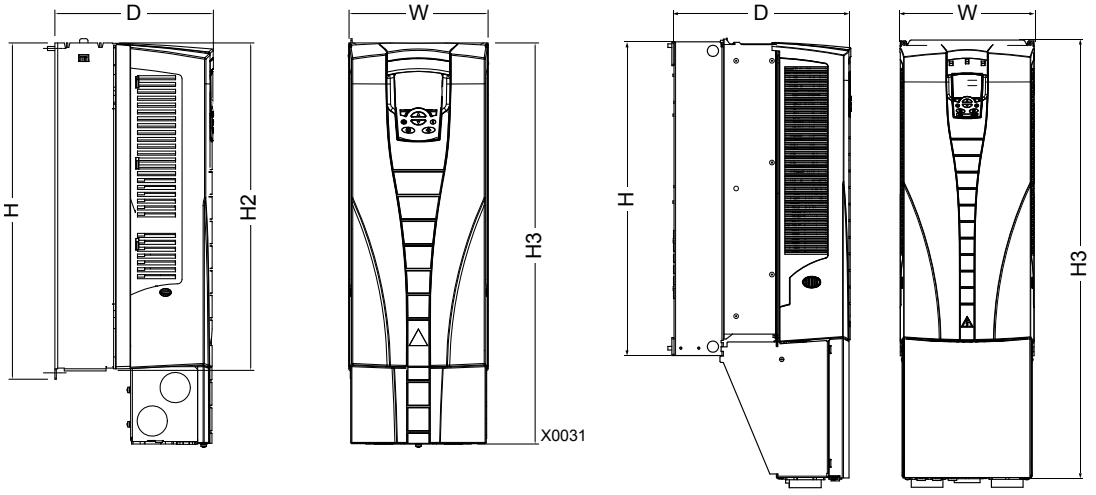
IP21 / UL type 1 and IP54 / UL type 12 – Dimensions for each frame size												
Ref.	R1		R2		R3		R4		R5		R6	
	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in
W1[1]	98.0	3.9	98.0	3.9	160	6.3	160	6.3	238	9.4	263	10.4
W2[1]	--	--	--	--	98.0	3.9	98.0	3.9	--	--	--	--
H1[1]	318	12.5	418	16.4	473	18.6	578	22.8	588	23.2	675	26.6
a	5.5	0.2	5.5	0.2	6.5	0.25	6.5	0.25	6.5	0.25	9.0	0.35
b	10.0	0.4	10.0	0.4	13.0	0.5	13.0	0.5	14.0	0.55	18.0	0.71
c	5.5	0.2	5.5	0.2	8.0	0.3	8.0	0.3	8.5	0.3	8.5	0.3
d	5.5	0.2	5.5	0.2	6.5	0.25	6.5	0.25	6.5	0.25	9.0	0.35

[1] Center to center dimension.

Outside dimensions

Drives with IP21 / UL type 1 enclosures

Types ACS550-x1-246A-4 and ACS550-01-290A-4, frame size R6



IP21 / UL type 1 – dimensions for each frame size												
Ref.	R1		R2		R3		R4		R5		R6	
	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in
W	125	4.9	125	4.9	203	8.0	203	8.0	265	10.4	302	11.9
H	330	13.0	430	16.9	490	19.3	596	23.5	602	23.7	700	27.6
H2	315	12.4	415	16.3	478	18.8	583	23.0	578	22.8	698	27.5
H3	369	14.5	469	18.5	583	23.0	689	27.1	736	29.0	888[1]	35.0[1]
D	212	8.3	222	8.7	231	9.1	262	10.3	286	11.3	400	15.8

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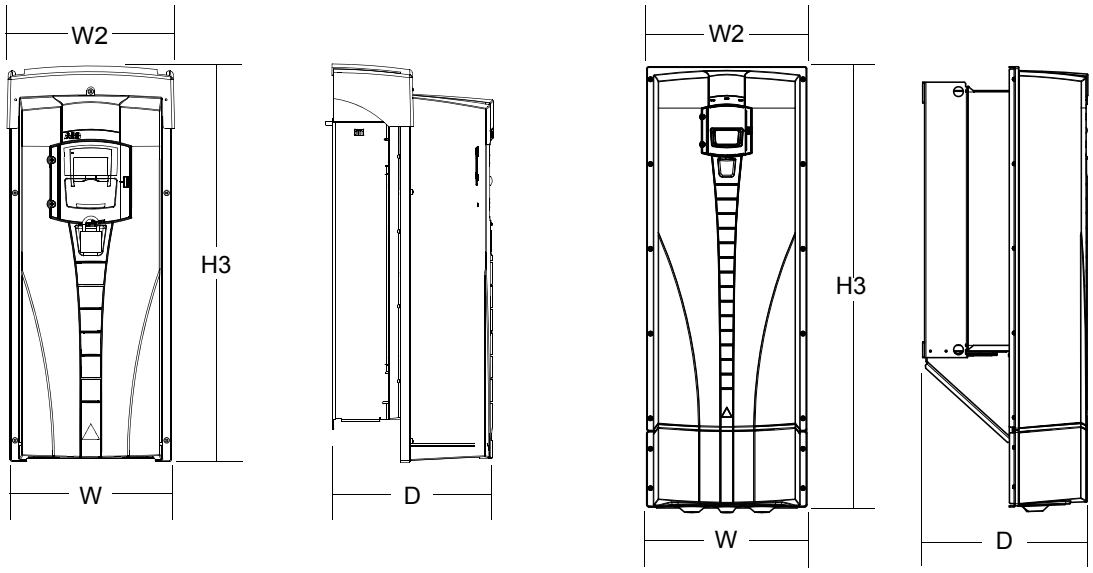
1. ACS550-x1-246A-4 and ACS550-01-290A-4: 979 mm / 38.5 in.

Drives with IP54 / UL type 12 enclosures

Type ACS550-01-290A-4, IP54
(UL type 12 not available), frame size R6



IP54 / UL type 12 – Dimensions for each frame size												
Ref.	**R1**		**R2**		**R3**		**R4**		**R5**		**R6**[2]	
	mm	**in**	**mm**	**in**	**mm**	**in**	**mm**	**in**	**mm**	**in**	**mm**	**in**
W	213	8.4	213	8.4	257	10.1	257	10.1	369	14.5	410	16.1
W2	222	8.8	222	8.8	267	10.5	267	10.5	369	14.5	410	16.1
H3	461	18.2	561	22.1	629	24.8	760	29.9	775	30.5	924[1]	36.4[1]
D	234	9.2	245	9.7	254	10.0	284	11.2	309	12.2	423	16.7

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1. ACS550-01-290A-4: 1119 mm / 44.1 in.
2. UL type 12 not available for ACS550-01-290A-4.

Weight

The following table lists typical maximum weights for each frame size. Variations within each frame size (due to components associated with voltage/current ratings and options) are minor.

Enclosure	**Weight**											
	R1		**R2**		**R3**		**R4**		**R5**		**R6**	
	kg	**lb**	**kg**	**lb**	**kg**	**lb**	**kg**	**lb**	**kg**	**lb**	**kg**	**lb**
IP21 / UL type 1	6.5	14.3	9.0	19.8	16	35	24	53	34	75	69[1]	152[1]
IP54 / UL type 12	8.0	17.6	11.0	24.3	17.0	37.5	26.0	57.3	42.0	93.0	86.0[2]	190[2]

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1. ACS550-x1-246A-4, IP21 / UL type 1: 70 kg / 154 lb
   ACS550-01-290A-4, IP21 / UL type 1: 80 kg / 176 lb.
2. ACS550-x1-246A-4, IP54 / UL type 12: 80 kg / 176 lb
   ACS550-01-290A-4, IP54: 90 kg / 198 lb (UL type 12 not available).

Degrees of protection

Available enclosures:

- IP21 / UL type 1 enclosure. The site must be free of airborne dust, corrosive gases or liquids, and conductive contaminants such as condensation, carbon dust and metallic particles.
- IP54 / UL type 12 enclosure. This enclosure provides protection from airborne dust and light sprays or splashing water from all directions.

  Note: UL type 12 enclosure is not available for type ACS550-01-290A-4.

Compared to the IP21 / UL type 1 enclosure, the IP54 / UL type 12 enclosure has:

- the same internal plastic shell as the IP21 enclosure
- a different outer plastic cover
- an additional internal fan to improve cooling
- larger dimensions
- the same rating (does not require a derating).

Ambient conditions

The following table lists the ACS550 environmental requirements.

Ambient environment requirements		
	Installation site	**Storage and transportation in the protective package**
Altitude	• 0…1000 m (0…3 300 ft) • 1000…2000 m (3 300…6 600 ft) if P_N and I_{2N} derated 1% every 100 m above 1000 m (300 ft above 3 300 ft)	
Ambient temperature	• Min. -15 °C (5 °F) – no frost allowed • Max. (fsw = 1 or 4) 40 °C (104 °F); 50 °C (122 °F) if P_N and I_{2N} derated to 90% • Max. (fsw = 8) 40 °C (104 °F) if P_N and I_{2N} derated to 80% • Max. (fsw = 12) 30 °C (86 °F) if P_N and I_{2N} derated to 65% (to 50% for 600 V, R4 frame sizes, that is for ACS550-U1-032A-6 … ACS550-U1-062A-6)	-40…70 °C (-40…158 °F)
Relative humidity	5…95%, no condensation allowed	

Ambient environment requirements		
	Installation site	**Storage and transportation in the protective package**
Contamination levels (IEC 721-3-3)	• No conductive dust allowed. • The ACS550 should be installed in clean air according to enclosure classification. • Cooling air must be clean, free from corrosive materials and free from electrically conductive dust. • Chemical gases: Class 3C2 • Solid particles: Class 3S2	Storage • No conductive dust allowed. • Chemical gases: Class 1C2 • Solid particles: Class 1S2 Transportation • No conductive dust allowed. • Chemical gases: Class 2C2 • Solid particles: Class 2S2

The following table lists the standard stress testing that the ACS550 passes.

Stress tests		
	Without shipping package	**Inside shipping package**
Sinusoidal vibration	Mechanical conditions: In accordance with IEC 60721-3-3, Class 3M4 • 2…9 Hz 3.0 mm (0.12 in) • 9…200 Hz 10 m/s^2 (33 ft/s^2)	In accordance with ISTA 1A and 1B specifications.
Shock	Not allowed	In accordance with IEC 68-2-29: max. 100 m/s^2 (330 ft/s^2), 11ms
Free fall	Not allowed	• 76 cm (30 in), frame size R1 • 61cm (24 in), frame size R2 • 46 cm (18 in), frame size R3 • 31 cm (12 in), frame size R4 • 25 cm (10 in), frame size R5 • 15 cm (6 in), frame size R6

Materials

Material specifications	
Drive enclosure	• PC/ABS 2.5 mm, color NCS 1502-Y or NCS 7000-N • Hot-dip zinc coated steel sheet 1.5…2 mm, thickness of coating 20 micrometers. If the surface is painted, the total thickness of the coating (zinc and paint) is 80…100 micrometers. • Cast aluminium AlSi • Extruded aluminium AlSi
Package	Corrugated board, expanded polystyrene, plywood, raw wood (heat dried). Package wrap consists of one or more of the following: PE-LD plastic wrap, PP or steel bands.

Material specifications	
Disposal	The drive contains raw materials that should be recycled to preserve energy and natural resources. The package materials are environmentally compatible and recyclable. All metal parts can be recycled. The plastic parts can either be recycled or burned under controlled circumstances, according to local regulations. Most recyclable parts are marked with recycling marks. If recycling is not feasible, all parts excluding electrolytic capacitors and printed circuit boards can be landfilled. The DC capacitors contain electrolyte and, if the drive is not provided with the RoHS marking, the printed circuit boards contain lead, both of which are classified as hazardous waste within the EU. They must be removed and handled according to local regulations. For further information on environmental aspects and more detailed recycling instructions, please contact your local ABB distributor.

Applicable standards

Drive compliance with the following standards is identified by the standard "marks" on the type designation label.

Mark	Applicable standards	
CE	EN 50178 (1997)	Electronic equipment for use in power installations
	IEC/EN 60204-1 (2005)	Safety of machinery. Electrical equipment of machines. Part 1: General requirements. *Provisions for compliance:* The final assembler of the machine is responsible for installing: • an emergency-stop device • a supply disconnecting device.
	IEC/EN 60529 (2004)	Degrees of protection provided by enclosures (IP code)
	IEC 60664-1 (2002)	Insulation coordination for equipment within low-voltage systems. Part 1: Principles, requirements and tests
	IEC/EN 61800-5-1 (2003)	Adjustable speed electrical power drive systems. Part 5-1: Safety requirements. Electrical, thermal and energy
	IEC/EN 61800-3 (2004)	Adjustable speed electrical power drive systems. Part 3: EMC requirements and specific test methods
	IEC/EN 61000-3-12	Electromagnetic compatibility (EMC). Part 3-12: Limits - Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current > 16 A and = 75 A per phase
	IEC/EN 61800-3 (2004)	Adjustable speed electrical power drive systems. Part 3: EMC requirements and specific test methods
c UL us LISTED	UL 508C	UL Standard for Safety, Power Conversion Equipment, third edition
	C22.2 No. 14	CSA Standard for Industrial Control Equipment (for ACS550-U1 drives only)

CE marking

CE A CE mark is attached to the drive to verify that the drive follows the provisions of the European Low Voltage and EMC Directives.

Note: The 600 V ACS550-U1 drives are not CE approved.

Compliance with the EMC Directive

The Directive defines the requirements for immunity and emissions of electrical equipment used within the European Union. The EMC product standard (IEC/EN 61800-3 [2004]) covers requirements stated for drives.

Compliance with IEC/EN 61800-3 (2004)

See page *305*.

C-Tick marking

The drive carries C-Tick marking.

C-Tick marking is required in Australia and New Zealand. A C-Tick mark is attached to the drive to verify compliance with the relevant standard (IEC 61800-3 (2004) – Adjustable speed electrical power drive systems – Part 3: EMC product standard including specific test methods), mandated by the Trans-Tasman Electromagnetic Compatibility Scheme.

The Trans-Tasman Electromagnetic Compatibility Scheme (EMCS) was introduced by the Australian Communication Authority (ACA) and the Radio Spectrum Management Group (RSM) of the New Zealand Ministry of Economic Development (NZMED) in November 2001. The aim of the scheme is to protect the radio frequency spectrum by introducing technical limits for emission from electrical/ electronic products.

Compliance with IEC/EN 61800-3 (2004)

See page 305.

UL/CSA markings

An UL mark is attached to ACS550 drives to verify that the drive follows the provisions of UL 508C.

A CSA mark is attached to ACS550-**U1** type drives to verify that the drive follows the provisions of C22.2 NO. 14.

The ACS550 is suitable for use in a circuit capable of delivering not more than 100 kA RMS symmetrical amperes, 600 V maximum. The ampere rating is based on tests done according to UL 508.

Branch circuit protection must be provided in accordance with local codes.

The ACS550 has an electronic motor protection feature that complies with the requirements of UL 508C and, for ACS550-U1, C22.2 No. 14. When this feature is selected and properly adjusted, additional overload protection is not required unless more than one motor is connected to the drive or unless additional protection is required by applicable safety regulations. See parameters 3005 (MOT THERM PROT) and 3006 (MOT THERM RATE).

The drives are to be used in a controlled environment. See section *Ambient conditions* on page 300 for specific limits.

Note: For open type enclosures, i.e. drives without the conduit box and/or cover for IP21 / UL type 1 drives, or without the conduit plate and/or hood for IP54 / UL type 12 drives, the drive must be mounted inside an enclosure in accordance with National Electric Code and local electrical codes.

Brake choppers, when applied with appropriately sized brake resistors, will allow the drive to dissipate regenerative energy (normally associated with quickly decelerating a motor). Frame sizes R1 and R2 have a built-in brake chopper as standard equipment. For frame sizes R3…R6, contact your ABB representative for appropriate parts. See section *Brake components* on page 289.

IEC/EN 61800-3 (2004) Definitions

EMC stands for **E**lectro**m**agnetic **C**ompatibility. It is the ability of electrical/electronic equipment to operate without problems within an electromagnetic environment. Likewise, the equipment must not disturb or interfere with any other product or system within its locality.

First environment includes establishments connected to a low-voltage network which supplies buildings used for domestic purposes.

Second environment includes establishments connected to a network not directly supplying domestic premises.

Drive of category C2: drive of rated voltage less than 1000 V and intended to be installed and commissioned only by a professional when used in the first environment.

Note: A professional is a person or organisation having necessary skills in installing and/or commissioning power drive systems, including their EMC aspects.

Category C2 has the same EMC emission limits as the earlier class first environment restricted distribution. EMC standard IEC/EN 61800-3 does not any more restrict the distribution of the drive, but the using, installation and commissioning are defined.

Drive of category C3: drive of rated voltage less than 1000 V, intended for use in the second environment and not intended for use in the first environment.

Category C3 has the same EMC emission limits as the earlier class second environment unrestricted distribution.

Compliance with the IEC/EN 61800-3 (2004)

The immunity performance of the drive complies with the demands of IEC/EN 61800-3, category C2 (see page *305* for IEC/EN 61800-3 definitions). The emission limits of IEC/EN 61800-3 are complied with the provisions described below.

First environment (drives of category C2)

1. The internal EMC filter is connected.
2. The motor and control cables are selected as specified in this manual.
3. The drive is installed according to the instructions given in this manual.
4. The motor cable length does not exceed the allowed maximum length specified in section *Motor cable length for 400 V drives* on page *284* for the frame size and switching frequency in use.

   WARNING! In a domestic environment, this product may cause radio inference, in which case supplementary mitigation measures may be required.

Second environment (drives of category C3)

1. The internal EMC filter is connected.
2. The motor and control cables are selected as specified in this manual.
3. The drive is installed according to the instructions given in this manual.

4. The motor cable length does not exceed the allowed maximum length specified in section *Motor cable length for 400 V drives* on page *284* for the frame size and switching frequency in use.

   WARNING! A drive of category C3 is not intended to be used on a low-voltage public network which supplies domestic premises. Radio frequency interference is expected if the drive is used on such a network.

   Note: It is not allowed to install a drive with the internal EMC filter connected on IT (ungrounded) systems. The supply network becomes connected to ground potential through the EMC filter capacitors, which may cause danger or damage the drive.

   Note: It is not allowed to install a drive with the internal EMC filter connected to a corner grounded TN system as this would damage the drive.

Product protection in the USA

This product is protected by one or more of the following US patents:

4,920,306	5,301,085	5,463,302	5,521,483	5,532,568	5,589,754
5,612,604	5,654,624	5,799,805	5,940,286	5,942,874	5,952,613
6,094,364	6,147,887	6,175,256	6,184,740	6,195,274	6,229,356
6,252,436	6,265,724	6,305,464	6,313,599	6,316,896	6,335,607
6,370,049	6,396,236	6,448,735	6,498,452	6,552,510	6,597,148
6,600,290	6,741,059	6,774,758	6,844,794	6,856,502	6,859,374
6,922,883	6,940,253	6,934,169	6,956,352	6,958,923	6,967,453
6,972,976	6,977,449	6,984,958	6,985,371	6,992,908	6,999,329
7,023,160	7,034,510	7,036,223	7,045,987	7,057,908	7,059,390
7,067,997	7,082,374	7,084,604	7,098,623	7,102,325	7,109,780
7,164,562	7,176,779	7,190,599	7,215,099	7,221,152	7,227,325
7,245,197	7,250,739	7,262,577	7,271,505	7,274,573	7,279,802
7,280,938	7,330,095	7,349,814	7,352,220	7,365,622	7,372,696
7,388,765	D503,931	D510,319	D510,320	D511,137	D511,150
D512,026	D512,696	D521,466	D541,743S	D541,744S	D541,745S
D548,182S	D548,183S				

Other patents pending.