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## BRISBANE CITY COUNCIL BRISBANE WATER

## SP302 - Progress Road Pump Station



Operation \& Maintenance Manual Contract Number BW50080-04/05

## Progress Road Pump Station-SP302 Operation \& Maintenance Manual

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VLT 5000
VLT* 6000 HVAC

Danfoss Graham

## Modbus RTU Option Card



## VLT ${ }^{\circledR} 6000$ Adjustable Frequency Drive

## Instruction Manual

## ADANGER

Rotating shafts and electrical equipment can be hazardous. Therefore, it is strongly recommended that all electrical work conform to National Electrical Code (NEC) and all local regulations. Installation, startup and maintenance should be performed only by qualified personnel.

Motor control equipment and electronic controls are connected to hazardous line voltages. When servicing drives and electronic controls, there will be exposed components at or above line potential. Extreme care should be taken to protect against shock. Stand on an insulating pad and make it a habit to use only one hand when checking components. Always work with another person in case of an emergency. Disconnect power whenever possible to check controls or to perform maintenance. Be sure equipment is properly grounded. Wear safety glasses whenever working on electric control or rotating equipment.

## AWARNING

## Warnings Against Unintended Start

1. While the drive is connected to the $A C$ line, the motor can be brought to a stop by means of external switch closures, serial bus commands or references. If personal safety considerations make it necessary to ensure that no unintended start occurs, these stops are not sufficient.
2. During programming of parameters, the motor may start. Be certain that no one is in the area of the motor or driven equipment when changing parameters.
3. A motor that has been stopped may start unexpectedly if faults occur in the electronics of the drive, or it an overload, a fault in the supply $A C$ line or a fault in the motor connection or other fault clears.
4. If the "Local/Hand" key is activated, the motor can only be brought to a stop by means of the "Stop/Off" key or an external safety interlock.


#### Abstract

ACAUTION Electronic components of BACLink portal are sensitive to electrostatic discharge (ESD). ESD can reduce performance or destroy sensitive electronic components. Follow proper ESD procedures during installation or servicing to prevent damage.


## ADANGER

Touching electrical parts may be fatal, even after equipment has been disconnected from AC line. To be sure that capacitors have fully discharged, wait 14 minutes after power has been removed before touching any internal component.

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Introduction

## About This Manual

This manual provides comprehensive instructions on the installation and set up of the Modbus RTU option card for the VLT 6000 Adjustable Frequency Drive to communicate over a Modbus network.

For specific information on installation and operation of the adjustable frequency drive, refer to the VLT 6000 Operating instructions.

This manual is intended to be used for both instruction and reference. It only briefly touches on the basics of the Modbus protocol whenever necessary to gain an understanding of the Modbus RTU option card for the VLT 6000.

This manual is also intended to serve as a guideline when you specify and optimize your communication system. Even if you are an
experienced Modbus programmer, it is suggested that you read this manual in its entirety before you start programming since important information can be found in all - sections.

Assumptions This manual assumes that you have a controller that supports the interfaces in this document and that all the requirements stipulated in the controller, as well as the

VLT 6000 Adjustable Frequency Drive, are strictly observed, along with all limitations therein.

## What You Should Already Know

The VLT 6000 Modbus RTU option card is designed to communicate with any controller that supports the interfaces defined in this
document. It is assumed that you have full knowledge of the capabilities and limitations of the controller.

References $\quad V L T^{\infty} 6000$ Installation, Operation and Instruction Manual, Danfoss Graham document number 23-6108-00.
(Referred to as the VLT 6000 Operating instructions in this document.)

## Modbus RTU Overview

VLT 6000 with Modbus RTU Option Overview

The common language used by all Modicon controllers is the Modbus RTU (Remote Terminal Unit) protocol. This protocol defines a message structure that controllers will recognize and use, regardless of the type of networks over which they communicate. it describes the process a controller uses to request access to another device, how it will respond to requests from the other devices, and how errors will be detected and reported. It establishes a common format for the layout and contents of message fields.

During communications on a Modbus RTU network, the protocol determines how each controlier will know its device address, recognize a message addressed to it, determine the kind of action to be taken, and extract any data or other information contained in the message. If a reply is required, the controller will construct the reply message and send it.

Controllers communicate using a masterslave technique in which only one device (the master) can initiate transactions (called
queries). The other devices (slaves) respond by supplying the requested data to the master, or by taking the action requested in the query.

The master can address individual slaves, or can initiate a broadcast message to all slaves. Slaves retum a message (called a response) to queries that are addressed to them individually. Responses are not returned to broadcast queries from the master.

The Modbus RTU protocol establishes the format for the master's query by placing into it the device (or broadcast) address, a function code defining the requested action. any data to be sent, and an error-checking field. The slave's response message is atso constructed using Modbus protocol. It contains fields confirming the action taken, any data to be returned, and an errorchecking field. If an error occurred in receipt of the message, or if the slave is unable to perform the requested action, the slave will construct an error message and send it in response.

The VLT 6000 Adjustable Frequency Drive with the Modbus RTU option card installed communicates in Modbus RTU format over an EIA-485 (formerly RS-485) network. The option card acts as a translator between the drive's internal FC protocol and Modbus RTU. This allows access to the drive's Control Word and Bus Reference.

The Control Word allows Modbus to control several important functions of the drive:

- Start
- Stop the drive in several ways:

Coast stop
Quick stop
DC Brake stop
Normal (ramp) stop

- Reset after a fault trip
- Run at a variety of preset speeds
- Run in reverse
- Change the active setup
- Control the drive's two built-in relays

The Bus Reference is commonly used for speed control.

It is also possible to access the drive parameters, read their values, and, where possible, write values to them. This permits a range of control possibilities, including controlling the drive's setpoint when its internal PID controller is used.

## Danfoss



VLT 6000 Modbus RTU Option Card

Modbus RTU Option Card Baud Rate and Parity Settings

The Modbus RTU communication protocol accesses the internal Danfoss FC protocol within the VLT 6000 to control the drive through serial communications. (The Modbus-to-FC interface uses 9600 Baud, 8 Bits, Even Parity, and 1 Stop Bit.)

The Modbus RTU option card has a 9-input DIP switch for setting baud rate and parity (see figure below). The option card generally uses 9600 baud rate with no parity. Set the switch positions in accordance with the following instructions.

- Set input switches 1-3 to ON to select 9600 baud rate.
- Set input switches 4 and 5 to ON to select no parity.

Switches 6-9 are unassigned reserved switches. Their setting does not matter.

## NOTE

Set baud rate and parity switch settings prior to installing Modbus RTU option card for ease of access.

For Modbus RTU networks operating at other than 9600 baud and no parity, determine switch positions from the tables provided below.


9600 Baud Rate and No Parity Switch Settings

| Baud Rate | SW1 | SW2 | SW3 |
| :--- | :---: | :---: | :---: |
| 300 | OFF | OFF | OFF |
| 1200 | OFF | OFF | ON |
| 2400 | OFF | ON | OFF |
| 4800 | OFF | ON | ON |
| 9600 | ON | ON | ON |
| 19200 | ON | OFF | ON |


| Parity | SW4 | SW5 |
| :--- | :---: | :---: |
| None | ON | ON |
| Odd | OFF | ON |
| Even | OFF | OFF |

Optional Baud Rate and Parity Switch Settings

## Danfuss

Modbus RTU Option Card Network
Address Settings

The Modbus RTU option card has an address and termination 9-input DIP switch. The Modbus network address for the VLT 6000 is set by DIP switch positions on the switch. Pin 9 is an ON/OFF switch for network termination. DIP switch positions are read on power-up onty, so position changes will not be recognized until the next power-up.

- Set the Modbus address for the VLT 6000 in accordance with the table below. The default input setting is for ADDRESS 1 and termination ON .


Address and Termination

| Address <br> (Hex) | SW1 <br> $2^{0}$ | SW2 <br> $2^{1}$ | SW3 <br> $2^{2}$ | SW4 <br> $2^{3}$ | SW5 <br> $2^{4}$ | SW6 <br> $2^{5}$ | SW7 <br> $2^{6}$ | SW8 <br> $2^{7}$ | TERM |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Default <br> 01 | ON | OFF | OFF | OFF | OFF | OFF | OFF | OFF | ON |
| 55 | ON | OFF | ON | OFF | ON | OFF | ON | OFF | ON |
| AA | OFF | ON | OFF | ON | OFF | ON | OFF | ON | ON |
| F7 | ON | ON | ON | OFF | ON | ON | ON | ON | ON |

Address Input Selection

VLT 6000
Parameter Settings

The Modbus RTU option card interface to the VLT 6000 Adjustable Frequency Drive FC protocol requires drive parameter values selected as shown. They are the default settings for those parameters and probably require no change to operate the drive using Modbus. The Modbus RTU option card always transmits to the drive in which it resides as address one (001). See the VLT 6000 Operating Instructions for details on selecting and changing parameter values, if necessary.

- Parameter 500, Protocol: FC protocol
- Parameter 501, Address: 001
- Parameter 502, Baud Rate: 9600 baud

Modbus RTU Option Card Environmental Requirements

Environmental requirements for the Modbus RTU option card are listed below.

| Description | Requirement |
| :--- | :--- |
| Operating temperature | $-5^{\circ} \mathrm{F}$ to $+140^{\circ} \mathrm{F}\left(-20^{\circ} \mathrm{C}\right.$ to $\left.+60^{\circ} \mathrm{C}\right)$ |
| Storage temperature | $-40^{\circ} \mathrm{F}$ to $+176^{\circ} \mathrm{F}\left(-40^{\circ} \mathrm{C}\right.$ to $\left.+80^{\circ} \mathrm{C}\right)$ |
| Humidity | $5 \%$ to $95 \%$ relative, non-condensing |


| Power | The Modbus RTU option card is powered by |
| :--- | :--- |
| Supply | 24 VDC and draws 38 mA of current at 24 V . |

Installation

The following section describes the installation procedures for the Modbus RTU option card. For additional information on installation and operation of the VLT 6000 , refer to the VLT6000 Operating Instructions.

## ADANGER

VLT adjustable frequency drive contains dangerous voltages when connected to line voltage. After disconnecting from power line, wait at least 14 minutes before touching any electrical components.

## AWARNING

Only a competent electrician should carry out electrical installation. Improper installation of motor or drive can cause equipment failure, serious injury or death. Follow this manual, National Electrical Codes and local safety codes.

## ACAUTION

Electronic components of. adjustable frequency drive and Modbus RTU option card are sensitive to electrostatic discharge (ESD). ESD can reduce performance or destroy sensitive electronic components. Follow proper ESD procedures during installation or servicing to prevent damage.

## ACAUTION

It is responsibility of user or installer of VLT adjustable frequency drive to provide proper grounding and motor overload and branch protection according to National Electrical Codes and local codes.

## Damposs

1. Access to Control Card Cassette

## 2. Disconnect Control Card Cassette

## NEMA 1 Drives:

- Remove Local Control Panel (LCP) by pulling out from top of display (A) by hand. LCP connector on panel back will disconnect.
- Remove protective cover by gently prying with a screw driver at notch (B) and lift cover out of guide pin fittings.


## NEMA 12 Drives:

- Open front panel of drive by loosening captive screws and swing open.
- Disconnect Local Control Panel (LCP) cable.

- Remove control wiring by unplugging connector terminals (A).
- Remove grounding clamps (B) by removing two screws holding each in place. Save screws for reassembly.
- Loosen two captive screws (C) securing cassette to chassis.


3. Remove Cassette and Ribbon Cables

- Lift control card cassette from bottom.
- Unplug two ribbon cables (A) and (B) from VLT 6000 control board.
- Unhinge cassette at top to remove.


## NOTE

Ribbon cables will need to be reconnected to same connections from which removed.

4. Secure Modbus RTU Option Card

- On back of cassette, insert edge of Modbus RTU option card into slot at side of cassette (A).
- Secure opposite side of card with 2 self-tapping screws and washers provided (B). Using a Torx T - 10 screw driver, tighten to 8 in-lbs.


5. Wire

Modbus RTU
Option Card Connector to VLT 6000 Terminals

## NOTE

Use 18 to 22 gauge wire. Torque terminals to 4.5 in-lbs. Modbus interface connector terminals 5 and 6 are spares.

- Wire Modbus interface connector (24 V power) pin 1 to VLT 6000 terminal 12 or 13.
- Wire Modbus interface connector (RTxD) pin 2 to VLT 6000 terminal 69.
- Wire Modbus interface connector (com) pin 3 to VLT 6000 terminals 39 and 61.
- Wire Modbus interface connector ( $\mathrm{RT} \times \mathrm{D}^{\prime}$ ) pin 4 to VLT 6000 terminal 68.
- Plug Modbus interface connector into bottom of Modbus RTU option card.

Pin 1

6. Install Ribbon Cables

## NOTE

Ribbon cables must be reconnected to same connections from which removed.

- Connect control card cassette to hinge at top of drive.
- Connect ribbon cables.

- Fasten control card cassette by alternately tightening two captive screws (A). Tighten to 8 in -lbs.
- Route control wires through clamp fasteners ( B ) and secure clamps with two screws.
- Connect control terminals (C) by firmty pressing them into connector receptacles.

NEMA 1 Drives

- Install LCP by sliding bottom into guide slats on cradle, then press into place ensuring that connector on back of LCP is engaged.
- Replace protective cover by positioning guide pins at bottom of cover into holes in bottom of chassis and snap top of cover into place.

NEMA 12 Drives

- Plug cable from LCP into connector on main control card.


8. Plug in

Terminal Connector

- Connect Modbus signal wire ( $\mathrm{RT} \times \mathrm{D}+$ ) to pin 1 of EIA-485 (formerly RS-485) connector.
- Connect Modbus signal wire (Com) to pin 2 of EIA-485 connector.
- Connect Modbus signal wire (RTxD-) to pin 3 of EIA-485 connector.
- Plug EIA-485 connector into terminal port at side of Modbus RTU option card.


EIA-485 Connector

## NEMA 12 Drives

- Close front cover panel and fasten with captive screws. Tighten to 7 in-lbs.

The Modbus RTU option card has two LEDs. One LED is used as a status for Modbus RTU communications and the other as a status for VLT 6000 drive communications. Both LEDs use the same communications patterns. On power up, each LED state is flashed on for 250 milliseconds (Red, Green, Orange, Off). The VLT 6000 LED powers up
first, then the Modbus LED. After power up, the following are the only valid states:

- Flashing Green ( 1 Hz ): Communications online (VLT 6000 LED) or receiving data (Modbus LED)
- Flashing Red ( 1 Hz ): Communications time out
- Solid Red: Fault, communications halted


Option Card Operability Loop Back Test

A loop back test to confirm Modbus RTU option card operability can be performed. The option card must be removed from the adjustable frequency drive to gain access to the 9 -input dip switch for baud rate and parity and to rewire the option card connectors.

## ADANGER

Ensure that power has been removed from adjustable frequency drive for a minimum of 14 minutes to allow voltage to dissipate.

- Remove the option card in accordance with the procedures described in the installation section of this manual.
- Set the dip switch positions in accordance with the table below.
- Remove all wiring from both the 6 -pin option card connector and the 3-pin EIA-485 connector.
- Wire the 6-pin option card connector to the 3-pin ElA-485 connector as described below.

6-Pin Connector ElA-485 Connector

| Pin 2 | to | Pin 3 |
| :--- | :--- | :--- |
| Pin 3 | to | Pin 2 |
| Pin 4 | to | $\operatorname{Pin} 1$ |

- Apply power to the unit.

After the normal status LED check at power-up (see Status LEDs), the loop back test sets both LEDs to orange for a successful test or red if the test fails. The orange or red indicator lasts around 10-15 seconds. The - LEDs will then flash red or green communication indications.

| SW1 | SW2 | SW3 | SW4 | SW5 | SW6 | SW7 | SW8 | SW9 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ON | ON | ON | OFF | OFF | ON | ON | ON | ON |

Loop Back Test Switch Positions

Remote Terminal Unit

The controllers are setup to communicate on the Modbus network using RTU (Remote Terminal Unit) mode, with each 8-bit byte in
a message contains two 4-bit hexadecimal characters. The format for each byte is shown below.

| Coding System: | 8-bit binary, hexadecimal 0-9, A-F Two hexadecimal characters contained in each 8 -bit field of the message |
| :---: | :---: |
| Bits Per Byte: | 4 start bit <br> 8 data bits, least significant bit sent first 1 bit for even/odd parity; no bit for no parity 1 stop bit if parity is used; 2 bits if no parity |
| Error Check Field: | Cyclical Redundancy Check (CRC) |

Modbus RTU Message
Framing Structure

A Modbus RTU message is placed by the transmitting device into a frame with a known beginning and ending point. This allows receiving devices to begin at the start of the message, read the address portion, determine which device is addressed (or all devices, if the message is broadcast), and to know when the message is completed. Partial messages are detected and errors set as a result.

The allowable characters transmitted for all fields are hexadecimal 0-9, A-F. The adjustable frequency drives monitor the network bus continuously, including 'silent'
intervals. When the first field (the address field) is received, each drive or device decodes it to determine whether it is the addressed device.

Modbus RTU messages addressed to zero are converted to broadcast messages using the FC protocol. No response is needed on broadcast messages.

To ensure the attribute data returned is the most current, each attribute access must include one attribute only.

A typical message frame is shown below.

| Start | Address | Function | Data | CRC Check | End |
| :---: | :---: | :---: | :---: | :---: | :---: |
| T1-T2-T3-T4 | 8 Bits | 8 Bits | $n \times 8$ Bits | 16 Bits | T1-T2-T3-T4 |

Typical Modbus RTU Message Structure

Modbus RTU
Message
Framing
Structure (continued)

## Start/Stop Field

Messages start with a silent interval of at least 3.5 character times. This is implemented as a multiple of character times at the 9600 network baud rate (shown as Start T1-T2-T3-T4). The first field then transmitted is the device address. Following the last transmitted character, a similar interval of at least 3.5 character times marks the end of the message. A new message can begin after this interval.

The entire message frame must be transmitted as a continuous stream. If a silent interval of more than 1.5 character times
occurs before completion of the frame, the receiving device flushes the incomplete message and assumes that the next byte will be the address field of a new message.

Similarly, if a new message begins earlier that 3.5 character times following a previous message, the receiving device will consider it a continuation of the previous message. This will set an error, since the value in the final CRC field is not valid for the combined messages.

## Modbus RTU <br> Message <br> Framing <br> Structure <br> (continued)

## Address Field

The address field of a message frame contains 8 bits. Valid slave device addresses are in the range of $0-247$ decimal. The individual slave devices are assigned addresses in the range of $1-247$. ( 0 is reserved for broadcast mode, which all slaves recognize.) A master addresses a slave by placing the slave address in the address field of the message. When the slave sends its response, it places its own address in this address field to let the master know which slave is responding.

## Function Field

The function field of a message frame contains 8 bits. Valid codes are in the range of 1-255 decimal. (See Appendix $A$ tor a description of supported Modbus functions.) When a message is sent from a master to a slave device, the function code field tells the slave what kind of action to perform.

When the slave responds to the master, it uses the function code field to indicate either a normal (error-free) response, or that some kind of error occurred (called an exception response). For a normal response, the slave simply echoes the original function code. For an exception response, the slave returns a code that is equivalent to the original function code with its most-significant bit set to a logic 1. In addition, the slave places a unique code into the data field of the response message. This tells the master what kind of error occurred, or the reason for the exception. See the Exception Codes section in this maniual for definitions.

## Data Field

The data field is constructed using sets of two hexadecimal digits, in the range of 00 to FF hexadecinal. These are made from one RTU character. The data field of messages sent from a master to slave device contains additional information which the slave must use to take the action defined by the function code. This can include items like discrete and register addresses, the quantity of items to be handled, and the count of actual data bytes in the field. The data field can have a length of zero.

## CRC Check Field

Messages include an error-checking field that is based on a cyclical redundancy check (CRC) method. The CRC field checks the contents of the entire message. It is applied regardless of any parity check method used for the individual characters of the message. The CRC value is calculated by the transmitting device, which appends the CRC as the last field in the message. The receiving device recalculates a CRC during receipt of the message and compares the calculated value to the actual value received in the CRC field. If the two values are not equal, an error results.

The error checking field contains a 16 -bit binary value implemented as two 8 -bit bytes. When this is done, the low-order byte of the field is appended first, followed by the highorder byte. The CRC high-order byte is the last byte sent in the message.

## Coil/Register Addressing

All data addresses in Modbus messages are referenced to zero. The first occurrence of a data item is addressed as item number zero. For example:

The coil known as 'coil 1' in a programmable controller is addressed as coil 0000 in the data address field of a Modbus message. Coil 127 decimal is addressed as coil $007 \mathrm{E}_{\text {HEX }}$ ( 126 decimal).

Holding register 40001 is addressed as register 0000 in the data address field of the message. The function code field already specifies a 'holding register' operation. Therefore, the ' $4 \times 0 \times X$ ' reference is implicit. Holding register 40108 is addressed as register $006 \mathrm{~B}_{\text {IEX }}$ ( 107 decimal).

## Translation from Modbus RTU Protocol to FC Protocol

Refer to Serial Communication for FC Protocol in the VLT 6000 Operating instructions for details on the Danfoss FC protocol used for Modbus RTU serial communication within the VLT 6000 Adjustable Frequency Drive.

## Parameter Block

## PKE

PKE contains AK with the parameter commands and replies, and PNU with the parameter number. The AK value is determined by the Modbus function code. Coil 65 decimal determines whether data written to the drive are stored in EEPROM and RAM (coil $65=1$ ) or just RAM (coil $65=$ 0). PNU is translated from the register address contained in the Modbus read/write message. The parameter number is translated to Modbus as ( $10 \times$ parameter number) DECMAL.

## IND

IND contains the index. The index is used, together with the parameter number, for read/write access. Index has 2 bytes - a low byte and a high byte. However, only the low byte is used for indexing. The high byte is used for reading and writing text. IND is set by a register in Modbus ( $40001_{\text {HEE }}$ ). ND must be cleared by the Modbus master after reading/writing text.

PWE $E_{\text {HIGn }} / P W E_{\text {LOW }}$
PWE contains the parameter value. The parameter value block consists of 2 words (4 bytes). The value depends on the command given (AK). PWE is zero filled on reads. On writes, PWE is filled with the data field of the Modbus write message.

## $\mathrm{PCD}_{1} / \mathrm{PCD}_{2}$

PCD contains the process word block. The parameter value block consists of 2 words (4 bytes). The process word block is divided into two blocks of 16 bits and is stored in Modbus as status coils. The mapping of the PCD is shown below.

## Process Block Updates

Upon every write to the PCD coils, the process block is written to the drive and returned from the drive. On parameter reads and writes, the PCD is deactivated on messages from the Modbus RTU option card to the drive. The PCD coils are updated on response messages from the drive to the Modbus RTU option card.

## Text Blocks

Parameters stored as text strings are accessed the same as the other parameters except PWE is replaced with the text block. The maximum text block size is 20 characters. If a read request for a parameter is for more characters than the parameter stores, the response is space filled. If the read request for a parameter is for less characters than the parameter stores, the response is truncated.

|  | $\mathrm{PCD}_{1}$ | $\mathrm{PCD}_{2}$ |
| :--- | :--- | :--- |
| Control packet <br> (master $\rightarrow$ slave) | Control word <br> (Coils 1-16) | Reference value <br> (Coils 17-32) <br> ( |
| Reply pack |  |  |
| (slave $\rightarrow$ master) |  |  | | Status word |
| :--- |
| (Coils 33 -48 ) | | Given output frequency |
| :--- |
| (Coils 49 -64$)_{\text {DEC }}$ |

## PCD Mapping

FC Protocol Control Word Bit Descriptions

Control Word Bit Descriptions

|  |  |  |
| :---: | :---: | :---: |
| 00 | Premet Refflsis |  |
| 04 | Prepet Ref. MSE |  |
| 42 | Dt Brate | Ho DCEmeke |
| 03 | Cometstop | notonetstop |
| 04 | "oulck" stop | Ho-Galckistop |
| 05 | Freexe Fres. | G0Freste Freq. |
| 08 | Remptiep | start |
| 07 | no Reset | Retert |
| 0 0魅 | mo Jog | Jog |
| 09 | mofanation |  |
| 10 | Data Not Vaild | Detr Velld |
| 11 | Re!ny 1 ofF | Relsy 10 N |
| 12 | Rellay 2 OFF | Rollay 2 ON |
| 13 | . setupLsB |  |
| 14 | Setupmst |  |
| 13 | -0 Reversima | Reverelag |

## Stop Commands

The precedence of the stop commands is as follows:

1. Coast stop
2. Quick stop
3. DC Brake
4. Normal (Ramp) stop

## Conversion

 FactorMemory Mapping

## Conversion

The different attributes for each parameter can be seen in the section on factory settings. Since a parameter value can only be transferred as a whole number, a conversion factor must be used to transfer decimals.

## Example:

Parameter 201: Minimum Frequency, conversion factor 0.1. If parameter 201 is to be set to 10 Hz , a value of 100 must be. transferred, since a conversion factor of 0.1 means that the transferred value will be

| Index | Factor |
| :---: | :---: |
| 74 | 3.6 |
| 2 | 100.0 |
| 1 | 10.0 |
| 0 | 1.0 |
| -1 | 0.1 |
| -2 | 0.01 |
| -3 | 0.001 |
| -4 | 0.0001 | be understood as 10.0 .

## Parameter Values

## Standard Data Types

Standard data types are int16, int32, uint8, uint 16 and uint 32 . They are stored as $4 \times$ registers ( $40001-4$ FFFF). The parameters. are read using function 03 Registers." Parameters are written using function $6_{\text {Hex }}$ "Preset Single Register" for 1 register ( 16 bits), and function $10_{\text {rex }}$ "Preset Multiple Registers" for 2 registers ( 32 bits). Valid sizes to read are 1 register ( 16 bits) and 2 registers ( 32 bits).

## Nonstandard Data Types

Nonstandard data types are text strings and are stored as $4 x$ registers (40001-4FFFF). The parameters are read using function $03_{\text {mex }}$ "Read Holding Registers" and written using function ${ }^{-10}$ HEX "Preset Mulliple Registers." Valid sizes to read are 1 register (2 characters) through 10 registers (20 characters). See Text Blocks section in this manual for truncation/ space fill rules. IND (Modbus Register 1) must be written with a value of $0400_{\text {HEX }}$ (read) or $0500_{\text {HEX }}$ (write) prior to reading or writing a text string.

Status Coils Map (128 coils total)

| Address (Decimal) | Description |
| :--- | :--- |
| $1-16$ | $\mathrm{PCD}_{1}$ Control word (master $\rightarrow$ slave) |
| $17-32$ | $\mathrm{PCD}_{2}$ Reference value (master $\rightarrow$ slave) |
| $33-48$ | $\mathrm{PCD}_{1}$ Status word (slave $\rightarrow$ master) |
| $49-64$ | $\mathrm{PCD}_{2}$ Given output frequency (slave $\rightarrow$ master) |
| 65 | Write memory storage type bit (used with AK), see PKE $^{26-128}$ |

Memory
Mapping:
Register
Maps

Register Maps ( $\mathbf{6 5 5 3 6}$ registers total)

| Address (Decimal) | Description |
| :---: | :---: |
| 00001 | IND (index word) |
| 00002 | Modbus Communications Timeout Value (10 millisecond units) |
| 00003 | Drive Communications Timeout Value ( 10 millisecond units) |
| 00004-00009 | Reserved |
| $\begin{aligned} & \hline 00010 \\ & \downarrow \\ & 00170 \\ & \hline \end{aligned}$ | Parameter 001, Language <br> $\downarrow$ <br> Parameter 017, Operating State at Power-up |
| 00180-09999 | Reserved |
| $\begin{aligned} & 01000 \\ & \downarrow \\ & 01170 \end{aligned}$ | Parameter 100, Configuration $\downarrow$ <br> Parameter 117, Motor Thermal Protection |
| 01180-01999 | Reserved |
| $\begin{aligned} & 02000 \\ & \downarrow \\ & 02280 \end{aligned}$ | Parameter 200, Output Frequency Range $\downarrow$ <br> Parameter 228, Warning: High Feedback |
| 02290-02999 | Reserved |
| $\begin{aligned} & 03000 \\ & \downarrow \\ & 03280 \\ & \hline \end{aligned}$ | Parameter 300, Terminal 16 Digital Input $\downarrow$ <br> Parameter 328, Pulse Feedback, Max. Freq. |
| 03290-03999 | Reserved' |
| $\begin{aligned} & 04000 \\ & \downarrow \\ & 04270 \\ & \hline \end{aligned}$ | Parameter 400, Reset Function $\downarrow$ <br> Parameter 427, PID Lowpass Filter Time |
| 04280-04999 | Reserved |
| $\begin{aligned} & 05000 \\ & \downarrow \\ & 05660 \end{aligned}$ | Parameter 500, Protocol $\downarrow$ <br> Parameter 566, FLN Time Function |
| 05670-05999 | Reserved |
| $\begin{aligned} & 06000 \\ & \downarrow \\ & 06310 \\ & \hline \end{aligned}$ | Parameter 600, Operating Data: Operating Hours <br> Parameter 631, Nameplate: Communication Option Ordering No. |
| 06320-06999 | Reserved |
| $\begin{aligned} & \hline 07000 \\ & \downarrow \\ & 07110 \\ & \hline \end{aligned}$ | Parameter 700, Relay 6, Output Function $\downarrow$ <br> Parameter 711, Relay 9, Off Delay |
| 07120-65536 | Reserved |

Message
Translation Examples

EXAMPLE 1: Start Motor, Run Speed $\mathbf{4 0 \%}$

Modbus function OF HEX (Force Multiple Coils).
Message sent to Modbus RTU option card from Modbus master

| Byte 0 | Byte 1 | Byte 2 | Byte 3 | Byte 4 | Byte 5 | Byte 8 | Byto 7 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{gathered} \text { Slave } \\ \text { Address } \\ \hline \end{gathered}$ | Function | Coil Addr HI | Coll Addr LO | \% of Coils HI | \% of Coils CO | Byte Cotnit | $\begin{gathered} \text { Force Data HI } \\ \text { Coils }(0.7) \\ \hline \end{gathered}$ |
| 01 | OF | 00 | 00 | 00 | 20 | 04 | 7C |


| Byte 8 | Byte 9 | Byte 10 | Byte11 |
| :---: | :---: | :---: | :---: |
| Force Data <br> LO <br> Coils (8-15) | Force Data HI <br> Colls (16-23) | Forca Data <br> L0 <br> Colls (24-31) | Error Check |
| 04 | 99 | 19 | $[37][43]$ |

Modbus message string:
[01] [ OF [ OO ] [00] [00] [20] [04] [7C] [04] [99] [19] [37] [43]
Start Command: $0000010001111100=047 C_{\text {HEX }}$ (reversed)
(see FC Protocol Control Word Bit Descriptions)
Modbus message string:
[01] [OF] [00] [00] [00] [20] [04] [7C] [04] [99] [19] [37] [43]
NOTE: Speed Command: $4000_{\text {HEX }}=100 \%$ speed $40 \%$ of $4000_{\text {Hex }}=1999_{\text {HEX }}$ (reversed)

Message retumed to Modbus master from Modbus RTU option card

| Byte 0 | Byte 1 | Byte 2 | Byte 3 | Byte 4 | Byte 5 | Byte 6 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Slave <br> Address | Function | Coil Addr Hi | Coil Addr LO | No. of Coils <br> HI | No. of Coils <br> LO | Error Check |
| 01 | $0 F$ | 00 | 00 | 00 | 20. | $[54][13]$ |

All values are in hexadecimal.

Message Translation Examples (continued)

EXAMPLE 2: Ramp Stop Motor
Message sent to Modbus RTU option card from Modbus master

| Byta 0 | Byte 1 | Byte 2 | Byte 3 | Byte 4 | Byta 5 | Byte 8 | Byte 7 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Slave | Function | Coil Addz HII | Coll Addr LO | \# of Coils HI | of Coils LO | Bye Count | $\begin{aligned} & \text { Force Dath } \mathrm{HI} \\ & \text { Colls }(0-7) \end{aligned}$ |
| 01 | OF | 00 | 00 | 00 | 20 | 04 | 3 C |


| Byte 8 | Byta 9 | Byte 10 | Byte 11 |
| :---: | :---: | :---: | :---: |
| Force Data <br> LO <br> Coils (0-15) | Force Data HI <br> Colls (16-23) | Force Data <br> LO <br> Coils (24-31) |  |
| 04 | 00 | 00 | Eror Check |
|  | $[89][191$ |  |  |

Modbus message string:
[01] [0F] [00] [00] [00] [20] [04] [3C] [04] [00] [00] [89] [19]
Stop Command: $0000010000111100=043 C_{\text {Hex }}$ (reversed) (see FC Protocol Control Word Bit Descriptions)
. Speed Command: 0\%
Message returned to Modbus master from Modbus RTU option card

| Byte 0 | Byte 1 | Byte 2 | Byte 3 | Byte 4 | Byte 5 | Byte 6 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Slave <br> Address | Function | Coil Addr HI | Coil Addr LO | No. of Coils <br> HI | No. of Coils <br> Lo | Emor Check |
| 01 | $0 F$ | 00 | 00 | 00 | 20 | - |

## All values are in hexadecimal.

## EXAMPLE 3: Coast Stop Motor

Message sent to Modbus RTU option card from Modbus master

| Byte 0 | Byte 1 | Byta 2 | Byta 3 | Byte 4 | Byta 5 | Byta 6 | Byte 7 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{gathered} \text { Slawe } \\ \text { Address } \end{gathered}$ | Function | Coll Addr Hi | Coll Addr LO | \# of Colls Hi | \% of Coils LO | Byte Count | $\begin{aligned} & \text { Foroe Data HI } \\ & \text { Coils (0.7) } \end{aligned}$ |
| 01 | - OF | 00 | 00 | 00 | 20 | 04 | 20 |


| Byte E | Byte 9 | Byte 10 | Byte 11 |
| :---: | :---: | :---: | :---: |
| Force Data <br> LO <br> Colis (B-15) | Force Data HI <br> Coils (16-23) | Force Data <br> LO <br> Colis (24-31) | Error Check |
| 2 C | 00 | 00 | - |

Modbus message string:
[01] [0F] [00] [00] [00] [20] [04] [20] [2C] [00] [00] [-- ]
Coast Command: $0010110000100000=2 \mathrm{C} 2 \mathrm{O}_{\text {HEX }}$ (reversed) (see FC Protocol Control Word Bit Descriptions)
Speed Command: 0\%

Message returned to Modbus master from Modbus RTU option card

| Byte 0 | Byte 1 | Byte 2 | Byte 3 | Byte 4 | Byte 5 | Byte 6 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Stave <br> Address | Function | Coil Addr HI | Coil Addr LO | No. of Coils | No. of Coils | Error Check |
| 01 | $-0 F$ | 0 |  | 00 | 00 | 20 |

## Message Translation Examples (continued)

EXAMPLE 4: Write Parameter 104, Motor Frequency, with 60 Hz
(Data Type 6: UINT16)
(Conversion factor $=0$ )
Modbus Function $06_{\text {HEx }}$ Preset Single Register
Message sent to Modbus RTU option card from Modbus master

| Byte 0 | Byte 1 | Byte 2 | Byte 3 | Byte 4 | Byte 5 | Byte 6 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Slave Address | Function | Register Addr HI | Register Addr LO | $\begin{gathered} \text { Preset Data } \\ \text { HI } \end{gathered}$ | $\begin{gathered} \hline \text { Preset Data } \\ \text { LO } \\ \hline \end{gathered}$ | Error Check |
| 01 | 06 | 04 | 0 F | 00 | 3 C | - |

Modbus message string:
[01] 06] [04] [0F] [00] [3C] [ error check]
$\rightarrow$
Parameter $104=0 \mathrm{FO} 4_{\mathrm{HEX}}$ (reversed)
Note that the starting address of a register is the parameter number $\times 10 \%$ in HEX .
$104 \times 10=1040-1=1039=0$ FO4 ${ }_{\text {нex }}$ (reversed)
Modbus message string:
[01] 06] [O4] [OF] [OO] [3C] [ error check ]

$$
\text { Speed }(60 \mathrm{~Hz})=3 \mathrm{C}_{\mathrm{HEX}}
$$

Message returned to Modbus master from Modbus RTU option card

| Byte 0 | Byte 1 | Byta 2 | Byte 3 | Byte 4 | Byta 5 | Byte 6 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Slave <br> Address | Function | Register <br> Addr $\mathbf{H I}$ | Register <br> Addr LO | Preset Data <br> HI | Preset Data <br> LO | Error Check |
| 01 | 06 | 04 | $0 F$ | 00 | $3 C$ |  |

All values are in hexadecimal.

EXAMPLE 5: Read Parameter 514,
Motor Current = 3 Amps
(Data Type 7: UINT32)
(Conversion Factor =-2)

Modbus Function 03 ${ }_{\text {HEX }}$ Read Holding Registers
Message sent to Modbus RTU option card from Modbus master

| Byte 0 | Byte 1 | Byte 2 | Byte 3 | Byte 4 | Byte 5 | Byte 6 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Slave <br> Address | Function | Start Addr HI | Start Addr LO | No. of Points <br> HI | No. of Points <br> LO | Error Check |
| 01 | 03 |  | 14 | 13 | 0 | 0 |

Parameter 514 ( 5139 ) $=1413_{\text {rex }}$
Note that the starting address of a register is the parameter number $\times 10-1$ in HEX.
Message sent to Modbus master from Modbus RTU option card

| Byto 0 | Byta 1 | Byte 2 | Byte 3 | Byte 4 | Byte 5 | Byte 6 | Byat 7 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Slave Address | Function | Byte Count | $\begin{gathered} \text { Data } \mathrm{HI} \\ \text { (Reg 45140) } \end{gathered}$ | $\begin{gathered} \text { Dataio } \\ (\text { Reg } 4514 \mathrm{D}) \end{gathered}$ | $\begin{gathered} \text { Data HI } \\ \text { (Reg 45141) } \end{gathered}$ | $\begin{gathered} \text { Data LO } \\ \text { (Reg } 45141 \text { ) } \\ \hline \end{gathered}$ | Error Check |
| 01 | 03 | 04. | 00 | 00 | 01 | 2 C | - |

All values are in hexadecimal.

Message Translation Examples (continued)

EXAMPLE 6: Write Parameter 533, Display Text 1, (VLT 6000 only) with "1234567890" (Data Type 9: Text String).

Modbus Function 06 Hex Preset Single Register
Write IND with "0500" to perform a text
write.
Message sent to Modbus RTU option card from Modbus master

| Byte 0 | Byte 1 | Byte 2 | Byto 3 | Byte 4 | Byte 5 | Byte 6 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Slave <br> Address | Funclion | Register | Register | Presel Data | Preset Data | Error Check |
| 01 | 06 | Addr HI | Addr LO | HI | LO |  |
| 01 | 00 | 00 | 05 | 00 | - |  |

Message sent to Modbus master from Modbus RTU option card

| Byte 0 | Byte 1 | Byte 2 | Byta 3 | Byte 4 | Byte 5 | Byte 6 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Slave <br> Address | Function | Register <br> Addr H$]$ | Register <br> Addr LO | Presel Data <br> H1 | Preset Data <br> LO | Error Check |
| 01 | 06 | 00 | 00 | 05 | 00 |  |

Commands Modbus to text mode.
Modbus Function $10_{\text {HEX }}$ Preset Multiple Registers
Message sent to Modbus RTU option card from Modbus master

| Byta 0 | Byte 1 | Byte 2 | Byte 3 | Byta 4 | Byte 5 | Byte 6 | Byte 7 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Slave Address | Function | Start Addr HI | Stat Addr LO | No. of Reglstars HI | No. of Registers LO | Byte Count | $\begin{aligned} & \text { Data HI } \\ & \text { (Reg } 414 \mathrm{Dz}) \end{aligned}$ |
| 01 | 10 | 14 | D1 | 00 | 05 | OA | 31 |


| Bytes | Byte 9 | Byte 10 | Byte 11 | Byte 12 | Byte 13 | Byte 14 | Byta 15 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{gathered} \text { Dota HI } \\ \text { (Reg 414D2) } \end{gathered}$ | $\begin{gathered} \text { Data Hi } \\ \text { (Reg 414D3) } \end{gathered}$ | $\begin{aligned} & \text { Data +1 } \\ & (\text { Reg } 41403) \end{aligned}$ | $\begin{aligned} & \text { Data HI } \\ & \text { (Reg 414D. } \end{aligned}$ | $\begin{gathered} \text { Data HI } \\ \text { (Reg } 414 \mathrm{D} 4 \text { ) } \end{gathered}$ | $\begin{gathered} \text { Data HI } \\ \text { (Reg } 414 \mathrm{D} 5 \text { ) } \end{gathered}$ | $\begin{gathered} \text { Data BI } \\ (\text { Reg } 41405) \end{gathered}$ | $\begin{gathered} \text { Data Hi } \\ \text { (Reg 414D6) } \end{gathered}$ |
| 32 | 33 | 34 | 35 | 36. | 37 | 38 | 39 |


| Byta 16 | Byte 17 |
| :---: | :---: |
| Data HI | Error Check |
| (Reg 414D6) |  |
| 30 | - |

Note that the starting address of a register is the parameter number $\times 10-1$ in HEX .
Message sent to Modbus master from Modbus RTU option card

| Byte 0 | Byte 1 | Byte 2 | Byte 3 | Byte 4 | Byte 5 | Byte 6 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Slave <br> Address | Function | Start Addr HI | Start Addr LO | No. Regislers <br> HI | No. Registers <br> LO | Error Check |
| 01 | 10 | 14. | D1 | .00 | 05 |  |

All values are in hexadecimal.

Exception Codes

When the VLT 6000 responds to the master via the Modbus serial network, it uses the function code field to indicate either a normal (error-free) response or an error (called an exception response). In an error-free response, the drive simply echoes the original function code. For an exception response, the drive will return a code that is equivalent
to the original function code with its mostsignificant bit set to a logic 1. In addition, the drive places a unique code into the data field of the response message. This tells the master what kind of error occurred, or the reason for the exception. The tables below identify the codes and describe their meaning.

| Modbus <br> Code <br> (decimal) | Meaning |
| :---: | :--- |
| 00 | The parameter number does not exist |
| 01 | There is no write access to the parameter |
| 02 | The data value exceeds the parameter limits |
| 03 | The used sub-index does not exist |
| 04 | The parameter is not of the array type |
| 05 | The data type does not match the parameter called |
| 17 | Data change in the parameter called is not possible in the present <br> mode of the drive. Some parameters can only be changed when the <br> motor has stopped |
| 130 | There is no bus access to the parameter called |
| 131 | Data Change is not possible because factory setup is selected |
| 255 | Message Timeout |

VLT 6000 Errors

| Modbus <br> Code <br> (decimal) | Meaning |
| :---: | :--- |
| 64 | Invalid Data Address |
| 65 | Invalid Message Length |
| 66 | Invalid Data Length |
| 67 | Invalid Function Code |

Modbus RTU Errors

APPENDIX A

Supported
Function
Codes

Appendix A describes the following functions supported by the Modbus RTU option card.

| Read Coil Status ( $01_{\text {HeX }}$ ) | Read Holding Registers ( 03 Hex) |
| :---: | :---: |
| Force Single Coil (05 | Preset Single Register (06 |
| Force Multiple Coils ( $0 \mathrm{~F}_{\text {Hex }}$ ) | Preset Multiple Registers ( $10_{\text {HEX }}$ ) |

## Description

Reads the ON/OFF status of discrete outputs ( $0 \times$ references, coils) in the slave. Broadcast is never supported for reads.

## Query

The query message specifles the starting coil and quantity of coils to be read. Coils are addressed starting at zero. Coils 1-16 are addressed as 0.15.

Example of a request to read coils 1-16 from slave device 01.

| Field Name | Example (HEX) |
| :--- | :--- |
| Slave Address | 01 |
| Function | 01 |
| Starting Address HI | 00 |
| Starting Address LO | 00 |
| No. of Points HI | 00 |
| No. of Points LO | 10 |
| Error Check (CRC) | - |

## Response

The coil status in the response message is packed as one coil per bit of the data field. Status is indicated as: $1=O N ; 0=O F F$. The LSB of the first data byte contains the coil addressed in the query. The other coils follow toward the high order end of this byte, and from 'low order to high order' in subsequent bytes.

If the returned coil quantity is not a multiple of eight, the remaining bits in the final data byte will be padded with zeros (toward the high order end of the byte). The Byte Count field specifies the quantity of complete bytes of data.

| Field Name | Example (HEX) |
| :--- | :--- |
| Slave Address | 01 |
| Function | 01 |
| Byte Count | 02 |
| Data (Coils 8-1) | 55 |
| Data (Coils 16-9) | AA |
| Error Check (CRC) | - |

## Force Single Coil ( $05_{\text {HEX }}$ )

## Description

Forces a single coil ( $0 X$ reference) to either ON or OFF. When broadcast, the function forces the same coil references in all attached slaves.

## Query

The query message specifies the coil reference to be forced. Coils are addressed starting at zero. Coil 1 is addressed as 0 . Force Data $=0000_{\text {HEX }}$ (OFF) or FF $00_{\text {HEX }}$ (ON).

Example of a request to set coil 1 (addressed as 0 ) from slave device 01 .

| Field Name | Example (HEX) |
| :--- | :--- |
| Slave Address | 01 |
| Function | 05 |
| Coil Address HI | 00 |
| Coil Address LO | 00 |
| Force Data HI | FF |
| Force Data LO . | 00 |
| Error Check (CRC) | - |

## Response

The normal response is an echo of the query, returned after the coil state has been forced.

| Field Name | Example (HEX) |
| :--- | :--- |
| Slave Address | 01 |
| Function | 05 |
| Force Data HI | FF |
| Force Data LO | 00 |
| Quantity of Coils HI | 00 |
| Quantity of Coils LO | 0 A |
| Error Check (CRC) | - |

## APPENDIX A

Force

## Description

Multiple Coils
( $0 \mathrm{~F}_{\text {HEX }}$ )
Forces each coil ( $0 X$ reference) in a sequence of coils to either ON or OFF. When broadcast, the function forces the same coil references in all attached slaves.

## Query

The query message specifies the coil references to be forced. Coils are addressed starting at zero. Coil 1 is addressed as 0 .

Example of a request to set 10 coils starting at coil 1 (addressed as 0 ) from slave device 01 .

| Field Name | Example (HEX) |
| :--- | :--- |
| Slave Address | 01 |
| Function | 0 F |
| Coil Address HI | 00 |
| Coil Address LO | 00 |
| Quantity of Coils HI | 00 |
| Quantity of Coils LO | 0 A |
| Byte Count | 02 |
| Force Data HI (Coils 8-1) | FF |
| Force Data LO (Coils 10-9) | 03 |
| Error Check (CRC) | - |

## Response

The normal response returns the slave address, function code, starting address, and quantity of coils forced.

| Field Name | Example (HEX) |
| :--- | :--- |
| Slave Address | 01. |
| Function | 0 F |
| Coil Address HI | 00 |
| Coil Address LO | 00 |
| Quantity of Coils HI | 00 |
| Quantity of Coils LO | 0 A |
| Error Check (CRC) | - |

## APPENDIX A

Read
Holding Registers
( $03_{\text {HEX }}$ )

## Description

Reads the binary contents of holding registers ( $4 x$ references) in the slave. Broadcast is never supported for reads.

## Query

The query message specifies the starting register and quantity of registers to be read. Registers are addressed starting at zero. Registers 1-4 are addressed as 0-3.

Example of a request to read registers 40001-03 from slave device 01.

| Field Name | Example (HEX) |
| :--- | :--- |
| Slave Address | 01 |
| Function | 03 |
| Starting Address HI | 00 |
| Starting Address LO | 00 |
| No. of Points HI | 00 |
| No. of Points LO | 03 |
| Error Check (CRC) | - |

## Response

The register data in the response message are packed as two bytes per register, with the binary contents right justified within each byte. For each register, the first byte contains the high order bits and the second contains the low order bits.

| Field Name | Example (HEX) |
| :--- | :--- |
| Slave Address | 01 |
| Function | 03 |
| Byte Count | 06 |
| Data HI (Register 40001) | 55 |
| Data LO (Register 40001) | AA |
| Data HI (Register 40002) | 55 |
| Data LO (Register 40002) | AA |
| Data HI (Register 40003) | 55 |
| Data LO (Register 40003) | AA |
| Error Check (CRC) | - |

APPENDIX A

Preset
Single Register ( $\mathbf{0 6}_{\text {HEX }}$ )

## Description

Presets a value into a single holding register ( $4 \times$ reference). When broadcast, the function presets the same register reference in all attached slaves.

## Query

The query message specifies the register reference to be preset. Registers are addressed starting at zero. Register 1 is addressed as 0 .

Example of a request to preset register 40002 to $0003_{\mathrm{HEx}}$ in slave device 01.

| Field Name | Example (HEX) |
| :--- | :--- |
| Slave Address | 01 |
| Function | 06 |
| Register Address HI | 00 |
| Register Address LO | 01 |
| Preset Data HI | 00 |
| Preset Data LO | 03 |
| Error Check (CRC) | -- |

## Response

The normal response is an echo of the query, returned after the register contents have been passed.

| Field Name | Example (HEX) |
| :--- | :--- |
| Slave Address | 01 |
| Function | 06 |
| Register Address HI | 00 |
| Register Address LO | 01 |
| Preset Data HI | 00 |
| Preset Data LO | 03 |
| Error Check (CRC) | -- |

## APPENDIX A

| Preset | Description <br> Multiple |
| :--- | :--- |
| Presets values into a sequence of holding <br> registers ( $4 \times$ references). When broadcast, |  |
| Registers | $\left.\begin{array}{l}\text { the function presets the same register } \\ \text { (10 } \\ \text { HEX }\end{array}\right)$ |
|  | references in all attached slaves. |
|  | Query |
|  | The query message specifies the register <br> references to be preset. Registers are <br> addressed starting at zero. Register 1 is <br> addressed as 0. |

Example of a request to preset two registers starting at 40002 to $00 \mathrm{AA}_{\text {HEX }}$ and $0102_{\mathrm{HE}}$, in slave device 1.

| Field Name | Example (HEX) |
| :--- | :--- |
| Slave Address | 01 |
| Function | 10 |
| Starting Address HI | 00 |
| Starting Address LO | 01 |
| No. of Registers HI | 00 |
| No. of Registers LO | 02 |
| Byte Count | 04 |
| Write Data HI (Register 40001) | 00 |
| Write Data LO (Register 40001) | 0 A |
| Write Data HI (Register 40002) | 01 |
| Write Data LO (Register 40002) | 02 |
| Error Check (CRC) | - |

## Response

The normal response returns the slave address, function code, starting address, and quantity of registers preset.

| Field Name | Example (HEX) |
| :--- | :--- |
| Slave Address | 01 |
| Function | 10 |
| Starting Address HI | 00 |
| Starting Address LO | 01 |
| No. of Registers HI | 00 |
| No. of Registers LO | 02 |
| Error Check (CRC) | - |

## APPENDIX A

## Danfoss Graham

## Division of Danfoss Inc.

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## Detailed Specifications for ERICO's TDS-DINLINE SURGE DIVERTER TDS180-4S

## Applications

Lightning transients and surges are a major cause of expensive electronic equipment failure and business disruption. Damage may result in loss of computers, data and communications, loss of revenue, and loss of profits. The new TDSDINLINE family of surge diverters and filters offer economical and reliable protection from power transients in even the most strenuous applications.

Transient Discriminating Technology (TDS) introduces the first quantum leap in transient suppression technology for mains powered equipment. It offers a new level of safety and reliability, yet retains optimum protection levels critical for electronic equipment. TDS is an active frequency based device that discriminates between the slower mains voltages and the higher speed transients. When transient frequencies are detected the patented TDS "Quick-Switch" technology "switches in" robust protection devices to limit the transient to safe levels. The frequency discrimination circuit controlling the TDS "Quick-Switch" ensures that the device is virtually immune to the effects of the $50 / 60 \mathrm{~Hz}$ sustained overvoltages, allowing fault voltages of up to 480 V rms without degradation, and providing over-voltage robustness in excess of the demanding new and emerging standards.

TDS technology is essential for any site where abnormal over-voltages can occur or where the possible catastrophic failure of traditional technologies due to overvoltage events can not be tolerated.

The TDS 180-4S unit provides this technology in a single mode shunt-only, 72 mm width module. Its unique design allows it to be configured for $\mathrm{Ph}-\mathrm{N}$ or $\mathrm{Ph}-\mathrm{E}$ or N -E applications.

Rated to a surge capacity of $80 \mathrm{kA}(8 / 20 \mu \mathrm{~s})$, internally 160 kA of surge material is provided for additional robustness and to provide long service life. The unit is designed for sites with a medium risk of transients or for secondary protection applications. For the protection of high exposure sites or critical equipment higher surge rated TDS DINLINE units, or TDS MOVTEC ${ }^{\text {TM }}$ should be installed.

## Features

- Robust against abnormal over-voltage
- UL1449 Edition 2 compliant
- Single phase primary protection for medium exposure sites or secondary protection applications
- Single mode protection, configurable to $\mathrm{Ph}-\mathrm{N}, \mathrm{Ph}-\mathrm{E}$ or $\mathrm{N}-\mathrm{E}$ protection
- 35 mm DIN rail mount, DIN 43880 profile matches common MCBs
- 72 mm width compact design fits into most switch and distribution boards
- Electronic status indicator ideal for poorly illuminated locations
- Long Service life
- Optional retrofittable TDS Alarm Relay for remote alarms

LIGHTNING PROTECTION/GRQUNDIFG

## TDS-DINLINE SURGE DIVERTER TDS180-4S

SPECIFICATIONS
Operation:
Nominal input voltage
Input frequency
Max. permissible abnormal over-voltage
Power systems
Earth leakage current Protection: Modes
Let through voltage @ $3 \mathrm{kA} 8 / 20 \mu \mathrm{~s}$
Let through voltage @ $20 \mathrm{kA} 8 / 20 \mu \mathrm{~s}$
Surge rating $8 / 20 \mu \mathrm{~s}$
Surge rating $10 / 350 \mu \mathrm{~s}$
Energy rating
Multipulse ${ }^{\text {TM }}$ capability
Aggregate surge material
Alarms and Indicators:
Protection status indication
Alarm contacts Physicals:
Environmental rating
Operating conditions
Enclosure style
Dimensions (W x D x H)
Weight
Encapsulation
Enclosure material
Surface finish
Wiring terminals
Warranty


220-277 Vrms
$50 / 60 \mathrm{~Hz}$
480 Vrms
TN-C, TN-S, TN-C-S (MEN), TT
$<2 \mathrm{~mA}$
$\mathrm{Ph}-\mathrm{N}, \mathrm{Ph}-\mathrm{E}$ or $\mathrm{N}-\mathrm{E}$
$<720 \mathrm{~V}$
$<910 \mathrm{~V}$
80kA
16kA
3840J
Yes
$160 \mathrm{kA} 8 / 20 \mu \mathrm{~s}$
Two, electronic. $\mathrm{On}_{\mathrm{n}}=\mathrm{OK}$
User configurable, with optional TDS-AR
IP20
-35 to $+55^{\circ} \mathrm{C}, 0-90 \%$ humidity
DIN 43880
$72 \times 88 \times 70 \mathrm{~mm}$
350 g (approx.)
Shockguard
Flame Retardent UL94V-0
Spark eroded finish
Accepts up to $6 \mathrm{~mm}^{2}$
5 years
UL1449 Edition 2
AS 3260, IEC 950
Certificate of suitability, Electricity Regulator ANSI/IEEE C62.41-1991 Cat A, Cat B, Cat C. ANSI/IEEE C62.45-1987 Life cycle testing. AS/NZS 1768-1991 Cat A, Cat.B, Cat C. BS 6651:1992 Cat A, Cat B. IEC801-5 Installation Class 5. IEC 61643-1

Note: Other operating voltages and frequencies are available on application.
For specifications on other DNNLINE products, refer to relevant Specifications Sheet.
Exceeding nominal operating voltage while transient events occur may affect product life.
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Model Number
TDS180-4S-277

Description
TDS 277V 80KA SURGE SUPPRESSOR

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| :---: | :---: | :---: | :---: | :---: | :---: |
| Sydrey | Ph:+81 2 9479-8500 | fax+ 112 8980-5092 | Perth | ph:-61189358-1233 | fax+6189350-1404 |
| Medboume | Ph:+81 3 9894-2677 | tax+8139894-3216 | Singapore | ph:+ 85-783-2477 | faxt $655633-2397$ |
| Canberra | ph:+812 8257-3055 | tax+812 6257-3127 | Mhailand | ph= 868 627-8037-8 | fax.+662 627-9168 |

ERICO's coordinated approach to facility protection - CADWELD, CRITEC, ERITECH www.erico.com


# Power interruptions can affect productivity, cost dollars and at times, safety 

## Circuit condition sensing circuit

In today's highly competitive environment it is essential to be able to rely on a continuous power supply.
Modern buildings and industrial complexes have critical loads such as essential lighting, computers and continuously operating industrial equipment. An uninterrupted power supply is vital for these functions.
Reliability of your power supply can be achieved with a Terasaki automatic transfer switch comprising a basic transfer switch for the actual switching and a logic control panel, or control circuit to automatically sense when to switch. Whenever mains voltage drops below $85 \%$ of the nominal line voltage, the logic controller signals the emergency source engine to start, then automatically transfers the load to the emergency source by activating the motor driven circuit breakers in the BTS (basic transfer switch).

The transfer operation is initiated and controlled by a compact logic panel comprising voltage and phase monitoring relays, time delay relays and logic relay (or PLC logic type). An adjustable time delay relay prevents changeover due to momentary voltage fluctuation. When the load has been transferred the supply is continually monitored to determine when the load can be transferred back to the preferred supply. An adjustable time delay relay (TDEN) prevents the transfer switch returning the load to the normal supply until the voltage has stabilised.
The basic transfer section comprising motor operated circuit breakers and interlocks is controlled by the logic panel and performs the automatic transfer only when commanded to do so by the logic panel.
The logic control also provides a voltage-free contact to initiate starting the emergency engine.
The standard TemLogic panels may be customised with up to 12 optional functions (refer pages 9-22 to 9-25 for details)


Caption?


Caption?

## TERASAKI

## Transfer switches

## BASIC TRANSFER SWITCHES

Terasaki transfer switches may be supplied without TemLogic control panels where customers prefer to design their own automatic control. This assembly is known as a basic transfer switch.

Each basic transfer switch includes two motor operated circuit breakers mechanically and electrically interlocked for safety. One additional auxiliary switch for customer use is supplied as standard on each circuit breaker. The assembly is mounted on a white painted base plate and wired to terminals allowing for simple customer connection.

## BTS options:

Extra auxiliary contacts.
Alarm switch.
Shunt trip.
Other options include:
Common loadside busbars.
Enclosure.
Voltage:
Standard voltage is 240 V AC .
Special voltages:
110 V, AC, 110 V DC, 24 V DC
available on request.



## Transfer switches

## Multiple functions - <br> Protection, isolation and switching in one compact device

Circuil breaker transfer switches provide integral circuit protection, automatic switching and circuit isolation in one compact device. Other features include:

- A choice of moulded case or air circuit breaker.
- Auxiliary and optional alarm contacts which indicate the status of each MCCB 'on - off or tripped', and may be used to signal to a master controller or building management system.
- Indicator flags on the motor mechanism to show motor operation status.

D Dual mechanical and electrical interlocking is provided for safety.
] Simple connection. Control wiring is pre-wired to a terminal strip. External control connections are simple 3 wire on-off/reset common. Terasaki automatic transfer switches are space saving, economical and more flexible when compared to the alternative arrangement using electro-magnetic contactors and switch fuse units for circuit protection.

## Precise protection co-ordination

MCCBs with microprocessor overcurrent relays, have the flexibility to provide multiple protective functions. Their precise co-ordination enables the transfer switch to become an integral part of the overall grading (selectivity) scheme.

Terasaki electronic MCCB protection characteristics


## TERASAKI <br> Transfer switches

## Conserves energy

Circuit breaker transfer switches have three stable positions: 'on', 'off' and 'tripped'. These positions are maintained mechanically, thus energy consumption and maintenance is reduced by eliminating the need for electromagnetic coils.

## 3 Stable positions



Stable positions - conserve energy, reduce maintenance
Each position is mechanically stable eliminating the need for continuously energised coils curtailing waste energy and reducing maintenance compared to electrically held devices.

## True RMS monitoring unaffected by harmonics

Tem-Break MCCBs with electronic OCRs detect true RMS of the load current. Therefore, the tripping characteristics are unaffected by harmonics. Thermal magnetic MCCBs are also unaffected. Nuisance tripping is avoided and precise protection is maintained.


## (9) TERASAKI

## Automatic transfer switches

## Moulded case interlocked pairs

The versatility of the cable mechanical interlock fitting allows us to offer almost any combination of MCCBs from 400 A to 2500 A as an interlocked pair. Each MCCB is supplied asembled with cable mechanical interlock fitting, motor operator and auxiliary contacts for electrical interlocking plus one for customer use. The auxiliary contact leads are terminated at an auxilary connection block on the side of the breaker for convenience of customer wiring.
The cable wire is supplied. Please specify length.



Interlocked 3 pole type MCCB to MCCB


9

[^0]
## Automatic transfer switches

## Quality assurance

Each Terasaki automatic transfer switch is made to an identical bill of materials. A wiring schematic and connection diagram is supplied with each BTS to simplify installation and wiring. Quality Assurance is in accordance with Australian Standards.


## Remote emergency off (optional)

A shunt trip (optional) is available with Terasaki automatic or basic transfer switches. This optional feature enables remote tripping of the mains or emergency circuit breakers.

## Auto reset (optional)

Each basic transfer switch may be equipped for auto reset. If either circuit breaker is tripped manually via a shunt trip or by the sensing of overcurrent, the auto reset automatically returns the MCCB to the 'off' position. This feature requires the use of one additional auxiliary contact or an alarm contact. Please specify when ordering.


Shunt trip


Alarm / auxiliary switch

## Transfer switches



SlimLine transfer switches. Available in horizontal or vertical configurations.

## Slimline BTS

Slimline transfer switches featuring the cable/rod mechanical interlock system are more flexible than the standard walking beam models and can save valuable switchboard width when in the vertical configuration. The Slimline is available in two forms:
a) Fully assembled wired and mounted vertical or horizontal on a base plate (with rod type mechanical interlock).
b) Without baseplate and wiring. An interlocking cable is supplied loose.

The arrangement described in b) above finds its application in Form 2, 3 and 4 compartmented switchboards. This model is supplied partially assembled to enable the interlocking cable (wire) to be passed from one compartment to another without disturbing segregation barriers.
The MCCBs are supplied with motor, mechanical interlock fitting and auxiliary contacts fully assembled. The switchboard manufacturer then has the option of mounting the MCCBs complete with accessories in the position which best suits the switchboard construction.

## Flexibility in MCCB selection

Different current (and frame size) rated MCCBs may be selected where the EMERGENCY supply feeds essential circuits only. By using a smaller frame MCCB on the emergency circuit a more economical arrangement can be achieved.
A wide diversity of Slimline transfer switches are available featuring models as diverse as 2500 A - 400 A. Three pole/four pole models are also available.


## (9) TERASAK! Basic transfer switches (BTS) With motor

| MCCBs used | Ampere Range | Interrupting cap.$(415 \mathrm{~V})$ |  |  | Overall 3 pole ${ }^{4}$ ) dimensions (mm) |  |  | Cat. No. ') <br> 3 pole BTS | Cat. No. ') <br> 4 pole BTS |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Icu | Ics | OCR type | W | $\mathrm{H}^{\mathbf{~}}$ ) | D |  |  |
| XS125CJ | 40-63 | 18 | 9 | Therm Mag | 305 | 209 | 235 | BS1C633 | BS1C644 |
| XS125CJ | 63-100 | 18 | 9 | Therm Mag | 305 | 209 | 235 | BS1C133 | BS1C144 |
| XSt25CJ | 79-125 | 18 | 9 | Therm Mag | 305 | 209 | 235 | BS1C233 | BS1C244 |
| XS125NJ | 40-63 | 30 | 15 | Therm Mag | 305 | 209 | 235 | BS1N633 | BS1N644 |
| XS125NJ | 63-100 | 30 | 15 | Therm Mag | 305 | 209 | 235 | BS1N133 | BS1N144 |
| XS125NJ | 79-125 | 30 | 15 | Therm Mag | 305 | 209 | 235 | BS1N233 | BS1N244 |
| XH125NJ | 40-63 | 50 | 25 | Therm Mag | 305 | 209 | 235 | BH1N633 | BH1N644 |
| XH125NJ | 63-100 | 50 | 25 | Therm Mag | 305 | 209 | 235 | BH1N133 | BH1N144 |
| XH125NJ | 79-125 | 50 | 25 | Therm Mag | 305 | 209 | 235 | BH1N233 | BH1N244 |
| XH125PJ | 40-63 | 50 | 50 | Therm Mag | 305 | 209 | 235 | BH1P633 | BH1P644 |
| XH125PJ | 63-100 | 50 | 50 | Therm Mag | 305 | 209 | 235 | BH1P133 | BH1P144 |
| XH125PJ | 79-125 | 50 | 50 | Therm Mag | 305 | 209 | 235 | BH1P233 | BH1P244 |
| XH160PJ | 100-160 | 50 | 50 | Therm Mag | 336 | 237 | 258 | BH2P133 | BH2P144 |
| XS250NJ | 100-160 | 35 | 18 | Therm Mag | 336 | 237 | 241 | BS2N133 | BS2N144 |
| XS250NJ | 163-250 | 35 | 18 | Therm Mag | 336 | 237 | 241 | BS2N233 | BS2N244 |
| XH250NJ | 100-160 | 50 | 25 | Therm Mag | 336 | 237 | 258 | BH2N133 | BH2N144 |
| XH250NJ | 100-250 | 50 | 25 | Therm Mag | 336 | 237 | 258 | BH2N233 | BH2N244 |
| X5400CJ | 100-250 | 35 | 18 | Therm Mag | 500 | 323 | 325 | BS4C233 | BS4C244 |
| X\$400C. | 250-400 | 35 | 18 | Therm Mag | 500 | 323 | 325 | BS4C433 | BS4C444 |
| XS400NJ | 163-250 | 50 | 25 | Therm Mag | 500 | 323 | 325 | BS4N233 | BS4N244 |
| XS400NJ | 250-400 | 50 | 25 | Therm Mag | 500 | 323 | 325 | BS4N433 | BS4N444 |
| XH400PJ | 250-400 | 65 | 50 | Therm Mag | 500 | 323 | 325 | BH4P433 | BH4P444 |
| X ${ }^{\text {d }}$ 400SE | 125-250 | 50 | 25 | Ejectronic | 500 | 323 | 325 | B\$4S233 | BS4S244 |
| XS400SE | 200-400 | 50 | 25 | Electronic | 500 | 323 | 325 | BS4S433 | BS4S444 |
| XH400SE | 125-250 | 65 | 33 | Electronic | 500 | 323 | 325 | BH4S233 | BH4S244 |
| XH400SE | 200-400 | 65 | 33 | Electronic | 500 | 323 | 325 | BH4S433 | BH4S444 |
| XH400PE | 125-250 | 65 | 50 | Electronic | 500 | 323 | 325 | BH4P233 | BH4P244 |
| XH400PE | 200-400 | 65 | 50 | Electronic | 500 | 323 | 325 | BH4P433 | BH4P444 |
| XS630CJ | 250-400 | 45 | 23 | Therm Mag | 550 | 433 | 341 | BS6C433 | BS6C444 |
| XS630CN | 400-630 | 45 | 23 | Therm Mag | 550 | 433 | 341 | BS6C633 | BS6C644 |
| XS630NJ | 250-400 | 65 | 33 | Therm Mag | 550 | 433 | 341 | BS6N433 | BS6N444 |
| XS630NJ | 400-630 | 65 | 33 | Therm Mag | 550 | 433 | 341 | ES6N633 | BS6N644 |
| XH630PJ | 250-400 | 85 | 50 | Therm Mag | 550 | 433 | 341 | BH6P433 | BH6P444 |
| XH630PJ | 400-630 | 85 | 50 | Therm Mag | 550 | 433 | 341 | BH6P633 | BH6P644 |
| XS630SE | 315-630 | 50 | 33 | Electronic | 550 | 433 | 341 | B56S633 | BS6S644 |
| XH630SE | 315-630 | 65 | 33 | Electronic | 550 | 433 | 341 | BH6S633 | BH6S644 |
| XH630PE | 315-630 | 65 | 50 | Electronic | 550 | 433 | 341 | EH6P633 | BH6P644 |
| XS800NJ | 500-800 | 65 | 33 | Therm Mag | 550 | 433 | 341 | BS8N833 | BS8N844 |
| XH800PJ | 500-800 | 85 | 50 | Therm Mag | 550 | 433 | 341 | BH8P833 | BH8P844 |
| XS800SE | 400-800 | 50 | 25 | Electronic | 550 | 433 | 341 | BS8S833 | BS8S844 |
| XH800PE | 400-800 | 65 | 50 | Electronic | 550 | 433 | 341 | BH8P833 | BH8P844 |
| XS1250SE | 500-1000 | 65 | 49 | Electronic | 553 | 530 | 300 | ES12S1033 | BS12S1044 |
| XS1250SE | 625-1250 | 65 | 49 | Electronic | 553 | 530 | 300 | BS12S1233 | BS12S1244 |
| XS1600SE | 800-1600 | 85 | 64 | Electronic | 553 | 570 | 320 | BS16\$1633 | BS16\$1644 |
| XS2000SE | 1000-2000 | 100 | 64 | Electronic | 774 | 490 | $361{ }^{3}$ ) | BS20E2033 | BS20E2044 |
| XS2500SE | 1250-2500 | 100 | 64 | Electronic | 774 | 490 | $361{ }^{3}$ ) | B\$25E2533 | B\$25E2544 |
| TL100NJ | 40-63 | 85 | 85 | Therm Mag | 305 | 300 | 235 | BT1N633 | BT1N644 |
| TL100NJ | 63-100 | 85 | 85 | Therm Mag | 305 | 300 | 235 | BTtN133 | BT1N144 |
| TL250NJ | 163-250 | 100 | 100 | Therm Mag | 500 | 323 | 325 | BT2N233 | BT2N244 |
| TL400NE | 200-400 | 100 | 100 | Electronic | 500 | 323 | 325 | BT4E433 | BT4E444 |
| TL630NE | 315-630 | 125 | 70 | Electronic | 553 | 490 | 320 | BT6E633 | BT6E644 |
| TL800NE | 400-800 | 125 | 70 | Electronic | 553 | 490 | 320 | BT8E833 | BT8E844 |
| TL1250NE | 625-1250 | 125 | 85 | Electronic | 553 | 490 | 320 | BT12E1233 | BT12E1244 |
| Note: ') Ordering sheet refer page 9-21 |  |  |  |  | ${ }^{3}$ ) Depth does not include rear connect busbars. <br> ${ }^{\text {4 }}$ ) Detailed dimensions $3 / 4$ pole reler following pages. |  |  |  |  |

## (9) TERASAK <br> Basic transfer switches (BTS) <br> 3 and 4 pole combinations

| MCCBs used | Ampere Range | Interrupting cap. ( 415 V) |  | OCR type | Overall dimensions (mm) ') |  |  | $\begin{aligned} & \text { Cat. No. ') } \\ & 3 \mathrm{P}+4 \mathrm{P} \\ & \text { BTS } \end{aligned}$ | $\begin{aligned} & \text { Cat. No. }{ }^{1} \text { ) } \\ & 4 \mathrm{P}+3 \mathrm{P} \\ & \text { BTS } \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Icu | Ics |  | W (4 p |  | D |  |  |
| XS125ca | 40-63 | 18 | 9 | Therm Mag | 350 | 209 | 235 | BS1C634 | BS1C643 |
| XS125G | 63-100 | 18 | 9 | Therm Mag | 350 | 209 | 235 | BS1C134 | BS1C143 |
| XS125Ca | 79-125 | 18 | 9 | Therm Mag | 350 | 209 | 235 | BS1C234 | BS1C243 |
| XS125NJ | 40-63 | 30 | 15 | Therm Mag | 350 | 209 | 235 | BS1N634 | BS1N643 |
| XS125NJ | 63-100 | 30 | 15 | Therm Mag | 350 | 209 | 235 | BS1N134 | BS1N143 |
| XS125NJ | 79-125 | 30 | 15 | Therm Mag | 350 | 209 | 235 | BS1N234 | BS1N243 |
| XH125NJ | 40-63 | 50 | 25 | Therm Mag | 350 | 209 | 235 | BH1N634 | BH1N643 |
| XH125NJ | 63-100 | 50 | 25 | Therm Mag | 350 | 209 | 235 | BH1N134 | BH1N143 |
| XH125NJ | 79-125 | 50 | 25 | Therm Mag | 350 | 209 | 235 | BHiN234 | BH1N243 |
| XH125PJ | 40-63 | 50 | 50 | Therm Mag | 350 | 209 | 235 | BH1P634 | BH1P643 |
| XH125PJ | 63-100 | 50 | 50 | Therm Mag | 350 | 209 | 235 | BH1P134 | BH1P143 |
| XH125PJ | 79-125 | 50 | 50 | Therm Mag | 350 | 209 | 235 | BH1P234 | BH1P243 |
| XH160PJ | 100-160 | 50 | 50 | Therm Mag | 406 | 237 | 258 | BH2P134 | BH2P143 |
| XS250NJ | 100-160 | 35 | 18 | Therm Mag | 406 | 237 | 241 | BS2N134 | BS2N143 |
| XS250NJ | 163-250 | 35 | 18 | Therm Mag | 406 | 237 | 241 | BS2N234 | BS2N243 |
| XH250NJ | 100-160 | 50 | 25 | Therm Mag | 406 | 237 | 258 | BH2N134 | BH2N143 |
| XH250NJ | 100-250 | 50 | 25 | Therm Mag | 406 | 237 | 258 | BH2N234 | BH2N243 |
| xS400\% | 100-250 | 35 | 18 | Therm Mag | 500 | 323 | 325 | BS4C234 | BS4C243 |
| XS400CJ | 250-400 | 35 | 18 | Therm Mag | 500 | 323 | 325 | BS4C434 | BS4C443 |
| XS400NJ | 163-250 | 50 | 25 | Therm Mag | 500 | 323 | 325 | BS4N234 | BS4N243 |
| XS400NJ | 250-400 | 50 | 25 | Therm Mag | 500 | 323 | 325 | BS4N434 | BS4N443 |
| XH400PJ | 250-400 | 65 | 50 | Therm Mag | 500 | 323 | 325 | BH4P434 | BH4P443 |
| XS400SE | 125-250 | 50 | 25 | Electronic | 500 | 323 | 325 | BS4S234 | BS4S243 |
| XS400SE | 200-400 | 50 | 25 | Electronic | 500 | 323 | 325 | BS4S434 | BS4S443 |
| XH400SE | 125-250 | 65 | 33 | Electronic | 500 | 323 | 325 | BH4S234 | BH4S243 |
| XH400SE | 200-400 | 65 | 33 | Electronic | 500 | 323 | 325 | BH4S434 | BH4S443 |
| XH400PE | 125-250 | 65 | 50 | Electronic | 500 | 323 | 325 | BH4P234 | BH4P243 |
| XH400PE | 200-400 | 65 | 50 | Electronic | 500 | 323 | 325 | BH4P434 | BH4P443 |
| XS630CJ | 250-400 | 45 | 23 | Therm Mag | 690 | 433 | 341 | BS6C434 | BS6C443 |
| XS6300 | 400-630 | 45 | 23 | Therm Mag | 690 | 433 | 341 | BS6C634 | BS6C643 |
| XS630NJ | 250-400 | 65 | 33 | Therm Mag | 690 | 433 | 341 | BS6N434 | BS6N443 |
| XS630NJ | 400-630 | 65 | 33 | Therm Mag | 690 | 433 | 341 | BS6N634 | BS6N643 |
| XH630PJ | 250-400 | 85 | 50 | Therm Mag | 690 | 433 | 341 | BH6P434 | BH6P443 |
| XH630PJ | 400-630 | 85 | 50 | Therm Mag | 690 | 433 | 341 | BH6P634 | BH6P643 |
| XS630SE | 315-630 | 65 | 33 | Electronic | 690 | 433 | 341 | BS6S634 | BS6S643 |
| XH630SE | 315-630 | 65 | 33 | Electronic | 690 | 433 | 341 | BH6S634 | BH6S643 |
| XH630PE | 315-630 | 65 | 50 | Electronic | 690 | 433 | 341 | BH6P634 | BH6P643 |
| XS800NJ | 500-800 | 65 | 33 | Therm Mag | 690 | 433 | 341 | BS8N834 | BS8N843 |
| XH800PJ | 500-800 | 85 | 50 | Therm Mag | 690 | 433 | 341 | BH8P834 | BH8P843 |
| XS800SE | $400-800$ | 50 | 25 | Electronic | 690 | 433 | 341 | BS85834 | BS8S843 |
| XH800PE | 400-800 | 65 | 50 | Electronic | 690 | 433 | 341 | BH8P834 | BH8P843 |
| XS1250SE | 500-1000 | 65 | 49 | Electronic | 693 | 530 | 300 | BS12S1034 | BS12S1043 |
| XS1250SE | 625-1250 | 65 | 49 | Electronic | 693 | 530 | 300 | BS12S1234 | BS12S1243 |
| XS1600SE | 800-1600 | 85 | 64 | Electronic | 693 | 570 | 320 | BS16S1634 | BS16S1643 |
| XS2000SE | 1000-2000 | 100 | 64 | Electronic | 994 | 490 | $361{ }^{\text {² }}$ ) | BS20E2034 | BS20E2043 |
| XS2500SE | 1250-2500 | 100 | 64 | Electronic | 994 | 490 | $361{ }^{\text {\% }}$ ) | BS25E2534 | BS25E2543 |
| TL100NJ | 40-63 | 85 | 85 | Therm Mag | 350 | 300 | 235 | BT1N634 | BT1N643 |
| TL100NJ | 63-100 | 85 | 85 | Therm Mag | 350 | 300 | 235 | BT1N134 | BT1N143 |
| TL250NJ | 163-250 | 100 | 100 | Therm Mag | 500 | 323 | 325 | BT2N234 | BT2N243 |
| TL400NE | 200-400 | 100 | 100 | Electronic | 500 | 323 | 325 | BT4E434 | BT4E443 |
| TLG30NE | 315-630 | 125 | 70 | Electronic | 693 | 490 | 320 | BT6E634 | BT6E643 |
| TL800NE | 400-800 | 125 | 70 | Electronic | 693 | 490 | 320 | BT8E834 | BT8E843 |
| TL1250NE | 625-1250 | 125 | 65 | Electronic | 693 | 490 | 320 | BT12E1234 | BT12E1243 |

Note: ${ }^{1}$ ) Ordering sheet refer page 9-21.
${ }^{3}$ ) Depth does not include rear connect busbars.
${ }^{2}$ ) Height includes attached busbar on sizes 630 A \& above.
*) Refer NHP for dimensions (generally similar to 4 pole sizes)

## MCCB Technical data

## Thermal Magnetic MCCBs

Thermal-Magnetic MCCBs are available from 125AF to 800AF. Depending on the type of MCCB thermal and/or magnetic trip setting may be adjustable.

| MCCB type | Fixed <br> thermal | Adjustable <br> thermal | Fixed <br> magnetic | Adjustable <br> magnetic |
| :--- | :--- | :---: | :---: | :---: |
| XS125CS, XS125NS | - | - | - | - |
| XS125CJ, XS125NJ | - | - | - | - |
| XH125NJ, XH125PJ | - | - | - | - |
| XH160PJ | - | - | - |  |
| XE225NC | - | - | - |  |
| XS250NJ, XH250NJ | - | - | - |  |
| XH250PJ | - | - | - |  |
| XS400CJ, XS400NJ, XH400PJ | - | - | - |  |
| XS630CJ, XS630NJ, XH630PJ | - | - | - |  |
| XS800NJ |  | - | - |  |
| XH800PJ |  | - | - |  |

- Yes
- No

Access to setting dials
From 125AF to 250AF the thermal adjustment is visible from the front of the MCCB. At 400AF and above a protective cover must be removed to gain access to the settings. To achieve access to the settings the cover screw under the 'sealed' label must be removed.

To adjust the individual trip settings turn the setting dial with a flat bladed screwdriver.
Once set secure the cover and apply a new sealing label.


XH250NJ


XS400NJ


XS400NJ (cover removed)

## TEASAK!

## MCCB Technical data

## Thermal Adjustment

TemBreak MCCBs have a wide thermal adjustment range, one of the largest on the market. The rated current ' l ' is continuously adjustable from $63 \%$ to $100 \%$ of its nominal current ' In '. There are three main points of calibration marked at $63 \%, 80 \%$ and $100 \%$, as shown in the diagram below.

## Magnetic Adjustment

The magnetic adjustment is available on MCCBs of 400AF and above. The magnetic setting ' 1 m ' is continuously adjustable from $500 \%$ to $1000 \%$ of its rated current ' $1 n$ '. There are five main points of calibration marked as multiples of $\mathrm{In}_{\mathrm{n}} ; 5,6,7.1,8.5, \& 10$. These are shown in the diagram below.


## Examples

1. XS125NJ/125A MCCB set at $\mathrm{I}_{\mathrm{r}}=0.8$, the rated current is calculated as $125 \times 0.8=100 \mathrm{~A}$
2. $X S 400 \mathrm{NJ} / 400 \mathrm{~A} M C C B$ set at $\mathrm{I}_{\mathrm{m}}=6$, the magnetic setting is calculated as $400 \times 6=2400 \mathrm{~A}$
3. $\mathrm{XS} 630 \mathrm{NJ} / 630 \mathrm{~A} M C C B$ set at $\mathrm{I}_{\mathrm{f}}=0.8 \& \mathrm{Im}=5.0$

The rated current is calculated as $630 \times 0.8=504 \mathrm{~A}$
The magnetic setting is calculated as $630 \times 5=3150 \mathrm{~A}$
Note that the magnetic setting is a multiple of the nominal current $l_{n}$ and not the rated current $t$. Alt thermal and magnetic trip settings are expressed as $A C$ r.m.s. values.
All MCCBs are calibrated at $45^{\circ} \mathrm{C}$ unless otherwise specified.

Breakers with adjustable magnetic trip

| Breaker | Rated current (A) | Magnetic trip current (A) |  |  | 6 | 5 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Scale 10 | 8.5 | 7.1 |  |  |
| XS400CJ | 250 | 2500 | 2125 | 1775 | 1500 | 1250 |
|  |  |  |  |  |  |  |
| XH400PJ | 400 | 4000 | 3400 | 2840 | 2400 | 2000 |
|  |  |  |  |  |  |  |
| XS630NJ | 630 | 6300 | 5355 | 4473 | 3780 | 3150 |
| XH630PJ | 630 , | \%66300 | 5355 | 人29.4473. | 3780 | + 3150 |
| XS800NJ | 800 | 8000 | 6800 | 5680 | 4800 | 4000 |
| XH800PJ | 800 | $\pm 88000$ | 6800 | , | 4800 | - 4000 |

Note: Settings; 3-poles can be adjusted simultaneously with one adjustment dial.

## TEBASAK <br> MCCB Technical data

Time/current characteristic curves


Ambient compensating curves


## Example 1

The XS250NJ set at its maximum thermal setting of 250A experiences an overload of 1000A. What would be the tripping time?

## Solution

As the axis are 'percent' rated current the overload as a percentage to rated current is

$$
\frac{100 \mathrm{~A}}{250}=400 \%
$$

The maximum and minimum on the curve are the tolerance bands. Therefore at $400 \%$ overload the tripping time would be as follows:
Maximum trip time $=30$ seconds
Minimum trip time $=10$ seconds
Average trip time $=\mathbf{2 0}$ seconds
Due to strict quatity control of the manufacturing and calibration processes, the characteristic curve of most MCCBs will follow the 'average' curve within the tolerance band.

## Example 2

The XS250NJ is calibrated at 250 A for $45^{\circ} \mathrm{C}$ ambient. If the temperature rose to $55^{\circ} \mathrm{C}$ what effect would this have?

## Solution

At $55^{\circ} \mathrm{C}$ the ambient compensating factor is $93 \%$, i.e. $250 \times 0.93=232.5 \mathrm{~A}$.

In other words the XS160NJ would act as an MCCB set at 232.5A, in $55^{\circ} \mathrm{C}$.

## (9) TEASAMI <br> MCCB Technical data

## XS125CS, XS125NS

Time/current characteristic curves


Ambient compensating curves


## XS125CJ, XS125NJ, XH125NJ, XH125NJ

Time/current characteristic curves


Ambient compensating curves


## (9) ITBASAN <br> MCCB Technical data

## XE225NC

Time/current characteristic curves


Ambient compensating curves


## XH160PJ, XS250NJ, XH250NJ

Time/current characteristic curves


Ambient compensating curves


## (9) TEBASAM <br> MCCB Technical data

## XH250PJ, XS400CJ, XS400NJ, XH400PJ

Time/current characteristic curves


Ambient compensating curves


## XS630CJ, XS630NJ, XH630PJ

Time/current characteristic curves


Ambient compensating curves


## (9) TEASAK <br> MCCB Technical data

## XS800NJ, XH800PJ

Timefcurrent characteristic curves


Ambient compensating curves


## XM30PB

Time/current characteristic curves


## Ambient compensating curves



## ( 9 ) IEASAN <br> MCCB Technical data <br> 新 <br> A

## TL30F

Time/current characteristic curves


Ambient compensating curves


## TL100NJ

Time/current characteristic curves


Ambient compensating curves


## MCCB Technical data

## TL100EM

Time/current characteristic curves


Ambient compensating curves


## TL250NJ

Time/current characteristic curves


Ambient compensating curves


## MCCB Technical data

## Microprocessor based characteristics and adjustments

## Characteristics

The standard microprocessor based MCCB from Terasaki has the most flexible characteristics on the European market. In addition to the standard overload and short circuit protection, there are a number of options available to meet specific applications.


- Standard
- Optional
- Not available

MCCB types include XV mining MCCBs.

| Legend |  | Application |  |
| :---: | :---: | :---: | :---: |
| LTD | Long Time Delay | Overload protection, True R.M.S. |  |
| STD | Short Time Delay | Short circuit protection and selectivity | Standard for all |
| INST | Instantaneous | Short circuit protection, fast acting | TemBreak |
| $1^{2}$ R RAMP |  | Provides easier grading with downstream fuses | Microprocessor |
| Pick-up LED |  | Lights on LTD overload, flashes on PTA pick-up | MCCBs |
| Test Port |  | Facility for TNS-1 OCR checker for calibration checking |  |
| PTA | Pre-Trip Alarm | Useful for loadshedding application |  |
| GFT | Ground Fault Trip | Protection against ground faults |  |
| LEDs | Light Emitting Diodes | Indication of fault for faster diagnosis |  |
| HI-INST | High Instantaneous | High inrush applications, increased selectivity |  |

## Access to setting dials

To adjust the settings on the microprocessor TemBreak, the sealed label must be broken and the cover fixing screws removed. To adjust the individual trip settings, turn the setting dial with a flat bladed screwdriver. Align the setting required between the black dots marked on the dial.


## MCCB Technical data

## Microprocessor based characteristics and adjustments operation settings

Standard time current curves


Standard microprocessor adjustments


The $I^{2}$ t ramp switch, which is provided as standard, assists in discrimination with downstream fuses.
With the switch off, the STD operates with a definite time characteristic: $L$ with the switch on, the characteristic alters to a ramp: $k$, cutting off the corner which poses a potential selectivity problem.

| Setting Dial |  | Available adjustments |  |
| :---: | :---: | :---: | :---: |
| Base current setting | 10 | 0.63-0.8-1.0 $\mathrm{ln}^{\text {m }}$ | Amps |
| LTD pick up | 11 | 0.8-0.85-0.9-0.95-1.0 $\times 10$ | Amps |
| LTD setting | T1 | 5-10-15-20-25-30 (at la $\times 600 \%$ ) | Secs |
| STD pick up | 12 | 2-4-6-8-10 10 | Amps |
| STD setting | T2 | 0.1-0.15-0.2-0.25-0.3 | Secs |
| INST pick up | 13 | 3-12-x lo (continuously adjustable) | Amps |

[^1]
## MCCB Technical data

## Adjustment of TemBreak (electronic type) tripping characteristics

Electronic models of TemBreak come standard with an 8-bit microprocessor Over Current Relay (OCR). It is the OCR which provides the functions necessary for protection, while maintaining a high level of reliability.

The wide OCR adjustment range allows the circuit breaker to be set-up in order to trip under certain conditions. Adjustments can be made to the tripping current as well as tripping time of the breaker.

Note: The ground fault trip and pre-trip alarm cannot be used simultaneously in a single breaker.

Front view


Figure 1. Electronic OCR adjustment possible (with label removed).


## Adjustment method

Remove the sealing label, loosen and remove the cover fixing screws and remove the cover. To adjust the individual trip settings, turn the setting dial with a flat bladed screwdriver.
Note: Align the groove (end marked with dots) between the bands for the required setting.
For example, the diagram right shows $l_{0}=1.0$.
The INST. and GFT pick-up currents are continuously adjustable.


Secure the cover and apply the sealing label.

## (9) TBiasak

## MCCB Technical data

## Microprocessor based characteristics and adjustments operation and examples

## Overload adjustment

The rated current of the microprocessor based TemBreak is adjusted using two current multipliers. This process achieves high accuracy adjustment from $50 \%$ to $100 \%$. These are the LTD pickup dial ( $\mathrm{I}_{1}$ ) and the Base Current ( $\mathrm{l}_{0}$ ) selector switch.

The rated current (LTD pick-up) is achieved as follows:
$l_{\text {Rawe }}=\ln \times l_{0} \times l_{1}$
In the example shown on the right the rating would be:
$I_{\text {farito }}=1250 \times 1.0 \times 1.0=1250 \mathrm{~A}$
In total there are 15 possible increments of adjustment
 between 50 and $100 \%$ as shown below.

## Base current



Current dial


Breaker
rated current $72 \%$ in this
rated current


## Example - Settings

In the example shown on the right what are all the settings in Amps?
Solution
$I_{\text {Ratima }} L T D$ pickup $=\ln \times \operatorname{lo} \times l_{1}$
$1250 \times 0.8 \times 0.9=900 \mathrm{~A}$
STD pickup $=\ln \times \ln \times l_{2}$
$1250 \times 0.8 \times 4=4000 \mathrm{~A}$
INST pickup $=\ln \times 10 \times 13$
$1250 \times 0.8 \times 12=12,000 \mathrm{~A}$
GFT pickup $=\ln \times 10$

$$
1250 \times 0.1=125 \mathrm{~A}
$$

(Nole that GFT is a function of $\mathrm{l}_{\mathrm{n}}$ and not lo )


Example - Time/Current Curves



## TERASAK

## MCCB Technical data

## Options (electronic type) TemBreak

## Pre-trip alarm (PTA)

The PTA continuously monitors the true r.m.s. value of the load current. When the load current exceeds the pre-set current ( lp ) an LED gives local alarm that the MCCB is approaching an overload situation.
Should the current lp be exceeded for 40 secs a (1a) contact will close to provide remote indication and/or load shedding.

PTA specifications
Pick up current $(\mathrm{A})$ : [le]

Adjustable steps of $70,80,90,100 \%$ of the selected rated current [ 1 l$]$.
Setting tolerance $\pm 10 \%$
Note: The long time-delay trip does not operale 'first' when the pick-up current is adjusted to $100 \%$ of the rated current $[1 \mathrm{l}]$.

PTA characteristics


| Operating time (s) [lp] |  | 40 secs (fixed definite time-delay) setting tolerance is $\pm 10 \%$ |  |  |
| :---: | :---: | :---: | :---: | :---: |
| Output contact | Rating of contact | Normally open contact, (1a) Integral lead is standard length ( 450 mm ) |  |  |
|  |  |  | Resistive load | Inductive load |
|  |  | 250 V AC | 125 V A (2 A max) | 20 V A (2 A max) |
|  |  | 220 V DC | 60 W (2 A max) | 10 W (2 A max) |
| PTA indication |  | Pick-up LE |  |  |



## MCCB Technical data

## Adjustment of TemBreak electronic type OCR with ground fault

## Ground fault trip

The GFT pick-up current is continuously adjustable from $10 \%$ to $40 \%$ of the rated CT current.
Notes: The ground fault trip and pre-trip alarm cannot be used simultaneously in a single breaker.
XS400NE, XH400NE are not available with ground fault function.
When a three pole breaker is used in a 3 phase, 4 wire system, a separate CT is required for the neutral line. (refer NHP).

## GFT specifications



Continuously adjustable from 10 to $40 \%$ of the rated CT current (lct) setting tolerance is $+/-15 \%$

Is XIct
Time-delay (S): [TG]


The GFT has a definite time-delay characteristic and is adjustable in steps of $0.1,0.2,0.3,0.4,0.8 \mathrm{~s}$. Total clearing time is +50 ms and resettable time is -20 mS for the preset time delay.
GFT characteristics
Tg SEC


4th CT for GFT

| Rating (A) | Type |
| :--- | :--- |
| 2500 | UXOY0007A |
| 2000 | UXOY0006A |
| 1600 | UXOY0005A |
| 1250 | UXOY0004A |
| 1000 | UXOY0003A |
| 800 | UXOY0002A |
| 630 | UXOY0001A |



## Dimensions (mm)

| Rating (A) | A | B | C | D | E | F | H | CH | M | N |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| $2500-1000$ | 140 | 110 | 50 | 10 | 80 | 85 | 145 | 75 | 85 | 35 |
| $800-630$ | 105 | 100 | 40 | 8 | 50 | 75 | 110 | 57 | 50 | 20 |

## TERASAK

## MCCB Technical data

## TemBreak electronic type with ground fault

External neutral sensor (4th CT)
External neutral sensors are required whenever optional earth fault is used on 3 phase 4 wire systems

The position and direction of 4th CT


## The direction of 4th CT



## MCCB Technical data

## Trip indicators

The LEDs when lit, indicate which trip function tripped the breaker, long-time-delay (LTD), short-time delay' instantaneous (STD/NST) or ground fault (GFT) (control power required).

Note: If a pre-trip alarm (PTA) is fitted, the LED control power can be used (common).

Trip indicator display (1250AF and above)


Trip indicator display (400AF to 800AF) and OCR controller example: XS, XH, XV400
An optional feature available with TemBreak electronic type
An external trip indicator box is required with 400AF models. are fault indication contacts - these are voltage free and provide a signal of the cause of trip (long time, STDINST).


Notes: For dimensions of $\mathrm{XS} / \mathrm{XH800SE}, \mathrm{PE}$ and $\mathrm{XV630/800PE}$ refer to pages 7-39 and 7-40, add dimensions of OCR CONTROLLER and TRIP INDICATION box (above).

## MCCB Technical data

OCR controller (PTA and trip indication)

OCR controller mounting position


Dimension table (mm)

| Ampere frame | Type of мсСв |  |  | B |
| :---: | :---: | :---: | :---: | :---: |
|  |  | With UVT controller | Without UVT controller |  |
| 400 | X 8400 | 34 | 97 | 48 |
|  | XH400 | 34 | 97 | 48 |
|  |  |  |  |  |
| 800 | X 8800 | 64 | 151 | 60 |
|  | XH800 | 64 | 151 | 60 |
|  |  |  |  |  |
| 1600 | XS1600SE | 51 | 114 | 92 |
|  |  |  |  |  |
| 2500 | XS2500NE | 54 | 180 | 115 |

OCR controller (PTA and trip indication)
The OCR controller is installed in the left hand side of the breaker (standard). This can also be installed externally to the breaker (please specify when ordering).
OCR controller specifications
Control power source
Rated voltage $100-120 \mathrm{~V} \mathrm{AC}$ or $200-240 \mathrm{~V} \mathrm{AC}$
Consumption 2 VA
Note: The permissible range of control power is $85-110 \%$ of the rated voltage.
OCR controller connection diagram $\left.\left.{ }^{1}\right)^{\prime}\right)$


OCR controller dimensions (Installed external to the breaker)


7

[^2] MCGB Technical dat

Time/Current curves XS400, XH400, XV400
Time/current characteristic curves


Overcurrent tripping characteristics

| CT rated curent (A) (li.) | 250, 400 |
| :---: | :---: |
| Base current setting (A) (10) | ( In$) \times(0.63-0.8-1.0)$ |
| Long time-delay pick-up currert (A) ( ${ }^{\text {(1) }}$ ) | (10) $\times$ (0.8.0.85-0.9.0.95-1.0) Non-tripping at (li) setting $\times 105 \%$ and below. Tripping at $125 \%$ and above. |
| Long time-delay time setings ( $S$ ) (T) | ( $5 \cdot 10-15 \cdot 27.30$ ) at (11) $\times 600 \%$ current. Setting toterance $\pm 20 \%$ |
| Sheot time-delay pick-up current (A): (l) | (10) $\times$ (2-4-6-8-10) Setuing tolerance $\pm 15 \%$ |
| Shert time-delay time settings (S) ( $\mathrm{T}_{2}$ ) | Opening time $(0.1,0.15,0.2,0.25,0.3)$ in the definite time-delay. Total clearing time is +50 mS and resetuable time - 20 mS for the time-delay setting |
| Instantaneous trip pick-up current (A) (b) | Continuously adjustable from (io) x (3 io 12) <br> Setting tolerance $\pm 20 \%$ |
| - Pre-trip alarm pick-up current (A) (1.) | (1.) $\times(0.7,0.8,0.91 .0)$ Seiting tolerance $\pm 10 \%$ |
| - Pre-trip alam time setting (S) (T) | 40 fixed definite time-delay. Sening tolerance $\pm 10 \%$ |

Note: - Optional
Under lined values will be applied as standard ratings unless otherwise specified when ordering

## XS630, XH630, XV630, XS800, XH800, XV800 <br> Time/current characteristic curves



## Overcurrent tripping characteristics



## MCCB Technical data

## Microprocessor based characteristics and adjustments XS1250SE, XV1250NE, XS1600SE, XS2000NE, XS2500NE

Time/current characteristic curves


## Overcurrent tripping characteristics

| CT rated current (A) (tn) | 1000, 1250, 1600, 2900, 2500 |
| :---: | :---: |
| Base current setting (A) (k) | ( h$) \times(0.63-0.8-1.0)$ |
| Long [ime-delay pick-up current (A) ( 1 ) | (b) $\times$ (0.8-0.85-0.9-0.95-1.0) Non-tripping at (l) setting $\times 105 \%$ and below. Tripping at $125 \%$ and above. |
| Long lime-delay time settings (S) ( $\mathrm{T}_{1}$ ) | (5-10-15-20-30) at (1.1) $\times 600 \%$ curtent. Setting tolerance $\pm 20 \%$ |
| Short time-delay pick-up curent (A): | (k) $\times$ (2-4-6-8-10) Setting tolerance $\pm 15 \%$ |
| Short time-delay time setings (S) (Ti) | Opening time $\{0.1,0.15,0.2,0.25,0.3\}$ in the defirite time-delay. Total clearing time is +50 mS and resettable time - 20 mS for the time-delay setting |
| Inslantaneours trip pick-up ourrenl (A) (1) | Continuously adjustable from (lo) $\times$ ( 3 to 12 ) <br> Sening tolerance $\pm 20 \%$ |
| - Pte-tip alarm pick-up curent (A) (1.) | (h) $\times(0.7,0.8,0.9,1.0)$ Setting tolerance $\pm 10 \%$ |
| - Pre-trip alarm time seting (S) (Tr) | 40 fuxed definite time-delay. Senting tolerance $\pm 10 \%$ |
| - Ground fault trip pick-up current (A) (la) | Continuously adjustable from $\left(\mathrm{I}_{\mathrm{r}}\right) \times(0.1$ to 0.4$)$ Setting tolerance $\pm 15 \%$ |
| - Ground fault trip time setting (S) (To) | opening time ( $0.1-0.2-0.3-0.4-0.8)$ in the definite time-delay. Total clearing time is +50 mS and resettable time is - 20 mS for the time-delay settings |

Note: - Opicnal
Undertined values will be appled as standard ratings unless otherwise
specified when ordering

## MCCB Technical data

## Time/Current curves Mathematical analysis

## MCCB curves

A microprocessor MCCB has three major regions on its overcurrent tripping characteristic, namely Long Time Delay (LTD) for overload protection, Short Time Delay (STD) and Instantaneous (INST), both for short-circuit protection.

The following is an insight into how these curves interact and could act as a guide for hand-drawing the curves. TemCurve Selectivity Analysis Software is available for computerised generation of curves (refer to page 7-24).
Firstly consider the following basic characteristic curve shown in figure 1.
The LTD takes the form of a curve and has the following characteristic equation:

$$
\left(l^{2}-1\right) \cdot t=k
$$

where ' $k$ ' is a constant. To determine $k$, the calibration point of the LTD should be used, i.e. $t=T_{1}$ at $\mathrm{I}_{1}=6(600 \%)$.
IEC - 947-2 states that a breaker must not trip below 105\% of its rated current, and always trip at $130 \%$ of its rated current. Terasaki microprocesssor MCCBs however are calibrated to trip between $105 \%$ and $125 \%$, giving them a higher degree of accuracy. If the middle point is taken then the pick-up of the MCCB is $115 \%$ of its rated current.
The STD and INST parts of the curve can be drawn more easily as they are simply a series of horizontal and vertical lines determined by the $\mathrm{I}_{2}$ and $\mathrm{T}_{2}$ settings for the STD, and $\mathrm{I}_{3}$ setting for the INST.

Example
If we assume that we have:
XS1250SE with 1250A CTs and
$\mathrm{I}_{0}=1, \mathrm{I}_{1}=0.8, \mathrm{~T}_{1}=30 \mathrm{secs}$,
$\mathrm{I}_{2}=8, \mathrm{~T}_{2}=0.2 \mathrm{sec}$ and
$I_{3}=12$ (dial setting on OCR)
then the characteristic curve can be constructed as follows.
To draw the LTD we firstly need to determine the constant $k$, as follows:
$k=\left(l^{2}-1\right) \cdot t=\left(6^{2}-1\right) \cdot 30=1050$
giving the characteristic equation:
$\left(1^{2}-1\right) \cdot t=1050$
By simple arithmetic the tripping times for each level of overload can now be determined.
For $400 \%$ overload (for the example this is equivalent to $1250 \times 1.0 \times$ $0.8 \times 4=400 \mathrm{~A}$ ).

$$
t=\frac{1050}{\left(1^{2}-1\right)}=\frac{1050}{\left(4^{2}-1\right)}=70 \mathrm{secs}
$$

The STD and INST can be constructed as follows with
$I_{2}=I_{n} \times I_{0} \times I_{2}$
$I_{3}=I_{n} \times I_{0} \times I_{3}$
Please note that 20 ms is taken as an average tirne for the INST trip of the MCCB as it is the maximum time it will take the MCCB to trip. In practice the breaker will open much faster, particularly at high faults where the current limiting qualities of the MCCB become more effective.



## MCCB Technical data

OCR checker, inspection and maintenance


The TemBreak (Electronic) OCR checker, Type TNS-1, is a portable easy-to-use instrument for field testing the trip functions.
It checks the pick-up current and tripping time value of the LTD, STD, INST. and GFT functions.


## MCCB Technical data

TemBreak XM30PB
Outline dimensions (mm)

ASL: Arrangement standard line H: Handle frame centre line

## Preparation of conductor



Drilling plan


Rear connected (optional)


Drilling plan



Panel cut-out dimensions shown give an allowance of 1.0 mm
around the handle escutcheon.

Plug-in (optional)
Drilling plan


## (9) TBASAK

## MCCB Technical data

TemBreak XS125CS, CJ, NS, NJ, XH125NJ, PJ and TL30F MCCBs

Outline dimensions (mm)
Front connected (standard)


ASL: Arrangement standard line H: Handle frame centre line

Note: XS125NS 1 pole only
Drilling plan

Rear connected (optional)

Plug-in (optional)
Mounting block
Drilling plan


## (9) TBasan

## MCCB Technical data

TemBreak TL100F - TL100EM - TL100NJ
ASL: Arrangement standard line ㄴ: Handle frame centre line
Outline dimensions (mm)


Rear connected
Bold stud type


## Front connected

 TL100NJ

Panel cut-out


Panel cut-out dimensions should give an allowance of 1.0 mm around the handle escutcheon.

Nate: Interpole barriers standard on TL100EM and TL.100NJ.

## MCCB Technical data

## Motor operators for XS125, XH125,

 TL100NJ, TL30F $\left.{ }^{\prime}\right)^{2}$ )ASL: Arrangement standard line H: Handle frame centre line

Outline dimensions (mm)
Front connected (standard)


## Rear connected (optional)

## 7



Plug-in (optional)


Notes: ') For dimensions of 7MB-3BA2 used for TL100EM TL100F refer to NHP.
${ }^{\text { }}$ ) Dimensions for TL100NJ not showing length of MCCB. Refer page 7-27.
Above outline dimensions are for $A C$ motors. Contact NHP for details for DC motors.

## ITRASAK

## MCCB Technical data

## TemBreak XE225NC

ASL: Arrangement standard line H : Handle frame centre line
Outline dimensions (mm)

## Front connected (standard)

 available on request
Panel cutout


Panel cut-out dimensions should give an allowance of 1.5 mm around the handle escutcheon.

## Rear connected (optional)



## Drilling plan

Note: In the standard shipment mode, both terminals on the line side and the load side are in a horizontal direction.

## MCCB Technical data

## Motor operators for XE225NC

Outline dimensions (mm)
Front connected (standard)


With terminal bars
Drilling plan
conductor


- Breakers with terminal bars available on request.

Rear connected (optional)


ASL: Arrangement standard line
나: Handle frame centre line

## (9) TERASAK

## MCCB Technical data

## TemBreak XS250NJ

ASL: Arrangement standard line
H: Handle frame centre line
Outline dimensions (mm)
Front connected (standard)


Breakers with terminal bars available on request.


## MCCB Technical data

## Motor operators for XS250NJ

Outline dimensions (mm)
Front connected (standard)

Preparation of conductor

## With terminal

 bars (optional)Drilling plan


- Breakers with terminals bars available on request.


ASL: Arrangement standard line
H: Handle frame centre line

## TERASAKI

## MCCB Technical data

## TemBreak XH160PJ and XH250NJ

Outline dimensions (mm)


Note: Breakers with terminal bars available on request.


## MCCB Technical data

## Motor operators for XH160PJ and XH250NJ

## Outline dimensions (mm)

Front connected (standard)
 the line side and the load side are in the horizontal direction
Plug-in (optional)


## MCCB Technical data

TemBreak TL225F, TL250NJ
Outline dimensions (mm)


Front connected



Note: In the standard shipment mode, both teminals on the line side and the load side are in a horizontal direction.

Drilling plan

Panel cut-out


Panol cut-out dimensions should ghe an allowance of 1.0 mm around the handle escutcheon.

## MCCB Technical data

TemBreak XS400, XH400, XV400, XH250PJ
ASL: Arrangement standard line
H : Handle frame centre line
Outline dimensions (mm)

Front connected (standard)
Optional extension busbars


## Rear connected (optional)



Note: In the standard shipment mode, both terminals on the line side or the load side are in horizontal direction.

Drilling plan


Panel cut-out


Pamel cut-out dimenslons shown give an allowance of 1.0 mm around the handle escutcheon.

Plug-in (optional)


## MCCB Technical data

TemBreak TL400NE
ASL: Arrangement standard line
H: Handle frame centre line
Outline dimensions (mm)


## MCCB Technical data

## Motor operators for XS400, XH400, XV400, TL250NJ, TL400NE ${ }^{1}$ )

Outline dimensions (mm)
Front connected (standard)

Drilling plan


Rear connected (optional)


Note: In the standard selection mode, both terminals on the line side and the load side are in the horizontal direction

Plug-in (optional)


Panel cut-out


Panel cut-out dimenslons shoutd give an allowance of 1.0 mm around the handie escutcheon.

ASL: Arrangement standard line
t: Handle frame centre line

## MCCB Technical data

TemBreak 630A frames
XS630, XH630, XV630
Outline dimensions (mm)
Front connected (standard)


Rear connected (optional)


7

Plug-in (optional)


## MCCB Technical data

## TemBreak 800A frames XS800, XH800, XV800

ASL: Arrangement standard line
H : Handle frame centre line

Outline dimensions (mm)

Front connected (standard)


Rear connected (optional)



Panel cut-out


Panel cut-out dimensions shown give an allowance al 1.0 mm around the handle escutcheon.
Plug-in (optional)

Mounting block
Drilling plan


## MCCB Technical data

## Motor operators for XS630, XH630,

 XV630PE, XS800, XH800, XV800PEOutline dimensions (mm)

Front connected (standard)



Rear connected (optional)


Note: In the standard selection mode, both terminals on the line side and the load side are in the horizontal direction.

Plug-in (optional)


ASL: Arrangement standard line
H : Handle frame centre line

## MCCB Technical data

## TemBreak XS/XV1250

Outline dimensions (mm)

ASL: Arrangement standard line
H: Handle frame centre line

Front connected (standard)



Drilling plan


Noto: In the standard shipment mode, both terminals on the line side and the load side are in a horizontal direction.

Panel cut-out


Panel cut-out dimensions shown give an allowance of 1.5 mm around the handle escutcheon.

Plug-in (optional)


Drilling plan


## MCCB Technical data

## Motor operators for XS/XV1250, (1000A and 1250A) NE \& SE types

Outline dimensions (mm)
Front connected (standard)


Drilling plan


Rear connected (optional)
Drilling plan


Noto: In the standard selection mode, both terminals on the line side and the load side are in the horizontal direction.

Panel cut-out


Panel cut-out dimensions shown give an allowance of 1.0 mm around the motor operator frame.

Plug-in (optional)


Mounting block
Drisling plan

ASL: Arrangement standard line H: Handle trame centre line

## MCCB Technical data

TemBreak XS1600SE, TL630, TL800, TL1250NE
ASL: Arrangement standard line H : Handle frame centre line
Outline dimensions (mm)

Front connected (standard)


Panel cut-out


Panell cut-out dimensions shown give an allowance of 1.5 mm around the hande escutcheon.

Draw-out (optional)
Drilling plan


## MCCB Technical data

## Motor operators for XS1600 SE types, TL630NE, TL800NE, TL1250NE

## Outline dimensions (mm)



Rear connected


Draw out (optional)


ASL: Arrangement standard line
$\mathrm{L}: \quad$ Handle frame centre line

## MCCB Technical data

## Motor operators for XS1600

## TL630NE, TL800NE, TL1250NE

Outline dimensions (mm)

Front connected (standard)
Drilling plan


## Panel cut-out



Panel cut-out dimensions shown give an allowance of 1.0 mm around the motor operator frame.

Draw out Drilling plan


ASL: Arrangement standard line
H: Handle frame centre line

## MCCB Technical data

TemBreak XS2000NE
ASL: Arrangement standard line
H : Handle frame centre line
Outline dimensions (mm)


## MCCB Technical data

## TemBreak XS2500NE

ASL: Arrangement standard tine
H: Handle frame centre line

Outline dimensions (mm)
Rear-connected (RC standard, no FC version)


- Panel cut-out dimenslons shown given an allowance of 2 mm around the handle escutcheon.


## MCCB Technical data

Motor operators XMB types for XS2000NE \& XS2500NE

## MCCB accessories

Outline dimensions (mm)
Front connected (optional)

## Drilling plan



Rear connected (standard)


Draw-out (optional)


ASL: Arrangement standard line
H : Handle frame centre line

## MCCB Technical data

## Motor operators XMB types for XS2000NE \& XS2500NE

## Outline dimensions (mm)

Front connected (standard)


Drilling plan


ASL: Arrangement standard line
ㄴㄴ: Handle frame centre line

TemBreak MCCB's

## XH400 series electronic type

- Current limiting.
- True RMS monitoring.
- $1^{2}$ t switch to assist in obtaining selectivity.
- Unique contact structure.
- Electronic trip unit with Long, Short \& Instantaneous adjustments.
- Adjustment range 50-100\% of nominal current rating.
- Standards AS 2184/AS 3947-2.
- Special models.
- Max voltage (INSUL) 690V.

XH400NE (65kA) 3 pole ${ }^{1}$ )

| 160 | 80 | 160 | XH400NE 160 3 |
| :--- | :--- | :--- | :--- |
| 250 | 125 | 250 | XH40ONE 250 3 |
| 400 | 250 | 400 | XH400NE 400 3 |

Short circuit capacity

| Model | VC | Voltage |
| :--- | :--- | :--- |
| XH400NE | 65 kA | 415 V 50 Hz |

Refer to ratings chart at the front of this section. For ratings to AS 3947-2 and AS 2184, and Ics/lcu.

OCR options (factory fitted)

| Description | Code |
| :--- | :--- |
| Pre-trip alarm | LSIP |
| Fault indicators | FI |
| Special LTD curves | - |

Product extensions
Chassis (MHC, UHC)
OCR checker
OCR adjustments
TemCurve
Residual current relays

Base standards
IEC 947-2
BS EN 60947 Part 2
VDE 0660 Part 1
AS 3947-2/Australia
AS 2184-1990/Australia ${ }^{2}$ )
NEMA USA
ANSI C37. 13/USA
JIS C 8372/JAPAN
JEC 160/JAPAN

Approvals
ASTA/UK, Aust. standards
Marine
NK/JAPAN
LR/UK
AB/USA
GL/GERMANY
BV/FRANCE

| Dimensions $(\mathrm{mm})$ <br> Description | Height | Width | Depth | kg |
| :--- | :--- | :--- | :--- | :--- |
| XH400NE 3 pole | 260 | 140 | 103 | 5 |
| XH400NE 4 pole | 260 | 185 | 103 | 6.2 |


${ }^{2}$ ) MCCB's only.


MCCB Technical data

## Connections and mountings

## MCCB accessories

Front-connection type (FC)

Compression terminals


Attached flat bar


Types of terminal screws (Compression terminal and bar)
Breakers and screw size
XE series
(Economical)

| XS series <br> (Standard) | XH series <br> (High-fault level) | XM series <br> (Motor protection) |
| :--- | :--- | :--- |

Pan headed screw

XS125CJ M8 XH125NJ M8 XM30PB M5

XS125NJ M8 XH125PJ M8

Hex socket head bolt

| XE225NC | M8 | XS250NJ M8 | XH250NJ M8 |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | XH160PJ M8 |  |
|  |  | XS400 | M10 | TL250NJ M10 |  |
|  |  | XH400 | M10 | TL400NJ | M10 |

## Connections and mountings

MCCB accessories
Rear-connection type (RC)

## Bolt stud

Horizontal (standard)

## Vertical



Applicable breakers
XE series XE225NC

- X Xs series

XS250, XS400
XS630, XS800.

- XH series

XH160, XH250, XH400, XH630, XH800.

- XM series XM30РB.

Flat bar stud


Applicable breakers
Horizontal ') XS1250, XV1250NE
Vertical XS1600, XS2000NE XS2500NE.

MCCB accessories

## Types of connections and mountings

## Plug-in Type

Switchboard use

mounting block

## MCCB Technical data

## Types of connections and mountings

Draw-out type (DO indent)
Two-position type i
Applicable breakers

- XS series

XS400, XS630, XS800, XS1250.

- XH series

XH160, XH250, XH400, XH630, XH800.

- The plug-in type breaker is housed in the draw-out cradle.
- The draw out cradle has two positions "connected" and "isolated".
- The auxiliary circuits are automatically connected or isolated by the auxiliary circuit terminals on the plug-in breaker.
- Manual connector type is available.
- Safety trip (first draw out mechanism). The breaker will trip automatically if it is drawn out while still in the 'on' position.
- Position keylock in isolated position (optional). Available on request.
- IP 20 degree of protection (optional). Available on request.


MCCB Technical data

Crimp lugs (compression type)

| Frame (A) | Breaker | Nominal wire size ( $\mathrm{mm}^{2}$ ) |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 1.5 | 2.5 | 4 | 6 | 10 | 16 | 25 |
| XM30 | XM30PB | CAL1.5-5 | CA12.5-5 | CAL4-5 | CAL6-5 | CALTO-5 | Cal16-6 |  |
|  |  | MT25-M5 | MT2.5-M5 | MT4-M5 | MT6-M5 | MT10-M5 | MT16-M5 |  |
| 125 | XS125CJ | - | CAL25-8 | CAL4-8 | CAL6-8 | CAL10-8 | CAL16-8 | CAL25-8 |
|  | XS125NJ | MT2.5-M8 | MT2.5-M8 | MT4-MA | MTE-M6 | MT10-M8 | MT16-M8 | MT25-M8 |
|  | XH125NJ |  |  |  |  |  |  |  |
|  | XH125PJ |  |  |  |  |  |  |  |
|  | TL100NJ |  |  |  |  |  |  |  |
|  | TL30F |  |  |  |  |  |  |  |



$\square$ Commercially available compression terminals available from CABAC - Cable Accessories and JST Australia.
Key: CAL = CABAC lugs
MT = JST lugs

## Connection

(one electric cable)
If low clearance occurs use a recommended tape or insulation.


Connection (two electric cables) H low clearance occurs use a recommended tape or insulation.


MCCB Technical data

## Time/Current curves <br> Mathematical analysis

A microprocessor MCCB has three major regions on its overcurrent tripping characteristic, namely Long Time Delay (LTD) for overload protection, Short Time Delay (STD) and Instantaneous (INST), both for short-circuit protection.
The following is an insight into how these curves interact and could act as a guide for hand-drawing the curves. TemCurve Selectivity Analysis Software is available for computerised generation of curves (refer to page 9-80).
Firstly consider the following basic characteristic curve shown in figure 1 .
The LTD takes the form of a curve and has the following characteristic equation:

$$
\left(l^{2}-1\right) \cdot t=k
$$

where ' $k$ ' is a constant. To determine $k$, the calibration point of the LTD should be used, i.e. $t=T_{1}$ at $I_{1}=6(600 \%)$.
IEC - 947-2 states that a breaker must not trip below 105\% of its rated current, and always trip at $130 \%$ of its rated current. Terasaki microprocesssor MCCBs however are calibrated to trip between $105 \%$ and $125 \%$, giving them a higher degree of accuracy. If the middle point is taken then the pick-up of the MCCB is $115 \%$ of its rated current.

The STD and INST parts of the curve can be drawn more easily as they are simply a series of horizontal and vertical lines determined by the $\mathrm{I}_{2}$ and $\mathrm{T}_{2}$ settings for the STD, and $\mathrm{I}_{3}$ setting for the INST.

If we assume that we have:
XS1250NE with 1250A CT's and
$\mathrm{l}_{0}=1, \mathrm{l}_{1}=0.8, \mathrm{~T}_{1}=30 \mathrm{secs}$,
$\mathrm{I}_{2}=8, \mathrm{~T}_{2}=0.2 \mathrm{sec}$ and
$I_{3}=12$
then the characteristic curve can be constructed as follows.
To draw the LTD we firstly need to determine the constant $k$, as follows:
$k=\left(l^{2}-1\right) \cdot t=\left(6^{2}-1\right) \cdot 30=1050$
giving the characteristic equation:
( $1^{2}-1$ ) $t=1050$
By simple arithmetic the tripping times for each level of overload can now be determined.
For $400 \%$ overload (for the example this is equivalent to $1250 \times 1.0 \times$ $0.8 \times 4=400 A$ ).

$$
t=\underset{\left(1^{2}-1\right)}{1050}=\frac{1050}{\left(4^{2}-1\right)}=70 \text { secs }
$$

The STD and INST can be constructed as follows with
$I_{2}=I_{n} \times I_{0} \times I_{2}$
$I_{3}=I_{n} \times I_{0} \times I_{3}$
Please note that 20 ms is taken as an average time for the INST trip of the MCCB as it is the maximum time it will take the MCCB to trip. In practice the breaker will open much faster, particularly at high faults where the current limiting qualities of the MCCB become more effective.

## TemBreak XH400

ASL: Arrangement Standard Line L : Handle frame centre line

## Outline dimensions (mm)

Front connected (standard)


Drilling plan


Rear connected (optional)


Note: In the standard shipment mode, both terminals on the line side or the load side are in horizontal direction.

Panel mount


Panel cutout dimensions shown give an allowance of 1.0 mm around the handle escutcheon.

## Plug-in (optional)



Motor operators for XH400

Outline dimensions (mm)
Front connected (standard)

## Drilling plan



Rear connected (optional)


Note: In the standard selection mode, both terminals on the line side and the load side are in the horizontal direction

## Plug-in (optional)



ASL: Arrangement Standard Line
난: Handle frame centre line

Miniature circüit breakers and fuse fault current limiters co-ordination chart
For fault current levels up to 50kA at 415 V


Notes: 1) Minimum fuse size is based on grading under overload of one MCB with one set of fuses. Where a single set of fuses protects more than one MCB, the minimum fuse size shall be increased to allow for load biasing effects.
${ }^{2}$ ) Maximum fuse size based on testing to AS 3439.1 clause 8.2.3.

[^3]Application data

## Selectivity and Cascading Applications

A higher reliance on electrical supply and safety in commerce and industry has increased awareness in circuit breaker technology and applications. Additionally, while maximising system safety and reliability, efficient economy of overall costs is also of great importance.
The combination of these factors has given rise to more precise methods of circuit breaker application.
Two common terminologies relating to general power backup and system protection are: Selectivity (Discrimination) and Cascading (Back-up). In general terms, Selectivity is used to improve system reliability and to ensure a continuous supply of power to as high a degree as possible. Cascading on the other hand is where an upstream breaker is used to "back-up" a lower specification breaker installed downstream to clear a fault current, and is generally used where economics plays a significant part in system design.

## Selectivity (Discrimination)

Previously known as "Discrimination", the most basic form of Selectivity is where two circuit breakers are connected in senies. A higher amperage breaker is installed upstream, and a lower amperage breaker downstream. Should an overload or short circuit occur downstream, the downstream breaker will trip, but the upstream breaker will not, hence feeding parts of the system which are fault-free. This is the concept of Selectivity.
Selectivity is generally used, for example in critical applications, feeding essential loads. It is important to ensure total installation power is not lost due to a small or minor fault in a sub part of the overall electrical system, for example in a local distribution board. Total power loss could affect vital systems such as in Hospitals or Computer Centres etc.
The principle of Selectivity (Discrimination) is based upon an analysis of several types of circult breaker characteristics. These include tripping characteristics (timecurrent curves), Peak Let Through Current (Iment and Energy Let Through (ITT).
Selectivity can be "enhanced" beyond the breaking capacity of the downstream device provided it is backed up by an appropriately selected upstream device, which should not trip (unlatch) under stated conditions.

## Cascading (Back-up)

Cascading is achieved by using an upstream device to assist (back-up) a downstream device in clearing a fault current that happens to be greater than the breaking capacity of the downstream device.
In Cascading applications, the upstream device may have to trip (unlatch) in order to give sufficient protection to the downstream device, thus interrupting supply of power to all devices downstream. Therefore, Cascading is generally used in applications involving the supply of non-essential loads, such as basic lighting. The main benefit of Cascading is that in certain circumstances circuit breakers with breaking capacities lower than the prospective fault level, and hence lower in cost, can be safely used downstream provided it is backed-up by the relevant upstream breaker.

## Cascade / Selectivity Tables

The Selectivity and Cascade tables shown in the following pages are structured as follows.


Selectivity: The Selectivity or Enhanced Selectivity limit of the two nominated devices in series. Up to this level of fault current the downstream device will trip (unlatch) before the upstream device. Above this level, the upstream may also trip.
Cascade: The enhanced or maximum downstream fault current that can be safely interrupted when both breakers are installed in series. Both breakers may trip (unlatch).
The Selectivity and Cascade levels stated by NHP are fully compliant with the requirements of the applicable standards. Selection of breakers should be in accordance with the selection tables.
The figures stated in NHP tables are for nominated Terasaki devices only, and should not be used as guidance for using alternative brands of circuit breakers.

## TemBreak MCCB's and Safe-T/Din-T MCB's - Selectivity and Cascade tables at 415V

Guide


Upstream MCCB
XS400SE

| Downstream MCB | kA (rms) | $\begin{gathered} \text { XS125CJ } \\ 18 \end{gathered}$ | $\begin{gathered} \text { XS125NJ } \\ 30 \end{gathered}$ | XH125NJ 50 | $\begin{gathered} \text { XS250NJ } \\ 35 \end{gathered}$ | $\begin{gathered} \text { XH250NJ } \\ 50 \end{gathered}$ | $\begin{gathered} \text { XS400CJ } \\ 35 \end{gathered}$ | $\begin{gathered} \text { XS400NJ } \\ 50 \end{gathered}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Din-T6 (2-25A) | 6 | 18/18 | 25/25 | 25/25 | 25/25 | 25/25 | - | - |
| DIn-T6 (32-63A) | 6 | 18/18 | $20 / 25$ | 20/25 | 25/25 | 25/25 | - | - |
| Din-T10 (0.5-25A) | 10 | 18/18 | 25/30 | 30/50 | 35/35 | 35/50 | 35/35 | 35/50 |
| Din-T10 (32-63A) | 10 | 18/18 | 20/25 | 20/25 | 25/25 | 25/25 | 25/25 | 25/25 |
| DRCBH (10-25A) | 10 | 18/18 | 25/30 | 30/50 | 35/35 | 35/50 | 35/35 | 35/50 |
| DRCBH (32A) | 10 | 18/18 | 20/25 | 20/25 | 25/25 | 25/25 | 25/25 | 25/25 |
| Din-T10H (80-125A) | 10 | 4/18 | 4/25 | 4/25 | 15/15 | 15/15 | 10/10 | 10/10 |
| Din-T15 (6-16A) | 25 | 18/25 | 25/30 | 30/50 | 35/35 | 35/50 | 35/35 | 35/50 |
| Din-T15 (20A) | 20-25 ) | 18/20 | 25/30 | 30/50 | 35/35 | 35/50 | 35/35 | $\therefore 35 / 50$ |
| Din-T15 (32A) | 15-25 ) | 18/18 | 25/30 | 30/50 | 35/35 | 35/50 | 35/35 | 35/50 |
| Din-T15 (40-63A) | 10-12.5 ) | 18/18 | 20/25 | 20/25 | 25/25 | 25/25 | 25/25 | 25/25 |
| Safe-T (16-63A) | 6 | 3/10 | 3/10 | 3/10 | - | - | - | - |
| SRCB (16-20A) | 6 | 3/10 | 3/10 | 3/10 | - | - | - | - |

Note: ') Dependant on the number of poles. Refer to NHP.

## TemBreak Plus MCCB's'- Selectivity and Cascade tables at 415V

Guide


Selectivity Cascade
Upstream MCCB

| Downstream MCCB | kA (rms) | $\begin{gathered} \text { XS400SE } \\ 50 \end{gathered}$ | $\begin{gathered} \text { XH400SE } \\ 65 \end{gathered}$ | $\begin{gathered} \text { XS630SE } \\ 50 \end{gathered}$ | $\begin{gathered} \text { XH630SE } \\ 65 \end{gathered}$ | $\begin{gathered} \text { Xs800SE } \\ 50 \end{gathered}$ | XH800SE 65 | $\begin{gathered} \text { XS1250SE } \\ 65 \end{gathered}$ | $\begin{gathered} \text { XS1600SE } \\ 85 \end{gathered}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| XS125CJ | 18 | 15/50 | 15/50 | 18/30 | 18/30 | 18/30 | 18/30 | 18/18 | 18/18 |
| XS125NJ | 30 | 25/50 | 25/50 | 30/30 | 30/30 | 30/30 | 30/30 | 30/30 | 30/30 |
| XH125NJ | 50 | 35/50 | 35/65 | 50/50 | 50/65 | 50/50 | 50/65 | 50/50 | 50/50 |
| XH125PJ | 50 | 35/50 | 35/65 | 50/50 | 50/65 | 50/50 | 50/65 | 50/50 | 50/50 |
| XH160PJ | 50 | 25/50 | 25/65 | 50/50 | 50/65 | 50/50 | 50/65 | $\cdots 50 / 50$ | 50/50 |
| XE225NC | 18 | 15/30 | 15/30 | 18/30 | 18/30 | 18/30 | 18/30 | 18/18 | 18/18 |
| XS250NJ | 35 | 15/50 | 15/65 | 35/50 | 35/65 | 35/50 | 35/65 | 35/35 | 35/35 |
| XH250NJ | 50 | 25/50 | 25/65 | 50/50 | 50/65 | 50/50 | 50/65 | 50/50 | 50/50 |
| XH250PJ | 65 | - | - | 10/50 | 10/65 | 25/50 | 25/65 | 50/65 | 50/65 |
| XS400CJ. | $\underline{35}$ | -/50 | -/50 | 10/50 | 10/65 | 25/50 | 25/65 | 35/42 | 35/42 |
| XS400NJ | 50 | - | -/65 | 10/50 | 10/50 | 25/50 | 25/65 | 50/65 | 50/65 |
| XS400SE | 50 | $\cdots$ | -/65 | 10/50 | 10/65 | 25/50 | 25/65 | 50/65 | 50/65 |
| XH400PJ | 65 | $\cdots-$ | - | 10/50 | 10/65 | 25/50 | 25/65 | 50/65 | 50/65 |
| XH400SE | 65. | - | - | 10/50 | 10/65 | 25/50 | 25/65 | 50/65 | 50/65 |
| XH400PE | 65 | - | - | 10/50 | 10/65 | 25/50 | 25/65 | 50/65 | 50/65 |
| XS630CJ | 45 | - | - | - | -/50 | 7/50 | $7 / 50$ | $30 / 45$ | 30/45 |
| XS630NJ | 65 | - | - | - | - | 7/50 | 7/65 | 30165 | 30/85 |
| XS630SE | 50 | $\cdots \cdot$ | - | - | -/65 | - | - | $30 / 65$ | $30 / 85$ |
| XH630PJ | 85 | - | - | - | - | - | - | 30/65 | 30/85 |
| XH630SE | 65 | $\cdots$ | - | - | - | - | - | 30/65 | 30/85 |
| XH630PE | 65 | - | - | - | $\pm$ | - | - | 30/65 | 30/85 |
| XS8000NJ | 65 | - - . | - | , - | \% | - | - | 15/65 | -20/85 |
| XS800SE | 50 | - | - | - | - | - | -165 | 15/65 | 20/85 |
| XH800PJ | 85 | - | - | - | - | $\cdot$ | - | 15/65 | 20185 |
| XH800SE | 65 | - | - | - | - | $\bullet$ | - | 15/65 | 20185 |
| XH800PE | 65 | - | - | $\cdots$ | - | - | - | 15/65 | $20 / 85$ |
| XS1250SE | 65 | - | - | - | - | - | - | - | 20/65 |

Standard TemBreak MCCB's - Selectivity and Cascade tables at 415V
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Selectivity Cascade
Upstream MCCB

| Downstream MCCB | kA (ms) | $\begin{gathered} \mathrm{XH} 125 \mathrm{NJ} \\ 50 \end{gathered}$ | $\begin{gathered} \text { XS250NJ } \\ 35 \end{gathered}$ | $\begin{gathered} \text { XH250NJ } \\ 50 \end{gathered}$ | $\begin{gathered} \text { XS400CJ } \\ 35 \end{gathered}$ | $\begin{gathered} \text { XS400 NJ } \\ 50 \end{gathered}$ | $\begin{gathered} \text { XS400NE } \\ 50 \end{gathered}$ | $\begin{gathered} \text { XH400NE } \\ 65 \end{gathered}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| XS125CJ | 18 | -/50 | 3730 | $3 / 50$ | 4/35 | 4/50 | $6 / 50$ | $6 / 50$ |
| XS125NJ | 30 | -/50 | 3/30 | 3/50 | 4/35 | 4/50 | 6/50 | 6/50 |
| XH125NJ | 50 | - | - | - | - | - | 6/50 | 6/65 |
| XE225NC | 18 | - | -130 | -130 | -130 | -/30 | 6/30 | 6/30 |
| XS250NJ | 35 | - | - | - | - | 4/50 | 6/50 | 6/65 |
| XH250NJ | 50 | - | - | - | - | $4 / 50$ | 6/50 | 6/65 |
| XS400CJ | 35 | - | - | - | - | -/50 | -/50 | -150 |
| XS400NJ | 50 | - | - | - | - | - | - | -165 |
| XS400NE | 50 | - | - | - | - | - | - | 165 |
| XH400NE | 65 | - | - | - | - | $\cdots$ | - | - |
| XS630CJ | 45 | * | $=$ | - * | - | - | - | $\pm$ |
| XS630NJ | 65 | - | -. | - | - | - | $\bullet$ | - |
| XS630NE | 50 | - | - | - | - | - | - | - |
| XH630NE | 65 | - | - | - | - | - | $\cdots$ | - |
| XS800NJ | 65 | - | - | - | - | - | - | - |
| XS800NE | 50 | - | - | - | - | . - | $\cdots$ | - |
| XS1250NE | 65 | - | - | - | - | - | - | - |
| XS1600NE | 100 | - | - | - | - | - | - | - |

Upstream MCCB

| Downstream MCCB | kA (rms) | $\begin{gathered} \text { XS630CJ } \\ 45 \end{gathered}$ | $\begin{gathered} \text { XS630NJ } \\ 65 \end{gathered}$ | $\begin{gathered} \text { XS630NE } \\ 50 \end{gathered}$ | $\begin{gathered} \text { XH630NE } \\ 65 \end{gathered}$ | $\begin{gathered} \text { XS800NJ } \\ 65 \end{gathered}$ | $\begin{gathered} \mathrm{XSBOONE} E \\ 50 \end{gathered}$ | $\begin{gathered} \text { XH800NE } \\ 65 \end{gathered}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| XS125CJ | 18 | 6/30 | $6 / 30$ | 14/30 | 18/30 | 10/30 | 14/30 | 14/30 |
| XST25NJ | 30 | 6/30 | 6/30 | 18/30 | 18/30 | 10/30 | 18/30 | 18/30 |
| XH125NJ | 50 | - | - | - | - | 12/65 | 30150 | - |
| XE225NC | 18 | 6/25 | 6/30 | 10/30 | 10/30 | 8/30 | $12 / 30$ | 12/30 |
| XS250NJ | 35 | 6/45 | 6/50 | . 10/50 | 10/65 | $8 / 50$ | $12 / 50$ | $12 / 65$ |
| XH250NJ | 50 | - | - | 10/50 | - | 10/65 | $22 / 50$ | - |
| XS400CJ | 35 | 6/35 | 6/50 | 7.5/50 | 7.5/65 | 6/50 | 10/50 | 10/65 |
| XS400NJ | 50 | - | - | 7.5/50 | 7.5/65 | 6/50 | $10 / 50$ | 10/65 |
| XS400NE | 50 | - | - | $10 / 50$ | 10/65 | $6 / 50$ | 10/50 | 10/65 |
| XH400NE | 65 | - | - | - | - | - | - | 10/65 |
| XS630CJ | 45 | - | $\cdot$ | - | - | - | - | - |
| XS630NJ | 65 | - | - | - | - | * | - | - |
| XS630NE | 50 | - | - | - | * | - | + | * |
| XH630NE | 65 | - | $\square$ | * | * | - | - | - |
| XS800NJ | 65 | - | - | * | * | - | - | - |
| XS800NE | 50 | - | - - | - - | - | - | " | - |
| XS1250NE | 65 | - | $\bullet$ | - | - | - | - | - |
| XS1600NE | 100 | - | $\cdots$ | - | - | - - | $\cdots$ | - |

## Standard TemBreak MCCB's - Selectivity and Cascade tables at 415V

Guide


| Downstream MCCB | kA (rms) | XH800PJ 85 | $\begin{gathered} \mathrm{XS} 1250 \mathrm{NE} \\ 65 \end{gathered}$ | $\begin{gathered} \text { XS1600NE } \\ 100 \end{gathered}$ | $\begin{gathered} \text { XS2000NE } \\ 100 \end{gathered}$ | $\begin{gathered} \text { XS2500NE } \\ 100 \end{gathered}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| XS125CJ | 18 | 10/30 | 18118 | 18/18 | 18/18 | 18/18 |
| XS125NJ | 30 | 10/30 | 30/30 | 30/30 | 30/30 | 30/30 |
| XH125NJ | 50 | 12/65 | 50/50 | 50/50 | 50/50 | 50/50 |
| XE225NC | --. 18 | 8/30 | $18 / 18$ | 18/18 | 18/18 | 18/18 |
| XS250NJ | 35 | 8/65 | 25/35 | 35/35 | 35/35 | 35/35 |
| XH250NJ | $50^{\circ}$ | 10/65 | 35/50 | 50/50 | 50/50 | 50/50 |
| XS4000.J | 35 | 6/65 | 20/42 | 35/42 | 35/42 | 35/42 |
| XS400NJ | 50 . | 6/65 | 20/65 | 35/65 | 35/65 | 50/65 |
| XS400NE | 50 | 6/65 | 20/65 | 35/65 | 35/65 | 50/65 |
| XH400NE | 65 | - | $20 / 65$ | 35/65 | 35/65 | 50/65 |
| XS630CJ | 45 | -/50 | 15145 | 20/45 | 35/45 | 35/45 |
| XS630NJ | $=65$ | -7/85 | 15/65 | 20/85 | 35/85 | 35/85 |
| XS630NE | 50 | -/85 | $15 / 65$ | 20/85 | 35/85 | 35185 |
| XH630NE | - 65 | -/85 | 15/65. | -. 20/85 | 35/85 | $35 / 85$ |
| XSB00NJ | 65 | -/85 | 15/65 | 20/85 | 35/85 | 35/85 |
| XS800NE | 50 | -/85 | 15/65 | 20/85 | 35/85 | 35/85: |
| XS1250NE | 65 | - | - | 20/65 | 35/65 | 35/65 |
| XS1600NE | 100 |  | - | - | $\therefore=$ | 35/65 |

## Motor Starting - Introduction

Generally, an item of switchgear is selected on the basis of one or more performance criteria, be it current/power carrying or interrupting capabilities.

Additional consideration is often necessary when several different pieces of switchgear are connected in series, none more so than in motor starting applications. As motors play a significant part in most modern day electrical systems it is important to ensure that the components of switchgear controlling and protecting the motor will interact with each other, or in other words, they are "co-ordinated".
In order to protect and operate a motor several components may be used, each with a different function. A typical set-up is as follows:

| Short Circuit |  |
| :--- | :--- |
| Protective Device |  |
| (S.C.P.D.) | The main purpose of the Short Circuit Protective <br> Device (SCPD) is to give protection against short <br> circults. <br> Commonly used devices are circuit breakers or <br> fuses. Each offer particular benefits and both <br> Configurations are commonly used. |

M

What problems can occur?
At the instant the motor is supplied with power it draws an "in-rush current" to its terminals, before gradually decaying to a normal operating current.
Should the in-rush current be high, it could be detected by the SCPD and classed as a fault current. If a high in-rush current should occur or even after repeated stop-start (inching) operations of the motor the SCPD may trip, albeit without a fault in the system. This is commonly known as "nuisance tripping" of the SCPD.
Special care must be taken when selecting a SCPD for motor-starting applications to prevent nuisance tripping, and at the same time ensuring adequate protection to the motor and associated cabling.

Another function of the SCPD is to protect the control device (e.g. contactor) from high-current, high-energy faults. Therefore, attention must also be paid when selecting an SCPD-Starter (contactor + thermal overload relay) combination.

When clearing a fault every SCPD has a finite opening time, which will result in an amount of fault current and energy being "let-through" to the downstream system and other devices. At the same time, a control device, such as a contactor can only withstand a finite level of fault current and energy, otherwise internal damage could occur.
Even at relatively low fault levels the electromagnetic forces created by the fault current can cause the contacts of a contactor to lift. This can cause heating or even mild arcing which in turn can damage or weld the contacts of the contactor.

Furthermore, the let-through current of the SCPD can distort the bi-metal strip in the overload relay. This can prevent the restoration of the bi-metal strip to its original configuration on cooling, altering the relay's protection characteristics and resulting in under or over protection of the motor.

What solutions are available to me? Good component design in association with correct component co-ordination is the only way to ensure reliable protection and operation under abnormal condition.
Terasaki circuit breakers and Sprecher + Schuh starter combinations are tested to provide full and safe co-ordination for most motor starting applications.


## Motor Starting

## What is co-ordination

The motor starter consists of a combination of contactor, overload relay and Short Circuit Protection Device (SCPD) being either fuses or circuit breakers.
During motor starting and at normal loading, the overload relay protects both the motor and cables by tripping the cortactor in a time inversely proportional to the current. However, under short circuit conditions, the response time would be too long and the fuses or circuit breakers must takeover to interrupt the fault current therefore limiting energy passed through the starter components. When this is successfully achieved, the combination is said to be co-ordinated.

It is a requirement of the Australian Standard AS 3947.4.1 that combination motor starters are capable of withstanding the effects of load side short circuits. Some damage to the combination is permitted, but this must be confined and not present a risk to the operator, or damage equipment adjacent to the starter.
Contactors and thermal overload relays only have limited ability to withstand the high current associated with a fault such as an intemal motor short. Their design is optimised for performance at much lower currents and to design in the ability to control or withstand high fault levels would add to costs and possibly reduce its performance at normal levels.

## The standards

The requirements of several standards can be applied to these combination units. The Wiring Rules, AS 3000, are concerned mainly with setting standards for the fixed wiring. In this regard the concern is the wiring between the protection device and the motor.
As motors can experience short term overloading the current rating of a fuse can be up 4 times and a circuit breaker 2.5 times the full load rating of the motor. The Wiring Rules allow the overload protection and the short circuit protection to be provided by different devices. This allows magnetic only circuit breakers, or back-up type fuses, to be used in conjunction with a contactor/thermal overload relay configuration.
Isolating switches must also be provided in the motor or control circuit. These are to be in clear view of any person working on the motor, or provided with a locking device.
AS 3947.4.1 specifies testing requirements for the combination of components required to perform the motor control and protection functions. If the equipment has been mounted in a switchboard it is possible to meet the testing requirements of AS 3947.2 short circuit withstand of the outgoing circuit at the same time as the tests to AS 3947.4.1 are performed.

Both standards look at the performance of the equipment when a fault occurs on the outgoing circuit. It is accepted in these standards that some damage may be sustained by the components of the starter when subjected to short circuit conditions.
AS 3947.2 requires that during the tests the equipment installed in the switchboard performs in accordance to its own standard. A selection by the customer of the performance required needs to be made, as AS 3947.4.1 allows for Type ' 1 ' and Type ' 2 ' performance.

## Type ' 1 '

Under short circuit conditions the starter shall not cause danger to persons or the installation. The starter itself may need repair.
Type ' 2 '
After a short circuit the starter is suitable for further service. A contact weld is permitted, but it must be easily separated - for example, by a screwdriver, without significant deformation.
Type ' 2 ' co-ordination does not mean the starter is suitable for normal operation without inspection/repair of the contacts. So, in both cases it is important that the condition of the starter is checked, to ensure that the SCPD has operated and that no damage has taken place.

Notes: IEC Standards are the basis of many Australian Standards. AS 3947.4.1 is equivalent to IEC 947.4.1 and AS 3947.2 is equivalent to IEC 947.2.
Both Australian standards list some amendments to the IEC versions.

Typical arrangement for co-ordination test


Application data

## Motor Starting <br> Protective devices selection

In most cases very liftle difference will be noticed in the service performance of a system using fuses as against circuit breakers.
The circuit breaker is easier when it comes to restoring power, but as tripping should only be the result of a system fault it is unwise to reclose the circuit breaker without finding the cause. In this regard it is normal for only a "skilled person" to attend to fuse replacement and they are more likely to check for other problems.
As the circuit breaker or fuse is operating in conjunction with separate motor overload protection, it is the contactor which responds to overload problems. This is different to a protective device on a distribution circuit. For this application the advantages of the circuit breakers easy return to service has caused a general trend towards using circuit breakers.

Consideration should be given to preventing unskilled people from reclosing a tripped circuit breaker in a motor control application. This can be done by making the switchboard only accessible to the correct people, or by requiring the switchboard to be opened to reset the circuit breaker.
It must be assumed with both Type ' 1 ' and Type ' 2 ' co-ordination that if the short circuit protective device has operated there is a fault in the motor, or wiring to it and that the starter itself needs attention.
It is the let-through energy of the protective device which determines the damage to the starter. As this varies greatly between different models, it is essential that only proven combinations are used.

NHP, Sprecher + Schuh and Terasaki have now conducted many tests on different combinations and these are detailed in the co-ordination tables.

## Terasaki circuit breakers for short circuit protection

Terasaki circuit breakers have been tested in combination with Sprecher + Schuh contactors and overloads and can be used for Type '1' and Type '2' co-ordination requirements. (Refer to following tables for actual combinations).
TemBreak
A new generation of MCCB's offering a choice of 3 series (economical, standard and high fault) and two types, ie, adjustable thermal magnetic or microprocessor based solid state OCR are available from Terasaki. Both types have common construction features and interchangeable plug-in accessories. TemBreak thermal-magnetic MCCB's offer a wide adjustment range, with $63 \%$ to $100 \%$ of rated current. Each MCCB is individually calibrated to ensure precision tripping on overcurrent.

## TemBreak electronic type

The rated current of the electronic type TemBreak is adjustable in 15 steps from $50 \%$ to $100 \%$ of the nominal rated current, using the base current (lo) select switch and the pickup current (11) setting dial.

This is one of the essential features for precise protection co-ordination and for low voltage distribution systems.

## TemBreak motor protection circuit breaker

The XM30PB circuit breaker will protect contactor starters with direct connected overcurrent relays with ratings 1 amp to 12 amp in systems with up to 50 kA ms prospective short circuit. The protection is due to the special current limiting effect of the XM30PB.

## Motor starter protection

The XM30PB circuit breaker has been developed for motor starter protection and is suitable as the Short Circuit Protection Device (SCPD) for motor starters equipped with either direct connected or CT connected overcurrent relays.

## XM30PB compared to HRC fuse

The circuit breaker tripping characteristic is more suitable for protection of starters than the HRC fuse. Unlike the HRC fuse, the breaker can be selected to trip instantaneously at a predetermined current level just lower than the maximum breaking current of the starter contactor, thus always protecting the contactor against opening fault currents higher than its capability. This can be seen from the typical breaker and fuse tripping characteristics compared to the contactor breaking capacity in figure 1.
No protection is provided by the fuse when the overcurrent is of value B to C amps should the contactor open by earth fault relay. If the breaker is used as a SCPD then protection is provided for all currents in excess of the instantaneous trip current of the breaker. Also, the circuit breaker can be tripped by earth fault relay and so prevent the risk of contactor damage due to the long delay of the HRC fuse interruption if the fault current is of a value between $B$ and $C$.

Flg 1.


Type ' 1 ' short circuit co-ordination Motor starter co-ordination table for DOL starting 50kA at 415 V to AS 3947-41

## TYPE 1 50kA

| Motor <br> size <br> kW |
| :--- |
| Approx. <br> amps |
| 0.37 |
| 0.55 |

## Type ' 2 ' short circuit co-ordination Terasaki Din-T at 50kA

The 10kA Din-T miniature circuit breaker gives an amazing 50kA performance when used in the combinations shown in the co-ordination tables. For the low current ratings, the resistance of the thermal overloads assists in reducing the current to a level that the Din-T can handle with ease. For the higher ratings a Sprecher + Schuh limiter block lifts the combined performance to the 50 kA level.
All the listed Din-T combinations include a rotary isolator which allows external control. To reset the starter after a short circuit, access to the breaker is required. This can be used to prevent unskilled operators from reclosing the motor starter after a fault.
It should also be remembered that whenever the circuit breaker trips under high fault currents, the contactor must be checked for welded contacts.

## TYPE 2 50kA



KTA 3 Motor starter combination

## Type '2' co-ordination table for Din-T circuit breakers with rotary isolator DOL starting 50kA @ 415V to AS 3947.4.1

| Motor <br> size <br> kW | Approx. amps 영 415V | Sprecher + Schuh isolator | Terasaki circuit breaker | Sprecher + Schuh current limiter | Sprecher + Schuh contactor | Sprecher + Schuh thermal overload relay | Thermal overload range |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0.37 | 1.1 | LA3-80 | Dint 10/4 | - | CA 7-9 | CT $7-24 \div$ | 1-1.6 |
| 0.55 | 1.5 | LA 3-80 | Din $-T$ 10/4 | - | CA 7-9 | CT 7-24 | 1-1.6 |
| 0.75 | 1.8 | LA 3-80 | Din-T 10/4 | - : | CA 7-9 | CT 7-24 | 1.6-2.4 |
| 1.1 | $\underline{2.6}$ | LA 3-80 | Din-T 10/6 | $\cdots \quad$ - | CA 7-23 | CT 7-24 | 2.4-4 |
| 1.5 | 3.4 | LA 3-80 | Din-T10/6 | $\cdots$ | CA $7-23$ | CT 7-24 | 2.44 |
| 2.2 |  | LA 3-80 | Din-T $10 / 10$ | KTL 3-65 | CA 7-23 | CT 7-24 | $4-6$ |
| 3.0 | 6.5 | LA 3-80 | Din-T $10 / 16$ | KTL 3-65 | CA 7-23 | CT 7-24 | 6-10 |
| 4.0 | 8.2 | LA 3-80 | Din-T 10/16 | KTL. 3-65 | CA 7-23 | CT 7-24 | $6-10$ |
| 5.5 | 11.0 | LA 3-80 | Din-T 10/20 | KTL 3-65 | CA 7-23 | CT 7-24 | 10-16 |
| 7.5 | 14.0 | LA 3-80 | Din-T $10 / 32$ | KTL 3-65 | CA 7-30 | CT $7-45$ | 10-16 |
| 11.0 | 21.0 | LA 3-80 | Din-T 10/40 | KTL 3-65 | CA $7-30$ | CT 7-45 | 16-24 |
| 15:0 | 28.0 | LA 3-100 | Din-T 10/63 | KTL 3-65 | CA 7-37 | CT 7-45 | 18-30 |
| 18.5 | 34.0 | LA 3-100 | Din-T $10 / 63$ | KTL 3-65 | CA 7-37 | CT 7-45 | 30-45 |

Type ' 2 ' short circuit co-ordination
Motor starter co-ordination table for DOL starting 50 kA at 415 V to AS 3947-4-1

| Motor <br> size <br> kW | Approx. amps | Terasaki circuit breaker | Sprecher + Schuh contactor type | Sprecher + Schuh thermal overload relay type ${ }^{\text { }}$ ) | Settings range amps |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 0.37 | 1.1 | XM30PB/1.4 | CA 7-9 | CT 7-24-1.6 | 1-1.6 |
| 0.55 | 1.5 | XM30PB/2 | CA 7-9 | CT. 7-24-1.6 | 1-1.6 |
| 0.75 | 1.8 | XM30PB/2.6 | CA 7-9 | CT 7-24-2.4 | 1.6-2.4 |
| 1.1 | 2.6 | XM30PB/4.0 | CA 7-16 | CT 7-24-4 | 2.4-4 |
| 1.5 | 3.4 | XM30PB/5 | CA 7-16 | CT 7-24-4 | 2.4-4 |
| 2.2 | 4.8. | XM30PB/8 | CA 7-16 | CT 7-24-6 | 4-6 |
| 3 | 6.5 | XM30PB/10 | CA 7-30 | CT 7-24-10 | 6-10 |
| /4 | 8.2 | XM30PB/12 | CA 7-30 | CT 7-24-10 | 6-10 |
| 5.5 | 11 | XH125NJ/20 | CA 7-30 | CT 7-24-16 | 10-16 |
| 7.5 | 14 | XH125NJ/20 | CA 7-30 | CT 7-24-16 | 10-16 |
| 11 | 21 | XH125NJ/32 | CA 7-30 | CT 7-24-24 | 16-24 |
| 15 | 28 \% | XH125NJ/50 | $\therefore$ CA $7-43$ | CT 7-45-30 | 18-30 |
| 18.5 | 34 | XH125NJ/50 | CA 7-43 | CT 7-45-45 | 30-45 |
| '22 | 40 | XH125NJ/63 | CA $7-43$ | CT 7-45-45 | 30-45 |
| 30 | 55 | XH125NJ/100 | CA 7-85 | CT 7-75 ${ }^{2}$ ) | 45-60 |
| 37 | 66 | XH125NJ/100 | CA 7-85 | CT $7.75{ }^{2}$ ) | 60-75 |
| 45 | 80 | XH125NJ/125 | CA 6-105-(E) | CT 6-90 | 70-90 |
| 55 | 100 | XH125NJ/125 ) | CA 6-105-(E) | CT 6-110 | 85-110 |
| 75 | 130 | XH250NJ/250 | CA 6-140-(E]) | CT 6-150 | 105-150 |
| 90 | -155, | XH250NJ/250 | CA 6-170-EI | CT 6-200 | 140-200 |
| 110 | 200 | XH250NJ/250 ') | CA 6-210-El | CEF 1-41/42 | 160-400 |
| 132 | 225 | XS400SE/400 | CA 6-210-EI | CEF 1-41/42 | 160-400 |
| 160 | 270 | XS400SE/400 | CA 6-300-E] | CEF 1-41/42 | 160-400 |
| 200 | 361 | XS400SE/400 | CA 6-420-EI | CEF 1-41/42 | 160-400 |
| 200 | 361. | XS400SE/400 | CA 5-450 | CEF 1-22 ${ }^{2}$ ) | 160-400 |
| 250 | 425 | XS630SE/630 | CA 5-700 | CEF 1-52 ${ }^{2}$ | 160-630 |
| 320 : | 538 - | XS630SE/630 | - CA 5-700 | CEF 1-52 ${ }^{2}$ | 160-630 |

Notes: ${ }^{1}$ ) Use 'magnetic only' breaker or next higher circuit breaker/contactor combination. Refer NHP.
2) Use with separate mounting bracket.
${ }^{3}$ ) Thermal or electronic overload relays may be used. Combinations based on the thermal overload relay tripping before the circuit breaker at overload currents up to the molor locked rotor current.

## Type ' 2 ' short circuit co-ordination <br> Motor starter co-ordination table for DOL starting $65 \mathrm{kA}, 415 \mathrm{~V}$ to AS 3947-4-1

| Motor size kW | Approx. amps | Terasaki circuit breaker | Sprecher + Schuh contactor | Sprecher + Schuh overload relay ') | Settings range amps |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 0.37 | 1.1 | XM30PB/1.4 | CA 7-9 | CEP 7 | 1.0-2.9 |
| 0.55 | 1.5 | XM30PB/2 | CA 7-9 | CEP 7 | 1.0-2.9 |
| 0.75 | 1.8 | XM30PB/2.6 | CA 7-9 | CEP 7 | 1.0-2.9 |
| 1.1 | 2.6 | XM30PB/4.0 | CA 7-16 | CEP 7 | 1.6-5 |
| 1.5 | 3.4 | XM30PB/5 | CA 7-16 | CEP 7 | 1.6-5 |
| 2.2 | 4.8 | XM30PB/8 | CA 7-16 | CEP 7 | 3.7-12 |
| 3 | 6.5 | XM30PB/10 | CA 7-30 | CEP 7 | 3.7-12 |
| 4 | 8.2 | XM30PB/12 | CA 7.30 | CEP 7 | 3.7-12 |
| 5.5 | 11 | TL30F/20A | CA 7.30 | CEP 7 | 3.7-12 |
| 7.5 | 14 | TL30F/30A | CA 7-30 | CEP 7 | 12-32 |
| 11 | 21 | TL30F/30A | CA 7-30 | CEP 7 | 12-32 |
| 15 | 28 | TL100NJ/50A | CA 7-43 | CEP 7 | 12-32 |
| 18.5 | 34 | TL100NJ/50A | CA 7-43 | CEP 7 | 12-37 |
| 22 | 40 | TL100NJ/63A | CA 7-43 | CEP 7 | 14-45 |
| 30 | 55 | TL100NJ/100A | CA 7-72 | CEP 7 | 26-85 |
| 37 | 66 | TL.100NJ/100A | CA 7-72 | CEP 7 | 26-85 |
| 45 | 80 | TL.100NJ/100A | CA 6-105-(El) | CT 6-90 | 70-90 |
| 55 | 100 | XH400SE/250 | CA 6-105-(EI) | CT 6-110 | 85-110 |
| 75 | 130 | XH400SE/250 | CA 6-140-(E) | CT 6-150 | 105-150 |
| 90 | 155 | XH400SE/250 | CA 6-170-EI | CT 6-200 | 140-200 |
| 110 | 200 | XH400SE/250 | CA 6-210-EI | CEF 1-41/42 | 160-400 |
| 132 | 225 | XH400SE/400 | CA 6-210-EI | CEF 1-41/42 | 160-400 |
| 150 | 250 | XH400SE/400 | CA 6-250-EI | CEF 1-41/42 | 160-400 |
| 160 | 270 | XH400SE/400 | CA 6-300-EI | CEF 1-41/42 | 160-400 |
| 200 | 361 | XH400SE/400 | CA 6-420-EI | CEF 1-41/42 | 160-400 |
| 200 | 361 | XH400SE/400 | CA 5-450 | CEF 1-22 ${ }^{2}$ ) | 160-400 |
| 250 | 425 | XH630SE/630 | CA 5-700 | CEF 1-52 ${ }^{2}$ ) | 160-630 |
| 320 | 538 | XH630SE/630 | CA 5-700 | CEF 1-52 ${ }^{2}$ ) | 160-630 |

[^4]${ }^{2}$ ) Use with separate mounting bracket.
Combinations based on the overload relay tripping before the circuit breaker at overload currents up to the motor locked rotor current.

## Type ' 2 ' short circuit co-ordination Motor starter co-ordination table for DOL starting 85kA, 415V to AS 3947-4-1

## TYPE 2

 85kA| Motor size kW | Approx. FLC at 415 V amps | Terasaki circuit breaker | Sprecher + Schuh contactor type | Sprecher + Schuh thermal overload type ') | Settings range amps |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 0.37 | 1.1 | XM30PB/1.4 | CA 7-9 | CEP 7-M32-2.9-10 | 1.0-2.9 |
| 0.55 | 1.5. | $\cdots$ XM30PB/2 | CA 7-9 | CEP 7-M32-2.9-10 | 1.0-2.9 |
| 0.75 | 1.8 | XM30РВ/2.6 | CA 7-9 | CEP 7-M32-2.9-10 | 1.0-2.9 |
| 1.1 | 2.6 | XM30РB/4 | CA 7-16 | CEP 7-M32-2.9-10 | 1.0-2.9 |
| 1.5 | 3.4 | XM30PB/5 | CA 7-16 | CEP 7-M32-5-10 | 1.6-5 |
| 2.2 | 4.8 | XM30РB/8 | CA 7-30 | CEP 7-M32-12-10 | 3.7-12 |
| 3 | 6.5 | XM30PB/8 | CA 7-30 | CEP 7-M32-12-10 | 3.7-12 |
| 14 | 8.2 | XM30PB/10 | CA 7-30 | СЕР 7-M32-12-10 | 3.7-12 |
| 5.5 | 11 | TL100NJ/20 | CA 7-30 | CEP 7-M32-12-10 | 3.7-12 |
| 7.5 | 14 | TL100NJ/20 | CA 7-30 | CEP 7-M32-32-10 | 12-32 |
| 9 | 17 | TL100NJ/32 | CA 7-30 | CEP 7-M32-32-10 | 12-32 |
| 10 | 19 | TL100NJ/32 | CA 7-30 | CEP 7-M32-32-10 | 12-32 |
| 11 | 21 | TL100NJ/32 | CA 7-30 | CEP 7-M32-32-10 | 12-32 |
| 115 | 28 | .TL100 NJ/50 | CA 7-43 | CEP 7-M32-32-10 | 12-32 |
| 18.5 | 34 | TL100NJ/50 | CA 7-43 | CEP 7-M37-37-10 | 12-37. |
| 22 | 40 | TL100NLI/63 | CA 7-43 | - CEP 7-M45-45-10 | 14-45 |
| 30 | 55 | TL100N $\mathrm{N} / 100$ | CA 7-72 | CEP 7-M85-85-10 | 26-85 |
| 37 | 66 | TL100NJ/100 | CA 7-72 | CEP 7-M85-85-10 | 26-85 |
| 45 | 80 | TL250NJ/160 | CA 6-105 | CEP 7-M85-85-10 | 26-85 |
| 55 | 100. | TL250NJ/160 | CA 6-105 | CEF 1-11/12 | 0.5-180 |
| 75 | 135 | TL250NJ/250 | CA 6-210-EI | CEF 1-11/12 | 0.5-180 |
| 90 | 160. | TL250NJ/250 | CA 6-210-EI | CEF 1-11/12 | -0.5-180 |
| 110 | 200 | TL.250NJ/250 | CA 6-210-EI | CEF 1-41/42/52 | 160-630 |
| 132 | 230 | TL400NE/400 | CA 6-210-EI | CEF 1-41/42/52 | 160-630 |
| 160 | 270 | TL400NE/400 | CA 6 -300-EI | CEF 1-41/42/52 | 160-630 |
| 200 | 361 | TL400NE/400 | CA 6-420-EI | CEF 1-41/42/52 | 160-630: |

[^5]Combinations based on the overload relay tripping before the circuit breaker at overload currents up to the motor locked rotor current.

## Motor circuit application table for DOL starting General applications

High fault range

| Motor rating (kW) | Approx. FLC (amps) | Din-T <br> C\&D Curve | Safe-T | $\begin{aligned} & \text { XS125CJ } \\ & \text { XS125NJ } \\ & \text { XH125NJ } \end{aligned}$ | XE225NC | XS250NJ <br> XH250NJ | XS400SE <br> XH400SE <br> XS400CJ <br> XS400NJ | XH630SE <br> XS630SE <br> XS630CJ <br> XS630NJ | XS800NJ <br> XH800SE XS1250SE <br> XSBOOSE 1000 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0.37 | 1.1 | 4 | 6 |  |  |  |  | . |  |
| 0.55 | 1.5 | 4 | 6 | 20 | - |  | - |  |  |
| 0.75 | 1.8 | 6 | 6 | 20 |  |  |  |  |  |
| 1.1 | 2.6 | 10 | 6 | 20 |  |  |  |  |  |
| 1.5 | 3.4 | 10 | 10 | 20 |  |  |  |  |  |
| 2.2 | - 4.8 | 16 | 16 | 20 |  | - |  |  |  |
| 3.0 | 6.5 | 20 | 16 | 20 |  |  |  |  |  |
| 14 | 8.2 | : 25 | 20 | 20 |  |  | $\cdots$ |  |  |
| 4.5 | 9 | 32 | 25 | 20 |  |  |  |  |  |
| 5.5 | 11 | 32 | $32 \%$ | 32 |  |  |  |  |  |
| 7.5 | 14 | 40 | 40 | 32 |  |  |  |  |  |
| 10 | 19 | 50 | 50 | 50 |  |  | * |  |  |
| 11 | 21 | 50 | 50 | 50 |  |  |  |  |  |
| 15 | 28 - | 63 | 63 | 63 |  |  |  |  |  |
| 18.5 | 34 | $100{ }^{\text {) }}$ | 80 | 100 |  |  |  |  |  |
| 22 | 40 | 125) |  | 100 | $2 \times$ | $\square-5$ | - | andex |  |
| 25 | 46 | 125 ) | 100 | 100 |  |  |  |  |  |
| 30 | 55 |  |  | 125 |  | 160 |  | 4. |  |
| 37 | 66 |  |  | $125{ }^{9}$ ) | 125 | 160 |  |  |  |
| 45 | 80 |  |  | $125^{3}$ ) | 125 | 160 |  |  | + |
| 55 | 100 |  |  |  | 175 | 160 | 250 |  |  |
| 75 | 130 | + |  | F | 225 | 250 | 250 | \% |  |
| 00 | 155 |  |  |  |  | 250 | 250 |  |  |
| 110 | 200 |  |  |  |  | $\cdots$ | 400 | 400 |  |
| 132 | 225 |  |  |  |  |  | 400 | 400 |  |
| $160^{\circ}$ | 270 | $\cdots$ |  |  |  |  | 400 | 400 |  |
| 185 | 320 |  |  |  |  |  | $400{ }^{\text {\% }}$ ) | 630 |  |
| 200 | 361 | \% |  |  |  |  | $400^{2}$ ) | 630 | . $\cdot$. $\cdot$ - |
| 220 | 380 |  |  |  |  |  |  | 630 | $800{ }^{2}$ ) |
| 250 | 430 |  |  |  |  |  |  | 630 | 800 |
| 280 | 480 |  |  |  |  |  |  | $630{ }^{2}$ ) | 800 |
| 300 | 510 | 。 | . |  |  |  |  | $630{ }^{2}$ ) | 800 |
| 375 | 650 |  |  |  |  |  |  |  | $800{ }^{2}$ ) |
| 450 | . 750 |  |  |  |  |  |  |  | 1000 |

Notes: These motor circuit application tables are to be used as a selection guide for average 3 phase, 4 pole 415 V motors for standard applications only. The table is based on holding $125 \%$ of full load current (FLC) continuously and $600 \%$ ol FLC for at least 10 seconds. Lower circuit breaker ratings are possible in some applications. Refer NHP.
I) 80,100 and 125 amp refers to Din-T10H type.
${ }^{2}$ ) Type 'SE' TemBreak MCCB only.
${ }^{\text {² }}$ ) Use magnetic-only TemBreak MCCB. Refer NHP.
Adjustable magnetic trips set to high. Thermal magnetic TemBreak adjustable $63 \%-100 \%$ of NRC (nominal rated current). Din-T MCB's are calibrated to IEC 898 Curve ' $C$ ' \& 'D'. Selected sizes of ' $D$ ' Curve are available from stock. Refer NHP.

## Motor circuit application table for reduced voltage starting General applications

Breaker type and current rating, star delta, auto transformer resistor or reactance starting

|  |  |  |  | XS125CJ |  |  | XS400SE | XH630SE |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Motor | Approx. | Din-T |  | XS125NJ |  |  | XH400SE | XS630SE | XS800NJ |  |
| rating | FLC | C\& D |  | XH125NJ |  | XS250NJ | XS400CJ | XS630CJ | XH800SE | XS1250 |
| (kW) | (amps) | Curve | Safe-T | TL100NJ ${ }^{\text {) }}$ | XE225NC | XH250NJ | XS400NJ | XS630NJ | XSboose | 1000 |


| 0.37 | 1.1 | 4 | 6 |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0.55 | 1.5 | 4 | 6 | 20 |  |  |  |  |  |  |
| 0.75 | 1.8 | 4 | 6 | 20 |  |  |  |  |  |  |
| 1.1 | 2.6 | 6 | 6 | 20 |  |  |  |  |  |  |
| 1.5 | 3.4 | 10 | 6 | 20 |  |  |  |  |  |  |
| 2.2 | 4.8 | 10 | 10 | 20 - | * |  |  |  |  |  |
| 3.0 | 6.5 | 16 | 16 | 20 |  |  |  |  |  |  |
| 4 | 8.2 | 20 | 16 | 20 | -.. |  |  |  |  |  |
| 4.5 | 9 | 20 | 16 | 20 |  |  |  |  |  |  |
| 5.5 | 11 | 25 | 20 | 20 |  |  |  |  |  |  |
| 7.5 | 14 | 32 | 25 | 20 |  |  |  |  |  |  |
| 10 | 19 | 40 | 40 | 32 | - - |  |  |  |  |  |
| 11 | 21 | 50 | 40 | 32 |  |  |  |  |  |  |
| 15 | 28 - | 50 | 50 | 50 | " |  |  | + |  |  |
| 18.5 | 34 | 63 | 63 | 50 | - |  |  |  |  |  |
| 22 | 40 | 80.$)$ | 63 | 63 | *-". |  |  | * |  |  |
| 25 | 46 | 100 ) | 80 | 100 |  |  |  |  |  |  |
| 30 | $55 .$. | 125 ) | 100 | 100 | \% 160 |  |  |  | . |  |
| 37 | 66 | 125) |  | 100 | 125.160 |  |  |  |  |  |
| 45 | 80 |  |  | 125 | 125 160 | 250 |  | - |  |  |
| 55 | 100 |  |  |  | $150 \quad 160$ | 250 |  |  |  |  |
| 75 | 130 | - - |  | 4 | 175 250 | 250 |  |  |  | $=$ |
| 90 | 155 |  |  |  | 225 250 | 250 |  |  |  |  |
| 110 | 200 |  |  | - | 250 | 250 | 400 |  |  |  |
| 132 | 225 |  |  |  |  | 400 | 400 |  |  |  |
| 160 | 270 | . |  |  |  | 400 | 400 |  |  | - |
| 185 | 320 |  |  |  |  | 400 | 400 | $800^{2}$ ) |  |  |
| 200 | 361 |  |  |  | \% | $400^{2}$ ) | 630 | $800^{2}$ ) |  |  |
| 220 | 380 |  |  |  |  |  | 630 | 800 |  |  |
| 250 | 430 |  |  | , | - | * | 630 | 800 |  |  |
| 280 | 480 |  |  |  |  |  | 630 | 800 |  |  |
| 300 | 510 | \% | $\because$ |  | . |  | 630 | 800 |  |  |
| 375 | 650 |  |  |  |  |  |  | $800^{2}$ ) | 1000 |  |

[^6]
## Motor circuit application table fō DOL FIRE PUMP starting duty

Breaker type and current rating (A)

| Motor rating (kW) | Approx. FLC (amps) | Din-T <br>  <br> Curve | Safe-T | хM30PB | $\begin{aligned} & \text { XS125CJ } \\ & \text { XS125NJ } \\ & \text { XH125NJ } \\ & \text { TL100NJ }{ }^{\prime} \text { ) } \end{aligned}$ | TLit00F TL100C | XE225NC | $\begin{aligned} & \text { XS250NJ } \\ & \text { XH250NJ } \end{aligned}$ | XS400SE <br> XH400SE <br> $\times 5400 \mathrm{CJ}$ <br> $\times 5400 \mathrm{NJ}$ | $\begin{aligned} & \text { XH630SE } \\ & \text { XS630SE } \\ & \text { XS630CJ } \\ & \text { XS630NJ } \end{aligned}$ | xs800 XH800 XS800 | XS1250SE $1000$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0.37 | 1.1 | 4 | 6 | 3.6 |  |  |  |  |  |  |  |  |
| 0.55 | 1.5 | 6 | 6 | 3.6 |  |  |  |  |  | $\because \cdot$ |  |  |
| 0.75 | 1.8 | 6 | 6 | 5 | 20 | 15 |  |  |  |  |  |  |
| 1.1 | 2.6 | 10. | 6 | 7.4 | 20 | 15 | - |  |  |  |  |  |
| 1.5 | 3.4 | 16 | 10 | 10 | 20 | 15 |  |  |  |  |  |  |
| 2.2 | 4.8 ${ }^{\text {\% }}$ | 20 | 16 | 12 | 20 | 15 |  |  | $\cdots$ | - |  |  |
| 3 | 6.5 | 25 | 20 |  | 20 | 20 |  |  |  |  |  |  |
| 4 | 8.2 | 32- | 25. |  | 32 | 30 |  |  |  |  |  |  |
| 4.5 | 9 | 32 | 32 |  | 32 | 30 |  |  |  |  |  |  |
| 5.5 | 11: | 40 | 40 | * | $32 \cdots$ | 30 | * |  | ... |  |  |  |
| 7.5 | 14 | 50 | 50 |  | 50 | 40 |  |  |  |  |  | -- |
| 10. | 19 | 63 | 50 |  | 50 | 50 |  |  | - | . |  |  |
| 17 | 21 | 63 | 63 |  | 63 | 60 |  |  |  |  |  |  |
| 15 | $28{ }^{\text {" }}$ | 100 ) | 80 |  | 100 | 75 |  |  | - |  |  |  |
| 18.5 | 34 | 125) | 100 |  | 100 | 75 |  |  |  |  |  |  |
| 22- | 40 | - 3 | - |  | 125 | 75 |  | $\cdots$ |  |  | . |  |
| 25 | 46 |  |  |  | 125 | 100 |  |  |  |  |  |  |
| 30 | 55 | :- |  | \% |  | 100 | 125 | 160 | - |  |  | $\because$ |
| 37 | 66 |  |  |  |  |  | 150 | 160 |  |  |  | \% |
| 45 | 80 |  | . |  |  |  | 175 | 250 | 250 | , |  |  |
| 55 | 100 |  |  |  |  |  | 225 | 250 | 250 |  | - |  |
| 75 | 130 |  | . |  |  |  |  |  | $400 \quad \because$ |  |  |  |
| 90 | 155 |  |  |  |  |  |  |  | 400 |  |  |  |
| 110 | 200 |  |  | " |  |  |  | " | 400 | 630 | - |  |
| 132 | 225 |  |  |  |  |  |  |  | 400 | 630 |  |  |
| 160 | 270 |  |  |  |  |  |  |  | 400 | 630 |  |  |
| 185 | 320 |  |  |  |  | \% |  |  | $400{ }^{2}$ ) | 630 |  |  |
| 200 | 361 |  |  |  |  |  |  |  |  | 630 | 800 |  |
| 220 | 380 |  |  |  |  |  |  |  |  | 630 | 800 |  |
| 250 | 430 |  |  |  |  |  |  |  |  | 630 | 800 |  |
| 280 | 480 |  |  |  |  |  |  |  |  |  | 800 |  |
| 300 | 510 |  |  |  |  |  |  |  |  | $\because$ | 800 |  |
| 375 | 650 |  |  |  |  |  |  |  |  |  | $800{ }^{\circ}$ ) | 1000 |
| 450 | 750 |  | $\because$ |  |  |  |  | $\cdots$ | - | ; |  | 1000 |

[^7] applications only. The table is based on holding $125 \%$ FLC continuously and $600 \%$ FLC for at least 20 seconds. ') 80,100 and 125 amp refers to Din-T10H type.
${ }^{2}$ ) Type 'SE' TemBreak MCCB only.
3) TL100NJ up to 100A only.

Din-T MCB's are calibrated to IEC 898 Curve ' $C$ ' \& 'D'. Selected sizes of 'D' Curve are available from stock refer NHP.

## Motor starting table for DOL starting at 1000 V AC 50 Hz

| Motor <br> size <br> kW | Full load <br> current <br> amperes | MCCB | Voltage |
| :--- | :--- | :--- | :--- |
| $0.37-10$ | $0.4-7.5$ | TL100EM/15 | 1000 V |
| 11.0 | 9.0 | TL100EM/20 | 1000 V |
| $15-18.5$ | $12-14.5$ | TL100EM/30 | 1000 V |
| $22-33$ | $17-23$ | TL100EM/40 | 1000 V |
| $37-50$ | $28-38$ | TL100EM/50 | 1000 V |
| $55-80$ | $40-57$ | TL100EM/75 | 1000 V |
| $90-110$ | $65-78$ | TLL100EM/100 | 1000 V |
| 150 | 102 | XV400NE/160 | 1000 V |
| $185-220$ | $138-160$ | XV400NE/250 | 1000 V |
| $220-500$ | $160-350$ | XV400NE/400 | 1000 V |



TemBreak XV400NE
mining breaker


Sprecher + Schuh 1000V CA 6 contactor
(Refer Part A for more information)

## MCCB's for protection of Power Factor Correction (PFC) units

In circuits containing capacitor banks for Power Factor Correction (PFC) two conditions that the circuit breaker must overcome are as follows:

1. Voltage surges during MCCB opening.
2. Nuisance tripping due to in-rush current.
3. Voltage surges during MCCB opening At the instant where the MCCB has to open, the voltage developed across its contacts can be up to twice the supply voltage, which can have damaging consequences should the breaker be slow to operate. If this worse case scenario actually occurs a potential re-arcing can take place across the contacts of the MCCB, until the breaker has fully opened and the distance between the contacts is at a maximum.
Re-arcing at each instant can be:
$\begin{array}{ll}\text { 1st re-arcing } & - \\ \text { 2nd re-arcing } & - \\ \text { 3 } & \text { supply voltage } \\ \text { 3rd re-arcing } & -\quad 7 \times \text { supply voltage voltage }\end{array}$
Internal capacitor damage will occur if the voltage level is greater than the capacitor's Dielectric Strength. With modern-day protection devices, (for example the Terasaki TemBreak MCCB's) this problem will not occur.
The numerous cases of re-arcing are mainly a result of older style "dependant manual closing" devices, which rely on the operator speed for opening or closing.
All Terasaki MCCB's are of the "manually independent closing" type, with high speed opening to prevent re-arcing between the contacts.
4. Nuisance tripping due to in-rush current When feeding a circuit containing a PFC unit the circuit breaker and the PFC unit can be exposed to a large in-rush current, equal to the instantaneous value of the power source. The end result of this is a large in-rush current, which could cause the circuit breaker to operate instantaneously due to its shon-circuit protection. (The value of in-rush current will depend on the source voltage, the inductance and reactance in the circuit).
Special care should be taken to ensure that the MCCB selected will not nuisance trip due to high in-rush currents.
The table below shows typical MCCB selections for varying capacitor ratings, and the breaker selection is by a rule-ofthumb.

$$
\text { Capacitor Rated Current }=\frac{\mathrm{kVAR} \times 1000}{\sqrt{3} \times \mathrm{V}} \quad(\mathrm{~A})
$$

## kVAR: Capacitor Rating

## V: Source Voltage

MCCB Rating = Capacitor Rated Current $\times 1.5(\mathrm{~A})$
Once the MCCB rating has been determined, the MCCB type should be selected according to the short circuit fault level of the system.

MCCB's selection for power factor capacitor application

| Voltage 415V (3D) <br> Capacitor Capacitor <br> rating <br> (kVAR) <br> ratred (A) |  |  | Recommended MCCB's $\left.{ }^{1}\right)^{7}$ ) Type/Rating (A) |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  |
| 5 | 7 |  | $\underline{\square}$ | XS125CJ/20 | XS125NJ/20 | XH125NJ/20 |
| 10 | 13.9 |  |  | XS125CJ/32 | XS125NJ/32 | XH125NJ/32 |
| 15 | 20.9 |  | $\pm$ | XS125CJ/50 | XS125NJ/50 | XH125NJ/50 |
| 20 | 27.8 |  |  | XS125CJ/50 | XS125NJ/50 | XH125NJ/50 |
| 25 | 34.8 |  | $\ddagger$ | XS125CJ/63 | XS125NJ/63 | XH125NJ/63 |
| 30 | 41.7 |  |  | XS125CJ/100 | XS125NJ/100 | XH125NJ/100 |
| 40 | 55.6 |  |  | XS125CJ/100 | XS125NJ/100 | XH125NJ/100 |
| 50 | 69.6 |  |  | XS125CJ/125 | XSt25NJ/125 | XS125NJ/125 |
| 75 | 104 | XE225NC/150 | XS250NJ/160 | XH250NJ/160 |  |  |
| 100 | 139 | XE225NC/225 | XS250NJ/250 | XH250NJ/250 | XS400SE/250 | XH400SE/250 |
| 150 | 209 |  | XS400CJ/400 | XS400NJ/400 | XS400SE/400 | XH400SE/400 |
| 200 | 278 |  | XS400C.J/400 | XS400NJ/400 | XS400SE/400 | XH400SE/400 |
| 300 | 417 |  | XS630CJ/630 | XS630NJ/630 | XS630SE/630 | XH630SE/630 |
| 400 | 556 | XS800NJ/800 | XS800SE/800 | XH800SE/800 |  |  |
| 500 | 696 | XS1250SE/1250 |  |  |  |  |
| 600 | 835 | XS1250SE/1250 |  |  |  |  |
| 800 | 1113 | XS1600SE/1600 |  |  |  |  |
| 1000 | 1391 | XS2000SE/2000 |  |  | " |  |

Note: ${ }^{1}$ ) Select applicable short circuit rating required by system specifications.
${ }^{\text {z }}$ ) TemBreak Plus MCCBs can also be used.

## Application data

## MCCB use in high frequency ( 400 Hz ) applications

. General
Terasaki TemBreak MCCB's are designed to operate primarily in 50 or 60 Hz systems. However, it is possible to use the same MCCB's in high frequency ( 400 Hz ) applications provided consideration is taken to the effects high frequencies will have on the breaker.
A consequence of high frequencies is an increase in Eddy currents in conductors, including those internal to the breakers. This generally causes an increase of temperature in and around the breaker. As such, some derating allowances must be made when selecting a breaker in these 400 Hz systems.
Thermal Magnetic MCCB's
In low overload (thermal) regions the current required to trip the MCCB is reduced as a result of the heat generated due
to the higher Eddy currents. As a result the thermal protection must be derated to take the heating effect into account.
In short-circuit (magnetic) regions, the demagnetising effects of the Eddy currents mean that a larger fault will be required to trip the breaker. The rule of thumb generally used is that the Magnetic/Instantaneous Trip setting will be approximately twice that at normal $50 / 60 \mathrm{~Hz}$ operation.
Electronic MCCB's
Electronic MCCB's offer better performance at higher frequencies, although some consideration must be taken with regards to the heating effects caused by the Eddy currents. The figures in the table give the maximum Over Current Relay (OCR) rated current setting $\left(I_{0} \times I_{1}\right)$ that should be used when in high frequency applications.

| MCCB Model | MCCB Type | Rating at $50 / 60 \mathrm{~Hz}$ (A) | Cable size in $\mathrm{mm}^{\mathbf{2}}$ as specified IEC 947-1 | MCCB rating at 400 Hz <br> (A) |
| :---: | :---: | :---: | :---: | :---: |
| XS125CJ | Th/Mag | 20 | 2.5 | 18 |
| XS125NJ |  | 32 | 6 | 30 |
|  |  | 50 | 10 | 45 |
|  |  | 63 | 16 | 58 |
|  |  | 100 | 35 | 89 |
|  |  | 125 | 50 | 110 |
| XH160PJ | Th/Mag | 160 | 70 | 147 |
| XE225NC | Th/Mag | 125 | 50 | 116 |
|  |  | 150 | 50 | 135 |
|  |  | 175 | 70 | 155 |
|  |  | 200 | 95 | 185 |
|  |  | 225 | 95 | 195 |
| XS250NJ | Tw/Mag | 160 | 70 | 147 |
| - |  | 250 | 120 | 210 |
| XH250NJ | Th/Mag | 160 | 70 | 147 |
|  |  | 250 | 120 | 210 |
| XH250PJ | Th/Mag | 250 | 120 | 240 |
| XS400NJ | Th/Mag | 250 | 120 | 240 |
| XH400P.J |  | 400 | 240 | 330 |
| XS630CJ | Th/Mag | 400 | 240 | 320 |
| XS630NJ |  | 630 | $2 \times 185$ | 475 |
| XS600NJ | Th/Mag | 800 | $2 \times 240$ | 600 |
| XS400SE | Electronic | 250 | 120 | 238 |
| XH400NE/SE/PE | Electronic | 400 | 240 | 360 |
| XS630SE | Electronic | 630 | $2 \times 185$ | 600 |
| XH530NE/SE/PE |  |  |  |  |
| XS800SE | Electronic | 800 | $2 \times 240$ | 640 |
| XH800NE/SE/PE |  |  | , | - |
| XS1250SE | Electronic | 1250 | $2 \times(80 \times 5 t)$ | 800 |
| XS1600SE | Electronic | 1600 | $2 \times(100 \times 5 t)$ | 900 |

Note: When used at 400 Hz , the rated current setting of the OCR must not exceed the values shown in Column 4.

## Circuit breaker selection for DC applications

The characteristics of an MCB or MCCB for DC applications are different from AC. The main differences are as follows:

1. Maximum permissible voltage is reduced in value (refer table).
2. Number of electrical operations is reduced (refer table).
3. Magnetic trip current increases by $40 \%$.

## Selecting the circuit breaker

When selecting the MCB most suitable for the protection of DC circuits the following criteria must be considered:
$\square$ Rated current.
P. Rated voltage which determines the number of poles required to be involved in the interruption of the circuit.

- The type of DC system used.
- Maximum short circuit current to determine the breaking capacity.
As a general rule the Isc (short circuit current at the battery terminals) can be calculated as follows:

$$
\mathrm{Isc}=\frac{\mathrm{Vb}}{\mathrm{Ri}}
$$

Where Vb - maximum discharge battery voltage
Where Ri - internal resistance (sum of all calls resistance) generally expressed in Ampere/hour capacity of the battery.

Terasaki MCB use in DC systems

| MCB | Breaking <br> capacity <br> type | KA ${ }^{1}$ ) |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |

Example: For a Din-T10 to break 10kA at 110V DC it must have 2 poles connected in series.
Breaking capacities of TemBreak MCCB in DC systems
MCCB

| type | 24/48/60V | 125 V | 250 V | 350 V | 500V | 600 V |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| XS125NJ | $25^{*}$ | 20 | 15 | 10 | $7.5^{2}$ ) | $\left.5{ }^{2}\right)$ |
| XH125NJ | . 50 | 40 | 40 | 10. | $7.5{ }^{2}$ ) | $5^{2}$ ). |
| XS250NJ | 25 | 40 | 40 | 10 | 7.5 | 5 |
| XH250NJ | 50 | 40 | 40 | 20 | 15 | $\cdots 10$ |
| XS400NJ | 50 | 40 | 40 | 20 | 15 | 15 |
| XS630NJ | 50 | 40 | 40 | 30 | 20 | 20 |
| XS800NJ | 50 | 40 | 40 | 30 | 20 | 20 |
| XS1000ND ${ }^{\text { }}$ ) | - | 40 | 40 | 30 | 20 | 20 |
| XS1250ND ${ }^{\text { }}$ ) | - | 40 | 40 | 30 | 20 | 20 |
| XS1600ND ${ }^{\text {\% }}$ | - | 40 | 40 | 30 | 20 | 20 |
| (XS2000ND ${ }^{\text {9 }}$ | - | 40 | 40 | 30 | 20 | 20 |
| XS2500ND ${ }^{\text {) }}$ | - | 40 | 40 | $\because 30$ | 20 | 20 |

## Notes:

${ }^{1}$ ) Time constant $(U R)<=15 \mathrm{~ms}$; excludes 50/63A where the time constant $(\llcorner/ \mathbb{R})<=4 \mathrm{~ms}$.
${ }^{2}$ ) Special version of the standard AC circuit breaker. Standard circuit breakers cannot be used at these ratings. Please specify for use on 500 or 600 V DC on application. Indent only.
${ }^{3}$ ) Magnetic trip only, without overload protection. Indent only.
For voltage levels up to and including 250V DC standard 2 -pole breakers maybe be used, with both poles connected in series. For voltage levels greater than 250 V DC 3 -pole breakers must be used, with all three poles connected in series as shown.
The time constant ( $L / R$ ) of the circuit should be:
less than 2 ms at rated current.
less than 2.5 ms for overload ( $2.5 \times \mathrm{in}$ ). less than 7 ms for short circuit $\leq 10 \mathrm{kA}$. less than 15 ms for short circuit > 10 kA .

The following connection diagram should be applled to TemBreak circuit breakers when the voltage is greater than 250 V DC.


## Circuit breaker selection for DC application (cont.)

## Arrangement of breaking poles according to type of system.

Both poles insulated from earth
Protection only


The poles required to interrupt the fault can be divided between the ( + ) and ( - ) polarities. The total number of poles connected in series should be capable of breaking the short circuit current at a voltage level of $\mathrm{U}_{\mathrm{b}}$.
Sharing the circuit breaker interrupting poles between both polarities also ensures isolation as well as protection of the system.

One polarity of the DC supply is earthed
Protection only


Full protection is assured if the total number of poles in series on the side not connected to earth are capable of breaking the short circuit current at a voltage level of $\mathrm{U}_{\mathrm{b}}$.
If full isolation is required then at least one interrupting pole is also required on the earthed polarity side.


MCCB selection for 50 V DC battery applications 3 poles in parallel
TemBreak MCCBs may be connected with 3 poles in parallel.
Rated current $=3 \times 0.8=2.4 \times \mathrm{MCCB}$ nominal rated current ( I ) for 3 poles in parallel.

Protection and Isolation


Protection and Isolation


Protection and Isolation

The centre point of the DC supply is earthed


To ensure full protection the number of poles connected in series on each polarity must be capable of breaking the maximum short circuit current, but at a reduced voltage level of $U_{b} / 2$.
Having circuit breaker interrupting poles breaking both polarities ensures isolation as well as protection of the system.

## Selection of MCCB's for use in welder circuits

1. Definitions
$\mathbf{P}=\quad$ Rated capacity of welder in kVA.
$\mathbf{V}=\quad$ Welder rated voltage.
$11=$ Maximum primary current $(\mathrm{PN})$.
$\mathrm{T}_{1}=$ Current 'ON' period.
$T_{2}=$ Current 'OFF' period.
$\mathrm{T}_{\mathbf{1}}+\mathrm{T}_{\mathbf{2}}=$ One welding cycle time.
B = Duty ratio, current 'ON' period divided by one welding cycle.
Ie $=\quad$ Thermally equivalent continuous current.
2. MCCB selection
a) Current rating

It can be seen from the diagrams below that the welder only draws current intermittently. MCCB selection should be based on the thermally equivalent continuous current, l.e. the current which would produce the MCCB average temperature shown in the dlagram below.
It can further be seen that the MCCB temperature will not be constant but will vary as the load varies.


The thermally equivalent continuous current, le, may be calculated from:


$$
\left(B=\frac{T_{1}}{T_{1}+T_{2}}\right)
$$

Note: The rated capacity of a spot welder is normally expressed in terms of its $50 \%$ duty ratio, ie. $\mathrm{B}=0.5$.

Once an MCCB has been selected, it is necessary, to compare the maximum primary current $\mathrm{I}_{1}$ and the current 'ON' period, $T_{t}$ with the MCCB characteristic curve to ensure that it will not trip.


Current

Note: A tolerance of 10 to $15 \%$ should be included to allow for variations in the supply voltage and equipment.

General guide lines for MCCB selection

| Selection factor | MCCB rating |
| :--- | :--- |
| Resistance welders | 3.00 max |
| Transfomer arc welders | 2.00 max |

SAA wiring rules states that a circuit breaker protecting a circuit from which one or more welders are supplied may be greater than the rating of the protected conductor calculated as follows:
The maximum demand of the circuit excluding that of the largest welding machine plus
i) Three times the primary current of the largest resistance welding.
ii) Two times the primary ratings of the largest transformer arc welders.

## Selection of MCCB's for use in welder circuits

b) Instantaneous setting

The MCCB's instantaneous trip setting should be high enough to avoid nuisance tnipping due to the welding transformers excitation inrush current. When voltage is supplied to the transformers primary side, the iron core is saturated. This results in the flow of a large inrush current caused by a combination of the DC component of the voltage at the instant of closing and the residual magnetic flux of the transformer. The transformer input current value when the welder secondary is completely short-circuited is about $30 \%$ higher than the value calculated from the nominal maximum power input of the welder. So the maximum welder input current, Im, at the start of welding is given by:

$$
I_{m}=\frac{P_{m} \times 1000}{V} \times 1.3 \times \mathrm{K}
$$

The value of $K$ varies depending on the type of welder control employed. (Some form of synchronous closing is nearly always employed in order to stabilise the welding work and to prevent nuisance tripping of the MCCB).
$K=1$ to 1.5 for synchronous type with peak control.
$K=1.4$ to 3 for synchronous type without peak control.
$K=2$ to 6 for non-synchronous soft start type.
If the protection of the thyristor stack is also required, the instantaneous trip setting must be greater than Im, but less than the surge on-state current rating of the thyristor stack:

Im < $\mathrm{I}_{\text {ws }}<$ $\qquad$
where:
Is = surge on-state current rating of thyristor stack, in A
Im = maximum welder input current at start of welding, in $A$

1 inst $=$ MCCB Instantaneous trip setting, in A
$1.1=$ Factor to allow for $\pm 10 \%$ tolerance on the instantaneous setting
c) MCCB breaking capacity

The MCCB breaking capacity should be higher than the estimated shor-circuit fault level of the system.

## Primary LV/LV transformer protection

When selecting an MCCB to protect the primary of an LV/LV transtormer, the inrush current during initial energisation must be taken into account.
The magnitude of inrush current for any transformer is governed by several variables:

1. The primary winding resistance.
2. The supply impedance.
3. The excitation current.

The excitation current is, in theory at a maximum when the voltage is at a minimum, and vice versa.
Usually the level does not exceed 30 times the normal operating current.
If the incush current is not known then a rule of thumb is that it is approximately 15 x the Primary Current.

|  | 1 phase 240V |  |  | 3 phase 415V |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{aligned} & \text { Transformer } \\ & \text { (kVA) } \\ & \hline \end{aligned}$ | $\begin{aligned} & \text { MCCB } \\ & \text { type } \\ & \hline \end{aligned}$ | MCCB rating | $\mathrm{BC}(\mathrm{kA})$ $\text { at } 240 \mathrm{~V}$ | MCCB type | MCCB rating | BC (kA) <br> at 415 V |
| 5 | XS125NS | 50 | 25 | XS 125 NJ | 20 | 30 |
| 7.5 | XS125NS | 63 | 25 | XS 125 NJ | 32 | 30 |
| 10 | XS125NS | 100 | 25 | XS125NJ | 32 | 30 |
| 15 | XE225NC | 125 | 25 | XS125NJ | 50 | 30 |
| -* | XS250NJ | 160 | 50 |  | $\cdots$ |  |
| - | XH250NJ | 160 | 85 |  |  |  |
| 20 | XS250NJ | 160 | 50 | XS125NJ | 63 | 30 |
|  | XH250NJ | 160 | 85 |  |  |  |
| 30 |  |  |  | XS 125 NJ | 100 | 30 |
| 50 |  |  |  | XS125NJ | 125 | 30 |
| 75 |  |  |  | XE225NC | 225 | 18 |
|  | - |  |  | XS250NJ | 250 | 35 |
| 100 |  |  |  | XS400SE | 250 | 50 |
| 150 | - - |  |  | XS400SE | 250 | 50 |
| 200 |  |  |  | XS400SE | 400 | 50 |
| 300 | $\cdots$ |  |  | XS630SE | 630 | 50 |

The above breaker selections are based upon inrush currents calculated using the table below

| (kVA) | Single-phase transformer |  | Three-phase transformer |  |
| :---: | :---: | :---: | :---: | :---: |
|  | First peak multiplier | Decay time constant | First peak multiplier | Decay time constant |
| 5-10 | 34 | 3-6 | 32 | 3-6 |
| 15-20 | 33 | 3-6 | 30 | 3-6 |
| 30 | - | - | 26 | 3-6 |
| 50 | - | - | 24 | 4-7 |
| 75 | - | - | 20 | 4-7 |
| 100 | - | - | 18 | 6-10 |
| 150 | - | $\bullet$ | 16 | 6-10 |
| 200 | - | - | 14 | 6-10 |
| 300 | - | - | 12 | 6-10 |

Notes: First peak multiplier is the first peak current as a multiple of the transformer rated current.
The above table/multipliers are in general larger than the practical current levels, as the current limiting by the circuit impedance is not taken into account.

## MCB selection for high pressure sodium lamps

## Assumption

1. The maximum inrush current which the circuit will pass is a feature of the current limiting ballast and not the lamp.
Assuming these ballasts comply with the relevant IEC specification the circuit will pass currents not exceeding twice the appropriate lamp nominal current.
2. Run up time 10 minutes with the current decaying exponentially.
3. Based on $415 / 240 \mathrm{~V} 3$ phase or 240 V single phase systems.

## This table provides details for Din-T type 'C' MCB's

| Power | Number of fittings per phase |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 50w | 2 | 4 | 7 | 9 | 12 | 24 | 86 | 48 | 60 | 76 | 108 |
| 70W | 1 | 3 | 5 | 6 | 8 | 17 | 25 | 34 | 42 | 54. | 77 |
| 150W | - | 8 | 2 | 3 | 4 | 8 | 12 | 16 | 20 | 25 | 36 |
| 250W | - | - | 1 | 1 | 2 | 4 | 0.7 | 9 | 12 | 15 | 21 |
| 400w | - | $\bigcirc$ | $\bigcirc$ | 1 | 9 | 3 | 4 | 6 | 8 | 9 | 13 |
| 700W | - |  |  |  | - | 1 | $\pm 2$ | 3 | 4 | 5 | $7 \geqslant$ |
| MCB(Amps) | 7 | 2 | 4 |  | 6 | 10 | 46 | 20 | 25 | 32 | 50 |

## Example

Given 42 lamps each 250 W installed on a 415 V 3 phase
system.
Which MCB must be selected?
Number of tubes per phase $=\frac{42}{3}=14$
Therefore from the table above a 32A MCB should be selected.
A short circuit rating as appropriate must be selected.

## MCB selection for fluorescent lighting loads

## Assumptions

1. The power rating of the ballast is $25 \%$ of power of the tubes.
2. Power factor -0.6 for non compensated fittings 0.86 for compensated fittings.
3. MCB's are installed in an enclosure with external ambient of $25^{\circ} \mathrm{C}$.
4. Based on $415 / 240 \mathrm{~V} 3$ phase or 240 V single phase systems.
5. MCB is used for circuit protection only, not switching.

For switching duties of Din-T MCBs refer NHP.

This table provides details for Din-T type 'C' MCB's


## MCB selection for incandescent lighting loads

Assumptions

1) Tungsten lamps have theoretical inrush current of 14 times normal current, when switched from cold.
2) The circuit impedance typically limits the inrush to 10 times normal running current, the inrush current peaking at 0.0007 seconds falling exponentially to normal nunning current within 0.1 seconds.
3) Consider the worst case, if all lamps are switched on simultaneously, then nuisance tripping of MCB may result.
4) Above is based on $415 / 240 \mathrm{~V} 3$ phase and neutral or 240 V single phase system and 240 V lamps.
5) MCB is used for circuit protection only, not switching. For switching duties of Din-T MCB's refer NHP.

## Method

In order to cope with this inrush the following formula should be used to calculate breaker size:
Breaker rating $=\frac{W \times 10}{P \times 240 \times 1 \text { inst }}$
Where $W=$ total wattage
Where $P=$ Number of phases
I inst $\quad=$ Minimum instantaneous tripping co-efficient.
C curve $=5$
D curve $=10$

Notes: Observe the requirements of AS 3000 tor No. of lighting points on a final sub-circuit.

TemBreak MCCB clearance requiréments at $380 / 415 \mathrm{~V}$

Clearance requirements for MCCB's (phase to phase and earth).
When MCCB's are called upon to interrupt large short circuits lonised gas and arcing material is expelled from the vents, usually at the top of the MCCB.
This ionised gas is highly conductive and is also at an elevated temperature when it exits the MCCB via the arc vents. Care must be taken therefore to avoid an arcing fault occurring due to the presence of the ionised gas.

Therefore, incoming conductors must be insulated right up to the terminal opening of the MCCB. This also applies to the attached busbars supplied as a proprietory part with the MCCB.
Proprietary type interpole barriers may be used to achieve creepage and clearance requirements.
Conductors must not impede the flow of ionised gas.

## Insulating distance from Line-End for 380/415V

When earth metal is installed within the proximity of the breakers the correct insulating distance must be maintained.

WARNING:
EXPOSED CONDUCTORS INCLUDING TERMINALS AT ATTACHED BUSBARS MUST BE INSULATED TO AVOID POSSIBLE SHORT CIRCUITING OR EARTHING DUE TO FOREIGN MATTER COMING INTO CONTACT WITH THE CONDUCTORS.

Notes: When using the terminal bar (optional), the specified insulating distance must be maintained.
All dimensions in mm .
When earthed metal is installed within the proximity of the breakers the correct insulating distance must be maintained (refer to Table 1). This distance is necessary to allow the exhausted arc gases to disperse.

This distance is necessary to allow the exhausted arc gases to disperse.


Table 1 below illustrates the min clearance that must be maintained

A Distance from lower breaker to open charging part of terminal on upper breaker (front connection) or the distance from lower breaker to upper breaker end (rear connection and plug-in type)
B1 Distance from breaker end to ceiling (earthed metal)

Table 1
This table is valid for 380/415V


## Clearance fór mining MCCB's ( 1100 V ) and incoming coonnections

The arc chamber in Terasaki TemBreak circuit breakers is located adjacent to the LINE side terminals. The chamber is vented through holes located just above each line terminal. The holes are covered by a flap which deflects when arc gases are being expelled. Even at low fault levels the arc gases that are released are very hot and reduce the dielectric strength of the air in the vicinity of the terminals. If care is not taken when installing the TemBreak this gas can cause arcing faults on the incoming bars or cables.

Significant voltage transients may also be produced as inductive circuits are switched and contribute to an arcing fault.

These problems attect all circuit breaker installations to varying degrees.
To ensure that problems are not created by the installation please observe the following recommendations.


## Notes:

1: Always observe LINE/LOAD marking.
2: Ensure insulation on incoming conductors is adequate. Do not use low grade heat shrink (some grades split at operating temperatures).
3: Minimum clearance to earth metal, Above and below breaker - 120mm (XV1250NE-150mm) To sides of breaker $\mathbf{~} 40 \mathrm{~mm}$.

4: Switchboard construction to be a minimum form 2 to AS 3439.1 with $\mathrm{P} 3 \times$ protection between busbar and circuit break zones.
5: Actual construction can vary to the above but in all cases it is the responsibility of the switchboard manufacturer to ensure compliance to the relevant standard ie. AS 3439.1.
9) TL100EM MCCB's must use a TL100EMTLC lineside terminal cover, XV400 can use either a terminal cover or Interpole Barniers.

## MCCB mounting angles

The overcurrent tripping characteristics of TemBreak are not influenced by the mounting angles for electronic and thermal magnetic types.

The XM30PB motor circuit protectors however, use an oil filled dashpot style trip mechanism, which can be affected. Refer to the diagram below.


Note:
1: The above diagram applies to an XM30 MCCB mounted either way

## Calculation of circuit fault level

## NHP Nomogram

Fault calculation
The NHP Nomogram is a simple and easy to use aid. Developed by NHP to enable convenient and accurate calculation of circuit fault current.
When selecting circuit breakers for the use in modern distribution systems, it is important to calculate the fault level and then choose an MCCB with breaking capacity that is either higher or at least equal to the circuit fault current.

How to use the Nomogram
In the nomogram all you need to know is the size and length of the cable or cables and the size of the Transformer in KVA. The fault level at the terminals of the transformer is very dependant upon the Transformer internal impedance eg. the Australian Standard for a 2000 kVA transformer is $6.5 \%-7 \%$ impedance. This results in a fault level of $40-43 \mathrm{kA}$.

However, many Supply Authorities are now installing low impedance transformer eg. 5\% or less. Thus if the impedance is $5 \%$ then the fault level will be 56 kA . If the impedance is unknown on the side of caution choose $Z=$ $5 \%$ in your calculations.
eg. From the table, the maximum fault level of a 2000 kVA transformer, with $Z=5 \%$ is 56 kA . Proceed then to calculate the resultant fault level by applying the cable size and length in metres to the Transformer secondary fault level and calculate the resultant. By following the example shown it can be seen that the fault level is reduced from 50 kA to 6.7 kA .

Application data

## Short circuit calculation nomogram

Please refer to previous page for instructions on use.


Application notes
A series of application notes are available on Terasaki breakers from your nearest NHP branch. The notes cover the following subjects.
Ref No. Description
5006 Specification for corrosive proofing of MCCB's
5025 De-rated current of ACB's when enclosed
5093 De-rated current of MCCB's when enclosed
5088 De-rating of TemBreak electronic MCCB's when enclosed
5067 DC applications of ACB's
5065 Reverse connection
5074 Thynistor protection with MCCB's
5078
ELCB's at high frequency
5087
5083
5086
5195
ACB's and MCCB's at high altitude
Circuit breaker life mechanical and electrical
TemBreak UVT: transient response time
Inspection and maintenance of earth leakage and moulded case circuit breakers.

## IP rating protection against ingress of dust and liquids



|  | 1st digit <br> Degree of protection against contact and ingress of foreign bodies | IP | 2nd digit <br> Degree of protection against ingress of liquids |
| :---: | :---: | :---: | :---: |
|  | No protection | 0 | No protection |
| 1 | Protection against ingress of solid foreign bodies with diameters greater than 50 mm | 1 | Protection against vertically falling water drops |
| 2 | Protection against contact with the fingers, protection against ingress of solid foreign bodies with diameter greater than 12 mm | 2 | Protection against obliquely falling water, up to an angle of $15^{\circ}$ |
|  | Protection against contact with wires etc., with diameters greater than 2.5 mm , or ingress of solid foreign bodies with diameters greater than 2.5 mm | 3 | Protection against obliquely sprayed water, up to an angle of $60^{\circ}$ from the vertical |
|  | Protection against contact with wires etc., with diameter greater than 1 mm , or ingress of solid foreign bodies with diameters greater than 1 mm | 4 | Protection against sprayed low pressure water from any direction |
|  | Complete protection against contact with live parts, protection against harmful deposits of dust | 5 | Protection against water-jets from any direction - limited ingress permitted |
| 6 | Complete protection against contact with live parts, protection against ingress of dust | 6 | Protection against strong jets of water eg. ship decks |
|  |  | 7 | Protection against temporary immersion in water |
|  |  | 8 | Protection against indefinite immersion in water - under pressure |

XS125 series
D Adjustment range 63-100\% of nominal current rating.

- Standards AS 2184/AS 3947-2.
[] Adjustable thermal and fixed magnetic trip.
- Max. voltage (INSUL) 690V.

XS125CJ (18kA) 3 pole
Ampere

| rating | Min | Max | Cat. No. |
| :--- | :--- | :--- | :--- |
| 20 | 12.5 | 20 | XS125C0203 |
| 32 | 20 | 32 | XST250J323 |
| 50 | 32 | 50 | XS125CJ503 |
| 63 | 40 | 63 | XS125CJ633 |
| 100 | 63 | 100 | XST25CJ4003 |
| 125 | 80 | 125 | XS125CJ4253 |
| 125 | Non-Auto (1.8kA for 1sec) | XS125NN394) |  |

XS125NJ (30kA) 2 pole
Ampere

| rating | Min | Max | Cat. No. |
| :---: | :---: | :---: | :---: |
| 20 | 12.5 | 20 | XS12500202 |
| 32 | 20 | 32 | X 5125013322 |
| 50 | 32 | 50 | XS12500502 |
| 63 | 40 | 63 | XS12500632 |
| 100 | 63 | 100 | XS125N04002 |
| 125 | 80 | 125 | XS12503 ¢252 |

XS125NJ (30kA) 3 pole

| 20 | 12.5 | 20 | XS12500203 |
| :---: | :---: | :---: | :---: |
| 32 | 20 | 32 | XS125以323 |
| 50 | 32 | 50 | XS125M0503 |
| 63 | 40 | 63 | XS12510633 |
| 100 | 63 | 100 | XS125N0 4003 |
| 125 | 80 | 125 | XS125N0 2253 |

XS125NJ (30kA) 4 pole



Dimensions (mm)

| Description | Height |  |  | Width | Depth | kg |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| $X S 125 C J$ | 3 pole | 155 | 90 | 86 | 1.3 |  |
| $X S 125 N J$ | 2 pole | 155 | 90 | 86 | 1.3 |  |
| $X S 125 N J$ | 3 pole | 155 | 90 | 86 | 1.3 |  |
| $X S 125 N J$ | 4 pole | 155 | 120 | 86 | 1.58 |  |


|  |  |
| :---: | :---: |

Short circult capacity

| Model | I/C | Voltage |
| :--- | :--- | :--- |
| $X S 125 \mathrm{CJ}$ | $18 \mathrm{kA}(\mathrm{AS} 2184)$ | 415 V 5 Hz |
| XS 125 NJ | $30 \mathrm{kA}(\mathrm{AS} 2184)$ | 415 V 50 Hz |


| DCuse | I/C ${ }^{3}$ ) | Voltage |
| :--- | :--- | :--- |
| $X S 125 C J$ | 10 kA | 250 VDC |
| $X S 125 \mathrm{NJ}$ | 15 kA | 250 VDC |

Refer to ratings chart at the front of this section. For ratings to AS 3947-2 and AS 2184, and Icsi/cu.

MCCB Technical data

## Connectións and mountings

MCCB accessories
Front-connection type (FC)

Compression terminals


Attached flat bar


Types of terminal screws (Compression terminal and bar)
Breakers and screw size
XE series
(Economical)

| XS series | XH series <br> (High-fault level) | XM series <br> (Motor protection) |
| :--- | :--- | :--- |

Pan headed screw


Hex socket head bolt

| D) | XE225NC | M8 | XS250NJ | M8 | XH250NJ | M8 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  | XH160PJ | M8 |
| \% |  |  | X 8400 | M10 | TL250NJ | M10 |
| ( ${ }^{\text {a }}$ |  |  | XH400 | M10 | TL400NJ | M10 |
| $\Rightarrow$ |  |  | XV400 | M10 | XH250PJ | M10 |

MCCB Technical data

## Connections and mountings <br> Rear-connection type (RC)

Bolt stud
Breaker


Applicable breakers

- XS series

XS125CJ, XS125NJ
] XH series XH125NJ, XH125PJ

# TemBreak XS125CS, CJ, NS, NJ, XH125NJ, TL30F MCCBs 

ASL: Arrangement Standard Line ㄴ: Handle frame centre line

Outine dimensions (mm)
Front connected (standard)



Note: XS125NS 1 pole onty Drilling plan



Plug-in (optional)
Mounting block
Drilling plan


## Plug-in Type

Switchboard use


Types of plug-in mounting blocks for switchboard use


## Plug-in type

## Degree of protection

The degree of protection provided by the mounting blocks for plug in type TemBreak is IP 20 as defined in IEC Pub 529
Standard Safety Trip (Trip first plug-in mechanism) indent.

- The breaker will trip automatically if it is withdrawn while still in the "ON" position. It is not possible to "plug-in" the breaker when it is in the "ON" position.

Application table (up to 100A frame)

| Breaker | IP cover code | Pole | Qty Req. |
| :--- | :--- | :--- | :--- |
| XS125 | IP 20 | $2,3 P$ | 1 2 |

XH125

[^8]Crimp lugs' (compression type)

| Frame (A) | Breaker | Nominal wire size ( $\mathrm{mm}^{\mathbf{2}}$ ) |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 1.5 | 2.5 | 4 | 6 | 10 | 16 | 25 |
| XM30 | XM30PB | CAL1.5-5 | CAL2.5-5 | CAL4-5 | CALS-5 | CAL10-5 | CAL16-6 |  |
|  |  | MT2.5-M5 | MT2.5-415 | MT4-M5 | MT6-M5* | WT10-M5 | MT16-M5 |  |
| 125 | XS125CJ | - | CAL2.5-8 | CAL4-8 | CAL6-8 | CAL10-8 | CAL16-8 | CA125-8 |
|  | XS125NJ | MT2.5-M8 | MT2.5-M18 | MT4-M8 | MT6-N8 | NT10-MB | MT16-M8 | MT25-M ${ }^{\text {M }}$ |
|  | XH125NJ |  |  |  |  |  |  |  |
|  | XH125PJ |  |  |  |  |  |  |  |
|  | TL100NJ |  |  |  |  |  |  |  |
|  | TL30F | \%.. |  |  |  |  |  |  |




Commercially available compression terminals available from CABAC - Cable Accessories and JST Australia.
Key: CAL = CABAC lugs
MT $=$ JST lugs

## Connection

(one electric cable)
If low clearance occurs use a recommended tape or insulation.


## Connection

(two electric cables)
If low clearance occurs use a recommended tape or insulation.


MCCB Technical data

XS125CJ, XS $125 \mathrm{NJ}, \mathrm{XH} 125 \mathrm{NJ}$
XH125NJ
Time/current characteristic curves


Ambient compensating curves


TemBreak XS125CS, CJ, NS, NJ, XH125NJ,'PJ and TL30F MCCBs
ASL: Arrangement Standard Line
$H$ : Handle frame centre line
Outline dimensions (mm)
Note: XS125NS 1 pole only Drilling plan


Rear connected (optional) Drilling plan


Panel mount


Panel cut out dimensions shown give an allowance of 1.0 mm around the handle escutcheon.

Plug-in (optional)


Mounting block

Drilling plan


Môtor ōperators fồ XS125

Outline dimensions (mm)


## Rear connected (optional)



Plug-in (optional)


ASL: Arrangement Standard Line
L : Handle frame centre line

Notes: 'Above outline dimensions are for AC motors. Contact NHP for details for DC motors.

## Application data

-Miniatừê circuit breakers and fúşe fault current lîmiters co-ordiñation chaŕ
For fault current levels up to 50kA at 415 V

| Circuit breaker Type | Rating amps | Min. fuse amps ${ }^{\text {1 }}$ ) | Maximum fuse - amp |  |
| :---: | :---: | :---: | :---: | :---: |
|  |  |  | BS 88 | DIN |
| Safe-T | 6-10 | 50 | $160{ }^{2}$ ) | 160 |
|  | 16-25 | 63 | $200 \%$ | 200 |
|  | 32 | 80 | $200^{2}$ ) | 200 |
|  | 40-50 | 100 | $200{ }^{2}$ ) | 200 |
|  | 63-100 | 160 | $200^{2}$ ) | 200 |
| SRCB | 10 | 50 | 160 | 160 |
|  | 16-20 | 63 | 200 | 200 |
| Din-T6 | 2-25 | 20-63 | 160 | 160 |
|  | 32-63 | 100 | 160 | 160 |
| Din-T10 \& | 0.5-6 | 20 | 200 | 200 |
| Din-T15 | 10 | 25 | 200 | 200 |
|  | 16 | 35 | 200 | 200 |
|  | 20-32 | 63 | 200 | 200 |
|  | 40-63 | 100 | 200 | 200 |
| DRCEH | 10 | 25 | 200 | 200 |
| (10kA) | 16 | 35 | 200 | 200 |
|  | 20-32 | 63 | 200 | 200 |
| Din-T10H | 80 | 160 | 200 | 200 |
|  | 100 | 200 | 200 | 200 |
|  | 125 | 250 | 250 | 250 |
| Tembreak MCCB's |  |  |  |  |
| XS125NJ/CJ | 16-125 | 250 | 400 | 400 |

Notes: ") Minimum fuse size is based on grading under overload of one MCB with one set of fuses. Where a single set of fuses prolects more than one MCB, the minimum fuse size shall be increased to allow for load biasing effects.
${ }^{2}$ ) Maximum fuse size based on testing to AS 3439.1 clause 8.2.3.

Tables based on the following maximum pre-arching $1^{2}$ t for both BS 88 and DIN fuses:
$160 \mathrm{~A}-0.62 \times 10^{5}, \quad 200 \mathrm{~A}-1.2 \times 10^{5}, \quad 250 \mathrm{~A}-2.1 \times 10^{5}$.
Suitable fuses include NHP, GEC, Siemens and Brovara-Crady.
Fuses with higher current ratings may be used providing $l^{2} t$ values are equal to, or less than the levels above.
Semi-conductor fuses have very low $1^{2} t$ values and may suit some applications.
Attention is also drawn to AS 3000 clause 7.10 .4 .4 regarding the use of fault current limiters in installations containing fire and smoke control equipment, evacuation equipment and lifts.

A higher reliance on electrical supply and satety in commerce and industry has increased awareness in circuit breaker technology and applications. Additionally, while maximising system safety and reliability, efficient economy of overall costs is atso of great importance.
The combination of these factors has given rise to more precise methods of circuit breaker application.
Two common terminologies relating to general power backup and system protection are: Selectivity (Discrimination) and Cascading (Back-up). In general terms, Selectivity is used to improve system reliability and to ensure a continuous supply of power to as high a degree as possible. Cascading on the other hand is where an upstream breaker is used to "back-up" a lower specification breaker installed downstream to clear a fault current, and is generally used where economics plays a significant part in system design.

## Selectivity (Discrimination)

Previously known as "Discrimination", the most basic form of Selectivity is where two circuit breakers are connected in series. A higher amperage breaker is installed upstream, and a lower amperage breaker downsiream. Should an overload or short circuit occur downstream, the downstream breaker will trip, but the upstream breaker will not, hence feeding parts of the system which are fault-free. This is the concept of Selectivity.
Selectivity is generally used, for example in critical applications, feeding essential loads. It is important to ensure total installation power is not lost due to a small or minor fault in a sub part of the overall electrical system, for example in a local distribution board. Total power loss could affect vital systems such as in Hospitals or Computer Centres etc.
The principle of Selectivity (Discrimination) is based upon an analysis of several types of circuit breaker characteristics. These include tripping characteristics (timecurrent curves), Peak Let Through Current ( $l_{\text {pook }}$ ) and Energy Let Through (IZT).
Selectivity can be "enhanced" beyond the breaking capacity of the downstream device provided it is backed up by an appropriately selected upstream device, which should not trip (unlatch) under stated conditions.

## Cascading (Back-up)

Cascading is achieved by using an upstream device to assist (back-up) a downstream device in clearing a fault current that happens to be greater than the breaking capacity of the downstream device.
In Cascading applications, the upstream device may have to trip (unlatch) in order to give sufficient protection to the downstream device, thus interrupting supply of power to all devices downstream. Therefore, Cascading is generally used in applications involving the supply of non-essential loads, such as basic lighting. The main benefit of Cascading is that in certain circumstances circuit breakers with breaking capacities lower than the prospective fault level, and hence lower in cost, can be safely used downstream provided it is backed-up by the relevant upstream breaker.
Cascade / Selectivity Tables
The Selectivity and Cascade tables shown in the following pages are structured as follows.


Selectivity: The Selectivity or Enhanced Selectivity limit of the two nominated devices in series. Up to this level of fault current the downstream device will trip (unlatch) before the upstream device. Above this level, the upstream may also trip.
Cascade: The enhanced or maximum downstream fault current that can be safely interrupted when both breakers are installed in series. Both breakers may trip (unlatch).
The Selectivity and Cascade levels stated by NHP are fully compliant with the requirements of the applicable standards. Selection of breakers should be in accordance with the selection tables.

The figures stated in NHP tables are for nominated Terasaki devices only, and should not be used as guidance for using alternative brands of circuit breakers.

Application data

TemBreak MCCB's and Safe-T/Diñ-T MCB's - Selectivity and Cascade
tables at 415 V
Guide


Upstream MCCB
XS400SE

| Downstream MCB | kA (rms) | $\begin{gathered} \text { XS125CJ } \\ 18 \\ \hline \end{gathered}$ | $\begin{gathered} \text { XS125NJ } \\ 30 \\ \hline \end{gathered}$ | $\begin{gathered} \text { XH125NJ } \\ 50 \\ \hline \end{gathered}$ | $\begin{gathered} \text { XS250NJ } \\ \mathbf{3 5} \\ \hline \end{gathered}$ | $\begin{gathered} \mathrm{XH} 250 \mathrm{NJ} \\ 50 \\ \hline \end{gathered}$ | $\begin{gathered} \text { XS400CJ } \\ 35 \\ \hline \end{gathered}$ | $\begin{gathered} \text { XS400NJ } \\ 50 \end{gathered}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Din-T6 (2-25A) | 6 | 18/18 | $25 / 25$ | 25/25 | 25/25 | $25 / 25$ | - | - |
| Din-T6 (32-63A) | 6 | 18/18 | $20 / 25$ | 20/25 | 25/25 | 25/25 | - | $\cdots$ |
| Din-T10 (0.5-25A) | 10 | 18/18 | 25/30 | $30 / 50$ | 35/35 | 35150 | 35/35 | 35/50 |
| Din-T10 (32-63A) | 10 | 18/18 | 20/25 | 20/25 | 25/25 | $25 / 25$ | 25/25 | 25/25 |
| DRCBH (10-25A) | 10 | $18 / 18$ | 25/30 | 30150 | 35/35 | 35/50 | 35/35 | 35150 |
| DRCBH (32A) | 10 | 18/18 | $20 / 25$ | $20 / 25$ | 25/25 | 25/25 | 25/25 | $25 / 25$ |
| Din-T10H (80-125A) | 10 | 4/18 | $4 / 25$ | 4/25 | 15/15 | 15/15 | $10 / 10$ | $10 / 10$ |
| Din-T15 (6-16A) | 25 | 18/25 | 25/30 | $30 / 50$ | 35/35 | 35/50 | 35/35 | 35/50 |
| Din-T15 (20A) | 20-25 ) | $18 / 20$ | 25/30 | $30 / 50$ | 35/35 | 35/50 | 35/35 | 35/50 |
| Din-T15 (32A) | 15-25 ) | 18/18 | 25/30 | $30 / 50$ | 35/35 | 35/50 | 35/35 | 35/50 |
| Din-T15 (40-63A) | 10-12.5) | 18118 | 20/25 | $20 / 25$ | 25/25 | 25/25 | $25 / 25$ | 25/25 |
| Safe-T (16-63A) | 6 | 3/10 | 3/10 | 3/10 | - - | * | - | - |
| SRCB (16-20A) | 6. | 310 | $3 / 10$ | 3110 | - | \% | - - | - |

Note: ') Dependant on the number of poles. Refer to NHP.

Application data

TèmBreak Plus MCCB's -Selectivity and Cascade tablès ât 415V
Guide


Upstream MCCB

| Downstream MCCB | kA (rms) | $\begin{gathered} \text { XS400SE } \\ 50 \end{gathered}$ | $\begin{gathered} \mathrm{XH} 400 \mathrm{SE} \\ 65 \end{gathered}$ | $\begin{gathered} \text { XS630SE } \\ 50 \end{gathered}$ | $\begin{gathered} \mathrm{XH} 630 \mathrm{SE} \\ 65 \end{gathered}$ | $\begin{gathered} \text { XS800SE } \\ 50 \end{gathered}$ | $\begin{gathered} \text { Xh800SE } \\ 65 \end{gathered}$ | $\underset{65}{\mathrm{XS} 1250 \mathrm{SE}}$ | XS1600SE $85$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| XS125CJ | 18 | 15/50 | 15/50 | 18/30 | 18/30 | 18/30 | 18/30 | 18/18 | 98118 |
| XS125NJ | 30 | 25/50 | 25/50 | 30/30 | 30/30 | 30/30 | 30/30 | 30/30 | 30/30 |
| XH125NJ | 50 | 35/50 | 35/65 | 50/50 | 50/65 | 50/50 | $50 / 65$ | $50 / 50$ | 50150 |
| XH125PJ | 50 | 35/50 | 35/65 | $50 / 50$ | 50/65 | 50/50 | $50 / 65$ | $50 / 50$ | 50/50 |
| XH160PJ | 50 | $25 / 50$ | 25/65 | 50/50 | 50/65 | $50 / 50$ | $50 / 65$ | $50 / 50$ | $50 / 50$ |
| XE225NC | 18 | 15/30 | 15/30 | 18/30 | 18/30 | 18/30 | 18/30 | 18/18 | 18118 |
| XS250NJ | 35 | 15150 | 15/65 | 35/50 | 35/65 | $35 / 50$ | $35 / 65$ | 35/35 | 35/35 |
| XH250NJ | 50 | 25/50 | $25 / 65$ | $50 / 50$ | 50/65 | 50/50 | 50/65 | $50 / 50$ | 50150 |
| XH250PJ | 65 | - | - | $10 / 50$ | 10/65 | 25150 | $25 / 65$ | 50165 | $50 / 65$ |
| XS400CJ | 35 | -/50 | -150 | 10/50 | 10/65 | 25/50 | 25/65 | 35/42 | 35/42 |
| XS400NJ | 50 | - | -65 | $10 / 50$ | 10/50 | $25 / 50$ | 25165 | 50/65 | 50165 |
| XS400SE | 50 | - | -165 | $10 / 50$ | 10/65 | 25/50 | 25/65 | $50 / 65$ | 50/65 |
| XH400PJ | 65 | - | - | $10 / 50$ | 10/65 | 25/50 | $25 / 65$ | 50/65 | $50 / 65$ |
| XH400SE | 65 | - | - | $10 / 50$ | 10/65 | 25/50 | 25/65 | 50/65 | $50 / 65$ |
| XH400PE | 65 | $=$ | - | $10 / 50$ | 10/65 | 25/50 | $25 / 65$ | $50 / 65$ | 50/65 |
| XS630C-J | 45 | - | - | - | -150 | $7 / 50$ | $7 / 50$ | $30 / 45$ | $30 / 45$ |
| XS630NJ | 65 | - | - | - | - | 7150 | $7 / 65$ | 30/65 | $30 / 85$ |
| XS630SE | 50 | - | - | - | -165 | - | - | $30 / 65$ | $30 / 85$ |
| XH630PJ | 85 | - | - | - | - | - | * | 30/65 | 30185 |
| XH630SE | 65 | - | - | - | - | - | - | 30/65 | 30185 |
| XH630PE | 65 | - | - | - | - | - | $=$ | $30 / 65$ | 30/85 |
| XS800NJ | 65 | - | - | - | - | - | - | 15/65 | $20 / 85$ |
| XS800SE | 50 | - | - | - | - | - | -65 | 15/65 | $20 / 85$ |
| XH800PJ | 85 | - | - | - | - | - | - | 15/65 | 20185 |
| XH8000SE | 65 | - | - | - | - | - | - | 15/65 | $20 / 85$ |
| XH800PE | 65 | - | - | - | - | - | - | $15 / 65$ | $20 / 85$ |
| XS1250SE | 65 | - | - | - | - | - | - | - | 20/65 |

Štandard TemBreak MCCB's. Selectivity ảnd Cascade tables at 415 V
Guide


Selectivity Cascade
Upstream MCCB

| Downstream MCCB | kA (rms) | $\begin{gathered} \text { XH125NJ } \\ 50 \end{gathered}$ | $\begin{gathered} \text { XS250NJ } \\ 35 \end{gathered}$ | $\underset{50}{\mathrm{XH} 250 \mathrm{NJ}}$ | $\begin{gathered} \text { XS400CJ } \\ 35 \end{gathered}$ | $\begin{gathered} \text { XS400NJ } \\ 50 \end{gathered}$ | $\begin{gathered} \text { XS400NE } \\ 50 \end{gathered}$ | XH400NE $65$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| XS125CJ | 18 | -150 | 3/30 | 3/50 | 4/35 | $4 / 50$ | $6 / 50$ | 6/50 |
| XS125NJ | 30 | -150 | 3/30 | $3 / 50$ | 4/35 | 4/50 | 6/50 | 6/50 |
| XH125NJ | 50 | - | - | - | - | - | 6/50 | 6/65 |
| XE225NC | 18 | - | -/30 | -30 | -130 | -130 | 6/30 | 6/30 |
| XS250NJ | 35 | - | - | - | - | $4 / 50$ | $6 / 50$ | 6/65 |
| XH250NJ | 50 | - | - | - | - | $4 / 50$ | 6/50 | 6/65 |
| XS400CJ | 35 | - | - | - | - | -150 | -150 | -150 |
| XS400NJ | 50 | - | - | - | - | - | - | -/65 |
| XS400NE | 50 | - | - | - | - | - | - | -/65 |
| XH400NE | 65 | $\bullet$ | - | $\cdots$ | - | - | - | - |
| XS630CJ | 45 | - | - | - | - | - | - | - |
| XS630NJ | 65 | - | - | - | - | - | - | - |
| XS630NE | 50 | - | - | - | - | - | - | - |
| XH630NE | 65 | - | - | - | - | - | - | - |
| XS800N 3 | 65 | - | -. | - | - | $\bullet$ | - | - |
| XS800NE | 50 | * | - | - | . $\cdot$. | - | - | - |
| XS1250NE | 65 | - | - | - | - | $\checkmark$ | - | - |
| XS1600NE | 100 | - | - | - | - | - | $\cdots$ | - |

Upstream MCCB

| Downstream MCCB | kA (rms) | $\begin{gathered} \text { XS630CJ } \\ 45 \end{gathered}$ | $\begin{gathered} \text { XS630NJ } \\ 65 \end{gathered}$ | $\begin{gathered} \text { XS630NE } \\ 50 \end{gathered}$ | $\begin{gathered} \mathrm{XH} 630 \mathrm{NE} \\ 65 \end{gathered}$ | XS800NJ 65 | $\begin{gathered} \mathrm{XS800NE} \\ 50 \end{gathered}$ | $\begin{gathered} \text { XH800NE } \\ 65 \end{gathered}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| XS125C. | 18 | $6 / 30$ | 6130 | 14/30 | 18130 | 10/30 | $14 / 30$ | 14/30 |
| XS125NJ | 30 | 6130 | $6 / 30$ | 18/30 | 18/30 | 10/30 | 18/30 | 18/30 |
| XH125NJ | 50 | - | - | - | - | 12/65 | 30150 | - |
| XE225NC | 18 | $6 / 25$ | $6 / 30$ | $10 / 30$ | $10 / 30$ | 8/30 | 12 ¢30 | 12/30 |
| XS250NJ | 35 | $6 / 45$ | 6150 | $10 / 50$ | 10/65 | 8150 | 12150 | $12 / 65$ |
| XH250NJ | 50 | - | - | $10 / 50$ | - | 10/65 | $22 / 50$ | - |
| XS400CJ | 35 | $6 / 35$ | $6 / 50$ | 7.5/50 | 7.5/65 | 6/50 | 10/50 | 10/65 |
| XS400NJ | 50 | - | - | 7.5/50 | 7.5165 | 6/50 | 10/50 | 10/65 |
| XS400NE | 50 | - | - | $10 / 50$ | 10/65 | 6/50 | $10 / 50$ | $10 / 65$ |
| XH400NE | 65 | - | - | - | - | - | - | 10/65 |
| XS630CJ | 45 | - | * | - | - | - | - | - |
| XS630NJ | 65 | - | - | - . | - | - | * | - |
| XS630NE | 50 | - | - | - | - | - | - | - |
| XH630NE | 65 | - | - | - | - | - | - | - |
| XS800NJ | 65 | - | - | - | - | - | - | - |
| XS800NE | 50 | - | - | - | - | - | - | - |
| XS1250NE | 65 | - | - | - | - | - | - | - |
| XS1600NE | 100 | - | $=$ | * - | - | - | - | - |

## Application data

Standard TemBreak MCCB's. Selectivity and Cascade tables at 415 V
Guide


Selectivity Cascade

| Downstream MCCB | kA (rms) | $\begin{gathered} \text { XH800PJ } \\ 85 \end{gathered}$ | $\begin{gathered} \mathrm{XS} 1250 \mathrm{NE} \\ 65 \end{gathered}$ | $\begin{gathered} \text { XS1600NE } \\ 100 \end{gathered}$ | $\begin{gathered} \text { XS2000NE } \\ 100 \end{gathered}$ | $\begin{gathered} \text { XS2500NE } \\ 100 \end{gathered}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| XS125C3 | 18 | 10/30 | $18 / 18$ | 18/18 | $18 / 18$ | 18118 |
| XS125NJ | 30 | $10 / 30$ | 30/30 | 30/30 | $30 / 30$ | 30/30 |
| XH125NJ | 50 | $12 / 65$ | 50/50 | 50/50 | $50 / 50$ | $50 / 50$ |
| XE225NC | 18 | 8/30 | 18/18 | 18/18 | $18 / 18$ | 18/18 |
| XS250NJ | 35 | $8 / 65$ | 25/35 | 35/35 | 35/35 | 35/35 |
| XH250NJ | 50 | 10/65 | 35/50 | 50/50 | 50/50 | 50/50 |
| XS400CJ | 35 | $6 / 65$ | 20/42 | 35/42 | 35/42 | 35/42 |
| XS400NJ | 50 | $6 / 65$ | 20/65 | 35/65 | 35/65 | 50/65 |
| XS400NE | 50 | $6 / 65$ | 20/65 | 35/65 | 35/65 | 50/65 |
| XH400NE | 65 | - | 20/65 | 35/65 | 35/65 | 50/65 |
| XS630C. ${ }^{\text {J }}$ | 45 | -/50 | 15/45 | 20/45 | 35/45 | 35/45 |
| XS630NJ | 65 | -/85 | 15/65 | $20 / 85$ | 35/85 | 35/85 |
| XS630NE | 50 | -185 | 15/65 | $20 / 85$ | 35/85 | 35/85 |
| XH630NE | 65 | -185 | 15/65 | $20 / 85$ | 35/85 | 35/85 |
| XS800NJ | 65 | -185 | 15/65 | 20185 | 35/85 | 35/85 |
| XS800NE | 50 | -/85 | 15/65 | 20/85 | 35/85 | 35185 |
| XS 1250 NE | 65 | - | - | $20 / 65$ | 35/65 | 35/65 |
| XS1600NE | 100 | - | - | - | - | 35165 |

## Motor Starting - Introduction

Generally, an item of switchgear is selected on the basis of one or more performance criteria, be it current/power carrying or interrupting capabilities.

Additional consideration is often necessary when several different pieces of switchgear are connected in series, none more so than in motor starting applications. As motors play a significant part in most modern day electrical systems it is important to ensure that the components of switchgear controlling and protecting the motor will interact with each other, or in other words, they are "co-ordinated".
In order to protect and operate a motor several components may be used, each with a different function. A typical set-up is as follows:


M

## What problems can occur?

At the instant the motor is supplied with power it draws an "in-rush current" to its terminals, before gradually decaying to a normal operating current.

Should the in-rush current be high, it could be detected by the SCPD and classed as a fault current. If a high in-rush current should occur or even after repeated stop-start (inching) operations of the motor the SCPD may trip, albeit without a fault in the system. This is commonly known as "nuisance tripping" of the SCPD.

Special care must be taken when selecting a SCPD for motor-starting applications to prevent nuisance tripping, and at the same time ensuring adequate protection to the motor and associated cabling.
Another function of the SCPD is to protect the control device (e.g. contactor) from high-current, high-energy faults. Therefore, attention must also be paid when selecting an SCPD-Starter (contactor + thermal overload relay) combination.

When clearing a fault every SCPD has a finite opening time, which will result in an amount of fault current and energy being "let-through" to the downstream system and other devices. At the same time, a control device, such as a contactor can only withstand a finite level of fault current and energy, otherwise internal damage could occur.
Even at relatively low fault levels the electromagnetic forces created by the fault current can cause the contacts of a contactor to lift. This can cause heating or even mild arcing which in turn can damage or weld the contacts of the contactor.

Furthermore, the let-through current of the SCPD can distort the bi-metal strip in the overload relay. This can prevent the restoration of the bi-metal strip to its original configuration on cooling, altering the relay's protection characteristics and resulting in under or over protection of the motor.
What solutions are available to me? Good component design in association with correct component co-ordination is the only way to ensure reliable protection and operation under abnormal condition.
Terasaki circuit breakers and Sprecher + Schuh starter combinations are tested to provide full and safe co-ordination for most motor starting applications.


## Motor Stâting <br> What is co-ordination

The motor starter consists of a combination of contactor, overload relay and Short Circuit Protection Device (SCPD) being either fuses or circuit breakers.
During motor starting and at normal loading, the overload relay protects both the motor and cables by tripping the contactor in a time inversely proportional to the current. However, under short circuit conditions, the response time would be too long and the fuses or circuit breakers must takeover to interrupt the fault current therefore limiting energy passed through the starter components. When this is successfully achieved, the combination is said to be co-ordinated.

It is a requirement of the Australian Standard AS 3947.4.1 that combination motor starters are capable of withstanding the effects of load side short circuits. Some damage to the combination is permitted, but this must be confined and not present a risk to the operator, or damage equipment adjacent to the starter.
Contactors and thermal overtoad relays only have limited ability to withstand the high curtent associated with a fault such as an internal motor short. Their design is optimised for performance at much lower currents and to design in the ability to control or withstand high fault levels would add to costs and possibly reduce its performance at normal levels.
The standards
The requirements of several standards can be applied to these combination units. The Wiring Rules, AS 3000, are concerned mainly with setting standards for the fixed wiring. In this regard the concern is the wiring between the protection device and the motor.
As motors can experience short term overloading the current rating of a fuse can be up 4 times and a circuit breaker 2.5 times the full load rating of the motor. The Wiring Rules allow the overload protection and the short circuit protection to be provided by different devices. This allows magnetic only circuit breakers, or back-up type fuses, to be used in conjunction with a contactor/thermal overload relay configuration.
Isolating switches must also be provided in the motor or control circuit. These are to be in clear view of any person working on the motor, or provided with a locking device.
AS 3947.4.1 specifies testing requirements for the combination of components required to perform the motor control and protection functions. If the equipment has been mounted in a switchboard it is possible to meet the testing requirements of AS 3947.2 short circuit withstand of the outgoirg circuit at the same time as the tests to AS 3947.4.1 are performed.

Both standards look at the performance of the equipment when a fault occurs on the outgoing circuit. It is accepted in these standards that some damage may be sustained by the components of the starter when subjected to short circuit conditions.

AS 3947.2 requires that during the tests the equipment installed in the switchboard performs in accordance to its own standard. A selection by the customer of the performance required needs to be made, as AS 3947.4.1 allows for Type ' 1 ' and Type ' 2 ' performance.

Type ' 1 '
Under short circuit conditions the starter shall not cause danger to persons or the installation. The starter itself may need repair.
Type '2'
After a short circuit the starter is suitable for further service. A contact weld is permitted, but it must be easily separated - for example, by a screwdriver, without significant deformation.
Type ' 2 ' co-ordination does not mean the starter is suitable for normal operation without inspection/repair of the contacts. So, in both cases it is important that the condition of the starter is checked, to ensure that the SCPD has operated and that no damage has taken place.

Notes: IEC Standards are the basis of many Australian Standards. AS 3947.4.1 is equivalent to IEC 947.4.1 and AS 3947.2 is equivalent to IEC 947.2.
Both Australian standards list some amendments to the IEC versions.

Typical arrangement for co-ordination test


## Môtồ Stârting

Protective devices selection
In most cases very little difference will be noticed in the service performance of a system using fuses as against circuit breakers.
The circult breaker is easier when it comes to restoring power, but as tripping should only be the result of a system fault it is unwise to reclose the circuit breaker without finding the cause. In this regard it is normal for only a "skilled person" to attend to fuse replacement and they are more likely to check for other problems.
As the circuit breaker or fuse is operating in conjunction with separate motor overload protection, it is the contactor which responds to overload problems. This is different to a protective device on a distribution circuit. For this application the advantages of the circuit breakers easy return to service has caused a general trend towards using circuit breakers.
Consideration should be given to preventing unskilled people from reclosing a tripped circuit breaker in a motor control application. This can be done by making the switchboard only accessible to the correct people, or by requiring the switchboard to be opened to reset the circuit breaker.
It must be assumed with both Type ' 1 ' and Type ' 2 ' co-ordination that if the short circuit protective device has operated there is a faut in the motor, or wiring to it and that the starter itself needs attention.
It is the let-through energy of the protective device which determines the damage to the starter. As this varies greatly between different models, it is essential that only proven combinations are used.

NHP, Sprecher + Schuh and Terasaki have now conducted many tests on different combinations and these are detailed in the co-ordination tables.

## Terasaki circuit breakers for short circuit protection

Terasaki circuit breakers have been tested in combination with Sprecher + Schuh contactors and overloads and can be used for Type '1' and Type '2' co-ordination requirements. (Refer to following tables for actual combinations).

## TemBreak

A new generation of MCCB's offering a choice of 3 series (economical, standard and high fault) and two types, ie, adjustable thermal magnetic or microprocessor based solid state OCR are available from Terasaki. Both types have common construction features and interchangeable plug-in accessories. TemBreak thermal-magnetic MCCB's offer a wide adjustment range, with $63 \%$ to $100 \%$ of rated current. Each MCCB is individually calibrated to ensure precision Iripping on overcurrent.

## TemBreak electronic type

The rated current of the electronic type TemBreak is adjustable in 15 steps from $50 \%$ to $100 \%$ of the nominal rated current, using the base current ( l ) select switch and the pickup current (11) setting dial.
This is one of the essential features for precise protection co-ordination and for low voltage distribution systems.

## TemBreak motor protection cirĉuit breaker

The XM30PB circuit breaker will protect contactor starters with direct connected overcurrent relays with ratings 1 amp to 12 amp in systems with up to 50 kA rms prospective short circuit. The protection is due to the special current limiting effect of the XM30PB.
Motor starter protection
The XM30PB circuit breaker has been developed for motor starter protection and is suitable as the Short Circuit
Protection Device (SCPD) for motor starters equipped with either direct connected or CT connected overcurrent relays.

## XM30PB compared to HRC fuse

The circuit breaker tripping characteristic is more suitable for protection of starters than the HRC fuse. Unlike the HRC fuse, the breaker can be selected to trip instantaneously at a predetermined current level just lower than the maximum breaking current of the starter contactor, thus always protecting the contactor against opening fault currents higher than its capability. This can be seen from the typical breaker and fuse tripping characteristics compared to the contactor breaking capacity in
figure 1.
No protection is provided by the fuse when the overcurrent is of value B to C amps should the contactor open by earth fault relay. If the breaker is used as a SCPD then protection is provided for all currents in excess of the instantaneous trip current of the breaker. Also, the circuit breaker can be tripped by earth fault relay and so prevent the risk of contactor damage due to the long delay of the HRC fuse interruption if the fault current is of a value between $B$ and $C$.

Fig 1.


[^9]Application data

Motor starter co-ordination table for DOL starting 50kA at 415V to AS 3947-41

## TYPE 1 50kA

| Motor <br> size <br> kW |
| :--- |
| Approx. <br> amps |
| 0.37 |
| 0.55 |
| 0.75 |
| 1.1 |

[^10]
## Type ' 2 ' short circuit co-ordination Terasaki Din-T at 50kA

The 10kA Din-T miniature circuit breaker gives an amazing 50kA performance when used in the combinations shown in the co-ordination tables. For the low current ratings, the resistance of the thermal overloads assists in reducing the current to a level that the Din-T can handle with ease. For the higher ratings a Sprecher + Schuh limiter block lifts the combined performance to the 50 kA level.

All the listed Din-T combinations include a rotary isclator which allows external control. To reset the starter after a short circuit, access to the breaker is required. This can be used to prevent unskilled operators from reclosing the motor starter after a fault.

It should also be remembered that whenever the circuit breaker trips under high fault currents, the contactor must be checked for welded contacts.

## TYPE 2 50kA



KTA 3 Motor starter combination

Type '2' co-ordination table for Din-T circuit breakers with rotary isolator DOL starting 50kA @ 415V to AS 3947.4.1

| Motor <br> size <br> kW | Approx. amps @ 415 V | Sprecher + <br> Schuh <br> Isolator | Terasaki circuit breaker | Sprecher + Schuh current limiter | Sprecher + Schuh contactor | Sprecher + <br> Schuh <br> thermal <br> overload <br> relay | Thermal overload range |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0.37 | 1.1 | LA 3-80 | Din-T 10/4 | - | CA 79 | CT $7-24$ | 1-1.6 |
| 0.55 | 1.5 | LA 3-80 | Din-T $10 / 4$ | - | CA 7-9 | CT 7-24 | 1-1.6 |
| 0.75 | 1.8 | LA 3-80 | Din-T 1014 | - | CA $7-9$ | CT 7-24 | 1.6-2.4 |
| 4.4 | 2.6 | LA 3-80 | Din-T 10/6 | - | CA 7-23 | CT 7-24 | 2.4-4 |
| 1.5 | 3.4 | LA 3-80 | Din-T 10/6 | , | CA 7-23 | CT $7-24$ | 2.4-4 |
| 2.2 | 4.8 | LA 3-80 | Din-T 10/10 | KTL 3-65 | CA 7-23 | CT 7-24 | 4-6 |
| 3.0 | 6.5 | LA 3-80 | Din-T 10/16 | KTL 3-65 | CA 7-23 | CT 7-24 | 6-10 |
| 4.0 | 8.2 | LA 3-80 | Din-T 10/16 | KTL 3-65 | CA 7-23 | CT 7-24 | 6-10 |
| 5.5 | 11.0 | LA 3-80 | Din-T 10/20 | KTL 3-65 | CA $7-23$ | CT $7-24$ | 10-16 |
| 7.5 | 14.0 | LA 3-80 | Din-T 10/32 | KTL 3-65 | CA 7 -30 | CT 7-45 | 10-16 |
| 11.0 | 21.0 | LA 3-80 | Din-T 10/40 | KTL 3-65 | CA. $7-30$ | CT 7-45 | 16-24 |
| 15.0 | 28.0 | LA 3-100 | Din-T 10/63 | KTL 3-65 | CA. 7.37 | CT 7-45 | 18-30 |
| 18.5 | 34.0 | LA 3-100 | Din-T 10/63 | KTL 3-65 | CA 7-37 | CT 7-45 | 30-45 |

Application data

Type ' 2 ' short circuit co-ordination
Motor starter co-ordination table for DOL starting 50kA at 415V to AS 3947-4-1

## TYPE 2 50kA

| Motor size kW | Approx. amps | Terasaki circuit breaker | Sprecher + Schuh contactor type | Sprecher + Schuh thermal overload relay type ${ }^{3}$ ) | Settings range amps |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 0.37 | 1.1 | XM30PB/1.4 | CA 7-9 | CT 7-24-1.6 | t-1.6 |
| 0.55 | 1.5 | XM30PB/2 | CA $7-9$ | CT 7-24-1.6 | 1-1.6 |
| 0.75 | 1.8 | XM30PB/2.6 | CA $7-9$ | CT 7-24-2.4 | 1.6-2.4 |
| 1.1 | 2.6 | XM30PB/4.0 | CA 7-16 | CT 7-24-4 | 2.4-4 |
| 1.5 | 3.4 | XM30PB/5 | CA 7-16 | CT 7-24-4 | 2.4-4 |
| 2.2 | 4.8 | XM30PB/8 | CA 7-16 | CT 7-24-6 | 4-6 |
| 3 | 6.5 | XM30PB/10 | CA 7-30 | CT 7-24-10 | 6-10 |
| 4 | 8.2 | XM30PB/12 | CA 7-30 | CT 7-24-10 | 6-10 |
| 5.5 | 11 | XH125NJ/20 | CA 7-30 | CT 7-24-16 | 10-16 |
| 7.5 | 14 | XH125NJ/20 | CA 7 -30 | CT 7-24-16 | 10-16 |
| 11 | 21 | XH125NJ/32 | CA. 7 -30 | CT 7-24-24 | 16-24 |
| [15 | 28 | XH125NJ/50 | CA 7-43 | CT 7-45-30 | 18-30 |
| 18.5 | 34 | XH125NJ/50 | CA 7-43 | CT 7-45-45 | 30-45 |
| 22 | 40 | XH125NJ/63 | CA 7-43 | CT 7-45-45 | 30-45 |
| 30 | 55 | $\times H 125 N J / 100$ | CA 7-85 | CT $7.75{ }^{2}{ }^{\circ}$ | 45-60 |
| 37 | 66 | XH125NJ/100 | CA 7-85 | CT 7-75 ${ }^{\text {2 }}$ | 60-75 |
| 45 | 80 | X $\mathrm{H} 125 \mathrm{~N} / \mathrm{M} / 25$ | CA 6-105-(E) | CT $6-90$ | 70-90 |
| 55 | 100 | XH125NJ/125 ) | CA 6-105-(EI) | CT 6-110 | 85-110 |
| 75 | 130 | XH250NJ/250 | CA 6-140-(E) | CT 6-150 | 105-150 |
| 90 | 155 | XH250NJ/250 | CA 6-170-Er | CT 6-209 | 140-200 |
| 110 | 200 | XH250NJ/250 ${ }^{\text {) }}$ | CA. $6-210$ - ${ }^{\text {ct }}$ | CEF 1-4/442 | 160-400 |
| 132 | 225 | XS400SE/400 | CA 6-210-EI | CEF 1-41/42 | 160-400 |
| 160 | 270 | XS400SE/400 | CA6-300-E | CEF 1-41/42 | 160-400 |
| 200 | 361 | XS400SE/400 | CA 6-420-EI | CEF 1-41/42 | 160-400 |
| 200 | 361 | XS400SE/400 | CA 5-450 | CEF 1-22 ${ }^{\text {\% }}$ ) | 160-400 |
| 250 | 425 | XS630SE/630 | CA 5-700 | CEF $1-52{ }^{\text {2 }}$ | 160-630 |
| 320 | 538 | XS630SE/630 | CA 5-700 | CEF 1-52 ${ }^{\text {2 }}$ | 160-630 |

[^11]
## Application data

| Motor size kW | Approx. amps | Terasaki circuit breaker | Sprecher + Schuh contactor | Sprecher + Schuh overload relay ') | Settings range amps |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 0.37 | 1.1 | XM30PB/1.4 | CA 7-9 | CEP 7 | 1.0-2.9 |
| 0.55 | 1.5 | XM30PB/2 | CA 7.9 | CEP 7 | 1.0-2.9 |
| 0.75 | 1.8 | XM30PB/2.6 | CA 7-9 | CEP 7 | 1.0-2.9 |
| 1.1 | 2.6 | XM30PB/4.0 | CA 7-16 | CEP 7 | 1.6-5 |
| 1.5 | 3.4 | XM30PB/5 | CA 7-16 | CEP 7 | 1.6-5 |
| 2.2 | 4.8 | XM30РB/8 | CA 7-16 | CEP 7 | 3.7-12 |
| 3 | 6.5 | XM30PB/10 | CA 7 -30 | CEP 7 | 3.7-12 |
| 4 | 8.2 | XM30РB/12 | CA 7 -30 | CEP 7 | 3.7-12 |
| 5.5 | 11 | TL30F/20A | CA 7-30 | CEP 7 | 3.7-12 |
| 7.5 | 14 | TL30F/30A | CA 7-30 | CEP 7 | 12-32 |
| 11 | 21 | 7L30F/30A | CA 7-30 | CEP 7 | 12-32 |
| 15 | 28 | TL100NJ/50A | CA 7-43 | CEP 7 | 12-32 |
| 18.5 | 34 | TL100NJ/50A | CA 7-43 | CEP 7 | 12-37 |
| 22 | 40 | TL. 100NJ/63A | CA 7-43 | CEP 7 | 14-45 |
| 30 | 55 | TL100NJ/100A | CA 7.72 | CEP 7 | 26-85 |
| 37 | 66 | TL.100NJ/100A | CA 7-72 | CEP 7 | 26-85 |
| 45 | 80 | TL100NJ/100A | CA 6-105-(EI) | CT 6-90 | 70-90 |
| 55 | 100 | XH400SE/250 | CA 6-105-(El) | Cr 6-110 | 85-110 |
| 75 | 130 | XH400SE/250 | CA 6-140-(El) | CT 6-150 | 105-150 |
| 90 | 155 | XH400SE/250 | CA 6-170-EI | CT 6-200 | 140-200 |
| 110 | 200 | XH400SE/250 | CA 6-210-El | CEF 1-41/42 | 160-400 |
| 132 | 225 | XH400SE/400 | CA 6-210-EI | CEF 1-41/42 | 160-400 |
| 150 | 250 | XH400SE/400 | CA 6-250-EI | CEF 1-41/42 | 160-400 |
| 160 | 270 | XH400SE/400 | CA 6-300-EI | CEF 1-41/42 | 160-400 |
| 200 | 361 | XH400SE/400 | CA 6-420-EI | CEF 1-4/142 | 160-400 |
| 200 | 361 | XH400SE/400 | CA 5-450 | CEF 1-22 ${ }^{2}$ ) | 160-400 |
| 250 | 425 | XH630SE/630 | CA 5-700 | CEF 1-52 ${ }^{2}$ ) | 160-630 |
| 320 | 538 | XH630SE/630 | CA 5-700 | CEF 1-52 ${ }^{2}$ ) | 160-630 |

[^12]
## trpasak

Type ' 2 ' short circuit co-ordination
Motor starter co-ordination table for DOL starting
85kA, 415V to AS 3947-4-1

| Motor size kW | Approx. FLC at 415 V amps | Terasaki circuit breaker | Sprecher + Schuh contactor type | Sprecher + Schuh thermat overload type ') | Settings range amps |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 0.37 | 1.1 | XM30PB/1.4 | CA 7-9 | CEP 7-M32-2.9-10 | 1.0-2.9 |
| 0.55 | 1.5 | XM30PB/2 | CA 7.9 | CEP 7-M32-2.9-10 | 1.0-2.9 |
| 0.75 | 1.8 | XM30PB/2.6 | CA 7-9 | CEP 7-M32-2.9-10 | 1.0-2.9 |
| 1.1 | 2.6 | XM30PB/4 | CA 7-16 | CEP 7-M32-2.9-10 | 1.0-2.9 |
| 1.5 | 3.4 | XM30PB/5 | CA 7-16 | CEP 7-M32-5-10 | 1.6-5 |
| 2.2 | 4.8 | XM30PB/8 | CA 7-30 | CEP 7-M32-12-10 | 3.7-12 |
| 3 | 6.5 | XM30PB/8 | CA 7-30 | CEP 7-M32-12-10 | 3.7-12 |
| 4 | 8.2 | XM30PB/10 | CA 7-30 | CEP 7-M32-12-10 | 3.7-12 |
| 5.5 | 11 | TL100NJ/20 | CA 7.30 | CEP 7-M32-12-10 | 3.7-12 |
| 7.5 | 14 | TL100NJ/20 | CA 7-30 | CEP 7-M32-32-10 | 12-32 |
| 9 | 17 | TL100NJ/32 | CA 7-30 | CEP 7-M32-32-10 | 12-32 |
| 10 | 19 | TL100NJ/32 | CA 7-30 | CEP 7-M32-32-10 | 12-32 |
| 11 | 21 | TL100NJ/32 | CA 7-30 | CEP 7-M32-32-10 | 12-32 |
| 15 | 28 | TL100NJ/50 | CA 7-43 | CEP 7-M32-32-10 | 12-32 |
| 18.5 | 34 | TL100NJ/50 | CA 7-43 | CEP 7-M37-37-10 | 12-37 |
| 22 | 40 | TL100NJ/63 | CA 7-43 | CEP 7-M45-45-10 | 14-45 |
| 30 | 55 | TL100NJ/100 | CA 7-72 | CEP 7-M85-85-10 | 26-85 |
| 37 | 66 | TL100NJ/100. | CA 7-72 | CEP 7-M85-85-10 | 26-85 |
| 45 | 80 | TL250NJ/160 | CA 6-105 | CEP 7-M85-85-10 | 26-85 |
| 55 | 100 | TL250NJ/160 | CA 6-105 | CEF 1-11/12 | 0.5-180 |
| 75 | 135 | TL250NJ/250 | CA 6-210-E | CEF 1-11/12 | 0.5-180 |
| 90 | 160 | TL250NJ/250 | CA 6-210-E | CEF 1-11/12 | 0.5-180 |
| 410 | 200 | TL250NJ/250 | CA 6-210-EI | CEF 1-41/42/52 | 160-630 |
| 132 | 230 | TL400NE/400 | CA 6-210-E1 | CEF 1-41/42/52 | 160-630 |
| 160 | 270 | TL400NE/400 | CA 6-300-E | CEF 1-41/42/52 | 160-630 |
| 200 | 361 | TL400NE/400 | CA 6-420-EI | CEF 1-41/42/52 | 160-630 |

Notes: ') Thermal or electronic overload relays may be used. Combinations based on the overload relay tripping before the circuit breaker at overload currents up to the motor locked rotor current.

Application data

Môtor circcuit application table for DOL starting
General applications
High fault range

| Motor rating (kW) | Approx. FLC (amps) | Din-T <br> C\&D <br> Curve | Safe-T | $\begin{aligned} & \text { XS125CJ } \\ & \text { XS125NJ } \\ & \text { XH125NJ } \end{aligned}$ | XE225NC | $\begin{aligned} & \text { XS250NJ } \\ & \text { XH250NJ } \end{aligned}$ | XS400SE <br> XH400SE <br> XS400CJ <br> XS400NJ | XH630SE <br> XS630SE <br> XS630CJ <br> XS630NJ | XS800NJ <br> XH800SE XS1250SE <br> XS800SE 1000 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0.37 | 1.1 | 4 | 6 |  |  |  |  |  |  |
| 0.55 | 1.5 | 4 | 6 | 20 | ; |  |  | - |  |
| 0.75 | 1.8 | 6 | 6 | 20 |  |  |  |  |  |
| 1.1 | 2.6 | 10 | 6 | 20 |  |  |  |  |  |
| 1.5 | 3.4 | 10 | 10 | 20 |  |  |  |  |  |
| 2.2 | 4.8 | 16 | 16 | 20 |  |  |  |  |  |
| 3.0 | 6.5 | 20 | 16 | 20 |  |  |  |  |  |
| 4 | 8.2 | 25 | 20 | 20 |  |  |  |  |  |
| 4.5 | 9 | 32 | 25 | 20 |  |  |  |  |  |
| 5.5 | 11 | 32 | 32 | 32 | . |  |  |  |  |
| 7.5 | 44 | 40 | 40 | 32 | * - |  | - - | . | $\cdots$ |
| 10 | 19 | 50 | 50 | 50 |  |  |  |  |  |
| 11 | 21 | 50 | 50 | 50 | $\cdots$ |  |  |  | $\cdots$ |
| 15 | 28 | 63 | 63 | 63 |  |  |  |  |  |
| 18.5 | 34 | 1009 | 80 | 100 |  |  | $\bigcirc$ |  |  |
| 22 | 40 | $125{ }^{\text {') }}$ | 100 | 100 |  |  |  |  |  |
| 25 | 46 | 125) | 100 | 100 |  | - | $\because$ | $\cdots$ |  |
| 30 | 55 |  |  | 125 |  | 160 |  |  |  |
| 37 | 66 |  |  | $125{ }^{3}$ ) | 125 | 160 |  |  |  |
| 45 | 80 |  |  | $125{ }^{3}$ ) | 125 | 160 |  | , |  |
| 55 | 100 |  |  |  | 175 | 160 | 250 |  |  |
| 75 | 130 |  |  |  | 225 | 250 | 250 |  |  |
| 90 | 155 |  |  |  |  | 250 | 250 |  |  |
| 110 | 200 |  |  |  |  |  | 400 | 400 | ? |
| 132 | 225 |  |  |  |  |  | 400 | 400 |  |
| 160 | 270 |  |  |  |  |  | 400 | 400 |  |
| 185 | 320 |  |  |  |  |  | $400^{2}$ ) | 630 |  |
| 200 | 361 |  |  |  |  |  | $400{ }^{2}$ ) | 630 |  |
| 220 | 380 |  |  |  |  |  |  | 630 | $800^{2}$ ) |
| 250 | 430 |  |  |  |  |  |  | 630 | 800 |
| 280 | 480 |  |  |  |  |  |  | 6307 | 800 |
| 300 | 510 |  |  |  |  |  |  | $630{ }^{2}$ ) | 800 |
| 375 | 650 |  |  |  |  |  |  |  | $800^{2}$ ) |
| 450 | 750 |  |  |  |  |  |  |  | 1000 |

Notes: These motor circuit application tables are to be used as a selection guide for average 3 phase, 4 pole 415 V motors for standard applications only. The table is based on holding $125 \%$ of full load current (FLC) continuously and $600 \%$ of FLC for at least 10 seconds. Lower circuit breaker ratings are possible in some applications. Refer NHP.
${ }^{1}$ ) 80.100 and 125 amp refers to Din-T10H type.
${ }^{\text {2 }}$ ) Type 'SE' TemBreak MCCB only.
${ }^{3}$ ) Use magnetic-only TemBreak MCCB. Refer NHP.
Adjustable magnetic trips set to high. Thermal magnetic TemBreak adjustable $63 \%-100 \%$ of NRC (nominal rated current). Din-T MCB's are calibrated to IEC 898 Curve 'C' \& 'D'. Selected sizes of 'D' Curve are avallable from stock. Refer NHP.

## Môtor cir̂cuit application table for reduced voltage starting General applications

Breaker type and current rating, star delta, auto transformer resistor or reactance starting

| Motor rating (kW) | Approx. FLC (amps) | $\begin{aligned} & \text { Din-T } \\ & \text { C\&D } \\ & \text { Curve } \end{aligned}$ | Safe-T | $\begin{aligned} & \text { XS125CJ } \\ & \text { XS125NJ } \\ & \text { XH125NJ } \\ & \text { TL100NJ }{ }^{\prime} \text { ) } \end{aligned}$ | XE225NC | $\begin{aligned} & \text { XS250NJ } \\ & \text { XH250NJ } \end{aligned}$ | XS400SE <br> XH400SE <br> XS400CJ <br> XS400NJ | XH630SE <br> XS630SE <br> XS630CJ <br> XS630NJ | XS800NJ <br> XH800SE <br> XS800SE | $\begin{aligned} & \text { XS1250SE } \\ & \text { t000 } \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0.37 | 1.1 | 4 | 6 |  |  |  |  |  |  |  |
| 0.55 | 1.5 | 4 | 6 | 20 |  |  |  |  |  |  |
| 0.75 | 1.8 | 4 | 6 | 20 |  |  |  |  |  |  |
| 1.1 | 2.6 | 6 | 6 | 20 |  |  |  |  |  | . |
| 1.5 | 3.4 | 10 | 6 | 20 |  |  |  |  |  |  |
| 2.2 | 4.8 | 10 | 10 | 20 |  |  |  |  |  |  |
| 3.0 | 6.5 | 16 | 16 | 20 |  |  |  |  |  |  |
| 4 | 8.2 | 20 | 16 | 20 |  |  | - | $\cdots$ |  |  |
| 4.5 | 9 | 20 | 16 | 20 |  |  |  |  |  |  |
| 5.5 | 11 | 25 | 20 | 20 |  |  |  |  |  |  |
| 7.5 | 14 | 32 | 25 | 20 |  |  |  |  |  |  |
| 10 | 19 | 40 | 40 | 32 | $\cdots$. |  |  |  |  |  |
| 11 | 21 | 50 | 40 | 32 |  |  |  |  |  |  |
| 15 | 28 | 50 | 50 | 50 |  |  |  |  |  |  |
| 18.5 | 34 | 63 | 63 | 50 |  |  |  |  |  |  |
| 22 | 40 | $\left.80{ }^{1}\right)$ | 63 | 63 |  |  |  |  |  |  |
| 25 | 46 | 100) | 80 | 100 |  |  |  | $\cdots$ |  |  |
| 30 | 55 | 125) | 100 | 100 |  | 160 |  |  |  |  |
| 37 | 66 | 125) |  | 100 | 125 | 160 |  |  |  |  |
| 45 | 80 |  |  | 125 | 125 | 160 | 250 |  |  |  |
| 55 | 100 |  |  |  | 150 | 160 | 250 |  |  |  |
| 75 | 130 |  |  |  | 175 | 250 | 250 |  |  |  |
| 90 | 155 |  |  |  | 225 | 250 | 250 | $\cdots$ | $\cdots$ |  |
| 110 | 200 | * |  |  |  | 250 | 250 | 400 |  |  |
| 132 | 225 |  |  |  |  |  | 400 | 400 |  |  |
| 160 | 270 |  |  |  |  |  | 400 | 400 |  |  |
| 185 | 320 |  |  |  |  |  | 400 | 400 | $\left.800^{2}\right)$ |  |
| 200 | 361 |  |  |  |  |  | $400^{2}$ ) | 630 | $800^{2}$ ) |  |
| 220 | 380 |  |  |  | - |  |  | 630 | 800 |  |
| 250 | 430 |  |  | . |  |  |  | 630 | 800 |  |
| 280 | 480 |  |  |  |  |  |  | 630 | 800 |  |
| 300 | 510 |  |  |  |  |  |  | 630 | 800 | , |
| 375 | 650 |  |  |  |  |  |  |  | $800{ }^{\text {² }}$ | 1000 |

[^13]Mồtor cir̂çûit application table for DOL FIRE PUMP starting dû́ty
Breaker type and current rating (A)

| Motor rating (kW) | Approx. FLC (amps) | Din-T C\& Curve | Sate-T | XM30PB | $\begin{aligned} & \text { XS125CJ } \\ & \text { XS125NJ } \\ & \text { XH125NJ } \\ & \text { TL100NJ ') } \end{aligned}$ | TL100F TL100C | XE225NC | XS250NJ <br> XH250N」 | XS400SE <br> XH400SE <br> XS400CJ <br> XS400NJ | XH630SE XS630SE XS630CJ XS630NJ | XS800 <br> XH800 <br> XS800 | $\begin{aligned} & \text { E XS1250SE } \\ & \text { E } 1000 \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0.37 | 1.1 | 4 | 6 | 3.6 |  |  |  |  |  |  |  |  |
| 0.55 | 1.5 | 6 | 6 | 3.6 |  |  |  |  |  |  |  |  |
| 0.75 | 1.8 | 6 | 6 | 5 | 20 | 15 |  |  |  |  |  |  |
| 1.1 | 2.6 | 10 | 6 | 7.4 | 20 | 15 |  |  |  |  |  |  |
| 1.5 | 3.4 | 16 | 10 | 10 | 20 | 15 |  |  |  |  |  | + |
| 2.2 | 4.8 | 20 | 16 | 12 | 20 | 15 |  |  |  |  |  |  |
| 3 | 6.5 | 25 | 20 |  | 20 | 20 |  |  |  |  |  |  |
| ${ }_{4}$ | 8.2 | 32 | 25 |  | 32 | 30 |  |  |  |  |  |  |
| 4.5 | 9 | 32 | 32 |  | 32 | 30 |  |  |  |  |  |  |
| 5.5 | 11 | 40 | 40 |  | 32 | 30 |  |  |  |  |  |  |
| 7.5 | 14 | 50 | 50 |  | 50 | 40 |  |  |  |  |  |  |
| 10 | 19 | 63 | 50 |  | 50 | 50 |  |  |  |  |  |  |
| 11 | 21 | 63 | 63 |  | 63 | 60 |  |  |  |  |  |  |
| 15 | 28 | 100 ${ }^{\text {) }}$ | 80 |  | 100 | 75 |  |  |  |  |  |  |
| 18.5 | 34 | 125) | 100 |  | 100 | 75 |  |  |  |  |  |  |
| 22 | 40 |  |  |  | 125 | 75 |  |  |  |  |  |  |
| 25 | 46 |  |  |  | 125 | 100 |  |  |  |  |  |  |
| 30 | 55 |  |  |  |  | 100 | 125 | 160 |  |  |  |  |
| 37 | 66 |  |  |  |  |  | 150 | 160 |  |  |  |  |
| 45 | 80 |  |  |  |  |  | 175 | 250 | 250 |  |  |  |
| 55 | 100 |  |  |  |  |  | 225 | 250 | 250 |  |  |  |
| 75 | 130 |  |  |  |  |  |  |  | 400 |  |  |  |
| 90 | 155 |  |  |  |  |  |  |  | 400 |  |  |  |
| 110 | 200 |  |  |  |  |  |  |  | 400 | 630 |  |  |
| 132 | 225 |  |  |  |  |  |  |  | 400 | 630 |  |  |
| 160 | 270 |  |  |  |  |  |  |  | 400 | 630 |  |  |
| 185 | 320 |  |  |  |  |  |  |  | $400^{2}$ ) | 630 |  |  |
| 200 | 361 |  |  |  |  |  |  |  |  | 630 | 800 |  |
| 220 | 380 |  |  |  |  |  |  |  |  | 630 | 800 |  |
| 250 | 430 |  |  |  |  |  |  |  |  | 630 | 800 |  |
| 280 | 480 |  |  |  |  |  |  |  |  |  | 800 |  |
| 300 | 510 |  |  |  |  |  |  |  |  |  | 800 |  |
| 375 | 650 |  |  |  |  |  |  |  |  |  | $800{ }^{2}$ ) | 1000 |
| 450 | 750 |  |  |  |  |  |  |  |  |  |  | 1000 |

Notes: These motor circuit application tables are to be used as a selection guide for average 3 phase, 4 pole 415 V motors for standard applications only. The table is based on holding $125 \%$ FLC continuously and $600 \%$ FLC for at least 20 seconds.

1) 80,100 and 125 amp refers to Din-T10H type.
${ }^{2}$ ) Type 'SE' TemBreak MCCB only.
${ }^{3}$ ) TL100NJ up to 100A only.
Din-T MCB's are calibrated to IEC 898 Curve 'C' \& 'D'. Selected sizes of 'D' Curve are available from stock refer NHP.

## Application data

Motor starting table for DOL starting at 1000 V AC 50 Hz

| Motor <br> size <br> kW | Full load <br> current <br> amperes | MCCB | Voltage |
| :--- | :--- | :--- | :--- |
| $0.37-10$ | $0.4-7.5$ | TL100EM/15 | 1000 V |
| 11.0 | 9.0 | TL100EM/20 | 1000 V |
| $15-18.5$ | $12-14.5$ | TL100EM/30 | 1000 V |
| $22-33$ | $17-23$ | TL100EM/40 | 1000 V |
| $37-50$ | $28-38$ | TL100EM/50 | 1000 V |
| $55-80$ | $40-57$ | TLL00EM/75 | 1000 V |
| $90-110$ | $65-78$ | TL100EM/100 | 1000 V |
| 150 | 102 | XV400NE/160 | 1000 V |
| $185-220$ | $138-160$ | XV400NE/250 | 1000 V |
| $220-500$ | $160-350$ | XV400NE/400 | 1000 V |



TemBreak XV400NE mining breaker


Sprecher + Schuh 1000V CA 6 contactor
(Refer Part A for more information)

## MicCB's fôr protection of Power Factor Correction (PFC) units

In circuits containing capacitor banks for Power Factor Correction (PFC) two conditions that the circuit breaker must overcome are as follows:

1. Voltage surges during MCCB opening.
2. Nuisance tripping due to in-rush current.
3. Voltage surges during MCCB opening At the instant where the MCCB has to open, the voltage developed across its contacts can be up to twice the supply voltage, which can have damaging consequences should the breaker be slow to operate. If this worse case scenario actually occurs a potential re-arcing can take place across the contacts of the MCCB, until the breaker has fully opened and the distance between the contacts is at a maximum.
Re-arcing at each instant can be:
1st re-arcing - $3 \times$ supply voltage
2nd re-arcing - $5 \times$ supply voltage
3rd re-arcing - $7 \times$ supply voltage
Internat capactor damage will occur if the voltage level is greater than the capacitor's Dielectric Strength. With modern-day protection devices, (for example the Terasaki TemBreak MCCB's) this problem will not occur.
The numerous cases of re-arcing are mainly a result of older style "dependant manual closing" devices, which rely on the operator speed for opening or closing.
All Terasaki MCCB's are of the "manually independent closing" type, with high speed opening to prevent re-arcing between the contacts.
4. Nuisance tripping due to in-rush current When feeding a circuit containing a PFC unit the circuit breaker and the PFC unit can be exposed to a large in-rush current, equal to the instantaneous value of the power source. The end result of this is a large in-rush current, which could cause the circuit breaker to operate instantaneously due to its short-circuit protection. (The value of in-rush current will depend on the source voltage, the inductance and reactance in the circuit).
Special care should be taken to ensure that the MCCB selected will not nuisance trip due to high in-rush currents.
The table below shows typical MCCB selections for varying capacitor ratings, and the breaker selection is by a rule-ofthumb.

$$
\begin{equation*}
\text { Capacitor Rated Current }=\frac{\mathrm{kVAR} \times 1000}{\sqrt{3} \times V} \tag{A}
\end{equation*}
$$

## kVAR: Capacitor Rating

## V: Source Voltage

MCCB Rating $=$ Capacitor Rated Current $\times 1.5(\mathrm{~A})$
Once the MCCB rating has been determined, the MCCB type should be selected according to the short circuit fault level of the system.

MCCB's selection for power factor capacitor application

| Voltage 415V (3D) |  | Recommended MCCB's ${ }^{\boldsymbol{\eta}}{ }^{2}$ ) Type/Rating (A) |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Capacitor rating (kVAR) | Capacitor rated current (A) |  |  |  |  |  |
| 5 | 7 |  |  | XS125CJ/20 | XS125NJ/20 | X $\mathrm{H} 125 \mathrm{NJ} / 20$ |
| 10 | 13.9 |  |  | XS125CJ/32 | XS125NJ/32 | XH125NJ/32 |
| 15 | 20.9 |  |  | XS125CJ/50 | XS $125 \mathrm{NJ} / 50$ | XH125NJ/50 |
| 20 | 27.8 |  |  | XS125CJ/50 | XS125NJ/50 | $\mathrm{XH} 125 \mathrm{NJ} / 50$ |
| 25 | 34.8 |  |  | XS125CJ/63 | XS125NJ/63 | XH125NJ/63 |
| 30 | 41.7 |  |  | XS125CJ/100 | XS125NJ/100 | XH125NJ/100 |
| 40 | 55.6 |  |  | XS125CJ/100 | XS125NJ/100 | $\mathrm{XH} 125 \mathrm{NJ} / 100$ |
| 50 | 69.6 |  |  | XS125CJ/125 | XS125NJ/125 | XS125NJ/125 |
| 75 | 104 | XE225NC/150 | XS250NJ/160 | XH250NJ/160 |  |  |
| 100 | 139 | XE225NC/225 | XS250NJ/250 | XH250NJ/250 | XS400SE/250 | XH400SE/250 |
| 150 | 209 |  | XS400CJ/400 | XS400NJ/400 | XS400SE/400 | XH400SE/400 |
| 200 | 278 |  | XS400CJ/400 | XS400NJ/400 | XS400SE/400 | XH400SE/400 |
| 300 | 417 |  | XS630CJ/630 | XS630NJ/630 | XS630SE/630 | XH630SE/630 |
| 400 | 556 | XS800NJ/800 | XS800SE/800 | XH800SE/800 |  |  |
| 500 | 696 | XS1250SE1250 |  |  |  |  |
| 600 | 835 | XS1250SE1250 |  |  |  |  |
| 800 | 1113 | XS1600SE1600 |  |  |  |  |
| 1000 | 1391 | XS2000SE/2000 |  |  |  |  |


${ }^{2}$ ) TemBreak Plus MCCBs can also be used.

## MCCB use in high frequency $(400 \mathrm{~Hz})$ applications

General
Terasaki TemBreak MCCB's are designed to operate primarily in 50 or 60 Hz systems. However, it is possible to use the same MCCB's in high frequency ( 400 Hz ) applications provided consideration is taken to the effects high frequencies will have on the breaker.
A consequence of high frequencies is an increase in Eddy currents in conductors, including those internal to the breakers. This generally causes an increase of temperature in and around the breaker. As such, some derating allowances must be made when selecting a breaker in these 400 Hz systems.
Thermal Magnetic MCCB's
In low overioad (thermal) regions the current required to trip the MCCB is reduced as a result of the heat generated due
to the higher Eddy currents. As a result the thermal protection must be derated to take the heating effect into account.
In short-circuit (magnetic) regions, the demagnetising effects of the Eddy currents mean that a larger fault will be required to trip the breaker. The rule of thumb generally used is that the Magnetic/Instantaneous Trip setting will be approximately twice that at normal $50 / 60 \mathrm{~Hz}$ operation.

## Electronic MCCB's

Electronic MCCB's offer better performance at higher frequencies, although some consideration must be taken with regards to the heating effects caused by the Eddy currents. The figures in the table give the maximum Over Current Relay (OCR) rated current setting ( $I_{0} \times I_{;}$) that should be used when in high frequency applications.

| MCCB Model | MCCB Type | Rating at $50 / 60 \mathrm{~Hz}(\mathrm{~A})$ | Cable size in mm ${ }^{\mathbf{2}}$ as specified IEC 947-1 | MCCB rating at 400 Hz <br> (A) |
| :---: | :---: | :---: | :---: | :---: |
| XS125C.J | Th/Mag | 20 | 2.5 | 18 |
| XS125NJ |  | 32 | 6 | 30 |
|  |  | 50 | 10 | 45 |
|  |  | 63 | 16 | 58 |
|  |  | 100 | 35 | $89 \div \cdots$ |
|  |  | 125 | 50 | 110 |
| XH160PJ | Th/Mag | 160 | 70 | 147 |
| XE225NC | Th/Mag | 125 | 50 | 116 |
|  |  | 150 | 50 | 135 |
|  |  | 175 | 70 | 155 |
|  |  | 200 | 95 | 185 |
|  |  | 225 | 95 | 195 |
| XS250NJ | Th/Mag | 160 | 70 | 147 |
|  |  | 250 | 120 | 210 |
| XH250NJ | Th/Mag | 160 | 70 | 147 |
|  |  | 250 | 120 | 210 |
| XH250PJ | Th/Mag. | 250 | 120 | 240 |
| XS400NJ | Th/Mag | 250 | 120 | 240 |
| XH400PJ |  | 400 | 240 | 330 |
| XS630CJ | Th/Mag | 400 | 240 | 320 |
| XS630NJ |  | 630 | $2 \times 185$ | 475 |
| XS800NJ | Th/Mag | 800 | $2 \times 240$ | 600 |
| XS400SE | Electronic | 250 | 120 | 238 |
| XH400NE/SE/PE | Electronic | 400 | 240 | 360 |
| XS630SE | Electronic | 630 | $2 \times 185$ | 600 |
| XH630NE/SE/PE |  |  |  |  |
| XS800SE | Electronic | 800 | $2 \times 240$ | 640 |
| XH800NE/SE/PE |  |  |  |  |
| XS1250SE | Electronic | 1250 | $2 \times(80 \times 5 t)$ | 800 |
| XS4600SE | Electronic | 1600 | $2 \times(100 \times 5 t)$ | 900 |

Note: When used at 400 Hz , the rated current setting of the OCR must not exceed the values shown in Column 4.

Application data

## Circuit breaker selection for DC applications

The characteristics of an MCB or MCCB for DC applications are different from $A C$. The main differences are as follows:

1. Maximum permissible voltage is reduced in value (refer table).
2. Number of electrical operations is reduced (refer table).
3. Magnetic trip current increases by $40 \%$.

Selecting the circuit breaker
When selecting the MCB most suitable for the protection of DC circuits the following criteria must be considered:

- Rated current.
- Rated voltage which determines the number of poles required to be involved in the interruption of the circuit.
- The type of DC system used.
- Maximum short circuit current to determine the breaking capacity.
As a general rule the Isc (short circuit curfent at the battery terminals) can be calculated as follows:

$$
\mathrm{Isc}=\frac{\mathrm{Vb}}{\mathrm{Ri}}
$$

Where Vb - maximum discharge battery voltage
Where Ri - internal resistance (sum of all calls resistance) generally expressed in Ampere/hour capacity of the battery.

Terasaki MCB use in DC systems
$\left.\begin{array}{|lllllllll|}\hline \begin{array}{l}\text { MCB } \\ \text { type }\end{array} & \begin{array}{l}\text { Breaking } \\ \text { capacity } \\ \text { KA }\end{array} & & \text { No. of poles connected in series }\end{array}\right)$

Example: For a Din-T10 to break 10kA at 110 V DC it must have 2 poles connected in series.
Breaking capacities of TemBreak MCCB in DC systems
MCCB

| type | 24/48/60V | 125 V | 250V | 350 V | 500 V | 600 V |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| XS125NJ | 25 | 20 | 15 | 10 | $7.5{ }^{2}$ ) | $5^{2}$ ) |
| XH125NJ | 50 | 40 | 40 | 10 | $7.5{ }^{\text {2 }}$ ) | $5^{2}$ ) |
| XS250NJ | 25 | 40 | - 40 | 10 | 7.5 | 5 |
| XH250NJ | 50 | 40 | 40 | 20 | 15 | 10 |
| XS400NJ | 50 | 40 | 40 | 20 | 15 | 15 |
| XS630NJ | 50 | 40 | 40 | 30 | 20 | 20 |
| XS800NJ | 50 | 40 | 40 | 30 | 20 | 20 |
| XS1000ND ${ }^{\text {' }}$ | - | 40 | 40 | 30 | 20 | 20 |
| XS1250ND ${ }^{\text {) }}$ | - | 40 | 40 | 30 | 20 | 20 |
| XS1600ND ${ }^{\text {I }}$ | - | 40 | 40 | 30 | 20 | 20 |
| XS2000ND ') | - | 40 | 40 | 30 | 20 | 20 |
| (XS2500ND ') | - | 40 | 40 | 30 | 20 | 20 |

## Notes:

1) Time constant $(\mathrm{L} / \mathrm{R})<=15 \mathrm{~ms}$; excludes 50/63A where the time constant (LR) $<=4 \mathrm{~ms}$.
${ }^{2}$ ) Special version of the standard AC circuit breaker. Standard circuil breakers cannot be used at these ratings. Please specify for use on 500 or 600 V DC on application. Indent only.
${ }^{3}$ ) Magnetic trip only, without overload protection. Indent only.
For voltage levels up to and including 250V DC standard 2-pole breakers maybe be used, with both poles connected in series. For voltage levels greater than 250V DC 3-pole breakers must be used, with all three poles connected in series as shown.
The time constant (L/R) of the circuit should be:
less than 2 ms at rated current.
less than 2.5 ms for overload ( 2.5 xin ).
less than 7 ms for short circuit $\leq 10 \mathrm{kA}$.
less than 15 ms for short circuit > 10 kA .

The following connection diagram should be applied to TemBreak circult breakers when the voltage is greater than 250 V DC.


## Ciřcuit bréaker selection for DC application (cont.)

## Arrangement of breaking poles according to type of system.

Both poles insulated from earth
Protection only


The poles required to interrupt the fault can be divided between the (+) and (-) polarities. The total number of poles connected in series should be capable of breaking the short circuit current at a voltage level of $U_{b}$.
Sharing the circuit breaker interrupting poles between both polarities also ensures isolation as well as protection of the system.

One polarity of the DC supply is earthed
Protection only


Full protection is assured if the total number of poles in series on the side not connected to earth are capable of breaking the short circuit current at a voltage level of $\mathrm{U}_{\mathrm{b}}$.

If full isolation is required then at least one interrupting pole is also required on the earthed polarity side.


MCCB selection for 50 V DC battery applications 3 poles in parallel
TemBreak MCCBs may be connected with 3 poles in parallel.
Rated current $=3 \times 0.8=2.4 \times$ MCCB nominal rated current ( In ) for 3 poles in parallel.

Protection and Isolation


## Protection and Isolation



Protection and Isolation

The centre point of the DC supply is earthed


To ensure full protection the number of poles connected in series on each polarity must be capable of breaking the maximum short circuit current, but at a reduced voltage level of $\mathrm{U}_{\mathrm{b}} / 2$.

Having circuit breaker interrupting poles breaking both polarities ensures isolation as well as protection of the system.

## Sélêctión ${ }^{n}$ óf'MCCB's for use in

 welder circuits1. Definitions
$\mathbf{P}=\quad$ Rated capacity of welder in KVA.
$V=\quad$ Welder rated voltage.
I1 = Maximum primary current (PN).
$T_{1}=$ Current 'ON' period.
$\mathrm{T}_{2}=$ Current 'OFF' period.
$T_{1}+T_{2}=$ One welding cycle time.
B = Duty ratio, current 'ON' period divided by one welding cycle.
Ie $=$ Thermally equivalent continuous current.
2. MCCB selection
a) Current rating

It can be seen from the diagrams below that the welder only draws current intermittently. MCCB selection should be based on the thermally equivalent continuous current, i.e. the current which would produce the MCCB average temperature shown in the diagram below.
It can further be seen that the MCCB temperature will not be constant but will vary as the load varies.



The thermally equivalent continuous current, le, may be calculated from:

$$
\text { Ie }=
$$


$\times \sqrt{B}$

$$
\left(B=\frac{T_{1}}{T_{1}+T_{2}}\right)
$$

Note: The rated capacity of a spot welder is normally expressed in terms of its $50 \%$ duty ratio, ie. $\mathrm{B}=0.5$.

Once an MCCB has been selected, it is necessary, to compare the maximum primary current $I$ and the current 'ON' period, $\mathrm{T}_{1}$ with the MCCB characteristic curve to ensure that it will not trip.


Note: A tolerance of 10 to $15 \%$ should be included to allow for variations in the supply voltage and equipment.

General guide lines for MCCB selection

| Selection factor | MCCB rating |
| :--- | :--- |
| Resistance welders | 3.00 max |
| Transformer arc welders | 2.00 max |

SAA wiring rules states that a circuit breaker protecting a circuit from which one or more welders are supplied may be greater than the rating of the protected conductor calculated as follows:
The maximum demand of the circuit excluding that of the largest welding machine plus
i) Three times the primary current of the largest resistance welding.
ii) Two times the primary ratings of the largest transformer arc welders.
b) Instantaneous setting

The MCCB's instantaneous trip setting should be high enough to avoid nuisance tripping due to the welding transformers excitation inrush current. When voltage is supplied to the transformers primary side, the iron core is saturated. This results in the flow of a large inrush current caused by a combination of the DC component of the voltage at the instant of closing and the residual magnetic flux of the transformer. The transformer input current value when the welder secondary is completely short-circuited is about $30 \%$ higher than the value calculated from the nominal maximum power input of the welder. So the maximum welder input curtent, 1 m , at the start of welding is given by:

$$
I_{m}=\frac{P_{m} \times 1000}{V} \times 1.3 \times K
$$

The value of $K$ varies depending on the type of welder control employed. (Some form of synchronous closing is nearly always employed in order to stabilise the welding work and to prevent nuisance tripping of the MCCB).
$K=1$ to 1.5 for synchronous type with peak control.
$K=1.4$ to 3 for synchronous type without peak control.
K $=2$ to 6 for non-synchronous soft start type.
If the protection of the thyristor stack is also required, the instantaneous trip setting must be greater than $1 m$, but less than the surge on-state current rating of the thyristor stack:
$\mathrm{I}_{\mathrm{m}}<\mathrm{I}_{\text {Wst }}<$ $\qquad$
where:
Is = surge on-state current rating of thyristor stack, in $A$
Im = maximum welder input current at start of welding, in A
$I_{\text {mst }}=$ MCCB Instantaneous trip setting, in A
$1.1=$ Factor to allow for $\pm 10 \%$ tolerance on the instantaneous setting
c) MCCB breaking capacity

The MCCB breaking capacity should be higher than the estimated short-circuit fault level of the system.

## Application data

Primary LV/LV trañsformer protection

When selecting an MCCB to protect the primary of an LV/LV transformer, the inrush current during initial energisation must be taken into account.
The magnitude of inrush current for any transformer is governed by several variables:

1. The primary winding resistance.
2. The supply impedance.
3. The excitation current.

The excitation current is, in theory at a maximum when the voltage is at a minimum, and vice versa.
Usually the level does not exceed 30 times the normal operating current.
If the inrush current is not known then a rule of thumb is that it is approximately 15 x the Primary Current.

|  | 1 phase 240V |  |  | 3 phase 415V |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Transformer (kVA) | MCCB type | MCCB rating | BC (kA) <br> at 240 V | MCCB type | MCCB rating | $\begin{aligned} & \mathrm{BC}(\mathrm{kA}) \\ & \text { at } 415 \mathrm{~V} \end{aligned}$ |
| 5 | XS125NS | 50 | 25 | XS125NJ | 20 | 30 |
| 7.5 | XS125NS | 63 | 25 | XS125NJ | 32 | 30 |
| 10 | XS125NS | 100 | 25 | XS125NJ | 32 | 30 |
| 15 | XE225NC | 125 | 25 | XS125NJ | 50 | 30 |
|  | XS250NJ | 160 | 50 |  |  |  |
|  | XH250NJ | 160 | 85 |  |  |  |
| 20 | $\mathrm{XS} 250 \mathrm{NJ}$ | 160 |  | $X S 125 \mathrm{NJ}$ | $63$ | $30$ |
|  |  |  |  |  |  |  |
| 30 |  |  |  | XS125NJ | 100 | 30 |
| 50 |  | $\cdots$ |  | XS125NJ | 125 | 30 |
| 75 |  |  |  | XE225NC | 225 | 18 |
|  |  |  |  | XS250NJ | 250 | 35 |
| 100 |  |  | $\cdots$ | XS400SE | 250 | 50 |
| 150 |  |  |  | XS400SE | 250 | 50 |
| 200 |  |  | - | XS400SE | 400 | 50 |
| 300 |  |  |  | XS630SE | 630 | 50 |

The above breaker selections are based upon inrush currents calculated using the table below

Single-phase transformer


Notes: First peak multiplier is the first peak current as a multiple of the transformer rated current.
The above table/multipliers are in general larger than the practical current levels, as the current limiting by the circuit impedance is not taken into account.

## MCB selection for high pressure so dium lamps

## Assumption

1. The maximum inrush current which the circuit will pass is a feature of the current limiting ballast and not the lamp.
Assuming these ballasts comply with the relevant IEC specification the circuit will pass currents not exceeding twice the appropriate lamp nominal current.
2. Run up time 10 minutes with the current decaying exponentially.
3. Based on $415 / 240 \mathrm{~V} 3$ phase or 240 V single phase systems.

This table provides details for Din-T type 'C' MCB's
Power Number of fittings per phase

| 50W | 2 | 4 | 7 | 9 | 42 | 24 | 36 | 48 | 60 | 76 | 108 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 70W | 1 | 3 | 5 | 6 | 8 | 177 | 25 | 34 | 42 | 54 | $\overline{7}$ |
| 150W | 0 | 9 | 2 | 3 | 4 | 8 | 12 | 16 | 20 | 25 | 36 |
| 250W | 0 | - | 1 | 3 | 2 | 4 | 07 | 9 | 12 | 15 | 21 |
| 400W | 0 | 0 | - | 4 | 0 | 3 | 4 | 6 | 7 | 9 | 13 |
| 700W | : | $\bigcirc$ | 앙 | O | - | 1. | 2 | 3 | 4 | 5 | 7 |
| MCB(Amps) | 4 | 2 | 4 | 4 | 6 | 10 | 16 | 20 | 25 | 32 | 50 |

## Example

Given 42 lamps each 250 W installed on a 415 V 3 phase system.
Which MCB must be selected?
Number of tubes per phase $=$
$\frac{42}{3}=14$

Therefore from the table above a 32A MCB should be selected.
A short circuit rating as appropriate must be selected.

MCB selêction for fluorescent lighting loãds
Assumptions

1. The power rating of the ballast is $25 \%$ of power of the tubes.
2. Power factor -0.6 for non compensated fittings 0.86 for compensated fittings.
3. MCB's are installed in an enclosure with external ambient of $25^{\circ} \mathrm{C}$.
4. Based on $415 / 240 \mathrm{~V} 3$ phase or 240 V single phase systems.
5. MCB is used for circuit protection only, not switching.

For switching duties of Din-T MCBs refer NHP.

This table provides details for Din-T type 'C' MCB's

| Type of fitting | Power <br> (W) | Number of fittings per phase |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Single non compensated | 20 | 45 | 66 | 79 | 100 | 116 | 150 |
|  | 40 | 22 | 33 | 39 | 50 | 57 | 75 |
|  | 65 | 14 | 20 | 24 | 30 | 36 | 50 |
|  | 80 | 11 | 16 | 20 | 25 | 29 | 40 |
| Single compensated | 20 | 64 | 94 | 113 | 143 | 166 | 200 |
|  | 40 | 32 | 47 | 57 | 72 | 83 | 110 |
|  | 65 | 20 | 29 | 35 | 44 | 51 | 70 |
|  | 80 | 16 | 23 | 28 | 36 | 41 | 55 |
| Itwin compensated | $2 \times 20$ | 32 | 47 | 57 | 72 | 83 | 110 |
|  | $2 \times 40$ | 16 | 23 | 28 | 36 | 41 | 55 |
|  | $2 \times 65$ | 10 | 14 | 17 | 22 | 25 | 35 |
|  | $2 \times 80$ | 8 | 11 | 14 | 17 | 20 | 30 |
| Recommended <br> MCB rating | Amps | 10 | 16 | 20 | 25 | 32 | 50 |

## MCB selection for incandescent lighting loads

Assumptions

1) Tungsten lamps have theoretical inrush current of 14 times normal current, when switched from cold.
2) The circuit impedance typically limits the inrush to 10 times normal running current, the inrush current peaking at 0.0007 seconds falling exponentially to normal running current within 0.1 seconds.
3) Consider the worst case, if all lamps are switched on simultaneously, then ruisance tripping of MCB may result.
4) Above is based on $415 / 240 \vee 3$ phase and neutral or 240 V single phase system and 240 V lamps.
5) MCB is used for circuit protection only, not switching. For switching duties of Din-T MCB's refer NHP.

Method
In order to cope with this inrush the following formula should be used to calculate breaker size:
Breaker rating $=\frac{W \times 10}{P \times 240 \times 1 \text { inst }}$

Where $\mathrm{W}=$ total wattage
Where $P=$ Number of phases
$\mid$ inst $\quad=$ Minimum instantaneous tripping co-efficient.
C curve $=5$
D curve $=10$

## Application data

TemíBreak MCCB clearance requírementŝ at $380 / 415 \mathrm{~V}$

Clearance requirements for MCCB's (phase to phase and earth).
When MCCB's are called upon to interrupt large short circuits ionised gas and arcing material is expelled from the vents, usually at the top of the MCCB.
This ionised gas is highly conductive and is also at an elevated temperature when it exits the MCCB via the arc vents. Care must be taken therefore to avoid an arcing fault occurring due to the presence of the ionised gas. Therefore, incoming conductors must be insulated
right up to the terminal opening of the MCCB. This also applies to the attached busbars supplied as a proprietory part with the MCCB.
Proprietary type interpole barriers may be used to achieve creepage and clearance requirements.
Conductors must not impede the flow of ionised gas.

Insulating distance from Line-End for 380/415V
When earth metal is installed within the proximity of the breakers the correct insulating distance must be maintained.

WARNING:
EXPOSED CONDUCTORS INCLUDING TERMINALS AT ATTACHED BUSBARS MUST BE INSULATED TO AVOID POSSIBLE SHORT CIRCUITING OR EARTHING DUE TO FOREIGN MATTER COMING INTO CONTACT WITH THE CONDUCTORS.

Notes: When using the terminal bar (optional), the specified insulating distance must be maintained.
All dimensions in mm.
When earthed metal is installed within the proximity of the breakers the correct insulating distance must be maintained (refer to Table 1). This distance is necessary to allow the exhausted arc gases to disperse.

This distance is necessary to allow the exhausted arc gases to disperse.


Table 1 below illustrates the min clearance that must be maintained

A Distance from lower breaker to open charging part of terminal on upper breaker (front connection) or the distance from lower breaker to upper breaker end (rear connection and plug-in type)

B2 Distance from breaker end to insulator
C Clearance between breakers
D Distance from breaker side to side plate (earthed metal)

B1 Distance from breaker end to ceiling (earthed metal)
Table 1
This table is valid for $380 / 415 \mathrm{~V}$

| MCCB type | A | B1 | B2 | C | D |
| :---: | :---: | :---: | :---: | :---: | :---: |
| XM30PB | 30 | 10 | 10 | 0 | 25 |
| XS125CJ, XS 125 NJ , XH125NJ, XH125PJ, | + 75 | 45 | 这 25 | 0 | 25 |
| XE225NC | 50 | 40 | 40 | 0 | 50 |
| XS250NJ , Y, | 80 | 60 | +2 30 | 0 | 25 |
|  | 400 | 60 | 30 | 0 | 25 |
| XH250PJ, XS400CJ, XS $400 \mathrm{NJ}, \mathrm{XS} 400 \mathrm{SE}$ | 100 | 70 | 40 | 0 | 30 |
|  | 120 | 70 | 40 | 0 | 30 |
| XH630SE, XH800SE; XH800PE | 150 | 80 | - 50 | 0 | 40 |
| XS1250SE | 150 | 720 | - 40 | 0 | 30 |
| XH630PJ, XH800PJ, XS1600NE, XS2000NE, XS2500NE | 150 | 150 | , 100 | 0 | 100 |

## Cleârance for mining MCCB's (1100 V) and inĉoring cónnections

The arc chamber in Terasaki TemBreak circuit breakers is located adjacent to the LINE side terminals. The chamber is vented through holes located just above each line terminal. The holes are covered by a flap which deflects when arc gases are being expelled. Even at low fault levels the arc gases that are released are very hot and reduce the dielectric strength of the air in the vicinity of the terminals. If care is not taken when installing the TemBreak this gas can cause arcing faults on the incoming bars or cables.

Significant voltage transients may also be produced as inductive circuits are switched and contribute to an arcing fault.
These problems affect all circuit breaker installations to varying degrees.
To ensure that problems are not created by the installation please observe the following recommendations.


## Notes:

1: Ahways observe LINE/LOAD marking.
2: Ensure insulation on incoming conductors is adequate. Do not use low grade heat shrink (some grades split at operating temperatures).
3: Minimum clearance to earth metal, Above and below breaker - 120 mm (XV1250NE -150 mm ) To sides of breaker -40 mm .

4: Switchboard construction to be a minimum form 2 to AS 3439.1 with IP3x protection between busbar and circuit break zones.
5: Actual construction can vary to the above but in all cases it is the responsibility of the switchboard manufacturer to ensure compliance to the relevant standard ie. AS 3439.1.
${ }^{\text {b }}$ ) TL100EM MCCB's must use a TL100EMTLC lineside terminal cover. XV400 can use either a terminal cover or Interpole Barniers.

## MCCB mounting angles

The overcurrent tripping characteristics of TemBreak are not infuenced by the mounting angles for electronic and thermal magnetic types.

The XM30PB motor circuit protectors however, use an oil filled dashpot style trip mechanism, which can be affected. Refer to the diagram below.

Diagram at right is only applicable to XM30PB motor circuit protectors.


Note:
1: The above diagram applies to an XM30 MCCB mounted either way

## Calculation of circuit fault level

## NHP Nomogram

## Fault calculation

The NHP Nomogram is a simple and easy to use aid. Developed by NHP to enable convenient and accurate calculation of circuit fault current.

When selecting circuit breakers for the use in modern distribution systems, it is important to calculate the fault level and then choose an MCCB with breaking capacity that is either higher or at least equal to the circuit fault current.

## How to use the Nomogram

In the nomogram all you need to know is the size and length of the cable or cables and the size of the Transformer in kVA. The fault level at the terminals of the transformer is very dependant upon the Transformer internal impedance eg. the Australian Standard for a 2000kVA transformer is $6.5 \%-7 \%$ impedance. This results in a fault level of 4043kA.

However, many Supply Authorities are now installing low impedance transformer eg. $5 \%$ or less. Thus if the impedance is $5 \%$ then the fault level will be 56 kA . If the impedance is unknown on the side of caution choose $Z=$ $5 \%$ in your calculations.
eg. From the table, the maximum fault level of a 2000 kVA transformer, with $Z=5 \%$ is 56 kA . Proceed then to calculate the resultant fault level by applying the cable size and length in metres to the Transformer secondary fault level and calculate the resultant. By following the example shown it can be seen that the fault level is reduced from 50 kA to 6.7 kA .

Please refer to previous page for instructions on use.


## Âpplicatiốn notes

A series of application notes are available on Terasaki breakers from your nearest NHP branch. The notes cover the following subjects.
Ref No. Description
5006 Specification for corrosive proofing of MCCB's
5025 De-rated current of ACB's when enclosed
5093 De-rated current of MCCB's when enclosed
5088 De-rating of TemBreak electronic MCCB's when enclosed
5067 DC applications of ACB's
5065
5074
5078
Reverse connection
Thyristor protection with MCCB's
ELCB's at high frequency
5087
5083
ACB's and MCCB's at high altitude
Circuit breaker life mechanical and electrical
5086
TemBreak UVT: transient response time
5195
Inspection and maintenance of earth leakage and moulded case circuit breakers.

## IP rating protection against ingress of dust and liquids



IP 1st digit
Degree of protection against contact and ingress of foreign bodies

| 0 | No protection |
| :--- | :--- |
| 1 | Protection against ingress of solid foreign bodies with | diameters greater than 50 mm

2 Protection against contact with the fingers, protection against ingress of solid foreign bodies with diameter greater than 12 mm
3 Protection against contact with wires etc., with diameters greater than 2.5 mm , or ingress of solid foreign bodies with diameters greater than 2.5 mm

4 Protection against contact with wires etc., with diameter greater than 1 mm , or ingress of solid foreign bodies with diameters greater than 1 mm

5 Complete protection against contact with live parts, protection against harmful deposits of dust

6 Complete protection against contact with live parts, protection against ingress of dust

IP 2nd digit Degree of protection against ingress of liquids

0 No protection
1 Protection against vertically falling water drops

2 Protection against obliquely falling water, up to an angle of $15^{\circ}$

3 Protection against obliquely sprayed water, up to an angle of $60^{\circ}$ from the vertical

4 Protection against sprayed low pressure water from any direction

5 Protection against water-jets from any direction-limited ingress permitted

6 Protection against strong jets of water eg. ship decks

7 Protection against temporary immersion in water
8 Protection against indefinite immersion in water - under pressure

SLB

## New Range

## Standard load－break

 switches20 to 4000 A

－Double break contacts per phase
－Fully visible breaking indication
－Excellent electrical characteristics
－Full range of standard and customised accessones
－COMO M range isolators designed for motor control applications

## 『Gロanmec

SLB Standard load-break switches COMO M 20 to 100 A


The COMO M range of load-break switches offer compact IP 20 finger safe solutions for switching up to and including 100 A . They are ideal for the arduous switching of motors.
Standard mounting is by DIN rail or base mount with screws.
The COMO M comes complete with direct mount handle, or pistol handles and shaft. Fourth pole and auxiliary switching can also be achieved with easy clip-on modutes - refer accessories.

## Front operated surface mount

(Supplied with direct or external handle)

|  | AC 22400 V <br> (A) | AC 23400 V <br> (A) | $\begin{aligned} & \mathrm{AC} 23400 \mathrm{~V} \\ & (\mathrm{~kW}) \end{aligned}$ | Handle type | Cat. No. |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 20 A | 20 | 20 | 9 | Direct | SLB20D3P |
|  |  |  |  | Pistol | SLB 2OP 3P |
| 25 A | 25 | 25 | 11 | Direct | SLE2503P |
|  |  |  |  | Pistol | SLB25P3P |
| 32 A | 32 | 32 | 15 | Direct | SLB32D3P |
|  |  |  |  | Pistol | SLB32P3P |
| 40 A | 40 | 40 | 18.5 | Direct | SLP4003P |
|  |  |  |  | Pistol | SIBG60P3P |
| 63 A | 63 | 63 | 30 | Direct | SLB63D3P |
|  |  |  |  | Pistol | SLB63P3P |
| 80 A | 80 | 80 | 40 | Direct | SLBEOD 3P |
|  |  |  |  | Pistol | SLB80P3P |
| 100 A | 100 | 80 | 40 | Direct | SLBFTOOD 3 P |
|  |  |  |  | Pistol | SLBEOOP3P |



SLB 63... 100

SLB Standard load-break switches SIRCO 125 to 4000 A

The SIRCO range of load-break switches offer compact solutions for switching from 125 A to 4000 A . Base mounting is standard.
The SIRCO range are a proven, reliable design that more than suit harsh Australian conditions.
The switches come complete with extended shaft and door mountable pistol grip handle. Available in three and four pole versions with a large range of accessories to choose from.
Front operated surface mount
(Supplied with external handle and shaft)
SLB 125... 630

| 125 A | (A) | (A) | (kW) | No. of poles ${ }^{\text {') }}$ ) | Cat. No. |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | 125 | 125 | 63 | 3 | S1B2253P |
|  |  |  |  | 4 | S1812544P |
| 160 A | 160 | 160 | 80 | 3 | SLB1603P |
|  |  |  |  | 4 | SLB 1604 P |
| 200 A | 200 | 200 | 100 | 3 | SLE2003P |
|  |  |  |  | 4 | 518,2004P |
| 250 A | 250 | 250 | 132 | 3 | SL82503P |
|  |  |  |  | 4 | SLB2504P |
| 315 A | 315 | 315 | 160 | 3 | SLB3153P |
|  |  |  |  | 4 | SLB3534P |
| 400 A | 400 | 400 | 220 | 3 | SLBG003P |
|  |  |  |  | 4 | SLE4004P |
| 500 A | 500 | 400 | 280 | 3 | 5LB5003P |
|  |  |  |  | 4 | SLB5004P |
| 630 A | 630 | 500 | 280 | 3 | SLB6303P |
|  |  |  |  | 4 | BSLB6304P |
| 800 A | 800 | 800 | 450 | 3 | SLB8003P |
|  |  |  |  | 4 | ['SLB8004P |

Notes: ${ }^{2} 6$ and 8 pole switches available on indent. Refer NHP.
i) Available on indent only.


SLB 800... 3150

## 

## SLB Standard load-break switches <br> SIRCO 125 to 4000 A (cont'd)

The SIRCO range of load-break switches offer compact solutions for switching from 125 A to 4000 A .


SLB 800... 3150 Base mounting is standard.
The SIRCO switches come complete with extended shaft and door mountable pistol grip handle. Available in three and four pole versions with a large range of accessories to choose from.

## Front operated surface mount

(Supplied with external handle and shaft)

|  | AC 21400 V <br> (A) | AC 23400 V <br> (A) | $\text { AC } 23400 \mathrm{~V}$ $(\mathrm{kW})$ | No. of poles ${ }^{1}$ ) | Cat. No. |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 1000 A | 1000 | 1000 | 560 | 3 | SLB10003P |
|  |  |  |  | 4 | i] SLE 10004 P |
| 1250 A | 1250 | 1000 | 560 | 3 | SLB 122503P |
|  |  |  |  | 4 | - ${ }^{\text {SLB }} 12506 \mathrm{P}$ |
| 1600 A | 1600 | 1000 | 560 | 3 | SLB160003P |
|  |  |  |  | 4 | i SLB 16004P |
| 1800 A | 1800 | 1000 | 560 | 3 | SLBE18003P |
|  |  |  |  | 4 | 1) 51818004 P |
| 2000 A | 2000 | 1250 | 710 | 3 | SLB20003P |
|  |  |  |  | 4 | [i] ${ }^{\text {L }}$ 200004P |
| 2500 A | 2500 | 1250 | 710 | 3 | SLB 25003P |
|  |  |  |  | 4 | 1] SLB250064P |
| 3150 A | 3150 | 1250 | 710 | 3 | SEB315093P |
|  |  |  |  | 4 | - SEB31504P |
| 4000 A | 4000 | 1250 | 710 | 3 | StB40009P ${ }^{2}$ ) |
|  |  |  |  | 4 | 152B40004 ${ }^{\text {P }}$ ) |

Notes: i) 6 and 8 pole switches available on indent. Refer NHP.
${ }^{2}$ ) Supplied with $2 \mathrm{~N} / 0$ and $2 \mathrm{~N} / \mathrm{C}$ auxiliaries as standard.
[i] Available on indent only.


SL8 4000

SLB Standard load-break switches
Accessories

Extemal mount handles (accepts up to 3 padlocks in the 'OFF' position)


| To suit | Type | Colour | IP rating | Cat. No. |
| :---: | :---: | :---: | :---: | :---: |
| SLB 20... 100 | Selector | Black | 65 | SEBPHOE |
|  |  | Red/Yellow | 65 | ( SEBPH02 |
|  | Pistol | Black | 65 | SEBPH03 |
|  |  | Red/yellow | 65 | 1 $54 B \mathrm{PH} 09$ |
| SLB 125... 630 | Pistol | Black | 65 | SLBPH405 |
|  |  | Red | 65 | 4 SLBPH06 |
| SLB 800... 1800 | Pistol | Black | 65 | SLBPR 07 |
|  |  | Red | 65 | LisLBPRO8 |
| SLB 2000... 3150 | Pistol | Black | 65 | SLBPRO9 |
|  |  | Red | 65 | ( SLBPPHTO |
| SLB 4000 | Pistol | Black | 65 | SLBPHEA |



SLB DH

Direct mount handles

| To suit | Colour | Cat. No. |
| :---: | :---: | :---: |
| SLB 20...40 | Black | SEEDHOL |
| SLB 63... 100 | Black | SLBDH02 |
| SLB 125...160 | Black | SLBDH03 |
| SLB 200...630 | Black | SLBDH03 |
| SLB 800... 3150 | Black | SLBDH 05 |
| SLB 4000 | Black | SLBDP06 |

Fourth pole module (Simultaneous switching)


SLB FP

| To suit | AC 22400 V <br> (A) | AC 23400 <br> (A) |
| :---: | :---: | :---: |
| SLB 20... 40 | 20 | 20 |
|  | 25 | 25 |
|  | 32 | 32 |
|  | 40 | 40 |
| SLB 63... 100 | 63 | 63 |
|  | 80 | 80 |
|  | 100 | 100 |


| To suit | Thermal rating (A) | Cat. No. |
| :--- | :--- | :--- |
| SLB 20...40 | 40 | SLBN 40 |
| SLB $63 \ldots 100$ | 100 | SLBN 100 |

Note: Special handles available (IP 66, metal versions) - contact NHP.
i Avaitable on indent only.

SLB Standard load-break switches
Accessories

## Shaft extensions

| To suit | Shaft length(mm) | Type |  | Cat. No. |
| :---: | :---: | :---: | :---: | :---: |
|  |  | Selector | Pistol |  |
| SLB 20... 100 | 55 | $\checkmark$ |  | Wabiss5 |
|  | 150 | $\checkmark$ |  |  |
|  | 200 | $\checkmark$ |  | SVIEBSS200. |
|  | 300 | $\checkmark$ |  | S SLBS300 |
|  | 150 |  | $\checkmark$ | ESLBS150_1 |
|  | 200 |  | $\checkmark$ | - SLBIS200-1 |
|  | 300 |  | $\checkmark$ | \% 5 SLB5 530001 |


| To suit | Shaft length (mm) | Cat. No. |
| :---: | :---: | :---: |
| SLB 125... 250 | 120 |  |
| SLB 125...630 | 200 | C-SLBS20020 |
|  | 250 | CMES520. |
|  | 320 | S SLES320 |
|  | 500 | SLBS500 |
|  | 750 | SLES750 |


| To suit | Shaft length (mm) | $\begin{aligned} & 800- \\ & 1800 \mathrm{~A} \end{aligned}$ | $\begin{aligned} & 2000- \\ & 3150 \mathrm{~A} \\ & \hline \end{aligned}$ | 4000 A | Cat. No. |
| :---: | :---: | :---: | :---: | :---: | :---: |
| SLB 800... 3150 | 200 | $\checkmark$ | $\checkmark$ |  |  |
|  | 450 | $\checkmark$ | $\checkmark$ |  | - SLBE450, |
| SLB 800...4000 | 320 | $\checkmark$ | $\checkmark$ | $\checkmark$ |  |

Interlocking device - to accommodate Castell lock (Lock not supplied)

| To suit | Castell lock | Cat. No. |
| :--- | :--- | :--- |
| SLB $125 \ldots 630$ | K Type | KLBLRA |
| SLB $800 \ldots 1800$ | K Type | SLBLK2 |
| SLB $2000 \ldots 4000$ | K Type | SLBLE3 |



SLB Standard load-break switches

## Accessories

Terminal shrouds and screens (Screw fixing)


SLB TS
Shrouds


SLB TS
Screens

| To suit | IP rating | Mounting position | No. of poles | Cat. No. |
| :---: | :---: | :---: | :---: | :---: |
| SLB 20... 40 |  | top/bottom | 3 | SLBESTO1 |
| SLB $63 . . .100$ |  | top/bottom | 3 | SLBTSIO2 |
| SLB 20... 40 |  | top/bottom | 1 | SLBTS103 |
| SLB 63...100 |  | top/bottom | 1 | SLBITSO4 |
| SLB 125... 160 | 20 | top/bottom | 3 | SEBTST05 |
|  | 20 | top/bottom | 4 | 1SEBTS 06 |
| SLB 200... 250 | 20 | top/bottom | 3 | SEBTSO7 |
|  | 20 | top/bottom | 4 | [i] SEBTS08 |
| SL8 315...630 | 20 | top/bottom | 3 | SLRTSS09 |
|  | 20 | top/bottom | 4 | i SEBTST0 |
| SL8 800 | screen | top/bottom | 3 | SLPISS |
|  |  |  | 4 | [15 SETS 12 |
| SLB 1000... 1800 | screen | top/bottom | 3 | SLBITSM3 |
|  |  |  | 4 | - $\mathrm{SLBTS54}$ |
| SLB 2000...4000 ${ }^{1}$ |  | top/bottom |  | 0) |

## Auxiliary contacts (Early-break)



| To suit | Type | (A) | Contacts | Cat. No. |
| :---: | :---: | :---: | :---: | :---: |
| SLB 20... 100 |  |  | N/O/N/C | SlBAX 01 |
| SLB 125... 3150 | N/O/N/C | 16 | 1st $\mathrm{N} / \mathrm{O} / \mathrm{N} / \mathrm{C}$ | SLBAX 02 |
|  |  |  | 2nd $N / O / N / C$ | SLBAXO3 |
| SLB $4000{ }^{\text { }}$ ) | $\mathrm{N} / \mathrm{O} / \mathrm{N} / \mathrm{C}$ | 16 | $2 \mathrm{~N} / 0 / \mathrm{N} / \mathrm{C}$ | ${ }^{\text {a }}$ ) |
| SLB 125... 800 | $\mathrm{N} / \mathrm{O}+\mathrm{N} / \mathrm{C}$ | 16 | 1st $\mathrm{N} / \mathrm{O}+\mathrm{N} / \mathrm{C}$ | SLBAX 04 |
|  | $\mathrm{N} / \mathrm{O}+\mathrm{N} / \mathrm{C}$ | 16 | 2nd $N / O+N / C$ | SLB/AX05 |
| SLB 1000... 3150 | $\mathrm{N} / \mathrm{O}+\mathrm{N} / \mathrm{C}$ | 16 | 1st $\mathrm{N} / \mathrm{O}+\mathrm{N} / \mathrm{C}$ | SLBAX06 |
|  | $\mathrm{N} / 0+\mathrm{N} / \mathrm{C}$ | 16 | 2nd $\mathrm{N} / \mathrm{O}+\mathrm{N} / \mathrm{C}$ | SLBAX 07 |

Notes: Included as standard with switch.
(1) Available on indent only.

## Shaft table (Standard shaft supplied with switch and handle)

| To suit | Shaft | Max back-plate to door |
| :--- | :--- | :--- |
| SLB 20...100 | SLB S150-1 | 185 mm |
| SLB $125 \ldots 160$ | SLB S120 | 174 mm |
| SLB 200...250 | SLB S120 | 185 mm |
| SLB $315 \ldots 630$ | SLB S200-2 | 297 mm |
| SLB $800 \ldots 1800$ | SLB S320-1 | 546 mm |
| SLB 2000...3150 | SLB S320-1 | 693 mm |

NHP

## Technical data and ratings chart

## COMO M SLB 20 to 100 A

Ratings to AS 3947-3 and IEC 60947-3


Note: $240 / 415 \mathrm{~V}$ ratings suitable for use on $230 / 400 \mathrm{~V}$ in accordance with AS 60038 : $\mathbf{2 0 0 0}$.

Technical data and ratings chart

## SIRCO SLB 125 to 630 A

Ratings to AS 3947-3 and IEC 60947-3


[^14]
# Technical data and ratings chart SIRCO SLB 800 to 4000 A 

Ratings to AS 3947-3 and IEC 60947-3


Notes: ${ }^{1} 50 \mathrm{kA}$ switch available in larger frame size. Refer NHP.
240/415 V ratings suitable for use on 230/400 V in accordance with AS 60038: 2000.

Technical data and dimensions (mm) COMO M SLB 20 to 100 A

COMO M 20 to 40 A


COMO M 63 to 100 A


COMO M Selector handle door drilling


COMO M Pistol handle door drilling


# Technical data and dimensions (mm) SIRCO SLB 125 to 2500 A 

## SIRCO 125 to 2500 A



| Rating <br> A | Switch bodyF 3 pF |  | Switch mounting M 3p M 4p |  | $T$ | U | $v$ | Connection terminals |  |  | $z$ | AA |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 800 | 280 | 360 | 255 | 335 | 80 | 50 | 60.5 | 7 | 47.5 | 47.5 | 46.5 | 321 |
| 1000 | 280 | 360 | 255 | 335 | 80 | 50 | 60.5 | 7 | 47.5 | 47.5 | 46.5 | 321. |
| 1250 | 372 | 492 | 347 | 467 | 120 | 90 | 44 | 8 | 53.5 | 53.5 | 47.5 | 288 |
| 1600 | 372 | 492. | 347 | 467 | 120 | 90 | 44 | 8 | 53.5 | 53.5 | 47.5 | 288 |
| 1800 | 372 | 492 | 347 | 467 | 120 | 90 | 44 | 8 | 53.5 | 53.5 | 47.5 | 288 |



| Rating | Overall dimensions |  | Switch mounting |  |
| :---: | :---: | :---: | :---: | :---: |
| A | A 3p | A 4p | M 3p | M 4p |
| 2000 | 372 | 492 | 347 | 467 |
| 2500 | 372 | 492 | 347 | 467 |

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## Technical data and dimensions（mm） SIRCO SLB 3150 to 4000 A

## SIRCO 3150 A


Castell Drilling

Switch mounting

| Rating | Overall dimensions |  |  | A 4p |
| :--- | :--- | :--- | :--- | :--- |
| $\mathbf{A}$ | A 3p | Switch mounting |  |  |
| 3150 | 372 | 492 | M 4p |  |

## SIRCO 4000 A



| Rating | Overall dimensions |  | Switch body |  | Switch mounting |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| A | A 3p | A 4p | F 3p | F 4p | M 3p | M 4p |
| 4000 | 684 | －804． | 470 | 590 | 347 | 467 |

SIRCO Connection terminals－ $\mathbf{8 0 0}$ to $\mathbf{4 0 0 0} \mathrm{A}$

800－1000 A

1250－1800 A

2000－2500 A

$3150-4000$ A

# AC contactors <br> 3 pole open type with AC coil 

## Ratings to IEC 947 and AS 3497 415V



Contactor CA 7-9


Contactor CA 7-72


Contactor CA 6-105-EI


Contactor CA 6-170-EI


Contactor CA 6-250-EI


Contactor CA 6-420-EI
O For CA 7 contactors with coil terminals on line side, add ...V AC to Catalogue No. Eg - CA 7-9-10-240V AC ${ }^{\text {J }}$ )
O For CA 7 contactors with coil terminals on load side, add ...V AC-U to Catalogue No. Eg - CA 7-9-10-240V AC-U

AC ${ }^{19}$ ) AC $1{ }^{\prime \prime}$ ) Auxiliary contacts

Notes: ') 1000 volt ratings (). Standard voltages for CA 6-300-EI.. 420-EI 48, 110, 240 and 415V AC. Standard voltages for CA 5-370...1200, 110, 240 and 415 V AC. held in NHP stock for convenience.
${ }^{\text {}}$ ) Electronically controlled mechanism (ECM) with interface suffix (EI).
$\left.{ }^{5}\right) \quad 55^{\circ} \mathrm{C}$ enclosed.

| $\begin{aligned} & \text { AC } \mathbf{3}^{2} \\ & \left.\mathbf{k W}{ }^{1}\right) \end{aligned}$ | AC 3 <br> Amps ') | Amps $40^{\circ} \mathrm{C}$ | Amps $60^{\circ} \mathrm{C}$ | stand N/O | dard N/C | Max. | Cat. No. ${ }^{2}$ ) |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 4 | 9 | 32 | 32 | 1 | 0 | 9 | CA 7-9-10...V AC CA 7.9.01...V AC |  |
|  |  |  |  | 0 | 1 | 9 |  |  |
| 5.5 | 12 | 32 | 32 | 1 | 0 | 9 | CA 7-12-10...V AC |  |
|  |  |  |  | 0 | 1 | 9 | CA 7-12-01...V AC |  |
| 7.5 | 16 | 32 | 32 | 1 | 0 | 9 | CA 7-16-10...V AC |  |
|  |  |  |  | 0 | 1 | 9 | CA 7-16-01...V AC |  |
| 11 | 23 | 32 | 32 | 1 | 0 | 9 | CA 7-23-10..V AC |  |
|  |  |  |  | 0 | 1 | 9 | CA 7-23-01...VAC) |  |
| 15 | 30 | 50 | 45 | 0 | 0 | 8 | CA 7-30-00. VAC |  |
| 18.5 | 37 | 50 | 45 | 0 | 0 | 8 | CA 7-37-00..VAC $=$ |  |
| 22 | 43 | 85 | 63 | 0 | 0 | 8 | CA 7 -43-00...VAC |  |
| 30 | 60 | 100 | 100 | 0 | 0 | 8 | CA $760000 . . V A C$ |  |
| 37 | 72 | 100 | 100 | 0 | 0 | 8 | CA 7.72 .00. V $V$ AC |  |
| 45 | 85 | 100 | 100 | 0 | 0 | 8 | CA 7-85-00...V AC |  |
| 55 (45) | 95 (33) | 160 | 135 | 1 | 1 | 8 | CA 6-85-11, V AC) |  |
| 75 (55) | 130 (40) | 160 | 135 | 1 | 1 | 8 | CA 6-105-1t.VAC= |  |
| 90(75) | 155 (55) | 250 | 210 | 1 | 1 | 8 | CA 6-140-11..V AC |  |
| 75 (55) | 130 (40) | 160 | 135 | 1 | 1 | 8 | CA 6-105-EF-11..V AC) |  |
| 90 (75) | 155 (55) | 250 | 210 | 1 | 1 | 8 | CA 6-140-EI-11...V AC) |  |
| 100 (90) | 170 (65) | 250 | 210 | 1 | 1 | 8 | CA 6-170-EI-11..V AC) |  |
| 132 (111) | 225 (80) | 350 | 300 | 1 | 1 | 8 | CA 6-210-E-11...V AC) |  |
| 150 (133) | 258 (95) | 350 | 300 | 1 | 1 | 8 | CA 6-250-E1-11...V AC ${ }^{+}$) |  |
| 185 (163) | 320 (115) | 450 | 380 | 1 | 1 | 8 | CA 6-300-El-11...V AC) |  |
| 250 (225) | 425 (160) | 500 | 425 | 1 | 1 | 8 | CA 6-420-El-11...V AC) |  |
| 220 (220) | 370 (155) | 500 | 420 | 2 | 2 | 8 | CA 5-370... ${ }^{\text {V AC' }}$ |  |
| 265 (280) | 450 (200) | 600 | 510 | 2 | 2 | 8 | CA 5-450..V AC') |  |
| 325 (355) | 550 (250) | 780 | 645 | 2 | 2 | 8 | CA 5-550..V AC) |  |
| 430 (500) | 700 (340) | 1000 | 850 | 2 | 2 | 8 | CA 5-700...V AC ${ }^{5}$ ) |  |
| 520 (550) | 860 (380) | 1100 | 930 | 2 | 2 | 8 | CA 5-860...V AC') |  |
| 600 | 1000 | 1200 | 1020 | 1 | 1 | 8 | CA 5-1000...V AC') |  |
| 700 | 1150 | 1350 | 1150 | 1 | 1 | 8 | CA 5-1200...V AC) |  |

${ }^{2}$ ) Add control voltage to Cat. No. when ordering: 24, 32, 110, 240, 415, 440 V 50 Hz . Standard voltages for CA 6-105-El...250-El are 24, 48, 110, 240 and 415 V AC.
${ }^{3}$ ) All CA 7 coils can be reversed for line or load side coil terminals as required. Both versions are
${ }^{\text {a }}$ ) Contact NHP for recommended cable size.

## The highest switching capacity in the smallest space



## Compact without compromise

Compact without compromise is the best way to describe the CA 7 range of contactors and motor protection relays from Sprecher + Schuh. In spite of the new compact dimensions, the CA 7 range features high breaking capacity and extraordinary flexibility. Up to 18.5 kW the contactors are only 45 mm wide and even the largest 45 kW frame is only 72 mm wide. The CA 7 contactors are the main component in the new Advanced Control System (ACS).

## With CA 7 you have flexibility with auxiliary contacts

Common auxiliaries from 9 to 85 amps
Three fitting positions
O Front mounting.
O Side mounting left.
O Side mounting right.
Alternatively you can choose to combine left, right and front mounting auxiliary contacts to fulfil your requirements.
Instead of the top mounted auxiliary contacts, on or off delay timing modules or mechanical latches can be fitted.



Motor switching rating AC 3 @ 415V

| CA 7-9 | 4kW | 45 mm | 9 |
| :---: | :---: | :---: | :---: |
| CA 7-12 | 5.5 kW |  | 12A |
| CA 7-16 | 7.5kW |  | 16A |
| CA 7-23 | 11 kW |  | 23A |
| CA 7-30 | 15kW | 45 mm | 30A |
| CA 7-37 | 18.5kW | mm | 37A |
| CA 7-43 | 22kW | 54 mm | 43A |
| CA 7-60 | 30kW |  | 60A |
| CA 7-72 | 37 kW | 72 mm | 72A |
| CA 7-85 | 45kW |  | 85A |

## With CA 7 you have more clip on accessories

Common accessories from 9 to 85 amps
O On and off delay pneumatic timers.
O Coil mounted electronic timers on delay, off delay, star delta.
O Coil mounted 24 V DC interface.
O Coil mounted RC and varistor suppressor modules.
O Mechanical latch.
O Mechanical interlock.
O Mechanical interlock with integrated N/C interlock contacts.
O Moulded wire link sets for DOL, reversing and star delta starters.
O Large choice of front and side mounting auxiliary contacts.

Refer catalogue SACS

## Innovation and ease of use provide solutions for your control systems

## Coil terminals are always in the correct position

The coil terminations on the CA 7 contactors can be supplied optionally at the top or the bottom of the contactor. It is also a simple task to change this on site should the requirements change.
When CA 7 contactors are used in combination with KTA 7 circuit motor circuit breakers the bottom coil terminations are used. For use with standard CT 7 thermal or CEP 7 electronic overloads the top coil termination should be selected.

## Mechanical interlocks save space

Only 9 mm wide, the CM 7 mechanical interlock snaps into place between any of the CA 7 contactors. It is allowed also to interlock different sizes of the CA 7 range with the same interlock.
The basic mechanical interlock is supplemented by a variation with built in N/C auxiliary contacts for electrical interlocking. This version is also only 9 mm wide and further minimises space requirements.


## With Sprecher + Schuh you can choose the best protection for your motors.




CA 7 contactors provide improved wiring terminals
The main terminals of all CA 7 contactors are designed to accept at least two cables. At the same time they comply with safety standards regarding touch protection.
The larger contactors CA 7-30 and upwards employ a special cage terminal which allows the connection of two cables in separate chambers.
The ease of wiring with CA 7 contactors saves both time and money.



High tech electronic protection type CEP 7 in trip class 10 or 20.


Standard thermal overloads type CT 7
sprechert
sthuh

## Accessories for ACS contactors CA 7

Wiring sets - spare coils

Refer catalogue SACS

## Unique reversible coil

The CA 7 coils can be freely rotated so that the coil connections are on the line side or the load side of the contactor. Line side connection is ideal for access to terminals when an overtoad CT 7 or CEP is fitted. Load side connection of coils is advisable when a KTA 3-25 circuit breaker is used for example.


CA 7


CA 7...U0

# ACS Short circuit co-ordination Type '2' with KT 7 circuit breakers 

-Refer Catalogue $\mathrm{C}-\mathrm{CO}$

## Automatic Type ' 2 ' co-ordination ') with no-oversizing of contactors

DOL starting
50/65 kA @ 415V

| Motor <br> size <br> kW | Approx. <br> amps <br> @ 415V | Sprecher + <br> Schuh <br> circuit breaker | Setting <br> range <br> amps | Magnetic <br> amps | Sprecher + Schuh <br> contactor | IAC-3 <br> amps |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 0.18 | 0.60 | KT 7-25S | $0.40-0.63$ | 8.2 | CA 7-9 | 9 |
| 0.25 | 0.80 | KT 7-25S | $0.63-1.00$ | 13 | CA 7-9 | 9 |
| 0.37 | 1.10 | KT 7-25S | $1.00-1.60$ | 21 | CA 7-9 | 9 |
| 0.55 | 1.50 | KT 7-25S | $1.00-1.60$ | 21 | CA 7-9 | 9 |
| 0.75 | 1.80 | KT 7-25S | $1.60-2.50$ | 33 | CA 7-9 | 9 |
| 1.10 | 2.60 | KT 7-25S | $2.50-4.00$ | 52 | CA 7-9 | 9 |
| 1.15 | 3.40 | KT 7-25S | $2.50-4.00$ | 52 | CA 7-9 | 9 |
| 2.20 | 4.80 | KT 7-25S | $4.00-6.30$ | 80 | CA 7-9 | 9 |
| 3.00 | 6.50 | KT 7-25S | $6.30-10.0$ | 130 | CA 7-9 | 9 |
| 4.00 | 8.20 | KT 7-25S | $6.30-10.0$ | 130 | CA 7-9 | 9 |
| 5.50 | 11.00 | KT 7-25S | $10.0-16.0$ | 208 | CA 7-12 | 12 |
| 7.50 | 14.00 | KT 7-25S | $10.0-16.0$ | 208 | CA 7-16 | 16 |
| 9.00 | 17.00 | KT 7-25H | $14.5-20.0$ | 260 | CA 7-23 | 23 |
| 11.00 | 21.00 | KT 7-25H | $18.0-25.0$ | 325 | CA 7-23 | 23 |
| 15.00 | 28.00 | KT 7-45H | $23.0-32.0$ | 416 | CA 7-30 | 30 |
| 18.50 | 34.00 | KT 7-45H | $32.0-45.0$ | 585 | CA 7-37 | 37 |
| 22.00 | 40.00 | KT 7-45H | $32.0-45.0$ | 585 | CA 7-43 | 43 |
| 30.00 | 55.00 | KT 3-100 | $40.0-63.0$ | 882 | CA 7-60 | 60 |
| 37.00 | 66.00 | KT 3-100 | $63.0-90.0$ | 1260 | CA 7-72 | 72 |
| 45.00 | 80.00 | KT 3-100 | $63.0-90.0$ | 1260 | CA 7-85 | 85 |

Definition Type '2' co-ordination according to IEC 947-4-1:

- The contactor or the starter must not endanger persons or systems in the event of a short circuit
- The contactor or the starter must be suitable for further use
- No damage to the overload relay or other parts may occur with the exception of welding of the contactor or starter contacts provided that these can be easily separated without significant deformation (such as with a screwdriver)
- In the event of a short circuit, fast opening current limiting circuit breakers KT 7 make it possible to build economical, fully short circuit co-ordinated starter combinations in accordance with IEC 947-4-1, Type '2' co-ordination
- Type '2' co-ordination without oversizing of contactors means: Type ' 1 ' = Type ' 2 '

Note: ${ }^{1}$ ) What is meant by Automatic Type '2' co-ordination?
The high speed operation of the new KT 7 motor protection circuit breakers means that contactors need not be oversized to achieve type ' 2 ' co-ordination. Simply select the normal AC 3 rated contactor and the corresponding KT 7 circuit breaker and type ' 2 '
 co-ordination is assured.

Refer Catalogue C-co
TemBreak or fuse DOL starting
50/65kA @ 415V to AS 3947.4.1

## TemBreak or fuse

Terasaki

| Motor size $\mathbf{k W}$ | Approx. amps | circuit or breaker | NHP HRC fuse | Sprecher + Schuh contactor type | Sprecher + Schuh thermal O/L relay type | Setting range amps |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0.37 | 1.1 | XM30PB/1.4 | NTIA-6 | CA 7-9 | CT 7-24 | 0.6-1.6 |
| 0.55 | 1.5 | XM30PB/2 | NTIA-6 | CA 7-9 | CT 7-24 | 0.6-1.6 |
| 0.75 | 1.8 | XM30PB/2.6 | NTIA-10 | CA 7-9 | CT 7-24 | 1.6-2.6 |
| 1.1 | 2.6 | XM30PB/4.0 | NTIA-10 | CA 7-9 | CT 7-24 | 2.4-4 |
| 1.5 | 3.4 | XM30PB/5 | NT/A-10 | CA 7-9 | CT 7-24 | 2.4-4 |
| 2.2 | 4.8 | XM30PB/8 | NTIA-16 | CA 7-9 | CT 7-24 | 4-6 |
| 3.0 | 6.5 | XM30PB/10 | NTIA-16 | CA 7-9 | CT 7-24 | 6-10 |
| 4.0 | 8.2 | XM30PB/12 | NTIA-25 | CA 7-9 | CT 7-24 | 6-10 |
| 5.5 | 11 | XH125NJ/20 | NTIA-32 | CA 7-12 | CT 7-24 | 10-16 |
| 7.5 | 14 | XH125NJ/20 | NTIS-40 | CA 7-16 | CT 7-24 | 10-16 |
| 11 | 21 | XH125NJ/32 | NTIS-50 | CA 7-23 | CT 7-24 | 16-24 |
| 15 | 28 | XH125NJ/50 | NTIS-63 | CA 7-30 | CT 7-45 | 18-30 |
| 18.5 | 34 | XH125NJ/50 | NTCP-80 | CA 7-37 | CT 7-45 | 30-45 |
| 22 | 40 | XH125NJ/63 | NTCP-80 | CA 7-43 | CT 7-45 | 30-45 |
| 30 | 55 | XH125NJ/100 | NTCP-100 | CA 7-60 | CT 7.75 | 45-60 |
| 37 | 66 | XH125NJ/100 | NTF-160 | CA 7.72 | CT 7.75 | 60-75 |
| 45 | 80 | XH125NJ/125 ${ }^{\text {) }}$ | NTF-160 | CA 6-85 | CT 7-100 | 70-90 |
| 55 | 100 | XH125NJ/125 ') | NTF-200 | CA 6-105-(El) | CT 6-110 | 85-110 |
| 75 | 130 | XH250NJ/250 | NTKF-250 | CA 6-140-(El) | CT 6-150 | 105-150 |
| 90 | 155 | XH250NJ/250 ${ }^{\text {) }}$ | NTKF-250 | CA 6-170-EI | CT 6-200 | 140-200 |
| 110 | 200 | XH250NJ/250 ) | NTKF-315 | CA 6-210-EI | CEF 1-41/42 | 160-400 |
| 132 | 225 | XH400NE/400 | NTMF-355 | CA 6-210-EI | CEF 1-41/42 | 160-400 |
| 150 | 250 | XH400NE/400 | NTMF-355 | CA 6-250-EI | CEF 1-41/42 | 160-400 |
| 160 | 270 | XH400NE/400 | NTMF-400 | CA 6-300-EI | CEF 1-41/42 | 160-400 |
| 185 | 310 | XH400NE/400 | NTTF-450 | CA 6-300-Et | CEF 1-41/42 | 160-400 |
| 200 | 361 | XH400NE/400 | NTTM-500 | CA 6-420-E//CA 5-450 | CEF 1-41/42 | 160-400 |
| 250 | 425 | XH630NE/630 | NTTM-630 | CA 6-420-EI/CA 5-450 | CEF 1-52 | 160-630 |
| 315 | 530 | XH630NE/630 | NTLM-710 | CA 5-550 | CEF 1-52 | 160-630. |

Notes: Fuses 65 kA . XH125NJ circuit breaker combinations limited to 50 kA , others 65 kA . Overloads may be changed to different types eg. thermal style to electronic. Some combinations also gives Type ' 2 ' performance.

1) Use 'magnetic only' breaker.

Refer Catalogue C -co
Fuse protection DOL starting ')
Fuse
50 \& 65kA @ 415V to AS 3947.4.1

| Motor size kW | Approx. amps @ 415 V | NHP HRC fuse to BS88 | Sprecher + Schuh contactor | Sprecher + Schuh overload relay $\left.{ }^{2}\right)^{3}$ ) | Setting range amps |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 0.37 | 1.1 | NTIA-4 | CA 7-9 | CEP 7 | 1.0-2.9 |
| 0.75 | 1.8 | NTIA-6 | CA 7-9 | CEP 7 | 1.0-2.9 |
| 1.5 | 3.4 | NTIA-10 | CA 7-9 | CEP 7 | 1.6-5 |
| 2.2 | 4.8 | NTIA-16 | CA 7-9 | CEP 7 | 3.7-12 |
| 4.0 | 8.2 | NTIA-20 | CA 7-9 | CEP 7 | 3.7-12 |
| 5.5 | 11 | NTIA-25 | CA 7-12 | CEP 7 | 3.7-12 |
| 7.5 | 14 | NTIA-32 | CA 7-16 | CEP 7 | 12-32 |
| 11 | 21 | NTIS-50 | CA 7-30 | CEP 7 | 12-32 |
| 15 | 28 | NTIS-63 | CA 7-30 | CEP 7 | 12-37 |
| 18.5 | 34 | NTCP-80 | CA 7-37 | CEP 7 | 12-37 |
| 22 | 40 | NTCP-80 | CA 7-43 | CEP 7 | 14-45 |
| 30 | 55 | NTCP-100 | CA 7-60 | CEP 7 | 26-85 |
| 37 | 66 | NTF-125 | CA 7-72 | CEP 7 | 26-85 |
| 45 | 80 | NTF-160 | CA 7-85 | CEP 7 | 26-85 |
| 55 | 100 | NTF-200 | CA 6-105 (EI) | CT 6-110 | 85-110 |
| 75 | 130 | NTKF-250 | CA 6-140-EI | CT 6-150 | 105-150 |
| 90 | 155 | NTKF-250 | CA 6-170-E | CT 6-200 | 140-200 |
| 110 | 200 | NTKF-315 | CA 6-210-E | CEF 1-41/42 ${ }^{\text {4 }}$ ) | 160-400 |
| 132 | 225 | NTMF-355 | CA 6-210-E! | CEF 1-41/42 ${ }^{\text {4 }}$ ) | 160-400 |
| 150 | 250 | NTMF-355 | CA 6-250-EI | CEF 1-41/42 ${ }^{\text {4 }}$ ) | 160-400 |
| 185 | 320 | NTTM-450 | CA 6-300-E! | CEF 1-41/42 ${ }^{\text { }}$ ) | 160-400 |
| 250 | 425 | NTTM-560 | CA 6-420-E! | CEF 1-52 ${ }^{4}$ ) | 160-630 |
| 320 | 538 | NTLM-710 | CA 5-550 | CEF 1-52 ${ }^{4}$ ) | 160-630 |
| 380 | 650 | NTLM-800 | CA 5-700 | CEF 1-11/12P ${ }^{4}$ ) | $300-1200$ |

Notes: 7 Fuses with equal or lower let through energy may also be used.
${ }^{\text {2 }}$ ) Thermal overloads may be used instead of electronic CEP 7.
${ }^{3}$ ) Above 37 kW overloads may also be electronic or thermal.
4) CET 4 may be used instead of CEF 1.

Refer Catalogue C-CO
TemBreak circuit breakers DOL starting
50kA @ 415 V to AS 3947.4.1

TemBreak

| Motor size kW | Approx. amps | Terasaki circuit breaker | Sprecher + Schuh contactor | Sprecher + Schuh overload relay | Setting range amps |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 0.37 | 1.1 | XM30PB/1.4 | CA 7.9 | CT 7-24-1.6 | 1-1.6 |
| 0.55 | 1.5 | XM30PB/2 | CA 7-9 | CT 7-24-1.6 | 1-1.6 |
| 0.75 | 1.8 | XM30PB/2.6 | CA 7-9 | CT 7-24-2.4 | 1.6-2.4 |
| 1.1 | 2.6 | ХМ30PB/4.0 | CA 7-16 | CT 7-24-4 | 2.4-4 |
| 1.5 | 3.4 | XM30PB/5 | CA 7-16 | CT 7-24-4 | 2.4-4 |
| 2.2 | 4.8 | XM30PB/8 | CA 7-16 | CT 7-24-6 | 4-6 |
| 3 | 6.5 | XM30PB/10 | CA 7-30 | CT 7-24-10 | 6-10 |
| 4 | 8.2 | XM30PB/12 | CA 7-30 | CT 7-24-10 | 6-10 |
| 5.5 | 11 | XH125NJ/20 | CA 7-30 | CT 7-24-16 | 10-16 |
| 7.5 | 14 | XH125NJ/20 | CA 7-30 | CT 7-24-16 | 10-16 |
| 11 | 21 | XH125NJ/32 | CA 7-30 | CT 7-24-24 | 16-24 |
| 15 | 28 | XH125NJ/50 | CA 7-43 | CT 7-45-30 | 18-30 |
| 18.5 | 34 | XH125NJ/50 | CA 7-43 | CT 7-45-45 | 30-45 |
| 22 | 40 | XH125NJ/63 | CA 7-43 | CT 7-45-45 | 30-45 |
| 30 | 55 | XH125NJ/100 | CA 6-85 | CT 7-75 ${ }^{2}$ ) | 45-60 |
| 37 | 66 | XH125NJ/100 | CA 6-85 | CT 7-75 ${ }^{\text {\% }}$ ) | 60-75 |
| 45 | 80 | XH125NJ/125 | CA 6-105-EI | CT 6-90 | 70-90 |
| 55 | 100 | XH125NJ/125 ${ }^{\text {) }}$ | CA 6-105-EI | CT 6-110 | 85-110 |
| 75 | 130 | XH250NJ/250 | CA 6-140-EI | CT 6-150 | 105-150 |
| 90 | 155 | XH250NJ/250 | C A6-170-EI | CT 6-200 | 140-200 |
| 110 | 200 | XH250NJ/250 ) | CA 6-210-EI | CEF 1-41/42 | 160-400 |
| 132 | 225 | XS400NE/400 | CA 6-210-EI | CEF 1-41/42 | 160-400 |
| 150 | 250 | XS400NE/400 | CA 6-250-EI | CEF 1-41/42 | 160-400 |
| 160 | 270 | XS400NE/400 | CA 6-300-EI | CEF 1-41/42 | 160-400 |
| 200 | 361 | XS400NE/400 | CA 6-420-El | CEF 1-41/42 | 160-400 |
| 200 | 361 | XS400NE/400 | CA 5-450 | CEF 1-22 ${ }^{2}$ ) | 160-400 |
| 250 | 425 | XS630NE/630 | CA 5-700 | CEF 1-52 ${ }^{2}$ ) | 160-630 |
| 320 | 538 | XS630NE/630 | CA 5-700 | CEF 1-52 ${ }^{2}$ ) | 160-630 |

Notes: Overloads may be thermal or electronic.
Combinations based on the overload tripping before the circuit breaker at overload currents up to the motor locked rotor current.
${ }^{1}$ ) Use 'magnetic only' breaker or next higher circuit breaker / contactor combination.
${ }^{2}$ ) Use with separate mounting bracket.
Data for 65 kA co-ordination available refer Cat. C-CO.

Refer Catalogue C-CO
TemBreak circuit breakers DOL starting. 85kA @ 415V to AS 3947.4.1 TemBreak

| Motor size kW | Approx. FLC <br> © 415 V (A) | Terasaki circuit breaker | Sprecher + Schuh contactor | Sprecher + Schuh thermal O/L type | Setting range (A) |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 0.37 | 1.1 | XM30PB/1.4 | CA 7-9 | CEP 7-M32-2.9-10 | 1.0-2.9 |
| 0.55 | 1.5 | XM30PB/2.0 | CA 7-9 | CEP 7-M32-2.9-10 | 1.0-2.9 |
| 0.75 | 1.8 | XM30PB/2.6 | CA 7-9 | CEP 7-M32-2.9-10 | 1.0-2.9 |
| 1.1 | 2.6 | XM30РB/4 | CA 7-16 | CEP 7-M32-2.9-10 | 1.0-2.9 |
| 1.5 | 3.4 | XM30РВ/5 | CA 7-16 | CEP 7-M32-5-10 | 1.6-5 |
| 2.2 | 4.8 | XM30PB/8 | CA 7-30 | CEP 7-M32-12-10 | 3.7-12 |
| 3 | 6.5 | XM30PB/8 | CA 7-30 | CEP 7-M32-12-10 | 3.7-12 |
| 4 | 8.2 | XM30PB/10 | CA 7-30 | CEP 7-M32-12-10 | 3.7-12 |
| 5.5 | 11 | TL100NJ/20 | CA 7-30 | CEP 7-M32-12-10 | 3.7-12 |
| 7.5 | 14 | TL100NJ/20 | CA 7-30 | СЕР 7-M32-32-10 | 12-32 |
| 9 | 17 | TL100NJ/32 | CA 7-30 | CEP 7-M32-32-10 | 12-32 |
| 10 | 19 | TL100NJ/32 | CA 7-30 | CEP 7-M32-32-10 | 12-32 |
| 11 | 21 | TL100NJ/32 | CA 7-30 | CEP 7-M32-32-10 | 12-32 |
| 15 | 28 | TL100NJ/50 | CA 7-43 | CEP 7-M32-32-10 | 12-32 |
| 18.5 | 34 | TL.100NJ/50 | CA 7-43 | CEP 7-M37-37-10 | 12-37 |
| 22 | 40 | TL100NJ/63 | CA 7-43 | CEP 7-M45-45-10 | 14-45 |
| 30 | 55 | TL100NJ/100 | CA 7-72 | CEP 7-M85-85-10 | 26-85 |
| 37 | 66 | TL100 NJ/100 | CA 7.72 | CEP 7-M85-85-10 | 26-85 |
| 45 | 80 | TL250NJ/160 | CA 6-105 | CEP 7-M85-85-10 | 26-85 |
| 55 | 100 | TL250 $\mathrm{N} / 160$ | CA 6-105 | CEF 1-11/12 | 0.5-180 |
| 75 | 135 | TL250NJ/250 | CA 6-210-EI | CEF 1-11/12 | 0.5-180 |
| 90 | 160 | TL250NJ/250 | CA 6-210-EI | CEF 1-11/12 | 0.5-180 |
| 110 | 200 | TL250NJ/250 | CA 6-210-EI | CEF 1-41/42/52 | 160-630 |
| 132 | 230 | TL400NE/400 | CA 6-210-EI | CEF 1-41/42/52 | 160-630 |
| 160 | 270 | TL400NE/400 | CA 6-300-EI | CEF 1-41/42/52 | 160-630 |
| 200 | 361 | TL400NE/400 | CA 6-420-EI | CEF 1-41/42/52 | 160-630 |

Din-T circuit breakers with rotary isolator. DOL starting. 50kA @ 415V to AS 3947.4.1

| Motor size kW | Approx. amps @ 415 V | Sprecher + Schuh isolator | Terasaki circuit breaker | Sprecher + Schuh current limiter | Sprecher + Schuh contactor | Schuh thermal O/L relay | Thermal overload range |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0.37 | 1.1 | LA 7-80 | Din-T 10/4 | - | CA 7-9 | CT 7-24 | 0.6-1.6 |
| 0.55 | 1.5 | LA 7-80 | Din-T 10/4 | - | CA $7-9$ | CT 7-24 | 1-1.6 |
| 0.75 | 1.8 | LA 7-80 | Din-T 10/4 | - | CA 7-9 | CT 7-24 | 1.6-2.4 |
| 1.1 | 2.6 | LA 7-80 | Din-T $10 / 6$ | - | CA 7-23 | CT 7-24 | 2.4-4 |
| 1.5 | 3.4 | LA 7-80 | Din-T 10/6 | - | CA 7-23 | CT 7-24 | 2.4-4 |
| 2.2 | 4.8 | LA 7-80 | Din-T $10 / 10$ | KTL 3-65 | CA 7-23 | CT 7-24 | 4-6 |
| 3 | 6.5 | LA 7-80 | Din-T 10/16 | KTL 3-65 | CA 7-23 | CT 7-24 | 6-10 |
| 4 | 8.2 | LA 7-80 | Din-T $10 / 16$ | KTL 3-65 | CA 7-23 | CT 7-24 | 6-10 |
| 5.5 | 11 | LA 7-80 | Din-T 10/20 | KTL 3-65 | CA 7-23 | CT 7-24 | 10-16 |
| 7.5 | 14 | LA 7-80 | Din-T 10/32 | KTL 3-65 | CA 7-30 | CT 7-45 | 10-16 |
| 11 | 21 | LA 7-80 | Din-T $10 / 40$ | KTL. 3-65 | CA 7-30 | CT 7-24 | 16-24 |
| 15 | 28 | LA 7-100 | Din-T 10/63 | KTL 3-65 | CA 7-37 | CT 7-45 | $18 \cdot 30$ |
| 18.5 | 34 | LA 7-100 | Din-T $10 / 63$ | KTL 3-65 | CA 7-37 | CT 7-45 | 30-45 |

ACS contactors CA 7
Technical data

| tactor |  | CA＇7－9 | CA 7 －12 | CA 7－16 | CA 7－23 | CA 7－30 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Number of switching operations |  |  |  |  |  |  |
| Mechanical | ［Mill］ | 13 | 13 | 13 | 13 | 13 |
| Electrical AC 3 （400V） | ［Mill］ | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 |
| Weight with AC coil（DC coil） | ［kg］ | 0.39 （0．6） | 0.39 （0．6） | 0.39 （0．6） | 0.39 （0．73） | 0.48 （0．85） |
| Terminal for main contacts |  | 点 | 点 | 帯 | 兴 | 匋 |
| Terminal size to IEC 947－1 |  | $2 \times$ A4 | $2 \times 14$ | $2 \times \mathrm{A} 4$ | $2 \times$ A4 | $2 \times 86$ |
| Flexible wire with sleeve ET曷 | 1 wire［ $\mathrm{mm}^{2}$ ］ | 1．．． 4 | 1．．． 4 | $1 . . .4$ | 1．．． 4 | 2．5．．． 10 |
|  | 2 wire［ $\left.\mathrm{mm}^{2}\right]$ | 1．．． 4 | 1．．． 4 | 1．．．4 | 1．．． 4 | 2．5．． 10 |
| Stranded／solid core <br>  | 1 wire［ $\mathrm{mm}^{2}$ ］ | 1．5．．． 6 | 1．5．．． 6 | 1．5．．．6 | 1．5．．． 6 | 2．5．．． 16 |
|  | 2 wire［mm］ | 1．5．．． 6 | 1．5．．． 6 | 1．5．．．6 | 1．5．．． 6 | 2．5．．．16 |
| Tightening torque | ［ Nm ］ | 1．．． 2.5 | 1．．．2．5 | 1．．．2．5 | 1．．．2．5 | 1．5．．．3．5 |
| Contactor |  | CA 7－37 | CA 7－43 | CA 7－60 | CA 7.72 | CA 7－85 |

Number of switching operations

| Mechanical | ［Mill］ | 13 | 12 | 10 | 10 | 10 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Electrical AC 3 （400V） | ［Mill］ | 1.3 | 1.3 | 1 | 1 | 1 |
| Weight with AC coil（DC coil） | ［kg］ | 0.49 （0．85） | 0.51 （1．0） | 1.45 （1．47） | 1.45 （1．47） | 1.45 （1．47） |
| Terminal for main contacts |  |  | 田 |  | 皆 | 舃 |
| Terminal size to IEC 947－1 |  | $2 \times 86$ | B7＋B6 | B9＋B7 | B9＋${ }^{\text {7 }}$ | B9＋ $\mathrm{B}_{7}$ |
| Flexible wire with sleeve | 1 wire［ $\mathrm{mm}^{2}$ ］ | 2．5．．． 10 | 2．5．．． 16 | 2．5．．． 35 | 2．5．．． 35 | 2．5．．． 35 |
| E－T－ | 2 wire［ $\left.\mathrm{mm} \mathrm{m}^{2}\right]$ | 2．5．．． 10 | 2．5．．． 10 | 2．5．．． 25 | 2．5．． 25 | 2．5．．． 25 |
| Stranded／solid core | 1 wire［ $\mathrm{mm}^{2}$ ］ | 2．5．．． 16 | 2．5．．． 25 | 2．5．．． 50 | 2．5．．．50 | 2．5．．．50 |
| E－7 | 2 wire［ $\mathrm{mm}^{2}$ ］ | 2．5．．．16 | 2．5．．．16 | 2．5．．． 35 | 2．5．．． 35 | 2．5．．． 35 |
| Tightening torque | ［ Nm ］ | 1．5．．．3．5 | 1．5．．．3．5 | 2．．． 6 | 2．．． 6 | 2．．． 6 |
| Control circuit |  | CA 7－9 | CA 7－12 | CA 7－16 | CA 7－23 | CA 7－30 |
| Operating limits |  |  |  |  |  |  |
| AC 50／60Hz | Pick－up［ $\mathrm{xU}_{\text {d }}$ ］ | 0．85．．．1．1 | 0．85．．．1．1 | 0．85．．1．1 | 0．85．．．1．1 | 0．85．．．1．1 |
|  | Drop－out［ $\mathrm{xU}_{5}$ ］ | 0．3．．．0．6 | 0．3．．．0．6 | 0．3．．．0．6 | 0．3．．．0．6 | 0．3．．．0．6 |


| Pick－up and hold power <br> AC $50 / 60 \mathrm{~Hz}$ |  |  |  |  |  |  |
| :---: | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
|  | Pick－up［VAW］PF | $70 / 50 / 0.71$ | $70 / 50 / 0.71$ | $70 / 50 / 0.71$ | $70 / 50 / 0.71$ | $80 / 60 / 0.75$ |
| Hold［VAW］PF | $8 / 2.60 / 0.33$ | $8 / 2.6 / 0.33$ | $8 / 2.6 / 0.33$ | $9 / 3 / 0.33$ | $9 / 3 / 0.33$ |  |

Operating times

| AC $50 / 60 \mathrm{~Hz}$ | Make［ms］ | 15．．． 30 | 15．．． 30 | 15．．． 30 | 15．．． 30 | 15．．． 30 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Break［mS］ | 10．．． 60 | 10．．． 60 | 10．．． 60 | 10．．．60 | 10．．． 60 |
| Control circuit |  | CA 7－37 | CA 7－43 | CA 7－60 | CA 7.72 | CA 7－85 |
| Operating limits |  |  |  |  |  |  |
| AC $50 / 60 \mathrm{~Hz}$ | Pick－up［ $\mathrm{XU}_{5}$ ］ | 0．85．．．1．1 | 0．85．．1．1 | 0．85．．．1．1 | 0．85．．．1．1 | 0．85．．．1．1 |
|  | Drop－out［ $\mathrm{XU}_{5}$ ］ | 0．3．．．0．6 | 0．3．．．0．6 | 0．3．．．0．6 | 0．3．．． 0.6 | 0．3．．． 0.6 |

Pick－up and hold power

| AC $50 / 60 \mathrm{~Hz}$ | Pick－up［VAW］PF | $80 / 60 / 0.75$ | $80 / 60 / 0.75$ | $200 / 110 / 0.55$ | $200 / 110 / 0.55$ | $200 / 110 / 0.55$ |
| ---: | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
|  | Hold［VA／W］PF | $9 / 3 / 0.33$ | $10 / 3.2 / 0.32$ | $16 / 4.5 / 0.28$ | $16 / 4.5 / 0.28$ | $16 / 4.5 / 0.28$ |
| Operating times |  |  |  |  |  |  |
| AC $50 / 60 \mathrm{~Hz}$ | Make［mS］ | $15 \ldots 30$ | $15 \ldots 30$ | $18.5 \ldots 30$ | $18.5 \ldots . .30$ | $18.5 \ldots 30$ |
|  | Break［mS］ | $10 \ldots 60$ | $10 \ldots 60$ | $10 \ldots 60$ | $10 \ldots 60$ | $10 \ldots 60$ |

ACS contactors CA 7 Technical data

ACS contactors CA 7
Technical data


|  |  | Built-in auxiliary contacts CA 7-9... 85 |  |  |  |  | Clip-on auxiliary contacts Front mount Side mount |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Switching DC loads |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| L/R<1ms, resistive loads at: | [V] | 24 | 48 | 110 | 220 | 440 | 24 | 48 | 110 | 220 | 440 | 24 | 48 | 110 | 220 | 440 |
|  | [A] | 12 | 9 | 3.5 | 0.55 | 0.2 | 12 | 9 | 3.5 | 0.55 | 0.2 | 6 | 3.2 | 0.45 | 0.18 | 0.1 |
| L/R<15ms, inductive loads with economy resistor in series at: |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | [V] | 24 | 48 | 110 | 220 | 440 | 24 | 48 | 110 | 220 | 440 | 24 | 48 | 110 | 220 | 440 |
|  | [A] | 9 | 5 | 2 | 0.4 | 0.16 | 9 | 5 | 2 | 0.4 | 0.16 | 2 | 1.6 | 0.3 | 0.12 | 0.05 |
| DC-13, switching electro |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| magnets at: | [V] | 24 | 48 | 110 | 220 | 440 | 24 | 48 | 110 | 220 | 440 | 24 | 48 | 110 | 220 | 440 |
|  | [A] | 5 | 2 | 0.7 | 0.25 | 0.12 | 5 | 2 | 0.7 | 0.25 | 0.12 | 3 | 1.5 | 0.6 | 0.3 | 0.2 |

ACS contactors CA 7 Technical data

## Âdditional rating data - contactors to IEC'947

Contactor
CA 7-9 CA 7-12 CA 7-16 CA 7-23 CA 7-30 CA 7-37 CA 7-43 CA 7-60 CA 7-72 CA 7-85
AC1 resistive load
switching 3-
Ambient temperature $40^{\circ} \mathrm{C}$

| $\left.J_{8}^{1}\right)$ | $[\mathrm{A}]$ | 32 | 32 | 32 | 32 | 50 | 50 | 85 | 100 | 100 | 100 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 240 V | $[\mathrm{~kW}]$ | 10 | 10 | 13 | 13 | 18 | 20 | 25 | 36 | 36 | 40 |
| 415 V | $[\mathrm{~kW}]$ | 18 | 18 | 23 | 23 | 32 | 36 | 45 | 64 | 64 | 71 |
| 690 V | $[\mathrm{~kW}]$ | 30 | 30 | 38 | 38 | 54 | 60 | 75 | 108 | 108 | 120 |

Ambient temperature $60^{\circ} \mathrm{C}$

| $\left.\rho_{6}{ }^{\prime}\right)$ | $[\mathrm{A}]$ | 32 | 32 | 32 | 32 | 45 | 45 | 63 | 100 | 100 | 100 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 240 V | $[\mathrm{~kW}]$ | 8 | 8 | 10 | 10 | 14 | 16 | 20 | 29 | 29 | 34 |
| 415 V | $[\mathrm{~kW}]$ | 14 | 14 | 17 | 17 | 26 | 28 | 36 | 51 | 51 | 61 |
| 690 V | $[\mathrm{~kW}]$ | 24 | 24 | 29 | 29 | 44 | 48 | 60 | 86 | 86 | 102 |

AC motor switching
AC 2, AC 3, AC 4

| 240 V | $[\mathrm{~A}]$ | 11.5 | 14.5 | 20 | 26.5 | 34 | 37 | 42 | 62 | 70 | 85 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 415 V | $[\mathrm{~A}]$ | 9 | 12 | 16 | 23 | 30 | 37 | 43 | 60 | 72 | 85 |
| 690 V | $[\mathrm{~A}]$ | 5 | 7 | 9.3 | 12 | 17 | 20 | 25 | 34 | 42 | 49 |
| 240 V | $[\mathrm{~kW}]$ | 3 | 4 | 5.5 | 7.5 | 10 | 11 | 13 | 18.5 | 22 | 25 |
| 415 V | $[\mathrm{~kW}]$ | 4 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 | 45 |
| 690 V | $[\mathrm{~kW}]$ | 4 | 5.5 | 7.5 | 10 | 15 | 18.5 | 22 | 30 | 37 | 45 |

Rated making capacity

| $I_{\theta} \mathrm{AC} 4,50 \mathrm{~Hz}$ | $\max .690 \mathrm{~V}[\mathrm{~A}]$ | 135 | 180 | 240 | 345 | 450 | 555 | 645 | 900 | 1080 | 1275 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |

Rated breaking capacity

| le AC 4 | max. $460 \mathrm{~V}[\mathrm{~A}]$ | 135 | 180 | 240 | 345 | 450 | 555 | 645 | 900 | 1080 | 1275 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | max. 690 V [ A$]$ | 75 | 105 | 140 | 140 | 255 | 300 | 375 | 510 | 630 | 735 |

Short circuit protection
without protection relay
fuse 9 G to IEC 947-4-1

| co-ordination type '1' | [A] | 50 | 50 | 50 | 63 | 100 | 125 | 160 | 200 | 250 | 250 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| co-ordination type '2' | [A] | 20 | 25 | 25 | 35 | 50 | 80 | 100 | 100 | 125 | 160 |

Main current circuit

| resistance | $[m \Omega]$ | 2.7 | 2.7 | 2.7 | 2 | 2 | 2 | 1.5 | 0.9 | 0.9 | 0.9 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |

Power dissipated by all
circuits at le AC 3

| $[w]$ | 0.7 | 1.2 | 2.1 | 3.2 | 5.4 | 8.2 | 8.3 | 9.7 | 14 | 19.5 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |

Total power dissipation

| at le AC 3 | AC control [ w ] | 3.3 | 3.8 | 4.7 | 6.2 | 8.4 | 11.2 | 11.5 | 14.2 | 18.5 | - |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | DC control [w] | 6.7 | 7.2 | 8.1 | 12.4 | 14.6 | 17.4 | 18.4 | 14.6 | 18.9 | - |
| Life span in millions of operations |  |  |  |  |  |  |  |  |  |  |  |
| Mechanical | AC control | 13 | 13 | 13 | 13 | 13 | 13 | 12 | 10 | 10 | 10 |
|  | DC control | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 10 | 10 | 10 |

## Operating times (DC)

| Make (mS) | 40...70 | 40... 70 | 40... 70 | 40... 70 | 50... 80 | 50... 80 | 50... 80 | 20.. 40 | 20... 40 | 20... 40 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Break (mS) | 7... 15 | 7... 15 | 7... 15 | 7... 15 | $7 . .15$ | 7... 15 | - | - | - | - |

Note: ${ }^{1}$ ) Contact NHP for recommended cable size.

# ACS contactors CA 7 Dimensions 

Dimensions in (mm)


Mounting position


Contactor (AC control)

| Type | a | b | c | c1 | c2 | od | d1 | d2 $\left.{ }^{\prime}\right)$ |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| CA 7-9...CA 7-23 ${ }^{2}$ ) | 45 | 81 | 80.5 | 75.5 | 6 | 4.5 | 60 | 35 |
| CA 7-30...CA 7-37 | 45 | 81 | 97.5 | 92.6 | 6.5 | 4.5 | 60 | 35 |
| CA 7-43 | 54 | 81 | 100.5 | 95.6 | 6.5 | 4.5 | 60 | 45 |
| CA 7-60...CA 7-85 | 72 | 122 | 117 | 111.5 | 8.5 | 5.4 | 100 | 55 |

(DC control)

| Type | a | b | c | c1 | c2 | dd | d1 | d2') |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| CA 7-9C...CA 7-16C | 45 | 81 | 106.5 | 101.5 | 6 | 4.5 | 60 | 35 |
| CA 7-23C | 45 | 81 | 123.5 | 119 | 6 | 4.5 | 60 | 35 |
| CA 7-30C...CA 7-37C | 45 | 81 | 141.5 | 136.5 | 6.5 | 4.5 | 60 | 35 |
| CA 7-43C | 54 | 81 | 144.5 | 140 | 6.5 | 4.5 | 60 | 45 |
| CA 7-60C...CA 7-85C | 72 | 122 | 117 | 111.5 | 8.5 | 5.4 | 100 | 55 |

## Accessories

| Accessories Contactor with |  | (AC control) (mm) | (DC control) (mm) |
| :---: | :---: | :---: | :---: |
| Front mounting auxiliary contact | 2 or 4 pole | c/c1 + 39 | c/c1 + 39 |
| Side mounting auxiliary contact | 1 or 2 pole | a+9 | a+9 |
| Pneumatic timing module |  | c/c1 + 58 | - |
| Electronic timing module | coil mounting | b +24 | $b+24$ |
| Mechanical interlock | mounts between contactors | a +9 | a +9 |
| Mechanical latch |  | c/c1 + 61 | - |
| Interface | coil mounting | b +9 | - |
| Suppressor | coil mounting | b + 3 | b +3 |
| With inscriptions ${ }^{3}$ ) | labels | +0 | +0 |
|  | label support system V4N5 | +5.5 | +5.5 |

## Notes: $\quad$ ) DIN Rail mounting 35mm to EN 50022

${ }^{2}$ ) Dimensions for 4 pole contactors same as 3 pole with auxiliary.
${ }^{3}$ ) Dimensions with inscriptions.

## Dimensions with and without contactors

Dimensions in (mm)
CEP 7, CEP 7s and CEP 7-B mounted on CA 7 contactors


| Cat. No. | a | $b$ | b4 | c | e1 | e2 | d1 | d2 | h | j | 6d |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| CA 7-9/12/16/23 with CEP 7 or CEP 7 S | 45 | 131 | 86 | 88.5 | 16.5 | 69 | 60 | 35 | 86.5 | 2 | 4.2 |
| CA 7-9/12/16/23 with CEP 7-B | 54 | 137 | 97 | 90.7 | 5.1 | 59 | 60 | 35 | 85.1 | 2 | 4.2 |
| CA 7-30/37 with CEP 7 or CEP 75 | 45 | 136.5 | 91.5 | 92 | 16.5 | 69 | 60 | 35 | 104 | 2 | 4.2 |
| CA 7-30/37 with CEP 7-B | 54 | 137 | 97 | 92.1 | 5.2 | 59 | 60 | 35 | 104.7 | 2 | 4.2 |
| CA 7-43 with CEP 7, CEP 75 or CEP 7-B | 54 | 136.5 | 91.5 | 93 | 22 | 69 | 60 | 45 | 107 | 2 | 4.2 |
| CA 7-60/72/85 with CEP 7, CEP 75 or CEP 7-B | 72 | 188.5 | 120 | 120 | 18 | 84.5 | 100 | 55 | 125.5 | 2 | 5.5 |

CEP 7 with separate mounting bracket


| Type | $\mathbf{a}$ | $\mathbf{b}$ | $\mathbf{c}$ | $\mathbf{d}$ | $\mathbf{e}$ |
| :--- | :---: | :---: | :---: | :---: | :---: |
| CEP 7-37-P-A | 45 | 90 | 75 | 30 | 75 |
| CEP 7-45-P-A | 55 | 90 | 96.5 | 40 | 75 |
| CEP 7-85-P-A | 70 | 115 | 110 | 55 | 105 |

General $\cdots n$

CT 7.24
CT 7-45
CT 7-75
CT $7: 100^{\prime}$

| Weight | $[\mathrm{kg}]$ | 0.13 | 0.21 |
| :--- | :---: | :---: | :---: |
| Standards |  | 0.21 | 1.3 |
| Climatic |  | IEC 947, EN 60 947, DIN VDE 0660, UL, LRS, GUS, CSA |  |
|  |  | damp/heat, constant, to DIN, IEC 68, Part 2-3 |  |
| Ambient temperature | open | damp/heat, cyclic, to DIN, IEC 68, Part 2-30 |  |
|  | enclosed | $-25 \ldots+60^{\circ} \mathrm{C}$ |  |

Temperature compensation
continuous temperature range $-5 \ldots+40^{\circ} \mathrm{C}$ to IEC 947,
EN 60947; PFB: $-5 . . .+50^{\circ} \mathrm{C}$
Shock resistance (sinusoidal 10ms) [G]

| Protection | IP 00 IP 2LX |
| :--- | :---: |
| Protection | touch proof (VDE 0106, Part 100) |

## Contactor, timer and overload selection chart for auto transformer starters

| ATS kW | Line <br> contactor | Trans <br> contactor | Star <br> contactor | Timer | Overload |
| :--- | :--- | :--- | :--- | :--- | :--- |
| 11 | CA 7-23-10 | CA 7-16-10 | CA 7-9-10 | RZ7 FSY2D | CEP 7-M32-32-10 |
| 15 | CA 7-30-00 | CA 723-10 | CA 7-12-10 | RZ7 FSY2D | CEP 7-M37-37-10 |
| 18.5 | CA 7-37-00 | CA 7-30-00 | CA 7-16-10 | RZ7 FSY2D | CEP 7-M37-37-10 |
| 22 | CA 7-43-00 | CA 7-30-00 | CA 7-23-10 | RZ7 FSY2D | CEP 7-M45-45-10 |
| 30 | CA 7-60-00 | CA 7-37-00 | CA 7-30-00 | RZ7 FSY2D | CEP 7-M85-85-10 |
| 37 | CA 7-72-00 | CA 7-43-00 | CA 7-30-00 | RZ7 FSY2D | CEP 7-M85-85-10 |
| 45 | CA 7-85-00 | CA 7-60-00 | CA 7-37-00 | RZ7 FSY2D | CEP 7-M85-85-10 |
| 55 | CA 6-85-11 | CA 7-60-00 | CA 7-43-00 | RZ7 FSY2D | CT 6-110 |
| 75 | CA 6-105-11 | CA 7-85-00 | CA 7-60-00 | RZ7 FSY2D | CT 6-150 |
| 90 | CA 6-140EI-11 | CA 6-85-11 | CA 7-72-00 | RZ7 FSY2D | CT 6-200 |
| 110 | CA 6-170EI-11 | CA 6-105-11 | CA 7-85-00 | RZ7 FSY2D | CEF 1-41 |
| 132 | CA 6-210EI-11 | CA 6-140EI-11 | CA 6-105-11 | RZ7 FSY2D | CEF 1-41 |
| 150 | CA 6-250EI-11 | CA 6-140EI-11 | CA 6-105-11 | RZ7 FSY2D | CEF 1-41 |
| 185 | CA 6-300EI-11 | CA 6-210EI-11 | CA 6-140EI-11 | RZ7 FSY2D | CEF 1-41 |
| 220 | CA 6-420EI-11 | CA 6-210EI-11 | CA 6-140-EI-11 | RZ7 FSY2D | CEF 1-41 |

Contactor, timer and overload selection chart for star delta starters

| SDSkW | Line <br> contactor | Delta <br> contactor | Star <br> contactor | Timer | Overload |
| :--- | :--- | :--- | :--- | :--- | :--- |
| 7.5 | CA 7-9-10 | CA 7-9-01 | CA 7-9-01 | RZ7 FSY2D | CEP 7-M32-12-10 |
| 11 | CA 7-12-10 | CA 7-12-01 | CA 7-9-01 | RZ7 FSY2D | CEP 7-M32-32-10 |
| 15 | CA 7-16-10 | CA 7-16-01 | CA 7-9-01 | RZ7 FSY2D | CEP 7-M32-32-10 |
| 18.5 | CA 7-23-10 | CA 7-23-01 | CA 7-12-01 | RZ7 FSY2D | CEP 7-M32-32-10 |
| 22 | CA 7-23-10 | CA 7-23-01 | CA 7-16-01 | RZ7 FSY2D | CEP 7-M32-32-10 |
| $30-37$ | CA 7-37-00 | CA 7-37-00 | CA 7-23-01 | RZ7 FSY2D | CEP 7-M45-45-10 |
| 45 | CA 7-60-11 | CA 7-60-11 | CA 7-30-00 | RZ7 FSY2D | CEP 7-M85-85-10 |
| 55 | CA 7-60-11 | CA 7-60-11 | CA 7-37-00 | RZ7 FSY2D | CEP 7-M85-85-10 |
| 75 | CA 7-85-00 | CA 7-85-00 | CA 7-43-00 | RZ7 FSY2D | CEP 7-M85-85-10 |
| 90 | CA 6-85-11 | CA 6-85-11 | CA 7-60-00 | RZ7 FSY2D | CT 6-90 |
| 110 | CA 6-105-11 | CA 6-105-11 | CA 7-72-00 | RZ7 FSY2D | CT 6-110 |
| 132 | CA 6-140EI-11 | CA 6-140EI-11 | CA 7-85-00 | RZ7 FSY2D | CT 6-150 |
| 150 | CA 6-170EI-11 | CA 6-170EI-11 | CA 6-85-00 | RZ7 FSY2D | CTA 6-200 |
| 185 | CA 6-210EI-11 | CA 6-210EI-11 | CA 6-105-11 | RZ7 FSY2D | CEF 1-41 |
| 220 | CA 6-210-EI-11 | CA 6-210-El-11 | CA 6-140-EI-11 | RZ7 FSY2D | CEF 1-41 |

ACS thermal overloads CT 7 Dimensions with and without contactors

## Mounted on CA 7 contactors



CT 7-24, CT 7-45, CT $7-75$

| Type | For contactor | a | b | b1 | c | c1 | c2 | c3 | c4 | c5 | 6d | d1 | d2 | e1 | e2 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| CT 7-24 | CA 7-9... 23 | 45 | 127 | 83 | 96 | 91 | 15 | 51 | 39 | 5 | 4.5 | 60 | $\left.35{ }^{\prime}\right)$ | 16.5 | 51 |
|  | CA 7-30... 37 | 45 | 127 | 83 | 105 | 99 | 6.5 | 51 | 39 | 9.5 | 4.5 | 60 | $\left.35{ }^{\prime}\right)$ | 16.5 | 51 |
| CT 7-45 | CA 7-30... 37 | 60 | 140 | 97 | 105 | 99 | 6.5 | 51 | 39 | 6.5 | 4.5 | 60 | $\left.35^{\prime}\right)$ | 16.5 | 57 |
|  | CA 7-43 | 60 | 140 | 97 | 107 | 103 | 6.5 | 51 | 39 | 8.5 | 4.5 | 60 | $\left.45^{1}\right)$ | 16.5 | 57 |
| CT 7-75 | CA 7-60... 85 | 72 | 185 | 120 | 125 | 120 | 8.5 | 51 | 39 | 28.5 | 5.4 | 100 | $55^{\prime}$ ) | 16.5 | 82 |

Separate mounting with bracket


Separate mounting


| Type | $\mathbf{a}$ | $\mathbf{b}$ | $\mathbf{b 1}$ | $\mathbf{c}$ | $\mathbf{c 1}$ | $\mathbf{c 2}$ | $\mathbf{c 3}$ | dd | d1 | d2 | e1 |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| CT 7-24 | 45 | 85 | 44 | 95 | 70.5 | 5 | 51 | 4.5 | $60 \ldots 74$ | $\left.35^{1}\right)$ | 16 |
| CT 7-75 | 60 | 90 | 44 | 117 | 112 | 15 | 51 | 5.4 | 74 | $\left.50^{1}\right)$ | 16 |
| CT 7-90 | 100 | 120 | - | 135 | - | 5 | 51 | 6.2 | 74 | $\left.80^{1}\right)$ | 0 |

Notes: ') Standard DIN rail to EN 50 022-35
${ }^{2}$ ) With reset rod, maintain 9 mm maximum operating radius from centre of reset button.
c3 Reset magnet
c4 Auxiliary contact block

## MTR Level Relay



The MTR level relay has proven itself to be simple and extremely reliable in pump stations everywhere. The MTR controls one pump or one alarm. The MTRA controls one pump and one alarm.

## - Safe

The extra low sensing voltage ensures maintenance staff and operators are protected at all times.

- Four sensitivities

Allows the relay to operate effectively in a wide range of conductive liquids.

- Activation delays

Each output can have a different time delay to overcome wave action and turbulence.

- LED indication

High intensity LED indicators ensure clear signals. Power On (green). Alarm On (red). Pump On (yellow).

- Dipswitch programmable

All settings are easily selectable from the front panel.

- Proven reliability

The proven design and performance of the relay ensures long-term reliability of the MultiTrode system.

- I.S application

Perfect for I.S application when used with an MTISB.

- Unique two-sensor operation (MTRA only) Pump and alarm can be controlled using two or three sensors. Two-sensor operation is ideal for budget applications or where space is limited.
- DIN rail or screw mounting
- Low installed cost


## Specifications

| Mode of operation: MTR Mode MTRA Mode | Charge/Discharge (Fill or Empty) Discharge ONLY |
| :---: | :---: |
| Probe Inputs: |  |
| Sensor inputs | MTR : 2 / MTRA: 3 |
| Sensor voltage | 10/12VAC Nominal |
| Sensor current | 0.8 mA max. (per sensor) |
| Sensitivity | 1k, 4k, 20k, 80k |
| Relay Outputs: |  |
| MTR relay output | 2 contact sets : 1 N/O \& 1 C/O |
| MTR Output delay | 0, 2.5, 5, 10, 20, 40, 80, 160 sec |
| MTRA relay output | 2 relays : both $\mathrm{N} / \mathrm{O}$ |
| MTRA Output delay | Pump: 0.5, 10; Alarm: 0.5, 15 sec |
| Relay contact rating | 250 VAC |
|  | 5A Resistive, 2A Inductive |
| Relay contact life | $10^{5}$ Operations |
| Terminal size | $2 \times 13$ AWG / $2.5 \mathrm{~mm}^{2}$ |
| Display |  |
| LEDs: | Power On Pump Alarm |
| MTR | Green Red |
| MTRA | Green Yellow Red |
| Physical Product: |  |
| Dimensions | $2.7 / 8 \mathrm{H} \times 1.3 / 4 \mathrm{~W} \times 4.1 / 2 \mathrm{O}$ (Inches) $72 \mathrm{H} \times 45 \mathrm{~W} \times 14 \mathrm{D}(\mathrm{mm})$ |
| Mounting Enclosure | DIN Rail or $2 \times \# 6$ Screws / $2 \times$ M4 Screws |
|  | Makrolon (self-extinguishing) |
|  |  |



| Available Models \& |  |  |
| :---: | :---: | :--- |
| 415VAC | MTering Information |  |
| 240 VAC | MTR-1 | n/a |
| 110VAC | MTR-2 | MTRA-2 |
| 24VAC | MTR-3 | MTRA-3 |
| 24VDC | MTR-4 | MTRA-4 |
| 12VDC | MTR-5 | MTRA-5 |
|  | MTR-6 | MTRA-6 |

## MULTITRODE

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## 1 Introduction

The MultiTrode level control relay is a solid-state electronic module in a hi-impact plastic case with a DIN rail attachment on the back, making a snap-on-snap-off installation. Any number of relays can be easily added to the DIN metal rail then wired together to form a complex pumping system that other wise may have to be controlled and operated by a programmed PLC.

The relay is normally matched with the MulitiTrode probe which works in conjunction with the relay and uses the conductivity of the liquid to complete an electrical circuit.

## 2 Electrical Overview



There are 10 screw terminals on the unit. Facing the relay as shown, we look at the bottom terminals (left to right):

- Lo - (Charge mode). This is the point when the probe is dry the relay will turn on.
- Lo - (Discharge mode). This is the point when the probe in the tank is dry the relay will tum off.
- Hi -(Charge mode). This is the point when the probe in the tank is wet a relay will tum off
- Hi - (Discharge mode). This is the point when the probe in the tank is wet a relay will tum on.
- C - is common earth. All earth bonding must be terminated here for correct operation.
- "L " is "live" (240V AC)
- " $N$ " is "neutral" (240V AC)

If the tank is plastic, or if you are conducting tests in a plastic bucket, or the vessel has no earth point inside, you must install an earth rod within the tank, vessel or bucket and make sure that it is bonded back to $C$ on the relay unit.

## 3 DIP Switches

### 3.1 DIP Switches

(See Wiring Diagram for full program functions.)

### 3.1.1 DIP 182

DIP 1 and 2 control the Sensitivity, in other words the cleaner the liquid the higher the sensitivity setting must be. Concentrated acids, minerals are by their own chemical composition highly conductive, so a low level of sensitivity is required, purified water is almost an insulator against electrical current flow so a higher sensitivity inside the relay is required.

### 3.1.2 DIP 3, 4 \& 5

DIP switches 3,4 and 5, control delay on activation. For example, in discharge mode with DIP switches 3, 4 and 5 set to 10 seconds, when the Hi point becomes wet it will activate the motor and it will take 10 seconds of continual coverage of the probe sensor to make the relay close and start the pump. This is invaluable when the probe is in a turbulent part of a well where fluid is splashing around touching the sensors momentarily, and false activation cannot be tolerated.

### 3.1.3 DIP 6

DIP switch 6 controls the charge/discharge function. Set "ON" for charge, and "OFF" for discharge


### 3.2 Relay Contacts \& their Applications

### 3.2.1 Contacts $15,16 \& 18$

Contacts 15,16 , and 18 are used for electronic or visual notification of a change in state at the pump itself. Contacts 15,16 , and 18 are used for more advanced applications because they are a changeover relay, their state may be the same as contacts 25,28 or the opposite. Both sets of contactors are triggered simultaneously. An example is when in discharge mode, (see Figure 1).
You have a gravity flow coming in so the fluid reaches the lower sensor PB1, contacts 15 and 18 are open ( 15 being common to both contact 16 and 18) contacts 25 and 28 are also normally open but contacts 1516 in this current situation are closed, whether PB1 is wet or dry is of no concern all will stay the same. The level now rises to PB2 and both relays change state, contacts 25 and 28 close to turn on the pump, contacts 15 and 16 are open, with 15 and 18 closed.

In advanced applications this state change may be fed into a logic device to indicate the pump is running or the pump has stopped and perhaps light an LED or incandescent light source for visual confirmation that a change has occurred in the relay.

### 3.2.2 Contacts 25 \& 28

Contacts 25 and 28 are used to control pump states. Contacts 25 and 28 are mostly used for tuming on motors via a starting relay or solenoid, so, these sets of contacts react to the rising or falling levels of the fluid inside the tank, they will operate to turn on a pump in discharge mode when the top sensor is wet and in charge mode tum on the pump when the bottom sensor is dry.

## 4 Practical Overview

### 4.1 Discharge Mode - DIP switch 6 set to "OFF"



Figure 1 - Discharge Mode
Figure 1 shows two probes, (PB1 connected to Lo and PB2 connected to Hi ). The pit is mostly underground and there is a gravity-fed inlet at the top left-hand side. The pit is empty with PB1 completely dry. Dipswitch 6 is set to "OFF."


The relay operation depends on the electrical conductivity of liquid in the pit, i.e. no liquid = no current flow. The level starts to rise and covers PB1.

This is a discharge operation so we do not want the relay to close and start a pump until the well is full so as the water rises it reaches PB2, the relay closes and the pump starts. The level now drops below PB2 but the pump still continues to run, the level continues to drop below PB1 the relay opens the pump stops.

### 4.2 Charge Mode - DIP switch 6 set to "On"



Figure 2 - Charge Mode
Note: $\quad C$ " is connected to common bonded earth. The unit will not operate correctly if not earthed.
Let's look at the same relay but in a tank that is charging (DIP 6 is now on). See Figure 3, where liquid is being pumped into a tank, and discharging through a gravity feed, the tank is on steel stands " $x$ " metres above the ground.


With the tank full, PB1 and PB2 will be wet, the relay is off, and the pump has stopped. Water is slowly fed out from the bottom, and now as PB2 (HI) becomes dry nothing happens; the water now drops to below PB1 (Lo), and the pumps restarts to fill the tank.
The pump will continue to fill the tank until PB2 (HI), becomes wet again.

### 4.3 MTRA Relay with Alarm (Discharge Applications Only)



Figure 3-MTRA Operation MTIRM形RA Installation \& Troubleshooting

The MTRA relay works in the same way as the MTR relay except the MTRA has a separate alarm output, and does not have a charge mode. The planned application is to close a contact to illuminate a warning alarm light. . Various other applications have included introducing a third probe to latch another relay.

In Figure 2 we see three probes in a pit that is plastic, note the steel rod in the tank. (In a plastic vessel a steel rod must be used to create an earth retum in the liquid so probes can function.) PB1, PB2, and PB3 are dry, and the relay power LED is on. When water enters the pit and wets PB1, nothing happens, water now reaches PB2 causing contacts 13 and 14 to close, the pump LED to light, and the water to drop.

If, for example, the pump has its inlet partially blocked, the level continues to rise and wets PB3. This closes a separate relay that can activate a red flashing light, an audible fog hom or send a 5 volt pulse into another device with the common cause to warn human beings that a spill is due to occur. If the pumps become unclogged and PB3 becomes dry the alarm opens again and breaks the circuit that stops the light from flashing or the foghorn from sounding.

## 5 Most Common Installation Problems

The relay requires a path between the probes to earth through the liquid. If you are testing in a plastic bucket, have installed the probe in a plastic tank or have no good earthing in the vessel you will need to install a separate earth and make sure all earth bonding comes back to the C terminal. Most problems like these are traced back to a lack of or poor earthing, or open circuits in the probe wiring.
Now is the time to check the relay by using "the bridge testing line technique" remember you must simulate a fluid flow to correctly ascertain a good relay or a bad one. (All DIPswitch settings from 1 to 6 should be off.)
Cut two pieces of insulated flexible copper wire one black one red 250 mm long, strip both ends back 10 mm on both cables, and join one black end and one red end. Insert the joined ends into C on the relay box, observing all safe electrical practises. You should have one black wire and one red wire free.

Set your relay for discharge mode (DIP switch 6 is off) with no sensors connected to the unit, connect the red wire to Lo - nothing should happen (if it does retum the relay for replacement or repair*). Now connect the black wire to the Hi terminal the relay activated LED should light instantly (if it does not, the relay should be returned for repair*).

## 6 Troubleshooting

| I have checked all the DIPswitches and settings but in discharge mode as soon as the bottom sensor gets wet the pump turns on then tums off almost straight away. | - This is the most common problem encountered with relay set up and commissioning, the probe in the bottom of the tank is wired into the Hi terminal instead of the Lo terminal. |
| :---: | :---: |
| The installation went fine but now and again the pump will not tum on even though I am sure the probe ls wet. | - Check the sensitivity level sel on the relay, some times the level is set for foul water but due to changes in the flow the water becomes grey or clear, try changing the setting from 20 KO to $80 \mathrm{~K} \Omega$ and monitor the results carefully. |
| All wiring is complete and all DIPswitches have been checked but the pump will not tum on at all. | - If you have completed the test schedule for the relay and it passed then check the wiring to the sensors - for this is now where the problem lies or in the earthing arrangements. If possible check the resistance between the sensor cable and the steel sensor on the probe to prove a solid connection. |

* Please contact your distributor or agent before returning any product for repair or warranty claim.



## The MultiTrode Probe

MultiTrode probes are unsurpassed for rugged reliability, cost effectiveness and simplicity. Designed for the tough, turbulent conditions found in water, sewage and industrial tanks and sumps, the probes can be found in the simplest and the most complex water and wastewater management systems around the world.

- Low maintenance
- Simple installation
- Excellent in turbulence
- Short \& long term cost savings
- Environmentally friendly
- Safe, low sensing voltage
- Unaffected by fat, grease, debris and foam
- Positive pump cut-out
- Safe - MTISB Barrier


## Reliable in all conditions

Operation is unaffected by build up of fat, grease debris and foam, which causes other systems such as floats, bubblers, pressure and ultrasonic transducers to fail. Turbulence does not affect the probe operation. The rugged, streamlined design eliminates tangling and is ideal for confined spaces.
Positive pump cut-out
Operational consistency is important to longevity, low maintenance and cost control. The positive pump cut-out ensures pumps are turned off at the same level every time. This avoids damage due to pump over run and the cost of additional control equipment.
Safe for people and environment The extra low sensing voltage ensures operators and maintenance staff are protected. All MultiTrode products are environmentally safe, containing no mercury or other harmful contaminants.

## Cost savings

The low cost of equipment, installation and maintenance makes MultiTrode one of the most efficient level control systems available. Plus robust construction and longevity ensures continued cost savings when compared to other systems on the market.

## Standard and custom probes

MultiTrode manufactures a wide range of standard probes, from a single sensor $(200 \mathrm{~mm})$ to a ten-sensor probe $(1000 \mathrm{~mm}$ increasing to a maximum of nine metres). Custom probes can be manufactured to suit your requirements.

## Installation

Installation is straightforward. Probes are easy to install without entering the wet area. The probe is simply lowered in from the top and suspended by its own cable, using the mounting kit supplied.

## MTAK-1 Mounting Kit (Supplied)

The mounting bracket is a standard accessory supplied with all multi-sensor probes (not standard with 0.2/1-xx single sensor probe).
The MTAK-1 mounting bracket has an integral cleaning device. All metal components are stainless steel.


## MTAK-2 Mounting Kit (Optional extra)

This extended bracket provides up to 300 mm extra wall clearance. This bracket is not included as standard with probes.


## Ordering Examples and Information

| Model <br> Code | Probe <br> Length <br> $(\mathbf{m} / \mathbf{i n})$ | Sensor <br> Separation <br> $(\mathbf{m m} / \mathbf{i n})$ | Cable <br> Length* <br> $(\mathbf{m} / \mathrm{ft})$ | Number of <br> Sensors |
| :---: | :---: | :---: | :---: | :---: |
| $0.2 / 1-10$ | $0.2 / 8$ | $\mathrm{~N} / \mathrm{A}$ | $10 / 33$ | 1 |
| $0.5 / 3-10$ | $0.5 / 16$ | $150 / 6$ | $10 / 33$ | 3 |
| $1.0 / 10-10$ | $1 / 40$ | $100 / 4$ | $10 / 33$ | 10 |
| $1.5 / 10-30$ | $1.5 / 60$ | $150 / 6$ | $30 / 100$ | 10 |
| $2.0 / 10-30$ | $2 / 80$ | $200 / 8$ | $30 / 100$ | 10 |
| $2.5 / 10-30$ | $2.5 / 96$ | $250 / 10$ | $30 / 100$ | 10 |
| $3.0 / 10-30$ | $3 / 115$ | $300 / 12$ | $30 / 100$ | 10 |
| $6.0 / 10-30$ | $6 / 224$ | $600 / 24$ | $30 / 100$ | 10 |
| $9.0 / 10-30$ | $9 / 368$ | $900 / 40$ | $30 / 100$ | 10 |

*Cable Length $10 \mathrm{~m} / 33 \mathrm{ft}$ or $30 \mathrm{~m} / 100 \mathrm{ft}$

| Probe Length <br> (meters) | Sensor <br> Points | Cable Length <br> (meters) |
| :---: | :---: | :---: |
| 2.5 | 10 | 10 |

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MultiTrode Inc • USA
6560 East Rogers Circle
Boca Raton Florida 33487
Tel: +15619948090 Fax: +1 5619946282
sales@multitrode.net

| Product: | MultiTrode Probe |
| :--- | :--- |
| Notes: | Correct probe installation and troubleshooting |

## Probe Installation \& Troubleshooting

## 1 Correct Probe Installation

### 1.1 Important Notes

- Hang probe in turbulent area of wet well
- Do not install the probe in a stagnant area or comer where grease and debris may collect. Stilling wells are not suggested.
- Ensure a minimum of 300 mm ( 12 inches) clearance from any surface
- Ensure bottom of probe is 12.5 mm ( $1 / 2$ inch) above minimum pumping level
- Do not use the bottom sensor as earth or ground
- The Probe cable must be buried (outside the well) in a separate metal conduit and shielded for correct operation of the level-sensing device
- Most pits are adequately earthed or grounded and do not require any reference rods, however PVC or Fibre Glass Tanks without pumps or metallic grounded pipe require reference rods

2 Probe Location


Figure 1-Locating the probe in the vessel
The MultiTrode probe is designed to be supported on its control cable (see Fig.1) from the Suspension/ Cleaning bracket supplied with the probe. It is desirable for the probe to be located near the inflow in a reasonably turbulent area of the wet well.

The inflow should not be allowed to run directly on to the probe, but the surface agitation of the inflow area is beneficial in keeping the probe clean. Before deciding on the probe location, the wet well should be pumped down as far as possible and the probe suspended from its approximate position to ensure that adequate clearance exists from objects in the pit. A minimum of 300 mm ( 12 inches) clearance should be maintained from any conductive surfaces.

Application Note
AN55-2

| Product: | MultiTrode Probe |
| :--- | :--- |
| Notes: | Comect probe installation and troubleshooting |

## 3 Mounting

Fix the Suspension/Cleaning Bracket (Fig.1) on to the inside of the wet well, ensuring the clearance form covers and the ladder access. To mount the probe, first thread the cable through the stainless steel hook provided. Place the hook onto the mounting bracket or eyeball and adjust the cable length until the bottom of the probe is $12.5 \mathrm{~mm}\left(1 / 2^{1 /}\right)$ above the minimum liquid level.

Fasten the cable to the hook using cable ties. Draw the loose end through the conduit to the control panel.

## 4 Cleaning

Provide sufficient slack in the cable to allow the probe to be drawn through the cleaning bracket (Fig.1), or taken out of the well for cleaning. MultiTrode systems are designed so that the need for probe cleaning is greatly reduced or eliminated. This is achieved by correctly, positioning the probe and selecting sensitivity on the level controller.

## 5 Accessories

### 5.1 MTAK 2 Extended Mounting Bracket

The MTAK-2 (Fig.2) is an optional extra. It is made from $2.5 \mathrm{~mm}\left(1 / 8^{n}\right) 3 / 16$ stainless steel and can be used with all multi-sensored probes to give a greater, free-swinging area. It has an in-built squeegee blade style probe cleaner and includes stainless steel hook and cable ties.


Figure 2 - MTAK 2 Extended Mounting Bracket Kit

## 6 How the MultiTrode Probe Works

As the level rises and contacts the probes sensor/s a circuit is completed.


Figure 3 - How the probe works

Application Nơte

| Product: | MultiTrode Probe |
| :--- | :--- |
| Notes: | Correct probe installation and troubleshooting |

## 7 Probe Theory

The probe is manufactured from uPVX moulded Housing incorporating 2 sensor points of Avesta 254 SMO high-grade stainless alloy.
The probe has no moving parts and no electronic components inside; the probe utilizes the conductive state of the liquid to complete a circuit.
If tank is PVC or fibreglass and has no metal grounded objects such as pumps, then the system will need a ground reference rod. Multitrode suggests a 6 mm stainless steel rod suspended in liquid, then grounded.

## 8 Trouble Shooting

| Controller falls to activate (when expected) | Remove probe connection from controller <br> - Short circuit the probe inputs on the controller to ground, start with p10 working your way down to p 1 |
| :---: | :---: |
| Does the controller activate? | No, Setup problem or actual faults on controller - go to trouble shooting guide or the product manual <br> Yes, This means controller functional - while the probe (or probe segment) is immersed measure the resistance to ground of that sensor with a high $\Omega$ resistance meler. <br> Is it open circuited? <br> - Yes - end of issue - wires faulty - check for damages cables <br> - No - Check grounding on earth rod in pit, and grounding on Controller, check for earth continuity across installation <br> Note: Extemal contamination such as excess oil can insulate probe in aneas such as wash down plants and workshops for diesel motors. |
| Pumps activate prematurely | Check sensitivity setting on controller. Set to next lowest setting. <br> Note: $\quad$ This is caused by extemal contaminates of sticky composition, and also very conducfive - can cause premature activation in some industrial applications. |
| Excessive fat build-up on probes | - Move probe to a more turbulent area of pit, preferably close to inflow |
| Probe works erratically | Check any junctions in probe cable, especially where moisture can penetrate. <br> Note: Running the probe cable in the same conduit as pump power cables can cause inductance into probe cable and give false readings. |
| High alarm activates after some delay when sensor is immersed | Check build-up on sensor - clean <br> Note: $\quad$ This may be caused by some areas containing heavy sludge such as finals of treatment plants, the sludge can, over extended time, dry out over sensor. A delay of 20 to 60 seconds can be experienced due to moisture slowly penetrating build-up. Increasing sensitivity will also remedy the problem. |



Visit http://www.multitrode.com/for the latest information

### 6.2 Maintenance Procedures

This product is designed to operate under specific environmental, supply and load conditions. Should these conditions change, consult a licenced electrician or electrical engineer before operating this product.

These procedures are to be performed only by a licenced electrician as they may expose live equipment.

The Switchgear and Controlgear Assembly is essentially maintenance free, however the following safety measures and routine maintenance is recommended.

- Where fitted, ensure cabinet vents and filters are clear and clean.
- During operation, ensure all doors and covers are secure and closed.
- All faults are to be investigated and repaired by an appropriately licenced electrician.
- All components to be operated in accordance with manufacturers data.
- The protective devices within switchboards are designed to operate in the event of a short circuit or overload condition. In the event of these devices operating under such conditions the device or devices must be inspected and tested by a suitably trained person to ascertain its condition prior to reconnecting the protective device to the supply.


## Periodic checks should ensure

- The switchboard is clean and free of any contaminants, which could reduce the insulation properties of the switchboard.
- All entries are seajed to ensure no vermin can enter.
- There is no evidence of overheating, arcing or moisture.
- The earthing system is maintained and is adequate to allow correct operation of protective devices.
- Insulation resistance is maintained to appropriate levels.
- Check terminations for correct tension.
- Test operation of protective devices.
- Re-calibrate instrument loops as required.

Refer to AS-CONSTRUCTED electrical drawings for details of protection equipment settings.

No special tools or equipment are required to perform routine maintenance.

## CUBICLE FAN TYPE

## FAN TYPE:

COSMOTEC
MODEL GKV 3000-220 + GKF - 30


The SARI 2 is a combined monitoring device for motor insulation resistance and seal oil water content for sewage water pumps.
The SARI 2 is small and easy to install. It provides local warnings as well as relays the data to all major control and monitoring outstations like PumpManager 2000.

## OPERATION

The SARI 2 monitoring device supervises the insulation resistance of motor stator windings. The SARI 2 is simply wired between one of the mains phases and ground. The resistance is measured when the motor is stopped and disconnected from the mains. While the motor is running, the monitoring is halted and the latest measurement is valid until the pump stops again.
The SARI 2 also continuously monitors the water content in the seal oil chamber when connected to a proper oil conductivity probe with the standard $4 \ldots 20 \mathrm{~mA}$ output. Grundfos highly recommends to use the most modern OCT 1 oil condition transmitter, that easily bolts on to large Grundfos sewage pumps.
The monitoring function can be limited to only one type of use, if required. The SARI 2 is normally mounted on an DIN rail of the pumping station's control panel.

NOTE Please note, that the insulation resistance monitoring can not be used with pumps continuously connected to frequency converters. The internal resistance of the converter itself disturbs the measurement.

## INSTALLATION

The SARI 2 is intended for both stand-alone alarm use and for interfacing with a remote monitoring system.

## STAND-ALONE USE

For the stand-alone use the two separate alarm limits can be locally adjusted from the control knobs. The SARI 2 has one green and one red indication lights for each control: In the stand-alone use the lights indicate the measured value in respect to the alarm limit as described in the table beside. Normally, when the pump is fully operational, both the green indication lights are continuously on.
The SARI 2 has a local alarm output, which is a potential free, normally open relay contact. The output is common to both controls. This can be used for relaying the alarm and/or for stopping the operation of the pump.

The SARI 2 provides detailed information on the condition of the winding insulation as well as on the seal leakage before alarm levels are reached. This again provides an early warning for maintenance and enables prediction of the required service actions.



## USE WITH REMOTE CONTROL \& MONITORING

Additionally, the SARI 2 monitoring device has a transistor output giving a pulse width modulated information on both measurements for the PumpManager 2000 or other suitable telemetry system.
The PumpManager 2000 continuously receives the measured data, compares them to the pre-set alarm limits and stores into the local memory. The alarms are given within seconds at the display and the control lights. They are also provided to the alarm relays of the PumpManager 2000 outstation as well as to the manager system, if used. In this configuration the alarm limits are set at the outstation as parameters and the control knob adjustments are not valid. Therefore, when the SARI 2 is used in conjunction with the PumpManager 2000, it is recommended not to use the alarm relay of the SARI 2 for stopping the pump. Including the measurements from the SARI 2 requires modification in the standard program of the PumpManager 2000.
The stored data can be further relayed to the manager system for the trend analysis by the manager system software. The values are daily averages of the measurements.

## CONTROLS

Both insulation resistance and seal oil condition measurements have control knobs for adjusting the alarm limits for the stand-alone use.
The setting range for seal oil condition is $5 . . .60 \% \mathrm{H}_{2} \mathrm{O}$. The recommended alarm limit is $20 . . .40 \%$.
The setting range for insulation resistance is $100 \mathrm{k} \Omega . .10 \mathrm{M} \Omega$. The recommended alarm limit is 2...5M .

## FREQUENCY CONVERTER USE

The continuous use of frequency converters prevents motor winding insulation resistance monitoring with the help of SARI 2 monitoring device. The SARI 2 is wired between one of the mains phases and ground. The resistance is measured, when the motor is stopped and disconnected from the mains. Therefore in installations, where the pump is continuously connected to a frequency converter, the measurement may present the resistance of the converter instead of the motor.


The content may vary due to continuous product development.

## DEMAG

Cranes \& Components

## C

## Operating instructions

Demag chain hoist DKUN 2 - DKUN 5 - DKUN 10 - DKUN 16 - DKUN 20


## Manufacturer

## Demag Cranes \& Components GmbH

P.O. Box 67 - D-58286 Wetter

Telephone ( $+49 / 2335$ ) 92-0 : Telefax $(+49 / 2335) 927676$
www.dernagcranes.com

Please fill in the following table before first putting the chain hoist into service. This provides you with a definitive documentation of your. Dernag chain hoist and important information if you ever have to contact the manufacturer or his representative.

| Owner |
| :--- |
| Where in use |
| Model |
| Serial number |
| Main/creep hoist motor number |
| Main hoist motor number |
| Travel drive unit nümber |
| Operating voltage |
| Control voltage |
| Frequency |
| Wiring diagram number |
| Direct control |
| Contactor control |

## Accompanying documents

Component parts:list for Demag chein hoist

| DKUN 2 | 22250144 | 721 15817 |
| :---: | :---: | :---: |
| DKUN5 | 22250644 | 721 IS 817 |
| DKUN 10 | 22251144 | 721 IS 817 |
| DKUN 16 | 22254644 | 721 IS 817 |
| DKUN 20 | 22251644 | 721 IS 817 |
| DSK Assembly instructions | 20648544 | 720:18951 |
| Component parts list for DSK control pendant | 222.380 .44 | 721 IS 951 |
| Assembly instructions DST | 20616544 | 720 is 951 |
| Component parts Ifst for DST control pendant | 22214244 | 721 is 951 |
| DSE assembly instructions | 21421444 | 720:15 951 |
| Technical data for DSE control pendant | 20311944 | 714.15951 |
| Test and inspection booklet for Demag chain hoist | 21426044 | 720:IS 817 |
| Technical data |  |  |
| Demag chain hoist DKUN 1-20 | 20284644 | 714 IS 817 |
| RU/HU/EU DK assembly instructions | see page 54 |  |
| Assembly - Adjustment - Dimensions |  |  |
| RKDK-EKDK low-headroom.monorail hoist | 20287644 | 714 IS 817 |
| CF 5 Techinical data - Assembly - Component parts | 20332944 | 714 IS 845 |
| CF 8 Technical data - Assembly - Component parts | 20320944 | 714 IS 845 |

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## 0 Foreword

## C $\epsilon$

You have purchased a Dernag product.
This chain hoist was manufactured in äccordance with German and European standards and regulations, e.g. EC. Machinery Directive $98 / 37 / \mathrm{EC}$, and state-ofthe art engineering principles.
Demag electric chain hoists are of modular design.
The main assemblies include:

- the gearbox
- the hoist motor
- the integrated electrics
- the chain drive mectranism
- the control pendant

These operating instructions are designed to provide the operator with appropiriate instructions for safe and conrect operation and to faciltate maintenance.
Every indivdual given the task of trensporting, instaling, commissioning, operathg, maintaining and reparing our chain hoists and additional equipment must have read and understood

- the operating instructions
- the safety regulations and
- safety instructions in the individual chapters and sections.

The operating instructions must be availabie to the operating personnel at all times in order to prevent operating emors and to ensure smooth and trouble-free operation of our products.

### 0.1 Copyright

These operating instructions must be treated confidentially. They should only be used by authorized personnel. They may onty be entiusted or made available to third partes with the prior witten consent of Dernag. All docurnents are protected within the sense of copynght law.
Nó part of this documentation may be reproduced, utilized or trensmitted without specific prior consent. Infringements are an offence resulting in obligatory compensatory damages.
All industrial rights reserved.

### 0.2 After-sales service

Our after-sales service will provide you with all tectinicad information on Demeg products and their systematic application.
Should you have any questions regarding our products; please refer to one of our after-sales service stations, the relevant representative or to our main office.
Kindly quote the senal or order number (see test and lisispection bookdet, chain hoist data plate) in any correspondence or for spare part orders.
Specitying this clata ensures that you receive the correct information or the required spare parts.
The relevant after-seles service station of Demag is specified for example on the back page of the test and inspection booket.

### 0.3 Liability for defects

### 0.4 Limitations of liability.

These operating: instructions must be read carefully before installing and putting chain hoists into operation.
We assurne no liability for damage and maffunctions resulting from failure to comply with the operating instructions.
Any liability claims for deficts must be made by quoting the order number immediately on detecting the defect:

Liability claims for defects are void in the event of:

- inappropriate use,
- faulty devices or equipment connected or attached to the chain hoist which are not partol our scope of supplies and services,
- use of non-genulne spare:parts and accessories,
- refubishment or modification of the chain hoist unless approved in writing by Demag.
Wearing parts are not subject to liability for defects.

All technical information, data and instrictions for operation contained in these operating instructions were up-to-date on going to print and are compiled on the basis of our experience and to the best of our knowledge.
We reserve the night to incorporate technical modifications within.the scope of further development of the hoist units which are the subject of these operating instructions. The information, illustrations and descriptions contained in these operating instructions are therefore orily intended for information purposes.
The descriptions and illustrations contained in this docurneritation do not necessarily correspond to the scope of delivery or ary subsequent:spare part delivery, either, the drawings and illustrations are not to scale.
Only documentation belonging to the actual order is valid.
We assume no liability tor defects, damage: and malfunctions caused as a result of operating errors, noncompliance with these operating instructions or omitted and/or inappropriate repairs and maintenance.
We expressly point out that only Demag spare parts and accessories approved by us may be used: Accordingly, this also applies to other manufacturers' parts supplied by us.
For satety reasons, the fitting and use of spare parts or accessories which have not been approved and unauthorized modification and conversion of the hoist unit are not permitted; we assume no liability for defects or damages resulting therefrom.
With the exclusion of eny further claims, our liability for defects and other liability obligations for any defects pertaining to the products supplied or fauts in the documentation delivered or any negligence on our part are exclusively based on the stipitations of the original contract. Any further claims, in particular any and all clams for damages, are excluded with the exception of legal claims in accordance with product liability legisiation.

### 0.5 Definitions

## Owner

Owners (employer; company) are defined as persons who own chain hoists and who use them appropriately or allow them to be operated by suitable andinstructed persons.

## Operating personnel

Operating personnel are defined'as persons entrusted by the owner of the chain hoist with operation and/or transportation of the equipment.

## Specialist personnel

Specialist personnel are defined as persons assigned by the owner to carry out special tasks such as instalation, setting-up, maintenance and faut elmination.

## Qualified electrician

Qualified electricians are defined as' persons, who, owing to their technical training, knowledge and experience of electrical installations as well as knowledge of the relevant standards and regutations, are able to assess the tasks given to them and identify and eliminate potential hazards.

## Trained person

Trained persons are defined as persons who have been instructed and trained for the tasks assigned to them and on the possible hazards resulting from incorrect handling and who have been informed about the required protective devices, protective measures, relevant regulations, codes of practice, accident prevention regulations and operating conditions and who have proven their qualifications.

## Experienced tectinician

Experienced technicians are defined as persons, who, owing to ther technical training and experience, have sufficient knowledge of chain hoists and are familiar with the relevant national industrial safety regulations. codes of practice, accident prevention regulations, directives and generaly accepted engineering standards enabling them to judge the safe operating condition of chain hostts.

Qualified electricians are defined as persons who, owing to their technical training, knowledge and experience of electrical installations as well as knowledge of the relevant standards; codes of practice and regulations, are able to assess the tasks given to thern and to identify and elminnate potential hazards.

Assigned expert engineer (in the Federal Republic of Germany according to BGV D8 $\$ 23$ (VBG 8); for determining the S.W.P.)
An assigned expert engineer is defined as an experienced technician specifically assigned 'by the manufacturer to 'determine the remaining duration of service (service life) of serial hoists and for carying out general overhauls of chain hoists (S.W.P. = safe working perioct).

## Authorized expert engineer (according.to BGV D6 § 28 (VBG 9))

In addition to the expert engineers'of the Technical Supervisory and Inspection Board; an authorized expert enginger for the inspection of chain hoists is defined as an expert engineer authoized by the Industrial Employers' Mutual Insurance Association.

## Chain hoists

Chain hoists are systems used for lifting and moving loads, such as cranes, crabs and travelling hoist units, rail systems.
-VBG (BGV DG) = Geminan Industial Emplojers' Mutual lnsurance Association respongible tor the provantion of eccidents

## 1 Safety instructions

### 1.1 Symbols

These symbols are used throughout the operating instructions in order to visteally indicate hazard wamings.

$\triangle$
Saftey at work symbol
Thts symbor appears in the operating instructions next to all instructions relating to safety at work whierever a potential denger to life and:limb exists.
Followi these instructions at all times and be perticularty carefuland cautious.
Pass on safety instuctions to all persons entrusted with working on the chain hioist. In addition to thie safety instructions, observe all general safety regulations at all times.

Waming against electrical hazards
Contact with live parts can result in immediate death. Protective covers e.g. covers
and enclosures) marked with this sign may only be opened by qualified electricians:
Before opening ali relevant operating, contro, fead or other voltages must be disconnected.


Warning against suspended load
Ary person rervaining in this danger zone may suffer serious infury or death. This applies in particular to non-positive locked load handing a atachmentse.g. magnet and vacuum systems. In each case the special safetyand poperating. instructions contained in the operating instructons for the load finaliting attachment in question must be compled with.

Operating hazard for the'installation
This symbolin the operating instuctions indicates al warnings whict, it not complied with, may resilt in damage to the chain hoist or the load.

- Electric chain' hoists are only intended for fifting and moving loads and may be used" as stationary or travelling units.
"(4) EGectric chain hoisists may only be operated when in perfect wording order by trained
Tis, personnel In accordance with the retevant safety and accident prevention regulations.
If t This also includes complance with operating and maintenance conditions specified in the operating instructions.
Chain hoists are industral equipment designed to be used with a rated voltage of up to $690 . \mathrm{V}$ for attemating curent.
Power, feed is via power supply lines (moblie cables, open or enclosed power conductor systems; cable duuns). These systems are live up to the terminals of the isolating switch (mains connection switch, isolating switch), The relevantisolating switchmust.be switched of when pertorming maintenance/repar work.
- "During operation or when the main switch is not switched off, electrical components inside enclosures, motors, switchgear cabinets; terminal boxes, etc., carry dangerous voltages. This voltage may cause fatal injuries.
Serious personal injury or damage to property may occur in the event of:
- unauthoized removal of covers.
- inappropriate use of the chain hoist,
- incorrect operation,
- insufficieient maintenarce,
- exceeding the maximum permitted load
(The rated load capacity/S.W.L. is the maximum permitted load: Pay attention to the sum of the load to be lifted and the load handling attachment.),
- working on live parts.

Advise operators to avoid inching as far as possible. It might cause excessive wear' and premature fallure of the chain holst. Inching means giving short pulses to the motor to obtain small movements, e:g. when lifting loads or moving the travelling

### 1.3 Prohibited practices



Certain work and practices are prochibited when using the chain hoist as they may involve danger to life and limb and result in lasting damage to the chain hoist, e.g::

- Unsafe load hardling (e.g. swinging the load).
- Do not handle suspended loads above persons.
- Do not pull or drag suspended loads at an angle.
- Do not pull free fixed or obstructed loads with the chain hoist.
- Do not exceed the maximum permitted load and permitted load dimensions.
- Do not leave:suspended loads unsupervised.
- Do not allow the chain to inn over edges.
- Do not use the chain as a load bearing sling.
- Always move the chain hoist with puish travel trolley by pulling on the load, bottom block or load hook assembly - never pull on the control pendant.
- Do not allow loads to drop when the chain is in a slack condition.
- Do not subjact the control pencidant to inappropriate mechanical loads.
- Transporting persons, unless ifting devices are specifically approved for transporting:persons, is not permitted.
- Do not tamper with or manipulate electrical equipment.
- Chain hoists must be suspended in such a way that they do not collide with stationary equipment and structures, e.g. when slewing jib cranes are slewed.


### 1.4 General safety information



Persons under the influence of drugs, adcohol or medicines which affect reactions must not instail, operate, put into service, maintain, repair or disassemble chain hoists:
Any conversions and modifications to the installation require the witten consent of Demag.
Work on electrical equipment of chain hoists may only be camed out by qualifed electricians in accordance with electrical regulations. In the event of malfunctions, chain hoist operation must be stopped; the hoist switched off:and the relevant main switches locked immediatery. Defects must be rectified immediately.
National accident prevention regulations and codes of practice and general safety regutations must be observed whèn operating our products. Important information and instructions are marked by corresponding symbols. Follow these instructions andor safety regulations in order to avoid accidents and damage. The operating instructions must be kept available at the place where the chain hoist is in use at all times. They incude sigrificant aspects and appropriate excerpts from the relevant guidelines, standards and regulations. The owner must instruct his personnel appropriately.
Any failure to comply with the safety instructions stated in these operating instructions can result in death or personal injury.
'Observe general statutory and othèr óbligatory regulations relating to accident prevention:and emvironmental protection and basic heath and safety requirements in addition to those included in these operating instructions. Such requirements may also relate, for example, to the hañlling of hazardous materials or the provision/ wearing of personal protection equipment. Comply with these regulations and general accident provention regulations relevant for the place at which the chain hoist is used and follow the instructions theref: when workng with the chain holst. The chain hoist may still constitute a danger to life and limb if it is not installed, operated, maintained or used appropiatefy by personnel which have not been trained or specially instructed. The operating instructions must, if required, be supplemented by the owner with instructions and infomation (e.g. factory regulations) relating to organization of work, working procedures, operating personnel, etc. Supervising and reporting obligations as well as special operating condifions must also be taken into consideration.
Personnel assigned to woiking with the chain hoist must have read and understood the operating instructions and, in particular, the chapter on safety information.
All activties relating to chain hoists which are not described in these operating instructions may only be carrled out by specialist personnel specifically tralned for the particular chain hoist.
The owner must ensure that personnel work in a safety and hazard-conscious manner in compliance with the operating instructions.

The owner must ensure that the chain hoist is only operated when in proper working order and that all retevent safety requirements and regulations are complied with.

- Chain hoists must be taken out of service immediately if functional defects or irregularities are detected. In the event of a stoppage le.g: "It defects regarding safe and reliable operation äre detected; in emergency sítuations, in the ovient of operating malfunctions, for repairs and maintenance purposes, if damage is detected or after finishing work), the operator/expenenced technician must cany out all prescribed satety measires (e.g. for cränes operating outdoors; ensure wind drift satety catch is fitted) or observe that they are automatically carried out. Personal protective clothing must be worn as necessary or as required by regulations. Personnel must not wear loose clothing, lewelléry, inclurding rings or long hair loose Infiuy may oocur, for example, by being caưht of drawn iñto the mechanism. An safety and hazard information and recommendations on the chain hoist, at access points and mains connection switches must be maintained in complete and legible condition: Inching (i.e. giving shor pulses to the moton) must always be avoided.Emergency limit stop devices (e.g: slipping ciutch or emergency linit switch) must not be approached in nomal operation.
Modifications, additions to and conversions of the chain hoist which may impair safety in any way must not be caried out withour the consent of Demag. This also epplies to the installation and adjustment of safety devicess as well as for porforming welds on load bearing parts. Safety devices must not be rendered inoperative: Only genuine Demag spare parts may be used: Observe prescribed deadines or those specified in the operating instuctions for routine checks/inspections.


### 1.5 Selection and qualification of operating personnel

For independent operation or maintenance of tiechain hoist, the owner may only employ persons

- who are at least 18 years of age,
- who are mentally and physically suitable.
- who have been instructed in the operation or maintenance of the chain hoist and have proven their qualification to the owner in this respect (n) addition to theoretical training, instruction elso inclüdes sufficient practical operating experience: as well as acquining the ability to identify defects which are a hazard to safe operation),
- who can be expected to cairy out the work assigned to them reliably.

The owner must assign operating and maintenance personnel to their relevant tasks.

## - $x^{2}$

- Installation and disassembly work may only be performed by experienced technicians.
- Installation and disassembly work must be coordinated by the persorn carirying out the work and the owher within the scope of their responsibility.
- The working and danger zone must be made sate:
- The instalation must be isolated in accordance with the relevant electrical regulations.
- Customer-specific regulations must be observed.
- Only appropriate, tested and calibrated tools and equipment may be used.
- The electrode hidder and earth must be connected to the same assembly when welding work is cartied out. If the current flow is retumed via protective conductors, screening elements or anti-fnction beanings, serious damage may be caused to these or other components.


### 1.7 Safety insstructions when first putting the hoist into serviceiafter completing installation <br> 

### 1.8 Safety instructions for operation

- The working and danger area must be made safe.
- First check that the voltage and frequency specified on the data plates match the owner's mains power supply.
- All clearance dimensions and safety distances (see approval drawing) must be checked before putting the hoist into service.
- When putting the hoist unit into service, it may be neciessary to perform work in the danger zone.
- In the course of putting the hoist unit into service, it may be necessary to temporanity render safety devices or features inoperative.
- It must be ensured that only trained personnel are employed for putting the hoist unit into service:

The operator must check the function of the brakes and emergency limit stop devices before starting work.
All instructions and measures described in the operating instructions with regard to safe operation and items concerning general safety and accident prevention which have to be observed before; during and after putting into service must be strictly complied with. Ary failure to comply can lead to accidents resulting in fatalities. Chain hoists must be taken out of service immediately or not put into operation if any defects relating to operating safety and reliability are detected. Satety devices must not be rendered inoperative or modifed in contradiction to their intended use. Orly operate chain hoists when anf protective devices and safety-retevant equipment, e.g. movable protective devices and emergency-stop devices, are fitted and fully functioning.
Anybody who identifies an ummediate danger of personal injury must actuate the emergency-stop button without delay. This also applies in the case of damage occuring to parts of the installation and equipment which makes immediate stoppage necessary. After an "emergency-stop"; the operator must not switch on and restart the chain hoist until an experienced tectricianitis satisfied that the cause which led to actuation of this fuinctionthas beien rectified and that continued operation of the installation constitutes no füther hazard.
Chain hoists must be switched of immediately in the event of the following faults:

- In the event of damage to electrical devices and cables as well as parts of the insulation.
- In the event of brake and satety device failure.
- The chain hoist is provided with a slipping clutch às overload protection.

In the event of overload, the following situations may occuir:

1. The load is not lifted, the "slipping cutch responds.
2. The load is lifted, however ; atter switching of the 隹ting motion, the load slowity moves downwards. tn this case, the load must be immediately deposited by actuating the control switch.

- Malfunction: The slipping ciutch must be readjusted or overload has occured.

Before:switching on/putting into operation of the chain hoist it must be ensured that nobody is endangered by operation of the hoist.
If the operator notices persons who may be exposed to a risk to health or personal safety by operation of the chain hoist; he must suspend operation immediately and may not resume operation again until the persons are outside the danger zone.


Before putting the chain hoist into operation, the operator musti be satisfied that the installation is in safe and correct operating condition.
Work on chain hoists may only be carried out when instructions to this effect have been issued; when operation and function of the chain hoist have been explained and when the working and danger zone has been made safe. Cooling devices, such as ventilation openings, may not be rendered permanenthy inoperative (e.g. covered or closed).
Special local conditions or special applications can lead to situations which were not known when this chapter was witten. In such cases, special safety measures must be implemented by the owner.

### 1.9 Safety instructions for maintenance

Maintenancómeasures are defined às regular mantenance inspoction and repair work.
Mechanical and electrical repars and mantenance work may onty be carried out by appropiattely trained personne (experienced technicians)

C
ve z Adustment, maintenanco and inspection activites and inspection deadines inctiding specifications conceming replacernent of parts/assemblies prescribed in the operating instructions must be observed.
Ensure that all electical components are deenergized betore commencing work on electrical instalations and dovices. When ail work on the chain hoist has been completed, operation of the crain hoist must not resume uintil the owner has given approval to this effect:
r
Unauthorized persons must be prochibited trom caring out work on machinery or parts of the chain hoist Béfore stanting allrepair and maintenance work, the chain hoist must be switched offitaken out of operation'and secured (switches must be locked against accidental or unauthonzed puting into operation (restarting). F . st It must be ensured that

- "the chain hoist is switched off and checked that it ts de energized and, in special cases, isolated,
- moving parts are stationary and stopped ty y yt
- moving parts cannot start moving while meintenance work being perfomed
- the power supply caniot be accidentally restored as long as the hoist unit has been taken out of service for maintenance and repair purposes.
- Ensure that operating end eupitiary materials as well as spare parts ary of in a safe and emvironmentally sound way.



Instructions for reparir, work in the course of operation
The danger zone must be marked of with redwhite safety chains or safoty tapeand indicated with warning signs. We Ty yex. In each individual case, the owner of the person specified by tim must check
twhether the retevant work may be carred of il In the course of operation without isk
4 co of, personal infury owing to the partioutar local conditions.
*To avoidiniury only use calibrated and appropiate toos and audilary materials for maintenance, inspection and fepair purposes $n \rightarrow$
Tift there is a risk of objects falling, the danger zone must be made safe. Maintain a sufficient safety distance to rotating paris to prevent dothing, parts of the body or hair becoming entangled 5


Avodid naked fames, extreme heat and sparks in the vicintity of cleaningogents and flammable parts or perts labie to deformation (eg wood plastic parts, of grease):-
 gases may evolve or insulation may be damaged we

Additional instructions for repair workion electical equilpment.
Only use, genuine fuse links with specifed amperage and tripptrig characteristics? Defective fuse links must not be repared or bridged and must only be replaced by: Ftuse links" of the' same type. Switch off the chain hoist immediately in the event of electrical power Suply malfuntions. Work on the electronic and electrical components or equipment may onty be carried out by qualifed electícians. finspection: maintenance and repair work is to be caried out on parts of chain hoists, these must - If rescribed by regulations 6 be isolated First verty the safe isolation of the parts from the suppty before commencing work. The electrical equipment of the chain hoist must be inspected and ctiecked at regular intervals. Defects, such as loose connections, dánaged cabies and worn contactors must be rectified immediately.

Since it is possible that after a longer period of operation the switching points of relays (time, frequency; monitoring relays) chainge due to ageing of the components, the relay switching points in circuits relevant to salety must be checked at regular intervals.
Electrical equipment must be replaced as a preventive measure on reaching the limit of its theoretical duration of service (service life).
If work has to be carted out on live parts, a second person must be avalable in order to actuate the emergency-stop button or mains connection switch/isolating switch for voftage disconnection in an emergency.
The second person must be taniliar with resuscitation measures.
Only use insuated tools:
Before disconrigcting and connecting electrical pugg-and-socket connections, atways disconnect them from the supply this does not epply to mains connections, provided they do not represent at dangerous contact voltage in the sense of the säfety regulations).

## 2 Technical data

### 2.1 Designation



### 2.2 Explanation of chain

 hoist designation

### 2.3 Selection criteria

The load apectrum
(n most cases estimatect) can be evatiated in ac cordance with the foltowing definitions:

1 1gtht
Hoist infls which are usualy sidfect to vory sinas toeds and in exceptional casps only to mexdmum .back


2 medium
Hoist units which ara usually sublect to smell loats but rather ofter to maximum loeds.


3 heavy
Hokst untts which are usually subject to mestim loads but freciventity to meximum loads.


4 very heavy
Hoist whits which ere usinatly subject to maximum or atriost maximurn loads.


The size of the hoist is determined by the load spectrum, average operating time per working day, SWL and reeving.

1. What are the operating conditions?
2. What is the specifed SWL?
3. To what height must be load be lifted?
4. What is the required lifting speed?
5. Do the loads need to be fifted and lowered with high precision?
6. Is horizontal load travel required?
7. How is controf to be effected?

| The group ts determined from the operating time and load specturn. |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Load spectrum |  |  |  | Averegs operating time per day in working tiours |  |  |  |
| 1 |  |  | 40 to i | 40 to 2 | 24 | 448 | 8-16 |
| 2 | medium $\Rightarrow$ | $\cdots$ | 4 t to.0,5 | 10 to 1 | $1-2$ | 2-4 | 4-8 |
| 3. | haxy |  | पp to 0,25 | up to 0.5 | 0,5-1 | 1-2 | 24 |
| 4 | very heavy |  | $4 \mathrm{to} 0,12$ | up to 0,25 | 0,25-0.5 | 0,5-1. | 1-2 |
| Group of mectionisris to FEM |  |  | 1 cm | 1 Bm | 1 Am | 2 n | 3 m |
| Reoving |  | Range: | Slza |  |  |  |  |
| 1/1 | 2/1 |  |  |  |  |  |  |
| SWh kg |  |  |  |  |  |  |  |
| 160 | 315 | - | - | - | - | - | 180 |
| 200 | . 400 |  | - | $\because$ | - | + | 200 |
| 250: | 500 |  | $\checkmark$ | -. | $=$ | 250 | 250 |
| $315 \Rightarrow 630$ |  | - | $\stackrel{-}{\square}$ | - | 315 | - | 315 |
| 460 | 800 | DKUN 2 | $400^{-7}$ | - | - | 400 | * |
| 500 | 1000 |  | $\checkmark$ | -: | 500 | - | 500 |
| 630 | 1250 | DOWN 5 | 830 | - | - | - . | 630 |
| 80 | 1600 | - | - | $\cdot$ | - | 800 | 800 |
| 1000 | 2000 | - | - | - | 1000 | 1000 | ; |
| 1250 | 25000 | Oxdiv 10 | 1250 | - | 1250 | - | 1250 |
| 1600 | 3200 | DKAN 16 |  | 1600 | - | 1600 | - |
| 2000 | 4000 | - | - | - | 2000 | - | - |
| 2500 | 5000 - D | DIUN 20 | - | 2500 | - | $\cdots$ | $\pm$ |

Example (see $\Rightarrow-$-)
swi
Load spectum
Lifting speed
315 kg
"medium" from table
$8 \mathrm{~m} / \mathrm{min}$
Reeving
$1 / 1$
Average hook path 2 m
Number of cycles/hour
20
Working time/day 8 hours
Thie average operating time per working day is estimated or calculated as follows:
Op. time/day $=\frac{2 \times \text { average hook path } \times \text { no. of cycles } / \mathrm{h} \times \text { working time/day }}{60 \times \ddot{x} \text { lifting speed }}=$

$$
\begin{array}{ll}
2 \times 2 \times 20 x & =1,34 \text { hours } \\
860 \times 8 &
\end{array}
$$

For the medium load spectrum and an average daily operating time of 1,34 hours the table shows FEM group 1 A m. For an SWL of 315 kg and $1 / 1$ reeving; the table indicates a hoist stze DKUN 2-315.

## 2．4 Selection table

| SWL | \＄tze | FM | Hook palh <br> m． | Hoist speed $\mathrm{m} / \mathrm{min}$ |  |  | Motor siza | $P$ <br> kW | $n$$n m$$n$ | CDF <br> $\infty$ <br>  | Hook <br> cimersion <br> $C$ <br> min 17 | max weight$4 \mathrm{~kg} 3$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 16 |  |  |  | V1 | V2 | Vi3 |  |  |  |  |  |  |
| 160 | DKUN 2－160 K33 1／1 | 3 m | 3；4；6；8 | － | － | 25 | KMK 7182． | 0，75 | 2680 | 60 | ． 35 | 25 |
|  | DKLN $2-160 \mathrm{NV3} 1 / 1 \mathrm{f}$ |  |  | － | － | 25／4 | KMK 80B $2 / 12$ | 0，750， | 2720／380 | 40820 | 355 | 31 |
| 300 | DKUN 2－200 K／ $11 / 1$ | 3 m | 3；4； $6 ; 6$ | 8 | － | － | KMP 71． 82 | 0.4 | 2940 | 60 | ${ }^{7} 355$ | 25 |
|  | DKUN 2－200 $\mathrm{KV} 11 / 1 \mathrm{~F} 4$ |  |  | $8 / 2$ | － | － | KNK 80 こ28 | 0.40 .1 | 2770675 | ${ }^{4} 4020$ | 355 | 29 |
|  | DEXUN 2－200 K22 1／1 |  |  | － | 14 | － | KMK 71B2 | 0.76 | 2680 ＇ | $\because 60$ | 355 | 25 |
|  | DiON $2-200 \mathrm{~K} 21 / 1 \mathrm{~F} 4$ |  |  | － | 14／3，5 | － | KMKK 60 B 2／8 | 0，75／0，17 | 2800／685 | 40420 | 355 | 31 |
| 250 | OKUN $2250 \mathrm{KV1} 1 / 1$ | 2 m | 3；4；6；8 | 8 | － | $\stackrel{\rightharpoonup}{*}$ | KMP 71 ${ }^{\text {2 } 2}$ | 0，4． | C28407\％ | 360 | 355 | 25 |
|  | DKUN 2－250 KV：1／1 F4． |  |  | $8 / 2$ | － | － | 10MK 80228 | 0，40，1 | 27701675 | 40／20 | 355 | 29 |
|  | DKNN 2－250 Kiv2 1／1 |  |  | － | 14 | － | KMK7182 | 0，75： | 2680 | 60 | 356 | 25 |
|  | OHN 2－250 KV2 1／1．F4 |  |  | － | 14／3，5 | － | KMK 80828 | 0，7510，17 | 28006685 | $40 / 20$ | 355 | 31 |
|  | Dran $5-250 \mathrm{KVa} 1 / 1$ | 3 m | 3；4；6； 8 | － | － | ${ }^{+}-25$ | KMK B0日2 | 1.4 | 2720 | 500\％$\times 1$ | 395. | 38 |
|  | DKON 5－250 KV3 ，1／2 F6 |  |  | － | － | 25／4 | KMMK 90，B 2／t2 | 1，20，18 | 28404430 | 40／20 | T 395 | \％45 |
| 315 | DKLN 2－315 KW1 1／1 | 1 Am | 3；4；6；${ }^{\text {c }}$ | 8 | － | ＂ | GMK 7182 | 0，76 | 2880 | 60 | 355 | 25. |
|  |  |  |  | $8 \times 2$ | － | － | 10 NK 8082 t | 0，750， 17 | 28006685 | 4020 | 355 | 31 |
|  | DKN $2-315 \mathrm{~K}$／ $1 / 1$ |  |  | ＊ | 12.5 | － | RaK 71.82 | 0，75 | 2680 | 6， $60^{\circ}$ | 355 | 25 |
|  | DKKN 2－315 KV2 1／1 F4 |  |  | ： | 12，5／3，1 | － | 以кK $80 \mathrm{~B} 2 / 8$ | 0，750，17 | 28006685 | 40／20． | 355 | 31. |
|  | OKKN 5－315 kVi 1／1 | 3 m | $3 ; 4 ; 6 ; 8$ | 8 | － | － | KMK 71 B 2 | 0.75 | 2680 | 460： | 385 | 34 |
|  | DKUN 5－315 KV1 1／t F4 |  |  | 82 | － | －${ }^{-}$ | KMK80 228 | 0，75／0，17 | 2800／685 | 40／20： | 395 | 38 |
|  | DKKUN 5－315 K2 1／1 |  |  | ＊ | 15 | － | KMK 80， 2 | 1，4 | ${ }^{2} 2720^{\circ}$ | 60 | 396 | 38 |
|  | DGUN 5－315 KV2 1／1 F4 |  |  | － | 12，5／3， 1 | $\cdots$ | KMK $8083 / 8$ | 0，7510，17 | 28006685 | $40 / 20$. | 395 | 38 |
|  | DKUN 2－160 KV3 2\％ | 3 m | 3； 4 | $\because$ | － | 12，5 | KMK－71B2 | 0，75 | 2680 | 60 | 416 | 26 |
|  | DKUN 2－150 KV3 211 |  |  | － | － | 12，5／2 | KMK 80 B $2 / 12$ | 0，750，1． | 2720／380 | ${ }^{7} 4020$ | 415 | 32 |
| 400 | DKUN 2－400 $\mathrm{Ky} 1 / \mathrm{t}$ | 1 Cm | 3；4；6； 8 | 8 | － | $\because$ | GMK 7182 | 0.75 | $\therefore 2880{ }^{2}$ | 60\％ | 3555 | 25 |
|  | DFON 2－400 $\mathrm{KV1} 11 / 1 \mathrm{Fs}$ |  |  | 82 | － | － | KMK 80 B2／8 | 0，7510，17 | 28001685 | $4{ }^{4} \mathbf{1} 20^{\circ}$ | 355．： | ${ }_{-} \times 31$ |
|  | DKUN 5－400 KV11 1／1 | 2 m | 3；4；6；8 | 8 | － | － | KMK－71 B 2 | 0，75 | 2680 | －60\％ | － 396 | 34 |
|  | DKAN 5－400 KV1 1／1 F4 |  |  | $8 / 2$ | － | － | KMK 90 2 2／8 | $0,85 / 0.2$ | 2770688 | $40 / 20$ | C 395 | $\bigcirc 43$ |
|  | DKUN 5－400 KV2 1／1 |  |  | － | 15 | － | KMK 80 日 2 | 1，4 | 2720 | 60 Et | Pr395 | 438 |
|  | OKUN 5－400 KV2 $1 / 1 \mathrm{~F} 4$ |  |  | － | 12，513．1 | $\cdots$ | KMK 90 В 28 | 1，7／0．42 | 28001640 | 40，20 | 395 | 45 |
|  | OKNUN 2－200 KV1 $2 / 1$ | 3 m | 13，4 | 4 | ＊ | －${ }^{\text {c }}$ | KMP71日2 | 0，4 | 2940 | 60 | 415 | 26 |
|  | OKUN 2－200 KV1 2／1 F4 |  |  | $4 / 1$ | ＋ | － | KMK B0 228 | 0，4／0，10． | 2770675 | 40200 | 415 | 30 |
|  | DKUN 2－200 KV2 $2 / 1$ |  |  | － | 7 | ．．． | KMK 71：B 2 | 0，75 | 2680 | 60 | 415 | 26 |
|  | DKUN 2－200 $\mathrm{KV} 22 / 1 \mathrm{F4}$ |  |  | － | 7／1，7 | $\cdots$ | KMK 80 － $2 / 8$ | 0，75／0，17 | $2800 \% 685$ | $40 / 20$ | 4． 415 | 32 |
| 500 | DKCUN 5－500 KV9 1／1 | 1 Am | 3；4；6；8 | 8 | － | － | KMK 71： 2 | 0,75 | 2680 | ＂60 | － 395 | 34 |
|  | DFON 5－500 K／V1 1／1 F4 |  |  | 842 | － | － | KMK 00228 | 0，850，2 | 27704665 | $40 / 20$ | 12393 | 43 |
|  | DKUN 5－500 KV2 1／1 |  |  | － | 15 | － | KMK 80 B 2 | 1，4 | 2720 | ${ }^{6} 60$ |  | ＋38 |
|  | DKUN 5－500 KV2 1／1 F4 |  |  | － | 12，5／3，1 | $3 \cdot$ | KMK 90 В $2 / 8$ | 1，780，42 | 28001640 | 4020 | T396 | 45 |
|  | OKUN 10－500 KV3 1／4 | 3 m | 3，4；6；8 | $\bullet$ | － | 20 | KMK 90 B 2 | 2.1 | 2730 | 60 | 480 | 64 |
|  | DKUN 10－500 KV3 $1 / 1 \mathrm{f6}$ |  |  | － | ＊ | 2013，3 | KMK 100 B 219 | 20，31 | $2800 / 400$ | $40 / 20$. | 480 | 73 |
|  | DKUN 2－250 KV1 $2 / 1$ | 2 m | 3； 4 | 4 | $\checkmark$ | － | KMP 7182 | 0，4 | 2840 | 60 | 415 | 26 |
|  | DKUN 2－250 KV1 $2 / 1$ F4 |  |  | $4 / 1$ | － | －＇ | KMK $8022 / 8$ | 0，4／0， 1 | 2770675 | $40 / 20$ | 415 | 30 |
|  | DKON 2－250 K／ $22 / 1$ |  |  | － | 7 | $\cdots$ | KMK 71 B 2 | 0.75 | 2680 | 60 | 415 | 26 |
|  | DKUN 2－250 KV2 2／1 F4 |  |  | $=$ | 7／1，7 | － | KMMK 80－8 $2 / 8$ | 0，7500，17 | 2800685 | 40.20 | 415 | 39 |
|  | DKUN 5－250 $\mathrm{NW} 32 / 1$ | 3 m | 3：4． | $\cdot$ | $\bullet$ | 12.5 | KWK 80 B2 | 1.4 | 2720 | 60 | 465 | 40 |
|  | DK1AN 5－250 KV3 2／1 F6 |  |  | $\bullet$ | $\checkmark$ | 12，5／2 | KIAK 90 B 2／12 | 1，2／0，16 | $2840 / 430$ | $40+20$ | 465 | 47. |
| 630 | DKUN 5－630 Kivi 1／1 | 1 Cm | 3：4；6； 8 | 8 | ：－ | － | KMK 80 B 2 | 4，4 | 2720 | 60. | 396 | 38 |
|  | OKIN 5－e30 KV1 1／1 F4 |  |  | $8 / 2$ | － | － | KM゙K 90 В 2 自 | 1，7／0，42 | 28001840 | 40／20． | 395 | 45 |
|  | DKUN 10－630 KV！1／1 | 3 m | $3 ; 4 ; 6 ; 8$ | 9 | － | － | KGK 9082 | 2，9 | 2730 | 60 | 480 | 64 |
|  | DKUN $10-630 \mathrm{KV} 11 / 1 \mathrm{F4}$ ． |  |  | 9／2，2． | － | $-$ | KM1K 90 B 2／8 | 1，7／0，42 | 2800／640 | $40 / 20$ | 480. | 64 |

1）Hook dimension＂ O ＂with lang sispenston eye
2）For lymit switch cut－of for the haghest hook position，hook dimension C is increased by 80 imm

| SWL | Size | FEM | Hook peth |  | tokst spead $\mathrm{m} / \mathrm{min}$ |  | Motor sizes | P | n | $\begin{gathered} \mathrm{CDFF} \\ \% \end{gathered}$ | Hook crimensian | max． weight |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| kg |  |  | m | V | V2 | $v 3$ |  | NW | mpm |  | mmy ${ }^{\text {m }}$ | kg 3 |
| 630 | DKEN 10－630 KV2 1／1． | 3 m | 3；4；6； 8 | － | 12.5 | － | KMK 80 B 2 | 2.1 | 2730 | 60 | 480 | 64 |
|  | OKIN 10－630 KV2 1／1 F4 |  |  | － | 12，513，1］ | ＊ | KMK90日20 | 1，70，42 | 23001640 | $40 \cdot 20$ | 480 | 64 |
|  | DFUN 2 － 315 KV 121 | 1：Aㅍm | 3：4 | 4 | － | － | 以WK 71 B2 | 0.75 | 2030 | 60 | 415 | 26 |
|  | OKON 2－315 KV1 2／1F4 |  |  | $4 / 1$ | － | － | 101480日2阤 | 0，75，0，17 | 2800／685 | ． $40 / 20$ | 415 | 32 |
|  | OXXN 2－315 KV2 $2 / 1$ |  |  | － | 6，3． | － | 以杖71－ 2 | 0,75 | 2680 | 60 | 415： | 26 |
|  | DKYN 2－315 KV2 2／1．F4 |  |  | － | 6，3／4，5 | － | 19KK80 B 2／8 | 0，7510，17 | 28006895 | $40 / 20$ | $415 \%$ | 32 |
|  | DKW 5－315 kVi 21 | 3 m | 3，4 | 4 | － | － | KWK71 B2 | 0，75 | 2695 | 60 | 465 | 36 |
|  | DiQN $5-315 \mathrm{KV} 12 / 1 \mathrm{F4}$ |  |  | $4 / 1$ | － | － | 人MK $80 \mathrm{~B}^{\text {B } 28}$ | 0，7510，17 | $2000 / 695$ | 40／20 | 465 | 40 |
|  | DKWN 5－315 kV2 $2 / 1$ |  |  | － | 7，5 | $\therefore$ | HMK 80日 2 | 1.4 | 2720 | 60 | 485 | 40 |
|  | DKUN 5－315 KV2 24 F 4 |  |  | － | 6；3／1；5 | － | KMK 80 B $2 / 8$ | 0，75／0，17 | 28001685 | 40／20 | 465 | 40 |
| 600 | DiCN 10.900 KV 171 | 2 m | 3；4；6； 8 | 9 | － | － | HMK90 B2 | 2，1 | 2730 | 60 | 480 | 64 |
|  | DKLW 10－800 K／1 1／9 F4 |  |  | 9／2，2 | － | － | KMK 90828 | 1．70．42． | $2800 / 840$ | 40／20 | 480 | 64 |
|  | DKUN 10－800 kV2 I／ |  |  | － | 12，5 | － | КМК 90 ¢ 2 | 2，1 | 2730 | 60 | 480 | 64 |
|  | DW1／v 10－800 kN2．1／1．F4． |  |  | － | 12，5／3，${ }^{\text {a }}$ | － | KMK 100 E 2／8 | 2，50，62 | 2720／820 | $40 / 20$ | 480 | 73 |
|  | OKIN 16－800 kV1 1／9 | 3 m | 3；4；6；8 | 8 | ． | － | KNK 90＇B2 | 2.1 | 2730 | 60 | 540 | 68 |
|  | DKUN 16－800 KV1 1／1：F4 |  |  | 82 | － | － | KVK 90 B $2 / \mathrm{A}$ | 1，7／0，42 | 2800V40 | 40／20 | 540 | 68 |
|  | DKUN 10－800 KV2 1／1： |  |  | － | 12，5 | － | KNK 60 B2 | 2.1 | 2730 | 60 | 540 | 68 |
|  | Drad $16-800 \mathrm{KV} 21 / 1 \mathrm{F4}$ |  |  | ＋ | 12，53，1 | － | KMK 100 B2／8 | 2，5／0，62 | 2720／620 | 4020 | 540 | 77 |
|  | DKUN 2－400 KV1 $2 / 1$ | 1 Cm | 3； 4 | 4 | － | ＋ | KMK 71 22 | 0.75 | 2980 | $\infty$ | 415 | 26 |
|  |  |  |  | 4／1 | － | － | 10MK 000 B 28 | 0．75．0，17 | 2800／895 | 40／20 | 415 | 32 |
|  | DKMN 5－400 kV1 $2 / 1$ | 2 m | 3； 4 | 4 | － | － | KMK 7.1 B 2 | 0,75 | 26850 | 60 | 485 | 36 |
|  | DKUN 5－400 KVt 2／1 F4 |  |  | $4 / 1$ | － | － | KMK 60 二 $2 / 8$ | 0．85／0，2 | 2770665 | $40 / 20$ | － 465 | 45 |
|  | OKUN 5－400 KıV2 2 \％ |  |  | － | 7.5 | $\because$ | KMK 80 BL 2 | 1，4 | $2720^{-}$ | 80 | 485： | 40 |
|  | DKUN 5－400 KV2 $2 / 4 \mathrm{~F} 4$ |  |  | $\cdot$ | 6，31，5 | － | KMK 90 E 2／8 | －1，70，42． | 2800／640 | －49／20： | － 486 | 47 |
| $1000$ | DKIN 10－1000 $\mathrm{KVI} \mathrm{1/1}$ | TiAm： | 3：4；6；8 | 9 | － | － | GMK9082 | 2.1 | 2730 | B0 | 480 | 64 |
|  | OKAN 10－1000 $\mathrm{kV} 11 / 1 \mathrm{FF}$ |  |  | 9／2，2 | $\square$ | $\because$ | KMK908 $2 / 8$ | 1，7／0，42 | 2800／640 | 40／20 | 4480 | 64 ． |
|  | OKUN 10－1000 K22 1／1 |  |  | － | ＋2，5 | － | KMK． 100 B 2 | 3 | 2780 | 60 | － $480{ }^{\circ}$ | 73 |
|  | OKUN 10－1000 KV2 1／1 F4 |  |  | － | 12，5／3， 1 | － | KMK 100 S 2／8 | 2，50，62 | 27201820 | 40／20 | 480 | 73 |
|  | DKUN 16－1000 KV1 1／1 | 2 m | 3；4；6； 8 | 日 | － | － | LGK 90日 2 | 2.1 | 2730 | 60 | 540. | 68 |
|  | DKNN 16－1000 KV1 1／1 F4 |  |  | $8 / 2$ | － | － | KOKK 90 B 2／8 | 1，7\％，42 | 2800640 | $40 / 20$ | 540 ！ | 68 |
|  | DKIN 16－1000 kV2 $\overline{1 / 1}$ |  |  | － | 12，5 | $-$ | KMK 10082 | 3 | 2780 | 60 | 540 ： | 77 |
|  | DKN 10－1000 KV2 $1 / 1 \mathrm{~F} 4$ |  |  | $\checkmark$ | －12，5／3， 1 | － | KMK 100 B 2／8 | 2，5／0，62 | 2720／620 | $40 / 20$ | 540 ： | 77 |
|  | DKLN 5－500 $\mathrm{KV1}^{2 / 1}$ | 1 Am | 3； 4 | 4 | － | － | KMK 71 72 | 0，75 | 2680. | 60 | 465 | 36 |
|  | DKNN 5－500 KV＇2／．F4 |  |  | 4／1 | $\bullet$ | － | 101K．902．2／8 | 0，85，0，2 | 2770／665 | 4020 | 465 | 45 |
|  | DKLN 5－500 1022 zr |  |  | － | 7.5 | ＊ | KMK 8082 | 1,4 | 2720 | 60 | 465 | 40 |
|  | DKUN 5－500 KV2 2.211 F 4 |  |  | $\cdots$ | 6，3，1，5 | － | YMK 90 B2／8 | 1．76．42 | 28009640 | 4020 | 465 | 47 |
|  | OKIN 10－500 KBS 21 | 3 m | 3：4 | $\cdot$ | － | 10 | KMKK 90 日 2 | 2，1 | 2730 | 60 | 580 | 70 |
|  | DKUN 10－500 KV3 $2 / 1 \mathrm{FG}$ |  |  | － | － | ＇1011，6 | KMK100日 212 | 2，00，31 | 2800／400 | $40 / 20$ | 580 | 79 |
| 1250 | DKKN 10－1250 مV1 1／1． | 1 Cm | 3；4；6； 8 | 9 | － | $\cdots$ | KMK 90 В 2 | 2.1 | 2730 | 60 | 480. | 64 |
|  | DKUN 10， $1250 \mathrm{KVIT} 1 / 1 \mathrm{F4}$ |  |  | 9／2，2 | － | － | KMK $100 \mathrm{~B} 2 / 8$ | 2，50．62 | 27206620 | 40／20 | $\cdots, 480 \cdot \square$ | ＋73． |
|  | DKUN 16－1250 KV1 1／1 | 1 Am | 3；4； $6 ; \overline{8}$ | 8 | － | $\cdots$ | KMK90 B 2 | 2，1 | 2730 | B0 | 540 | 73 |
|  | DKUN 1B－1250 KV1 1／1 F4 |  |  | 812 | $=$ | － | KMK 100 B 2／8 | 2．5．0．62 | 2720／620 | 40／20 | 540 | 82 |
|  | DKUN 20－1250 KV1 1／1 F4 | 3 m | 3；4；6； 8 | $8 / 2$ | － | － | KМK 100日 2 艮 | 2，5／0，62 | 2720／620 | 40220 | 630 | 100 |
|  | DKUN 20－1260 K／v2 1／1．F4 |  |  | － | 12，5／3．1 | － | KMK 112 日 28 | 4／0，97 | 2770／670 | 40／20 | 630 | 115 |
|  | OKUN 20－1250 KV3 1／1 F4 |  |  | $\cdot$ | － | 16／4 | KMK 112日 2／8 | 4，0．97 | 2770／670 | $40 \% 20$ | 630 | 115 |
|  | DKUN 5－630 $\mathrm{KV1} 2 / 1$ | 1 Cm | 3：4 | 4 | － | － | KMK 8082 | 1.4 | 2720 | 60 | 465 | 40 |
|  | DKUNV 5－630 KV1 $2 / 1 \mathrm{~F} 4$ |  |  | $4 / 1$ | $\stackrel{+}{-}$ | － | 10 MK 90 B 278 | 1，7／0，42 | 2800640 | 40,20 | 465 | 47 |
| 1）Hook dimension＂ C ＂with long suspensioni ${ }^{\text {yjo }}$ <br> 2）For limit switch cut－off for the highest hook position，hook dimension C is increased by 80 n <br> 3）For 3 m hook path |  |  |  |  |  |  |  |  |  |  |  |  |


| SWL | Size | FEM | Hook path |  | ioist speod minin |  | Motor size | P | n ． | $\%$ | Hook dimeniston | －max welght |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\log$ |  |  | m | V1 | V2 | V3 |  | kW． | 1 pm |  | mmiy | kg 3 |
| 1600 | DKUN 16－1600 KV1 1／1 | 1 日 | 3；4；6；8 | 8 | － | － | KNKK 100 安 2 | 3.0 | 2780 | 60 | 540 | 82 |
|  | DFOUN 16－1600 KV1 1／1 F4 |  |  | $8 / 2$ | － | － | KOK 100 E 28 | 2．5／0，62 | 27201200 | 4020 | 540 | 82 |
|  | DKUN 20－1600 KV1 1／1 F4 | 2 m | 3；4；6；8 | 9／2 | － | － | KOKK 100 B 288 | 2，50，62 | 2720680 | 40／20 | 630 | 100 |
|  | DKUN 20－1600 KV2 1／1 F4 |  |  | － | i2，5／3， 1 | － |  | 40，97 | 27701670 | 4020 | 630 | 115 |
|  | DEXN 10－800 KV1 21 | 2 m | 3：4 | 4，5 | － | － | 1 MK 90 B 2 | 2.1 | 2730 | 60 | 580 | 70 |
|  | DIUN 10－800 KV1 $2 / 1$ F4 |  |  | 4，5\％1， | － | ＊ | H0， 90 Bra | 1，7，0，42 | 2800／640 | $40 / 20$ | 580 | 70 |
|  | OHINN 10－800 KV2 $2 / 1$ |  |  | － | 6，3 | － | KMK90 B？ | ．2，${ }^{\text {＇}}$ | － 2730 | $60^{-}$ | 580 | 70 |
|  | D＋UN 10－800 KV2 $211 \mathrm{F4}$ |  |  | － | 6，3／1，5 | － | KNKK 100 B 2／8 | 2，50，02 | 27201820 | 40／20： | 590 | 78 |
|  | DKUN 18－800 KVI $2 / \mathrm{i}$ | 3 m | 3：4 | 4 | － | － | KMK 90 B 2 | 2.1 | 2730 | 60 － | 840 | ． 76 |
|  | D＋UN 18－800 KV1 21 F 4 |  |  | 4／1 | － | － | KMK 90 B 7／8 | 1，7，0．42： | 28001640 | 4020. | 640 | 76 |
|  | D＋UN 16－800 KV2 $2 / 1$ |  |  | － | 6，3 | － | ¢01K90－ 2 | 21 | 2730 | 60 | 640 | 76 |
|  | D／4N 16－800 KV2 2／1．F4 |  |  | － | 6，311，5 |  | ROMS 100828 | 2，510，62 | 2720／820 | 4020． | 640 | 82 |
| 2000 |  | 1 Äm | 3；4；6； 8 | $8 / 2$ | － | － | FOMC 112 В 28 | 4／0，97 | 2770670 | $40 / 20$ | 630 | 115 |
|  | OKON 10－1000 KV1 $2 / 1$ | 1 Am | 3： 4 | 4，5 | － | － | KNK 90 －2 | 2,1 | 2730 | 60. | 580 | 70 |
|  | DKUN 10－1000 KV1 $2 \mathrm{fl} \mathrm{F}_{4}$ |  |  | 4，511，11 | － | － | KMK 90 B $2 / 8$ | 1．710．42 | 2800／840 | 40／20 | 580 | 70 |
|  | DKUN 10－1000 KV2 211 |  |  | － | 6,3 | － | KNK 100 B 2 | 3.0 | 2780 | 60 | 530 | 79 |
|  | DRON 10－1000 KV2 $2 / 1$ F4 |  |  | － | 6，3／1，5 | － | FMAK 100 B2／8 | 2，50，62 | $2720 / 620$ | 4020 | 590 | 79 |
|  | DKTN 16－1000 KV1 2／1 | 2 m | 3：4 | 4 | － | － | 内VK90 22 | 2，1 | 2730 | 00 | 640 | 76 |
|  | DKON 16：1000 KV1 2／1．F4 |  |  | 4／1 | ＊ | － | KMK 90 B20 | 1；7／0，42 | 28001640 | $40 / 20$ | 640 | 76 |
|  | DKWN 16．1000 K／2 2il |  |  | － | 6，3 | － | KMK 100 B 2 | 3.0 | 2790： | 60 | 840 | B5 |
|  | OKUN 16－1000 KV2 $2 / 1$ F4 |  |  | － | 6，3／1，5 | $\cdots$ | ROM 100828 | 2，510，62 | 2720／620 | ${ }^{2} 40200$ | 640 | 85 |
| 2500 | DKLN 20－2500 KV1 1／1 F4 | 1 Brim | 3，4，6，6 | $9 / 2$ | － | $=$ | KMK 112 E 旦2／8 | ．40，97 | 2770870 | $40 \times 20$ | 630 | 115 |
|  | OHON 10：1250 KV1 $2 / 1$ | 1 Cm | $3$ | 4.5 | ： | ： | WMK90日 2 | 21 | 2730 | 60 | 580 | 70 |
|  | DKUN 10－1250 KV1 2／1 F4 |  |  | 4，5／1，1 | － | － | KMK $100 \mathrm{B2} 28$ | 2，50，62： | 2720／620 | 40220 | 580 | 79 |
|  |  | 1／Am | 3：4 | 4 | － | － | WMK 90 В 2 | 2，1． | 2730 | － 60 | 840 | 76 |
|  | DHUN 16－1250 KV1．2／1 F4 |  |  | 4／1 | － | － | LOMK 100 B 288 | 2，50，62 | 2720／620 | $40 / 20$ | 640 | 85 |
|  | DFUN 20－1250 KV1．21：F4 | 3 m | $3 ; 4$ | $4 / 1$ | － | $\cdot$ | KMK 100 B 28 B | 2，50，62 | 2720／520 | 40，20 | 755 | 106 |
|  | DKUN 20－1250 102 211F4 |  |  | － | 6．3／1．5 | － | KNK 112 B 28 A | 40,97 | 2770670 | 40／20 | 755 | 121 |
|  | DKUN 20－1250 KV3 2／1 F4 |  |  | $\cdots$ | － | 82 | KMK 112 B 2／B | 40，97 | 2770670 | $40 / 20$ | 755 | 121 |
| 3200 | DKNN 16．1600 KV1 211 | 1 Emm | 3； 4 | 4 | $=$ | － | KMK 100 B 2 | 3，0 | $2780^{-1}$ | 60. | 040 | 85 |
|  | DKLN 16－1600 KVE 24 TH |  |  | 411 | － | － | KMK 100 B 2／B | 2，50，62 | 2720620 | ．40220 | 640. | 85 |
|  | D＋LN 20－1600 KVi 214 F 4. | 2 m | 3：4 | $4 / 1$ | － | － | KMK 100 B2／8 | －2，5／0．62 | 2720／620 | 40／20 | 755 | 106 |
|  | OKON 20－1600 KV2 $211 \mathrm{F4}$ |  |  | $\bullet$ | 6，3／1，5 | $\because$ | KMK 112 日 2／8 | 400，97： | 2770／670 | 40／20 | 755 | 121 |
| 4000 | DKUN 20：2000 KV12 21 F 4 | 1 Ant | 3； 4 | $4 / 1$ | － | － | KMK 1：12 B 28 | 40，97 | 27701780 | $40 / 20$ | 755 | 121 |
| 5000 | DKIN 20－2500 KV1 2／1／F4 | 1 Brm | 3： 4 | 4／1 | － | － | KNK $112 \mathrm{~B} 2 / 8$ | －4，0，97 | 2770／670 | $40 \% 20$ | 755 | 121 |

1）Hock dimension＂ C ＂with long suspension eye
2）For limit switch cut－aff tor the highest hook position；hook cirnension C is increased by 80 men 3）For 3 mhook path

### 2.5 Hoist motor data

Main/creep lifting F4
Required supply cable conductor cross sections and fuse links

| Size <br> :KMK | Grow of mechartsms 10 FEM | P <br> kW | COF\% | n mpm. | Starts/n | Frated carrent $\mathbb{N N}^{\text {and }}$ starting comment la for 50 Hz |  |  |  |  |  | $\frac{\infty}{\infty}$ | $\frac{\infty}{\varphi_{A}}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  | 230 V |  | 400N |  | 500 V |  |  |  |
|  |  |  |  |  |  | IN(A) | $1 \mathrm{~A}, \mathrm{~A}$ | IN (A) | IA (A) | IN (A) | IA (A) |  |  |
| 60 278 | 1 Cm <br> 1 Bm <br> 1 Am <br> 2 m <br> 3 m | $\begin{aligned} & 0,41 \\ & 0,1 \end{aligned}$ | $\begin{aligned} & 401 \\ & 20 \end{aligned}$ | $\begin{aligned} & 2770 \\ & 675 \end{aligned}$ | $\begin{aligned} & 120 \\ & 240 \end{aligned}$ | $\begin{aligned} & 26 \\ & 2.6 \end{aligned}$ | $\begin{aligned} & \mathbf{8 , 1} \\ & 3,8 \end{aligned}$ | $\begin{aligned} & 1,5 \\ & 1,5 \end{aligned}$ | $\begin{aligned} & 5,3 \\ & 2,2 \end{aligned}$ | $\begin{aligned} & 1,1 \\ & 1,1 \end{aligned}$ | $\begin{aligned} & 3,8 \\ & 1,6 \end{aligned}$ | $\begin{aligned} & 0,80 \\ & 0,62 \end{aligned}$ | $\begin{aligned} & 0,84 \\ & 0,84 \end{aligned}$ |
| $80 \mathrm{~B} \mathrm{2/8}$ |  | $\begin{aligned} & 0,75 \\ & 0,17 \end{aligned}$ | $\begin{aligned} & 401 \\ & 20 \end{aligned}$ | $\begin{gathered} 28001 \\ 685 \end{gathered}$ | $\begin{aligned} & 1201 \\ & 240 \end{aligned}$ | $\begin{aligned} & 3,8 \\ & 3,8 \end{aligned}$ | $\begin{gathered} 15,5 \\ 5.5 \end{gathered}$ | $\begin{aligned} & 2,2 \\ & 2,2 \end{aligned}$ | $\begin{aligned} & 90 \\ & 3,2 \end{aligned}$ | $\begin{aligned} & 1,6 \\ & 1,6 \end{aligned}$ | $\begin{aligned} & 6,5 \\ & 2,3 \end{aligned}$ | $\begin{aligned} & 0,80 \\ & 0,57 \end{aligned}$ | $\begin{aligned} & 0.90 \\ & 0.86 \end{aligned}$ |
| 902218 |  | $\begin{array}{r} 0.85 \\ -0,2 \\ \hline \end{array}$ | $\begin{aligned} & 401 \\ & 20 \\ & \hline \end{aligned}$ | $\begin{gathered} 27701 \\ 665 \\ \hline \end{gathered}$ | $\begin{aligned} & 120 \\ & 240 \end{aligned}$ | $\begin{aligned} & 4,6 \\ & 2,7 \end{aligned}$ | $\begin{aligned} & 20 \\ & 5,1 \end{aligned}$ | $\begin{array}{r} 2.6 \\ 1.6 \end{array}$ | $\begin{gathered} 11,6 \\ 3.0 \end{gathered}$ | $\begin{aligned} & 1,9 \\ & 1.1 \end{aligned}$ | $\begin{gathered} 8,4 \\ 2,1 \end{gathered}$ | $\begin{aligned} & 0,81 \\ & 0,59 \end{aligned}$ | $\left[\begin{array}{r} 0,79 \\ -0,77 \end{array}\right.$ |
| 00B2/8 |  | $\begin{array}{r} 1,7 \% \\ 0,42 \\ \hline \end{array}$ | $\begin{aligned} & 400 \\ & 20 \end{aligned}$ | $\begin{gathered} 28000 \\ 640 \end{gathered}$ | $\begin{aligned} & 120 \% \\ & 240 \end{aligned}$ | $\begin{array}{r} 7,7 \\ 4,4 \\ \hline \end{array}$ | $\begin{array}{r} 35 \\ 8,6 \\ \hline \end{array}$ | $\begin{aligned} & 4,4 \\ & 2,5 \\ & \hline \end{aligned}$ | $\begin{array}{r} 20 \\ 5,0 \\ \hline \end{array}$ | $\begin{array}{r} 3,2 \\ 1,8 \\ \hline \end{array}$ | $\begin{array}{r} 14,4 \\ 3,6 \\ \hline \end{array}$ | $\begin{aligned} & 0,90 \\ & 0,60 \end{aligned}$ | $\begin{array}{r} 0,82 \\ 0,75 \\ \hline \end{array}$ |
| $100 \mathrm{~B} \mathrm{2/8}$ |  | $\begin{aligned} & 2,51 \\ & 0,62 \\ & \hline \end{aligned}$ | $\begin{aligned} & 40 \\ & 20 \end{aligned}$ | $\begin{gathered} 2720 \\ 620 \end{gathered}$ | $\begin{aligned} & 1201 \\ & 240 . \end{aligned}$ | $\begin{aligned} & 11,9 \\ & \mathbf{5}, 8 \end{aligned}$ | $\begin{gathered} 49 \\ 11,9 \end{gathered}$ | $\begin{aligned} & 6,9 \\ & 3,4 \end{aligned}$ | $\begin{aligned} & 29 \\ & 6.8 \end{aligned}$ | $\begin{array}{r} .4 ; 9 \\ 2,4 \end{array}$ | $\begin{aligned} & 21 \\ & 49 \end{aligned}$ | $\begin{aligned} & 0,86 \\ & 0,65 \end{aligned}$ | $\begin{aligned} & 0,79 \\ & 0,72 \end{aligned}$ |
| 112 B 2/8 |  | $\begin{gathered} 4 / \\ 0,97 \end{gathered}$ | $\begin{aligned} & 40 . \\ & 20 \end{aligned}$ | $\begin{gathered} 2770 \\ 670 \end{gathered}$ | $\begin{aligned} & 1201 \\ & 240 \end{aligned}$ | $\begin{array}{r} 19,2 \\ 11,9 \end{array}$ | $\begin{aligned} & 91 \\ & 24 \end{aligned}$ | $\begin{aligned} & 11,1 \\ & 6,9 \end{aligned}$ | $\begin{gathered} 53 \\ 13,7 \end{gathered}$ | $\frac{8}{4,9}$ | $\begin{array}{r} 38 \\ .9,9 \end{array}$ | $\begin{aligned} & 0,82 \\ & 0,50 \end{aligned}$ | $\begin{aligned} & 0,68 \\ & 0,68 \end{aligned}$ |


| Size <br> KMK | Group of mechEnisms to FEM | Mains connection delay huse for 50 Ht 1] |  |  | 1. Supply traes for 5\% voltage drop $\Delta$ U and starting curment la for 50 Hz 2) |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 230 V | 400 V | 500 V | $230 \mathrm{~V}(4 \mathrm{U} 11.5 \mathrm{~V}$ |  | $400 \mathrm{~V}(\triangle) \cup 20 \mathrm{~V})$ |  | $500 \mathrm{~V}(4) \cup 25 \mathrm{~V})$ |  |  |
|  |  | A | A | A. | mm | m | $\mathrm{mm}^{2}$ | m | mmi | m | $\cdots$ |
| $80 \geq 2 / 8$ | 1 Cm <br> 1. Bm <br> 1 An <br> 2 m <br> 3 m | 6 | B | 6 | 1.5 | 73. | 1,5 | 100 | 1,5 | 100 | $\infty$ |
| $80 \mathrm{~B} 2 / 8$. |  | 6 | 6 | 6 | 1.5 | 42-- | 1,5 | 100 | 1.5 | 100 | 0 |
| 80 $\geqslant 2 / 8$. |  | 10 | 6 | 6 | 1,5 | 35 | 1,5 | 100 | 1,5 | $=100$ | 0 |
| $90 \mathrm{~B} 2 / 8$ |  | 10 | 10 | 8 | 2,5 | 28 | 1.5 | 59 | 1.5 | 100 | 0. |
| $100 \mathrm{~B} 2 \ddot{8}$ |  | 16 | 16 | 10: | 2,5 | 23 | 1.5 | 42 | 1,5 | 77 | 7 |
| 112 a 2/6 |  | 35 | 20 | 16 | 2,5 | $16{ }^{\circ}$ | 1,5 | 30 | 1,5* ${ }^{3}$ | - $47^{2}$ | 74 |

Main/creep lifting F6

| Stza <br> KHK | Group of meochanistis to FB | P. <br> KW | Cof \% | n <br> pm | Startsin | Rated curment IN and starting current la bei 50 Hz |  |  |  |  |  | $\begin{aligned} & \cos \\ & \boldsymbol{N} \end{aligned}$ | $\begin{aligned} & \infty 0 s \\ & \Phi_{i}: A \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  | 230 V |  | 400V |  | 500 V |  |  |  |
|  |  |  |  |  |  | IN (A) | IA A | IN (A) | (A $A$ ( ${ }^{\text {c }}$ | IN(A) | IA ( A |  |  |
| $80 \cdot 82 / 12$ | 3 m | $\begin{gathered} 0.75 \% \\ 0,1 \\ \hline \end{gathered}$ | $\begin{aligned} & 401 \\ & 20 \\ & \hline \end{aligned}$ | $\begin{gathered} 27201 \\ 380 \end{gathered}$ | $\begin{aligned} & 1201 \\ & 240 \end{aligned}$ | $\begin{aligned} & 3.7 \\ & 3.7 \end{aligned}$ | $\begin{gathered} 15.0 \\ 4.8 \end{gathered}$ | $\begin{aligned} & 2,1 \\ & 2.1 \end{aligned}$ | $\begin{aligned} & 9,0 \\ & 2,7 \end{aligned}$ | $\begin{aligned} & 15 \\ & 1.5 \end{aligned}$ | $\begin{aligned} & 6,5 \\ & 2,0 \end{aligned}$ | $\begin{aligned} & 0,84 \\ & 0,73 \end{aligned}$ | $\begin{array}{r} 0,87 \\ 0,77 \end{array}$ |
| $90 \mathrm{~B} 2 / 12$ |  | $\begin{aligned} & 1,21 \\ & 0,16 \end{aligned}$ | $\begin{aligned} & 401 \\ & 20 \\ & \hline \end{aligned}$ | $\begin{gathered} 2840 \\ \hline 430 \\ \hline \end{gathered}$ | $\begin{aligned} & 1201 \\ & 240 \\ & \hline \end{aligned}$ | $\begin{aligned} & 6,4 \\ & .5,7 \\ & \hline \end{aligned}$ | $\begin{gathered} 35 \\ 8,9 \end{gathered}$ | $\begin{aligned} & 3,7 \\ & 3,3 \end{aligned}$ | $\begin{aligned} & 20 \\ & 4.0 \end{aligned}$ | $\begin{aligned} & 2,7 \\ & 2,4 \end{aligned}$ | $\begin{aligned} & 14,4 \\ & 2,0 \end{aligned}$ | $\begin{aligned} & 0.75 \\ & 0,59 \end{aligned}$ | $\begin{aligned} & 0,85 \\ & 0.79 \end{aligned}$ |
| $10082 / 12$ |  | $\begin{aligned} & 2,0 \% \\ & 0,31 \end{aligned}$ | $\begin{aligned} & 40 \\ & 20 \end{aligned}$ | $\begin{gathered} 28001 \\ 400 \end{gathered}$ | $\begin{aligned} & 120 \\ & 240 \end{aligned}$ | $\begin{aligned} & 9,9 \\ & 8,0 \end{aligned}$ | $\begin{aligned} & 49 \\ & 10 \end{aligned}$ | $\begin{aligned} & 5,7 \\ & 3,5 \end{aligned}$ | $\begin{aligned} & 29 \\ & 5.8 \end{aligned}$ | $\begin{aligned} & 4,1 \\ & 2,5 \end{aligned}$ | $\begin{aligned} & 20 \\ & 4.2 \end{aligned}$ | $\begin{aligned} & 0,89 \\ & 0,53 \end{aligned}$ | $\begin{array}{r} 0,79 \\ 0,64 \end{array}$ |



## Main hoist

| Sizo | Gröup of mechanisms to FEM | P <br> kW | COF \% | $n$ pm: | Startsh | Rated curent ! N and starting current ! A for 50 Ftz |  |  |  |  |  | $\begin{aligned} & \cos \\ & \varphi_{\mathrm{N}} \end{aligned}$ | $\begin{aligned} & \cos \\ & \varphi_{A} \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  | 230 V |  | 400 N |  | 500 V |  |  |  |
|  |  |  |  |  |  | IN(A) | \|ACA | $1 \mathrm{~N}(\mathrm{~A})$ | (A. A) | $\mathbb{N}(4)$ | IA (A) |  |  |
| KMP 7182 | $\begin{aligned} & 1 \mathrm{Cm} \\ & 1 \mathrm{Em} \\ & 1 \mathrm{Am} \\ & 2 \mathrm{~m} \\ & 3 \mathrm{~m} \end{aligned}$ | 0.40 | 60 | 2840 | 360 | 3.7 | 16,4 | 2.1 | 9.5 | 1,5 | 6.8 | 0.52 | 0,74 |
| KUK 71 B 2 |  | 0,75 | 60 | 2680 | 350 | 4.2 | 16,4 | 2.4 | 9.5 | 1,8 | 8,8 | 0.75 | 0,74. |
| K0\%K 80 B 2 |  | 1.4 | 60 | 2720 | 360 | 73 | 33 | 4.2 | 19 | 3.0 | 13,7 | 0,80 | 0.82 |
| K0kK $90 . \mathrm{B} 2$ |  | 2.1 | 60 | 2730 | 360 | 9,9 | 46 | 5,7 | 28 | 4,1 | 19 | . 081 | 0,83 |
| KHK 100 B 2 |  | 3,0 | 60 | 2780 | 360 | 14,6 | 77 | 8.4 | 44 | 6.1 | 32 | 0,78 | 0.78 |


| Sizs | Group of mectiarisims to FEM | Mains connection delay fuse for 50 itz 1$)$ |  |  | Supply fines lor 5\% votege drop 4 U and starting current li lor 50 tz ¢! |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 230 V | 400 V | 500 V | 230 V ( $\triangle$ U 11,5V) |  | $400 \mathrm{~V}(\triangle) 20 \mathrm{~V}$ |  | $500 \mathrm{~V}(\mathrm{~A} \cup 25 \mathrm{~V}$ |  |
|  |  | A | A | A | mm ${ }^{2}$ | m | mmp | m | $\mathrm{mm}{ }^{2}$ | m |
| KMP 71 B 2 | $\begin{aligned} & 1 \mathrm{~cm} \\ & 1 \mathrm{Bm} \\ & 1 \mathrm{Am} \\ & 2 \mathrm{~m} \\ & 3 \mathrm{~m} \end{aligned}$ | 8 | 6 | 6 | 1,5 | 46 | 1,5 | 100 | 1,5 ${ }^{\prime}$ | 100 |
| KMK 71 B 2 |  | 6 | 6 | 6 | 1.5 | 46 | 15 | 100 | 1.5 | 100 |
| KMK 60 B 2 |  | 16 | 10 | 6 | 2,5 | 34 | 1,5 | 62 | 1,5 | 100 |
| KMK 90 B 2 |  | 16 | 10 | 10 | 2,5 | 24 | 1.5 | 45 | 1,5 | 77 |
| KMK 100 B 2 |  | 20 | 16 | 10 | 2,5 | 15 | 1,5 | 28 | 1,5 | 49 |

### 2.6 Travel motor data EUistandard-headroom monorail hoist EK low-headroom monorail hoist

| Slze | P <br> kW | COF\% | $n$ <br> ram |  |  |  |  |  |  | $\begin{aligned} & \infty \\ & \Phi . N \end{aligned}$ | $\begin{aligned} & \infty \\ & \phi_{A} \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | 230 V |  | 400 N |  | 500 V |  |  |  |
|  |  |  |  | IN(A) | HA (A) | IN(A) | IA $A$ ) | IN(A) | IA (A) |  |  |
| 13/3.PKF 2 | 0,2 | 40 | 2890. | $1 ; 1$ | 5,7 | 0,63 | 3.3 | 0,46 | 2,4 | 0.73 | 0,74 |
|  | 0.14 | 40 | 1390 | 0.77 | 2,6 | 0,44 | 1.5 | 0,32 | 1.1: | 0.76 | 0.74 |
| 13/3 PKF 8 | 0,05: | 40 | 710 | 0.95 | 2.2 | 0,55 | 1.3 | 0,4 | 0,91 | 0,48 | 0,7 |
| 13/6 PF 2 | 0,3 | 40 | 2840 | 1.5 | 8,8 | 0,85 | 5 | 0,68 | 4 | 0,78 | 0,8 |
| 13/6 PF 4 | 0,2 | 40 | 1320 | 1;1 | 3 | 0,62 | 1.7 | 0,49 | 1,4 | 0,86 | 0,88 |
| 13/6 PF 8 | 0.1 | 40 | 710 | 1,6 | 3,7 | 0,96 | 2,1 | 0,68 | t,5 | 0,50 | 0.72 |
| $13 / 6 \mathrm{PKF} 8 / 2$ 13/6 PF $8 / 2$ | $\begin{aligned} & 0,077 \\ & 0,27 \end{aligned}$ | 40 | $\begin{aligned} & 6801 \\ & 2900 \end{aligned}$ | $\begin{aligned} & 1,3 \\ & 1,8 \end{aligned}$ | $\begin{aligned} & 2,6 / \\ & 8,6 \end{aligned}$ | $\begin{gathered} 0,74 / \\ 1,1 \\ \hline \end{gathered}$ | $\begin{aligned} & 1,51 \\ & 5.0 \end{aligned}$ | $\begin{aligned} & 0.53 / \\ & 0.76 \end{aligned}$ | $\begin{aligned} & 1,1 / 6 \\ & 3,6 \end{aligned}$ | $\begin{gathered} 0,57 / \\ 0,71 \\ \hline \end{gathered}$ | $\begin{aligned} & 0,86 \\ & 0,86 \end{aligned}$ |
| 13/6 PKF 12/4 13/6 PF 12/4 | $\begin{gathered} 0,051 \\ 0,17 \end{gathered}$ | $\begin{aligned} & 20 \\ & 40 \\ & \hline \end{aligned}$ | $\begin{aligned} & 4501 \\ & 1440 \end{aligned}$ | $\begin{aligned} & 2,2 \\ & 1 ; 8 \\ & \hline \end{aligned}$ | $\begin{aligned} & 2,81 \\ & 6,2 \end{aligned}$ | $\begin{aligned} & 1,3! \\ & 1,1 \\ & \hline \end{aligned}$ | $\begin{aligned} & 1,6 \\ & 3,6 \end{aligned}$ | $\begin{gathered} 0,911 \\ 0,76 \end{gathered}$ | $\begin{aligned} & 1,21 \\ & 2,8 \end{aligned}$ | $\begin{aligned} & 0,66 / \\ & 0,55 \end{aligned}$ | $\begin{aligned} & 0,82 / \\ & 0,86 \end{aligned}$ |
| KMF 80 A 2 | 0,65 | 40 | 2570 | 3,0 | 9,6 | 1.7 | 5,5 | -1,4 | 4,4 | 0,93 | 0,84 |
| KMF 80 A 4 | 0,32 | 40 | 1350 | 1,7 | 5.5 | 0,95 | 3:1 | 0.76 | 2,5 | 0,74 | 0.82 |
| KMF 80 A $8 / 2$ | $\begin{gathered} 0,13 \\ 0.5 \end{gathered}$ | 40 | $\begin{aligned} & 630 / \\ & 2710 \end{aligned}$ | $\begin{aligned} & 2,0 \\ & 2,5 \end{aligned}$ | $\begin{aligned} & 3,3 / \\ & 9,9 \end{aligned}$ | $\begin{aligned} & 1,11 \\ & 1,4 \end{aligned}$ | $\begin{aligned} & 1,9 / \\ & 5.7 \end{aligned}$ | $\begin{array}{r} 0.911 \\ 1.1 \end{array}$ | $\begin{aligned} & 1,51 \\ & 4,6 \end{aligned}$ | $\begin{aligned} & 0,711 \\ & 0,88 \end{aligned}$ | $\begin{aligned} & 0.844 \\ & 0.84 \end{aligned}$ |



### 2.7.2 Hook dimension C Click-fit trolleys




### 2.7.3 Curve radii for RU/HU/EUDK and CF 5/CF 8 trolleys

CF 5 standard headroom monorail hoist (max. SWL 550 kg ) Hook dimension C from girder nunnling sürface

| Mounting arrangement. |  | Fiange whtth 50-91 mm |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | At rigit angles to the track girder |  |  |  | Peratel to the track gforer |  |  |  |
| Range | Reeving | ¢ | Chain collector box size |  |  | C | Orain collector box size |  |  |
|  |  |  | 1 | 2 | 3 |  | 1 | 2 | 3 |
|  |  |  | $\mathrm{Ci}_{1}$ |  |  |  | C1 |  |  |
| DKUN 2 | $1 / 1$ | 370 | 435 | 495 | 540 | 390 | 455 | 515 | 560 |
|  | 21 | 430 |  |  |  | 450 |  |  |  |

For trolley assembly instructions see section 5.19.
CF. 8 standard headroom monorati hoist (max. SWL 850 kg )
Hook dimension C trom girder running surface.

| Mounting arrangement |  | Track girciors with paraliof flanges |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Flange whdth $55-143 \mathrm{~mm}$ |  |  |  |  |  |  |  |
|  |  | At right anglas to the track girder |  |  |  | Perailet to the track girder |  |  |  |
| Range | Reoving | C | Chain cotlector box size |  |  | C | Chatn collector box size. |  |  |
|  |  |  | 1 : | 2 | 3 |  | 1. | 2 | 3 |
|  |  |  | Cl |  |  |  | C1. |  |  |
| DKUN 2 | 1/1 | 400 | 460 | 520 | 565 | 420 | 480 | 540 | 585 |
|  | $2 / 1$ | . 460 |  |  |  | 480 |  |  |  |
| DKUN 5 | $1 / 1$ | 445 | 490. | 550. | 595 | 465 | 510 | 570 | 615 |
|  | $2 / 1$ | 515 |  |  |  | 535 |  |  |  |
| Mounting artangement |  | Track girdera with stoping tanges |  |  |  |  |  |  |  |
|  |  | Flange width $58-143 \mathrm{~mm}$ |  |  |  |  |  |  |  |
|  |  | At rigit angieas to the track girder |  |  |  | Parallel to the track girder |  |  |  |
| Range | Reering | C | Chain collector box size |  |  | 0 | Chain collactor box size: |  |  |
|  |  |  | 1 | 2 | 3 |  | 1 | 2. | 3 |
|  |  |  |  | 01 |  |  | C\% |  |  |
| DKUN 2 | $1 / 1$ | 390 | 450 | 510 | 555 | 410 | 470 | 530 | 575 |
|  | $2 / 1$ | 450 |  |  |  | 470 |  |  |  |
| DKON 3. | $1 / 1$ | 435 | 480 | 540 | 585 | 455 | 500 | 560 | 605 |
|  | 2/1 | 505 |  |  |  | 525 |  |  |  |

For trolley assembly instructions see section 5.20 .
The specified curve radil apply for normal applications. Contact the manufacturer or his representative for frequent curve travel operation (e.g. automatic installations).

Cuive radill in mm

| Trolley stre: | Track groder |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
|  | round-adged |  | square-edged |  |
|  | Flange width | Rimin | Flange width | Rimin |
| CF 5. | 50-91 | 800 | 50-91 | 800 |
| CF. 8 | 58-143 | 800 | 55-143 | 800 |
| RU 3 OK | $\begin{gathered} 50 \\ 58-90 \end{gathered}$ | $\begin{aligned} & 1200 \\ & 900 \end{aligned}$ | 50-90 | 900 |
| . HU 6 DK | 58-300 | 1000 | 58-300 | '1200 |
| AU 11 DK HU1t DK EU 11 DK | 56-300 | 1800 | 58-300 | 2000 |
| $\begin{aligned} & \text { RU } 22 \mathrm{DK} \\ & \text { HU22DK } \end{aligned}$ $\text { EU } 22 \mathrm{DK}$ | $\begin{aligned} & 82-143 \\ & 144-200 \\ & 201.300 \end{aligned}$ | $\begin{aligned} & \hline 2300 \\ & 1900 \\ & 1300 \\ & \hline \end{aligned}$ | $82-300$ <br> - | $2575$ |
| RU 36-N EU 36-N: | 90-300 | 3000 | 90-300 | 3500 |
| RU 55 DK EU 55 DK | $\begin{aligned} & 106-186 \\ & 187-300 \end{aligned}$ | 3000 | $\begin{aligned} & 106-186 \\ & 187.300 \end{aligned}$ | 3500 |

2.7.4 Trolley with special crossbar Flange width $144-300 \mathrm{~mm}$


Suitable for:
Chain hoist turned $90^{\circ}$ and suspended with standard sisispension eye.
As RU, HU or EU trolley.
For flange withs $144-300 \mathrm{~mm}$.

For assembling trolleys see 20284644

Hook dimension'C from girder nunning surface

| Trolley stze | Max SWL$\mathrm{kg}$ | Ftange width mm | Hotst size | Suspension oye. |  |  |  |  |  |  | Suspension thay. |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | $\begin{array}{\|c\|} \hline \text { Hook fitm. C } \\ \hline \text { Peoving } \\ \hline \end{array}$ |  | $\frac{\text { C2 }}{\text { Cisin collector box size }}$ |  |  |  |  | $\begin{array}{\|c\|} \hline \text { Hook dim. C } \\ \text { Reeving } \\ \hline \end{array}$ |  | $\frac{\mathrm{C} 2}{\mid \text { Chain colector box size }}$ |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  | 1/1 | $2 / 1$ | 1 | 2 | 3 | 4 | 5 | $1 / 1$ | $2 / 1$ | 1 | 2 | 3 | 4 | 5 |
| RU B:DK | 700 | 144-300 | OKUN 1-100-125-180-200 | 435 | 495 | 485 | 545 | - | : | - | - | - | - | - | $\cdots$ | - |  |
|  |  |  | DKUN2-160-200-250-315 | 456 | 515 | 515 | 575 | 820 |  |  | 460 | 520 | 520 | 550 | 625 |  |  |
|  |  |  | DKUKL5-250-315 | 405 | 565 | 540 | 600 | 845 |  |  | 505 | 575 | 550 | 610 | 855 |  |  |
|  |  |  | DKUN5-400-500-630 | 495 | - |  |  |  |  |  | 505 | - |  |  |  |  |  |
| RU 11 DK | t350 | 144-300: | DKUN2-400 | - | 520 | 520 | 580 | 625 | - | - | - | 525 | 525 | 585 | 630 |  | : |
|  |  |  | DKONS-400-500-630 | - | 570 | 545 | 605 | 650 |  |  |  | 580 | 555 | 615 | 660 |  |  |
| RU 22 DK | 2600 | 144-300 | DKUN10-500-630-800-1000-1250 | 625 | 725 | - | - | - | 770 | 890 | 650 | 750 | - | - | - | B05 | 925. |
|  |  |  | DEXNT16-800-1000-1250 | 675 | 775 |  |  |  |  |  | ; |  |  |  |  |  |  |
|  |  |  | DKUN16-1600 | 675 | - |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| EU 11 HU 11 DK | 1350 | 144-300 | DKUN2-160-200-250-375-400 | 455 | 520 | 520 | 680 | 625 | - | - | 465 | 525 | 525 | 585 | 630 | - | - |
|  |  |  | DKUNS -250-315-400-500-630 | 510 | 570 | 545 | 605 | 650 |  |  | 510 | . 680 | 555 | 615 | 660 |  |  |
| EU 22 <br> Hil 220 OK | 2600 | 144-300 | DKUN10-600-530-800-1000-1250 | 625 | 725 | - | - | - | 770 | 890 | 650 | 750 | - | , | - | 805 | 925 |
|  |  |  | DKUN16 -800-1000-1250 | 675 | 775 |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | OKUN16-1600 | 675 | - |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

2.8 EU 11/EU 22 DK travel speeds with 13/3 PKF and 13/6 PKF motor

| Travel drive |  |  | Possible travel speeds in approc. ... m/min |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | 28 | 14 | 7 | 7/29 | 4,6/14 |
|  |  |  | 13/3 PKF 2 | $13 / 3$ PKF 4 | 13, PKFF 8 | 13/6 FKF $8 / 2$ | 13/6 PKF 12/4 |
| Part no. | Votrage | 230/400 V | 56306244 | 56306444 | 56306744 | - | - |
|  |  | 400 V | - | - | - | . 56305744 | 56305644 |

2.9 EU 36-N/EU 55 DK travel speeds with 13/6. PF motor up to 3600 kg

| Travel ditive: |  |  | Possibie travel speeds to approx. - m/min |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | 25 | 12,5 | $8{ }^{6}$ | 8,3/25 | 4,2/12,5 |
|  |  |  | 136 PF 2 | 13/6 PF 4 | 1368 FF 8 | $136 \mathrm{PF} 8 / 2$ | 13/6 PF $12 / 4$ |
| Part nis. | Voltage | 230/400 V | 56391344 | :563916 44 | $56396444^{\circ}$ | - | - |
|  |  | 400 V | - | - | - | 56396894 | :66398244 |

### 2.10 EU 55 DK travel speeds with KMF 80 motor up to 5000 kg



## 3 General

### 3.1 Handling



## Notes on inspections in accordance with

Relevant accident prevention regulations for wiñches, hoists änd towing devices

BGY D8:(VBG 8) Relevant accident:prevention regulations for cranes BGVV D6 (VBG 9)

The EG machinery directive requirements are therefore also complied with. Inspection when putting the hoist into operation for the first time If hoist units are used as cranes, an inspection must be carried out by an expert enginear in accödarice with reevant-accident prevention regulations BGV D6 § 25 for cranes.
Chain hoists used in accordance with relevant accident prevention regulations for winches, hoists and towing devices BGV D8 must be inspected by: an experienced technícian
The inspection in accordance with relevant accident prevention regulations for winches, hoists and towing derices BGV D8 mainly consists of a visual inspection and a function check. It is designed to ensure that the equipment is in a safe condition and that any defects and damage, e.g. caused by inappropriate handing during transport, are identified and repaired.
In addition, regulations specific to cranes must also be taken into consideration duining acceptance and other inspections in accordance with relevant accident prevention regulations for cranes BGV D6

## Routine inspections

Hoists and cranes must be inspected by an experienced technician at least once a year. Routine inspections mainly consist of a visual inspection and a function check which shouldinctude a check to determine the condition of components and equipment regarding damage; wear, corrosion or other alterations, and a check to determine the integrity and efficiency of safety devices and brakes. It may be necessary to dismantle the hoist in order to inspect wearing parts.
Load canyingimeans must be inspected along their entire length, including those parts which cannot normally be seen.
The owner must arrange for all inspections to be carried out and documented in the test and inspection:bookst of the:chain:hoist.

### 3.2 Noise emission measurement according to DIN 45635

The noise emission levels ( $L_{\text {one }}$ ) are:
DKUN 2 up to $14 \mathrm{~m} / \mathrm{min}$

|  | above $14 \mathrm{~m} / \mathrm{min}$ | $73^{+2} \mathrm{~dB}(A)$ |
| :--- | :--- | :--- |
| OKUN 5 | up to $14 \mathrm{~m} / \mathrm{min}$ | $72^{+2} \mathrm{~dB}(\mathrm{~A})$ |
|  | above $14 \mathrm{~m} / \mathrm{min}$ | $74^{+2} \mathrm{~dB}(\mathrm{~A})$ |
| DKUN 10 | up to $14 \mathrm{~m} / \mathrm{min}$ | $75^{+2} \mathrm{~dB}(A)$ |
|  | above $14 \mathrm{~m} / \mathrm{min}$ | $77^{+2} \mathrm{~dB}(\mathrm{~A})$ |
| DKUN 16 | up,to $14 \mathrm{~m} / \mathrm{min}$ | $75^{+2} \mathrm{~dB}(\mathrm{~A})$ |
|  | above $14 \mathrm{~m} / \mathrm{min}$ | $77^{\circ 2} \mathrm{~dB}(\mathrm{~A})$ |
| DKUN 20 |  | $78^{* 2} \mathrm{~dB}(\mathrm{~A})$ |

at a distance of 1 mfrom the chain hoist.
These noise emission levels were mëasured under maximum load.
Structural Influences such as

- transmission of noise via steel structures
- reffaction of noise from walls, stc.
were not allowed for in the above measurements.


### 3.3 Chain hoists operating outdoors

 against the weather. Travelling hoists should be kept under shetter if they are not used for a considerable length of time.
# 3.4 Packing and storage 

The chain hoist and accessories such as chain, hook with fittings, bottom block and control pendant as well as the chain collector box and trolley are shipped in cardboard packaging.
Store the chain hoist and accessortes in a dry place.

### 3.5 Paint finish

The chain hoist is supplied it the following standard colours:

| Chain holst | RAL 5009 | Azure blue |
| :--- | :--- | :--- |
| Bottom block/hook with fittings | RAL 1007 | Chrome yellow |
| Hook | RAL 9005 | Jet black |
| Trolley | RAL 5009 | Azure blue |

Other colours and special colours can also be ordered.
3.6 Operating conditions $s^{4}$ the chain hoist can be coerated at:

- $-10^{\circ}$ to $+40^{\circ} \mathrm{C}$
- air humbity up to $80 \%$
- Air pressure úp to 1000 m above sea level

Other operatring conditions are also possible.
Please refer to the manufacturer for information on any modifications that may be necessary.
See page 2 for the address:

## 4 Description

### 4.1 Design



### 4.2 Hoist motor

### 4.3 Gearbox

The hoist motor is the proven sliding rotor brake motor with a newly developed ro-tor-shaft connection, torsionally resistant, axially free fail-safe coupling and conical brake with asbestos-free brake lining. Type of enclosure IP 55.

The gearbox is of two-stage coaxial design.
The gearbox is lubricated by a mineral oil to DIN 51502 CLP 220.
The first stage of the reduction gear has helical gearing. The wheel of the first gear stage has an integrated slipping clutch. It performs the function of an emergency limit stop device for the highest and lowest hook position and protects the Demag chain hoist against extreme overloads. The slipping clutch also fulfils the EC guideline requirements regarding a load control device starting with an SWL of 1000 kg .
If the emergency limit stop device - in this case the slipping clutch - is approached in normal operation, operation must be limited according to relevant national regulations and those of Demag.
In this case, an additional operating limit switch is required.

### 4.4 Chain and sprocket drive

### 4.5 Chain hoist

### 4.6 Electrical equipment



### 4.7 Contról pendant

The standard chain hoist is designed for direct controi: The chain troist can be supplied with contactor control as an option or if requilied by. regulations.
Firther electrical equipment indudes:
Limit switches for lifting and lowering, geared limit switches with up to eight switching points, pulse generator, single-phase design, plüg-and-socket connections for power supply line and controf pendant, electric overigad cut-off.

### 4.6.1 Direct control

Direct control is effected in the main circuit by means of the DSK 3 D... and DST contró pendarit.
The control pendant is supplied with the control cable connected to it: Connect the separately suipplied control pendant In accordance with the wining diagram. Plastic-sheathed wire cords:are used for strain reliof of the DST control cabte, the DSK 3 : D... control cable is provided with strain relief by means of a flexible hose. For control cable strain relief, see sections 5.6 and 5.7 for DSK 3 D... and DST controf pendant assembly instructions.
The special Demag chain is of highty wear-resistant material with a high degree of surface hardening, zinc-plated with additional surface treatrient. Onty ctiains marked with Demag may be used. The chain hoist has a six-pocket chain drive sprocket and a hardened chain guide.

The housing is of strong die-cast ahminium and thus light-weight and robust.
The pivoting chain collector box is of tough; flexible, impact-resistant plastic.

### 4.6.2 Contactor control

Contactor control is effected in the auxiliary circuit by means of the Demag control pendant. The control pendant required depends on the application.
Control pendant DSK 3 S... for Dermäg chain hoists without electric'travel trolley, control pendant DST or DSE for Demag chain fioists with electric traved trolley. Connect the separately supplied control pendant in accordance with the wiring diagram:
Plastic-sheathed wire cords are used for strain relief of the DST and DSE control cable, the DSK 3 S... control cable is provided with strain relief by means of a flexible hose.
The hoist and travel drive contactors, as well as the main contactor and the control transformer are combined into one set of electrical equipment (see fig. 1).
The control circuit is fed from a transformer, the secondary of which is connected to earth.

The shock and impact-resistant housings are of high quality thermoplastic in the case of DSK and DSE units and of glass-fibre reinforced polyester in the case of DST units and are resistant to fuels, satt water, fats, oils and alkaline solutions.
Type of enclosure IP 55 (65) for DSK and IP 65 for DST/DSE.
Strong mineral (e.g, hydrochloric or sulphuric) acids may corrode pendant switch casings. Replace such pendant switches in good time.

# 4:8 Suspension fittings 

Five types of suspension fitting provide a wide range of mounting possibilities.
Long suspension eye - standard design
For monorail and KBK trolleys
Short suspension eye
For optimum utilization of the available hook path (not suitable for KBK).
Suspension ring - tumed $90^{\circ}$
For arrangement of the chain foist parallel to the gircer
Suspension hook
For quicidy changing the position of the chain troist and changing the mounting position by increments of $90^{\circ}$ (not suitable for trolleys).

## Special suspension eye

For fitting the carier link with straln gauge or the electro-magnetic load link. Additional bore holes in the housing of the chain hoist provide further mounting possibibilities.

### 4.9 Trolley

The load capacity of the Demag chain hoist must not exceed the load capacity of the trolley.

### 4.9.1 Track

When selecting a track, we suggest you specity our KBK crane construction kit track section (fig. 2) of special design. The light-weight; cold-rolled track sections feature a smooth running surface and offer the advantage of simple power supply by means of trailing cables or integrated busbars. The use of I beans according to DIN 1025 as tracks is also:possible:
The track radius on curved sections should always be as large as possible in order to ensure good travel characteristics.
I beam tracks should be bent with the utmost care in order to obtain a clean, regular curve: Ready-made curved sections are avallable for our special KBK'track, Hoist travel on I beam tracks must in no way be.obstructed by protruding suispension bolts, screw heads, butt straps, clamping plates, etc. These types of obstruction can be avoided by using our special KBK track section.
Resilient buffers should be mounted at travel wheel axde level at the ends of tracks: in order to prevent the hoist from derailing.

KBK 100
KBK I
KBK H-L
II
II-R



KBK III

## 5 Assembly instructions

### 5.1 Electrical equipment



Work on electrical equipment may only be carried out by qualified electricians: or trained personnel, see also section 1 "Safety instructions".
Each Demag chain hoist is provided with a wiring diagram showing details of the controls.

The wiring of the chain hoist complies in all respects with current DIN VDE- and accident preverition regulations. Unauthorized intervention and:modifications may result in infringement of these regulations.
The switchgear is designed for extreme conditions. However, its 䓲e depends on usage.
Actuise operators to avoid inching (i.e. giving short pulses to the motor to obtain small movernents) as far as possible, e.g. when:liffing loads, to prevent excessive contact burning and thus premature destruction of the switchigear.
Inching operations can largely be eliminated by using two-speed hoist and traved motors.


### 5.2 Connection to the electrical supply



First check whether the voltage and frequency stamped on the data plate match your. mains supply:
The terminals for mains connection are located on the rear wall of the electrical enclosure.
To cornect the power supply cable, the electrical equipment cover must be removed and, in the case of hoists with contactor control, the switchgear set must be swung to the side.
A 4-lead cable with an earth lead (PE) is required for current supply.
The required supply cable conductor cross sections, the maximum permissible sup$\bar{p} l y$ cable length and fuse links can bee seen in the tables in sections 2.5 and 2.6.
Please note that the length of the supply line specified for a given cross section must not be exceeded in order to avoid excessive voltage drop, which might prevent the conical rotor of the motor from sliding into running position when the motor is switched on.
The wiring canied out in our factory includes an earth lead which is connected to all parts of the equipment whichrelevant regulations require to be included in the protective measures.
The protective conductor marked green/yellow in the supply line must be connected to the green/yellow earth terminal.
Connect leads LT, L2 and L3 in accordance with the wiring diagram. Open the cage clamp terminals with a $3,5 \mathrm{~mm}$ wide screwdriver as in fig. 3.

### 5.3 Connecting the control cable <br> Connect the control cable in accordance with the wiring diagram.

5.4 Checking the direction of movement

When the control pendant button for "ifting" is pressed, the load hook must move upwards.

If this is not the case, leads L2 and L3 of the supply cable should be changed over. (Switch off the mains supply before changing over the leadsl)
5.5 Replacing the control fuse link

The control fuise link ( 1 ) is held in: fuse terminal on the control transformer. The required amperage of the fuse link can be seen on the transformer data plate.


### 5.6 Assembly instructions for DSK control pendant

Electrical instalation work must only be caried out by a qualified electrician, see also section 1 "Safety instructions".
Control pendant suspension height approx. 1000 mm above floor level:
For spectal strain relief solutions see operating instuctions:
Ident no. 206489 44.(720 IS 951)

Strain relief with special flexiblē hose
Push special flexible hose 1 over slide bush 2 and secuire with hose clip 3. Inisert slide bush 2 in DK housing 11.


Strain relief with special flexible hose and plug-and-socket connection



### 5.6.1 Connection and strain relief of the DSK controf pendant

Loosen the three housing screws 9 . Remove lower part 8 of the housing. Pass flexible boot 2 over flexible hose 1. Slide flexible hose onto connecting socket 4 unti it stops and secure it to the latter by tightening clip 3. Pass cable 5 through clamp 6 and clarnp tight. Carefully lay conductors 7 and connect them to terminals.


Connect only in compliance with the wining diagram.
Switching elements CBD 1 / CBC 2:
Ft bridges 14-64, 24-54 tor switching element CBD 1 and 13-53, 23-63 for CBD 2.
Switching elements CBD 1, CBS 1, CBD 2 and CBS 2 can ondy be fitted in one predetermined position defined by a rib.
Refit lower part 8 of the housing by tightening the screws provided for this purpose.
Ensure that sealing washers are placed: below screw head 9.



5.6.2 Strain relief with special flexible hose and plug-and-socket connection

Push special flexible hose 1 over threaded bush (not illustrated). Insert strain relief plate 12 under hose cilp 3 and secure by tightening hose clip. Push sealing sileeve 13 over threaded bush until the latter is no longer visible (use grease or simblas hutricant). and secure with hose clip 14.
Hook strain relief rods 15 to Demag chain hoist DK and connect to strain relief plate 12 by means of snap hook 16 .

For further information see assembly instructions DSK control pendants Ident. no. 20848544

### 5.7 Assembly instruction for DST control pendant



Electrical installation work must only be carried out by a qualfied electrician, see also section 1 "Safaty instructions".
Control pendant suspension height approx. 1000 mm above floor level.



Fig. 5
41000244.eps

Control pendant with sloove protecting against kinking 18 .
Strain rellef by wire cords; see figs. 4 and 5.
Loosen the 4 or 6 housing screws 8 . Remove lower part 7 of the housing: By tightening the two screws securing; cap 12 to upper part 13 of the housing, press, sleeve protecting against kinking 18 against the housing. Cut off steeve protectingagainst kinking 18 as required for the relevant cabte diameter (see markings on sleeve). Pass cable 2 through sleeve 18 and clarmp 4 (small opening for cäblees of. $10-20 \mathrm{~mm}$ diameter and wide opening for cables of 20-26 mm diameter' and ctarmp the cable by tightening the screws. Tighten cip 19 on sleeve 18 This ensures that the cable intet is water-tight. Carefilly bunch conductors 5 behind clip 8 and connect them to terminals as required.


Coninect only in compliances with the wiring diagram.

Only use bridges 33-34, 43-44 for switching element SED 1 ZD and 11-22, 21-12 for switctuing element SED 27D. Remove bridges $34-62$ and 44-52 on switching element SED 27D for liftinghowering. Double switching elements SED 10 and SED 2 2 can only be fitted in one predetermined position defined by pin 14. Fit lower part 7 of the housing by tightening screws 8 . Ensure that sealing washers are placed below screw heads 8 .


## Strain relief by means of wire cords

Hook strain relief rods 32 to Demag chain hoist DK. Thread strain reliet cords 33 through loops of strain reliet rods 32 and insert in slots of retaining plates 34 (part no. $864: 662$ 44) in the shape of an " S " (seed fig. 5).

For further information see assembly instructions DST control pendants Ident. no. 20616544

### 5.8 Assembly instructions for DSE control pendant


5.8.1 Connecting the control cable with vulcanised strain relief wire cords to the DSE control pendant


For connecting the control cable with vulcanised strain relief wire cords; proceed as follows:

- Undo the four recessed head screws (1) and remove rear part (2) of the housing.
- Remove housing cap (3)
- Cut off protective sleeve (4) as required for the relevant control cable diameter.
- Push protective sleeve (4) onto control cable: (5). Use hudricant (e.g. washing-up liquid).
- Separate vulcanised strain relief wire cords (6) from control cable (5) (fig. 8).
- Push tube clip (B) up to strain relief wire cords (6) and control cable (5).
- Undo the two recessed head screws (13) of pressure sleove (7).
- Push pressure sleove (7) onto control cable (5) (fig. 6).
- Side control cable (5) through washer (9) and sealing ring (10).

The sealing washers and the sealing rings are assigned to the corresponding control cable dlameter in accordance with table. 1.

- Strip insulation from the end of the control cable (fig. 7). Pay attention to the mounting dimenerioions!
- Pull conductors into front part (11) of the housing.
- Slide washer (10), sealing'ring (9) and:pressure sleeve: (7) down to the front part (11) of the housing.
- Tighten the two recessed head screws (13).
- Stip sheathing of strain relief wire cords (6) (fig. 6).
- Shorten strain reliaf wire cords (6) (fig. 6) and insert on the side in the groove of pressure sleeve (7)
- Fix strain relief wire cords with tube clip (8) (fig. 6).
- Connect conductors in accordance with witing diagram and assignment diagram in rear part (2) of the housting.
- Open the cage clamp terminals with a 3.5 mm wide screwdriver or an offset screwdriver as shown in fig. 9 (part no. 772798 44).
- Push protective sleeve (4);onto pressure sleeve (7). The protective sleeve is flush with the pressure sleeve flange.
- Fit housing cap (3).
- Screw rear part (2) of the housing back onto front part (11) of the housing.
- Finally fit bumper (12) (see section 5.8.2).

Table 1

| Control tabla outside diarneter | Pressure slogve with seal |  | Control cable outsicte dameter | Prossure slecye with seal |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 100.5 = 14,5 | $\begin{gathered} \text { Hem } 9 \\ 2 \times 772.57644 \\ \text { Sealing washer } \\ 10.15 \text {. } \end{gathered}$ | 42029544.008 | 15-20 | Hem 9 <br> $1 \times 772574.44$ <br> Serifing washer $15-20$ | 4tBCOH44.eps |
|  | $\begin{gathered} \text { Hem } 10 \\ \times 77257544 \end{gathered}$ <br> Seeting ing 10-15 |  |  | $\begin{gathered} \text { Ltem } 10 \\ \times 77254644 \end{gathered}$ <br> Sealing ining 15-20. |  |

### 5.8.2 Fitting the rubber bumper

Fit the bumper at room temperature.
We recommend that a wbricant (e.g. washing-up liquid) be used for further assembly.


### 5.8.3 Connecting the strain relief wire cord



Connecting the control cable with wilcanised strain relief wire cords to the DK housing.

- Separate vulcanised strain relief wire cords from the control cable äs shown in the table above (for dimensions see fig. 11).
- Shorten strain relief wire cords by approx. 100 mm and strip sheathing in accordance with the thimble ciameter +30 mm for fiting Talurit clamp (6).
- Slide one Talurit clamp (6), each, onto the strain relief wire cords.
- Place strain relief wire cords around thimbles (4), insert into Talurit clamp (6) and secure using pliers while the rope is tensioned.
- Hook strain relief rods (1) to DK housing (see page 11).
- Hook strain relief rods (1) to thimbles (4) as strown in the fig. 10.

Plug-and-socket connection


Screw-type connection


Fig. 1.1

1) To ensure strain refer of the control cable, the control cetple must be epprox; 100 man longer than the ..required strain retief corts.

## 5:9 Fitting the chain for 1/1 reeving <br> Fitting the load hook assembly and limit stop



5.10 Fitting the chain for $2 / 1$ reeving Fitting the bottom block and limit stop




### 5.11 Converting suspension eye, suspension hook and suspension ring from $1 / 1$ to $2 / 1$ reeving



$2 / 1$ reeving

$41047344 . e p s$
$41047444 . \mathrm{eps}$
4:047144.eps

5.12 Fitting the chain collector box


### 5.13 Fitting the counter-

 weights and cover retainer for DKUN 2/DKUN 5 .


Allocation of counterweights

|  | DKUN 2 |  |  |  | DKUN 5 |  |  |  | DKUN 2 |  |  |  | DKUNS |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Number of counterweights lor contactor control with transformer:. |  |  |  |  |  |  |  | Number of counterweights for direct control |  |  |  |  |  |  |  |
|  | Pert no. |  |  |  |  |  |  |  | Partno. |  |  |  |  |  |  |  |
|  | 83512744 |  |  |  | 83612744 : |  |  |  | 83512744 |  |  |  | 83612744 |  |  |  |
|  | Motor |  |  |  | Motor |  |  |  | Motor |  |  |  | Motor |  |  |  |
|  | KNP | 1 MKK |  |  | 10.3 K |  |  |  | KMP | MMK |  |  | KMK |  |  |  |
|  | 71:B | 71 B | 80 B | 807 | 71.8 | 80 B | 90 B | 902 | 71:B: | 71 B | 80. B | 802 | 71 B | 808 | 90 B | 90 Z |
| With short cover | - | - | - | * | - | - | - | * | 4 | 4 | 8 | 7 | 3 | 6 | - | 8 |
| With lorg cover | * | 1 | 3 | 2 | 1 | 2 | 4 | 3 | 2 | 2 | 7 | 4 | 3 | 6 | 7 | 4 |

Cover retainer part no. 83655344

### 5.14 Fitting the counterweights and cover retainer for DKUN 10-16-20





### 5.15 Fitting the supporting roller on EU 11 DK trolleys for flange widths $58-143 \mathrm{~mm}$



## 5:16 Fitting RU/EUDK drop

 stops

### 5.17 Example for mounting

EU'11 DK
Supporting roller up to flange width
143 mm only
with ZMS strain gauge carrier link

EU 11 DK
with suspension eye and crossbar yoke
from flange width 144 mm
EU11 DK
with suspension ring and trolley crossthar yoke from flange width 144 mm


## EU 11 DK

with ZMS strain gauge carrier link and crossbar yöke from flange width 144 mm

40266344.eps


### 5.18 Assembling RU/HU/EUDK trolleys

Assembling RU / EU 36-N (with adjusting rings for infinitely variable track gauge), see assembly instructions 214800.44

For further assembly and adjustment, refer to:
'RU 3 D̈K trolleys
FiU 6 DK trolleys
RU 11 DK trolleys
RU 22 DK trolleys
EU 11 DK trolleys
$\begin{array}{ll}20660044 & 720 \text { IS } 845 \\ 20660144 & 720 \text { IS } 845 \\ 206602.44 & 720 \text { IS } 845 \\ 20660344 & 720 \text { IS } 845 \\ 206604: 44 & 720 \text { IS } 845\end{array}$

| EU 11 DK trolleys | 20660444 | 720 IS 845 |
| :--- | :--- | :--- |
| EU 22 DK trolleys | 20660544 | 720 IS 845 |
| RU $36-$ N.trolleys | 21480044 | 720 IS 845 |
| EU $36-$ trolleys | 21480044. | 720 IS 845 |
| RU 55 DK trolleys | 206.58044. | 720 IS 845 |
| EU 55 OK trolleys | 20658144 | 720 IS.845 |

Trolley crossbars tightening torques RU $3 / \mathrm{RU} 6$ DK

RU 11/RU 22 DK
HU 11/HU 22 DK
EU 11/EU 22 DK


Assembling RU / EU 36-N (with adjusting rings for infinitely variable track gauge), see assembly instructions 21480044


## Assembling the trolley

Fitting the travel drive

Removing/fiting the trolley crosšbar loc̈knut EU 11/EU 22 DK

Insert trolley crossbar (1) into:side cheek (2) (see fig. 13). Then adjust the trolley according to the girder flange width of the track by arranging the distance washers as specified on page 54 . Assembling trolleys.

EU11/EU22 DK: The locknut (3) must be tightened to the specified tightening torque (see fig. 12).
EU 55 DK: $\quad$ The castie nut (3) must be tightened to the specific tightening torque (see fig. 12) and secured with a spil pin.
Since girder flange width tolerances are relatively high, the gap between the travel wheel flange and the girder flange must be checked on both sides to ensure that the play does not exceed 2 mm

Knock the split sleeve into the hole in the side cheek (2). Then fill the traved drive with grease - approx. $60 \mathrm{~g}_{;}$part no. 47291544 -see fig. 13. Screw travel drive (6) to side cheok (2) with screw (5). Ft the travel drive in such a way that the play between the teeth of the drive pinion and the two travel wheels is the same.

If the locknut is complately removed from the crossbar; a new locknut acc. to DIN 985 must be used.
The:locknut can be screwed onto the trolley crosisbar for pre-assembly without being pre-tensioned.
For final assembly, only unscrew the locknut until the trolley can be placed on the girder.
Then tighten the locknut with the specified tightening lorque (see fig. 12).
5.19 Fitting the CF 5 trolleys


### 5.20 Fitting the CF 8 trolleys

Pay attention to girder type!


Fitting the trolleys


## 6 Putting the Demag chain hoist into service

When determining the hook path/itting height, make sure that when in the lowest hook position, the load hook or bottom block is lying on the floor (limit stop at the dead end of the chain should not touch the chain guide base plate).

6.1 Inspection when putting the hoist into operation

### 6.2 Safety instructions



### 6.3 Starting operation

Ali fitting and assembly work must be completed in accordance with the operating instructions and the hoist chaln must be greased.
Operation with defective or damaged chains results in a high risk of accident for persons and the chain hoist and is therefore prohibited.
Any change or modification which preipulices satety must be reported to the nearest person responsible immediately. Unauthorized repairs are not permitted:
When putting the hoist into operation for the first time, the inspections in accordance with section 8.3 ; table 2 must be carried out.

### 6.4 Notes regarding the motor

The surfices marked on the motor shaft shown in fig. 14 are preserved with Rustban 391. The trwolute spline is coaled with lutricating varrish 321.
The preservative and the lubricating varnish must not be removed when dismantling the motor. When maintenance is caried out, the surfaces marked below must be checked and a new coat must be applied, if, required:


The red paste which can be seen in the area of the braking surface is used for preservation until putting into operation and running th the braking surface of the motor. This preservative must not be removed, however, it is not necessary to apply it again during maintenance.

## 7 Taking the Demag chain hoist out of 'service



### 7.1 Emergency-stop button

Every chain hoist features an emergency-stop device with which all motions can be stopped in the event of a hazard.
The emergency-stop button is arranged on the control pendant.
To actuate the emergency-stop button; press the button until it reaches the end stop and automatically latches.
To unlock the actuated emergency-stop button, tum the push button in the direction of the arrows and release.
The emergeicicy-stop device must only be reset after the hazard and its cause have beon eliminated.

### 7.2 Taking the holst out of service at the end of the shift

When the work has been complêted, raise the hook assombly or bottom blockoutside the travel area: switch of the power supply at the mains connection or isolating switch.

### 7.3 Taking the hoist out of service for maintenance purposes:

Maintenance work on the Demag chain hoist must not commence before the load has been removed and the mains switch/lsolator switched off. The relevant accident prevention regulations'and statutory regulations must be observed for operation and maintenance.
Tests and inspections required in addition to those specified in the maintenance schedule (see table 2) must be cariled out, see also section 1 "Safety instructions".

## 8 Inspections/maintenañce/geneeral overhaul GO

### 8.1 Inspection before starting work and during operation

Table 2
Inspection and maintenance schedule

| Check when putting into operation, witien starting operation and during operation | See section | Betore putting into operation | When starting operation | Evary 6 months | Once per yeer |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Lubricate chain (under heavy-duty conctions the chain musil be hericateod more feguenth) | 8.5 | X | $x$ |  | x |
| Check etactrical swichetar end wifing | 5.1 | $\dot{x}$ |  | x |  |
| Check operation of emergency tritt sidtch, if futed: |  | $x$ | $x$ |  | $x$ |
| Creok strain retoving oboments, control cables and control pendant huxsing for damage |  | x | X |  | $\times$ |
| Check operation of the sfipping ciutch | 8.9 |  |  |  | X |
| Check operation of the brake | 8.6 | ' x . | $x$ |  | $x$ |
| Check hook and hook safaty catch |  | $\times$ | $\bar{x}$ |  | $\bar{\chi}$ |

## Check during operation

| Check and apply further grease to bearing pobtts of suspension eyes, suspension hook: assembly and suspension eye turned $90^{\circ}$; as required | $\begin{array}{c\|} \hline 5.11-5.12 \\ 5.18-5.19 \\ 5.20 \\ \hline \end{array}$ |  |  |  | x |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Check brike stupec, echest brake or replace brake cup, es required | 8.6 |  |  |  | X. |
| Check troley crosshar connection | 5.18. |  |  |  | X, |
| Check suspension eye, locking eferments; bracket for sisipension ejya and securing ëloments (clips, etc.) | 5.11 |  |  |  | X |
| Check $\overline{\text { Suspenision }}$ eye/suspension hook assemsly and ensure suspension eye turned $90^{\circ}$ is property secured | 5.11 |  |  |  | X |
| Check tight fit of securing botts on load took assermidy | $5.9{ }^{\circ}$ |  |  |  | X |
| Check hooks fior cracks, deformation and Wiear | 8.4 | - |  |  | X |
| Check hook safety cateti for doformation $\quad$ " |  |  |  |  | X |
| Oneck hook bearing for magr | . |  |  |  | $x$ |
| Bontorn blocke utricate chain sprocket beering and check thatt fit of securing bots | 5.10 |  |  |  | X |
| Check chain sprocket, return sproctuei and chain guide |  |  |  |  | $X$ |
| Check ohain and chain conlector boxx me properly secured | .5.12 |  |  | . | $X$ |
| Check chain for deformation, crecks, piting, reduction in the thickness of the Rots ar increase in pltch otes to wear , efongation caused by deformation | 8.5 |  |  | , | X |
| Check securing ehanents (cips, bolts, etc.) for tight fit and corrosion | $\begin{gathered} 5.11-5.12 \\ 5.18-5.1 \theta \\ 5.20 \end{gathered}$ |  |  |  | $x$ |
| Check end epply or. gupplannent corrosion protection, es required | $\stackrel{\square}{\circ}$ |  |  |  | $X$ |
|  |  |  |  |  | X |
| Chack troliey, crosstar and condition of bufiers | $\begin{gathered} 5.18-5.19 \\ 5.20 \\ \hline \end{gathered}$ |  |  |  | X |
| Check hotrication of gaered travel roliers of monoral hoist | 8.8 |  |  |  | X |
| Check On lexal | $\cdots$ - |  |  |  | X |
| Change ol | 8.7 . |  | every 4 - | - 5 yers |  |
| Check bearing points of rotor for cormsion | 6.4 |  | every 5 | 5 years |  |


| The general overhaud should colncide with the annual inspertion |  | On reaching the theoretical durstion of service |
| :---: | :---: | :---: |
| Ft chain-foist specific Derneg 90 set | 8.3 | X |

The small parts (screws, washers ...) to be replaced during maintenance and assembly work äre not listed separately. The tasks specified in the inspection and maintenance schedule must be carried out during a GO.

The specified maintenance.intervals apply to nommal chain hoist service conditions. If the annual calculation of the actual duration of service $S$.indicates that the theoretical duration of service $D$ will be reached before a period of $8-10$ years. regutar maintenance work must be adapted to the operating conditions and maintenanice must be cämied out at shorter intervals.
For repairs, only use genuine Demag parts (see component parts list).

### 8.4 Suspension eye, hook, trolley crossbar

If a check or inspection reveals that these components are wom beyond the dimensions shown in fig: 15 and the tables, or if cracks can be seen in these parts, they must be replaced at once See pages $42-45$ for replacing the hook in the load hook assembly or in the bottom block.

| Chain hoist DK |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Range |  | OKUN 2 | DKUN 5 | DKiUN 10 | DKUN:16 | DKUN 20 |
| Suspenslon eve min. coimenstion E |  | 13 | 17 | 24:5 | 24,5 | 30 |
| Load hook min. demension $f$ for mevinig | 1/1 | 16,2 | 19.35 | 23,6 | 31 | 31 |
|  | $2 / 1$ | 19,35 | 23,6 | 30,86 | 35 | 44 |

Trolley for DKUN 2

| Renge. | RU 3 | Ru6 |  | PUH1/EUT1 |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Flanga width mm | 59-90 | 58-143 | 144300 | 58-143 | 144-300 |
| Trōlley crosstar min. demension V | 16 | 24 | 30 | 30 |  |
| Trolley croiststar min. dimension hi | * | - | 14,5 | $=$ | 17,5 |

## Trolley for DKUN 5

| Range | RU3 | RUB |  | PGM1/EU11 |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Flange with mm | 5800 | 58-143 | 144-300 | 58-143 | 144-300 |
| Trimpy crosstear min. dimension. $v$ | 16 | 24 | 32 | 30 | 38.5 |
| Trotley croshber min, dmension h1 | - - | . - | 14.5 | - | 17,5. |

## Trolley for DKUN 10

| Range | RU 6 |  | RU111EU 11 |  | RU 22FE 22 |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Flange with mm | 58-143. |  | 50-143 | 144-300 | 82-143 | 144-300 |
| Trolitey orossber min. dimerision $v$ | 24 | 32 | 30 | 38,5 | 45,5 |  |
| Trollay croesbar min. comension hy | - | 14,5 | - | 17:5 | * | 26,5 |


| Trolley for DKUN 16 |
| :--- |
| Range |
| Fange whth my |
| Tholley crosstar |
| min. dirnension $v$ |

Trolley for DKUN 20

| Painge | RU22ME 22 |  | RUS $30-\mathrm{N} / \mathrm{ELS}^{36-N}$ |  | RU 55/EU 55 |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Flange witht imm | 82-143 | 144-300 | 90-180 | 181-300 | 106-188 | 187-300 |
| Trolley crosstar min dimension $\bar{v}$ | 45.5 |  | 44 | 43 | 57 | 67 |

### 8.5 Hoist chain



Fig. 16
41050444.eps


8:5.2 Checking wear or deformation of the original Demag chain In addition to selecting the correct hoist unit, owners of electric chain hoists are obliged by relevant accident prevention regulations to constantly check the round section steel chain in order to ensure optimum operating safety and, therefore, to avoid serious accidents.
Where normal duty conditions prevail, the chain should be checked once: year (seo section 8.2, table 2).
If routine maintenance reveals that the titervals are too long, they shoutd be adapted to the specific operating conditions.
A partial load must be suspended from the load hook when measuring the chain for weer or defomation. This measurement can be taken in two different ways.

1. As in fig. 17 with a caliper gauge
2. As in fig. 18 with a chaln gauge

## Measuring with the caliper gauge

Measurements on: 11 chain links may be taken in steps of $2 \times 3$ and $1 \times 5$ chain links (see table 3 and fig. 17).
The sum total of the 3 readings taken, i.e. a1 $+a 2+a 3$, must not exceed limit a in table 3. Otherwise, the chain must be replaced.
Since this is a chain of special manufacture with the name Demag stamped on every 12th link for chain size $4,2 \times 12,2$ and 5,3 as well as every 10 th link for chain sizes $7.4 \times 21,2-8,7 \times 24,2$ and $10,5 \times 28,2$ replacements must not be procured from any source other thian Demag.

Do you find that, on fitting a new chain, it does not run smoothly over the sprocket? Please contact our atter-sales service centro.


The use of chains other than those supplied by Dernag is niot permitted.

Chains and chain sprockets are designed to fit each other precisely. Your using a chain of a make other than Demag renders any liability and guarantee claims:null and void.

Table 3

| Demag chain thoist | OKUN 2 | OKUN 5 | DKUN 10 | OKUN. 16 | DKUN 20 |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Chain destenation $d x$ i | 4,2 $\times 12,2$ | $5.3 \times 15,2$ | 7,4×21:2 | $8.7 \times 24.2$ | $10,5 \times 28,2$ |
| Urith dimensionta aceording to DIN 685 pert 5 |  |  |  |  |  |
| Oversil length of 11 fiks, maximum crinerision am a $1+\mathrm{a} 2+\mathrm{a}^{3}$ | 144.7 mm | 180,3 min | 253 mm | 289,2 min | 337.4 mm |
| Inside length of a link, maxiturn cimension: | 12,8 mm | $15,9 \mathrm{~mm}$ | 22,4 mm | 25.5 mm | 29.8 mm |
| Masisiring the ctrath Enk diementar, (see fig. 17) Minimum dimension d $m=0,9 \times d$ | 3,8mm | 4;8 nm | 6.7 mm | 7.8 mm | 9.45 mm |

Refer to sections 5.9 and 5.10 for replacing the chain when required.


When the chain hoist is operated with a dry-running chain, the chain guide, chain sprocket and return sprocket of the bottom block must also be replaced when the chain is replaced.

Chain gauge
Part no. 83602544


### 8.6 Brake

8.6.1 KMK main hoist motor brake and KMF travel motor brake 80

| Number of shims |  |  |
| :--- | :---: | :---: |
| Motor | Cunntity | Shim thiciness |
| $71 / 80$ | $2 \times 5$ | $0,8 \mathrm{~mm}$ |
| 90 | $2 \times 6$ | $0,8 \mathrm{~mm}$ |
| 100 | $2 \times 9$ | 1 mm |
| 112 | $2 \times 10$ | 1 mm |

8.6.2 Adjusting the brake with shims

Demag chain hoists are supplied with the brake adjusted for the minimum rotor displacement path of approx.
$1,5-2,0 \mathrm{~mm}$ for $7,1,80,90$ motors and
$1,8-2,3 \mathrm{~mm}$ for 100,112 motors.
As the brake liring wears down, the path of rotor displacement increases.
The brake must be adjusted before the path of displacement has reached a.mavimum of $3,0 \mathrm{~mm}$ for $71,80,90$ motors and $3,5 \mathrm{~mm}$ for 100.112 motors.
It is therefore imperative to ensure, by regular maintenance, that the brake is adjusted before the maximurn rotor displacement is reached.
For brake adjusiment the load must be removed from the chain hoist.
Adjustment can be repeated several times.
it is advisable to have a spare brake cup in stock.



Loosen brake sthicta


### 8.6.3 Changing the brake cup



206501k5.p65/240105


Brake release stimu
Fi brake shield


20650145.pes/240105



Number of shims

| Moter | Quendty | Shim thickuess |
| :---: | :---: | :---: |
| 71 | $2 \times 5$ | $0,8 \mathrm{~mm}$ |

Demag chain hoists are supplied with the brake adjusted for the minirrum rotor displacement path of approx. $1,5-2 \mathrm{~mm}$ for the KMP 71 motor.
As the brake lining wears down, the path of rotor displacement increases.
The brake must be adiusted before the path of cisplacement has reached a maximum of $3,0 \mathrm{~mm}$ for the KMP 71 motor.
It is therefore imperative to ensure, by reguar maintenance, that the brake is adjusted before the maximum rotor displacement is reached.
For brake adjustment the load must be removed from the Demag chain hoist.
Adjustment can be repeated several times.
It is advisable to have a spare brake cup in stock.

1. Measure the path of rotor clisplacement:

For KMP motors which are not fitted with a fan; remove the black plastic cap from the brake end cap, turn it and determine differeñce dimeinsion lu by pressing on the brake release stimup (see fig. 19).
2. Loosen the four nuts (2) and remove brake end cap (1).
3. Reriove the necessary number of shims (3) in onder to obtain a path of displacement of $1-1.5 \mathrm{~mm}$ (shim thickness $0,8 \mathrm{~mm}$ ): it is absolutely essential that the number of shims at the top is the same as at the bottom.
4. Screw. on brake end cap (1) everliy with the four hexagon socket nuts (2) with a tightening torque of $10,5 \mathrm{Nm}$. Any paint or dirt trust be removed from the centering faces.
5. Check path of rotor displacement (should be $1-1 ; 5 \mathrm{~mm}$ ).

8.6.7 Traval motor brake 13/3. PKF, 13/6 PKF and 13/6 PF


Demag travel drives are supplied with the brake adjusted for the minimum rotor displacement of äpprox. $1-1,5 \mathrm{~mm}$.
As the brake linuing wears down, the path of rotor displacement increases.
it is therefore imperative to ensure, by regutar maintenance, that the brake is adjust: ed before the maximum rotor displacement is reached.
Adjustment can be repeated several times.
It is advisable to have a spare brake lining of a complete brake end cap available.

### 8.6.8. Adjusting the brake with shims

Meäsure the path of rotor cisplacement:
This is done by measuring the distance between the motor shaft end and the brake end cap, first with the brake engaged (fig. 20) and then with the brake released (fig. 21). If the path of displacement is approx. 3 mm , the brake must be adjusted.


Loosen the four nuts (2) and remove brake end cap (1).
Remove the necessary number of shims (3) in order to obtain a path of displacement of $1-1,5 \mathrm{~mm}$ (shim thickness $0,8 \mathrm{~mm}$ ); it is absolutely essentiad that the number of shiris at the top is the same as at the bottom.
Screw on brake end cap (1) evenly with the four hexagon socket nuts (2) (for tightening torque see fig. 22). Any palnt or dirt must be removed from the centering faces.
Check path of rotor displacement (should be 1-1,5 mm).
Loosen the four hexagon socket nuts (2) and remove brake end cap (1) with its wom lining.
8.6.9 Fitting new brake lining to travel motor

Remove old brake lining from brake end cap.
Glue new brake lining into brake end cap (see section 8.6.10).


### 8.6.10 Giluing on brake linings



### 8.7 Gearbox



A two-component glue is supplied with every replacament brake lining. The linifing must be hedd in position by a clamping device.
Remove end cap (brake end shietd) (1), heat to 100-150 C and remove wom brake fining. (To do this, put the end cap on a heating plate and poutr some water into recess " $X$ " of the end cap. The required temperature has been reached when the water boiks. Remove the remains of the old lining with a screwdriver or simitar tool). Surfaces to be glued together must be froe from grease, oil, paint, nust, dirt and moisture. They should be emery-papered and wiped with acetone or any other good solvent.
Squeeze adhesive out of the two tubes supplied and mix the two components thoroughly in a ratio of 1:1. Apply a thin layer to both surfaces with a brush or paint scraper.
Locate annular brake lining (2) in its proper position and apply pressure by fitting pressure disc (3), bott (4), washer (5) and nut (6) as illustrated in fig. 23.
Allow the glue to solidity under pressure for 20 hours at room temperature.
Remove the gluing jig (components 3 to 6 ).
Fit adjusting shims and end cap (see section 8.6.8).

## Oil lubrication

Under normal operating conditions, the oil must be changed at least every 4 years.
Under exceptional conditions, e.g. increased ambient temperatures, we recommend that ol changes be adapted to suit these conditions.

## Oil change

Drain the old oil at operating temperature. To do this, first remove the air vent screw at the top of the gearbox and then the plug at the bottom, and the cil will run out: The flushing oil should have a viscosity of $46-68 \mathrm{~mm}^{2} / \mathrm{s}$ at $40^{\circ} \mathrm{C}$.
The quantity of flushing oil used should be approximately twice that specified for Lubrication. Then flush the gears by switching the hotst on and allowing the hook to ruin several times over the entire length of its path. Then drain the flushing oilland refill the gearbox with oil as specified for lubrication. The required quantity and grade of oil can be seen from the table below.

## Oil grades

For ambient temperatures of approx. $-10^{\circ} \overline{\mathrm{C}}$ to $+50^{\circ} \mathrm{C}$, a gear of of $220 \mathrm{~mm} \mathrm{~m}^{2} / \mathrm{s}$ at $40^{\circ} \mathrm{C}$ with mild high-pressure additives should be used, DIN 51502 CLP 220 , e.g. BP ENERGOL GR-XP 220, Esso Spartan EP 220, SHEL Omala oili:220, Mobilgear 630 or Aral Degol BG 220.
At higher or lower amblent temiperatures, the type of oil used should be adapted to the specific condilitions:

Dispose of waste oil in accordance with: environmental protection requirements.
Quantity of oil in litres

| Piange | OKUN 2 | DKUN 5 | DKUN10 | DKUN 16 | DKUN 20 |
| :--- | :---: | :---: | :---: | :---: | :---: |
| Litre | 0,15 | 0,25 | 0,4 | 0,4 | 0,7 |

Part no. 47290244 , 1litie

### 8.8 EU 11 DK/EU 22 DK/ EU $36-\mathrm{N} / \mathrm{EU} 55$ DK electric trolley gearbox

The gearbox is lubricated with grease (approx. 60 g ).
Under nomal conditions this grease suffices for approx. 2 years after which the gears need relubricating. The geared travel wheeds must be lubricated regularty with the same grease.
Part no. 011058 44, 60 g .

### 8.9 Adjusting the slipping clutch



Under nomal operating condifions, the slipping ctutch does not need to be adjusted. The clutch runs in the oil bath and the linings are virtually wear-free. The slipping clutch is initially set in the factory. Adjustment of the slipping cutch may only be carned out by authorized specialists. An increase of the tripping torque which exceeds the factory setting is not permitted.

Adjust the slipping clutch with the fiction force checking device.
Part no. 83670844
For further information see Adjusting the slipping clutch 20697444.

1
Only allow siliping clutch to slip at creep lifting speed (fi provided) while lifting.

A new safety nut must be fitted each time the clutch lining is replaced.

## 9 Measures necessary for achieving safe working periods

The safety and health provisions of EC directive 98/37/EC make t a legal requirement to eliminate special hazards which may be caused by, for example, fatigue and ageing. This requirement is also reflected in relevant accident prevention regulations and codes of practice, such es the 3rd supplement to UW/BGV D8 (VBG 8) of 1.4.1996 in Germany. This requirement obbges the owner of serial hoist units to determine the actual duration of servica of the hoist unit on the basis of the operating hours, load spectra and/or recording factors. This is based on FEM 9.755/06. 1993 "Measures for achieving safe working periods for powered serial hoist units (S.W.P.)". The objective of this rule is to determine measures for achieving safe working periods over the entire curation of service, athough, according to the state-of-the-art, the hoist units are designed for specific periods of operation.
Premature failure cannot, however, be nuled out.
The following items have been taken from FEM rule 9.755 with reference to the electric chain hoist:

1. The actual duration of service detemined on the basts of operating time and kaad must be documented at leasi once per year.
2. The operating time Ti, (number of operating hours) can be estimated or read on an elapsed time indicator.
3. The load $k_{\text {mi }}$ (foad spectrum) must be estimated.
4. The value determined for operating time $T_{i}$ using an elapsed time indicator must be multiplied by the type of recording factor $f=1,1$.
5. The value determined for the estimated operating hours and load spectrum must be multiplied by the type of recording factor $f=1,2$.
6. The actual duration of service $S$ is calculated as: $S=k_{\text {miv }} \times T_{i} \times f$
7. A general overhaul must be carried out on reaching the theoretical duration of service.
8. All checks and inspections and the general overhaul must be arranged by the owner of the hoist unit.

A general overtaul is defined as:
Inspection of the machinery for the purpose of detecting all defective components and/or components and parts close to failure and the replacement of all such components and parts. Following a general oveihaul, the machinery is in a condition similar to that of the:same machinery in new condition as far as the principle of operation and performance values are concerned.
For electric chain hoists classified according to. FEM 9.511, the following theoretical durations of service apply (converted into full load hours):
Table 4:

|  | 1 Cm | 1 Bm | $1 \mathrm{Am}:$ | 2 m |
| :--- | :--- | :--- | :--- | :--- |
| [h] | 200 | 400 | 800 | 1600 |
|  |  |  | 3 m |  |
|  |  |  |  |  |

The ectual duration of service is considerably increased if the thoist unit is. only operated with partial load. For a chain hoist operated on average with half load, for example, this results in an 8 -fold increase in the actual duration of service; with operation at one quarter of the full.load, a 64 -fold increase.

### 9.1 Calculating the actual duration of service S

9.1.1 Estimating the load spectrum factor $\mathbf{k}_{\mathrm{mm}}$ (by the owner)

The actual duration of service $S$ of the electric chain hoist can be determined as follows:

$$
S=k_{\mathrm{mi}} \times T_{i} \times f
$$

$\mathrm{k}_{\mathrm{mi}} \quad$ : Actual load spectum;factor
$\mathrm{T}_{i} \quad$ : Number of operating hours
1 : Factor depending on the type of recording
To simplify estimation, each type of load can be grouped into $k_{m}$ baad spectrum modules. The types of load are simplified and quoted as $1 / 4,1 / 2,3 / 4 \mathrm{load}$ and tuil load. Dead loads are added to the kads. Loads up to 20\%, of the rated loed capacity are not taken into consideration.
The operating time for each type of load is divided up within the inspection interval (e.g. 1 year) in terms of percentage.

The folkwing bar diagram shows the $k_{\text {if }}$ load spectrim modules for the load conditions without load up to full load in time increments of 5 and $10 \%$, Larger shares of the time period must be correspondingly added together.


The load spectrum factor $k_{m y}$ can be obtained by adding together the individual $k_{m}$ load spectrum modiules;
9.1.2 Calcutating the number of hours of óperation (operating time) $\mathrm{T}_{\text {; }}$ (by the owner)

The operating time can be calculated by means of an elapsed time indicator or according to the following method:
Operating time per inspection interval:
$T_{1}=\frac{\text { (Lifing }+ \text { loweringi } \times \text { cycles } / h \times \text { working time/day } \times \text { days/inspoction interval }}{60 \times \text { hoist speed }}$ $60 \times$ hoist speed

Only lifting and lowering movements are counted, long and cross travel times are not taken into consideration.

### 9.1.3 Factor depending on type of recording f

### 9.2 Example: DKUN 10-1.000 KV1 in 1Am

| Hoist speed | $:$ | $9 \mathrm{~m} / \mathrm{min}$ |
| :--- | :---: | :--- |
| No. of cycles per hour | $:$ | $10 \mathrm{cycles} / \mathrm{h}$ |
| Lfting and lowering | $:$ | $(2+2) \mathrm{m} / \mathrm{cycte}=4 \mathrm{~m} / \mathrm{cyte}$ |
| Operating time per day | $:$ | $8 \mathrm{H} /$ day |
| Days per inspection interval | $:$ | 250 daysinspection interval |
| $\qquad T_{i}=\frac{4 \times 10 \times 8 \times 250}{60 \times 9}$ | $=148,1 \mathrm{hinspection}$ interval |  |

In the operating time as calculated above, the chain hoist has transported the following laads:


Adding the load spectrum modules $\mathrm{k}_{\mathrm{m}}$ together results in the load spectrum factor:

$$
k_{m 1}=0,119
$$

Thus, the actual duration of service amounts to:

$$
S=k_{m o} \times T_{i} \times f=0,119 \times 148,1 \times 1,2=21,2 \text { hours }
$$

For classification in FEM group of mechanisms 1Am (see DKUUN data plate) with 800 hours of theoretical duration of service (see table 5) the hoist has a theoretical remaining duration of service of 778,8 hours.
Documentation
Enter these values in your test and inspection booklet or craneinstallation test and inspection booket. This entry may appear as follows:

Table 5


| $\text { DEMAG } \underset{\text { Cranes s componenis }}{ }$ | EC conformity declaration Demag chain hoist DKUN, DKES, DKST in acourdance with EC Directives 89/336/EEC, Annex I, 99/37/EEC, Añex LIA and 732323 EGC, Annax III | 1 Pagess) Paga 1 |
| :---: | :---: | :---: |
|  |  | Heant no. |
|  |  | [ 20440544 |

Hereby we,

## Demag Cranes \& Components GmbH <br> Komponententechnik,

declare that the product

## Demag chain hoist DKUN, DKES, DKST

of serial design ready for USe" with or without the relevant serial trolleys has been declared in conformity with the provisions of the following relevant regulations:

| EC EMV Directive | $89 / 336 / E E C$ |
| :---: | :--- |
| armended by | $92 / 31 / E E C$ and $93 / 68 / E E C$ |
| EC Machinery Directive | $98 / 37 / E E C$ |
| EC Low Voltage Directive | $73 / 23 / E E C$ |
| amended by | $93 / 68 / E E C$ |
| Applied harmonised standards: |  |

EN 292-1, 292-2 Safoty of Machinery
EN 50081-2 Electromagnetic compatibility
EN 50082-2 Electromagnetic compatibility
EN 60034-1 Rating and performance for rotating electrical machines
EN 60034-5 Types of enclosure for rotating electrical machines
EN 60204-32 Electrical equipment, requirements for hoists
EN 60529 - Types of enclosure (IP code)
EN 60947-1 Low voltage switchgear
Applied standards and technical specifications: \#
DIN VDE 0160 Electronic equipment for use in electrical power installations and their assembly into electrical power Installations
FEM 9.511 Classification of mechanisms
FEM $9.671 \quad$ Chains for holst units
FEM $9.683 \quad$ Travel and hoist motor selection
FEM 9.755 Measures for achleving sale working periods
FEM $9.811 \quad$ Specifications for rope and chain hoists

Wetter, den 19. 7. 1999
Place and datè of issue

ppa. Dr. Neupert Technik
Hebezeuge und Komponenten


Hebe- und Komponententechnik

1) Design ready for use requires a scopos of parts es specified in Works Standard 01231399.

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## Component parts

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$22951003:$

[^15]Main/creep hoist motor KMK 100 B 2/12


Helical gearbox, 2-stages
Helical gearbox, combination with corresponding motor for one/two hoist speeds


Helical gearbox, 2-stages
Helical gearbox, combination with corresponding motor for one/two hoist speeds

20751005.4:

Helical gearbox, 2-stages
Helical gearbox, combination with corresponding motor for one/two hoist speeds

| Itern no. | Part no. | Quantity | Desigimation |  | Material | Standard |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 35 | 34638899 | 1 | Ofinder pin 5 h $11 \times 45$ |  | St A ${ }^{\text {a }}$ F | Dî̀ ${ }^{\text {d }} 7$ |
| 36 | 34638999 | 2 | Cytuder, in 5 hilx 28 |  | St AaF | ON 7 |
| 37 | 34264799 | 1 | Retaining ing 47X1,75 |  | Fectst | DiN 472 |
| 38 | 36055499 | $t$ | Grooved beil bearing 6204 |  | Wh-St it | DNA 625 |
| 39 | 83710244 | 1 | Gearbox housing DK10 T.t | 1) |  |  |
| 40 | 33887499 | 1 | Sealvar ring A10 X16 X1 |  | CU | DiN 7803 |
| 41 | 31335499 | 1 | Screw phug Miox1 |  | 5.8 | DIN 909 |
| 42 | 34294644 | 1 | Eloeding veive AM10X1 |  |  |  |
| 43 | 34251744 | 1 | Toterance ring 16x 10 |  |  |  |
| 44 | 83729444 | 1 | Base plate chrim guide DK10 | chwitem 43 |  |  |
| 45 | 83717844 | 2 | Spring cfip tastaner 7,4×21,2 |  |  |  |
| 47 | 83806344 | 1 | Chain collector box DK10-20GR. 4 - | max 8 mm cherm $48-50$ |  |  |
| 47 | 83806544 | 1 | Ohein colector boox DK10-20GP. 5 | max 20 m , cow items $48 \cdot 50$ |  |  |
| 48. | 83807044 | 1 | Double spring wasteer DK10/20 |  |  |  |
| 49 | 83806944 | 1 | Septoch 12H1 1) ${ }^{\text {P205 Nut }}$ | , |  |  |
| 50 | 34297644 | 1 | Secring cip SL 12 SXN08 |  |  |  |
| 51 | 83708344 | 1 | Stop placa DK10 | 2) |  | - |
| 52 | 83769944 | 1 | Crain $7,4 \times 21.2$ | 3) |  |  |
| 53 | 32142399 | 4 | Hex.socket cyind.bcrew M10 X 20 |  | 10.9 A2FLL | DN 912: |
| 54 | 83737744 | 1 | Chain guide set DK10 | c/witems 57-59,66 |  |  |
| 55 | 83716344 | 2 | Bush 40,5) $48,5 \times 12,3$ |  |  |  |
| 56 | 83738044 | 1 | Output staft DK10/16 | cow item 57 |  |  |
| 57 | 36640999 | 1. | Oif 58.1 A $25 \times 33 \times 6$ |  | NER-CFW | DIN-3760 |
| 59 | 92491644 | 1 | O-ring $34 \times 36$ |  | NE 70 | 메N-3770 |
| 59 | 83707844 | 1. | Piot section DK10 $7 \times 21$ |  |  |  |
| 60 | 83761944 | i | Load hook crossbearn DK10 | c/w iterss 63-65 |  |  |
| 61 | 83764544 | 1 | Eyering trensverse DK10 | C/w items 62,65 |  |  |
| 62 | 83764244 | 1 | Evering OK10 |  |  |  |
| 89 | 83865044 | 1 | Load hook rimber 52.5 T |  |  |  |
| 64 | 83866944 | 1 | Hook Gafuty catch GR. 5 |  |  |  |
| 65 | $8 \mathbf{8 3 7 6 2 5 4 4}$ | 1 | Crossbearn CK10 |  |  |  |
| 68 | 89703544 | 1 | Prolective sleeve DK10/16 |  |  |  |
| 67 |  |  | Stage 1: for two Hotst speeds | Mot KMK $90 \mathrm{~B} 2 / 8$ |  |  |
| 67 | 13847684 | 1 | Shat DK10 KMK 908. | 1000.800, $830, \mathrm{~V} 1.1=79.9$ |  |  |
| 67 | 13847684 | 1 | Shat DK 10 KMK 908 | 630, $V 2,1=58,8$ |  |  |
|  |  |  | Stage 1 for two Hotst apoods | Mot KMK $100 \mathrm{~B} 2 / 8$ |  |  |
| 67 | 14335684 | $\dagger$ | Shatt coupling DK10/16 | 1250, V1, i $-79,9$ |  |  |
| 67 | 14335684 | 1 | Shat coupling DK10/18 | $1000,800, V 2, i=58,8$ |  |  |
|  |  |  | Stage 1 for two Holet spoeds | Mot KOMK $100 \mathrm{~B} 2 / 12$ |  |  |
| 67 | 14335684 | 1 | Shaft coinding DK10/16 | $500, \vee 3,1=36.2$ |  |  |
|  |  |  | Stage 1 for one Hoist speed | Mot KMK 90 B 2 |  |  |
| 67. | 13847884 | 1 | Shaf DK10 HMK 908 | $1250,1000,800,630, \vee 1.1=79.9$ |  |  |
| $67{ }^{\text { }}$ | 13847694 | 1 | Shat DK10 KMK 908 | $800,630, \vee 2, i=58,8$ : |  |  |
| 67. | 13847694 | 1 | Shaft DK10 KAK 908 | 500, $\vee 3.1=36.2$ |  |  |
|  |  |  | Stage 1 for one Hoitat epeed | Mot KMIK 100 E 2 |  |  |
| 67 | 14335684 | 1 | Shêt coupling OK10/16 | $1000, \vee 2,1=58,8$ |  |  |

22251005. 
1) Quantity 0.40 litre, part no: $47290244(1,0 \mathrm{~kg})$
2) Fox firnit stop (fiem 51) to the 10ith chann ific.

10 3) Suppled per metre, state bength required when ondering.

## \# Chain guide

Fittings for RKDK - EKDK low-headroom monorail hoist

22251007.46

Hook with fittings, 1/1 reeving


| Item no. | Part $n 0$. | Quantity | Dasigration: |  | Martorlal | Stardard |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | 83774044 | 1 | Hook fiting OK10 | cwitems 2;5-7 |  |  |
| 2 | 83775344 | 1 | Buffer cover 1,0 T |  |  |  |
| 3 | 35091099 | 4 | Found head dowel pin $3 \times 5$ |  | St A2F' | DiN 1476 |
| 4 | 83591044 | 2 | Capactly prate 0,5 T AL | -DKLN 10,500 |  |  |
| 4 | 03591744 | 2 | Capucity plate $0,63 T$ AL. | DIUN 10,630 |  |  |
| 4. | 83591844 | 2 | Capacity plate 0.8T AL | DKUN 10.800 |  |  |
| 4 | 83590844 | 2 | Capacity plate 1 T AL | DKUN 10, 1000: |  |  |
| 4 | 83591944 | 2 | Capactiy plate 1,25T AL | OKUN 10, 1250 |  |  |
| 5 | 83775244 | 1 | Hook fitinge DK10 |  |  |  |
| 8 | 83717844 | 2 | Spring ctp tastenar 7:4×21,2 |  |  |  |
| 7 | 83765044 | 1 | Loed hook number 4 1,251 | chw liem 8 |  |  |
| 8 | 83765944 | 1 | Hook spiety cetch GR. 4 |  |  |  |

22051007.41


22351004

Electrical components
Direct control

## Electrical components Direct control

| Hemmo. | Payt no. | Quantity | Desigragtion |  | Material | Standard |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | 83712044 | 1 | Hood short DK10-20 |  |  |  |
| 1 | 83712344 | $i$ | Hoodiong DK10-20 |  |  |  |
| , | 32158399 | 2 | Hex.socket cyindscrow M $8 \times 50$ |  | 8.8 A2F |  |
| 3 | 73917544 | 2 | O-ring $7.3 \times 2,4$ B |  | NE 70769 |  |
| 4 | 83712744 | . | Coxinterweight DK10/16 | Mot. 90 B, cover short |  |  |
| 4 | 83712744 | 3 | Counterwelight DK10/16 | Mot. 90 B , cover kong |  |  |
| 4 | 83712744 | 7 | Counterwoight DK10/16 | Mot. $100 \mathrm{~B} \mathrm{2}$, |  |  |
| 4 | 83712744 | 5 | Counterweigh OK10/16 | Mot. $100 \mathrm{~B} 2 / \mathrm{B}, \mathrm{B} 2 / 12$, |  |  |
| 5 | 83722144 | 1 | Seal DK10 $3 \times 980$ |  |  |  |
| 6 | 34054299 | 6 | Washer A17 $\times 30 \times 3$ | Miot. 90 B , cover shat | 140 HN A 2 F |  |
| 6 | 34054299 | 8 | Wastrer A17 $\times 30 \times 3$ | Mot 90 B, cover fong | 140HV A2F | DRN 125 |
| 6 | 34054299 | 2 | Wesher A17 $\times 30 \times 3$ | Mot. 100 B 2 ; cover long | 140N N A 2 F | $\text { DN } 125$ |
| 7 | 34050199 | 2 | Wester A13 $\times 24 \times 2,5$ |  | $140-N \quad A 2 F$ | $\text { DN } 125$ |
| 8 | 15072099 | 2. | Countersunk screw M $\times 25$ |  | 8.8A2FT40 | $\text { DNV } 7901$ |
| 11 | 83620244 | 1 | Fughti unit M20 | $\stackrel{ }{ }$ |  |  |
| 11. | 83605844 | 1 | Pught unt PG16 |  |  |  |
| 12 | 83605144 | 1 | Stide h cornection plece $20 / 3$ |  |  |  |
| 13 | 83620144 | 3. | Pright unit, dimmy M25 |  |  |  |
| 13 | 836605244 | 3. | Puighin unt, dimmy PG21 |  |  |  |
| 14 | 53746184 | 2. | Courter mut M2S EMV M |  |  |  |
| 19 | 83605044 | 1 | Seal cable gide | Geerbox side |  |  |
| 20 | 89541744 | 1 | Suppaiting red $15 / 5,5 \times 160 \mathrm{M}$ |  |  |  |
| 21 | 89539544 | 1 | Modtrir termmal $2,5 \times 4 \times 1 \mathrm{DFPR}$ | 4 conoductors |  |  |
| 22 | 89628444 |  | Módeer tomital $2,5 \times 4 \times 1$ DPDR | 4 conductors 1) |  |  |
| 23 | 89628344 |  | Moctur terminal $2.5 \times 2 \times 1 \mathrm{CPDR}$ | 2 conductors 1) |  |  |
| 24 | 89528544 | 1 | End plate 264-368 | 2 conduetors 1 |  |  |
| 25 | 89641944 | 1 | Enit engle TS15 |  |  |  |
| 26 | 32475099 | 3 | Traad rofing scriow CEM 4X 12 |  | St-TX A2F | DiN 7500 |
| 27 | 83704844 | , | Cabie gide |  | STX A2F | D-1.750 |
| 27 | 83704744 | 1 | Cable guide 19100 B-Dikio |  |  |  |
| 28 | 31892499 | 2 | Haxsocket cyfind. screw M $5 \times 16$ | Mott 90 | 10.9 A2F:L |  |
| 28 | 32147999 | 2 | Hexsocket cytrciscrew M $6 \times 16$ | Mot. 100 | 10.9 A AFEL | DIN 912 |
| 29 | 34387344 | 2 | Screw locking dovice M 5 | Mot 90 |  |  |
| 29 | 34387444 | 2 | Screw bockng device M6 | Mot. 100 |  |  |
| 30 | 83604944 | 1 | Elow piece cabte tray GR1 | Miot. 90 |  |  |
| 30 | 83704944 | 1 | Elbow piece cable tray Gr. 2 | Mot. 100 |  |  |
| 31 | 05480684 | 1 1: | O-ing $46 \times 2,5+0.08$ | Mict. 90 |  |  |
| 31 | 00988684 | 1 | Oing $58 \times 2,5+-0,08$ | Mot 100 | Perturan | $\text { DIN- } 3771$ |
| 34 | 83615044 | 1. | Seat catte guida | Motor side |  |  |
| 35 | 83755344 | $\pm$ | Cower socuing sat. DK10,16,20 |  |  |  |

22251009.48

## Electrical components

## Contactor control



Electrical components Contactor control


## Limit switch for the upper and lower hook position

1/1 reeving


Limit switch for the upper hook position

| tem no. | Part no. | Quantity | Doskignation | Matartar | Standard |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | 63776944 | 1 | Limit switcting set OK10 |  |  |
| 3 | 34087999 | 1 | Pressure spring 3,6 $\mathbf{3} \mathbf{3 6 , 4 \times 1 5 5}$ |  |  |
| 4 | . 83728644 | 2 | Cut-out sleve DK10 |  |  |

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## Limit switch for the upper and lower hook position

| Hem no. | Part no. | Quantity | Destynation |  | Material | Standard |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | 83778344 | 1 | Limit swithing set OK10 | Basic sel |  |  |
| 2 | 83778244 | 1 | Limut switching set DK1016 | Supp. set |  |  |
| 3 | 34087999 | 2 | Pressure sping $3,8 \times 36,4 \times 155$ |  |  |  |
| 4 | 83728844 | 4 | Cut-out sleeve DK10 |  |  |  |
| 5 | 83800654 | 1 | Chain collector box OK10-20GR. 5 | max. chain length 17 m |  |  |

Limit switch for the upper and lower hook position $2 / 1$ reeving


Limit switch for the upper hook position


| 83778344 | 1 | Limit Switching set DK 10 |
| :---: | :---: | :---: |
| 34087999 | 2 | Pressture spring $3.6 \times 38.4 \times 155$ |
| 83728644 | 4 | Cut-out sleave DK10 |

$\begin{array}{lll}83728644 & 2 & \text { Pressurre spring } 3.6 \times 38,4 \times 155 \\ & 4 & \text { Cut-out stove DK10 }\end{array}$
22551013.46

Limit switch for the upper and lower hook position

| Hemino. | Peatino. | Ouantity | Designation |  | Materala | Standaind |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | 83778344 | 1 | Limit owitching sot DK10 | Basic sat |  |  |
| 2 | 83778244 | 1 | Limit sivitching sät DK10.16 | Supp. set |  |  |
| 3 | 34087989 | 3 | Pressure spring $3,6 \times 36,4 \times 155$ |  |  |  |
| 4 | 83728644 | 6 | Cut-out sleeve .DK10 |  |  |  |
| 5 | 83806544 | 1 | Chain collector box DK10-20GR. 5 | max. chain length 17 m |  |  |

## Reinforced M24 x $1: 5$ cable sleeve insert



Hand chain drive for HU 11 DK/HU 22 DK trolley


Standard headroom monorail hoist Trolley RU 6 DK

Suitable for Demag chain hoist DKUN 10-500, 1/1 reeving

## SWL 700 kg

Flange width $58-300 \mathrm{~mm}$


| Hemno. | Part no. | Quantity | Designation |  | Material | Standard |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | 83963444. | 1 | Ir,untr,whicylw/o crosso R R 8 | chwitem 3 |  |  |
| 2 | 63963244 | 1 | Triuntriwh coniwho crossb. Ruf | c/w them 4 |  |  |
| 3 | 8396144 | 2 | Side plate PUCDK | civ tems 6, 8, 16 |  |  |
| 4 | 83963044. | 2 | Sice plate truwh.con.w/o geer rim. | chiv lems 6,9, 16 |  |  |
| 5 | 83963944 | 1 | Crossbeam PU 6. Fib. 58-90 | ciwitems 10.13 |  |  |
| 5 | 83964044 | 1 | Crossbeem RU 6. Fo. 91-143 | Cwiterns 10-13 |  |  |
| 5 | 83952044 | 1 |  | awiters $10 \cdots+2 ; 14$. |  |  |
| 5 | 83952144. | 1 | Crissbeam RU 6. Fbiset-300 | Ow iterns 10-12; 14 |  |  |
| 6 | 03970944 | 2 | Bush 17,1×32 $\times 0.6$ |  |  |  |
| 7 | 36822399 | 1 | Grooved bail bearing 620327 |  | Wer-st | DIN 625 |
| 8 | 03983844 | 2 | Codundical trwheel 65.15PK OZ | cowitisin 7 |  |  |
| 9 | 83563544 | 2 | Conical travel whoet 85.15 PKOZ | c/witem 7 |  |  |
| 10 | 33468699 | 2 | Hexagonal mut M20 X1,5 |  | a A2F | DIN 980 |
| 1.1 | 56312444 | 10 | Wastier $20,3 \times 30 \times 4$ | F. W. 58-90 |  |  |
| 11 | 56312444 | 16 | Washer $20,3 \times 30 \times 4$ | F. W. 91-143 |  |  |
| $1: 1$ | 56312444 | 16. | Washer $20,3 \times 30 \times 4$ | FI. W. 144-200 |  |  |
| 11 | 56312444 | 28 | Wastrer $20,3 \times 30 \times 4$ | F. W. 201 - 300 |  |  |
| 12 | 83963744 | 1 | Tube $30 \times 4.5 \times 77$ | F. W. $58-90$ |  |  |
| 12 | 83963844 | 1 | Tibe $30 \times 4.5 \times 110$ | A.W. 91-143 |  |  |
| 12 | 83951244 | 1 | Tube $38 \times 9 \times 163$ | A. W. 144 - 200 |  |  |
| 12 | 83951344 | 1 | Tube $38 \times 8 \times 220$ | F: W. 201-300 |  |  |
| 13 | 34248890 | 2 | Pretaining ring $30 \times 2$ | A.W. 53-143 | Fedst | DiN 471 |
| 14 | 34248498 | 2 | Fetaining ring 3ix $\times 2,5$ | F. W. $144-300$ | Fedst | ONN 471 |
| 16 | 83961744 | 1 | Capacity plate 700 KG |  |  |  |
| 17 | 32141099 | 2 | Hexs socket cytind.screw M $8 \times 20$ |  | 10.9 A2FIL | OIN 912 |
| 18. | 83973744 | 1 | Current collecior tube 400 |  |  |  |

22251015. .ta

Standard headroom monorail hoist Trolley RU 11 DK SWL 1350 kg

Suitable for Demag chain hoist
DKUN 10-800/1000/1250, 1/1 reeving
DKUN 10-500/630, 1/1 and 2/1 reeving

## Flange width 58-300 mm



Standard headroom monorail hoist Trolley EUU 11 DK
SWL 1350 kg

Suitable for Demag chain hoist DKUN 10-800/1000/1250, 1/4 reeving DKUN 10-500/630, 1/1 and 24 reeving

Flange width 58 - 300 mm



Trolley RU 22 DK
SWL 2600 kg

Suitable for Demag chain hoist DKUN 10-500/630/800/1000/1250,
1/1 and 2/1 reeving

## Flange width 82 - 300 mm



| ftemno. | Partino. | Quantily | Desigpation |  |  | Material | . | Standard |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | 84011344 | 1 | Tr.entrwhlurivwio crosgo, RU22 | cowitem 2 |  |  |  |  |
| 2 | 84011044 . | 2 | Sido plate trviwh urivwio gim. | ciwiterns 4,5 |  |  |  |  |
| 3 | 83955644 | 1 | Crosbbem PU22, FD. 62 -143 | CNu ftems B-11 |  |  |  |  |
| 3 | 83965744. | 1 | Crossboern Pue2 Fb. 144-200 | cwitems 8-11 |  |  |  |  |
| 3 | B3955844 | 1 | Crossbearn PLJ22. Fb. $201-300$ | cowitems 8-11. |  |  |  |  |
| 4 | 83964744 | 1. | Capecity plate 2600 KS |  |  |  |  |  |
| 5 | 84016044 . | 2 | Unversat tratel whoel 112 1SPK OZ | chwitems 6,7 |  |  |  |  |
| ${ }^{8}$ | 84017244 | 1 | Bush 30,2X $33 \times 17.4$ |  |  |  |  |  |
| 7 | 38822699 | 1 | Gropved bell beering 620822 |  |  | Whz-St |  | DNA 625 |
| 8 | 33468799 | 2 | Hevagonal nut M30 $\times 2$ |  |  | 8 A2F |  | CAN 985 |
| 9 | 50222044 | 19 | Whasher $35,5 \times 60 \times 4$ | \%ค. W. $82=143$ |  |  |  |  |
| 9 | 50222044 | 16 | Washer 35,5x $50 . \times 4$ | FI, W: 144-200 |  |  |  |  |
| 9 | 50222044 | 27 | Waster 35, $5 \times 50 \times 4$ | F. W. 201-300 |  |  |  |  |
| 10 | 83955044 | 1 | Tubig $51 \times 7,1 \times 109$ | FI. W. 82 - 143 |  |  |  |  |
| 10 | 83955144 | 1 | Tibe $51 \times 7,1 \times 174$ | ค. $\dot{W}$. $144-200$ |  |  |  |  |
| 10 | 83955244 | 1 | Tibe $51 \times 7.1 \times 230$ | FI. W. 201-300 |  |  |  |  |
| 11. | 34244299 | 2 | Retaring rimg $52 \times 3$ |  |  | Fectst |  | DiN 471 |
| 14 | 32141099 | 2 | Hexsocket cyndiscrew M $6 \times 20$ |  |  | 10.9 AOFIL |  | DiN 912 |
| 15 | 63973744 | 1 | Current collector tubio 400 |  |  |  |  |  |
| 30 | 56334044 | 1 | Crossbeem RU10PK Fib.144-200 | c/w items 31-33 |  |  |  |  |
| 30 | 56344544 | 1 | Crostheern RU10PK Fib,201-300 | cwiterss 31-33 |  |  |  |  |
| 31 | 34243599 | 2 | Retairing ring $35 \times 2,5$ |  |  | Fodst 14 |  | QN $471^{\prime}$ |
| 32 | 34351499 | 2 | Shim 35x $45 \times \mathrm{y}$ |  |  | St2k50 |  | DN 988 |
| 33 | 56334644 | 1 | Pin $35 \times$ X4,5 Nut |  |  |  |  |  |

Standard headroom monorail hoist
Trolley EU 22 DK
SWL 2600 kg

Suitable for Demag chain hoist DKUN 10-500/630/800/1000/1250, 1/1 and 2/1 reeving

Flange width $82-300 \mathrm{~mm}$


| Hemin no. | Part no. | Quantity | Destranation |  | Materlat | Standard |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | 84011444 | 1 | Trun tr.wiliuriv.w/o crossb. Etz2 | Cowiterns 2, 8 |  |  |  |
| 2 | 84011644 | 1 | Side plate tiv.wh.univ.w/o grm | c/whems 4,5 |  |  |  |
| 3 | 839956344 | 1 | Crossbearn El22 Fh. 82-143 | cowterns 12-15 |  |  |  |
| 3 | 83950444 | 1 | Crossbesm Eul2 Fib:144-200 | ciw Items 12-15 |  |  |  |
| 3 | 83950544 | 11 | Crossbearn EU22 Fib,201-300 | c/w terms 12-15 |  |  |  |
| 4 | 83964744 | $1:$ | Capactiy plate 2600KG |  |  |  |  |
| 5 | 84016044 | 2 | Universal trevel whioal 11215 CK OZ | ciw terms 6.7 |  |  |  |
| 自 | B4017244 | 1. | Bush 30,2X38 $\times 17,4$ |  |  |  |  |
| 7 | 36822699 | 1 | Grooved ball bearing 620022 |  | West | DiN | 625 |
| 8 | 84011744 | 1 | Side pate triwth.üviwigear im | Ofw itan 9 |  |  |  |
| 9 | 64017044 | 2 | Universal tratil wheol 112 1SPKC MZ | cow taris 10, \%1 |  |  |  |
| 10 | 36822699 | 1 | Grooved bai bearting 620627 |  | Wz-St | DiN | 825 |
| 11 | 84017344 | 1. | Busin 30,2X $38 \times 23,2$ |  |  |  |  |
| 12 | 33468799 | 1. | Hexagonal fut M30 $\times 2$ |  | B. A2F | DIN | 985 |
| 13 | 50222044 | 19 | Washer $35,5 \times 50 \times 4$ | ค. W, $82-143$ |  |  |  |
| 13 | 50222044 | 17 | Washer $35,5 \times 50 \times 4$. | F. W. $144-200$ |  |  |  |
| 13 | -50222044 | 28 | Wegher $35,5 \times 50 \times 4$ | F. W. 201-300 |  |  |  |
| 14 | 83955044 | 1 | Tube $51 \times 7,1 \times 109$ | F. W. $82-143$ |  |  |  |
| 14 | 83955144 | 1 | Tube $51 \times 7,1 \times 174$ | F. W. 144-200 |  |  |  |
| 14 | 83955244 | 1 | Tube $51 \times 7,1 \times 230$ | F. W. $201-300$ |  |  |  |
| 15 | 34244299 | 2 | Fetaining-ting 52x3 |  | Fedst | DEN | 471 |
| 18 | 83973744 | 1. | Curemt collector tube 400 |  |  |  |  |
| 19 | . 32141098 | 2 | Hexsocker cytind 9crew M $8 \times 20$ |  | 10.9 A 2 Fl | DiN | 912 |
| 40 | 83976844 | 1 | - Crossbeam EU10/22Fto 144-200 | c/w iterms $41-43$ |  |  |  |
| 40 | 83976944 | 1 | Crosstuarn E $10 / 22 F 6,201-300$ | CAW Herms $41-43$ |  |  |  |
| 41 | 34243599 | 2 | Rotaining ring $35 \times 2,5$ |  | Fedst IL | DIN | 471 |
| 42 | 34351499 | 2 | Shim $35 \times 45 \times 1$ |  | StekSo | Din | 988 |
| 43 | 56334644 | 1. | Fin $35 \times 84.5 \mathrm{Nut}$ |  |  |  |  |

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## Travel drive PKF 13/3 and PKF 13/6



## Bridge

## Low-headroom monorail hoist RK/EKDK



## Bridge

Low-headroom monorail hoist RK/EKDK

| Hemmo. | Part no. | Ouantity: | Dosiqnation |  | Material | Standard |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | 83945144 | 1 | Longiturimed girdor DK10- | siza 22, c/w iterns 2. 3, 5-16 |  |  |
| 1 | 83942544 | 1 | Longituchnad ginder DK10 | size 11, Cow iterns 2, 4-16 |  |  |
| 2 | 15048999 | 4 | Hexagonas screw M12 $\times 80$ |  | 8.8 ARF | 150 4014. |
| 3 | 83986544 | 1 | Sol-eblyring bearing KDK GR. 22 |  |  |  |
| 4 | 83084544 | 1 | Seft-aigring bearing KiLK GR. 11 |  |  |  |
| 5 | 33461244 | 4 | Lock mat VM12 |  | 8 A2F | DIN S80 |
| 6 | 34250399 | 1 | Fetaining ith $25 \times 2$ |  | Fedst il | ON 471 |
| 7 | 34142499 | 5 | Shim 25x $35 \times 1$ |  | St2k50 | DNT 988 |
| 8 | 83717146 | 1 | Pin $25 \mathrm{H} 5 \times 78$ Nut |  |  |  |
| 9 | 34503399 | 1 | Sptit sleeve $5 \times 36$ |  | ST | 150-8752 |
| 10 | 34034199 | 2 | Waster $26 \times 44 \times 4$ |  | 100HN A2F | DiN 128 |
| 11 | 34349899 | 2 | Supporting plate $25 \times 35 \times$ ? | - | Fedst | DN 988 |
| 12 | 89788044 | 1 | Retim sheave $7.4 \times 21.2 \mathbf{z 5}$ | Neede-rulier assembly, $z=5$ |  |  |
| 13 | 339664999 | 8 | Strain washer $13 \times 28 \times 3$ |  | Fedst | DN 6796 |
| 15 | 83993844 | 1 | Fotaining plate. $7 \times 21$ |  |  |  |
| 16 | 83993444 | 1 | End brackat 7,4×21;20ikio |  |  |  |
| 17 | 97820644 | 2 | Butter - $50 \times 20 \mathrm{M10}$ SHP |  |  |  |
| 18 | 33461044 | 2 | Lock nut VM10 |  | 8 A2F | CON 980 |
| 19 | 83761044 | 2 | Setbon 16H11 1100 Nut |  |  |  |
| 20 | 34287744 | 2 | Seçurng clp SL. 16 SXN08 |  |  |  |
| 21 | 89774044 | , | Hock fitings DK10 | 1/1, see Page 12 |  |  |
| 22 | 89780144 | 1. | Bottom' block "DK10 1CM RUD: | 2/1, see Pexge it |  |  |
| 24 | 83717844 | 2 | Spring ctp fasterer $7.4 \times 1,2$ | 2/1. |  |  |
| 25 |  |  | Travel drive PKF 13/3 and 13/6 | seeppage 28 |  |  |

$225510 c 0$

Low-headroom monorail hoist Trolley size 11 RKDK Flange width $91-300 \mathrm{~mm}$

Suitable for Demag chain hoist DKUNT $10-300 / 1000,1 / 1$ reeving DKUN 10-630, 1/1 and $2 / 1$ reeving

Trolley A


| Item no. | Part na. | Quantity | Designation | Miatertal | Standard |
| :---: | :---: | :---: | :---: | :---: | :---: |


| 1 | 84010344 | 1 | Triuntrwidunviw/o croseb. RU71 | cowntem 2 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 2 | 84010844 | 2 | Side plate trwwhLunlvw/o g.din | chw herni 4.5 |  |  |  |
| 3 | 83996844 | 1 | Crussteam RKDKK10 Fb. 91-143 |  |  |  |  |
| 3 | 83590644 | 1 | Crossbearm FKO 人10 Fb.144-200. | chw items B - 11. 13. |  |  |  |
| 3 | 83997044 | 1 | Grussbearn PKOK10 Fin-201-300 | c/w iterris 8 - 11, 13 |  |  |  |
| 4 | 83862744 | 1 | Cepacty ptate 135014 |  |  |  |  |
| 5 | 84014044 | 2 | Universal trivel wheel 80 1SPK OZ | cwiteris 6,7 |  |  |  |
| 6 | B3970944 | 1 | Collar packing stome |  |  |  |  |
| 7 | 36820499 | 1 | Grooved bell bearing 62042 |  | Wz-St | DIN | 625 |
| 8 | 33460299 | 2 | Hepicegional mut M24 X2. |  | 8 A2F | DIN | 885 |
| 8 | 54222444 | 18 | Washer $24,5 \times 36,5 \times 4$ | A. W. B1-143 |  |  |  |
| $\theta$ | 50322444 | 14 | Washer $24,5 \times 36,5 \times 4$ | F. W, 144-200 |  |  |  |
| $\theta$ : | 56322444 | 30 | Washer 24,5x 36,5X4 | F. W. $201-300$ |  |  |  |
| 10 | B3993044 | 1 | Tuta $32 \times 3,5 \times 113$ | F. W. $91-143$ |  |  |  |
| 10. | 83993144 | 1 | Tupe $32 \times 3,5 \times 166$ | F, W, 144 - 200 |  |  |  |
| 10 | Egg93244 | 1 | Tu6e $32 \times 3,5 \times 223$ | A. W. 201-300 |  |  |  |
| 11 | 34253290 | 2 | Fretaining itng $32 \times 1.5$ |  | FedSt | DiN | 47.1 |
| 13 | 83953044 | 1 | Pin cross beem Ruli | F. W. $91-143$ |  |  |  |
| 13. | 83958144 | 1 | Pin cross beam Rilli | F.W. $144-200$ |  |  |  |
| 13. | 83958244 | 1 | Pin cross beam FU11 | F. W. 201-300 |  |  |  |
| 14. | 32141099 | 2 | Hex socket cytind screw M $9 \times 20$ |  | 10.9 A2FE | DIN | 912 |
| 15 | 83973744 | 1 | Current collector tube 400 |  |  |  |  |

2251021.1 M

Low-headroom monorail hoist
Trolley size $6 / 2 \mathrm{RKDK}$
Flange width 91 - 300 mm


| Item no. | Part no. | Cuarity | Dealigration |  | Niateram | Standard |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | 83963944 | 1 |  | cownem 3 |  |  |
| 2 | B6394044 | 1 |  | c/w tem 4 |  |  |
| 3 | 83982544 | 2 | Side plate PU 6-2. $\mathrm{M}^{\text {M }}$ | c/whems 6, 8 |  |  |
| 4 | 83982444 | 2 | Side ptate trywhiconw/o geter rim | owiterns 6, 9 |  |  |
| 5 | 83983344 | 1 | Crosibeami FIKDK Fb. 91-143 | Swillems 10, 12, 13 | - |  |
| 5 | 83983444 | 1 | Crossbeam PACKK Fib.144-200 | chw terns 10, 12, 13 |  |  |
| 5 | 83983544 | 1 | Crossbeem RKOK Fib,201-300 | ofw iterms 10, 12, 13 |  |  |
| 6 | 83970844 | 1 | Bush 17,1× $32 \times 9,6$ |  |  |  |
| 7 | . 36822399 | 1 | Grooved bell bearing 620322 |  | Whest | Din . 625 |
| 8 | 83963644 | 1 | Oytucrical triwheal 65 1SpK OZ | 6hwnem 7 |  |  |
| 9 | -83963544 | 1 | Contal tratel wheal 65 1SPK O2 | chwitern 7 |  |  |
| 10 | 33468699 | 2 | Hemegonal nut M20 $\times 1,5$ |  | . 8 A2F | DIN 985 |
| 12 | . 56312444 | 18 | Washer 20,30 $30 \times 4$ | F. W. 91-143 |  |  |
| 12 | . 56312444 | 18 | Washer 20,3x $30 \times 4$ | F. W. 144-200 |  |  |
| 12 | 56312444 | 30 | Washer 20,3x $30 \times 4$ | F. W. 201-300 |  |  |
| 13 | 63983944 | 1 | FIn cross beam FU $\mathcal{C} / 2$ | Fl. W. 97-143 |  |  |
| 13 | 63963044 | 1 | Pin cross bearn Pu $6 / 2$ | P. W. 144-200 |  |  |
| 13 | 83983144 | 1 | Fin couss beam FU $6 / 2$ | F.W. $201-300$ |  |  |

Low-headroom monorail hoist Trolley size 22 RKDK

Suitable for Demag chain hoist DKUN 10-800 $1000,2 / 1$ reeving

## Flange width 82 - 300 mm

Trolley A

..tem no. Part no. Ouantity Designation. Material Stardard

840113 84011644 83956044 83996144 83998244 83964744 84016044 64017244 36822680 33468799 50222044 5022204 50222044 83995544 83995644 83995744 83995444 83955344 83955444 83958344 32141090 83973744
$\frac{\text { Guarity }}{1}$


Cirrent oollector tubs 400
cowhem 2
owiterms 4,5
cowitems 日 - 11: 13
CWiterns $8-11$, 13
CAw itaris $B=11,13$
Chiteriss 6;7

| Wz-St | DiN E25 |
| :--- | :--- |
| $8 \quad$ AOF | ON 985 |

F. W. $82-143$
F. W. $144=200$

ค. W. $201-300$
ค. W. 82 - 143
F. W. $144-200$

FI.W. 20t- 300
ค. W. $82-143$
F. W: 144-200
F. W. $201-300$


Low-headroom monorail hoist Trolley size 11 EKDK
Flange width 91-143 mm

Suitable for Demag chain hoist DKUN $10-800 / 1000,1 / 1$ reeving DKUN 10-630, 1/1 and 2/1 reoving

## Trolley A


41188045.aps

Hem no.
Past no: Quantity Dealgration

Standard

84010444 84010944 87995144 839837.44 64014044 83970044 36220499 840t0744 84015044 :3682,0499 83975944 33460299 50322444 83993044 34253299 83973744 32141099 83913044 30021144 34142699 08453344 93058944 30044044

Tr.un.tr.whiliunkiw/ocroses. 日ل11 Side pats trvwtilurww/o g.rm Crosstagam ECDK10 FB: 91-143 Cepercity ipláto 1350KG: Uhversel trevel whoal 501 SPK OZ Coliar packing sleove Grooved tial bearing 6204 Z Side plate tw.whlurw.w.geer rin Universal travel wheed 86 1SPKMZ Grooved bet bearing 6204 2 Collar packing sleeve EUII Hexiggonal inut M24 $\times 2$ Wastyer $24.5 \times 36.5 \times 4$ Tube $32 \times 3.5 \times 113$ Reteining ring $32 \times 1,6$ Curtent coniactoritube 400 Hex.sockat cyfrd.scrow M B X 20 Supporting roler urit Supporting roig Urit
Locx screw M $0 \times 25$ VB.FIPP Shtio $10 \times 16 \times 0,5$
Trivel wheel 44
Safety ctamp 7
Lockinit M6 VB.RIPP

Chw therns 2, B
cow homs 4; 5
ow items $12 \cdot+5,32$
CAN iterns 6, 7.


Low-headroom monorail hoist
Trolley size 6/2 EKDK

## Flange width 91-143 mm

## Trolley B



| Hemno. | Part no. | Quantity | Destgnation |  | Metariad | Standard |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | 83983944 | 1 | Trunitrutlicyl.w/o crossb, RU 6/2 | cowitem 3 |  |  |
| 2 | 83984044 | 1 | Tr.un.twhl.cori.w/o crossb. RU $\mathrm{ES}_{2}$ | owntem 4 |  |  |
| 3 | 83982544 | 2 | Side pate PUJ $6-2 \mathrm{ZML}$ | chwems 6 , 8 |  |  |
| 4 | 83982444 | 2 | Side plate ituwilicon w/o gear rim | cow thens 6,9 |  |  |
| 5 | 83983344 | 1 | Crossboam RKCK Fib. 91-143. | c/w limme 10, 12, 13 |  |  |
| 8 | 83970844 | 1 | Bush. 17,1× $32 \times 9,6$ |  |  |  |
| 7 | 36822399 | 1 | Grooved bell bearing 6203 22 |  | Whast | DN 625 |
| 8 | 83983644 | 1 | Cytudrical trwheel 651SPK OZ: | c/w Hem 7 |  |  |
| 9 | 83983544 | 1 | Conical travel wheel 65 1 SPK OZ | cowitem 7 |  |  |
| 10 | 33468899 | 2 | Haxagonal mut $\mathrm{M} 20 \times 1,5$ |  | a A2F | DIN 885 |
| 12 | 56312444 | 18 | Wesher $20,3 \times 30^{\circ} \times 4$ |  |  |  |
| 13 | 89982944 | 1 | Pin cross beam RUe 2 |  |  |  |

## Low-headroom monorail hoist <br> Trolley size 11 EKDK <br> Flange width $144-300 \mathrm{~mm}$

Trolley A


| Hem no. - | Part no: | cuantity | Desigrration |  |  | Material | Standard |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | 84010444 | 1 |  | cin items 2, |  |  |  |
| 2 | B4010844 | 1 | Slide plate truwhlumiliw/o g.rim | cow itoms 4,5 | - |  |  |
| 3 | 83895244 | 1. | Crossbeam ECDK10 Fb. 144-200 | cow items 12-15. |  |  |  |
| 3 | 83995344 | 1. | Crossbeami EKDK10 Fib $201-300$ | chiterts 12 - 15 |  |  |  |
| 4 | 83062744 | 1 | Capacity plate 1350k6 |  |  |  |  |
| 5 | 84014044 | 2 | Universal traval wheol 80 1SPKOZ | chw itoms 6,7 |  |  |  |
| 6 | 80970944 | 1 | Colar pacting stave |  |  |  |  |
| 7 | 36820498 | 1 | Grooved bail bearing 6204 Z |  | . | Wr-St | OIN 625 |
| 9 | 84010744 | 1 | Sida plate trvwhluind.w.gear rim | owitem 9 |  |  |  |
| 9 | 84015044 | 2 | Universal travel wheel 80 1SPK MZZ | cow iteris 10, 11 |  |  |  |
| 10 | 36820499 | 1 | Growed bed beaning 6204 Z |  |  | Whe-St | DIN. 625 |
| 11 | 83975944 | 1 | Cotlar packing sleeve: EU11 |  |  |  |  |
| 12 | 33460299 | $i$ | Hexagonel nut M24 X2 |  |  | 8 ACF | DAN: 985 |
| 13 | 56322444 | 18 | Waster $24,5 \times 36,5 \times 4$ | f. W. 144-200 |  |  |  |
| 13 | 56322444 | 29 | Wesher $24.5 \times 36,5 \times 4$ | R. W. 201: 300 |  |  |  |
| 14 | 83993144 | 1 | fube $32 \times 3.5 \times 166$ | F, W. 144-200 |  |  |  |
| 14 | 83993244 | 1 | Tibe $32 \times 3,5 \times 223$ | F. W. 201-300 |  |  |  |
| 18 | 34253299 | 2 | Retaining fing 32x1,5 |  |  | Fedst | DIN. 471 |
| 18 | 83973744 | 1 | Current coilector tube 400 |  |  |  |  |
| 19 | 32141099 | 2 | Hexsocket cyind.screw M $\times 20$ |  |  | 10.9 A2F!L | DIN 912 |
|  |  |  |  |  |  |  | 22257 |

Low-headroom monorail hoist Trolley size 6/2 EKDK
Flange width $144-300 \mathrm{~mm}$

## Troiley B



41180544,6ps

| Itern mo. | Part no. | Quantify: | Destratation |  | Material | Stanctard |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | 83983944 | 1 | Truntruhlicyiw/o crossb. AU B/2 | cwitem 3 |  |  |
| 2 | 83984044 | 1 | Triuritrwhlicoiniw/o crossb. RUI 6/2 | Cowhem 4 |  |  |
| 3 | 83982544 | 2. | Side plate RU6-2 CH | chitems 6, 8 |  |  |
| 4 | 839892444 | 2 | Side piate truwhiconiwio gear inm | Chw tems 6, 9 |  |  |
| 5 | 83980444 | 1 | Crossbearn PKDK Fb, 144-200 | cw Hems-10, 12, 13 |  |  |
| 5 | 83083544 | 1 | Crosstoam FiKOK Fio.201-300 | ow thems 10, 12,13 |  |  |
| 6 : | 69970944 | 1 | Bush 17,1×32 $\times 9,6$ |  |  |  |
| 7 | 36822399 | 1 | Grocyed ball bearing 620327 | * | We-St | DiN 625 |
| 6 | 83983644 | 1 | CyEndrical trwheoa 651SPK OZ | c/witern 7 |  |  |
| 9 | 83963544 | 1 | Conical travel wheel 65 1 SPK O2 | c/witern 7 |  |  |
| 10 | 33468699 | 2 | Hexagonal nut M20 $\times 1.5$ | 80 Nm | 8. $A \dot{2}$ | DiN 985 |
| . 12 | 56312444 | 18. | Washer $20,3 \times 30 \times 4$ | F. W. $144=200$ |  |  |
| 12 | 56312444 | $30^{\circ}$ | Washer 20,3x $30 \times 4$ | FI. W. $201-300$ |  |  |
| 13 | 83983044 | 1 | Prin cross beam RU' $6 / 2$ | F. W. $144-200$ |  | * |
| 13 | 83983144 | $\cdot 1$ | Pin cross beeñ PUV $6 / 2$ | F. W. 201-300 |  |  |

22250027.女

Flange width $82-300 \mathrm{~mm}$


| Hemin no. | Parino. | Quartity | Desigration |  | Materier | Standerd |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | 84011444 | 1 | Tr.unitr.wh.unk. w/o crossh. EJ22 | cfwiterns 2,8 |  |  |
| 2 | 84011644 | 1 | Side plate trv,whlurikww/o girft | cwitems 4,5 |  |  |
| 3 | 83996344 | 1 | Crossbeem EKDK Fib. 82-143 | chwlems 12: 18 |  |  |
| 3 | 83996444 | 1 | Crossbearn EKDK Fbo.144-200 | chwitams 12-16 |  |  |
| 3 | 83996544 | 1 | Crossbeem EKDK Fbo.201-300 | chwiterms 12-16 |  |  |
| 4 | 83964744 | 1 | Capacity plate' 2600kg |  |  |  |
| 5 | 84016044 | 2 | Universed traval wheat 112.15 SFO Z | ciwiterns 6,7 |  |  |
| 6 | 84017244 | 1 | Bush 30,2×39 $\times 17.4$ |  |  |  |
| 7 | S6E22693 | 1 | Grocved bell bearing 620027 |  | W $\mathbf{W}-\mathbf{S t}$ | Did 625 |
| 8 | 84011744 | 1 | Side plate truwhluniviwgoer im | chiftern $\theta$ |  |  |
| 9 | 84017044 | 3 | Univerged trevel wheel 11215 KK MZ | c/witerns 10, 11 |  |  |
| 10 | 36822699 | 1 | Grocved bell bearng ax06 27 |  | Wh-St | - Din 625 |
| 11 | B4017344 | 1 | Bush $302 \times 38 \times 23.2$ |  |  |  |
| 12 | 30468798 | 1 | Hexagonal nut M39: X2 |  | $g$ A2F | DAN 985 |
| 13 | 50222044 | 21 | Washer 35,5×50 $\times 4$ | F. W. $82-143$ |  |  |
| 13. | 50222044 | 19 | Washar 35,5x $50 \times 4$ | F. W. 144-200 |  |  |
| 13. | $50222044$ | 29 | Washer $35,5 \times 50 \times 4$ | FiW:201-300 |  |  |
| 14 | 83996544 | 2 | Tube $44,5 \times 4 \times 21,5$ | F. W. 82 -1143 |  |  |
| 14 | 83995844 | 2 | Tube $44.5 \times 4 \times 54$ | F. W. 144-200 |  |  |
| 14 | c B3995744 | 2 | Ture $44,5 \times 4 \times 82,5$ | F. W. $201 \cdot 300$ |  |  |
| 15 | 83905444 | 1 | Tube $44.5 \times 4 \times 48$ |  |  |  |
| 16 | 83907744 | 1 | Pin cross beam PLB. 82.143 |  |  |  |
| 16 | 83908144 | 1 | Pin cross beam FLB.144-200 |  |  |  |
| 16 | 83908544 | 1 | Pro grues beam fig.201-300 |  |  |  |
| 18 | 83973744 | 1 | Curent collector inbe. 400 |  |  |  |
| 19 | 32141099 | 2 | Hexsocket cyindscrew M8 $\times 20$ |  | 10.9 A2FHL | DAN 912 |

Low-headroom monorail hoist
Trolley size 11/2 EKDK
Flange width $82-300 \mathrm{~mm}$


## Strain gauge carrier link ZMS 1250

1/1 reeving

22251030.410

## Strain gauge carrier link ZMS 2500

 $2 / 1$ reeving

## Drop stop fittings RU/EUDK





## KBK 0, KBK 25, KBK 100

 Trailing power supply lines

Mannesmann Dematic AG
P.O. Box 67, D-58286 Wetter

Telephone ( +492335 ) 92-0, Teletax ( +492335 ) 927676
Internet http/i/www.dematic.com

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Selection criteria, project-drafting example, component parts, assembly instructions, spare parts, price calculation.



For supplying power to mobile equipment, particularly hoists and cranes, three trailing: cable systems are available:


1) 3 keg with snap-on cable holder

The cable trolleys run inside the rail section and are this protected from damaging Influences. They can be used for the flexible routing of flat and round-section cables.
The cable trolleys are suitable for carrying hoses, electrical or pneumatic. tools, for quickly changing the positions of lamps etc:


## Project-drafting and assembly instructions

Project-drafting and general assembly For profect-drafting of hoisting installations up to 1000 V rated voltage, the relevant instructions: electrical regulations acc. to VOE 0100 , part 726 (hoisting equipment) must be followed.
The permissible inner bending radius for cables must be adhered to:
$\therefore$ : Bables up to 8 mm externol diameter/thickness: $3 \cdot \mathrm{D}$.
$=4$ cables up to 12 mm extema diameter/thickness: $4 \cdot \mathrm{D}$,
$\therefore$, cables above 12 mm extemad diametei/thickness: $5 \cdot \mathrm{D}$.
: D = thickness of filat cables or outer diameter of round-section cables.
Afanimiber of flat ciables are lald on each cable trolley, it must be ensured that the
$\therefore$ a thickest cable is on the top. The cables should not be strapped together at the bot: tom of the lóop.
The length of the cable lofps (or cablo trolley spacing) must be sufficient to allow the trolloys to be pushed together easily withoit pressure, even if the cables are compar-

- atively stif or if a number of cables are laid on top of each other:

The lergth of track sections holding accurnudated cable trolleys must be calculated on
the basisof the cable's permissible bending diameter and the number of cables.
E Each of these track sections must be supported by an additional suspension fitting.
The radis of curved tracks should be as wide as possible. The distance between

- individual cablettrolleys must aways be smaller than the curve radius. The cable troligys should be connected by strainer wires shoter than the cable itseff:
Th. is the track sectionsimust be fitted so that there is sufficient space on both sides to rule out the possibitity of the cable bumping against ratings or machinery etc.
In wither assembly instructions are giventin the sections describing the components.



For determining the cable conductor cross-section, see techinical datà sheet 20185744.

For cables, see tëchnical data sheet:201 56544.
For electrical installation materials see technical data sheets 20156644 and 20156844.

## Determining the max distance between susperisiön fitings ivi

|  | KRK0* |  |  |  |  | КВК 25 |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Plastic cathe trobeys |  |  |  |  | Steal cable troleys |  |  |  |  |  |  |
|  |  |  |  |  |  | Plastic casle trolleys |  |  |  |  |  |  |
|  | Load per cable trolty (kg) |  |  |  |  |  |  |  |  |  |  |  |
|  | 3 | 6 | 9 | 12 | 15 | 3 | 6 | 9 | 12 | 15 | 20 | 25 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1 | 5.2 | 3.7 | 3.0 | 2.6 | 23 | 5,7 | 4.5 | 3,7 | 3,2 | 2.8 | 2,5 | 2.2 |
| +. 2 | 3,7. | 2.6 | 2.1 | 1,8 | 1,6: | 4.5 | - 3,2 | 2.6 | 2.3 | 2,0 | 1,8 | 1,6 |
| 3 | 3.0 | 2,1 | 1,7 | 1,5 | 1,3 | : 3.7. | 2.6 | 2,1 | 1,8 | 1,6 | 1.4 | 1,3 |
| \% 4 | 2.6 | 1.8 | 1,5 | 1,2 | 170 | 3,2. | 2,3 | 1.8 | 1.6 | 1.4 | 1.2 | 1,1 |
| $4 * 5$ | 2.3 | 1.8 | 1,3 | 1.0 | 0.8 | 2.9 | 2.0 | 1.6 | 1,4 | 1:3 | $1,3$. | 1,0 |
| 6 | 2.1 | 1.5 | 1.1 | 0.8 | 0,7 | 2,6 | 1,8 | 1,5 | 1,3 | 1,2 | 1.0 | 0,9 |
|  | 2,0 | -1,4 | 1,0 | 0,7 | $80^{\circ}$ | 2,4 | 17.7 | 1.4 | 1.2 | 1.1 | 0.0 | * |
|  | 1.9 | 1,3 | 0.9 | - | $\therefore$ | 2,3 | 1,6 | 1,3 | 1,1 | 100 | - | - |
| $\rightarrow{ }^{\text {a }}$ | 1.7 | 1.1 | - | $\therefore$ | - | 2.1 | 1.5 | 1.2 | 1,0 | 0.9 | - | -. |
| (10) | 1.6 | $\cdots$ | - | \% | \% | 2,0: | $-1,4$ | t,1 | 0,9 | - | - | - |

n $\rightarrow \rightarrow$ For KBK 25, the maximum distance from foint to centre of suspension fitting is
${ }^{2} \mathrm{xt}^{2}=0,15 \cdot \mathrm{w}_{\mathrm{w}}$
*he For distance of jolnt from suspension fiting for $K B K 0$, see page 6 under "Track connecting clamp".


Fồ KBK 100, the maximurn distance from joint to centre of suspension fitting is $s t=0,15 \cdot t_{w}$
Calculation method for current supply cables:

Number of cable trolleys $=\frac{19 \mathrm{~m}}{0,8 \mathrm{~m}^{2} 2}-1=109^{\circ} \quad$ Selected: 11 cable trolleys

?
armatis
Loadingper cable trolley $=\frac{19 \mathrm{~m} \cdot 1,2 \cdot(142+0,35) \mathrm{kg} / \mathrm{m}}{1-1+1 \mathrm{i}}=28 \mathrm{~kg}$
Distance between suspension fittings as in tabie:

| KBKO: | $I=1,6 \mathrm{~m}$ |
| :--- | :--- |
| KBK $25:$ | $\quad 1=2,0 \mathrm{~m}$ |

Max. distance of joint from suspension fitting for KBK 25: st: $=0,15 \cdot 2,0 \mathrm{~m}=0,3 \mathrm{~m}$ Solected: KBK 25 with $1 \mathbf{w}=1 ; 7 \mathrm{~m}$
Track section hodding accumulated cable trolleys:
Permissible inner bending diameter of thickest fiat cable $=2 \cdot 5 \cdot 1.4 \mathrm{~mm}=140 \mathrm{~mm}$ :
External bending diameter $=140 \mathrm{~mm}+2 \cdot 14 \mathrm{~mm}=168 \mathrm{~mm}$

F4 -
Part no.

## Components required for KBK 25 supply line:

4 straight sections, 5 m long (1) sträght section of 4 m cut from 5 m section)
98151544
n. $\because 3$ track connecting clamps it . 981520,44
2 track stop bolts 98112044
1 track end clamp : 98115144
12 "VR" type track holding brackets 98153544
11 trolleys for flat cable 98103044

KBK 0 - rail and suspension fittings


Träck section


Note for assembly:
'-
The end rails of a track are to ibe attached by at least two suspension fittings. On both sides of each rail joint, there must be two suspension fittings. Sub-sections of track are to be placed in the middle.
Curved sections are to be suspended from one suspension fitting near each conneciing ctamp and from one in the middle.
The instructions on page 3 must be followed when curved sections are used.
Fnish: atuminium

| Descotation | Approce weight kg: | Pat no. |
| :---: | :---: | :---: |
| Staight section IG $=3000 \mathrm{~mm}$ | $\therefore 2,1$ | 981.28844 |
| Straight section IG $=4000 \mathrm{~mm}$ | - 2,8 | 98123044 |
| Straight section 16 = 5000 mm | 3.5 | 98723244 |

Curved sections with a max. unroled length of 1 m and a radius of $1-3 \mathrm{~m}$ avalable on request.
Track sections with stove enamel finish to protect against acid atmospheres are àvail= able on request.

## Track connecting clamp



The track clamp is used for connecting sections together and is clamped in a central position over the joint.
Short-type: only for connecting curved sections, to be arranged near a suspersion trating ary fat

Long-type can be arranged at any distance from a suspension fitting, but not for connecting curved sections.

Finish: gavanized

| Desocription . | Approx: weight kg | Pat no. |
| :---: | :---: | :---: |
| Track connectirg clamp, tong: | : 0,23 | 98126844 |
| Frack commecting clamp, short | 0:14.." | 981.2584 |

Track stop bolt
K


KBK 0 - rail and suspension fittings



Track endiclamp


Finish: galvanized
Clamping plate: plastic;black

4
4. 5\%



*
Movable limit stop


KBK 0 - plastic cable trolleys
KBK 25 - plastic cable trolleys

## Flat cable trolley with snap-on cable holder

Stirup with clamping plate


If the space over the clamping plate of the plastic cable trolley is not sufficient, a stirrup witha clamping plate is suspended from the clamping plate of the plastic cable trolley:
A number of hangers can be arranged one below the other. The total loading on the additional hangers must not be more than $5 . \mathrm{kg}$ (also; do not exceed max. permissible loading for cable trolley).

Finish: Stirup: gafvanized
Clamping plate: plastic, black

| Description | Approx wough kg: | part $n 0$. |
| :---: | :---: | :---: |
| Stlimp with ctamping plate R25 | $00^{1}$ | 081.02944 |
| Stimp with clamping plate P 45 | 0,09 | 98047044 |

## KBK 0 - plastic cable trolleys KBK 25 - plastic cable trolleys



Cable trolley


Finish:- Fràme and clamping plate: plastic, black, Stirup: galvanized
Axle with ball beanings: steel

- Travel wheels: plastic, neutral colour

Temperature range $-20^{\circ} \mathrm{C}$ to $+70^{\circ} \mathrm{C}$
Resistant to mineral lubricating oils and greases, petrol and alkaline sotutions.
ximited resistance to trichloretrylene; carbon tetrachioride and acids. Avoid direct suinlight.
Travel speed: up to $63 \mathrm{~m} / \mathrm{min}$. Higher speeds are possible with reduced loads and shörter opereting periods (max $100 \mathrm{~m} / \mathrm{min}$ ).


## Towing trolley



For towing the current supply cable.

Trolleys for pendant control switch and $16 / 24$-pole plug-and-socket device


Finish: gâkanized
Trofleys same as cable trolley, seepage:5:

| a Desorption - | - Approx weght kg | Pat no. |
| :---: | :---: | :---: |
| F. Trobeys tor pondant control switcti and plug-aind-socker device | $\cdots$ \% 0,06 | 981.41544 |

Trolleys for pendant control switch which can be used with a 16 or 24 pole phog-andsocket device.

Spring-loaded friction pads prevent the trolleys fromiruning back uniritentionally:
The detachable holders to which the strain-relief parts are fitted make it possibie for a defective pendant control switch to be rapidly exchanged together with its control cable.
 device forpendant controls

thepole plug-and-socket device, which can be
switch, oonsisting of an upper and lower part. L Lower part complete with socket and wo eg 21 cable:outlets.
Upper part complete with plug, doublo-sided locking ciamp and straight Pg 21 cable outlet:
For twist-type cable entry glarid and screw-in union for cable entry, seet technical data sheet 20156544.
24-pole plug-and-socket device on request.
' Fintish: AlS clie-cast housing

$2,5 \mathrm{~mm}^{2}, 16$ poles +PE (earth), rated voltage: $380 \mathrm{~V}-$, rated current: 16 A , insulation group: C to VDE:0110, type of enclosure IP 55 to DAN 40050.

## KBK 25 - rail and suspension fittings

## Track section



Note for assembly:
The end rails of a track are to be attached by at least two suspension fittings. On both sides of each rail jöint, theré must be two suspension fittings. Track subsections are to be placedin the middle.
Cuirved sections are to be suspended from one suspension fitting near each connecting clamp and form one in the middie.
The instructions on page 3 must be followed.

- Finshi galvanized .

| Description $\quad \cdots \quad{ }^{\text {at }}$ | FApmox weight kg: | Part no. |
| :---: | :---: | :---: |
| Straght section $\mathrm{C}_{6}=5000 \mathrm{~mm}$ | 872 | 98151544 |
| Curved section $90^{\circ} ; R=750 \mathrm{~mm}{ }^{\text {a }}$ | 117 | 98150644 |
| Cirved section 900 R , 1000 mm | ${ }^{-7 x}$ I 2,26 | 98150744 |
| Curvod section, $900,8=1500 \mathrm{~mm}$ | , 3,39 | 98150844 |
| \% |  |  |

Track connecting clamp
41463844.eps

Note for assembly:
The track sections are firmly connected owing to the frictional force of the track contnecting camp: The track sections are additionally protected against being drawn apart'as follows: using'a pair of pliers (approx. 5 mm wide), bend up the top ends of the sections being joined with a track connecting clamp about 2 to $\$ 3 \mathrm{~mm}$. These bent-up ends are held in a groove in the connecting ctamp.

Finishi: galvanized

|  | Acorox. welght kg | Per no. |
| :---: | :---: | :---: | :---: |
| Description | 0.3 | 98152044 |

2. . . .
 fittings.

## KBK 25 - rail and súspension fittings

## Suspension fitting



Finish: galvanized
Square dowel: plastic, black

| Description | Max. iosoing | Approx. weghtikg | Parino: |
| :---: | :---: | :---: | :---: |
| W Whpo bracket | 150 kg | 0,11 | 981530.44 |
| atre type brickat. | 150 kg | 0, 14 | 881535.44 |
| Or type bracket | 150 kg | 0.16 | 981540.44 |
| * 4, ب-C top tracket | 150 kg | 0.17 | 98154544 |

Track end clamp

## KBK 25 - rail and suspension fittings

Note for assembly:
The stop bolt is fitted in the trackbetween the end clamp and the first cable trolley. As'a result; the cable trolley is prevented from nuning into the end clamp.
F. Findsh: galvanize


Dlameter of hole: 9 mm

| Description * : | Approx weight kg | Part no. |
| :---: | :---: | :---: |
| Track stop bolt ${ }^{\text {a }}$ | 4 0,06: 4 | 98112044 |

E
Track stop bolt

Movable limit stop

Cablectlip




## Cable deflector



For preventing cable loops in track sections, where cable trolleys are accumulated, from striking against adjacent objects.

## Cable trollèvs



Towing trolleys


Trolleys for pendant control switch and 16/24-pole plug and-socket device


Finish: gatvanized Steel travel wheels, antificiction bearings:
6.2 mm dia hioles are provided for strainer Wires.
Temperature range: see data for cables selected.
Travel speed up to $63 \mathrm{~m} / \mathrm{min}$ : Higher speeds are possible with reduced loads. and shorter operating periods (max.
$100 \mathrm{~m} / \mathrm{min})^{\prime}$.

| Description | Max. foacing | Approx weight kg | Pat no. |
| :---: | :---: | :---: | :---: |
| Cable trotiey for tax cabla: |  |  |  |
| 1) with 25 mm ractus | 25 kg | 0.29 | $\xrightarrow{98165044}$ |
| 2) with 45 mm radius | 25 kg | 0,35 | 98155144 |
| Figida | 25 kg | 0,29 | 198157044 |
| Cable troney for |  |  |  |
| one noundsection catie | 25 kg | 0,27 | 98156044 |
| two roundsection cables | 25 kg | 0,34 | 80156144: |

Finish: galvanized
Trolleys same as cable trolley the; above.

| Descriptont | A Aprox: weigit kg . | P Pat mor |
| :---: | :---: | :---: |
| Towing trolleys | , 1, 1.4 | 981.576'44. |

For towing the current supply cable.

Finish: gatvanized
Trobleys: same as cable trolley, see above

| Description | Approx. <br> weight kg. | Part no. |
| :--- | :---: | :---: |
| Trodeys tor pendent <br> control switch and | 1,25 | 381,58044 |

Trolleys for pendant coontrōl switch which can be used with a 16 or 24pole plug-and-socket device. Spingloaded friction pads prevent the trolleys from running back unintentionally: The detachable holders to which the strainreliet paits are fitted make it possible for a defective pendant control switch to be rapidly exchanged together with - its control cable. The plug-and-socket device must be ordered separately. see page 10.

## 

Straight section


The track sections have three coupling sleeves at each end of being boited together or for fiting the end cap with end stop.


Curved section
Curved sections are to be suspended from one suspension fitting near each track joint and from one in the middle.
Finish: red (RAL 2002) - -

| "Ange of curve $\vdots$ a |  |  | Approx. wibght kg | Part |
| :---: | :---: | :---: | :---: | :---: |
| $30^{\circ}$ | 1 4588 | -8325\% | 1.4 | $99467 \dagger 44$ |
| $60^{\circ}$ | 325 | 563\% | 2,8 | 98467244 |
| - 7 - $900^{\circ}$ | - ${ }^{-650}$ | - - - -650"* | 4,2 | 984-873 44 |

Joint bolt set

The joint bolt set is used for connecting the track section (track joint).
Finish: gavanized


| Description |
| :--- |
| Joint bott set, completa |

## Track end clamp


The end clamp is fitted to the cap with stop at the end of the track.
The purpose of the end clampis to relleve the cable of strain: This clamp ensures that the cable is carned to the next connecting point without pull.
If cables wider than' 52 mm are laidand/or if the stop boll (see page 16) is used, the
, end clamp shown on page 19 must beemployed.
Finish: galvanizad
Clamping plate: plastic, black

| Description | Approx. weight kg | Part no. |
| :--- | :---: | :---: |
| Track end clemp | 0.1 | $982: 11444$ |

## KBK 100 - rail and suspension fittings

## Suspension fittings fôr current supply:line



Parts for fitting " $D$ " and "W type brackets to be provided by customer or available on request: For mounting with C rails, see technical data sheet 20175844.
Finish: gavanized


Wh type track holding bracket, comprsing:

| Al dampange section | 150 kg | 0,7 | 98465644 |
| :--- | :--- | :--- | :--- |

1) Nole loactabdity of C rall.

End cap with end stop


Finish: Cap with bolts: gakanized, end stop: mubber..

| Descripion | Appirx wedit kg | Pain no |
| :--- | :---: | :---: |
| End cep with end stop | 0,1 | 08454044 |

The end of the track is closed by means of the end cap with end stop.

Track stop bolt


Stop at end of track, if an end section mușt be shotened (and the bot hoiding sleoves removed); otherwise use end cap with end slop.
Diameter of holes 11 mm , ${ }^{2}$
Finish: Nut and bolt galvanized
Buffer Vulcollan

| Description |  | Approx. wetght kg | Part no. |
| :--- | :---: | :---: | :---: |
| Track end ctamp | 0.07 | 884670.44 |  |

## KBK 100 - plastic cable trolleys



For a flat cable trolley with snap-on cabie holder the following parts must be ordered separatery:

1. Trolley for cable holder
2. Snap-on cable hodder
3. Cable strap $340 \times 8 \mathrm{~mm}$ for cable holder

Sequence of assembly operations:
Surn tily operaki.

- Pass cable stap (3) through the two slots in the supporting plate of cabie holder (2)
- Distribite cable holders (2) atequal distance over the entire cable length.
- Place cable strap (3) over the cable on each holder (2) and firmly tightent the strap.
- Snap cablé hoddoŕn (2) onto trofley (1).

See top of page 8 for further assembly instructions.
Finish: plästic, black

- Axte with bita

Travel wheels:
Technical details see trolley in the next section.


| Description | Max, loading | Approx, weight kg | Pert no. |
| :--- | :---: | :---: | :---: |
| Cable troley | 25 kg | 0,2 | $98046044^{\circ}$ |

## KBK 100 - steel cable trolleys

Cable trolleys

-Finish: gavanized 3

- Sterit travel wheels, entifriction beamgs.
$\because 6.2 \mathrm{~mm}$ dia holes are provided for strainer wires.
Temperature range: see data fó cables selected.
Travel speed up to 63 m/min: Highier spoeds are possible with reduced loads and shorter operating periods.

| Description $\quad . \quad$ | Max loading | Approx weghtir k. | Payt no. |
| :---: | :---: | :---: | :---: |
| Cable trolloy for fat catre |  |  |  |
| 1) with 25 mmiradus | 40 kg . | $\therefore 0 ; 29$ | 98460544 |
| 2) with 45 mmi ratu | 40 kg | 0.35 | $984606^{\prime 4}$ |



For towing trolley see page 19 Trolleys for pendant control switch on request.

KBK 100 －heavy－duty cable trolleys

## Flat cable trolley

Finish：gativanized
Plastic travel wheels，antitiction bearings
10 mm dia．holes are provided for strainer wires．
These cable trolleys cannot negotiate ctives．
－2y Temperature range． $20^{\circ} \mathrm{C}$ to $+70^{\circ} \mathrm{C}$ ．
－务
with reduced loads and
$\therefore$ 为家

| Description ．－－－－ | －Maxitoadryge | Approx：waight kg | Part no． |
| :---: | :---: | :---: | :---: |
| Flat catio trolley | $-400 \mathrm{~kg}$ | 1.5 | 98465044 ： |

## Track end clamp



The end clamp is fitted to the end of the track to relieve the cable of strain：This clamp ensures that the cable is carried to the next connection point without pull． The end of the track is closed with the end cap complete with end stop（see page 16）．

## Towing trolley



Plastic traver wheels, antifiction bearings
Operating conditions as for flat cable trolleys, see aböve.


For towing the current supply cable.

Part no.

98104544
98101844
98101944
98102044

98102544
98103344
98103444
98046844
98140344
98140444
98141444
98138144

98155244
98156344
98156444
98155844
98157744
98156244
980.46844

98155744
98157144
98459344
98140444
98141444
98138144

98046144
98103344
98103444
980.468 .44

984:607:44
98156344
98156444
98155844
98157744
98156244
980468.44
"981 55744

KBK 0 / 25 / 100 project-drafting and price calculations

Customer.



Gustomer no.:
Project/order no: $\qquad$


Cross travel power supply cable, KBK
Mobile pendant control switch, KBK
Long travel power supply cable,"KBK
tot power supply cable, approx

$$
4
$$

$\qquad$ m.

For sketch of cable arangerient, seepage 15 :
Processed by, (name/dept): $\qquad$ Date: $\qquad$ $\frac{\text { trating power }}{\text { Trailen }}$


## Total cost



## Trạiling power <br> supply cables



Tótal cost

1) Enter the price of the standard length rounded up to the toll meter.

## Certificate of Test and Examination

$$
\begin{aligned}
& 4078
\end{aligned}
$$


;



[^0]:    Enclosed BTS

[^1]:    Note: A special generator $T_{1}$ setting adjustment of $1-5 \sec \left(a t I_{1} \times 600 \%\right)$, is also available. Please contact NHP for details.

[^2]:    Notes: ' ${ }^{1}$ ) Standard torque for the terminal screws M3.5-0.88~1.18 Nm ( $9 \sim 12 \mathrm{Kgf} . \mathrm{cm}$ )
    ${ }^{\text { }}$ ) Connected cable size - Max $2.0 \mathrm{~mm}^{2}$

[^3]:    Tables based on the following maximum pre-arching $1^{2} t$ for both BS 88 and DIN fuses:
    $160 \mathrm{~A}-0.62 \times 10^{5}, \quad 200 \mathrm{~A}-1.2 \times 10^{5}, \quad 250 \mathrm{~A}-2.1 \times 10^{5}$.
    Suitable fuses include NHP, GEC. Siemens and Brovara-Crady
    Fuses with higher current ratings may be used providing $I^{2} t$ values are equal to, or less than the levels above. Semi-conductor fuses have very low $1^{2} t$ values and may suit some applications.

    Attention is also drawn to AS 3000 clause 7.10.4.4 regarding the use of fault current limiters in installations containing fire and smoke control equipment, evacuation equipment and lifts.

[^4]:    Notes: ') Thermal or electronic overload relays may be used.

[^5]:    Notes: ') Thermal or electronic overload relays may be used.

[^6]:    Notes: These motor circuit application tables are to be used as a selection guide for average 3 phase, 4 pole 415 V motors for standard applications only. The table is based on holding $\mathbf{1 2 5 \%}$ FLC continuously and $350 \%$ FLC for at leasl 20 seconds.
    ${ }^{1}$ ) 80,100 and 125 amp refers to Din-T10H type.
    ${ }^{2}$ ) Type 'SE' TemBreak MCCB only.
    ${ }^{3}$ ) TLIOONJ up to 100 A only.
    If co-ordination to IEC 947-4-1 is required refer to Type 1 and 2 co-ordination tables, contact NHP.
    Din-T MCB's are calibrated to IEC 898 Curve ' $C$ ' 8 ' $D$ '. Selected sizes of ' $D$ ' Curve are available from stock. Refer NHP.

[^7]:    Notes: These motor circuit application tables are to be used as a selection guide for average 3 phase, 4 pole 415 V motors for standard

[^8]:    IP 20 degree of protection and safety trip ${ }^{1}$ ) are available for plug-in type breakers, for switchboard and distribution board use.

[^9]:    - Normal CA 3 rating of contactor
    - Meximum breading currmat of contactor
    - Cut-off current of tuse

    I - Instiantanecus titpping current of breeker

[^10]:    Notes: ') Use 'magnetic only' breaker. Refer NHP for details.
    ${ }^{7}$ ) Thermal or electronic overload relays may be used. Some combinations also achieve Type ' 2 ' performance. CA 7 contactor can be replaced with equivalent CA 3 size.

[^11]:    ${ }^{1}$ ) Use 'magnetic only' breaker or next higher circuit breaker/contactor combination. Refer NHP
    ${ }^{2}$ ) Use with separate mounting bracket.
    ${ }^{3}$ ) Thermal or electronic overload relays may be used.
    Combinations based on the thermal overfoad relay tripping before the circuit breaker at overload currents up to the motor locked rotor current.

[^12]:    Notes: ${ }^{1}$ ) Thermal or electronic overload relays may be used
    ${ }^{2}$ ) Use with separate mounting bracket.
    Combinations based on the overload relay tripping before the circuit breaker at overload currents up to the motor locked rotor current.

[^13]:    Notes: These motor circuit application tables are to be used as a selection guide for average 3 phase, 4 pole 415 V motors for standard applications only. The table is based on holding $125 \%$ FLC continuously and $350 \%$ FLC for at least 20 seconds.

    1) 80,100 and 125 amp refers to Din-T10H type.
    ${ }^{2}$ ) Type 'SE' TemBreak MCCB only.
    ${ }^{3}$ ) TL 100 NJ up to 100A only.
    If co-ardination to IEC 947-4-1 is required refer to Type 1 and 2 co-ordination tables, contact NHP.
    Din-T MCB's are calibrated to IEC 898 Curve ' $C$ ' \& 'D'. Selected sizes of 'D' Curve are available from stock. Refer NHP.
[^14]:    Note: 240/415 V ratings suitable for use on 230/400 V in accordance with AS 60038:2000.

[^15]:    1) When ondering a rotor or stator, a set of thrust ings itern no. 12) must also be ordered for adjesting the eir gep
    6. (adjist with feeler gauge no, 2, them no. 38)
