ABB INDUSTRIAL DRIVES

ACS880-604 1-phase brake units as modules

Hardware manual

ACS880-604 1-phase brake units as modules

Hardware manual

3AUA0000106244 Rev C
EN
Original instructions
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Table of contents

1

Introduction to the manual

Contents of this chapter

This chapter introduces this manual.

Safety instructions

Obey all safety instructions of the drive.

- Read the **complete safety instructions** before you install, commission, use or service the drive. The complete safety instructions are given in ACS880 multidrives cabinets and modules safety instructions (3AUA0000102301 [English]).
- Read the warnings of the software function before you take the function in use or change its default parameter settings. Read the warnings of the parameter before you change its default setting. Refer to the firmware manual.

Target audience

The manual is intended for people who plan the installation of or start up the brake unit. Read the manual before working on the unit. You are expected to know the fundamentals of electricity, wiring, electrical components and electrical schematic symbols.

Related documents

For more documentation, go to www.abb.com/drives/documents.

	ACS880 multidrive modules link list

You can find all documentation related to the multidrive modules on the Internet at https://sites-apps.abb.com/sites/lvacdrivesengineeringsupport/content.

Terms and abbreviations

Term	Description
Brake chopper	Conducts the surplus energy from the intermediate circuit of the drive to the brake resistor when necessary. The chopper operates when the DC link voltage exceeds a certain maximum limit. The voltage rise is typically caused by deceleration (braking) of a high inertia motor.
Brake chopper module	Brake chopper enclosed in a metal frame or housing. Intended for cabinet installation.
Brake resistor	Dissipates the drive surplus braking energy conducted by the brake chopper to heat
Brake unit	Brake chopper modules and the necessary auxiliary equipment, such as control electronics, fusing and cabling
Cubicle	One section of a cabinet-installed drive. A cubicle is typically behind a door of its own.
DC link	DC circuit between rectifier and inverter
Drive	Frequency converter for controlling AC motors
EMC	Electromagnetic compatibility
IGBT	Insulated gate bipolar transistor
Intermediate circuit	DC circuit between rectifier and inverter
Inverter	Converts direct current and voltage to alternating current and voltage.
Multidrive	Drive for controlling several motors which are typically coupled to the same machinery. Includes one supply unit, and one or several inverter units.
NBRA	Series of optional brake chopper modules
NBRC	Brake chopper control board
Parameter	In the drive control program, user-adjustable operation instruction to the drive, or signal measured or calculated by the drive. In some (for example fieldbus) contexts, a value that can be accessed as an object. For example, variable, constant, or signal.
Rectifier	Converts alternating current and voltage to direct current and voltage
SAFUR	Series of brake resistors

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Operation principle and hardware description

Contents of this chapter

This chapter introduces the operation principle and construction of the brake unit.

Product overview

The ACS880-604 is an air-cooled resistor brake unit available in the ACS880 multidrive modules product range. The design presented in this manual has a NBRA-658C, NBRA-659C or NBRA-669C brake chopper module with two brake resistors. The chopper module cubicle has an inlet and an outlet for cooling air, and a fan blows the air through the module. The two resistors are installed in a separate cubicle and share another cooling fan.

An optional attenuator in the chopper module cubicle suppresses voltage spikes at chopper input. The attenuator must be installed if it is possible to disconnect all inverter units from the DC link with the supply unit on.

Chopper/resistor combinations can be connected in parallel to achieve a higher braking capacity. However, each chopper module must have its own resistors.

Operation principle

The brake chopper handles the extra energy generated by motor during a quick deceleration. The extra energy increases the drive DC link voltage. The chopper connects the brake resistor to the DC link whenever the voltage is higher than the operation limit of the chopper. Energy consumption by the resistor losses lowers the voltage until it is below the limit at which the chopper stops.

Chopper voltage selection

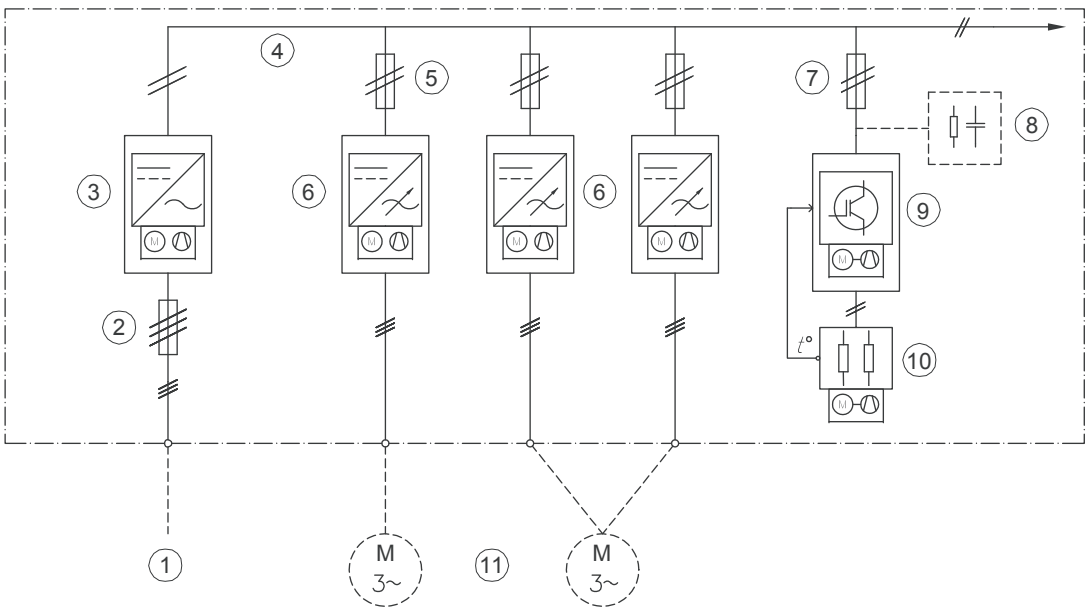
The brake chopper starts operating when the drive DC link voltage exceeds the "on" limit (Ubr_on). The brake chopper stops operating when voltage goes below the "off" limit (Ubr_off). Voltage limits depend on the position of voltage selection jumper. Refer to Selecting the voltage (page 34).

When to use resistor braking

Resistor braking is necessary for high capacity braking of the motor and machinery if a regenerative drive cannot be used.

Single-line diagram of the drive system

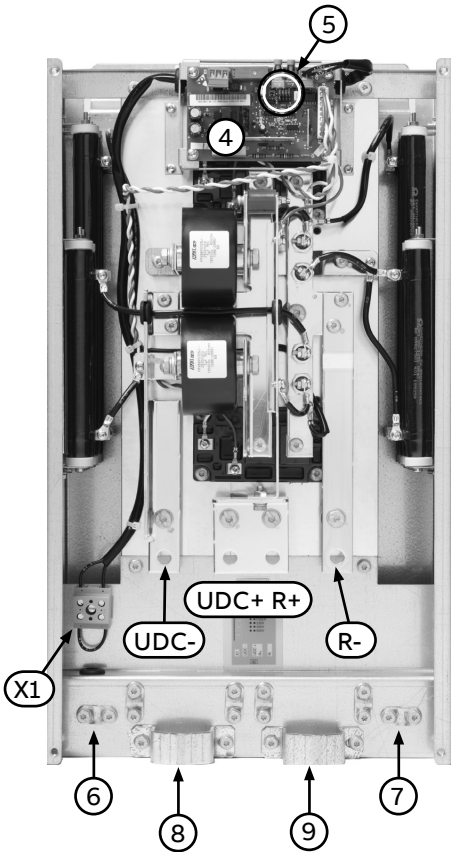
The diagram below shows a typical common DC link drive system.



1	AC supply
2	Input (AC) fuses
3	Supply unit
4	DC link
5	Inverter DC fuses
6	Inverter units. In this example, one of the units consists of two inverter modules connected in parallel.
7	Brake chopper DC fuses
8	Attenuator. Suppresses voltage spikes at chopper input.
9	Brake chopper module
10	Brake resistors
11	Motors

Layout

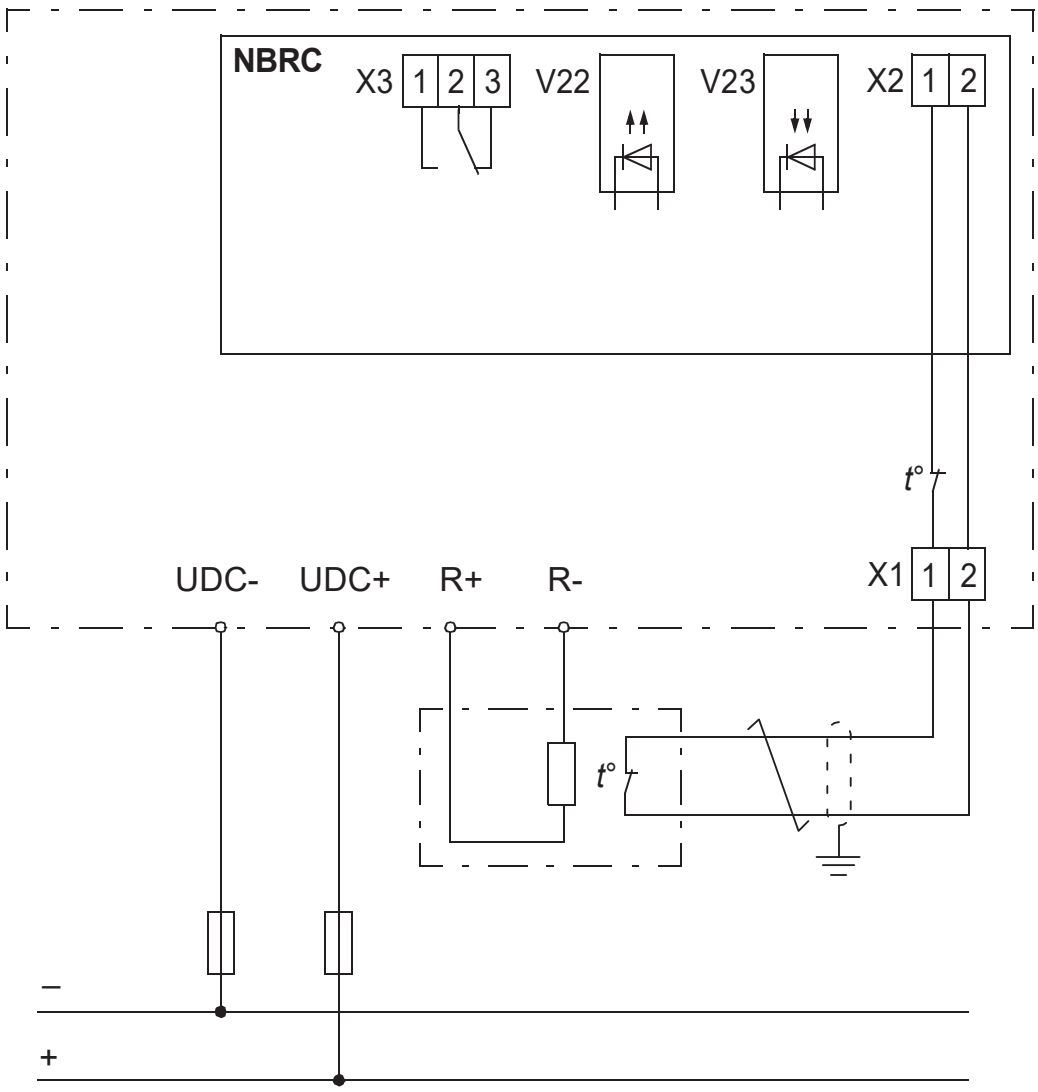
The components of the brake chopper module are shown below.



1	Fastening points on back plate (two at the top, two at the bottom)	8	Clamp for drive cable
2	Front cover fastening screws	9	Clamp for resistor cable
3	Front cover	X1	Enable input terminal block
4	Chopper control board (NBRC) with control terminals	UDC-	Power connection terminals
5	Voltage selection jumper	UDC+	
6	PE (protective earth) clamp	R+	
7	Grounding clamp	R-	

Overview of power and control connections

The diagram below shows the power and control connections of the brake chopper module.



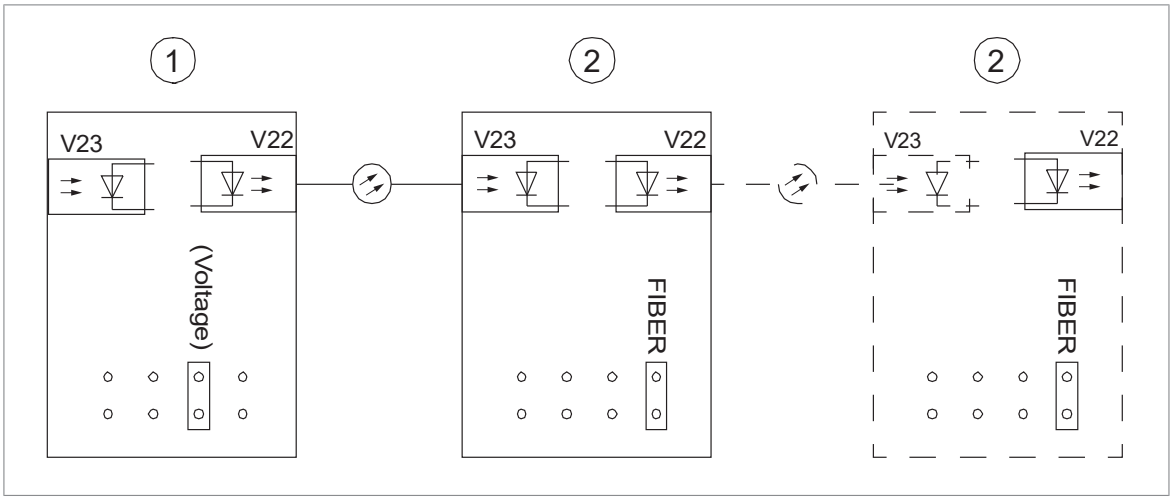
X1, X2	Chopper enable inputs
X3	Fault indication relay output.
V22	Fiber optic cable connection: Chopper control signal to another chopper (Transmitter)
V23	Fiber optic cable connection: Chopper control signal from another chopper (Receiver)

Controlling the brake chopper from an external control location

The brake chopper can be controlled from an external control location via a fiber optic link (terminals V22 and V23 on the chopper control board). Using the link, it is possible to synchronize several brake choppers.

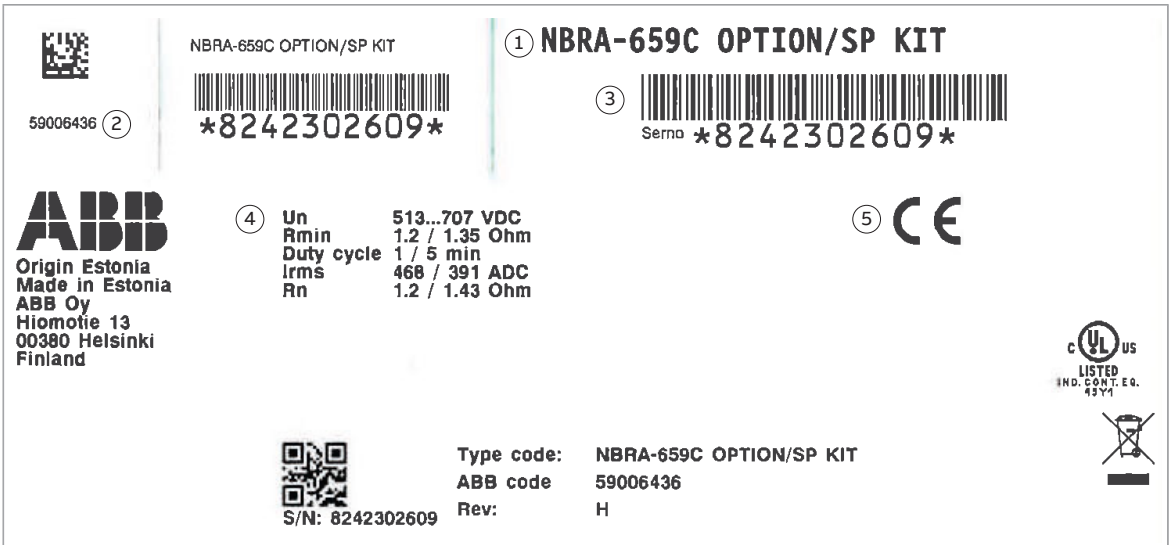
Master-follower connection

When several brake choppers are in use, the first chopper in the chain acts as the master for the other choppers. The voltage selection jumper of the master (1) is set to the appropriate voltage at the factory, while the followers (2) are set to FIBER.



Type designation label

Each brake chopper module is equipped with a type designation label. An example label is shown below.



1	Type designation
2	Brake chopper module order code
3	Serial number • The first digit of the serial number refers to the manufacturing plant. • The next four digits refer to the unit's manufacturing year and week respectively. • The remaining digits complete the serial number so that there are no two units or modules with the same number.
4	Ratings
5	Valid markings

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Planning the installation

Contents of this chapter

This chapter contains instructions on selecting, placing and protecting the brake circuit components and cables.

Limitation of liability

The installation must always be designed and made according to applicable local laws and regulations. ABB does not assume any liability whatsoever for any installation which breaches the local laws and/or other regulations. Furthermore, if the recommendations given by ABB are not followed, the drive may experience problems that the warranty does not cover.

- **North America**

Installations must be compliant with NFPA 70 (NEC)[1)] and/or Canadian Electrical Code (CE) along with state and local codes for your location and application.

[1)] National Fire Protection Association 70 (National Electric Code).

Generic guidelines

Refer to ACS880 multidrives cabinets and modules electrical planning instructions (3AUA0000102324 [English]) for the generic guidelines for planning the electrical installation (selecting cables, routing cables, etc.) of multidrives cabinets and modules.

Equipping the drive with a main contactor and manual control switch or switches

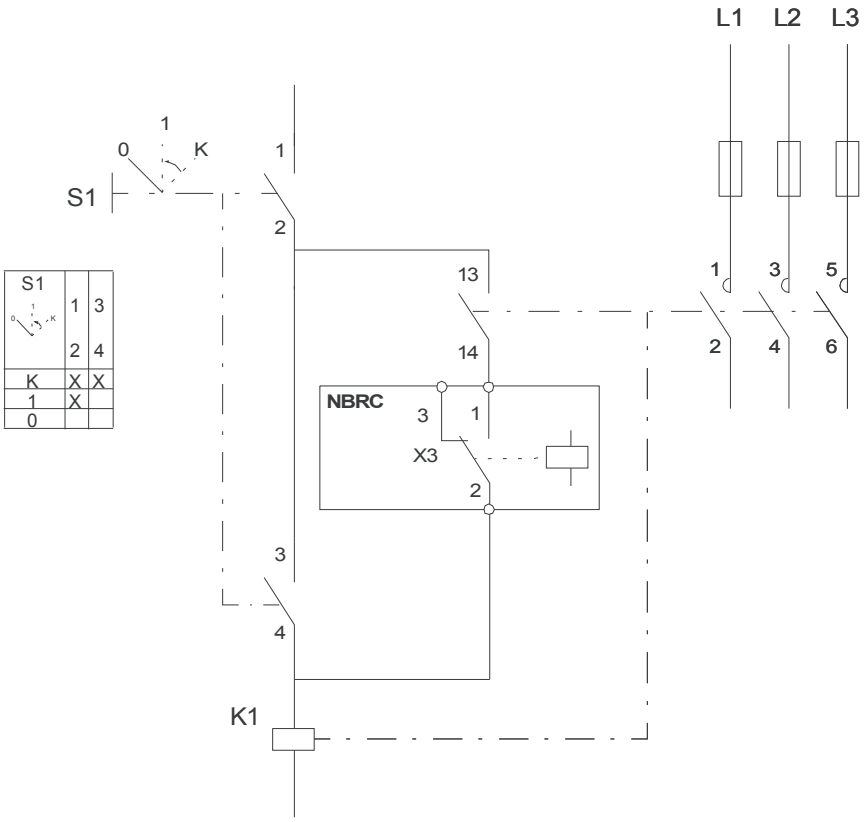
It is highly recommended to equip the drive with a main contactor and wire it to fault indication relay output X3 on the chopper control board. This configuration also requires a manual start/stop switch(es) for system start-up.

The relay output indicates chopper faults, for example, in a thermal overload situation (see Protecting the system against thermal overload (page 24)). The changeover switch opens when a failure is detected or the chopper is unpowered.

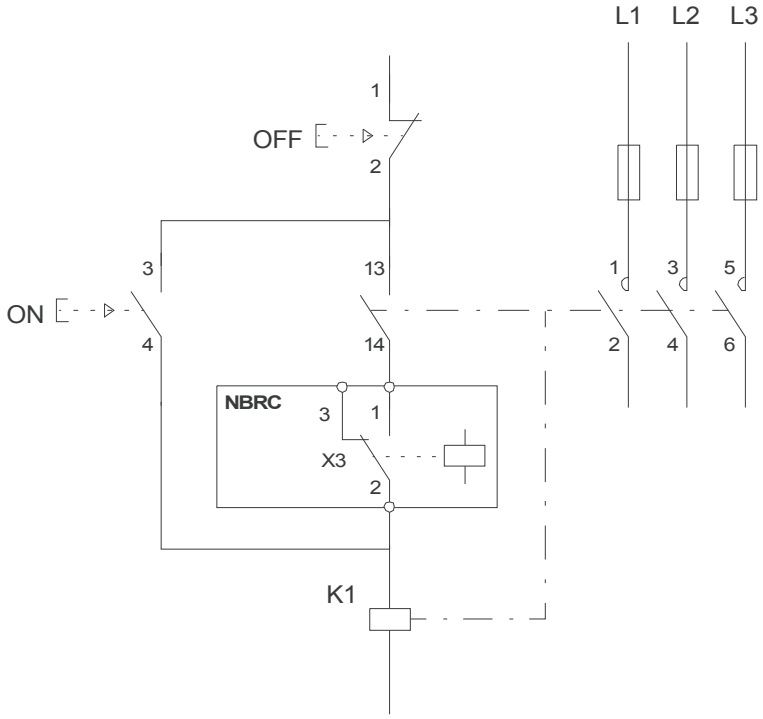
WARNING!
In a chopper failure, always switch off the power supply to the drive. This is the only way to guarantee safe operation in case of a chopper failure since the chopper is unable to disconnect the resistor from the intermediate circuit.

For connection examples, see the diagram.

Example 1



Example 2



Selecting the brake circuit components

1. Calculate the maximum power generated by the motor during braking (P_{max}).
2. Select a suitable brake chopper and brake resistor combination for the application using the data given under Ratings (page 57). This condition must be met:
   $$P_{brmax} > P_{max}$$
   The P_{brmax} values in the rating table are specified for the reference braking cycle (10 seconds of braking, 50 seconds of rest). If the actual duty cycle does not correspond to the reference cycle, the maximum allowed braking power P_{br} must be used instead. See section Calculating the maximum braking power.
3. Check the resistor selection. The energy generated by the motor during a 400-second period must not exceed the resistor heat dissipation capacity E_R.

   Note: If the E_R value is not sufficient, it is possible to use a four-resistor assembly in which two standard resistors are connected in parallel, two in series. The E_R value of the four-resistor assembly is four times the value specified for the standard resistor.

Note:

- The resistor assembly must be equipped with a thermal switch (all SAFUR resistors include a thermal switch). Make sure that the switch is properly isolated (over 2.5 kV) and shrouded against contact.
- If you use a custom resistor, make sure that its resistance is within the allowed range (minimum, maximum), and the heat dissipation capacity of the resistor is high enough. Refer to the instructions below.

Minimum resistance for custom resistors

Make sure that resistance is higher than or equal to the resistance of the ABB default resistor. Refer to the technical data.

Maximum resistance for custom resistors

Make sure that the custom resistor resistance value is below the maximum limit. This is how you can calculate it:

The resistor power consumption must be higher than the maximum power generated by the motor during the braking cycle. In other words, this condition must be true:

$$P_R > P_{max}$$

The equation for the resistor power consumption is:

$$P_R = \frac{U_{dc}^2}{R}$$

Substitute the term on the right to the original in-equation and convert it to a condition for the maximum resistance value:

$$\frac{U_{DC}^2}{R} > P_{max} \Rightarrow \frac{U_{DC}^2}{P_{max}} > R$$

Calculate the term on the left. The result is the maximum resistance limit.

Resistor heat dissipation capacity

Make sure that the resistor heat dissipation capacity ER is high enough for the braking cycle that you have. Refer to step 3 above for the ABB default resistor and the default braking cycle.

P_R	Resistor power consumption when connected to the drive DC link
P_{max}	Maximum power generated by the motor during braking
U_{DC}	Voltage over the resistor during braking: 1.35 · 1.20 · 415 V DC when supply voltage is 380…415 V AC 1.35 · 1.20 · 500 V DC when supply voltage is 440…500 V AC 1.35 · 1.25 · 690 V DC when supply voltage is 525…690 V AC
R	Resistor resistance value (ohm)

WARNING!
Never use a brake resistor with a resistance value below the minimum allowed resistance value specified for that particular drive or brake chopper combination. The chopper and the drive cannot to handle the overcurrent by the low resistance.

Calculating the maximum braking power

The P_{brmax} value for each standard brake chopper and brake resistor combination is given in the rating table. The rated value is specified for a reference braking cycle (10 s of braking, 50 s of rest). If the actual braking cycle does not correspond to the reference cycle, you have to calculate the maximum allowed braking power as shown below.

1. Braking energy transferred during any ten minute period must be less than or equal to the energy transferred during the reference braking cycle:
   $$n \cdot P_{br} \cdot t_{br} \leq P_{brmax} \cdot 100 \text{ s}$$
   where:

n	Number of braking pulses during a ten-minute period
P_{br}	Maximum allowed braking power (kW)
t_{br}	Braking time (s)
P_{brmax}	Maximum braking power for a reference cycle (kW)

2. The braking power must not exceed the rated maximum value P_{brmax}:
   $$P_{br} \leq P_{brmax}$$

Example 1

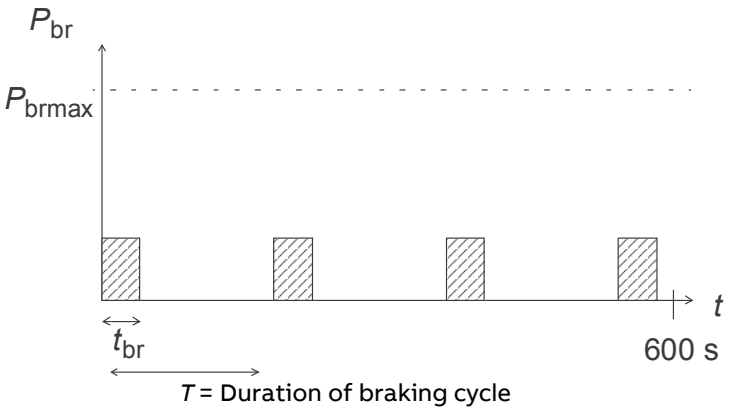
The duration of braking cycle is 30 minutes. The braking time is 15 minutes.

Result: If the braking time exceeds ten minutes, the braking is considered continuous. The allowed continuous braking power is 10 percent of the maximum braking power (P_{brmax}).

Example 2

The duration of a braking cycle is three minutes. The braking time is 40 seconds.

1. $P_{br} \leq \frac{P_{brmax} \cdot 100\ \mathrm{s}}{4 \cdot 40\ \mathrm{s}} = 0.625 \cdot P_{brmax}$



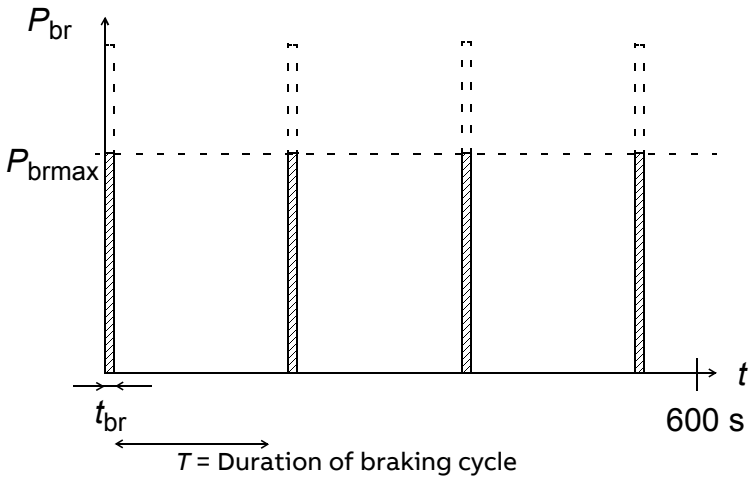
2. $P_{br} < P_{brmax}$
   OK.

Result: The maximum allowed braking power for the cycle is 62% of the rated value given for the reference cycle.

Example 3

The duration of a braking cycle is three minutes. The braking time is 10 seconds.

1. $P_{br} \leq \frac{P_{brmax} \cdot 100\ \mathrm{s}}{4 \cdot 40\ \mathrm{s}} = 2.5 \cdot P_{brmax}$



2. $P_{br} > P_{brmax}$
   Not allowed.

Result: The maximum allowed braking power for the cycle is equal to the maximum braking power (P_{brmax}).

Selecting and routing brake chopper cable

- Select a cable that is compliant with the ABB brake chopper cable specification. Refer to technical data.
- Make sure that you install the brake chopper module inside the same cabinet line-up with the drive, and route the cabling inside the cabinet.
- Make sure that the chopper cable is not longer than 3 m (9.8 ft) meters. Longer cables increase the inductance in the circuit. It can cause drive or chopper fault trips, or other malfunctions. If you need longer cables, consult ABB for further guidance.

Selecting and routing the brake resistor cables

Selecting the brake resistor cables

- Select cables that are compliant with the ABB brake resistor cable specification. Refer to technical data.
- Make sure that the resistor cable is not longer than 50 m (164 ft). Longer cables increase the inductance in the circuit and may cause drive or chopper fault trips, or other malfunctions. If you need longer cables, consult ABB.

Minimizing electromagnetic interference

Make sure that the installation is compliant with the EMC requirements. Obey these rules in order to minimize electromagnetic interference caused by the rapid voltage and current changes in the resistor cables:

- Shield the brake resistor cable. Use shielded cable or a metallic enclosure. If you use unshielded single-core cables, route them inside a cabinet that efficiently suppresses the radiated emissions.
- Install the cables away from other cable routes.
- Avoid long parallel runs with other cables. The minimum parallel cabling separation distance is 0.3 meters (1 ft).
- Cross the other cables at 90° angles.
- Keep the cable as short as possible in order to minimize the radiated emissions and stress on the brake chopper. The longer the cable the greater the radiated emissions, inductive load and voltage peaks over the IGBT semiconductors of the brake chopper.

Selecting the installation location for the brake resistors

Protect the open (IP00) brake resistors against contact. Install the brake resistor in a place where it cools effectively. Arrange the cooling of the resistor so that:

- no danger of overheating is caused to the resistor or nearby materials, and
- the temperature of the space that the resistor is in does not go above the allowed maximum value.

WARNING!
The materials near the brake resistor must be non-flammable. The surface temperature of the resistor is high. Airflow from the resistor can have a high temperature. If the exhaust vents connect to a ventilation system, make sure that the material withstands high temperatures. Protect the resistor against contact.

Selecting the chopper enable input cable

Make sure that the cable connecting the resistor thermal switch to chopper enable input X1 meets the following requirements:

- shielded cable
- rated operating voltage between a core and ground > 750 (U_0)
- insulation test voltage > 2.5 kV.

Protecting the system against thermal overload

The drive control program includes a resistor and resistor cable thermal protection function, which can be tuned by the user. For more information, refer to the drive or inverter unit firmware manual. The brake chopper also protects itself and the resistor cables against thermal overload, provided that the following conditions are met:

- the resistor assembly is equipped with a thermal switch, which is connected to chopper enable input X1
- fault indication relay output X3 is wired to the main contactor/breaker control circuit of the drive
- the cables are dimensioned according to the instructions in this manual.

Protecting the system against short-circuits

Equip the brake unit with fuses.

The fuses protect the brake chopper, the brake resistor and the brake circuit cables in a short-circuit situation.

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Mechanical installation

Contents of this chapter

This chapter contains installation instructions and examples.

Examining the installation site

The brake chopper module must be installed in upright position. The degree of protection of the module is IP00. Take this into account when selecting the installation site. Install the chopper inside a cabinet.

Obey the general ACS880 multidrive module cabinet installation instructions given in Drive modules cabinet design and construction instructions (3AUA0000107668 [English]). In addition, observe these restrictions:

- The brake chopper module can be grounded to the cabinet frame through the mounting screws if the galvanic connection to PE (protective earth) is good enough.
- Leave 150 mm (5.91 in.) free space below and above the brake chopper module.
- Leave enough space for the fuses and the cooling fan.
- To prevent the module from overheating, do not install it directly above the brake resistors.

Tools

Make sure you have these tools available:

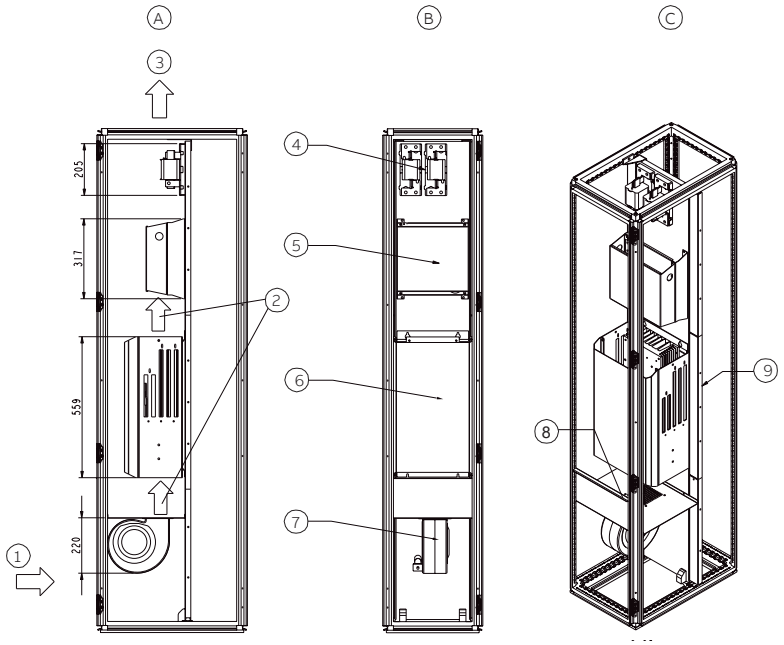
- drill with suitable bits
- screwdriver and/or wrench with a set of suitable bits
- mounting screws (M6).

Installing the brake chopper module

1. Mark the locations of the four holes onto the installation surface. For the module dimensions, see Dimension drawings (page 69).
2. Drill the mounting holes. Make sure that dust and burr from drilling does not enter the module or other equipment at the installation site.
3. Put screws into the holes. Tighten the screws far enough to make sure that they can carry the weight of the module.
4. Lift the module onto the mounting screws.
5. Tighten the screws.

Examples: Installing the brake chopper module and related components

Example 1: Installation into a Rittal VX25 enclosure



A	Brake chopper cubicle, side view
B	Brake chopper cubicle, front view
C	Brake chopper cubicle, right-top view
1	Air flow in. Use a door with an air inlet at the bottom
2	Air flow into components
3	Air flow out. Use a roof with an air outlet.
4	DC fuses
5	Attenuator
6	Brake chopper module
7	Cooling fan
8	Cooling fan mounting plate[1)]
9	Plastic bars on both sides to block air flow[1)]

1) Illustration available at ABB engineering support site. Contact ABB for access.

Example 2: Installation into a generic enclosure

Note: To ensure proper cooling, the brake chopper module and the cooling fan must be positioned exactly as illustrated in relation to each other.

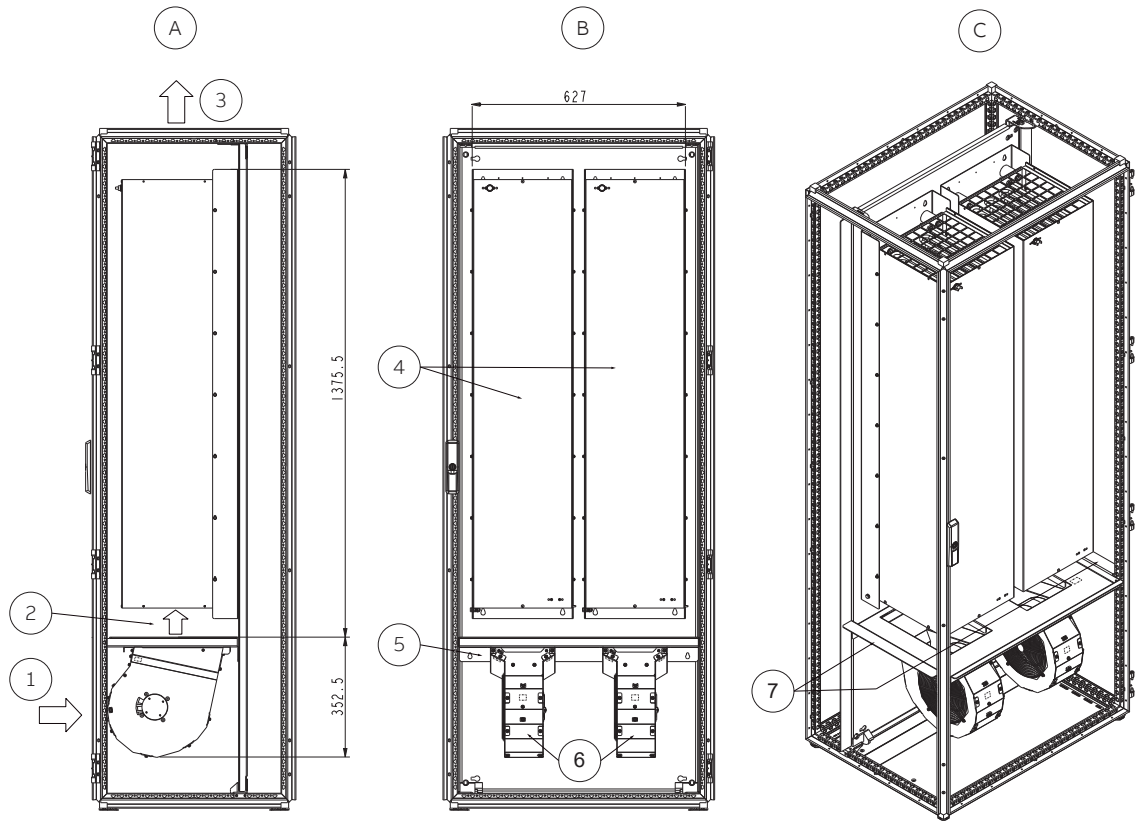
The components in the generic enclosure should be installed in similar locations as in Example 1: Installation into a Rittal VX25 enclosure.

1. Attach the brake chopper module to the installation surface of the enclosure. See section Installing the brake chopper module (page 26).
2. Install the cooling fan using a separate mounting plate. The mounting plate is also used to prevent cooling air recirculation in the cabinet. Therefore, the plate has to cover the whole cross-sectional area of the cabinet.

For more information on the dimensions, see chapter Dimension drawings (page 69).

Examples: Installing the brake resistors and cooling fan

Example 1: Installation into a Rittal VX25 enclosure



A	Brake resistor cubicle, side view
B	Brake resistor cubicle, front view
C	Brake resistor cubicle, left-top view
1	Air flow in. Use a door with an inlet.
2	Air flow into components.
3	Air flow out. Use a ventilated roof.
4	Brake resistors
5	Cooling fan mounting plate[1)]
6	Cooling fans
7	Steel air guides on both sides of the mounting plate[2)]

1) Illustration available at ABB engineering support site (3AXD50000472338). Contact ABB for access
2) Illustration available at ABB engineering support site (3AXD50000472628). Contact ABB for access.

Example 2: Installation into a generic enclosure

Note: To ensure proper cooling, the brake resistor and the cooling fan must be positioned in relation to each other. Make sure that the cooling air flows through the resistors and cools them down.

The components in the generic enclosure should be installed in similar locations as in Example 1: Installation into a Rittal VX25 enclosure.

1. Attach the brake resistors to the installation surface of the enclosure using four M6 screws per rail.
2. Attach each brake resistor to the rails using four M6 screws.
3. Install the cooling fans using a separate mounting plate.

For more information, see Dimension drawings (page 69).

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Electrical installation

Contents of this chapter

The wiring diagrams in this chapter are simplified presentations. For details, refer to the example circuit diagrams in the manual.

Note: The instructions do not cover all possible cabinet constructions.

Safety and liability

The installation must always be designed and made according to applicable local laws and regulations. ABB does not assume any liability whatsoever for any installation which breaches the local laws and/or other regulations. Furthermore, if the recommendations given by ABB are not followed, the drive system may experience problems that the warranty does not cover.

Electrical safety precautions

These electrical safety precautions are for all persons who do work on the drive, motor cable or motor.

This procedure gives information on how to de-energize the drive and make it safe to do work on it. The procedure does not include all possible drive configurations.

WARNING!
Obey these instructions. If you ignore them, injury or death, or damage to the equipment can occur. If you are not a qualified electrical professional, do not do electrical installation or maintenance work. Do these steps before you do installation or maintenance work.

1. Prepare for the work.

- Make sure that you have a work order.
- Do an on-site risk assessment or job hazard analysis.
- Make sure that you have the correct tools available.
- Make sure that the workers are qualified.
- Select the correct personal protective equipment (PPE).
- Stop the drive and motor(s).

2. Clearly identify the work location and equipment.
3. Disconnect all possible voltage sources. Make sure that connection is not possible. Lock out and tag out.
   - If the drive is equipped with a DC/DC converter unit or a DC feeder unit: Open the disconnecting device of the energy storage connected to the unit. The disconnecting device is outside the drive cabinet. Then open the DC switch-disconnector [Q11] of the unit.
   - Open the main disconnecting device of the drive.
   - Open the charging switch if it is present.
   - Open the disconnector of the supply transformer. (The main disconnecting device in the drive cabinet does not disconnect the voltage from the AC input power busbars of the drive cabinet.)
   - Open the auxiliary voltage switch-disconnector (if it is present), and all other possible disconnecting devices that isolate the drive from dangerous voltage sources.
   - If there is a permanent magnet motor connected to the drive, disconnect the motor from the drive with a safety switch or by other means.
   - Open the main isolating device of the drive.
   - Disconnect all dangerous external voltages from the control circuits.
   - After you disconnect power from the drive, wait 5 minutes to let the intermediate circuit capacitors discharge before you continue.
4. Protect other energized parts in the work location against contact and take special precautions when close to bare conductors.
5. Measure that the installation is de-energized. Use a high-quality voltage tester. If the measurement requires that you remove shrouding or other cabinet structures, obey the local laws and regulations applicable to live electrical work. This includes, but is not limited to, electric shock and arc protection.
   - Before and after you measure the installation, verify the operation of the voltage tester on a known voltage source.
   - Make sure that the voltage between the input power terminals of the drive (L1, L2, L3) and the grounding (PE) busbar is zero.
   - Make sure that the voltage between the output power terminals of the drive (U, V, W) and the grounding (PE) busbar is zero.

     Important! Repeat the measurement with the DC voltage setting of the voltage tester. Measure between each phase and ground. There is a risk of dangerous DC voltage charging due to leakage capacitances of the motor circuit. This voltage can remain charged for a long time after the drive power-off. The measurement discharges the voltage.
   - Make sure that the voltage between the drive DC busbars and the grounding (PE) busbar is zero.
   - If the drive is equipped with a DC/DC converter unit or a DC feeder unit: Make sure that the voltage between the energy storage terminals of the unit (ES+ and ES-) and the grounding (PE) busbar is zero.

6. Install temporary grounding as required by the local regulations.
7. Ask for a permit to work from the person that is responsible for the electrical installation work.

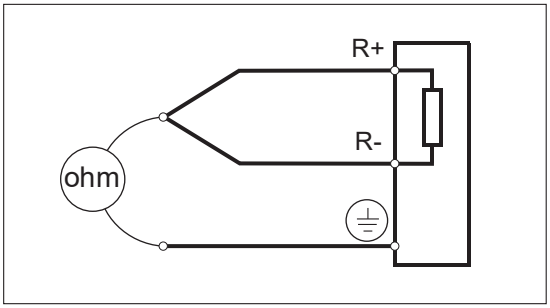
Measuring the insulation of the resistor circuit

WARNING!
Obey the safety instructions of the drive. If you ignore them, injury or death, or damage to the equipment can occur. If you are not a qualified electrical professional, do not do installation, commissioning, or maintenance work.

Do not make any voltage tolerance or insulation resistance tests on the brake chopper modules. Every brake chopper module has been tested for insulation between the main circuit and the chassis at the factory.

Measure the insulation of the brake resistor assembly as follows:

1. Stop the drive and do the steps in section Electrical safety precautions (page 31) before you start the work.
2. Make sure that the resistor cable is connected to the resistor, and disconnected from the chopper output terminals R+ and R-.
3. At the brake unit end, connect the R+ and R- conductors of the resistor cable together. Measure the insulation resistance between the combined conductors and the PE conductor by using a measuring voltage of 1 kV DC. The insulation resistance must be higher than 1 Mohm.



General notes

Printed circuit boards

WARNING!
Use an antistatic wrist strap when you handle printed circuit boards. Do not touch the boards unnecessarily. The boards are sensitive to electrostatic discharge.

Handling fiber optic cables

WARNING!
Obey these instructions. If you ignore them, damage to the equipment can occur.

- Handle the fiber optic cables with care.
- When you disconnect the fiber optic cables, always hold the connector, not the cable.
- Do not touch the ends of the fibers. They are sensitive to dirt.
- Do not bend the fiber optic cables too tightly. The minimum allowed bend radius is 35 mm (1.4 in).

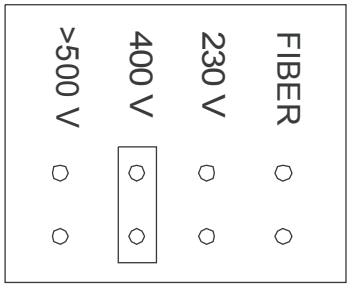
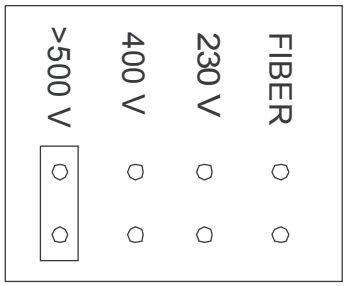
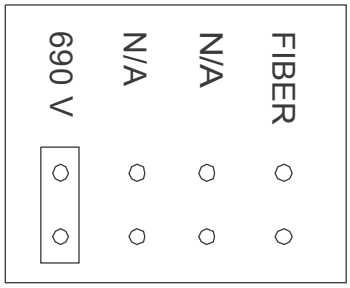
Selecting the voltage

NBRA-658 and NBRA-659 brake choppers have an NBRC-51 brake chopper control unit, and can be used with 400 or 500 V drive nominal supply. NBRA-669 has an NBRC-61 brake chopper control unit, and can be used only with 690 V drive nominal supply.

WARNING!
Obey the safety instructions of the drive. If you ignore them, injury or death, or damage to the equipment can occur. If you are not a qualified electrical professional, do not do installation, commissioning, or maintenance work.

To adjust the setting:

1. Stop the drive and do the steps in section Electrical safety precautions (page 31) before you start the work.
2. Remove the chopper front panel by undoing the four screws at the top and bottom of the panel.
3. Set the voltage selection jumper on the chopper control board to the appropriate voltage as shown below.

• Drive supply voltage 380…415 V • Brake chopper control unit NBRC-51 • Ubr_on 674 V, Ubr_off 660 V	
• Drive supply voltage 440…500 V • Brake chopper control unit NBRC-51 • Ubr_on 811 V, Ubr_off 795 V	
• Drive supply voltage 525…690 V • Brake chopper control unit NBRC-61 • Ubr_on 1120 V, Ubr_off 1096 V	

Note: If you have parallel choppers which are synchronized through the fiber optic link (master-follower connection):

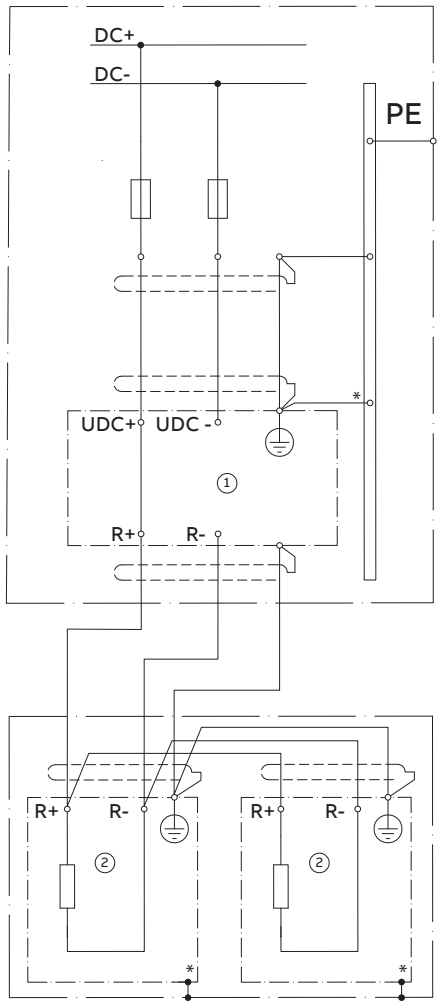
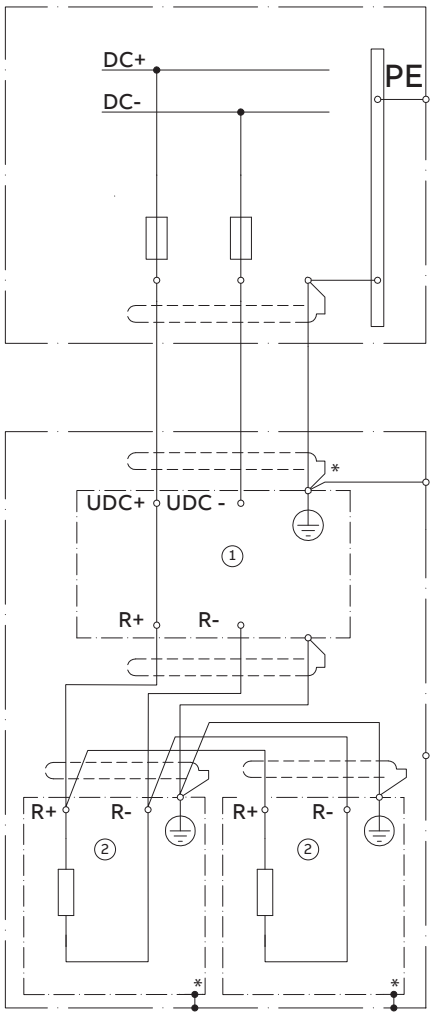
- select the voltage in the master chopper only
- set the voltage jumper to FIBER in the follower choppers.

WARNING!
An incorrect jumper setting or missing jumper can cause brake chopper malfunctioning or damage to the chopper or resistor.

Connecting the DC and resistor cables

WARNING!
Never connect the output terminals of the brake chopper together. It short-circuits the chopper and will damage it.

Connection diagram

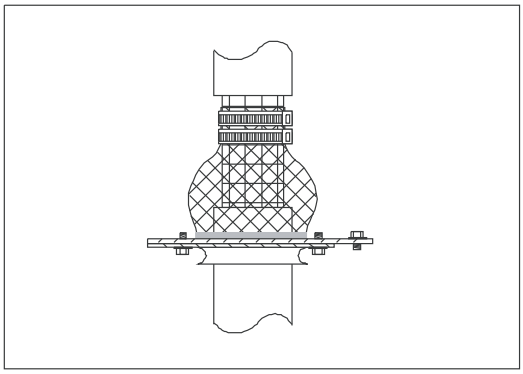
Brake chopper module and resistors in separate cubicles	Brake chopper module and resistor in the same cubicle
	

1	NBRA-6XX
2	Resistor assembly

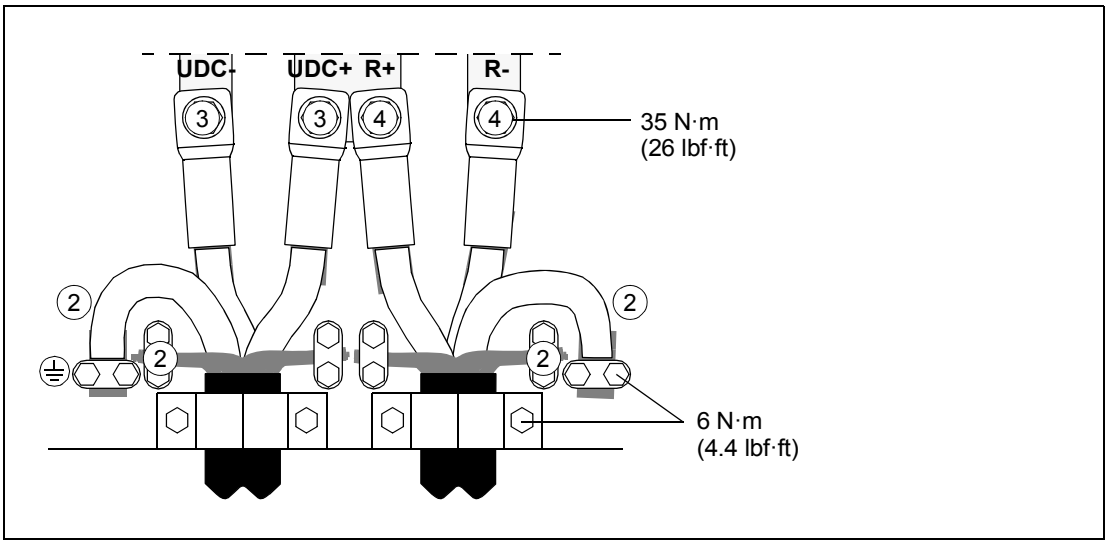
* The chopper and resistor housings can be grounded to the frame through the mounting screws if the galvanic connection to PE (protective earth) is good enough.

Connection procedure

1. If the drive DC link and the brake unit are located in separate cabinets, ground the DC cable 360 degrees at the cabinet entries.

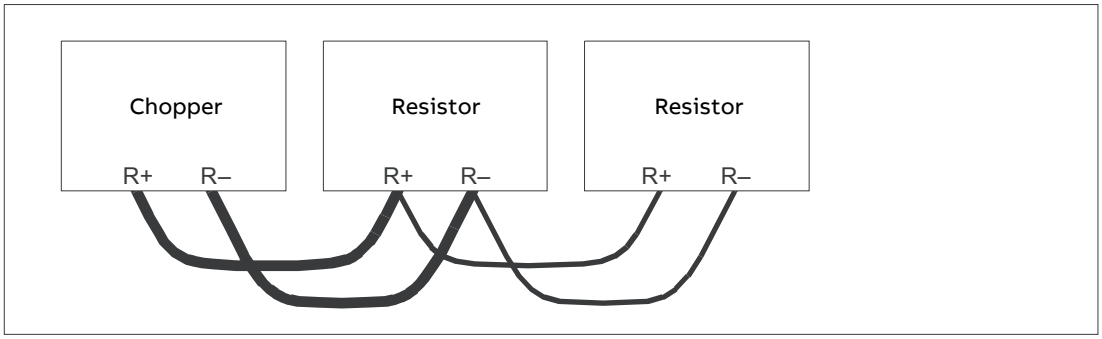


2. At the brake chopper end, connect the twisted shields (protective earth conductor) of the DC and resistor cables and the third conductors to the grounding terminals.
3. Connect the conductors to the UDC+ and UDC- terminals of the brake chopper as shown below.
4. Connect the conductors to the R+ and R- terminals of the brake chopper as shown below.



5. Connect the brake resistors in parallel as shown below. See the Connection diagram (page 36) for the cable shield grounding.

   Note: The cable between the chopper and the first resistor must be able to carry the entire braking power. Provide adequate support for the cables below the chopper and resistor units.



Connecting the brake resistor thermal switch

Connect the thermal switches of the resistors in series and to chopper enable input X1 as shown in section Overview of power and control connections (page 14).

6

Installation checklist

Contents of this chapter

This chapter contains a list for checking the mechanical and electrical installation of the brake chopper.

Checklist

Check the mechanical and electrical installation of the brake chopper before start-up. Go over the checklist together with another person.

WARNING!
Obey the safety instructions of the drive. If you ignore them, injury or death, or damage to the equipment can occur. If you are not a qualified electrical professional, do not do installation, commissioning, or maintenance work.

WARNING!
Stop the drive and do the steps in section Electrical safety precautions (page 31) before you start the work.

☑	**Check that ...**
☐	The brake chopper module has been attached properly on an even, vertical and non-flammable mounting plate.
☐	There is an adequately sized protective earth (ground) conductor between the brake chopper and the cabinet PE busbar.
☐	All protective earth (ground) conductors have been connected to the appropriate terminals and the terminals have been tightened to the torque specified. The galvanic connection between the brake chopper module frame and the cabinet is good. (Fastening points must be unpainted.)
☐	The DC supply voltage matches the nominal input voltage of the brake chopper module. Check the type designation label.
☐	The setting of the voltage selection jumper is correct. See section Selecting the voltage (page 34).
☐	The DC cable has been connected to the appropriate terminals, and the terminals have been tightened to the specified torque.
☐	Specified DC fuses have been installed.
☐	The resistor cable has been connected to the appropriate terminals, and the terminals have been tightened to the specified torque.
☐	The brake resistor cable has been routed away from other cables.
☐	The control cables have been connected to the appropriate terminals, and the terminals have been tightened to the specified torque.
☐	There are no tools, foreign objects or dust from drilling inside the brake unit cabinet.
☐	All shrouds and the front panel of the brake chopper module are in place. Cabinet doors have been closed.

7

Start-up

Contents of this chapter

This chapter contains the start-up procedure of the brake unit.

ABB recommends that you connect a commissioning PC tool (DriveComposer) to the inverter unit that will be used to test the braking. By using the tool, you can set up the parameters and monitor the drive during the test.

Start-up procedure

Tasks	☑
Safety	
WARNING! Obey the safety instructions of the drive. If you ignore them, injury or death, or damage to the equipment can occur. If you are not a qualified electrical professional, do not do installation, commissioning, or maintenance work. **WARNING!** Make sure that the disconnector of the supply transformer is locked to open position, i.e., no voltage is, or can be, connected to drive inadvertently. Check also by measuring that there is no voltage connected. **Note:** Some brake resistors are coated with oil film for protection. The protective oil will burn off when the brake resistor is used for the first time. Make sure that there is proper ventilation.	
Powering up the drive DC bus and starting up the inverters	
WARNING! Before the power switch-on, make sure that there are inverters connected to the intermediate circuit. A rule of thumb: the sum of the inverter powers must be at least 30% of the rated power of the brake unit (Pbrmax value). Too few inverters connected results in a low intermediate circuit capacitance. Upon the power switch-on, the DC voltage will overshoot the controller voltage limit, causing an immediate switching to braking mode. High brake current will blow the inverter DC fuses.	

Tasks	☑
Make sure that all cabinet doors are closed.	☐
Close the disconnector of the supply transformer.	☐
Start the supply unit. See the procedure in the supply unit hardware manual. When started, the supply unit charges the capacitors of all inverters and brake units connected to the DC bus.	☐
Start-up the inverter units. See the procedure in the inverter unit hardware manual.	☐
Deactivate the overvoltage controllers of all inverter units (parameter 30.30 Overvoltage control in the primary control program).	☐
Operational tests	
Make sure that the stop mode of the motor to be decelerated is ramp stop (parameter 21.03 Stop mode in the primary control program) and set the deceleration time according to the drive control mode in parameter group 23, 26 or 28. Use a relatively long deceleration time at first.	☐
Start the drive and increase the rotation speed of the high-inertia machinery that will generate power to the drive intermediate circuit when it is decelerated. Use a low speed at first.	☐
Give a stop command to the inverter running the motor. Make sure that the brake chopper evokes and operates during the deceleration of the motor. Monitor the DC voltage level in the inverter unit with Drive Composer PC tool during the braking. The DC voltage level during the braking indicates the brake unit operation: **Successful braking:** DC voltage level is less than 1.2 · 1.35 · U1max [1)] **Unsuccessful braking:** DC voltage level exceeds 1.21 · 1.35 · U1max[1)] and inverter trips on overvoltage. Refer to chapter Fault tracing (page 43).	☐
Repeat the stop sequence a few times with higher rotation speeds and shorter deceleration times.	☐

1) U1max value is:

415 V when the drive supply voltage is 380…415 V AC

500 V when the drive supply voltage is 440…500 V AC

690 V DC when the drive supply voltage is 525…690 V AC

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Fault tracing

Contents of this chapter

This chapter describes the fault tracing possibilities of the brake unit.

Fault indications

A fault in the resistor braking circuit prevents fast motor deceleration, and may cause the drive to trip on a fault.

If a fault is detected by the chopper control board, the brake chopper disconnects the brake resistor from the intermediate circuit, and the chopper fault indication relay output is de-energized.

Depending on the application, the relay output either opens the drive main circuit breaker or gives a fault indication to the overriding control system. See the circuit diagrams delivered with the unit.

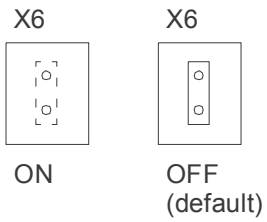
Fault indication/Fault	Cause	Remedy
Fault indication relay output switches off the main power or gives a fault indication to an overriding control system.	Chopper or resistor overheated.	Check connections. Let equipment cool.
	No enable input received by chopper control board.	Check that enable input is on.
	Short circuit in resistor or power cables.	Check power cables and resistor.
	Chopper control board failure. Chopper damaged; it is not able to disconnect resistor from intermediate circuit.	Contact local ABB representative.

Fault indication/Fault	Cause	Remedy
Chopper does not function.	Chopper voltage setting too high. Inverter overvoltage control is on.	Check voltage setting. Check parameters of all inverters.Product.Type != NBRA [1)] Check that enable input is on.
Chopper starts to function at too low a DC voltage.	Chopper voltage setting too low.	Check voltage setting.
Inverter trips on fault 3210 DC link overvoltage.	Chopper voltage setting is too high.	Check voltage setting. Check parameters of all inverters.[1)]
Brake resistor or chopper overheats.	The maximum brake cycle exceeded or resistor cooling insufficient.	Check duty cycle and resistor cooling.
	Chopper voltage setting incorrect or jumper missing.	Ensure that voltage setting is correct and jumper is properly in place.

1) Refer to Start-up (page 41) for the parameters to check.

NRED voltage reducer selection for NBRA-669

The NRED voltage reducer can be used to protect the NBRC-61 chopper control board from overvoltage peaks. Jumper X6 on the chopper control board defines if the NRED voltage reducer is used. By default, the NRED voltage reducer is used and the jumper is set to OFF (recommended).



Note: When the jumper is set to ON, the NRED voltage reducer is not used. You must use this setting if the chopper control board is replaced with a newer version and the brake chopper does not include the NRED voltage reducer board. If you replace the chopper control board, see the manual for the replacement chopper control board for information on NRED voltage reducer.

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Maintenance

Contents of this chapter

This chapter describes the maintenance of a brake unit.

Maintenance intervals

The tables show the maintenance tasks that can be done by the end user. For the ABB Service offering, contact your local ABB Service representative (new.abb.com/contact-centers).

Description of symbols

Action	Description
I	Inspection (visual inspection and maintenance action if needed)
P	Performance of on/off-site work (commissioning, tests, measurements or other work)
R	Replacement

Recommended maintenance intervals after start-up

Maintenance task/object	Years from start-up													
	0	1	2	3	4	5	6	7	8	9	10	11	12	...
Cooling fans														
Cooling fans										R				
Inspections														
Checking tightness of cable and busbar terminals. Tightening if needed.		I	I	I	I	I	I	I	I	I	I	I	I	I
Checking ambient conditions (dustiness, corrosion, temperature)		I	I	I	I	I	I	I	I	I	I	I	I	I
Spare parts		I	I	I	I	I	I	I	I	I	I	I	I	I

Note:

- The maintenance and component replacement intervals are based on the assumption that the equipment operates within the specified ratings and ambient conditions. ABB recommends annual drive inspections to ensure the highest reliability and optimum performance.
- Long-term operation near the specified maximum ratings or ambient conditions may require shorter maintenance intervals for certain components. Contact your local ABB Service representative for additional maintenance recommendations.

Cabinet

Cleaning the interior of the cabinet

WARNING!
Obey the safety instructions of the drive. If you ignore them, injury or death, or damage to the equipment can occur. If you are not a qualified electrical professional, do not do electrical installation, commissioning or maintenance work.

WARNING!
Use an antistatic wrist strap and a vacuum cleaner with an antistatic hose and nozzle. A normal vacuum cleaner creates static discharges which can cause damage to circuit boards.

1. Stop the drive and do the steps in section Electrical safety precautions (page 31) before you start the work.
2. Open the cabinet door.
3. Clean the interior of the cabinet. Use a vacuum cleaner and a soft brush.
4. Clean the air inlets of the fans and air outlets of the modules (top).
5. Clean the air inlet gratings (if any) on the door.
6. Close the door.

Power connections

Retightening the power connections

WARNING!
Obey the safety instructions of the drive. If you ignore them, injury or death, or damage to the equipment can occur. If you are not a qualified electrical professional, do not do installation, commissioning, or maintenance work.

1. Stop the drive and do the steps in section Electrical safety precautions (page 31) before you start the work.
2. Examine the tightness of the cable connections. Use the tightening torques given in the technical data.

Cooling fans

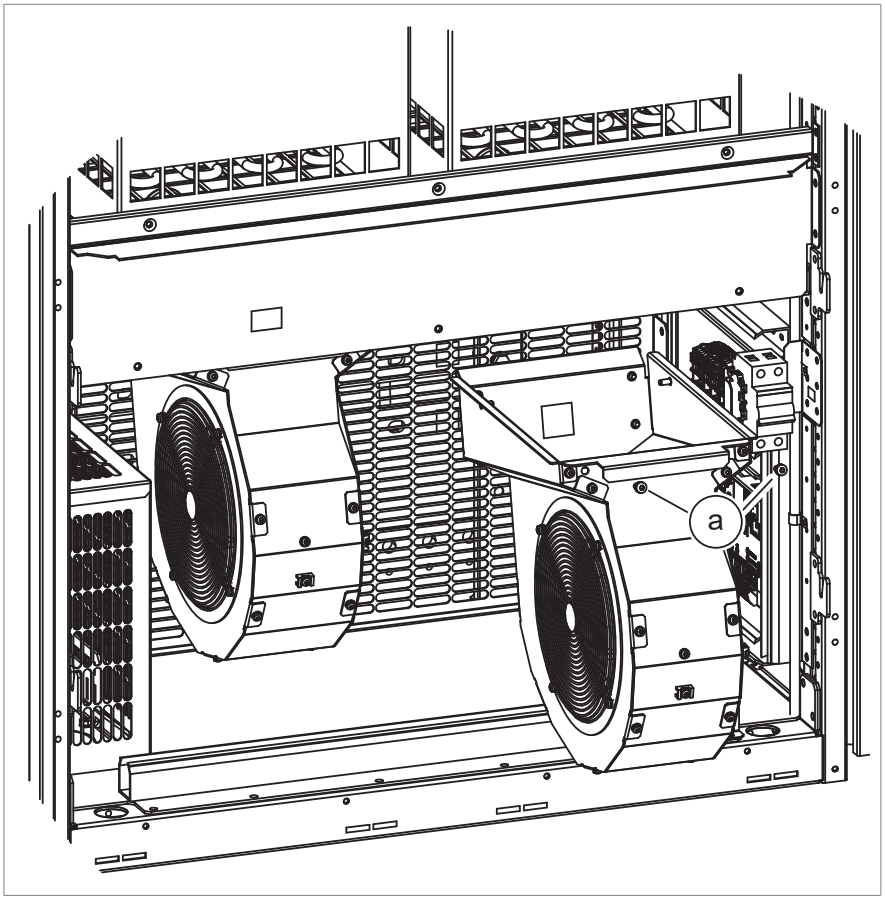
The life span of the cooling fan depends on the running time of the fan, ambient temperature and dust concentration.

Replacement fans are available from ABB. Do not use other than ABB specified spare parts.

Replacing the resistor cooling fan

WARNING!
Wear protective gloves and long sleeves. Some parts have sharp edges.

1. Stop the drive and do the steps in section Electrical safety precautions (page 31) before you start the work.
2. Remove any shrouding in front of the cooling fans.
3. Disconnect the fan wiring.
4. Undo the two fastening screws (a).
5. Pull the fan housing outwards.
6. Install a new fan in reverse order.



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Ordering information

Contents of this chapter

This chapter lists the components and accessories available for the brake unit.

Brake chopper modules

ACS880-604-...	Qty	Ordering code	Module type
U_n = 400 V (Range 380…415 V)			
0210-3	1	59006428	NBRA-658C
0320-3	1	59006436	NBRA-659C
0640-3	2		
0960-3	3		
1280-3	4		
1600-3	5		
1920-3	6		
U_n = 500 V (Range 380…500 V)			
0260-5	1	59006428	NBRA-658C
0400-5	1	59006436	NBRA-659C
0800-5	2		
1200-5	3		
1600-5	4		
2000-5	5		
2400-5	6		
U_n = 690 V (Range 525…690 V)			
0400-7	1	59012517	NBRA-669C
0800-7	2		
1200-7	3		
1600-7	4		
2000-7	5		
2400-7	6		

Brake chopper cooling fan

Fan supply	Qty	Ordering code
230 V 50/60 Hz	1 per chopper module	64114158
115 V 50/60 Hz	1 per chopper module	64114191

Fuses and fuse bases

Each brake chopper module is connected to the DC bus of the drive system through fuses. The table also shows a suitable fuse base.

A fuse with the same ratings from another manufacturer can be used if it meets the ratings, and its melting curve does not exceed that of the fuse listed here.

ACS880-604-...	Qty	Fuse			Fuse base	
		Ordering code	Type	Data	Ordering code	Type
U_n = 400 V (Range 380…415 V)						
0210-3	2	10028183	Bussmann 170M5142	400 A, 1250 V	10028205	170H3005
0320-3	2	10028191	Bussmann 170M5146	630 A, 1250 V		
0640-3	4					
0960-3	6					
1280-3	8					
1600-3	10					
1920-3	12					
U_n = 500 V (Range 380…500 V)						
0260-5	2	10028183	Bussmann 170M5142	400 A, 1250 V	10028205	170H3005
0400-5	2	10028191	Bussmann 170M5146	630 A, 1250 V		
0800-5	4					
1200-5	6					
1600-5	8					
2000-5	10					
2400-5	12					
U_n = 690 V (Range 525…690 V)						
0400-7	2	10028191	Bussmann 170M5146	630 A, 1250 V	10028205	170H3005
0800-7	4					
1200-7	6					
1600-7	8					
2000-7	10					
2400-7	12					

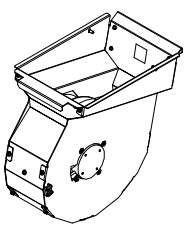
Brake resistors

Each brake chopper module has two resistors of its own.

ACS880-604-...	Qty	Ordering code	Type	Data
U_n = 400 V (Range 380…415 V)				
0210-3	2	3AXD50000420384	SAFUR 210F575/K160	575 V, 210 kW, R = 3.4 ohm
0320-3	2	3AXD50000419593	SAFUR 180F460/K160	180 kW, R = 2.4 ohm
0640-3	4			
0960-3	6			
1280-3	8			
1600-3	10			
1920-3	12			
U_n = 500 V (Range 380…500 V)				
0260-5	2	3AXD50000420353	SAFUR 125F500/K160	125 kW, R = 4.0 ohm
0400-5	2	3AXD50000456482	SAFUR 200F500/K160	200 kW, R = 2.7 ohm
0800-5	4			
1200-5	6			
1600-5	8			
2000-5	10			
2400-5	12			
U_n = 690 V (Range 525…690 V)				
0400-7	2	3AXD50000456482	SAFUR 200F500/K160	200 kW, R = 2.7 ohm
0800-7	4			
1200-7	6			
1600-7	8			
2000-7	10			
2400-7	12			

Brake resistor cooling fan

The two resistors (connected to one brake chopper module) each have a cooling fan of its own.

Fan supply	Qty	Ordering code	Illustration
230 V 50/60 Hz	2 per chopper module (1 per resistor)	3AXD50000100170	
115 V 50/60 Hz	2 per chopper module (1 per resistor)	3AXD50000100187	

Attenuator

The attenuator suppresses voltage spikes at the chopper input. The attenuator is otherwise optional, but must be fitted if all inverter units have a DC switch.

Brake unit	Qty	Ordering code	Data
All types	1 per chopper module	64019236	NRCB-010006

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Technical data

Contents of this chapter

This chapter contains the technical specifications of the brake units, for example, the ratings, sizes and technical requirements, provisions for fulfilling the requirements for CE and other markings. Standard brake resistor and cooling fan specifications are also included where applicable.

Ratings

Chopper only

ACS880-604-...	Module type	P_{brmax} kW	R ohm	I_{max} A	I_{rms} A	P_{cont} kW	Duty cycle (1 min / 5 min)		Duty cycle (10 s / 60 s)	
							P_{br} kW	I_{rms} A	P_{br} kW	I_{rms} A
U_N = 400 V (Range 380…415 V)										
0210-3	NBRA-658C	230	1.70	384	109	70	230	355	230	355
0320-3	NBRA-659C	353	1.20	545	149	96	303	468	353	545
0640-3	2 × NBRA-659C	706	0.60	1090	298	192	606	936	706	1090
0960-3	3 × NBRA-659C	1058	0.40	1635	447	288	909	1404	1059	1635
1280-3	4 × NBRA-659C	1411	0.30	2180	596	384	1212	1872	1412	2180
1600-3	5 × NBRA-659C	1764	0.24	2725	745	480	1515	2340	1765	2725
1920-3	6 × NBRA-659C	2117	0.20	3270	894	576	1818	2808	2118	3270

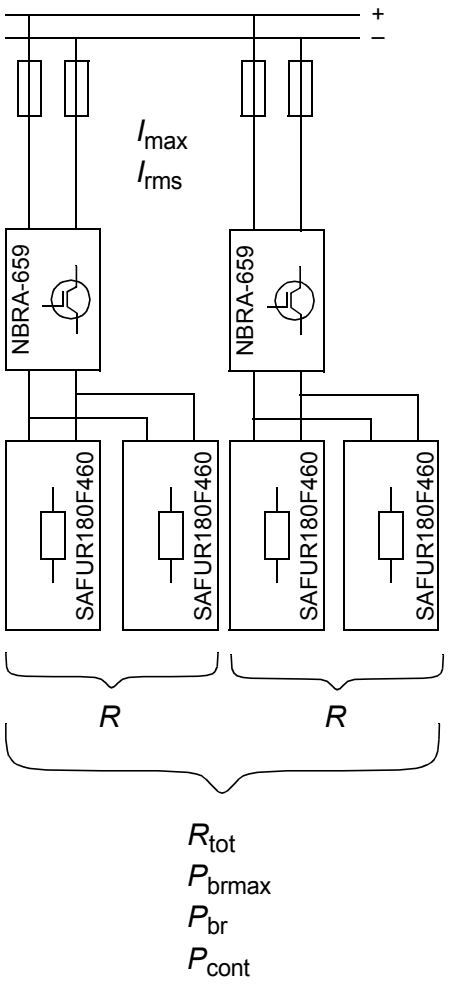
ACS880-604-...	Module type	P_{brmax} kW	R ohm	I_{max} A	I_{rms} A	P_{cont} kW	Duty cycle (1 min / 5 min)		Duty cycle (10 s / 60 s)	
							P_{br} kW	I_{rms} A	P_{br} kW	I_{rms} A
U_N = 500 V (Range 380…500 V)										
0260-5	NBRA-658C	268	2.15	380	101	81	268	331	268	331
0400-5	NBRA-659C	403	1.43	571	136	109	317	391	403	498
0800-5	2 × NBRA-659C	806	0.72	1142	272	218	634	782	806	996
1200-5	3 × NBRA-659C	1208	0.48	1713	408	327	951	1173	1209	1494
1600-5	4 × NBRA-659C	1611	0.36	2284	544	436	1268	1564	1612	1992
2000-5	5 × NBRA-659C	2014	0.29	2855	680	545	1585	1955	2015	2490
2400-5	6 × NBRA-659C	2417	0.24	3426	816	654	1902	2346	2418	2988
U_N = 690 V (Range 525…690 V)										
0400-7	NBRA-669C	404	2.72	414	107	119	298	267	404	361
0800-7	2 × NBRA-669C	807	1.36	828	214	238	596	534	808	722
1200-7	3 × NBRA-669C	1211	0.91	1242	321	357	894	801	1212	1083
1600-7	4 × NBRA-669C	1615	0.68	1656	428	476	1192	1068	1616	1444
2000-7	5 × NBRA-669C	2019	0.54	2070	535	595	1490	1335	2020	1805
2400-7	6 × NBRA-669C	2422	0.45	2484	642	714	1788	1602	2424	2166

Chopper with standard resistors

ACS880-604-...	Module type	Resistor type	P_{brmax} kW	R ohm	I_{max} A	I_{rms} A	P_{brcont} kW	Duty cycle (1 min / 5 min)		Duty cycle (10 s / 60 s)		E_R kJ
								P_{br} kW	I_{rms} A	P_{br} kW	I_{rms} A	
U_N = 400 V (Range 380…415 V)												
0210-3	NBRA-658C	2 × SAFUR 210F575/K160	2×21	230	1.7	348	65	42	130	200	224	346
0320-3	NBRA-659C	2 × SAFUR 180F460/K160	2×30	353	1.20	545	84	54	167	444	287	444
0640-3	2 × NBRA-659C	2 × (2 × SAFUR 180F460/K160)	4×30	706	0.60	1090	168	108	333	514	575	888
0960-3	3 × NBRA-659C	3 × (2 × SAFUR 180F460/K160)	6×30	1058	0.40	1635	252	162	500	771	862	1332
1280-3	4 × NBRA-659C	4 × (2 × SAFUR 180F460/K160)	8×30	1411	0.30	2180	336	216	667	1028	1150	1776
1600-3	5 × NBRA-659C	5 × (2 × SAFUR 180F460/K160)	10×30	1764	0.24	2725	420	270	833	1285	1437	2220
1920-3	6 × NBRA-659C	6 × (2 × SAFUR 180F460/K160)	12×30	2117	0.20	3270	504	324	1000	1542	1724	2664
U_N = 500 V (Range 380…500 V)												
0260-5	NBRA-658C	2 × SAFUR 125F500/K160	2×18	268	2.00	408	45	36	111	137	192	237
0400-5	NBRA-659C	2 × SAFUR 200F500/K160	2×27	403	1.35	605	67	54	167	206	287	355
0800-5	2 × NBRA-659C	2 × (2 × SAFUR 200F500/K160)	4×27	806	0.68	1210	134	108	333	412	575	710
1200-5	3 × NBRA-659C	3 × (2 × SAFUR 200F500/K160)	6×27	1208	0.45	1815	201	162	500	618	862	1065
1600-5	4 × NBRA-659C	4 × (2 × SAFUR 200F500/K160)	8×27	1611	0.34	2420	268	216	667	824	1150	1420
2000-5	5 × NBRA-659C	5 × (2 × SAFUR 200F500/K160)	10×27	2014	0.27	3025	335	270	833	1030	1437	1775
2400-5	6 × NBRA-659C	6 × (2 × SAFUR 200F500/K160)	12×27	2417	0.23	3630	402	324	1000	1236	1724	2130
U_N = 690 V (Range 525…690 V)												
0400-7	NBRA-669C	2 × SAFUR 200F500/K160	2×27	404	1.35	835	97	54	167	149	287	257
0800-7	2 × NBRA-669C	2 × (2 × SAFUR 200F500/K160)	4×27	807	0.68	1670	194	108	333	298	575	514
1200-7	3 × NBRA-669C	3 × (2 × SAFUR 200F500/K160)	6×27	1211	0.45	2505	291	162	500	447	862	771
1600-7	4 × NBRA-669C	4 × (2 × SAFUR 200F500/K160)	8×27	1615	0.34	3340	388	216	667	596	1150	1028
2000-7	5 × NBRA-669C	5 × (2 × SAFUR 200F500/K160)	10×27	2019	0.27	4175	485	270	833	745	1437	1285
2400-7	6 × NBRA-669C	6 × (2 × SAFUR 200F500/K160)	12×27	2422	0.23	5010	582	324	1000	894	1724	1542

Definitions

Example: ACS880-604-0640-3

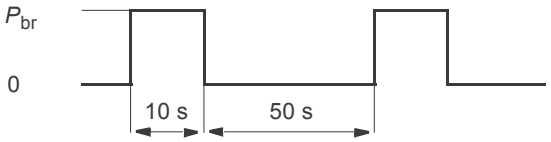


Brake unit

E_R	Energy pulse that all the resistors of the unit put together will withstand (400 s duty cycle). This energy will heat the resistor elements from 40°C to the maximum allowable temperature.
I_{max}	Maximum peak current of the whole brake unit
P_{brcont}	Maximum continuous power rating
P_{brmax}	Maximum short-term (1 min every 10 mins) braking power
R	Resistance of specified resistors (per chopper module). This is also the minimum allowed resistance for the resistor assembly.
R_{tot}	Total brake resistor resistance of the whole brake unit

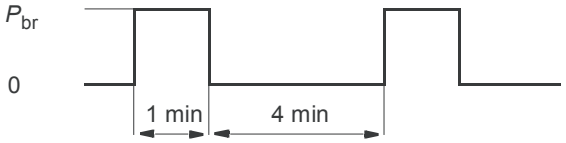
Duty cycle (10 s / 60 s)

I_{rms}	Total rms current during a period of 10 seconds with braking power P_{br}
P_{br}	Maximum braking power, allowed for 10 seconds every 60 seconds

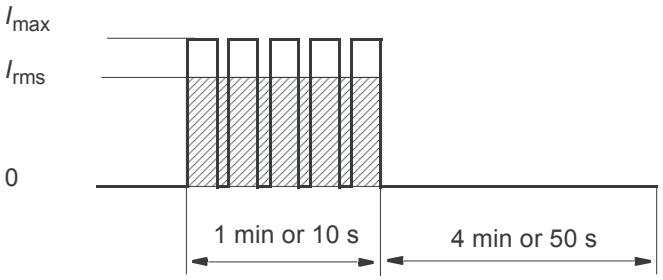


Duty cycle (1 min / 5 min)

I_{rms}	Total rms current during a period of 1 minute with braking power P_{br}
P_{br}	Maximum braking power, allowed for 1 minute every 5 minutes



Brake current wave form



DC fuses

See chapter Fuses and fuse bases (page 53).

Dimensions, weights and free space requirements

Component	Height		Width		Depth		Weight	
	mm	in.	mm	in.	mm	in.	kg	lb
Brake chopper module NBRA-658C/659C/669C	583.5	22.97	334	13.15	240	9.45	26	57
Brake resistor SAFUR125F500/180F460/200F500/210F575	1320	51.97	300	11.81	345	13.58	32	71
Brake chopper cooling fan 115 V 50/60 Hz (*excluding capacitor)	218	8.58	130*	5.12	258	10.16	3.6	8
Brake chopper cooling fan 230 V 50/60 Hz (*excluding capacitor)	244	9.61	130*	5.12	217	8.54	3.2	7.1
Brake resistor cooling fan 115/230 V 50/60 Hz	327	12.87	341	13.43	397	15.63	10.4	22.9

See also chapter Dimension drawings (page 69).

150 mm (5.91 in.) free space is required below and above the brake chopper module.

Losses, cooling data and noise

The heat loss of brake chopper is one percent of the braking power.

ACS880-604	Module type	Brake chopper module only			With specified resistors (option +D151)		
		Air flow		Noise[1)]	Air flow		Noise[1)]
		m³/h	ft³/min	dB(A)	m³/h	ft³/min	dB(A)
U_N = 400 V (Range 380…415 V)							
0210-3	NBRA-658C	660	389	64	2500	1470	66
0320-3	NBRA-659C	660	389	64	2500	1470	66
0640-3	2 × NBRA-659C	1320	777	67	5000	2940	69
0960-3	3 × NBRA-659C	1980	1166	68	7500	4410	70
1280-3	4 × NBRA-659C	2640	1554	69	10000	5890	71
1600-3	5 × NBRA-659C	3300	1943	70	12500	7360	72
1920-3	6 × NBRA-659C	3960	2331	71	15000	8830	73
U_N = 500 V (Range 380…500 V)							
0260-5	NBRA-658C	660	389	64	2500	1470	66
0400-5	NBRA-659C	660	389	64	2500	1470	66
0800-5	2 × NBRA-659C	1320	777	67	5000	2940	69
1200-5	3 × NBRA-659C	1980	1166	68	7500	4410	70
1600-5	4 × NBRA-659C	2640	1554	69	10000	5890	71
2000-5	5 × NBRA-659C	3300	1943	70	12500	7360	72
2400-5	6 × NBRA-669C	3930	2331	71	15000	8830	73
U_N = 690 V (Range 525…690 V)							
0400-7	NBRA-669C	660	389	64	2500	1470	66

ACS880-604	Module type	Brake chopper module only			With specified resistors (option +D151)		
		Air flow		Noise[1)]	Air flow		Noise[1)]
		m^3/h	ft^3/min	dB(A)	m^3/h	ft^3/min	dB(A)
0800-7	2 × NBRA-669C	1320	777	67	5000	2940	69
1200-7	3 × NBRA-669C	1980	1166	68	7500	4410	70
1600-7	4 × NBRA-669C	2640	1554	69	10000	5890	71
2000-7	5 × NBRA-669C	3300	1943	70	12500	7360	72
2400-7	6 × NBRA-669C	3960	2331	71	15000	8830	73

1) Measured in a typical ABB (ACS880-607) cabinet installation.

Brake circuit cable sizes

Installation of brake choppers and brake resistors requires a cable for each chopper and resistor. This table gives the typical size for copper cables with PVC (70 °C) or XLPE (90 °C) insulation. With the ABB SAFUR resistors, use only resistor cables that have min. 90 °C cable conductor temperature rating. Make sure that the cable voltage rating is higher than the brake chopper operating voltage. Refer to Selecting the brake circuit components.

The cable sizing is based on a maximum of 6 cables installed with a spacing of at least the cable's diameter between each cable side by side on a ladder type cable tray, with a maximum of three trays on top of each other (with 30 cm of space between the trays) in an ambient temperature of 30 °C (IEC 60364-5-52).

ACS880-604-...	Module type	Required amount of chopper cables	Chopper cable (Cu) [1]	Resistor cable (Cu) [2]
			Multicore mm²	Multicore mm²
U_n = 400 V (Range 380…415 V)				
0210-3	NBRA-658C	1	3×95+50	3×50+25
0320-3	NBRA-659C	1	3×185+95	3×95+50
0640-3	2 × NBRA-659C	2	3×185+95	3×95+50
0960-3	3 × NBRA-659C	3	3×185+95	3×95+50
1280-3	4 × NBRA-659C	4	3×185+95	3×95+50
1600-3	5 × NBRA-659C	5	3×185+95	3×95+50
1920-3	6 × NBRA-659C	6	3×185+95	3×95+50
U_n = 500 V (Range 380…500 V)				
0260-5	NBRA-658C	1	3×95+50	3×50+25
0400-5	NBRA-659C	1	3×185+95	3×95+50
0800-5	2 × NBRA-659C	2	3×185+95	3×95+50
1200-5	3 × NBRA-659C	3	3×185+95	3×95+50
1600-5	4 × NBRA-659C	4	3×185+95	3×95+50
2000-5	5 × NBRA-659C	5	3×185+95	3×95+50
2400-5	6 × NBRA-659C	6	3×185+95	3×95+50
U_n = 690 V (Range 525…690 V)				
0400-7	NBRA-669C	1	3×185+95	3×95+50
0800-7	2 × NBRA-669C	2	3×185+95	3×95+50
1200-7	3 × NBRA-669C	3	3×185+95	3×95+50
1600-7	4 × NBRA-669C	4	3×185+95	3×95+50
2000-7	5 × NBRA-669C	5	3×185+95	3×95+50
2400-7	6 × NBRA-669C	6	3×185+95	3×95+50

1) Size of the cable between the drive DC link and the brake chopper.
2) Size of the cable between the brake chopper and the first resistor which carries the entire braking power, see section Connecting the DC and resistor cables (page 36).

Maximum cable length of the resistor cable

The maximum cable length of the resistor cable or cables is 50 m (164 ft).

Note: In order for the installation to comply with the EMC Directive, unshielded single-core cable can only be used if it is routed inside a cabinet that efficiently suppresses radiated emissions.

Maximum inductance for the brake chopper circuit

The maximum inductance allowed to the brake chopper circuit is 30 µH. The total inductance of the brake chopper cable, brake chopper, brake resistor cable and brake resistor. With SAFUR brake resistors you do not need to calculate the maximum resistor circuit inductance, if resistor cable length is 50.0 m or less and the chopper cable length is 3.0 m or less.

Brake chopper terminal data

Module type	UDC+, UDC-, R+, R-				Grounding clamps		
	Hole diameter mm	Screw	Tightening torque		Max. wire size mm^2	Tightening torque	
			N·m	lbf·ft		N·m	lbf·ft
NBRA-658C NBRA-659C NBRA-669C	11	M10	35	26	70	6	4.5

Brake resistor terminal data

Resistor type	R+, R- and grounding terminals			
	Hole diameter mm	Screw	Tightening torque	
			N·m	lbf·ft
SAFUR125F500 SAFUR180F460 SAFUR200F500 SAFUR210F575	7	M6	7	5.2

Protection classes

Degrees of protection (IEC/EN 60529)	IP00
Enclosure types (UL 50/50E)	UL Open Type
Overvoltage category (IEC/EN 60664-1)	III
Protective class (IEC/EN 61800-5-1)	I

Ambient conditions

This section gives the environmental requirements for the converter module. The converter module must be used in a heated indoor controlled environment.

	Operation installed for stationary use	Storage in protective package	Transportation in protective package
Altitude above sea level	0…4000 m (13123 ft)* for module 0…2000 m (6562 ft) for cabinet components Output derated above 1000 m (3281 ft). See section Altitude derating. *Neutral-grounded TN and TT network systems, non-corner-grounded IT network systems. Corner-grounded TN, TT and IT network systems up to 600 V.	-	-

	Operation installed for stationary use	Storage in protective package	Transportation in protective package
Air temperature	0 … +45 °C (+32 … +113 °F), no condensation allowed. Output derated in the range +45 … +55 °C (+113 … +131 °F).	-40 … +70 °C (-40 … +158 °F)	-40 … +70 °C (-40 … +158 °F)
Relative humidity	Maximum 95%, no condensation allowed	Maximum 95%, no condensation allowed	Maximum 95%, no condensation allowed
	No condensation allowed. Maximum allowed relative humidity is 60% in the presence of corrosive gases.		
Contamination	IEC/EN 60721-3-3:2002: Classification of environmental conditions - Part 3-3: Classification of groups of environmental parameters and their severities - Stationary use of weather protected locations	IEC 60721-3-1:1997	IEC 60721-3-2:1997
Chemical gases	Class 3C2	Class 1C2	Class 2C2
Solid particles	Class 3S1	Class 1S3 (packing must support this, otherwise 1S2)	Class 2S2
	No conductive dust allowed.		
Vibration	IEC 61800-5-1 IEC 60068-2-6:2007, EN 60068-2-6:2008 Environmental testing Part 2: Tests -Test Fc: Vibration (sinusoidal) 10 … 57 Hz, max. 0.075 mm amplitude 57 … 150 Hz 1 *g* Tested in a typical cabinet assembly according to: Max. 1 mm (0.04 in.) (peak value, 5 … 13.2 Hz), max. 0.7 *g* (13.2 … 100 Hz) sinusoidal	IEC/EN 60721-3-1:1997	IEC/EN 60721-3-1:1997
Shock IEC 60068-2-27:2008, EN 60068-2-27:2009 Environmental testing - Part 2-27: Tests - Test Ea and guidance: Shock	Not allowed	With packing max. 100 m/s^2 (330 ft./s^2) 11 ms	With packing max. 100 m/s^2 (330 ft./s^2) 11 ms

Materials

Disposal

The main parts of the drive can be recycled to preserve natural resources and energy. Product parts and materials should be dismantled and separated.

Generally all metals, such as steel, aluminum, copper and its alloys, and precious metals can be recycled as material. Plastics, rubber, cardboard and other packaging material can be used in energy recovery.

Printed circuit boards and DC capacitors need selective treatment according to IEC 62635 guidelines.

To aid recycling, most plastic parts are marked with an appropriate identification code. In addition, components containing Substances of Very High Concern (SVHCs) are listed in the European Chemicals Agency SCIP database. SCIP is the database for information on Substances of Concern in articles as such or in complex objects (Products) established under the Waste Framework Directive (2008/98/EC). For more information, contact your local ABB distributor or consult the European Chemicals Agency SCIP database to find out which SVHCs are used in the drive and where the components are located.

Contact your local ABB distributor for more information on environmental aspects. End of life treatment must follow international and national regulations.

For more information on ABB end of life services, refer to new.abb.com/service/end-of-life-services.

Packaging of brake unit

This is a complete list of the package materials. The materials vary depending on the frame size (packages do not contain all materials listed below).

- Cardboard (heavy duty quality with wet strength glue in large modules)
- Molded pulp
- Plywood
- Wood
- PP (strapping)
- EPP (foam)
- PE (plastic bag and/or VCI film)
- Metal (fixing clamps, screws).

Packaging of options

- Cardboard
- Kraft paper
- PP (straps)
- PE (film, bubble wrap)
- Plywood, wood (only for heavy components)

The materials vary according to the item type, size and shape. The typical package is a cardboard box with paper filling or bubble wrap. ESD-safe packing materials are used for printed circuit boards and similar items.

Manuals

Printed product manuals are made of recyclable paper. Product manuals are available on the Internet.

Auxiliary circuit current consumption

Cooling fan type	U_n	f	I_n	I_{start}
	V AC	Hz	A	A
Brake resistor cooling fan	230	50/60	2.25	4.5
Brake resistor cooling fan	115	50/60	4.1	8.2
Brake chopper cooling fan	115	50/60	1.8	3.6
Brake chopper cooling fan	230	50	0.65	1.3
	230	60	0.85	1.7

U_n Nominal voltage
f Frequency
I_N Nominal current consumption
I_{start} Starting current consumption

UL marking

The brake chopper module is cULus Listed with the rated voltages.

The cooling fans are cURus Recognized or cULus Listed.

The fuses are cURus Recognized.

The SAFUR brake resistors do not have UL certification.

More information on standards and markings

See Electrical planning instructions for ACS880 multidrive cabinets and modules (3AUA0000102324 [English]).

12

Dimension drawings

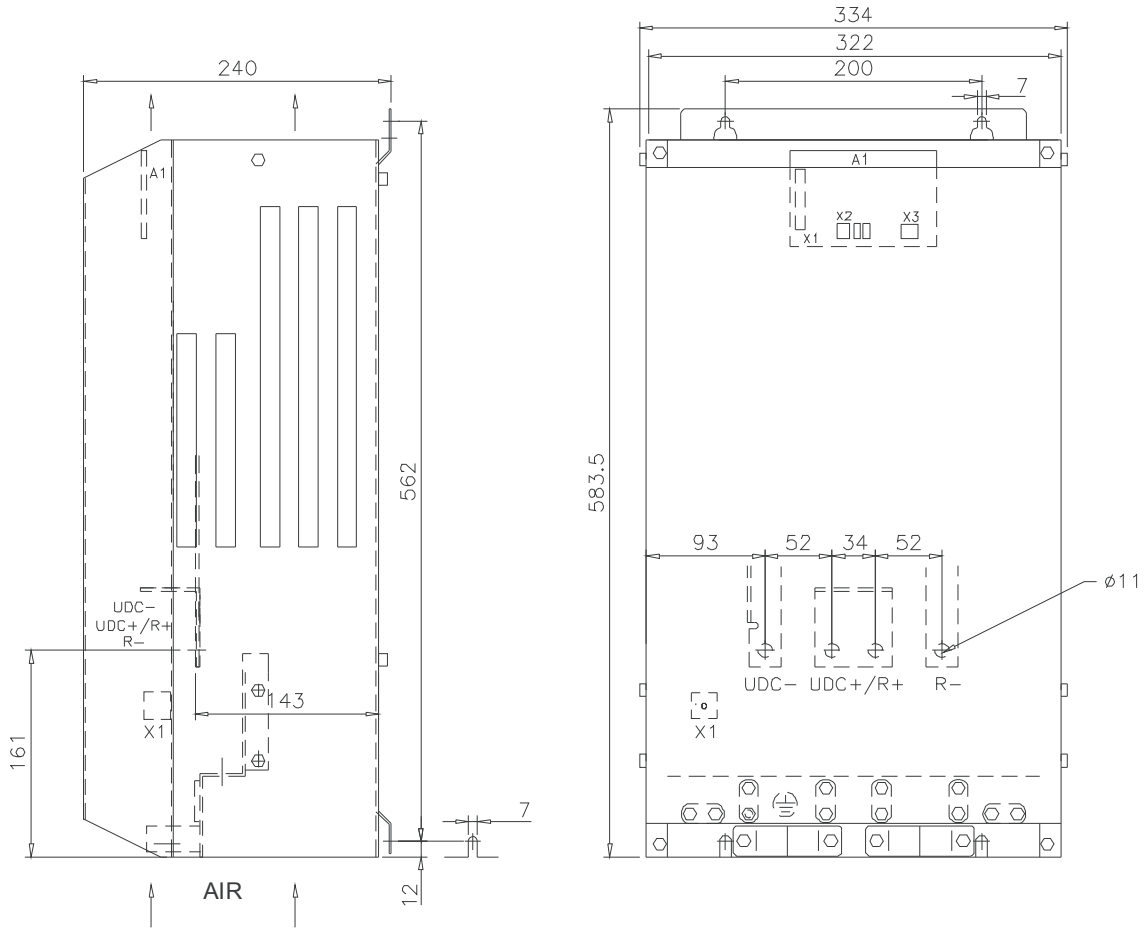
Contents of this chapter

This chapter contains the dimension drawings of the brake chopper module, as well as the standard brake resistors and cooling fans.

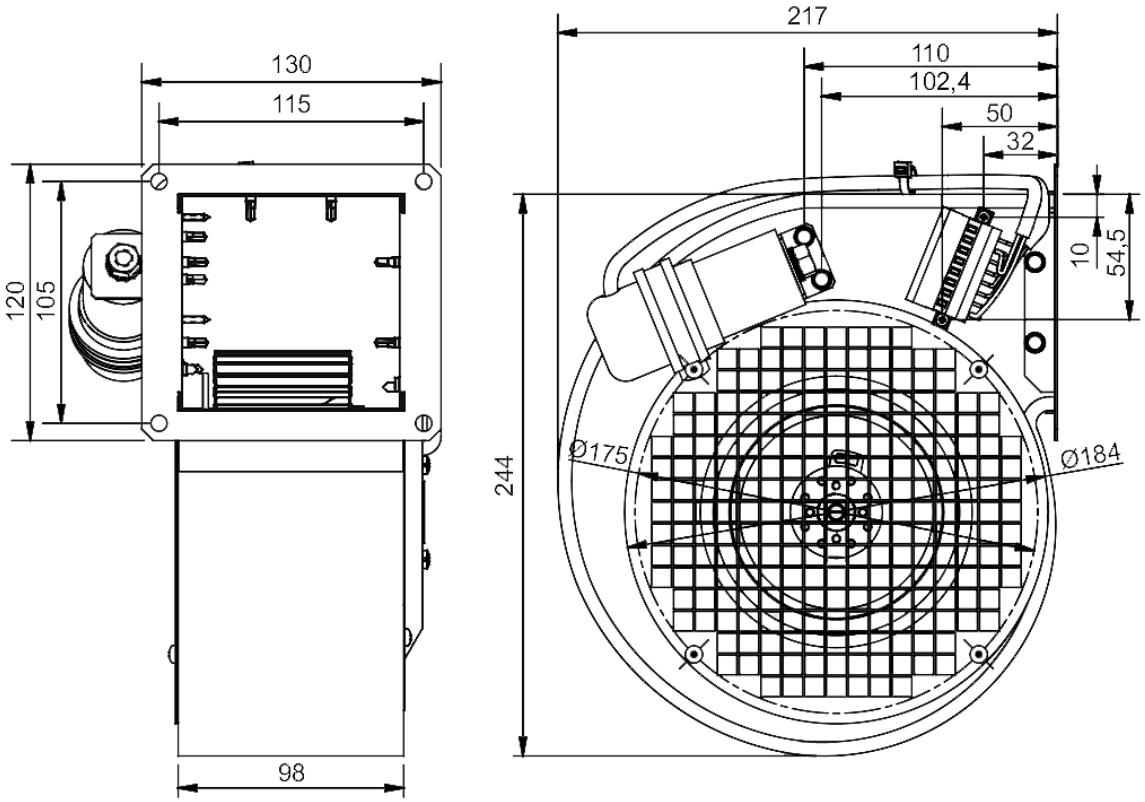
The dimensions are in millimeters. To convert to inches, use the formula:

25.4 mm = 1 in.

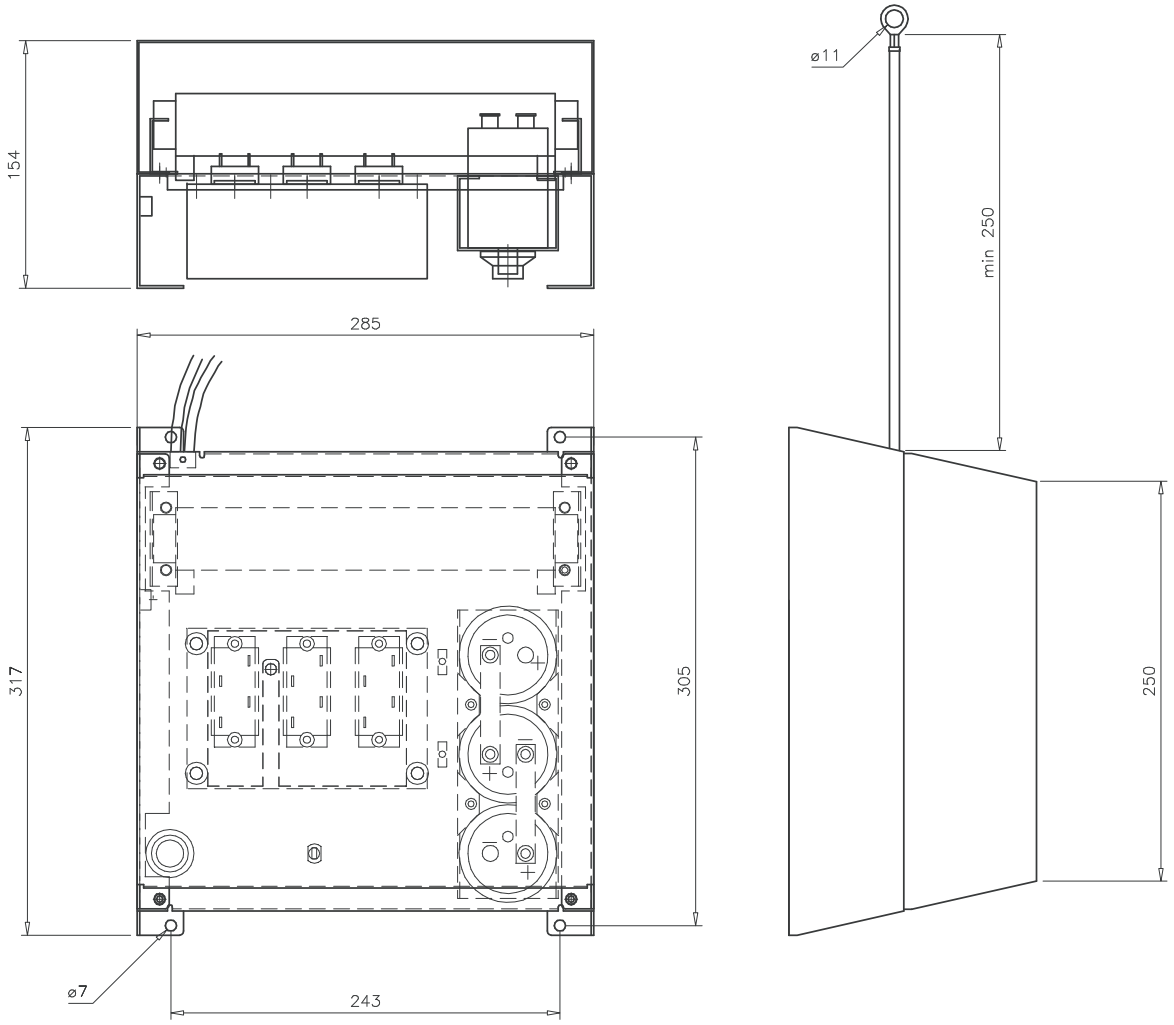
Brake chopper modules NBRA-658, NBRA-659, NBRA-669



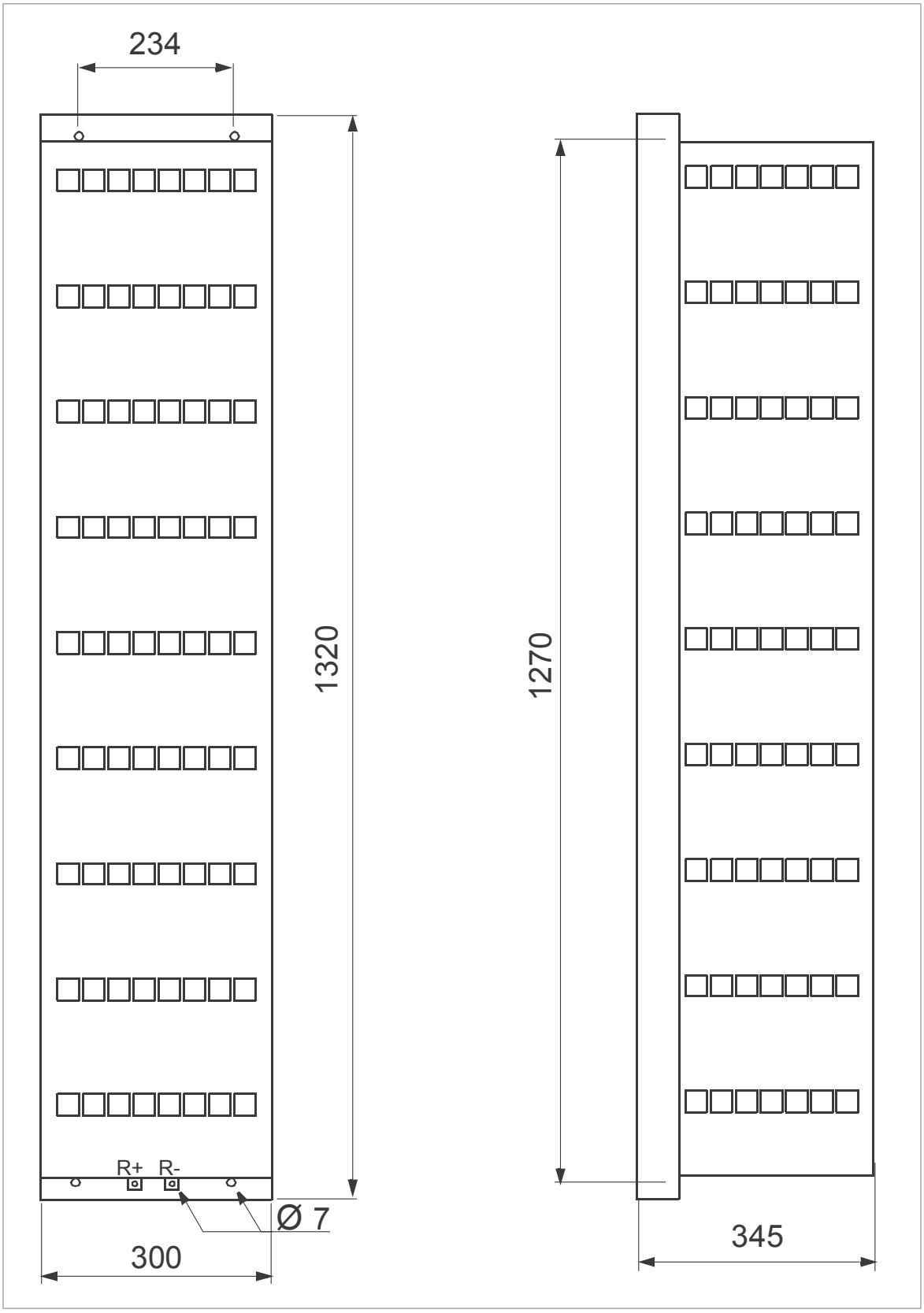
Brake chopper cooling fan 230 V 50/60 Hz



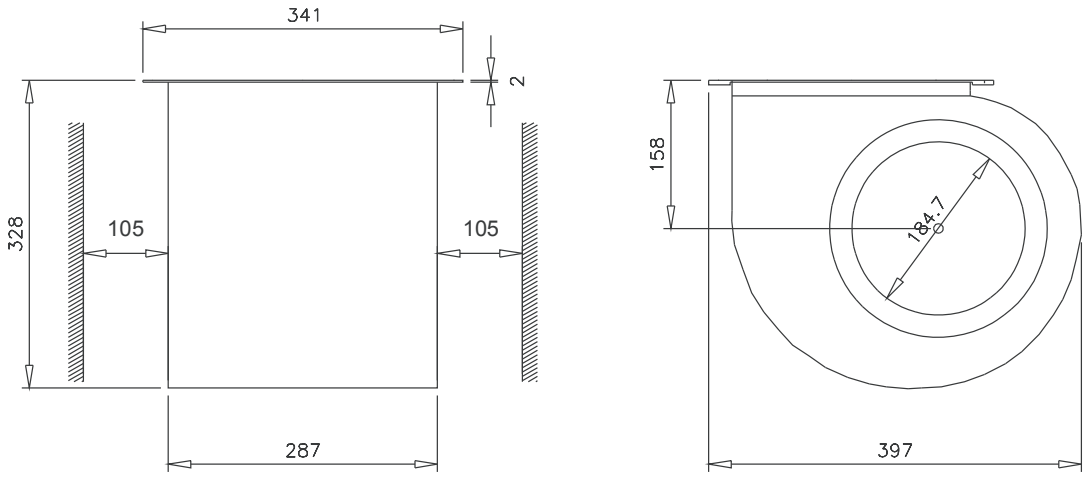
Attenuator



Brake resistor



Brake resistor cooling fan



13. Example circuit diagrams

Contents of this chapter

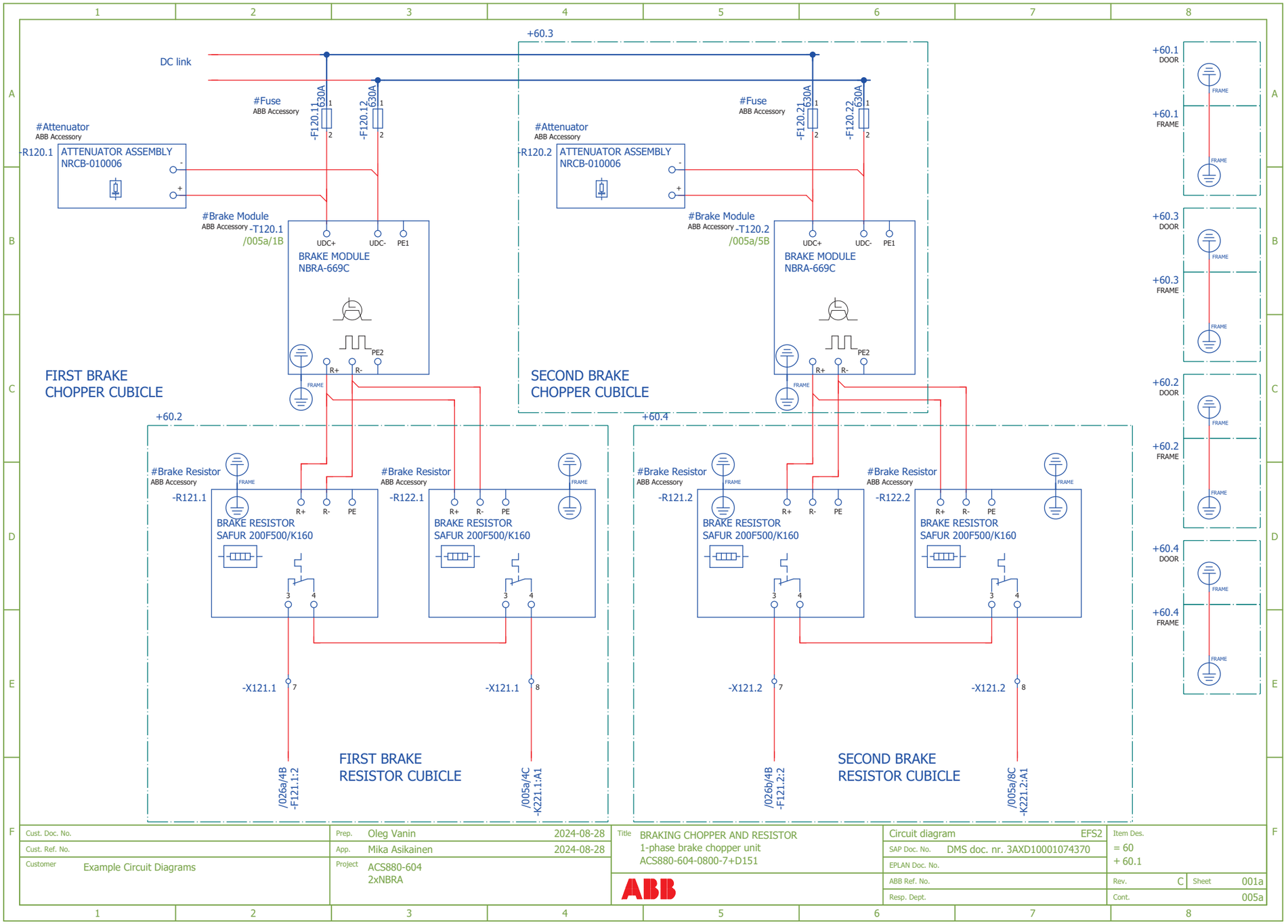
This chapter contains example circuit diagrams of a brake unit.

The purpose of these diagrams is to help in:

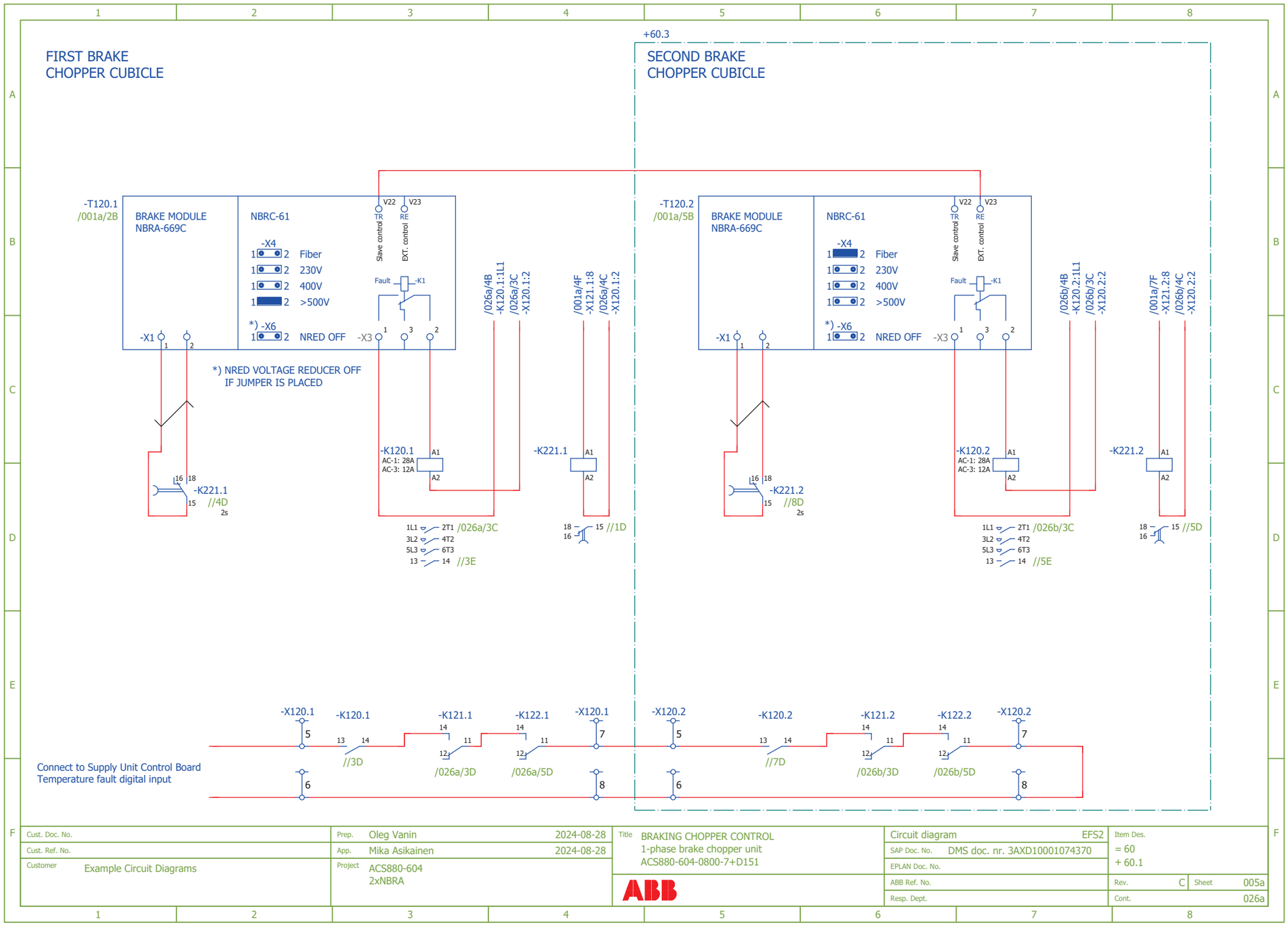
- understanding the internal connections and operation of a brake unit, and
- learning how to wire a brake unit.

In an installation with parallel-connected brake chopper modules, one chopper acts as the master for the others. The switching of the follower chopper(s) is controlled by the master via a fiber optic link.

Brake unit with two chopper modules - Sheet 001a

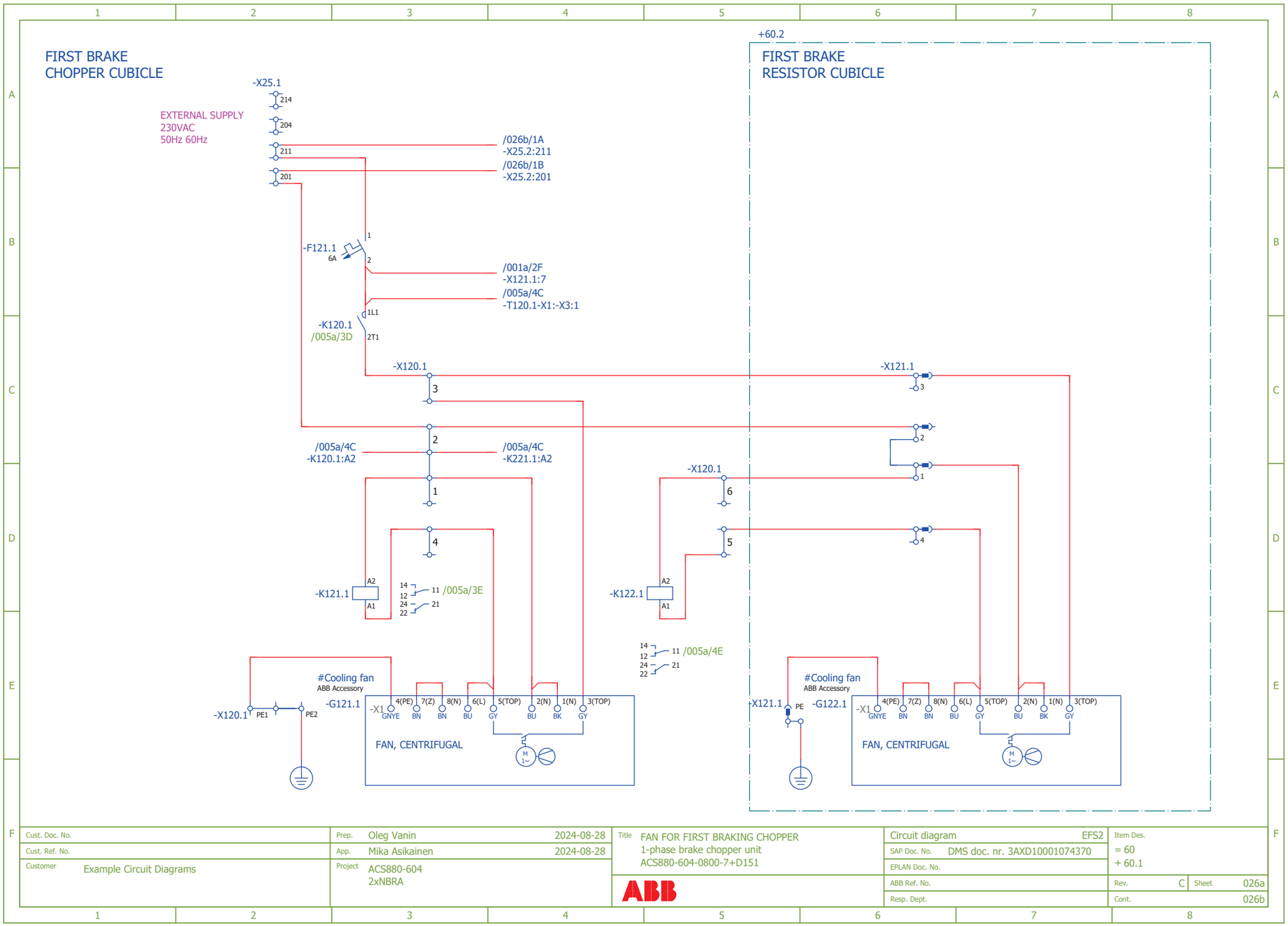


Brake unit with two chopper modules - Sheet 005a



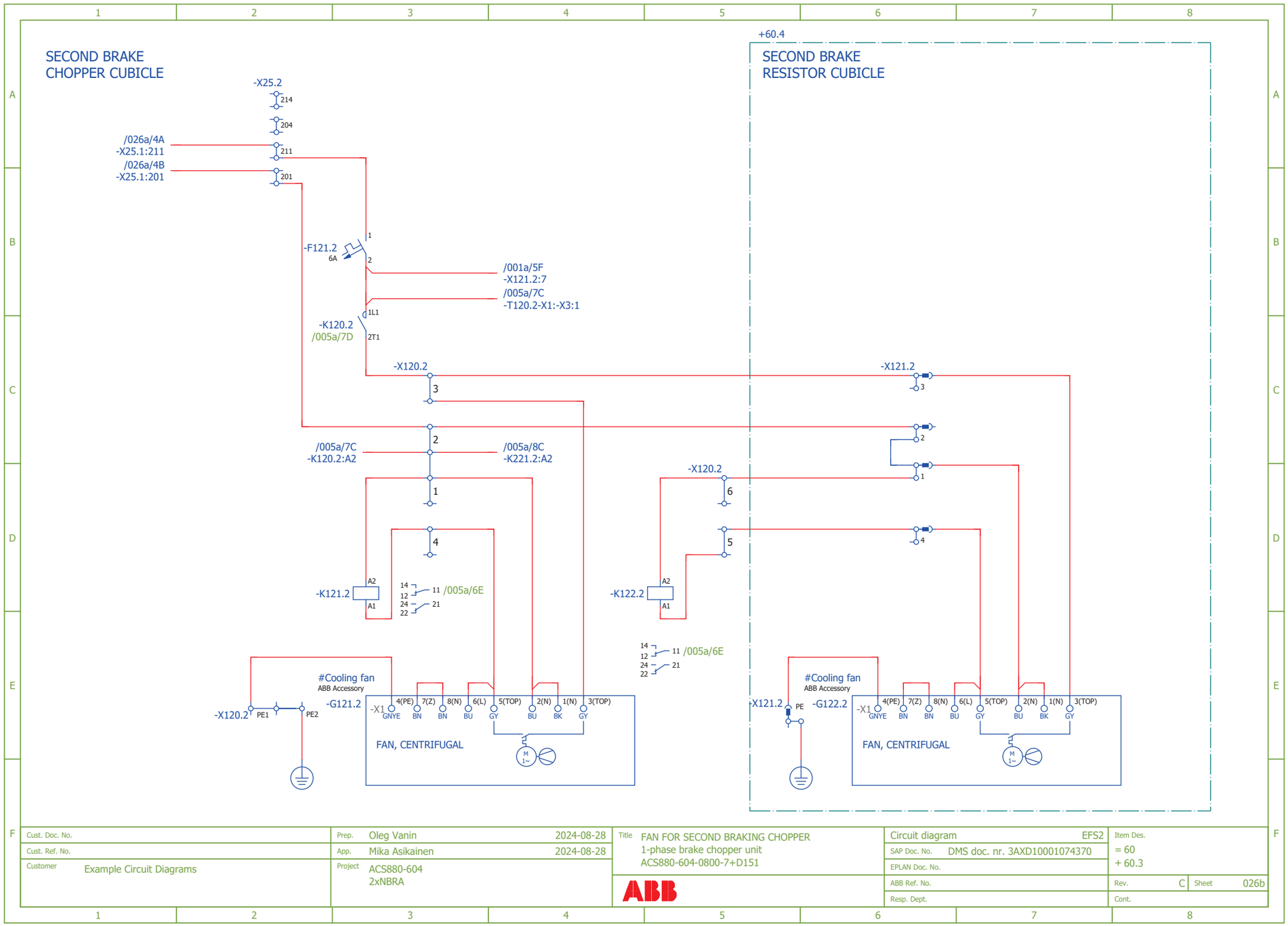
Cust. Doc. No.	Prep. Oleg Vanin 2024-08-28	Title BRAKING CHOPPER CONTROL 1-phase brake chopper unit ACS880-604-0800-7+D151	Circuit diagram EFS2	Item Des. = 60 + 60.1	
Cust. Ref. No.	App. Mika Asikainen 2024-08-28		SAP Doc. No. DMS doc. nr. 3AXD10001074370		
Customer Example Circuit Diagrams	Project ACS880-604 2xNBRA	ABB	EPLAN Doc. No.		
			ABB Ref. No.	Rev. C	Sheet 005a
			Resp. Dept.	Cont.	026a

Brake unit with two chopper modules - Sheet 026a



Cust. Doc. No.	Prep. Oleg Vanin 2024-08-28	Title FAN FOR FIRST BRAKING CHOPPER 1-phase brake chopper unit ACS880-604-0800-7+D151	Circuit diagram EFS2	Item Des. = 60 + 60.1	
Cust. Ref. No.	App. Mika Asikainen 2024-08-28		SAP Doc. No. DMS doc. nr. 3AXD10001074370		
Customer Example Circuit Diagrams	Project ACS880-604 2xNBRA	ABB	EPLAN Doc. No.		
			ABB Ref. No.	Rev. C	Sheet 026a
			Resp. Dept.	Cont.	026b

Brake unit with two chopper modules - Sheet 026b



Cust. Doc. No.	Prep. Oleg Vanin 2024-08-28	Title FAN FOR SECOND BRAKING CHOPPER 1-phase brake chopper unit ACS880-604-0800-7+D151	Circuit diagram EFS2	Item Des. = 60 + 60.3	
Cust. Ref. No.	App. Mika Asikainen 2024-08-28		SAP Doc. No. DMS doc. nr. 3AXD10001074370		
Customer Example Circuit Diagrams	Project ACS880-604 2xNBRA	ABB	EPLAN Doc. No.		
			ABB Ref. No.	Rev. C	Sheet 026b
			Resp. Dept.	Cont.	

1 Could not get value of expression: Product.Type != NBRA: Unknown variable: NBRA in file: /bl(1931518)/bl(1931519)/lang(en)/DMS/Files/Multidrives HW/DC-DC converters and brakes/Fault tracing/id(835675)ix(1924643)v(a6)ACS880-60x 1-phase_fault indications.xml

Further information

Product and service inquiries

Address any inquiries about the product to your local ABB representative, quoting the type designation and serial number of the unit in question. A listing of ABB sales, support and service contacts can be found by navigating to new.abb.com/contact-centers.

Product training

For information on ABB product training, navigate to new.abb.com/service/training.

Providing feedback on ABB manuals

Your comments on our manuals are welcome. Navigate to forms.abb.com/form-26567.

Document library on the Internet

You can find manuals and other product documents in PDF format on the Internet at www.abb.com/drives/documents.

a372 (working)
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3AUA0000106244 Rev C (EN) 2025-04-08