



Certification and Approvals

Coordination with Short-circuit Protection Devices



| Rated Output Pe [kW] | Rated Current Ie [A] | Motor Type | Manual M |
|-------------------------|-------------------------|-------------|----------|
| 0.37 | | S2X80 In1.6 | MS325-0 |
| 0.55 | 1.5 | S2X80 In2 | MS325-0 |
| 0.75 | 1.9 | S2X80 In2.5 | MS325-0 |
| 1.1 | 2.8 | S2X80 In3.2 | MS325-0 |
| 1.5 | 3.5 | S2X80 In5 | MS325-0 |
| 2.2 | 5 | S2X80 In6.5 | MS325-0 |
| 3 | 6.6 | S2X80 In8.5 | MS325-0 |
| 4 | 8.6 | S2X80 In11 | MS325-0 |
| 5.5 | 11.5 | S2X80 In16 | MS325-0 |
| 7.5 | 15.2 | S2X80 In20 | MS325-0 |
| 11 | 22 | S2X80 In25 | MS325-0 |
| 15 | 28.5 | | |
| 18.5 | 36 | | |
| 22 | 42 | | |
| 30 | 56 | | |
| 37 | 63 | | |
| 45 | 75 | | |
| 55 | 88 | | |
| 65 | 100 | | |
| 75 | 115 | | |
| 90 | 135 | | |
| 110 | 160 | | |
| 135 | 190 | | |
| 160 | 225 | | |
| 190 | 270 | | |
| 225 | 320 | | |
| 270 | 380 | | |
| 320 | 450 | | |
| 380 | 530 | | |
| 450 | 630 | | |
| 530 | 750 | | |
| 630 | 900 | | |
| 750 | 1100 | | |
| 900 | 1350 | | |
| 1100 | 1650 | | |
| 1350 | 2000 | | |
| 1650 | 2400 | | |
| 2000 | 2900 | | |
| 2400 | 3500 | | |
| 2900 | 4200 | | |
| 3500 | 5000 | | |
| 4200 | 6000 | | |
| 5000 | 7200 | | |
| 6000 | 8700 | | |
| 7200 | 10500 | | |
| 8700 | 12500 | | |
| 10500 | 15000 | | |
| 12500 | 18000 | | |
| 15000 | 21500 | | |
| 18000 | 26000 | | |
| 21500 | 31000 | | |
| 26000 | 37000 | | |
| 31000 | 44000 | | |
| 37000 | 53000 | | |
| 44000 | 64000 | | |
| 53000 | 77000 | | |
| 64000 | 92000 | | |
| 77000 | 110000 | | |
| 92000 | 135000 | | |
| 110000 | 160000 | | |
| 135000 | 195000 | | |
| 160000 | 240000 | | |
| 195000 | 290000 | | |
| 240000 | 350000 | | |
| 290000 | 420000 | | |
| 350000 | 500000 | | |
| 420000 | 600000 | | |
| 500000 | 720000 | | |
| 600000 | 870000 | | |
| 720000 | 1050000 | | |
| 870000 | 1250000 | | |
| 1050000 | 1500000 | | |
| 1250000 | 1800000 | | |
| 1500000 | 2150000 | | |
| 1800000 | 2600000 | | |
| 2150000 | 3100000 | | |
| 2600000 | 3700000 | | |
| 3100000 | 4400000 | | |
| 3700000 | 5300000 | | |
| 4400000 | 6400000 | | |
| 5300000 | 7700000 | | |
| 6400000 | 9200000 | | |
| 7700000 | 11000000 | | |
| 9200000 | 13500000 | | |
| 11000000 | 16000000 | | |
| 13500000 | 19500000 | | |
| 16000000 | 24000000 | | |
| 19500000 | 29000000 | | |
| 24000000 | 35000000 | | |
| 29000000 | 42000000 | | |
| 35000000 | 50000000 | | |
| 42000000 | 60000000 | | |
| 50000000 | 72000000 | | |
| 60000000 | 87000000 | | |
| 72000000 | 105000000 | | |
| 87000000 | 125000000 | | |
| 105000000 | 150000000 | | |
| 125000000 | 180000000 | | |
| 150000000 | 215000000 | | |
| 180000000 | 260000000 | | |
| 215000000 | 310000000 | | |
| 260000000 | 370000000 | | |
| 310000000 | 440000000 | | |
| 370000000 | 530000000 | | |
| 440000000 | 640000000 | | |
| 530000000 | 770000000 | | |
| 640000000 | 920000000 | | |
| 770000000 | 1100000000 | | |
| 920000000 | 1350000000 | | |
| 1100000000 | 1600000000 | | |
| 1350000000 | 1950000000 | | |
| 1600000000 | 2400000000 | | |
| 1950000000 | 2900000000 | | |
| 2400000000 | 3500000000 | | |
| 2900000000 | 4200000000 | | |
| 3500000000 | 5000000000 | | |
| 4200000000 | 6000000000 | | |
| 5000000000 | 7200000000 | | |
| 6000000000 | 8700000000 | | |
| 7200000000 | 10500000000 | | |
| 8700000000 | 12500000000 | | |
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| 77000000000 | 110000000000 | | |
| 92000000000 | 135000000000 | | |
| 110000000000 | 160000000000 | | |
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| 160000000000 | 240000000000 | | |
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| 350000000000 | 500000000000 | | |
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| 195000000000000000 | 290000000000000000 | | |
| 240000000000000000 | 350000000000000000 | | |
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| 350000000000000000 | 500000000000000000 | | |
| 420000000000000000 | 600000000000000000 | | |
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| 720000000000000000 | 1050000000000000000 | | |
| 870000000000000000 | 1250000000000000000 | | |
| 1050000000000000000 | 1500000000000000000 | | |
| 1250000000000000000 | 1800000000000000000 | | |
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| 2150000000000000000 | 3100000000000000000 | | |
| 2600000000000000000 | 3700000000000000000 | | |
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| 3700000000000000000 | 5300000000000000000 | | |
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| 6400000000000000000 | 9200000000000000000 | | |
| 7700000000000000000 | 11000000000000000000 | | |
| 9200000000000000000 | 13500000000000000000 | | |
| 11000000000000000000 | 16000000000000000000 | | |
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| 19500000000000000000 | 29000000000000000000 | | |
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| 29000000000000000000 | 42000000000000000000 | | |
| 35000000000000000000 | 50000000000000000000 | | |
| 42000000000000000000 | 60000000000000000000 | | |
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| 60000000000000000000 | 87000000000000000000 | | |
| 72000000000000000000 | 105000000000000000000 | | |
| 87000000000000000000 | 125000000000000000000 | | |
| 105000000000000000000 | 150000000000000000000 | | |
| 125000000000000000000 | 180000000000000000000 | | |
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| 215000000000000000000 | 310000000000000000000 | | |
| 260000000000000000000 | 370000000000000000000 | | |
| 310000000000000000000 | 440000000000000000000 | | |
| 370000000000000000000 | 530000000000000000000 | | |
| 440000000000000000000 | 640000000000000000000 | | |
| 530000000000000000000 | 770000000000000000000 | | |
| 640000000000000000000 | 920000000000000000000 | | |
| 770000000000000000000 | 110 | | |

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Standards, Specifications and Certifying Organizations

Definitions

ABB low voltage devices are developed and manufactured according to the rules set out in IEC international standards, in EN European standards and in national ones such as NF, DIN and BS.

● Compliance to standards

A declaration of conformity signed by the manufacturer is available on request. Certification Body Certificates (CB certificates) are also available to prove the complete conformity to standards.

● Certified products

In some cases, products are approved according to a given standard by a Certification Body and the manufacturer is regularly visited by this Body in order to check the respect of the design and the materials used.

This process creates a certified product. This is the case of UL (Underwriters Laboratories) and CSA (Canadian Standard Association) for instance (see below).

● Marine approved products

For devices installed on board ships, Marine assurance companies require devices approved by independent classification societies, see list below.

Specifications

● International Specifications

The International Electrotechnical Commission, IEC, which is part of the International Standards Organization, ISO, publishes IEC publications which act as a basis for the world market.

● European Specifications and National Specifications

The European Committee for Electrotechnical Standardization (CENELEC), which groups together 18 European countries, publishes EN standards. These European standards differ very little from IEC international standards and have similar numbering.

The same applies for national standards which use, without exception, the same numbering and reproduce the texts of these unified standards in their entirety. Contradicting national standards are withdrawn.

● European Directives

The guarantee of the free movement of goods within the European Community means that any regulatory differences between member states have been eliminated. The European directives set up common rules that are included in the legislation of each state while contradictory regulations are cancelled.

Three directives are essential:

– **Low Voltage Directive 73/23/EEC** concerns electrical equipment from 0 to 1000 V a.c. and from 0 to 1500 V d.c.

This specifies that compliance with the requirements that it sets out is **acquired** if the equipment conforms to the standards harmonized on a European level: EN 60947-1 and EN 60947-4-1 for contactors.

– **Machines Directive 89/392/EEC** for safety specifications of machines and equipment on **complete machines**. Machines bearing the CE mark comply with these specifications.

– **Electromagnetic Compatibility Directive 89/336/EEC** which concerns all devices able to create electromagnetic disturbance. Standard EN 60947-4-1 does not set out **any requirement** concerning the level of emission or immunity of contactors which do **not have any active electronic components**. Owing to this fact, compliance with standard EN 60947-4-1 meets the requirements for CE marking, with respect to this directive.

CE Marking:

CE marking indicates that the marked equipment conforms to the relevant EU directive.

CE marking is part of an administrative procedure and guarantees free movement of the product within the European Community.


● Standards in Canada and the USA

Canadian and American specifications are more or less equivalent but differ greatly from IEC, NF, DIN and BS standards.

UL Underwriters Laboratories USA Certificates of compliance on request

CSA Canadian Standard Association Canada Certificates of compliance on request

UL (USA) specifications make the following distinction between devices:

"Recognized" Authorized to be included in equipment, if the equipment in question has been entirely mounted and wired by qualified personnel. These devices bear the mark 

"Listed" Authorized to be included in equipment and for separate sale as components. These devices bear the mark 

● Certification in China: Compulsory China Certification

● Marine Approvals

The following specifications must be respected when these devices are used on ships:

| | | | | | |
|------------|------------------------------|---------------|---------------|-------------------------------|--------|
| BV | Bureau Veritas | France | MRS | Maritime Register of Shipping | Russia |
| DNV | Det Norske Veritas | Norway | PRS | Polski Rejestr Statkow | Poland |
| GL | Germanischer Lloyd | Germany | R.I.Na | Registro Italiano Navale | Italy |
| LRS | Lloyd's Register of Shipping | Great Britain | | | |

● **Other approvals: ANCE:** Mexico, **GOST:** Russia (please consult your local ABB sales office).

Standards, Specifications and Certifying Organizations

Specifications (cont.)

● International Standards

| | |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| IEC 60947-1 | Low-voltage switchgear and controlgear – Part 1: General rules. |
| IEC 60947-4-1 | Low-voltage switchgear and controlgear – Part 4: Contactors and motor starters – Section 1: Electromechanical contactors and motor starters. |
| IEC 60947-5-1 | Low-voltage switchgear and controlgear – Part 5: Control circuit devices and switching elements – Section 1: Electromechanical control circuit devices. |
| IEC 60947-5-4 | Low-voltage switchgear and controlgear – Part 5-4: Control circuit devices and switching elements. Method of assessing the performance of low-energy contacts. Special tests. |
| IEC 60947-6-1 | Low-voltage switchgear and controlgear – Part 6: Multiple function equipment – Section 1: Automatic transfer switching equipment. |
| IEC 60204-1 | Electrical equipment of industrial machines – Part 1: General requirements. |
| IEC 60715 | Dimensions of low-voltage switchgear and controlgear. Standardized mounting on rails for mechanical support of electrical devices in switchgear and controlgear installations. |

● European Standards

| | |
|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EN 50 005 | Low-voltage switchgear and controlgear for industrial use – Terminal marking and distinctive number: General rules (Annex L of IEC 60947-1). |
| EN 50 011 | Low-voltage switchgear and controlgear for industrial use – Terminal marking, distinctive number and distinctive letter for particular contactor relays (NFC 63-031). |
| EN 50 012 | Low-voltage switchgear and controlgear for industrial use – Terminal marking and distinctive number for auxiliary contacts of particular contactors (NFC 63-032). |
| EN 60947-1 | Low-voltage switchgear and controlgear – Part 1: General rules. |
| EN 60947-4-1 | Low-voltage switchgear and controlgear – Part 4: Contactors and motor starters – Section 1: Electromechanical contactors and motor starters. |
| EN 60947-5-1 | Low-voltage switchgear and controlgear – Part 5: Control circuit devices and switching elements – Section 1: Electromechanical control circuit devices. |
| EN 60947-5-4 | Low-voltage switchgear and controlgear – Part 5-4: Control circuit devices and switching elements. Method of assessing the performance of low-energy contacts. Special tests. |
| EN 60947-6-1 | Low-voltage switchgear and controlgear – Part 6: Multiple function equipment – Section 1: Automatic transfer switching equipment. |
| EN 60204-1 | Electrical equipment of industrial machines – Part 1: General requirements. |
| EN 60 715 | Dimensions of low-voltage switchgear and controlgear. Standardized mounting on rails for mechanical support of electrical devices in switchgear and controlgear installations. |

● National Standards

European countries national standards reproduce the corresponding **EN...** standards. Codification is built by addition of a prefix to **EN** numbering. For instance:

| | |
|-----------------|------------------|
| – France | NF EN... |
| – Germany | DIN EN... |
| – Great Britain | BS EN... |
| – Italy | CEI EN... |
| – Sweden | SS EN... |

Test Certifying Organizations

● LOVAG

ABB Control is a member of the **ASEFA** (Association of French Test Stations for Electrical Apparatus) whose platforms are accredited by **COFRAC** (national test network).

This independent organization is authorized to deliver certificates of testing and conformity with standards, especially IEC. **ASEFA** is one of the signatories of the **LOVAG** (Low Voltage Agreement Group) agreement which ensures reciprocal recognition between the main European certifying organizations for low voltage electrical tests by delivering certificates of LOVAG conformity.

| | | | | | |
|----------------------------------------------------------|--------------------------|---------------------------------------------------------|------------------|------------------------------|------------------|
| Members of LOVAG : | ACAE Italy | SEMKO Sweden | ALPHA Germany | ASEFA France | CEBEC Belgium |
| Production centres LOVAG affiliated ABB | ABB Sace Italy | ABB Automation Technology Products Sweden | – | ABB Entelec France | – |



Certifications and Approvals

Designed according to the appropriate specifications, the devices in this catalogue have been built and tested. They can be used in most countries without any further certifications.

Some countries, however, require certification according to their own national standards. In other cases, the Marine for example, approvals ratifying that particular specifications have been met are necessary.

The table below shows the approvals and certifications for different devices.










The following documents may be obtained on request: – certificates of conformity.

– certificates of certification or approval.

The use of certified devices does not exonerate the equipment supplier from complying with the legal specifications of the country concerned.

Explanation of symbols:

■ **Standard design approved**, the company labels bear the certification mark when this is required.













| Certifications and approvals | | Certifications | | | Approvals: ship classification societies | | | | | |
|------------------------------|-------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Mark | |  |  |  |  |  |  |  |  |  |
| Abbreviation Approved in | | CSA Canada | UL USA | CCC China | BV France | GL Germany | LRS Gr. Britain | DNV Norway | RINa Italy | MRS Russia |
| 3-pole Contactors | | | | | | | | | | |
| Control supply | Contacteur type | | | | | | | | | |
| a.c. | A 9 ... A 75 | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | – |
| | A 95 ... A 300 | ■ | ■ (3) | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| a.c. / d.c. | AF 50 ... AF 75 | ■ | ■ | – | – | – | – | – | – | – |
| | AF 95 ... AF 750 | ■ (1) | ■ (3) | ■ | ■ (2) | ■ | ■ | ■ (2) | ■ (2) | – |
| | AF 1350 ... AF 1650 | – | ■ (3) | ■ | ■ | ■ | ■ | – | – | – |
| d.c. | AL 9 ... AL 40 | ■ | ■ | ■ | – | – | – | – | – | – |
| | AL 9Z ... AL 16Z | ■ | ■ | – | – | – | – | – | – | – |
| | AE 50, AE 75 | ■ | ■ | ■ | – | – | – | – | – | – |
| | AE 95, AE 110 | ■ | ■ (3) | – | – | – | – | – | – | – |
| | TAL 9 ... TAL 40 | ■ | ■ | ■ | – | – | – | – | – | – |
| | TAE 50 ... TAE 75 | – | – | ■ | – | – | – | – | – | – |
| | TAE 95, TAE 110 | – | – | – | – | – | – | – | – | – |
| a.c. | UA 16 | – | – | ■ | – | – | – | – | – | – |
| | UA 26 ... UA 75 | ■ | ■ | ■ | – | – | – | – | – | – |
| | UA 95, UA 110 | ■ | ■ (3) | ■ | – | – | – | – | – | – |
| | UA 16..RA ... UA 75..RA | ■ | ■ | ■ | – | – | – | – | – | – |
| | UA 95..RA, UA 110..RA | – | ■ (3) | – | – | – | – | – | – | – |
| a.c. | GA 75 | ■ | ■ | – | – | – | – | – | – | – |
| d.c. | GAE 75 | ■ | ■ | – | – | – | – | – | – | – |
| a.c. or d.c. | EH 1200 | ■ | ■ | ■ | – | – | – | – | – | – |
| 4-pole Contactors | | | | | | | | | | |
| Control supply | Contacteur type | | | | | | | | | |
| a.c. | A 9, A 16 | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | – |
| | A 26 | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | – |
| | A 45 | ■ | ■ | – | – | – | – | – | – | – |
| | A 50, A 75 | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | – |
| a.c. | EK 110 ... EK 550 | ■ | ■ | ■ | – | – | – | – | – | – |
| | EK 1000 | – | – | ■ | – | – | – | – | – | – |
| a.c. / d.c. | AF 45 ... AF 75 | ■ | ■ | – | – | – | – | – | – | – |
| d.c. | AL 9 ... AL 26 | ■ | ■ | – | – | – | – | – | – | – |
| | AE 45 | ■ | ■ | – | – | – | – | – | – | – |
| | AE 50, AE 75 | ■ | ■ | – | – | – | – | – | – | – |
| | TAL 9 ... TAL 26 | ■ | ■ | – | – | – | – | – | – | – |
| | TAE 45 ... TAE 75 | – | – | – | – | – | – | – | – | – |
| d.c. | EK 110 ... EK 550 | ■ | ■ | ■ | – | – | – | – | – | – |
| | EK 1000 | – | – | ■ | – | – | – | – | – | – |

(1) Only AF 145 ... AF 750

(2) Only AF 400 ... AF 750

(3) UL listed to U.S. and Canadian Safety Standards.

Certifications and Approvals

| Certifications and approvals | Certifications | | | | | Approvals: ship classification societies | | | | | | |
|------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Mark |  |  |  |  |  |  |  |  |  |  |  |  |
| Abbreviation Approved in | CSA Canada | UL USA | UL USA | CCC China | PTB Germany | BV France | GL Germany | LRS Gr. Britain | DNV Norway | PRS Poland | RINa Italy | MRS Russia |

Contactor relays

| Control supply | Type | CSA | UL | UL | CCC | PTB | BV | GL | LRS | DNV | PRS | RINa | MRS |
|----------------|----------------|-----|----|----|-----|-----|----|----|-----|-----|-----|------|-----|
| a.c. | 4-pole N... | ■ | — | ■ | ■ | — | ■ | ■ | ■ | ■ | — | ■ | — |
| | 8-pole N... | ■ | — | ■ | ■ | — | ■ | ■ | ■ | ■ | — | ■ | — |
| d.c. | 4-pole NL... | ■ | — | ■ | — | — | — | — | — | — | — | — | — |
| | 4-pole NL Z... | ■ | — | ■ | — | — | — | — | — | — | — | — | — |
| | 8-pole NL... | ■ | — | ■ | — | — | — | — | — | — | — | — | — |
| | 4-pole TNL... | ■ | — | ■ | — | — | — | — | — | — | — | — | — |
| | 8-pole TNL... | ■ | — | ■ | — | — | — | — | — | — | — | — | — |

Manual Motor Starters

| Amps | Type | CSA | UL | UL | CCC | PTB | BV | GL | LRS | DNV | PRS | RINa | MRS |
|-------------|--------|-----|----|----|-----|-----|----|----|-----|-----|-----|------|-----|
| 0.16 ... 16 | MS 116 | ■ | — | ■ | ■ | — | — | — | — | — | — | — | — |
| 0.16 ... 25 | MS 325 | ■ | — | ■ | ■ | — | ■ | ■ | ■ | ■ | — | — | — |
| 11 ... 50 | MS 450 | ■ | — | ■ | ■ | — | — | ■ | — | ■ | — | — | — |
| 28 ... 100 | MS 495 | ■ | — | ■ | ■ | — | — | ■ | — | ■ | — | — | — |

Thermal O/L Relays

| Amps | Type | CSA | UL | UL | CCC | PTB | BV | GL | LRS | DNV | PRS | RINa | MRS |
|-------------|--------------|-----|----|----|-----|-----|----|----|-----|-------|-----|------|-----|
| 0.10 ... 32 | TA 25 DU | ■ | — | ■ | ■ | ■ | ■ | ■ | ■ | ■ | — | ■ | — |
| 18 ... 42 | TA 42 DU | ■ | — | ■ | ■ | ■ | ■ | ■ | ■ | ■ | — | ■ | — |
| 18 ... 80 | TA 75 DU | ■ | — | ■ | ■ | ■ | ■ | ■ | ■ | ■ | — | ■ | — |
| 29 ... 80 | TA 80 DU | ■ | — | ■ | ■ | ■ | — | ■ | — | — | — | — | — |
| 65 ... 110 | TA 110 DU | ■ | — | ■ | ■ | ■ | — | ■ | — | — | — | — | — |
| 66 ... 200 | TA 200 DU | ■ | — | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| 130 ... 310 | TA 450 DU/SU | ■ | — | ■ | ■ | ■ | ■ | ■ | ■ | ■ (1) | ■ | ■ | ■ |

(1) Except for SU types.

Electronic O/L Relays

| Amps | Type | CSA | UL | UL | CCC | PTB | BV | GL | LRS | DNV | PRS | RINa | MRS |
|--------------|-----------|-----|----|-------|-----|-----|----|----|-----|-----|-----|------|-----|
| 0.1 ... 18.9 | E 16 DU | ■ | — | ■ | — | ■ | ■ | ■ | ■ | ■ | — | — | — |
| 65 ... 200 | E 200 DU | ■ | — | ■ | — | ■ | ■ | ■ | ■ | ■ | — | — | — |
| 105 ... 320 | E 320 DU | ■ | — | ■ | — | ■ | ■ | ■ | ■ | ■ | — | — | — |
| 170 ... 500 | E 500 DU | ■ | — | ■ | — | ■ | ■ | ■ | ■ | ■ | — | — | — |
| 270 ... 800 | E 800 DU | ■ | — | ■ | — | ■ | ■ | ■ | ■ | ■ | — | — | — |
| 375 ... 1250 | E 1250 DU | — | — | ■ (3) | — | — | — | — | — | — | — | — | — |

Accessories for contactors and contactors relays

| Designation | Type | CSA | UL | UL | CCC | PTB | BV | GL | LRS | DNV | PRS | RINa | MRS |
|--------------------|---------------------|-----|----|-------|-----|-----|----|----|-----|-----|-----|------|-----|
| Auxiliary contacts | CA 5-... | ■ | — | ■ | ■ | — | ■ | ■ | — | ■ | — | — | — |
| | CE 5-... | — | — | ■ | — | — | — | ■ | — | — | — | — | — |
| | CAL 5-11 | ■ | — | ■ | ■ | — | ■ | ■ | — | ■ | — | — | — |
| | CAL 18-11 | ■ | — | ■ (3) | ■ | — | — | — | — | — | — | — | — |
| | CEL 18-... | — | — | ■ (3) | — | — | — | — | — | — | — | — | — |
| | CAL 16-11 | ■ | — | ■ | — | — | — | — | — | — | — | — | — |
| Elec. Timer | TE5S... | — | ■ | — | — | — | — | — | — | — | — | — | — |
| Pneum. Timer | TP... | ■ | — | ■ | — | — | ■ | ■ | — | ■ | — | — | — |
| Mech. Interlock. | VM 5 | ■ | — | ■ | — | — | ■ | ■ | — | — | — | — | — |
| Elec. Interlock. | VE 5 | ■ | — | ■ | — | — | ■ | ■ | — | — | — | — | — |
| Mech. Interlock. | VM 300, VM 750 | ■ | — | ■ | — | — | — | — | — | — | — | — | — |
| Latching unit | WB 75-A | ■ | — | ■ | — | — | — | ■ | — | — | — | — | — |
| Surge suppressors | RV5 | ■ | — | ■ | — | — | ■ | ■ | — | ■ | — | — | — |
| | RC5 | ■ | — | ■ | — | — | — | ■ | — | ■ | — | — | — |
| | RT5 | ■ | — | ■ | — | — | — | ■ | — | — | — | — | — |
| Connecting links | BEA 7 ... BEA 110 | ■ | ■ | — | — | — | — | ■ | — | — | — | — | — |
| | BEA 185 ... BEA 750 | ■ | — | ■ (3) | — | — | — | ■ | — | — | — | — | — |

(3) UL listed to U.S. and Canadian Safety Standards.

Terms and Technical Definitions

Circuits

- auxiliary circuit:
All the conductive parts of a contactor designed to be inserted in a different circuit from the main circuit and the contactor control circuits.
- control circuit:
All the conductive parts of a contactor (other than the main circuit and the auxiliary circuit) used to control the contactor's closing operation or opening operation or both.
- main circuit:
All the conductive parts of a contactor designed to be inserted in the circuit that it controls.

Thermal Overload Relay Tripping Classes

IEC 60947-4-1 defines tripping classes 10 A, 10, 20 and 30. Types 10 A, 10, etc. correspond to the maximum tripping time for a making current at 7.2 times the setting current.

Furthermore, for each class the standard specifies the tripping time for 1.5 times the setting current and sets the non tripping condition at 1.05 times the setting current.

All these data are summarized in the table below.

Extract from IEC 60947-4-1:

| Tripping class | 10 A | 10 | 20 | 30 |
|----------------------------------------------------------------------------|-------------|--------|--------|--------|
| Max. tripping time for 1.5 times the setting current (warm state) s | 120 | 240 | 480 | 720 |
| Tripping time for 7.2 times the setting current (cold state) s | 2 - 10 | 4 - 10 | 6 - 20 | 9 - 30 |
| For 1.05 times the setting current | No tripping | | | |

Electromagnetic compatibility

AF... contactors comply with IEC 60947-1, 60947-4-1 and EN 60947-1, 60947-4-1 standards.

Definitions:

Environment A: "Mainly relates to low-voltage non public or industrial networks/locations/installations (EN 50082-2 article 4) including highly disturbing sources".

Environment B: "Mainly relates to low-voltage public networks (EN 50082-1 article 5) such as residential, commercial and light industrial locations/installations. Highly disturbing sources such as arc welders are not covered by this environment".

Notice for AF... contactors: This product has been designed for environment A. Use of this product in environment B may cause unwanted electromagnetic disturbances in which case the user may be required to take adequate mitigation measures.

Coordination of Protections against Short Circuit

The goal here is to protect electromechanical starters and softstarters.

Any starter is designed to:

- start motors,
- ensure continuous functioning of motors,
- disconnect motors from the supply line,
- guarantee protection of motors against overloads.

The starter is typically made up of a switching device (contactor) and an overload protection device (thermal overload relay TOR or electronic overload relay EOR). These two devices **MUST** be coordinated with equipment capable of providing protection against short circuit (SCPD: short circuit protective device): typically a circuit breaker with magnetic release only or a switch fuse. These are not necessarily part of the starter.

The characteristics of the starter must comply with the international standard IEC 60947-4-1 which defines the above items as follows:

contactor: a mechanical switching device having only one position of rest, operated otherwise than by hand, capable of making, carrying and breaking currents under normal circuit conditions including overload conditions.

overload release: overload relay or release which operates in the case of overload and also in case of loss of phase.

circuit-breaker: defined by IEC 60947-2 as a mechanical switching device, capable of making, carrying and breaking currents under normal circuit conditions and also making, carrying for a specified time and breaking currents under specified abnormal circuit conditions.

IEC publication 60947-4-1 defines coordination types "1" and "2":

- Type "1" coordination requires that, in the event of a short-circuit, the contactor or starter does not endanger persons or installations and will not then be able to operate without being repaired or parts being replaced.

- Type "2" coordination requires that, in short-circuit conditions, the contactor or starter does not endanger persons or installations and will be able to operate afterwards. The risk of contacts being light welded is acceptable. In this case, the manufacturer must stipulate the measures to be taken with respect to maintenance of the equipment.

Terms and Technical Definitions

Rated Operational Current I_e

Current rated by the manufacturer. It is mainly based on the rated operational voltage U_e , the rated frequency, the utilization category, the rated duty and the type of protective enclosure, if necessary.

Conventional Free Air Thermal Current I_{th}

Current that the contactor can withstand in free air for a duty time of 8 hours without the temperature rise of its various parts exceeding the maximum values given by the standard.

Operating Cycle or Cycle

Includes one making operation and one breaking operation.

Cycle Time

This is the sum of the current flow time and the no-current time for given cycle.

Electrical Durability

Number of on-load operating cycles that the contactor is able to carry out. It depends on the utilization category.

Mechanical Durability

Number of no-current operating cycles that a contactor is able to carry out.

Assessed Failure Rate

Defined according to IEC 60947-5-4. This rate is given in standard industrial environments for the contactor relays and for the built-in auxiliary contact of contactors.

Load Factor

Ratio of the on-load operating time to the total cycle time x 100.

Switching Frequency

Number of switching cycles per hour.

Plugging

Stopping or fast reversal in rotation direction of a motor by two supply leads being interchanged while the motor is running.

Inching

Energization of a motor's circuit repeatedly or for short periods with the aim of obtaining small movements of the driven mechanism.

Coil Operating Limits

Expressed in multiples of the nominal control circuit voltage U_c for the upper and lower limits.

Mounting Position

Comply with the manufacturer's instructions. Restrictions are to be taken into account for certain mounting positions.

Rated Breaking or Making Capacity

Root mean square (r.m.s.) value of the current that the contactor is able to break or make at a given voltage according to the conditions specified by standards and for a given utilization category.

Intermittent Duty

Duty during which the contactor is successively closed or open for periods which are too short to enable the contactor to achieve thermal balance.

Ambient Temperature

Air temperature close to the contactor.

Time

- Time constant:
Ratio of the inductance to the resistance ($L/R = \text{mH}/\Omega = \text{ms}$).
- Short-time withstand current:
Current that the contactor is able to withstand in closed position for a short time interval and in specified conditions.
- Closing time:
Time interval between the beginning of the closing operation and the instant the contacts touch on all the poles.
- Opening time:
Time interval between the specified starting instant of the opening operation and the instant the contacts separate on all the poles.

Rated Control Voltage U_c

Control voltage value for which the control circuit is sized.

Rated Operational Voltage U_e

Voltage to which the contactor's utilization characteristics refer. In three-phase it is the phase-to-phase voltage.

Rated Insulation Voltage U_i

Reference voltage for dielectric tests and creepage distances.

Rated Impulse Withstand Voltage U_{imp}

Peak value of an impulse voltage, having a specified form and polarity, which does not cause breakdown in specific test conditions.

Shock Withstand

Requirement for vehicles, crane drives, installations on board ships and plug-in equipment. For the acceptable "g" values, the contacts must not change position and the thermal overload relays must not trip.

Resistance to Vibrations

Requirements for vehicles, boats and other means of transport. For the specified vibration amplitude and frequency values the device must remain able to operate.

Standards and Utilization Categories

Standards:

IEC publications 60941-1, 60947-4-1 and 60947-5-1 should be referred to on an international level with respect to contactors, contactor relays and thermal O/L relays.

Utilization Categories:

A contactor's duty is characterised by the utilization category together with the rated operational voltage and current indicated.

Utilization Categories for Contactors According to IEC 60947-4-1:

| | | |
|-----------------------------|-------|------------------------------------------------------------------------------------------------|
| Alternating current: | AC-1 | Non-inductive or slightly inductive loads, resistance furnaces. |
| | AC-2 | Slip-ring motors: starting, switching off. |
| | AC-3 | Cage motors: starting, switching off running motors. |
| | AC-4 | Cage motors: starting, plugging, inching. |
| | AC-5a | Discharge lamp switching. |
| | AC-5b | Incandescent lamp switching. |
| | AC-6a | Transformer switching. |
| | AC-6b | Capacitor bank switching. |
| | AC-8a | Hermetic refrigeration compressor motor control with manual resetting of overload releases. |
| | AC-8b | Hermetic refrigeration compressor motor control with automatic resetting of overload releases. |
| Direct current: | DC-1 | Non inductive or slightly inductive loads, resistance furnaces. |
| | DC-3 | Shunt motors: starting, plugging, inching, dynamic breaking of d.c. motors. |
| | DC-5 | Series motors: starting, plugging, inching, dynamic breaking of d.c. motors. |
| | DC-6 | Incandescent lamp switching. |

Utilization Categories for Contactor Relays According to IEC 60947-5-1:

| | | |
|-----------------------------|-------|--------------------------------------------------------------------------|
| Alternating current: | AC-12 | Control of resistive loads and static loads with opto-coupler isolation. |
| | AC-13 | Control of static loads with transformer isolation. |
| | AC-14 | Control of weak electromagnetic loads (≤ 72 VA). |
| | AC-15 | Control of electromagnetic loads (> 72 VA). |
| Direct current: | DC-12 | Control of resistive loads and static loads with opto-coupler isolation. |
| | DC-13 | Control of d.c. electromagnets. |
| | DC-14 | Control of d.c. electromagnets having economy resistors. |

In fact some applications, and the specific criteria characterizing the various loads controlled by contactors, may modify the utilization characteristics of the contactors. The main applications concerned are:

Capacitor Bank Switching

Account must be taken of high peaks when the current is made and of harmonic currents during continuous duty. For this application, IEC publication 60947-4-1 stipulates utilization category AC-6b. The operational currents or powers acceptable for the contactors are determined by our electrical tests; IEC publication 60947-4-1 gives the calculating formula for determining the operational current (Table 7 b).

Transformer Switching

Account must be taken of the peaks due to magnetization phenomena when the current is made.

For this application, IEC publication 60947-4-1 stipulates utilization category AC-6a. The operational currents or powers acceptable for the contactors are determined using the values obtained for AC-3 or AC-4 category tests and the calculating formula given in IEC 60947-4-1 (Table 7 b).

Lighting Circuit Switching

The current peaks occurring on energization of the circuit and the power factor VA depend on the type of lamps, the connection mode and whether or not there is compensation.

For this application, IEC publication 60947-4-1 stipulates two standard utilization categories:

- AC-5a for discharge lamp switching.
- AC-5b for incandescent lamp switching.

Slip-ring Motor Switching

The contactors used for short-circuiting rotor resistors can be used for rotor voltages above their natural nominal operational voltage.

The conditions of use of rotor contactors depend on the connection mode of the main poles. IEC 60947-4-1 stipulates AC-2 utilization category.

The current values on circuit closing and the current and voltage values on circuit opening (as well as a generally low load factor) are easily withstood by the contactors.

Standards and Utilization Categories

Utilization Categories (cont.)

d.c. Power Circuit Switching

Arc suppression is more difficult in direct current than in alternating current. Higher the time constant and voltage, heavier the breaking conditions: consequently several poles have to be connected in series.

a.c. High Current Circuit Switching

Possibility of increasing performances by connecting poles in parallel.

Circuit Switching during Temporary and Intermittent Duty

In these cases higher operational currents are acceptable, the appropriate uprating factors are given in this catalogue (section 2).

Influence of the Length of the Conductors used in the Contactor Control Circuit

According to the operational voltages, the cross-sectional areas, the coil consumption and the control layout, difficulties due to line resistances and capacitances may appear during contactor closing and opening orders. The corresponding information is given in this catalogue (section 2).

Making and Breaking Conditions for Utilization Categories

| Utilization category | Durability test conditions | | | | | | Occasional operation Making and Breaking Capacities - 50 operating cycles | | | | | |
|----------------------|----------------------------|---------|----------------------------------|---------------------|---------|----------------------------------|------------------------------------------------------------------------------|-----------|----------------------------------|---------------------|-----------|----------------------------------|
| | Making conditions | | | Breaking conditions | | | Making conditions | | | Breaking conditions | | |
| | I/I_e | U/U_e | Cos. φ or L/R (ms) | I/I_e | U/U_e | Cos. φ or L/R (ms) | I_c/I_e | U_r/U_e | Cos. φ or L/R (ms) | I_c/I_e | U_r/U_e | Cos. φ or L/R (ms) |

Contactors for a.c. circuit switching

| | | | | | | | | | | | | | |
|-------------|----------------------------|---|------|------|---|------|------|------|------|------|------|------|------|
| AC-1 | 1 | 1 | 0.95 | 1 | 1 | 0.95 | 1.5 | 1.05 | 0.8 | 1.5 | 1.05 | 0.8 | |
| AC-2 | 2.5 | 1 | 0.65 | 2.5 | 1 | 0.65 | 4 | 1.05 | 0.65 | 4 | 1.05 | 0.65 | |
| AC-3 | $I_e < 17 \text{ A}$ | 6 | 1 | 0.65 | 1 | 0.17 | 0.65 | 10 | 1.05 | 0.45 | 8 | 1.05 | 0.45 |
| | $17 < I_e < 100 \text{ A}$ | 6 | 1 | 0.35 | 1 | 0.17 | 0.35 | 10 | 1.05 | 0.45 | 8 | 1.05 | 0.45 |
| | $I_e > 100 \text{ A}$ | 6 | 1 | 0.35 | 1 | 0.17 | 0.35 | 10 | 1.05 | 0.35 | 8 | 1.05 | 0.35 |
| AC-4 | $I_e < 17 \text{ A}$ | 6 | 1 | 0.65 | 6 | 1 | 0.65 | 12 | 1.05 | 0.45 | 10 | 1.05 | 0.45 |
| | $17 < I_e < 100 \text{ A}$ | 6 | 1 | 0.35 | 6 | 1 | 0.35 | 12 | 1.05 | 0.45 | 10 | 1.05 | 0.45 |
| | $I_e > 100 \text{ A}$ | 6 | 1 | 0.35 | 6 | 1 | 0.35 | 12 | 1.05 | 0.35 | 10 | 1.05 | 0.35 |

Contactors for d.c. circuit switching

| | | | | | | | | | | | | |
|-------------|-----|---|-----|-----|---|-----|-----|------|-----|-----|------|-----|
| DC-1 | 1 | 1 | 1 | 1 | 1 | 1 | 1.5 | 1.05 | 1 | 1.5 | 1.05 | 1 |
| DC-3 | 2.5 | 1 | 2 | 2.5 | 1 | 2 | 4 | 1.05 | 2.5 | 4 | 1.05 | 2.5 |
| DC-5 | 2.5 | 1 | 7.5 | 2.5 | 1 | 7.5 | 4 | 1.05 | 15 | 4 | 1.05 | 15 |

Contactor relays for a.c. circuit switching

| | | | | | | | | | | | | | |
|--------------|--------------------------|----|---|-----|---|---|-----|----|-----|-----|----|-----|-----|
| AC-14 | ($\leq 72 \text{ VA}$) | – | – | – | – | – | – | – | – | – | – | – | |
| AC-15 | (> 72 VA) | 10 | 1 | 0.7 | 1 | 1 | 0.4 | 6 | 1.1 | 0.7 | 6 | 1.1 | 0.7 |
| | | | | | | | | 10 | 1.1 | 0.3 | 10 | 1.1 | 0.3 |

Contactor relays for d.c. circuit switching

| | Standard operation | | | | | | Occasional operation Making and Breaking Capacities - 50 operating cycles | | | | | |
|--------------|--------------------|---------|------------|---------------------|---------|------------|------------------------------------------------------------------------------|---------|------------|---------------------|---------|------------|
| | Making conditions | | | Breaking conditions | | | Making conditions | | | Breaking conditions | | |
| | I/I_e | U/U_e | $T_{0.95}$ | I/I_e | U/U_e | $T_{0.95}$ | I/I_e | U/U_e | $T_{0.95}$ | I/I_e | U/U_e | $T_{0.95}$ |
| DC-13 | 1 | 1 | 6 P(1) | 1 | 1 | 6 P(1) | 1.1 | 1.1 | 6 P(1) | 1.1 | 1.1 | 6 P(1) |
| DC-14 | – | – | – | – | – | – | 10 | 1.1 | 15 ms | 10 | 1.1 | 15 ms |

(1) The value "6 x P" is the result of an empirical relation which is estimated to represent most d.c. magnetic loads up to the highest limit of $P = 50 \text{ W}$ ($6 \times P = 300 \text{ ms}$). It is accepted that loads having drawn energy above 50 W are made up of weaker loads in parallel. As a consequence, the 300 ms value must form the highest limit whatever the value of the power drawn.

Key:

U (I) = applied voltage (current)

U_r = recovery voltage

L/R = test circuit time constant

$U_e (I_e)$ = rated operational voltage (current)

I_c = making and breaking current expressed in d.c. or in a.c. like the r.m.s. value of the symmetrical components

$T_{0.95}$ = time required to reach 95% of the current in steady-state conditions, expressed in milliseconds

Degrees of Protection

General

In an installation, the degree of protection required for electrical equipment depends on the environmental characteristics. The degree of protection, ensured by the enclosure of equipment or by the cubicle containing the equipment is expressed by the IP code which gives the level of protection against access to hazardous parts, the ingress of foreign bodies and/or the ingress of water, in compliance with IEC 60529, IEC 60947-1.

Besides the IP symbol, the complete code has two figures followed (optionally) by two additional letters. A short description of the elements used in IP coding is given below.

| IP... code | Figures or letters | Specifications for installation protection | Protection of persons |
|---------------------------------------------------|--------------------|----------------------------------------------------------|------------------------------------------------|
| First figure | | Against ingress of foreign bodies | Against access to hazardous parts with: |
| | 0 | No protection | No protection |
| | 1 | Diameter > 50 mm | Back of hand |
| | 2 | Diameter > 12.5 mm | Finger |
| | 3 | Diameter > 2.5 mm | Tool |
| | 4 | Diameter > 1 mm | Wire |
| | 5 | Limited protection against dust | Wire |
| | 6 | Total protection against dust | Wire |
| Second figure | | Against entrance of water having a harmful effect | |
| | 0 | No protection | |
| | 1 | Vertical dripping | |
| | 2 | Dripping at a vertical angle of < 15° | |
| | 3 | Rain at a vertical angle of < 60° | |
| | 4 | Splashing | |
| | 5 | Low pressure water jet | |
| | 6 | Powerful water jets | |
| | 7 | Temporary immersion | |
| | 8 | Permanent immersion | |
| Additional letter (optional) for use with: | | Against ingress of foreign bodies | Against access to hazardous parts with: |
| First figure 0 | A | Stopped by a barrier with a 50 mm Ø sphere | Back of hand |
| First figure 0 or 1 | B | Entrance of test finger limited to 80 mm | Finger |
| First figure 1 or 2 | C | Wire with 2.5 mm Ø and length of 100 mm | Tool |
| First figure 2 or 3 | D | Wire with 1 mm Ø and length of 100 mm | Wire |
| Additional letter (optional) | | Specific additional information | |
| | H | High voltage apparatus | – |
| | M | Moving parts which are moving during water test | |
| | S | Moving parts which are stationary during water test | |
| | W | Specified atmospheric conditions | |

Note: The type of enclosure or cubicle in which the equipment must be installed prevails with respect to the degree of protection.

Climatic Withstand of Devices

The life time of devices are mainly influenced by series of climatic factors which cause their corrosion.

In practice, besides climatic conditions, there are other factors which may damage equipment such as fungi, insects (termites), dust, work site dirt and aggressive environment (salty or sulphurous atmosphere, etc.) which can often only be identified at the place of installation.

Climatic stress, definitions and test conditions are dealt with in national publications such as the DIN 50 series and UTE 63-100 publication which are attached to international publications such as IEC 60068.

The test conditions are:

| Description | Symbolization | Time of one cycle | Cycle phase time | Temperature in test chamber | Relative humidity |
|-----------------------------------|---------------------------|-------------------|------------------------------------------|-----------------------------|-------------------|
| Humidity and variable temperature | IEC 60068-2-30 Test Db | 24 hours | 12 hours including rise in temperature | 40 °C | 95 % |
| | | | 12 hours including cooling (open device) | 25 °C | 95 % |

ABB contactors have been used for many years in the most countries, with hot and humid climates for example: Brazil, Indonesia, India or on ships. Experience has shown that ABB devices can be used in most countries throughout the world.

The climate of the country in which the apparatus is installed is not the determining choice factor.

Account must be taken of:

- the immediate environment of the devices (sheltered, ventilated, temperature),
- the aggressivity of the immediate atmosphere at the place of installation,
- the length and frequency of non operating periods.

In the case of frequent condensation (i.e. the formation of condensation caused by rapid changes in temperature), heating resistors must be installed in cubicles (100 to 250 W per m³ of enclosure).

The table below gives the cases where heating is necessary.

| Environment | | Operating conditions | Climate | Internal heating of enclosure |
|---------------------------|-------------------------------------|------------------------|-----------------------|-------------------------------|
| Inside premises | No running water No condensation | Continuous or not | All climates | Without |
| | | Continuous | All climates | Without |
| | With running water | Frequent or long stops | Temperate Tropical | Without With |
| Outside, sheltered | No running water no condensation | Continuous or not | Temperate | Without |
| | | | Tropical | With |
| Outside or by the seaside | With running water | Continuous | All climates | Without |
| | | | Temperate | Without |
| | | | Tropical | With |

The entrance of dust, insects, dirt, etc. in devices may be prevented if the appropriate degree of protection according to IEC 60529 is chosen (See "Degree of protection" table).



Coordination with Short-circuit Protection Devices

In compliance with standards IEC 60947-4-1 and EN 60947-4-1, we define for the contactors and starters the type, rating and characteristics of the short-circuit protection devices SCPD which allow selective protection against overloads and ensure protection against short circuits.

Basic Functions

Any starter is designed to:

- start motors,
- ensure continuous functioning of motors,
- disconnect motors from the supply line,
- guarantee protection of motors against overloads.

The starter is typically made up of a switching device (contactor) and an overload protection device (thermal overload relay TOR or electronic overload relay EOR).

These two devices MUST be coordinated with equipment capable of providing protection against short circuit (SCPD: short circuit protective device): typically a circuit breaker with magnetic release only or a switch fuse. These are not necessarily part of the starter..

Applicable Standards

IEC 60947-4-1 (EN 60947-4-1) precisely defines the different points to be considered in order to carry out correct coordination.

Complete coordination for a combination includes the following points:

- Selectivity test between the overload relay and the short-circuit protection device SCPD.
- Short-circuit condition tests:

- at prospective "r" currents - These currents depend on the rated operational current of the starter (I_e AC-3) and are given by the standard (Table 11). For example:

$r = 1\text{ kA}$ for I_e AC-3 < 16 A

$r = 3\text{ kA}$ for 16 A < I_e AC-3 < 63 A

$r = 5\text{ kA}$ for 63 A < I_e AC-3 < 125 A etc.

- at the rated prospective short-circuit current " I_q " - This is the maximum current that the combination can withstand, for example 50 kA.

Types of Coordination

IEC 60947-4-1 (EN 60947-4-1) defines two types of coordination according to the expected level of service continuity. Acceptable extreme damage for the switchgear is divided into two types.

Type 1: In short-circuit conditions, the contactor or starter does not endanger persons or installations and will not be able to then operate without being repaired or having parts replaced.

Type 2: In short-circuit conditions, the contactor or starter does not endanger persons or installations and will be able to operate afterwards. The risk of contacts light welding is acceptable.

The Complete ABB Offer

ABB has acquired years of experience with respect to problems of coordination and is able to make a complete offer based on tests performed in its qualified laboratories. This offer includes 400 V, 500 V, 690 V networks.

A complete data base of coordination tables, according to IEC 60947-4-1 (EN 60947-4-1), is available on the ABB Website.

In the coordination tables the following short-circuit protection devices are recommended:

- Moulded case circuit-breakers (MCCBs)
- Miniature circuit-breakers (MCBs)
- Switch-disconnector-fuses (aM, gG and BS)
- Manual Motor Starters (M.M.S.)

General Remarks Applicable to all Tables

- Each table is defined for a maximum ambient temperature of 40 °C. For higher temperatures, apply a derating factor according to the following rules:
 - Fuses: factor of 0.8 applied to I_n for an ambient temperature of 70 °C.
 - MCCBs and MCBs: factor of 0.8 applied to I_n for an ambient temperature of 60 °C.
 - The starter derating factor depends on the operating conditions of thermal overload relays:
 - Factor of 0.9 applied to I_n for an ambient temperature of 70 °C.
- Each table is defined for motor currents: 3-phase motors, 4-pole.
- **Normal starting** means a starting time < 2 s. - **Difficult starting** means an accelerating time 10 s < t_s < 30 s.
 - Tripping classes** of thermal O/L relays according to IEC 60947-4-1 (EN 60947-4-1): 10 A and 10 for DU types and 30 for SU types.
- In the tables with MCCBs, these are fitted with the magnetic relay alone. Setting is always carried out at > 12.3 I_e AC-3 so that the transient current peak occurring during starting does not lead to tripping.

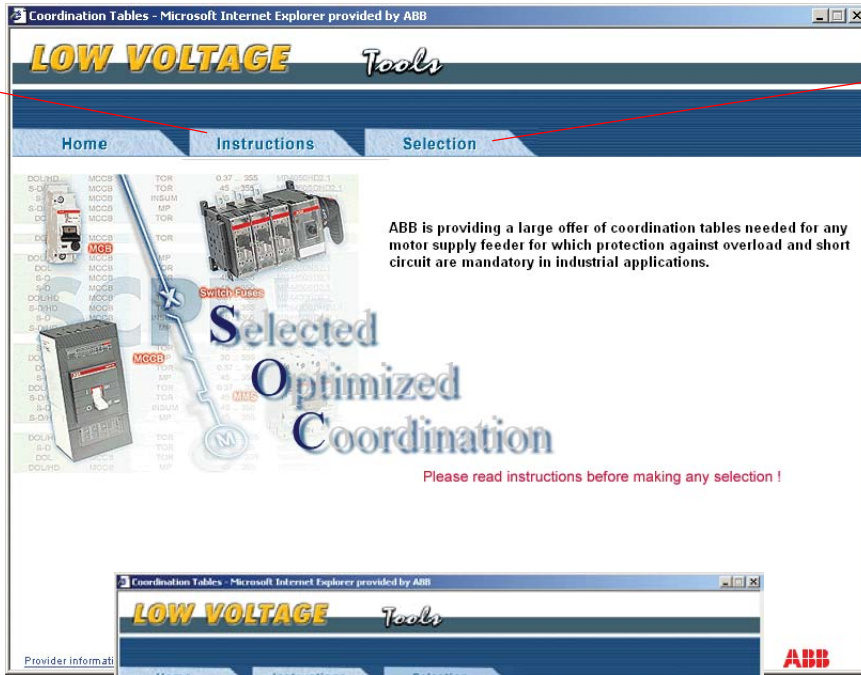
Coordination with Short-circuit Protection Devices

A motor starter is typically made up of a switching device (contactor) and an overload protection device (see opposite page "Basic Functions"). **These two devices MUST be coordinated with an equipment capable of providing protection against short circuit (SCPD: Short Circuit Protection Device).**

A complete data base of coordination tables, according to IEC 60947-4-1 (EN 60947-4-1), is available on the ABB Website: see www.abb.com/lowvoltage then go to the right menu: "Support", select: "Online Product Selection Tools".

Online Selected Optimized Coordination Tables

- [Introduction](#)
- [Instructions](#)
- [F.A.Q.](#)
- [Troubleshooting](#)



Short Circuit Protection Device (SCPD) selection

Selection

- [Switch-disconnector-fuses \(aM and gG\)](#)
- [Miniature Circuit-Breakers \(MCBs\)](#)
- [Moulded Case Circuit-Breakers \(MCCBs\)](#)
- [Manual Motor Starters \(MMS\)](#)

| Rated Output [kW] | Rated Cu [A] |
|-------------------|--------------|
| 0.06 | 0.22 |
| 0.09 | 0.22 |
| 0.12 | 0.41 |
| 0.18 | 0.60 |
| 0.25 | 0.83 |
| 0.37 | 1.12 |
| 0.55 | 1.48 |
| 0.75 | 1.9 |
| 1.1 | 2.6 |
| 1.5 | 3.5 |
| 2.2 | 4.8 |
| 3 | 6.5 |
| 4 | 8.5 |
| 5.5 | 11.5 |
| 7.5 | 15 |
| 11 | 22 |

| Rated Output [kW] | Rated Current [A] | Type | Fuse Rating gG-Fuse [A] | Fuse Type and Size | Type | Type | Current setting range [A] | Max. Allowed Setting Current [A] | Table |
|-------------------|-------------------|----------|-------------------------|--------------------|------|------------|---------------------------|----------------------------------|---------------|
| 0.37 | 1.1 | OS 32S_4 | 4 | OFAA 00H | AG | TA250U 1.4 | 1.0 - 1.4 | 1.4 | FA3300S1002.2 |
| 0.37 | 1.1 | OS 32S_3 | 3 | OFAM 00aM | AG | TA250U 1.4 | 1.0 - 1.4 | 1.4 | FA3300S1002.2 |
| 0.37 | 1.1 | OS 32S_4 | 4 | OFAA 00H | AG | ODPCB_ | 7 | 1.3 | FA3300S1002.2 |
| 0.37 | 1.1 | OS 32S_2 | 2 | OFAM 00aM | AG | ODPCB_ | 7 | 1.4 | FA3300S1002.2 |

Complete coordination tables are available for the **Short Circuit Protection Device (SCPD)**, the **Contactors** and the **Overload Protection Device** according to the **Rated Operational Voltage U_e** , the **Rated Short-circuit Current I_n** , the **Coordination Type** (type 1 or 2) and the **Motor Power**.

www.abb.com/lowvoltage Online Selected Optimized Coordination Tables

Coordination with Short-circuit Protection Devices according to IEC 60947-4-1

IEC Fuse Coordination Table

IEC Fuses for Short-circuit Protection - Thermal Overload Relay for Motor Protection

Updated table is available on the ABB Website:

see www.abb.com/lowvoltage then go to the right menu: "Support", select: "Online Product Selection Tools".

Coordinated protections of motor Starters.
Direct-on-line starter with Switch Fuse
400 V, 80 kA, IEC/EN 60947-4-1, AC-3, type 2
Normal start
Table number: FG4080NS2.2

| Motor | Rated Output [kW] | Rated Current [A] | Switch-Fuse | | Contactor | Overload Protection Device | | Max. Allowed Setting Current [A] |
|-------|-------------------|-------------------|-------------|-------------------------|-----------|----------------------------|-------------------------------------------------------------|----------------------------------|
| | | | Type | Fuse Rating gG / gM [A] | | Type | Current setting range [A] t6 setting max for starter [s] | |
| | | | | | | | 1.0 - 1.4 | 1.4 |
| | | | | | | TA25DU 1.4 | 1.3 - 1.8 | 1.8 |
| | | | | | | TA25DU 1.8 | 1.7 - 2.4 | 2 |
| | | | | | | TA25DU 2.4 | 2.2 - 3.1 | 3.1 |
| | | | | | | TA25DU 3.1 | 3.5 - 5.0 | 5 |
| | | | | | | TA25DU 5.0 | 2.8 - 4.0 | 3.7 |
| | | | | | | TA25DU 4.0 | 4.5 - 6.5 | 6.5 |
| | | | | | | TA25DU 6.5 | 6.0 - 8.5 | 8 |
| | | | | | | TA25DU 8.5 | 7.5 - 11 | 9 |
| | | | | | | TA25DU 11 | 10 - 14 | 12 |
| | | | | | | TA25DU 14 | 13 - 19 | 15.5 |
| | | | | | | TA25DU 19 | 13 - 19 | 17 |
| | | | | | | TA25DU 19 | 13 - 19 | 25 |
| | | | | | | TA25DU 19 | 13 - 19 | 25 |
| | | | | | | TA25DU 25 | 18 - 25 | 32 |
| | | | | | | TA25DU 32 | 24 - 32 | 37 |
| | | | | | | TA25DU 32 | 29 - 42 | 40 |
| | | | | | | TA25DU 42 | 29 - 42 | 40 |
| | | | | | | TA25DU 42 | 29 - 42 | 50 |
| | | | | | | TA75DU 42 | 36 - 52 | 60 |
| | | | | | | TA75DU 62 | 45 - 63 | 63 |
| | | | | | | TA75DU 63 | 45 - 63 | 80 |
| | | | | | | TA75DU 63 | 45 - 63 | 80 |
| | | | | | | TA80DU 80 | 60 - 80 | 90 |
| | | | | | | TA110DU 90 | 65 - 90 | 90 |
| | | | | | | TA200DU 90 | 65 - 90 | 90 |

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Example for 400 V, I_n up to 80 kA, coordination type 2

Complete coordination tables are available for the **Short Circuit Protection Device (SCPD)**, the **Contactor** and the **Overload Protection Device** according to the **Rated Operational Voltage U_e**, the **Rated Short-circuit Current I_n**, the **Coordination Type** (type 1 or 2) and the **Motor Power**.

www.abb.com/lowvoltage Online Selected Optimized Coordination Tables

Coordination with Short-circuit Protection Devices according to IEC 60947-4-1

BS Fuse Coordination Table

BS Fuses for Short-circuit Protection - Thermal Overload Relay for Motor Protection

Updated table is available on the ABB Website:

see www.abb.com/lowvoltage then go to the right menu: "Support", select: "Online Product Selection Tools".

Coordinated protections of motor Starters.

Direct-on-line starter with Switch Fuse
415 V, 80 kA, IEC/EN 60947-4-1, AC-3, type 2
Normal start

Table number: FGB4180NS2.31ABB

| Motor | | Switch-Fuse | | Contactor | Overload Protection Device | | Max. Allowed Setting Current |
|-------------------|-------------------|-------------|----------------------------------|-----------|----------------------------|-------------------------------------------------------------|------------------------------|
| Rated Output [kW] | Rated Current [A] | Type | Fuse Type and Rating gG / gM [A] | Type | Type | Current setting range [A] t6 setting max for starter [s] | [A] |
| 0.37 | 1.15 | OS 20B_A1 | ANIT4 | A0 | TA25DU 1.4 | 1.0 - 1.4 | 1.2 |
| 0.55 | 1.4 | OS 20B_A1 | ANIT6 | A0 | TA25DU 1.8 | 1.3 - 1.8 | 1.6 |
| 0.75 | 2 | OS 20B_A1 | ANIT6 | A0 | TA25DU 2.4 | 1.7 - 2.4 | 2 |
| 1.1 | 2.5 | OS 20B_A1 | ANIT10 | A0 | TA25DU 3.1 | 2.2 - 3.1 | 2.7 |
| 1.5 | 3.5 | OS 20B_A1 | ANIT16 | A0 | TA25DU 4.0 | 2.8 - 4.0 | 3.7 |
| 2.2 | 5 | OS 20B_A1 | ANIT16 | A0 | TA25DU 5.0 | 3.5 - 5.0 | 5 |
| 3 | 6.5 | OS 20B_A1 | ANIT20 | A0 | TA25DU 6.5 | 4.5 - 6.5 | 6.5 |
| 4 | 8.4 | OS 20B_A1 | ANIT20 | A0 | TA25DU 8.5 | 6.0 - 8.5 | 8.4 |
| 5.5 | 11 | OS 20B_A1 | ANIT32 | A12 | TA25DU 11 | 7.5 - 11 | 11 |
| 5.5 | 11 | OS 32B_A2 | ATIA32M40 | A26 | TA25DU 14 | 10 - 14 | 14 |
| 7.5 | 14 | OS 32B_A2 | ATIA32M50 | A26 | TA25DU 19 | 13 - 19 | 18 |
| 11 | 21 | OS 32B_A2 | ATIA32M63 | A30 | TA25DU 25 | 18 - 25 | 21 |
| 15 | 28 | OS 32B_ | ATIS63M80 | A40 | TA42DU 32 | 24 - 32 | 25 |
| 18.5 | 35 | OS 63B_ | ATIS63M80 | A40 | TA42DU 42 | 29 - 42 | 32 |
| 18.5 | 35 | OS 100B_ | ATIS63M100 | A60 | TA75DU 42 | 29 - 42 | 35 |
| 22 | 40 | OS 100B_ | ATIS63M100 | A60 | TA75DU 52 | 36 - 52 | 42 |
| 30 | 55 | OS 125B_ | ATCP100M125 | A63 | TA75DU 63 | 45 - 63 | 45 |
| 30 | 55 | OS 125B_ | ATCP100M160 | A85 | TA80DU 63 | 45 - 63 | 55 |
| 37 | 66 | OS 125B_ | ATCP100M160 | A85 | TA80DU 80 | 60 - 80 | 63 |
| 45 | 80 | OS 125B_ | ATCP100M160 | A85 | TA110DU 90 | 65 - 90 | 72 |
| 55 | 100 | OS 160B_ | ATCP100M200 | A115 | TA110DU 110 | 80 - 110 | 80 |

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Example for 415 V, I_q up to 80 kA, coordination type 2

Complete coordination tables are available for the Short Circuit Protection Device (SCPD), the Contactor and the Overload Protection Device according to the Rated Operational Voltage U_e, the Rated Short-circuit Current I_q, the Coordination Type (type 1 or 2) and the Motor Power.

www.abb.com/lowvoltage Online Selected Optimized Coordination Tables

Coordination with Short-circuit Protection Devices according to IEC 60947-4-1

Miniature Circuit-Breaker (MCB) Coordination Table

Miniature Circuit-Breakers (MCBs) for Short-circuit Protection - Thermal Overload Relay for Motor Protection

Updated table is available on the ABB Website:

see www.abb.com/lowvoltage then go to the right menu: "Support", select: "Online Product Selection Tools".

Coordinated protections of motor Starters.

Direct-on-line starters with S 273/S283-K Circuit Breaker
400 V, 35 kA, 50/60Hz, AC-3, EN/IEC 60947-4-1, type 2

Table number: MC4035NS2.1

| Motor | Rated Current [A] | Rated Output [kW] | Miniature Circuit-Breaker Type | Instantaneous tripping current [A] | Limiter Type | Instantaneous tripping current [A] | Contactor Type | Overload Relay Type | Current setting range [A] | Trip Class | Max allowed setting current [A] |
|-------|-------------------|-------------------|--------------------------------|------------------------------------|--------------|------------------------------------|----------------|---------------------|---------------------------|------------|---------------------------------|
| 0.06 | 0.22 | | S 273-K1 | 12 | | | A9 | TA25DU0.25 | 0.16 - 0.25 | | 0.25 |
| 0.09 | 0.34 | | S 273-K1 | 12 | | | A9 | TA25DU0.4 | 0.25 - 0.4 | | 0.4 |
| 0.12 | 0.44 | | S 273-K1 | 12 | | | A9 | TA25DU0.63 | 0.4 - 0.63 | | 0.63 |
| 0.18 | 0.60 | | S 273-K1.6 | 19.2 | | | A9 | TA25DU0.63 | 0.4 - 0.63 | | 0.63 |
| 0.25 | 0.83 | | S 273-K1.6 | 19.2 | | | A9 | TA25DU1 | 0.63 - 1 | | 1 |
| 0.37 | 1.12 | | S 273-K2 | 24 | | | A9 | TA25DU1.4 | 1 - 1.4 | | 1.35 |
| 0.55 | 1.45 | | S 273-K3 | 36 | | | A9 | TA25DU1.8 | 1.3 - 1.8 | | 1.75 |
| 0.75 | 1.9 | | S 273-K3 | 36 | | | A9 | TA25DU2.4 | 1.7 - 2.4 | | 2.35 |
| 1.1 | 2.6 | | S 273-K4 | 48 | | | A16 | TA25DU2.4 | 1.7 - 2.4 | | 2.95 |
| 1.5 | 3.5 | | S 273-K6 | 72 | | | A26 | TA25DU3.1 | 2.3 - 3.1 | | 3.75 |
| | | | | | | | A26 | TA25DU4 | 2.8 - 4 | | 4.75 |
| | | | | | | | A26 | TA25DU5 | 3.5 - 5 | | 6.25 |
| | | | | | | | A26 | TA25DU6.5 | 4.5 - 6.5 | | 8 |
| 2.2 | 4.8 | | S 273-K8 | 96 | | | A26 | TA25DU8.5 | 6 - 8.5 | | 10.5 |
| 3 | 6.5 | | S 283-K10 | 140 | | | A30 | TA25DU11 | 7.5 - 11 | | 13.5 |
| 4 | 8.5 | | S 283-K13 | 182 | | | A30 | TA25DU14 | 10 - 14 | | 18.5 |
| 5.5 | 11.5 | | S 283-K16 | 224 | | | A30 | TA25DU19 | 13 - 19 | | 24 |
| 7.5 | 15 | | S 283-K20 | 280 | | | A40 | TA42DU25 | 18 - 25 | | |
| 11 | 22 | | S 283-K32 | 448 | | | | | | | |

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Example for 400 V, I_q up to 35 kA, coordination type 2

Complete coordination tables are available for the **Short Circuit Protection Device (SCPD)**, the **Contactor** and the **Overload Protection Device** according to the **Rated Operational Voltage U_e**, the **Rated Short-circuit Current I_q**, the **Coordination Type** (type 1 or 2) and the **Motor Power**.

www.abb.com/lowvoltage Online Selected Optimized Coordination Tables

Coordination with Short-circuit Protection Devices according to IEC 60947-4-1

Moulded Case Circuit-Breaker (MCCB) Coordination Table

Moulded Case Circuit-Breakers (MCCBs) for Short-circuit Protection - Thermal Overload Relay for Motor Protection

Updated table is available on the ABB Website:

see www.abb.com/lowvoltage then go to the right menu: "Support", select: "Online Product Selection Tools".

Coordinated protections of motor Starters.
 Direct-On-Line starters with Moulded Case Circuit Breaker 400/415 V, 80 kA, 50/60HZ, IEC/EN 60947-4-1, AC-3, type 2
 Normal start
 Table number: MB4080NS2.2

| Motor | | Moulded Case Circuit Breaker | Contactor | Overload Relay | KORC | Max allowed setting current [A] |
|------------------|-------------------|------------------------------|-----------|----------------|-------------------------|---------------------------------|
| Rated Power [kW] | Rated Current [A] | Type | Type | Type | Number of primary turns | |
| 0.37 | 1.1 | T2L160 MF 1.6 | A6 | TA25DU1.4; | 1-1.4 | 1.4 |
| 0.55 | 1.5 | T2L160 MF 1.6 | A6 | TA25DU1.8 | 1.3-1.8 | 1.6 |
| 0.75 | 1.9 | T2L160 MF 2 | A16 | TA25DU2.4; | 1.7-2.4 | 2 |
| 1.1 | 2.8 | T2L160 MF 3.2 | A26 | TA25DU4 | 2.8-4 | 3.2 |
| 1.5 | 3.5 | T2L160 MF 4 | A26 | TA25DU5; | 3.5-5 | 4 |
| 2.2 | 5 | T2L160 MF 5 | A26 | TA25DU6.5 | 4.5-6.5 | 5 |
| 3 | 6.6 | T2L160 MF 8.5 | A30 | TA25DU8.5; | 6-8.5 | 8.5 |
| 4 | 8.6 | T2L160 MF 11 | A60 | TA25DU11 | 7.5-11 | 11 |
| 5.5 | 11.5 | T2L160 MF 12.5 | A60 | TA25DU14; | 10-14 | 12.5 |
| 7.5 | 15.2 | T2L160 MA 20 | A60 | TA25DU19 | 13-19 | 19 |
| 11 | 22 | T2L160 MA 32 | A60 | TA25DU25; | 18-25 | 25 |
| 15 | 28.5 | T2L160 MA 52 | A60 | TA75DU42 | 29-42 | 42 |
| 18.5 | 36 | T2L160 MA 52 | A60 | TA75DU52; | 36-52 | 50 |
| 22 | 42 | T2L160 MA 80 | A63 | TA75DU52 | 36-52 | 65 |
| 30 | 56 | T2L160 MA 80 | A75 | TA75DU80; | 60-80 | 75 |
| 37 | 68 | T2L160 MA 100 | A95 | TA75DU80 | 60-80 | 96 |
| 45 | 83 | T4L250 PR221-1 In160 | A110 | TA110DU110; | 80-110 | 110 |
| 55 | 98 | T4L250 PR221-1 In250 | A145 | TA110DU110 | 80-110 | 145 |
| 75 | 135 | T4L250 PR221-1 In250 | A185 | E200DU; | 60-200 | 185 |
| 90 | 158 | T4L320 PR221-1 In320 | A210 | E200DU | 60-200 | 210 |
| 110 | 193 | T4L320 PR221-1 In320 | A260 | E320DU; | 100-320 | 260 |
| 132 | 232 | T5L400 PR221-1 In400 | A260 | E320DU | 100-320 | 260 |

Example for 400/415 V, I_q up to 80 kA, coordination type 2

Complete coordination tables are available for the Short Circuit Protection Device (SCPD), the Contactor and the Overload Protection Device according to the Rated Operational Voltage U_e, the Rated Short-circuit Current I_q, the Coordination Type (type 1 or 2) and the Motor Power.

www.abb.com/lowvoltage Online Selected Optimized Coordination Tables

Coordination with Short-circuit Protection Devices according to IEC 60947-4-1

Manual Motor Starter (MMS) Coordination Table

MS 116 Manual Motor Starter (MMS) for Short-circuit and Motor Protection

Updated table is available on the ABB Website:

see www.abb.com/lowvoltage then go to the right menu: "Support", select: "Online Product Selection Tools".

Coordinated protections of motor Starters.

Table number: MM4016NS1.MS116.2

| Motor | Rated Current [A] | Type | Instantaneous tripping current [A] | Current setting range [A] | Contactor Type | Max. allowed setting current [A] |
|-------|-------------------|------------|------------------------------------|---------------------------|----------------|----------------------------------|
| 0.06 | 0.22 | MS116-0,25 | 3 | 0,16 - 0,25 | A0 | 0,25 |
| 0.09 | 0.34 | MS116-0,40 | 4.8 | 0,25 - 0,40 | A0 | 0,4 |
| 0.12 | 0.44 | MS116-0,63 | 7.56 | 0,40 - 0,63 | A0 | 0,63 |
| 0.18 | 0.72 | MS116-1,00 | 12 | 0,63 - 1,00 | A0 | 1 |
| 0.25 | 0.83 | MS116-1,00 | 12 | 0,63 - 1,00 | A0 | 1 |
| 0.37 | 1.12 | MS116-1,60 | 19.2 | 1,00 - 1,60 | A0 | 1,6 |
| 0.55 | 1.45 | MS116-1,60 | 19.2 | 1,00 - 1,60 | A0 | 1,6 |
| 0.75 | 1.9 | MS116-2,50 | 30 | 1,60 - 2,50 | A0 | 2,5 |
| 1.1 | 2.59 | MS116-4,00 | 48 | 2,50 - 4,00 | A0 | 4 |
| 1.5 | 3.45 | MS116-4,00 | 48 | 2,50 - 4,00 | A0 | 4 |
| 2 | 4 | MS116-6,30 | 75.6 | 4,00 - 6,30 | A0 | 6,3 |
| 2.2 | 4.8 | MS116-6,30 | 75.6 | 4,00 - 6,30 | A0 | 6,3 |
| 3 | 6.48 | MS116-10,0 | 120 | 6,30 - 10,0 | A12 | 10 |
| 4 | 8.6 | MS116-10,0 | 120 | 6,30 - 10,0 | A12 | 10 |
| 5.5 | 11.1 | MS116-12,0 | 144 | 8,00 - 12,0 | A12 | 12 |
| 7.5 | 14.8 | MS116-16,0 | 192 | 10,0 - 16,0 | A16 | 16 |

Comments :

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Example for 400 V, I_n up to 16 kA, coordination type 1

Complete coordination tables are available for the **Short Circuit Protection Device (SCPD)**, the **Contactor** and the **Overload Protection Device** according to the **Rated Operational Voltage U_e**, the **Rated Short-circuit Current I_n**, the **Coordination Type** (type 1 or 2) and the **Motor Power**.

www.abb.com/lowvoltage Online Selected Optimized Coordination Tables

Coordination with Short-circuit Protection Devices according to IEC 60947-4-1

Manual Motor Starter (MMS) Coordination Table

MS 325 Manual Motor Starter (MMS) for Short-circuit and Motor Protection

Updated table is available on the ABB Website:

see www.abb.com/lowvoltage then go to the right menu: "Support", select: "Online Product Selection Tools".

Coordinated protections of motor Starters.
400 V, 50 kA/50/60Hz, AC-3, EN/IEC 60947-4-1, type 2
Table number: MM4050NS2.2

| Rated Output [kW] | Rated Current [A] | Motor | Manual Motor Controller | Instantaneous tripping current [A] | Current setting range [A] | Type | Contactor | Max allowed setting current [A] |
|-------------------|-------------------|------------|-------------------------|------------------------------------|---------------------------|------|-----------|---------------------------------|
| 0.06 | 0.22 | MS325-0.25 | 2.44 | 0.16 - 0.25 | | A0 | 0.25 | |
| 0.09 | 0.34 | MS325-0.40 | 3.9 | 0.25 - 0.40 | | A0 | 0.4 | |
| 0.12 | 0.44 | MS325-0.63 | 6.14 | 0.40 - 0.63 | | A0 | 0.63 | |
| 0.18 | 0.72 | MS325-1.00 | 11.5 | 0.63 - 1.00 | | A0 | 1 | |
| 0.25 | 0.83 | MS325-1.00 | 11.5 | 0.63 - 1.00 | | A0 | 1 | |
| 0.37 | 1.12 | MS325-1.60 | 18.4 | 1.00 - 1.60 | | A0 | 1.6 | |
| 0.55 | 1.46 | MS325-1.60 | 18.4 | 1.00 - 1.60 | | A0 | 1.6 | |
| 0.75 | 1.9 | MS325-2.50 | 28.75 | 1.60 - 2.50 | | A0 | 2.5 | |
| 1.1 | 2.59 | MS325-4.00 | 50 | 2.50 - 4.00 | | A12 | 4 | |
| 1.5 | 3.46 | MS325-4.00 | 50 | 2.50 - 4.00 | | A12 | 4 | |
| 2 | 4 | MS325-6.30 | 78.75 | 4.00 - 6.30 | | A26 | 6.3 | |
| 2.2 | 4.8 | MS325-6.30 | 78.75 | 4.00 - 6.30 | | A26 | 6.3 | |
| 3 | 6.48 | MS325-9.00 | 135 | 6.30 - 9.00 | | A26 | 9 | |
| 4 | 8.6 | MS325-9.00 | 135 | 6.30 - 9.00 | | A26 | 9 | |
| 5.5 | 11.1 | MS325-12.5 | 187.5 | 9.00 - 12.5 | | A26 | 12.5 | |
| 7.5 | 14.8 | MS325-16.0 | 240 | 12.5 - 16.0 | | A26 | 16 | |
| 9 | 18.3 | MS325-20.0 | 300 | 16.0 - 20.0 | | A26 | 20 | |
| 11 | 21.5 | MS325-25.0 | 375 | 20.0 - 25.0 | | A30 | 25 | |
| 15 | 30 | MS450-32.0 | 416 | 22.0 - 32.0 | | A30 | 30 | |
| 18.5 | 37 | MS450-40.0 | 520 | 28.0 - 40.0 | | A40 | 38 | |
| 22 | 45 | MS450-50.0 | 650 | 36.0 - 50.0 | | A50 | 47.5 | |
| ^^ | ^^ | ^^ | ^^ | ^^ | ^^ | ^^ | ^^ | |

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Example for 400 V, I_q up to 50 kA, coordination type 2

Complete coordination tables are available for the **Short Circuit Protection Device (SCPD)**, the **Contactor** and the **Overload Protection Device** according to the **Rated Operational Voltage U_e**, the **Rated Short-circuit Current I_q**, the **Coordination Type** (type 1 or 2) and the **Motor Power**.

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