

Installation and Start-up Guide

ACS-BRK Brake Units

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ACS-BRK
Brake Units

Installation and Start-up Guide

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Safety



Warning! All electrical installation and maintenance work on the ACS-BRK brake units should be carried out by qualified electricians.



Warning! Do not attempt any work on a powered ACS-BRK. After disconnecting the mains from the feeding frequency converter which brake unit is connected to, always wait 5 minutes to allow intermediate circuit capacitors to become discharged before working on the ACS-BRK brake unit. Always check (with voltage indicating instrument) that the ACS-BRK is unpowered before beginning the work.



Warning! Never attempt to repair a broken unit; always contact the supplier for replacement.



Warning! In normal heavy loading, maximum temperature of the wall attachment reaches +90°C. Temperature of the body and the cover may be higher. In heavy overloading cases, temperature of the wall attachment may be higher.

Note! For more technical information, contact your local supplier.

Because of the variety of uses for this equipment and because of the differences between this solid-state equipment and electromechanical equipment, the user of and those responsible for applying this equipment must satisfy themselves as to the acceptability of each application and use of the equipment. In no event will ABB be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

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Table of Contents

| | |
|--|-----|
| Safety..... | iii |
| Chapter 1 - About This Manual | 1 |
| Chapter 2- Product Overview | 3 |
| Chapter 3 - Technical Details | 5 |
| Electrical Specifications | 5 |
| Environmental Specification..... | 5 |
| Mounting..... | 5 |
| Ventilation..... | 6 |
| Mechanical Specification | 7 |
| Chapter 4 - Electrical Installation..... | 9 |
| Chapter 5 - Mandatory Installation Instructions According to the EMC Directive..... | 13 |
| Chapter 6 - Selection of Brake Unit..... | 15 |
| A. Normal and Heavy Duty Use | 16 |
| B. Choosing the Correct ACS-BRK for Repetitive Peak Load Duty | 17 |
| C. Choosing the Correct ACS-BRK for Single Peak Duty..... | 20 |

Chapter 1 – About This Manual

This manual provides you with the information necessary to select the correct ACS-BRK brake unit and to install it.

Safety instructions are at the beginning of the manual. Read them carefully and exercise appropriate care when working with the unit.

Manual Contents:

Chapter 2 Product Overview

Chapter 3 Technical Details

Chapter 4 Electrical Installation

Chapter 5 Mandatory Installation Instructions According to the EMC Directive

Chapter 6 Selection of Brake Unit

Chapter 2 – Product Overview

When the drive application requires rapid or accurate deceleration of the motor, an ACS-BRK braking unit is needed. The braking unit converts the kinetic energy of the motor into thermal energy.

ACS-BRK braking units consist of a braking resistor and control electronics. These brake units can be used with the following ABB frequency converter series for both 200 - 240 V and 380 - 480 V line voltage.

- ACS 100
- ACS 140
- ACS 400

Each brake unit can be connected to any of the frequency converter listed above. The brake unit is selected according to the required braking power, not according to the rated power of the frequency converter. This guarantees the best price/performance ratio to the customer.

Example:

We have a 400 V drive application. The *required continuous braking power is 100 W* and the power rating of the frequency converter is 2.2 kW.

→ The right selection is ACS-BRK-A.

Chapter 3 – Technical Details

Electrical Specifications

Table 1 Input ratings.

| Terminal name | Terminal use | Voltage |
|-----------------------------------|----------------------------------|---------------------------------|
| U _{C+} , U _{C-} | Power supply | 200 - 850 V DC |
| T1, T2 | Overload indication (thermostat) | 110-220 V AC, max 8 A, 50/60 Hz |

The operating voltage selection for the brake unit must be the same as the input voltage of the frequency converter. This selection is done using jumpers located on the control board of ACS-BRK, see Chapter 4 – Electrical Installation.

Table 2 Output ratings.

| Brake Unit Type | Input voltage of the frequency converter | Resistance | P _{average} | P _{peak} (20s) |
|-----------------|--|------------|----------------------|-------------------------|
| ACS-BRK-A | 200 - 240 V AC 380 - 480 V AC | 400 Ω | 150 W | 350 W 1000 W |
| ACS-BRK-B | 200 - 240 V AC 380 - 480 V AC | 150 Ω | 400 W | 1000 W 2400 W |
| ACS-BRK-C | 200 - 240 V AC 380 - 480 V AC | 32 Ω | 2000 W | 4500 W 12000 W |
| ACS-BRK-D | 200 - 240 V AC 380 - 480 V AC | 10.5 Ω | 7000 W | 14000 W 42000 W |
| ACS-BRK-E | 200 - 240 V AC - | 4 Ω | 5000 W | 30000 W |
| ACS-BRK-F | 200 - 240 V AC - | 50 Ω | 400 W | 2400 W |

Environmental Specification

Table 3 Environmental limits.

| | |
|--|--------------|
| Operating temperature | 0 - 40 °C |
| Storage and transportation temperature | -40 - +70 °C |
| Enclosure rating | IP 21 |

Mounting

ACS-BRK brake units must be mounted vertically on a solid non-inflammable vertical surface. The parts in contact with the mounting surface of the unit may reach +90 °C and the rest of the metal parts may exceed +150 °C.

Ventilation

Maintain a minimum clearance to all directions to ensure efficient ventilation. The minimum clearance for models A, B and F is 150 mm, for model C 300 mm and for models D and E 500 mm. The ventilation of the mounting area must be efficient enough to carry away the power losses generated by the ACS-BRK. The power losses are listed in Table 2.

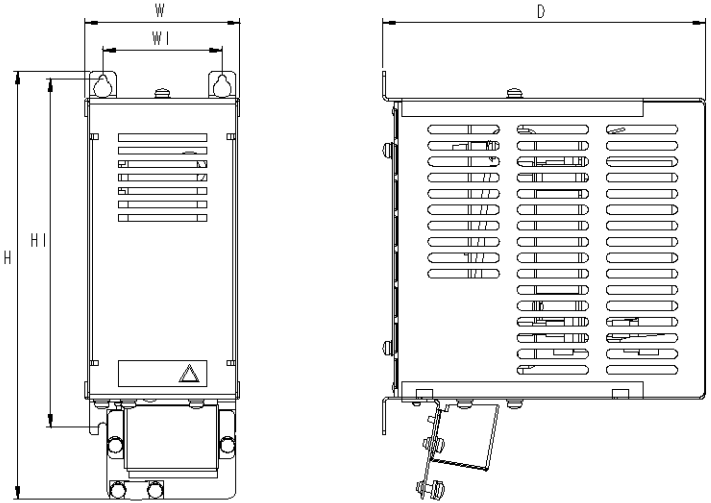


Figure 1 ACS-BRK Dimensional drawing for types A, B and F.

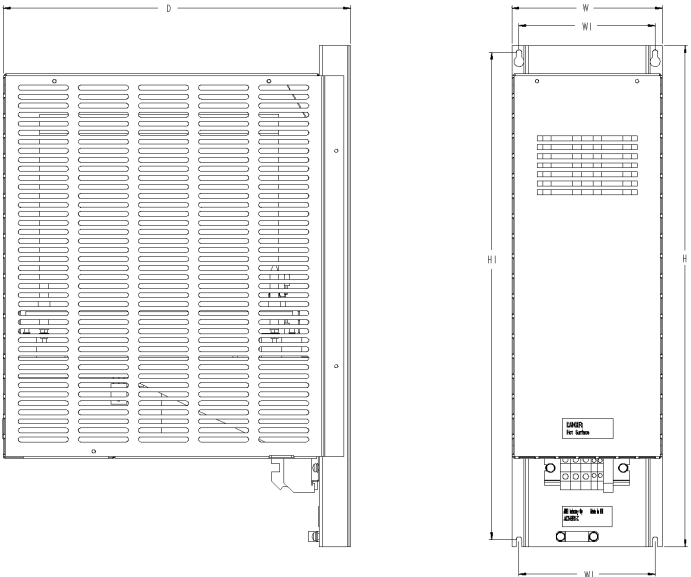


Figure 2 ACS-BRK Dimensional drawing for types C, D and E.

Mechanical Specification

Table 4 ACS-BRK Dimensions.

| All dimensions are in millimetres | | | | | | | |
|-----------------------------------|-------|--------|-------|-----|-----|-------------|------------|
| Brake Unit | Width | Height | Depth | h1 | w1 | Weight (kg) | Mounting |
| ACS-BRK-A | 90 | 240 | 180 | 196 | 67 | 1.2 | 4 mm screw |
| ACS-BRK-B | 90 | 300 | 285 | 230 | 67 | 1.5 | 4 mm screw |
| ACS-BRK-C | 150 | 500 | 347 | 486 | 136 | 7.5 | 5 mm screw |
| ACS-BRK-D | 270 | 600 | 450 | 582 | 252 | 20.5 | 6 mm screw |
| ACS-BRK-E | 270 | 600 | 450 | 582 | 252 | 18.5 | 6 mm screw |
| ACS-BRK-F | 90 | 300 | 285 | 230 | 67 | 1.5 | 4 mm screw |

Chapter 4 – Electrical Installation

1 Select the Right Voltage Range

Voltage range is selected using jumpers located inside the brake unit.

- A Open the ACS-BRK unit according to the following pictures:

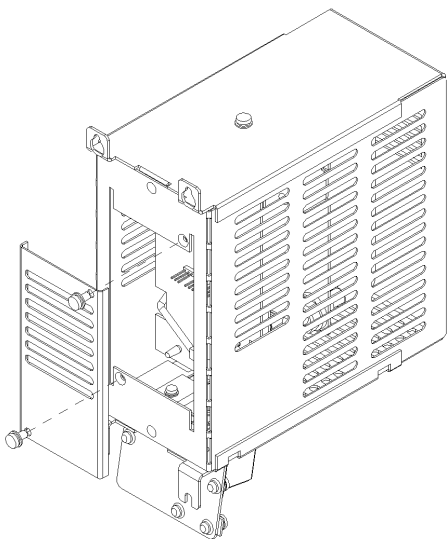


Figure 3 Opening the ACS-BRK unit, models A, B and F.

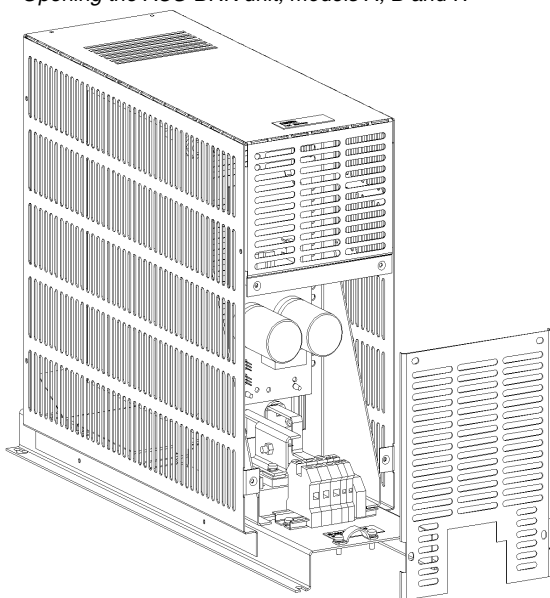


Figure 4 Opening the ACS-BRK unit, models C, D and E.

- B** Select the voltage range using jumpers according to the nominal AC line voltage supplied to the frequency converter. Jumper settings according to line voltages are given in Figure 5 and Figure 6. The factory default setting is 440 - 480 V.

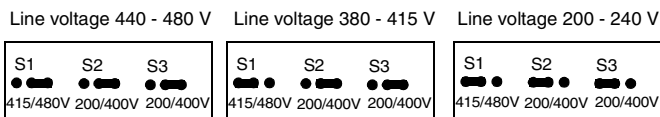


Figure 5 Voltage range selection with jumpers, models A, B and F.

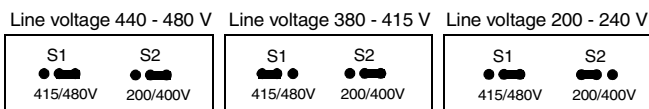


Figure 6 Voltage range selection with jumpers, models C, D and E.

- C** Put the cover lid back and tighten the screws.

2 Mount the unit

ACS-BRK must be mounted vertically on a solid flat non-inflammable vertical surface. Leave free space to all directions, 150 mm for types A, B and F, 300 mm for type C and 500 mm for types D and E. See Chapter 3 – Technical Details.



NOTE! Maximum temperature of the parts in contact with the mounting surface is +90 °C. Temperature of the body may be higher.

NOTE! The heat radiating from the brake unit will raise the temperature of nearby objects.

3 Power cabling



Warning! Before working on the frequency converter ensure isolation of the mains supply from the input terminals of the frequency converter. Wait at least 5 minutes and measure the DC-link voltage (voltage between U_{C-} and U_{C+}) before beginning the work.

For power wiring in the Industrial Environment (Second Environment) refer to Figure 7. The length of the cable between the frequency converter and the brake unit must not exceed five metres, types A, B and F. The maximum length for types C, D and E is 100 m.

No separate fuses in the braking circuit are required if the following conditions are met:

- the mains cable of the frequency converter is protected with fuses
- no mains cable or fuse overrating takes place
- in the braking circuit the specified cable is used, see Table 5 “Recommended cable sizes.”
- the cross sectional area of the Brake Unit cabling must always be larger or equal than the cross sectional area of the main cabling of the frequency converter

For power wiring, using input RFI filter with the frequency converter, in the First Environment, see Chapter 5 – Mandatory Installation Instructions According to the EMC Directive.

NOTE! The contactor may not be installed between the braking unit and the frequency converter.

4 Protection of the brake unit

To prevent dangerous overtemperatures in a case of malfunction and overloading the input contactor of the frequency converter must be connected in series with the thermostat of the ACS-BRK unit, see Figure 7.

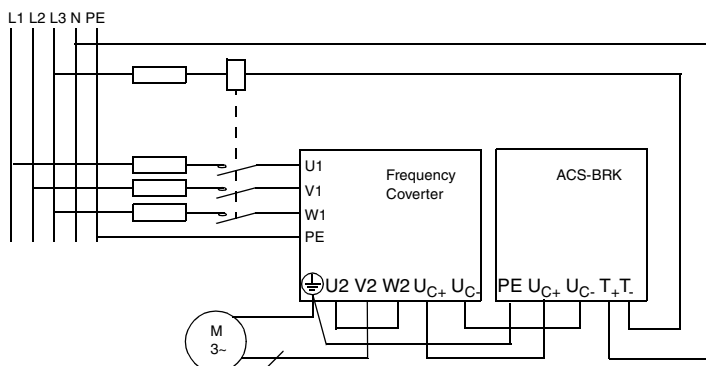


Figure 7 Electrical connection.

Table 5 Recommended cable sizes.

| Brake unit type | Input voltage of the frequency converter | P_{average} | P_{peak} (20 s) | Power cable mm^2 (copper) | Overload indicator cable mm^2 (copper) |
|-----------------|--|----------------------|--------------------------|------------------------------------|---|
| ACS-BRK-A | 200 - 240 V AC 380 - 480 V AC | 150 W | 350 W 1000 W | 2 x 2,5 + 2,5 | 2 x 2,5 |
| ACS-BRK-B | 200 - 240 V AC 380 - 480 V AC | 400 W | 1000 W 2400 W | 2 x 2,5 + 2,5 | 2 x 2,5 |
| ACS-BRK-C | 200 - 240 V AC 380 - 480 V AC | 2000 W | 4500 W 12000 W | 2 x 16 + 16 | 2 x 2,5 |
| ACS-BRK-D | 200 - 240 V AC 380 - 480 V AC | 7000 W | 14000 W 42000 W | 2 x 35 + 35 | 2 x 2,5 |
| ACS-BRK-E | 200 - 240 V AC - | 5000 W | 30000 W | 2 x 35 + 35 | 2 x 2,5 |
| ACS-BRK-F | 200 - 240 V AC - | 400 W | 2400 W | 2 x 2,5 + 2,5 | 2 x 2,5 |

Note! ABB frequency converters have an internal overvoltage controller that must be disabled when the braking unit is used. Parameter numbers are given in the following table.

Table 6 Disabling overvoltage controller.

| Frequency converter type | Parameter number | Set parameter value to |
|--------------------------|------------------|------------------------|
| ACS 100 | 308 | 0 |
| ACS 140 | 2005 | 0 |
| ACS 400 | 2005 | 0 |

Chapter 5 – Mandatory Installation Instructions According to the EMC Directive

Follow the instructions given in ACS 100, ACS 140 or ACS 400 EMC Instructions.

In First Environment, defined in the product standard EN 61800-3, the brake unit supply cable must have an effective cable screen (braid or foil screen, e.g. Ölflex-110 SY-NR for 200...240 V units, Ölflex-Servo-FD 780 CP, Lappkabel or MCCMK, NK Cables, for 380...480 V units). In addition, with 200...240 V frequency converters the motor cable must be run through the output choke ACS-CHK-A.

Route the control cables as far as possible from the mains, motor and chopper supply cables (at least 20 cm). Where control cables must cross power cables make sure they are at an angle as near 90 ° as possible. Also the cable routing must be done so that the distance from the sides of the converter is at least 20 cm to avoid excessive radiation to the cable.

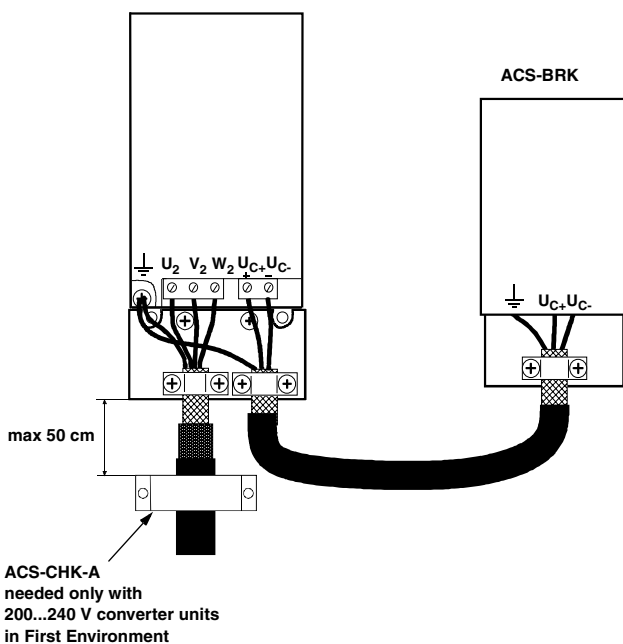


Figure 8 Cable connections between ACS-BRK and the frequency converter.

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Chapter 6 – Selection of Brake Unit

Define the required actual average braking power.

Note that the brake unit selection is based on the required braking power and not on the power rating of the frequency converter.

Select the brake unit so that P_{average} of the brake unit is equal or more than the required average braking power and momentary braking power is equal or less than P_{peak} . See Table 7.

Table 7 Selecting brake unit.

| Brake Unit Type | Input voltage of the frequency converter | P_{average} | P_{peak} |
|-----------------|--|----------------------|--------------------|
| ACS-BRK-A | 200 - 240 V AC 380 - 480 V AC | 150 W | 350 W 1000 W |
| ACS-BRK-B | 200 - 240 V AC 380 - 480 V AC | 400 W | 1000 W 2400 W |
| ACS-BRK-C | 200 - 240 V AC 380 - 480 V AC | 2000 W | 4500 W 12000 W |
| ACS-BRK-D | 200 - 240 V AC 380 - 480 V AC | 7000 W | 14000 W 42000 W |
| ACS-BRK-E | 200 - 240 V AC - | 5000 W | 30000 W |
| ACS-BRK-F | 200 - 240 V AC - | 400 W | 2400 W |

The easiest way to select the appropriate brake unit is to use Table 8 and Table 9 in paragraph A. If more specific selection is needed, see paragraphs B and C.

A. Normal and Heavy Duty Use

If the actual braking power is not known, the following split into normal and heavy duty use can be used for selection of the braking unit.

1 Normal duty use

Less than 60 % motor's nominal power is needed.

Braking is required for less than 10 % of the 200 s cycle time (i.e. duty time is less than 20 s).

2 Heavy duty use

100 % motor's nominal power is needed.

Braking is required for less than 10 % of the 200 s cycle time.

Table 8 Brake unit selection table for voltage range 200 V.

| P_{shaft} / [kW] | Normal duty | Heavy duty | P_{shaft} / [kW] | Normal duty | Heavy duty |
|---------------------------|-------------|------------|---------------------------|-------------|------------|
| 0.37 | ACS-BRK-A | ACS-BRK-A | 5.5 | ACS-BRK-C | ACS-BRK-E |
| 0.55 | ACS-BRK-A | ACS-BRK-B | 7.5 | ACS-BRK-C | ACS-BRK-E |
| 0.75 | ACS-BRK-B | ACS-BRK-B | 11 | ACS-BRK-E | ACS-BRK-E |
| 1.1 | ACS-BRK-B | ACS-BRK-F | 15 | ACS-BRK-E | ACS-BRK-E |
| 1.5 | ACS-BRK-B | ACS-BRK-F | 18.5 | ACS-BRK-E | ACS-BRK-E |
| 2.2 | ACS-BRK-F | ACS-BRK-F | 22 | ACS-BRK-E | ACS-BRK-E |
| 3 | ACS-BRK-F | ACS-BRK-C | 30 | ACS-BRK-E | ACS-BRK-E |
| 4 | ACS-BRK-F | ACS-BRK-C | | | |

Table 9 Brake unit selection table for voltage ranges 415 V and 480 V.

| P_{shaft} / [kW] | Normal duty | Heavy duty | P_{shaft} / [kW] | Normal duty | Heavy duty |
|---------------------------|-------------|------------|---------------------------|-------------|------------|
| 0.37 | ACS-BRK-A | ACS-BRK-A | 5.5 | ACS-BRK-C | ACS-BRK-C |
| 0.55 | ACS-BRK-A | ACS-BRK-A | 7.5 | ACS-BRK-C | ACS-BRK-C |
| 0.75 | ACS-BRK-A | ACS-BRK-A | 11 | ACS-BRK-C | ACS-BRK-C |
| 1.1 | ACS-BRK-A | ACS-BRK-B | 15 | ACS-BRK-C | ACS-BRK-D |
| 1.5 | ACS-BRK-A | ACS-BRK-B | 18.5 | ACS-BRK-C | ACS-BRK-D |
| 2.2 | ACS-BRK-B | ACS-BRK-B | 22 | ACS-BRK-C | ACS-BRK-D |
| 3 | ACS-BRK-B | ACS-BRK-C | 30 | ACS-BRK-D | ACS-BRK-D |
| 4 | ACS-BRK-B | ACS-BRK-C | 37 | ACS-BRK-D | ACS-BRK-D |

B. Choosing the Correct ACS-BRK for Repetitive Peak Load Duty

Choose appropriate brake unit for repetitive peak load duty by following the next 6 steps.

- 1 Calculate the maximum power P_{max} generated by motor during braking.
- 2 Define the duty time t_1 .
- 3 Define the cycle time t_2 .

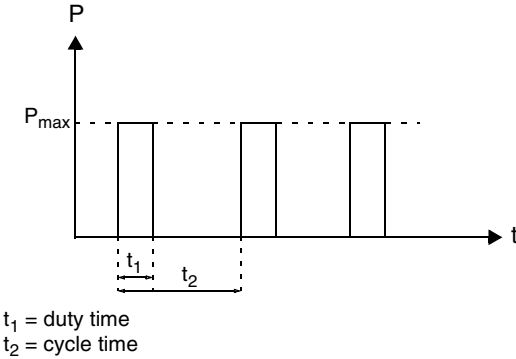


Figure 9 Defining the duty cycle.

- 4 Calculate the average braking power P_{ave} ,

$$P_{ave} = \frac{t_1}{t_2} \cdot P_{max}$$

- 5 Calculate the energy during the peak

$$E = t_1 \cdot P_{max}$$

- 6 Choose the brake unit from the figure so that the operating point is within safe operating area. See Figure 10 and Figure 11.

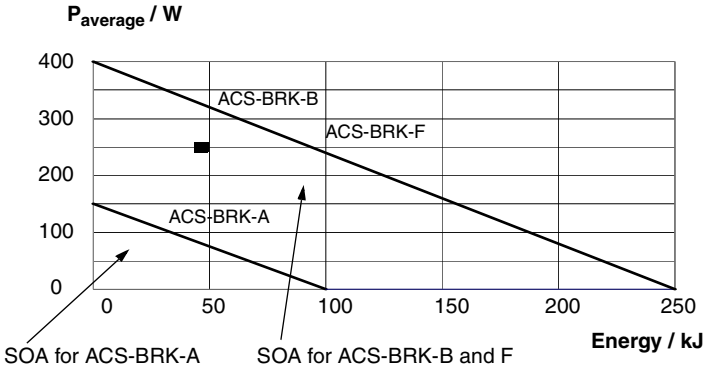


Figure 10 Safe operating area (SOA) for types ACS-BRK-A, -B and -F.
 ■ Example 1, the resulting point.

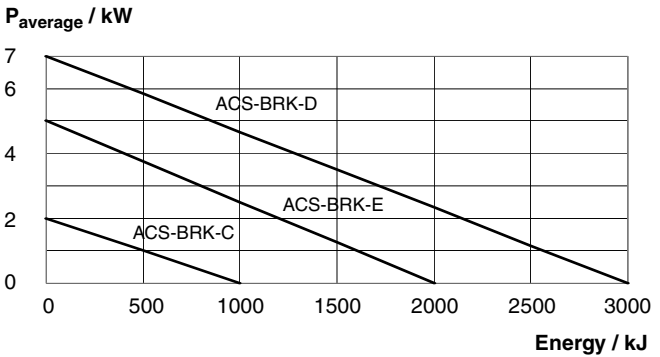


Figure 11 Safe operating area (SOA) for types ACS-BRK-C, -D and -E.

- 7 Check that at any time P_{peak} value is not exceeded (refer to Table 7 on page 159).

Example 1:

A 30 s motor deceleration ramp is needed every three minutes. The nominal torque of the motor has to be available throughout the deceleration time. The motor is rated 1.5 kW and 240 V.

$$P_{\text{average}} = \frac{30}{180} \cdot 1500 = 250 \text{ W} \quad E = 1500 \text{ W} \cdot 30 \text{ s} = 45 \text{ kJ}$$

Note! This is not the actual P_{average} value during the motor deceleration ramp. The above calculation method is only used to simplify the selection of braking unit.

The resulting point 250 W, 45 kJ is out of the safe operating area of ACS-BRK-A but within that of ACS-BRK-B and -F, see Figure 10. Table 7 shows that with the line voltage of 240 V AC, ACS-BRK-F is the correct selection.

C. Choosing the Correct ACS-BRK for Single Peak Duty

The term “single peak duty” means that the motor has to be stopped once in a while with short or accurate ramp time. This is typical e.g. in a case of emergency stopping. The time between these single peaks must be more than 40 minutes, otherwise the brake unit must be selected as in chapter 6 B.

- 1 Calculate the maximum power P_{\max} generated by motor during braking.
- 2 Define the deceleration ramp time.
- 3 Choose the brake unit from the following diagram, so that the operating point is within the safe operating area, see Figure 12 and Figure 13.

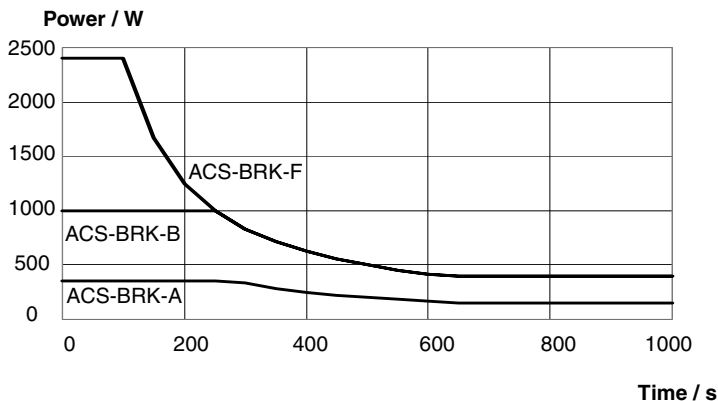


Figure 12 SOAs of the 200 V series converters.

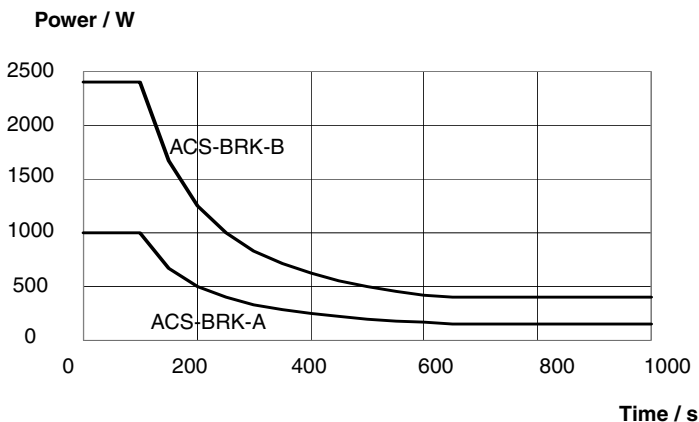


Figure 13 SOAs of the 400 V series converters.

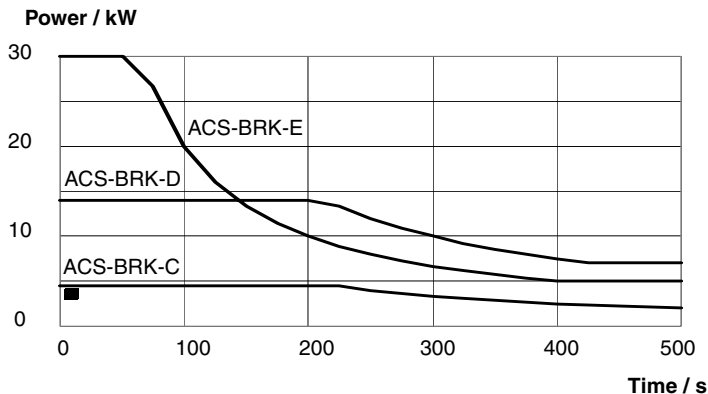


Figure 14 SOAs of the 200 V series converters.

■ Example 2, the resulting point.

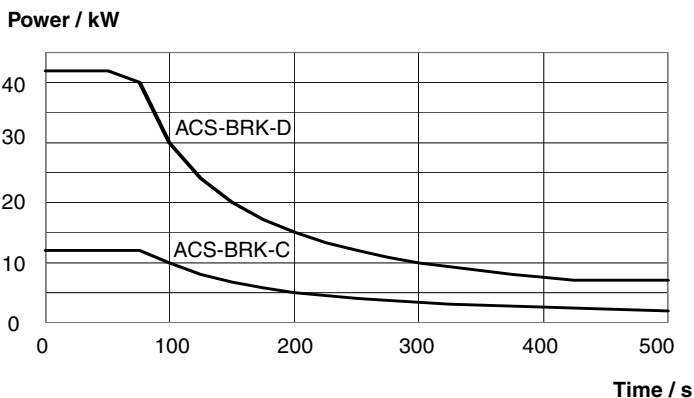


Figure 15 SOAs of the 400 V series converters.

Example 2:

- 200 V application
- maximum braking power during the cycle $P_{\max} = 4 \text{ kW}$
- deceleration time is 10 s

After checking from the Figure 14 that the resulting point is in SOA, the correct braking unit can be selected and it is ACS-BRK-C.



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