

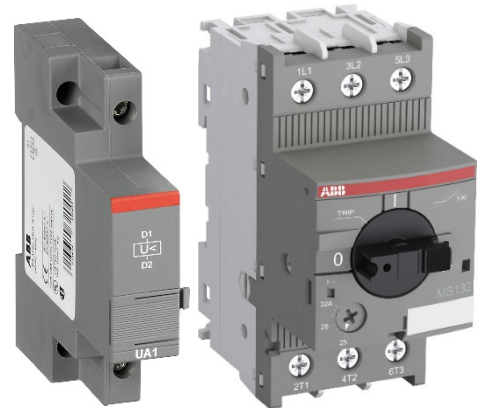
APPLICATION NOTE

# Emergency switching-off application

## Manual motor starters

## Undervoltage release

**Emergency switching-off applications with manual motor starters from ABB provide machine and job safety for nominal currents up to 80 A. They comply with IEC/EN 60204-1 standard stop-category 0 and in addition to legal and standard requirements for electrical and functional safety of machinery.**



### Introduction

This publication gives an overview on functionality and on relevant standards for an emergency switching-off application according to stop-category 0. It also explains how to select the necessary components to realize this kind of application.

In case of emergency off, power to the system must be switched off to prevent electrical hazards (e.g. electric shocks). Emergency switching-off applications must be used to shut off the flow of electricity in installations, whenever there is a risk of electrical shocks or damages for people and equipment.

This application can be found in many industries such as:

- food and beverage
- packaging machinery
- plastics processing
- metallurgy and metal processing
- timber industry
- manufacturing industry

To realize an emergency switching-off application the combination of a manual motor starter with an undervoltage release and an emergency off device (e.g. push-button) provides a reliable and economic solution to ensure safety at work.

### Manual motor starters

Manual motor starters (MMS) are protection devices for the main circuit. They combine motor/load control and protection in a single device.

Manual motor starters are a compact and economic solution for motor and load protection up to 45 kW (400 V) / 80 A. Further features are the built-in disconnect function, temperature compensation, trip-free mechanism and a rotary handle with a clear switch position indication. Manual motor starters are suitable for three- and single-phase applications. Auxiliary contacts, signaling contacts, undervoltage releases, shunt trips, power in-feed blocks and locking devices for protection against unauthorized changes are available as accessory.

## Electrical scope:

Characteristic for this application is that after pushing the emergency off device, the source of electrical energy is cut off (disconnected) and further danger is averted. An example for possible applications are laboratory benches.

## Motor-operated scopes:

In these cases, the dangerous situation might still be existing, even if, after pushing the emergency off button, the current flow has been interrupted. Typical applications include:

- small machinery
- food processors
- industry doors
- carwash facilities
- lifting devices

## Function

In case of a hazardous situation with a running motor pushing the emergency off device, will cause the MMS to trip, which disconnects the motor from the mains. The risk of electrical hazards is averted. Signaling contacts may be used for visualization of a trip event.

**The result of a risk evaluation of the machine or other loads determines the necessity for an emergency off function.**

## Emergency switching-off

The Emergency switching-off function is used to switch off the electrical power supply of machines and other loads. This is done to prevent users from any risk of electrical energy (for example electrical shocks). The emergency switching-off function is typically triggered by manual action of a single person.

Emergency off devices are a requirement in Europe due to the Machinery Directive (2006/42/EC) and its harmonized standards EN ISO 12100, EN 60204-1 and EN ISO 13850. Emergency switching-off is done by disconnecting the supply energy, typically with electromechanical switching devices. This results in a category 0 stop. Note: For emergency stop applications, hazardous movements have to be stopped (e.g. with motor brakes).

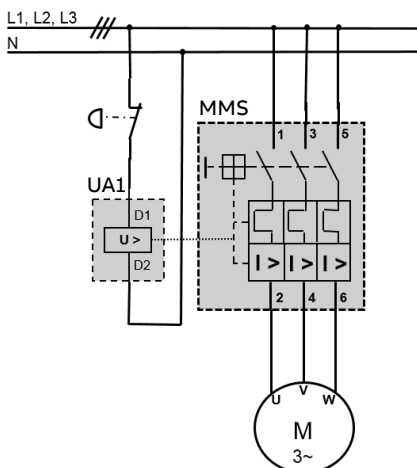
## Example

The diagrams below show an example of an emergency switching-off application, in which a combination of manual motor starter (MMS) and undervoltage release (UA1) can only be switched on, as soon as the undervoltage release is energized. If the voltage is applied and the manual motor starter is switching on, pressing the emergency off button will de-energize the undervoltage release. Through the internal mechanical connection, the main contacts of the manual motor starter are being opened and the load is switched off immediately (Figure 1).

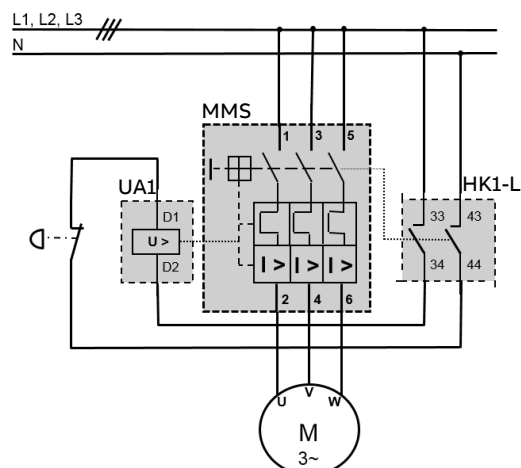
Furthermore, the actual state of the manual motor starter can be ensured via an additional auxiliary contact (HK1, HK1-L or SK1), to control a signal light or to add a redundancy to the application.

To save energy an auxiliary switch with two leading normally open contacts (HK1-L), can disconnect the undervoltage release from its supply, so that it is not permanently energized. When the User is activating the ON/OFF handle from the manual motor starter, the leading auxiliary contact is closing earlier than a conventional auxiliary contact (HK1), which ensures a safe switching on of the application (example 2).

**Diagram example 1:**



**Diagram example 2, with additional auxiliary contacts:**



## Components

Emergency switching-off applications according to IEC/ EN60204-1 stop category 0 using an ABB manual motor starter are designed for nominal currents up to 80 A. The components must be selected according to the requirements and they have to comply with international regulations and standards (see Table 1: Referred standards and guidelines on page 4).

Even under difficult environmental circumstances and operation conditions the components of this solution stay reliable throughout their complete life cycle.

Since an emergency switching-off solution needs to interrupt the flow of electricity to the machine or other loads as quickly as possible without creating additional hazards, a risk analysis needs to be conducted in any case to ensure a safe application.

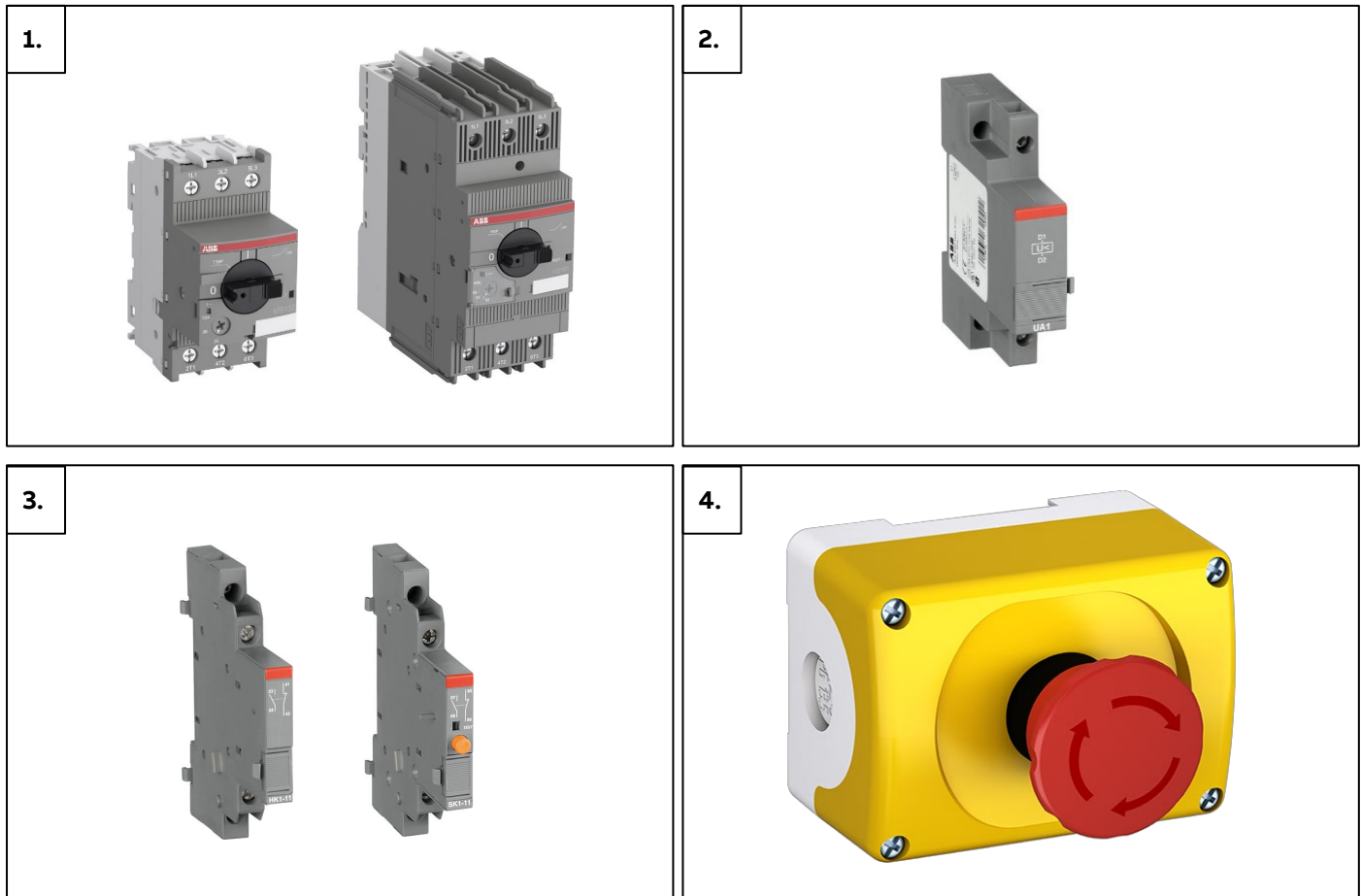
## Benefits and scope

The emergency switching-off application is useful for machinery and equipment preventing hazards for human life and machinery. It can be used for applications (e.g. motors) with nominal currents up to 80 A and maximum rated operating voltages up to 690 V AC / 250 V DC (e.g. MS132).

The benefit of this application is also: This solution provides proven components and principles. And a wire break leads to immediate switching off.

### List of components

- |   |                       |
|---|-----------------------|
| 1. Manual motor starter                     | MS116, MS132 or MS165 |
| 2. Undervoltage release                     | UA1                   |
| 3. Auxiliary contactor or Single contact    | HK1-L (and SK1)       |
| 4. Emergency off device                     | MEPY1-x               |
| Enclosure / Door mounting kit (if required) | IB132-x or DMS132-x   |



More information about ABB manual motor starters are easily accessible on ABB's [website](https://library.abb.com) and in ABB's Download center: (<https://library.abb.com>) All Categories > Products > Low Voltage Products and Systems > Control Products > Manual Motor Starters

## Standards and Directives

The Table below lists applicable standards and relevant guidelines for the presented solution. The solution complies also with the stop category 0 - system as described in the harmonized standards ISO 12100, IEC 60204-1, NFPA 79 and ISO 13850. Note: The stop category descriptions from IEC 60204-1 and NFPA 79 are virtually identical, with the primary difference being the use of the definitions in the IEC standard instead of including that information in the description as in the NFPA standard.

<b>IEC/EN 60947-1</b>	Low-voltage switchgear and controlgear – Part 1: General rules
<b>IEC/EN 60947-2</b>	Low-voltage switchgear and controlgear – Part 2: Circuit breakers
<b>IEC/EN 60947-4-1</b>	Low-voltage switchgear and controlgear – Part 4-1: Contactors and Motor-Starters
<b>IEC/EN 60947-5-1</b>	Low-voltage switchgear and controlgear – Part 5: Control circuit devices and switching elements
<b>DIN EN 60204-1</b>	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
<b>ISO 12100</b>	Safety of machinery - General principles for design - Risk assessment and risk reduction
<b>ISO 13850</b>	Safety of machinery - Safety of machinery - Emergency stop function - Principles for design
<b>ISO 13849-1</b>	Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design
<b>2014/35/EU</b>	Low Voltage Directive
<b>2006/42/EC</b>	Machinery Directive
<b>2011/65/EU</b>	Restriction of Hazardous Substances Directive (RoHS)
<b>NFPA 79</b>	Electrical Standard for Industrial Machinery
<b>NFPA 79 No. 301</b>	Uses identical definitions for stop function categories

Table 2: Referred standards and guidelines

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